CHAPTER 8

CLOSED MOUNTAIN BUSHVELD

8.1 Background

Although a number of phytosociological studies have been conducted on the bushveld (the local term equivalent to savanna) of ultramafic substrates in southern Africa (Werger *et al.* 1978; Van der Meulen 1979; Breebaart & Deutschlander 1997), several vegetation types on this type of substrate still remain poorly investigated. An example is the Mountain Bushveld identified by Siebert *et al.* (2002a) on the norite, pyroxenite and anorthosite hills and mountains of the SCPE (Van Wyk & Van Wyk 1997; Van Wyk & Smith 2001). Ultramafic mountains and hills are floristically noteworthy in that they harbour many plant endemics with distributions associated with this particular geological substrate (Iturralde 1995; Madulid & Agoo 1995; Siebert *et al.* 2001).

Various vegetation types have been recognised on the dry dolomitic hills and mountains of the northeastern Drakensberg Escarpment (Matthews 1991; Matthews *et al.* 1992), an area adjacent to the SCPE with which it shows a definite floristic affinity (Siebert 1998). Acocks (1953) mapped the mountain bushveld in the SCPE as three major veld types, namely Mixed Bushveld (18), Sourish Mixed Bushveld (19) and North-Eastern Sandy Highveld (57). A more generalised classification of the same region's vegetation is given by Low & Rebelo (1996), who recognises only one major vegetation type, namely Mixed Bushveld (18). Plant communities of the *Kirkia wilmsii–Terminalia prunioides* Closed Mountain Bushveld (Siebert *et al.* 2002a) are described in this contribution.

The study area (Figure 13) is characterised by considerable diversity in geology (Kent 1980) and physiography (Land Type Survey Staff 1987; 1988; 1989). The vegetation of the SCPE can be broadly described as undulating mountain bushveld that is bordered by a Northeastern Sandy Highveld Grassland-mountain bushveld ecotone in the south and a

mountain bushveld-Mixed Bushveld ecotone in the north. Most of the undulating hills and mountains of the region are predominantly covered by bushveld, described as the *Kirkia wilmsii–Terminalia prunioides* bushveld (Siebert *et al.* 2001a). Due to the heterogeneity of the environmental factors in the region, this major vegetation type is intermingled with several other major vegetation types (Siebert *et al.* 2001a). Fourty of the Sekhukhuneland endemics/near-endemics occur in this vegetation type (Siebert 1998).

Landform variation exhibits complex patterns (Werner 1999) and plays an important role in the development of the local flora (White 1981; Siebert 1998). Two major physiographic entities are characteristic of the study area, namely, (a) mountain slopes and (b) valleys. Mountain slopes are defined as the scarps, midslopes and footslopes of undulating hills and mountains. Valleys are defined as the low-lying valleybottoms and footslopes between the hills and mountains, which are usually traversed by a stream or river.

The average annual rainfall is 578 mm (South African Weather Bureau 1998), but the rainfall pattern is strongly influenced by the local topography (Siebert 1998). Rainfall varies from as little as 400 mm in some of the valleys due to rainshadows, to an estimated 600 mm on the summit of the Leolo Mountains (Erasmus 1985). Temperatures for the study area range from 0°C to 38°C, with a daily average of 20°C (Weather Bureau 1998). The northern and western parts of the study area are on average warmer than the southern and eastern parts (Siebert 1998). The northern parts of the region exhibit average daily temperatures of 28.3°C maximum and 7.2°C minimum.

8.2 Classification

Analysis of the *Kirkia wilmsii–Terminalia prunioides* Closed Mountain Bushveld resulted in the identification of 20 plant communities, which are grouped as five associations and 20 sub-associations (Table 19). These were subsequently hierarchically classified. The two major vegetation types are ecologically interpreted on the grounds of the physical environment, namely mountain slopes or valleys. Hence, macro-climatic and/or geological variation plays a role in local differentiation of the plant communities. The major plant communities relate to soil properties, rockiness and terrain type, with aspect and slope also

important. Associations are distinctive and easily distinguishable in the field. This might be attributed to the uniformity of the environmental factors for each of the major groups, causing a distinct distribution pattern of habitats and associated vegetation.

Vegetation types of this area were identified and described as either slope bushveld, valley bushveld, disturbed veld or river thicket. Hence, the hierarchical classification of the vegetation reinforces the correlation between habitat and plant communities (Figure 14). The distribution of SCPE endemic/near-endemic and Red Data List taxa among various plant communities is listed in Table 20. A summary of selected community attributes is supplied in Table 21.

Plant communities of the *Kirkia wilmsii–Terminalia prunioides* Closed Mountain Bushveld recognised in the study area are classified as follows:

I. *Enneapogono scoparius–Kirkia wilmsii* community of mountain slopes

1. *Combreto apiculati–Kirkietum wilmsii*
   - 1.1 *Combreto apiculati–Kirkietum wilmsii clerodendretosum glabrae*
   - 1.2 *Combreto apiculati–Kirkietum wilmsii eustachetosum paspaloidis*
   - 1.3 *Combreto apiculati–Kirkietum wilmsii bridelietosum mollis*
   - 1.4 *Combreto apiculati- Kirkietum wilmsii chaetacanthetosum costatii*
   - 1.5 *Combreto apiculati–Kirkietum wilmsii hermannietosum boraginiflorae*
   - 1.6 *Combreto apiculati–Kirkietum wilmsii themedetosum triandrae*
   - 1.7 *Combreto apiculati–Kirkietum wilmsii nuxietosum congestae*
2. *Panico deustii–Dichrostachetum cinereae*
   - 2.1 *Panico deustii–Dichrostachetum cinereae sporoboletosum stapfianii*
   - 2.2 *Panico deustii–Dichrostachetum cinereae maeruetosum angolensis*
   - 2.3 *Panico deustii–Dichrostachetum cinereae melhanietosum prostratae*
   - 2.4 *Panico deustii–Dichrostachetum cinereae melhanietosum acuminatae*

II. *Eragrostis curvula–Combretum hereroense* community of valleys

3. *Fingerhuthio africanae–Boscietum foetidae*
   - 3.1 *Fingerhuthio africanae–Boscietum foetidae elaeodendretosum transvaalensis*
   - 3.2 *Fingerhuthio africanae–Boscietum foetidae aloetosum globuligemmae*

3.3 *Fingerhuthio africanae–Boscietum foetidae euphorbietosum ingentis*

3.4 *Fingerhuthio africanae–Boscietum foetidae sesamothamnetosum lugardii*

4. *Hippocrateo longipetiolatae–Euphorbietum tirucalli*

4.1 *Hippocrateo longipetiolatae–Euphorbietum tirucalli emilietosum transvaalensis*

4.2 *Hippocrateo longipetiolatae–Euphorbietum tirucalli aristidetosum transvaalensis*

4.3 *Hippocrateo longipetiolatae–Euphorbietum tirucalli bothriochloetosum insculptae*

5. *Celtido africanea–Combretetum erythrophyllii*

5.1 *Celtido africanea–Combretetum erythrophyllii acacietosum caffrae*

5.2 *Celtido africanea–Combretetum erythrophyllii acacietosum galpinii*

8.3 Description

The *Kirkia wilmsii–Terminalia prunioides* Closed Mountain Bushveld is predominantly restricted to the warm slopes and valleys of undulating ultramafic hills and mountains. Surface rocks are predominant and abundant in various habitats, with average rock size varying between 0.1 and 1 m (10–70% surface cover) on the slopes of hills and between 0.05 and 2 m (5–65% surface cover) in the valleys. The vegetation can be classified into broad-leaved mountain woodlands and microphyllous, disturbed valley thickets (Edwards 1983). An outstanding feature of this bushveld type is the fact that it constitutes a unique vegetation type that differs significantly from the surrounding and other bushveld types of southern Africa.

I. *Enneapogono scoparius–Kirkia wilmsii* community of mountain slopes

Environmental data. The vegetation is a closed broad-leaved bushveld of mountain slopes. The alliance is found predominantly on northern aspects. It occurs on moderate (3–5°) to steep slopes (5–15°), mainly on midlopes, but also to a lesser degree on either footslopes or scarps (Table 21). Soils are shallow and predominantly constitute rocky Glenrosa forms. The soil surface is covered by 15–65% of rock with an average diameter of 0.3–1 m (Table 21).

Diagnostic and dominant/prominent taxa. Diagnostic species are represented by species group R (Table 19) and include the tree *Acacia nigrescens*, the shrubby climber

Asparagus laricinus, perennial herb *Commelina africana*, and the grass *Enneapogon scoparius*. Dominant species include the trees *Acacia senegal* var. *leiorachis* and *Kirkia wilmsii*, the herbs *Psiadia punctulata* and *Barleria saxatilis*, and the grasses *Themeda triandra* and *Heteropogon contortus*.

Notes on floristic diversity. Floristic links with the other alliance is visible in species groups AA, AC, AJ and AQ (Table 19). Strong floristic links exist between the two alliances. The average number of species encountered per sample plot for this alliance is 38, with the total number of plant species being a minimum of 123 taxa (33 relevés) (Table 21). There are 29 plant taxa of conservation value, 15 are SCPE endemics, 14 are SCPE near-endemics and three are Red Data List taxa (Table 20). Of these taxa, 11 are restricted to this alliance in the SCPE.

1. *Combreto apiculati–Kirkietum wilmsii* ass. nova hoc loco
Nomenclatural type: relevé 165 (holotypus)

Environmental data. The vegetation representing this association is dense short woodland on the midslopes and scarps of the mountains and hills of the study area. It is mostly found on the northeastern aspects. It is restricted to the Steelpoort-Burgersfort region (Steelpoort Subcentre of Plant Diversity), with the orientation of hills and mountains in this area generally east-west, thus providing northern slopes facing into the Steelpoort River basin. The habitat is rocky with relatively steep slopes (5–15°) (Table 21). Average rock size varies from 0.3 to 1 m in diameter and covers 30–70% of the soil surface. The dominant soil type is the Glenrosa form, classified as an ortic A-horizon over a lithocutanic B-horizon.

Diagnostic and dominant/prominent taxa. Characteristic species are represented by species group A (Table 19). The association is characterised by diagnostic small trees/shrubs, namely *Acacia exuvialis*, *Combretum apiculatum*, *Grewia monticola*, *Triaspis glaucophylla* and the succulent tree *Aloe marlothii*. The fern *Pellaea calomelanos* is the only diagnostic herbaceous species. Other dominant woody species include *Acacia nigrescens*, *A. senegal* var. *leiorachis*, *Dichrostachys cinerea* and *Kirkia wilmsii*. *Enneapogon scoparius*, *Heteropogon contortus* and *Panicum deustum* are the most

dominant grasses and *Asparagus laricinus*, *Corbichonia decumbens* and *Commelina africana* the most conspicuous forbs.

Notes on floristic diversity. This bushveld association is common in the SCPE and a floristic affinity exists with the other Closed Mountain Bushveld communities of the Centre in species groups AA, AC and AJ (Table 19). In this association the average number of plant species recorded per relevé is 38, and the minimum total number of species recorded for the association is 123 (33 relevés) (Table 21). Twenty plant taxa of conservation value occur in this association (Table 20), namely nine SCPE endemics and 11 SCPE near-endemic (the highests number recorded for any of the associations in the study), of which a high number of three plant species are Red Data List taxa. Five of these taxa are restricted to this association only, with the endemics *Stylochaeton* sp. nov. (*Siebert 1332*) and *Xerophyta retinervis* (tree-form) (*Van Wyk & Siebert 13208*), and the near-endemic *Jatropha latifolia* var. *latifolia* well represented in most of the sub-associations.

1.1 *Combreto apiculati–Kirkietum wilmsii clerodendretosum glabrae* sub-ass. nova hoc loco

Nomenclatural type: relevé 119 (holotypus)

Environmental data. The vegetation is dense woodland on the relatively shallow soils of slightly south facing midslopes on the northern aspect of the Schurinksberg. This sub-association is associated with exposed shale formations with moderately steep sloped sides of 9–12° (Table 21). The surface rock cover percentage is average for the association, namely 50–65%, with the exposed rocks averaging diameters of 500–800 mm in diameter (Table 21). The dominant soil type is the Glenrosa form.

Diagnostic and dominant/prominent taxa. In the SCPE this association is characterised by species group B (Table 19). *Clerodendrum glabrum*, *Dombeya rotundifolia*, *Ormocarpum kirkii* and *Rhus batophylla* are the diagnostic woody species of this syntaxon. Diagnostic herbaceous species include *Buttonia superba*, *Cucumis hirsutus*, *Plectranthus xerophilus* and the fern-ally, *Selaginella dregei*. There are no diagnostic grasses. *Enneapogon scoparius*, *Panicum deustum* and *P. maximum* are the most prominent grasses.

Achyranthes aspera, the succulent *Aloe castanea* and *Cryptolepis oblongifolium* are the dominant forbs. Other prominent plants are the woody species *Acacia exuvialis*, *Combretum apiculatum*, *Elephantorrhiza goetzei*, *Kirkia wilmsii* and *Triaspis glaucophylla*.

Notes on floristic diversity. This plant community is not a typical SCPE syntaxon, for its substrate is sedimentary in origin. However, it is included due to the strong floristic link that it exhibits with other sub-associations in species group G (Table 19), namely the slopes of Thaba Sekhukhune (sub-association 1.3) and the slopes of the Dwarsrivier Hills (sub-association 1.4). It also shows a relationship with association 5 in species group AP (Table 19). The average number of plant species encountered per sample plot is 30, with the total number for this association being 40 (three relevés) (Table 21). Four taxa with a conservation status are present in the association (Table 20), of which one is a SCPE endemic, three are SCPE near-endemics. The endemic, *Rhus batophylla*, is a Red Data List taxon and is restricted to the sub-association.

1.2 *Combreto apiculati–Kirkietum wilmsii eustachetosum paspaloidis* sub-ass. nova hoc loco
Nomenclatural type: relevé 116 (holotypus)

Environmental data. The vegetation is tall closed woodland on north-facing midslopes of the Schurinksberg. It is associated with predominantly exposed shale formations. The sub-association is found on relatively steep slopes (12–15°) (Table 21). Soils are predominantly of the Glenrosa form. The soil surface is covered by 40–60% of rock with a diameter of 450–600 mm (Table 21).

Diagnostic and dominant/prominent taxa. Characteristic species of the association are represented by species group C (Table 19). Woody species diagnostic of the association only include the semi-scandent *Rhoicissus tridentata*. Diagnostic herbaceous taxa are the geophyte *Boophane disticha*, the climbing Asclepiadaceae members *Ceropegia ampliata* and *Pergularia daemia*, and the forb *Lotononis pulchra*. The only diagnostic grass is *Eustachys paspaloides*. Prominent woody species of the sub-association are *Combretum*

apiculatum, *Commiphora africana*, *C. mollis*, *Dichrostachys cinerea* and *Kirkia wilmsii*. Dominant grasses are *Digitaria eriantha*, *Enneapogon scoparius*, *Heteropogon contortus* and *Setaria lindenbergiana*. *Aspillia mossambicensis*, *Commelina africana* and *Urginia epigea* are the most conspicuous forbs of the sub-association.

Notes on floristic diversity. A notable floristic link exists with the rest of the association in species groups G and M, and with other associations in species groups AP (Table 19). The average number of plant species encountered per sample plot in this sub-association is 41, with the total number of plant species being 55 taxa (three relevés) (Table 21). There are four plant taxa of conservation value in the association that comprise two SCPE endemics and two SCPE near-endemics (Table 20).

