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A PHYTOSOCIOLOGICAL CLASSIFICATION OF THE HLANE WILDLIFE SANCTUARY, SWAZILAND

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Abstract – A phytosociological classification of the vegetation of the Hlane Wildlife Sanctuary was undertaken, with special reference to the vegetation structure and the correlation between plant communities and the biotic and abiotic environment. This study contributes to the drafting of a management plan for the sanctuary.

Introduction

A botanical study of the Hlane Wildlife Sanctuary was undertaken under the auspices of the Hlane Conservation Authority and on request of Mr. T. E. Reilly, official in charge of nature conservation in Swaziland. The study is a contribution to the drafting of a management plan for Hlane, which will be done by the research staff of the Kruger National Park. Before any proposals on management can be made, however, a basic knowledge of the plant communities is a necessity.

Except for studies by Acocks (1953) and Compton (1966), no other botanical work has been done in this part of Swaziland. The vegetation of Hlane is comparable with vegetation in other parts of the Republic of South Africa e.g. the south-eastern areas of the Kruger National Park. Descriptions of these areas were published by Van der Schijff (1957) and Van Wyk (1973).

Agriculturalists nowadays exercise more pressure on nature conservation in Swaziland, and in the specific case of Hlane, they want the land for the production of sugar-cane. Apart from this, diamonds were found in Hlane and at the moment prospecting is being done in the north-western corner of the reserve. Against this background, it is important to stress the unique qualities of Hlane as a conservation area. The undisturbed knobthorn savanna (*Acacia nigrescens* savanna), as it occurs in Hlane at present, is not duplicated anywhere else in Swaziland. For this reason it is important to make the Swazi nation aware of the aesthetical value of Hlane as a nature reserve and to convince them to conserve this reserve for future generations.

Historical Notes

During the middle 1940's a piece of land in Swaziland was purchased from funds raised from the selling of cattle culled in overstocked areas. This land therefore belonged to the Swazi nation and was held in trust by the King himself. The western portion of this land was commonly used as grazing for cattle, but an area of about 14 200 ha in the north-east, was excluded by the King for the specific purpose of nature conservation. This area is now known as the Hlane Wildlife Sanctuary.

As a result of increasing poaching activities in 1962, King Sobusa II asked Mr. T. E. Reilly, the officer in charge of Mlilwane Wildlife Sanctuary, to take charge of Hlane as well (Grimwood 1973). During 1968 the area to the west of the main road (Fig. 1) was proclaimed as a Game Sanctuary under the Game Act. According to the Act, shooting of any game in this area was prohibited, but free access was still allowed. The area to the east of the main road, however, was retained by the King for limited hunting activities by his personal approval.

The ideal is that the whole of Hlane should be protected for the future as a "National Park", but up to now the area is still administered by the Trust Commission.

Site description

Hlane is situated between 31°50′ and 31°57′ eastern longitude and 26°08′ and 26°23′ southern latitude on both sides of the main road between Stegi and the Tambankulu Estates. The reserve covers an area of 14 200 ha and is situated on the western Lebombo-flats approximately 200 m above sea level. It is a flat terrain with a few drainage lines, of which the White Umbuluzi, forming part of the north-western boundary of the reserve and the Black Umbuluzi on the northern boundary are the most important. Other smaller streams are the Mlaule and Ntohlwana. Koppies are almost absent, except for outcrops of Karoo Sandstone of which "Hunters Rock" in the north-west is a good example (Fig. 1).

Geology and soils

Basically the whole of Hlane is situated in one geological system, i.e. the Karoo System. Directly to the west of the reserve it adjoins the Basement Granite. Two series are distinguished under the Karoo System, namely the Ecca and Stormsberg series (Hamilton and Cooke 1965).

The Ecca series occurs in the western part of the reserve and overlies the Basement Granite mentioned above. This series consists of shales and grindstones and can vary in texture, but usually decompose into brackish, heavy structured, grey soils. These soils are susceptible to erosion as a result of the high concentration of sodium salts present. According to Harmse (1975) these soils belong to the Sterkspruit, Valsrivier and Estcourt forms.

The two sediments of the Stormberg series, Red Beds and Cave Sandstone occur on top of and to the east of the Ecca shales. The layers of the

Stormberg series tilt eastward at an angle of between 10° and 20° (Van de Schijff 1957). Red Beds and Cave Sandstone give rise to red to yellow sandy soils which can be very deep. These soils are not common in Hlane, but do occur in the north-west in the vicinity of Hunters Rock. Typical outcrops of Cave Sandstone can be seen here.

Drakensberg basalt occurs to the east of the Red Beds and Cave Sandstone. These lavas cover the whole of the eastern part of Hlane and with decomposition give rise to dark coloured clay soils which can vary in depth from 10 cm to 70 centimetres.

Dolerite intrutions also occur in the basalt areas. The soils that are derived from the dolerite closely resemble those derived from basalt, except that the texture is coarser and chemically these soils are less fertile (Gertenbach 1978). These soils are usually not so deep and undecomposed rock might occur on top of the soil.

