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A classification of the vegetation of the western Transvaal dolomite and chert grassland, South Africa

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Relatively little is known about the vegetation of the western Grassland Biome in South Africa. The classification of the dolomite and chert grassland in the western Transvaal (Fa land type) forms part of a research programme on the syntaxonomic and synecological synthesis of the vegetation of the western Grassland Biome. Using a numerical classification technique (TWINSPAN) as a first approximation, the classification was refined by applying Braun-Blanquet procedures. The result is a phytosociological table from which two new alliances, six new associations, two new sub-associations and two new communities without syntaxonomic rank are recognized. The new syntaxa are ecologically interpreted as well as described. Associated gradients in habitat were identified by using an ordination algorithm (DECORANA). This study should contribute to the present knowledge and ecological understanding of the vegetation of the western Transvaal.

Relatief min inligting is oor die plantegroei van die westelike Grasveldbioom van Suid-Afrika beskikbaar. Die klassifikasie van die plantegroei van die dolomitiese en chert-grasveld in die Wes-Transvaal (Fa-landtipe) vorm deel van die sintaksonomiese en sinekologiese sintese van die plantegroei van die westelike Grasveldbioom. 'n Numeriese tegniek (TWINSPAN) is as eerste klassifikasie van die floristiese data aangewend. Daarna is die Braun-Blanquet-prosedure gevolg om twee nuwe alliansies, ses nuwe assosiasies, twee nuwe subassosiasies en twee nuwe gemeenskappe sonder range in 'n fitososiologiese tabel te identifiseer. Die nuwe sintaksons word ekologies geïnterpreteer en beskryf. Geassosieerde gradiënte in habitat is deur toepassing van 'n ordeningsalgoritme (DECORANA) geïdentifiseer. Hierdie studie behoort 'n waardevolle bydrae tot die ekologiese kennis oor die plantegroei van die Wes-Transvaal te lewer.

Keywords: Braun-Blanquet, Fa land type, Grassland Biome, vegetation classification.

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Introduction

Mentis and Huntley (1982) as well as Scheepers (1986) stated the necessity to determine the location and extent of the major vegetation types and subtypes within the Grassland Biome. As part of a phytosociological research programme on the syntaxonomic synthesis of the vegetation of the Grassland Biome in South Africa, several studies have been carried out (Bezuidenhout 1988; Turner 1989; Kooij 1990; Myburgh 1990; Breytenbach 1991; du Preez 1991; Eckhardt 1993). A mosaic of land types occur in the study area (Figure 1). As land types represent an ecologically based stratification of the study area, each land type is separately used to describe the vegetation of the western Transvaal grassland (Bezuidenhout, in prep.). In this paper, a description of the vegetation of the Fa land type in the study area is presented. A broad, regional account of the vegetation of the Fa land type and a number of other land types was given by Acocks (1953, 1988). Vegetation studies have been conducted in the Potchefstroom area (Louw 1951), Lichtenburg area (Morris 1973), Abe Bailey Nature Reserve (Van Wyk 1983) and the Mooi River catchment area (Bezuidenhout 1988). A part of the dolomite or Klipveld vegetation was described by Bezuidenhout and Bredenkamp (1990). In the Jack Scott Nature Reserve, which is situated adjacent to the north-eastern boundary of the study area, the dolomite vegetation was investigated by Coetzee (1974) and Scogings and Theron (1990).

Proper land use requires a classification of the vegetation (Van Rooyen *et al.* 1981), in order to identify conservation priorities.

This is a comprehensive vegetation classification of the dolomite and chert area which includes the entire Fa land type in the western Transvaal. This report forms part of the synthesis of the vegetation of the western Grassland Biome of South Africa and the results should contribute significantly to the ultimate aim of a phytosociological and syntaxonomical synthesis of the western Grassland Biome.

Study area

The study area is situated in the western part of the Highveld Agricultural Region in the Transvaal and is bounded by latitudes 25°45′ and 27°15′ south and longitudes 24°45′ and 28° 00′ east (Figure 1). The Fa land type covers approximately 557 320 ha of land, and the Land Type Survey Staff (1984) estimated that 35% is unavailable for agronomy. The main rock types which underly the Fa land type are dolomite and chert of the Chuniespoort Group (Transvaal Sequence). The slightly undulating plains are dissected by prominent rocky chert ridges (Land Type Survey Staff 1984). More than 50% of the main soil types are relatively shallow (between 50 and 150 mm) and rocky (dolomite and chert) with the dominant soil forms Mispah, Glenrosa and shallow Hutton (Land Type Survey Staff 1984).

The vegetation is distributed in a complex mosaic pattern, and is not dominated by a single or a few species. It rather represents a mosaic of many co-dominants (Louw 1951). According to the Acocks (1988) classification, the largest part of the Fa land type vegetation is represented by the western variations of the Bankenveld (veld type 61a) while the remaining

Some of the data for this research were collected by H.B. while employed by the Department of Agricultural Development, Grassland Research Centre, Private Bag X05, Lynn East, 0039 Republic of South Africa.

parts are represented by *Cymbopogon – Themeda* veld (veld type 48b).

The Fa land type is drained by the Schoonspruit and the Mooi River and their tributaries. The sources of both river systems are springs which originate from the dolomite water reservoir in the northern central part of the Fa land type (Du Toit 1954).

Altitudes vary between 1356 and 1450 m above sea-level.

According to the Köppen climate classification system, two climatic regions occur over the study area, namely a cool dry steppe with summer rains and a warm temperate climate with summer rains. The rainfall exceeds 600 mm per year (Lichtenburg 601 mm, Potchefstroom 625 mm and Carletonville 670 mm) which is relatively high for the study area (Bezuidenhout, in prep.). The summer temperatures are high, with the mean maximum monthly temperatures exceeding 32°C during October to January, while the mean minimum monthly temperatures are below –1°C during May to September. The winters are severely frosty (Weather Bureau 1988).

