CHAPTER 6

SOUTPANSBERG ARID NORTHERN BUSHVELD COMMUNITIES

Introduction

In an overview of the vegetation of the Soutpansberg Conservancy and the Blouberg Nature Reserve (Chapter 4), the *Diplorhynchus condylocarpon–Burkea africana* Soutpansberg Leached Sandveld was identified as a Major Vegetation Type. The classification of this Major Vegetation Type is addressed in this chapter.

Only a few isolated detailed phytosociological studies have been done on the arid savannas of the Limpopo Province, which includes Breebaart & Deutchlander (1997), Siebert (2001), Du Plessis (2001), Henning (2002) and Götze (2002). B.Sc. Honores students from the University of Pretoria have done a number of smaller studies throughout the province as part of their practical training and to develop management plans for privatised game reserves and game ranches. These studies however, focussed on management planning and ended in reports rather than journals. The level of detail included in these studies varies and were often determined by scale and intensity of management practiced by landowners. The arid systems of the Limpopo Province, and for that matter most of the southern African savannas (Du Plessis 2001), have only been sampled in localised patches, such as areas of high conservation value and or high economic value. Therefore, the vegetation of many areas remains to be investigated and described in order to complete the puzzle of patchy vegetation studies throughout the province. One such a puzzle piece is the arid northern bushveld of the Soutpansberg mountain range.

Acocks (1953) mapped the vegetation of this area as Mixed Bushveld (18) on the plain directly north of the Soutpansberg mountain, Sourish Mixed Bushveld (19) along the northern foot slopes and Sour Bushveld (20) south of the northern most ridges. He described these Veld Types as “a Deadalian maze of variations and transitions”. Despite Acocks’ valuable efforts, and due to the scale of his map, he failed to identify and describe most of the plant communities discussed in this chapter,

and urged that more work had to be done to unravel these complex vegetation patterns. Although not mapped as such, the *Adansonia*–Mixed Thornveld he described under the heading of Arid Sweet Bushveld may be regarded as a coarse description for the vegetation of the northern plains of the Soutpansberg Conservancy. Van Rooyen & Bredenkamp (1998) also recognised the uniqueness of this region's vegetation. However, without the necessary data, they too had to lump these communities under the broad term of Soutpansberg Arid Mountain Bushveld.

Vegetation classification

The analysis of the vegetation data resulted in the identification of eight plant communities, classified into eight associations (Table 5). The plant communities of the *Adansonia digitata–Acacia nigrescens* Soutpansberg Arid Northern Bushveld (within the SC) are classified as follows:

Adansonia digitata–Acacia nigrescens Soutpansberg Arid Northern Bushveld Major Vegetation Type.
Classified under the *Commiphoro mollis–Colophospermetea mopani* described by Winterbach *et al.* (2000)

1. *Commiphoro tenuipetiolatae–Adansonietum digitatae*
2. *Ledebourio ovatifoliae–Commiphoretum mollii*
3. *Phyllantho reticulati–Acacietum nigrescentis*
4. *Tinneo rhodesianae–Combretetum apiculati*
5. *Dichrostachyo cinereae–Spirostachyetum africani*
6. *Themedo triandrae–Pterocarpetum rotundifolii*
7. *Cypero albostriati–Syzygietum cordatum*
8. *Sesamothamno lugardii–Catophractetum alexandri*

Table 5 Phytosociological table of the plant communities of the *Adansonia digitata–Acacia nigrescens* Soutpansberg Arid Northern Bushveld Major Vegetation Type

Association no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Relev number	1 1 1 1 1	1 1 1		1 1 1 1	1 1 1 1	1 1 1	1 1 1 1	1 1 1 1 1 1
	8 8 8 8 9 9 9 9 9 9 9 9 9 0 0 0 0 5	3 3 4 4 4 4 6 0 0 1	5 5 5 6 6 6 6	3 4 4 4 4 5 0 0 0 0 3 4	7 7 8 8	6 7 7	4 4 4 4	4 4 4 4 4 4
	6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 0	7 8 1 2 3 4 1 5 6 0	7 8 9 0 2 3 4	2 5 6 7 8 6 4 7 8 9 1 0	8 9 0 1	9 0 1	6 7 8 9	0 1 2 3 4 5
Species Group A								
Diagnostic species of the *Commiphoro tenuipetiolatae–Adansonietum digitatae*								
Tephrosia macropoda	+ + + + + + + + + + + + + + + + + +							
Sclerocarya birrea ssp. caffra	a b a + + + + + + + a 1 a a a 1	+ + + +	+	+ 1 +			r	
Commiphora tenuipetiolata	+ 1 1 + + + + + + + 1 1 1 +	+ +	+	+				
Ledebouria apertiflora	+ + + + + + + + + + + + + + +	+ +						
Aristida stipitata ssp. graciliflora	+ + + + 1 1 1 + + + a 1	+			+		+	+
Tricholaena monachne	+ + 1 + + + + + + + + +							
Hermannia boraginiflora	+ + + + + + + + + + +							
Blepharis subvolubilis	+ + + + + + + + + + + + +		+					
Dicerocaryum eriocarpum	+ + + + + + + + + + + +	+						
Chamaecrista mimosoides	+ + + + + + + + + + + +	+	+	+	+			+
Albizia anthelmintica	+ + 1 1 + + + + + + a							
Barleria species	+ + + + +							
Phyllanthus maderaspatensis	+ + + + + + + + + +							
Indigofera adenoides	+ + + + + + + + + +							
Sansevieria hyacinthoides	+ + + + + + + + + +	+	+	+				+
Corchorus trilocularis	+ + + + + + + +							
Schotia brachypetala	r + + + + +						+	
Agathisanthemum bojeri	+ + + + + + + +							
Asparagus asparagoides	+ + + + + + +							
Acacia nilotica ssp. kraussiana	+ r r + 1	+		1 1				
Commelina africana	a 1 +	+	+					+
Maytenus senegalensis	+ + + +	r						
Solanum kwebense	+ + + + +	+ +						
Eragrostis pseudosclerantha	1 1 +							

Acacia erioloba	+ + +						r	
Acacia burkei	+ + +							
Ehretia obtusifolia	+ + +			+			+	+
Polygala hottentotta	+ + +							
Ochna natalitia	+ + +			+				
Euclea natalensis	+ + +			+				
Tephrosia longipes	+ + +	+			+			
Eragrostis pallens	+ + +						+	

Species Group B

Diagnostic species of the *Ledebourio ovatifoliae–Commiphoretum mollii*

Ledebouria ovatifolia		+ + + + + + + +	+					
Asparagus cooperi		+ + + + + +		+				
Barleria elegans		+ + + + +	+	+				
Dalbergia nitidula	r	+ + + + + +	+	+				
Ocimum canum		+ + + + +	+					
Asparagus racemosus		+ + + + + +		+				
Abutilon angulatum var. angulatum		+ + + + + +	+					
Stapelia gigantea		+ + + +	+					
Euclea undulata	r	+ + + + +		r +				
Lantana rugosa	+	+ + +				+		
Pyrostria hystrix		+ + + +	r					
Aloe globuligemma		+ + + +			+			
Rhigozum obovatum		+ + +		+				
Pseudolachnostylis maprouneifolia	r	r + +		+ +		+		
Toddaliopsis bremekampii		r + +						

Species Group C

Adansonia digitata	1 1 1 a + 1 1 1 1 + 1 1 1 1 1 1	1 1 1 + 1 1 1 1 + +						
Blepharis diversispina	+ 1 + 1 + + + + + + + + + + + + 1 + + +	+ + + + + +	+	+				
Terminalia prunioides	a 1 b a 1 a + + + +	+ + 1 + + 1 1 + + +						
Ximenia americana var. microphylla	+ + + + + + + +	+ + + + + + + +	+	+ +			+	+
Combretum mossambicense	+ + + + + + + + + + + +	+ + + + + + +	+					
Gossypium herbaceum ssp. africanu	+ + + + + + + +	+ + + + + + +		+ +				
Commiphora viminea	+ + + + + + + + + +	+ + + + +						

Waltheria indica	+ + + + + + +	+ + + + +		+ +	+		+	+

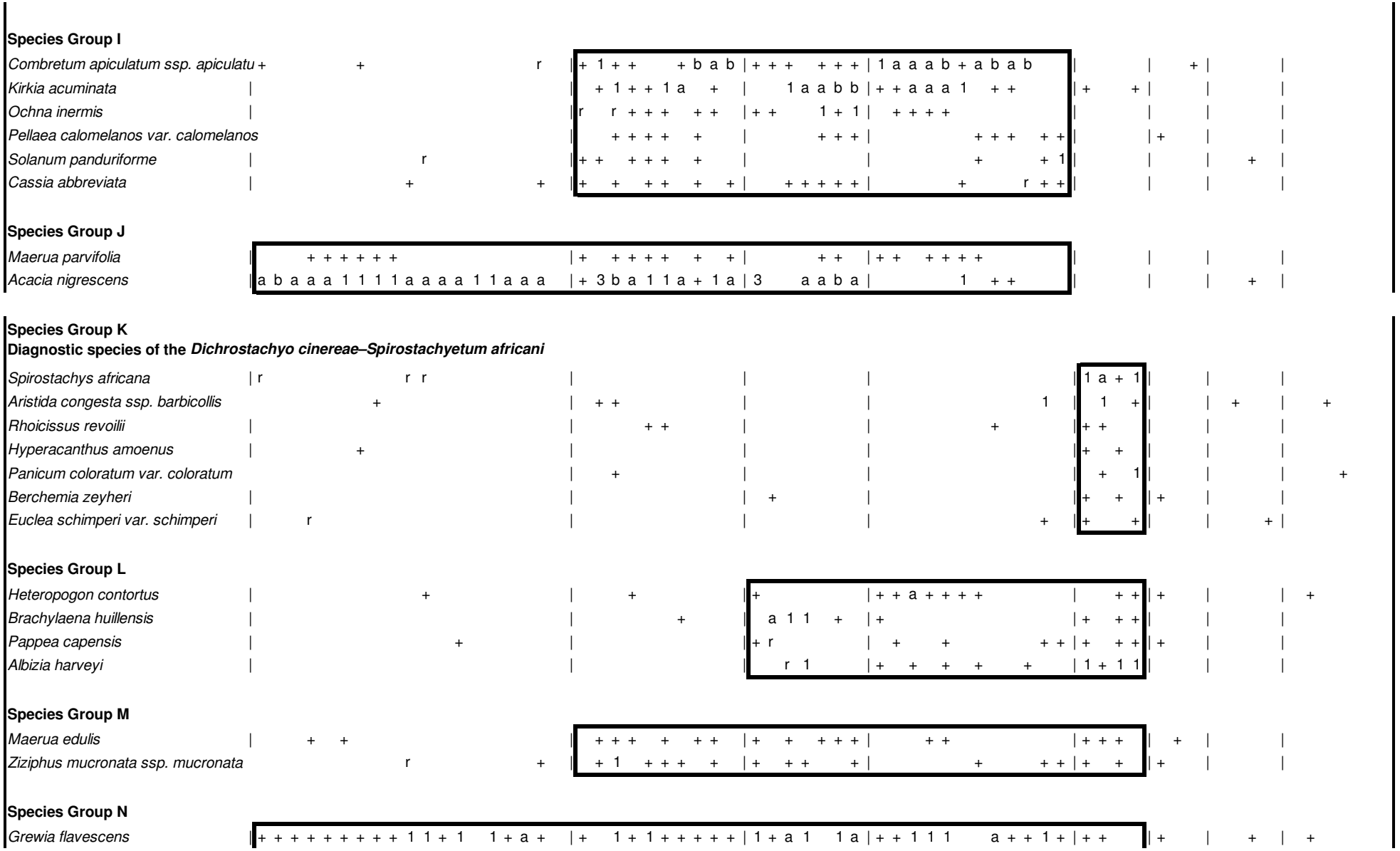
Species Group D
Diagnostic species of the *Phyllantho reticulati–Acacietum nigrescentis*