Climate

Hlane has a warm temperate climate with rain especially in the summer months. No temperature data are available for Hlane, but figures from Stegi, at a much higher altitude (600 m), give a mean daily maximum for January of 27,1° C and 20,9° C for July. The mean daily minimum is 17,1° C for February and 9,9° C for July. These means were calculated over a period of 51 years (Weather Bureau 1965). It can be assumed that the temperatures will be higher at Hlane in the summer and lower in winter. Confirmed cases of frost are known for Hlane (T. E. Reilly, *pers. comm.*)

Rainfall data are available for Homestead, 20 km north-west of Hlane and for Tambankulu Estates, 8 km to the north-east. According to these data, the mean annual rainfall for Homestead is 701 mm, calculated over a period of 58 years and 677 mm for Tambankulu Estates, calculated over 18 years (Masson 1975). January and February are the wettest months with over 100 mm rainfall per month, while almost no rain occurs during the period from May to August.

Natural Fauna

Poaching played an important role in controlling the numbers of especially larger game species on Hlane in the past. The last roan antelope in Swaziland for example, was found dead in a snare in 1962 (Grimwood 1973). After Reilly took over management of Hlane in 1967, the numbers of game started to increase and at present large herds of wildebeest *Connochaetes taurinus,* zebra *Equus burchelli antiquorum* and impala *Aepyceros melampus* are common. In 1972 about 5 500 wildebeest, 6 000 impala and 800 zebra were counted in the reserve. Other larger game species include white rhinoceros *Ceratotherium simum,* kudu *Tragelaphus strepsiceros,* waterbuck *Kobus ellipsiprymnus* and giraffe *Giraffa camelopardalis.* Several smaller species like steenbuck *Raphicerus campestris,* duiker *Sylvicapra grimmia,* nyala, *Tragelaphus angasi* and bushbuck *T. scriptus*

also occur. Some spotted hyaena *Crocuta crocuta* and black-backed jackal *Canis mesomelas* are the only predators. A large variety of birds, reptiles and insects also occur in the reserve.

The wildebeest, impala and zebra populations increased to such an extent, that some of them died off during the critical winter months when food was not readily available and low in nutritive value. Just after this survey was completed a large number of these animals died and investigation showed that it was a result of the low protein content of the pasture during the winter months. Urgent attention must be given to aspects of overutilization of pastures and determination of the carrying capacity in the Hlane Game Reserve.

Fire

As in the rest of Africa, fire also played an important role in Swaziland, in maintaining the vegetation structure (West 1965). For the last decade, however, fire was used more scientifically on Hlane to get rid of old unpalatable grass and to prevent bush encroachment. No strict rotational treatments were applied, burning treatments rather depended on the decision of the officer in charge of the reserve. This brought about that some areas were burned annually, while other areas were burned less frequently. Treatments were applied after the first rain in spring (R. Girdwood, *pers. comm.*)*

Vegetation

The aim of this study was to describe and map the different plant communities of Hlane and with this as basis, to do further work in determining the carrying capacity of the different communities. This paper only deals with the first aspect of the study. Attention was also given to the structural variation within these plant communities, because this variation might correlate with the habitat preferences of the different game species concerned.

According to Acocks (1953) Hlane is situated in Veldtype 10 i.e. the Lowveld. This veldtype occurs on the western Lebombo flats on basaltic soils at low altitudes. It stretches from Natal in the south, through Swaziland to the Kruger National Park in the north. The vegetation is dominated by knobthorn *Acacia nigrescens* and marula *Sclerocarya caffra* with rooigras *Themeda triandra* and buffalo grass *Panicum maximum* as the dominant grasses. Compton (1966) also describes this area as Lowveld. Van Wyk (1973) refers to this vegetation as Knobthorn-Marulaveld on basaltic flats and dolerite intrusions.

Methods

During February 1976, 29 stratified random plots were dispersed over the whole area of Hlane. Plot sizes varied from 200 m^2 to 400 m^2 de-

*R. Girdwood, Warden Hlane, Post Office, Stegi.

pending on the density of the vegetation. A list of all plant species occurring on a plot were made and a cover-abundance value allocated to each species, according to a nine point scale as used by Barkman, Doing and Segal (1964), i.e.:

5 – Species covering > 75% of the plot.
4 – Species covering 50%–75% of the plot.
3 – Species covering 25%–50% of the plot.
2B – Species covering 13%–25% of the plot, independent of the number present.
2A – Species covering 5%–12% of the plot, independent of the number present.
2M – Species covering < 5% but many of it present.
1 – Many individuals with a cover of < 5%, or a few individuals with a cover of < 5%.
\+ – A few individuals with a low cover.
R – Single individuals with a low cover.

The vegetation structure was analised at every plot by estimating the percentage crown cover for the following four height classes:
Class I: Field layer (0 m–1 m)
Class II: 0 m–2 m
Class III: 2 m–6 m
Class IV: > 6 m
The percentage crown cover per height class for every community was obtained by calculating the mean percentage per height class for the different plots in that community.

Utilization of the field layer was estimated at every plot in the following classes:
High (H), Moderate (M), Low (L)

The geological formation was noted and the topography described in the following categories:

Flat (F), Concave (C), Convex (X), Sloping (S)

Combinations of these categories were also used.