1.3 *Combreto apiculati–Kirkietum wilmsii bridelietosum mollis* sub-ass. nova hoc loco
Nomenclatural type: relevé 300 (holotypus)

Environmental data. In the SCPE this association is tall dry woodland bush clumps on mountain slopes running into the Steelpoort River Valley, from Roossenekal in the south, to Steelpoort in the north. The habitat of the association is characterised by the igneous rocks ferrogabbro and granofire, covered by Glenrosa soils. However, these are not part of the Rustenburg Layered Suite, which result in different environmental (edaphic) factors than expected. It occurs on relatively steep slopes (7–12°) and on northern aspects. Rock cover and average rock diameter is average for the study area, namely 30–50% of the soil surface and a relatively large diameter of 500–750 mm, respectively (Table 21).

Diagnostic and dominant/prominent taxa. Species group E contains the diagnostic species for this association, which are characterised by the tree *Bridelia mollis*, the grass *Aristida bipartita*, and the forbs *Indigofera filipes*, *Justicia odora* and *Rhynchosia pauciflora* (Table 19). Other prominent species of the sub-association include the trees *Combretum apiculatum*, *Commiphora africana*, *C. glandulosa*, *Grewia monticola*, *Kirkia wilmsii* and *Pappea capensis*. Forbs such as *Barleria lancifolia*, *Clerodendrum ternatum* and *Melhania burchellii*, and grasses such as *Enneapogon scoparius* and *Heteropogon contortus* are dominant in the sub-association.

Notes on floristic diversity. A notable floristic link exists with the rest of the association in species groups M, and with other associations in species groups AA (Table 19). The average number of plant species encountered per sample plot in this sub-association is 34, with the total number of plant species recorded being 60 taxa (four relevés) (Table 21). Three taxa of conservation value are part of the sub-association, of which one is a SCPE endemic and two are near-endemics (Table 20).

1.4 *Combreto apiculati–Kirkietum wilmsii chaetacanthetosum costatii* sub-ass. nova hoc loco

Nomenclatural type: relevé 220 (holotypus)

Environmental data. This sub-association is tall, open woodland of the peripheral hills running adjacent to the norite massive of the SCPE, between it and the Schurinksberg. It is a true SCPE mountain bushveld community, for it is underlain by pure pyroxenite. It is associated with midslopes and scarps on northern aspects. The substrate is rock that gave rise to Glenrosa form soils. The soil surface is covered by 30–50% rock, of a larger average size of 0.4–1 m in diameter (Table 21). Slope of the habitat is moderately steep, usually 5–12°.

Diagnostic and dominant/prominent taxa. Diagnostic species are represented by species group F (Table 19). Diagnostic herbs include *Ipomoea obscura*, *Sphedamnocarpus pruriens* and *Sphenostylis angustifolia*. The tree, *Lannea discolor*, and the geoxylic suffrutex, *Tylosema fassoglense*, are both diagnostic woody species. *Sorghum bicolor* is the diagnostic grass. The sub-association is dominated by large trees/shrubs of which *Commiphora africana*, *Combretum apiculatum*, *Elephantorrhiza praetermissa*, *Grewia monticola*, *Kirkia wilmsii*, *Pappea capensis*, *Sterculia rogersii* and *Ziziphus mucronata* are the most frequent. Conspicuous forbs are *Chaetacanthus costatus*, *Clerodendrum ternatum* and *Jasminum multipartitum*. Dominant grasses include *Digitaria eriantha*, *Enneapogon scoparius* and *Heteropogon contortus*.

Notes on floristic diversity. A specific floristic link exists with certain groups in the association (species groups I and L) (Table 19). It is also the last of four sub-associations characterised by the trees *Pappea capensis* and *Ozoroa sphaerocarpa* in species group G (Table 19). One of the highest average numbers of species encountered per sample plot in this association and the study area, namely 45, was recorded for this sub-association. The total number of taxa recorded for this sub-association is 100 (five relevés) (Table 21). Four SCPE endemics, of which one is a Red Data List taxon, and six SCPE near-endemics are found in this sub-association (Table 20). Of its 10 taxa of conservation value, two taxa are restricted to this sub-association and the next three sub-associations (1.5, 1.6 & 1.7) of the association. The plant species concerned are the SCPE near-endemic *Jatropha latifolia* var. *latifolia* and the undescribed SCPE endemic *Stylochaeton* sp. nov. (*Siebert 1332*).

1.5 *Combreto apiculati–Kirkietum wilmsii hermannietosum boraginiflorae* sub-ass. nova hoc loco
Nomenclatural type: relevé 250 (holotypus)

Environmental data. This sub-association represents tall, closed woodland interspersed with patches of open shrubland and well-developed grass layer. It is restricted to northern aspects. The habitat is mostly restricted to large hills of gabbro, norite and anorthosite, but also occurs on ferrogabbro. It occurs on midslopes and scarps, on black and red soils of the Glenrosa form. It lies on moderate to steep sloped areas (5–15°). Rock cover on the surface is 35–55%, with rocks reaching relatively large medium size of 0.65–1 m in diameter (Table 21).

Diagnostic and dominant/prominent taxa. Diagnostic species occurring in this sub-association are listed in species group H (Table 19). It is characterised by the absence of the diagnostic tree and grass species. Diagnostic forbs include *Hermannia boraginiflora, H. glanduligera, Pentarrhinum insipidum* and *Tephrosia forbesii*. The small shrub *Mundulea sericea* is the only diagnostic woody species. Dominant herbaceous taxa include the forbs *Barleria saxatilis, Blepharis subvolubilis* and the semi-woody *Psiadia punctulata*. Prominent grasses are *Heteropogon contortus, Panicum deustum* and *Themeda triandra*. Dominant woody taxa include the shrubs *Elephantorrhiza praetermissa* and *Grewia*

vernicosa, and the trees *Combretum apiculatum*, *Commiphora africana*, *C. mollis*, *Kirkia wilmsii* and *Terminalia prunoides*.

Notes on floristic diversity. A notable floristic link exists with the rest of the association in species groups L and M, and with other associations in species group U (Table 19). The average number of plant species encountered per sample plot is 39, with a total number of 84 plant taxa (five relevés) (Table 21). Four SCPE endemics and five SCPE near-endemics, of which the endemic *Elephantorrhiza praetermissa* is a Red Data List taxon, are found in this sub-association (Table 20). Of its nine taxa of conservation value, none are restricted to it.

1.6 *Combreto apiculati–Kirkietum wilmsii themedetosum triandrae* sub-ass. nova hoc loco
Nomenclatural type: relevé 191 (holotypus)

Environmental data. This sub-association represents shorter closed woodlands of hill slopes in the Steelpoort River Valley where it is restricted to northern aspects. It prefers midslopes and scarps of norite, pyroxenite and anorthosite hills with a moderate to steep slope (5–15°). It occurs on lithosols of the Mispah and Glenrosa forms. Approximately 35–60% of the soil surface is covered by rocks, with a medium size of 300–750 mm in diameter (Table 21).

Diagnostic and dominant/prominent taxa. Characteristic species are represented by species group J (Table 19). The diagnostic species found in this variant are predominantly herbaceous, namely *Rhynchosia crassifolia*, *R. totta*, *Solanum pseudocapsicum* (naturalised alien), *Thesium burkei* and *Tulbaghia ludwigiana*, and the succulent *Euphorbia schinzii*. *Cussonia transvaalensis*, *Karomia speciosa* and *Pavetta inandensis* are the diagnostic woody species. Other conspicuous woody species are *Acacia nigrescens*, *A. senegal* var. *leiorachis*, *Combretum apiculatum*, *Commiphora mollis*, *Elephantorrhiza praetermissa*, *Kirkia wilmsii*, *Ochna enermis* and *Terminalia prunioides*. *Aspilia mossambicensis*, *Clerodendrum ternatum*, *Commelina africana* and *Psiadia punctulata*. Dominant grasses include *Enneapogon scoparius*, *Eragrostis rigidior*, *Heteropogon contortus*, *Panicum deustum* and *Themeda triandra*.

Notes on floristic diversity. Floristic affinities shows a notable link with the rest of the association in species groups L and M, and with other associations in species groups U, AC and AJ (Table 19). The average number of plant species encountered per sample plot is 40 and the total number of plant species recorded for this sub-association is 123 (10 relevés), the highest total number of species recorded for the association (Table 21). Of the ten taxa of conservation value, four are SCPE endemics, six near-endemics and one of these is a Red Data List taxon (Table 20).

1.7 *Combreto apiculati–Kirkietum wilmsii nuxietosum congestae* sub-ass. nova hoc loco
Nomenclatural type: relevé 211 (holotypus)

Environmental data. This vegetation type is tall, closed woodland with patches of grassland on northern aspects of exposed norite, pyroxenite and anorthosite hills in the Steelpoort and Dwars River valleys. The sub-association occurs on soils of the Mispah form, which is an ortic A-horizon over solid rock. It lies on relatively steep sloped scarps (9°). Rock cover of the surface is high, between 50–70%, with a relatively large average rock diameter between 0.75–1.5 m (Table 21).

Diagnostic and dominant/prominent taxa. Diagnostic species for this sub-association are listed in species group K (Table 19). Diagnostic woody species are the shrubs *Acacia davyi*, *Barleria rotundifolia*, *Ficus abutifolia*, *Nuxia congesta* and *Rhoicissus sekhukhuniensis*. Diagnostic forbs include *Cyphia transvaalensis*, *Hermannia floribunda*, *Hibiscus calyphyllus*, *Ruttya ovata* and *Tetradenia brevispicata*. No diagnostic grasses occur. Prominent small trees in this vegetation unit are *Commiphora mollis*, *Croton gratissimus*, *Elephantorrhiza praetermissa*, *Grewia monticola*, *Kirkia wilmsii* and *Sterculia rogersii*. *Andropogon schirensis*, *Enneapogon scoparius*, *Eragrostis rigidior*, *Heteropogon contortus*, *Panicum deustum* and *Themeda triandra* dominate the grass layer. The herbaceous layer is sparse and rare; it does not warrant further treatment.

Notes on floristic diversity. Slight floristic affinities linked with the rest of the association in species groups L and M, and a weak connection with associations 2 to 5 (Table 19). The average number of plant species encountered per sample plot in this sub-

association is 32, with the total number of plant species being 73 taxa (three relevés) (Table 21). Nine plant taxa with conservation value are part of the sub-association, and comprise four SCPE endemic and five SCPE near-endemics. It has one of the highest numbers of Red Data List taxa (two species) recorded for any of the sub-associations in the Closed Mountain Bushveld. The two species are the endemic *Elephantorrhiza praetermissa* and the near-endemic *Asparagus clareae*, both categorised as Insufficiently Known. One taxon, the near-endemic *Cyphia transvaalensis*, is restricted to it (Table 20).

2. *Panico deustii–Dichrostachetum cinereae* ass. nova hoc loco
Nomenclatural type: relevé 149 (holotypus)

Environmental data. This is typical anomalous tall woodland on deep soils of footslopes of mountains and hills in the Steelpoort River Valley. This is another vegetation type restricted to the Steelpoort Subcentre. It is an association of deep soils and therefore occurs on the footslopes below any geological substrate. It occurs on all aspects of hills and mountains. The habitat has a rather gentle slope of 3–5°, levelling towards the Steelpoort River. Soils are divers and dependent on the mother material. Typical soils include red loam such as the Bonheim, Hutton and Shortlands forms. Average rock size is 0.1–1 m in diameter and it covers 10–50% of the soil surface (Table 21).

Diagnostic and dominant/prominent taxa. Species group R and U (Table 19) contains the characteristic species for this association, with no species shared exclusively between the sub-associations of the association. Therefore the diagnostic species will be listed under each of the sub-associations. Dominant taxa of the association include the trees/shrubs *Acacia nigrescens*, *A. senegal* var. *leiorachis*, *A. tortilis*, *Dichrostachys cinerea*, *Kirkia wilmsii* and *Terminalia prunioides*. Dominant forbs are also frequent and include *Asparagus laricinus*, *Kyphocarpha angustifolia* and the succulent *Aloe castanea*. Grasses are abundant, namely *Andropogon schirensis*, *Aristida canescens*, *Enneapogon scoparius*, *Eragrostis curvula*, *Heteropogon contortus*, *Sporobolus ioclados* and *Themeda triandra*.

Notes on floristic diversity. This association is floristically related to, and forms the ecotone between associations 1 and 3 in species groups U, Z, AA, AC and AJ (Table 19).

In this association the minimum total number of species recorded for the association is 114 (23 relevés) and the average number of plant species recorded per relevé is 35 (Table 21). Of the 20 plant taxa of conservation value that occur in this association (Table 20), 11 are SCPE endemics (the highests number recorded for any of the associations in the Closed Mountain Bushveld) and nine are SCPE near-endemics, of which one *Elephantorrhiza praetermissa* is a Red Data List taxon. Two of these taxa are restricted to this association only.

2.1 *Panico deustii–Dichrostachetum cinereae sporoboletosum stapfianii* sub-ass. nova hoc loco

Nomenclatural type: relevé 155 (holotypus)

Environmental data. This is woodland with a well-developed shrub layer on midslopes and footslopes of hills of pyroxenite, norite and anorthosite. It occurs on all aspects on red loam soils of predominantly the Bonheim form (melanic A-horizon and underlain by a pedocutanic B). The soil surface is covered by 25–40% rock, of a relatively small average size of 200–400 mm in diameter (Table 21). Slope of the habitat is usually gently sloped and average 3–5°.

Diagnostic and dominant/prominent taxa. Diagnostic species are represented by species group N (Table 19). The community is characterised by diagnostic herbaceous species such as the forbs *Polygala uncinata* and *Raphionacme velutina*, the succulent *Fockea angustifolia*, and the grasses *Cenchrus ciliaris*, *Digitaria argyrograpta* and *Sporobolus stapfianus*. Diagnostic woody species include the shrubs *Bauhinia tomentosa* (form), *Rhigozum obovatum*, *Rhus gueinzii* and *Tinnea rhodesiana*. Dominant woody species are *Acacia senegal* var. *leiorachis*, *Boscia albitrunca*, *Croton menyhartii*, *Kirkia wilmsii* and *Terminalia prunioides*. *Andropogon schirensis*, *Aristida rhiniochloa*, *Enneapogon scoparius*, *Eragrostis curvula*, *Heteropogon contortus* and *Themeda triandra* are the most dominant grasses. Conspicuous small shrubs/forbs include *Asparagus laricinus*, *Barleria saxatilis*, *Indigofera hilaris*, *Monechma divaricatum*, *Petalidium oblongifolium* and *Psiadia punctulata*.

Notes on floristic diversity. The sub-association has the same floristic affinity as the association. However, a weak relationship does exist with sub-associations 3.1 and 3.2 in species group W, probably because all occur on Bonheim soils (Table 19). The average number of species encountered per sample plot is 39, with the total number for this variant being 114 (nine relevés), both values are the highest numbers recordeded for any sub-association in this association (Table 21). It has 12 plant taxa of conservation value, that is six SCPE endemics (one is a Red Data List taxon) and six near-endemics were recorded for this sub-association (Table 20).

2.2 *Panico deustii–Dichrostachetum cinereae maeruetosum angolensis* sub-ass. nova hoc loco

Nomenclatural type: relevé 149 (holotypus)

Environmental data. This sub-association represents tall, closed woodlands on the footslopes of pyroxenite and ferrogabbro hills. It usually occurs on red loam soils of the Hutton (ortic A-horizon on a red apedale B) and Shortlands (ortic A-horizon on a red structured B) forms. The habitat lies on relatively gently sloped areas (3–5°). Rock cover on the surface is 30–50%, with rocks reaching a relatively large average size of 0.5–1 m in diameter (Table 21).

