3. *Combretum collinum/Combretum zeyheri* Woodland

Location and Geomorphology

This landscape is situated along the upper course of the Mbyamide River in the central southern district between the Sabie and Crocodile Rivers. It covers approximately 540 km² which represents 2,8 percent of the KNP. The underlying granite and gneiss is deeply weathered resulting in a undulating landscape with distinct uplands and bottomlands. The area is drained exclusively by the Mbyamide River and its tributaries. The altitude varies between 450 and 550 metres above sea level.

Climate

The climate is mild and the absence of frost is an important characteristic. Temperatures of about 40 °C in the summer is not unusual. The average rainfall varies between 600 and 700 mm per year and occurs mainly during the summer. The temperature data for Pretoriuskop (Table 1) is also applicable to this landscape.

Soil Pattern

Venter (1981) describes the soil of the uplands in this landscape as red, course, fersiallitic sands and loams. Harmse & Van Wyk (1972) classified the soil on the uplands mainly as Hutton and Clovelly Forms with Portsmouth and Paleisheuwel respectively as the dominant Series. The soil is deeply leached and has good internal drainage. The soil pattern differs from that of the Lowveld Sour Bushveld (Landscape 1) in that a definite ecotone is present.

There is a definite seepline where the topography changes from convex to concave and superfluous rainwater that has fallen on the uplands move downlands and laterally to appear on the surface. These soils are saturated with water in the rainy season and gleyed horizons are present (Fig. 7). It is in this seepline that temporary springs originate during the rainy season. Dominant types of soil under these conditions are Estcourt, Kroonstad, Cartref, Wasbank and Longlands. These types of soil are generally classified as duplex soils.

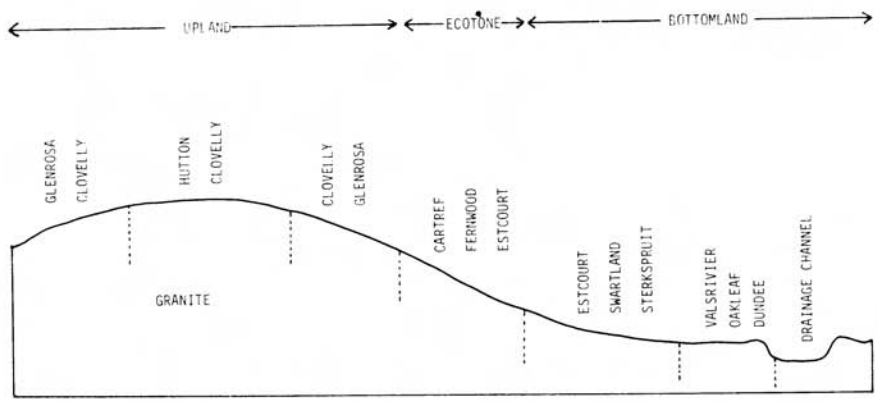

Fig. 7. Diagrammatic representation of a granite undulation.

Accumulations of clay and minerals have taken place in the bottomlands. The result is that the bottomland soils are clayey and have a high concentration of mineral salts. Soils commonly present in the bottomlands are Valsrivier, Swartland, Sterkspruit, Glenrosa, Wasbank, Cartref and Estcourt. On the banks of spruits, under-developed soils of the Oakleaf and Dundee Forms (Fig. 7) can be expected.

This sequence of soil types from the upland to the bottomland is referred to as a catenary sequence and is usually constant for a specific landscape. That is why Coetzee (1983) as quoted in the introduction included the phrase "recurrent pattern" in the definition. Exceptions to this normal sequence of soil types do occur, but are not sufficiently important to justify the creation of a new "landscape".