The classification of the vegetation was based on the principles laid down by the Zurich-Montpellier school of thought. Braun-Blanquet played an important role in the formulation of these principles and therefore this method is often referred to as the "Braun-Blanquet method for the classification of vegetation". A description of the principles of this method is given by Küchler (1967), Westhoff and Den Held (1969), Shimwell (1971), Westhoff and Van der Maarel (1973), Mueller-Dombois and Ellenberg (1974) and Werger (1974).

Description of the plant communities

The vegetation of Hlane can be divided into a dense evergreen bush-

veld in the west and an open deciduous savanna in the east. It is discussed under the following headings:

1. *Spirostachys africana/Euclea divinorum* Bushveld
2. *Acacia nigrescens/Themeda triandra* Savanna
3. *Strychnos madagascariensis/Terminalia sericea* Sandveld
4. Transitional plots
5. Riverine vegetation

Certain woody species like *Dichrostachys cinerea* and *Ziziphus mucronata* and herbaceous species like *Panicum maximum, Urochloa mosambicensis* and *Thunbergia dregeana* occur in all the above mentioned vegetation types.

1. *Spirostachys africana/Euclea divinorum* Bushveld

The *Spirostachys africana/Euclea divinorum* Bushveld occurs in the western parts of Hlane on the grey soils derived from shales of the Ecca series (Fig. 2) This bushveld is differentiated by the *Spirostachys africana/ Euclea divinorum* species group (Table I). The species groups as used in this text do not correspond with the "Ecological species groups" as described by Mueller-Dombois and Ellenberg (1974). It was only a convenient way of referring to a certain group of species without making a long list every time. The reason why ecological species groups cannot be used, is the lack of knowledge of the environmental relations of all plant species concerned. The *Spirostachys africana/Euclea divinorum* Bushveld is subdivided into the following communities:

1.1 *Acacia luederitzii/Spirostachys africana* Bushveld.
1.2 *Euclea undulata/ Spirostachys africana* Bushveld.

1.1 *Acacia luederitzii/Spirostachys africana* Bushveld

This community is represented on plots 25 and 26 at Hlane (Fig. 1). The soils are grey and belong to the Sterkspruit and Valsrivier Forms (Harmse 1975). This community is usually found near drainage lines. It is differentiated by the *Acacia luederitzii/Sporobolus fimbriatus* species group (Table 1). The woody vegetation of the community is predominantly evergreen while the herbaceous layer is seasonal. Trees in the 6 m height class occur infrequently and have a crown cover of about six per cent (Fig. 3). Dominant trees in this height class are *S. africana, A. leuderitzii* and *Cassine transvaalensis*. The 2 m–6 m height class is dense (36% cover) with crowns overlapping at some stages. The height class mainly consists of the following species:
Euclea divinorum, Acacia luederitzii, Spirostachys africana.

The 0 m–2 m height class is open (3%) as far as the individuals in this height class are concerned. The individuals of the 2 m–6 m height class, however, also contribute to crown cover in this height class. If this is taken into consideration the height class is also quite dense (Fig. 4).

Fig. 2. Vegetation map of the Hlane Wildlife Sanctuary.

