

Chapter 5. Structural analysis of the woody stratum of

Bynespoort Game Park

6.1 Structural analysis

Following the BECVOL analysis (Smit, 1996) described in chapter 3, the following results and conclusions can be presented for each of the plant communities determined. The same communities were used, as in the previous chapter for the veld condition. Figure 14 to Figure 20 graphically compare each of the values given in Table 5. They just confirm and justify the explanations given in this chapter.

1. *Harpochloa falx* - *Elionurus muticus* mountain grassland

The community is dominated by perennial grasses, and contains few trees as a result of the exposed high altitude in the rocky quartzite ridge. There is a total of 250 ind./ ha (Fig 14). Only three species were encountered in the transect. *Burkea africana* was the most dominant at 150 individuals per hectare. These were all young or coppiced individuals. *Combretum molle*

and *Acacia karroo* were the next most abundant at 50 individuals per hectare.

(*Zizania mucronata*, *Acacia karroo* bushveld variation)

Almost all of the leaf dry mass occurs below 1.5 m (128 kg ha⁻¹) (Fig 18)

The leaf volume of the community is 583 m³.ha⁻¹ (Fig 15), and the evapotranspiration tree equivalent is only 1167.ha⁻¹ (Table 5)(Fig 16). This emphasises that there are few trees in the community. It is therefore not an important community for browsers.

This community contains 950 woody individuals per hectare. The community

The total leaf mass is 277 kg.ha⁻¹ (Fig 17). The leaf mass is by far the highest below a height of 1.5 m where it is 189 kg.ha⁻¹, with only 17 kg.ha⁻¹ (Fig 18). In the height class of 2 m to 5 m, the leaf dry mass is 69 kg.ha⁻¹ (Fig 19)(Fig 20).

community has 3918 m³.ha⁻¹ with *Acacia caltra* and *Terron* as dominant

2. *Wahlenbergia undulata* - *Hyparrhenia hirta* old field grassland

The vegetation is fairly high, extending in the sandy soil where we are

This community was identified as an old field grassland. The woody vegetation was only coppiced individuals of *Acacia karroo*. There are 250 individuals per hectare in the community. With a very low leaf volume (285 m³.ha⁻¹)(Fig 15), and evapotranspiration tree equivalent (571.ha⁻¹)(Fig 16), it is clear that the importance of the woody stratum is insignificant for browsers.

The coourance of these young *Acaia karroo* individuals may be an indication that they are encroaching into the old field. This may often be indicative of the stage of succession, *Acacia karroo* being a pioneer species, although the

species may also be dominant in climax vegetation, eg. Community 5.1
(*Ziziphus mucronata* *Acacia karroo* bushveld variation).

Almost all of the leaf dry mass occurs below 1.5 m ($128 \text{ kg}\cdot\text{ha}^{-1}$)(Fig 18).

With a total of $137 \text{ kg}\cdot\text{ha}^{-1}$, only $9 \text{ kg}\cdot\text{ha}^{-1}$ occurs above 1.5 m (Table 5).

3. *Terminalia sericea* - *Burkea Africana* bushveld on sand

This community contains 950 woody individuals per hectare, followed by *Acacia*

This community contains 950 woody individuals per hectare. The community is dominated by *Terminalia sericea* with $600 \text{ ind}\cdot\text{ha}^{-1}$, followed by *Burkea Africana* with approximately $150 \text{ ind}\cdot\text{ha}^{-1}$. *Dichrostachys ciliaris* is also present at a density of 50 individuals per hectare, and it will be valuable to monitor this density as this tree can be highly invasive. The total leaf volume of the community is $3918 \text{ m}^3\cdot\text{ha}^{-1}$ with *Acacia caffra* and *Terminalia sericea* contributing the most. The evapotranspiration tree equivalent is $7836 \text{ m}^3\cdot\text{ha}^{-1}$ (Fig 16) which is fairly high, especially in the sandy soil where water drains very rapidly.

most in the stratum below a height of 1.5 m (Table 5)

The stratum has a leaf dry mass of $1721 \text{ kg}\cdot\text{ha}^{-1}$. Below a height of 1.5 m only $56 \text{ kg}\cdot\text{ha}^{-1}$ is found, between 1.5 and 2 m, $69 \text{ kg}\cdot\text{ha}^{-1}$, and the largest percentage ($1056 \text{ kg}\cdot\text{ha}^{-1}$) between 2 and 5 m (Table 5). The high density of *Terminalia sericea* and the fact that all the individuals are of a similar age suggests that this species is encroaching on the surrounding grassland as found by Brown (1997) in the Borakolalo Nature Reserve. However, the

the *Solenum panduforme* - *Acacia karroo* disturbed bushveld variation

abundance of this species is probably a result of the sandy conditions that prevail in these areas.

4. *Tristachya leucothrix* - *Trachypogon spicatus* mountain bushveld

The community contains approximately 850 individuals per hectare. *Rhus leptodictya* dominates with 450 individuals per hectare, followed by *Acacia caffra* with 200 individuals per hectare. The leaf volume is $728 \text{ m}^3 \cdot \text{ha}^{-1}$ and the evapotranspiration tree equivalent of 1457 per hectare. This is not very high as a result of the lack of broad leafed trees and large individuals, because of shallow soils, and the cooler conditions of the higher altitude and the south facing slopes. *Protea caffra* is very specific to the cool south facing slopes of the quartzite ridges.

