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Vegetation ecology of Sekhukhuneland, South Africa: *Kirkia wilmsii–Terminalia prunioides* Closed Mountain Bushveld

SJ Siebert[1,2]*, AE van Wyk[1] and GJ Bredenkamp[1]

[1] Department of Botany, University of Pretoria, Pretoria 0002, South Africa
[2] Present address: SABONET, c/o National Botanical Institute, Private Bag X101, Pretoria 0001, South Africa
* Corresponding author, e-mail: stefan@nbipre.nbi.ac.za

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A hierarchical classification, description, and ecological and floristic interpretations are presented on one of the six major vegetation types of the Sekhukhuneland Centre of Plant Endemism, namely the *Kirkia wilmsii–Terminalia prunioides* Closed Mountain Bushveld. Relevés were compiled in 103 stratified random plots. A TWINSPAN classification, refined by Braun-Blanquet procedures, revealed 20 plant communities, which are divided into five associations and 20 sub-associations. Many new syntaxa are described and ecologically interpreted. For each of the plant communities the floristic richness, endemism and conservation status was determined. A selected set of environmental factors is provided to aid with the delimitation of plant communities. The floristic information, proposed classification, general description and vegetation key, can be used for the identification of conservation areas, land-use planning and further research.

Introduction

Plant communities of the *Kirkia wilmsii–Terminalia prunioides* Closed Mountain Bushveld [CMB] (Siebert *et al.* 2002) are described in this contribution and form part of a comprehensive vegetation and floristic survey of the Sekhukhuneland Centre of Plant Endemism [SCPE]. This paper characterises and interprets the vegetation units and the associated habitats of the CMB, and provides an assessment of the plant diversity, endemism and threatened taxa of the various plant communities. A vegetation key is presented to assist with the easy identification of the syntaxa of the CMB in the region. Habitat data are provided to aid with future, more comprehensive ecological analysis. The background and objectives of the research are provided elsewhere (Siebert *et al.* 2002b).

Study Area

The study area comprises the central part of the SCPE (Figure 1); the Sekhukhuneland Centre is defined and discussed in Siebert *et al.* (2002a). The study area is discussed in Siebert *et al.* (2002b). Note that the extent of occurrence of the CMB differs slightly from that of the Open Mountain Bushveld [OMB].

Methods

The final TWINSPAN division of the main table (415 relevés) of Siebert *et al.* (2002), separated the *Kirkia wilmsii–Terminalia prunioides* Closed Mountain Bushveld from the *Combretum hereroense–Grewia vernicosa* Open Mountain Bushveld. This was a marginal division, with both savanna vegetation types sharing the majority of their species and occurring in the same terrain types on mountain/hill slopes and in valleys of the central region of the SCPE. The division of the two vegetation types is based on the significant occurrence of preferential species, which are listed in Table 1 together with significant non-preferential ones.

The methodology for the analyses of vegetation data and refinement of the classification follows Siebert *et al.* (2002b). Floristic and habitat data of the CMB was obtained from 103 stratified random sample plots. A multivariate approximation (TWINSPAN) (Hill 1979) of the vegetation, based on the floristic data set, was used to distinguish several vegetation types. Braun-Blanquet procedures were used to further refine the resultant classification in the MEGATAB computer programme (Hennekens 1996).

Results and Discussion

An analysis of the *Kirkia wilmsii–Terminalia prunioides* Closed Mountain Bushveld resulted in the identification of four major vegetation units and 20 plant communities, which are grouped as five associations and 20 sub-associations (Table 2). These were subsequently hierarchically classified, described and interpreted. Approximately 600 (30%) of the SCPE's approximately 2 000 known plant taxa were recorded during the survey of the CMB, with only the most conspicuous and dominant taxa presented in Table 2. The dis-

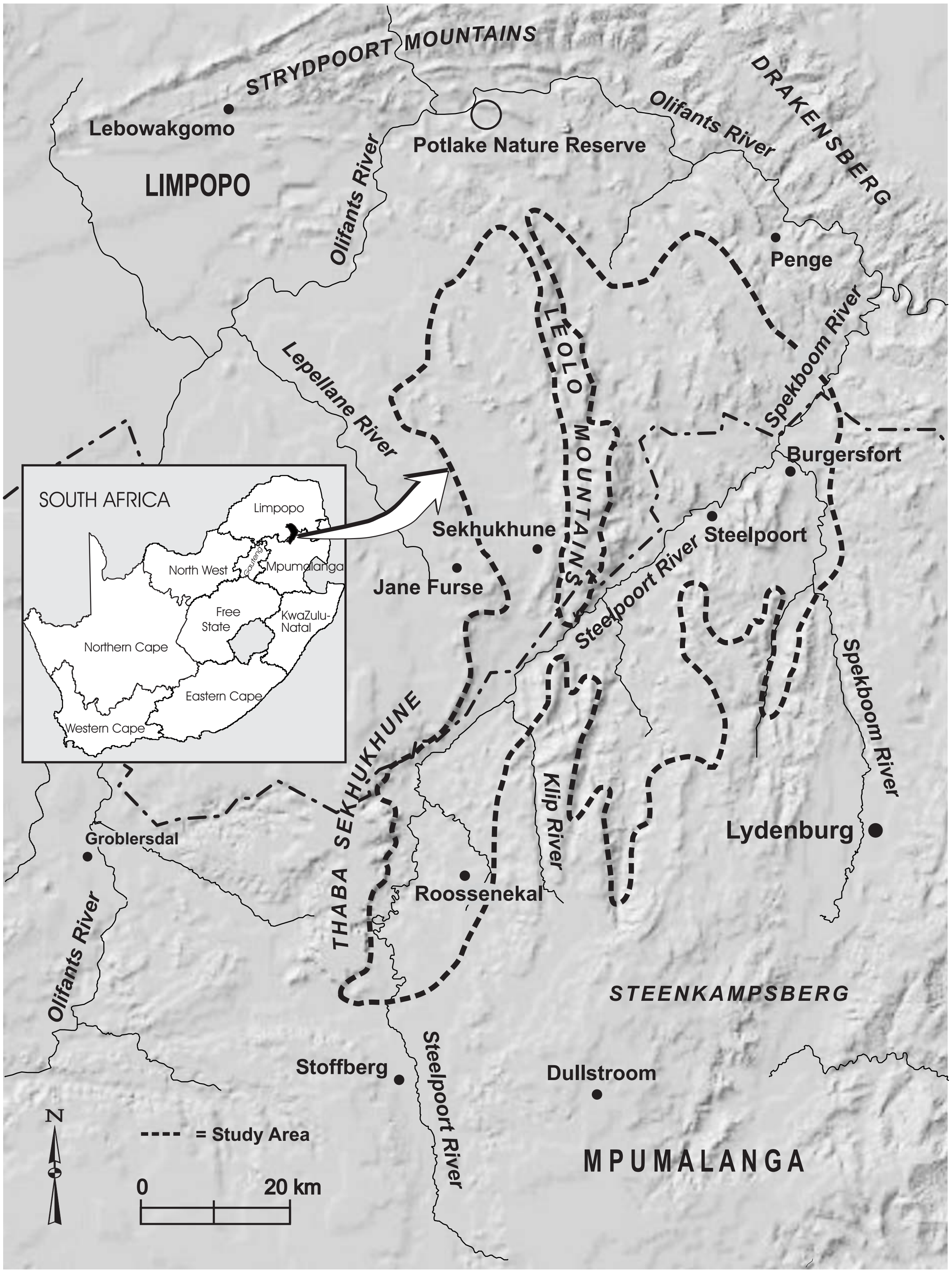

Figure 1: Extent of occurrence of the Closed Mountain Bushveld of the Sekhukhuneland Centre of Plant Endemism in Limpopo (Northern Province) and Mpumalanga, South Africa

Table 1: Preferential species for each of the two Mountain Bushveld types expressed as a percentage of the total number of revelés (n) in each data set

Species	OMB (n = 91)	CMB (n = 103)	Correlation (r)	Difference
Preferential species for OMB:			0.73*	
Vitex obovata subsp. *wilmsii*	73.6%	3.9%		69.7%
Tinnea rhodesiana	60.4%	11.7%		48.7%
Brachylaena ilicifolia	48.4%	3.9%		44.5%
Themeda triandra	76.9%	34.0%		42.9%
Euclea crispa	44.0%	2.9%		41.1%
Berkheya insignis	34.1%	0%		34.1%
Gnidia caffra	34.1%	1.0%		33.1%
Diheteropogon amplectens	36.3%	3.9%		32.4%
Senecio latifolius	30.8%	0%		30.8%
Orthosiphon fruticosus	31.9%	2.9%		29.0%
Preferential species for CMB:			0.961**	
Panicum maximum	26.4%	70.9%		44.5%
Dichrostachys cinerea	15.4%	54.4%		39.0%
Terminalia prunioides	26.4%	56.3%		29.9%
Grewia flava	4.4%	33.0%		28.6%
Boscia albitrunca	6.6%	35.0%		28.4%
Sarcostemma viminale	4.4%	31.1%		26.7%
Rhus engleri	2.2%	28.2%		26.0%
Commiphora mollis	3.3%	29.1%		25.8%
Euclea divinorum	2.2%	26.2%		24.0%
Acacia nigrescens	3.3%	26.2%		22.9%
Non-preferential species:			0.813**	
Corbichonia decumbens	22.0%	22.3%		0.3%
Indigofera hilaris	24.2%	22.3%		1.9%
Petalidium oblongifolium	23.1%	26.2%		3.1%
Jasminum multipartitum	20.9%	17.5%		3.4%
Heteropogon contortus	54.9%	48.5%		6.4%
Psiadia punctulata	29.7%	36.9%		7.2%
Aloe cryptopoda	24.2%	32.0%		7.8%
Leucas capensis	20.9%	12.6%		8.3%
Raphionacme galpinii	24.2%	15.5%		8.7%
Pellaea calomelanos	36.3%	26.2%		10.1%

*Significant positive correlation
**Highly significant positive correlation

tribution of 41 Sekhukhuneland Centre endemic/near-endemic (Siebert 1998) and Red Data List (Hilton-Taylor 1996) taxa among various plant communities is also indicated in Table 2.

Classification

Plant communities of the *Kirkia wilmsii–Terminalia prunioides* Closed Mountain Bushveld recognised for the SCPE are classified as follows (Figure 2):

I. *Enneapogono scoparii–Kirkion wilmsii*

1. *Enneapogono scoparii–Kirkietum wilmsii*
   1.1 *Enneapogono scoparii–Kirkietum wilmsii clerodendretosum glabri*
   1.2 *Enneapogono scoparii–Kirkietum wilmsii solanetosum incani*
   1.3 *Enneapogono scoparii–Kirkietum wilmsii bridelietosum mollis*
   1.4 *Enneapogono scoparii–Kirkietum wilmsii lanneetosum discoloris*
   1.5 *Enneapogono scoparii–Kirkietum wilmsii munduletosum sericeae*
   1.6 *Enneapogono scoparii–Kirkietum wilmsii karomietosum speciosae*
   1.7 *Enneapogono scoparii–Kirkietum wilmsii nuxietosum congestae*

II. *Urochloo mosambicencis–Eucleion divinorum*

2. *Enneapogono cenchroidis–Acacietum leiorachidis*
   2.1 *Enneapogono cenchroidis–Acacietum leiorachidis rhigozetosum obovati*
   2.2 *Enneapogono cenchroidis–Acacietum leiorachidis maeruetosum angolensis*
   2.3 *Enneapogono cenchroidis–Acacietum leiorachidis bolusanthetosum speciosae*
   2.4 *Enneapogono cenchroidis–Acacietum leiorachidis gardenietosum volkensii*
3. *Fingerhuthio africanae–Boscietum foetidae*
   3.1 *Fingerhuthio africanae–Boscietum foetidae elaeodendretosum transvaalensis*
   3.2 *Fingerhuthio africanae–Boscietum foetidae aloetosum globuligemmae*

Table 2: Phytosociological table of the Closed Mountain Bushveld of the Sekhukhuneland Centre of Plant Endemism

Relevè number	115 119 121	113 116 118	290 298 300 304	206 213 220 233 232	161 241 250 262 263	131 151 154 165 168 170 172 189 191 194	186 197 211	155 157 158 159 187 198 258 273 274	149 212 228 270 300	148 299 308 309	114 117 220 327 329	126 140 145 147 217 229	143 150 180 183 201 202 253 256	267 268 305 306 326 328	292 293 294 311 325	392 394 395	391 398 400 405 411 412	384 385 386 393 404	176 177 178 236	179 184 208 389
Alliance					I								II						III	
Association	1.	1.	1.	1.	1.	1.	1.	2.	2.	2.	2.	3.	3.	3.	3.	4.	4.	4.	5.	5.
Sub-association	1	2	3	4	5	6	7	1	2	3	4	1	2	3	4	1	2	3	1	2
Number of relevès					**33**				**23**				**25**				**14**		**8**	
	3	3	4	5	5	10	3	9	5	4	5	6	8	6	5	3	6	5	4	4
Number of species					**222**				**178**				**197**				**187**		**115**	
	40	55	60	100	84	123	73	114	96	65	82	98	131	83	55	97	130	122	52	66
Mean number of spp./relevè					**37**				**35**				**36**				**40**		**30**	
	30	41	34	45	39	40	32	39	38	32	29	38	43	29	33	45	38	38	32	28
SCPE Endemics					**9**				**11**				**9**				**9**		**1**	
	1	2	1	4	4	4	4	6	7	2	5	4	5	2	3	4	9	2	1	1
SCPE Near-endemics					**10**				**10**				**10**				**8**		**1**	
	3	2	2	6	5	6	5	6	6	7	4	8	6	2	3	4	5	3	1	1
Red Data List taxa					**2**				**1**				**2**				**4**		**0**	
	1	0	0	1	1	1	2	1	1	1	0	0	0	0	2	1	3	0	0	0
Restricted to syntaxon					**6**				**3**				**4**				**6**		**1**	
	1	0	0	0	0	0	1	0	1	0	1	0	0	0	3	0	4	0	0	0
Total syntaxon					**20**				**21**				**20**				**18**		**2**	
	4	4	3	10	9	10	9	12	13	9	9	12	11	4	7	8	15	5	2	2
Tree cover %					**10**				**8**				**9**				**6**		**15**	
	8	11	10	11	8	10	8	8	8	8	8	11	10	9	4	5	4	8	12	17
Mean tree height (m)					**5.5**				**4.5**				**4.75**				**4**		**7**	
	5.5	5	6	6.5	4.5	6	5.5	4.5	5	4.5	4.5	5	4.5	5.5	4	3.5	3	5	6.5	7.5
Shrub cover %					**3**				**4**				**4**				**8**		**4**	
	4	2	4	3	3	4	2	4	4	3	6	4	5	3	2	6	11	4	6	3
Mean shrub height (m)					**1.9**				**2**				**1.6**				**1.75**		**1.8**	
	2	1.75	2	2.25	1.5	2	1.75	2.5	1.75	1.65	2.25	1.75	1.6	1.65	1.5	1.5	2	1.75	1.8	1.85
Forb cover %					**5**				**5**				**7**				**8**		**3**	
	3	4	3	6	6	5	5	6	5	3	4	6	11	4	5	9	7	9	2	4
Mean forb height (m)					**0.75**				**0.5**				**0.6**				**0.5**		**0.4**	
	1	0.65	0.45	1.1	0.8	0.5	0.75	0.6	0.5	0.45	0.55	0.6	0.75	0.6	0.5	0.4	0.55	0.6	0.4	0.45
Grass cover %					**15**				**16**				**10**				**12**		**9**	
	6	33	13	17	11	16	7	16	11	30	11	10	9	17	6	14	6	17	10	8
Mean grass height (m)					**0.8**				**0.8**				**0.6**				**0.6**		**0.8**	
	0.75	0.85	0.65	1	0.9	0.8	0.75	0.65	0.75	0.9	0.8	0.65	0.6	0.6	0.55	0.5	0.55	0.7	0.8	0.85
Total cover %					**33**				**33**				**30**				**34**		**31**	
	21	50	30	37	28	35	22	34	28	44	29	31	35	33	17	33	27	38	30	32
Geology					**P/N/A/S/G/F**				**M/N/A/P/F/G/S**				**Q/P/F/N**				**N/A/Q**		**Q**	
	S	S	G/F	P	N/A/G/F	P/N/A	P/N/A	N/A/M	P/F	P/G	N/A/M	P/Q	Q	F/Q	N/Q	N/A	N/A	N/Q	Q	Q
Soil type					**Gs/Ms**				**Hu/Sd/Bo/Gs**				**Bo/Hu/Va/Gs/Sd**				**Gs/Ms/Sn**		**Oa**	
	Gs	Gs	Gs	Gs	Gs	Gs/Ms	Ms	Bo/Hu	Sd/Hu	Hu	Gs/Sd	Bo/Sd/Hu	Bo/Va	Bo/Va/Gs	Hu/Gs	Ms	Gs	Sn/Gs	Oa	Oa
Topographic position					**M/S**				**F/M**				**F/V**				**F/V**		**V**	
	M	M	M	M	M/S	M/S	S	M/F	F	F	F	F	F/V	F/V	F	F	F	F/V	V	V
Slope (°)					**10 (5-15)**				**4 (3-5)**				**3 (1-5)**				**4 (1-7)**		**3 (1-5)**	
	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					**N/E/S**				**N/S/W/E**				**W/E/N**				**N/E/S/W**		**-**	
	N/E/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	-	-
Rock cover %					**50 (30-70)**				**30 (10-50)**				**25 (10-50)**				**45 (20-65)**		**20 (5-40)**	
	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	20-30	5-20	5-40
Mean rock size (mm)					**650 (300-1500)**				**400 (200-1000)**				**250 (50-500)**				**1000 (200-2000)**		**150 (50-300)**	
	650	525	500-750	400-1000	650-1000	300-750	1125	200-400	500-1000	100-150	300-500	100-300	100-200	50-400	400-500	1450	500-2000	200-600	100-300	50-100

Geology: A = anorthosite; F = ferrogabbro; G = granophyre; M = magnetite; N = norite; P = pyroxenite; Q = alluvium; s = shale

Soil type: Oa = Oakleaf; Bo = Bonheim; Gs = Glenrosa; Hu = Hutton; Ms = Mispah; Sd = Shortlands; Sn = Steendal; Va = Valsrivier

Topographic position: S = scarp; M = midslope; F = footslope; V = valley

Endemism: $ = endemic, # = near-endemic

Red Data List: K = Insufficiently Known, E = Endangered, R = Rare, N = Not threatened in the northern provinces, but in other areas of southern Africa

Collectors: S = Siebert, W = Van Wyk

Cover abundance: R = rare, + = <1%, 1 = <5%, A = 5-12%, B = 12-25% and 3 = 25-50%

Growth form: t=tree; s=shrub; f=forb; g=grass

Table 2 cont.