Methods

Within the Fa land type, which was used as a first stratification unit in the investigation of the western Transvaal grasslands, terrain types were used for subsequent finer stratification. The term land type is used in a land-use classification system describing a homogeneous terrain with regard to soil pattern and climate (Land Type Survey Staff 1984). The following terrain types were recognized in the Fa land type: plateau (1), midslope (3), footslope (4a), floodplain (4b) and drainage line (5) (Figure 2). Relevés were compiled in 91 stratified sample plots. Plot sizes were fixed at 16 m^2 for the grassland vegetation and 100 m^2 for the woody vegetation (Bredenkamp & Theron 1978). For every plant species present in the sample plot, a cover-abundance value was estimated according to the Braun-Blanquet scale (Mueller-Dombois & Ellenberg 1974). Height and canopy cover for the tree, shrub and herbaceous layers were additionally recorded in each sample plot, and average values calculated for each plant community. Environmental information such as rock type, terrain type and soil type as well as soil depth and an estimation of rockiness of the soil surface, was noted (Figure 3). The soil nomenclature follows the classification of MacVicar *et al.* (1977). The floristic data were classified using TWINSPAN (Hill 1979a). The result from the classification was refined by Braun-Blanquet procedures (Mueller-Dombois & Ellenberg 1974). The final result of the classification procedure is represented in a phytosociological table (Table 1). An ordination technique, DECORANA (Hill 1979b), was also applied to the floristic data to illustrate floristic relationships between plant communities to detect possible gradients in and between communities and to detect possible habitat gradients associated with vegetation gradients (Figure 4). Taxa names conform to those of Gibbs Russell *et al.* (1985, 1987). New syntaxa are described and formal syntaxonomy, in accordance with the Code of Phytosociological Nomenclature (Barkman *et al.* 1986), is applied to the classification.

Results

Classification

In the phytosociological table, two alliances, six associations, two sub-associations and two communities without syntaxonomic rank are recognized (Table 1). No syntaxonomic rank is formally assigned to the latter two communities because too little information is available about them, and their syntaxonomic position is still uncertain. The hierarchical classification of the syntaxa is as follows:

1. *Grewio flavae – Rhoion pyroidis*
   - 1.1 *Rhoo lanceae – Acacietum eriolobae*
   - 1.2 *Zizipho mucronatae – Acacietum karroo*
   - 1.3 *Digitaria eriantha – Rhus pyroides* Shrubveld (community without syntaxonomic rank)
2. *Trachypogono spicati – Diheteropogonion amplectentis*
   - 2.1 *Loudetio simplicis – Diheteropogonetum amplectentis*
   - 2.2 *Alloteropsido semialatae – Tristachyetum leucothricis*
   - 2.3 *Cymbopogon excavatus – Diheteropogon amplectens* Grassland (community without syntaxonomic rank)
3. *Cymbopogono plurinodis – Eragrostidetum gummifluae*
   - 3.1 *Cymbopogono plurinodis – Eragrostidetum gummifluae aristidetosum canescentis*

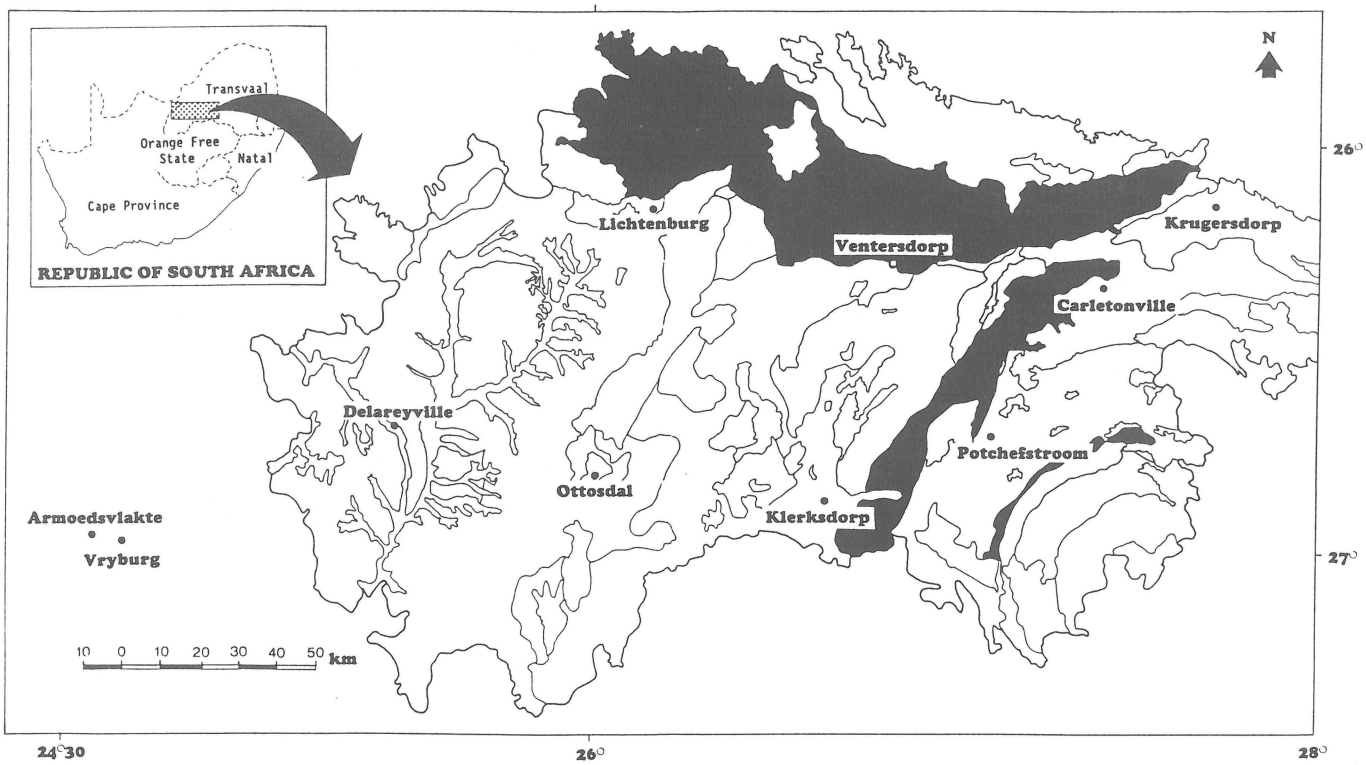

Figure 1 The location of the Fa land type (black areas) in the western Transvaal, South Africa (adapted from the Land Type Series 1979).

