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LANDSCAPES OF THE KRUGER NATIONAL PARK

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Abstract — Knowledge on the abiotic and biotic components of the Kruger National Park (KNP) system has increased to such an extent, that it was possible to zonate the KNP into landscapes. A landscape was defined as an area with a specific geomorphology, climate, soil and vegetation pattern together with the associated fauna. On this basis 35 landscapes were identified and described in terms of the components mentioned in the definition.

The objective of classification is that future management should be based on these landscapes. Relevant management considerations may change, but the landscape as a basic functional unit should not be negotiable.

Introduction

The plant communities occurring in the Kruger National Park (KNP) were classified and described using the Braun-Blanquet technique (Van Rooyen 1978; Gertenbach 1978; Coetzee 1983). The geographical distribution and size of these plant communities have shown such a complex pattern as to render it impossible to indicate individual plant communities or associations on a map of reasonable scale. Despite intensive research regarding the ecology of these plant communities, no practical management program based on these communities has been forthcoming. The intensity of these surveys has thus apparently surpassed the practical application of the results.

Studies regarding the climate (Gertenbach 1980), geology (Schutte 1974, 1982) soils (Harmse & Van Wyk 1972; Harmse, Van Wyk & Gertenbach 1974; Webber 1979; Venter 1981), vegegation (Gertenbach 1978; Van Rooyen 1978; Coetzee 1983) and animal life (Pienaar 1963; Joubert *in prep.*) have contributed towards an improved interpretation of the functioning of the ecosystem as a whole. Equipped with this information an attempt was made to divide the KNP into significant units for the purpose of practical conservation management. Such a zonation of the KNP was suggested by Joubert (1975), but with the availability of additional data the necessity for adjustments became inevitable.

Prevailing requirements have necessitated the formulation and acceptance of the concept of a landscape in the nature conservation context. A landscape is defined by Coetzee (1983) as " . . . an area with a recurrent pattern of plant communities with their associated fauna and abiotic habitat". Considering that vegetation and

abiotic habitat are not consistently recurrent, the following definition of a landscape has been formulated for the purpose of this study: "A landscape is an area with a specific geomorphology, macroclimate, soil and vegetation pattern and associated fauna". Therefore a landscape is comparable to a "Landtype" (Macvicar, Scotney, Skinner, Niehaus & Loubser 1974).

Although the original study of plant communities and their abiotic habitat was ostensibly too intensive, it would appear from the definition, that it did form the basis of the landscape characterisation. On the contrary, the conclusion can be made that the identification of landscapes is not possible without a thorough knowledge of soil and vegetation patterns.

It cannot be expected that the classification of the KNP into landscapes should be a demarcation of homogeneous units. On the contrary, heterogeneity occurs within a landscape, but an attempt has been made to group the most dominant soil and vegetation patterns.

Methods

Each landscape is discussed with respect to the five components mentioned in the definition. The geomorphology is discussed using geological descriptions of Brandt (1948), Schutte (1974), Cleverly & Bristow (1979), Bristow (1980), Schutte (1982) and Schutte & Clubley-Armstrong (1982) and the 1:100 000 maps of the KNP.

Climatic data were received from 22 ranger stations where rainfall is measured, five Class II weather stations and one Class I weather station where limited temperature data are recorded. A rainfall chart was compiled by Gertenbach (1980).

Descriptions of the soil types were done using 2 000 soil profiles dug in the KNP, as well as charts by Harmse & Van Wyk (1972); Harmse *et al.* (1974); Webber (1979) and Venter (1981). Vegetation descriptions were done by Codd (1951), Van der Schijff (1957), Pienaar (1963), Van Wyk (1973), Gertenbach (1978), Van Rooyen (1978) and Coetzee (1983). Additional descriptions of vegetation were also obtained from 1 500 Braun-Blanquet-plots in the KNP. The discussion of the associated fauna was done with the help of observations made during the annual aerial surveys (Joubert *in prep.*) as well as the experiences of other field staff. The geographical distribution of each of these landscapes are represented on the accompanying map (Fig. 1).

The landscapes should therefore be seen as functional management units distinguished on the basis of the entities described in the definition. The ideal is that any form of management should henceforth be based on the zonation of the KNP into landscapes. Management considerations per landscape could change in the short term, and should thus be reviewed from time to time, but the landscapes as a functional unit should not be negotiable.