Phyllanthus reticulatus	r	+	+ 1 a a a + +				+ +	
Setaria nigrirostris			1 1 + a + a +					
Ruspolia hypocrateriformis			+ + 1 + + 1 1					
Asparagus setaceus			+ + + + +	+ +				
Wrightia natalensis			+ + + + +					
Rhynchosia nervosa			+ + + + +					
Acalypha glabrata			+ + + 1 +	1				
Melhania prostrata	+		+ + + + +		+			
Brachylaena discolor			1 + + + +					
Canthium mundianum			+ + + +					
Pouzolzia mixta			+ + + +	+				
Barleria obtusa			+ + + +		+			+
Ruspolia hypocrateriformis var. australis			1 a 1					
Clerodendrum makanjanum			+ + +					
Loeseneriella crenata			+ + +					
Combretum molle		r	+ r	r				
Vangueria infausta ssp. infausta	+ +	+	+ +					
Bridelia cathartica			+ +	+				
Barleria rotundifolia	r		+ +	+ +				
Ficus ingens var. ingens		+ +	+ r				+	
Ruttya ovata			+ + +					
Aristida congesta ssp. congesta	+ +	+	+ r	r +	+			+
Maytenus tenuispina			+ +	+		+		
Ptaeroxylon obliquum			+ +					
Croton gratissimus			a +					
Phyllanthus pinnatus	r		+ +					

Species Group E

Sterculia rogersii	+ +	+ + + + + + + +	+ + + + +					
Cissus cornifolia	+	+ + + + + +	+ + + + + +	+				
Albizia brevifolia		+ + + + + +	+ + 1 a b					

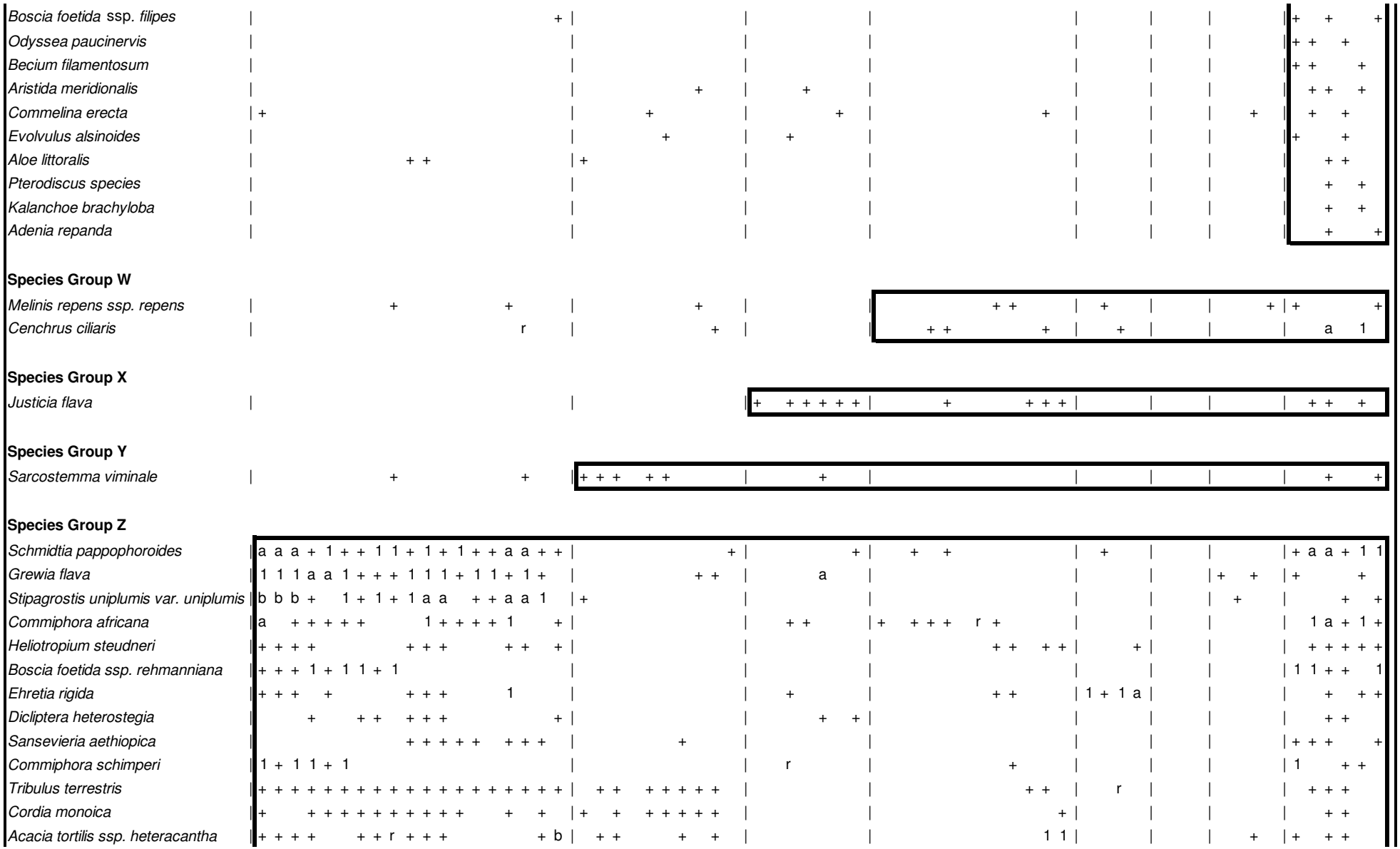
	1	2	3	4	5	6	7	8
Entandrophragma caudatum		+ + + + +	+ 1 + 1 +					
Markhamia zanzibarica		+ + + +	+ + + + +					
Lannea schweinfurthii var. stuhlmannii	r	+ + 1 1 + + +	+ + + +	+			+	
Tricalysia junodii var. kirkii		+ + r + + + 1 +	+ + + +	+				
Commiphora marlothii		+ 1 + + 1 +	+ + + +					
Gyrocarpus americanus ssp. africanus		+ 1 + 1 +	+ + + +					
Species Group F								
Pristimera longipitiolata	+ + + +	+ + + + + +	+ + 1 + + +	+ +	r		+	
Grewia subspathulata	+ + + 1 1 1 +	1 1 + 1 1 + + + +	+ 1 1 + + +					+
Grewia bicolor	+ + + + 1 1 1 1 1 1 + +	1 a + + + +	+ 1 + + + +					
Flueggea virosa ssp. virosa	+ +	+ + + + + + +	a a b 1 a + a	+ +				
Panicum deustum	+ +	+ +	+ + + +		+		+	
Asparagus exuvialis fo. exuvialis	+ + + + +		+ +					
Species Group G								
Diagnostic species of the *Tinneo rhodesianae–Combretetum apiculati*								
Tinnea rhodesiana			+ +	+ 1 a 1 a 1 + + + +				
Steganotaeni araliacea			+ +	r + + 1 + + +				
Barleria ovata			+	+ + 1 + + +				
Asparagus bechuanicus			+	+ + + + +				
Crabbea velutina			+	+ + + + +				
Psiadia punctulata	+ +		+	+ + 1 +	+	1		
Elephantorrhiza burkei				r + + +				
Aloe marlothii ssp. marlothii				+ 1 1	+			
Euphorbia ingens	r	+		+ 1 1				
Asparagus africanus			+	+ + +				
Asparagus suaveolens				+ + +				
Combretum imberbe	+			+ + +	r			
Diospyros villosa var. parvifolia				+ + +			+	
Kalanchoe paniculata				+ + +				
Species Group H								
Blepharis integrifolia			+ + +	+ + + + +				
Cardiospermum halicacabum			+ + +	+ + + + + +				


Species Group I
Combretum apiculatum ssp. apiculatu
Kirkia acuminata
Ochna inermis
Pellaea calomelanos var. calomelanos
Solanum panduriforme
Cassia abbreviata
Species Group J
Maerua parvifolia
Acacia nigrescens
Species Group K
Diagnostic species of the Dichrostachyo cinereae–Spirostachyetum africani
Spirostachys africana
Aristida congesta ssp. barbicollis
Rhoicissus revoilii
Hyperacanthus amoenus
Panicum coloratum var. coloratum
Berchemia zeyheri
Euclea schimperi var. schimperi
Species Group L
Heteropogon contortus
Brachylaena huillensis
Pappea capensis
Albizia harveyi
Species Group M
Maerua edulis
Ziziphus mucronata ssp. mucronata
Species Group N
Grewia flavescens