The leaf dry mass is $334 \text{ kg} \cdot \text{ha}^{-1}$, which is not high, because of the lack of broad leafed species, and the presence of the non-edible *Protea caffra*. The most important browsing height is below 1.5 m (Table 5).

5. *Cynodon dactylon* - *Acacia karroo* bushveld

For this community three separate analyses were done. The first was on the typical *Cynodon dactylon* – *Acacia karroo* bushveld. The second was done on the *Ziziphus mucronata* – *Acacia karroo* bushveld variation, and the third on the *Solanum panduforme* – *Acacia karroo* disturbed bushveld variation.

5. *Cynodon dactylon* - *Acacia karroo* bushveld

Being the community that covers the largest area, its woody stratum is also valuable for browsers. It contains approximately 1000 individuals per hectare, with *Acacia karroo* making up 75% of this. The other 25 % is made up by *Acacia caffra*, *Rhus lancea*, *R. leptodictya*, *R. pyroides*, and *Ziziphus mucronata*. The total leaf volume is 6653 m³.ha⁻¹, with *A. karroo* making up 6419 m³.ha⁻¹ of this. The evapotranspiration tree equivalent is 13306. ha⁻¹, which is rather high, but can be supported by the clayey soil, and relatively high rainfall.

The leaf dry mass is 3363 kg.ha⁻¹ in total, with 480 kg.ha⁻¹ below 1.5 m, 437 kg.ha⁻¹ between 1.5 and 2 m, and 2383 kg.ha⁻¹ between 2 and 5 m. This confirms the presence of tall trees with a conical shape typical of the *Acacia* spp., carrying much of the leaf mass near the top (Table 5).

5.1 *Ziziphus mucronata* - *Acacia karroo* bushveld variation

This variation appears to be more wooded than any of the other communities, and this is evident in the assessment of 1300 individuals per hectare. This variation is dominated by *Acacia karroo* with 900 individuals per hectare. The leaf volume of this variation is 7064 m³.ha⁻¹, and has a high

evapotranspiration tree equivalent of 14129 per hectare. This is a result of the general high density of trees, as well as the occurrence of some broad-leaved and evergreen species.

The total leaf dry mass is 3325 kg.ha⁻¹, and the most (2497 kg.ha⁻¹) occurs between the 2 m and 5 m browsing heights (Table 5), making this variation very valuable for the browsers giraffe and kudu.

5.2 *Solanum pandunifforme* - *Acacia karroo* disturbed bushveld variation

This variation is slightly less wooded than variation 5.1 with 900 individuals per hectare. It is dominated by *Acacia karroo* with 800 individuals per hectare. The other 100 individuals per hectare are made up by *Burkea africana*. The leaf volume of the variation is 5184 m³.ha⁻¹, and the evapotranspiration tree equivalent is 10367. ha⁻¹.

The leaf dry mass is 2547 kg.ha⁻¹ with none of it below 1.5 m, 189 kg.ha⁻¹ between 1.5 and 2 m, and 2148 kg.ha⁻¹ in the highest browsing height (Table 5).

6. *Euclea crispa* - *Acacia karroo* bushveld on diabase

This community is the most densely wooded with 3000 ind./ ha (Fig 14).

Euclea crispa is the most dominant with 1200 individuals per hectare,

followed by *Acacia robusta* with 800 individuals per hectare. *Rhus lancea* also has a fairly high density of 400 individuals per hectare. The high density of woody vegetation causes the leaf volume ($11682 \text{ m}^3 \cdot \text{ha}^{-1}$) (Fig 15), and the evapotranspiration tree equivalent (23364 ha^{-1}) to be particularly high. The mineral rich diabase substrate supports this high density of trees.

The leaf mass is also very high ($5429 \text{ kg} \cdot \text{ha}^{-1}$) (Fig 17), providing a very high density of leaf material. Below a browsing height of 1.5 m there is a dry mass of $698 \text{ kg} \cdot \text{ha}^{-1}$, between 1.5 and 2 m it is $415 \text{ kg} \cdot \text{ha}^{-1}$ and $3546 \text{ kg} \cdot \text{ha}^{-1}$ between 2 m and 5 m (Table 5).

7. *Combretum apiculatum* - *Dombeya rotundifolia* bushveld of northern slopes

The community contains a density of 950 individuals per hectare. This density is shared with 250 individuals per hectare by *Combretum molle*, 200 individuals per hectare by *Rhus leptodictya*, 150 individuals per hectare by *Acacia karroo*, 100 individuals per hectare by *Burkea africana* and 50 individuals per hectare by *Acacia caffra*, *Combretum molle*, *Dichrostachys cinerea*, *Dombeya rotundifolia*, *Rhus lancea* and *Strychnos pungens*. The leaf volume is $3009 \text{ m}^3 \cdot \text{ha}^{-1}$, and the evapotranspiration tree equivalent of $6019 \cdot \text{ha}^{-1}$. The uniqueness of the woody stratum of this community is also as a result of the hotter and drier micro-climate being induced by the north facing slopes of the quartzite ridges. The species are likely to occur in

warmer bushveld areas to the north, and this type of climate is created by the northern aspect of the slopes.

