

CHAPTER 5 VEGETATION

INTRODUCTION

PHYTOSOCIOLOGY

A plant community is a combination of plants that are dependent on their environment as well as on each other (Mueller-Dombois and Ellenberg 1974). Plant communities with similar interrelationships and environmental parameters often reflect similar floristic compositions (Westhoff and Van der Maarel 1982). Vegetation cover can therefore be divided into subunits of plant communities. The description and classification of such uniform or homogeneous units form the basis for phytosociological studies. The method of phytosociology used here is known as the Braun-Blanquet, the relevé or Zurich-Montpellier method, and is regarded as the standard method of vegetation survey and classification in most countries (Werger 1974). The method has been widely used in South Africa (Werger 1974; Bredenkamp and Theron 1976; Bredenkamp 1982; Behr and Bredenkamp 1988; Pauw 1988; Bredenkamp, Joubert and Bezuidenhout 1989; Kooij, Bredenkamp, and Theron 1990; Matthews 1991; Schmidt 1992; Van Heerden 1992; Schulze, Theron and Van Hoven 1994; Bezuidenhout 1994; Bezuidenhout 1995; Brown, Bredenkamp and Van Rooyen 1995; Orban 1995; Swart 1995; Brown, Bredenkamp and Van Rooyen 1996; Visser, Van Hoven and Theron 1996; Cilliers and Bredenkamp 1999). Scheepers (1983) suggested that the method be standardised for all phytosociological studies in South Africa. The Braun-Blanquet method may be used in all vegetation types south of the equator (Werger 1974). Myre (1960, 1962, 1964) applied the method in southern Mozambique and Volk and Leippert (1971) applied it in the Windhoek area, Namibia (Werger 1974). Werger, Wild and Drummond (1978) used the Braun-Blanquet approach in northern Zimbabwe, Cauldwell, Zieger, Bingham and Bredenkamp (1998) used the method in Central Province, Zambia and Botha (1999) used it in Central Kenya. Bredenkamp and Theron (1978) point out that the Braun-Blanquet method is advantageous for the management of natural plant communities. The method allows a hierarchical classification of vegetation into floristically and environmentally related groups. Numerous small vegetation communities, showing certain ecological similarities are grouped successively into larger, more practical units known as management units. A management programme can then be adapted and applied at different levels in the hierarchy of communities.

WOODY VEGETATION STRUCTURE

Peel (1990) considers the woody layer to be important to the ecology of an area for two reasons. Firstly, it provides an important food source and habitat for animals, especially browsers. Secondly, the woody plants exert an important influence on the species composition of the herbaceous layer. Similarly, Smit (1989a, 1989b, 1994, 1996) considers woody vegetation to be important due to competition with herbaceous vegetation for moisture; food for browsers; and the creation of subhabitats suitable for certain grasses.

Tainton (1981) states that in savanna communities the tree component of the vegetation should be analysed together with the herbaceous layer. A structural survey of the woody layer will allow the identification of bush encroachment, will indicate the success of an encroachment controlling programme, will give an indication of the available browse, and will indicate the condition of the woody layer in general.

The identification of vegetation communities and homogeneous units is invaluable in drawing up a management plan for an area (Bredenkamp and Theron 1978). Each homogeneous unit can be managed according to its specific environmental conditions and similar units can be grouped to form management units. A survey of the woody layer is essential to gain an understanding of the ecology of an area. Such a survey will allow the manager to determine the condition, species composition and structure of the woody layer in each homogeneous unit and this will then allow him to make certain decisions regarding the clearing of encroaching bush and also the suitability of each habitat for ungulates.

The objectives of phytosociological and structural assessments are to:

- Identify, describe, classify and map the homogeneous plant communities of the area.
- Compile a plant species list.
- Identify protected or endangered plant species.
- Identify ecologically sensitive areas.
- Identify problem plant species.
- Identify environmental parameters important in influencing the vegetation.
- Delineate management units for use in the future management of the study area.
- Describe the composition and structure (percentage canopy cover, density, leaf biomass) of the various layers within the woody vegetation layer in each of the homogeneous plant communities of the area.

METHODS

PHYTOSOCIOLOGICAL ASSESSMENT

The non-statistical Braun-Blanquet method, as described by Mueller-Dombois and Ellenberg (1974), Werger (1974) and Westhoff and Van der Maarel (1982), was used to classify the vegetation of Sango Ranch into homogeneous physiognomic-physiographic units. Phytosociological studies can be divided into an analytical and a synthetic phase (Werger 1974; Westhoff and Van der Maarel 1982). In the analytical phase the environmental, floristic and structural data are collected in the field. The data are then classified in the synthetic phase, to deliver the delineation of plant communities on the basis of their floristic and structural differences (Schmidt 1992).

Analytical Phase

The analytical phase was done over two growing seasons in 1998 and 1999, from mid-February to mid-May. An initial reconnaissance survey was done in January and February 1998 to become familiar with the topography and vegetation of the area. Voucher specimens of conspicuous plants were collected throughout the study period and were identified by the staff of the Harare National Herbarium in Harare, Zimbabwe.¹⁰

The study area was stratified into relatively homogeneous physiographic-physiognomic units by recognising and mapping possible uniform vegetation units from stereo aerial photographs (1:25 000) by means of a stereoscope (Walker 1976a). The physiographic-physiognomic units were drawn on a transparency and were then overlaid at the correct scale on a 1:50 000 topocadastral map. A geological map was also used to further assist in the identification of physiographic-physiognomic units. The stratification was reinforced by referring to all possible published environmental information and vegetation data relevant to the study area (Matthews 1991). The detailed vegetation descriptions of Wild (1955), Rattray (1957), Rattray (1961) and Farrell (1968) were used in this respect. All possible topographical, geological and soil types should be represented (Potgieter 1982). This enabled a sound stratification of the study area for efficient sampling of the representative vegetation types.

An attempt was made to place the plots in such a way that the habitat within the sample plots was as uniform as possible within each vegetation stand (Mueller-Dombois and Ellenberg 1974). Because homogeneity is extremely difficult to test

¹⁰ National Herbarium, PO Box CY550, Causeway, Harare, Zimbabwe.

for statistically it was assessed visually (Werger 1974). Care was taken that no plots were placed in ecotonal or degraded areas.

Subjective stratified random sampling was used to allocate sample plots *pro rata* to the size of the physiographic-physiognomic units. The number of plots thus allocated to a physiographic-physiognomic unit depended on the size of that unit. This ensured that areas were not over- or undersampled. The sample plots were then placed randomly within each homogeneous vegetation unit. Stratified random sampling allows sampling over the whole vegetation unit, while still ensuring that statistical errors are kept to a minimum (Mueller-Dombois and Ellenberg 1974).

The number and size of plots depended entirely upon the scale of the survey, the variation in the vegetation and the detail required (Werger 1974; Bredenkamp 1982). The time available and cost involved were also important determinants. The number and size of plots were chosen to reflect the total variety within the study area as adequately as possible (Werger 1974). Westfall (1981) suggested using a minimum of 10 plots per community. Barkman, Moravec and Rauschert (1976) stated that 10 relevés are the minimum required for an original diagnosis of an association or sub-association. Van Rooyen (pers. comm.)¹¹ suggested a minimum of five quadrats per homogeneous vegetation unit, and this was used. A total of 230 plots equating to one plot per 193 ha was therefore used.

Plot size was fixed at 200 m² (20 x 10 m) for savanna areas, because this size has been widely used in studies in the bushveld areas of South Africa (Coetzee 1983; Pauw 1988; Schmidt 1992; Van Heerden 1992; Schulze *et al.* 1994; Orban 1995). As far as possible the plots were rectangular, but in certain cases the plots were shaped as to conditions to ensure homogeneity (Kooij 1990; Matthews 1991). The plots were placed in a north-south direction or along a specific gradient. The physiographic-physiognomic units and plots were confirmed in the field and were sometimes adapted as required. Where the pre-determined position of the sample plots did not meet the requirements mentioned above, or fell on roads and other structures (Matthews 1991), the plots were moved to more suitable areas in compliance with the Braun-Blanquet methods (Werger 1974).

In the Braun-Blanquet method a complete species list of vascular plants is normally compiled for each stand to derive a comprehensive floristic description (Werger 1974). However, this requirement cannot always be met in arid and semi-

¹¹ Prof. N. van Rooyen, Department of Botany, University of Pretoria, Pretoria, 0002, South Africa.

arid areas (Werger 1974). The time available and the extent of the study area prevented multiple visits to each plot site. Therefore an attempt was made to compile as complete a species list as was possible in the time available.

Taxa were identified as far as possible in the study area by using the relevant field guides and keys and with the aid of species lists compiled by Wild (1955), Ratray (1957, 1961) and Farrell (1968). These were confirmed by Drummond¹² at the Harare National Herbarium. Voucher specimens were collected and pressed in triplicate according to the specifications of Fish (1997). The specimens are housed at Sango Ranch with another set at the National Herbarium in Harare. Taxa are named according to Arnold and De Wet (1993). A list of plant species with author names appears in Appendix A.

A Global Positioning System (GPS) reading in longitude and latitude and a terrain description were taken at each sample plot to facilitate future location of the specific stand. At each stand, species cover was estimated with the following cover-abundance scale given by Werger (1974):

- 5: any number with cover >75%
- 4: any number with cover >50-75%
- 3: any number with cover >25-50%
- 2b: any number with cover >12-25%
- 2a: any number with cover 5-12%
- 1: numerous, less than 5% cover or +-scattered
- +: few, with small cover
- r: solitary, with small cover

The following habitat factors (Pauw 1988; Schmidt 1992) were also recorded and placed into the relevant categories at each sample site:

1. Aspect.
2. Altitude in metres above sea level.
3. Exposure.
4. Gradient: 0-3° (flat), 4-8° (gradual), 9-16° (average), 17-26° (steep) and 27-45° (very steep).
5. Geomorphology: flat, concave or convex.
6. Topography: mountain, ridge, tallus, kloof, valley, plain, vlei, pan, floodplain, riverbed and riverbank.
7. Geology.

¹² Mr R.B. Drummond, 5 Chatsworth Road, Mt. Pleasant, Harare, Zimbabwe.

8. Percentage rock cover.
9. Rock/stone size: ≥ 10 mm (gravel), 11-50 mm (small stones), 51-200 mm (stones), ≥ 200 mm (rocks).
10. Degree of erosion: none, slight, moderate, severe.
11. Type of erosion (Anon. 1988): none, sheet, groove, donga, wind.
12. Intensity of burn (Joubert 1983): none, light, moderate, heavy.
13. Degree of trampling: none, slight, moderate, severe;
14. Degree of utilisation of the herbaceous layer (Coetsee 1993): none, slight, moderate, severe.
15. Biotic influences such as fire, termites and overgrazing.
16. Soil factors as determined from the soil survey.

The vegetation structure at each relevé was described according to a system of structural classification (Edwards 1983). The total canopy cover of the tree and shrub layers were recorded using the line intercept method (Mueller-Dombois and Ellenberg 1974) in a north-south directed line-transect starting at each quadrat. Cover values for grasses and herbs were derived from the Braun-Blanquet cover-abundance classes assigned to these layers.

Synthetic Phase

To classify the field data the floristic data in each relevé was consolidated and entered into the computer program TURBOVEG (Hennekens 1996a). The data were then analysed with the program MEGATAB (Hennekens 1996b). Two-Way Indicator Species Analysis (TWINSPAN) (Hill 1979b) is incorporated in the MEGATAB program and was applied to the data set.

Floristic data were also subjected to a Detrended Correspondence Analysis (DECORANA) (Hill 1979a) to determine vegetation gradients and to illustrate gradients common to the vegetation and the environmental factors. The results are depicted in a scatter diagram that may be compiled on any standard spreadsheet program.

Plant communities were named binomially according to the recommendations and guidelines of Barkman, Moravec and Rauschert (1986). The first name is the species name of a diagnostic plant species within the specific community. The second name is that of a dominant species. Diagnostic and dominant species are defined as follows (Schmidt 1992):

- A diagnostic species is one that predominates in one vegetation unit and has a constancy of occurrence of $> 75\%$, but is not restricted to it.

- A dominant species is one with > 30 % constancy of occurrence in a vegetation unit, with > 20 % cover-abundance values greater than 2b and a minimum of two cover-abundance values of > 2b.

An applicable physiognomic term according to the structural classification of Edwards (1983) is then added to the species names (Pauw 1988; Swart 1995).

Management units were identified on the basis of discontinuity and floristic affinity (Schulze *et al.* 1994). The management units were recognised on a TWINSPLAN (Hill 1979b) dendrogram showing the hierarchical classification of the major plant communities that was delivered by MEGATAB (Fuls *et al.* 1993). Plant communities showing similar floristic and environmental affinities were grouped into management units.

STRUCTURAL ASSESSMENT OF THE WOODY VEGETATION

Sampling technique

The survey was carried out at the same points as were used for the phytosociological survey. All the woody plants above 0.5 m height (Dörgeloh 1998) rooted within a belt transect (placed north-south) were recorded in compliance with Smit (1989a), Peel (1990), Smit (1994), Orban (1995), and Swart (1995). Since transect size depends on tree spacing (Mueller-Dombois and Ellenberg 1974) a transect of 50 x 2 m was used in the more closed mopane woodlands and one of 100 x 2 m in the more open areas. Because of the difficult terrain a transect of 50 x 2 m was used for surveys on koppies. The dimension meter of Smit (1989c, 1994) was used to measure maximum tree height, minimum tree height, maximum canopy diameter and minimum canopy diameter (Chapter 8). Smit (1989c, 1994) found the dimension meter to be accurate and rapid. The only problem, however, is obstruction by other trees in dense situations and tall grass covering stem bases (Smit 1989c, 1994).

Structural analysis

For classing the trees according to height, the following class levels were used: <0.75 m; 0.75 m-<1.5 m; 1.5 m-<2.5 m; 2.5 m-<3.5 m; 3.5 m-5.5 m; and >5.5 m (Coetzee and Gertenbach 1977). However, since most tall trees fell above these categories, the following categories were added: 5.5-<7.5 m; 7.5-<9.5 m; 9.5-<11.5 m; 11.5-<13.5 m; 13.5-15.5 m; and >15.5 m.

RESULTS AND DISCUSSION

Phytosociological classification

The phytosociological classification of the vegetation of Sango Ranch appears in Tables 6 to 9. The boundaries of the vegetation communities are depicted on a vegetation map (Figure 9). The Braun-Blanquet and TWINSPLAN analyses aided in identifying nine plant communities and 16 sub-communities. The TWINSPLAN dendrogram is presented in Figure 10. The following hierarchical classification of the vegetation of Sango Ranch was made:

1. The *Acacia tortilis* subsp. *heteracantha*-*Urochloa mosambicensis* Tall Closed Woodland
 - 1.1 The *Tephrosia purpurea* subsp. *leptostachya*-*Urochloa mosambicensis* Short Closed Woodland
 - 1.2 The *Dichrostachys cinerea* subsp. *africana*-*Urochloa mosambicensis* Short Closed Woodland
 - 1.3 The *Capparis tomentosa*-*Urochloa mosambicensis* Tall Closed Woodland
 - 1.4 The *Sporobolus nitens*-*Urochloa mosambicensis* Short Closed Woodland
2. The *Colophospermum mopane*-*Brachiaria deflexa* Short Thicket // Short Closed Woodland
 - 2.1 The *Commiphora edulis*-*Colophospermum mopane* Short Thicket
 - 2.2 The *Indigofera praticola*-*Colophospermum mopane* Short Closed Woodland
 - 2.3 The *Thilachium africanum*-*Colophospermum mopane*. Short Thicket
 - 2.4 The *Ruellia patula*-*Colophospermum mopane* Tall Closed Woodland
3. The *Combretum apiculatum* subsp. *apiculatum*-*Colophospermum mopane* Short Closed Woodland
4. The *Combretum apiculatum* subsp. *apiculatum*-*Digitaria milanjiana* Tall Closed Woodland
 - 4.1 The *Dalbergia melanoxylon*-*Combretum apiculatum* subsp. *apiculatum* Short Closed Woodland
 - 4.2 The *Commiphora africana*-*Digitaria milanjiana* Tall Closed Woodland
 - 4.3 The *Kirkia acuminata*-*Panicum maximum* Tall Closed Woodland

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Table 9. Phytosociological table of the plant communities of Sango Ranch, Save Valley Conservancy, Zimbabwe. Part 4.

Percentage rock cover	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 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 1 1	1 1 1 1 1 1 1 1 1 1
Herb layer utilisation	3 2 2 3 1 2 3 2 2	1 1 3 1 2 2 3 2 2 3	2 2 2 3 2 2 3 2 2 2	2 2 2 3 2 2 3 2 2 2	2 2 2 3 2 2 3 2 2 2	2 2 2 3 2 2 3 2 2 2	2 2 2 3 2 2 3 2 2 2
Woody layer utilisation	3 2 2 2 2 3 3 3 3	3 2 3 3 3 2 2 2 2 3	2 2 2 3 2 2 2 2 2 3	2 2 2 3 2 2 2 2 2 3	2 2 2 3 2 2 2 2 2 3	2 2 2 3 2 2 2 2 2 3	2 2 2 3 2 2 2 2 2 3
Degree of trampling	3 2 2 3 1 2 3 2 2	2 2 3 3 2 2 2 3 2 2	3 2 2 3 2 2 2 3 2 2	3 2 2 3 2 2 2 3 2 2	3 2 2 3 2 2 2 3 2 2	3 2 2 3 2 2 2 3 2 2	3 2 2 3 2 2 2 3 2 2
Degree of erosion	2 1 1 1 2 1 2 1 1	2 2 2 3 1 2 2 3 1 2	2 3 2 2 3 2 2 3 2 2	2 3 2 2 3 2 2 3 2 2	2 3 2 2 3 2 2 3 2 2	2 3 2 2 3 2 2 3 2 2	2 3 2 2 3 2 2 3 2 2
Topography	V V V V R V V R V R	R R R R R R S S S S	S S S S S S S S S S	S S S S S S S S S S	S R I I I I P P P P	P P P P P P P P P P	P P P P P P P P P P
Gradient	1 1 1 1 3 2 1 1 1	1 1 1 5 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 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
Aspect	S E E E N E S E E E	E E E E S S S S S S	S S S S S S S S S S	S S S S S S S S S S	S E S S S S S S S S	S S S S S S S S S S	S S S S S S S S S S
	E E E E	E E E E	E E E E	E E E E	E E E E	E E E E	E E E E
Terrain unit	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 1	1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1	2 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2
Geology	A A A A A A A A A A	A A A A A A A A A A	A A A A A A A A A A	A A A A A A A A A A	A A A A A A A A A A	A A A A A A A A A A	A A A A A A A A A A
	L L L L L L L L L L	L L L L L L L L L L	L L L L L L L L L L	L L L L L L L L L L	L L L L L L L L L L	L L L L L L L L L L	L L L L L L L L L L
	L L L L L L L L L L	L L L L L L L L L L	L L L L L L L L L L	L L L L L L L L L L	L L L L L L L L L L	L L L L L L L L L L	L L L L L L L L L L
Altitude	4 4 4 4 5 4 4 4 4	4 4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4 4
	4 5 5 5 4 5 5 3 3	4 5 5 5 3 6 5 3 3 3	5 3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3 3	4 4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4 4
	0 0 0 0 0 0 0 0 0	0 0 0 5 0 0 0 0 0	5 0 0 0 0 0 0 0 0	5 0 0 0 0 0 0 0 0	5 0 0 0 0 0 0 0 0	5 0 0 0 0 0 0 0 0	5 0 0 0 0 0 0 0 0
Relevé number	1 1 1 1 1 1 1 1	1 1 1 2 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 1 2 1 1 1 1 1	1 1 1 1 2 1 1 1 1 1	1 1 1 1 2 1 1 1 1 1
	8 3 3 6 6 8 8 8 8 9	0 9 4 2 2 0 2 1 0 3	1 1 2 4 1 1 1 1 1 1	1 1 2 4 1 1 1 1 1 1	1 1 2 4 1 1 1 1 1 1	1 1 2 4 1 1 1 1 1 1	1 1 2 4 1 1 1 1 1 1
	7 2 9 6 7 3 9 2 6	7 8 1 2 7 3 3 3 8 5	9 0 6 6 6 6 6 6 6 7	9 0 6 6 6 6 6 6 6 7	9 0 6 6 6 6 6 6 6 7	9 0 6 6 6 6 6 6 6 7	9 0 6 6 6 6 6 6 6 7
Number of species per relevé	2 1 1 1 2 1 1 0 1	1 1 1 0 1 1 0 1 1 0	0 0 1 1 0 0 0 0 0 0	0 0 1 1 0 0 0 0 0 0	0 0 1 1 0 0 0 0 0 0	0 0 1 1 0 0 0 0 0 0	0 0 1 1 0 0 0 0 0 0
	1 7 6 5 4 5 1 9 3	8 4 7 9 7 5 9 1 2 9	5 1 1 1 1 1 1 1 1 1	5 1 1 1 1 1 1 1 1 1	5 1 1 1 1 1 1 1 1 1	5 1 1 1 1 1 1 1 1 1	5 1 1 1 1 1 1 1 1 1
COMMUNITY	6	7	8	9			
SUBCOMMUNITY		7.1	7.2	7.3		9.1	9.2
SPECIES GROUP A							
<i>Acacia tortilis ssp heteracantha</i>	a 3 3 4 5 a 5		+				
<i>Ipomoea dichroa</i>	a 1 1 b + 1		1				
<i>Commelina benghalensis</i>	1 + + + +						
<i>Abutilon hirtum</i>	+ + + + 1		+				
<i>Grewia flavescens</i>	+ + + + +	+					
<i>Lonchocarpus capassa</i>	+ 1 + 3						
<i>Anisotes formosissimus</i>	a + b						
<i>Capparis tomentosa</i>	a + 1	r					
<i>Abutilon grandiflorum</i>	+ + + + 1	+					
<i>Abutilon ramosum</i>	+ + + +						
<i>Ctenolepis cerasiformis</i>	1 + + +						
<i>Corchorus trilocularis</i>	1 +						+ +
<i>Ipomoea pes-tigridis</i>	a +						+
<i>Cyathula orthacantha</i>	+ 1						
<i>Ipomoea tenuipes</i>	a 1						
<i>Setaria sagittifolia</i>	1 a		a				
<i>Urochloa mosambicensis</i>	a a						
<i>Cadaba termitaria</i>	+ +						
<i>Cucumis anguria</i>	1 +		+				
<i>Lagenaria sphaerica</i>	+ + a	+					
<i>Acacia galpinii</i>	b						
<i>Celosia trigyna</i>	b						
<i>Gymnosporia pufferlickoides</i>	a						
<i>Dactyloctenium giganteum</i>	1						
<i>Chloris virgata</i>	1						
SPECIES GROUP B							
<i>Cardiogyne africana</i>	+ b	1 a	r				
<i>Friesodielsia obovata</i>		1 +					
Hin 585		+ +					
<i>Sclerocarya birrea ssp caffra</i>		a					
<i>Justicia glabra</i>		a					
<i>Asystasia gangetica</i>		b	+				

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Table 9. Phytosociological table of the plant communities of Sango Ranch, Save Valley Conservancy, Zimbabwe. Part 4.

