*Short Communications*

# A comparison of tree density and canopy cover between different plant communities in Mixed Bushveld, Northern Province.

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Tree density and canopy cover were measured with the belt transect and line intercept methods respectively in eight plant communities in the Nylsvlei Nature Reserve. The general tree density in the study area was typical for the Mixed Bushveld areas of the Northern Province. The large variation in tree density and percentage canopy cover is discussed in terms of soil types.

**Key words**: Nylsvlei Nature Reserve, soil types

The structure of woody vegetation includes tree density, tree height and canopy cover. Woody plant cover is often expressed in terms of canopy cover since their small basal areas play a lesser role in the overall plant community (Holechek *et al.* 1989). Plant species composition, including tile woody component, and the spatial distribution (structure and productivity) is influenced by soil properties such as type, texture, nutrients, pH, salinity and most importantly soil moisture (O'Connor 1985; Tinley 1982). Tree density is also influenced by fire and grazing (Friedel 1988; Friedel & Blackmore 1988; Scholes & Walker 1993).

This study formed part of a larger vegetation survey to assess the habitat suitability for roan antelope (*Hippotragus equinus*). Scholes and Walker (1993) mentioned a thickening of the woody vegetation in the Nylsvlei Nature Reserve (NNR) and this data could serve as a baseline for comparing tree density and stucture over time in order to assess the extent of bush thickening. An extensive literature survey showed limited data on tree density and structure for the Mixed Bushveld. The aim of the tree survey was to estimate and compare tree density and percentage canopy cover between plant communities. The hypothesis that there is no difference in tree density and percentage canopy cover between plant commonities in Mixed Bushveld was tested.

The study was conducted in the NNR (24°39', 28°42') with a mean annual rainfall of 623 mm and a standard deviation of 134 mm (56 years) (Scholes & Walker, 1993). The plant communities investigated and the underlying soils were: 1) *Rhus leptodictya–Combretum apiculatum* Variation (lithosols underlain by rock), 2) *Cymbopogon plurinodis–Combretum apiculatum* Variation (lithosols underlain by rock), 3) *Eragrostis nindensis–Digitaria monodactyla* Variation (lithosols underlain by rock), 4) *Sporobolus ioclados–Acacia tortilis* Savanna (fine-textured illuvial soils with high clay contents), 5) Nyl River and floodplain (alluvial soils), 6) *Aristida bipartita–Setaria sphacelata* Savanna Variation (vertisols ancl mollisols), 7) *Aristida bipartita–Setaria sphacelata* Grassland Variation (vertisols and mollisols), and 8) *Eragrostis pallens–Burkea africana* Savanna (well drained residual soils). Most areas are burnt on a rotational basis every 2 to 4 years (Department Environmental Affairs, Northern Province).

Tree density and percentage canopy cover was measured at three sites in each of these eight plant communities. Tree density was measured once between December 1994 and January 1995 using the quantitative method described by Smit (1989). At each site, two belt transects, each 100 m by 2 m and 20 m apart, were used. All woody plants higher than 0,5 m were counted. Percentage canopy cover was measured with the line intercept method as described by Shukla and Srivastava (1992). Two lines of 100 m each and 20 m apart were used at each site. The distance of canopy intercept on the line was measured for each woody plant.

The mean tree density with 95% confidence intervals was calculated for each plant community. Differences in tree density and percentage canopy cover were tested with PROC GLM (SAS Institute 1990) at a 95% confidence level.

The average tree density in the NNR (all plant communities combined) was 1165 ±290 trees/ha. This tree density was similar to the density of 1119 woody plants/ha for the Mixed Bushveld in the Ellisras area found by Schmidt *et al.* (1995).

The large variations in the spatial distribution and structure of trees between plant communities (Figure l) can be expected from an area with diverse soil types as found in the NNR. The tree density and percentage canopy cover in the Nyl River and floodplain, and the *Aristida bipartita–Setaria sphacelata* Grassland variation had typically very few trees (less than 1 tree/ha). The seasonal high water table of the soils in these areas tend to drown woody seedlings (Frost 1987), hence the low low tree density. This data was not included in any further analyses.

Significant differences ($p = 0,05$) in tree density and percentage canopy cover between the remaining plant communities were noted. The highest tree density of 3992 ±1266 trees/ha was found in the *Rhus leptodictya–Combretum apiculatum* Variation (Figure 1) which differed ($p < 0,05$) from all the other plant communities. Friedel (1988) reported a tree density of 4513 trees/ha for *Combretum apiculatum* veld in Mixed Bushveld in an area not previously cleared, far from waterpoints, and with little grazing pressure. Percentage canopy cover of the *Rhus leptodictya–*