The total leaf dry mass is 1342 kg.ha⁻¹, with 107 kg.ha⁻¹ below a browsing height of 1.5 m, 268 kg.ha⁻¹ between a height of 1.5 m and 2 m, and 943 kg.ha⁻¹ between 2 m and 5 m (Table 5). This structure makes it an important community for browsers.

8. *Eucalyptus grandis* plantation

As this community is totally dominated by *Eucalyptus grandis*, which is not utilised by any of the ungulates, it is of no importance in this study, and it was not included in this analyses.

9. *Ischaemum fasciculatum* - *Phragmites australis* wetland

This wetland area has a relatively low density of 500 individuals per hectare. The species encountered in the transect were: *Acacia karroo* (300 individuals per hectare), *Rhus lancea* (50 individuals per hectare), and *Ziziphus mucronata* (150 individuals per hectare). The leaf volume is 2380 m³.ha⁻¹ and this is dominated by the broad leafed *Ziziphus mucronata*. The evapotranspiration tree equivalent is 4760. ha⁻¹.

The leaf dry mass for the community is 1123 kg.ha⁻¹, with 101 kg.ha⁻¹ below a browsing height of 1.5 m, 108 kg.ha⁻¹ between 1.5 m and 2 m, and 907 kg.ha⁻¹ between 2 m and 5 m (Table 5).

10. *Phragmites australis* slimes dams wetland

The community contains 200 individuals per hectare of woody vegetation.

This represents a community with few trees, dominated by *Phragmites australis*. The only trees found in the transect were individuals of *Acacia karroo*, and most of these seedlings or coppiced. The coppiced *Acacia karroo* were calculated at 150 individuals per hectare, and the normal individuals 50 individuals per hectare.

This results in a very low leaf volume (66 m³. ha⁻¹), and evapotranspiration tree equivalent (132 .ha⁻¹). The leaf dry mass is a total of 31 kg.ha⁻¹, with the largest mass being below a browsing level of 1,5 m (16 kg.ha⁻¹). This is supported by the fact that most of the individuals were coppiced (Table 5).

As most of the slimes dams are still water saturated, after 40 years, the presence of trees could only have a positive effect in drying out the soil. The planting of trees could also assist in beginning the rehabilitation of the slimes dams.

Table: 5 Results of BECVOL (Smit, 1996) analysis for Bynespoort Game Park

Community #	Plants/ha	Leaf volume	ETTE	LMass	LMass 1.5	LMass 2	LMass 5
1	250	583	1167	277	189	206	277
2	250	285	571	137	128	137	137
3	950	3918	7836	1721	56	125	1181
4	850	728	1457	334	103	114	168
5	1000	6653	13306	3363	480	917	3300
5.2	1300	7064	14129	3325	419	812	3309
5.3	900	5184	10367	2547	0	189	2337
6	3000	11682	23364	5429	698	1113	4659
7	950	3009	6019	1342	107	268	1211
9	500	2380	4760	1123	101	209	1116
10	200	66	132	31	16	28	31
AVERAGE	922.7273	3777.45455	7555.273	1784.455	208.8182	374.3636	1611.455

Table 6: Results of BECVOL (Smit, 1996) analysis concerning the browsing capacity for Bynespoort Game Park

Community #	BTE	BTE 1.5	BTE 2	BTE 5	CSI 2	CSI 4
1	1108	756	824	1108	3.7	3.7
2	547	513	547	547	0	0
3	6884	226	500	4726	69.6	58
4	1335	636	800	1335	10.4	0
5	13452	1919	3667	13198	111.9	67.3
5.2	13330	1676	3248	13237	136.4	42.2
5.3	10185	0	754	9349	101.9	70.1
6	21714	2793	4454	18637	210.2	131.2
7	5369	427	1073	4844	60	31
9	4493	402	838	4463	48	31
10	122	65	114	122	1.6	0
AVERAGE	7139.909	855.727273	1529	6506	68.51818	39.5