Diagnostic and dominant/prominent taxa. Diagnostic species are presented in species group O (Table 19). Diagnostic herbaceous taxa include forbs such as *Chlorophytum bowkeri*, *Evolvulus alsinoides*, *Ledebouria dolomiticola* and *Orthosiphon fruticosus*. The tree, *Maerua angolensis*, is the diagnostic woody species and the grass, *Enteropogon macrostachys*, the diagnostic grass. Other important dominant taxa are small trees/shrubs such as *Acacia senegal* var. *leiorachis*, *Croton gratissimus*, *Dichrostachys cinerea*, *Grewia flavescens* and *Terminalia prunioides*. Prominent grasses such as *Aristida canescens*, *Enneapogon scoparius*, *Panicum deustum*, *Sporobolus ioclados* and *Themeda triandra* are the most abundant in the sub-association. *Barleria saxatilis*, *Kyphocarpha angustifolia* and *Sanseviera hyacinthoides* are the most dominant forbs.

Notes on floristic diversity. The sub-association shows the same floristic affinities as the association. In this sub-association the number of plant species encountered per sample plot averages 38, with a total number of 96 plant taxa (five relevés) (Table 21). Of the 12 taxa with conservation value, seven are SCPE endemics (the second highest for the study and the highest for the association) and five are near-endemics (Table 20). One endemic is a Red Data List taxon.

2.3 *Panico deustii–Dichrostachetum cinereae melhanietosum prostratae* sub-ass. nova hoc loco

Nomenclatural type: relevé 299 (holotypus)

Environmental data. In the SCPE this sub-association represents tall, closed woodland on red loam Hutton form soils. The habitat is found on footslopes of mountains with a granofire base. Slope is predominantly level, but can be 3–5° (Table 21). It occurs on all aspects. Rock cover percentage is below average and varies from 10 to 15% and rock size is relatively small between 100–150 mm in diameter (Table 21).

Diagnostic and dominant/prominent taxa. Species group P (Table 19) contains the characteristic species for this sub-association, with diagnostic species including herbaceous taxa, namely the grass *Diheteropogon amplectens*, and the forbs *Crabbea angustifolia*, *Jatropha zeyheri*, *Melhania prostrata* and *Ptycholobium plicatum*. *Bolusanthus speciosus* is the only diagnostic tree. Other prominent taxa include the grasses *Andropogon schirensis*, *Enneapogon scoparius*, *Eragrostis curvula*, *Heteropogon contortus*, *Panicum deustum* and *Themeda triandra*. The sub-association is dominated by trees and shrubs, with very few prominent herbs. Dominant trees include *Acacia senegal* var. *leiorachis*, *Combretum hereroense*, *Dichrostachys cinerea*, *Euclea divinorum*, *Grewia vernicosa* and *Kirkia wilmsii*.

Notes on floristic diversity. The sub-association shows the same floristic affinities as the association. The average number of plant species encountered per sample plot in this sub-association is 32, with the total number being 65 taxa (four relevés) (Table 21). Nine taxa with conservation value occur in this sub-association (Table 20), namely two SCPE

endemics and seven near-endemics, which is the second highest number for the association and the highest for the sub-association. One Red Data List taxon was also recorded. No plant taxon with conservation value was restricted to it.

2.4 *Panico deustii–Dichrostachetum cinereae melhanietosum acuminatae* sub-ass. nova hoc loco

Nomenclatural type: relevé 117 (holotypus)

Environmental data. In the SCPE this sub-association is tall, closed woodland of footslopes, with a poorly developed grass layer. The habitat is characterised by bands of deep and shallow soils, usually associated with calcrete outcrops. It occurs on Glenrosa and Shortlands soil forms, hence the occurrence of deep (>300 mm) and shallow soils (<300 mm). It occurs on all aspects and gentle slopes of 3–5°. Rock cover and average size are an average 15–40% of the soil surface and 300–500 mm in diameter, respectively (Table 21).

Diagnostic and dominant/prominent taxa. Species group Q contains the diagnostic species for this sub-association, which are characterised by the trees *Mystroxylon aethiopicum* subsp. *schlechteri* and *Gardenia volkensii* (Table 19). Diagnostic herbaceous taxa include the forbs *Cyphostemma* sp. nov. (*Siebert 1383*), *Melhania acuminata*, *Pavonia senegalensis*, *Phyllanthus incurvus* and *Plectranthus neochilus*. Other prominent species of the sub-association include the trees/shrubs *Acacia tortilis*, *Dichrostachys cinerea*, *Grewia flavescens*, *Kirkia wilmsii* and *Terminalia prunioides*. Conspicuous forbs are *Asparagus laricinus*, *Sida dregei* and the succulent *Aloe castanea*. Prominent grasses are *Enneapogon cenchroides*, *Panicum deustum*, *P. maximum* and *Sporobolus ioclados*.

Notes on floristic diversity. Floristic affinities are the same as for the association. The average number of species encountered per sample plot in this sub-association is 29, with the total number of plant species numbered at 82 taxa (five relevés) (Table 21). Nine taxa of conservation value are part of the sub-association, of which five are SCPE endemics and four are SCPE near-endemics (Table 20). One taxon with conservation value, namely an endemic form of *Gnidia caffra* (*Van Wyk & Siebert 12975*), is restricted to the sub-association.

II. *Eragrostis curvula–Combretum hereroense* community of valleys

Environmental data. The vegetation is a closed broad-leaved bushveld of valleys. It occurs predominantly on level slopes (1–3°), only on footslopes and valleys. Soils are shallow (eg. Glenrosa form) on rocky exposures to deep (eg. Bonheim form) alluviums between the mountains. The soil surface is covered by 10–55% of rock with an average diameter of 0.1–2 m (Table 21).

Diagnostic and dominant/prominent taxa. No diagnostic species define this alliace (Table 2). However, certain species are dominant and include the trees *Combretum hereroense*, *Euclea divinorum* and *Rhus engleri*, the grasses *Aristida congesta*, *Eragrostis curvula*, *Heteropogon contortus* and *Panicum deustum*.

Notes on floristic diversity. Floristic links with the other alliances are visible in species groups U, Z, AA, AC, AJ, AN and AP (Table 19). Strong floristic links exist with certain groups in the other alliance. The average number of species encountered per sample plot for this alliance is 36, with the total number of plant species being a minimum of 131 taxa (47 relevés) (Table 21). There are 29 plant taxa of conservation value, 15 are SCPE endemics, 13 are SCPE near-endemics and five are Red Data List taxa (Table 20). Of these taxa, 11 are restricted to this alliance in the SCPE.

3. *Fingerhuthio africanae–Boscietum foetidae* ass. nova hoc loco
Nomenclatural type: relevé 202 (holotypus)

Environmental data. This association represents open tall woodlands on dry, warm, predominantly northernly aspects of mountains and hills. The mother material can be any of the following: ferrogabbro, norite, pyroxenite and anorthosite. It occurs on alluvium, which covers these substrates on footslopes and valleys. Relatively deep soils of the Bonheim, Hutton, Shortlands and Valsrivier forms are dominant, but are interspersed with Glenrosa lithosols. It lies on relatively level areas (1–3°). Rock cover on the surface is below average, between 10–40%, with rocks reaching a small average size of 100–400 mm in diameter (Table 21).

Diagnostic and dominant/prominent taxa. Diagnostic species are presented in species group S (Table 19). Diagnostic herbaceous taxa include succulent forbs, namely *Aloe burgersfortensis* and *Sarcostemma viminale*. *Boscia foetida* is the diagnostic woody species and *Fingerhuthia africana* the diagnostic grass. Other important dominant taxa are small trees/shrubs, namely *Boscia albitrunca*, *Combretum hereroense*, *Euclea divinorum* and *Terminalia prunioides*. Prominent forbs are *Asparagus suaveolens*, *Kyphocarpha angustifolia*, *Sanseviera hyacinthoides* and *Stylochaeton natalensis*. Grasses dominate the association and especially by *Aristida canescens*, *A. congesta*, *Eragrostis curvula*, *Panicum deustum* and *P. maximum*.

Notes on floristic diversity. The association has a strong link with associations 1 and 2 in species group AA and AC, associations 2 and 4 in species groups AJ, and associations 2 and 5 in species group AN (Table 19). The average number of species encountered per sample plot is 36, with a minimum total number of 131 plant taxa, which is the highests number recorded for any of the associations in the study area (25 relevés) (Table 21). Altogether 20 plant taxa of conservation value occur in this association and comprise nine SCPE endemics and 10 SCPE near-endemics (Table 20). Of the 20 taxa two are Red Data List taxa. Three taxa of conservation value are restricted to the association.

3.1 *Fingerhuthio africanae–Boscietum foetidae elaeodendretosum transvaalensis* sub-ass. nova hoc loco
Nomenclatural type: relevé 229 (holotypus)

Environmental data. This sub-association is tall, closed, but sparse woodland on pyroxenite and derived alluvium. It occurs on footslopes of hills and mountains, predominantly on westerly aspects. It occurs on red loam soils of the Bonheim (pedocutanic B), Hutton (red apedale B) and Shortlands (red structured B) forms. The soil surface is sparsely covered by 10–20% rock, which is of a small average size of 100–300 mm in diameter (Table 21). Slope of the habitat is usually level, between 1–3°.

Diagnostic and dominant/prominent taxa. Diagnostic species are represented by species group T (Table 19). The community is characterised by diagnostic forbs such as

Abutilon pycnodon, *Helichrysum rugulosum* and *Indigofera nebrowniana*. *Eragrostis capensis* is the diagnostic grass and *Catha transvaalensis* and *Elaeodendron transvaalensis* the diagnostic woody tree species. Dominant woody species are the trees *Acacia tortilis*, *Albizia anthelmintica*, *Croton gratissimus*, *Euclea divinorum*, *Rhus engleri* and *Terminalia prunioides*. *Aristida congesta*, *Eragrostis curvula*, *Heteropogon contortus*, *Panicum deustum* and *Themeda triandra* are the most important conspicuous grasses. Abundant forbs are frequent in the sub-association and include *Barleria saxatilis*, *Chaetacanthus costatus*, *Petalidium oblongifolium*, *Waltheria indica* and the succulent *Sarcostemma viminale*.

Notes on floristic diversity. The sub-association shows a similar floristic relationship as the association. However, it is doubtful whether this sub-association belongs with either association 2 or 3. This sub-association was included into association 3 on grounds of TWINSPAN classification. The community has a strong floristic identity in species group U with associations 1 and 2 (Table 19). It is, however, predominantly linked with sub-association 3.2 in species group W and with the rest of the association in species group Z and AN. It can therefore be seen as an ecotone between footslope and valley vegetation, as reflected by the occurrence of *Themeda triandra*. This sub-associations average number of plant species encountered per sample plot is 38, with the total number for this variant being 98 (six relevés) (Table 21). Four SCPE endemics and eight SCPE near-endemics were recorded, with the near-endemic figure the highest for the association and the whole study (Table 20). Of its 12 taxa of conservation value, no taxa are restricted to the sub-association.

3.2 *Fingerhuthio africanae–Boscietum foetidae aloetosum globuligemmae* sub-ass. nova hoc loco
Nomenclatural type: relevé 202 (holotypus)

Environmental data. The sub-association is low, dense woodland, with a well-developed herbaceous layer. It is associated with deep (> 1 m) soils in valleys. It occurs especially in the Steelpoort River Valley. Aspect is usually east or west due to the general southwest-northeast flow of the Steelpoort River. It lies on gentle slopes of 1–3°. Soils are

characteristically a red loam with a pedocutanic B-horizon, such as the Bonheim (melanic A-horizon) and Valsrivier (ortic A-horizon) forms. Approximately 10–50% of the soil surface is covered by rocks, with a relatively small average size of 100–200 mm in diameter (Table 21).

Diagnostic and dominant/prominent taxa. Diagnostic species representing this sub-association are presented in species group V (Table 19). *Acacia luederitzii*, *Cadaba aphylla*, *C. natalensis* and *Ximenia caffra* are the diagnostic shrubs of the sub-association. *Eragrostis pseudoscleranthα* and *Setaria incrassata* are the diagnostic grasses. The vegetation type is characterised by forbs and includes *Barleria prionitis*, *Chascanum pinnatifidum*, *Hibiscus micranthus*, *Indigofera enormis*, *Lotononis macrosepala*, *Pearsonia uniflora* and the succulent *Stapelia gigantea*. Important trees/shrubs of the association are *Acacia gerrardii*, *A. grandicornuta*, *A. nilotica*, *A. tortilis*, *Boscia albitrunca*, *Dichrostachys cinerea*, *Euclea divinorum*, *Grewia flava*, *Rhus engleri* and *Terminalia prunioides*. Prominent herbaceous taxa include are the succulents *Aloe burgersfortensis*, *A. globuligemma*, *Kleinia longiflora* and *Sanseviera hyacinthoides*. Abundant grasses are *Aristida canescens*, *Enneapogon cenchroides*, *Eragrostis curvula*, *E. lehmanniana*, *Fingerhuthia africana*, *Panicum deustum* and *Sporobolus fimbriatus*.

Notes on floristic diversity. The sub-association shows a strong floristic relationship with sub-associations 3.1 and 3.3 in species groups W and Y respectively. It has a strong floristic link with other sub-associations in species groups AA and AN (Table 19). The average number of plant species encountered per sample plot for this sub-association is 43, the highest for the association, with the total number of plant species being 131 taxa (8 relevés), the highest total for a sub-association in the association as well as the whole study (Table 21). Eleven taxa with conservation value occur in this sub-association, namely five SCPE endemics and six SCPE near-endemics (Table 20).

3.3 *Fingerhuthio africanae–Boscietum foetidae euphorbietosum ingentis* sub-ass. nova hoc loco

Nomenclatural type: relevé 306 (holotypus)

Environmental data. This vegetation type is tall closed woodland of predominantly dry northern, but also west and east aspects of mountain footslopes and valley. It lies on moderately sloped footslopes and valleys (1–3°). The community is restricted to ferrogabbro on footslopes and alluvium in the valleys. Thus the soils are of the Bonheim, Valsrivier and Glenrosa form. Rock cover is relatively low, with only 5–20% of the soil surface covered by rocks, with an average diameter of 50–400 mm (Table 21).

Diagnostic and dominant/prominent taxa. Diagnostic species are represented by species group X (Table 19). Only one grass species, *Eleusine coracana*, is diagnostic of the sub-association. *Indigofera circinnata* and *Ptycholobium contortum* are the diagnostic forbs, and *Ammocharis coranica* the diagnostic geophyte. *Erythrina lysistemon* is the diagnostic tree. Prominent trees of the sub-association are *Acacia nilotica*, *A. tortilis*, *Boscia albitrunca*, *Dichrostachys cinerea*, *Ehretia rigida*, *Euphorbia ingens* and *Rhus engleri*. Dominant herbaceous taxa include the succulent *Aloe greatheadii* and the geophyte *Urginea epigea*. The grasses *Eragrostis curvula*, *E. lehmanniana*, *Fingerhuthia africana*, *Panicum deustum*, *Schmidtia pappophoroides* and *Sporobolus fimbriatus*.

Notes on floristic diversity. The sub-association shows the same floristic relationships as the association. The average number of species encountered per sample plot is 29 and the total number recorded for this sub-association being 83 (six relevés) (Table 21). Four plant taxa with conservation value occur in this sub-association and comprise two SCPE endemics and two SCPE near-endemics (Table 20). These numbers are of the lowest recorded for any of the Closed Mountain Bushveld communities.