3.2 *Cymbopogono plurinodis – Eragrostidetum gummifluae eragrostidetosum superbae*

4. *Paspalo dilatati – Hyparrhenietum hirtae*

Description of the syntaxa

In the vegetation of the dolomite and chert grassland in the western Transvaal (Fa land type), two broad physiognomic classes, namely woodland and grassland, can easily be distinguished (Table 1, Figure 4). The hierarchical classification of the vegetation emphasizes the correlation between habitat and communities in the Fa land type, as was also noted by Scogings and Theron (1990) in the Jack Scott Nature Reserve, as well as the relationships between communities (Figure 3). The vegetation is often overgrazed and burned, as indicated by the

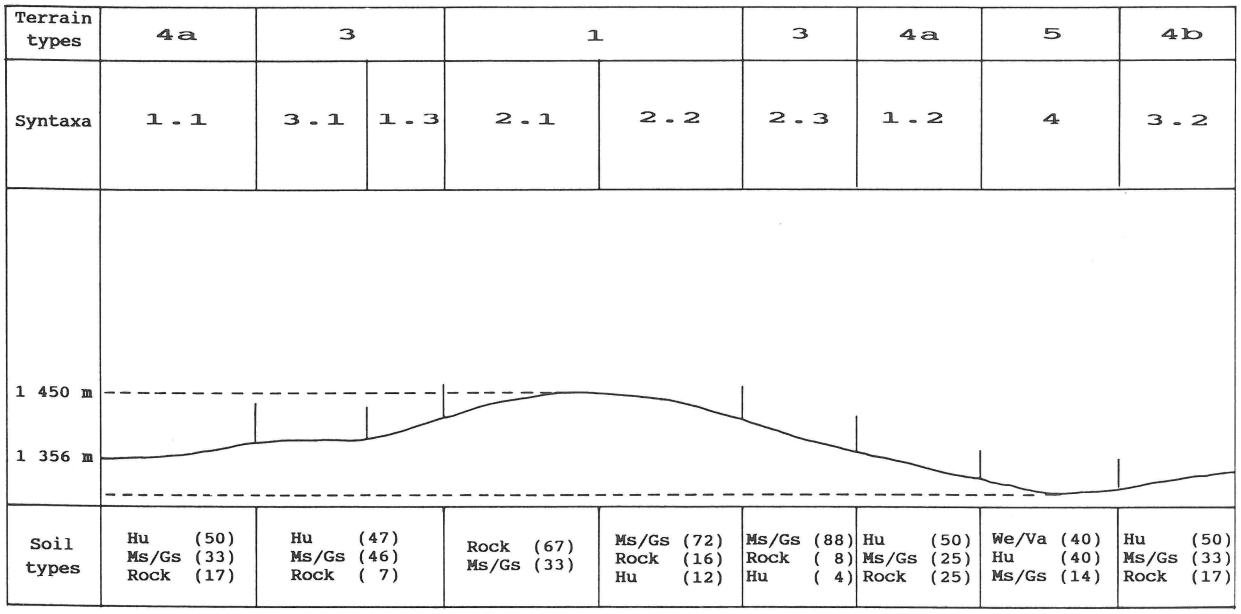

Figure 2 The location of the syntaxa on the topographical terrain types (adapted from Land Type Survey Staff 1984) within the dolomite and chert Grassland in the western Transvaal, South Africa (all abbreviations and numbers are explained in the text).

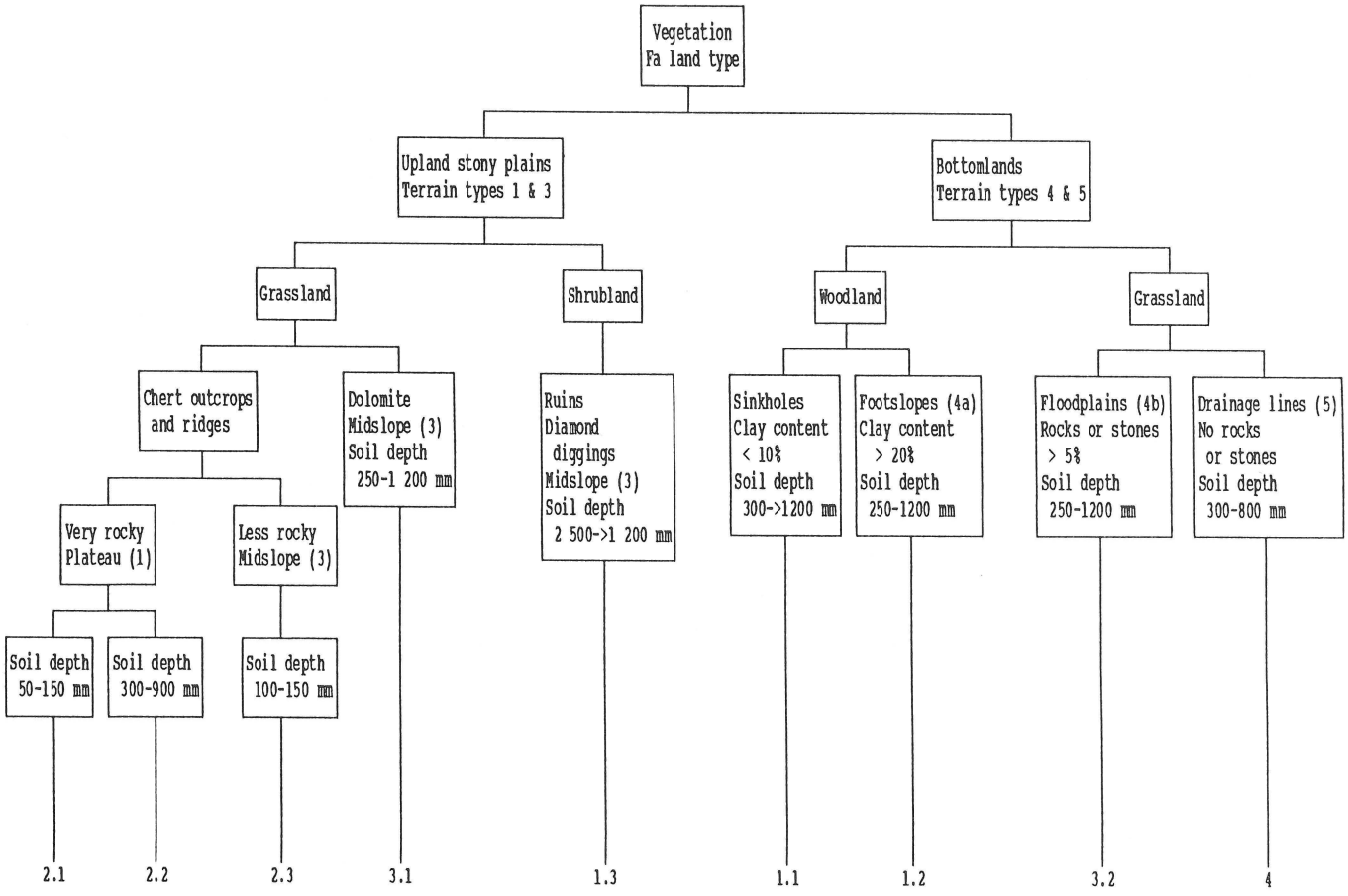

Figure 3 A dendrogram to illustrate the habitat relationships of the syntaxa, of the dolomite and chert Grassland in the western Transvaal, South Africa (all abbreviations and numbers are explained in the text).