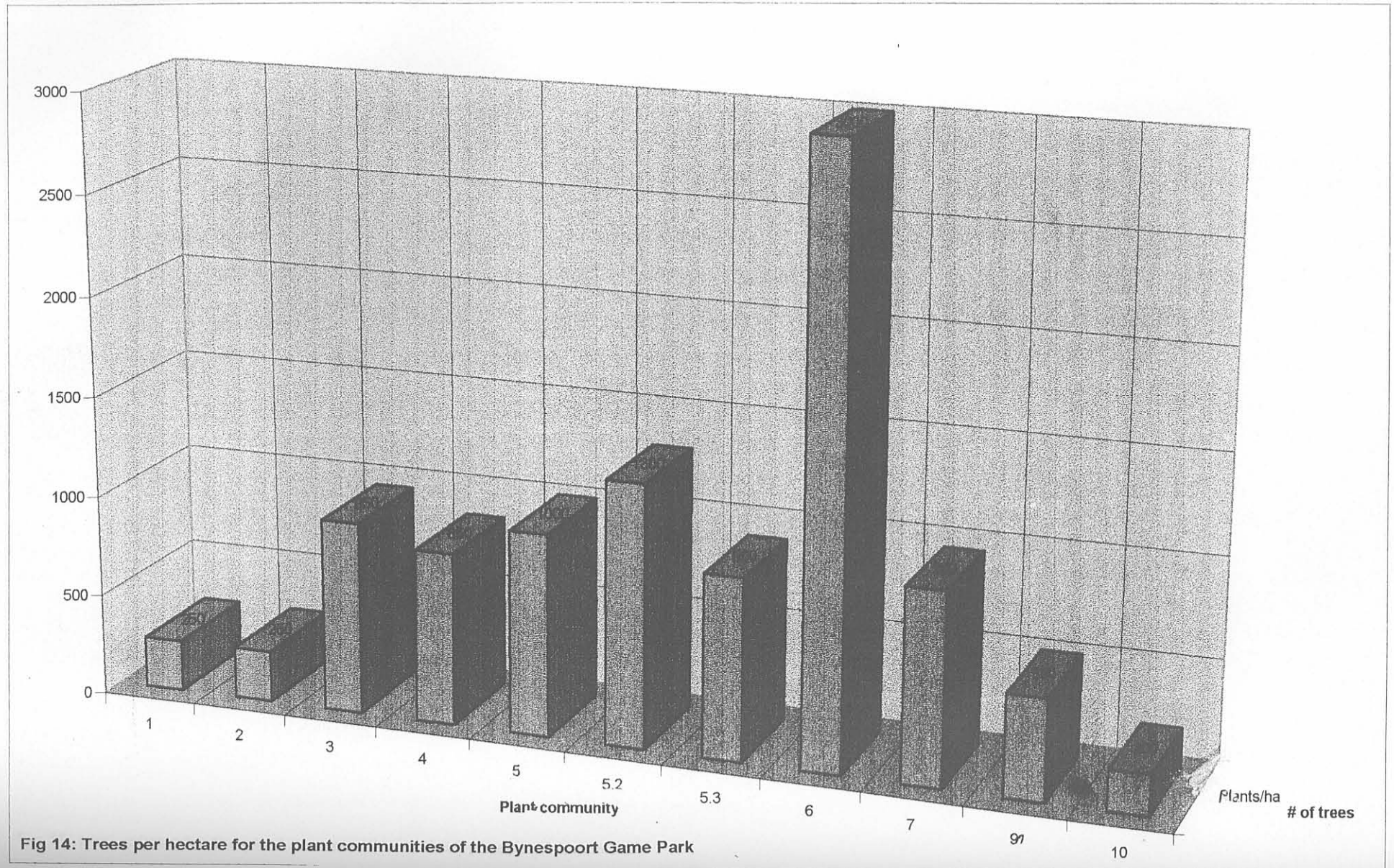


Fig 14: Trees per hectare for the plant communities of the Bynespoort Game Park

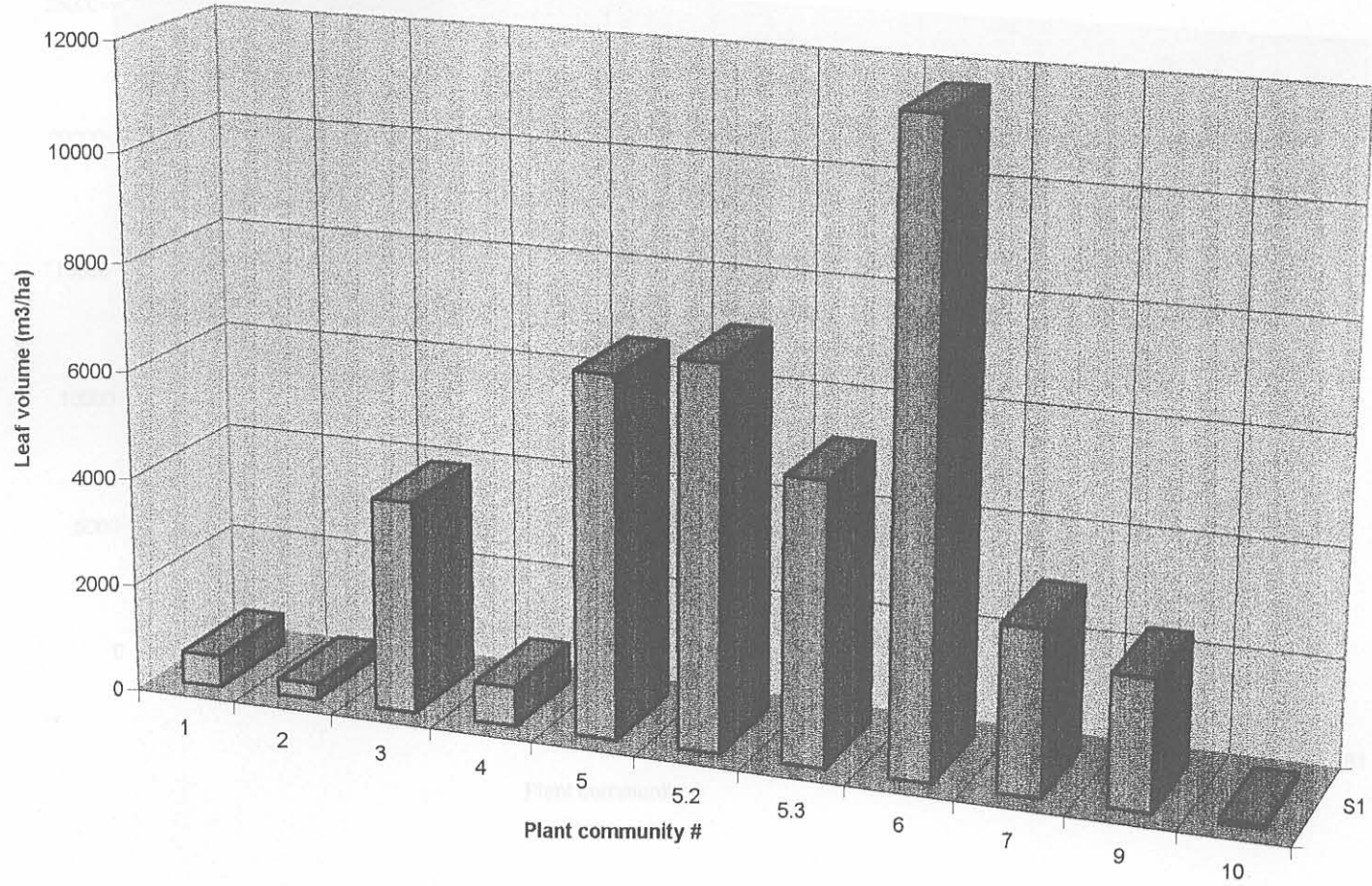