COMMUNITY	6		7		8		9		
SUBCOMMUNITY			7.1	7.2	7.3			9.1	9.2
SPECIES GROUP K									
<i>Phragmites mauritianus</i>					3	5	5	5	
SPECIES GROUP L									
<i>Nymphaea nouchali</i>								a	1
<i>Eragrostis curvula</i>								+	1
<i>Paspalidium obtusifolium</i>								5	
SPECIES GROUP M									
<i>Acacia xanthophloea</i>									b a
SPECIES GROUP N									
<i>Echinochloa colona</i>								3	5 4 3
<i>Cyperus digitatus ssp auricomis</i>					+			+	+ 1
SPECIES GROUP O									
<i>Grewia monticola</i>									+
<i>Combretum mossambicens</i>									+
<i>Berchemia discolor</i>									+
<i>Stylochaeton puberulus</i>									+
<i>Blairvillea gagana</i>									+
<i>Gardenia resiniflua</i>									+
Hin 476									+
<i>Digitaria velutina</i>									+
<i>Maerua decumbens</i>									+
<i>Commiphora edulis</i>									+
<i>Barleria kirkii</i>									+
<i>Cordia monoica</i>									+
<i>Gymnosporia senegalensis</i>									0
<i>Berchemia zeyheri</i>									+
<i>Pergularia daemia</i>									+
<i>Ocimum gratissimum</i>									+
<i>Tricalysia junodii</i>									+
<i>Vernonia lundensis</i>									+
<i>Urochloa panicoides</i>									+
<i>Indigofera varia</i>									+
<i>Commicarpus plumbagineus</i>									+
<i>Solanum pandurifome</i>									+
<i>Ptilostigma thonningii</i>									+
<i>Grewia bicolor</i>									+
Hin 592									+
<i>Azima tetracantha</i>									+
<i>Mariscus rehmannianus</i>									+
<i>Lantana camara</i>									1
<i>Ficus capreifolia</i>									+
<i>Albolyphus alnifolius</i>									+
<i>Strychnos madagascarie</i>									+
<i>Reissantia indica</i>									+

SANGO RANCH

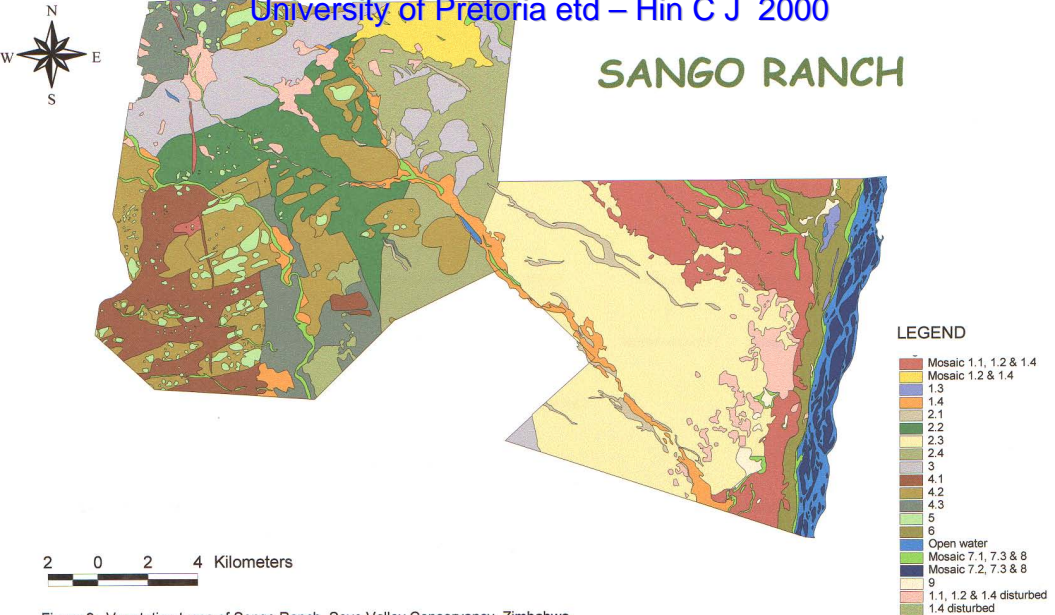


Figure 9: Vegetation types of Sango Ranch, Save Valley Conservancy, Zimbabwe.

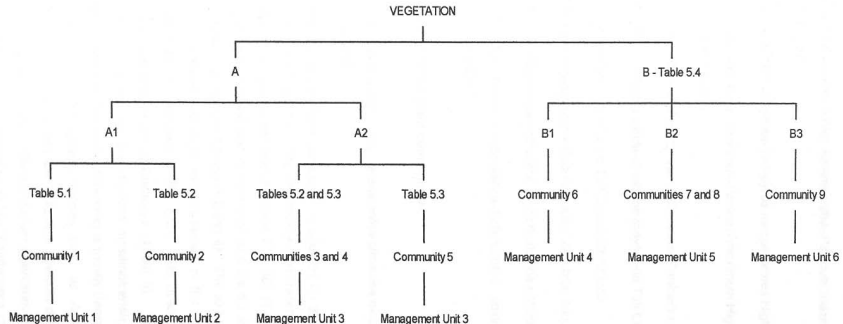


Figure 10. TWINSPAN dendrogram of the vegetation communities identified on Sango Ranch, Save Valley Conservancy, Zimbabwe.

5. The *Milletia usumarensis* subsp. *australis*–*Brachiaria deflexa* Short Koppie Thicket
6. The *Acacia tortilis* subsp. *heteracantha*–*Panicum maximum* Tall Closed Woodland
7. The *Dalbergia arbutifolia*–*Diospyros mespiliformes* High Riverine Forest
 - 7.1 The *Strychnos potatorum*–*Panicum maximum* High Closed Woodland // Short Thicket
 - 7.2 The *Albizia glaberrima* var. *glabresens*–*Panicum maximum* High Forest
 - 7.3 The *Faidherbia albida*–*Eriochloa meyeriana* Tall Closed Woodland
8. The *Phragmites mauritianus* Tall Closed Reedbeds
9. The *Echinochloa colona*–*Cyperus digitatus* subsp. *auricomus* Tall Open Wetland
 - 9.1 The *Paspalidium obtusifolium*–*Echinochloa colona* Tall Closed Grassland
 - 9.2 The *Acacia xanthophloea*–*Echinochloa colona colona* Tall Closed Woodland

Description of the plant communities

1. The *Acacia tortilis* subsp. *heteracantha*–*Urochloa mosambicensis* Tall Closed Woodland

This tall closed woodland community is situated on the floodplain of the Msaizi River (Figures 9 and 11). The community is represented by 65 relevés with an average of 12 species per relevé (range 7 to 30) (Table 6). This community is found on sandy outwash and is associated with the 4U and 8h soil families, which are derived from alluvium (Chapters 2 and 4). The altitude varies between 440 m and 560 m above sea level and the terrain is flat. This community can be recognised by the presence of the herbs *Sida ovata*, *Hibiscus micrantha* and *Tephrosia purpurea* subsp. *leptostachya* (Table 6). The dominant herbaceous species in this community are *Urochloa mosambicensis*, *Panicum maximum* and *Digitaria milanjiiana*. The herbaceous layer is mostly dense but in overutilised areas the soil is bare and pioneer species such as *Aristida junceiformis*, *Tragus berteronianus*, *Chloris virgata* and *Indigofera praticola* dominate. At the beginning of the 1999 growing season, *Dactyloctenium giganteum* was a prominent feature of the herbaceous layer. According to Van Oudtshoorn (1992), this species forms dense stands after seasons of good rainfall, which was the case during 1999. The diagnostic woody species is *Acacia tortilis* subsp. *heteracantha*. *Albizia*



Figure 11. The *Acacia tortilis* subsp. *heteracantha*-*Urochloa mosambicensis* Tall Closed Woodland Community on Sango Ranch, Save Valley Conservancy, Zimbabwe.

anthelminthica is also common. Another common woody species is *Cadaba termitaria*.

Structure of the woody layer

Histogrammatic representations of the percentage canopy cover and the density of the woody species in the *Acacia tortilis* subsp. *heteracantha*-*Urochloa mosambicensis* Tall Closed Woodland appear in Figures 12 and 13, respectively. The contribution of woody species contributing >1% to the total woody species composition appears in Table 7. The highest canopy cover and tree density are evident in height classes 0.75-<1.5 m and 1.5-<2.5 m (Figures 12 and 13). *Cadaba termitaria* is a frequent woody shrub in these layers but *Acacia tortilis* subsp. *heteracantha*, *Dichrostachys cinerea* subsp. *africana*, *Grewia monticola*, *Salvadora persica* and *Thilachium africanum* contribute highly (Table 7). This community is closed with a total canopy cover of 13 % and a total density of 336 individuals/ha (Figures 12 and 13). The highest tree class that qualifies as the dominant layer according to Edwards (1983) consists of *Acacia tortilis* subsp. *heteracantha* and it has a height of between 11.5 m and 13.5 m (Figure 12, Table 7). The community is therefore classified as a tall closed woodland and contains a low thicket component (Edwards 1983).

The *Acacia tortilis* subsp. *heteracantha*-*Urochloa mosambicensis* Tall Closed Woodland is sub-divided into four sub-communities:

1.1 The *Tephrosia purpurea* subsp. *leptostachya* - *Urochloa mosambicensis* Short Closed Woodland

This short closed woodland is found on the floodplain of the southeastern section of the Msaizi River and forms a mosaic with the *Dichrostachys cinerea* subsp. *africana*-*Urochloa mosambicensis* Short Open Woodland and the *Sporobolus nitens*-*Urochloa mosambicensis* Short Closed Woodland (Figures 9 and 14). The sub-community is represented by 14 relevés with a mean of 9 species per relevé (range 6-15) (Table 6). The vegetation of the *Tephrosia purpurea* subsp. *leptostachya*-*Urochloa mosambicensis* Short Closed Woodland is recognised by the presence of the diagnostic species *Tephrosia purpurea* subsp. *leptostachya* var. *pubescens* (Table 6). The woody layer is dominated by *Albizia anthelminthica*.

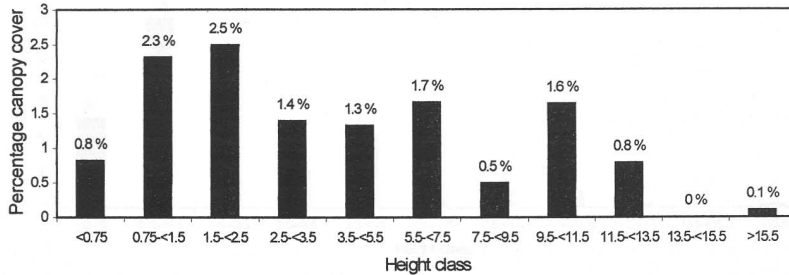


Figure 12. The percentage canopy cover in 11 height classes (m) of the woody species of the *Acacia tortilis* subsp. *heteracantha-Urochloa mosambicensis* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 13.0 %

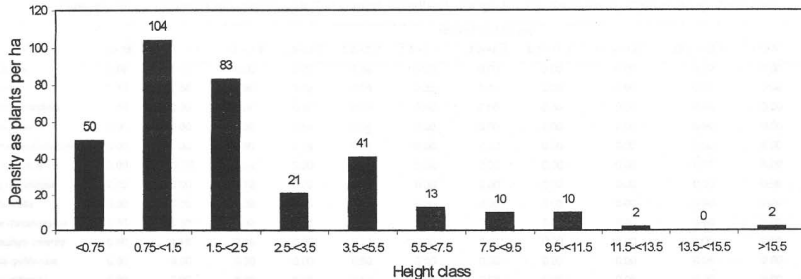


Figure 13. The density of the woody species in 11 height classes (m) of the *Acacia tortilis* subsp. *heteracantha*-*Urochloa mosambicensis* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 336.

Table 10. The percentage contribution of 17 woody species in 11 height classes to the total woody species composition of the *Acacia tortilis* subsp. *heteracantha* – *Urochloa mosambicensis* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											Total
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Acacia nilotica</i>	0.00	0.60	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	1.20
<i>Acacia tortilis</i>	1.19	2.68	0.90	1.49	6.54	2.38	1.49	2.08	0.60	0.00	0.00	19.35
<i>Albizia anthelminthica</i>	1.19	0.30	0.00	0.00	0.60	0.60	0.60	0.30	0.00	0.00	0.00	3.59
<i>Azima tetracantha</i>	0.30	0.60	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20
<i>Boscia mossambicensis</i>	0.00	0.30	0.60	1.19	0.90	0.00	0.00	0.00	0.00	0.00	0.00	2.99
<i>Cadaba termitaria</i>	0.00	12.20	6.54	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.04
<i>Capparis tomentosa</i>	0.60	0.90	1.19	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	2.99
<i>Cordia monoica</i>	0.30	0.30	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.40
<i>Dalbergia melanoxylon</i>	0.30	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90
<i>Dichrostachys cinerea</i>	0.90	1.19	2.38	0.90	0.90	0.30	0.00	0.00	0.00	0.00	0.00	6.57
<i>Diospyros quiloensis</i>	0.30	0.00	0.30	0.00	0.60	0.00	0.30	0.00	0.00	0.00	0.00	1.50
<i>Gardenia volkensii</i>	0.00	0.00	0.00	0.00	0.90	0.30	0.00	0.00	0.00	0.00	0.00	1.20
<i>Grewia flavescens</i>	0.00	1.19	1.49	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.98
<i>Grewia monticola</i>	0.30	0.30	2.08	1.19	0.60	0.00	0.00	0.00	0.00	0.00	0.00	4.47
<i>Maerua decumbens</i>	0.90	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50
<i>Salvadora persica</i>	0.90	4.17	2.98	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	8.35
<i>Thilachium africanum</i>	2.08	3.27	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.25



Figure 14. The *Tephrosia purpurea* subsp. *leptostachya*–*Urochloa mosambicensis* Short Closed Woodland on Sango Ranch, Save Valley Conservancy, Zimbabwe.

Structure of the woody layer

A histogrammatic representation of the percentage canopy cover and the density of the woody species in the *Tephrosia purpurea* subsp. *leptostachya*–*Urochloa mosambicensis* Short Open Woodland Sub-community appears in Figures 15 and 16, respectively. The contribution of eight woody species contributing >1% to the total woody species composition is presented in Table 10. The highest canopy cover and tree density are evident in height classes 0.75-<1.5 m and 1.5-<2.5 m (Figures 15 and 16). This is due to the shrub *Cadaba termitaria*, which is frequent in this height layer (Table 8). This community is closed with a total canopy cover of 12.0 % and a total density of 247 individuals/ha (Figures 15 and 16). The highest tree layer that qualifies as the dominant layer according to Edwards (1983) consists of *Albizia anthelminthica* and its height is 7.5-<9.5 m; the sub-community is thus classified as a short closed woodland with a low thicket component (Figure 15, Table 10, Edwards 1983).

1.2 The *Dichrostachys cinerea* subsp. *africana*–*Urochloa mosambicensis* Short Open Woodland

This short open woodland is found on the floodplain to the south of the Msaizi River and south of Msaize Ranch and forms a mosaic with the *Sporobolus nitens*–*Urochloa mosambicensis* Short Closed Woodland (Figures 9 and 17). The sub-community is represented by 10 relevés consisting of a mean of 12 species per relevé (range 7-17) (Table 6). This sub-community is associated with the same soil types as the *Tephrosia purpurea* subsp. *leptostachya* –*Urochloa mosambicensis* Short Open Woodland (Table 6). Habitat conditions are similar to the *Tephrosia purpurea* subsp. *leptostachya*–*Urochloa mosambicensis* Short Open Woodland in all but the altitude, which varies between 540 m and 570 m, and the presence of a north-facing relevé (Table 6). The herbaceous layer of the *Dichrostachys cinerea* subsp. *africana*–*Urochloa mosambicensis* Short Closed Woodland is dominated by *Sericorema remotiflora* (Table 6). The diagnostic woody species is *Dichrostachys cinerea* subsp. *africana*.

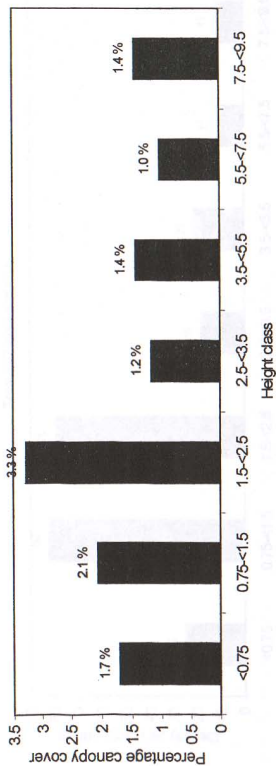


Figure 15. The percentage canopy cover in seven height classes (m) of the woody species of the *Tephrosia purpurea* subsp. *leptostachya*-*Urochloa mosambicensis* Short Open Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 12.1 %.

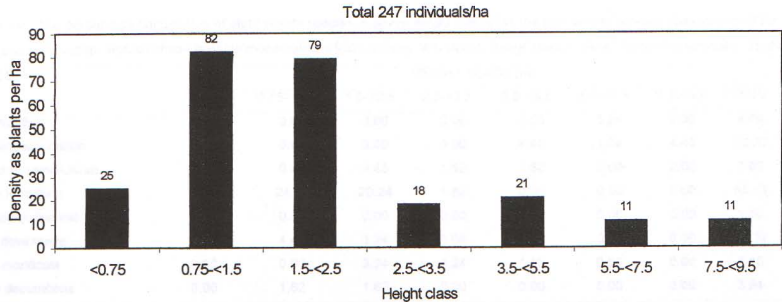


Figure 16. The density of the woody species in seven height classes (m) of the *Tephrosia purpurea* subsp. *leptostachya* *Urochloa mosambicensis* Short Open Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 247.

Table 10. The percentage contribution of eight woody species in seven height classes to the total woody species composition of the *Tephrosia purpurea* subsp. *leptostachya*-*Urochloa mosambicensis* Short Open Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)							TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	
<i>Acacia tortilis</i>	1.62	0.00	0.00	0.00	0.00	3.24	0.00	4.86
<i>Albizia anthelminthica</i>	0.00	0.00	0.00	0.00	4.45	1.62	4.45	10.52
<i>Boscia mossambicensis</i>	0.00	0.00	4.45	1.62	1.62	0.00	0.00	7.69
<i>Cadaba termitaria</i>	5.67	24.70	20.24	1.62	0.00	0.00	0.00	52.23
<i>Diospyros quiloensis</i>	0.00	0.00	0.00	0.00	1.62	0.00	0.00	1.62
<i>Grewia flavescens</i>	2.83	4.45	3.24	0.00	0.00	0.00	0.00	10.52
<i>Grewia monticola</i>	0.00	0.00	3.24	3.24	1.62	0.00	0.00	8.10
<i>Maerua decumbens</i>	0.00	1.62	1.62	0.00	0.00	0.00	0.00	3.24



Figure 17. The *Dichrostachys cinerea* subsp. *africana*–*Urochloa mosambicensis* Short Open Woodland on Sango Ranch, Save Valley Conservancy, Zimbabwe.

Structure of the woody layer

A histogrammatic representation of the percentage canopy cover and the density of the woody species in the *Dichrostachys cinerea* subsp. *africana*–*Urochloa mosambicensis* Short Open Woodland is depicted in Figures 18 and 19, respectively. The percentage contribution of woody species contributing >1% to the total woody species composition is presented in Table 11. The highest canopy cover is evident in height class 9.5-<11.5 m and the highest density is seen in height class 0.75-<1.5 m (Figures 18 and 19). The reason for this is the broad canopy of large *Acacia tortilis* subsp. *heteracantha* specimens; a few individuals will then deliver a large canopy cover. *A. tortilis* subsp. *heteracantha*, *Dichrostachys cinerea* subsp. *africana*, *Grewia flavescens* var. *flavescens* and *G. monticola* contribute most to the density in the 0.75-<1.5 m height class (Table 11). This community is slightly closed with a total canopy cover of 14.6 % and a total density of 405 individuals/ha (Figures 18 and 19). The highest tree layer that qualifies as the dominant layer according to Edwards (1983) consists of *Acacia tortilis* subsp. *heteracantha* and lies in the 9.5-<11.5 m class (Figure 18, Table 11). The sub-community is thus classified as a short closed woodland and contains a low thicket component (Edwards 1983).

1.3 The *Capparis tomentosa*–*Urochloa mosambicensis* Short Open Woodland

This short open woodland is found south of Masiyauta Pan adjacent to the Save River (Figures 9 and 20). It is represented by 10 relevés with an average of 12 species per relevé (range 8-17) (Table 6). This sub-community is also associated with the soil families 4U and 8h that are derived from alluvium (Chapter 4; Table 6). Altitude varies mostly between 440 m and 470 m. Several pans are found throughout this sub-community (Figure 9). *Acacia tortilis* subsp. *heteracantha*, *Capparis tomentosa*, *Thilachium africanum*, *Salvadora persica* and *Anisotes formosissimus* are characteristic species of the *Capparis tomentosa*–*Urochloa mosambicensis* Tall Closed Woodland (Table 6).

Structure of the woody layer

A histogrammatic representation of the percentage canopy cover and the density of the woody species in the *Capparis tomentosa*–*Urochloa mosambicensis* Short Open Woodland is depicted in Figures 21 and 22, respectively. The percentage

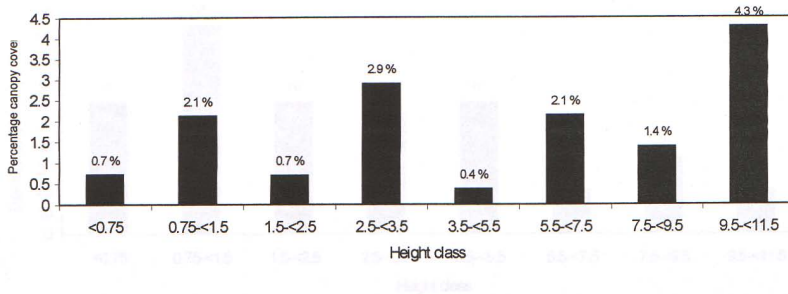


Figure 18. The percentage canopy cover in eight height classes (m) of the woody species of the *Dichrostachys cinerea* subsp. *africana*-*Urochloa mosambicensis* Short Open Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. Total canopy cover is 14.6 %.

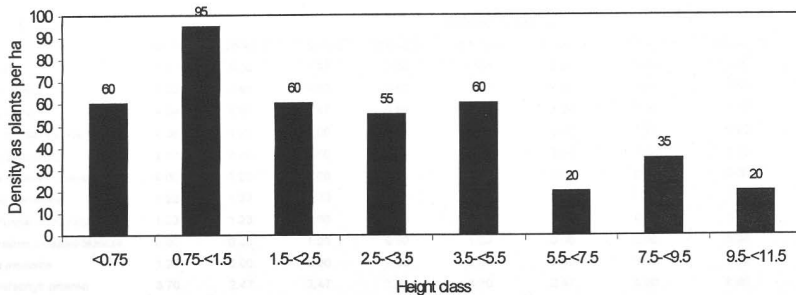


Figure 19. The density of the woody species in eight height classes (m) of the *Dichrostachys cinerea* subsp. *africana*–*Urochloa mosambicensis* Short Open Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total number of plants per ha is 405.