Vegetation

As is indicated by the name of the landscape, the vegetation on the uplands is dominated by *Combretum collinum* subsp. *suluense* and *C. zeyheri* (Fig. 8). This is a relatively dense bush savanna between 1 and 5 metres in height with larger trees sparsely dispersed. Other woody species occurring constantly on the uplands are as follows: *Terminalia sericea, Combretum apiculatum, Dichrostachys cinerea* subsp. *nyassana, Strychnos madagascariensis, Peltophorum africanum, Combretum molle, Pterocarpus rotundifolius, Maytenus heterophylla, Sclerocarya caffra, Acacia exuvialis, Dalbergia melanoxylon* and *Xeromphis obovata.*

The field layer is moderate to dense, less than 1 metre in height and is dominated by *Pogonarthria squarrosa, Tricholaena monachne, Hyperthelia dissoluta, Setaria flabellata, Loudetia simplex, Eragrostis rigidior, Trichoneura grandiglumis, Perotis patens, Brachiaria nigropedata, Digitaria eriantha* subsp. *pentzii, Panicum maxi-*

Fig. 8. Landscape 3. Upland *Combretum collinum/Combretum zeyeri* Woodland.

mum, *Aristida congesta* subsp. *congesta*, *A. congesta* subsp. *barbicollis*, *Heteropogon contortus* and *Rhynchelytrum repens*. Forbs in the field layer include the following: *Waltheria indica*, *Agathisanthemum bojeri*, *Kohautia virgata*, *Tephrosia polystachya*, *Clerodendrum ternatum* and *Rhynchosia totta*. The vegetation which occurs on the ecotone is dominated by an almost homogeneous stand of *Terminalia sericea*. The field layer is dense, up to 1 metre high and includes the following species: *Eragrostis gummiflua*, *Pogonarthria squarrosa*, *Hyperthelia dissoluta* and *Epaltes gariepina*.

Fig. 9. Landscape 3. Ecotone and Bottomland *Combretum collinum*/*Combretum zeyheri* Woodland.

The nutritive clayey bottomlands (Fig.9) are open savannas with a dense grass layer. Because of the sweeter nature of the grass in these bottomland areas, these parts are the first to be overgrazed and therefore are the first to show signs of retrogressive succession. The most important woody species are *Acacia nigrescens*, *A. nilotica* subsp. *kraussiana*, *Ormocarpum trichocarpum*, *Acacia gerrardii*, *Combretum hereroense*, *Grewia bicolor*, *Euclea natalensis*, *Ziziphus mucronata*, *Grewia hexamita*, *Albizia harveyi*, *Acacia exuvialis*, with *Spirostachys africana*, *Cassine aethiopica*, *Euclea divinorum*, *Schotia brachypetala*, *Pappea capensis* and *Diospyros mespiliformis* which are limited to the brackish footslopes. The field layer is dense with the following important species: *Themeda triandra*, *Digitaria eriantha* subsp. *pentzii*, *Heteropogon contortus*, *Cymbopogon plurinodis*, *Eragrostis superba*, *Enneapogon cenchroides*, *Aristida* subsp. *barbicollis*, *Schmidtia pappophoroides* and *Urochloa mosambicensis*. On the brackish footslopes

Dactyloctenium aegyptium and *Sporobolus nitens* are dominant. Dominant forbs are *Heliotropium steudneri, Abutilon austro-africanum, Ruellia patula, Justicia flava, Blepharis integrifolia* and *Cyphocarpa angustifolia.*

The riverine vegetation is very heterogeneous but the most common species are: *Diospyros mespiliformis, Spirostachys africana, Lonchocarpus capassa, Combretum imberbe, Schotia brachypetala, Acacia robusta, Cassine aethiopica* and *Euclea natalensis.* The grass layer is dominated by *Panicum maximum.*

Fauna

This landscape is preferred habitat for sable antelope, buffalo, kudu, white rhino, reedbuck and elephant, while smaller antelope like steenbok *(Raphicerus campestris)* and duikers occur constantly. Zebra are widely distributed forming groups of four to six individuals while wildebeest are normally absent from this landscape.