Panicum maximum	+ + + + + + + +	+ + + + + + + +	+	+ + + + + a a a	a a 1 1	+	
Commiphora glandulosa	+ a a a 1 1 + 1 1 1 + + 1	+ + + + + + +		+ + + + +	+ + +		
Boscia albitrunca var. albitrunca	+ + + + + + + +	+ + + + + +	+ + + +	+	1 + 1 1		
Grewia villosa	+ + +	+		+ + + + r + +	+ + +		+
Balanites maughamii	+ + + + +			+	+ + +		+
Euclea divinorum	+ + + +	+ + +		+ + +	+ + +		
Species Group O							
Diagnostic species of the *Themedo triandrae–Pterocarpetum rotundifolii*							
Themeda triandra	r	+	+	+		b 3 b	
Pterocarpus rotundifolius ssp. rotundifolius	+		+	1 +		a + 1	
Bolusanthus speciosus					r	1 + +	
Rhynchosia komatiensis				+		+ + +	
Acacia caffra						+ + +	
Indigofera hilaris						+ + +	
Gymnosporia buxifolia	+ +	+		+		+ + +	
Lannea discolor				+		+ +	
Dombeya rotundifolia var. rotundifolia				+ +		+ +	
Cleome gynandra			+			+ +	
Rhynchosia venulosa				+		+ +	
Acacia gerrardii var. gerrardii	+			1 1		+ +	
Species Group P							
Combretum hereroense				+ + r +	+ + +	+ +	
Species Group Q							
Enneapogon cenchroides	r	+ + + + a +		+ a b a a b b +	+ + 1 +	+ a 1	
Species Group R							
Grewia monticola	+ + + +	+ r + + 1 a + +	1	+ 1 1 1 1 + + a a 1 1	1 + 1 1	1 + +	
Commiphora mollis	b b b 1 1 1 1 1 1 1 b 1 a a 1 + b 1	b a a b a 3 + + + +	a	+ + 1 + + + + +	1 1 1 +	+ +	+
Ximenia caffra var. caffra	+ + + + + + + + +	+ + +		+ + + + +		+ +	+
Cleome angustifolia ssp. petersiana	+ + + + + + + + + + +	+		+	r	+ +	
Ozoroa paniculosa var. salicina	+ + + r		+	+ + +		1 1 +	+

Species								
Species Group S								
Diagnostic species of the *Cypero albostriati–Syzygietum cordatum*								
Cyperus albostriatus							3 4 4 3	
Syzygium cordatum							3 a b 3	
Hyphaene petersiana	+ +						1 a a a	
Cynodon dactylon	+	+			+		a a b 1	+
Acacia robusta ssp. clavigera	+			+			a + a +	
Thelypteris madagascariensis							+ 1 + a	
Senna petersiana	+			+			1 1 + +	
Persicaria serrulata							+ + + +	
Fimbristylis complanata							+ + + +	
Pycreus polystachyos							+ + + +	
Andropogon eucomus							+ + + +	
Fuirena pubescens							+ + + +	
Garcinia livingstonei	+ +						a b 1	
Albizia versicolor	+						+ 3 +	
Mystroxylon aethiopicum ssp. schlecl	+ +	+		+	+		a + b	
Bridelia mollis		+ +					+ a +	
Artabotrys brachypetalus	+				r		1 + +	
Ficus sycomorus							+ b	
Xanthocercis zambesiaca	+						b +	
Urochloa mosambicensis	+ +	+					+ +	
Cyperus distans							+ +	
Wahlenbergia grandiflora							+ +	
Cyperus solidus							+ +	
Hypericum lalandii							+ +	
Vernonia centaureoides							+ +	
Species Group T								
Philenoptera violacea	+	r		+ + +	+ +		1 1 + +	
Species Group U								
Grewia hexamita	+ + + + + + + + + + + + + 1	+ + + + 1 + + +	+ +				1 + 1 +	
Dichrostachys cinerea ssp. africana	+ + + + + + + + + + + +	+ + + + + + +	+ 1 + + +	+ + + + + + + + + a 1	a 1 a a		+ + +	
Plectroniella armata	a a 1 + + + + + + + + + +	+ +	+ +	1 + +		+	+ +	

Species	I	II	III	IV	V	VI	VII	VIII
Terminalia sericea	+ + + 1 1 1 + + + + +	+		r			+ +	+
Strychnos madagascariensis	+ + + + + 1 a 1	+ + + +		+ +			+ + +	
Peltophorum africanum	+ + + 1 +	+ +		+ + + 1		+	+ + +	
Euclea natalensis ssp. angustifolia	+ + + + + + +						+ +	
Rhus leptodictya	r + +			+	r		+ +	
Bulbostylis hispidula	+ + + +						+ +	
Acacia welwitschii ssp. delagoensis	+ r r	+ 1	r				+ +	
Species Group V								
Diagnostic species of the *Sesamothamno lugardii–Catophractetum alexandri*								
Catophractes alexandri								1 a a a 1 1
Commiphora pyracanthoides	+ +							1 a a a + a
Acacia nebrownii								1 1 1 1 + 1
Sesamothamnus lugardii								1 1 + 1 1 +
Ipomoea adenioides								1 1 1 1 +
Salvadora australis								+ 1 + + +
Acacia senegal var. rostrata								+ 1 + + +
Dicoma species								+ + + + +
Balanites pedicellaris								+ + + + +
Kyphocarpa angustifolia	r							+ + + +
Euphorbia guerichiana								+ + + +
Kleinia longiflora								+ + + +
Solanum coccineum								+ + + +
Becium angustifolium								+ + + +
Hibiscus calyphyllus	+							+ + + +
Rhigozum zambesiacum	1 +	+ +		r +				+ + + +
Sporobolus ioclados		+		1 +				+ + + +
Vernonia capensis								+ + + +
Acacia mellifera ssp. detinens								1 + +
Aptosimum lineare								+ + +
Lycium species								+ + +
Blepharis aspera								+ + +
Becium obovatum								+ + +
Barleria wilmsiana								+ + +
Tribulus zeyheri ssp. zeyheri								+ + +


Boscia foetida ssp. filipes
Odyssea paucinervis
Becium filamentosum
Aristida meridionalis
Commelina erecta
Evolvulus alsinoides
Aloe littoralis
Pterodiscus species
Kalanchoe brachyloba
Adenia repanda
Species Group W
Melinis repens ssp. repens
Cenchrus ciliaris
Species Group X
Justicia flava
Species Group Y
Sarcostemma viminale
Species Group Z
Schmidtia pappophoroides
Grewia flava
Stipagrostis uniplumis var. uniplumis
Commiphora africana
Heliotropium steudneri
Boscia foetida ssp. rehmanniana
Ehretia rigida
Dicliptera heterostegia
Sansevieria aethiopica
Commiphora schimperi
Tribulus terrestris
Cordia monoica
Acacia tortilis ssp. heteracantha

Hibiscus meyeri	+	+	+	+	+	+										+				+	+	+	+	+	+	+			+	+	+	+		+	+									+			+												+		1	+	+	+
Eragrostis lehmanniana var. lehman.			+			+						+	+				1	1				+	+	+			+	+	+																					+							+					+	+		+	+
Solanum incanum	+	+	+																+	+	+							+																+	+		+	+	+				+			+				+		+		+	

Community description

***Adansonia digitata–Acacia nigrescens* Soutpansberg Arid Northern Bushveld Major Vegetation Type**

The *Adansonia digitata–Acacia nigrescens* Soutpansberg Arid Northern Bushveld Major Vegetation Type is classified under the *Commiphoro mollis–Colophospermetea mopani* described by Winterbach *et al.* (2000). This class name was suggested by Winterbach *et al.* (2000), but the class was not formally described. Although not a single *Colophospermum mopane* tree was recorded within this vegetation type during field surveys, numerous diagnostic species characterising this class and the *Adansonia digitata–Acacia nigrescens* Soutpansberg Arid Northern Bushveld are shared. In a syntaxonomic synthesis of *Colophospermum mopane* vegetation in southern Africa, Du Plessis (2001) also described this phenomenon, whereby the dominant species forming part of the name description of a higher-level community within the hierarchical classification, is absent from lower level communities. Based on the complex of diagnostic species shared by *Colophospermum mopane* vegetation and the *Adansonia digitata–Acacia nigrescens* Soutpansberg Arid Northern Bushveld Major Vegetation Type, these two vegetation units are synecologically linked.

Numerous authors have described different aspects of the Soutpansberg Arid Northern Bushveld Major Vegetation Type, such as the *Adansonia*–Mixed Thornveld (14e) of the Arid Sweet Bushveld (Acocks 1953), the Soutpansberg Arid Mountain Bushveld (11) savanna vegetation type (Bredenkamp & Van Rooyen 1996), the Sweet Bushveld (17) savanna vegetation type (Van Rooyen & Bredenkamp 1996), the Mixed Bushveld (18) savanna vegetation type (Van Rooyen & Bredenkamp 1996), the *Colophospermum mopane–Commiphora glandulosa–Seddera capensis* open tree savanna in the northern most section of the Kruger National Park (Van Rooyen 1978, Van Rooyen *et al.* 1981), the *Commiphora–Terminalia prunioides* community of the Limpopo Plains (Louw 1970) and the *Ptycholobium contortum–Colophospermum mopane* Vegetation Type (Du Plessis 2001).

Environmental data

The *Adansonia digitata–Acacia nigrescens* Soutpansberg Arid Northern Bushveld Major Vegetation Type is confined to the rain-shadow northern ridges of the SC.

Although its plant communities are associated with a variety of topographic and edaphic conditions, most are adapted to prolonged water-stress conditions and unpredictable rainfall events. This vegetation type includes of a variety of arid ecosystems. With the exception of some isolated swamps dotted along the northern plains, all these communities are water-limited. Water-stress within these systems is brought about by both a lack of precipitation, as well as by the unavailability of soil water within the soils of high clay content. The small pore sizes among clay particles create strong adhesive forces between clay particles and the available water molecules, which inhibit the water from being taken up by hair-roots.