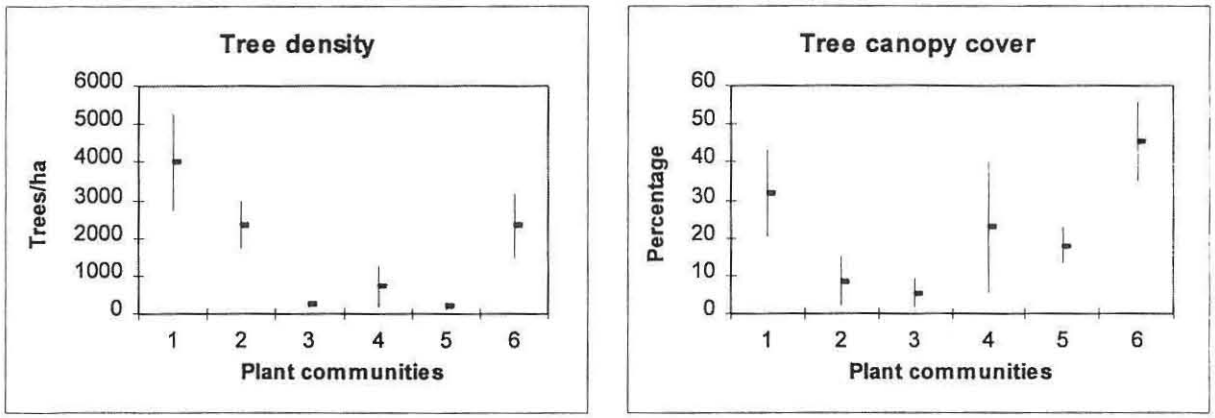


**Figure 1** Tree density and percentage canopy cover (mean and confidence interval) from six plant communities. Number one to four are described in the text. Plant community 5 is the *Aristida bipartita–Setaria sphacelata* Savanna Variation and 6 is the *Eragrostis pallens–Burkea africana* Savanna.

*Combretum apiculatum* Variation (31,8%; CI 11,35) also differed ($p < 0,05$) from the other plant communities except for the *Sporobolus ioclados–Acacia tortilis* Savanna.

Tree density and percentage canopy cover of the *Cymbopogon plurinodis–Combretum apiculatum* Variation (2358 ±635 trees/ha; 8,6% cover, CI 6,70) and the *Eragrostis nindensis–Digitaria monodactyla* Variation (250 ±77 trees/ha) differed ($p < 0,05$) from most other plant communities. Tree densities and canopy cover declined progressively from the *Rhus leptodictya–Combretum apiculatum* Variation to the *Eragrostis nindensis - Digitaria monodactyla* Variation (Figure 1). The latter plant community had the lowest overall canopy cover of 5,4% (CI 4,00). The underlying soil type (coarsely textured lithosols) is similar in these three plant communities. Grasslands such as the *Eragrostis nindensis–Digitaria monodactyla* Variation occur on lower slopes with poor drainage which are subject to regular frosts during winter (Frost 1987). Soil depth may also play a role.

A few large trees with a wide canopy spread were found in the *Sporobolus ioclados–Acacia tortilis* Savanna (illuvial soils) and the *Aristida bipartita–Setaria sphacelata* Savanna Variation (high clay turf soils). Tree density in the *Sporobolus ioclados–Acacia tortilis* Savanna of 708 ±534 trees/ha differed ($p < 0,05$) from all other plant communities. It was similar to that found by Friedel (1988) who reported an average tree density of 987 trees/ha for *Acacica tortilis* veld in the Northern Province Mixed Bushveld. The canopy cover was 22,8% (CI 17,55).

The lowest tree density (217 ±87 trees/ha) was found in the *Aristida bipartita–Setaria sphacelata* Savanna Variation (Figure 1) which differed ($p < 0,05$) from other plant communities but not from the *Eragrostis nindensis–Digitaria monodactyla* Variation. Trees in the former plant community are limited by the unstable (swelling calcareous clays) self-mulching vertisols which are being flooded in the rainy season. Trees are therefore confined to the drier areas only (Frost 1987). Fire may also play a role in decreasing tree densily. Friedel and Blackmore (1988) found a tree density of 9440 trees/ha in Red Turfveld protected from fire and grazing for 50 years. They also recorded an average density of 2775 trees/ha in areas that have been subjected to various degrees of grazing. An increase in tree density can be expected in areas protected from fire since fires control woody plants especially at the seedling stage (Scholes & Walker 1993). The canopy cover was 18,0% (CI 4,78).

Tree canopy cover in the *Eragrostis pallens–Burkea africana* Savanna differed ($p < 0,05$) from most other plant communities whereas the tree density (2333 ±848 trees/ha) did not differ ($p > 0,05$) from that in the *Cymbopogon plurinodis–Combretum apiculatum* Variation. The well drained, acid, dystrophic sandy soils vary from moderately shallow to deep (Frost 1987). This plant community is burnt every 3 to 5 years which may influence the woody component. Scholes and Walker (1993) found a tree basal area in broad-leafed savanna (protected from fire for 30 years) which was twice that of areas which were burnt regularly. This plant community had the highest canopy cover of 45,4% (CI 10,63).

The general tree density in the NNR was typical for the Mixed Bushveld areas of the Northern Province. The highest tree density was found in the *Rhus leptodictya–Combretum apiculatum* Variation. The floodplain along the Nyl River and the *Aristida bipartita–Setaria sphacelata* Grassland Variation were virtually devoid of trees. Low tree densities were also found in the *Aristida bipartita–Setaria sphacelata* Savanna variation. Canopy cover was highest in the *Eragrostis pallens–Burkea africana* Savanna and lowest in the *Eragrostis nindensis–Digitaria monodactyla* Variation. The large variation in tree density and tree canopy cover can probably be ascribed to the diverse soil types and the present fire regimes.

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