Table 11. The percentage contribution of 17 woody species in eight height classes to the total woody species composition in the *Dichrostachys cinerea* subsp. *africana*–*Urochloa mosambicensis* Short Open Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)								TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	
Hin 242	0.00	0.00	1.23	0.00	0.00	0.00	0.00	0.00	1.23
<i>Acacia nilotica</i>	0.00	0.00	0.00	0.00	1.23	0.00	0.00	0.00	1.23
<i>Acacia tortilis</i>	4.94	8.64	2.47	9.88	3.70	1.23	4.94	3.70	39.5
<i>Albizia anthelminthica</i>	0.00	1.23	0.00	0.00	0.00	0.00	1.23	0.00	2.46
<i>Azima tetraecantha</i>	2.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.47
<i>Boscia mossambicensis</i>	0.00	1.23	0.00	1.23	1.23	0.00	0.00	0.00	3.69
<i>Cadaba termitaria</i>	1.23	1.23	1.23	0.00	0.00	0.00	0.00	0.00	3.69
<i>Colophospermum mopane</i>	1.23	1.23	0.00	0.00	0.00	0.00	0.00	0.00	2.46
<i>Combretum mossambicense</i>	0.00	0.00	1.23	0.00	1.23	0.00	0.00	0.00	2.46
<i>Cordia monoica</i>	1.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.23
<i>Dichrostachys cinerea</i>	3.70	2.47	2.47	1.23	3.70	2.47	0.00	0.00	16.04
<i>Diospyros quiloensis</i>	0.00	0.00	0.00	0.00	1.23	0.00	0.00	0.00	1.23
<i>Grewia flavescens</i>	0.00	2.47	6.17	1.23	0.00	0.00	0.00	0.00	9.87
<i>Grewia monticola</i>	0.00	3.70	0.00	0.00	2.47	0.00	0.00	0.00	6.17
<i>Lonchocarpus capassa</i>	0.00	0.00	0.00	0.00	0.00	1.23	0.00	0.00	1.23
<i>Markhamia zanzibarica</i>	0.00	0.00	0.00	0.00	0.00	0.00	1.23	0.00	1.23
<i>Sclerocarya birrea</i>	0.00	0.00	0.00	0.00	0.00	0.00	1.23	0.00	1.23



Figure 20. The *Capparis tomentosa*–*Urochloa mosambicensis* Short Open Woodland on Sango Ranch, Save Valley Conservancy, Zimbabwe.

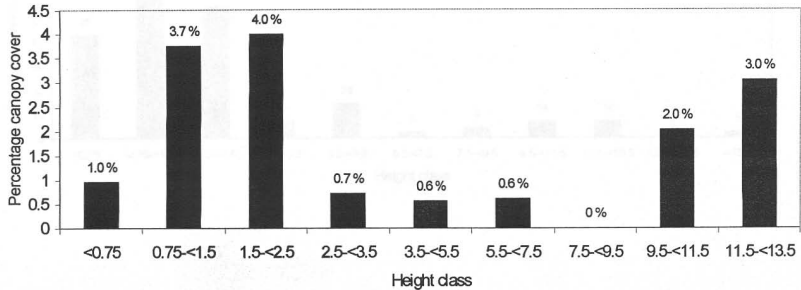


Figure 21. The percentage canopy cover in nine height classes (m) of the woody species of the *Capparis tomentosa-Urochloa mosambicensis* Short Open Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 15.6 %.

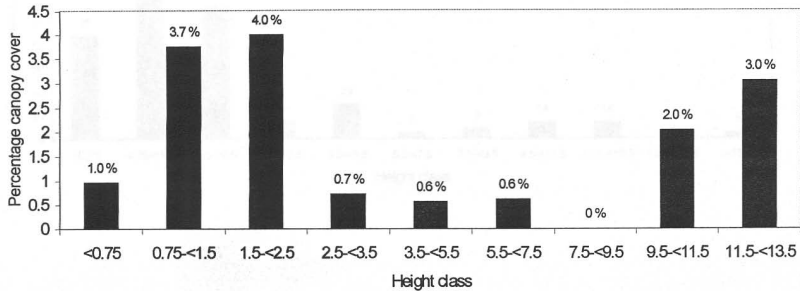


Figure 21. The percentage canopy cover in nine height classes (m) of the woody species of the *Capparis tomentosa*–*Urochloa mosambicensis* Short Open Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 15.6 %.

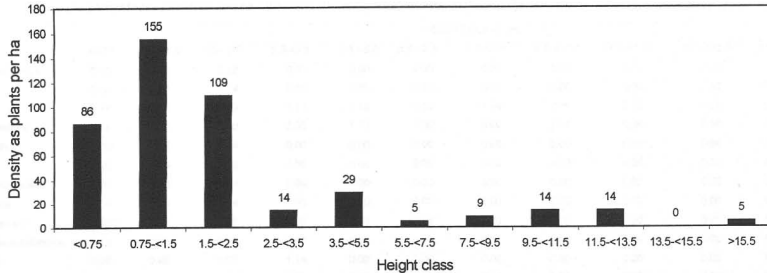


Figure 22. The density of the woody species in 11 height classes (m) of the *Capparis tomentosa*–*Urochloa mosambicensis* Short Open Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total number of plants per ha is 440.

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Table 12. The percentage contribution of 21 woody species in 11 height classes to the total woody species composition in the *Capparis tomentosa*–*Urochloa mosambicensis* Short Open Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Anisotes formosissimus</i>	0.00	4.10	3.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.28
<i>Lycium shawii</i>	0.00	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14
<i>Acacia tortilis</i>	1.14	3.18	0.00	1.14	3.18	0.00	1.14	2.05	3.18	0.00	0.00	15.01
<i>Albizia anthelminthica</i>	1.14	0.00	0.00	0.00	1.14	0.00	0.00	1.14	0.00	0.00	0.00	3.42
<i>Azima tetraacantha</i>	0.00	3.18	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.32
<i>Boscia foetida</i>	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14
<i>Boscia mossambicensis</i>	0.00	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14
<i>Cadaba termitaria</i>	1.14	6.14	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.42
<i>Capparis tomentosa</i>	2.05	4.09	7.27	0.00	0.00	1.14	0.00	0.00	0.00	0.00	0.00	14.55
<i>Combretum mossambicense</i>	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14
<i>Cordia monoica</i>	0.00	0.00	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14
<i>Dalbergia melanoxylon</i>	1.14	1.14	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.42
<i>Dichrostachys cinerea</i>	0.00	0.00	0.00	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	1.14
<i>Diospyros quiloensis</i>	0.00	0.00	1.14	0.00	1.14	0.00	1.14	0.00	0.00	0.00	0.00	3.42
<i>Grewia bicolor</i>	0.00	0.00	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.05
<i>Grewia flavescens</i>	0.00	2.05	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.10
<i>Grewia monticola</i>	0.00	1.14	3.18	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.46
<i>Lannea schweinfurthii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14	1.14
<i>Salvadora persica</i>	5.23	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.28
<i>Thilachium africanum</i>	2.05	6.14	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.33
<i>Ziziphus mucronata</i>	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14

contribution of woody species contributing >1% to the total woody species composition is presented in Table 12. The highest canopy cover and density is evident in the 0.75-<1.5 m and 1.5-<2.5 m height classes (Figures 21 and 22). *Capparis tomentosa*, *Anisotes formosissimus*, *Grewia flavescens* var. *flavescens*, *Cadaba termitaria*, *Thilachium africanum* and *Azima tetracantha* contribute mostly to the canopy cover and density (Table 12). This community is slightly closed with a total canopy cover of 15.6 % and a total density of 440 individuals/ha (Figures 21 and 22). The highest tree layer that qualifies as the dominant layer according to Edwards (1983) consists of *Acacia tortilis* subsp. *heteracantha* and lies in the 11.5-<13.5 m class (Figure 21, Table 12). The sub-community is thus classified as a tall closed woodland with a low thicket component (Edwards 1983).

1.4 The *Sporobolus nitens*–*Urochloa mosambicensis* Short Closed Woodland

This short closed woodland sometimes forms a mosaic with the *Tephrosia purpurea* subsp. *leptostachya*–*Urochloa mosambicensis* Short Open Woodland and the *Dichrostachys cinerea* subsp. *africana*–*Urochloa mosambicensis* Short Open Woodland and is sometimes found mixed with these two communities, especially along drainage lines (Figures 9 and 23). The sub-community is also found on the floodplains of the Saindota and Makore Rivers (Figure 9). This community is represented by 31 relevés with an average of 13 species per relevé (range 7-30) (Table 6). The soils in this community belong to the saline-sodic 8h soil family derived from alluvium and gneiss (Chapter 4; Table 6). Altitude varies between 440 m and 560 m and the terrain is a mostly flat valley but along the Makore River it becomes steeper (Figure 3). Percentage rock cover is low but along the Makore River stone and rock cover is higher (Table 6). The herb layer of this sub-community is recognised by *Sporobolus nitens* (Table 6). No diagnostic or dominant woody species are evident from Table 6.

Structure of the woody layer

A histogrammatic representation of the percentage canopy cover and the density of the woody species in the *Sporobolus nitens*–*Urochloa mosambicensis* Short Closed Woodland is depicted in Figures 24 and 25, respectively. The percentage contribution of woody species contributing >1% to the total woody species composition is presented in Table 13. The highest canopy cover is evident in the 3.5-<5.5 m and 5.5-<7.5 m height classes (Figure 24) and the highest density is seen in the 0.75-<1.5 m and 1.5-<2.5 m classes (Figure 25). *Acacia tortilis* subsp. *heteracantha* is once again responsible for this (Table 13). *Salvadora persica* is the dominant species in the 0.75-<1.5 m and 1.5-<2.5 m



Figure 23. The *Sporobolus nitens*–*Urochloa mosambicensis* Short Closed Woodland on Sango Ranch, Save Valley Conservancy, Zimbabwe.

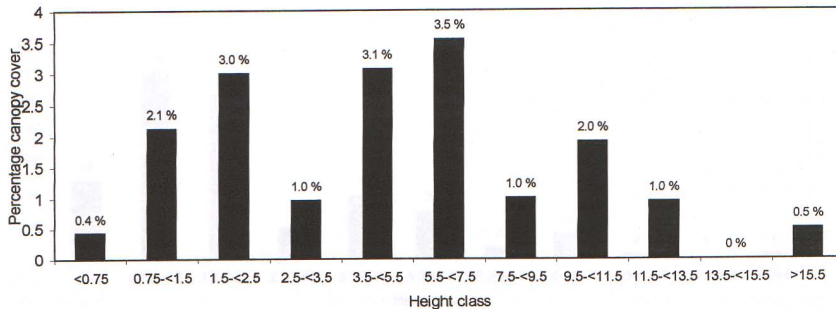


Figure 24. The Percentage canopy cover in 11 height classes (m) of the woody species of the *Sporobolus nitens*–*Urochloa mosambicensis* Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 17.5 %.

Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 374

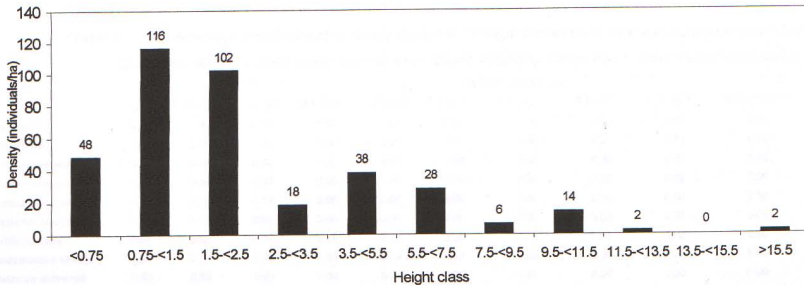


Figure 25. The density of the woody species in 11 height classes (m) of the *Sporobolus nitens*–*Urochloa mosambicensis* Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 374.

Table 13. The percentage contribution of 17 woody species in 11 height classes to the total woody species composition in the *Sporobolus nitens*–*Urochloa mosambicensis* Short Closed Woodland, Sango Ranch, Save Valley Conservancy.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<135	13.5-<15.5	>15.5	
<i>Acacia nilotica</i>	0.00	1.60	0.00	0.00	1.07	0.00	0.00	0.00	0.00	0.00	0.00	2.67
<i>Acacia tortilis</i>	0.53	2.14	1.60	0.00	3.21	4.81	1.60	3.21	0.53	0.00	0.00	17.63
<i>Albizia anthelminthica</i>	0.00	0.00	0.00	0.00	0.53	1.60	0.00	0.00	0.00	0.00	0.00	2.13
<i>Boscia mossambicensis</i>	0.00	0.00	0.53	0.00	1.60	0.00	0.00	0.00	0.00	0.00	0.00	2.13
<i>Cadaba termitaria</i>	2.67	3.21	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.41
<i>Capparis tomentosa</i>	0.53	1.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60
<i>Cordia monoica</i>	0.00	0.53	0.53	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06
<i>Dichrostachys cinerea</i>	1.07	2.14	5.35	1.60	2.14	0.53	0.00	0.00	0.00	0.00	0.00	12.83
<i>Diospyros quiloensis</i>	0.53	0.53	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	1.59
<i>Grewia bicolor</i>	0.53	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06
<i>Grewia flavescens</i>	0.53	0.53	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.59
<i>Grewia inaequilatera</i>	0.00	0.53	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06
<i>Grewia monticola</i>	0.53	0.00	3.21	2.14	0.53	0.00	0.00	0.00	0.00	0.00	0.00	6.41
<i>Maerua decumbens</i>	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53
<i>Phyllanthus reticulatus</i>	0.53	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06
<i>Salvadora persica</i>	0.00	10.16	8.02	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	18.71
<i>Thilachium africanum</i>	4.81	6.42	2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.37

height classes, but *Acacia tortilis* subsp. *heteracantha*, *Dichrostachys cinerea* subsp. *africana*, *Cadaba termitaria* and *Thilachium africanum* also contribute to the density (Table 13). This community is slightly closed with a total canopy cover of 17.5 % and a total density of 374 individuals/ha (Figures 24 and 25). The highest tree layer that qualifies as the dominant layer according to Edwards (1983) consists of *Acacia tortilis* subsp. *heteracantha* and lies in the 9.5- $<$ 11.5 m class (Figure 24, Table 13). The sub-community is thus classified as a short closed woodland with a low thicket component (Edwards 1983).

2. The *Colophospermum mopane*-*Brachiaria deflexa* Short Thicket // Short Closed Woodland

This community lies over the centre of Sango Ranch (Figures 9 and 26). The community is represented by 66 relevés with an average of 25 species per relevé (13-44) (Table 7). This community is associated with slightly more clayey midslope soils of the 4S, 4U, 4PE and 4S soil families (Chapter 4; Table 7). The soils are derived from gneiss, lava, shale, quartzite, limestone, grits and alluvium (Chapter 2; Table 7). Altitude varies between 460 m and 600 m. The terrain varies from rolling hills to flat plains and valleys. Rock cover is low except on the hills where large rocks and stones lie scattered on the surface. The herbaceous layer is mostly sparse but along drainage lines a dense herb layer is found. The herb layer is recognised by the diagnostic *Pupalia lappacea* var. *velutina* (Table 7). *Aristida junciformis* and *Enteropogon macrostachys* are also present. Dominant grasses are *Brachiaria deflexa*, *Urochloa mosambicensis*, *Panicum maximum* and *Eragrostis rigidior*. The pioneers *Pupalia lappacea* var. *velutina*, *Aristida junciformis*, *Plectranthus tetensis*, *P. caninus*, *Oropetium capense*, *Kylinga alba*, *Tragus berteronianus*, *Chloris virgata* and *Justicia flava* dominate on the 4U soils on alluvium, while *Sporobolus nitens* dominates on 8h soils. The diagnostic woody species is *Colophospermum mopane* and it dominates the woody layer in this community (Table 7).

Structure of the woody layer

Figures 27 and 28 depict a histogrammatic representation of the percentage canopy cover and the density of the woody species in the *Colophospermum mopane*-*Brachiaria deflexa* Short Thicket // Short Closed Woodland, respectively. The percentage contribution of woody species contributing $>$ 1% to the total woody species composition is presented in Table 14. The highest canopy cover is



Figure 26. The *Colophospermum mopane*–*Brachiaria deflexa* Short Thicket // Short Closed Woodland on Sango Ranch, Save Valley Conservancy, Zimbabwe.

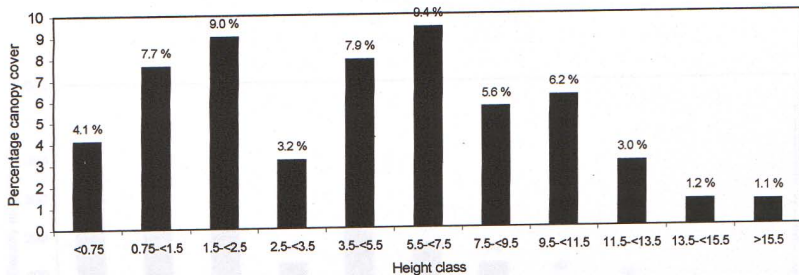


Figure 27. The density of the woody species in 11 height classes (m) of the *Colophospermum mopane*-*Brachiaria deflexa* Short

Figure 27. The percentage canopy cover in 11 height classes (m) of the woody species of the *Colophospermum mopane*-*Brachiaria deflexa* Short Thicket // Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 58.4 %.

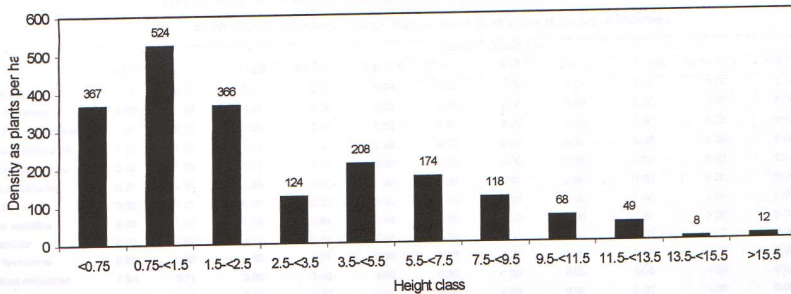


Figure 28. The density of the woody species in 11 height classes (m) of the *Colophospermum mopane*–*Brachiaria deflexa* Short Thicket // Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 2 018.

Table 14. The percentage contribution of 13 woody species in 11 height classes to the total woody species composition in the *Colophospermum mopane*–*Brachiaria deflexa* Short Thicket // Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Acacia erubescens</i>	0.00	0.28	0.21	0.00	0.64	0.21	0.00	0.00	0.00	0.00	0.00	1.34
<i>Cadaba termitaria</i>	0.60	1.84	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.65
<i>Colophospermum mopane</i>	6.45	7.72	6.60	2.41	5.52	5.81	3.90	2.30	1.80	0.28	0.42	43.21
<i>Combretum apiculatum</i>	1.13	1.20	1.13	1.63	2.20	0.50	0.00	0.00	0.00	0.00	0.00	7.79
<i>Dichrostachys cinerea</i>	0.35	1.35	0.21	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.12
<i>Diospyros quiloensis</i>	0.21	0.35	1.36	0.50	1.20	1.20	0.07	0.00	0.00	0.00	0.00	4.89
<i>Euclea divinorum</i>	0.00	0.21	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01
<i>Gardenia resiniflua</i>	0.00	0.28	0.50	0.64	0.28	0.00	0.00	0.00	0.00	0.00	0.00	1.70
<i>Grewia bicolor</i>	0.00	4.82	4.12	0.42	0.65	0.00	0.00	0.00	0.00	0.00	0.00	10.01
<i>Grewia flavescens</i>	0.92	0.00	1.63	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.26
<i>Phyllanthus reticulatus</i>	1.84	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.55
<i>Thilachium africanum</i>	0.71	1.77	0.35	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.90
<i>Tricalysia junodii</i>	2.76	2.30	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.77

evident in the 0.75-<1.5 m, 1.5-<2.5 m and 3.5-<5.5 m height classes (Figures 27) and the highest density is seen in the <0.75, 0.75-<1.5 m class (Figure 28). A shrub-like form of *Colophospermum mopane* is responsible for these figures (Table 14). This community is fairly closed with a total canopy cover of 58.4% (Figure 27) and total density of 2 018 individuals/ha (Figure 28). The highest tree layer that qualifies as the dominant layer according to Edwards (1983) consists of *Colophospermum mopane* and lies in the 9.5-<11.5 m class (Figure 27, Table 14). The high number of shrubs in some areas results in a mosaic of short closed woodland and thicket (Edwards 1983).

The *Colophospermum mopane*– *Brachiaria deflexa* Short Thicket // Short Closed Woodland can be sub-divided into four sub-communities:

2.1 The *Commiphora edulis*–*Colophospermum mopane* Short Thicket

The *Commiphora edulis*–*Colophospermum mopane* Short Thicket is situated along small drainage lines in the *Colophospermum mopane*–*Brachiaria deflexa* Short Thicket // Short Closed Woodland (Figures 9 and 29). The sub-community is represented by three relevés with an average of 27 species per relevé (Table 7). This sub-community lies on the alluvial 4U and 8h soil families that are found along the drainage lines of the *Colophospermum mopane*–*Brachiaria deflexa* Short Thicket // Short Closed Woodland (Chapter 4; Figure 9; Table 7). Altitude varies from 460 m to 570 m. The terrain is flat and surface rocks are absent (Table 7). The vegetation of drainage lines is moderately utilised and trampled, while no severe erosion is evident. The herb layer contains no diagnostic species but is dominated by the characteristic *Setaria pumila*, *Ctenolepis cerasiformis* and *Ipomoea dichroa* (Table 7). Dominant woody species in this sub-community include *Commiphora edulis* and *Gardenia resiniflua*.

Structure of the woody layer

Histograms of percentage canopy cover and density for this sub-community appear in Figures 30 and 31, respectively. The percentage contribution of woody species contributing >1% to the total woody species composition is presented in Table 15. The highest canopy cover is evident in the 0.75-<1.5 m, 1.5-<2.5 m, 3.5-<5.5 m and 7.5-<9.5 m height classes (Figures 30) and the highest density is seen in the 0.75-<1.5 m and 1.5-<2.5 m classes (Figure 31). Shrub-like forms of *Colophospermum mopane*, *Grewia* sp., *Grewia bicolor* and *G. monticola* are



Figure 29. The *Commiphora edulis*–*Colophospermum mopane* Short Thicket on Sango Ranch, Save Valley Conservancy, Zimbabwe.