The northern foot-slopes have high rock cover values, while the lower laying sandy plains have basically no surface rocks. Clay content of the soil varies from less than five percent to more than 55%. The structure of the vegetation can mainly be classified as short open woodland (Edwards 1983). The associated terrain includes flat sandy plains and gentle clayey foot-slopes (1–5°). The exception to this predominantly flat terrain, are the steep and clayey foot-slopes within the deep Sand River Gorge.

This major vegetation type is associated with the Namib Soil Form (McVicar *et al.* 1991) of Land Types Ae, Ag, Ia, Ib, and Fa derived from sandstone, quartzite and conglomerate of the Wyllies Poort Geological Formation, basalt from the Musekwa Geological Formation, as well as from narrow diabase intrusions or dykes within the Wyllies Poort Geological Formation (Botha 2004a; Patterson & Ross 2004a).

Altitude ranges from approximately 746 m to 1060 m above sea level. The average annual rainfall is 382 mm (South African Weather Bureau), varying between 330 mm on the farm Omloop to 435 mm on the farm Sandow. Rainfall events are irregular and localised north of the mountain range.

The *Adansonia digitata–Acacia nigrescens* Soutpansberg Arid Northern Bushveld Major Vegetation Type, like much of southern Africa's arid and semi-arid areas, is considered to function as event-driven and non-equilibrium ecosystems (Schultze & McGee 1978; Werger & Coetzee 1978; Coetzee 1983; Westoby 1979; De Angelis &

Waterhouse 1987; Westoby *et al.* 1989; Mentis *et al.* 1989; Laycock 1991; Behnke & Scoones 1993; Dodd 1994; Bredenkamp & Brown *in prep.*). The dynamics of these ecosystems are controlled by external control mechanisms (abiotic factors), which are not subject to feedback control from within the ecosystem (Ellis & Swift 1988). Climatic factors, such as the irregular and unpredictable droughts are often the main driving force of arid and semi-arid ecosystems (Noy-Meir 1982; Wiens 1984; Bredenkamp & Brown *in prep.*).

Diagnostic taxa

The diagnostic species for this group are presented in species group G (Table 1, Chapter 4). Diagnostic perennial woody species characterizing the communities of this vegetation type include *Adansonia digitata, Commiphora glandulosa, Blepharis diversispina, Grewia flava, Grewia subspathulata, Grewia hexamita, Boscia albitrunca* var. *albitrunca, Boscia foetida* subsp. *rehmanniana* and *Commiphora tenuipetiolata, Kirkia acuminata, Maerua parvifolia, Maerua edulis, Terminalia prunioides, Cassia abbreviata, Sterculia rogersii, Sansevieria aethiopica* and *Commiphora viminea. Tribulus terrestris* is a relatively strong diagnostic herbaceous species for the group, but due to its status as a widely distributed annual herb, it is not seen as a reliable indicator species for the Soutpansberg Arid Bushveld.

Dominant / prominent taxa

Dominant woody species of this vegetation type include *Adansonia digitata, Blepharis diversispina, Boscia foetida* subsp. *rehmanniana, Cassia abbreviata, Commiphora glandulosa, Commiphora tenuipetiolata, Cordia monoica, Grewia flava, Grewia hexamita, Grewia subspathulata, Kirkia acuminata, Sterculia rogersii, Terminalia prunioides* (Species Group G), *Commiphora mollis, Combretum apiculatum* subsp. *apiculatum* (Species Group H), *Hibiscus meyeri* (Species Group J), *Acacia nigrescens, Dichrostachys cinerea* subsp. *africana* and *Grewia monticola* (Species Group L). Prominent grass species include *Schmidtia pappophoroides, Stipagrostis uniplumis* var. *uniplumis* and *Panicum maximum* Species Group P). The general prominence of the herbaceous pioneer species *Tribulus terrestris* is an indication of frequent disturbances to the field layer.

1. *Commiphoro tenuipetiolatae–Adansonietum digitatae* ass. nov., hoc loco.

Nomenclatural type: Relevé 96 (holotypus)

Alternative name: *Commiphora tenuipetiolata–Adansonia digitata* Short Open Woodland of the Soutpansberg Arid Northern Sandveld / Plains

Environmental data

The vegetation of this association can be described as short open woodland (Edwards 1983) with large baobab trees breaking the monotone vegetation structure of the landscape. It is found exclusively north of the northern most ridges of the mountain, where aeolian (Kalahari) sands have covered the Musekwa sediments at the foot of the mountain. The habitat is flat and marks the beginning of the vast arid Limpopo plain north of the mountain. It is mostly confined to the Ia Land Type, with the Ae Land Type playing a minor role (Botha 2004a). The Hutton Soil Form (McVicar *et al.* 1991) is the dominant soil type. Surface rock-cover for this association is low.

Diagnostic taxa

This association is characterised by species group A (Table 5). Diagnostic woody species include *Sclerocarya birrea* subsp. *caffra, Commiphora tenuipetiolata, Blepharis subvolubilis* and *Albizia anthelmintica*, with a fair number of *Schotia brachypetala* associated with termitaria.

The herb layer is sparse with only a few hardy species, which includes diagnostic species such as *Tephrosia macropoda, Ledebouria apertiflora, Hermannia boraginiflora, Dicerocaryum eriocarpum, Chamaecrista mimosoides, Phyllanthus maderaspatensis, Indigofera adenoides, Sansevieria hyacinthoides* and *Agathisanthemum bojeri*.

Recorded diagnostic grass species included *Aristida stipitata* subsp. *graciliflora* and *Tricholaena monachne*.

Dominant / prominent taxa

Dominant and prominent woody species include *Commiphora tenuipetiolata*, *Sclerocarya birrea* subsp. *caffra* (Species Group A), *Adansonia digitata, Blepharis diversispina, Combretum mossambicense, Commiphora viminea, Terminalia*

prunioides, Ximenia americana var. *microphylla* (Species Group C), *Grewia bicolor* (Species Group F), *Acacia nigrescens* (Species Group J), *Commiphora glandulosa, Grewia flavescens* (Species Group N), *Commiphora mollis, Ximenia caffra* var. *caffra* (Species Group R), *Dichrostachys cinerea, Grewia hexamita, Plectroniella armata, Terminalia sericea* (Species Group U), *Acacia tortilis* subsp. *heteracantha, Boscia foetida* subsp. *rehmanniana, Commiphora africana, Cordia monoica* and *Grewia flava* (Species Group Z).

Due to the drought experienced at the time of the field survey, the field layer was sparse, with only the most drought resistant perennial species visible and available for collection and identification. None of the recorded forbs could be described as dominant. However, prominent forb species include *Blepharis subvolubilis*, *Chamaecrista mimosoides, Dicerocaryum eriocarpum*, *Hermannia boraginiflora, Ledebouria apertiflora, Tephrosia macropoda* (Species Group A), *Cleome angustifolia* subsp. *petersiana* (Species Group R), *Heliotropium steudneri, Sansevieria aethiopica* and *Tribulus terrestris* (Species Group Z).

Dominant grass species are *Aristida stipitata* subsp. *graciliflora* (Species Group A), *Schmidtia pappophoroides* and *Stipagrostis uniplumis* var. *uniplumis* (Species Group Z).

Some aspects of the *Commiphoro tenuipetiolatae–Adansonietum digitatae* have also been described by Acocks (1953) as the *Adansonia*–Mixed Thornveld (14e) of the Arid Sweet Bushveld, and by Van Rooyen & Bredenkamp (1996) as the Sweet Bushveld (17) savanna vegetation type of South Africa. This SC association also shares some floristic elements with the *Colophospermum mopane–Commiphora glandulosa–Seddera capensis* open tree savanna in the northern most section of the Kruger National Park (Van Rooyen 1978;Van Rooyen *et al.* 1981). In these plant communities *Adansonia digitata* and a variety of *Commiphora* species contribute greatly to the characteristic vegetation structure of open tree savanna. Gertenbach (1983) described this vegetation unit of the Kruger National Park as the *Adansonia digitata–Colophospermum mopane* Rugged Veld. However, the *Commiphoro tenuipetiolatae–Adansonietum digitatae* on the sandy plains of the SC is not associated with the rugged basalt koppies and slopes, as are the *Colophospermum*

mopane–Commiphora glandulosa–Seddera capensis open tree savanna of the northern KNP. Louw (1970) described similar vegetation north of the Soutpansberg as the *Commiphora–Terminalia prunioides* community. However, the *Commiphora–Terminalia prunioides* community and the *Colophospermum mopane–Commiphora glandulosa–Seddera capensis* open tree savanna of the northern Kruger National Park contain *Colophospermum mopane* as a strong floristic component, which does not occur within the *Commiphoro tenuipetiolatae–Adansonietum digitatae* of the SC. Floristic affinities between the above mentioned plant communities are therefore based on the complex of diagnostic species shared. The *Ptycholobium contortum–Colophospermum mopane* Vegetation Type described by Du Plessis (2001) lumps the *Commiphoro tenuipetiolatae–Adansonietum digitatae* as part of the Limpopo River Valley Mopane-veld north of the Soutpansberg. Straub (2002) described similar vegetation along the Limpopo River Valley as *Terminalia prunioides–Colophospermum mopane* woodland. These variations of the Mopane-veld are associated with arid areas of low and unpredictable annual rainfall (Du Plessis 2001). They are characterised by floristic elements of typically drier habitas, such as *Boscia* species, *Commiphora* species, *Terminalia prunioides* and *Adansonia digitata*.

2. *Ledebourio ovatifoliae–Commiphoretum mollii* ass. nov., hoc loco.