3.4 *Fingerhuthio africanae–Boscietum foetidae sesamothamnetosum lugardii* sub-ass. nova hoc loco

Nomenclatural type: relevé 311 (holotypus)

Environmental data. This sub-association represents dense shrublands, of undulating norite and anorthosite landscapes on footslopes. It is mostly restricted to Hutton soils interspersed with Glenrosa soils in the Burgersfort region. Easterly and northernly aspects are predominant. Slopes are gentle (3–5°). Rocks cover approximately 30–40% of the soil surface, with a diameter averaging between 400 and 500 mm (Table 21).

Diagnostic and dominant/prominent taxa. The diagnostic species for the sub-association are presented in species group AB (Table 19). The diagnostic species include the woody shrubs *Cadaba termitaria*, *Grewia bicolor*, *Maerua edulis*, *M. juncea*, *Triaspis hypericoides* var. *nelsonii*, and the succulent small tree *Sesamothamnus lugardii*. *Aristida adscensionis*, *Melinis repens*, *Pogonarthria squarrosa* and *Stipagrostis hirtigluma* var. *patula* are the diagnostic grasses. Diagnostic herbaceous taxa are common and include the succulents *Cissus quadrangularis*, *Euphorbia* sp. nov. (*Van Wyk 13194*), *Holubia saccata* and *Pterodiscus ngamicus*, the forbs *Cleome hirta*, *Decorsea schlechteri*, *Felicia mossamedensis*, *Indigofera heterotricha*, and the geophyte *Albuca* sp. nov. (*Siebert 856*). Other conspicuous forbs of the sub-association are *Justicia protracta*, *Stylochaeton natalensis* and the succulent *Aloe burgersfortensis*. Prominent woody species include *Boscia albitrunca*, *B. foetida* and *Grewia vernicosa*. The sub-association is characterised by the following grasses, *Aristida canescens*, *Eragrostis curvula*, *Fingerhuthia africana*, *Melinis nerviglumis* and *Panicum deustum*.

Notes on floristic diversity. Floristic affinities are the same as for the association. However, this plant ommunity can probably be upgraded to the level of association. It does not show any specific relationships with other sub-associations. It shows a strong floristic affinity with the Mopaneveld north of the Soutpanseberg (Du Plessis 2001). The average number of plant species encountered per sample plot is 33 and the total number of plant species for this sub-association is 55 (five relevés) (Table 21). Of the seven taxa of conservation value, three are SCPE endemics, three SCPE near-endemics and two Red

Data List taxa (Table 20). Three Red Data List taxa are also found. Three taxa with conservation priority are restricted to the sub-association, namely the two SCPE endemics *Albuca* sp. nov. (*Siebert 856*) and *Euphorbia* sp. nov. (*Van Wyk 13194*), the Red Data List taxon *Pachypodium saundersii* (Insufficiently Known for Swaziland). Species of biogeographic significance due to their disjunct distributions are *Polygala krumanina* (Karoo disjunct) and three Limpopo River Valley disjuncts, namely the small succulent trees *Sesamothamnus lugardii* and *Commiphora tenuipetiolata*, and herbaceous climber *Decorsea schlechteri*. The sub-association is similar to the *Sesamothamnus lugardii-Catophractes alexandri* Low Open Woodland (Visser *et al.* 1996).

4. *Hippocrateo longipetiolatae–Euphorbietum tirucalli* ass. nova hoc loco
Nomenclatural type: relevé 400 (holotypus)

Environmental data. Association of short, dense shrubland on alluvium, norite and anorthosite. It is restricted to midslopes, footslopes and valleys. This vegetation type is characteristic of the over-grazed areas between Burgersfort and Mecklenburg. Soils are of the Glenrosa, Mispah and Valsrivier forms, which are interspersed with black turf soils. The habitat occurs on all aspects and is gently to moderately sloped (1–7°). Approximately 45(10)-65 % of the soil surface is covered by stones with a relatively large average diameter of 0.5(0.1)-2 m (Table 21).

Diagnostic and dominant/prominent taxa. Diagnostic species are represented in species group AD (Table 19). The vegetation unit is dominated by diagnostic forbs, and includes *Dicoma tomentosa*, *Ledebouria marginata*, *Leucas capensis*, *Senna italica*, and the naturalised aliens *Catharanthus roseus* and *Schkuhria pinnata*. *Chloris virgata* is the only diagnostic grass. Diagnostic woody species are restricted to the scandent shrub *Hippocratea longipetiolata* and the succulent shrub *Euphorbia tirucalli*. Other prominent plant taxa of the association include the forbs *Abutilon guineense*, *Ocimum americanum* and the alien *Zinnia peruviana*, the grasses *Aristida congesta*, *A. rhiniochloa*, *Enneapogon cenchroides* and *Heteropogon contortus*, the shrub *Diospyros lycioides* subsp. *lycioides*, and the naturalised succulent tree aliens *Cereus peruvianus* and *Opuntia ficus-indica*.

Notes on floristic diversity. A strong floristic affinity exists with the valley bushveld of the region in species group AJ (Table 19), probably due to the similar habitats. However, the intense harvesting of firewood in this vegetation type is evident in species group AN, where the absence of woody species is distinct. The average number of species encountered per sample plot for this association is 40, which is the highest average recorded for any of the associations in the study area. The total number of plant species recorded is a minimum of 130 taxa (14 relevés) (Table 21). This association has 18 plant taxa with conservation value, of which 10 are SCPE endemics and eight SCPE near-endemics (Table 20). Of these, a high number (3) plant species are Red Data List taxa and one a taxon with a biogeographically noteworthy distribution and rarity in nature, *Eulophia leachii*. Six plant taxa with a conservation value, the most for the Closed Mountain Bushveld, are restricted to the association.

4.1 *Hippocrateo longipetiolatae-Euphorbietum tirucalli emilietosum transvaalensis* sub-ass. nova hoc loco
Nomenclatural type: relevé 395 (holotypus)

Environmental data. The habitat is a scattered dense shrubland on midslopes and footslopes of heavily grazed hills to the east of the Leolo Mountains. It occurs on no specific aspect and these are moderately sloped (5–7°). It is found predominantly on shalow Mispah soils overlying anorthosite and norite. An average rock cover of approximately 45–55% covers the soil surface, with a relatively large size of 1–2 m in diameter (Table 21).

Diagnostic and dominant/prominent taxa. Characteristic species are presented in species group AE (Table 19). There are predominantly herbaceous species diagnostic for this sub-association and include the indigenous forbs *Cyanotis speciosa*, *Emilia transvaalensis*, *Eulophia petersii*, *Lophiocarpus tenuissimus*, *Monsonia angustifolia*, *Ruellia patula*, *Thamnosma africana*, the geophyte *Ledebouria floribunda*, the sedge *Cyperus margaritaceus*, the fern *Cheilanthes involuta*, and the naturalised alien weeds *Acalypha indica*, *Atriplex lindleyi*, *Gomphrena celosioides* and *Mollugo nudicaulis*. The following two grasses are diagnostic: *Brachiaria brizantha* and *Schizachyrium sanguineum*. *Grewia vernicosa* and *Hippocratea longipedunculata* are prominent shrubs. Forbs such as

Geigeria ornativa, *Schkuhria pinnata* and *Waltheria indica* are the prominent forbs. *Aristida rhiniochloa*, *Melinis nerviglumis*, *Panicum natalense* and especially *Heteropogon contortus* are the most abundant grasses.

Notes on floristic diversity. Floristic relationships are the same as for the association. The average number of plant species encountered per sample plot in this association is 45, the highest for any sub-association in the study, with the total number of plant species being 97 taxa (three relevés) (Table 21). There are eight plant taxa of conservation value in the association (Table 20), namely four SCPE endemics and four SCPE near-endemics, of which one endemic is a Red Data List taxon.

4.2 *Hippocrateo longipetiolatae–Euphorbietum tirucalli aristidetosum transvaalensis* sub-ass. nova hoc loco
Nomenclatural type: relevé 400 (holotypus)

Environmental data. This is low closed woodland of midslopes and footslopes, usually associated with small kloofs. It lies on gentle slopes of 3–5° on all aspects. The geological substrate is norite and anorthosite and soils are predominantly of the Glenrosa form. A large proportion of approximately 45–65% of the soil surface is covered by large rocks, with a diameter of 0.5–2 m (Table 21).

Diagnostic and dominant/prominent taxa. Diagnostic species are represented by species group AF (Table 19). Small trees/shrubs are diagnostic of this community, namely *Calodendrum capense*, *Combretum petrophilum*, *Obetia tenax*, *Tecomaria capensis* and *Vangueria cyanescens*. Diagnostic herbs occur and include the fern *Cheilanthes hirta*, the climber *Clematis brachiata*, and the forbs *Commelina erecta*, *Hibiscus cannabinus*, *Leonotis intermedia*, *Leucas martinicensis*, *Orthosiphon tubiformis*, *Plectranthus venterii*, *Thunbergia neglecta* and *Tragia rupestris*. Diagnostic grasses are *Aristida transvaalensis*, *Brachiaria serrata*, *Mosdenia leptostachys* and *Urochloa panicoides*. Other taxa of importance are the grasses *Aristida congesta* and *Melinis nerviglumis*, the forbs *Hibiscus barnardii* and *Kedrostis foetedissima*, and the shrubs *Grewia vernicosa*, *Hippocratea longipetiolata* and the conspicuous large succulent *Aloe castanea*.

Notes on floristic diversity. Floristic relationships are the same as for the association. However, it seems as if this sub-association might be at an intermediate stage of disturbance, for it shares alien plant species with sub-associations 4.1 and 4.3 in species groups AG and AI respectively (Table 19). The average number of plant species encountered per sample plot is 38, with the total number of plant species being 130 taxa (six relevés), which is the highest number for any sub-association in the association (Table 21). This sub-association has the highest number of plant taxa with conservation value in this particular Closed Mountain Bushveld major vegetation type. The 14 taxa with a conservation priority include nine SCPE endemics (the highest number for the association and the study as a whole) and five SCPE near-endemics (Table 20). Of these three are Red Data List taxa and three species are resticted to the sub-association, namely the SCPE endemic *Plectranthus venteri* and the SCPE near-endemics *Orthosiphon tubiformis* and *Combretum petrophilum* (Rare).

4.3 *Hippocrateo longipetiolatae–Euphorbietum tirucalli bothriochloetosum insculptae* sub-ass. nova hoc loco
Nomenclatural type: relevé 393 (holotypus)

Environmental data. In the SCPE this sub-association represents open grazing between fields, characterised by large trees (> 10 m) that are remnants of former closed woodland. It is common on all aspects of footslopes and valleys. The habitat is characterised by alluvium and exposed layers of norite rock. Average rock diameter is below average for the study area and approximately 100–300 mm, covering a low percentage of the soil surface, namely 10–20%. It is characterised by gentle slopes (1–3°). Soil types are characterised black clays and turfs, predominantly the Steendal form.

Diagnostic and dominant/prominent taxa. The diagnostic species for this sub-association are presented in species group AH (Table 19). Diagnostic species of the vegetation type includes the indigenous forbs *Commicarpus plumbagineus*, *Cucumis zeyheri*, *Dyschoriste rogersii*, *Indigastrum parviflorus*, *Indigofera spicata* and *Sida cordifolia*, and the alien weeds *Alternanthera sessilis*, *Corchorus tridens*, *Flaveria bidentis*,

Solanum nigrum and *Xanthium strumarium*. *Combretum imberbe* is a large diagnostic tree. The weedy shrubs *Gossypium herbaceum* (indigenous) and *Senna didymobotrya* (alien), the alien succulents *Agave americana* and *A. sisalana* are also diagnostic. Large stands occur of the diagnostic grasses *Bothriochloa insculpta* and *Ischaemum fasciculatum*. *Aristida stipitata*, *Brachiaria eruciformis*, *Cynodon dactylon*, *Eragrostis cilianensis* and *Urochloa oligotricha* are the other diagnostic grasses. Prominent plant taxa include large specimens of *Acacia karroo*, *Boscia foetida*, *Schotia brachypetala*, *Ziziphus mucronata* and the succulent *Euphorbia tirucalli*. Conspicuous forbs are *Abutilon guineense*, *Achyranthes aspera* and *Sesamum triphyllum*. *Aristida congesta*, *A. rhiniochloa*, *Heteropogon contortus* and *Panicum maximum* are the abundant grasses.

Notes on floristic diversity. A strong floristic relationship exists with association 5 in species group AO (Table 19). Probably the result of both vegetation types occurring on alluvium near rivers. The average number of plant species encountered per sample plot is 38, with the total number of plant species recorded being 122 taxa (five relevés) (Table 21). There are six taxa of conservation value occurring in this sub-association, namely three SCPE endemics and three SCPE near-endemics (Table 20). This is one of the lowest numbers of taxa with conservation status recorded for sub-associations in this bushveld type.

5. *Celtido africanea–Combretetum erythrophyllii* ass. nova hoc loco
Nomenclatural type: relevé 184 (holotypus)

Environmental data. This riparian vegetation represents closed thickets with an alien plant species component in valleys along larger rivers such as the Steelpoort and Olifants. It is associated with the areas between the rural settlements and fields, and the rivers. It is a vegetation unit on predominantly red loam Oakleaf soils (ortic A-horizon and a neocutanic B-horizon). The slope is more or less level (1–5°), characteristic of the large alluvium filled valleys. Rock cover percentage is relatively low and varies from 5 to 40%, and average rock diameter is 50–300 mm (Table 21).

Diagnostic and dominant/prominent taxa. Species group AK contains the diagnostic species for this association (Table 19). Woody species are diagnostic of the sub-association, namely the indigenous trees *Celtis africana*, *Combretum erythrophyllum*, *Ficus sur*, *Olea europaea*, *Spirostachys africana*, the alien *Melia azedarach*, and the shrubs *Lippia javanica* and *Rhus pyroides*. Diagnostic forbs include *Asparagus racemosus*, *Pavonia burchellii*, *Sida spinosa*, and the climber *Secamone filiformis*. *Cymbopogon validus* is the only diagnostic grass. Other important dominant taxa include the woody species *Acacia karroo*, *Diospyros lycioides* subsp. *lycioides*, *Flueggea virosa*, *Hippobromus pauciflorus* and *Ziziphus mucronata*. Prominent forbs are *Achyranthes aspera*, *Cardiospermum corindum* and *Hypoestes aristata*. Prominent grasses in the association are *Panicum deustum* and *Sporobolus fimbriatus*.

Notes on floristic diversity. A floristic link exists with sub-association 4.3 in species group AO, and with sub-associations 1.1 and 1.2 in species group AP (Table 19). A slight floristic relationship is also visible with certain sub-associations of association 2 and 3 in species group AN (Table 19). The average number of species encountered per sample plot is 30, and the minimum total number of plant species for this sub-association is 66 (eight relevés). Three plant taxa of conservation value occur in this association, namely two SCPE endemics, one SCPE near-endemic taxon. This association has no Red Data List taxa and one taxon that merits conservation priority is restricted to it.

5.1 *Celtido africanea–Combretetum erythrophyllii acacietosum caffrae* sub-ass. nova hoc loco

Nomenclatural type: relevé 177 (holotypus)

Environmental data. This vegetation type is closed scattered woodland along the Steelpoort River in the broad valleys between mountains. The habitat is predominantly underlain by deep alluvial soils, especially by the red loam Oakleaf form. It lies on level slopes of 1–3°, on no specific aspect. Soil surface cover by rock is low for the study area, namely 5–20%, with a diameter averaging between 100 and 300 mm (Table 21).