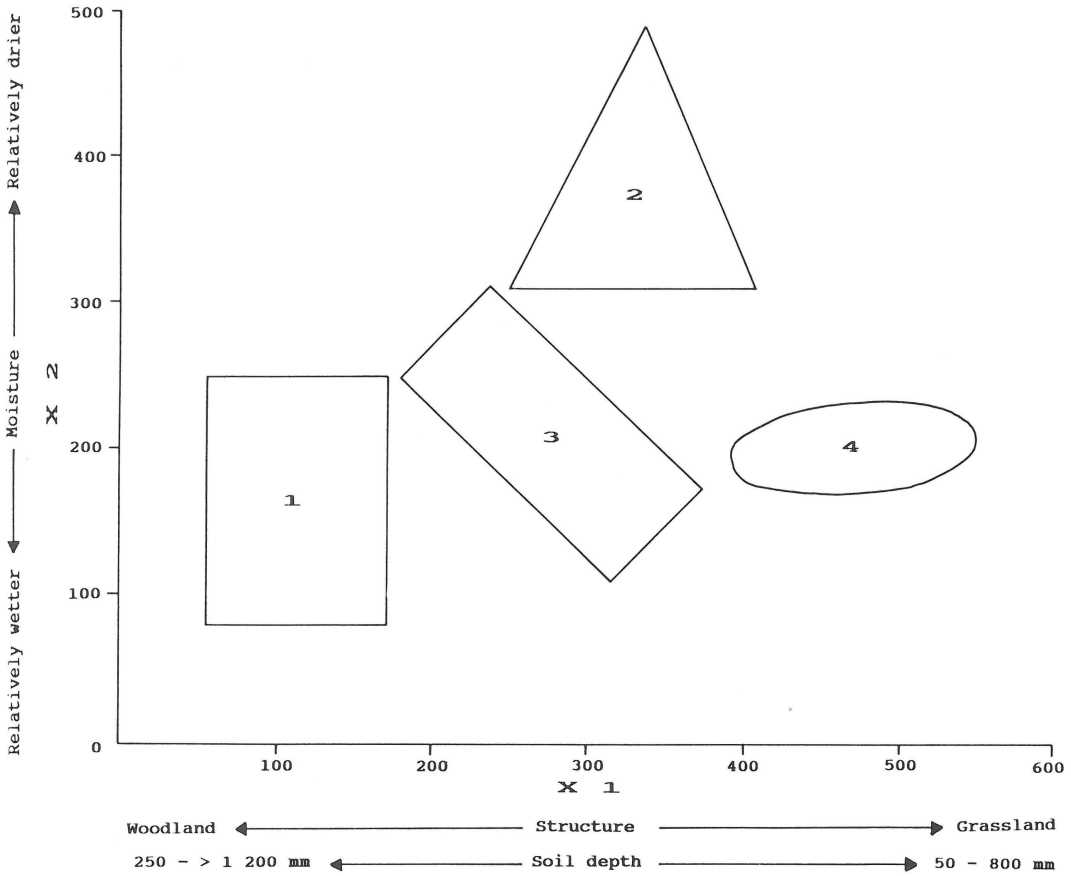

Figure 4 The relative positions of the major syntaxa (numbers refer to those in the text) along the first two axes of the ordination of the dolomite and chert Grassland in the western Transvaal, South Africa (all abbreviations are explained in the text).

Table 1 A phytosociological table of the vegetation of the dolomite and chert in the western Transvaal grassland, South Africa (all numbers are explained in the text)

Sample numbers	441666242 555451114 1111111 55555555450144 1121224 4411222 111111 222445501111114111111222224 011222
	004888405 222338444 2288948 342323233330544 7909013 4323010 222233 327342323355894666668903574 224017
	210132931 345461344 0229120 38209584699615 6972109 0317875 578989 095531785607706456780904 2 961663
Syntaxa numbers	1.1 | 1.2 | 1.3 | 2.1 | 2.2 | 2.3 | 3.2 | 3.3 | 4
Species group A	
Acacia erioloba	++4+1+5 4
Rhus lancea	22+222 2 + +
Pavonia burchellii	+++ + +
Eragrostis biflora	2 4 +
Eragrostis capensis	+2 + 1 + + ++ + +
Lantana rugosa	+ + + +
Setaria verticillata	4
Species group B	
Acacia karroo	1221+322+ + + + +
Ziziphus mucronata	+111++++ + +
Sporobolus fimbriatus	211 + ++
Tarchonanthus camphoratus	+++
Acacia hereroensis	12
Acacia caffra	2+
Species group C	
Maytenus heterophylla	+ + + + ++ + + + +
Protasparagus africanus	+ + + + + 1 + + +
Ehretia rigida	1+ + + + +
Brachiaria nigropedata	++ ++