Nomenclatural type: Relevé 44 (holotypus)

Alternative name: *Ledebouria ovatifolia–Commiphora mollis* Short Bushland on the arid clayey northern foot-slopes of the Soutpansberg

Environmental data

The vegetation structure of the *Ledebourio ovatifoliae–Commiphoretum mollii* association can be described as Short Bushland (Edwards 1983) on arid clayey northern foot-slopes and northern entrance of the Sand River Gorge of the Soutpansberg. The landscape is very arid with very little available soil moisture for uptake by plant roots. At times of drought, the field layer dies back dramatically, leaving the soil surface bare and exposed. During such times only the most drought resistant species remain visible, making identification and notation of the total floristic composition impossible. As this vegetation represents a non-equilibrium, event-driven system, this state is often found, and is considered as normal for this

vegetation. This has prompted the study to focus on dominant drought resistant perennial species as a means for association description and community identification.

This plant community is restricted to the diabase intrusions within the Wyllies Poort Geological Formation on the northern foot-slopes of the mountain, and in particular the northern entrance of the Sand River Gorge. The slope of the landscape varies from 5–15°. It is associated with the Fa Land Type and its Glenrosa and Mispah Soil Forms (Botha 2004; Patterson & Ross 2004). The soil clay content is high and exceeds 55% in some places. Surface rock cover varies between 25–50%.

Diagnostic taxa

This association is characterised by species group B (Table 5). Diagnostic woody species include *Dalbergia nitidula, Euclea undulata, Rhigozum obovatum* and *Pyrostria hystrix*.

Forbs and succulents recorded and presented in this group are *Ledebouria ovatifolia, Asparagus cooperi, Barleria elegans, Ocimum canum, Asparagus racemosus, Abutilon angulatum* var. *angulatum, Stapelia gigantea, Lantana rugosa* and *Aloe globuligemma*.

Dominant / prominent taxa

The dominant woody species are all very drought resistant, and include *Adansonia digitata* (Species Group C), *Terminalia prunioides* (Species Group C), *Commiphora marlothii* (Species Group E), *Gyrocarpus americanus* subsp. *africanus* (Species Group E), *Lannea schweinfurthii* var. *stuhlmannii* (Species Group E), *Grewia subspathulata* (Species Group F), *Combretum apiculatum* subsp. *apiculatum* (Species Group I), *Kirkia acuminata* (Species Group I), *Acacia nigrescens* (Species Group J), *Maerua edulis* (Species Group M), *Grewia flavescens* (Species Group N) and *Commiphora mollis* (Species Group R).

The field layer is poorly developed. This is especially true for times of below-average rainfall. None of the species recorded within the field layer could be described as prominent at the time of data gathering.

The *Ledebourio ovatifoliae–Commiphoretum mollii* shares numerous floristic links with the *Adansonia*–Mixed Thornveld (14e) of the Arid Sweet Bushveld (Acocks 1953), the *Commiphora–Terminalia prunioides* community (Louw 1970), the *Colophospermum mopane–Commiphora glandulosa–Seddera capensis* open tree savanna in the northern most section of the Kruger National Park (Van Rooyen 1978,Van Rooyen *et al.* 1981), the *Boscio albitruncae–Terminalietum prunioidis* (Coetzee 1983), the *Adansonia digitata–Colophospermum mopane* Rugged Veld Landscape (Gertenbach 1983), the Sweet Bushveld (17) savanna vegetation type of South Africa (Rooyen & Bredenkamp 1996) and the *Ptycholobium contortum–Colophospermum mopane* Vegetation Type (Du Plessis 2001). The soils of the above mentioned plant communities might generally be described as extremely arid, shallow, stony soils with a very high clay fraction. Drought resistant woody species dominate the vegetation structure and composition. The field layer is poorly developed and unstable due to the unpredictability of rainfall events and the frequent severe droughts within the area. They are all dominated by with a poorly developed and unstable field layer. The most prominent diagnostic species shared among these communities are *Terminalia prunioides, Adansonia digitata, Boscia albitrunca* var. *albitrunca, Boscia foetida* subsp. *rehmanniana*, numerous *Commiphora* species, *Sterculia rogersii*, numerous *Grewia* species, *Acacia nigrescens* and *Combretum apiculatum.*

Ledebourio ovatifoliae–Commiphoretum mollii of the northern clayey foot-slopes of the Soutpansberg and *Commiphoro tenuipetiolatae–Adansonietum digitatae* of the sandy plains north of the Soutpansberg share strong floristic links through Species Group C (Tabel 5). Based on strong group of diagnostic species presented in Species Group C, a new vegetation order and a new alliance are proposed, namely:

Terminalio prunioidis–Adansoniatalia digitatae order nov., hoc loco

Terminalio prunioidis–Adansonion digitatae all. nov., hoc loco.

Nomenclatural type: *Commiphoro tenuipetiolatae–Adansonietum digitatae*

The diagnostic species for these syntaxa are presented in species group C and include the woody species *Adansonia digitata, Blepharis diversispina, Terminalia prunioides,*

Ximenia americana var. microphylla, Combretum mossambicense, Gossypium herbaceum subsp. *africanum* and *Commiphora viminea*.

Numerous authors described such communities dominated by *Terminalia prunioides, Adansonia digitata, Boscia albitrunca* var. *albitrunca, Boscia foetida* subsp. *rehmanniana*, numerous *Commiphora* species, *Sterculia rogersii*, numerous *Grewia* species, *Acacia nigrescens* and *Combretum apiculatum* (Acocks 1953; Louw 1970; Van Rooyen 1978; Rooyen *et al.* 1981; Gertenbach 1983; Rooyen & Bredenkamp 1996b; Du Plessis 2001; Straub 2002). These communities occur predominantly on shallow clayey soils along rocky outcrops, ridges and steep slopes of gorges and rivers, which are associated with igneous and intrusive rock formations in semi-arid and arid areas. One of the driving factors seem to be frequent and prolonged water-stressed conditions for vegetation, intensified by high water retention capabilities of certain soil types (Schultze & McGee 1978; Werger & Coetzee 1978; Coetzee 1983; Du Plessis 2001; Bredenkamp & Brown *in prep*).

3. *Phyllantho reticulati–Acacietum nigrescentis* ass. nov., hoc loco.

Nomenclatural type: Relevé 63 (holotypus)

Alternative name: *Phyllanthus reticulatus–Acacia nigrescens* Low-lying Short Bushland at the southern ends of North-south-running gorges

Environmental data

The *Phyllantho reticulati–Acacietum nigrescentis* is located at low altitude (800–900 m above sea level) at the southern ends of the north-south openings in the east-west running ridges of the Soutpansberg. The vegetation of these gorges, especially that of the Sand River Gorge, show a strong gradient of declining soil moisture availability from south to north. The varying topography and miscellaneous soil types, lead to a very heterogeneous vegetation structure and composition. The shrub and tree layers are well developed and can be regarded as a Short Bushland (Edwards 1983). The field layer is generally poorly developed. This association is located within the Ib349, Ib362, Fa535 and Fa641 Land Types and associated with Glenrosa and Mispah Soil Forms (Botha 2004a; Patterson & Ross 2004a). Soil clay content is approximately 35–55%. This plant community is restricted to the diabase intrusions within the sandstone and conglomerate of the Wyllies Poort Formation, as well as diabase

intrusions within the basalt, tuff, sandstone and conglomerate of the Sibasa Formation. Surface rock cover varies between 15–40%.

Due to this association's position within the topography of the mountain's southern slopes, it may receive higher precipitation on a very localised scale, especially along the southern extremities of the Sand River Gorge. As moisture-laden air is pushed from the south against the sharp raising scarp of the Soutpansberg, it is forced through these ravines and gorges. The venturi-effect and the rapid cooling of the air lead to the formation of thick mist and fine rain at very localised patches (Matthews 1991; Matthews *et al.*1991).

Diagnostic taxa

This association is characterised by species group D (Table 5). The diagnostic woody species of this association include *Phyllanthus reticulatus, Ruspolia hypocrateriformis, Wrightia natalensis, Acalypha glabrata, Brachylaena discolor, Canthium mundianum, Pouzolzia mixta, Ruspolia hypocrateriformis* var. *australis, Clerodendrum makanjanum* and *Loeseneriella crenata.*

The grass layer is sparse, with the grass *Setaria nigrirostris* as the most prominent diagnostic grass species.

Diagnostic forbs include *Asparagus setaceus, Rhynchosia nervosa, Melhania prostrata* and *Barleria obtusa.*

Dominant / prominent taxa

A variety of woody species are prominent within this heterogeneous plant community and include *Ruspolia hypocrateriformis* var. *australis*, *Phyllanthus reticulatus* (Species Group D), *Sterculia rogersii*, *Albizia brevifolia*, *Entandrophragma caudatum*, *Markhamia zanzibarica* (Species Group E), *Pristimera longipitiolata*, *Grewia subspathulata*, *Grewia bicolor*, *Flueggea virosa* subsp. *virosa* (Species Group F), *Combretum apiculatum* subsp. *apiculatum, Kirkia acuminata, Ochna inermis, Cassia abbreviata* (Species Group I), *Acacia nigrescens* (Species Group J), *Brachylaena huillensis* (Species Group L), *Grewia flavescens* (Species Group N), *Dichrostachys cinerea* (Species Group U) and *Hibiscus meyeri* (Species Group Z).

Dominant herbaceous species within the field layer include *Justicia flava* (Species Group X) and *Cissus cornifolia* (Species Group E).

The most dominant grass recorded is *Setaria nigrirostris* (Species Group D).