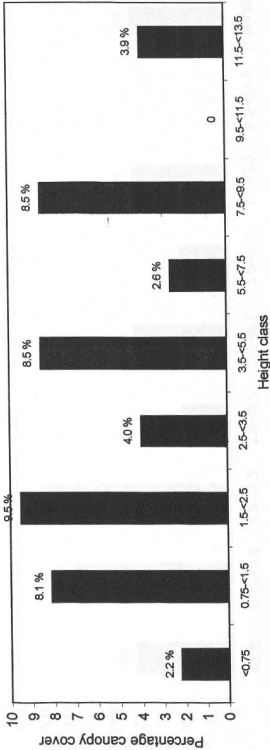


Figure 30. The percentage canopy cover in nine height classes (m) of the woody species of the *Commiphora edulis*-*Colophospermum mopane* Short Thicket, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 47.4 %.

Figure 31. The density of the woody species in nine height classes (m) of the *Commiphora edulis*-*Colophospermum mopane* Short Thicket, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 1 733.

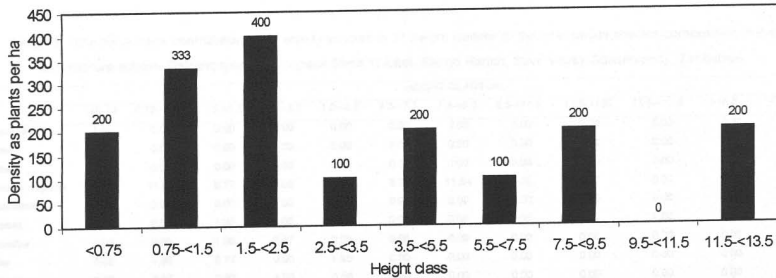


Figure 31. The density of the woody species in nine height classes (m) of the *Commiphora edulis*–*Colophospermum mopane* Short Thicket, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 1 733.

Table 15. The percentage contribution of 11 woody species in 11 height classes to the total woody species composition in the *Commiphora edulis*–*Colophospermum mopane* Short Thicket, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Acacia nigrescens</i>	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.90
<i>Celosia trigyna</i>	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.90
<i>Cissus cornifolia</i>	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.90
<i>Colophospermum mopane</i>	5.77	11.54	5.77	0.00	5.77	5.77	11.54	0.00	3.87	0.00	0.00	50.03
<i>Diospyros quiloensis</i>	0.00	0.00	0.00	0.00	1.90	0.00	0.00	0.00	0.00	0.00	0.00	1.90
<i>Euclea divinorum.</i>	0.00	0.00	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.90
<i>Gardenia resiniflua</i>	0.00	0.00	1.90	3.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.77
<i>Grewia bicolor</i>	0.00	1.90	5.77	0.00	1.90	0.00	0.00	0.00	0.00	0.00	0.00	9.64
<i>Grewia monticola</i>	0.00	3.87	3.87	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.87
<i>Grewia sp.</i>	0.00	0.00	3.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.87
<i>Grewia villosa</i>	0.00	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.90

responsible for the cover figures in the lower height classes, while *C. mopane*, *G. bicolor* and *G. monticola* contribute to the high density (Table 15). The highest tree layer that qualifies as the dominant layer according to Edwards (1983) consists of *Colophospermum mopane* and lies in the 7.5-<9.5 m class (Figure 32, Table 15). The high total canopy cover (47.4%; Figure 30), high total density (1 733 individuals/ha; Figure 31), the dominance of a short height class and a high shrub cover forms a short thicket structure (Edwards 1983).

2.2 The *Indigofera praticola*-*Colophospermum mopane* Short Closed Woodland

This short closed woodland lies more or less in the centre of Sango Ranch (Figures 9 and 32). It is represented by 12 relevés with an average of 25 species per relevé (range 15-36) (Table 7). The soils of this sub-community belong to the more heavily textured soils of the 4PE soil family on midslopes and are derived from gneiss, alluvium and shale (Chapter 4; Table 7). Altitude varies from 450 m to 575 m (Table 7). The herbaceous layer here is dominated mainly by *Tephrosia purpurea* subsp. *leptostachya* var. *pubescens* and *Ipomoea sinensis* subsp. *blepharosephala* (Table 7). *Acacia nilotica* subsp. *kraussiana* and *Commiphora glandulosa* are dominant woody species.

Structure of the woody layer

Histograms of percentage canopy cover and density for this sub-community are shown in Figures 33 and 34, respectively. The percentage contribution of woody species contributing >1% to the total woody species composition is depicted in Table 16. The highest canopy cover is evident in the 5.5-<7.5 m height class (Figure 33) and the highest density is seen in the 0.75-<1.5 m class (Figure 34). *Colophospermum mopane* is responsible for these cover and density figures (Table 16). The highest tree layer that qualifies as the dominant layer according to Edwards (1983) consists of *Colophospermum mopane* and lies in the 5.5-<7.5 m class (Figure 33, Table 16). The high total canopy cover (56.34 %; Figure 34), high total density (1 917 individuals/ha; Figure 33) and the dominance of a short height class results in the classification into a short closed woodland structure with a low thicket component (Edwards 1983).



Figure 32. The *Indigofera praticola*–*Colophospermum mopane* Short Closed Woodland on Sango Ranch, Save Valley Conservancy, Zimbabwe.

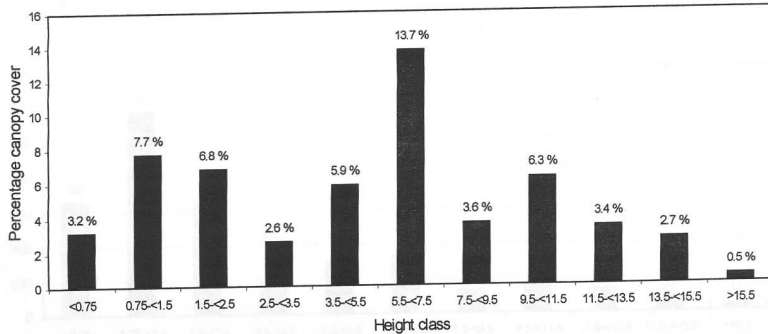


Figure 33. The percentage canopy cover in 11 height classes (m) of the woody species of the *Indigofera praticola*-*Colophospermum mopane* Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 56.3%.

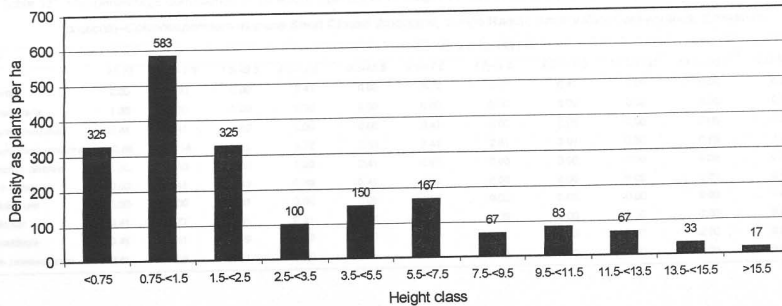


Figure 34. The density of the woody species in nine height classes (m) of the *Indigofera praticola*–*Colpospermum mopane* Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. Total plants per ha is 1 917.

Table 16. The percentage contribution of 10 woody species in 11 height classes to the total woody species composition in the *Indigofera praticola*-*Colophospermum mopane* Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Acacia tortilis</i>	0.00	0.00	0.00	0.41	0.00	0.00	0.41	0.41	0.00	0.00	0.00	1.23
<i>Cadaba termitaria</i>	1.30	4.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.1
<i>Combretum apiculatum</i>	0.41	0.41	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.00	1.23
<i>Colophospermum mopane</i>	10.85	19.14	9.13	1.72	5.63	7.41	2.61	3.91	3.50	0.89	1.72	66.51
<i>Dichrostachys cinerea</i>	1.30	0.89	0.89	1.30	0.41	0.00	0.00	0.00	0.00	0.00	0.00	4.79
<i>Diospyros quiloensis</i>	0.00	0.41	0.83	0.89	0.41	0.89	0.00	0.00	0.00	0.00	0.00	2.61
<i>Euclea divinorum</i>	0.00	0.00	2.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95
<i>Grewia bicolor</i>	0.41	1.72	0.41	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71
<i>Grewia monticola</i>	0.41	0.41	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71
<i>Rhigozum zambeziacum</i>	0.41	0.89	0.41	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	2.12

2.3 The *Thilachium africanum*–*Colophospermum mopane* Short Thicket

This short thicket is situated on the eastern half of Sango Ranch (Figures 9 and 35). The sub-community is represented by 20 relevés with an average of 26 species per relevé (range 16-44) (Table 7). The soils of this sub-community belong to the sandy 4U soil family, which lies on alluvium (Chapter 4; Table 7). Altitude varies between 450 m and 510 m and the terrain is a flat midslope with no surface stones or rocks (Table 7). No diagnostic herbaceous species are present in this sub-community (Table 7). Diagnostic woody species in this sub-community include *Thilachium africanum*, *Rhigozum zambesiicum* and *Balanites aegyptiaca*.

Structure of the woody layer

Histograms representing the percentage canopy cover and density for this sub-community are shown in Figures 36 and 37, respectively. The percentage contribution of woody species contributing >1% to the total woody species composition is depicted in Table 17. The highest canopy cover is evident in the 1.5-<2.5 m, 3.5-<5.5 m and 9.5-<11.5 m height classes (Figure 36) and the highest density is seen in the 0.75-<1.5 m class (Figure 37). A shrub-like *Colophospermum mopane* is responsible for the high cover values in these classes (Table 17). *Thilachium africanum* possesses the greatest density in the 0.75-<1.5 m height class (Table 17). Other species contributing to the high density in this height class include *C. mopane*, *Grewia bicolor*, *Cadaba termitaria* and *Tricalysia unodii* var. *kirkii* (Table 17). The highest tree layer that qualifies as the dominant layer according to Edwards (1983) consists of *Colophospermum mopane* and lies in the 9.5-<11.5 m class (Figure 36, Table 17). The very high total canopy cover (71.5%; Figure 36), total density (2 595 individuals/ha; Figure 37) and the high shrub cover results in the classification into a short thicket structure (Edwards 1983).

2.4 The *Ruellia patula*–*Colophospermum mopane* Tall Closed Woodland

This tall closed woodland runs in a north-south strip in the centre of Sango Ranch and crosses over into the Umkondo Lease (Figures 9 and 38). It is represented by 23 relevés with an average of 21 species per relevé (range 13-31) (Table 7). The dominant soils in this sub-community are classified into the heavily textured 4S soil family that is derived from the Umkondo Shales and Lavas (Chapter 4; Table 7). Altitude varies between 470 m and 560 m and the



Figure 35. The *Thilachium africanum*–*Colophospermum mopane* Short Thicket on Sango Ranch, Save Valley Conservancy, Zimbabwe.

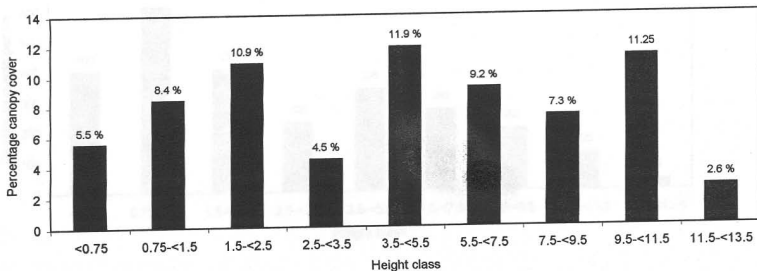


Figure 37. The density of the woody species in nine height classes of the *Thilachium africanum*-*Colophospermum mopane* Short

Figure 36. The percentage canopy cover in nine height classes (m) of the woody species of the *Thilachium africanum*-*Colophospermum mopane* Short Thicket, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 71.5 %.

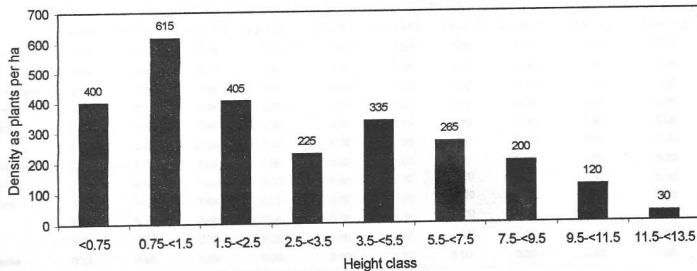


Figure 37. The density of the woody species in nine height classes of the *Thilachium africanum*–*Colophospermum mopane* Short Thicket, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 2 595.

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Table 17. The percentage contribution of 12 woody species in 11 height classes to the total woody species composition in the *Thilachium africanum*-*Colophospermum mopane* Short Thicket, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Balanites aegyptiaca</i>	0.39	0.58	0.39	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.55
<i>Cadaba termitaria</i>	1.16	3.47	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.40
<i>Colophospermum mopane</i>	4.05	4.62	8.86	7.51	11.18	10.02	7.32	4.43	1.16	0.00	0.00	59.15
<i>Commiphora merkeri</i>	0.00	0.19	0.00	0.00	0.58	0.00	0.00	0.19	0.00	0.00	0.00	0.96
<i>Diospyros quiloensis</i>	0.19	0.58	0.96	0.39	0.58	0.19	0.00	0.00	0.00	0.00	0.00	2.89
<i>Grewia bicolor</i>	0.77	3.28	0.39	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.63
<i>Rhigozum zambeziacum</i>	0.00	0.19	0.58	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	1.16
<i>Salvadora australis</i>	0.00	0.00	1.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.93
<i>Thilachium africanum</i>	1.35	5.59	0.96	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.09
<i>Tricalysia junodii</i>	4.24	3.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.71
<i>Ximenia caffra</i>	0.77	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96
<i>Zanthoxylum capense</i>	0.19	0.96	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.34

terrain is a mostly flat midslope (Table 7). Surface rocks are almost absent with a few areas having large rocks lying on the soil surface. The herbaceous layer here is recognised the diagnostic *Ruellia patula* and by the non-diagnostic *Plectranthus caninus*, *Pavonia burchellii* and *Sporobolus festivus* (Table 7). The woody layer contains no diagnostic species.

Structure of the woody layer

Histograms showing the percentage canopy cover and density for this sub-community are presented in Figures 39 and 40, respectively. The percentage contribution of woody species contributing >1% to the total woody species composition is depicted in Table 18. The highest canopy cover is evident in the 5.5-<7.5 m height class (Figure 39) and the highest density is seen in the 0.75-<1.5 m class (Figure 40). *Colophospermum mopane* is responsible for the high cover values in the 5.5-<7.5 m class (Table 18). *Grewia bicolor* and *Colophospermum mopane* possess the greatest density in the 0.75-<1.5 m height class (Table 18). The highest tree layer that qualifies as the dominant layer according to Edwards (1983) consists of *Colophospermum mopane* and lies in the >15.5 m class (Figure 39, Table 18). The high total canopy cover (47.9%; Figure 39), high total density of plants (1 849 individuals/ha; Figure 40) and the dominance of a tall layer thus results in the classification into a tall closed woodland structure with a low thicket component (Edwards 1983).

3. The *Combretum apiculatum* subsp. *apiculatum*–*Colophospermum mopane* Short Closed Woodland

This short closed woodland consists of low hills scattered within the *Ruellia patula*–*Colophospermum mopane* Short Thicket Sub-community and also lies in a narrow band in the north-west of Sango Ranch (Figures 9 and 41). The community is represented by eight relevés with an average of 18 species per relevé (range 14-23) (Table 7). The soils of this community belong to the 4S and 4PE soil families (Chapter 4; Table 7). The geology of the low hills and outcrops on which the community lies varies from gneiss and granite to conglomerate and limestone (Table 7). The altitude of these low hills varies between 540 m and 600 m. Large stones and rocks are found on the soil surface. The vegetation here is sometimes severely overutilised and trampling and erosion are slight to moderate. The dominant general species evident are *Hibiscus micrantha* and *Pupalia lappacea* var. *velutina* (Table 7). This community may be recognised by the presence of a combination of the diagnostic *Combretum apiculatum* subsp. *apiculatum* and the general *Colophospermum mopane*. Other important diagnostic

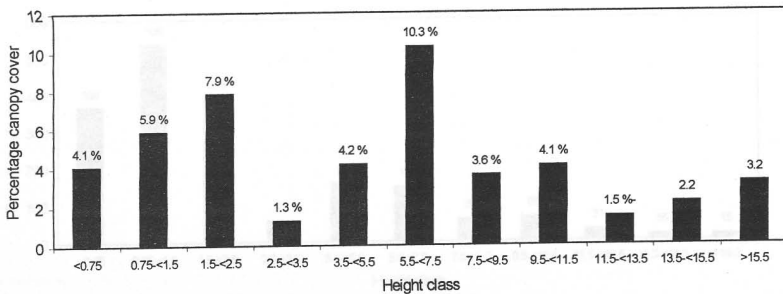


Figure 39. The percentage canopy cover in 11 height classes (m) of the woody species of the *Ruellia patula*-*Colophospermum mopane* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 47.9 %.

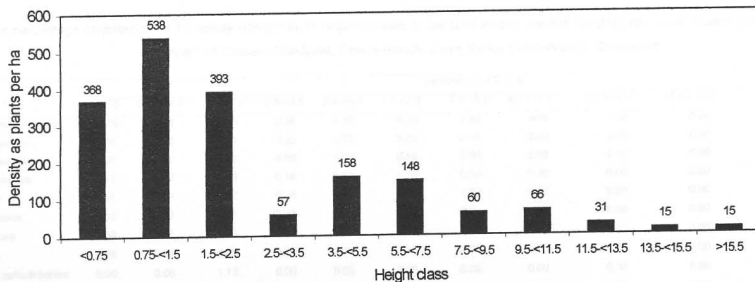


Figure 40. Density of the woody species in 11 height classes (m) of the *Ruellia patula*–*Colophospermum mopane* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha 1849.

Table 18. The percentage contribution of 11 woody species in 11 height classes to the total woody species composition in the *Ruellia patula*–*Colophospermum mopane* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Colophospermum mopane</i>	10.05	8.16	8.35	2.25	7.15	5.76	2.52	3.31	1.50	0.91	0.91	50.84
<i>Commiphora africana</i>	0.38	0.75	0.16	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	1.44
<i>Commiphora merkeri</i>	1.07	0.00	0.38	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	1.60
<i>Diospyros quiloensis</i>	0.16	0.47	1.56	0.16	1.71	0.38	0.00	0.00	0.00	0.00	0.00	4.42
<i>Grewia bicolor</i>	2.31	6.04	4.22	0.38	0.16	0.00	0.00	0.00	0.00	0.00	0.00	13.09
<i>Grewia flavescens</i>	0.16	0.69	0.91	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.14
<i>Grewia monticola</i>	0.00	0.75	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.95
<i>Grewia villosa</i>	0.38	3.04	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.79
<i>Gymnosporia putterlickoides</i>	0.00	0.00	1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13
<i>Thilachium africanum</i>	0.47	1.12	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50
<i>Tricalysia junodii</i>	1.93	5.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.05

woody species are *Acacia erubescens*, *Combretum imberbe*, *Azelia quanzensis*, *Phyllanthus reticulatus*, *Acacia nigrescens* and *Kirkia acuminata*. The community appears to be ecotonal area between community 2 and community 4.

Structure of the woody layer

Histograms showing the percentage canopy cover and density for this sub-community are presented in Figures 42 and 43, respectively. The percentage contribution of woody species contributing >1% to the total woody species composition is depicted in Table 19. The highest canopy cover is evident in the 1.5-<2.5 m height class (Figure 42) and the highest density is seen in the 0.75-<1.5 m and 1.5-<2.5 m classes (Figure 43). *Combretum apiculatum* subsp. *apiculatum*, *Grewia bicolor*, *G. flavescens* var. *flavescens* and *Phyllanthus reticulatus* contribute to the cover and density values in these classes (Table 19). The highest tree layer that qualifies as the dominant layer according to Edwards (1983) consists of *Combretum apiculatum* subsp. *apiculatum* and *Commiphora mollis* and lies in the 7.5-<9.5 m class (Figure 42, Table 19). The total canopy cover, total density (32.8 %, Figure 42; 926 individuals/ha, Figure 43, respectively) and the dominance of short tree layer results in a short closed woodland structure with a low thicket component .

4. The *Combretum apiculatum* subsp. *apiculatum*–*Digitaria milanjiana* Tall Closed Woodland

The *Combretum apiculatum* subsp. *apiculatum*–*Digitaria milanjiana* Short Closed Woodland lies on the western side of Sango Ranch (Figures 9 and 44). The community is represented by 56 relevés with an average of 24 species per relevé (range 12-38) (Table 8). The soils of this plant community vary from acidic shallow light soils to neutral and alkaline deeper heavy textured soils that belong to the 5G and 4PE soil families, respectively (Chapter 4; Table 8). These soils are derived from granite and gneiss (Chapter 4; Table 8). This community lies at 460 m and 650 m (Table 8). The terrain is mostly broken and rocky with scattered castle koppies and inselbergs of the *Millettia usumarensis* subsp. *australis*–*Brachiaria deflexa* Short Koppie Thicket Community. The vegetation is locally overutilised and trampled, and severe erosion occurs in one area. No diagnostic herbaceous species are found in this community (Table 8). The dominant species include *Urochloa mosambicensis*, *Chamaecrista absus*, *Panicum maximum*, *Brachiaria deflexa* and *Digitaria milanjiana*. The woody layer is characterised by the diagnostic

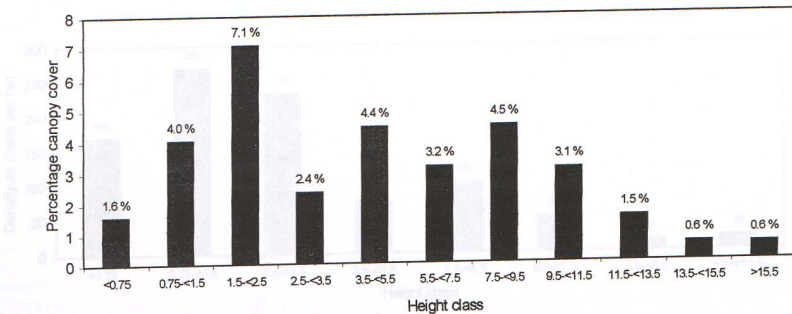


Figure 42. The percentage canopy cover in 11 height classes (m) of the woody species of the *Combretum apiculatum* subsp. *apiculatum*-*Colpospermum mopane* Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 32.8 %.

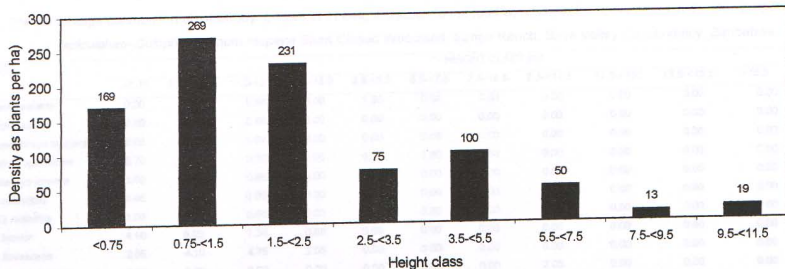


Figure 43. The densities of the woody species in nine height classes (m) of the *Combretum apiculatum* subsp. *apiculatum*-*Colphospermum mopane* Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 926.