Alliance	I							II											III	
Association	1 .	1 .	1 .	1 .	1 .	1 .	1 .	2 .	2 .	2 .	2 .	3 .	3 .	3 .	3 .	4 .	4 .	4 .	5 .	5 .
Sub-association	1	2	3	4	5	6	7	1	2	3	4	1	2	3	4	1	2	3	1	2
Species group A: Diagnostic species for *Enneapogono scoparii–Kirkion wilmsii* and *Enneapogono scoparii–Kirkietum wilmsii*																				
Enneapogon scoparius g	1 1 1	1 A 1	B . . B	A A 1 1 1	+ 1 1 1 +	1 A + 1 R + + B 1 1	1 1 .	. + . . . + . . .	. . . + R	. R . .	. + . . .	. . . . . +	. . . .	. . . . + R	. . . . .	. . .	. . . . . .	. 1 . . .	. . . .	. . . .
Triaspis glaucophylla s [#]	1 1 +	. R .	+ + + 1	+	1 R . + +	R + R + + 1 + . . +	+ . +	. . R + ...	. . . . .	R . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Acacia exuvialis t	1 + 1	. + 1	. + R .	. R . . +	. + R + .	. + 1 . + . 1 . R .	. + +	. . . R	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Combretum apiculatum t	+ + +	1 + 1	1 1 1 1	1 1 + 1 .	+ + 1 + +	1 + . + + 1 + 1 + .	. + +	. . . .	. + . R .	. . . .	. . . R R	. . . . . .	. . . .	. . . . . .	R . R R +	. . .	. . R . . .	. . . . .	. . . .	. . . .
Grewia monticola s	+ R +	+ . R	1 + 1 +	R + + + +	. + . . +	R . R + . . R + + +	+ + R	. . . .	. . R + .	. . R .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Clerodendrum ternatum f	+ R .	+ + .	+ R + +	1 + + R +	+ R . . .	+ + . + + + R R + .	. + .	. . . + ...	. . . . .	. . . .	. . . + +	. . R . . .	R	. . . . . .	. . . . .	R . .	. + ...	. . . 1 .	. . . .	. . . .
Aloe marlothii t	R + .	+ . +	. . + +	. . 1 . .	+	. + R + . + R . . +	. + .	. . . . R	. . . . +	. . . .	. . R R +	. . . . R .	. . . .	. . . . + R	. . . . .	. . .	. . . + . .	. . 1 . .	. . . .	. . . .
Pellaea calomelanos f	R R +	R R +	R R + R	+ + R R .	R . + + R	R . . + + R . + . .	+ . .	. . R	. . . . .	. . . .	. R . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . R	+	. . . . .	. . . .	. . . .
Commiphora mollis t	. + R	1 1 +	+ . . .	+ . + + 1	. + + 1 1	+ 1 1 R 1 . R . 1 +	+ + R	. . . R	. + + . .	. . . .	R . . + .	. . . . . .	. . . .	. . . . . R	+	. . .	. . . . . .	. . . . .	. . . .	. . . .
Commiphora africana t	. R +	+ + +	1 + . 1	. 1 1 + R	1 1 R . +	. . 1 R . 1 + . 1 R	. . +	. . + ...	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Sterculia rogersii t	. . +	+ + +	+ . . .	+ 1 + 1 +	. . + + .	+ 1 + . 1 . + . + +	+ + .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group B: Diagnostic species for *Enneapogono scoparii–Kirkietum wilmsii clerodendretosum glabri*																				
Elephantorrhiza goetzei s	+ 1 +	. R R	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Clerodendrum glabrum t	+ + 1	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	R	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	+ R . R .	. . . .	. . . .
Dombeya rotundifolia t	+ + +	. . .	. . . .	R . R . .	. . . . .	. . . . R . .	. + .	. . . .	. . . . R	. . . .	. . . . .	. . . . . .	. . . .	. . . . + .	. . . . .	. . R	+ . . R . .	. . . . .	. . . .	. . . .
Buttonia superba f	+ + R	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Ormocarpum kirkii s	+ + R	. . .	. . . .	. . . . .	. . . . .	. . . . R	. . .	. . . .	. . . . .	. . . .	. . . R .	. . . . . .	. . . .	. . . . . R	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Plectranthus xerophilus f [#]	R + +	R . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group C: Diagnostic species for *Enneapogono scoparii–Kirkietum wilmsii solanetosum incani*																				
Eustachys paspaloides g	. . .	+ + 1	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Setaria lindenbergiana g	. R .	+ + +	. . . .	. . . . R	. . . . R	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Solanum incanum f (form: *W13013*) [$]	. . .	+ + +	R . R R	. . . . .	. . . . .	. . . .	. . .	. . . .	. + . . .	. . . .	R	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Rhoicissus tridentata s	. . .	+ R +	. . . .	. . + . .	. . . . .	. . . .	+ . .	. . . .	. . . . .	. . . .	R	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Boophane disticha f	. . .	+ R .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group D: Diagnostic species for *Enneapogono scoparii–Kirkietum wilmsii bridelietosum mollis*																				
Bridelia mollis t	. . .	. . .	+ + R +	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . R . .	. . . . .	. . . .	. . . .
Melhania burchellii f	. . .	+ R .	R + + R	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. + . . .	. . . . . .	. . . .	. + R + . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Rhynchosia pauciflora f	. . .	. . .	+ . + R	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Justicia odora f	. . .	. . .	+ R . +	. . . . .	. . . . .	. . + ...	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Aristida bipartita g	. . .	. . .	. + + +	. R . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . R	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Indigofera filipes f	. . .	. . .	. R + +	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group E: Diagnostic species for *Enneapogono scoparii–Kirkietum wilmsii lanneetosum discoloris*																				
Lannea discolor t	. . .	. . .	. . . .	+ + + + .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Cymbopogon excavatus g	. . .	. . .	. . . .	+ . + + R	. . . R .	. . . .	. . R	. . . .	. . . . .	. . . .	. . . . .	. . R . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Sphenostylis angustifolia f	. . .	. . .	. . . .	R + + . R	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	+	. . . .	. . . .
Ipomoea obscura f	. . .	. . .	. . . .	. R + + +	. R . . .	. . . .	. . .	. . . .	. . . R .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. R	. . . . .	. . . .	. . . .
Tylosema fassoglense f	. . .	. . .	. . . .	R + . . +	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Sphedamnocarpus pruriens f	. . .	. . .	. . . .	. . + + R	. . . R .	. R	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group F																				
Pappea capensis t	+ + R	R + +	+ + + +	. + + + +	. . . . .	. . . .	R + R	. . R	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . R	. . . . .	. . .	. . . + . .	. . . . .	. . + +	. . . .
Lantana rugosa f	R . +	R + +	+ . + R	+ . R . +	. . . . .	. . . . R .	. . .	. . . . R + . + .	. + R . .	. . . .	. . . . .	. . . . . .	. + ...	. . . . . .	. . . . .	R . .	. . . . . .	. . . . .	. . . .	. . . .
Digitaria eriantha g	. R +	1 B A	. + + .	. 1 + . +	. . . . .	. R	. . .	. . + ...	. . . . .	. . . .	1 + R . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . + +	. . + . .	. . . .	. . . .
Ozoroa sphaerocarpa t	. + .	+ . .	. + + .	. . + + .	. . + . .	. . . .	. . .	. . . . . . + . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	R R	. . . . .	. . R	. . . . . .	. . . . .	. . . .	. . . .
Species group G: Diagnostic species for *Enneapogono scoparii–Kirkietum wilmsii munduletosum sericeae*																				
Mundulea sericea s	. . .	. . .	. . . .	. . . . .	+ + . + +	. . . . . . R . . .	. R .	. . . .	. . . R .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. + ...	. . . . .	. . . .	. . . .
Hermannia boraginiflora f	. . .	. . .	. . . .	. . R . .	+ R + . +	. . . .	. . .	. . R R	. . . . .	. . . .	. . . . .	. . . . . .	R . . . R . . .	. . . . . .	. . . . .	. R .	. . . . . .	. . . . R	. . . .	. . . .
Hermannia glanduligera f	. . .	. . .	. . . .	R	. + + + R	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Tephrosia forbesii f	. . .	. . .	. . . .	. . . . .	. R + . +	. . . .	R . .	. . . .	. . . R .	. . . .	. . . . .	. . . . . .	. . . . + . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Pentarrhinum insipidum f	. . .	. . .	. . . .	. . . . .	. . + R +	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group H																				
Jasminum multipartitum s	. . .	. . .	. . . .	+ + + R 1	+ R + . +	. . . .	. . R	. R . . . . . R R	. . . R .	R . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Jatropha latifolia f [#]	. . .	. . .	. . . .	R + R + +	R + + + R	. . . . R + ...	. R .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Decorsea galpinii f	. . .	. . .	. . . .	R R . + +	. R + R +	. + . R	. R .	. . . . R .	. . R . .	+ . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Aristida meridionalis g	. . .	. . .	R . R .	. 1 + . 1	. + 1 . +	. . . .	. . .	. . . . R .	. R . + .	. . . .	. . . . .	. . . . R +	. . . .	. . . . . .	. 1 . R +	. . .	. . . . . .	. . . . .	. . . .	. . . .
Ledebouria revoluta f	. . .	. . .	. . . .	. + R . +	R . + + .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .

Table 2 cont.

Alliance	I							II											III	
Association	1 .	1 .	1 .	1 .	1 .	1 .	1 .	2 .	2 .	2 .	2 .	3 .	3 .	3 .	3 .	4 .	4 .	4 .	5 .	5 .
Sub-association	1	2	3	4	5	6	7	1	2	3	4	1	2	3	4	1	2	3	1	2
Species group I: Diagnostic species for *Enneapogono scoparii–Kirkietum wilmsii karomietosum speciosae*																				
Ochna inermis s	. . .	. . .	. . . .	R . . . R	. . . R .	+ 1 R + + + + . + R	. . R	. . . R	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Karomia speciosa s	. . .	. . .	. . . .	. . . . .	. . . . .	+ + 1 . 1 + . + 1 +	. R .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Eragrostis rigidior g	. . .	. . .	. R . .	. R . . .	. . . + .	+ 1 . + + . 1 + 1 .	+ + .	R . . R	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Euphorbia schinzii f	. . .	. . .	. . . .	. . . . .	. . . . .	+ . + . + . + R . +	. . .	. . . . . . R . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. 1 +	. . . . . .	. . . . .	. . . .	. . . .
Blepharis subvolubilis f	. . .	. . .	. . . .	. . . . .	R . R . .	. 1 + . + . + R . +	. . R	. . . .	. . . . .	. . . .	. R . . .	. . . . . R	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Pavetta inandensis s	. . .	. . .	. . . R	. . . . .	. . . . .	+ . . + . R + + + .	. . .	. . . .	. . . R .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . +	. . . + . .	. . . . .	. . . .	. . . .
Species group J: Diagnostic species for *Enneapogono scoparii–Kirkietum wilmsii nuxietosum congestae*																				
Nuxia congesta t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	+ 1 +	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Hermannia floribunda f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	+ + .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Pouzolzia mixta t	. . .	R . R	. . R .	. . . . .	. . . . .	. R	+ R +	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Ruttya ovata f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	R + 1	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Hibiscus calyphyllus f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	+ . +	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Barleria rotundifolia f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. + 1	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . + . . .	. . . . .	. . . .	. . . .
Tetradenia brevispicata f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. + +	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group K: Diagnostic species for *Enneapogono cenchroidis–Acacietum leiorachidis rhigozetosum obovati*																				
Sporobolus stapfianus g	R 1 +	. . .	. . . .	. . . R .	. . . . .	. . . .	. . .	A A + . 1 A . R 1	. . . . .	. . . .	1	. . . . . .	. 1 . . . . + .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Croton menyhartii t	. . .	. . .	. . . .	. . . . .	. . . . .	. . + ... R	. . .	1 + . R + + . . +	. . . . .	. . . .	. . . . .	. . . . . .	. + R . + R . R	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Rhigozum obovatum s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	+ + R 1 + . + + R	. + . . .	. . . .	. . . . .	. . . . . .	. . + ...	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Cenchrus ciliaris g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . + . + ...	. . .	+ . + . . . R + .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Monechma divaricatum f	. . .	. . .	. . . .	. + . . .	. . . . .	. . . .	. . .	R 1 . + + 1 . + R	. . . . +	. . . .	. . . . .	. . . . . .	. + . + . R + .	. . . . 1 .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Bauhinia tomentosa s (form: *S444*) [$]	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. + + R . . + . +	. . . + .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Tinnea rhodesiana s	R . R	. . .	. . . .	R	R	. . . .	. . .	. . + + . R + . +	. . . . .	. . . .	. . . . .	. . . . . .	. . . + ...	. R	. . . . .	. . .	. . . + . .	. . . . .	. . . .	. . . .
Species group L: Diagnostic species for *Enneapogono cenchroidis–Acacietum leiorachidis maeruetosum angolensis*																				
Maerua angolensis t	. . .	. . .	. . . .	. . . . .	+	. . . .	. . .	. . + ...	+ + . + +	. . . .	. . . . .	. . . . . .	. . . .	. . . . + .	+ . . . R	. . .	. . . . . .	. . . . .	. . . .	. . . .
Chlorophytum bowkeri f	. . .	. . .	. . . .	. . . . .	. . . R .	. . . .	. . .	. . . .	R + + R .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Evolvulus alsinoides f	. . .	. . .	. . . .	. R . . .	. + . . .	. . . .	. . .	. . . . . . + . .	. + . + R	. . . .	. . . . .	. . . . . .	. . . .	. + ...	. . . . .	. R .	. . . . + +	. . . . .	. . . .	. . . .
Orthosiphon fruticosus f [$]	. . .	. . .	. . . .	. . . . .	. . + . .	. . . .	. . .	. . . .	. R + 1 .	. . . .	. . . . .	. . . . + .	. . . .	. . . . . .	. . . . .	. . .	. + ...	. . . . .	. . . .	. . . .
Ledebouria dolomiticola f [#]	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. R + . +	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Enteropogon macrostachys g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . R	. . .	. . . .	. . + + +	. . . .	. . . . .	. . . . . .	. R	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group M: Diagnostic species for *Enneapogono cenchroidis–Acacietum leiorachidis bolusanthetosum speciosae*																				
Melhania prostrata f	. . .	. . .	. . R .	. . . . .	. . . . .	. . . . R . .	. . .	. . . .	. + R . .	+ 1 + +	. . R . .	. . . R . .	. . . R	. . . . . .	. . . . .	+ . .	. . . . . .	. . . . .	. . . .	. . . .
Bolusanthus speciosus t	. . .	. . .	. . . .	. . . . .	. . . . .	R . . . + ...	. . .	. . . .	+	1 + R +	. . . . .	. . . . . .	. . . . . . + .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Diheteropogon amplectens g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	+ R + 1	. . . . .	. . R + . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Ptycholobium plicatum f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . R	. . . . .	R + + .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Crabbea angustifolia f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . . R	. . .	. . . .	. . . . .	. + R +	. . . . .	. . . . . .	. . . . R R . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Jatropha zeyheri f	. . .	. . .	R . . R	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. R + +	R	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group N: Diagnostic species for *Enneapogono cenchroidis–Acacietum leiorachidis gardenietosum volkensii*																				
Melhania acuminata f	. . .	. . .	. . . .	. . . . .	R	. . . .	. . .	. . . .	+ . . R R	. . . .	+ 1 . 1 +	. . . . . .	. . . 1	. . . . 1 .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Gardenia volkensii s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	+ + R + R	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Phyllanthus incurvus f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	+ . R . +	. . . . . .	. . . .	. . . . . .	. . . . .	R . .	. . . . . .	. . . . .	. . . .	. . . .
Plectranthus neochilus f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	+ . . + R	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Pavonia senegalensis f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. + + R .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . R .
Mystroxylon aethiopicum t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . . + . .	. . .	. . . .	. . . . .	R . . .	. R + + +	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . R	. . . .
Species group O: Preferential species for *Enneapogono cenchroidis–Acacietum leiorachidis*																				
Asparagus buchananii f	+ R R	R + R	R + R R	R + + R R	R R R R +	R R R R R R R R R .	. + R	R R R + + R R R R	R R R R R	. R R R	. + + . R	R . . . . R	. . . .	. R	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Commelina africana f	R R +	1 1 R	R + R +	+ R + R +	1 + R + R	R + + + 1 R + R + +	R + R	R . R . R R . . .	. . . + R	. . R +	R . + . +	. . R . . .	+ . R . . R . .	. . . . . .	. . . . .	. . .	. . . R . .	. . . . .	. . . .	. . . .
Sclerocarya birrea t	. + +	+ . +	. + 1 +	. + + + +	. + . + .	+ . . + R + + . + .	+ + .	. + . . R . + R .	+ + 1 . +	R . . R	. . R + R	+ . . . . +	. . . . . R . .	. . . . R .	. . . . .	. . .	. . + . . .	R	. . . .	. . . .
Enneapogon cenchroides g	. + +	. + .	+ . . R	+ . R . .	+ . + . .	. + + ... + . R	+ . .	+ + 1 + . + + + +	1 + . + 1	1 + + +	+ + . + R	. . . . . R	. . . . R . . .	. . . . + R	. . . . .	. . .	. . . . . .	. 1 . . .	. . . .	. . . .
Indigofera lydenburgensis f [#]	. R +	+ + R	. + . .	. + . . +	+ . R R .	. . R + . + . + . +	. . +	. . + R . . . R .	+ R R . .	. R . .	+ + . R .	R . . . . R	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group P: Diagnostic species for *Fingerhuthio africanae–Boscietum foetidae elaeodendretosum transvaalensis*																				
Elaeodendron transvaalensis t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	R . . .	. R . . .	+ + . R R +	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	+ . . .	. . . .
Eragrostis capensis g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	+	. . . .	. . . . .	+ R . + + R	. . . .	R	. . . . .	+ . .	. . . . . .	. . + . .	. . . .	. . . .
Abutilon pycnodon f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	R . .	. . . .	. . . . R	. . . .	. . . . .	R R + + . .	. . . .	. . . . . R	. . . . .	. . .	. . . . . .	. . . . +	. . . .	. . . .
Catha transvaalensis t [$]	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . R .	. + + R . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Indigofera nebrowniana f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. + + . + .	. . . . . + . .	. . . . . .	. . . . .	R . .	. . . . . .	. . . . .	. . . .	. . . .