4. Thickets of the Sabie and Crocodile Rivers

Location and Geomorphology

As the name indicates this landscape consists of the low lying areas along the two rivers and is underlain by archian granite and gneiss intersected by dolerite intrusions. The landscape is horseshoe-shaped, starting at the Sabie River with the Mtshawuspruit as the western boundary, along the Sabie eastwards to Lubyelubye, then southwards across the watershed to the Crocodile River and then westwards following the river banks to the vicinity of the Malelane restcamp. The topography is concave to relatively flat but is intersected by numerous spruits that flow into the two rivers. Spruits worth mentioning are the Nwaswitshaka, Nwatimwambo, Nwatimhiri and Lubyelubye that flow into the Sabie River and the lower Mbyamide, Bume and Mlambane that flow into the Crocodile River. A few granite koppies occur in the landscape of which Shirimanthanga, Renoster Koppies, Thekwane, Mlaleni, Siyalo and Sihehleni are the most important.

The altitude varies between 200 and 350 metres and the landscape occupies 1 242 km^2 or 6,2 percent of the KNP, which makes it one of the largest landscapes in the southern district.

Climate

The climate of this low-lying landscape shows greater extremes than the adjacent landscapes. As far as temperature is concerned a great variation between day and night-time temperatures is experienced. The average daily maximum temperature is above 31 °C for the months of November to March (Table 2) while sporadic frost occurs in the winter in the bottomlands. The rainfall varies between 500 and 550 mm per year with an annual average of 546 mm for Skukuza (Gertenbach 1980).

Table 2
Temperature data for Skukuza
(Data collected since 1965)

Temperature °C

Month	Average Daily Maximum	Absolute Maximum	Average Daily Minimum	Absolute Minimum
January	32,3	42,3	19,6	7,2
February	32,2	40,3	19,4	7,2
March	31,2	40,3	17,9	8,3
April	29,8	38,3	14,8	3,3
May	27,4	37,0	10,2	2,2
June	25,6	35,3	6,1	-2,2
July	25,4	36,1	5,6	-2,5
August	27,2	37,9	7,6	-0,1
September	29,4	40,6	11,6	1,1
October	30,8	41,7	15,1	6,6
November	31,8	44,5	17,5	6,7
December	32,3	44,4	19,2	8,3

Soil pattern

The soils in this landscape are normally shallow and where it is deeper it is usually saturated with sodium. It developed mainly as a result of the accumulation of clay and mineral elements in the low lying areas. Harmse & Van Wyk (1972) identified two groups of soils in this landscape, namely Mispah and Glenrosa soils on the uplands and Sterkspruit, Estcourt and Valsrivier soils in the bottomlands. Dundee, Oakleaf and Inhoek Forms of soil are usually found on the banks of spruits and rivers. The soils present in the vicinity of dolerite intrusions are usually darker in colour and Forms that can be expected are Mayo, Milkwood and Swartland. As a rule it can be said that the soils of this landscape are usually shallow and show no signs of a recurrent pattern.

Vegetation

This landscape is characterised by a dense woody vegetation which can basically be referred to as an *Acacia nigrescens/Combretum apiculatum* association and it corresponds to a large extent with the bottomland vegetation in Landscapes 3 and 5. Van Wyk (1973) refers to this landscape as ". . . thorny thickets on brackish granite flats, . . ." while Coetzee (1983) calls it ". . . spiny arid bushveld". Pienaar (1963) refers to it as ". . . dense thornbush thickets".