Discussion of Landscapes

1. Lowveld Sour Bushveld of Pretoriuskop

Location and Geomorphology

This landscape is located in the south-western corner of the KNP in the vicinity of Pretoriuskop and covers approximately 530 km² (2,8 percent of the KNP). Archain

granite and gneiss form the underlying material of this area and results in an undulating landscape with distinct uplands and bottomlands. Rocky granite koppies and deep incisions forming seasonal spruits are characteristic. Drainage takes place northwards *via* the Pabene and Mtshawu spruits to the Sabie River and south and eastwards via the Nsikazi and Mbyamide spruits to the Crocodile River. The altitude varies between 550 and 650 metres above sea level.

Climate

The annual rainfall varies between 600 and 1 000 mm with an average of 743,6 mm for Pretoriuskop (Gertenbach 1980). Precipitation usually occurs in summer with effective rains during the months October to April. The relatively high rainfall and absence of frost causes the grass to sprout even during winter, thereby providing green pasture out of season. Daytime temperatures of 35 °C during summer are common, but at the same time the temperature during winter is very moderate.
Table 1 shows the average daily maximum and minimum and absolute maximum and minimum temperatures for each month for Pretoriuskop.

Table 1
Temperature data for Pretoriuskop
(Data collected since September 1981)

Temperature °C

Month	Average Daily Maximum	Absolute Maximum	Average Daily Minimum	Absolute Minimum
January	29,2	35,4	18,8	16,7
February	31,0	37,0	18,3	14,0
March	32,1	39,0	17,8	13,0
April	27,8	33,5	15,1	8,0
May	25,1	33,0	12,7	8,5
June	23,9	30,0	8,8	4,0
July	24,8	32,0	9,3	4,5
August	26,7	34,0	11,0	6,0
September	26,9	36,1	14,4	8,6
October	23,7	33,0	13,2	9,5
November	30,1	39,7	17,6	14,0
December	28,6	35,5	17,4	14,2

Soil pattern

The soil pattern of the landscape corresponds strongly with the position in the topography. The soil on the uplands is red to yellow-brown in colour, varies from a sand to a sandy loam (6 to 15 percent clay) and is deeply leached. Harmse & Van

Wyk (1972) classifies the soils into the Hutton and Clovelly Forms with Portsmouth/Moriah and Paleisheuwel/Denhere respectively as the dominant Series.
Soils are classified by means of the South African soil classification system of Macvicar, Loxton, Lambrechts, Le Roux, Harmse, De Villiers, Verster, Merryweather & Van Rooyen (1977). A characteristic of the landscape is that the sandy soils occur from the uplands almost down to the drainage channels. This results in the bottomlands being narrow and relatively inconspicuous. An accumulation of clay and minerals has taken place in the bottomlands and therefore the soils in these areas are clayey with a strongly developed structure. Dominant soil Forms from the valleys are Estcourt, Wasbank, Valsrivier and Sterkspruit. On the banks of spruits soils occur that have been deposited in recent times and have undergone little or no soil forming processes. Such soils at times show clear layers of unconsolidated material and belong mainly to the Oakleaf and Dundee Forms.

Vegetation

Acocks (1975) describes the vegetation of this landscape under the name of Lowveld Sour Bushveld, while Van der Schijff (1957) and Pienaar (1963) provided long lists of plants which occur in this landscape. The vegetation structure of the uplands is an open tree savanna with relatively few low shrubs and the woody component is dominated by *Terminalia sericea* and *Dichrostachys cinerea* subsp. *nyassana* (Fig. 2). Important associated species are *Strychnos madagascariensis*, *S. spinosa*, *Peltophorum africanum*, *Combretum collinum* subsp. *suluense*, *C. zeyheri*, *C. apiculatum*, *C. molle*, *Ximenia caffra*, *Sclerocarya caffra*, *Parinari curatellifolia*, *Annona senegalensis*, *Antidesma venosum* and *Maytenus heterophylla*. This landscape is unique in the respect that many of the rarer species of trees in the KNP occur abundantly. Species that deserve mentioning are *Pterocarpus angolensis*,

Fig. 2. Landscape 1. Upland Lowveld Sour Bushveld of Pretoriuskop.

Albizia versicolor, Lannea discolor, Piliostigma thonningii and *Acacia sieberana* var. *woodii. Ficus sycomorus* which is common for riverine vegetation also occurs on the uplands of this landscape. The vegetation found on the koppies (Fig. 5) is comparable to that found in the Malelane Mountain Bushveld (Landscape 2).

The field layer is tall (1-2 metres), dense (70 percent crown cover) and is dominated by more sour species of grass like *Hyperthelia dissoluta, Elionurus argenteus, Hyparrhenia hirta, H. filipendula, Setaria perennis, Rhynchelytrum setifolium, Aristida congesta* susp. *congesta, Heteropogon contortus, Eragrostis lappula, E. atrovirens, Schizachyrium sanguineum, Diheteropogon amplectens, Pogonarthria squarrosa* and *Setaria flabellata. Vernonia natalensis* is the dominant forb in the field layer. The physiognomical dominance of *Hyperthelia dissoluta* is typical of the landscape.