Table 2 cont.

Alliance	I							II											III	
Association	1 .	1 .	1 .	1 .	1 .	1 .	1 .	2 .	2 .	2 .	2 .	3 .	3 .	3 .	3 .	4 .	4 .	4 .	5 .	5 .
Sub-association	1	2	3	4	5	6	7	1	2	3	4	1	2	3	4	1	2	3	1	2
Species group Q																				
Chaetacanthus costatus f	. . .	. . .	. . . .	1 + + + +	. . . + .	. . . 1 . 1 . . . +	. . .	+ . + + ...	+ . + . .	. . . .	+ + . . .	+ + + + . +	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Acacia senegal var. *leiorachis* t	. . .	. . +	. . + .	+ 1 . + +	+ . + + +	. + 1 1 1 + + + + .	+ . +	+ + + + + + A 1 +	+ 1 . 1 +	R 1 + 1	. + + + R	. + . . 1 1	. . . .	. . . . . .	+ + . . +	. . .	. . . . . .	. . . . .	. . . .	. . . .
Elephantorrhiza praetermissa s [K;$]	. . .	. . R	. . + .	+ . + 1 1	R + + + +	+ + + + + + + . . +	+ + .	+ . R . . . . R .	. . + R .	. + R .	+ . R . +	. + + + R .	. . . .	. . . . . .	. . . . .	. . .	. + R + . .	. . . . .	. . . .	. . . .
Barleria saxatilis f	. . .	. . .	. R . R	. + . . +	+ + + + +	. + ... + + .	. . .	. + + . + 1 . 1 +	+ + . + .	+ . . +	. . + . .	. . + + + +	R R . . . . . R	. . . . . .	. . . . .	+ R +	. + ...	. . . . .	. . . .	. . . .
Themeda triandra g	. . .	. . .	. . . .	. . 1 B .	1 B + 1 1	A . 1 1 A A 1 A A .	+ + .	. . + 1 + . + . .	1 . + A .	1 A B B	. + . + .	1 . 1 . + 1	. . . . . 1 . .	. + ...	. . . . .	1 . .	. . . . . .	. . . . .	. . . .	. . . .
Andropogon schirensis g	. . .	. . .	. . . .	. . . + +	. . . + .	. . R + . . + . . .	. + 1	. . + + + + . . .	A 1 . . .	. 1 + .	+ . . . R	+ . . R + .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Grewia flavescens s	. . .	. . .	. . . .	. . . . .	. + R . .	. R . . + . + . . .	. . .	+ R + . + R R R R	R R + 1 .	+ + R .	. + + R +	+ + . . R R	. . . .	. . . . 1 +	. . . . .	+ . .	. . . . . .	. . . . .	. . . .	. . . .
Indigofera hilaris f	. . .	. . .	. . . .	. . . . .	. . . . .	+ . . . R . R + + +	. . .	. R . + + R + . R	. . . . .	. R . +	. . . . .	. . + + R R	. . + R	. + ...	. . . . .	. . .	. R R . . .	. . . . .	. . . .	. . . .
Species group R: Diagnostic species for ***Fingerhuthio africanae–Boscietum foetidae aloetosum globuligemmae***																				
Aloe globuligemma f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . R . . + R . .	. . . . .	. . . .	. . . . .	. . . R . .	+ 1 . 1 1 1 + .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Acacia luederitzii t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	+ + . . + + . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Barleria prionitis f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	+ + + . + 1 . +	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Eragrostis pseudosclerantha g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. + + + . + . +	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Pearsonia uniflora f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. + R + . + R .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Hibiscus micranthus f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. + . + R . + R	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Cadaba natalensis s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. R + + 1 R + +	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group S																				
Albizia anthelmintica t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	+ . R . .	. . . .	. . . . .	1 + . . A +	. R R 1 R + . +	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Sporobolus nitens g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . . . + . . .	+	. . . .	. . . . .	+ R . + . +	1 + . . + + R .	. . . . . .	. . . . .	. . .	. . . . . .	. . + . .	. . . .	. . . .
Seddera suffruticosa f	. . .	. . .	. . . .	. . . . .	. + . . +	. . . . R . .	. . .	. . . .	. . . + .	. . . R	. . . . .	+ R . + . .	R . R . + + + +	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Blepharis saxatilis f	. . .	. . .	. . . .	. . . . .	. . . . .	+ . . . + . R . . .	. . .	. . . . . + . . .	. . . . .	. . . .	. . . . .	+ . R 1 R .	. + + . + . + .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Lepidagathis scabra f	. . .	. . .	. . . .	. . . . .	R . R . .	. + . + ...	. . .	. . + ... + .	. . . R .	. . . .	. . . . .	+ . R + . .	+ . . . + . + .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Dyschoriste fischeri f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. R + R . R	+ . R 1 . . R .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Acacia grandicornuta t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . + + R .	. R + . + + + R	. R	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group T: Diagnostic species for ***Fingerhuthio africanae–Boscietum foetidae euphorbietosum ingentis***																				
Euphorbia ingens t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . . R .	. . R	. . . . . + . . .	+ R R . +	. . + .	+	+	. . . R . . R .	+ 1 1 + 1 +	. . . . .	. . .	. . . + . .	. . + . +	. . . .	. . . .
Eleusine coracana g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	+ . A A . +	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Ptycholobium contortum f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	+ . + R . +	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Indigofera circinnata f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. + + . + .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Ammocharis coranica f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. + . + + .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Erythrina lysistemon t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . R	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. + . + . +	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group U																				
Eragrostis lehmanniana g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . R	. . . .	R . R . .	. . + . . .	1 1 1 . + . . .	. + . + A .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Kleinia longiflora f (form: *W13239*) [$]	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . . + + . . .	. . . . R	. . . .	. . . . .	. . . . . .	+ + . + . + . +	. . + R . +	. . . . .	. . .	R . R + . .	. . . . .	. . . .	. . . .
Dicliptera fruticosa f [#]	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . R .	. . . . .	. . . . . .	+ 1 + . . + . .	. . + . + R	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Acacia gerrardii t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . R .	. . . . .	. . . R . .	R + + + + . . R	+ + + . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Acacia karroo t (form: *P4*) [$]	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. + . R . . + .	. R + R + .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Aloe greatheadii f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. 1 R . R . + .	1 + . + . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Schmidtia pappophoroides g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . R + . .	. . + + . . . R	1 + . R . +	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Melhania rehmannii f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . . . . + . .	. . . . R	. . . .	. . . . .	. . . . . .	. . . + . R + +	. + . . + +	. . . . .	. . .	. . . R . .	. . . . .	. . . .	. . . .
Species group V: Diagnostic species for ***Fingerhuthio africanae–Boscietum foetidae sesamothamnetosum lugardii***																				
Cleome hirta f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	1 + + + +	. . .	. . . . . .	. . . . .	. . . .	. . . .
Holubia saccata f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	+ + R + .	R . .	. . . . . .	R R . R .	. . . .	. . . .
Maerua juncea s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	+ + R + .	. . .	. . . . . .	. . . . .	. . . .	. . . .
Felicia mossamedensis f	. . .	. . .	. R R .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	+ + R . +	. . .	. . . . . .	. . . . .	. . . .	. . . .
Sesamothamnus lugardii t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	+ + . + +	. . .	. . . . . .	. . . . .	. . . .	. . . .
Pogonarthria squarrosa g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	+ . 1 + +	. . .	. . . . . .	. . . . .	. . . .	. . . .
Aristida rhiniochloa g	. . .	. . .	. . . .	. . . . .	. . + . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	+ R . 1 1	. . .	. . . . . .	. . . . .	. . . .	. . . .
Species group W: Diagnostic species for ***Melino nerviglumis–Euphorbietum tirucalli***																				
Hippocratea longipetiolata s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	1 R .	1 . + + + +	. + . 1 .	. . . .	. . . .
Schkuhria pinnata f	. . .	. . .	. . R .	. . . . .	. . . . .	. . R	. . .	. . . . R	. . . . .	. . . .	R	. . . . R .	. . . . + . . .	. . . . . .	. . . . .	+ + +	+ . 1 . . .	. R + . .	. . . .	. . . .
Senna italica f	. . .	. . .	. . . .	R R . . R	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . R .	. . . . . .	. . . .	. . . . . .	. . . . .	+ + R	. . + R . .	. . + R .	. . . .	. . . .
Dicoma tomentosa f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . R . R	. . .	. . . R	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	+ . +	+ . + . . +	+ + . . .	. . . .	. . . .
Melinis nerviglumis g	. . .	. . .	. . + .	. + . . .	. . . . .	. . + . . . + . . .	. . +	R	. . . . .	. . . .	. . . . +	. . . . . .	. . . .	. . . . . .	. + + . .	+ 1 +	1 + . R 1 +	+ . + + +	. . . .	. . . .
Ledebouria marginata f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. + R	. . + R + .	. . + . +	. . . .	. . . .
Euphorbia tirucalli t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	+ . . + .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. + A	R + R . + +	1 + A . 1	. . . .	. . . .

Table 2 cont.

Alliance	I							II											III	
Association	1 .	1 .	1 .	1 .	1 .	1 .	1 .	2 .	2 .	2 .	2 .	3 .	3 .	3 .	3 .	4 .	4 .	4 .	5 .	5 .
Sub-association	1	2	3	4	5	6	7	1	2	3	4	1	2	3	4	1	2	3	1	2
Species group X: Diagnostic species for *Melino nerviglumis–Euphorbietum tirucalli emilietosum transvaalensis*																				
Brachiaria brizantha g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	+ + .	. . . . . .	. . . . .	. . . .	. . . .
Ledebouria floribunda f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	+ R +	. . . . . .	. . . . .	. . . .	. . . .
Emilia transvaalensis f	. . .	. . .	. . . .	R	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	R + +	R	. . . . .	. . . .	. . . .
Eulophia petersii f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	R + +	. . . . . .	. . . . .	. . . .	. . . .
Schizachyrium sanguineum g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	R + +	. . . . . .	. . . . .	. . . .	. . . .
Atriplex lindleyi f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	R + .	. . . . . .	. . . . .	. . . .	. . . .
Mollugo nudicaulis f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. + R	. . . . . .	. . . . .	. . . .	. . . .
Species group Y: Diagnostic species for *Melino nerviglumis–Euphorbietum tirucalli vanguerietosum cyanescentis*																				
Aristida transvaalensis g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	+ 1 1 . + +	. . . . .	. . . .	. . . +
Vangueria cyanescens s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . R	+ + . + + R	. . . . .	. . . .	. . . .
Leonotis intermedia f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	+ . + + R .	+ . . R .	. . . .	. . . .
Hibiscus cannabinus f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	+ . . + . +	. . . . .	. . . .	. . . .
Tragia rupestris f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . . . R . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. + + . + .	. . . . .	. . . .	. . . .
Obetia tenax t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. + + + 1 .	. . . . .	. . . .	. . . .
Plectranthus venterii f [$]	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . + + . +	. . . . .	. . . .	. . . .
Species group Z																				
Geigeria ornativa f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	R . .	R + . R . . + R R	. . . . .	. . R R	. . . . .	. . . . . .	. + . . . + . .	. R	. . . . .	+ 1 1	+ + 1 . . .	. . . . .	. . . .	. . . .
Eragrostis viscosa g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	1 . . .	. . . . .	. . . . . R	. . . .	. . . . . .	. . . . .	+ + R	. + R + R .	. . . . .	. . . .	. . . .
Seddera capensis f	. . .	. . .	. . . .	. . . . .	. . . . .	. 1 + ...	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . + . . + . .	. . . . . .	. . . . .	+ + .	. . + . + +	. . . . .	. . . .	. . . .
Hibiscus barnardii f [R;$]	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	R . +	+ R + + R +	. . . . .	. . . .	. . . .
Kedrostis foetidissima f	. . .	. . .	. . . .	R	. . . . .	. . . . . R	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	R . +	+ . + + + +	. . . . .	. . . .	. . . .
Portulaca kermesina f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. + +	+ . . . + +	. . . . .	. . . .	. . . .
Hibiscus pusillus f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. + R	. + + R . .	. . . . .	. . . .	. . . .
Species group AA: Diagnostic species for *Melino nerviglumis–Euphorbietum tirucalli flaverietosum bidentis*																				
Bothriochloa insculpta g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	A + . A 1	. . . .	. . . .
Ischaemum fasciculatum g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	+	A . + 3 .	. . . .	. . . .
Cynodon dactylon g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	1 + + + .	. . . .	. . . R
Flaveria bidentis f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	+ 1 + R +	. . . .	. . . .
Xanthium strumarium f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	1 + . + 1	. . . .	. . . .
Combretum imberbe t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . . . . R .	. . . . . .	. . . . .	. . .	. . . . . .	1 . + . +	. . . .	. . . .
Agave sisalana s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	+ . 1 + .	. . . .	. . . R
Species group AB																				
Sesamum triphyllum f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	+ + R . . .	+ A . + .	. . . .	. . . .
Gomphocarpus tomentosus f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	+ R . . . R	. . R . +	. . . .	. . . .
Zinnia peruviana f	. . .	. . .	. . R .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . R	. . . . .	. . . . . .	. . . .	. . . . R .	. . . . .	. + .	. R 1 . + .	R + . R +	. . . .	. . . .
Leucas sexdentata f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. R + + R .	. + R . +	. . . .	. . . .
Abutilon guineense f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . . R + . .	. . R . . .	. . . . .	. . .	. R + . R .	+ + . 1 1	. . . .	. . . .
Solanum panduriforme f	. . .	. . .	. . . .	. . . . .	. . . . .	. R	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	R . R	. . . . . R	. . . . .	. . .	. . + + . .	+ . . . 1	. . . .	. . . .
Hibiscus trionum f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . . R . . R .	. . . . .	. . . .	. . . . .	. . . . R .	. . . .	. . . . . .	. . . . .	. . .	. . + . R .	. + . + .	. . . .	. . . .
Species group AC: Diagnostic species for *Urochloo mosambicencis–Eucleion divinorum* and preferential species for the *Fingerhuthio africanae–Boscietum foetidae*																				
Petalidium oblongifolium f [#]	. . .	. . .	. . . .	. . . . .	. . . . .	R . R . + ... R	. . .	+ 1 1 . . + + . +	. . + . .	+ . R .	. . . . .	A + R + . +	1 R 1 . . + + +	. . . . + R	. R . . R	. R .	+ . R . . .	+ . . A .	. . . .	. . . .
Ximenia americana s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. R .	+ + . . + + . . .	+ . + . R	R . . .	. . R . .	+ . + R + R	. R R + + + R .	R . + R . +	. + . R +	. + +	R R . . R .	. R . . .	. . . .	. . . .
Combretum hereroense t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	+ . + R . . . . +	. . . + .	. 1 + +	. . . . +	. + + . R .	. + + 1	. + . . . R	. . + 1 .	R . .	R + . 1 + R	. . R + .	. . R .	. . . R
Acacia nilotica t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	+ . R . . + . + .	. R . . +	+ . . 1	+ 1 . . .	. R . . + +	. + R . + + 1 +	R 1 + 1 . +	+ . R . .	. . +	. . + + . +	1 1 . . A	. . . .	. . . .
Boscia foetida t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	R + R . . + . + .	. R . + .	. R . +	. + . + +	. + + 1 . +	1 . + . + . + 1	+ + . + + 1	. 1 + 1 .	R . .	. + . . + .	+ . 1 1 +	. . . .	. . . .
Acacia tortilis t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. + . . + . + + 1	. . R + 1	. + + R	. + . 1 1	. . + + 1 1	+ . 1 1 1 1 1 R	R . 1 1 1 1	. . R R .	+ + +	+ . + . + +	. R R . .	. . . .	. . . .
Rhus engleri t [#]	. . .	. . .	. . . .	. R . . .	. . . . R	. . . .	. . .	. + . R + ...	+	+ . . .	R + . . .	+ . 1 1 + +	+ . . + + 1 + +	+ . + + . .	+ . . . +	. . R	. . R R . R	+ . 1 + .	. . R .	. R . .
Urochloa mosambicensis g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. + R + . . + . +	. + . + R	R + + .	+ . . + R	. + . + . .	+ . R R . . . R	+ + R . + .	+ + . + +	+ . R	. + . + + .	. . . R +	. . . .	. . . .
Sporobolus ioclados g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. R . + . . 1 . .	+ 1 + . R	. + . .	. R 1 + +	+ R . . . +	. R . + . + . .	. + . B R .	. R + . .	. 1 +	1 + R . . .	. R . . +	. . . .	. . . .
Fingerhuthia africana g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . 1 . R . + . .	. . . R .	. . 1 +	+ . R . .	. + . + + +	+ + . . + + + A	+ R + 1 . .	+ . + 1 +	R R +	R . . R . .	+ A . + +	. . . .	. . . .
Kalanchoe paniculata f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . + . R . + . .	. + + . .	. + . .	. . . + +	. . R . + +	+ . . + ...	+ . . . + .	+ . + . 1	. . .	. . + . R +	. . + . R	. . . .	. . . .
Acacia erubescens t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . + + . . . R R	. . . R +	. . + .	+ . . . +	+ 1 + + . .	. 1 + . . + + R	. . 1 R + +	+ R R R +	+ + +	+ + + + + +	R . . R .	. . . .	. . . .
Euclea divinorum t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . + . + . + .	1 . + . .	+ . 1 +	+ . 1 . .	1 . 1 + 1 1	1 . . + + + 1 1	. + + + . +	. + . + .	+ R .	+ + + . + .	+ + + . .	. R . .	R . . .
Sarcostemma viminale f	. . .	. . .	. . . .	R	. . . . .	. . . .	. . +	. . . . + 1 . + .	+ R . . R	R . . .	. R + . .	+ R + 1 + R	+ . 1 1 + 1 R +	+ . + R . +	+ + R R +	+ 1 .	. R . + . .	. R R R .	. . . .	. . . .
Grewia bicolor s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . . + + + . +	. + + + .	. . + R	R . . R .	R + ...	. R R	. R R . + +	. + + . +	. . .	. . R R . .	R . . + +	. . . .	. . . .
Aloe burgersfortensis f [$]	. . .	. . .	. . . .	. + . . .	. . . . .	. . . .	. . .	. . . . + R . . +	+ . . R .	. R . .	. . . R .	+ . + + R .	+ 1 + 1 . . . +	. + ...	1 + + R 1	. R .	R R . . R +	+ . . R .	. . . .	. . . .