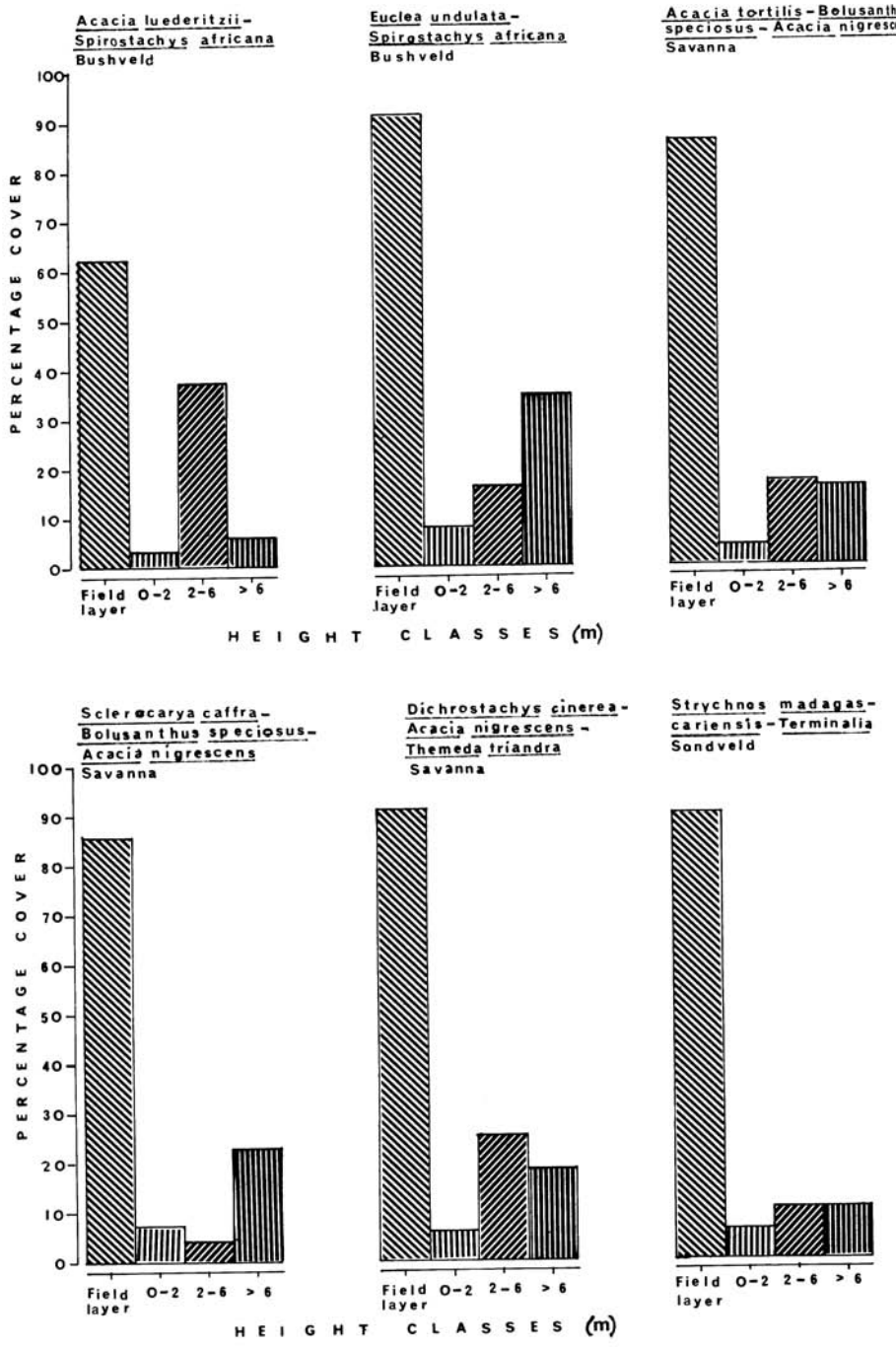

Fig. 3. Structural variation in the plant communities of Hlane.

Fig. 4. *Acacia luederitzii/Spirostachys africana* Bushveld.

As a result of the heavy structure of the soils, the field layer is usually not very dense (62%). The grasses are palatable and consist of species like *Sporobolus fimbriatus, S. nitens, Enteropogon monostachyus* and *Panicum maximum* under the trees. Herbs like *Ceinfugosia hildebrantii, Blepharis integrifolia* and *Abutilon austro-africanum* are common and are an indication of the heavy utilisation of the field layer. This layer is usually not higher than 50 centimetres. This community is related to the *Euclea undulata/ Spirostachys africana* Bushveld through the *Spirostachys africana/Euclea divinorum* species group.

1.2 *Euclea undulata / Spirostachys africana* Bushveld

This community is represented on plots 19, 20 and 27 on Hlane (Table 1). The soil is grey, but the structure of the subsoil especially is not as strong as in the case of the *Acacia luederitzii / Spirostachys africana* Bushveld. According to Harmse (1975) the dominant soil forms are Valsrivier and Swartland. The woody vegetation is evergreen, but is much denser than the *Acacia luederitzii / Spirostachys africana* Bushveld, to which there is a definite floristic resemblance.

The community is differentiated by the *Euclea undulata/Panicum deustum* species group and has a mean crown cover of 35% in the > 6 m height class (Fig. 3). Dominant species in this height class are *Spirostachys africana* and *Acacia grandicornuta*. The crowns of these trees can become so dense that they may overlap (Fig. 5). The 2 m–6 m height class has a cover of 17% with the same dominant species as in the > 6 m height class. Also in this case the higher individuals contribute to the 0 m–2 m height class, which actually has a cover of only five per cent. Species that play an important role in this height class are *Dichrostachys cinerea* and *Euclea undulata* which differentiate this community.

Fig. 5. *Euclea undulata/Spirostachys africana* Bushveld.

Characteristic of the community is the high cover in the field layer (92%) which mainly consists of *Panicum maximum*. The average height of the field layer is 90 cm and except for *Thunbergia dregeana*, hardly any herbs occur. The tall, dense grass as well as the dense woody vegetation, make this community almost unacceptable for wildebeest and zebra which are the main grazers at Hlane. The result is that this community is not utilized to a large extent. This can, however, serve as habitat for game like impala, bushbuck, kudu and duiker.

2. *Acacia nigrescens/Themeda triandra* Savanna

This deciduous savanna covers the eastern parts of Hlane on the basaltic soils (Fig. 2). Topographically, the area is very flat with few drainage lines. The soil is dark in colour and normally very clayey. The savanna is differentiated by the *Acacia nigrescens / Themeda triandra* group and has no relationship with the *Spirostachys africana/Euclea divinorum* Bushveld. It is comparable with the Knobthorn-Marula Veld as described by Van Wyk (1973) in the Kruger National Park. It is subdivided into:

2.1 *Bolusanthus speciosus/Acacia nigrescens/Themeda triandra* Savanna
2.2 *Dichrostachys cinerea / Acacia nigrescens / Themeda triandra* Savanna

2.1 The *Bolusanthus speciosus/Acacia nigrescens/Themeda triandra* Savanna is the most common community on the eastern parts of Hlane and is from a vegetation structural viewpoint, unique for southern Africa. This savanna is differentiated by the *Bolusanthus speciosus / Nidurella auriculata* species group and is subdivided into the following communities:

2.1.1 *Acacia tortilis / Bolusanthus speciosus / Acacia nigrescens* Savanna.