Table 19. The percentage contribution of 14 woody species in 11 height classes to the total woody species composition in the *Combretum apiculatum* subsp. *apiculatum*–*Colophospermum mopane* Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Acacia erubescens</i>	0.00	0.66	0.66	0.00	1.30	0.66	0.00	0.00	0.00	0.00	0.00	3.28
<i>Canthium glaucum</i>	0.00	0.66	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32
<i>Colophospermum mopane</i>	2.05	0.66	1.94	0.00	0.00	0.66	0.00	0.00	0.00	0.00	0.00	5.31
<i>Combretum apiculatum</i>	2.70	3.50	3.50	4.90	6.70	1.30	0.66	0.00	0.00	0.00	0.00	23.26
<i>Dichrostachys cinerea</i>	0.00	3.50	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.16
<i>Ehretia obtusifolia</i>	0.66	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32
<i>Gardenia resiniflua</i>	0.00	0.66	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32
<i>Grewia bicolor</i>	4.10	8.00	7.34	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32
<i>Grewia flavescens</i>	2.05	4.10	4.75	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.10
<i>Lannea schweinfurthii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.05	0.00	0.00	0.00	12.95
<i>Phyllanthus reticulatus</i>	5.40	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.05
<i>Strychnos madagascariensis</i>	0.66	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.00	0.00	0.00	7.45
<i>Thilachium africanum</i>	0.66	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32
<i>Tricalysia junodii</i>	0.00	1.30	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32
												3.35

species *Combretum apiculatum* subsp. *apiculatum*. The dominant woody species is *Diospyros quiloensis*.

Structure of the woody layer

The canopy cover and density for the woody layer of this community are depicted as histograms in Figures 45 and 46, respectively. The contribution of woody species contributing >1% to the total woody species composition in the various height classes is presented in Table 20. It is clear from Figure 45 that the highest canopy cover is found in the 1.5-<2.5 m height class. The highest density is observed in the 0.75-<1.5 m and 1.5-<2.5 m classes (Figure 46). The woody species contributing mostly to the canopy cover and density in these height classes are *Combretum apiculatum* subsp. *apiculatum*, *Grewia monticola* and *Phyllanthus reticulatus* (Table 20). The highest tree layer that qualifies as the dominant layer according to Edwards (1983) consists of *Acacia nigrescens* and lies in the >15.5 m class (Figure 45., Table 20). Total canopy cover and density are fairly high (34.8 %, Figure 45 and 1 032 individuals/ha, Figure 46) and this community is thus classified as a tall closed woodland with a low thicket component (Edwards 1983).

The *Combretum apiculatum* subsp. *apiculatum*–*Digitaria milaniana* Tall Closed Woodland can be sub-divided into three sub-communities:

4.1 The *Dalbergia melanoxylon*–*Combretum apiculatum* subsp. *apiculatum* Short Closed Woodland

This short closed woodland lies on the western side of Sango Ranch (Figures 9 and 47) and is represented by 13 relevés with an average of 21 species per relevé (range 12-32) (Table 8). The soils of this sub-community belong to the 4PE soil family, are light to heavy textured and are sometimes acidic (Chapter 4; Table 8). The soils are derived from gneiss, granite and dolerite (Table 8). This sub-community lies on an undulating and sometimes rocky and broken upland terrain at 560 m to 605 m (Table 8). This sub-community is characterised by the diagnostic species *Gardenia resiniflua*, *Dalbergia melanoxylon* and *Acacia gerrardii* (Table 8).

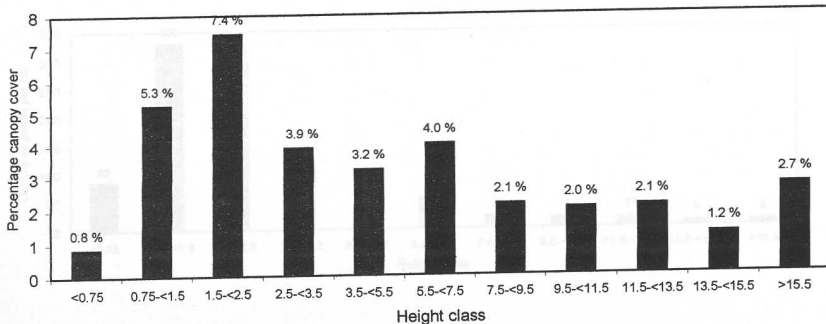


Figure 45. The percentage canopy cover in 11 height classes (m) of the woody species of the *Combretum apiculatum* subsp. *apiculatum*-*Digitaria milanijana* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 34.8 %.

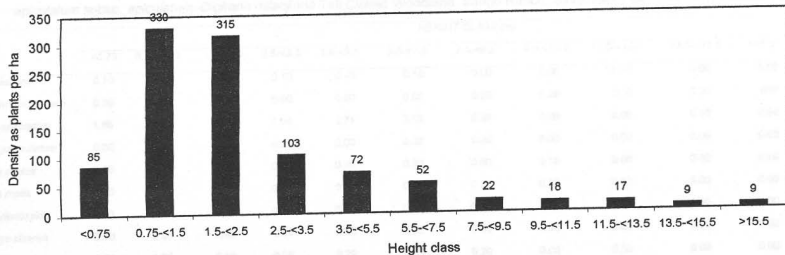


Figure 46. The density of the woody species in nine height classes (m) of the *Combretum apiculatum* subsp. *apiculatum*–*Digitaria milanjana* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 1032.

Table 20. The percentage contribution of 25 woody species in 11 height classes to the total woody species composition in the *Combretum apiculatum* subsp. *apiculatum*–*Digitaria milanijana* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Acacia erubescens</i>	0.10	0.10	0.00	0.10	0.49	0.10	0.00	0.00	0.10	0.00	0.00	0.99
<i>Colophospermum mopane</i>	0.30	0.40	0.39	0.00	0.00	0.00	0.20	0.20	0.70	0.20	0.10	2.49
<i>Combretum apiculatum</i>	1.65	4.10	5.04	1.94	2.71	2.13	0.39	0.29	0.00	0.10	0.00	18.35
<i>Combretum paniculatum</i>	0.00	1.45	1.74	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.58
<i>Commiphora edulis</i>	0.20	0.48	0.20	0.00	0.20	0.39	0.00	0.10	0.00	0.00	0.00	1.57
<i>Commiphora mollis</i>	0.10	0.10	0.00	0.00	0.00	0.48	0.20	0.29	0.00	0.00	0.00	1.17
<i>Dalbergia melanoxylon</i>	0.40	0.58	0.48	0.20	0.10	0.00	0.00	0.00	0.00	0.00	0.00	1.76
<i>Dichrostachys cinerea</i>	0.70	2.33	0.80	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.22
<i>Diospyros quiloensis</i>	0.30	1.00	0.10	0.29	0.29	0.29	0.20	0.00	0.00	0.00	0.00	2.47
<i>Grewia bicolor</i>	0.00	0.29	0.48	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.87
<i>Grewia gracillima</i>	0.00	0.00	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48
<i>Grewia flavescens</i>	0.10	1.40	2.33	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	4.03
<i>Grewia monticola</i>	0.30	4.36	3.50	0.58	0.39	0.00	0.00	0.00	0.00	0.00	0.00	9.13

Table 20 continued. The percentage contribution of 25 woody species in 11 height classes to the total woody species composition in the *Combretum apiculatum* subsp. *apiculatum*–*Digitaria milanjana* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

Species	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Gymnosporia buxifolia</i>	0.00	0.40	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
<i>Gymnosporia putterlickoides</i>	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
<i>Kirkia acuminata</i>	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.10	0.39	0.10
<i>Lannea schweinfurthii</i>	0.10	0.10	0.10	0.10	0.10	0.10	0.00	0.10	0.58	0.00	0.00	1.28
<i>Markhamia zanzibarica</i>	1.00	1.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.29
<i>Millettia usumarensis</i>	0.00	0.87	2.23	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.30
<i>Monodora junodii</i>	0.00	0.48	1.00	0.58	0.39	0.00	0.00	0.00	0.00	0.00	0.00	2.45
<i>Mundulea sericea</i>	0.80	0.20	0.20	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.36
<i>Phyllanthus reticulatus</i>	0.58	3.39	4.36	0.29	0.10	0.00	0.00	0.00	0.00	0.00	0.00	8.72
<i>Strychnos madagascariensis</i>	0.10	0.39	0.58	0.20	0.10	0.00	0.00	0.00	0.00	0.00	0.00	1.37
<i>Tricalysia junodii</i>	0.20	0.70	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.29
<i>Ziziphus mucronata</i>	0.10	0.29	0.29	0.10	0.00	0.10	0.20	0.00	0.00	0.00	0.00	1.37

Structure of the woody layer

The canopy cover and density in the woody layer (above) are depicted in Figure 46 and 47, respectively. Table 20 shows the percentage contribution of woody species representing 41% of the total woody biomass (above) in the various height classes. Figure 48 shows the 1000 m² plot. The canopy is based on the 1.5–2.5 m height class, while Figure 49 shows the six species density values in the 1.5–2.5 m and 1.5–2.5 m classes. The woody layer structure varied with a tall tree component (9.5–11.5 m) including a range of *Acacia* spp. (*A. drepanolobium* subsp. *apiculatum* and *Combretum apiculatum* subsp. *apiculatum*), *Euphorbia* spp. (*E. capensis* and *E. hirsuta*), *Commersonia bartramia*, *Combretum apiculatum* subsp. *apiculatum* and *Grass* (*Stylosanthes* spp.) in the greater canopy cover and density (Figure 46). The highest tree cover the grasses as the dominant



woody species, *Combretum apiculatum* and *Dalbergia melanoxylon* (Figure 47). The canopy cover and density in the woody layer (above) are depicted in Figure 46 and 47, respectively. Table 20 shows the percentage contribution of woody species representing 41% of the total woody biomass (above) in the various height classes. Figure 48 shows the 1000 m² plot. The canopy is based on the 1.5–2.5 m height class, while Figure 49 shows the six species density values in the 1.5–2.5 m and 1.5–2.5 m classes. The woody layer structure varied with a tall tree component (9.5–11.5 m) including a range of *Acacia* spp. (*A. drepanolobium* subsp. *apiculatum* and *Combretum apiculatum* subsp. *apiculatum*), *Euphorbia* spp. (*E. capensis* and *E. hirsuta*), *Commersonia bartramia*, *Combretum apiculatum* subsp. *apiculatum* and *Grass* (*Stylosanthes* spp.) in the greater canopy cover and density (Figure 46). The highest tree cover the grasses as the dominant

Structure of the woody layer

The canopy cover and density in the woody layer (above) are depicted in Figure 46

Figure 47. The *Dalbergia melanoxylon*–*Combretum apiculatum* subsp. *apiculatum* Short Closed Woodland on Sango Ranch, Save Valley Conservancy, Zimbabwe.

Structure of the woody layer

The canopy cover and density in the various height classes are depicted in Figures 48 and 49, respectively. Table 21 shows the percentage contribution of woody species contributing >1% to the total woody species composition in the various height classes. Figure 48 shows that the greatest canopy cover is found in the 1.5-<2.5 m height class, while Figure 49 shows that the greatest density occurs in the 0.75-<1.5 m and 1.5-<2.5 m classes. The community is thus fairly closed with a tall tree component (9.5-<11.5m) consisting mainly of *Combretum apiculatum* subsp. *apiculatum* and *Commiphora mollis* (Table 21). *Combretum apiculatum* subsp. *apiculatum* and *Grewia monticola* are responsible for the greatest canopy cover and density figures (Table 21). The highest tree layer that qualifies as the dominant layer according to Edwards (1983) consists of *Combretum apiculatum* subsp. *apiculatum*, *Colophospermum mopane*, *Commiphora mollis* and *Lannea schweinfurthii* and lies in the 9.5-<11.5 m class (Figure 48, Table 21). The total canopy cover (38.2 %, Figure 48) and total density (1 173 individuals/ha, Figure 49) result in the classification of this sub-community as a short closed woodland with a low thicket component (Edwards 1983).

4.2 The *Commiphora africana*-*Digitaria milanjiana* Tall Closed Woodland

This tall closed woodland is scattered throughout the *Combretum apiculatum* subsp. *apiculatum*-*Digitaria milanjiana* Tall Closed Woodland and the *Colophospermum mopane*-*Brachiaria deflexa* Short Thicket // Short Closed Woodland and possesses a patchy distribution (Figures 9 and 50). This sub-community is represented by 27 relevés with an average of 26 species per relevé (range 21-33) (Table 8). The terrain is a broken upland that is sometimes rocky (Table 8). The soils are mainly derived from gneiss, dolerite, granulite and lava and belong to the 5G and 4PE soil families (Chapter 4, Table 8). The soils vary from shallow light coarse-grained soils on gneiss, granulite and lava to deeper light textured fine to medium soils on gneiss (Chapter 4). The altitude varies between 515 m and 615 m. The herbaceous layer is characterised by the diagnostic *Tephrosia purpurea* subsp. *leptostachya* var. *pubescens*, *Heliotropum strigosum*, *Sporobolus nitens* as well as *Ipomoea sinensis* subsp. *blepharosephala* (Table 8). No diagnostic woody species are present.

Structure of the woody layer

The canopy cover and density for the various height classes are depicted in Figures 51 and 52. The contribution of woody species contributing >1% to the total

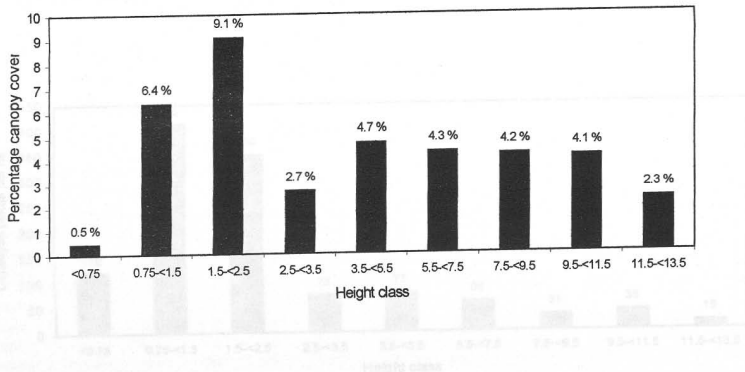


Figure 48. The percentage canopy cover in nine height classes (m) of the woody species of the *Dalbergia melanoxylon*–*Combretum apiculatum* subsp. *apiculatum* Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 38.2 %.

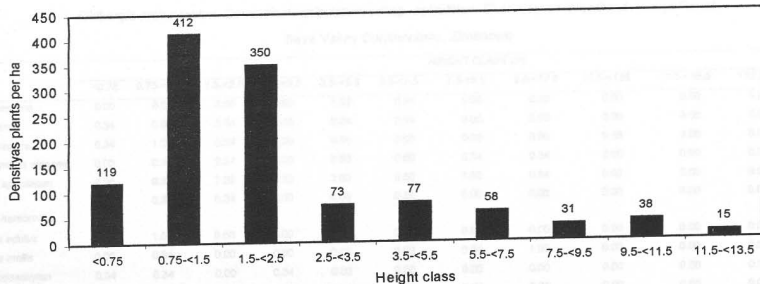


Figure 49. The density of the woody species in nine height classes (m) of the *Dalbergia melanoxylon-Combretum apiculatum* subsp. *apiculatum* Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 1 173.

Table 21. The percentage contribution of 23 woody species in 11 height classes to the total woody species composition in the *Dalbergia melanoxylon*–*Combretum apiculatum* subsp. *apiculatum* Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Acacia erubescens</i>	0.00	0.00	0.00	0.00	1.02	0.34	0.00	0.00	0.00	0.00	0.00	1.36
<i>Acacia gerrardii</i>	0.34	0.00	0.34	0.00	0.34	0.34	0.00	0.00	0.00	0.00	0.00	1.60
<i>Acacia nigrescens</i>	0.34	1.28	0.34	0.00	0.00	0.00	0.00	0.00	0.68	0.00	0.00	2.64
<i>Colophospermum mopane</i>	0.00	0.34	0.34	0.00	0.00	0.00	0.34	0.34	0.00	0.00	0.00	1.36
<i>Combretum apiculatum</i>	4.26	6.91	7.25	3.32	3.60	3.60	1.02	0.34	0.00	0.00	0.00	30.30
<i>Combretum hereorense</i>	0.00	0.34	0.34	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.00	1.02
<i>Commiphora edulis</i>	0.34	1.02	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.36
<i>Commiphora mollis</i>	0.00	0.34	0.00	0.00	0.00	0.00	0.34	1.02	0.00	0.00	0.00	1.70
<i>Dalbergia melanoxylon</i>	0.34	0.34	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02
<i>Dichrostachys cinerea</i>	1.62	0.00	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.64
<i>Diospyros quiloensis</i>	0.34	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.36

Table 21 continued. The percentage contribution of 23 woody species in 11 height classes to the total woody species composition in the *Dalbergia melanoxylon*-*Combretum apiculatum* subsp. *apiculatum* Short Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Grewia bicolor</i>	0.00	0.68	1.02	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	2.04
<i>Grewia flavescens</i>	0.00	2.98	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.41
<i>Grewia monticola</i>	0.68	5.29	3.24	0.68	0.68	0.00	0.00	0.00	0.00	0.00	0.00	10.57
<i>Gymnosporia buxifolia</i>	0.00	1.30	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.64
<i>Lannea schweinfurthii</i>	0.00	0.34	0.00	0.34	0.34	0.00	0.00	0.34	0.68	0.00	0.00	2.04
<i>Markhamia zanzibarica</i>	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02
<i>Millettia usumarensis</i>	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34
<i>Monodora junodii</i>	0.00	1.02	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.04
<i>Ormocarpum trichocarpum</i>	0.34	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02
<i>Strychnos madagascariensis</i>	0.34	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.36
<i>Xeroderris stuhlmani</i>	0.34	0.34	0.00	0.00	0.00	0.00	0.34	0.00	0.00	0.00	0.00	1.02
<i>Ziziphus mucronata</i>	0.00	0.68	0.00	0.00	0.00	0.34	0.68	0.00	0.00	0.00	0.00	1.74



Figure 50. The *Commiphora africana*–*Digitaria milanjiana* Tall Closed Woodland on Sango Ranch, Save Valley Conservancy, Zimbabwe.

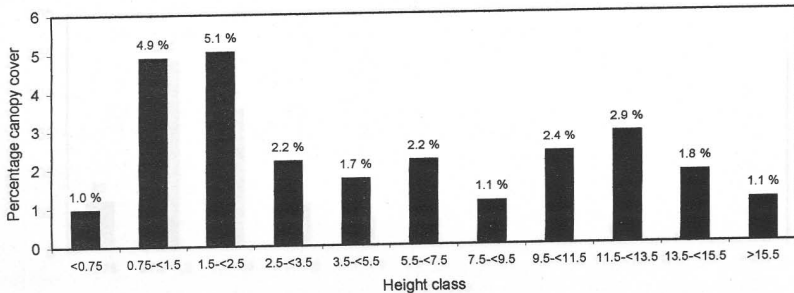


Figure 51. The canopy of the woody species in 11 height classes (m) of the *Ipomoea sinensis* subsp. *blepharosephala* – *Digitaria milanijana* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

The percentage canopy cover in 11 height classes (m) of the woody species of the *Ipomoea sinensis* subsp. *blepharosephala* – *Digitaria milanijana* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 26.2 %.

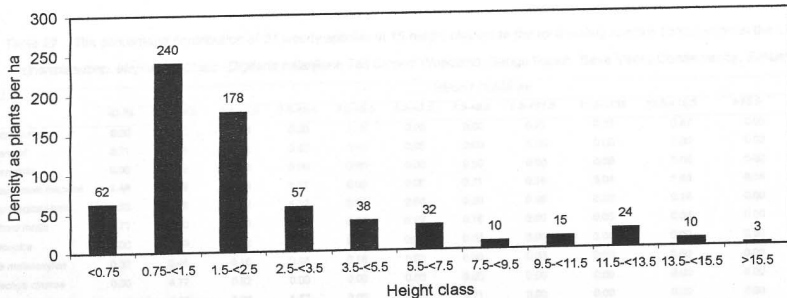


Figure 52. The density of the woody species in 11 height classes (m) of the *Ipomoea sinensis* subsp. *blepharosephala* – *Digitaria milanjana* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 669.

Table 22. The percentage contribution of 23 woody species in 15 height classes to the total woody species composition in the *Ipomoea sinensis* subsp. *blepharosephala* – *Digitaria milanjiana* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Acacia nigrescens</i>	0.00	0.00	0.16	0.00	0.16	0.00	0.00	0.71	0.77	0.87	0.00	2.67
<i>Albizia harveyi</i>	0.71	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.41
<i>Cissus cornifolia</i>	0.00	2.82	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.98
<i>Colophospermum mopane</i>	1.48	4.22	0.46	1.17	0.00	0.00	0.71	0.16	3.04	1.63	0.16	12.07
<i>Combretum apiculatum</i>	1.50	3.66	7.32	4.32	5.30	2.66	0.00	0.46	0.00	0.16	0.00	25.37
<i>Commiphora mollis</i>	0.71	0.00	0.00	0.00	0.00	0.87	0.16	0.00	0.00	0.00	0.00	1.74
<i>Cordia monoica</i>	0.00	0.00	0.62	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.93
<i>Dalbergia melanoxylon</i>	0.32	0.46	0.16	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00	1.08
<i>Dichrostachys cinerea</i>	0.00	4.77	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.39
<i>Diospyros quiloensis</i>	0.62	0.62	0.62	1.57	0.00	0.00	0.71	0.00	0.00	0.00	0.00	4.27
<i>Grewia flavescens</i>	0.00	1.48	3.05	0.32	0.16	0.00	0.00	0.00	0.00	0.00	0.00	5.01
<i>Grewia monticola</i>	0.32	9.61	7.86	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.41
<i>Phyllanthus reticulatus</i>	1.63	2.21	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00
<i>Tricalysia junodii</i>	0.16	1.64	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.95
<i>Ziziphus mucronata</i>	1.41	0.00	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.73

woody species composition is shown in Table 22. The highest canopy cover and density are evident in the 0.75-<1.5 m and 1.5-<2.5 m height classes (Figure 51 and 52). *Colophospermum mopane*, *Combretum apiculatum* subsp. *africanum*, *Dichrostachys cinerea* subsp. *africana* and *Grewia monticola* contribute to these height classes (Table 22). The highest tree layer that qualifies as the dominant layer according to Edwards (1983) consists of *Colophospermum mopane* and lies in the 11.5-<13.5 m class (Figure 51, Table 22). The total canopy cover (26.2 %, Figure 51), the total density (669 individuals/ha, Figure 52) and the tall tree layer result in the classification into a tall closed woodland with a short thicket component (Edwards 1983).

4.3 The *Kirkia acuminata*–*Panicum maximum* Tall Closed Woodland

This sub-community lies on the floodplain of the Makore River and also in the extreme north-west of Sango Ranch (Figures 9 and 53). The sub-community is represented by 15 relevés with an average of 26 species per relevé and a range of 13-38 (Table 8). The terrain in this sub-community consists of a rolling and sometimes broken and rocky valley (Table 8). The drainage lines are very deeply incised and dongas are evident, especially in west of the Makore River (Figure 3; Table 8). The herbaceous layer is overutilised in some areas with bare soil patches being evident. The soils are clayey, weakly saline-sodic, belong to the 8h soil family and are derived from gneiss and granite (Chapter 4, Table 8). The altitude of this sub-community varies between 520 m and 650 m. This sub-community is recognised by the diagnostic woody species *Tricalysia junodii* var. *kirkii* and *Kirkia acuminata* (Table 8).