Table 2 cont.

Alliance	I							II											III	
Association	1.	1.	1.	1.	1.	1.	1.	2.	2.	2.	2.	3.	3.	3.	3.	4.	4.	4.	5.	5.
Sub-association	1	2	3	4	5	6	7	1	2	3	4	1	2	3	4	1	2	3	1	2
Species group AD																				
Dichrostachys cinerea s	+ + R	+ 1 +	R + + +	. R . R +	+ . + . +	+ . . . 1 . 1 . . +	. . .	. . . . + 1 + + +	1 1 1 1 +	+ + 1 +	1 + + A 1	1 + . R + 1	+ R + A + 1 R +	. R 1 1 . 1	+ + . . .	+ + .	. . R . . .	+ . + + .	. . . .	. . . .
Eragrostis curvula g	+ . R	. . R	. + . R	R . R . .	. + . + .	. + R . . R . + . .	. . .	. + + . 1 + . + +	. . . + .	. + 1 .	. . + . R	. 1 . + 1 .	R 1 1 1 . 1 . 1	1 + + + . .	1 + . + .	. . .	+ + . . + .	. + . + .	. . . .	. . . .
Kyphocarpa angustifolia f	+ . +	. + .	. . R .	. + . . +	. + . R +	. 1 + R . . . . R +	. . .	R + R + R R + R R	+ . R + +	R . . .	. + . . R	R . . R . R	R R + . R . . R	R + . . . R	. + + + .	. + R	. R . . R .	. R R . .	. . . .	. . . .
Psiadia punctulata f	. + R	. . .	+ . + .	. . . . .	+ + . + +	. + + R + R . + R +	. R .	. R + R + + + + +	R . . . +	R . . .	. . . . .	. . . + + +	. + ... +	+ + . . + .	. R . R .	R . .	. + . + . .	. . . . .	. . . R	. . . .
Aristida canescens g	. + .	. . .	. . . R	1 + . . +	. . + + .	+ . . . . + + . . +	. R .	. + . + + . + . .	1 + + 1 .	+ . + .	+	+ . + + . +	. . + + + 1 . +	+ + ...	+ . + + 1	. R .	. . R . . R	. . . . R	. . . .	. . . .
Grewia flava s	. R .	. . +	. R + .	. . R + R	. . . . .	. + . . R . R 1 + R	. . .	. . . .	. + . . .	+ . . .	R . . R +	. . . R . .	R + + + R R + 1	R R + + . +	. + . + .	. . .	R . . R R .	. + 1 + .	. . . .	. . . .
Boscia albitrunca t	. . .	+ + +	R . . .	. + . . R	R	. . + ... R . .	. . +	+ + R . + + + + +	. + 1 . +	. . . +	. . R . .	+ + . R + +	+ + + + + + + +	. + 1 + . R	+ . + . +	. . +	. . + . R .	R . . . R	. . . .	. . . .
Commiphora glandulosa t	. . .	+ + +	. R + .	+ + . . .	. + . . +	. + . + + + . . R +	. + +	. . . + + . R . .	. + . R .	. R R .	+ + R . +	. R . + .	+ . . + . R + .	. . + + + .	. R R . .	. + R	+ + . + . +	+ . + + .	. . . .	. . . .
Sansevieria hyacinthoides f	. . .	. + +	. . . R	. . + + +	. + . . .	+ + + . + . + . . .	+ . R	. . + ... +	+ . 1 + +	. + . .	. . . R .	+ + ...	+ . + 1 . . . +	. . . R R .	. + + . +	. . .	. R + + R .	. . . . .	. . . .	. . . .
Aristida adscensionis g	. . .	. . .	R R . .	1 + . . R	+ . . + R	. 1 1 . . . . + . R	. . +	A 1 . . . R . 1 1	. . . 1 .	. . R .	. . . + .	+ 1 R + + R	+ + + . R + . +	+ . + R + +	. + + + R	1 1 1	1 + + + + +	1 A + + +	. . . .	. . . .
Aloe cryptopoda f	. . .	. . .	. R . R	+ . + + .	+ . . + .	. . . + . + . + + .	. . +	1 R + + + + . R .	. . . + .	R . . .	. . . . .	. . . . + R	. . . + + . + R	. . . . . .	R . R + R	R . .	. + . + R R	. R . . .	. . . .	. . . .
Grewia vernicosa s [#]	. . .	. . .	. R R .	. R . + +	. + R + +	+ . . . . + R + . .	R R .	. . R . 1 . . . +	. + R . R	. 1 + 1	. . . . .	R . + 1 + 1	+ . R + + . + 1	. . R R + +	+ 1 . + R	1 . 1	1 1 1 + . R	+ R R + 1	. . . .	. . . .
Waltheria indica f	. . .	. . .	. . . .	. . + R .	+ R + . R	. . . + ... +	. R .	. . . . R R + R R	R R . . .	. R R R	+	. R . . R +	. R . . . R . R	. R	. . . . .	R + +	+ + + . . .	. . + R .	. . . .	. . . .
Species group AE: Diagnostic species for *Combreto erythrophylli–Celtion africanae* and *Combreto erythrophylli–Acacietum karroo*																				
Celtis africana t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	A 1 + +	+ 1 1 .
Combretum erythrophyllum t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	A + 1 .	1 + 1 R
Pavonia burchellii f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	+ . + .	+ A 1 .
Melia azedarach t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . +	. . . . .	+ . + .	+ . R +
Ficus sur t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	+ . . +	A A . +
Lippia javanica s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . R	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. R + +	+ + R .
Olea europaea t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . . + . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . + +	. + R +
Species group AF: Diagnostic species for *Combreto erythrophylli–Acacietum karroo rhoetosum pyroidis*																				
Rhus pyroides t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	+	. . . . .	+ + + +	+ . . R
Zanthoxylum thorncroftii s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	1 + 1 .	. . . .
Cymbopogon validus g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	+ R 1 1	+ . . .
Acacia ataxacantha t	. . .	. . .	. . . .	R . R . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	+ 1 R 1	. . . .
Sida spinosa f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	R + . +	. . R .
Barleria obtusa f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. + R +	. . . .
Tarchonanthus camphoratus s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. R + +	. . . .
Species group AG: Diagnostic species for *Combreto erythrophylli–Acacietum karroo acacietosum galpinii*																				
Acacia galpinii t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	1 + 1 R
Morus japonica t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	+ + R .
Spirostachys africana t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. R . R	A 1 . R
Andropogon eucomus g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	+	. . . . .	. . . .	R + . 1
Hyparrhenia filipendula g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. + R 1
Syzygium cordatum t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . . R . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. + R +
Paspalum dilatatum g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	. . . . .	. . . .	. R + +
Species group AH																				
Ehretia rigida t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . . + . .	. . .	. . . .	. . R . +	. + . +	. . + R .	. R . + + .	. R . + + . . .	. + R + 1 1	. . . . .	. . .	. . . . . .	. . R . .	1 R + R	+ . R .
Hippobromus pauciflorus s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. R . + .	R . + .	R R . . .	+ + . R . +	. . R R . . + .	. . . R + .	. . . . .	. . .	. . . . . .	. . . . .	1 1 R 1	. 1 R .
Carissa bispinosa s	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	+ . . R .	. R R .	. . + . R	+ . + . R .	+ . . . + + + +	. + R . . .	. . . . .	. . .	. . . . . .	. . . . .	+ . + R	. + R R
Maytenus heterophylla s	. . .	. . .	. . R .	. . R . .	. . . . .	. . . .	. . .	. . . .	. . R . R	R . . R	R + . . .	. + + . + +	+ . + . . + + .	+ . + . + +	. . . . .	. . .	. . . . . R	. . . . .	R + + .	+ + . .
Sporobolus fimbriatus g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. + . . .	+ + . .	. . . + R	R . . + . .	+ 1 1 1 1 1 . .	A . A 1 . R	. . . . .	. . .	. . . . . .	. . . . .	. 1 1 +	A 1 1 +
Species group AI																				
Cardiospermum corindum f	. . .	. . .	. . . .	. . . . .	. . . . .	. . . . R . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. + .	. R	+ . + R +	R + R .	. 1 + .
Panicum deustum g	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	+ . R + 1	A A 1 A	1 1 1 .
Schotia brachypetala t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	R + + 1 .	. + + .	+ R . +
Achyranthes aspera f	. + R	. . R	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	. . .	. . . . . .	R + 1 . R	. 1 1 +	. + 1 .
Peltophorum africanum t	. . .	. . .	. R R .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . R	. . . R R	. . . . . .	. . . .	. . . . . .	. . . . .	. . R	. . . + . .	. + . R R	+ R . +	R + . +
Diospyros lycioides var. *lycioides* s	. . .	. . .	. . . .	. . . . .	. . R . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . .	. . . . . .	. . . . .	R . +	. R + . . .	. R 1 R +	1 . 1 +	+ 1 1 .
Acacia karroo t	. . .	. . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . . .	. . . . .	. . . .	. . . . .	. . . . . .	. . . + ...	. . . R . .	. . . . .	. . .	. . . . . .	. . + + +	+ R 1 +	+ A R +
Species group AJ																				
Panicum maximum g	1 1 +	+ + 1	. R R .	1 . 1 . .	1 + R + +	1 1 R 1 + + R + R +	A + .	. + A + + R . 1 +	+ + + 1 +	1 A . A	1 1 B 1 1	+ A . 1 1 +	+ + 1 + + + + .	+ + A 1 R 1	+ + R + .	. . R	. . + . . R	. R . + .	1 + . 1	+ . + 1
Kirkia wilmsii t	+ 1 1	+ 1 1	1 1 + 1	1 + 1 + 1	+ 1 + + 1	1 + 1 + + + . A 1 A	1 1 .	R + + 1 R + . + +	R + R + .	R + + +	+ 1 + . R	R R . . R R	. . R . R . . .	. . . . . .	. R . . .	+ + .	+ + . + R .	. + R . .	. + . .	+ + . .
Aloe castanea s [$]	+ R +	. . .	1 . . +	R	. R . . .	. . . R . + . . R .	. . R	R R . . . . A . 1	+ . + . .	. R . .	. + + 1 1	+ + . . . R	R + 1	. + ...	. . . . R	+ . A	3 . 3 . + .	+	. . R .	. . R .
Heteropogon contortus g	. R +	1 3 B	. 1 A .	1 A + . 1	1 . 1 1 1	1 + . + B 1 A 1 + 1	+ + .	A + B 1 . . 1 1 +	. + . 1 .	1 3 R .	. + . A +	. . 1 A . R	. . . + . . R .	+ 1 . . R .	R . R . .	A A A	A 1 + 1 R .	. 1 1 . .	. R . R	. R . .
Acacia nigrescens t	. + .	1 + .	1 + . .	. + . 1 .	. + + . +	+ . + . + . 1 . + .	. . +	+ 1 + . + + . + +	. + . . +	+ + . .	+ 1 . + .	R . + . + .	+ . . . . + . +	. . . . . .	. . . . .	+ R .	. . R . R .	+ 1 . + .	. + + .	. + R +
Ziziphus mucronata t	. . +	+ + R	+ . . +	+ + + + +	. R + . +	+ . + . + ...	. R +	. . + . R . R + .	. + R R .	R . + .	+ . + . .	. R	. R R . + R + .	. . + + . .	. 1 . + .	+ . .	. R . + R +	+ + 1 . +	+ + + .	+ + . .
Croton gratissimus t	. . .	. . .	. R R .	+ . . + .	1 R R + +	R . . . . R + . . .	+ 1 +	R + . A . + . + .	1 . + + .	1 . . .	R	+ + + 1 . .	+ . . + ...	. R	. . R . .	. + .	. A + + + R	. . . . R	R R . .	+ R . .
Terminalia prunioides t	. . .	. . .	. . . .	. R . R +	+ R + + R	+ R R 1 R + + + + +	R + .	+ 1 1 1 + + + + +	+ + R 1 .	1 . + +	1 1 1 . .	+ + 1 + + +	+ 1 + 1 1 1 + 1	+ + ...	. . . . .	+ + .	+ . . . R +	. . . + .	R R R .	R + . .