Fig 15: Leaf volume for the plant communities of the Bynespoort Game Park

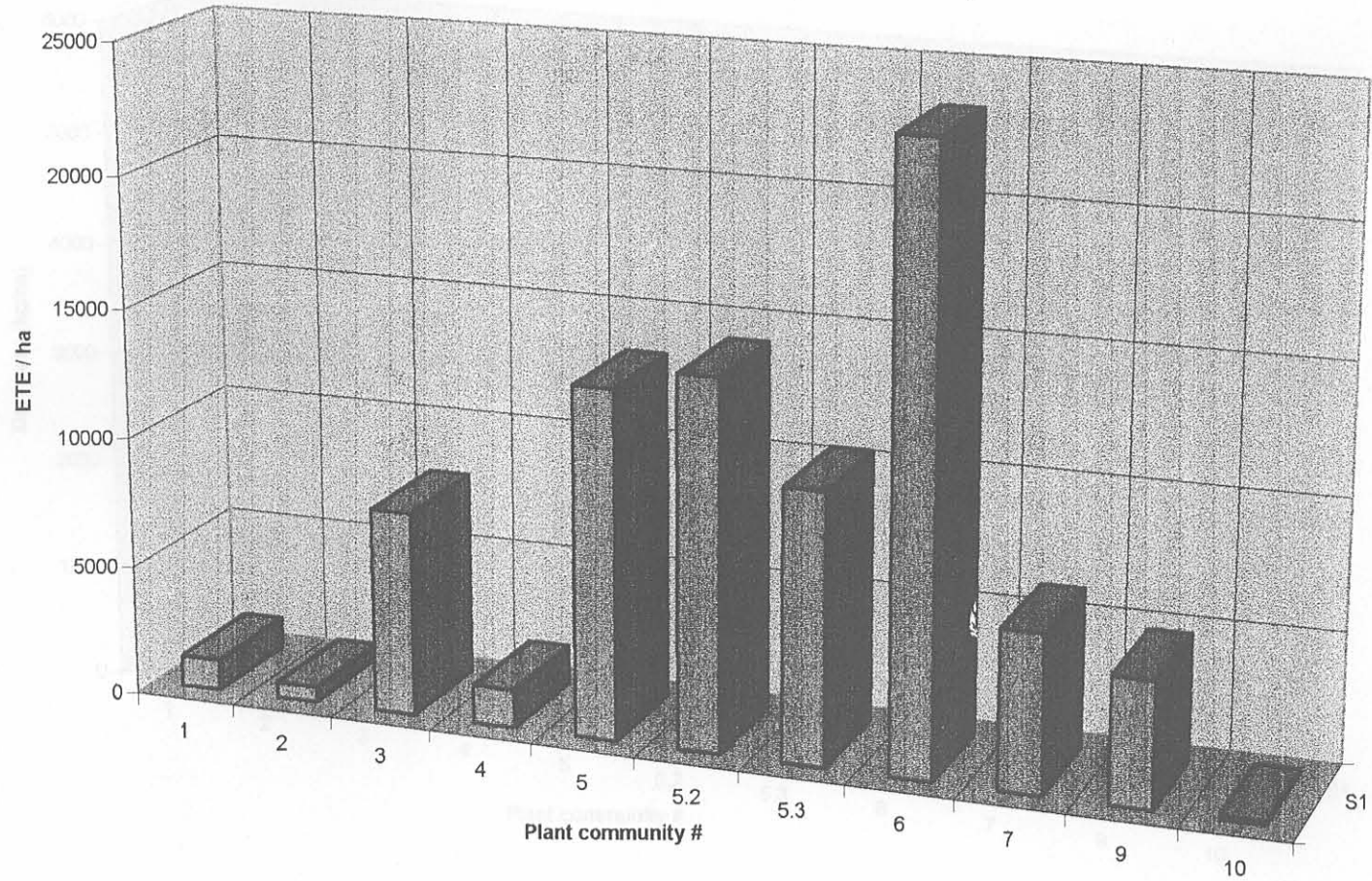


Fig 16: Evapotranspiration tree equivalent for the plant communities of the Bynespoort Game Park