Structure of the woody layer

Figures 54 and 55 show the canopy cover and density of this sub-community on the various height classes, respectively. Table 23 shows the percentage contribution of woody species contributing >1% to the total woody species composition in the various height classes. The highest canopy cover is found in the 1.5-<2.5 m and >15.5 m height classes (Figure 54), while the greatest density is observed in the 0.75-<1.5 m height class (Figure 55). *Combretum apiculatum* subsp. *apiculatum*, *C. mossambicense*, *C. paniculatum*, *Dichrostachys cinerea* subsp. *africana* and *Grewia monticola* contribute most towards these figures (Table 23). The highest tree layer qualifying as dominant (Edwards 1983) consists of *Kirkia acuminata* and lies in the <15.5 m class (Figure 54, Table 23). The total



Figure 53. The *Kirkia acuminata*–*Panicum maximum* Tall Closed Woodland on Sango Ranch, Save Valley Conservancy, Zimbabwe.

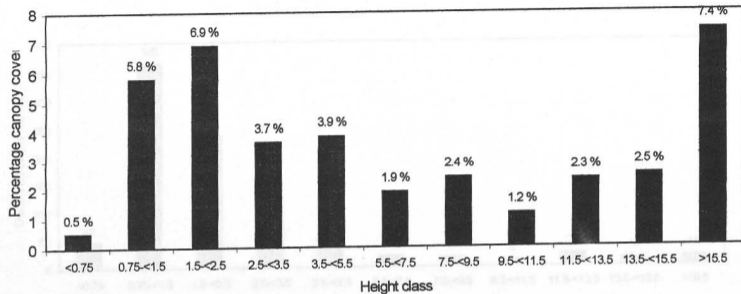


Figure 54. The percentage canopy cover in 11 height classes (m) of the woody species of the *Kirkia acuminata*–*Panicum maximum* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 38.4 %.

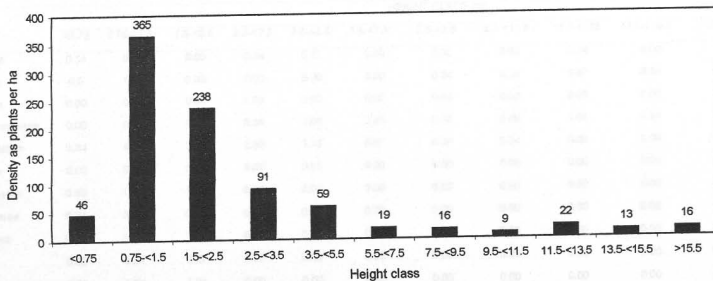


Figure 55. The density of the woody species in 11 height classes (m) of the *Kirkia acuminata*-*Panicum maximum* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 894.

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Table 23. The percentage contribution of 19 woody species in 11 height classes to the total woody species composition in the *Kirkia acuminata*-*Panicum maximum* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Acacia erubescens</i>	0.34	0.34	0.00	0.34	0.67	0.00	0.00	0.00	0.34	0.00	0.00	2.03
<i>Acacia nigrescens</i>	0.0	1.02	0.00	0.00	0.00	0.00	0.34	0.34	0.67	0.34	0.34	3.05
<i>Canthium glaucum</i>	0.00	0.00	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50
<i>Colophospermum mopane</i>	0.00	0.67	0.67	0.34	0.00	0.34	0.00	0.00	1.01	0.34	0.34	3.71
<i>Combretum apiculatum</i>	0.34	4.42	7.40	2.50	3.13	0.67	0.34	0.34	0.00	0.00	0.00	19.14
<i>Cordia grandicalyx</i>	0.00	0.34	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01
<i>Dalbergia melanoxylon</i>	0.68	1.70	1.80	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	4.52
<i>Dichrostachys cinerea</i>	0.34	3.02	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.70
<i>Diospyros quiloensis</i>	0.00	1.70	1.01	0.67	0.34	0.00	0.34	0.00	0.00	0.00	0.00	4.06
<i>Grewia bicolor</i>	0.00	0.34	0.67	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.68
<i>Grewia flavescens</i>	0.00	1.34	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.35

Table 23 continued. The percentage contribution of 19 woody species in 11 height classes to the total woody species composition in the *Kirkia acuminata*–*Panicum maximum* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Grewia monticola</i>	0.34	5.25	5.30	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.23
<i>Kirkia acuminata</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	1.01	1.35
<i>Lonchocarpus capassa</i>	0.00	0.34	0.34	0.00	0.00	0.00	0.34	0.00	0.00	0.00	0.00	1.02
<i>Monodora junodii</i>	0.00	0.34	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01
<i>Phyllanthus reticulatus</i>	1.34	0.00	0.67	1.50	0.34	0.00	0.00	0.00	0.00	0.00	0.00	3.85
<i>Strychnos madagascariensis</i>	0.00	0.34	0.67	0.67	0.34	0.00	0.00	0.00	0.00	0.00	0.00	2.02
<i>Tricalysia junodii</i>	0.34	0.34	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.18
<i>Ziziphus mucronata</i>	0.00	0.34	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.35

canopy cover (38.4%, Figure 54), the total density (894 individuals/ha, Figure 55) and the tall tree layer result in the classification into a tall closed woodland structure with a short thicket component (Edwards 1983).

5. The *Millettia usumarensis* subsp. *australis*–*Brachiaria deflexa* Short Koppie Thicket

The *Millettia usumarensis* subsp. *australis*–*Brachiaria deflexa* Short Koppie Thicket is found scattered throughout the *Combretum apiculatum* subsp. *apiculatum*–*Digitaria milanjiana* Tall Closed Woodland (Figures 9 and 56). An average of 22 species per relevé was recorded in 13 relevés (range 10-32) (Table 8). This community lies on the koppies that are scattered throughout the western side of Sango Ranch (Figure 9). The steep-sided koppies are extremely rocky and vary in altitude from 580 m and 650 m (Table 8). The soils are very shallow and coarse-grained and are grouped into the 5G soil family, derived from granite and gneiss (Chapter 4, Table 8). These soils are leached and therefore acidic and infertile (Chapter 4). This community can be recognised by the diagnostic species *Millettia usumarensis* subsp. *australis* (Table 8). *Brachiaria deflexa* dominates the herbaceous layer, while *Kirkia acuminata* and *Combretum apiculatum* subsp. *apiculatum* also dominate. Other dominant species in this community include *Grewia gracillima*, *Combretum mossambicense*, *C. microphyllum*, *Monodora junodii*, *Markhamia zanzibarica*, *Julbernardia* sp., *Artabotrys brachypetalus*, *Vitex isotjensis*, *Vitex buchananii*, *Diospyros lycioides* subsp. *sericea*, *Stadmannia oppositifolia*, *Mundulea sericea*, *Ficus tettensis*, *F. abutilifolia* and *Euphorbia confinalis*.

Structure of the woody layer

Canopy cover and density are depicted as histograms in Figures 57 and 58, respectively. The contribution of woody species with value >1% to the total woody species composition is shown in Table 24. The highest canopy cover is evident in the 1.5-<2.5 m height class (Figure 57). *Millettia usumarensis* subsp. *australis* reaches its highest density and canopy cover in the 1.5-<2.5 m class (Figures 57 and 58; Table 24). The dominant height class is 5.5-<7.5 m (Edwards 1983) and consists of *Combretum apiculatum* subsp. *apiculatum* and *Commiphora mollis* (Table 24). The community is classified as a short thicket due to the high shrub cover in the 1.5-<2.5 m class and the short tree layer (Edwards 1983).



Figure 56. The *Millettia usumarensis* subsp. *australis*–*Brachiaria deflexa* Short Koppie Thicket on Sango Ranch, Save Valley Conservancy, Zimbabwe.

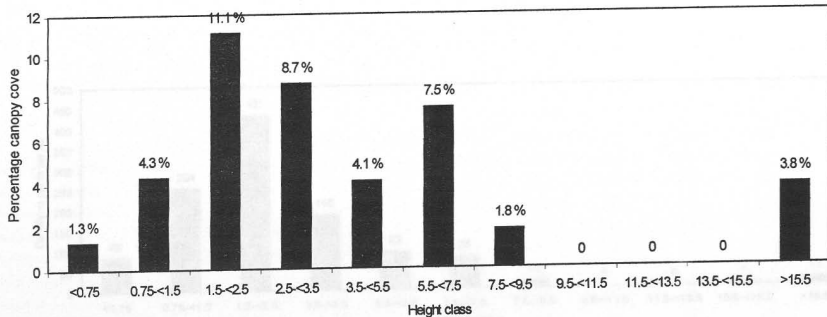


Figure 57. The percentage canopy cover in 11 height classes (m) of the woody species of the *Millettia usumarensis* subsp. *australis*-*Brachiaria deflexa* Short Koppie Thicket, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 42.7 %

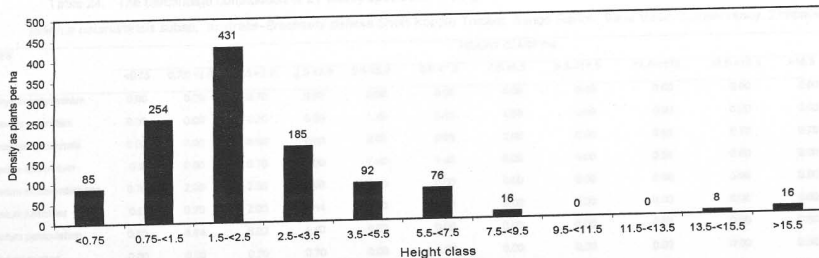


Figure 58. The density of the woody species in 11 height classes (m) of the *Millettia usumarensis* subsp. *australis*-*Brachiaria deflexa* Short Koppie Thicket, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 1163.

Table 24. The percentage contribution of 21 woody species in 11 height classes to the total woody species composition in the *Millettia usumarensis* subsp. *australis*-*Brachiaria deflexa* Short Koppie Thicket, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Artabotrys brachypetalus</i>	0.00	0.70	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40
<i>Brachylaena rotundata</i>	0.00	0.00	0.70	0.00	1.40	0.00	0.00	0.00	0.00	0.00	0.00	2.10
<i>Brachystegia spiciformis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.70	1.40
<i>Combretum apiculatum</i>	0.0	0.00	0.70	0.00	1.40	1.40	0.00	0.00	0.00	0.00	0.00	3.50
<i>Combretum mossambicense</i>	0.70	2.00	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.30
<i>Combretum padoides</i>	0.0	0.70	2.00	3.44	1.40	0.00	0.00	0.00	0.00	0.00	0.00	7.54
<i>Combretum paniculatum</i>	0.00	6.64	6.02	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.06
<i>Combretum zeyheri</i>	0.00	0.00	0.70	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40
<i>Commiphora mollis</i>	0.00	0.00	0.00	0.00	0.00	1.40	0.00	0.00	0.00	0.00	0.00	1.40
<i>Diospyros lycioides</i>	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00
<i>Diospyros quiloensis</i>	0.00	0.00	0.00	0.00	0.70	0.70	0.00	0.00	0.00	0.00	0.00	1.40

Table 24 continued. The percentage contribution of 21 woody species in 11 height classes to the total woody species composition in the *Millettia usumarensis* subsp. *australis*-*Brachiaria deflexa* Short Koppie Thicket, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<135	13.5-<15.5	>15.5	
<i>Ficus abutilifolia</i>	0.00	0.00	0.00	0.00	0.70	0.70	0.00	0.00	0.00	0.00	0.00	1.40
<i>Grewia gracillima</i>	0.00	0.70	2.00	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.10
<i>Grewia monticola</i>	0.00	0.00	0.70	0.70	0.70	0.00	0.00	0.00	0.00	0.00	0.00	2.10
<i>Millettia usumarensis</i>	0.00	2.00	7.91	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.61
<i>Monodora junodii</i>	0.00	0.70	2.00	2.00	1.40	0.00	0.00	0.00	0.00	0.00	0.00	6.10
<i>Mundulea sericea</i>	2.70	0.70	0.70	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.10
<i>Phyllanthus reticulatus</i>	0.00	2.00	9.30	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.30
<i>Vitellariopsis ferruginea</i>	0.00	0.70	0.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40

6. The *Acacia tortilis* subsp. *heteracantha*–*Panicum maximum* Tall Closed Woodland

This tall closed woodland lies to the west of the Save River and runs along the length of the river (Figures 9 and 59). An average of 16 species was recorded in nine relevés (range 11-24) (Table 9). This community is situated on the flat alluvium that lies adjacent to the Save River (Figure 9). The alluvium contains an extensive aquifer that is fed by the Save River (Chapter 2). The soils are sandy and deep, being moist at 1.2 m depth (Chapter 4). The soils belong to the 4U soil family (Table 9). Altitude varies between 430 m and 540 m. This community can be recognised by the diagnostic *Acacia tortilis* subsp. *heteracantha* which forms an almost closed canopy (Table 9). *Grewia flavescens* var. *flavescens*, *Acacia gelpinii*, *Acacia schweinfurthii*, *Dichrostachys cinerea* subsp. *africana* and *Grewia inaequilatera* are dominant species. No diagnostic herbaceous species exist in this community. *Panicum maximum* is the dominant herbaceous species (Table 9).

Structure of the woody layer

The canopy cover and density are represented in Figures 60 and 61, respectively. The percentage contribution of the woody species with value >1% in the various height classes to the total woody species composition is depicted in Table 25. The greatest canopy cover is found in the 1.5-<2.5 m height class (Figure 60), and the highest density is seen in the 0.75-<1.5 m and 1.5-<2.5 m classes (Figure 61). *Anisotes formosissimus*, *Acacia schweinfurthii*, *Grewia flavescens* var. *flavescens* and *G. inaequilatera* are responsible for the high canopy cover and density in these height classes (Table 25). The >15.5 m height class qualifies as the dominant layer (Edwards 1983) and consists of *Acacia tortilis* subsp. *heteracantha* (Figure 60, Table 25). The high canopy cover (53.2%, Figure 60), density (778 individuals/ha, Figure 63) and high dominant tree layer result in the classification as a tall closed woodland with a low thicket component (Edwards 1983).

7. The *Dalbergia arbutifolia*–*Diospyros mespiliformes* High Riverine Forest

This high riverine forest is located on the banks of the major rivers such as the Save, Makore, Msaizi and Saindota, and some of the smaller rivers and streams (Figures 9 and 62). It is represented by 12 relevés with an average of 10 species per relevé (range 3-18) (Table 9). The alluvium of this community is mostly flat, but in some areas the banks have been washed away forming steep slopes (Table 9). Within the bed of the Save River, sand deposition has formed a



Figure 59. The *Acacia tortilis* subsp. *heteracantha*–*Panicum maximum* Tall Closed Woodland on Sango Ranch, Save Valley Conservancy, Zimbabwe.

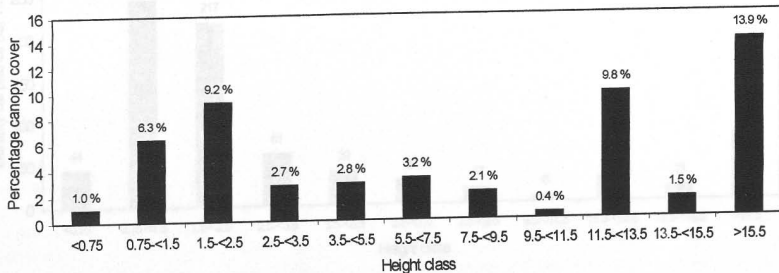


Figure 60. The percentage canopy cover in 11 height classes (m) of the woody species of the *Acacia tortilis* subsp. *heteracantha*-*Panicum maximum* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 53.2 %.

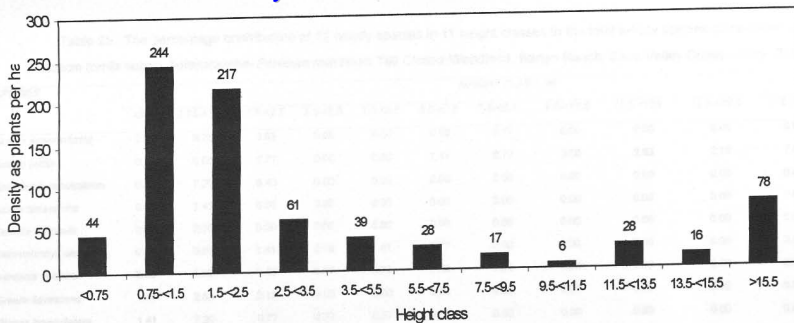


Figure 61. The density of the woody species in 11 height classes (m) of the *Acacia tortilis* subsp. *heteracantha*–*Panicum maximum* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 778.

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Table 25. The percentage contribution of 12 woody species in 11 height classes to the total woody species composition in the *Acacia tortilis* subsp. *heteracantha*–*Panicum maximum* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<135	13.5-<15.5	>15.5	
<i>Acacia schweinfurthii</i>	2.83	9.25	8.61	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.00	21.46
<i>Acacia tortilis</i>	0.00	0.00	0.77	0.00	0.00	1.41	0.77	0.00	2.83	2.10	7.84	15.72
<i>Anisotes formosissimus</i>	0.00	7.20	6.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.63
<i>Azima tetracantha</i>	0.00	1.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.41
<i>Cadaba termitaria</i>	0.00	2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.20
<i>Dichrostachys cinerea</i>	0.00	0.00	1.41	2.19	1.41	0.77	0.00	0.00	0.00	0.00	0.00	5.78
<i>Gardenia volkensii</i>	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77
<i>Grewia flavescens</i>	1.41	2.83	2.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.43
<i>Grewia inaequilatera</i>	1.41	7.20	0.77	0.77	0.77	0.00	0.00	0.00	0.00	0.00	0.00	10.92
<i>Gymnosporia buxifolia</i>	0.00	0.00	3.60	3.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.20
<i>Strychnos potatorum</i>	0.00	0.00	0.00	0.00	0.77	0.77	0.00	0.00	0.00	0.00	0.00	1.54
<i>Tricalysia junodii</i>	0.00	0.77	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.54



Figure 62. The *Dalbergia arbutifolia*-*Diospyros mespiliformes* High Riverine Forest on Sango Ranch, Save Valley Conservancy, Zimbabwe.

series of islands (Figure 9). The 4U soils are very sandy and in the Save Riverbed a series of layers are evident in the profile (Table 9). This community lies at 430 m and 460 m. Due to the closed tree canopy of this community, few herbaceous species occur (Table 9). *Panicum maximum* dominates in open areas. This community can be recognised by the presence of the woody diagnostic species *Dalbergia arbutifolia*, *Artabotrys brachypetalus* and *Diospyros mespiliformes*. No woody species dominates but common species include *Cardiogyne africana*, *Friesodielsia obovata*, *Scierocarya birrea* subsp. *caffra*, *Trichilia emetica*, *Croton megalobotrys*, *Kigelia africana*, *Hyphaene coriacea*, *Tabernaemontana elegans*, *Lannea schweinfurthii*, *Strychnos potatorum*, *Acacia schweinfurthii*, *Albizia glaberrima* var. *glabrescens*, *Grewia inaequilatera* and *Faidherbia albida*.

Structure of the woody layer

The canopy cover and density for this community are depicted as histograms in Figures 63 and 64, respectively. The percentage contribution of the woody species with a value >1% to the total woodyspecies composition is given in Table 26. The greatest canopy cover and density are evident in the 0.75-<1.5 m height class (Figure 63 and 64). *Friesodielsia obovata*, *Grewia inaequilatera* and *Grewia sulcata* contribute mainly to the cover and density in this height class (Table 26). The dominant height class is the >15.5 m class and consists of *Diospyros mespiliformes*, *Albizia glaberrima* var. *glabrescens* and *Faidherbia albida* (Figure 63, Table 26) (Edwards 1983). This community forms a very dense and closed high canopy (total canopy cover=103.2 %, Figure 63; total density 732 individuals/ha, Figure 64). The community is thus classified as a high forest with a significant low thicket component (Edwards 1983).

The *Dalbergia arbutifolia*–*Diospyros mespiliformes* High Riverine Forest can be sub-divided into three sub-communities:

7.1 The *Strychnos potatorum*–*Panicum maximum* High Closed Woodland

This high closed woodland lies on the banks of the major and minor rivers of Sango Ranch and is forms a mosaic with the *Faidherbia albida*–*Panicum maximum* High Closed Woodland Sub-community and the *Phragmites mauritianus* Tall Closed Reedbeds (Figures 9 and 65). It is represented by six relevés with an average of

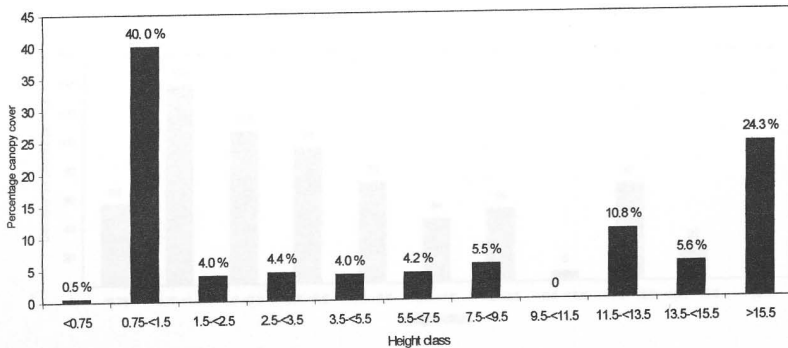


Figure 63. The percentage canopy cover in 11 height classes (m) of the woody species of the *Dalbergia arbutifolia*–*Diospyros mespiliformes* High Riverine Forest, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 103.2 %.

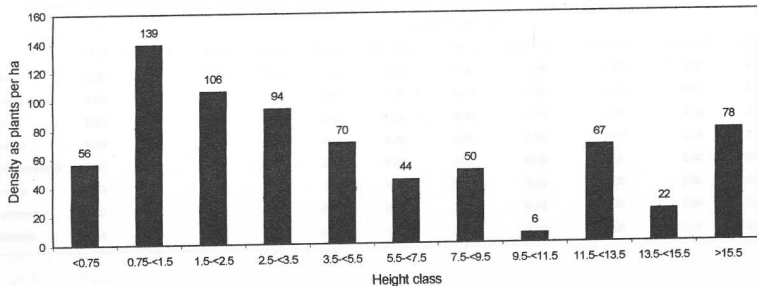


Figure 64. The density of the woody species in 11 height classes (m) of the *Dalbergia arbutifolia*–*Diospyros mespiliformes* High Riverine Forest, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 732.