2.1.2 *Sclerocarya caffra / Bolusanthus speciosus / Acacia nigrescens* Savanna.

2.1.1 *Acacia tortilis / Bolusanthus speciosus / Acacia nigrescens* Savanna.

This community (Fig. 6) was sampled on plots 4, 6, 7, 8 and 12 (Figs 1, 2, 3, 4 and Table 1). It occurs mainly in the far eastern area which is commonly known as Nzotho. The soil can vary in depth and shows signs of salination. According to Harmse (1975) the main soil forms are Bonheim, Milkwood and Mayo.

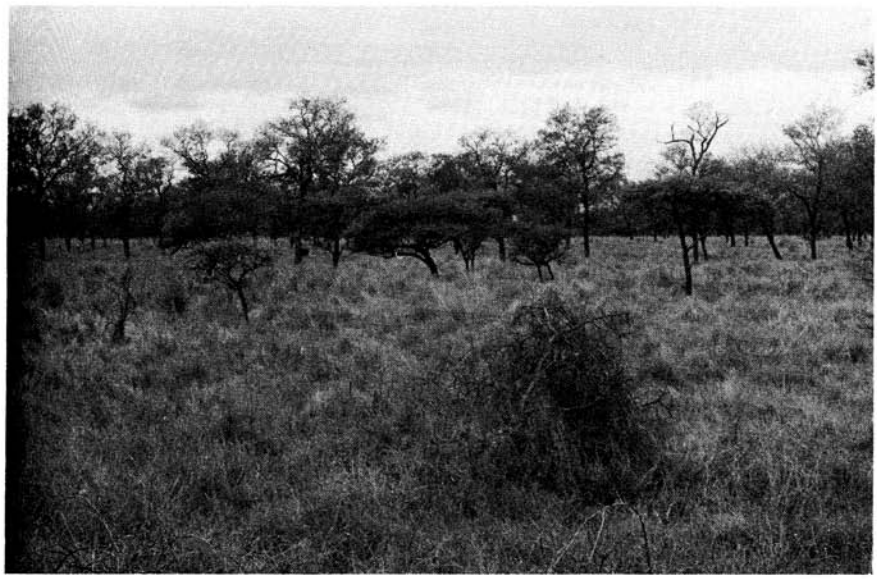

Fig. 6. *Acacia tortilis/Bolusanthus speciosus/Acacia nigrescens* Savanna.

The *Acacia tortilis / Bolusanthus speciosus / Acacia nigrescens* Savanna is actually an inops-variation of the *Bolusanthus speciosus/Acacia nigrescens / Themeda triandra* Savanna, because it contains no differentiating species (Westhoff and Van der Maarel 1973). It is, however, clear that species like *Acacia tortilis, A. nilotica* and *Justicia flava,* which have a larger distribution in other communities, have high values in this community (Table 1). Furthermore, this community is clearly distinguishable from the rest of the *Bolusanthus speciosus /Acacia nigrescens/Themeda triandra* Savanna, due to the absence of the *Sclerocarya caffra / Ipomoea obscura* species group.

The community has a crown cover of 16% in the > 6 m height class, which consists mainly of species like *Acacia nigrescens, A. tortilis* and *Ziziphus mucronata.* The 2 m-6 m height class is a bit

denser (17%) with *A. tortilis, Ziziphus mucronata* and *Bolusanthus speciosus* as dominant species. It is this height class that distinguishes the community from the *Sclerocarya caffra/Bolusanthus speciosus / Acacia nigrescens* Savanna where the height class is almost absent. The 0 m-2 m height class has a crown cover of four per cent with *A. tortilis, Dichrostachys cinerea* and *Ormocarpum trichocarpum* as dominants.

The field layer of the community is utilized extensively and periodically suffers from overgrazing. The crown cover is 86% with species like *Panicum maximum, Themeda triandra* and *Justicia flava* as dominants. The low cover of *Themeda triandra* as compared to the cover of the species in other communities is striking. This might be as a result of the periodic overgrazing.

High preference is given to the community by animal species like wildebeest and zebra and for this reason high priority must also be given to the community as far as management is concerned. The community is subject to bush encroachment by *Dichrostachys cinerea* and with serious overgrazing and absence of fire, it might change to a state which is unacceptable to most grazing animals.

Sclerocarya caffra/Bolusanthus speciousus/Acacia nigrescens Savanna

Plots 1, 2, 3, 5, 9, 10, 13, 15, 22, 23, 24 and 28 are examples of this community on Hlane (Fig. 1). The community is unique in southern Africa due to its peculiar structure.