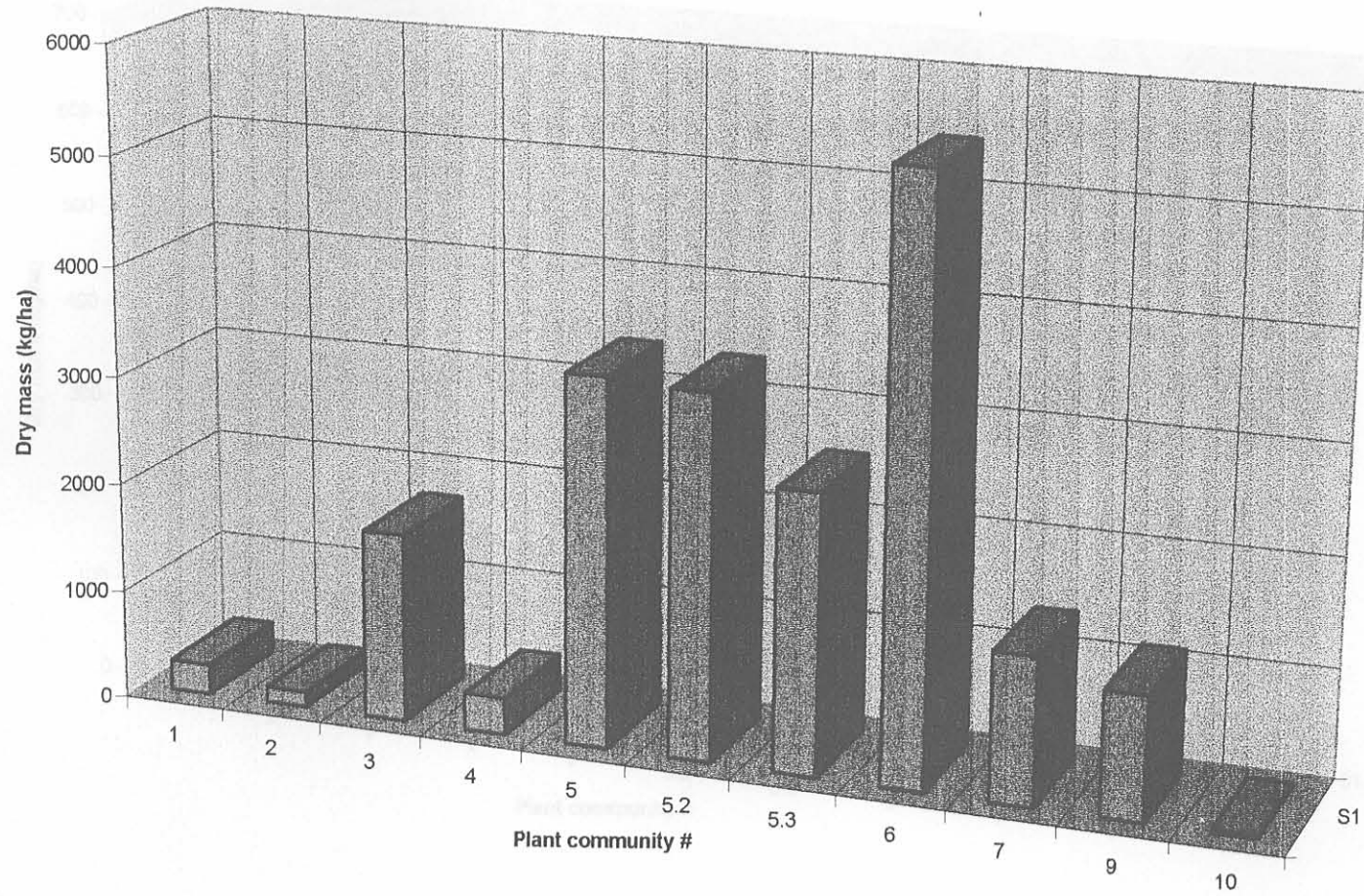


Fig 16: Leaf dry mass below a height of 1.5m for the plant communities of the Bynesport Game Park