The *Phyllantho reticulati–Acacietum nigrescentis*, as well as the *Commiphoro tenuipetiolatae–Adansonietum digitatae* and *Ledebourio ovatifoliae–Commiphoretum mollii*, contain *Acacia nigrescens* as a prominent species. Based on the prominence of *Acacia nigrescens* and the general vegetation structure of these associations, some similarities can be seen with the *Acacia nigrescens* dominated vegetation types of the southern Kruger National Park and the neighbouring reserves to its west (Acocks 1953; Bredenkamp 1981, 1987, 1991; Coetzee 1983; Gertenbach 1983, 1987). The *Acacia nigrescens* dominated plant communities of the Kruger National Park are currently viewed as part of the *Panico maximi–Acacietea tortilis* of the Central Bushveld (Winterbach 1998; Winterbach *et al.* 2000). However, based on the diagnostic species of the *Acacia nigrescens* dominated associations within the SC, these associations show stronger floristic links with the *Commiphoro mollis–Colophospermetea mopani* (Winterbach 1998; Winterbach *et al.* 2000; Du Plessis 2001). Due to the lack of syntaxonomic work over larger geographical ranges within southern Africa, the correct syntaxonomic position of these three *Acacia nigrescens* dominated associations within the SC is not yet clear. Further more, depending on whether emphasis is placed on the more persistent woody layer, or whether emphasis is placed on the more dynamic event-driven field layer, the syntaxonomic position of these *Acacia nigrescens* dominated communities may change. More vegetation studies pertaining the role of the herbaceous layer within the event-driven ecosystems of the southern African savannas with regard to syntaxonomy are sorely needed.

The *Phyllantho reticulati–Acacietum nigrescentis* shares very limited floristic links with the *Colophospermum mopane–Acacia nigrescens* Savanna Landscape of the northern Kruger National Park (Gertenbach 1983). The topographic diversity and strong moisture gradients associated with the *Phyllantho reticulati–Acacietum nigrescentis* of the SC contribute towards the high species richness within the woody layer, compared to the relatively low species richness in woody species associated

with the topographically simple north-western Kruger National Park (Gertenbach 1983). However, the herbaceous layer of the *Colophospermum mopane–Acacia nigrescens* Savanna Landscape has a higher species richness than the *Phyllantho reticulati–Acacietum nigrescentis* with its weakly developed field layer.

4. *Tinneo rhodesianae–Combretetum apiculati* ass. nov., hoc loco.

Nomenclatural type: Relevé 48 (holotypus)

Alternative name: *Tinnea rhodesiana–Combretum apiculatum* Short Bushland on semi-arid clayey slopes

Environmental data

The structure of the *Tinneo rhodesianae–Combretetum apiculati* can be categorized as Short Bushland (Edwards 1983). This association is restricted to the rain-shadow northern slopes north of the southern-most ridge of the mountain, but excludes the arid northern slopes of the northern-most ridge of the mountain. It is associated with the clayey soils derived from the basaltic rock of the Musekwa Formation, and fall within the Fa641 and Ae310 Land Types (Botha 2004a). The shallow soils are gravely and littered with talus rock fragments from the broken up quartzite formations at higher altitude. The top layer of soil is often mixed with sand washed down from higher lying quartzite, resulting in soil clay content of 20–35%. The dominant Soil Forms are Glenrosa and Mispah

Diagnostic taxa

This association is characterised by the diagnostic species presented in species group G (Table 5). Some of the woody species in this group include *Tinnea rhodesiana, Steganotaenia araliacea, Aloe marlothii* subsp. *marlothii* and *Euphorbia ingens*. Diagnostic species from the field layer include *Barleria ovata, Asparagus bechuanicus* and *Crabbea velutina*.

Dominant / prominent taxa

Prominent woody species within this association included *Tinnea rhodesiana, Steganotaenia araliacea* (Species Group G), *Combretum apiculatum* subsp. *apiculatum, Kirkia acuminata* (Species Group I), *Maerua parvifolia* (Species Group J) *Commiphora glandulosa, Grewia flavescens*, *Grewia villosa* (Species Group N),

Grewia monticola, Commiphora mollis (Species Group R) and *Dichrostachys cinerea* (Species Group U).

Due to the dense canopy cover provided by the trees and shrubs, the field layer of this association is poorly developed. The field layer is generally sparse with some patchy stands of grass cover. These stands are either dominated by *Enneapogon cenchroides* (Species Group Q), or by a mixture of *Heteropogon contortus* (Species Group L) and *Panicum maximum* (Species Group N).

Within the context of the Soutpansberg the floristic analyses resulted in this plant community being placed under the Soutpansberg Arid Northern Bushveld Major Vegetation Type. However, the *Tinneo rhodesianae–Combretetum apiculati* shares many of the diagnostic and dominant species of the *Terminalio sericeae–Combretetea apiculati* described by Winterbach *et al.* (2000) as part of the Central Bushveld savanna classes. It is therefore proposed that the *Tinneo rhodesianae–Combretetum apiculati* rather be classified as part of the *Terminalio sericeae–Combretetea apiculati*. However, this vegetation class is complex, sharing many floristic elements with the *Englerophyto magalismontani–Acacietum caffrae* (Winterbach 1988; Winterbach *et al.* 2000). Due to the topographic and geological diversity associated with these two vegetation classes, plant community turnover on a spatial scale is rapid. This results in mosaic vegetation patterns along the ever-changing environmental gradients. More phytosociological and syntaxonomical studies are needed in order to define the status and syntaxonomic positions of the mountain Bushveld and *Combretum apiculatum*-dominated plant communities of southern Africa.

The *Tinneo rhodesianae–Combretetum apiculati* shows some weak floristic links with the *Enneapogono scoparii–Acacietum leiorachis* described by Siebert (2001) and Siebert *et al.* (2003) as part of the Open Mountain Bushveld of Sekhukhuneland Centre of Endemism. It also shares some floristic links with the *Kirkia acuminata–Colophospermum mopane* woodland community located within the Limpopo River Valley (Straub 2002).

5. *Dichrostachyo cinereae–Spirostachyetum africani* ass. nov., hoc loco.

Nomenclatural type: Relevé 178 (holotypus)

Alternative name: *Dichrostachys cinerea–Spirostachys africana* Low Thickets on heavy clay soil

Environmental data

The structure of this plant community can be described as a Low Thicket (Edwards 1983). It is associated with very fine clayey alluvial soils in narrow valley bottoms. All of these valley bottoms are also associated with diabase dykes within the Ae310 Land Type of the surrounding quartzitic Wyllies Poort Geological Formation. Soil clay content exceeds 55%, and surface rock cover is negligibly low. Due to the amount of sand washed into and mixed with the clay, the soil cannot be described as vertic. The Mayo Soil Form is dominant within this section of the landscape. The species of this association are prone to water stress due to the clay particles' ability to withhold the available soil moisture from being taken up by the plant roots through its strong adhesive forces with the water. Due to the very palatable grazing and browsing produced by this association during the wet season, the vegetation is over-utilized and trampled by herbivore species. The veld is severely degraded and shows all the signs of bush encroachment and thickening.

Diagnostic taxa

This association is characterised by the diagnostic species presented in species group K (Table 5). The only strong indicator species within this group is *Spirostachys africana*. The field layer is weakly developed with only a few uncharacteristic annual species present.

Dominant / prominent taxa

The woody layer dominates this association and consists of drought resistant species such as *Spirostachys africana* (Species Group K), *Albizia harveyi* (Species Group L), *Maerua edulis* (Species Group M), *Balanites maughamii, Boscia albitrunca* var. *albitrunca, Euclea divinorum* (Species Group N), *Combretum hereroense* (Species Group P), *Commiphora mollis, Grewia monticola* (Species Group R), *Dichrostachys cinerea* (Species Group U) and *Ehretia rigida* (Species Group Z).

The grass *Panicum maximum* (Species Group N) was the most dominant species within the field layer. Due to the relatively high palatability of the field layer on these nutrient-rich clayey soils, compared to their relatively unpalatable surroundings within the SC, the *Dichrostachyo cinereae–Spirostachyetum africani* is regularly over-utilized by grazers and browsers. This over-utilisation gives the woody layer the competitive advantage above the field layer, resulting in the thickening of the woody stratum, which in turn results in even more favourable conditions for a woodland dominated vegetation (Bredenkamp 1986).

The *Dichrostachys–Acacia* Veld (14g) (Acocks 1953), the *Spirostachys africana–Sporobolus ioclados* woodland on granite plant community (Van Der Meulen 1979), the *Acacia tortilis–Spirostachys africana* Savanna community (Bredenkamp & Van Vuuren 1977), the bottomlands of the Thickets of the Sabie and Crocodile Rivers landscape (Gertenbach 1983) and the *Euclea divinorum–Acacia welwitschii* plant community (Gertenbach 1987) share some floristic links with the *Dichrostachyo cinereae–Spirostachyetum africani* of the SC. Due to the over-utilised and bush-encroached nature of the *Dichrostachyo cinereae–Spirostachyetum africani*, the woody layer is dominated by the pioneering woody species *Dichrostachys cinerea.* The *Dichrostachyo cinereae–Spirostachyetum africani* of the SC should be classified under the *Spirostacho africanae–Acacion tortilis*, as part of the *Sporobolo nitentis–Acaciatalia tortilis* within the *Acacienea nilotico–tortilis* subclass of the *Panico maximi–Acacietea tortilis* described by Winterbach *et al.* (2000).

6. *Themedo triandrae–Pterocarpetum rotundifolii* ass. nov., hoc loco.

Nomenclatural type: Relevé 170 (holotypus)

Alternative name: *Themeda triandra–Pterocarpus rotundifolius* Short Closed Grassland on steep basaltic slopes

Environmental data

The *Themedo triandrae–Pterocarpetum rotundifolii* can be described structurally as either a Short Closed Grassland, or as a Low Sparse Woodland (Edwards 1983), depending on the number of trees within the community. It is very restricted within the range of the study area and is associated with a steep section of basalt of the Sibasa Formation of the Soutpansberg Group on one of the inner or middle ridges of

the mountain. The shallow soil has a clay content of 20–35%, surface rock cover of 10–25% and the terrain has an incline of 20–30°. Though Botha (2004a) classified the area as the Fa641 Land Type of the Wyllies Poort Geological Formation, this basaltic island of the Sibasa Formation is atypical to its surroundings. It is associated with the Mayo Soil Form.

Diagnostic taxa

This association is characterised by the diagnostic species presented in species group O (Table 5). Due to the poorly developed woody layer, none of the woody species in species group O can be described as dominant. These woody species include *Acacia caffra, Acacia gerrardii* var. *gerrardii, Bolusanthus speciosus, Dombeya rotundifolia* var. *rotundifolia, Gymnosporia buxifolia, Lannea discolor* and *Pterocarpus rotundifolius* subsp. *rotundifolius.*

Diagnostic species within the field layer include the grass species *Themeda triandra* and the herbaceous species *Cleome gynandra, Indigofera hilaris, Rhynchosia komatiensis* and *Rhynchosia venulosa*.