Table 1 Continued

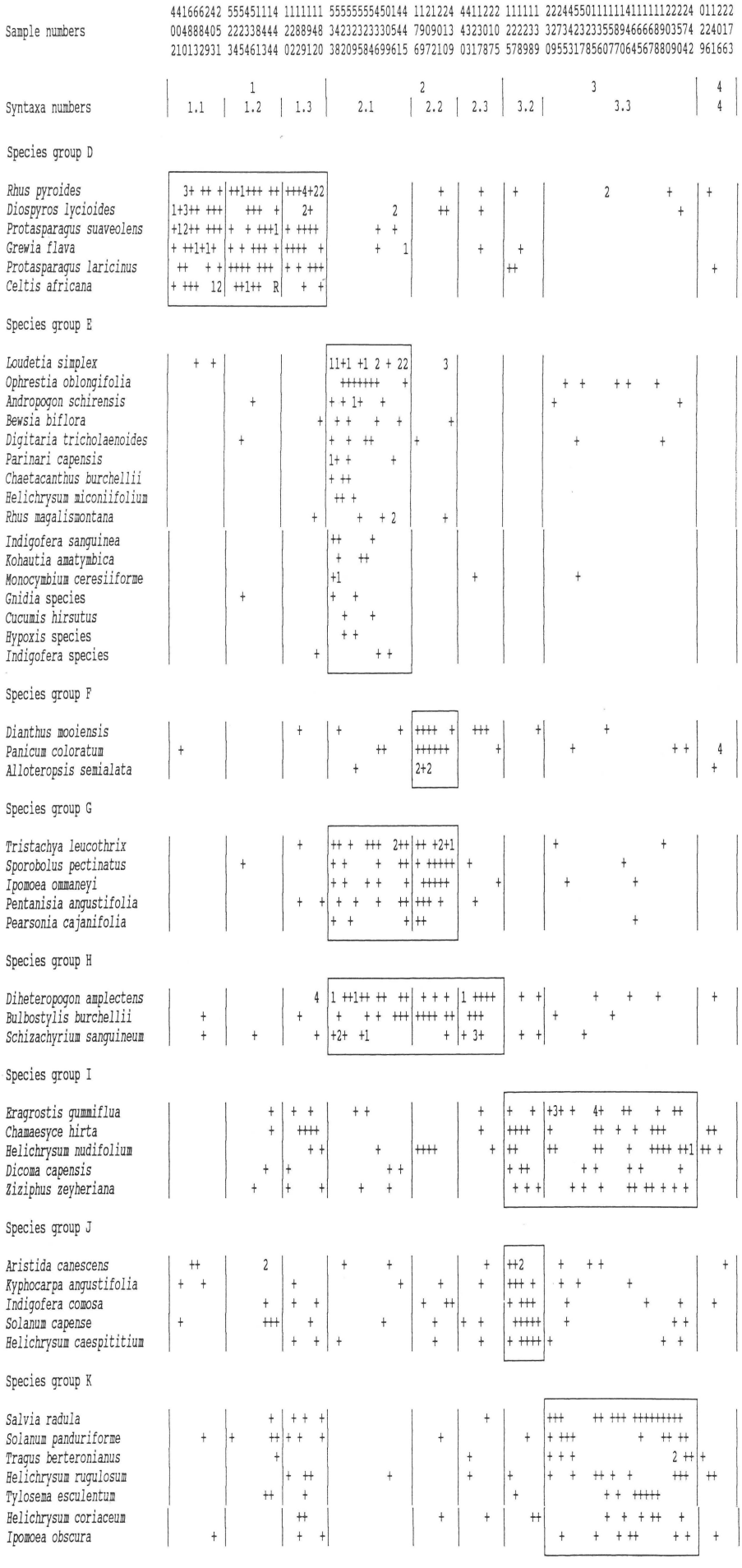

Table 1 Continued

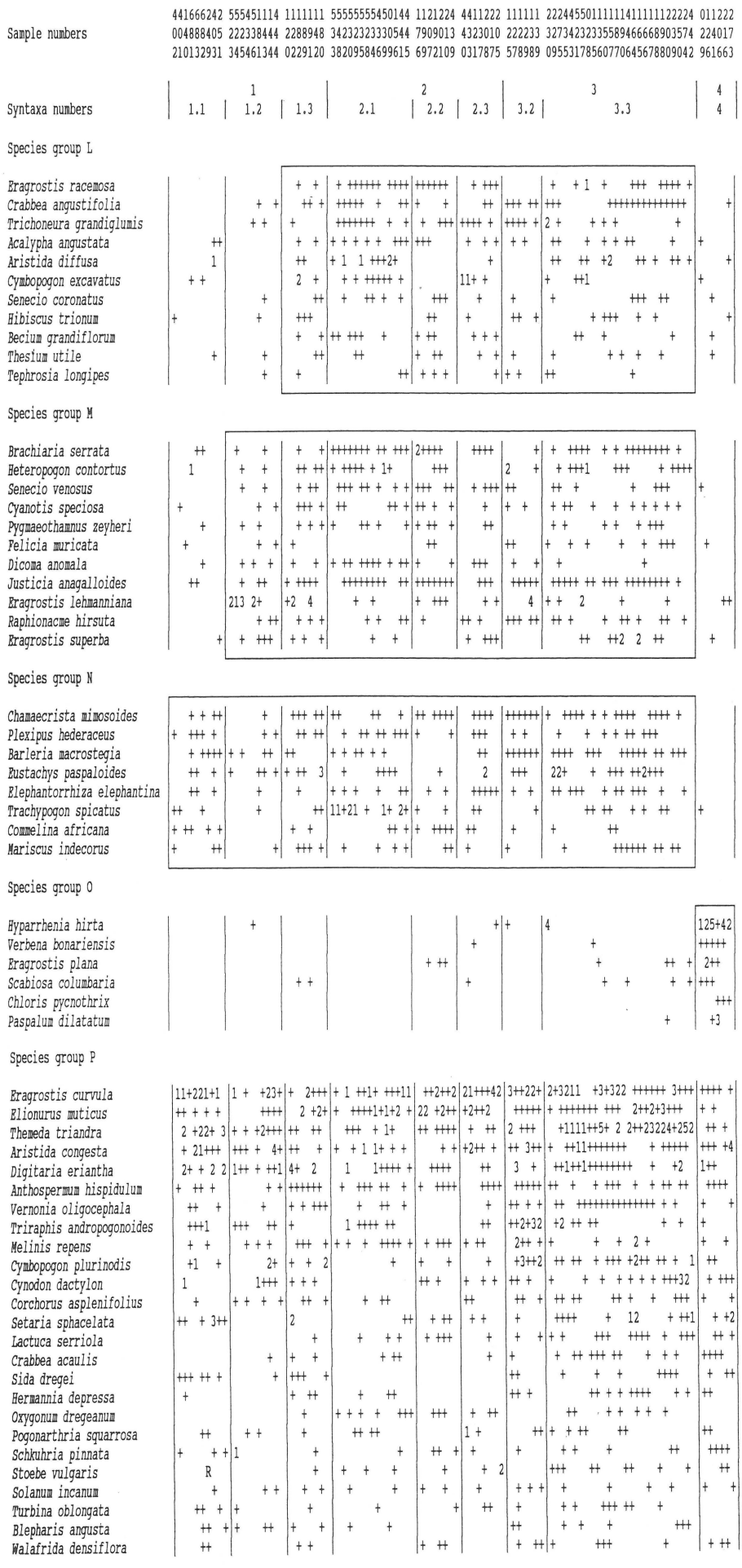

Table 1 Continued

Sample numbers	441666242 555451114 1111111 55555555450144 1121224 4411222 111111 222445501111114111111222224 011222 004888405 222338444 2288948 342323233330544 7909013 4323010 222233 327342323355894666668903574 224017 210132931 345461344 0229120 38209584699615 6972109 0317875 578989 095531785607706456788090 42 961663
Syntaxa numbers	1: 1.1 | 1.2 | 1.3; 2: 2.1 | 2.2 | 2.3; 3: 3.2 | 3.3; 4: 4
Rhynchosia nervosa	+ + + | + | + + | + + + | ++ + | + | + | + + | +
Polygala hottentotta	+ + + | | + | + | ++ + | + | + | + ++ + | +
Pollichia campestris	+ | + + ++ | + + | + ++ | | + | + | + + | +
Lightfootia denticulata	+ | | + + | + + + | ++ | + | + | + + |
Sphenostylis angustifolia	| | + | +++++ | ++++ | + | | + + + |
Gnidia capitata	+ + | | + + | + | + + | + | + ++ | + + | +
Lippia scaberrima	| + + | + | + | ++ | + | + + ++ + | +
Ipomoea bathycolpos	++ + | + + | + + | + | + + | + + | + |
Monsonia angustifolia	| + + + | | | + + | + | + + + | ++
Oxalis species	+ + | + | + ++ | + | + | + | + | +
Geigeria burkei	| | + ++ | + | ++ | + | +++ + + |
Hermannia lancifolia	| | | + | ++ | + + | + ++ + | + + |
Gomphrena celosioides	| + ++ | + | + | + | + | + |
Helichrysum callicomum	| | + | + | + + | + + | + | + | + |

Species with an occurrence of < 10 have been omitted.

presence of pioneer grasses such as *Aristida congesta, Cynodon dactylon, Eragrostis superba* and *Melinis repens* (Table 1; species group P).

1. *Grevio flavae – Rhoion pyroidis* all. nov.

Nomenclatoral type: relevé 189

This alliance represents the woody vegetation of the Fa land type and is characterized by species group D (Table 1). The diagnostic species are the tree *Celtis africana* and the shrubs *Rhus pyroides, Grewia flava* and *Diospyros lycioides,* and the two small shrubby species *Protasparagus suaveolens* and *P. laricinus.* Two associations and one community without syntaxonomic rank can easily be recognized. A total of 25 relevés represent this woody vegetation of the Fa land type.

1.1 *Rhoo lanceae – Acacietum eriolobae* ass. nov.

Nomenclatoral type: relevé 140

The *Rhoo lanceae – Acacietum eriolobae* is usually associated with the slightly undulating bottomlands of the Fa land type (Figure 3) and can be observed while travelling from Potchefstroom to Klerksdorp (Figure 1). This association is situated in the south-western area of the Fa land type near Klerksdorp. Sinkholes are characteristically present in this habitat which is underlain by dolomite. The soil is normally shallow (< 300 mm) and clayey but the sinkholes, which are mostly filled by deep (> 1200 mm) aeolian sand have a clay content less than 10%. The dominant soil forms are Hutton (Hu) (50% of this terrain type), Mispah (Ms) and Glenrosa (Gs) (together 33% of the terrain type) and also dolomite outcrops (17% of the terrain type) (Figure 2). The trees *Acacia erioloba* and *Rhus lancea,* the shrub *Lantana rugosa,* the forb *Pavonia burchellii* and the grasses *Setaria verticillata, Eragrostis biflora* and *E. capensis* are the diagnostic species (Table 1, species group A). *Acacia erioloba* is normally restricted to the deep sandy soils in the old sinkholes. Species from species groups C, D (diagnostic for the alliance), N and the more common, widely distributed species from species group P (Table 1) are present in this association. An average of 31 species was recorded per sample plot.