Diagnostic and dominant/prominent taxa. The diagnostic species are represented by species group AL (Table 19), with the woody species, *Acacia caffra*, *Tarchonanthus camphoratus* and *Zanthoxylum thorncroftii* conspicuous in the sub-association. No grasses are diagnostic, but there is one diagnostic forb, *Barleria obtusa*. *Acacia karroo*, *Celtis africana*, *Combretum erythrophyllum*, *Cryptolepis oblongifolium*, *Diospyros lycioides* subsp. *lycioides*, *Ehretia rigida*, *Hippobromus pauciflorus*, *Rhus pyroides* and *Ziziphus mucronata* are other dominant woody species of the sub-association. Important dominant grasses include *Cymbopogon validus*, *Panicum deustum* and *Sporobolus fimbriatus*. Common forbs are *Achyranthes aspera*, *Asparagus racemosus*, *Hypoestes aristata* and *Raphionacme galpinii*.

Notes on floristic diversity. Floristic links are the same as for the association. The average number of plant species encountered per sample plot is 32, with the total number for this sub-association 52 (four relevés) (Table 21). It has three taxa of conservation value, namely two SCPE near-endemics and one SCPE near-endemic (Table 20).

5.2 *Celtido africanea–Combretetum erythrophyllii acacietosum galpinii* sub-ass. nova hoc loco

Nomenclatural type: relevé 184 (holotypus)

Environmental data. The vegetation is tall, closed woodland on the banks of rivers in the SCPE. Hence, the vegetation unit is restricted to the broad valleys. The community is usually encountered as meandering vegetation (gallery woodland) on riverbanks amidst any of the communities discussed in the paper. It occurs on no specific aspects and a gentle slope (1–5°). It is found predominantly on deep alluvial soils of the Oakleaf form. Rock cover is average and approximately 5–40% of the soil surface, with a relatively small average diameter of 50–100 mm (Table 21).

Diagnostic and dominant/prominent taxa. Characteristic species are presented in species group AM (Table 19). The diagnostic herbaceous species for this sub-association are the forbs *Acalypha villicaulis* and *Kleinia fulgens*, and the sedges *Bulbostylis burchellii* and *Fuirena pubescens*. Diagnostic grasses include *Andropogon eucomis*, *Hyparrhenia*

filipendula and the alien, *Paspalum dilatatum*. *Acacia galpinii*, *Syzygium cordatum* and the alien, *Morus japonica*, are the diagnostic woody species. *Acacia karroo*, *Celtis africana*, *Combretum erythrophyllum*, *Diospyros lycioides* subsp. *lycioides*, *Ficus sur*, *Olea europea* subsp. *africana* and *Spirostachys africana* are the dominant trees, *Lippia javanica* is a common shrub, *Achyranthes aspera* and *Pavonia burchellii* are conspicuous forbs, and *Panicum deustum*, *P. maximum* and *Sporobolus fimbriatus* the most abundant grasses.

Notes on floristic diversity. Floristic relationships are the same as for the association. For this sub-association the average number of plant species encountered per sample plot is 28, with the total number of species being 66 taxa (four relevés) (Table 21). There are three plant taxa of conservation value in the association (Table 20), namely two SCPE endemics, one SCPE near-endemic. One plant species with a disjunct distribution, *Gnidia polycephala*, which has its main distribution area in the Northern Cape, is restricted to this sub-association in the SCPE.

8.4 Vegetation key

A vegetation key is presented to aid with the identification of the various syntaxa (Table 22). The definitions are broad indications of typical groups and should be seen as a guideline. A diagnostic characteristic of the vegetation or habitat is given, followed by the most diagnostic and visual species of a group. The first species is restricted to the specific group only, and the second is dominant in the group, but also occurs in other groups. Where one species is given, no species was restricted to the group only.

8.5 Ordination

On a local scale the Closed Mountain Bushveld is characterised by dry woodlands, which is quite distinctive from the Open Mountain Bushveld's low diversity of small trees/shrubs. The structure of this vegetation type is similar to that of typical Mixed Bushveld (Van Rooyen & Bredenkamp 1996) and does not have the stunted, sparse structure of the Open Mountain Bushveld. An extremely heterogeneous environment determines the plant communities within the Closed Mountain Bushveld. A combination of many factors such as

terrain type (slope or aspect), soil depth (lithosols or alluvium), soil moisture (riverbanks or open plains) or anthropogenically altered areas (fields or overgrazed areas), affects the species composition of these plant communities. The ordination indicated the gradients caused by the topography.

The scatter diagram displays the distribution of relevés along the first and second ordination axes (Figure 14). The vegetation units are represented as groups, their distribution on the diagram corresponding with certain physical environmental conditions. The terrain type, and consequently soil moisture, determines a definite gradient that is depicted by both the first (eigen value = 0.700) and second axis (eigen value = 0.499).

Topography influences the slope and soil depth, which in turn determines soil fertility and moisture retention. The gradient on the x-axis expresses nutrient levels, where the soils of the valleys on the right have higher concentrations than those of the hills on the left. This is supported by the high density of agriculture on the alluvium soils of the valleys, and hence the greater disturbance in these areas on the right of the scatter diagram. On the y-axis, the gradient indicates higher moisture availibity at the bottom of the scatter diagram, because high rock cover percentages reduces water evaporation in these communities, while other plant communites at the bottom of the graph are on the banks of permanent rivers. In the valleys the soils are clay-loams and on the rocky hillsides light clays. These loams and clays have lower water retention ability than the calcareous soils at the top of the scatter diagram, and therefore higher moisture availability. Calcium-rich soils have higher salt concentrations, which result in high moisture levels, but less available water. It is therefore expected that the calcareous soils would harbour a vegetation type with floristic elements that are common in the more arid Mopaneveld north of the Soutpansberg.

All these gradients correlate closely with each other and have a strong influence on the vegetation structure and species composition. The three most dominant and conspicuous taxa of each growth form (trees/shrubs/suffrutices, forbs/sedges and grasses) are given for each of the eight major vegetation types depicted in the scatter diagram (Table 23).

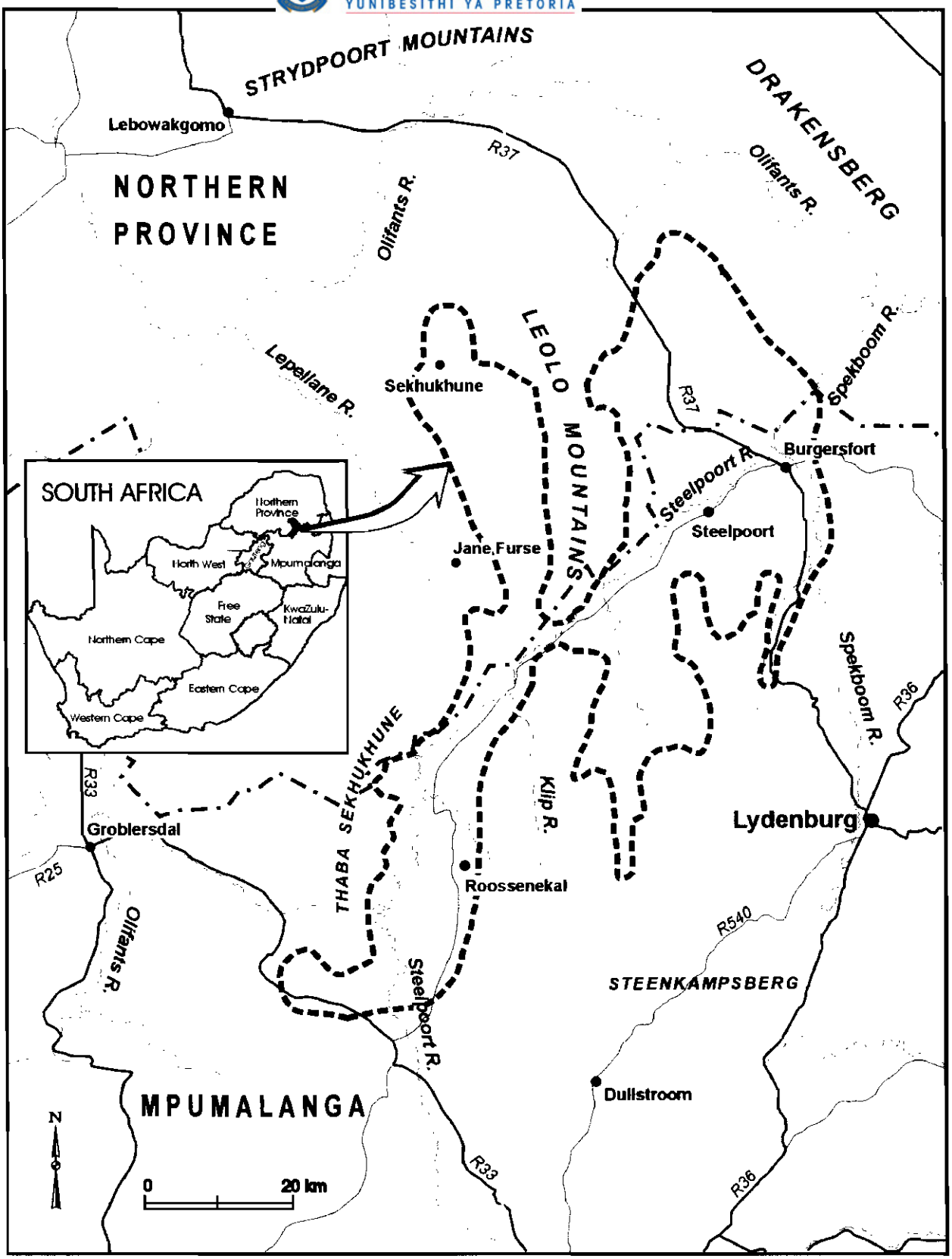

Figure 13 Location of the Closed Mountain Bushveld of the Sekhukhuneland Centre of Plant Endemism in the Northern Province and Mpumalanga, South Africa.

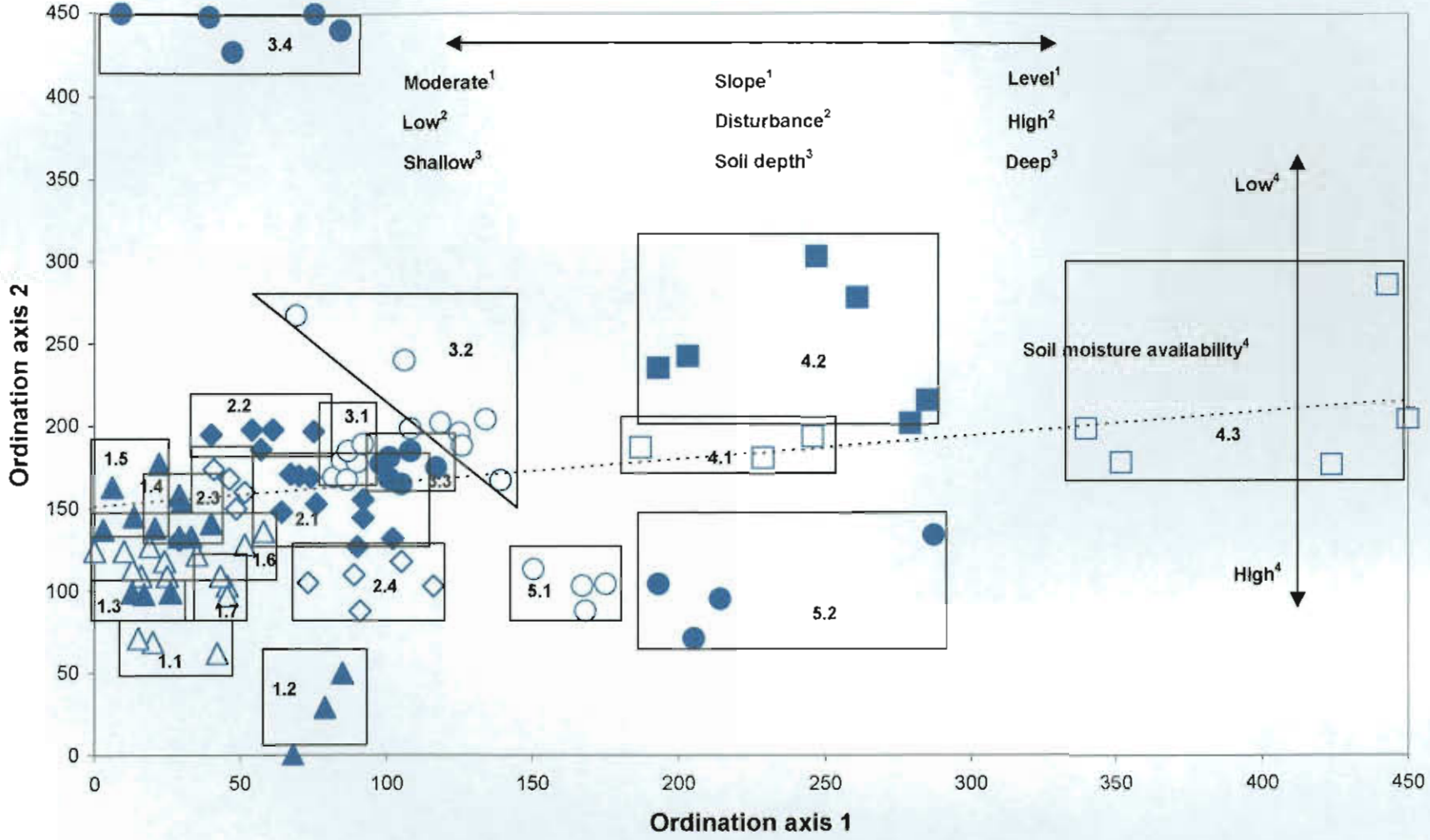

Figure 14 Relative positions of all the releves along the first and second axis of the ordination of the Closed Mountain Bushveld of the Sekhukhuneland Centre of Plant Endemism. Numbers correspond with the plant communities in Table 19.

Table 19 A phytosociological table of the Closed Mountain Bushveld of the Sekhukhuneland Centre of Plant Endemism.