The community occurs on deep, dark coloured soils, belonging to the Bonheim and Mayo forms (Harmse 1975) mainly in the central areas of Hlane (Fig. 2). The *Sclerocarya caffra / Bolusanthus speciosus / Acacia nigrescens* Savanna is differentiated by both the *Bolusanthus speciosus / Nidurella auriculata* species group and the *Sclerocarya caffra / Impomoea obscura* species group. This community has the last mentioned species group in common with the *Dichrostachys cinerea / Acacia nigrescens / Themeda triandra* Savanna, which shows the floristic resemblance between the two communities.

Structurally this community differs from all the other communities on Hlane. The > 6 m class is dense (23%) with the crowns sometimes overlapping (Fig. 7). *Acacia nigrescens* and *Sclerocarya caffra* are the dominant trees. The 2 m–6 m height class is almost absent with a cover of four per cent. Species that do contribute to the cover in this height class are *Ziziphus mucronata, Bolusanthus speciosus* and *Acacia tortilis.* The big difference in cover of the >6 m height class and the 2 m–6 m height class, is the outstanding feature of the community. There is difference in opinion about the stability of the community in the sense that there is no replacement of the older individuals. Another factor to take into consideration is the role that fire played in establishing and/or

maintaining this peculiar structure. Attention is given to these aspects in the discussion at the end of this paper.

Fig. 7. *Scelerocarya caffra/Bolusanthus speciosus/Acacia nigrescens* Savanna.

The 0 m–2 m height class has a cover of 7% to which the following species contribute:

Dichrostachys cinerea, Ormocarpum trichocarpum, Bolusanthus speciosus and *Grewia bicolor.*

With the absence of fire and under disturbed circumstances this community tends to become dense as a result of the encroachment of species like *D. cinerea.* Examples of encroachment are visible along the main road through the reserve (Fig. 8).

Fig. 8. Encroachment by *Dichrostachys cinerea* in the *Sclerocarya caffra/Bolusanthus speciosus/Acacia nigrescens* Savanna.

The field layer is almost the same as that of the *Acacia tortilis / Bolusanthus speciosus / Acacia nigrescens* Savanna and has a cover of 86%. *Themeda triandra* and *Panicum maximum* are the dominant grasses. This community serve as optimum habitat for wildebeest and zebra if the grass can be kept short.

2.2 *Dichrostachys cinerea / Bolusanthus speciosus / Acacia nigrescens* Savanna

The community usually occurs on well drained soils in the north-western corner of Hlane. It is also present on the basaltic soils where the soil is well drained. Plots 11, 16, 17 and 29 are examples of this community (Fig. 1). Once again the community is an inops-variation of the *Acacia nigrescens / Themeda triandra* Savanna (Westhoff and Van der Maarel 1973) and is characterized by the absence of the *Bolustanthus speciosus / Nidurella auriculata* species group. With more extensive investigation this community might show differentiating species. Species like *Combretum apiculatum, C. hereroense, Vangueria infausta* and *Kohoutia virgata* which are common for well drained soils (Gertenbach 1978) are present in this community.

It is a dense shrubveld with a crown cover of 19% in the > 6 m height class (Fig. 3). Dominant trees are *Sclerocarya caffra, Ziziphus mucronata* and sometimes *Acacia nigrescens*. The 2 m–6 m height class is also dense (25%) with *Ziziphus mucronata* and *Dichrostachys cinerea* as the dominants (Fig. 9). In comparison with the rest of the communities at Hlane, *D. cinerea* has a constantly high value (Table 1) and for this reason this species was included in the name of the community. The 0 m–2 m height class is somewhat open

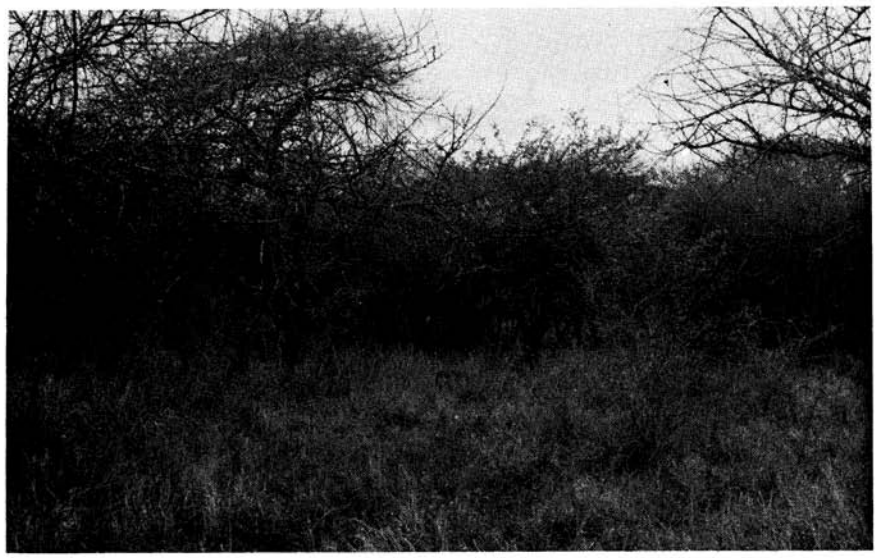

Fig. 9. *Dichrostachys cinerea/Acacia nigrescens/Themeda triandra* Savanna.