The tree stratum is well developed and is 6.5 m tall with a canopy cover of 24.7%. The shrub stratum is 1.8 m tall and has a canopy cover of 9.6%, while the herbaceous layer is 0.5 m tall with a canopy cover of 54.4%.

Aesthetically, this association is associated with one of the most scenic landscapes in the western Grassland Biome and certainly deserves high conservation priority.

1.2 *Zizipho mucronatae – Acacietum karroo* ass. nov.

Nomenclatoral type: relevé 523

This association is not prominent in the Fa land type but it occurs on the footslopes (4a) and sometimes may encroach into the floodplains (4b) where it holds a subordinate position in the floristic composition, as was also mentioned by Bredenkamp and Bezuidenhout (1990). This encroachment is usually the result of overgrazing or other forms of disturbance of the vegetation (Friedel 1987). The soils are relatively deep (250 – 1200 mm) and clayey (clay content > 20%) with the Hutton (Hu) (50% of the terrain type), Mispah (Ms) and Glenrosa (Gs) (25% of the terrain type) soil forms being dominant. The diagnostic species are the three *Acacia* tree species, namely *A. karroo, A. hereroensis* and *A. caffra,* as well as *Ziziphus mucronata,* while the shrub *Tarchonanthus camphoratus* and the grass *Sporobolus fimbriatus* are also diagnostic for this association (Table 1, species group B). The species of species groups C, D (diagnostic for the alliance), M, N and P are also present in this association (Table 1). An average of 32 species was noted per sample plot.

The tree stratum, which is dominated by *Acacia karroo,* is 5.9 m tall and has a canopy cover of 22.8% while the shrub stratum is 2.2 m tall with a canopy cover of 26.9%. The herbaceous layer is 0.6 m tall and has a canopy cover of 48.9%.

Similar communities were described on different geological strata (Bezuidenhout *et al.* 1988; Bredenkamp *et al.* 1989; Bezuidenhout & Bredenkamp 1991) and also on dolomite (Bezuidenhout & Bredenkamp 1990), but these communities have never been ranked syntaxonomically.

1.3 *Digitaria eriantha – Rhus pyroides* Shrubveld (community without syntaxonomic rank)

This community is usually associated with ruins and debris of old diamond diggings situated on the midslope (3) of the Fa land type, along archaic river beds. Surface rock usually comprises old diamond mine debris. The soils were disturbed and overturned as a result of the diggings and therefore soil depth varies between 250 and >1200 m. The clay content varies from 13 to 30%. This habitat leads to a relatively high diversity in floristic composition. This community is classified under the *Grewio flavae – Rhoion pyroidis,* and although no syntaxonomic rank is assigned to this shrubveld, it is suggested

that it may represent an association. There are no diagnostic species for this community but the strong presence of species group D (Table 1) (diagnostic for the alliance) characterizes this community. Species of species groups L, M, N and P (Table 1) are also present in this community. An average of 43 species per sample plot was recorded.

The tree stratum is poorly developed and is 4.4 m tall with a canopy cover of 10%. The shrub stratum is 2.4 m tall with a canopy cover of 14.9% while the well-developed herbaceous layer is 0.8 m tall and has a canopy cover of 56.4%.

A similar community was identified by Bezuidenhout and Bredenkamp (1990).

2. *Trachypogono spicati – Diheteropogonion amplectentis* all. nov.