The differentiating species of the landscape are *Acacia nigrescens, Combretum apiculatum, Grewia bicolor, G. flavescens, Dichrostachys cinerea* subsp. *africana, Euclea divinorum, Terminalia prunioides, Spirostachys africana* and *Acacia*

grandicornuta. Two variations of the vegetation can be identified *viz*. *Combretum apiculatum*-dominated uplands (Fig. 10) and *Acacia grandicornuta*-dominated bottomlands (Fig. 11). Both variations of vegetation are dense and according to Joubert (1976) the relative crown cover of woody species are as follows:

Stratum	Relative Crown Cover (%)
> 4 metres	7,4
3 - 4 metres	10,7
2 - 3 metres	11,0
1 - 2 metres	70,9

The soils of the uplands are shallow and stony and dense stands of the following woody plant species are present: *Combretum apiculatum*, *Acacia nigrescens*, *A. exuvialis*, *Terminalia prunioides*, *Dichrostachys cinerea* subsp. *africana*, *Grewia bicolor*, *G. flavescens*, *Combretum hereroense*, *Lannea stuhlmannii*, *Ziziphus mucronata*, *Sclerocarya caffra*, *Lonchocarpus capassa* and *Acacia tortilis*. The field layer is sparse and is dominated by *Aristida congesta* subsp. *barbicollis*, *Pogonarthria squarrosa*, *Rhynchelytrum repens*, *Panicum maximum*, *Urochloa mosambicensis*, *Schmidtia pappophoroides*, *Digitaria eriantha* var. *pentzii* and *Eragrostis rigidior*. Forbs normally present are *Waltheria indica*, *Tephrosia polystachya*, *Clerodendrum ternatum*, *Evolvulus alsinoides*, *Heliotropium steudneri*, *Aptosimum lineare*, *Kohautia virgata* and *Agathisanthemum bojeri*.

Fig. 10. Landscape 4. *Combretum apiculatum*-variation.

Fig. 11. Landscape 4. *Acacia grandicornuta*-variation.

On the brackish soils in the bottomlands *Combretum apiculatum* is less common and the lower shrub layer less dense. Sometimes large bare patches occur with only single *Acacia grandicornuta* trees. Dominant woody species are: *Acacia grandicornuta, Acacia nigrescens, A. exuvialis, Terminalia prunioides, Spirostachys africana, Dichrostachys cinerea* subsp. *africana, Grewia bicolor, G. flavescens, Xanthocercis zambesiaca, Euclea divinorum, Acacia tortilis, A. nilotica, Ormocarpum trichocarpum, Schotia brachypetala* and *Ehretia rigida*. Species which are relatively rare in other landscapes are constantly occurring in this landscape. Such species are: *Ptaeroxylon obliquum, Balanites maughamii, Croton gratissimus, Zanthoxylum humilis, Gardenia spatulifolia, Adenium obesum, Pavetta catophylla* and *Rhigozum zambesiacum*.

The field layer of this variation is once again sparse and for the most part in an over-utilised condition. Even under very favourable conditions no good, stable grass cover develops. As a result of overgrazing, fires occur less frequently in this landscape and thus the reason why it is usually densely overgrown with woody species. Grasses found in the brackish bottomlands include the following: *Sporobolus nitens, Urochloa mosambicensis, Chloris virgata, Aristida congesta* subsp. *barbicollis, Bothriochloa radicans, Schmidtia pappophoroides, Digitaria eriantha* var. *pentzii* and *Eragrostis trichophora*. Under conditions of lower utilisation grasses such as *Themeda triandra, Panicum maximum, Heteropogon contortus, Sporobolus smutsii* and *Cymbopogon plurinodis* sometimes increase. Forbs found on brackish spots include the following: *Dyschoriste rogersii, Abutilon austro-africanum, Crossandra mucronata, Justicia flava, Cyphocarpa angustifolia, Blepharis integrifolia, Pupalea lappacea, Euphorbia neopolycnemoides, Sansevieria hyacinthoides* and *Achyranthus aspera*.