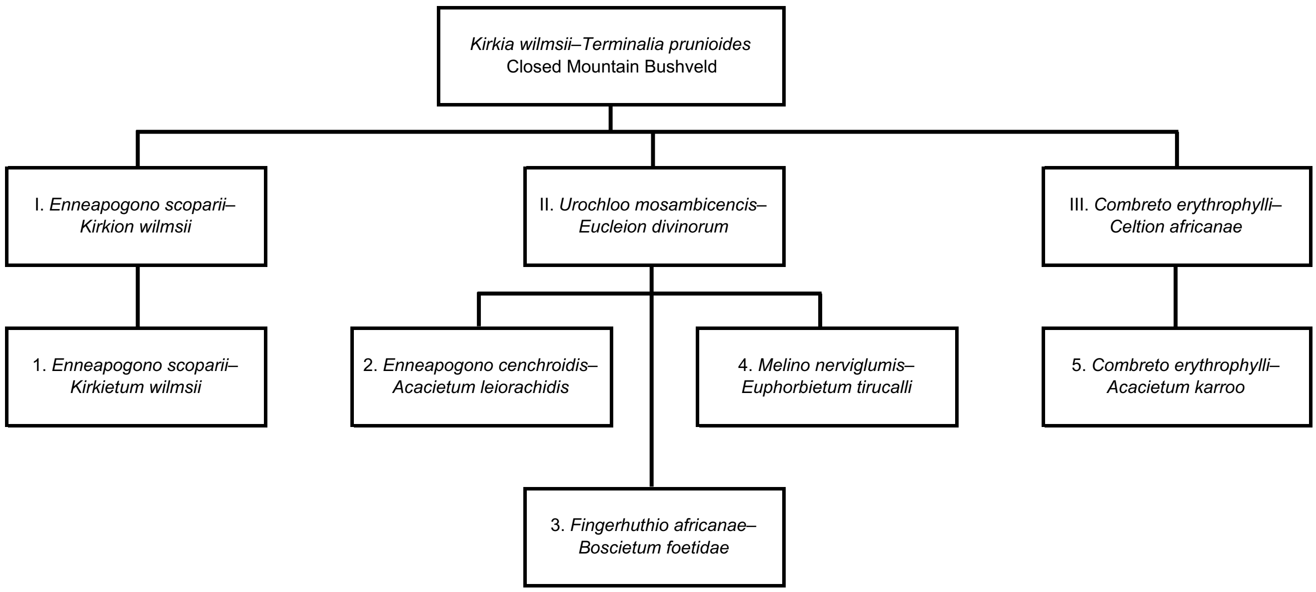

Figure 2: Dendrogram depicting the classification of the plant communities belonging to the Closed Mountain Bushveld of the Sekhukhuneland Centre of Plant Endemism

3.3 *Fingerhuthio africanae–Boscietum foetidae euphorbietosum ingentis*
3.4 *Fingerhuthio africanae–Boscietum foetidae sesamothamnetosum lugardii*

4. *Melino nerviglumis–Euphorbietum tirucalli*
4.1 *Melino nerviglumis–Euphorbietum tirucalli emilietosum transvaalensis*
4.2 *Melino nerviglumis–Euphorbietum tirucalli vanguerietosum cyanescentis*
4.3 *Melino nerviglumis–Euphorbietum tirucalli flaverietosum bidentis*

III. *Combreto erythrophylli–Celtion africanae*

5. *Combreto erythrophylli–Acacietum karroo*
5.1 *Combreto erythrophylli–Acacietum karroo rhoetosum pyroidis*
5.2 *Combreto erythrophylli–Acacietum karroo acacietosum galpinii*

A vegetation key is presented to facilitate plant community identification (Table 3) according to the procedure followed in Siebert *et al.* (2002).

Description

The *Kirkia wilmsii–Terminalia prunioides* Closed Mountain Bushveld is predominantly restricted to the warm slopes and valleys of undulating ultramafic hills and mountains of Sekhukhuneland. Surface rocks are predominant and abundant in various habitats, with average rock size varying between 0.1m and 1m (10–70% surface cover) on the slopes of hills and between 0.05m and 2m (5–65% surface cover) in the valleys. Plant communities were described as part of either broad-leaved mountain woodlands or microphyllous valley thickets/woodlands. An outstanding feature of this savanna type is the fact that it constitutes a unique vegetation type that differs substantially from the surrounding bushveld types of southern Africa (Siebert *et al.* 2002).

The five major vegetation units of the CMB are ecologically interpreted on the basis of the terrain type, namely slopes, plains, riverbanks and anthropogenic-altered areas. Slopes are defined as the scarps, midslopes and upper footslopes of mainly undulating hills and mountains. Plains are defined as the low-lying valley bottoms and lower footslopes between hills and mountains. Riverbanks are defined as the high-lying areas adjacent to or in the vicinity of perennial rivers. Anthropogenic-altered areas are defined as old fields, heavily grazed savanna, over-harvested woodlands, utilised mine properties and mine dumps. Within these five major units, plant communities are distinctive and easily distinguishable in the field, causing a distinct distribution pattern of habitats and associated vegetation. This is determined by an extremely heterogeneous environment, which relates to soil properties and depth, rockiness, terrain type, aspect, slope, moisture availability and human activities. A summary of selected community attributes is supplied in Table 2.

I. *Enneapogono scoparii–Kirkion wilmsii* all. nova hoc loco

Nomenclatural type: *Enneapogono scoparii–Kirkietum wilmsii* (holotypus), Association 1 described in this paper.

The alliance is floristically related to the *Kirkia wilmsii* Dolomite Vegetation (Van der Meulen 1979) and the *Kirkia wilmsii* Mountain Woodland (Brown *et al.* 1997).

Habitat. This alliance is typical of mountain slopes and scarps in Sekhukhuneland on moderate to steep slopes (5–15°). Soils are shallow and predominantly constitute the rocky Glenrosa form. The soil surface is covered by 30–70% of rock with an average diameter of 0.3–1.5m. Table 2 summarises selected habitat attributes for the alliance. It differs

Table 3: A key to the syntaxa of the Closed Mountain Bushveld of the Sekhukhuneland Centre of Plant Endemism

Leads/description	Go to/syntaxon
i. a Well-drained soils	**ii.**
b Seasonally waterlogged soils	*Fuirena pubescens–Schoenoplectus corymbosus* Wetland Vegetation
ii. a Broad-leaved savanna	**iii.**
b Microphyllous thornveld	*Acacia tortilis–Dichrostachys cinerea* Arid Northern Bushveld
iii. a Dense tree cover (mean >5%)	**iv.**
b Sparse tree cover (mean <5%)	*Themeda triandra–Senecio microglossus* Cool Moist Grasslands
iv. a Small rock size (<2m diameter)	**v.**
b Large rock size (>2m diameter)	*Hippobromus pauciflorus–Rhoicissus tridentata* Rock Outcrop Vegetation
v. a Predominantly closed woodlands	**1 *Kirkia wilmsii–Terminalia prunioides* Closed Mountain Bushveld**
b Predominantly open woodlands	*Combretum hereroense–Grewia vernicosa* Open Mountain Bushveld
1 a Steep slopes 5–12° (*Enneapogon scoparius* & *Kirkia wilmsii*)	**2**
b Moderate slopes 1–5° (*Panicum maximum*)	**3**
2 a Midslopes/scarps (*Pappea capensis* & *Sclerocarya birrea*)	**4**
b Midslopes only (*Commiphora mollis*)	**5**
3 a Plains/footslopes (*Acacia tortilis* & *Grewia vernicosa*)	**6**
b Riverbanks (*Combretum erythrophyllum* & *Sporobolus fimbriatus*)	**7**
4 a All aspects (*Clerodendrum glabrum* & *Acacia excuvialis*)	1.1 *Enneapogono scoparii–Kirkietum wilmsii clerodendretosum glabri*
b Northern aspects (*Ziziphus mucronata*)	**8**
5 a Mean tree height <5m (*Mundulea sericea* & *Barleria saxatilis*)	1.5 *Enneapogono scoparii–Kirkietum wilmsii munduletosum sericeae*
b Mean tree height >5m (*Grewia monticola*)	**9**
6 a Mean rock size 1m (*Melinis nerviglumis* & *Schotia brachypetala*)	**10**
b Mean rock size 0.4m (*Boscia albitrunca* & *Eragrostis curvula*)	**11**
7 a Mean tree height <7m (*Rhus pyroides* & *Hippobromus pauciflorus*)	5.1 *Combreto erythrophylli–Acacietum karroo rhoetosum pyroidis*
b Mean tree height >7m (*Acacia galpinii* & *Ficus sur*)	5.2 *Combreto erythrophylli–Acacietum karroo acacietosum galpinii*
8 a Shale (*Solanum incanum* & *Digitaria eriantha*)	1.2 *Enneapogono scoparii–Kirkietum wilmsii solanetosum incani*
b Ultramafic rock (*Grewia vernicosa*)	**12**
9 a Mean rock size <750mm (*Karomia speciosa* & *Acacia senegal*)	1.6 *Enneapogono scoparii–Kirkietum wilmsii karomietosum speciosae*
b Mean rock size >750mm (*Nuxia congesta* & *Pouzolzia mixta*)	1.7 *Enneapogono scoparii–Kirkietum wilmsii nuxietosum congestae*
10 a No alluvium (*Enneapogon cenchroides*)	**13**
b Mainly alluvium (*Boscia foetida*)	**14**
11 a Mean rock cover <30% (*Flaveria bidentis* & *Abutilon guineense*)	4.3 *Melino nerviglumis–Euphorbietum tirucalli flaverietosum bidentis*
b Mean rock cover >45% (*Geigeria ornativa* & *Kirkia wilmsii*)	**15**
12 a Granophyre/ferrogabbro (*Bridelia mollis* & *Triaspis glaucophylla*)	1.3 *Enneapogono scoparii–Kirkietum wilmsii bridelietosum mollis*
b Pyroxenite (*Lannea discolor* & *Jasminum multipartitum*)	1.4 *Enneapogono scoparii–Kirkietum wilmsii lanneetosum discoloris*
13 a Magnetite (*Aloe castanea*)	**16**
b Pyroxenite (*Themeda triandra*)	**17**
14 a Mean rock size <400mm (*Acacia tortilis*)	**18**
b Mean rock size >400mm (*Sesamothamnus lugardii*)	3.4 *Fingerhuthio africanae–Boscietum foetidae sesamothamnetosum lugardii*
15 a Slope 5-7° (*Emilia transvaalensis* & *Heteropogon contortus*)	4.1 *Melino nerviglumis–Euphorbietum tirucalli emilietosum transvaalensis*
b Slope 3-5° (*Vangueria cyanescens* & *Croton gratissimus*)	4.2 *Melino nerviglumis–Euphorbietum tirucalli vanguerietosum cyanescentis*
16 a Pedosol (*Rhigozum obovatum* & *Petalidium oblongifolium*)	2.1 *Enneapogono cenchroidis–Acacietum leiorachidis rhigozetosum obovati*
b Lithosol (*Gardenia volkensii* & *Acacia nigrescens*)	2.4 *Enneapogono cenchroidis–Acacietum leiorachidis gardenietosum volkensii*
17 a Mean rock cover >30% (*Maerua angolensis* & *Sanseviera hyacinthoides*)	2.2 *Enneapogono cenchroidis–Acacietum leiorachidis maeruetosum angolensis*
b Mean rock cover <15% (*Bolusanthus speciosus* & *Combretum hereroense*)	2.3 *Enneapogono cenchroidis–Acacietum leiorachidis bolusanthetosum spciosae*
18 a Pyroxenite/alluvium (*Elaeodendrum transvaalensis* & *Chaetacanthus costatus*)	3.1 *Fingerhuthio africanae–Boscietum foetidae elaeodendretosumtransvaalensis*
b Ferrogabbro/alluvium (*Eragrostis lehmanniana* & *Sporobolus fimbriatus*)	**19**
19 a Mean grass cover <10% (*Aloe globuligemma* & *Albizia anthelmintica*)	3.2 *Fingerhuthio africanae–Boscietum foetidae aloetosum globuligemmae*
b Mean grass cover >10% (*Euphorbia ingens* & *Ehretia rigida*)	3.3 *Fingerhuthio africanae–Boscietum foetidae euphorbietosum ingenti*

from the *Urochloo mosambicencis–Eucleion divinorum* and *Combreto erythrophylli–Celtion africanae* (described in this paper), in that it is characterised by shallow soils, rocky terrain and an undulating topography.

Vegetation structure. The vegetation of the alliance represents broad-leaved savanna. Diagnostic species are presented in species group A (Table 2) and include drought tolerant trees and shrubs such as *Aloe marlothii*, *Commiphora africana*, *C. mollis* and *Sterculia rogersii*. *Enneapogon scoparius* is the only diagnostic grass, and is a dominant species in *Kirkia wilmsii* plant communities. Granite and dolomite hills are characterised by *Kirkia wilmsii* throughout the central bushveld of South Africa (Van der Meulen 1979) and this diagnostic species, in combination with the characteristic diagnostic grass *Enneapogon scoparius*, supports the proposal of this plant community as an alliance of the proposed Mountain Bushveld Order (Siebert *et al.* 2002).

Floristic diversity. Floristic links with the other alliances are visible in species groups O, Q, AD and AJ (Table 2). Strong floristic links exist with the *Urochloo mosambicencis –Eucleion divinorum*. The average number of species encountered per sample plot for this alliance is 37, with the total number of plant species being a minimum of 222 taxa (33 relevés) (Table 2). There are 20 plant taxa of conservation value, nine are SCPE endemics and 10 are SCPE near-endemics, with two species listed as Red Data List taxa (Table 2). Six taxa of conservation value are restricted to this alliance in the study area (Table 4).

1. *Enneapogono scoparii–Kirkietum wilmsii* ass. nova hoc loco

Nomenclatural type: Relevé 191 (holotypus), Table 2

Habitat. The habitat of the association is extremely heterogeneous with no two sample plots exhibiting the same set of environmental factors (Table 2). It is restricted to the midslopes and scarps of the mountains and hills of the Steelpoort-Burgersfort region. The association is mainly found on relatively steep sloped northern aspects, as the orientation of hills and mountains in the study area are generally east-west, thus providing ample northern slopes facing into the Steelpoort River Valley (Table 2). Soil surfaces are rocky. The dominant soil type is the Glenrosa form, defined as an orthic A-horizon over a lithocutanic B-horizon (Table 2).

Vegetation structure. The vegetation representing this association is relatively dense tall, dry woodland. Diagnostic species are presented in species group A (Table 2). The association is characterised by small trees/shrubs, namely *Acacia exuvialis*, *Combretum apiculatum*, *Grewia monticola* and *Triaspis glaucophylla*. Other dominant woody species include *Acacia nigrescens*, *A. senegal* var. *leiorachis*, *Dichrostachys cinerea*, *Kirkia wilmsii* and *Sclerocarya birrea*. The tree cover is 10%, with some trees reaching heights of up to 7m. Due to a low shrub cover (3%), a typical African savanna structure is evident. *Enneapogon scoparius*, *Heteropogon contortus* and *Panicum maximum* are the most abundant grasses and contribute substantially to the grass cover of 15%. High grass cover on dry northern aspects is dependent on good rainy seasons and due to semi-arid conditions in Sekhukhuneland, annual fires are uncommon. In addition, many trees and forbs are succulent. *Asparagus buchananii* and *Commelina africana* are the most conspicuous forbs, but total forb cover is relatively low (5%).

Floristic diversity. This savanna association is common in the SCPE and a floristic affinity exists with the other CMB communities of the Centre in various species groups, especially the transitional *Enneapogono cenchroidis–Acacietum leiorachidis* (Table 2). Conservation priorities and diversity statistics are the same as for the alliance (Tables 2 and 4).

1.1 *Enneapogono scoparii–Kirkietum wilmsii clerodendretosum glabri* subass. nova hoc loco

Nomenclatural type: Relevé 119 (holotypus), Table 2

The vegetation of the sub-association is tall, dense woodland on relatively shallow soils of south facing midslopes (Table 2) along the northern escarp of the Schurinksberg. This sub-association is associated with exposed shale formations and is not a typical SCPE syntaxon, for the relevés form part of the control data set that was sampled on substrates of a sedimentary origin and not the ultramafic rocks of the Rustenburg Layered Suite. Diagnostic species are given in species group B (Table 2). *Clerodendrum glabrum, Dombeya rotundifolia*, *Elephantorrhiza goetzei* and *Ormocarpum kirkii* are the diagnostic woody species of this syntaxon and make up most of the 12% tree and shrub cover. Diagnostic herbaceous species include *Buttonia superba* and *Plectranthus xerophilus*. *Enneapogon scoparius* and *Panicum maximum* are the most prominent grasses, however, grass cover was sparse as a result of a dry spell. This sub-association shows a strong floristic link with the other sub-associations in species groups F and O (Table 2), namely the northern slopes of Thaba Sekhukhune and Dwars River Pass. Two taxa with conservation status are restricted to the association (Table 4), of which one is a SCPE near-endemic and the other the rare SCPE endemic, *Rhus batophylla*.

1.2 *Enneapogono scoparii–Kirkietum wilmsii solanetosum incani* subass. nova hoc loco

Nomenclatural type: Relevé 116 (holotypus), Table 2

The vegetation of the sub-association is tall, closed woodland on north-facing midslopes of the Schurinksberg. It is mainly associated with exposed shale formations and is the second community of the control data set. The sub-association is found on relatively steep slopes and rocky surfaces (Table 2). Diagnostic species of the association are presented in species group C (Table 2). Woody species diagnostic of the association include *Commiphora glandulosa* and the semi-scandent *Rhoicissus tridentata*. Tree cover is high (11%). Diagnostic herbaceous taxa include the geophyte *Boophane disticha* and forb *Solanum incanum*. The diagnostic grasses are *Eustachys paspaloides* and *Setaria lindenbergiana*, and together with the frequently occurring *Digitaria eriantha*, *Enneapogon scoparius* and *Heteropogon contortus*, they contribute to the highest grass cover recorded for the CMB (33%). The total vegetation cover of this sub-association is the highest for CMB (50%). Four plant taxa of conservation value occur in the sub-association, including two of the taxa restricted to the association (Table 4).