Fig 17: -Leaf dry mass for the plant communities of the Bynesport Game Park

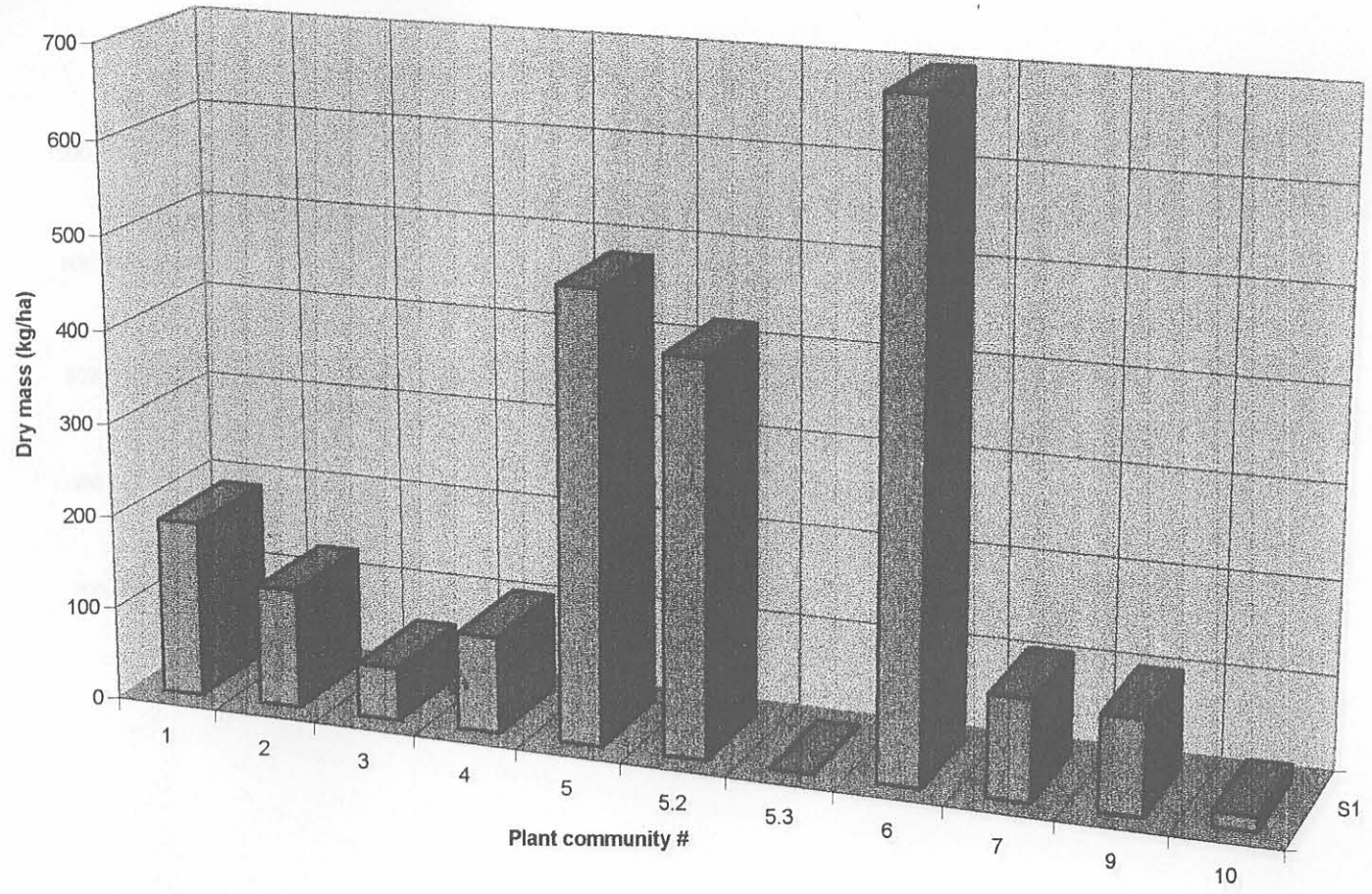


Fig 18: Leaf dry mass below a height of 1.5m for the plant communities of the Bynespoort Game Park