Some of the woody plant species that occur on the koppies in the landscape, strangely enough often concurs with vegetation expected on brackish soils. Such plants are: *Croton gratissimus, Schotia brachypetala, Sclerocarya caffra, Acacia nigrescens, Spirostachys africana* and *Lannea stuhlmannii.* Other woody species that occur on the koppies are: *Combretum hereroense, Ozoroa paniculosa, Ficus soldanella, Pterocarpus rotundifolius, Iboza riparia, Diospyros mespiliformis, Lannea discolor, Tricalysia allenii, Maytenus tenuispina,* and *Grewia hexamita.* Dominant grasses are *Panicum maximum* and *Digitaria eriantha* var. *pentzii.*

The soil is more clayey where dolerite intrusions occur and *Acacia nigrescens* is the dominant woody species. The grass cover is usually denser with grasses such as *Themeda triandra* and *Cymbopogon plurinodis* as the dominants.

The banks of the two large rivers in the langscape (Fig. 12) are densely overgrown with woody species and the following are the most common: *Ficus sycomorus, Breonadia microcephala, Nuxia oppositifolia, Combretum erythrophyllum, Diospyros mespiliformis, Acacia robusta, Trichilia emetica, Kigelia africana, Berchemia discolor* and *Ekebergia capensis,* while rare species such as *Anthocleista grandiflora* are also encountered here. The field layer is usually absent, but when present it is dominated by *Panicum maximum.*

Fig. 12. Landscape 4. Sabie River, Riverine Vegetation.

Fauna

This landscape accommodates what is probably the largest impala population in the whole of the KNP. Other common game species present are kudu, duiker, steenbok, bushbuck and giraffe *(Giraffa camelopardalis).* During 1974 a number of red duiker *(Cephalophus natalensis)* were released in the dense riparian vegetation,

and in 1981 a number of nyalas *(Tragelaphus angasii)* from Natal were also released here. Elephants are frequently found in this landscape especially during the dry winter months and a herd of 80 are regularly found in the Nwatimhiri bush. Lion *(Panthera leo)*, leopard *(Panthera pardus)*, wild dog and spotted hyaena are the most important predators, especially the former two species are relatively abundant in this landscape. Buffalo bulls are sometimes present in the reeds of the river beds, but breeding herds only visit this landscape on route to water. Hippo *(Hippopotamus amphibius)* are plentiful in the rivers and contribute largely towards keeping the grass short.

5. Mixed *Combretum* spp./*Terminalia sericea* Woodland

Location and Geomorphology

This landscape is discontinuous due to the fact that it consists of two areas which are separated by Landscape 4 *viz.* the thickets of the Sabie and Crocodile Rivers. One portion of this landscape occurs in the southern district and the remainder forms the south western part of the Central District as far north as the Orpen/Timbavati area.

The geological substrata are granite and gneiss with numerous dolerite instrusions which never exceed 10 metres in breadth (Schutte 1974). This landscape occurs mainly on or close to the watersheds and therefore includes only the upper courses of most spruits *viz.* the Mbyamite, Mlambane, Nwatimhiri and Nwatimwambu in the southern sub-region and the Nwatindlopfu, Nwaswitsontso, Sweni and Nwanedzi in the northern sub-region. The landscape is undulating with distinct uplands, ecotones and bottomlands. The altitude varies between 350 and 500 m and the landscape occupies 1 578 km^2 or 8,1 percent of the KNP.

Table 3
Temperature data for Satara
(Data collected since September 1981)
Temperature °C

Month	Average Daily Maximum	Absolute Maximum	Average Daily Minimum	Absolute Minimum
January	33,0	41,6	21,0	17,5
February	33,6	39,0	20,8	16,0
March	33,3	38,0	19,8	14,5
April	29,6	34,0	17,4	12,0
May	28,0	31,4	13,0	8,3
June	25,8	28,0	8,9	8,0
July	26,8	32,6	10,7	7,4
August	27,6	36,0	11,9	9,9
September	28,1	35,0	14,3	11,0
October	26,3	37,5	13,7	12,0
November	31,4	40,0	18,7	13,5
December	30,7	40,5	19,0	13,0