1.3 *Enneapogono scoparii–Kirkietum wilmsii bridelietosum mollis* subass. nova hoc loco

Nomenclatural type: Relevé 304 (holotypus), Table 2

This sub-association represents tall (6m), dry woodland that forms bush clumps on mountain slopes running into the Steelpoort River Valley, from Roossenekal in the south to Steelpoort in the north. The habitat is characterised by the igneous rocks of ferrogabbro and granophyre. These rocks are related, but do not form part of the Rustenburg Layered Suite, which results in different environmental (edaphic) conditions. It occurs on relatively steep, rocky slopes of north-eastern aspects. Species group D contains the diagnostic species for the sub-association (Table 2). Prominent species of the sub-association include the trees *Combretum apiculatum*, *Commiphora africana*, *Grewia monticola*, *Kirkia wilmsii* and *Pappea capensis*, forbs such as *Barleria lancifolia* and *Clerodendrum ternatum*, and the grass *Enneapogon scoparius*. Percentage cover for the different growth forms is typical for the association.

1.4 *Enneapogono scoparii–Kirkietum wilmsii lanneetosum discoloris* subass. nova hoc loco
Nomenclatural type: Relevé 220 (holotypus), Table 2

This sub-association represent tall woodlands of the peripheral hills running adjacent and between the norite massive of the SCPE and the shales of the Schurinksberg. It is a typical community of the SCPE Mountain Bushveld, for it is underlain by pure pyroxenite. It is associated with steep, rocky midslopes on northern aspects (Table 2). Diagnostic species are presented in species group E (Table 2). *Lannea discolor* is the only diagnostic tree and *Cymbopogon excavatus* the only diagnostic grass. The sub-association is dominated by large trees/shrubs (14% cover) of which *Commiphora africana*, *Combretum apiculatum*, *Elephantorrhiza praetermissa*, *Grewia monticola*, *Kirkia wilmsii*, *Pappea capensis*, *Sterculia rogersii* and *Ziziphus mucronata* are the most frequent. Trees of this sub-association reach average heights of 6.5m and constitute some of the tallest woodlands of the CMB. The typical African savanna structure allows for a well-developed and tall grass layer (17% cover; 1m high). Forbs are relatively tall for the CMB (average 1.1m) and have a cover of 6%. This plant community is the first sub-association of nine that make up the peculiar floristic affinity in species group Q (Table 2), which cuts across parts of three associations (1.4 to 3.1) and is determined by the presence of ultramafic rocks. The sub-association has the highest average number of species encountered per sample plot and therefore has the highest species richness per unit area in the CMB (Table 2). Of its 10 taxa of conservation value (Table 2), three are taxa restricted to the association (Table 4).

1.5 *Enneapogono scoparii–Kirkietum wilmsii munduletosum sericeae* subass. nova hoc loco
Nomenclatural type: Relevé 241 (holotypus), Table 2

This sub-association represents short, closed woodland interspersed with patches of open shrubland and a well-developed grass layer. The habitat is mostly restricted to northern aspects of large hills of gabbro, norite and anorthosite, and sometimes on ferrogabbro. It occurs on steep, rocky midslopes and scarps. Diagnostic species of this sub-association are given in species group G (Table 2). It is characterised by the presence of the diagnostic shrub, *Mundulea sericea*, and various associated diagnostic forbs. Dominant grasses are *Heteropogon contortus*, *Panicum maximum* and *Themeda triandra*. Prominent woody taxa include the shrubs *Elephantorrhiza praetermissa*, *Grewia vernicosa* and *Jasminum multipartitum*. A notable floristic link exists with the *Enneapogono scoparii–Kirkietum wilmsii lanneetosum discoloris* in species group H (Table 2). Three of the SCPE plant taxa of conservation value that are restricted to the association were recorded for this sub-association (Table 4).

Table 4: Rare and endangered species restricted to specific plant communities of the Sekhukhuneland Centre of Plant Endemism

Species	Family	Plant communities															
		1.1	1.2	1.4	1.5	1.6	1.7	2.1	2.2	2.4	3.2	3.3	3.4	4.1	4.2	5.1	5.2
Acacia sp. (*P4*)	FABA	.	.	.	.	.	.	.	.	.	$	$	.	.	.	.	.
Albuca sp. (*S856*)	LILI	.	.	.	.	.	.	.	.	.	.	.	$	.	.	.	.
Bauhinia tomentosa [form] (*S444*)	FABA	.	.	.	.	.	.	$	$	.	.	.	.	.	.	.	.
Combretum petrophilum	COMB	.	.	.	.	.	.	.	.	.	.	.	.	.	R#	.	.
Cyphia transvaalensis	LOBE	.	.	.	.	.	#	.	.	.	.	.	.	.	.	.	.
Euphorbia sp. (*W13194*)	EUPH	.	.	.	.	.	.	.	.	.	.	.	$	.	.	.	.
Gnidia caffra [form] (*W12975*)	TILI	.	.	.	.	.	.	.	.	$	.	.	.	.	.	.	.
Gymnosporia sp. (*S458*)	CELA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	$	$
Hibiscus barnardii	MALV	.	.	.	.	.	.	.	.	.	.	.	.	R$	R$	.	.
Jatropha latifolia var. *latifolia*	EUPH	.	.	#	#	#	#	.	.	.	.	.	.	.	.	.	.
Ledebouria dolomiticola	LAMI	.	.	.	.	.	.	.	$	.	.	.	.	.	.	.	.
Mosdenia leptostachys	POAC	.	.	.	.	.	.	.	.	.	.	.	.	.	K	.	.
Orthosiphon tubiformis	LAMI	.	.	.	.	.	.	.	.	.	.	.	.	.	#	.	.
Pachypodium saundersii	APOC	.	.	.	.	.	.	.	.	.	.	.	N	.	.	.	.
Plectranthus venterii	LAMI	.	.	.	.	.	.	.	.	.	.	.	.	.	$	.	.
Plectranthus xerophilus	LAMI	#	#	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Premna mooiensis [form] (*W13004*)	VERB	.	.	.	.	.	.	.	.	.	.	.	.	$	$	.	.
Rhus batophylla	ANAC	R$	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stylochaeton sp. (*S1332*)	ARAC	.	.	$	$	$	$	.	.	.	.	.	.	.	.	.	.
Xerophyta retinervis [form] (*W13208*)	VELL	.	$	$	$	$	.	.	.	.	.	.	.	.	.	.	.

$ = endemic; # = near-endemic; R = Rare; K = Insufficiently Known; N = threatened elsewhere
S = Siebert; *W* = Van Wyk

1.6 *Enneapogono scoparii–Kirkietum wilmsii karomietosum speciosae* subass. nova hoc loco

Nomenclatural type: Relevé 191 (holotypus), Table 2

This sub-association covers large parts of the SCPE and was well sampled during the survey (10 relevés). It represents tall (6m), closed (14%) woodlands of hill slopes in the Steelpoort River Valley where it is found on moderate to steep rocky midslopes and scarps of norite, pyroxenite and anorthosite hills. It occurs on lithosols of the Mispah and Glenrosa forms (Table 2). Diagnostic species are represented by species group I (Table 2). The diagnostic woody species are *Karomia speciosa*, *Ochna inermis* and *Pavetta inandensis*, and *Eragrostis rigidior* is the diagnostic grass. Conspicuous woody species include *Acacia nigrescens*, *A. senegal* var. *leiorachis*, *Combretum apiculatum*, *Commiphora mollis*, *Kirkia wilmsii* and *Terminalia prunioides*. Dominant grasses include *Heteropogon contortus*, *Panicum maximum* and *Themeda triandra*. Of the ten taxa of conservation value recorded for this sub-association, three are restricted to the association (Table 4).

1.7 *Enneapogono scoparii–Kirkietum wilmsii nuxietosum congestae* subass. nova hoc loco

Nomenclatural type: Relevé 197 (holotypus), Table 2

This vegetation type is tall, closed woodland with patches of grassland. The sub-association can be found on moderately sloped scarps of exposed norite, pyroxenite and anorthosite hills in the Steelpoort and Dwars River Valleys. The sub-association occurs on Mispah soils, namely an orthic A-horizon over solid rock (Table 2). The habitat is characterised by rock cover of up to 70% and rocks more than 1m in diameter. Although the community was undersampled, diagnostic species for this sub-association were easily obtained and are listed in species group J (Table 2). Diagnostic woody species comprise the shrubs *Nuxia congesta* and *Pouzolzia mixta*. Diagnostic semi-woody taxa include *Hibiscus calyphyllus*, *Ruttya ovata* and *Tetradenia brevispicata*. *Hermannia floribunda* is the only diagnostic forb. *Andropogon schirensis*, *Enneapogon scoparius* and *Themeda triandra* dominate the sparse grass layer (7% grass cover). Nine plant taxa with conservation value are part of the sub-association, and include a SCPE near-endemic which is restricted to it (Table 4). Two Red Data List taxa assessed as Insufficiently Known were recorded (Table 2).

II. *Urochloo mosambicencis–Eucleion divinorum*

Nomenclatural type: *Fingerhuthio africanae–Boscietum foetidae* (holotypus), Association 3 described in this paper.

The alliance is floristically related to the *Colophospermum mopane–Euclea divinorum* Tree Savanna (Van Rooyen *et al.* 1981) and the *Acacia tortilis–Carissa bispinosa* Woodland (Van der Meulen 1979).

Habitat. This alliance is typical of footslopes and valleys in Sekhukhuneland, on level to moderate slopes (1–5°). Soils are deep and predominantly constitute the Hutton (red apedale B), Bonheim (pedocutanic B) and Shortlands (red structured B) soil forms. The soil surface is covered by 20–60% of rock with an average diameter of 0.2–1.0m. Table 2 summarises selected habitat attributes for the alliance. It differs from the *Enneapogono scoparii–Kirkion wilmsii* and *Combreto erythrophylli–Celtion africanae* (both described in this paper), in that it is characterised by deep sandy or clay soils, rocky terrain and a level topography.

Vegetation structure. The vegetation of the alliance is predominantly microphyllous thornveld. Diagnostic species are presented in species group AC (Table 2) and include drought tolerant trees and shrubs of brackish soils, namely *Acacia nilotica*, *A. tortilis*, *Boscia foetida*, *Combretum hereroense*, *Euclea divinorum*, *Grewia bicolor*, *Rhus engleri* and *Ximenia americana*. Three succulent forbs and three grass species that are usually associated with calcareous or brackish soils are diagnostic for the alliance. *Petalidium oblongifolium*, a non-succulent forb of calcareous areas, is also diagnostic. *Kirkia wilmsii*, *Grewia vernicosa* and *Terminalia prunioides* are dominant tree species of the alliance, and in combination with the characteristic grass species for the SCPE Mountain Bushveld, *Heteropogon contortus* and *Panicum maximum*, the baseline floristic composition supports the proposal of this plant community as an alliance of the proposed Mountain Bushveld Order (Siebert *et al.* 2002).

Floristic diversity. Floristic links with the other alliances are visible in species groups O, Q, AD and AH (Table 2). Strong floristic links exist with the *Enneapogono scoparii–Kirkion wilmsii*. The mean number of species encountered per sample plot for this alliance is 37, with the total number of plant species being a minimum of 197 taxa (62 relevés) (Table 2). There are 35 plant taxa of conservation value, 18 are SCPE endemics and 15 are SCPE near-endemics, with six species listed as Red Data List taxa (Table 2). Twenty-one taxa of conservation value are restricted to this alliance in the study area (Tables 2 and 4). Restricted taxa not listed in Table 4 are *Brachylaena ilicifolia* (form), *Catha transvaalensis*, *Dicliptera fruticosa*, *Euclea linearis* (form), *Kleinia longiflora* (form), *Kleinia stapeliiformis*, *Leucas capensis* (form) and *Orthosiphon fruticosus*.

2. *Enneapogono cenchroidis–Acacietum leiorachidis* ass. nova hoc loco

Nomenclatural type: Relevé 155 (holotypus), Table 2

The association is definitely related to the lower ranks of the *Acacia tortilis–Carissa bispinosa* Woodland of Van der Meulen (1979). However, it is a unique system restricted to the Steelpoort-Burgersfort region of the eastern Rustenburg Layered Suite.

Habitat. This association occurs on deep soils of upper footslopes of mountains and hills in the Steelpoort River Valley. It is associated with most geological substrates of the valley. It occurs on all aspects of hills and mountains. The habitat is sloped gently (3–5°), levelling out towards the Steelpoort River. Soils are diverse and dependent on the mother material. Typical soils include red sand or loam of the Bonheim, Hutton and Shortlands forms. Rock size ranges from 0.2–1m in diameter and covers 10–50% of the soil surface (Table 2).

Vegetation structure. The association is not characterised by diagnostic taxa. Preferential species are presented in species group O (Table 2). No species are shared exclusively between any of the sub-associations of the association. Dominant taxa of this typical woodland (mean height of 4.5m) include the trees/shrubs *Acacia nigrescens*, *A. senegal* var. *leiorachis*, *A. tortilis*, *Dichrostachys cinerea*, *Kirkia* *wilmsii*, *Sclerocarya birrea* and *Terminalia prunioides*. Shrubs are tall (2m) and sparse (4%), which allows sufficient resources for the grass layer to develop. Abundant, characteristic grasses include *Andropogon schirensis*, *Aristida canescens*, *Enneapogon cenchroides*, *Eragrostis curvula* and *Themeda triandra*. The grass cover is 16%, which makes this the association with the best-developed grass layer in the CMB. Conspicuous and frequent occurring forbs are *Asparagus buchananii*, *Barleria saxatilis*, *Commelina africana* and *Indigofera lydenburgensis*.

Floristic diversity. This association is floristically related to, and forms the ecotone on the footslopes between, associations 1 and 3 in species groups O, Q and AH (Table 2). Of the high number of 21 plant taxa of conservation value recorded for this association (Table 2), 11 are SCPE endemics (the highests number recorded for any of the associations in this paper) and ten are SCPE near-endemics, of which one is a Red Data List taxon. Three plant taxa are restricted to the association (Table 4). The total number of species recorded for the association is 178 (23 relevés) and the average number of plant species recorded per relevé is 35 (Table 2).

2.1 *Enneapogono cenchroidis–Acacietum leiorachidis rhigozetosum obovati* subass. nova hoc loco
Nomenclatural type: Relevé 155 (holotypus), Table 2

This woodland has a well-developed shrub layer and occurs frequently on midslopes and footslopes of ultramafic hills. It occurs on any aspect on red loam soils of predominantly the Bonheim form (melanic A-horizon and underlain by a pedocutanic B). The soil surface is not particularly rocky (Table 2). Diagnostic species are presented in species group K (Table 2). The community is characterised by the diagnostic grasses *Cenchrus ciliaris* and *Sporobolus stapfianus*. An interesting combination of diagnostic woody species occurs for the sub-association and includes *Bauhinia tomentosa* (form), *Croton menyhartii*, *Rhigozum obovatum* and *Tinnea rhodesiana*. The shrubs of this sub-association are the tallest in the CMB (2.5m). *Monechma divaricatum* is the diagnostic forb. Dominant tree species are *Acacia senegal* var. *leiorachis*, *Boscia albitrunca* and *Terminalia prunioides*. *Enneapogon cenchroides*, *Eragrostis curvula* and *Heteropogon contortus* are the most dominant grasses. Conspicuous taxa of a relatively well-developed forb layer (6% cover) include *Asparagus laricinus*, *Barleria saxatilis*, *Indigofera hilaris*, *Petalidium oblongifolium* and *Psiadia punctulata*. The sub-association shows a slight relationship with the *Enteropogono macrostachyos–Sclerocaryetum birreae rhigozetosum obovati* of norite/pyroxenite foothills of the Leolo Mountains (Siebert *et al.* 2002b). Of the 12 recorded plant taxa of conservation value, one is a Red Data List taxon and one is a taxon restricted to the association (Tables 2 and 4).