Nomenclatoral type: relevé 533

This alliance occurs on the relatively flat or slightly undulating stony plains of the upland areas. The soil of this alliance is shallow (50 – 150 mm) and generally very rocky with the exception of the *Alloteropsido semialatae – Tristachyetum leucothricis* whose soil is deeper (300 – 900 mm). Two grass species, namely *Diheteropogon amplectens* and *Schizachyrium sanguineum*, and the grass-like forb *Bulbostylis burchellii* are the diagnostic species for this alliance (Table 1, species group H). These species are typical for the relatively dry upland, sandy or rocky, well-drained areas and do not occur on the floodplains or on other relatively wet, clayey, poorly drained bottomlands situations. This was also noted by Van Wyk and Bredenkamp (1986), Bredenkamp and Bezuidenhout (1990), Scogings and Theron (1990), and Bezuidenhout and Bredenkamp (1991). This alliance is described by 28 relevés and comprises two associations. One community without syntaxonomic rank is also recognized.

2.1 *Loudetio simplicis – Diheteropogonetum amplectentis* ass. nov.

Nomenclatoral type: relevé 533

The *Loudetio simplicis – Diheteropogonetum amplectentis* is strongly associated with the rocky chert outcrops and ridges on the plateau (1) of the Fa land type's undulating landscape (Figures 2 and 3). The limited shallow soil (50 – 150 mm) with a low clay content (< 10%) present in this association is predominated by chert outcrops (67% of the terrain type) and the Mispah (Ms) and Glenrosa (Gs) (33% of the terrain type) soil forms. Less than 10% of the soil surface is covered by scattered rocks. Diagnostic species of this association include the prominent grass species *Loudetia simplex, Andropogon schirensis, Bewsia biflora* and *Monocymbium ceresiiforme*, all associated with rocky areas, and the dwarf shrubs *Rhus magalismontana* and *Parinari capensis* as well as the conspicuous forbs *Ophrestia oblongifolia* and *Helichrysum miconiifolium* (Table 1, species group E). Species from species groups G and H (diagnostic for the alliance), and the widespread species of species groups L, M, N and P (Table 1) may also occur in this association. An average of 37 species per sample plot was recorded.

The tree stratum is absent and the shrub stratum is poorly developed, 1.0 m tall with a canopy cover of only 7.4%. The shrub stratum, with *Protea welwitschii* being prominent, is conspicuous in the central northern areas of the Fa land type, adjacent to the Sourish Mixed Bushveld (veld type 19) (Acocks 1988). The herbaceous layer has a canopy cover of 55.7% and is 0.8 m tall.

2.2 *Alloteropsido semialatae – Tristachyetum leucothricis* ass. nov.

Nomenclatoral type: relevé 176

This grassland association occurs on the relatively high altitude plateaux (1) and differs from the *Loudetio simplicis – Diheteropogonetum amplectentis* in that the soil is deeper (300 – 900 mm) and has a higher clay content (>10%). The dominant soil types present in this association are the Mispah (Ms) and Glenrosa (Gs) (72% of the terrain type) and the Hutton (Hu) (12% of the terrain type) forms (Figure 2). Large rocks cover 10 – 70% of the soil surface. The diagnostic species for this association are the grasses *Panicum coloratum* and *Alloteropsis semialata* and the inconspicuous forb *Dianthus mooiensis* (Table 1, species group F). The species of species groups G and H (diagnostic for the alliance), and widespread species of species groups L, M, N and P are also present in this association (Table 1). An average of 40 species was noted per sample plot.

The tree stratum is absent and a scanty shrub stratum may be present with a canopy cover of 5% and 1.8 m tall. The herbaceous layer, with *Tristachya leucothrix* and *Alloteropsis semialata* the prominent grasses, is 0.7 m tall and has a canopy cover of 47.9%.

Similar communities were identified by Van Wyk and Bredenkamp (1986) and Bezuidenhout and Bredenkamp (1990), but no formal syntaxonomical rank was assigned.

2.3 *Cymbopogon excavatus – Diheteropogon amplectens* Grassland (community without syntaxonomic rank)

This grassland community is also associated with the high-lying areas in the Fa land type (Figure 2). It is found on the midslopes (3) but is situated downslope, below the *Alloteropsido semialatae – Tristachyetum leucothricis* (2.2) (Figure 3). Mispah (Ms), Glenrosa (Gs) (88% of the terrain type) and Hutton (Hu) (4% of the terrain type) soil forms are dominant in this community. Less than 10% of the soil surface is covered with rocks and stones. No syntaxonomic rank was assigned to this grassland because too little is known about the syntaxonomic position of this community. There are no diagnostic species for this community but the presence of the diagnostic species for the alliance (species group H) and the absence of species groups D (diagnostic for *Grewio flavae – Rhoion pyroidis*) and I (diagnostic for *Cymbopogono plurinodis – Eragrostidetum gummifluae*) suggest that this community should be classified under the *Trachypogono spicati – Diheteropogonion amplectentis* (Table 1). Widespread species from species groups L, M, N and P (Table 1) are present in this community. An average of 32 species was recorded per sample plot.

The tree and shrub strata are absent but the herbaceous layer is well developed, 0.8 m tall and has a canopy cover of 57.1%.

Old cultivated areas left to recuperate are also found in this grassland.

3. *Cymbopogono plurinodis – Eragrostidetum gummifluae* ass nov.

Nomenclatoral type: relevé 135

This association occurs on the midslopes (3) and the bottomland floodplains (4b) of the Fa land type (Figures 2 and 3). The soils are relatively deep (250 – 1200 mm) and have a clay content of between 13 and 30%. The pioneer grass species *Eragrostis gummiflua* and the dwarf shrub *Ziziphus zeyheriana* as well as the conspicuous forbs *Helichrysum nudifolium* and *Dicoma capensis*, together with the inconspicuous forb *Chamaesyce hirta*, are diagnostic for this association (Table 1, species group I). The vegetation is often subjected to overgrazing, resulting in degradation and the subsequent presence of many pioneer species. Two sub-associations can be identified.

3.1 *Cymbopogono plurinodis – Eragrostidetum gummifluae aristidetosum canescentis* subass. nov.