The grass composition of the middleslopes of the landscapes change slightly and grasses such as *Loudetia simplex, Andropogon huillensis, Digitaria longiflora, Eragrostis capensis* and *E. gummiflua* occur more frequently.

The bottomlands in the landscape are narrow and when present is an open savanna with single trees and sparse shrubs and a denser grass cover (Fig. 3). Dominant woody species are *Acacia nilotica* subsp. *kraussiana, A. gerrardii, A. tortilis* subsp. *heteracantha, Combretum hereroense, Grewia bicolor, G. hexamita, G. monticola, Schotia brachypetala, Diospyros mespiliformis, Bolusanthus speciosus, Ziziphus mucronata, Cassine aethiopica, Euclea natalensis, E. divinorum, Rhus pyroides* and *A. nigrescens.* Grasses which occur in the bottomlands are *Digitaria eriantha* var. *pentzii, Eragrostis superba, Aristida congesta* subsp. *barbicollis, Sporobolus fimbriatus, Urochloa mosambicensis, Heteropogon contortus, Themeda triandra,*

Fig. 5. Landscape 1. Manung, a Granite Koppie.

Fig. 3. Landscape 1. Bottomland Lowveld Sour Bushveld of Pretoriuskop.

Fig. 4. Landscape 1. Vegetation on a stream bank.

Cymbopogon plurinodis and *Panicum maximum*. Because of the sweeter nature of the grasses in the bottomlands they are selected by game and it is usually these areas that show the first signs of overgrazing.

Spruit and river banks are dense and evergreen plants occur most frequently (Fig. 4). *Diospyros mespiliformis*, *Acacia robusta*, *Schotia brachypetala*, *Syzygium cordatum*, *S. guineense*, *Ficus sycomorus*, *Cassine aethiopica*, *Olea africana*, *Spirostachys africana*, *Bauhinia galpinii* and *Euclea natalensis* are the dominent woody species. The grass cover is sparse and is dominated by *Panicum maximum*. The palm *Phoenix reclinata* occurs in the sandy beds of the larger spruits.

Fauna

According to Pienaar (1963) this landscape is preferred habitat for reedbuck *(Redunca arundinum)* and kudu *(Tragelaphus strepsiceros)*. White rhino *(Ceratotherium simum)* occur regularly and it is the area with the largest concentration of sable antelope *(Hippotragus niger)* in the southern part of the KNP. According to Joubert *(in prep.)* at least 150 of these animals occur in this landscape. Oribi *(Ourebia ourebi)* occurred in this area during earlier years, but later became extinct. Attempts to re-establish this species took place in 1973-74 when animals were transferred from the highveld and released in this landscape. There is no evidence to prove that these attempts were successful. The last remaining herd of roan antelope *(Hippotragus equinus)* in the southern part of the KNP is also found in this landscape. The relative absence of elephant *(Loxodonta africana)* and buffalo *(Syncerus caffer)* from this landscape is as significant as is the presence of other game species, since this area is not acceptable to them. This landscape in its present form is also not good habitat for short grass grazers such as wildebeest *(Connochaetus taurinus)* and zebra *(Equus burchelli)*.

2. Malelane Mountain Bushveld

Location and Geomorphology

This landscape is located in the extreme south-western corner of the KNP and includes all the mountains of the Malelane and Stolznek areas. Geologically, archain granite and rock formation of the Swaziland System form the underlying material of this area. Mountains such as Sithungwane and Newu consist of granite, while Khandizwe, Tlhalabye and Mathili are made up of Swaziland rock formation. Dolerite intrusions also occur in the Swaziland System and granite. It has been observed that the parent material of the eastern slopes of a koppie consist of dolerite while the western slopes are mainly granite. The altitude varies from 350 to 800 metres with Khandizwe being the highest point at 847 metres. This landscape represents 2,4 percent of the area of the KNP. The slopes are steep and the most important spruits are the Nsikazi, Matjulu and Matjulwana.

Climate

This area has a moderate sub-tropical climate with warm summers and cool winters. The climate on the mountain plateaus is probably more extreme with the possibility of frost not excluded. The annual rainfall varies from 600 to 700 mm and probably

increases to more than 1 000 mm on the mountains. The average annual rainfall for Malelane and Stolznek is 620 and 723 mm respectively. According to Gertenbach (1980) the abnormally high average rainfall at Stolznek can be attributed to the short period in which rainfall has been recorded.