2.2 *Enneapogono cenchroidis–Acacietum leiorachidis maeruetosum angolensis* subass. nova hoc loco
Nomenclatural type: Relevé 212 (holotypus), Table 2

This sub-association represents tall (5m), closed woodlands on the footslopes of pyroxenite and ferrogabbro hills. It usually occurs on red loam soils of the Hutton (orthic A-horizon on a red apedale B) and Shortlands (orthic A-horizon on a red structured B) forms. The habitat is relatively rocky, with rocks reaching large mean diameters of up to 1m (Table 2). Diagnostic species are presented in species group L (Table 2). Diagnostic herbaceous taxa include species such as *Ledebouria dolomiticola* and *Orthosiphon fruticosus* that are also found on dolomites. *Maerua angolensis*, is the only diagnostic tree species and *Enteropogon macrostachys*, the only diagnostic grass. Other dominant taxa include small trees/shrubs such as *Acacia senegal* var. *leiorachis*, *Dichrostachys cinerea*, *Grewia bicolor* and *Terminalia prunioides*. Grass cover is 11% and dominated by *Aristida canescens*, *Enneapogon cenchroides* and *Themeda triandra*. *Barleria saxatilis*, *Kyphocarpha angustifolia* and *Sanseviera hyacinthoides* are the most dominant forbs. In species group AH (Table 2), this sub-association is the first syntaxon of a series (2.2 to 3.3) that shows an affinity with association 5 of riverbanks. The sub-association also shows a slight relationship with the *Enteropogono macrostachyo–Sclerocaryetum birrea asparagetosum sekukuniensis* of ferrogabbro slopes of the Leolo Mountains (Siebert *et al.* 2002b). There are 13 taxa of conservation value recorded for the sub-association, of which seven are SCPE endemics (in both cases the second highest numbers recorded for the CMB) (Table 2). One endemic is a Red Data List taxon and one near-endemic is restricted to the sub-association (Table 4).

2.3 *Enneapogono cenchroidis–Acacietum leiorachidis bolusanthetosum speciosae* subass. nova hoc loco
Nomenclatural type: Relevé 299 (holotypus), Table 2

In the SCPE this sub-association represents tall, closed woodland on red sandy-loam soils. The habitat is found along mountain footslopes with a granophyre base. It occurs on all aspects. Rock cover percentage is sparse and rock size is relatively small (100–150mm diameter) (Table 2). Species group M (Table 2) contains the diagnostic species for this sub-association, with herbaceous taxa such as the grass *Diheteropogon amplectens*, and numerous low growing forbs (0.45m). *Bolusanthus speciosus* is the only diagnostic tree. Prominent taxa include the grasses *Enneapogon cenchroides*, *Heteropogon contortus* and *Themeda triandra*. The sub-association is dominated by grasses (30% cover), with very few prominent herbs (3% cover). Dominant trees include *Acacia senegal* var. *leiorachis*, *Combretum hereroense*, *Dichrostachys cinerea*, *Euclea divinorum* and *Grewia vernicosa*. Total vegetation cover for this sub-association is 44%, the second most vegetated plant community of the CMB. The sub-association has a relationship with the *Loudetio simplicis–Eucleetum linearis* of alluvium soils on a norite/pyroxenite base (Siebert *et al.* 2002b). Nine taxa with conservation value occur in this sub-association (Table 2), which include seven SCPE near-endemics (the second highest number recorded for the CMB). One Red Data List taxon was also recorded.

2.4 *Enneapogono cenchroidis–Acacietum leiorachidis gardenietosum volkensii* subass. nova hoc loco
Nomenclatural type: Relevé 117 (holotypus), Table 2

In the SCPE this sub-association is tall, closed woodland with a well-developed shrub layer (6% cover). The habitat is characterised by alternative bands of deep (>300mm) or shallow (<300mm) soils (sometimes associated with calcrete or magnetite outcrops) of the Glenrosa or Shortlands forms. Species group N contains the diagnostic species for this sub-association, which are characterised by the tree *Mystroxylon aethiopicum* and shrub *Gardenia volkensii* (Table 2). Diagnostic herbaceous taxa comprise four forbs. Other prominent species of the sub-association include the small trees/shrubs *Acacia tortilis*, *Dichrostachys cinerea* and *Terminalia prunioides*. The succulent *Aloe castanea* is a frequently occurring and conspicuous species. Prominent grasses include *Enneapogon cenchroides*, *Panicum maximum* and *Sporobolus ioclados*. One taxon with conservation value is restricted to the sub-association (Table 4).

3. *Fingerhuthio africanae–Boscietum foetidae* ass. nova hoc loco

Nomenclatural type: Relevé 143 (holotypus), Table 2

The association is definitely related to the *Acacia erubescens* Woodland on Ferrogabbro of the western Rustenburg Layered Suite (Van der Meulen 1979). However, *Acacia erubescens* is not as common in the vegetation of the eastern Rustenburg Layered Suite.

Habitat. This is an association of dry and warm areas of gently sloping footslopes and broad valleys. The mother material can be ferrogabbro, norite and pyroxenite covered by alluvium. Subsequently, relatively deep soils of the Bonheim, Hutton, Shortlands and Valsrivier forms are dominant, but are interspersed with Glenrosa lithosols (Table 2). Rock cover on the surface is sparse, and rocks have a small size (mean diameter of 250mm) (Table 2).

Vegetation structure. Preferential species for these tall woodlands are presented in species group AC (Table 2). Prominent herbaceous taxa include succulent forbs, namely *Aloe burgersfortensis*, *Kalanchoe paniculata* and *Sarcostemma viminale*. Forb cover is high (7%) and nearly of the same level as the grass cover (10%) and is probably as a result of heavy grazing. Tree and shrub cover is 13% and the association is dominated by *Acacia erubescens*, *A. tortilis*, *A. nilotica*, *Boscia albitrunca*, *B. foetida*, *Dichrostachys cinerea* and *Euclea divinorum*. Common grasses of the association are *Aristida adscensionis*, *A. canescens*, *Eragrostis curvula*, *Fingerhuthia africana*, *Sporobolus fimbriatus* and *Panicum maximum*. Total vegetation cover is the lowest for the CMB (30% cover) probably due to overgrazing and it is suggested that its favourable terrain type is responsible for its extensive utilisation.

Floristic diversity. This association cannot stand alone and has various strong links with associations 1 and 2 in species group Q (ultramafic substrates), associations 2 and 4 in species group AC (brackish/calcareous soils), associations 1, 2 and 4 in species group AD (Mixed Bushveld components), and associations 2 and 5 in species group AH (thicket forming species) (Table 2). Altogether 20 plant taxa of conservation value occur in this association and include two Red Data List taxa (Table 2). Four taxa of conservation value are restricted to the association (Table 4). The average number of species encountered per sample plot is 36, with a total number of 197 plant taxa (25 relevés) (Table 2).

3.1 *Fingerhuthio africanae–Boscietum foetidae elaeodendretosum transvaalensis* subass. nova hoc loco

Nomenclatural type: Relevé 229 (holotypus), Table 2

This sub-association is tall (5m), closed woodland on pyroxenite and/or derived alluvium. It occurs on level footslopes of hills and mountains, predominantly on westerly aspects. It prefers red loam soils of the Bonheim, Hutton and Shortlands forms. The soil surface is sparsely covered with small rocks (Table 2). Diagnostic species are presented in species group P (Table 2). The community is characterised by diagnostic forbs and a diagnostic grass, *Eragrostis capensis*. *Catha transvaalensis* and *Elaeodendron transvaalensis* are the diagnostic tree species. Tree cover is 11% and includes dominant woody species such as *Albizia anthelmintica*, *Acacia tortilis*, *Croton gratissimus*, *Euclea divinorum*, *Rhus engleri* and *Terminalia prunioides*. *Aristida adscensionis*, *A. canescens*, *Eragrostis curvula*, *Fingerhuthia africana*, *Panicum maximum* and *Themeda triandra* are the most important conspicuous grasses of a sparse grass layer (10%). The association has a strong link with associations 1 and 2 in species group Q (ultramafic dominated mother material) and is the last of the crosscutting floristic affinity (Table 2). It can be seen as an ecotone between footslope and valley vegetation. This sub-association is related to the *Eragrostio lehmannianae–ippobrometum pauciflori rhoetosum batophyllae* of erosion gulleys in the Steelpoort River Valley (Siebert *et al.* 2002b). Of the 12 taxa of conservation value recorded for the sub-association, eight were SCPE near-endemics, the highest number recorded for the CMB.

3.2 *Fingerhuthio africanae–Boscietum foetidae aloetosum globuligemmae* subass. nova hoc loco

Nomenclatural type: Relevé 143 (holotypus), Table 2

The sub-association is low, dense woodland, with a well-developed forb layer (11% cover). It is associated with deep (>1m) soils in valleys, especially the northern areas of the Steelpoort River Valley. Aspect is usually east or west due to the general southwest-northeast flow of the river. Soils are characteristically a red loam with a pedocutanic B-horizon, such as the Bonheim (melanic A-horizon) and Valsrivier (orthic A-horizon) forms. Rock cover is sparse (Table 2). Diagnostic species of the sub-association are presented in species group R (Table 2). *Acacia luederitzii*, *Cadaba aphylla* and *Cadaba natalensis* are the diagnostic woody species of the sub-association. *Eragrostis pseudoscleranthа* is the diagnostic grass. The vegetation type is characterised by three forbs and the succulent *Aloe globuligemma*. Important trees/shrubs are the same as that for the association, but also includes *Acacia gerrardii* and *A. grandicornuta* and *Terminalia prunioides*. Prominent herbaceous taxa of its well-developed forb layer include the succulents *Aloe burgersfortensis*, *Kleinia longiflora* and *Sanseviera hyacinthoides*, and the non-succulent *Petalidium oblongifolium*. Abundant grasses of this sparse layer are *Eragrostis curvula*, *E. lehmanniana*, *Fingerhuthia africana*, *Sporobolus fimbriatus* and *S. nitens*. The sub-association shows a strong floristic relationship with both sub-associations 3.1 and 3.3 in species groups S and U respectively (Table 2). The sub-association has a high mean number of plant species per sample plot (43) and the highest total number of plant species per sub-association of the CMB (131 taxa for 8 relevés) (Table 2). One of the restricted taxa of conservation value, *Acacia karroo* (form), is restricted to sub-associations 3.2 and 3.3 (Table 4).

3.3 *Fingerhuthio africanae–Boscietum foetidae euphorbietosum ingentis* subass. nova hoc loco

Nomenclatural type: Relevé 306 (holotypus), Table 2

This vegetation type is tall (5.5m), closed woodland of predominantly dry northern, but also east and west aspects of mountain footslopes and valleys. The community is found from Roossenekal to Steelpoort and is restricted to ferrogabbro footslopes and alluvium in valleys. The soils are of the Bonheim, Valsrivier and Glenrosa forms. Rock cover is relatively low (Table 2). Diagnostic species are presented in species group T (Table 2). Only one grass species, *Eleusine coracana*, is diagnostic for the sub-association. There are three diagnostic forbs. *Erythrina lysistemon* and *Euphorbia ingens* are the diagnostic trees. Prominent trees of the sub-association are *Acacia tortilis*, *Boscia foetida* and *Ehretia rigida*. Conspicuous herbaceous taxa include the succulent *Aloe greatheadii* and the geophyte *Urginea epigea*. The grasses *Fingerhuthia africana*, *Panicum maximum*, *Sporobolus fimbriatus* and *S. ioclados* are abundant and contribute substantially towards the high grass cover of 17%. This sub-association also exhibits the typical African savanna structure with tall, but distributed trees, with a well-developed grass layer. The association has a strong link with sub-association 3.2 in species group U (iron-rich soils) and is the last community of the crosscutting floristic affinity with association 5 in species group AH (Table 2).

3.4 *Fingerhuthio africanae–Boscietum foetidae sesamothamnetosum lugardii* subass. nova hoc loco

Nomenclatural type: Relevé 311 (holotypus), Table 2

The sub-association is related to the *Sesamothamnus lugardii-Catophractes alexandri* Low Open Woodland described for an area north of the Soutpansberg (Visser *et al.* 1996).

This sub-association represents sparse woodland of undulating norite landscapes on mostly sandy Hutton soils interspersed with calcareous Glenrosa soils in the Burgersfort region. Slope of the habitat is gentle and rock cover and diameter is the highest for the association (Table 2). The diagnostic species for the sub-association are presented in species group V (Table 2). The diagnostic species include the woody shrub *Maerua juncea* and the succulent small tree, *Sesamothamnus lugardii*. *Aristida rhiniochloa* and *Pogonarthria squarrosa* are the diagnostic grasses. Prominent species of the sparse tree/shrub layer (6%) include *Boscia albitrunca*, *Cadaba termitaria*, *Grewia bicolor* and *G. vernicosa*. Dominant herbaceous taxa of the sub-association are *Indigofera heterotricha*, *Justicia protracta* and *Kyphocarpha angustifolia*, and the succulent *Aloe burgersfortensis*. The sparse grass layer (6%) is characterised by *Aristida canescens*, *Fingerhuthia africana*, *Panicum maximum* and *Urochloa mosambicensis*. Future research can probably upgrade this plant community to the level of association. It does not show any specific relationships with other sub-associations. Of the community's seven taxa of conservation value, three are restricted to it (Table 4). Several taxa are of biogeographic significance due to their disjunct distribution, namely *Polygala krumanina* (Karoo disjunct) and three Limpopo River Valley disjuncts: the small succulent trees *Sesamothamnus lugardii* and *Commiphora tenuipetiolata*, and the herbaceous climber *Decorsea schlechteri*. Two Red Data List taxa were recorded, namely *Asparagus clareae* (Insufficiently Known) and *Pachypodium saundersii* (Insufficiently Known for Swaziland).

4. *Melino nerviglumis–Euphorbietum tirucalli* ass. nova hoc loco

Nomenclatural type: Relevé 411 (holotypus), Table 2

Habitat. This is an association of short, dense shrubland on alluvium, norite and anorthosite. It is restricted to overgrazed and over-harvested areas of gentle to moderately sloped footslopes and valleys between Burgersfort and Mecklenburg. Soils are of the Glenrosa, Mispah and Steendal (melanic A-horizon over a soft carbonate B) forms, which are interspersed with black turf. Approximately 45% of the soil surface is covered by rocks with a relatively large diameter up to 2m (Table 2).

Vegetation structure. Diagnostic species are presented in species group W (Table 2). The vegetation unit is dominated by diagnostic forbs (8% cover), and includes *Dicoma tomentosa*, *Ledebouria marginata*, *Senna italica*, and the naturalised alien, *Schkuhria pinnata*. Diagnostic woody species are the scandent shrub *Hippocratea longipetiolata* and the succulent shrub *Euphorbia tirucalli*. The shrub cover is 8%, the highest for CMB, and includes prominent taxa such as *Aloe castanea*, *Diospyros lycioides* subsp. *lycioides*, *Grewia bicolor* and *G. vernicosa*. Although disturbed, the total vegetation cover is the highest for an association in the CMB (34%). As a consequence of the continuous grazing and harvesting of the system, the grass layer is dominated by species such as *Chloris virgata*, *Eragrostis viscosa* and especially *Aristida adscensionis*, *Melinis nerviglumis* and *Heteropogon contortus*. Naturalised alien succulent trees such as *Cereus peruvianus* and *Opuntia ficus-indica* occur frequently.

Floristic diversity. A strong floristic affinity exists with the other associations of the *Urochloo mosambicencis–Eucleion divinorum* in species groups AG and AL (Table 2). However, the intense harvesting of firewood in this vegetation type is evident in species groups X to AB, where the absence of woody species is distinct. This association has 18 plant taxa with conservation value. Of these, a high number of four plant species are Red Data List taxa (Table 2). It also has a taxon with a biogeographically noteworthy distribution and rarity in nature, *Eulophia leachii*. Six plant taxa with a conservation value are restricted to the association (Tables 2 and 4); together with association 1 the most for the CMB. The average number of species encountered per sample plot is 40, which is the highest average recorded for any of the associations of the CMB. The total number of plant species recorded is a minimum of 187 taxa (14 relevés) (Table 2).

4.1 *Melino nerviglumis–Euphorbietum tirucalli emilietosum transvaalensis* subass. nova hoc loco

Nomenclatural type: Relevé 395 (holotypus), Table 2

The habitat is a scattered shrubland on moderately sloped footslopes of heavily grazed hills to the east of the Leolo Mountains. It is found predominantly on shallow Mispah soils overlying anorthosite and norite. Rock cover is average, but the relative size is large (Table 2). Diagnostic species are presented in species group X (Table 2). The diagnostic herbaceous species include indigenous forbs and naturalised alien weeds. Two grasses are diagnostic, namely

Brachiaria brizantha and *Schizachyrium sanguineum*. Shrub cover is higher than that of the trees and *Grewia vernicosa* is the most abundant woody species. Prominent forbs include *Geigeria ornativa*, *Schkuhria pinnata* and *Waltheria indica* (9% cover; 0.4m high) (Table 2). *Aristida adscensionis*, *Eragrostis viscosa*, *Melinis nerviglumis* and especially *Heteropogon contortus*, are the most abundant grasses (12% cover; 0.5m high). A specific link exists with sub-association 4.2 in species group Z (Table 2). The mean number of plant species encountered per sample plot in this association is 45; together with sub-association 1.4 the highest average for the CMB. One taxon of conservation value in the sub-association is an endemic Red Data List taxon, *Hibiscus barnardii* (Table 2). Two taxa of conservation value restricted to the association are recorded for this sub-association (Table 4).