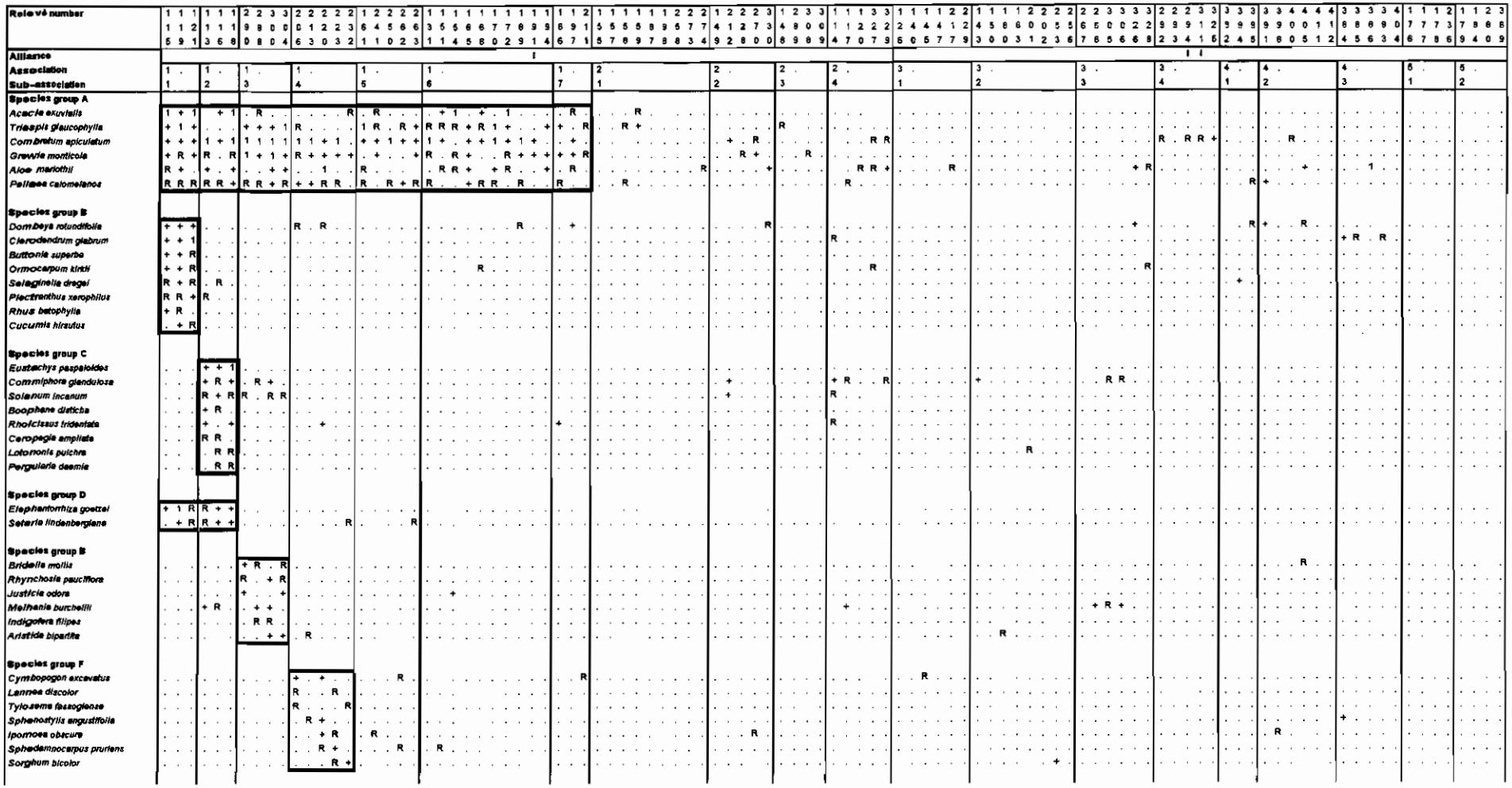

Table 19 continued.

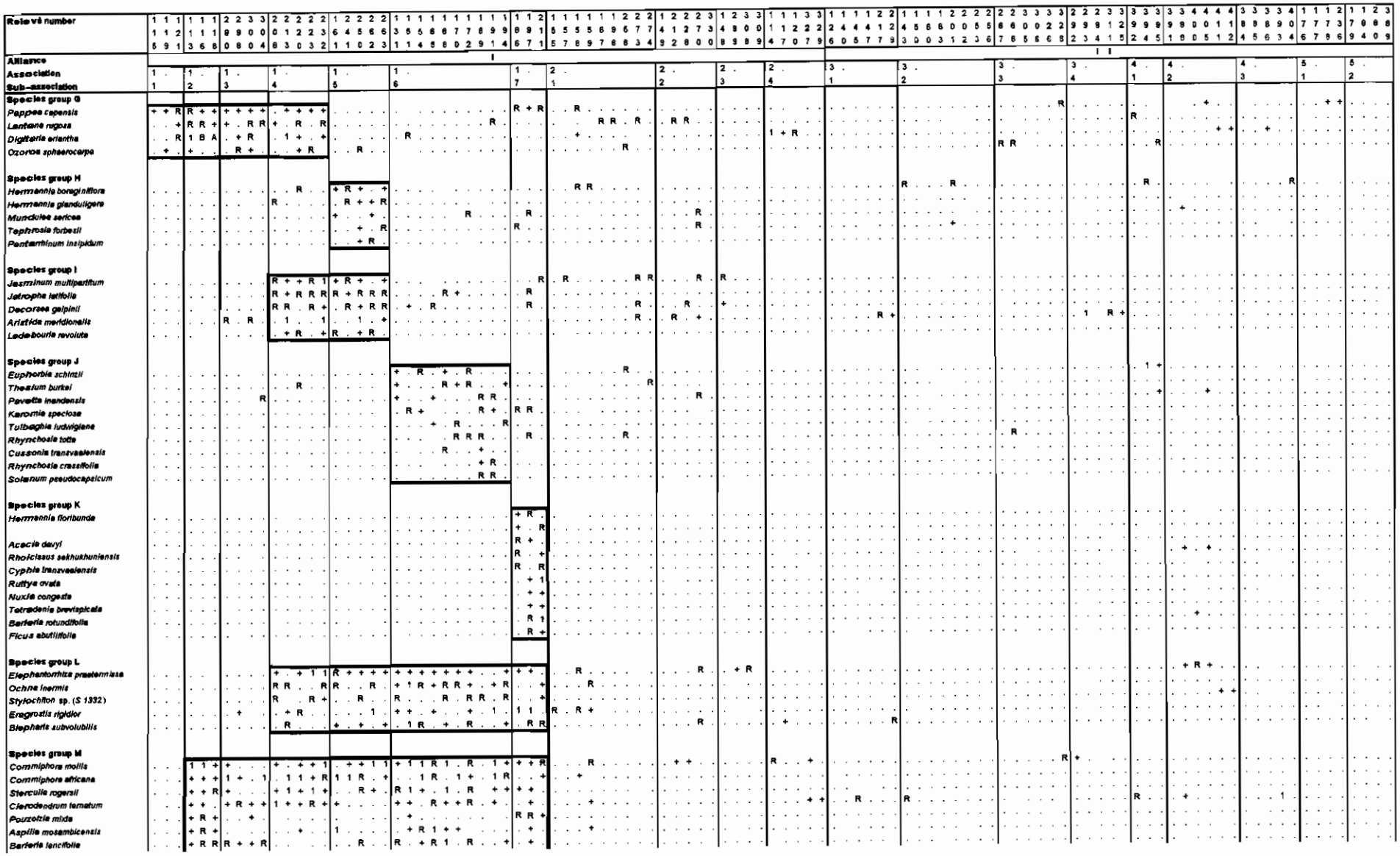

Table 19 continued.

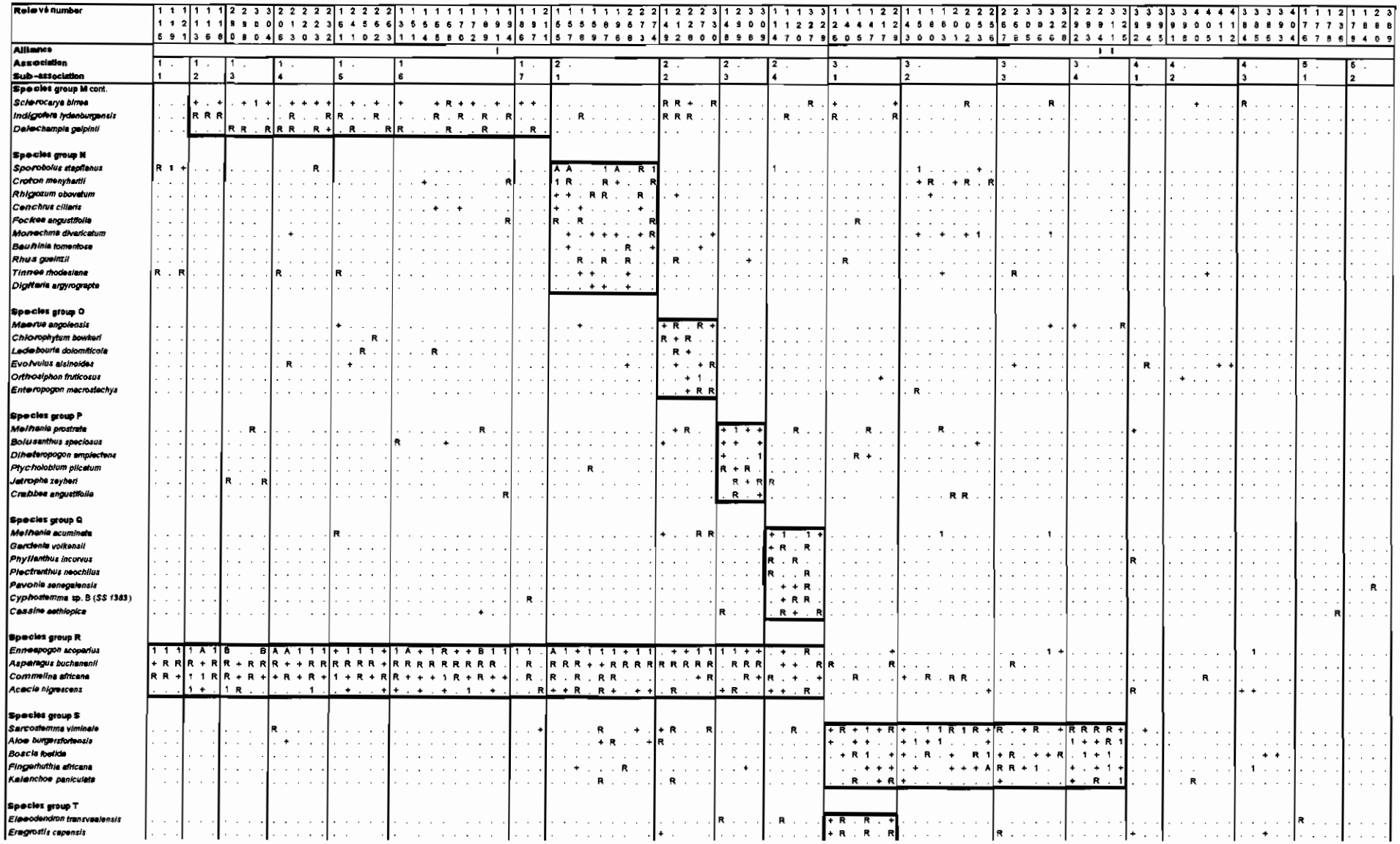

Table 19 continued.

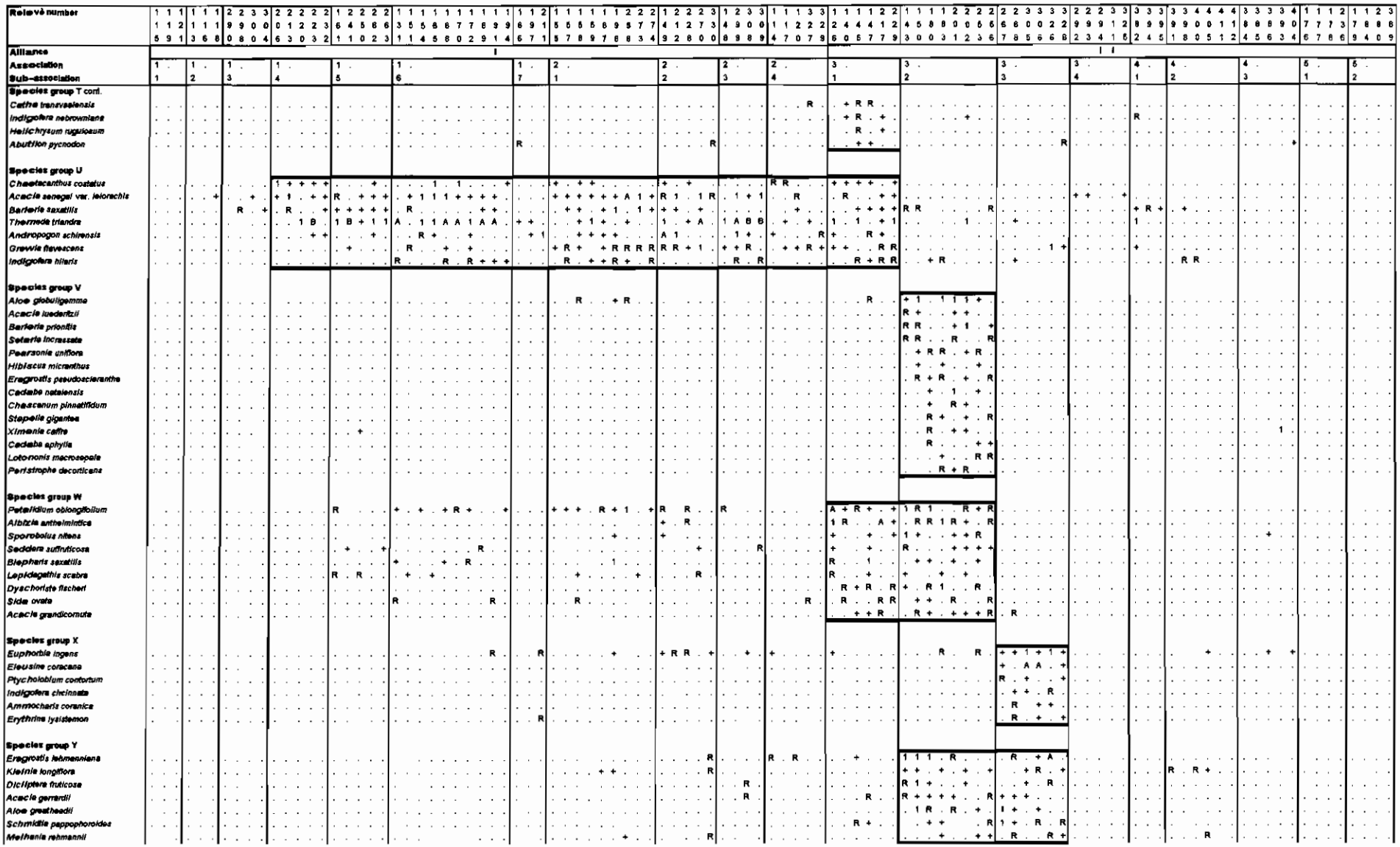

Table 19 continued.