Table 26. The percentage contribution of 20 woody species in 11 height classes to the total woody species composition in the *Dalbergia arbutifolia*–*Diospyros mespiliformes* High Riverine Forest, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Acacia galepinii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0.00	1.00
<i>Acacia schweinfurthii</i>	0.00	1.05	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.49
<i>Acacia tortilis</i>	0.00	0.00	0.00	0.00	1.87	0.00	0.00	0.00	0.00	0.00	0.00	1.87
<i>Albizia glaberrima</i>	0.00	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.70	5.57
<i>Artabotrys brachypetalus</i>	0.00	0.00	0.00	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.87
<i>Bridelia cathartica</i>	0.00	0.00	0.00	0.00	0.00	1.05	0.44	0.00	0.00	0.00	0.00	1.49
<i>Cardiogyne africana</i>	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	1.00
<i>Dalbergia arbutifolia</i>	0.54	0.44	0.00	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.85

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Table 26 continued. The percentage contribution of 20 woody species in 11 height classes to the total woody species composition in the *Dalbergia arbutifolia*-*Diospyros mespiliformes* High Riverine Forest, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Diospyros mespiliformes</i>	0.00	0.44	0.00	0.00	0.44	0.00	0.00	0.00	0.00	0.00	1.05	1.93
<i>Faidherbia albida</i>	0.00	0.00	0.00	6.67	0.00	6.67	0.00	0.00	0.00	6.67	13.33	33.3
<i>Friesodielsia obovata</i>	0.00	1.60	0.00	1.05	0.44	0.00	0.00	0.00	0.00	0.00	0.00	3.09
<i>Grewia inaequilatera</i>	2.13	3.47	9.02	0.00	2.33	0.00	0.00	0.00	0.00	0.00	0.00	19.02
<i>Grewia sulcata</i>	0.00	1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.88
<i>Gymnosporia buxifolia</i>	0.00	0.50	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	1.00
<i>Lannea schweinfurthii</i>	0.00	0.00	0.00	0.00	0.00	0.44	1.60	0.44	0.00	0.00	0.00	2.49
<i>Lantana camara</i>	0.00	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.87
<i>Monodora junodii</i>	0.54	0.54	0.44	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.97
<i>Strychnos potatorum</i>	0.00	0.00	0.00	0.44	0.44	0.44	0.00	0.00	0.00	0.00	0.00	1.33
<i>Syzgium guineense</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.57	0.00	0.00	5.57
<i>Trichilia emetica</i>	0.00	0.00	0.00	0.00	0.44	0.44	1.05	0.00	0.00	0.00	0.00	1.93



Figure 65. The *Strychnos potatorum*–*Panicum maximum* High Closed Woodland on Sango Ranch, Save Valley Conservancy, Zimbabwe.

15 species per relevé (range 14-18) (Table 9). The riverbanks are flat to steep, and in some places are vertical where they have been washed away (Table 9). The soils are a fertile sandy loam of the 4U soil family. Altitude varies between 430 m and 460 m. This closed sub-community may be recognised by the presence of the diagnostic species *Lannea schweinfurthii*, *Strychnos potatorum* and *Diospyros mespiliformes* (Table 9).

Structure of the woody layer

The canopy cover and density are shown in Figures 66 and 67, respectively. The 7 percentage contribution of woody species contributing >1% to the total woody species composition is depicted in Table 27. The highest canopy cover is seen in the 7.5-<9.5 m height class (Figure 66) and the greatest density is evident in the 0.75-<1.5 m class (Figure 67). *Bridelia cathartica*, *Lannea schweinfurthii* and *Trichilia emetica* contributes to the high canopy cover, while *Acacia schweinfurthii*, *Friesodielsia obovata* and *Grewia inaequilatera* are responsible for the high density (Table 27). The dominant height layer is >15.5 m (Edwards 1983) and consists of *Diospyros mespiliformes* (Table 27, Figure 66). The high canopy cover (62.9 %, Figure 66), total density (1 051 individuals/ha, Figure 67) and high tree layer result in the classification as high closed woodland with a low thicket component (Edwards 1983).

7.2 The *Albizia glaberrima* var. *glabresens*-*Panicum maximum* High Forest

This high forest lies on the islands within the Save Riverbed and is mixed with the *Faidherbia albida*-*Panicum maximum* High Closed Woodland and the *Phragmites mauritianus* Tall Closed Reedbeds (Figures 9 and 68). It is represented by four relevés with an average of 10 species per relevé (range 9-12) (Table 9). The terrain consists of a series of small to large islands that lie in the bed of the Save River (Figure 9). These islands are all the result of silt deposition. The soils are sandy and belong to the 4U soil family (Table 9). Altitude varies between 430 m and 455 m. The woody layer is very thick and is recognised by the diagnostic *Albizia glaberrima* var. *glabresens* (Table 9).

Structure of the woody layer

Canopy cover and density are depicted in Figures 69 and 70, respectively. The percentage contribution of the woody species with a value of >1% to the total

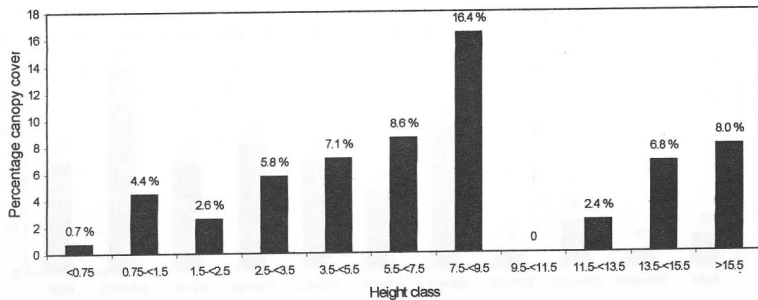


Figure 66. The percentage canopy cover in 11 height classes (m) of the woody species of the *Strychnos potatorum*-*Panicum maximum* High Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 62.9 %.

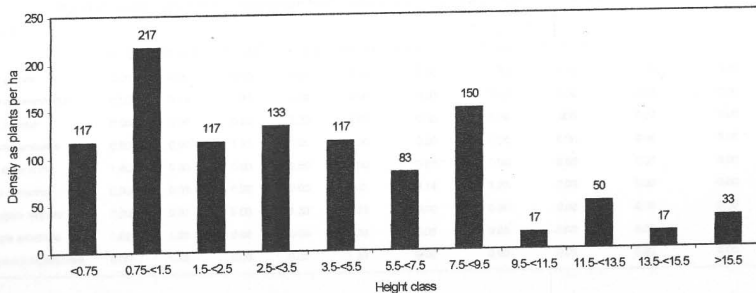


Figure 67. The density of the woody species in 11 height classes (m) of the *Strychnos potatorum*-*Panicum maximum* High Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 1 051.

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Table 27. The percentage contribution of 23 woody species in 11 height classes to the total woody species composition in the *Strychnos potatorum*-*Panicum maximum* High Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Acacia galpinii</i>	0.00	0.00	0.00	0.00	0.00	0.00	1.33	0.00	1.33	0.00	0.00	2.66
<i>Acacia schweinfurthii</i>	0.00	3.14	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.47
<i>Albizia harveyi</i>	0.00	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33
<i>Allophylus alnitifolius</i>	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33
<i>Azima tetraacantha</i>	1.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.62
<i>Bridelia cathartica</i>	0.00	0.00	0.00	0.00	0.0	3.14	1.33	0.00	0.00	0.00	0.00	4.47
<i>Cardogyne africana</i>	0.00	0.00	0.00	1.33	1.33	0.00	0.00	0.00	0.00	0.00	0.00	2.66
<i>Dalbergia arbutifolia</i>	1.62	1.33	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	4.28
<i>Diospyros mespiliformes</i>	0.00	1.33	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	3.14	5.80

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Table 27 continued. The percentage contribution of 23 woody species in 11 height classes to the total woody species composition in the *Strychnos potatorum*-*Panicum maximum* High Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<135	13.5-<15.5	>15.5	
<i>Diospyros quiloensis</i>	0.00	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33
<i>Friesodielsia obovata</i>	0.00	4.80	0.00	3.14	1.33	0.00	0.00	0.00	0.00	0.00	0.00	9.27
<i>Grewia inaequalatera</i>	6.40	4.80	1.33	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	13.86
<i>Gymnosporia buxifolia</i>	0.00	1.33	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	2.66
<i>Hyphaene coriacea</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	0.00	0.00	1.33
<i>Lannea schweinfurthii</i>	0.00	0.00	0.00	0.00	0.00	1.33	4.80	1.33	0.00	0.00	0.00	7.46
<i>Lonchocarpus capassa</i>	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33
<i>Monodora junodii</i>	1.62	1.62	1.33	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.90
<i>Reissantria indica</i>	0.00	1.62	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95
<i>Sclerocarya birrea</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	0.00	1.33
<i>Strychnos madagascariensis</i>	0.00	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33
<i>Strychnos potatorum</i>	0.00	0.00	0.00	1.33	1.33	1.33	0.00	0.00	0.00	0.00	0.00	3.99
<i>Trichilia emetica</i>	0.00	0.00	0.00	0.00	1.33	1.33	3.14	0.00	0.00	0.00	0.00	5.80
<i>Ziziphus mucronata</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	0.00	0.00	1.33



Figure 68. The *Albizia glaberrima* var. *glabresens*–*Panicum maximum* High Forest on Sango Ranch, Save Valley Conservancy, Zimbabwe.

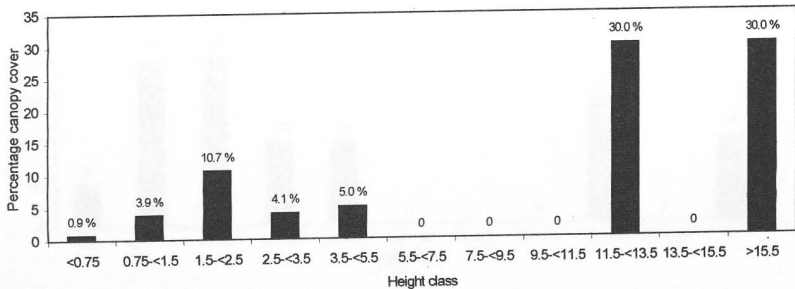


Figure 69. The percentage canopy cover in 11 height classes (m) of the woody species of the *Albizia glaberrima* var. *glabresens*-*Panicum maximum* High Forest, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 84.4 %.

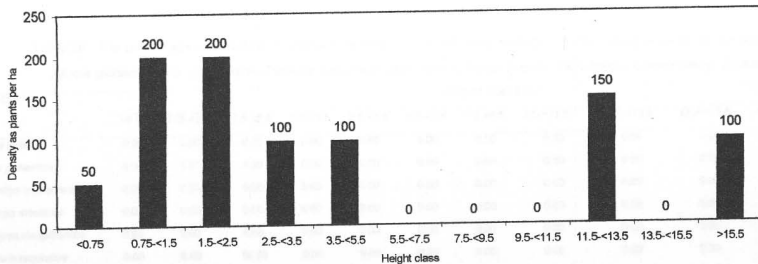


Figure 70. The density of the woody species in 11 height classes (m) of the *Albizia glaberrima* var. *glabresens*-*Panicum maximum* High Forest, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 900.

Table 28. The percentage contribution of nine woody species in 11 height classes to the total woody species composition in the *Albizia glaberrima* var. *glabresens*-*Panicum maximum* High Forest, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Acacia tortilis</i>	0.00	0.00	0.00	0.00	5.60	0.00	0.00	0.00	0.00	0.00	0.00	5.60
<i>Albizia glaberrima</i>	0.00	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.10	16.70
<i>Artabotrys brachypetalus</i>	0.00	0.00	0.00	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.60
<i>Dalbergia arbutifolia</i>	0.00	0.00	0.00	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.60
<i>Diospyros mespiliformes</i>	5.60	0.00	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.20
<i>Grewia inaequilatera</i>	0.00	5.60	16.70	0.00	5.60	0.00	0.00	0.00	0.00	0.00	0.00	27.90
<i>Grewia sulcata</i>	0.00	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.60
<i>Lantana camara</i>	0.00	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.60
<i>Syzgium guineense</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.70	0.00	0.00	16.70

composition is shown in Table 28. The greatest canopy cover is seen in the 11.5-
<13.5 m height class (Figure 69) and the highest density is observed in the 0.75-
<1.5 m and 1.5-<2.5 m height classes (Figure 70). *Syzigium guineense* and *Albizia*
glaberrima var. *glabrescens* are responsible for the canopy cover in this high layer,
while *Grewia inaequilatera* contributes to the density in the lower layers (Table 28).
The dominant height class is <15.5 m (Edwards 1983) and consists of *Albizia*
glaberrima var. *glabrescens* (Figure 69, Table 28). The canopy is closed (84.4 %,
Figure 69) and the sub-community is thus classified as a high forest and contains a
thicket-like low shrub component (Edwards 1983).

7.3 The *Faidherbia albida*-*Eriochloa meyeriana* High Closed Woodland

This high closed woodland forms a mosaic with both the *Diospyros mespiliformes*-
Panicum maximum High Closed Woodland and the *Albizia glaberrima* var.
glabrescens-*Panicum maximum* High Forest (Figures 9 and 71). The sub-
community is represented by two relevés with an average of 4 species per relevé
(range 3 to 5) (Table 9). The habitat here is similar to that of the *Strychnos*
potatorum-*Panicum maximum* High Closed Woodland and the *Albizia glaberrima*
var. *glabrescens*-*Panicum maximum* High Forest (Table 9). The soils are fairly
recently deposited and altitude varies between 430 m and 435m. This sub-
community is characterised by the diagnostic herbaceous species *Eriochloa*
meyeriana (Table 9). *Faidherbia albida* is diagnostic for this sub-community.

Structure of the woody layer

The canopy cover and density for this sub-community are depicted in Figures 72
and 73, respectively. The percentage contribution of woody species contributing
>1% to the total woody species composition is shown in Table 29. The greatest
canopy cover is found in the >15.5 m height class (Figure 72). The highest density
is observed in the 2.5-<3.5 m and 5.5-<7.5 m height classes (Figure 73).
Faidherbia albida is responsible for these cover and density values (Table 29).
The >15.5 m height class dominates and, together with the total cover (52%, Figure
74) and density (250 plants per ha, Figure 73) results in a high closed woodland
structural classification (Edwards 1983)



Figure 72. The *Faidherbia albida*–*Eriochloa meyeriana* High Closed Woodland on Sango Ranch, Save Valley Conservancy, Zimbabwe.

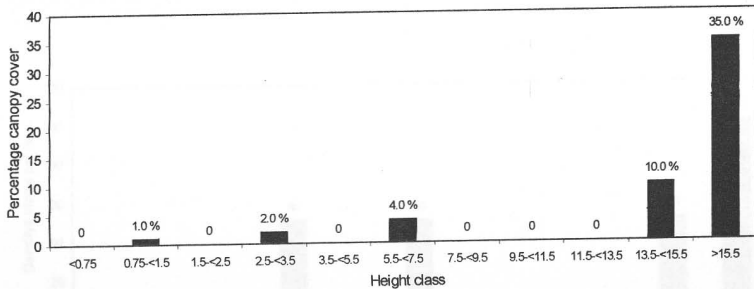


Figure 73. The percentage canopy cover in 11 height classes (m) of the woody species of the *Faidherbia albida*-*Eriochloa meyeriana* High Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 52 %.

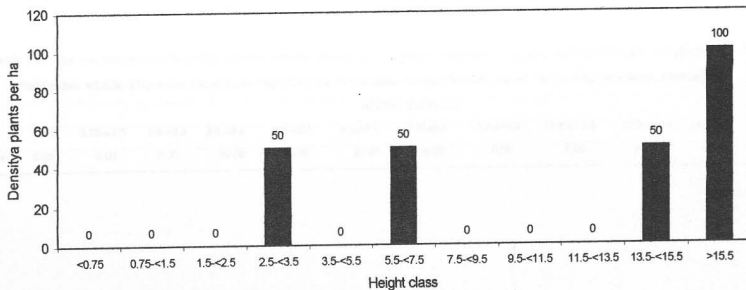


Figure 74. The density of the woody species in 11 height classes (m) of the *Faidherbia albida*-*Eriochloa meyeriana* High Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 250.

Table 29. The percentage contribution of one woody species in 11 height classes to the total woody species composition in the *Faidherbia albida*–*Eriochloa meyeriana* High Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Faidherbia albida</i>	0.00	0.00	0.00	20.00	0.00	20.00	0.00	0.00	0.00	20.00	40.00	100.00

8. The *Phragmites mauritianus* Tall Closed Reedbeds

The tall closed reedbeds are found along the riverbanks and beds of the rivers of Sango Ranch and is found in a mosaic with the *Strychnos potatorum*–*Panicum maximum* High Closed Woodland, the *Albizia glaberrima* var. *glabresens*–*Panicum maximum* High Forest and the *Faidherbia albida*–*Eriochloa meyeriana* High Closed Woodland (Figures 9 and 74). It is represented by three relevés with an average of 1 species per relevé (Table 9). The habitat is similar to that of the *Strychnos potatorum*–*Panicum maximum* High Closed Woodland, the *Albizia glaberrima* var. *glabresens*–*Panicum maximum* High Forest and the *Faidherbia albida*–*Eriochloa meyeriana* High Closed Woodland (Table 9). However, the soils are fairly recently deposited (Table 9). The herbaceous layer is dominated by the diagnostic *Phragmites mauritianus* (Table 9). No other herbaceous or woody species are found here.

No woody species are found in this community (Table 9).

9. The *Echinochloa colona*–*Cyperus digitatus* subsp. *auricomus* Tall Open Wetland

These wetlands are found scattered along the western bank of the Save River (Figures 9 and 75). It is represented by four relevés with an average of 5 species per relevé (range 3–6) (Table 9). This community lies on the alluvial plains and consists of a series of pans, the largest of which is Sune (Figure 9, Table 9). The 4U soils are extremely clayey and are in some cases vertic (Chapter 4). Aspect is south and altitude of the pans varies between 430 m and 440 m (Table 9). The herbaceous layer is recognised by the dominant and diagnostic *Echinochloa colona* and *Cyperus digitatus* subsp. *auricomus* (Table 9). No dominant species occur here and therefore the community name consists of the two diagnostic species. Other common species include *Nymphaea nouchali*, *Eragrostis curvula* and *Paspalidium obtusifolium*. No diagnostic woody species occur here. This community can, however be recognised by the presence of the common *Acacia xanthophloea*.

Structure of the woody layer

Canopy cover and density are presented as histograms in Figures 76 and 77, respectively. The percentage contribution of woody species contributing >1% to the total woody species composition is depicted in Table 31. The greatest canopy cover is found in the 11.5–<13.5 m height class (Figure 76), while the highest density appears in the 13.5–<15.5 m class (Figure 77). *Acacia xanthophloea*



Figure 74. The *Phragmites mauritianus* Tall Closed Reedbeds on Sango Ranch, Save Valley Conservancy, Zimbabwe.



Figure 75. The *Echinochloa colona*–*Cyperus digitatus* subsp. *auricomus* Tall Open Wetland, Save Valley Conservancy, Zimbabwe.

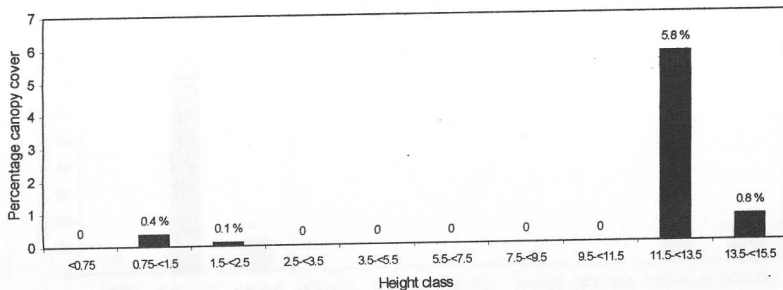


Figure 76. The percentage canopy cover in 10 height classes (m) of the woody species of the *Echinochloa colona*-*Cyperus digitatus* subsp. *auricomus* Tall Open Wetland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover 7.1 %.

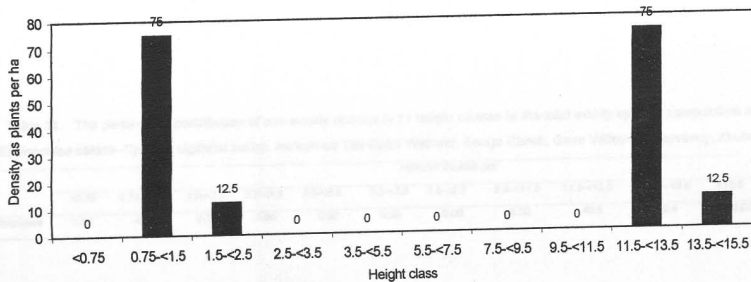


Figure 77. The density of the woody species in 10 height classes (m) of the *Echinochloa colona-Cyperus digitatus* subsp. *auricomus* Tall Open Wetland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 175.

Table 31. The percentage contribution of one woody species in 11 height classes to the total woody species composition in the *Echinochloa colona*-*Cyperus digitatus* subsp. *auricomus* Tall Open Wetland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

SPECIES	HEIGHT CLASS (m)										TOTAL	
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5		>15.5
<i>Acacia xanthophloea</i>	0.00	49.5	0.70	0.00	0.00	0.00	0.00	0.00	49.5	0.4	0.00	100.00

contributes completely to these values (Table 31). The dominant tree layer is in the 11.5-<13.5 m class and together with the low canopy cover (7.1 %, Figure 76) and the low density (175 individuals/ha, Figure 77) forms a tall open woodland (Edwards 1983).

The *Echinochloa colona*-*Cyperus digitatus* subsp. *auricomus* Tall Open Wetland is sub-divided into two sub-communities:

9.1 The *Paspalidium obtusifolium*-*Echinochloa colona* Tall Closed Grassland

This seasonally wet tall closed grassland lies within the *Echinochloa colona*-*Cyperus digitatus* subsp. *auricomus* Tall Open Wetland and forms a mosaic with the *Acacia xanthophloea*-*Echinochloa colona* Tall Closed Woodland (Figures 9 and 78). It is represented by two relevés with an average of 4 species per relevé (range 3 to 5). The habitat is the same as the *Echinochloa colona*-*Cyperus digitatus* subsp. *auricomus* Tall Open Wetland (Table 9). This sub-community can be recognised by the presence of the diagnostic species *Nymphaea nouchali*, *Eragrostis curvula* and *Paspalidium obtusifolium* (Table 9). No woody species are found in this sub-community (Table 9).

9.2 The *Acacia xanthophloea*-*Echinochloa colona* Tall Closed Woodland

This tall closed woodland appears in the *Echinochloa colona*-*Cyperus digitatus* subsp. *auricomus* Tall Open Wetland and forms a mosaic with the *Paspalidium obtusifolium*-*Echinochloa colona* Tall Closed Grassland (Figures 9 and 79). It is represented by two relevés with an average of 5 species per relevé (range 4 to 6) (Table 9). The habitat is the same as the *Paspalidium obtusifolium*-*Echinochloa colona* Tall Closed Grassland Wetland, except that the vegetation is more utilised and more sheet erosion is present (Table 9). The sub-community is recognised by the diagnostic *Acacia xanthophloea*. No other woody species are common (Table 9).