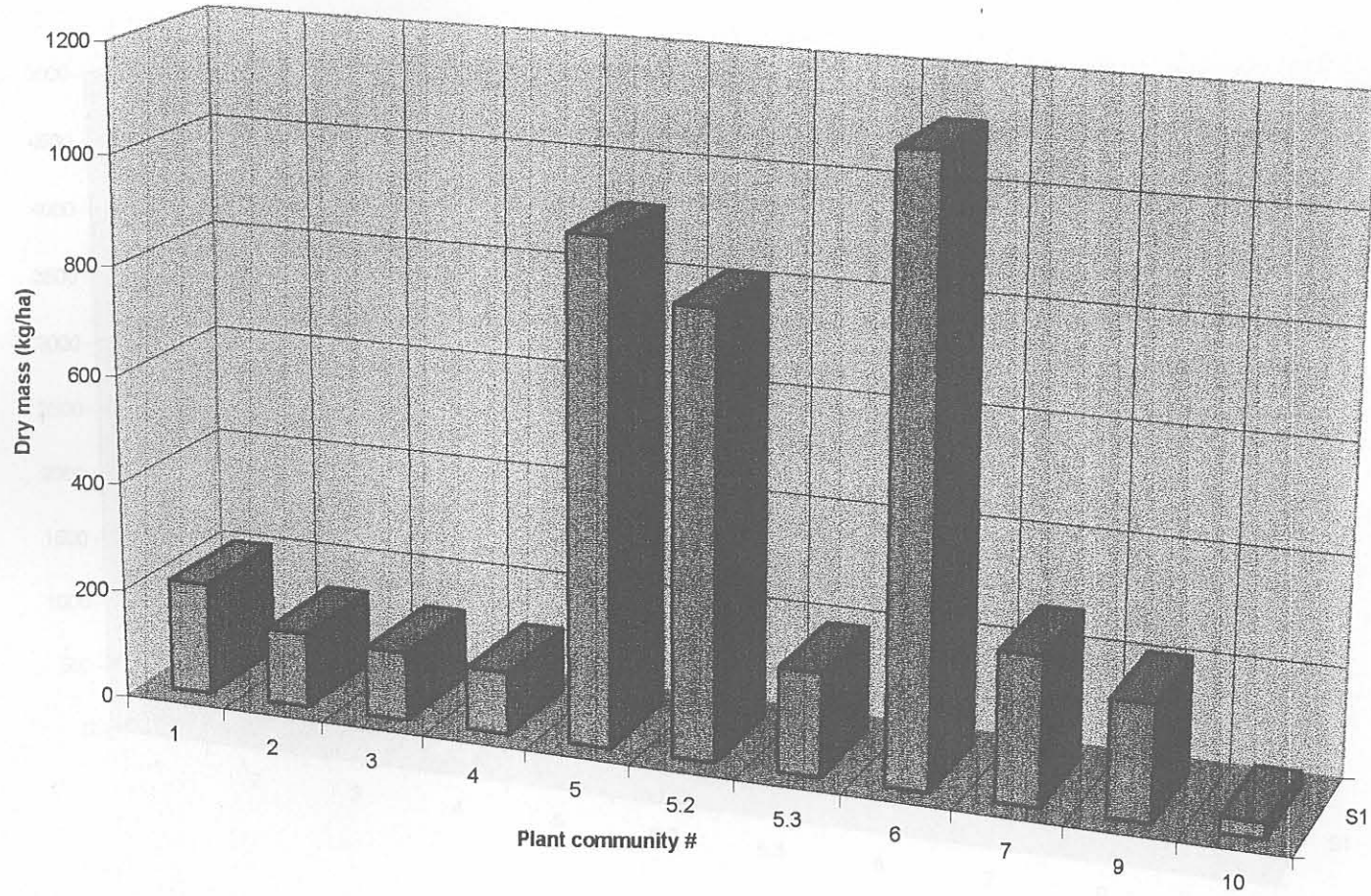


Fig 19: Leaf dry mass below a height of 2m for the plant communities of the Bynesport Game Park

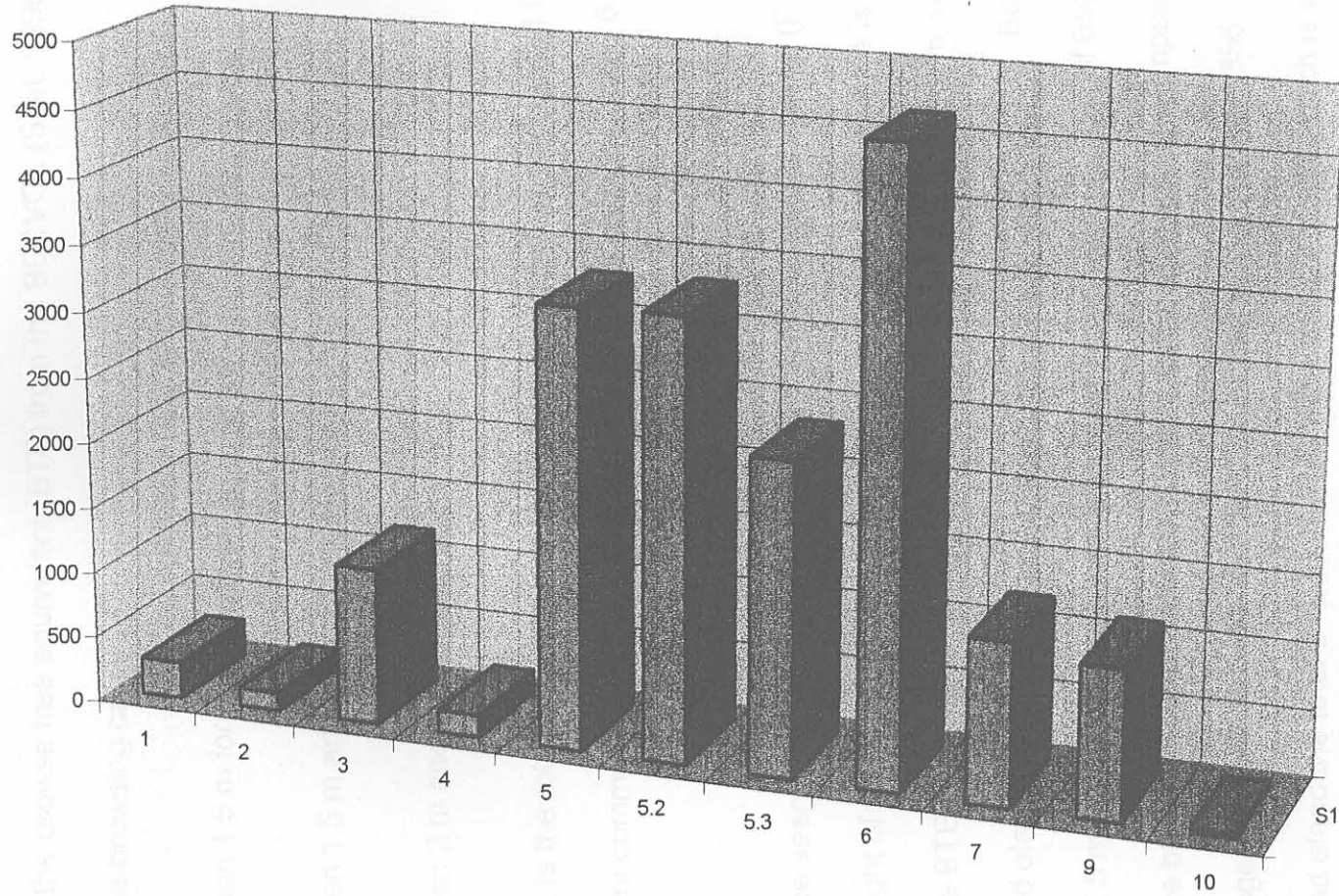


Fig 20: Leaf dry mass below a height of 5m for the plant communities of the Bynespoort Game Park