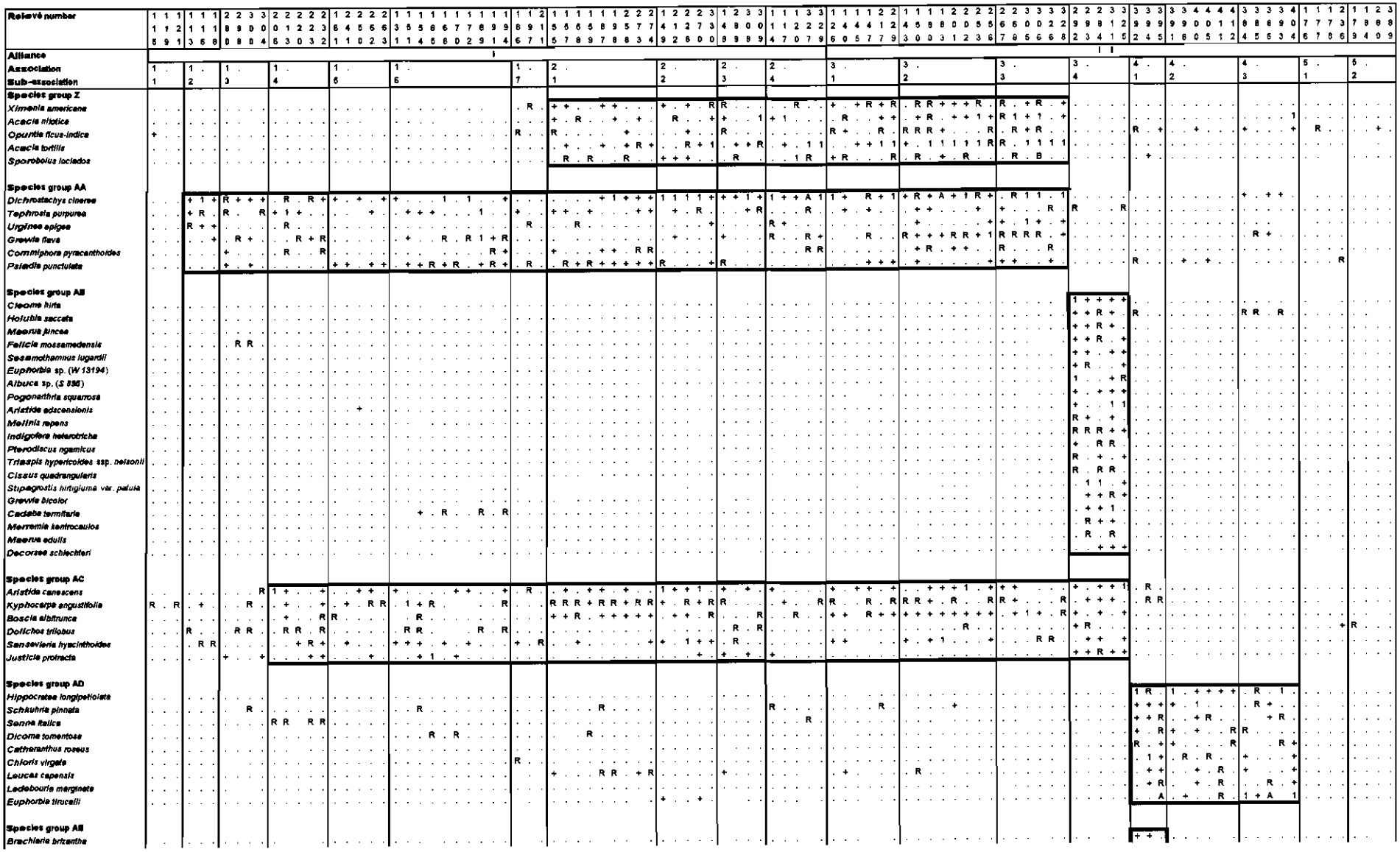

Table 19 continued.

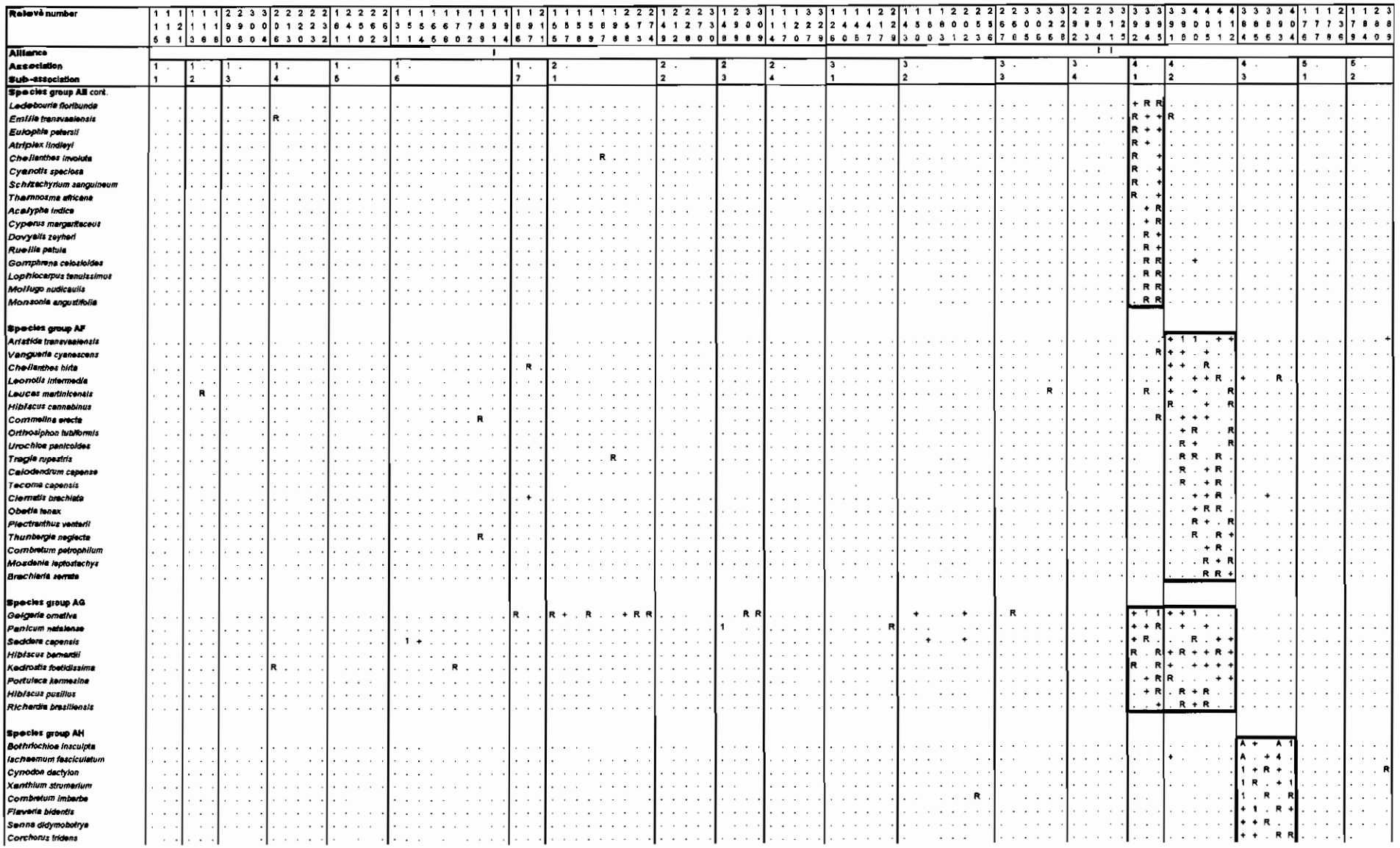

Table 19 continued.

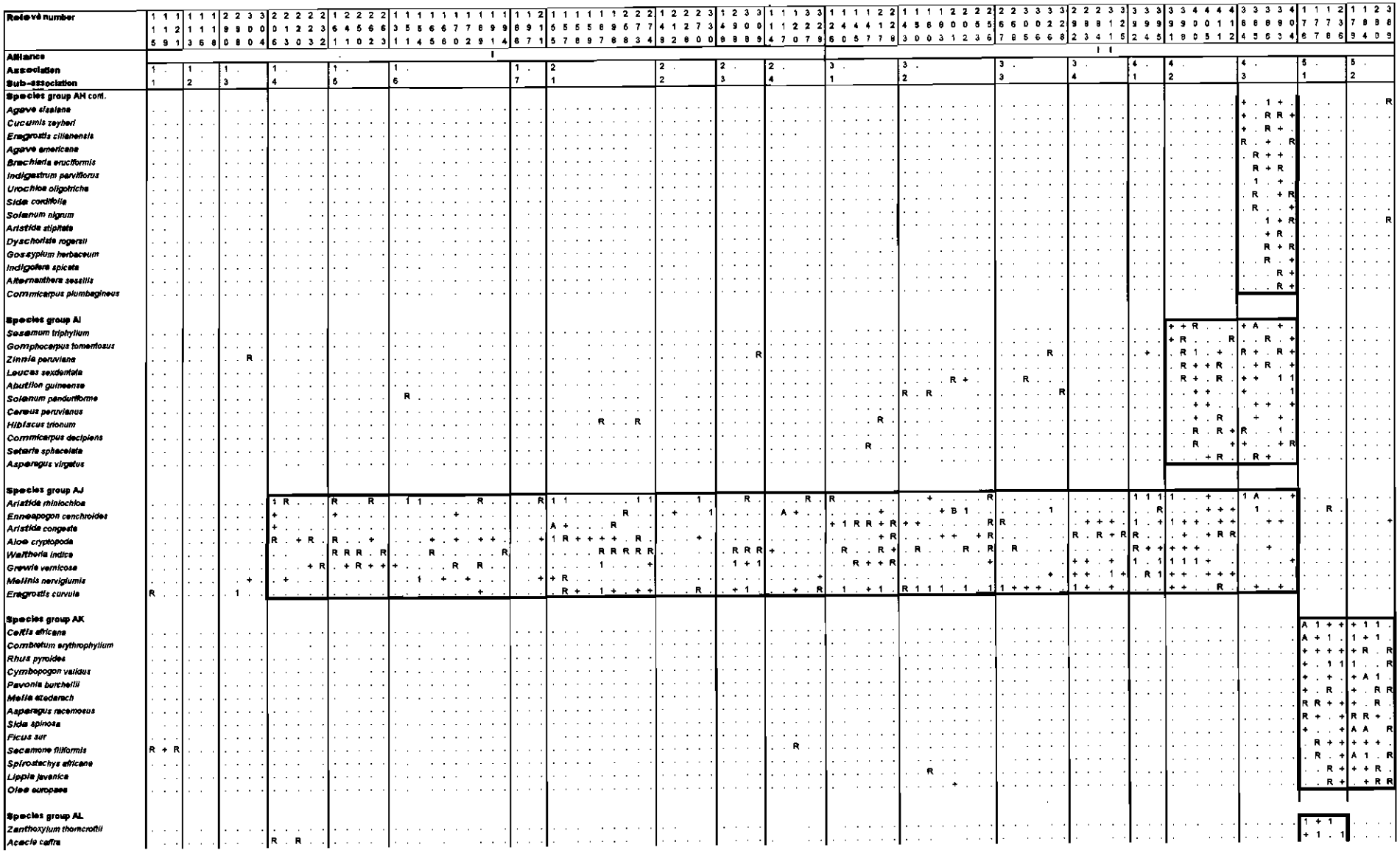

Table 19 continued.

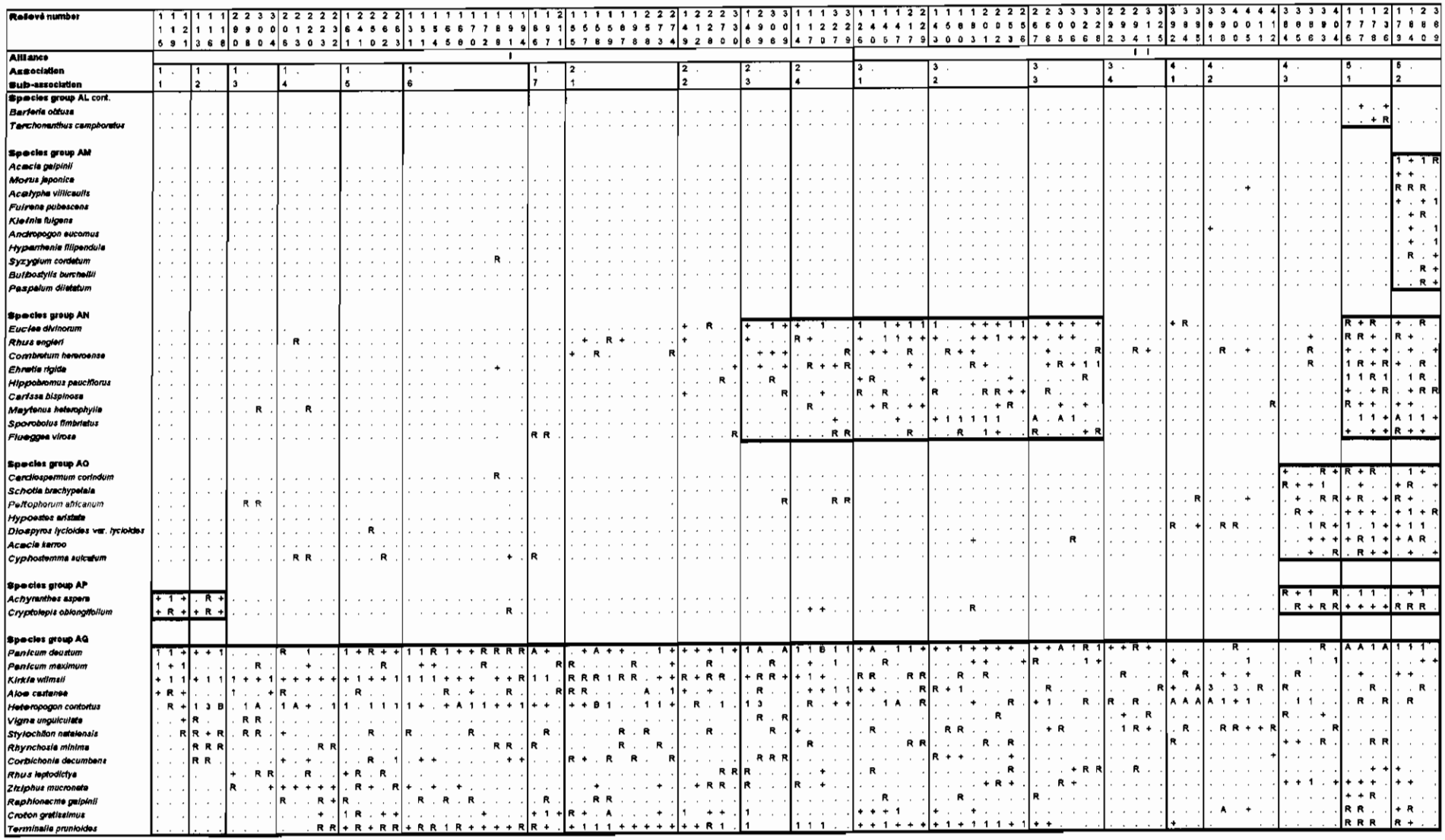

Table 20 Sekhukhuneland Centre endemic/near-endemic and Red Data List plant taxa of the Closed Mountain Bushveld.