Dominant / prominent taxa

Although none of the trees or shrubs is dominant, the few prominent but scattered woody species include *Bolusanthus speciosus, Pterocarpus rotundifolius* subsp. *rotundifolius* (Species Group O)*, Ozoroa paniculosa* var. *salicina* (Species Group R).

The field layer is dominated by the grasses *Themeda triandra* (Species Group O) and *Enneapogon cenchroides* (Species Group Q).

Dominant herbaceous species include *Rhynchosia komatiensis*, *Indigofera hilaris*, *Cleome gynandra*, *Rhynchosia venulosa* (Species Group O) and *Cleome angustifolia* subsp. *petersiana* (Species Group R).

The *Themedo triandrae–Pterocarpetum rotundifolii* shares some limited floristic links with the *Themeda triandra–Acacia gerrardii* association (Bredenkamp 1982), the *Sclerocarya caffra–Acacia nigrescens–Bothriochloa radicans–Themeda triandra–*

Digitaria eriantha brushveld (Coetzee 1983) and the *Themedo triandrae–Acacietum gerrardii* (Coetzee 1983) of the Mpumalange Lowveld. The soil properties of both these plant communities are typically derived from dolerite and basalt rock, which weather to heavy poorly drained clayey soils. The limited rainfall associated with these plant communities and the high water retention capabilities of the clay soils create extremely arid growing conditions for the plant species involved (Werger & Coetzee 1978; Coetzee 1983; Westoby 1979; Westoby *et al.* 1989; Mentis *et al.* 1989; Behnke & Scoones 1993; Bredenkamp & Brown *in prep.*). The vegetation structure is typically a dense grass sward with scattered dwarf shrubs.

7. *Cypero albostriati–Syzygietum cordatum* ass. nov., hoc loco.

Nomenclatural type: Relevé 146 (holotypus)

Alternative name: *Cyperus albostriatus–Syzygium cordatum* Sandveld Swamp Forest

Environmental data

Isolated swamps are dotted along fault scarps on the northern boundaries of resistant Soutpansberg Group quartzites (Scott 1982). At these localities, underground water filter to the surface to form "seepage-springs". The springs are situated within the Ia151 Land Type (Botha 2004), which is associated with deep undifferentiated deposits of scree and sand from the Quaternary System. These isolated swamps differ markedly from its surroundings and may be regarded as an azonal community. The vegetation structure varies according to the level of submergence. Along the open water edge, a thick fringe of sedges and water-tolerant grass species grow. The interspersed islands and tongues of higher ground and peat house a Tall Forest vegetation structure (Edwards 1983) and have been described as swamp forest (Scott 1982).

Diagnostic taxa

The *Cypero albostriati–Syzygietum cordatum* are characterised by the diagnostic species presented in species group S (Table 5). The diagnostic woody species include *Syzygium cordatum, Hyphaene petersiana, Acacia robusta* subsp. *robusta, Senna petersiana, Garcinia livingstonei, Albizia versicolor, Mystroxylon aethiopicum* subsp. *schlechteri, Bridelia mollis, Artabotrys brachypetalus, Ficus sycomorus, Xanthocercis zambesiaca* and *Hypericum lalandii*.

Diagnostic grass species are *Cynodon dactylon, Andropogon eucomus* and *Urochloa mosambicensis*.

Diagnostic sedges, forbs and ferns of this group are *Cyperus albostriatus, Thelypteris madagascariensis, Persicaria serrulata, Fimbristylis complanata, Pycreus polystachyos, Fuirena pubescens, Cyperus distans, Wahlenbergia grandiflora, Cyperus solidus*, *Vernonia centaureoides*.

Dominant / prominent taxa

Dominant tree and shrub species of this association are *Syzygium cordatum, Hyphaene petersiana*, *Acacia robusta* subsp. *clavigera, Garcinia livingstonei*, *Senna petersiana, Albizia versicolor, Mystroxylon aethiopicum* subsp. *schlechteri, Bridelia mollis, Artabotrys brachypetalus, Ficus sycomorus, Xanthocercis zambesiaca* (Species Group S), *Philenoptera violacea* (Species Group T) and *Grewia hexamita* (Species Group U).

The grasses *Andropogon eucomus* (Species Group S) and *Cynodon dactylon* (Species Group S) were recorded as the most dominant grasses.

The four most dominant sedges and ferns are *Cyperus albostriatus*, *Fimbristylis complanata*, *Fuirena pubescens*, *Pycreus polystachyos* and *Thelypteris madagascariensis* (Species Group S).

The *Cypero albostriati–Syzygietum cordatum* shares strong floristic links with the *Acacia albida–Ficus sycomorus* River / Fountain Forests of the northern Kruger National Park (Van Rooyen 1978, Van Rooyen *et al.* 1981). These plant communities are driven and maintained by the perennial flooded conditions of sandy soils. Tall hydrophilic tree species dominate the woody vegetation, while sedges and water tolerant grass species dominate the inundated forest fringes.

The *Syzygyium cordatum–Stenoclaena tenuifolia* swamp forest, the *Ficus trichopoda–Nephrolepis biserrata* swamp forest and the *Barrintonia acemosa–Bridelia micrantha* swamp forests of the Mfabeni peat swamps in St. Lucia (Venter 2003), show limited

floristic links with the woody component of the *Cypero albostriati–Syzygietum cordatum* of the SC. The extent of the Mfabeni peat swamps are far greater than the isolated swamps of the SC, and are therefore generally richer in swamp species.

The swamp forests of the Natal Coastal Plain Peatland Eco-Region (Marneweck *et al.* 2001; Grundling & Grobler 2005) share very limited floristic links with the *Cypero albostriati–Syzygietum cordatum* of the SC. These highly endangered Maputaland peat swamp forests are situated within the high-rainfall belt of the Mozambican coastal plain and are driven by very different ecological processes compared to the swamps of the SC.

The Closed Riverine Woodlands and the *Phoenix reclinata–Syzygium* spp. on Termitaria of the Okavango Delta in Botswana (Biggs 1979) share only limited floristic links with the *Cypero albostriati–Syzygietum cordatum* of the SC. These plant communities all occur along the slightly elevated sandy soils within the surrounding inundated plains. The dominant trees are hydrophilic and very typical for many of southern Africa's low lying riverine forests and woodlands.

8. *Sesamothamno lugardii–Catophractetum alexandri* ass. nov., hoc loco.

Nomenclatural type: Relevé 145 (holotypus)

Alternative name: *Sesamothamnus lugardii–Catophractes alexandri* Tall Sparse Shrubland on the Soutpansberg Saltpan

Environmental data

The vegetation of the *Sesamothamno lugardii–Catophractetum alexandri* is a Tall, Sparse Shrubland (Edward 1983) associated with the natural vegetation on the periphery of the saltpan at the north-western end of the Soutpansberg mountain range. The saltpan and its surroundings are part of a unique ecosystem within the surrounding landscape. The terrain is concave and is enriched with sodium chloride. This source of table salt has been mined since the end of the 19th century and is still mined for commercial benefit today. Salt is produced at two sites from the dry saltpan on Zoutpan 459 MS, where brines are pumped from a number of boreholes penetrating the underlying Karoo strata. The salt content of the brines is derived from the basal Karoo shales (Madzaringwe Formation) by groundwater action. The long

history of disturbance, over-utilization and overgrazing around the saltpan has left the vegetation in degrade state. The sodium-enriched vegetation attracts numerous grazers and browsers. The more common Soutpansberg savanna species show stunted growth forms within this association. An interesting assembly of halophytic plant species are associated with vegetation on the pan's periphery namely: *Heliotopium curassavicum, Suaeda fructicosa* and *Odyssea paucinervis*.

This association is associated with the Clovelly Soil Form (McVicar *et al.* 1991) of Land Type Ae305 derived from sand of the Quaternary System (Botha 2004a). The soil drains freely and has a depth of >600mm.

Diagnostic taxa

This association is characterised by the diagnostic species of species group V (Table 5). Woody species in this group include *Catophractes alexandri, Commiphora pyracanthoides, Acacia nebrownii, Sesamothamnus lugardii, Salvadora australis, Acacia senegal* var. *rostrata, Balanites pedicellaris, Rhigozum zambesiacum, Acacia mellifera* subsp. *detinens, Boscia foetida* subsp. *filipes* and a *Lycium* species.

Succulents include *Euphorbia guerichiana, Aloe littoralis, Pterodiscus* species and *Kalanchoe brachyloba*.

The grasslayer is heavily over-utilised. Some of the diagnostic grasses are *Sporobolus ioclados, Odyssea paucinervis* and *Aristida meridionalis.*

Diagnostic herbaceous species include the forbs *Ipomoea adenioides, Dicoma* species, *Kyphocarpa angustifolia, Kleinia longiflora, Solanum coccineum, Becium angustifolium, Vernonia capensis, Hibiscus calyphyllus, Aptosimum lineare, Becium obovatum, Barleria wilmsiana, Tribulus zeyheri* subsp. *zeyheri, Becium filamentosum, Evolvulus alsinoides* and *Adenia repanda.*

Dominant / prominent taxa

Dominant woody species include the drought resistant *Acacia mellifera* subsp. *detinens, Acacia nebrownii, Acacia senegal* var. *rostrata, Aloe littoralis, Balanites pedicellaris, Boscia foetida* subsp. *filipes, Catophractes alexandri, Commiphora*

pyracanthoides, Lycium species, *Rhigozum zambesiacum*, *Salvadora australis* (Species Group V), *Commiphora africana* and *Boscia foetida* subsp. *rehmanniana* (Species Group Z).

Succulents include *Euphorbia guerichiana*, *Kalanchoe brachyloba*, *Pterodiscus* species and *Sesamothamnus lugardii* (Species Group V).

Dominant grasses include *Eragrostis lehmanniana* var. *lehmanniana* and *Schmidtia pappophoroides* (Species Group Z).