4.2 *Melino nerviglumis–Euphorbietum tirucalli vanguerietosum cyanescentis* subass. nova hoc loco

Nomenclatural type: Relevé 411 (holotypus), Table 2

This is low, closed shrubland of footslopes usually associated with small kloofs. It lies on gentle slopes. The geological substrate is ultramafic and soils are predominantly of the Glenrosa form. A large proportion of the soil surface is covered by large rocks (Table 2). Diagnostic species are presented in species group Y (Table 2). *Obetia tenax* (small tree) and *Vangueria cyanescens* (shrub) are diagnostic for this community. Four diagnostic forbs occur and the diagnostic grass *Aristida transvaalensis*. Shrub cover percentage is the highest for the CMB (11%), with forb cover outcompeting grass cover by 1%. Tree cover is low and mean tree height is only 3m. Unique taxa recorded for the sub-association are the grasses *Mosdenia leptostachys* and *Urochloa panicoides*, the forbs *Leucas martinicensis* and *Thunbergia neglecta* and the shrubs *Combretum petrophilum* and *Tecomaria capensis.* This sub-association shares plant species with sub-associations 4.1 and 4.3 in species groups Z and AB respectively (Table 2) and might represent an intermediate stage between footslopes and plains of the association. The total number of plant species recorded for the sub-association is 130 taxa, the highest for a community in the CMB (Table 2). Strangely, this disturbed sub-association also has the highest number of plant taxa with conservation value in this particular CMB vegetation type. These 15 taxa include nine SCPE endemics (the highest number for the CMB) (Table 2). There are three Red Data List taxa recorded and four species of conservation value are resticted to the sub-association only (Tables 2 and 4).

4.3 *Melino nerviglumis–Euphorbietum tirucalli flaverietosum bidentis* subass. nova hoc loco

Nomenclatural type: Relevé 386 (holotypus), Table 2

In the SCPE this sub-association represents areas for grazing between fields, characterised by single large trees (>10m) that are remnants of former closed woodlands of the floodplain. It is common on all aspects of footslopes and valleys. Mean rock diameter is below average for the study area and covers a low percentage of the soil surface (Table 2). Soil types are characterised by black clays and turfs, predominantly the Steendal form. The diagnostic species for this sub-association are presented in species group AA (Table 2) and includes the alien species *Agave sisalana*, *Flaveria bidentis* and *Xanthium strumarium*. *Combretum imberbe* is a large diagnostic tree. Large stands of the diagnostic grasses *Bothriochloa insculpta* and *Ischaemum fasciculatum* occur (17% cover). Prominent trees include large specimens of *Acacia karroo*, *Boscia foetida*, *Schotia brachypetala* and *Ziziphus mucronata*, which are interspersed with the weedy shrubs *Gossypium herbaceum* (indigenous) and *Senna didymobotrya* (alien). Conspicuous forbs not listed in Table 2 include *Commicarpus plumbagineus*, *Corchorus tridens*, *Dyschoriste rogersii* and *Sida cordifolia*. *Aristida adscensionis*, *Brachiaria eruciformis*, *Cynodon dactylon*, *Eragrostis cilianensis* and *Urochloa oligotricha* are the most abundant grasses. A strong floristic relationship exists with association 5 in species group AI (Table 2), possibly indicating that it is an altered form of the *Combretum erythrophyllum–Celtis africana* Forest (Van der Meulen 1979) on alluvium near rivers.

III. *Combreto erythrophylli–Celtion africanae*

Nomenclatural type: *Combreto erythrophylli–Acacietum karroo* (holotypus), Association 5 described in this paper.

The alliance is floristically related to the *Combretum erythrophyllum–Celtis africana* Forest Alliance (Van der Meulen 1979).

Habitat. This alliance is typical of well-treed riverbanks in Sekhukhuneland. It is associated with level to moderate sloped (1–5°) deep alluvium soils of the Oakleaf form (orthic A-horizon over a neocutanic B). The soil surface is covered by 5–40% of rock with a mean diameter of 0.5–3m. Table 2 summarises selected habitat attributes for the alliance. It differs from the *Enneapogono scoparii–Kirkion wilmsii* and *Urochloo mosambicencis–Eucleion divinorum* (both described in this paper), in that it is characterised by deep loam soils, tall woodlands (>6m) and proximity to rivers.

Vegetation structure. The vegetation of the alliance is predominantly gallery forest. Diagnostic species are presented in species group AE (Table 2) and include trees and shrubs of moist soils, namely *Celtis africana*, *Combretum erythrophyllum*, *Ficus sur*, *Lippia javanica*, *Melia azedarach* and *Olea europaea*. *Pavonia burchellii*, a forb of shady areas, is also diagnostic. *Acacia karroo*, *Kirkia wilmsii*, *Peltophorum africanum*, *Schotia brachypetala* and *Ziziphus mucronata* are common tree species of the alliance, and as characteristic species for the SCPE Mountain Bushveld provide the baseline floristic composition to support the proposal of this plant community as an alliance of the proposed Mountain Bushveld Order (Siebert *et al.* 2002).

Floristic diversity. Limited floristic links with the other alliances are visible in species groups AH and AI (Table 2), which indicates that it is intermediate between the vegetation of CMB and that of rocky outcrops. The mean number of species encountered per sample plot for this alliance is 30, with the total number of plant species being a minimum of 115 taxa (8 relevés) (Table 2). There are two plant taxa of conservation value, one a SCPE endemic and one a SCPE near-endemic, with one taxon of conservation value restricted to this alliance in the study area (Tables 2 and 4).

5. *Combreto erythrophylli–Acacietum karroo* ass. nova hoc loco

Nomenclatural type: Relevé 184 (holotypus), Table 2

This association is related to the *Acacio ataxacanthae–Celtidetum africanae* of Dolomite Outcrops (Matthews *et al.* 1992), *Combretum erythrophyllum–Acacia karroo* Gallery Forest (Van der Meulen 1979) and *Diospyros whyteana–Celtis africana* Forest (Coetzee 1975).

Habitat. This association occurs on riverbanks along larger rivers such as the Steelpoort and Olifants and includes an alien plant species component. It is a vegetation unit on predominantly red loam Oakleaf soils. The slope is more or less level (1–5°), a characteristic of these broad, alluvium filled valleys. Rock cover percentage is relatively low and varies from 5–40%, and average rock diameter is 50–300mm (Table 2).

Vegetation structure. Diagnostic species for the tall, closed woodlands of this association is given in species group AE (Table 2). Diagnostic species are the same as for the alliance. Tree and shrub cover is the highest for CMB (19% cover and mean height of 7m). Abundant woody species include *Acacia karroo*, *Diospyros lycioides* subsp. *lycioides*, *Flueggea virosa* and *Hippobromus pauciflorus*. Prominent forbs include *Achyranthes aspera*, *Cardiospermum corindum* and *Hypoestes aristata* and the climber *Secamone filiformis* (3% forb cover). Prominent grasses in the association, typical of shady and/or moist areas, are *Panicum deustum*, *P. maximum* and *Sporobolus fimbriatus*.

Floristic diversity. A floristic link exists with associations 2 and 3 in species group AH, possibly ascribed to thicket-forming situations, and a link with association 4 in species group AI, possibly because sub-association 4.3 is floodplain vegetation (Table 2). Conservation priorities and diversity statistics are the same as the alliance (Tables 2 and 4).

5.1 *Combreto erythrophylli–Acacietum karroo rhoetosum pyroidis* subass. nova hoc loco

Nomenclatural type: Relevé 177 (holotypus), Table 2

This vegetation type is closed, scattered woodland along the Steelpoort River. The habitat is predominantly broad, slightly sloped banks underlain by deep alluvial soils. Soil surface rock cover is low for the CMB, with a small diameter (Table 2). Species group AF (Table 2) represents the diagnostic species, with the woody species *Acacia ataxacantha*, *Rhus pyroides*, *Tarchonanthus camphoratus* and *Zanthoxylum thorncroftii* diagnostic for the sub-association. Tree/shrub cover is high (18%), and subsequently forb cover is only 2%. Grass cover (10%) is surprisingly high, but occurs on the woodland edges, and includes the diagnostic grass *Cymbopogon validus*. *Barleria obtusa* and *Sida spinosa* are the diagnostic forbs. Mean tree height is 6.5m which provides a forest-like structure with a canopy. Very few species with conservation value was recorded.

5.2 *Combreto erythrophylli–Acacietum karroo acacietosum galpinii* subass.nova hoc loco

Nomenclatural type: Relevé 184 (holotypus), Table 2

The vegetation is tall, closed woodland on the banks of rivers in the SCPE. Hence, the vegetation unit is restricted to valleys. The community is usually encountered as meandering vegetation (gallery woodland) on riverbanks amidst any of the communities discussed in this paper. It occurs on a gentle slope and is predominantly encountered on deep alluviam soils. Rock cover is average with a relatively small mean diameter (Table 2). Diagnostic species are presented in species group AG (Table 2). Diagnostic grasses are common and include *Andropogon eucomis*, *Hyparrhenia filipendula* and the alien, *Paspalum dilatatum*. Trees of the sub-association grow tall (mean of 7.5m) and include the diagnostic species *Acacia galpinii*, *Spirostachys africana*, *Syzygium cordatum* and the alien, *Morus japonica*. Tree/shrub cover is 20% and dominates the community. A typical forest structure is evident with frequently occurring canopy trees such as *Celtis africana*, *Combretum erythrophyllum*, *Ficus sur* and *Olea europea* subsp. *africana*. Forb cover is low and includes the conspicuous species *Acalypha villicaulis*, *Achyranthes aspera*, *Kleinia fulgens* and *Pavonia burchellii*.

Conservation

Throughout the SCPE the remaining populations of plants and animals are under considerable pressure from exploitative land uses (Siebert *et al.* 2002a). Conservation of many localities of the same plant community (ecosystems) could be the most effective approach for the protection and survival of endemics of fractal landscapes such as ultramafic substrates (Witkowski and Liston 1997, With and King 1998, Harrison 1999). Certain SCPE plant endemics and threatened taxa of the CMB are restricted to specific plant communities. In the light of rapid development of the region, these vegetation units or areas need immediate attention and should be considered for conservation purposes. Important communities of conservation value, which are restricted to the SCPE, are in associations 1 to 4 (more specifically sub-associations 1.4, 1.6, 2.1, 2.2, 3.1, 3.2 and 4.2). Special attention should be given to the conservation of associations 2 and 3, as ecotones contain the maximum amount of adaptive variation of a species (Smith *et al.* 2001). Sub-associations 3.4, 4.1 and 5.2 should also be considered for they harbour very unique plant communities. If protected, threatened communities should be monitored by conservation biologists, as alien plant invasions in rare habitats and distinctive plant communities pose a significant challenge (Chiarucci and De Dominicis 1995, Stohlgren *et al.* 1999).

Furthermore, some species in plant communities of conservation value, show disjunct distributions with other regions in South Africa. A floristic link exists with the Northern Cape and North West Province (arid part of Savanna Biome), with species shared including *Acacia erioloba*, *Gnidia polycephala*, *Jamesbrittenia atropurpurea*, *Nuxia gracilis*, *Polygala krumanina*, *Pterothrix spinescens*, *Rhigozum obovatum* and *Stipagrostis hirtugluma* subsp. *patula*. Another floristic link, with the Lowveld, probably developed when species reached Sekhukhuneland via the Olifants River Valley and include taxa such as *Balanites maughamii*, *Diospyros mespiliformis*, *Lonchocarpus capassa* and *Ptaeroxylon obliquum*. In addition, many other floristic links exist with other areas in South Africa, for instance, *Schotia latifolia* and *Asparagus intricatus* with the Eastern Cape, and *Sesamothamnus lugardii* and *Commiphora tenuipetiolata* with the areas north of the Soutpansberg. It is, therefore, clear that although the SCPE falls predominantly in Mixed Bushveld (Van Rooyen and Bredenkamp 1996), its vegetation is extremely diverse and contains floristic elements from various other regions in South Africa.

Several rare, but widespread, species were recorded during the vegetation survey, but were not listed in the phytosociological table due to their rarity in habitat (recorded in one relevé of a species group). These taxa are the endemics *Cyphostemma* sp. (*Siebert 1383*), *Leucas capensis* (form: *Van Wyk 13007*), *Phyllanthus* sp. (*Siebert 470*), *Rhoicissus sekhukhuniensis*, and the near endemics *Asparagus clareae* (Insufficiently Known Red Data List taxon), *Brachylaena ilicifolia* (form: *Siebert 613*), *Euclea linearis* (form: *Siebert 937*), *Kleinia stapeliiformis* and *Vitex obovata* subsp. *wilmsii*.

Discussion

Ultramafic areas should not always be seen as open grassland areas (Wild 1965), as woodlands are common on these soils (Jaffrè 1980). Guy (1975) and Chiarucci (1994) have reported on woody communities that grow almost exclusively in sites with special pedo-morphological characters and do not show the extremely stunted woody species and grassland dominated communities typical of ultramafic substrates. On a local scale, the CMB is characterised by relatively dense woodlands, which is quite distinctive from the OMB's typical stunted, sparse structure and low diversity of small trees/shrubs (Siebert *et al.* 2002b). The structure of CMB is similar to that of Mixed Bushveld (Van Rooyen and Bredenkamp 1996).

It is speculated that an extremely heterogeneous set of large-scale environmental factors determines the plant communities within the CMB. A combination of many factors such as terrain type (slope or aspect), soil depth (lithosols or alluvium), soil moisture (riverbanks or open plains), soil type (sand or clay) or anthropogenically altered areas (fields or over-grazed/harvested areas), affects the species composition of these plant communities. Future work should focus on the extensive habitat data available for the SCPE to determine which dynamic environmental gradients contribute significantly towards the vegetation patterns of the CMB, because grass-tree coexistence in savannas is driven by the limited opportunities for tree saplings to escape both drought and the flame zone into the adult stage (Thrash 1998, Higgins *et al.* 2000), and hence is influenced by a complex network of local and large-scaled factors, notably water availability, herbivory, fire, soil texture, nutrients and anthropogenic interference (Cole 1986, Skarpe 1992, Breshears *et al.* 1998, Briske and Henderson 1998, Jeltsch *et al.* 1998, Lock 1998, Bjornstad *et al.* 1999, Higgins *et al.* 1999).

Vegetation patterns of the savanna of the SCPE should be seen as similar, but not synonymous, to the Mixed Bushveld defined by Van Rooyen and Bredenkamp (1996). Siebert *et al.* (2002) defined a unique type of Mountain Bushveld on the ultramafics of Sekhukhuneland, which is a useful contribution towards the work that remains to be done on the classification of the central savannas of South Africa. Interesting observations were made during the classification process:

- *Enneapogono scoparii–Kirkion wilmsii* is poorly studied in the northern provinces of South Africa. It proved extremely difficult to link this alliance to any other major vegetation types in the region. However, floristically it is related to the *Kirkia wilmsii* Dolomite Vegetation Types (Van der Meulen 1979) and the *Kirkia wilmsii* Mountain Woodland (Brown *et al.* 1997).
- *Urochloo mosambicencis–Eucleion divinorum* is floristically related to the *Colophospermum mopane–Euclea divinorum* Tree Savanna (Van Rooyen *et al.* 1981) and the *Acacia tortilis–Carissa bispinosa* Woodland (Van der Meulen 1979). These links indicate that soils can induce similar vegetation types across the borders of two different vegetation classes.
- *Enneapogono cenchroidis–Acacietum leiorachidis* contains associations that represent a transition between savannas of mountains/hills (*Enneapogono scoparii–Kirkion wilmsii*) and savannas of plains/valleys (*Fingerhuthio africanae–Boscietum foetidae*). This indicates the presence of clear-cut, classifiable ecotones on footslopes of mountains/hills.
- *Combreto erythrophylli–Celtion africanae* is floristically related to the *Combretum erythrophyllum–Celtis africana* Forest Alliance proposed by Van der Meulen (1979). The occurrence of this alliance along riverbanks throughout the central savannas of South Africa was first recognised 25 years ago and was never described formally.
- Anthropogenic plant communities are common in former homelands (Smits *et al.* 1999) and therefore human pressure cannot be ignored as a factor that influences the distribution of *Melino nerviglumis–Euphorbietum tirucalli* vegetation in the SCPE. Disturbed communities infested by alien species are usually ignored during surveys and not documented properly.

Concluding remarks

The classification obtained from TWINSPAN and refined by Braun-Blanquet procedures resulted in 20 vegetation units (plant communities) and associated habitat conditions. These vegetation units should be considered as ecologically interpretable communities for the area concerned. Seven plant communities have been identified as of high conservation priority.

It is hoped that the descriptions of the different vegetation units will make a significant contribution towards the understanding of the associations between plant communities and ultramafic substrates in the SCPE and southern Africa as a whole. Such an understanding is important as it contributes towards proper land-use management and will ensure the protection of the rare ecosystems of an ultramafic region that contains the largest known economically viable resources of platinum, chromium and vanadium on earth (Viljoen and Schurmann 1998).

The floristic and environmental data supplied in this paper can be meaningfully applied in management and conservation of these semi-arid, but valuable rangelands in the SCPE. The manner in which natural resources are used and managed will have a direct relation to its future productive capacity (Aucamp *et al.* 1992). Proper and sound future assessment of the region's vegetation should include aspects such as species rarity, habitat preference and vegetation dynamics. These aspects are important as they contribute to accurate identification and selection of conservation areas to protect rare and threatened species within a Centre of Endemism with a vast economic potential.

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