Taxon	Family	Syntaxa																			
		I											II								
		1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2
Acacia sp. nov. (*H pers. comm.*)	FABA	.	.	.	.	.	.	.	.	.	.	.	.	$r	$r	.	.	.	$+	$1	$1
Albuca sp. nov. (*S856*)	LILI	.	.	.	.	.	.	.	.	.	.	.	.	.	.	$+	.	.	.	.	.
Aloe burgersfortensis	LILI	.	.	.	$r	.	.	.	$+	$r	.	.	$+	$1	.	$1	.	.	.	.	.
Aloe castanea	LILI	#+	.	#+	#r	.	#r	.	#+	#+	.	#1	#+	#+	.	.	#+	#1	.	.	.
Asparagus clareae	ASPA	.	.	.	.	.	.	K#r	.	.	.	.	.	.	.	K#+	.	.	.	.	.
Bauhinia tomentosa [form] (*S444*)	FABA	.	.	.	.	.	.	.	$r	$r	.	.	.	.	.	.	.	.	.	.	.
Brachylaena ilicifolia [form] (*S613*)	ASTE	.	.	.	.	.	.	.	.	#r	#r	#r	.	.	.	.	#r	.	.	.	.
Catha transvaalensis	CELA	.	.	.	.	.	.	.	.	.	.	$r	$r	.	.	.	.	.	.	.	.
Combretum petrophilum	COMB	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R#r	.	.	.
Cyphia transvaalensis	LOBE	.	.	.	.	.	.	#r	.	.	.	.	.	.	.	.	.	.	.	.	.
Cyphostemma sp. nov. (*S1383*)	VITA	.	.	.	.	.	.	$r	.	.	.	$r	.	.	.	.	.	.	.	.	.
Dicliptera fruticosa	ACAN	.	.	.	.	.	.	.	.	.	#r	.	.	#+	#r	.	.	.	.	.	.
Elephantorrhiza praetermissa	FABA	.	.	.	K$1	K$+	K$1	K$+	K$r	K$r	K$r	.	.	.	.	.	.	K$+	.	.	.
Euclea linearis [form] (*S937*)	EBEN	.	.	.	.	.	.	.	.	.	#r	.	#r	.	.	.	.	.	.	.	.
Euphorbia sp. nov. (*W13194*)	EUPH	.	.	.	.	.	.	.	.	.	.	.	.	.	.	$+	.	.	.	.	.
Gnidia caffra [form] (*W&S12975*)	TILI	.	.	.	.	.	.	.	.	.	.	$r	.	.	.	.	.	.	.	.	.
Grewia vernicosa	TILI	.	.	.	#+	#+	#r	.	#+	.	#1	.	#+	#r	.	#+	#1	#1	#r	.	.
Gymnosporia sp. nov. B (*S458*)	CELA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	$r	$r
Hibiscus barnardii	MALV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R$+	R$1	.	.	.
Indigofera lydenburgensis	FABA	.	#+	.	#r	#r	#r	.	#r	#r	.	#r	#r	.	.	.	.	.	.	.	.
Jatropha latifolia var. *latifolia*	EUPH	.	.	.	#+	#+	#+	#r	.	.	.	.	.	.	.	.	.	.	.	.	.
Kleinia longiflora [form] (*W&S13239*)	ASTE	.	.	.	.	.	.	.	$r	$r	.	.	.	$+	$+	.	.	$+	.	.	.
Kleinia stapeliiformis	ASTE	.	.	.	.	.	.	.	.	.	.	.	#r	#r	.	#r	.	#r	.	.	.
Leucas capensis [form] (*W&S13007*)	LAMI	.	.	.	.	.	.	.	$+	.	$r	.	$r	$r	.	.	$+	$r	$+	.	.

Table 20 continued.

Taxon	Family	Syntaxa																			
		1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2
Orthosiphon fruticosus	LAMI	.	.	.	.	.	.	.	.	$r	.	.	$r	.	.	.	.	$r	.	.	.
Orthosiphon tubiformis	LAMI	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	#r	.	.	.
Pochypodium saundersii	APOC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Nr	.	.	.	.	.
Petalidium oblongifolium	ANAC	.	.	.	.	#r	#+	.	#1	#+	#r	.	#1	#+	.	.	.	.	.	.	.
Phyllanthus sp. nov. (*S470*)	EUPH	.	.	.	.	$r	$+	.	$+	$r	.	$r	.	$+	.	.	$+	$r	$r	.	.
Plectranthus venterii	LAMI	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	$+	.	.	.
Plectranthus xerophilus	LAMI	#+	#r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Premna mooiensis [form] (*W&S13004*)	VERB	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	$r	$+	.	.	.
Rhoicissus sekhukhuniensis	VITA	.	.	.	.	.	.	$r	.	.	.	.	.	.	.	.	.	$+	.	.	.
Rhus batophylla	ANAC	R$+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhus engleri	ANAC	.	.	.	#r	.	.	.	#+	#+	#r	#r	#1	#1	#+	.	.	.	#r	#+	#r
Solanum incanum [form] (*W&S13013*)	SOLA	.	$+	$+	.	.	.	.	.	$r	.	$r	.	.	.	.	.	.	.	.	.
Stylochaeton sp. nov. (*S1332*)	ARAC	.	.	.	$+	$r	$+	$r	.	.	.	.	.	.	.	.	.	.	.	.	.
Triaspis glaucophylla	MALP	#1	.	#1	#r	#+	#+	#r	#r	.	#r	.	.	.	.	.	.	.	.	.	.
Vitex obovata subsp. *wilmsii*	VERB	.	.		.	.	.	#r	.	.	.	.	#r	.	.	.	#r	.	#r	.	.
Xerophyta retinervis [form] (*W&S13208*)	VELL	.	$r	.	$r	$r	$r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SCPE endemics		1	2	1	4	4	4	4	6	7	2	5	4	5	2	3	4	9	3	2	2
SCPE near-endemics		3	2	2	6	5	6	5	6	5	7	4	8	6	2	3	4	5	3	1	1
Red Data List		1	0	0	1	1	1	2	1	1	1	0	0	0	0	2	1	3	0	0	0
Restricted to syntaxon		1	0	0	0	0	0	1	0	0	0	1	0	0	0	3	0	3	0	0	0
Restricted to association					6					2				3				5		1	
Total for syntaxon		4	4	3	10	9	10	9	12	12	9	9	12	11	4	7	8	14	6	3	3
Total for association					20					20				20				18		3	

Endemism: $ = endemic, # = near-endemic; **Red Data List:** K = Insufficiently Known, R = Rare, N = Not threatened in the northern provinces of South Africa, but in other areas of southern Africa;

Abundance in communities: 1 = abundant, + = frequent, r = rare, . = absent; **Collectors:** H = Hurter, S = Siebert, W = Van Wyk; **Bold** blocks represent community/syntaxon specific taxa;

Table 21 Environmental factors and selected attributes associated with the different plant communities of the Closed Mountain Bushveld.

Factors/attributes	Syntaxa																			
	I											II								
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2
Number of relevès	3	3	4	5	5	10	3	9	5	4	5	6	8	6	5	3	6	5	4	4
Total number of species	40	55	60	100	84	123	73	114	96	65	82	98	131	83	55	97	130	122	52	66
Average number of species per relevè	30	41	34	45	39	40	32	39	38	32	29	38	43	29	33	45	38	38	32	28
Number of endemics/ near-endemics	4	4	3	10	9	10	9	12	12	9	9	12	11	4	7	8	14	6	3	3
Number of Red Data List taxa	1	0	0	1	1	1	2	1	1	1	0	0	0	0	2	1	3	0	0	0
Geology*	S	S	G/F	P	N/A	P/N/A	P/N/A	N/A/M	P/F	G	S/M	P/Q	Q	F/Q	N/A	N/A	N/A	N/Q	Q	Q
Topographie position**	M	M	M	M/S	M/S	M/S	S	M/F	F	F	F	F	V	F/V	F	F	F	F/V	V	V
Slope (°)	9–12	12–15	7–12	5–12	5–15	5–15	9	3–5	3–5	3–5	3–5	1–3	1–3	1–3	3–5	5–7	3–5	1–3	1–3	1–5
Aspect	S	N	N	N	N	N	N	N/S/W	N/E	N/S/W	N/S/W	W	E/W	N/E/W	N/E	N/E/S	N/E/W	N/E/S/W	-	-
Predominant soil type***	Gs	Gs	Gs	Gs	Gs	Gs/Ms	Ms	Bo/Hu	Sd/Hu	Hu	Gs/Sd	Hu/Bo/Sd	Bo/Va	Bo/Va/Gs	Hu/Gs	Ms	Gs	Sn/Gs	Oa	Oa

Table 21 continued.

Factors/attributes	Syntaxa																			
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2
Rock cover percentage (%)	50–65	40–60	30–50	30–50	35–55	35–60	50–70	25–40	30–50	10–15	15–40	10–20	10–50	5–20	30–40	45–55	45–65	10–20	5–20	5–40
Average rock size (mm)	500–800	450–600	500–750	400–1000	650–1000	300–750	750–1500	200–400	500–1000	100–150	300–500	100–300	100–200	50–400	400–500	900–2000	500–2000	100–300	100–300	50–100

* A = anorthosite; F = ferrogabbro; G = granofire; M = magnetite; N = norite; P = pyroxenite; Q = Alluvium; S = Shale

** S = scarp; M = midslope; F = footslope; V = valley

*** Bo = Bonheim; Gs = Glenrosa; Hu = Hutton; Ms = Mispah; Sd = Shortlands; Sn = Steendal; Va = Valsrivier (X^1 Dominant soil type)

Table 22 A key to the syntaxa of the Closed Mountain Bushveld of the hills and valleys of the Sekhukhuneland Centre of Plant Endemism.

Leads/description	Go to/syntaxon
1a Steep sloped bushveld 5–12° (*Combretum apiculatum* & *Kirkia wilmsii*)	**2**
b Moderately sloped bushveld 1–7° (*Combretum hereroense*)	**3**
2a Rocks predominantly Rustenburg Layered Suite (*Elephantorrhiza praetermissa* & *Themeda triandra*)	**4**
b Rocks mainly Transvaal Sequence (*Pappea capensis*)	**5**
3a Lithosols (*Hippocratea longipetiolata* & *Heteropogon contortus*)	**6**
b Diverse sandy-loam soils (*Euclea divinorum* & *Terminalia prunoides*)	**7**
4a Mispah & Glenrosa soils (*Eragrostis rigidior*)	**8**
b Only Glenrosa soils (*Jasminum multipartitum*)	**9**
5a Granofire & ferrogabbro (*Bridelia mollis* & *Rhus leptodictya*)	1.3 *Combreto apiculati–Kirkietum wilmsii bridelietosum mollis*
b Shale (*Elephantorrhiza goetzei* & *Acacia exuvialis*)	**10**
6a Rock cover < 20% (*Bothriochloa insculpta* & *Schotia brachypetala*)	4.3 *Hippocrateo longipetiolatae–Euphorbietum tirucalli bothriochloetosum insculptae*
b Rock cover > 45% (*Panicum natalense* & *Melinis nerviglumis*)	**11**
7a Only Oakleaf soils (*Combretum erythrophyllum* & *Sporobolus fimbriatus*)	**12**
b Divers soils (*Sarcostemma viminale* & *Boscia albitrunca*)	**13**
8a Rock size < 750 mm (*Karomia speciosa* & *Petalidium oblongifolium*)	1.6 *Combreto apiculati–Kirkietum wilmsii themedetosum triandrae*
b Rock size > 750 mm (*Nuxia congesta* & *Croton gratissimus*)	1.7 *Combreto apiculati–Kirkietum wilmsii nuxietosum congestae*
9a Pyroxenite (*Sphedamnocarpus pruriens* & *Sterculia rogersii*)	1.4 *Combreto apiculati–Kirkietum wilmsii choetacanthetosum costatii*
b Norite (*Mundulea sericea* & *Barleria saxatilis*)	1.5 *Combreto apiculati–Kirkietum wilmsii hermannietosum boraginiflorae*
10a Southern aspect (*Clerodendrum glabrum* & *Panicum maximum*)	1.1 *Combreto apiculati–Kirkietum wilmsii clerodendretosum glabrae*
b Northern aspect (*Eustachys paspaloides* & *Commiphora africana*)	1.2 *Combreto apiculati–Kirkietum wilmsii eustachetosum paspaloidis*
11a Mispah (*Emilia transvaalensis* & *Aristida rhiniochloa*)	4.1 *Hippocrateo longipetiolatae–Euphorbietum tirucalli emilietosum transvaalensis*
b Glenrosa (*Aristida transvaalensis* & *Ocimum americanum*)	4.2 *Hippocrateo longipetiolatae–Euphorbietum tirucalli aristidetosum transvaalensis*
12a Rock size > 100 mm (*Acacia caffra* & *Cryptolepis oblongifolium*)	5.1 *Celtido africanea–Combretetum erythrophyllii acacietosum caffrae*
b Rock size < 100 mm (*Acacia galpinii* & *Ficus sur*)	5.2 *Celtido africanea–Combretetum erythrophyllii acacietosum galpinii*
13a Footslopes to midslopes (*Acacia nigrescens*)	**14**
b Footslopes to valleys (*Fingerhuthia africana* & *Eragrostis curvula*)	**15**

Table 22 continued.

Leads/description	Go to/syntaxon
14a Hutton (*Acacia senegal* var. *leiorachis*)	**16**
b Lithosol (*Gardenia volkensii* & *Aloe castanea*)	2.4 *Panico deustii–Dichrostachetum cinereae melhanietosum acuminatae*
15a Bonheim soils (*Acacia tortilis*)	**17**
b No Bonheim soil form (*Cadaba termitaria* & *Sanseviera hyacinthoides*)	3.4 *Fingerhuthio africanae–Boscietum foetidae sesamothamnetosum lugardii*
16a Rock cover > 25% (*Ximenia americana*)	**18**
b Rock cover < 15% (*Bolusanthus speciosus* & *Grewia vernicosa*)	2.3 *Panico deustii–Dichrostachetum cinereae melhanietosum prostratae*
17a No Valsrivier soil form (*Elaeodendron transvaalensis* & *Maytenus heterophylla*)	3.1 *Fingerhuthio africanae–Boscietum foetidae elaeodendretosum transvaalensis*
b Valsrivier soils (*Acacia gerrardii* & *Grewia flava*)	**19**
18a Rock size < 400 mm (*Rhigozum obovatum* & *Monechma divaricatum*)	2.1 *Panico deustii–Dichrostachetum cinereae sporoboletosum stapfianii*
b Rock size > 500 mm (*Maerua angolensis* & *Sclrocarya birrea*)	2.2 *Panico deustii–Dichrostachetum cinereae maeruetosum angolensis*
19a Alluvium (*Acacia luederitzii* & *Alae globuligemma*)	3.2 *Fingerhuthio africanae–Boscietum foetidae oloetosum globuligemmae*
b Alluvium interspersed with lithosols (*Eleusine coracana* & *Euphorbia ingens*)	3.3 *Fingerhuthio africanae–Boscietum foetidae euphorbietosum ingentis*

Table 23 The three most dominant and conspicuous plant taxa of each of the major vegetation types of the Closed Mountain Bushveld depicted in the DECORANA scatter diagram.

Major vegetation type	Trees/shrubs	Forbs/sedges	Grasses
1. *Combreto apiculati–Kirkietum wilmsii*	***Combretum apiculatum***	*Asparagus laricinus*	*Enneapogon scoparius*
(*Combretum apiculatum–Kirkia wilmsii*)	*Commiphora mollis*	*Clerodendrum ternatum*	*Heteropogon contortus*
	Kirkia wilmsii	*Commelina africana*	*Panicum deustum*
2. *Panico deustii–Dichrostachetum cinereae*	*Acacia senegal* var. *leiorachis*	*Barleria saxatilis*	*Enneapogon scoparius*
(*Panicum deustum–Dichrostachys cinerea*)	***Dichrostachys cinerea***	*Kyphocarpa angustifolia*	*Themeda triandra*
	Terminalia prunioides	*Waltheria indica*	***Panicum deustum***
3. *Fingerhuthio africanae–Boscietum foetidae*	*Acacia tortilis*	*Aloe burgersfortensis*	*Eragrostis curvula*
(*Fingerhuthia africana–Boscia foetida*)	*Boscia albitrunca*	*Psiadia punctulata*	***Fingerhuthia africana***
	Boscia foetida	*Sarcostemma viminale*	*Panicum deustum*
4. *Hippocrateo longipetiolatae–Euphorbietum tirucalli*	***Euphorbia tirucalli***	*Abutilon guineense*	*Aristida congesta*
(*Hippocratea longipetiolata–Euphorbia tirucalli*)	***Hippocratea longipetiolata***	*Leucas capensis*	*Aristida rhiniochloa*
	Diospyros lycioides	*Ocimum americanum*	*Heteropogon contortus*
5. *Celtido africanea–Combretetum erythrophylli*	***Celtis africana***	*Achyranthes aspera*	*Cymbopogon validus*
(*Celtis africana–Combretum erythrophyllum*)	***Combretum erythrophyllum***	*Hypoestes aristata*	*Panicum deustum*
	Ehretia rigida	*Pavonia burchellii*	*Sporobolus fimbriatus*