Herbaceous species are dominated by *Heliotropium steudneri*, *Hibiscus meyeri* and *Sansevieria aethiopica* (Species Group Z).

The *Sesamothamno lugardii–Catophractetum alexandri* shows some weak floristic links with the *Salvadora australis–Colophospermum mopane* main woodland community (Straub 2002) of the Limpopo River Valley and the *Salvadora angustifolia* Floodplains landscape (Gertenbach 1983) of the Kruger National Park. These vegetation units are associated with sodium rich soils. However, the processes of sodium accumulation within the soils of these plant communities differ radically. The *Salvadora australis–Colophospermum mopane* main woodland community (Straub 2002) of the Limpopo River Valley and the *Salvadora angustifolia* Floodplains landscape (Gertenbach 1983) of the Kruger National Park are both driven by flooding events of the nearby river systems, while the *Sesamothamno lugardii–Catophractetum alexandri* of the SC is not affected by any river system. The mechanism by which the salt of the Soutpansberg saltpan accumulated is still unclear, but may have been the result of oceanic influence (Hahn 2002).

The *Sesamothamno lugardii–Catophractetum alexandri* shares floristic elements with the *Eragrostis viscosa–Colophospermum mopane* major plant community of the semi-arid Mopaneveld (Du Plessis 2001) as part of the Etosha National Park (Le Roux *et al.* 1988). Both these vegetation units are prone to severe droughts and event-driven by nature (Du Plessis 2001). While the *Sesamothamno lugardii–Catophractetum alexandri* soils are sodium-rich, the soils of the *Eragrostis viscosa–Colophospermum mopane* major plant community are calcareous (Du Plessis 2001; Hahn 2002).

Drought resistant species such as *Catophractes alexandri*, numerous *Commiphora, Acacia* and *Boscia* species dominate the vegetation. *Colophospermum mopane,* which is the dominant species within the *Eragrostis viscosa–Colophospermum mopane* major plant community of the Etosha National Park, does not occur within the *Sesamothamno lugardii–Catophractetum alexandri* of the SC.

Ordination

On a broad and coarse scale, the Soutpansberg Arid Northern Bushveld Major Vegetation Type can be described as an open woodland system, with a relatively sparse distribution of woody species. The field layer is most often only of a temporary nature, dominated by annual species during times of abundant rainfall, which tends to disappear altogether during times of drought. This woodland dominated arid landscape is mostly confined to the north of the mountain range and include the northern plains and northern foot-slopes. Although the different associations forming this vegetation type are varied in vegetation structure and floristic composition, most of them share the ability to tolerate drought conditions and unpredictable rainfall events. A combination of soil moisture availability and soil texture plays a major role in the species composition of these communities.

The scatter diagram displays the distribution of relevés along the first and second ordination axes (Figure 9). The vegetation units are represented as groups and their distribution on the scatter diagram corresponds with certain physical environmental gradients. The soil texture, soil depth, incline, surface rock cover and consequently soil moisture availability, determines a gradient that is depicted by the first axis (eigen value = 0.782).

Those associations on the left of the diagram are associated with rocky and clayey slopes along the northern ridges and northern slopes within the rain-shadow of the Soutpansberg Mountain Range. These systems are very arid and highly event-driven due to unpredictable low rainfall and the high water retention capabilities of the shallow clayey soils. The rocky slopes lead to high runoff and weak infiltration of the available rainwater. The clay soils further impede water infiltration due to its poor drainage properties. Soil depth also contributes to this gradient of available soil moisture revealed by the x-axis. The shallow soils associated with the communities to the left pose restrictions on the potential amount of water that can be stored within the given volume of soil. Although clay soil has a greater potential field capacity to store water, the percentage of water available for uptake by roots are lower than the percentage available from sandy soil (White 1995). This is mainly due to stronger adhesive forces between water and the smaller clay particles than the larger sand particles. The distribution of associations along the x-axis is also correlated with a

declining surface rock cover from left to right along the axis. Surface rock cover and rockiness within the soil matrix have result in many complex interactions with the biota of a given area. It may increase rainwater runoff. It reduces available soil surface and subsequently increases the amount of rainwater per unit surface area. It provides shelter from desiccating elements such as wind and direct radiation. It provides protection against harsh grazing pressures under certain circumstances. Rocks in the soil matrix may hamper root penetration or may increase competition for the available soil and its available nutrients. The various ways, in which rockiness and surface rock cover may influence the associated vegetation, are numerous. This makes accurate ecological interpretation of the observed distribution of communities along the gradient of increasing surface rock cover extremely complex.

The soil clay fraction seems to reduce while the sand fraction increases to the right of the scatter plot. At the extreme right of the scatter plot, conditions are dramatically different from those associated with the plant communities along the left. This swamp forest community is associated with permanent wetness and flooded conditions. The soils are deep and sandy along this relatively flat plain. The swamp forest vegetation of the SC is less driven by drought events, and is more representative of the conventional equilibrium models (Tainton & Hardy 1999). This relatively stable state is maintained by the constant and predictable source of water from the underlying seepage-springs.

The second ordination axis (eigen value = 0.565) is displayed along the y-axis of the scatter plot. Like with the first ordination axis, the soil texture, soil depth, incline, surface rock cover and consequently soil moisture availability, determines a gradient that is depicted by the second axis. In addition, the soils of the association situated at the top pf the scatter plot, is enriched with sodium. The cluster of plant communities at the bottom left is associated with rocky and clayey slopes along the northern ridges and northern slopes within the rain-shadow of the Soutpansberg Mountain Range. These systems are very arid due to unpredictable low rainfall and the high water retention capabilities of the shallow clayey soils. These systems are highly event-driven. The plant community at the top is associated with the saltpan of the Soutpansberg. The soils are deep fine-grained sands, with some evidence of a calcareous layer relatively deep below the surface. The terrain is relatively flat, which

results in little runoff and good infiltration of available rainfall. Surface rock cover is low.

The large relative distances between some of the groupings suggest that these vegetation units do not belong to the same syntaxonomic classes. However, the commonly shared species separate them from the rest of the BNR and SC vegetation, grouping them together.

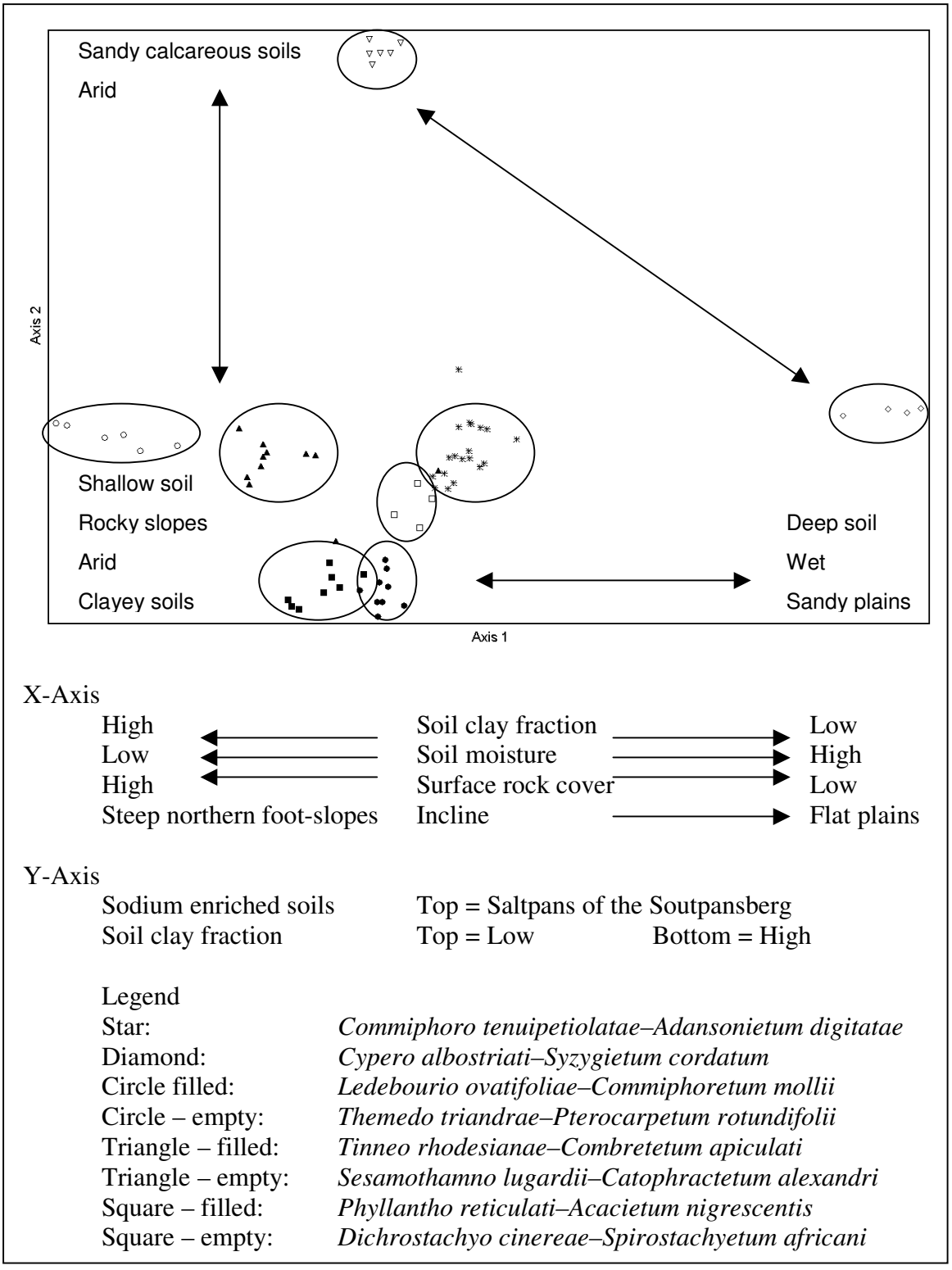


Figure 9 Relative positions of all the relevés along the first and second axis of the ordination of the *Adansonia digitata–Acacia nigrescens* Soutpansberg Arid Northern Bushveld Major Vegetation Type