(6%) with higher individuals also contributing to the layer. Dominant shrubs are *D. cinerea* and *Grewia hexamita*. The field layer is dense (91%) with *Panicum maximum* and *Digitaria pentzii* as dominant grasses. *Themeda triandra* has a strikingly low value in the community. This community is not utilized to a large extent.

3. *Strychnos madagascariensis/Terminalia sericea* Sandveld

This community occurs on the deep sandy soils derived from Cave Sandstone. It is very local on Hlane and only one plot (18) was sampled in the community. It is differentiated by species like *Terminalia sericea, Strychnos madagascariensis* and *Perotis patens* and was also described by Gertenbach (1978).

There is a relationship between this community, the *Dichrostachys cinerea / Acacia nigrescens / Themeda triandra* Savanna and the *Sclerocarya caffra / Bolusanthus speciosus / Acacia nigrescens* Savanna through the *Sclerocarya caffra/Ipomoea obscura* species group (Table 1).

The >6 m height class has a cover of 10% with *T. sericea* and *S. caffra* as the dominant trees (Figs 3 and 10). The only individuals of *Pterocarpus angolensis* at Hlane also occur in the community. The 2 m–6 m height class has a cover of 10% with *S. madagascariensis* and *Ziziphus mucronata* as dominants. The 0 m–2 m height class is less dense (6%) and species like *Dichrostachys cinerea* and *Xeromphis obovata* are common. Other species that usually occur in this community are:
Priva africana, Trichoneura grandiglumis, Leucas glabrata and *Lippia javanica.*
These species also contribute to the field layer that has a cover of 90% mainly made up by *Digitaria pentzii* and *Tephrosia purpurea*. According to Girdwood (*pers. comm.*) this community is not a natural one as there were disturbances like plowing in the past.

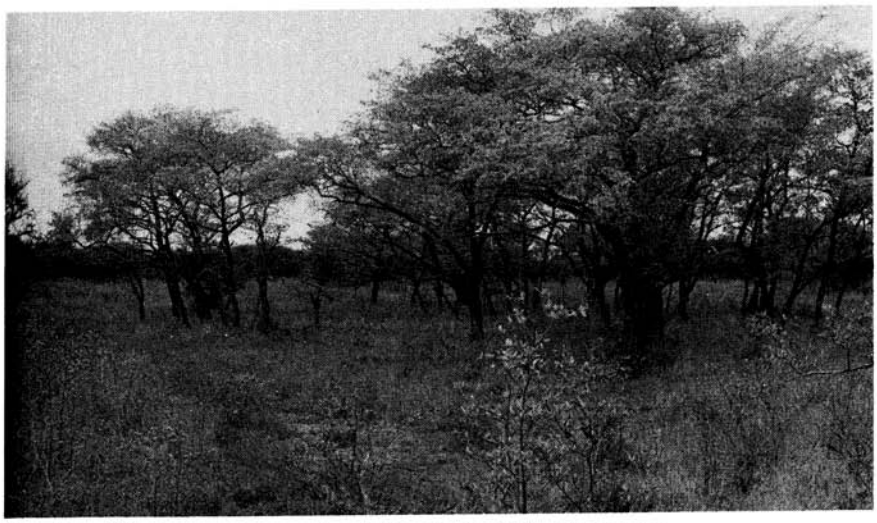

Fig. 10. *Strychnos madagascariensis/Terminalia sericea* Sandveld.

4. Transitional Plots

Plots 14 and 21 could have been left out, because it appeared that these two plots were laid out on a transition between the *Spirostachys africana/Euclea divinorum* Bushveld and the *Acacia nigrescens/Themeda triandra* Savanna. It is, however, interesting to note that species like *A. nigrescens, S. africana* and *T. triandra* can occur together. These transitional plots, however, have a floristic relation with the *Bolusanthus speciosus / Acacia nigrescens / Themeda triandra* Savanna.

5. Riverine vegetation

The riverine vegetation usually differs quite a lot from the surrounding communities. There is also a difference between the riverine vegetation on the basaltic soils and that on the shales. The riverine vegetation on the shales is quite dense with *Spirostachys africana* and *Euclea divinorum* playing an important role. *Panicum maximum* is the dominant grass. The riverine vegetation on the basaltic soils is more open but *P. maximum* is still the dominant grass. The trees are taller and species like *Acacia xanthophloea, A. robusta, Diospyros mespiliformis, Schotia brachypetala, Acacia, nigrescens* and *Lonchocarpus capassa* are usually present.

Discussion

The vegetation survey of Hlane was primarily undertaken to facilitate the formulation of a wildlife management policy for the reserve and was therefore not intended as a detailed analysis of the various plant communities. However, the need for a more intensive analysis of the vegetation especially with regard to structure and the influence of fire and herbivore utilization on the structure, cannot be overlooked. The unique structural features of the *Acacia nigrescens* communities provide optimal habitat conditions for especially wildebeest and zebra, and due to the relatively small area comprising Hlane, changes in the structural features of the habitat could seriously diminish its carrying capacity in terms of the dominant grazers.