Nomenclatoral type: relevé 125

The *Cymbopogono plurinodis – Eragrostidetum gummifluae aristidetosum canescentis* is associated with bottomlands but relatively high-lying, rocky, lower midslopes (3) just above the

floodplains of the Fa land type. There may be outcrops of dolomite rock, and sometimes rock sheets occur just beneath the soil surface in which case the soil is shallow (< 250 mm). Normally the soil is deeper than 250 mm with the Hutton (Hu) (47% of the terrain type), Mispah (Ms) and Glenrosa (Gs) (46% of the terrain type) soil forms predominant in this sub-association (Figure 2). The diagnostic species are the pioneer grass species *Aristida canescens* and the conspicuous pioneer forbs *Kyphocarpa angustifolia* and *Solanum capense* and the dwarf shrub *Indigofera comosa.* The inconspicuous mat-forming forb *Helichrysum caespititium* (Table 1, species group J) is also diagnostic. Species from species groups I (diagnostic for the association), L, M and N and the more common species from species group P are also present in this sub-association (Table 1). An average of 44 species was noted per sample plot.

The tree and shrub strata are absent. The herbaceous layer is degraded, 0.7 m tall, with a canopy cover of 35%.

3.2 *Cymbopogono plurinodis – Eragrostidetum gummifluae eragrostidetosum superbae* subass. nov.

Nomenclatoral type: relevé 135

This sub-association is found in the low-lying floodplains (4b) of the Fa land type (Figure 2). The soil (250 – 1200 mm deep) has more than 5% rocks and stones on the surface. The dominant soil forms are the Hutton (Hu) (50% of the terrain type), Mispah (Ms) and Glenrosa (Gs) (33% of the terrain type). The diagnostic species are the pioneer grass *Tragus berteronianus* and the forbs *Salvia radula, Solanum panduriforme, Helichrysum rugulosum, Tylosema esculentum, Helichrysum coriaceum* and *Ipomoea obscura* (Table 1, species group K). Other species from species groups I (diagnostic for the association), L, M, N and P are also present in this sub-association (Table 1). An average of 36 species was recorded per sample plot.

The tree stratum is absent. A poorly developed shrub stratum is locally present, with a canopy cover of 8%, and is 1.83 m tall. The well-developed herbaceous layer is 0.77 m tall and has a canopy cover of 62%.

4. *Paspalo dilatati – Hyparrhenietum hirtae* ass nov.

Nomenclatoral type: relevé 141

The *Paspalo dilatati – Hyparrhenietum hirtae* is strongly associated with the low-lying drainage lines (5) in the Fa land type. These seasonally wet bottomlands have soils with a higher clay content (> 25% clay) than those of the upland areas. No or very little rock or stone occur on the soil surface. The dominant soil forms present in this association are Westleigh (We), Valsrivier (Va) (40% of the terrain type) and Hutton (Hu) (40% of the terrain type) (Figure 2). The diagnostic species are the perennial grasses *Hyparrhenia hirta, Chloris pycnothrix, Eragrostis plana* and *Paspalum dilatatum* and the conspicuous forbs *Verbena bonariensis* and *Scabiosa columbaria* (Table 1, species group O). The only other species present are the more common species of species group P (Table 1). An average of 26 species was noted per sample plot.

A tree stratum is absent and the 1.7 m tall shrub layer covers less than 10% of the area. The herbaceous layer is well developed, with a canopy cover of 56.7%, and is 1.0 m tall.

This habitat is fairly unstable owing to seasonal flooding and subsequent desiccation which, together with the frequent overgrazing of these sites, causes the advanced state of degradation of the vegetation.

A similar community was described by Bezuidenhout and Bredenkamp (1990).

Ordination

In the ordination diagram the distribution of the major syntaxa along the first and second axes of the ordination is given (Figure 4). The syntaxa are restricted to specific spacial areas in the ordination diagram. It is possible to circumscribe the different syntaxa but a distinct discontinuity between them is impaired by the presence of a strong group of common species (Table 1, species group P). The presence of these common species is ascribed to the compilation of the data in a relatively homogenous land type.

Along the first axis the woodland syntaxa (1) occur to the left of the diagram while the grassland syntaxa (2 and 3) occur in the centre with the wetland syntaxa (4) to the right of the diagram. Along the second axis a gradient is illustrated which may be related to altitude and moisture (Figure 4). This trend confirms the result of the classification, and is not discussed further.

Conclusions

This is the first comprehensive syntaxonomical account of the vegetation of the dolomite and chert region (Fa land type) in the western Transvaal Grassland Biome. New syntaxa described include two alliances, six associations and two sub-associations with two communities without syntaxonomical status.

The floristic and habitat diversity of the Fa land type, especially the *Rhoo lanceae – Acacietum eriolobae* should have high conservation priority. Small nature reserves, such as the Abe Bailey Nature Reserve (1887 ha) (Van Wyk 1983) and a part of the Jack Scott Nature Reserve (2100 ha) (Coetzee 1974), are at present the only known protected vegetation areas in the Fa land type. It is alarming that only 4000 ha (0.72%) of this vegetation is being formally conserved. The presence of pioneer species in species groups L, M and N (Table 1) indicates that this vegetation is in a degraded state. The main factors seem to be the relatively low rainfall of the area over the past ten years and the continuous overgrazing of the natural vegetation by domestic stock. This classification of vegetation and associated habitat should form a basis for all vegetation-related management planning as well as for establishing priorities for conservation of land. This description of the Fa land type contributes considerably to the understanding and present knowledge of the western Transvaal grassland.

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Two new species of *Cineraria* L. (Senecioneae, Asteraceae)

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Two new species of *Cineraria* L., *C. austrotransvaalensis* Cron and *C. hederifolia* Cron, are described from the Transvaal. Their affinities, geographical distribution and conservation status are discussed.

Twee nuwe spesies van *Cineraria* L., *C. austrotransvaalensis* Cron en *C. hederifolia* Cron, vanuit die Transvaal word beskryf. Hulle affiniteite, geografiese verspreiding en bewaringstatus word bespreek.

Keywords: Asteraceae, *Cineraria*, new species, Senecioneae.

Introduction

Cineraria L. is an African genus with approximately forty-five species currently described, although a few of these are considered doubtful (Hilliard 1977; Jeffrey 1986). Most species are southern African, with a few in east and tropical Africa and one in Madagascar. The genus includes herbs and subshrubs, with alternate (or rarely radical), lobed leaves. The capitula are mainly heterogamous and radiate, with yellow florets. The cypselae are obovate, compressed, brown or black, and either glabrous or ciliate with thickened margins or wings.

The two new species described are from the Transvaal: *C. austrotransvaalensis* Cron from the koppies and ridges of the Witwatersrand and adjacent areas, and *C. hederifolia* Cron from the Blouberg in the north-west and the Drakensberg in the east. Both species are characterized by the tomentose (white-felted) indumentum, which is widespread in the genus and reflected in the name 'Cineraria', meaning grey or ash-coloured.