Soil pattern

Harmse & Van Wyk (1972) regards the soils of this landscape as shallow rocky soils and classify them in the Lithosol category. The most common soil Forms that occur are Mispah and Glenrosa. Clay accumulation took place to a limited degree in the bottomlands and Valsriver and Oakleaf soils developed. The soils of the mountainous plateaus are well drained, more deeply leached and is generally classified as Hutton soils.

Vegetation

The vegatation of this landscape is very heterogeneous, but *Combretum apiculatum* is omnipresent on the shallow soils regardless of the parent material of the soil (Fig. 6). The structure of the woody component varies from dense to moderate, 3 metre high shrubs with single trees and can be described as a bushsavanna. Other woody plants which occur regularly are *Acacia nigrescens, Combretum zeyheri, C. collinum, Terminalia sericea, T. prunioides, Dichrostachys cinerea* subsp. *africana,* and *Acacia tortilis.* The vegetation is very similar to that found on the koppies in the Lowveld Sour Bushveld of Pretoriuskop and elements of this landscape are also sporadically found amongst the mountains. Considering that Landscape 5 is adjacent to this mountain bushveld, elements of the latter also occur regularly in this landscape.

Fig. 6. Landscape 2. Malelane Mountain Bushveld.

From the nature of this mountainous landscape different micro-habitats occur *e.g.* small ravines which result in the occurrence of a range of unique plant species. A few that deserve to be mentioned are the following: *Kirkia wilmsii, Sterculia murex, Commiphora harveyi, Strychnos henningsii, Homalium dentatum, Premna mooiensis, Celtis africana, Aloe bainesii, Ficus capensis, F. sonderi, F. soldanella, Urera tenax, Olax dissitiflora, Portulacaria afra, Albizia versicolor, Dalbergia armata, Pterocarpus angolensis, Erythrina latissima, E. lysistemon, Vepris reflexa, Pittosporum viridiflorum, Croton gratissimus, Euphorbia ingens, E. evansii, Maytenus undata, Cassine aethiopica, Hippobromus pauciflorus, Berchemia zeyheri, Grewia monticola, Dombeya kirkii, D. cymosa, Ochna natalitia, Mimusops zeyheri, Manilkara mochisia, Breonadia microcephala, Tarchonanthus camphoratus, Brachylaena huillensis, Rauvolfia caffra, Olea africana, Heteropyxis natalensis, Commiphora neglecta, Acacia karroo, Sideroxylon inerme, Manilkara concolor, Apodytes dimidiata, Calodendrum capense, Tecomaria capensis, Cussonia natalensis, Faurea saligna* and *F. speciosa.*

The dominant grasses in this area are *Heteropogon contortus, Pogonarthria squarrosa, Panicum maximum, Digitaria eriantha* subsp. *pentzii, Cymbopogon plurinodis, Aristida congesta* subsp. *barbicollis, Tricholaena monachne, Trichoneura grandiglumis, Enneapogon cenchroides and Themeda triandra.* A common garden flower *Gerbera jamesonii* occurs extensively in this mountain veld.

Recently a new plant community was discovered on the mountain plateaus. It is an open *Acacia davyi*-savanna with *Tristachya hispida* as the dominant grass. The occurrence of this community suggests that a higher rainfall prevails and the possibility of frost is not excluded. This community is related to the grassveld on the highveld.

The bushy ravines on the slopes of the mountains accommodate sub-tropical forest vegetation with *Aloe bainesii* being a unique component. Tree ferns *(Alsophila dregei)* are common.

Fauna

This area is the most important habitat for mountain reedbuck *(Redunca fulvorufula),* grey rhebuck *(Pelea capriolus)* and reedbuck *(Redunca arundinum)* in the KNP. The mountain reedbuck population was strengthened by the importation of ± 200 animals from the Mountain Zebra National Park, while for all practical purposes the grey rhebuck has become extinct. During 1981, 20 individuals were re-established on the *Acacia davyi*-plateaus. Kudu and impala *(Aepyceros melampus)* are common in this area, while sable antelope and white rhino are generally less abundant. Animals such as elephant and buffalo occur in relatively low numbers while the same applies to wildebeest and zebra to a lesser degree. As a result of the rocky nature of this area, klipspringers *(Oreotragus oreotragus)* are plentiful with duikers *(Sylvicapra grimmia)* constantly present.

Carnivores such as wild dog *(Lycaon pictus)* and spotted hyaena *(Crocuta crocuta)* frequently make their lairs in the caves and crevices of the mountainous parts of this landscape. The last observation of brown hyaena *(Hyaena brunnea)* in the KNP was recorded in this landscape. Baboons *(Papio ursinus)* are also inhabitants of these koppies.