Fire has played an important role in the maintenance of the vegetation structure at Hlane. Should regular burning treatments, for some reason, not be applied, one can expect that bush encroachment will take place. Absence of the field layer, as a result of serious overgrazing, may be the cause of bush encroachment due to the lack of fire. It is important therefore, to maintain the populations of grazers at Hlane at such a level, that there should be enough old grass present to support a hot fire. Bush encroachment has already started to take place in the *Acacia tortilis / Bolusanthus speciosus / Acacia nigrescens* and *Sclerocarya caffra / Bolusanthus speciosus/Acacia nigrescens* Savanna's (Fig. 8). Urgent attention must therefore be given to the implementation of a more rigid burning programme, combined with culling operations, of especially the grazers, to stabilize these numbers at a level that would not exceed the carrying capacity of Hlane.

A gradual build-up of game took place at Hlane, starting in 1967, and ending in 1976 when large mortalities of wildebeest and zebra occurred. The population crash coincided with a few years of above average rainfall. Factors responsible for this crash may be one or more of the following:

(i) Overgrazing.
(ii) Selective grazing of the more palatable grasses.
(iii) Change in the habitat as a result of bush encroachment.
(iv) Grass with poor nutritive value caused by too much rain. (Grass growing under maximum conditions yield more fibre and water but less protein).
(v) Build-up of a reservoir of internal parasites on the grazing.
(vi) Change in the amount and distribution of artificial water supply.

All these factors are, however, density dependent and this stresses once again the necessity for the stabilization of the populations of grazers at an acceptable level.

The question may arise whether the *Sclerocarya caffra / Bolusanthus speciosus / Acacia nigrescens* Savanna as represented in Hlane, reflects a stable vegetation type with respect to its peculiar structure. The apparent absence, or scarcity, of young woody plants in the intermediate height classes between the field layer and mature trees could create the impression that replacement of old dying trees would be insufficient to maintain the physiognomic and structural characteristics of the community. Data collected during the survey indicated a density of approximately 30 trees/ha and assuming that the trees attain an age of 100 years, it would imply that recruitment to the tree layer at a rate of 1 tree/ha every 3,3 years would be sufficient to maintain the *status quo*. Under these circumstances a low density of woody plants under the 6 m height class would be expected, as reflected in this vegetation type in Hlane. In the absence of mortality factors affecting the larger seedlings that survive the fire hazards inflicted on the smaller seedlings in the field layer, and low rate of turn-over amongst the mature trees, the present rate of recruitment is believed to be sufficient to maintain the physiognomic and structural characteristics of this vegetation type.

A major contributing factor to the peculiar structure of this vegetation type is the almost exclusive presence of *Acacia nigrescens* in the height class > 6 m, with only sparse distribution of the woody plants. Had there been a greater variety of other woody species with differing growth forms, the conspicuous absence of woody growth in the intermediate heigh classes would have been obliterated, creating the impression of a more stable distribution of woody plants in the different heigh classes.

The vegetation communities of the Hlane Wildlife Sanctuary and their associated wild animal populations represent a natural relict of the erstwhile Swaziland Lowveld. This is especially important in view of the extensive changes to the natural wildlife and wilderness areas wrought

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by agricultural developments and human exploits (Fig. 11). It is therefore, deemed especially important that this relatively small 'natural' area by strictly protected for posterity, in an otherwise rapidly developing and changing environment.

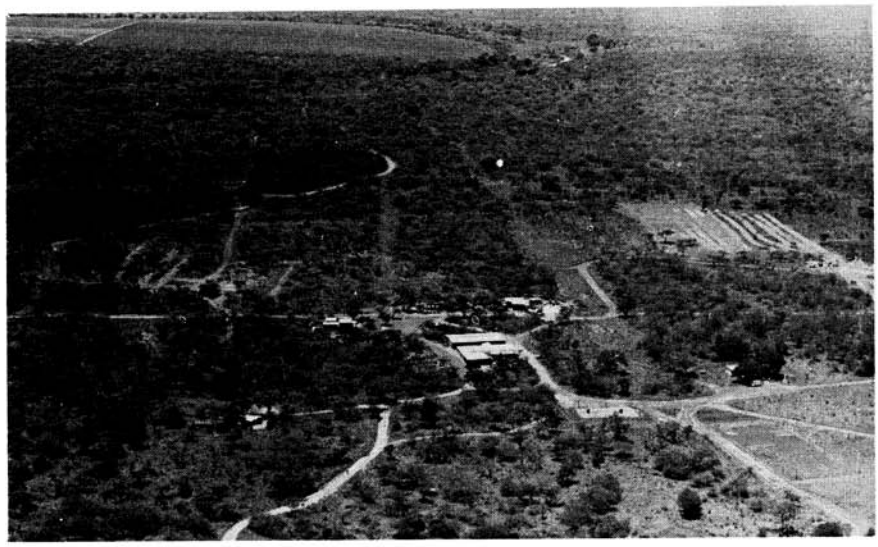

Fig. 11. Mining activities in Hlane, while the potential pressure of sugar farming can be seen in the background. October 1976.

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