Structure of the woody layer

The canopy cover and density are given in Figures 80 and 81, respectively. The percentage woody species composition contribution to the total woody species composition is presented in Table 32. The highest canopy cover is found in the 11.5-<13.5 m height class (Figure 80) and the greatest density is evident in the



Figure 78. The *Paspalidium obtusifolium*–*Echinochloa colona* Tall Closed Grassland on Sango Ranch, Save Valley Conservancy, Zimbabwe.



Figure 79. The *Acacia xanthophloea*–*Echinochloa colona* Tall Closed Woodland on Sango Ranch, Save Valley Conservancy, Zimbabwe.

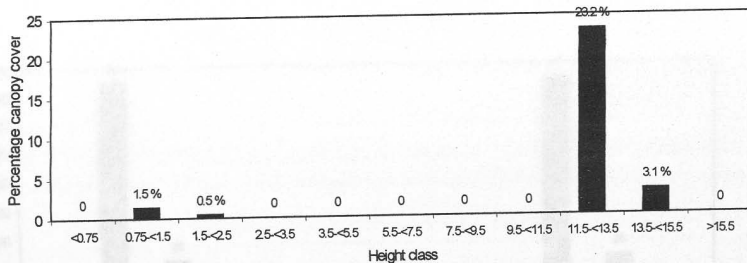


Figure 80. The percentage canopy cover in 11 height classes (m) of the woody species of the *Acacia xanthophloea*–*Echinochloa colona* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total canopy cover is 28.2 %.

Figure 81. The density of the woody species in 11 height classes (m) of the *Acacia xanthophloea*–*Echinochloa colona* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total density per ha is 350.

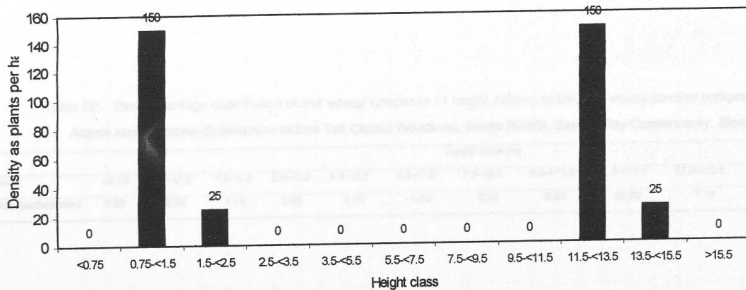


Figure 81. The density of the woody species in 11 height classes (m) of the *Acacia xanthophloea*-*Echinochloa colona* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe. The total plants per ha is 350.

Table 32. The percentage contribution of one woody species in 11 height classes to the total woody species composition in the *Acacia xanthophloea*–*Echinochloa colona* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe.

Species	Height class (m)											TOTAL
	<0.75	0.75-<1.5	1.5-<2.5	2.5-<3.5	3.5-<5.5	5.5-<7.5	7.5-<9.5	9.5-<11.5	11.5-<13.5	13.5-<15.5	>15.5	
<i>Acacia xanthophloea</i>	0.00	42.80	7.14	0.00	0.00	0.00	0.00	0.00	42.80	7.14	0.00	100.00

0.75-<1.5 m and 11.5-<13.5 m classes (Figure 81). *Acacia xanthophloea* is responsible for these figures (Table 32). The 11.5-<13.5 m height class is dominant and together with the total cover (28.2 %, Figure 80) and the total density (350 individuals/ha, Figure 81) form a tall closed woodland (Edwards 1983).

Ordination

The results of the DECORANA ordination are depicted as scatter diagrams in Figures 82 to 85. In the *Acacia tortilis-Urochloa mosambicensis* Tall Closed Woodland a gradient of sodic and non-sodic soils is seen on axis 2 (Figure 82). No gradient is evident on axis 1. In the *Combretum apiculatum* subsp. *apiculatum*-*Colophospermum mopane* Short Thicket and the *Colophospermum mopane*-*Brachiaria deflexa* Short Thicket // Short Closed Woodland a gradient is seen on axis 1, indicating deep sandy soils on the left and shallow rocky soils to the right (Figures 83 and 84). From Table 7 it is observed that subcommunities 2.1 and 2.3 lie on deep soils on alluvium and gneiss, while subcommunities 2.2 and 2.4, and community 3 lie on rocky shale, gneiss, lava and granite. No gradient is evident on axis 2. In the sourveld communities, a gradient ranging from flat to steep slope is evident on axis 2 in Figure 84. The *Combretum apiculatum* subsp. *apiculatum*-*Digitaria milaniana* Tall Closed Woodland lies to the left with gentle slopes and relatively few rocks while the *Millettia usumarensis* subsp. *australis*-*Brachiaria deflexa* Short Koppie Thicket lies to the right with steep slopes and rocky soils. No other gradients are evident. In the riverine communities a gradient in soil clay content is evident on axis 1, with sandy soils on the left and clay soils on the right (Figure 85). The *Acacia tortilis*-*Panicum maximum* Tall Closed Woodland, the *Dalbergia arbutifolia*-*Diospyros mespiliformes* High Riverine Forest and the *Phragmites mauritianus* Tall Closed Reedbeds lie on relatively sandy recently deposited alluvial soils, while the *Echinochloa colona*-*Cyperus digitatus* subsp. *auricomus* Tall Open Wetland lies on the soils of the pans that are high in clay (axis 1). On axis 2, a decrease in soil water content is observed. The soil water content is higher in the riverine and floodplain vegetation of community 9 and subcommunities 7.1, 7.2 and 7.3 and decreases toward community 6. Although community 6 has a lower soil water content than the floodplain and riverine communities, the soil water content is higher overall there than in all the other plant communities on Sango Ranch.

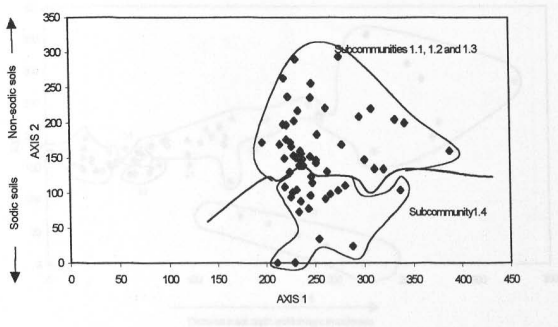


Figure 82. The DECORANA scatter diagram for the *Acacia tortilis* subsp. *heteracantha-Urochloa mosambicensis* Tall Closed Woodland, Sango Ranch, Save Valley Conservancy, Zimbabwe (see Table 6).

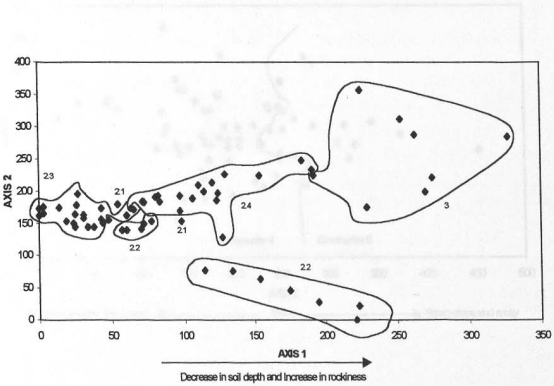


Figure 83. The DECORANA scatter diagram for the *Combretum apiculatum* subsp. *apiculatum*–*Colophospermum mopane* Short Closed Woodland (Community 4) and the *Brachiaria deflexa* Short Thicket // *Colophospermum mopane* Short Closed Woodland (2.1 to 2.4) and the *Combretum apiculatum* subsp. *apiculatum*–*Colophospermum mopane* Short Closed Woodland (3), Sango Ranch, Save Valley Conservancy, Zimbabwe (see Table 7).

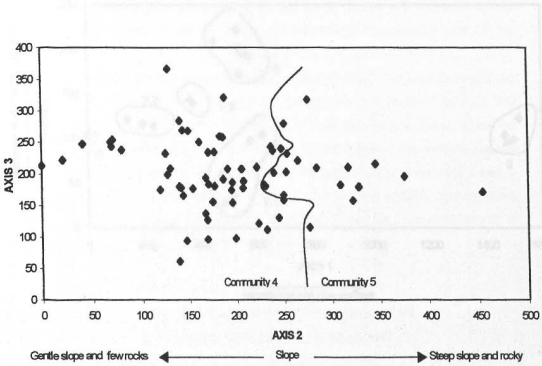


Figure 84. The DECORANA scatter diagram for the *Combretum apiculatum* subsp. *apiculatum*–*Digitaria milanjiana* Tall Closed Woodland (Community 4) and the *Millettia usumarensis* subsp. *australis*–*Brachiaria deflexa* Short Koppie Thicket Short Closed Woodland (Community 5), Sango Ranch, Save Valley Conservancy, Zimbabwe (see Table 8).

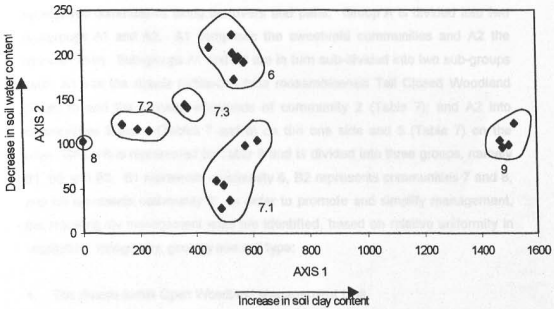


Figure 85. The DECORANA scatter diagram for the *Acacia tortilis* subsp. *heteracantha*-*Panicum maximum* Tall Closed Woodland (6), the *Dalbergia arbutifolia*-*Diospyros mespiliformes* High Riverine Forest (71.1, 7.2 and 7.3), the *Phragmites mauritianus* Tall Closed Reedbeds (8) and the *Echinochloa colona*-*Cyperus digitatus* subsp. *auricomus* Tall Open Wetland (9), Sango Ranch, Save Valley Conservancy, Zimbabwe (see Table 9).

Identification of management units

The dendrogram of the original TWINSPLAN classification (Figure 10) shows that the vegetation of Sango Ranch can be divided into two main groups. Group A contains the xerophytic and mesophytic communities and Group B the hydrophytic communities along the rivers and pans. Group A is divided into two sub-groups A1 and A2. A1 comprises the sweetveld communities and A2 the sourveld ones. Sub-groups A1 and A2 are in turn sub-divided into two sub-groups each: A1 into the *Acacia tortilis-Urochloa mosambicensis* Tall Closed Woodland (Table 6) and the mopane woodlands of community 2 (Table 7); and A2 into communities 3 and 4 (Tables 7 and 8) on the one side and 5 (Table 7) on the other. Group B is represented by Table 9 and is divided into three groups, namely B1, B2 and B3. B1 represents community 6, B2 represents communities 7 and 8, and B3 represents community 9. In order to promote and simplify management, the following six management units are identified, based on relative uniformity in vegetation, topography, geology and soil type:

1. The *Acacia tortilis* Open Woodland Management Unit
2. The *Colophospermum mopane* Woodland Management Unit
3. The *Combretum apiculatum* Woodland Management Unit
4. The *Acacia tortilis* Closed Woodland Management Unit
5. The *Diospyros mespiliformes* Riverine Management Unit
6. The *Echinochloa colona* Wetland Management Unit

Related plant communities are grouped where possible but practical considerations necessitated the inclusion of smaller units (Brown 1997). The boundaries of the management units are shown in Figure 86.

Description of the management units of Sango Ranch

1. *Acacia tortilis* Open Woodland Management Unit

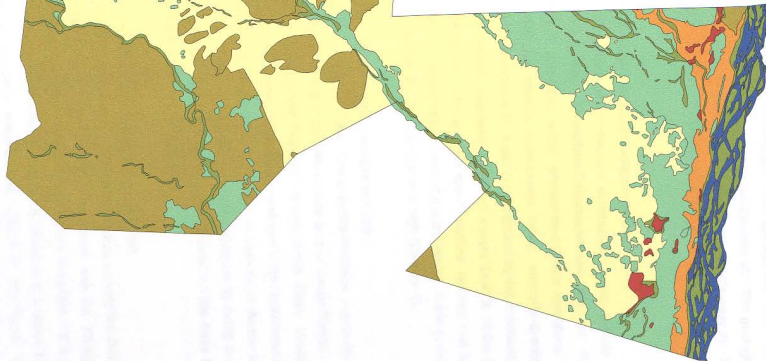
Management Unit 1 consists of the *Acacia tortilis* subsp. *heteracantha-Urochloa mosambicensis* Tall Closed Woodland and comprises 16.5 % of the total surface area of Sango Ranch. It is easily recognised by the presence of *Acacia tortilis* subsp. *heteracantha*, *Albizia anthelminthica* and *Urochloa mosambicensis* which has a short, open, woodland structure. This management unit is situated on a sandy outwash on floodplains (Chapter 2) and the soils are fairly sandy and fertile (Chapter 4). The grass cover is high (Chapter 6).



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LEGEND

- The *Echinops coloratus* Woodland Management Unit
- The *Diospyros mespiliiformis* Rivierine Management Unit
- The *Acacia tortilis* Open Woodland Management Unit
- The Mopanie Woodland Management Unit
- The *Acacia tortilis* Closed Woodland Management Unit
- The *Combretum apiculatum* Woodland Management Unit
- Open water



2 0 2 4 Kilometers

SANGO RANCH

Figure 86: Management units of Sango Ranch, Save Valley Conservancy, Zimbabwe.

2. The *Colophospermum mopane* Woodland Management Unit

This management unit consists of the *Colophospermum mopane*–*Brachiaria deflexa* Short Thicket // Short Closed Woodland. It is the largest unit and covers 50.5 % of the total surface area of Sango Ranch. The *Colophospermum mopane* Woodland Management Unit is easily recognised and consists of stands consisting almost exclusively of *Colophospermum mopane*. This management unit is found on the lower slopes, and the soils are fairly clayey (Chapter 4). The geological types vary between alluvium, gneiss, shale, lava and sandstone (Chapter 2). The grass cover varies from low under closed canopies to high in open areas (Chapter 6).

3. The *Combretum apiculatum* Woodland Management Unit

This management unit consists of the sourveld communities, which include the *Combretum apiculatum* subsp. *apiculatum*–*Colophospermum mopane* Short Thicket, the *Combretum apiculatum* subsp. *apiculatum*–*Digitaria milanjiana* Tall Closed Woodland and the *Millettia usumarensis* subsp. *australis*–*Brachiaria deflexa* Short Koppie Thicket (Table 7). It can be recognised by the dominance of *Combretum* spp. and *Digitaria milanjiana*. This unit covers 24.9 % of the total surface area of Sango Ranch. The soils are mostly shallow, leached and rocky (Chapter 4). The major geological types consist of granite, gneiss, mafic granulite, shale and limestone (Chapter 2). The grass cover is high (Chapter 6).

4. The *Acacia tortilis* Closed Woodland Management Unit

This management unit consists of the *Acacia tortilis*–*Panicum maximum* Tall Closed Woodland and covers 3 % of the total surface area of Sango Ranch. This management unit is distinguished from the *Acacia tortilis* Open Woodland Management Unit by the dominance of *Panicum maximum* in the herbaceous layer and a tall and closed tree canopy consisting almost exclusively of *Acacia tortilis* subsp. *heteracantha*. The soils are deep and fertile (Chapter 4) being derived from alluvium (Chapter 2). This management unit is situated on the Save River aquifer and soil moisture content is therefore high.

5. The *Diospyros mespiliformes* Riverine Management Unit

This management unit consists of the riverine communities, namely the *Dalbergia arbutifolia*–*Diospyros mespiliformes* High Riverine Forest and the *Phragmites mauritianus* Tall Closed Reedbeds. This management unit comprises 4.6 % of the surface area of Sango Ranch. It is recognised by the presence of a closed canopy forest consisting of *Diospyros mespiliformes*, *Strychnos potatorum*, *Croton megalobotrys*, *Faidherbia albida* and *Trichilia emetica*. A thicket-like shrub layer consisting of *Dalbergia arbutifolia* and *Acacia schweinfurthii* is also typical. The

soils are deep and fertile with a high water table (Chapter 4) and are derived from alluvium. The grass cover is low due to the closed canopy of the vegetation (Chapter 6).

6. The *Echinochloa colona* Wetland Management Unit

This management unit consists of the wetland community, the *Echinochloa colona*-*Cyperus digitatus* subsp. *auricomus* Tall Open Woodland and covers 0.5 % of the study area. It is recognised by the presence of *Echinochloa colona*, *Cyperus* sp. and *Acacia xanthophloea*. The pans forming these wetlands are found scattered throughout the plains of Sango Ranch (Figure 86). The soils have a high clay content and sometimes have a vertic nature (Chapter 4). The grass cover is high due to the openness of this vegetation type(Chapter 6).

CONCLUSION

Although different methods were used, the results obtained in this study are similar to those obtained by Wild (1955), Wild and Rattray (1955), Wild (1965), Farrell (1968), Du Toit (1990b), Du Toit and Price-Waterhouse (1994) and Goodwin *et al.* (1997). Nine major vegetation types related to certain environmental factors have been identified using 220 sample plots.

From Tables 6 to 9 it is evident that apart from the *Phragmites mauritianus* Tall Closed Reedbeds and the *Echinochloa colona*-*Cyperus digitatus* Tall Open Wetland, species richness is fairly high in all vegetation communities. Frequent species found on Sango Ranch belong to Species Groups P and Q (Table 6), T and U (Table 7), and Q and R (Table 8). Many of the species in Tables 6 to 9 indicate that certain floristic affinities exist between the different vegetation communities.

The *Acacia tortilis* subsp. *heteracantha*-*Urochloa mosambicensis* Tall Closed Woodland contains several pioneer species (Table 6). From the aerial photographs of the study area and historical records it is evident that several vegetation disturbances have occurred on Sango Ranch in the past. These areas are indicated on the vegetation map in Figure 9. Secondary succession by *Acacia tortilis* subsp. *heteracantha* is usually associated with recovery after ploughing, overgrazing and other forms of disturbance (Milton 1983). *Acacia tortilis* subsp. *heteracantha* and other associated pioneer woody species such as *Dichrostachys cinerea* subsp. *africana* and unpalatable pioneer grasses such as *Tragus berterorianus*, *Aristida junceiformis* and *Chloris roxburghiana* therefore dominate the areas of disturbed vegetation on Sango Ranch. In cases of severe disturbance

these species encroach severely and become densely wooded with a poor herbaceous layer. The undisturbed form of the *Acacia tortilis* subsp. *heteracantha-Urochloa mosambicensis* Tall Closed Woodland is more open and has a well-developed herbaceous layer containing palatable perennial grass species. The *Acacia tortilis* subsp. *heteracantha-Panicum maximum* Tall Closed Woodland seems to be closely associated with the *Acacia tortilis* subsp. *heteracantha-Urochloa mosambicensis* Tall Closed Woodland but the presence of the aquifer along the Save River separates the two (Figure 9).

The *Colophospermum mopane-Brachiaria deflexa* Short Thicket// Short Closed Woodland is typical of the southeastern Lowveld of Zimbabwe (Wild 1955; Wild and Rattray 1955; Wild 1965; Farrell 1968; Du Toit 1990b; Du Toit and Price-Waterhouse 1994 and Goodwin *et al.* 1997). This plant community is associated with the lower parts of the soil catena on clay-rich depositional soils (Timberlake 1995). The poor grass layer is typical (Henkel 1931; Timberlake 1995). On the lighter textured and shallow soils the woody layer is more open and the grass layer is well developed. Species richness in the woody layer is low, being dominated by almost pure stands of *C. mopane*. These homogeneous and almost exclusive stands of mopane are known as "cathedral mopane" (Timberlake 1995). The herbaceous layer, although mostly poorly developed is sometimes quite diverse. The *Combretum apiculatum* subsp. *apiculatum-Colophospermum mopane* Short Closed Woodland is an ecotonal community. It lies at the junction between the *Colophospermum mopane-Brachiaria deflexa* Short Thicket // Short Closed Woodland and the *Combretum apiculatum* subsp. *apiculatum-Digitaria milanijana* Tall Closed Woodland. It therefore possesses elements of both vegetation types.

The *Combretum apiculatum* subsp. *apiculatum-Digitaria milanijana* Tall Closed Woodland is typical of the Lowveld areas of southern Africa (Van Rooyen 1978; Coetzee 1983). It has the greatest species richness in both the woody and herbaceous layers and appears to be a sub-climax or climax vegetation type. The herbaceous layer is extremely well developed and this is important in fire management. The presence of *Julbernardia globiflora* and *Brachystegia spiciformis* shows an affinity with the Miombo woodlands further north. The *Milletia usumarensis* subsp. *australis-Brachiaria deflexa* Short Koppie Thicket is typical of koppies in the area (Du Toit and Price-Waterhouse 1994; Goodwin *et al.* 1997). The riverine and pan communities are also typical for the Lowveld areas of southern Africa.

The management units identified above are easily recognisable in the field and are based on environmental differences in the various vegetation types. Within each management unit, the herbaceous biomass, veld condition, and grazing and browsing capacity can be determined. This makes it possible to develop an ecological management plan for Sango Ranch. The management units can also be used to monitor the herbaceous biomass, veld condition, vegetation change and grazing/browsing capacity changes. The management practices can then be applied to each management unit according to its specific requirements.

Walker 1970, the line intercept method (Cantelo 1941, de Vries and Auerbach 1957), the stop method (Parker 1951, de Vries 1957), the wheel-plug method (Tilman and Hevenga 1955), the within plot method (Parker and Evans 1955, de Vries 1970), the descending point method (Parker 1951, de Vries 1957), the dry weight method (Tilman and Hevenga 1955), the comparative point method (Parker and Evans 1955), the stop-point method (Parker 1951), the meter and wheel method (Evans and Clark 1957), the line transect method (Dryden 1959), a combination of the dry weight and the comparative method (Bryman, Gouwsen and Rietman 1990, Schmidt 1992), and laser infrared reflectance spectrometry (García-Cardo, García-Cardo and Pardo-Cabero 1991). However, estimates of species composition are more accurately determined with the wheel-plug apparatus (Tilman and Hevenga 1955) or modifications thereof (Meritt 1971). The stop-point method (Parker 1951) has not been used extensively in savanna vegetation (de Vries 1957, Orlin 1958, Swan 1959). A sample size of 200 points is commonly used (Parker and Walker 1964). The stop-point and wheel-plug methods are normally used in conjunction with the nearest-plant method (Moore, Collins and Wright 1960; Evans and Clark 1967; Evans, Clark and Evans 1969; Bryman et al. 1990; Hardy and Walker 1991). However, criticism has been leveled at the nearest-plant method (Bryman et al. 1990). Moreover, Bryman et al. (1990) regard the technique as unsuitable for use in any area where annual species dominate and the ecological status of grass species varies from year to year.

The various techniques used for determining species composition have been evaluated by various authors (Johnson 1957; Walker 1970; Becker and Crockett 1971; Meritt 1971; Swan, Coenders and Ewings 1982; Gillen and Smith 1986; Gouwsen and Clark 1987; Elgert and Anderson 1987; Friedel and Shaw 1987; Havelly and Graydon 1987; Evans et al. 1990; García-Cardo et al. 1991) and the general consensus is that no one technique alone is completely accurate. Each author implements a different technique and this is of course dependent on the conditions that prevailed when the methods were tested. It seems as if they