

*Colophospermum mopane* as the climate became wetter. Both landscapes are unique to South Africa and deserve special priority in conservation.

#### Fauna

The thick mopane forest is ideal habitat for elephant breeding herds. Buffalo and impala are commonly found. Rare species of game such as nyala and Sharpe's grysbok (*Raphicerus sharpei colonicus*) are fairly common in this landscape. Kudu bushbuck and duiker prefer the dense bush. Steenbok occur less frequently in this area.

### 16. Punda Maria Sandveld on Cave Sandstone

#### Location and Geomorphology

Cave Sandstone of the Clarence Formation form outcrops extending from north-east of Punda Maria to just north of the Levubu River. A small strip of this sedimentary rock also occurs on the contact between the granite and basalt and is particularly conspicuous near the Timbavati picnic area, between the Olifants and Letaba Rivers and along the Tsende River. This Cave Sandstone forms prominent koppies and is a unique and impressive landscape. Important koppies in the KNP can be associated with this landscape. Good examples are Matikiti, Mangadyane, Nsemane, Mtshatu, Hatlani, Xantangelane, Makahanya, Hutwini and Mashikiri. The most important spruit that drains this landscape in the north is the Nkovakulu. The main component of the landscape is koppies or outcrops with sand plateaus and bottomlands. The altitude varies between 300 and 370 metres and the landscape occupies 117 km<sup>2</sup> or 0,6 percent of the KNP.

#### Climate

The annual rainfall of this landscape varies considerably seeing that it is a long narrow area running throughout the KNP. The applicable rainfall is most likely that of Punda Maria which receives 588 mm annually. The part of the landscape in the south-east of Letaba most probably receives far less rain. The temperature data for Punda Maria presented in Table 7, is applicable to this landscape.

#### Soil Pattern

The soils of this landscape are mainly lithosols or solid rock with a thin layer of soil (Mispah) in the hollow places. On the plateaus and bottomlands, a deep grey to yellow sandy soil, of the Clovelly or Fernwood Forms is present.

#### Vegetation

The koppies in the landscape accommodate a unique vegetation which includes many rare species (Fig. 35). Van Rooyen (1978) regards the following woody species as characteristic: *Stadmannia oppositifolia* subsp. *rhodesica*, *Steganotaenia araliacea*, *Boscia angustifolia*, *Diospyros lycioides*, *Ficus ingens*, *F. soldanella*, *F. tettensis*, *F. sonderi*, *Commiphora marlothii*, *Terminalia sericea*, *Rothmannia fischeri*, *Maerua angolensis*, *Kirkia acuminata*, *Gyrocarpus americanus*, *Ptaeroxylon*

*obliquum*, *Strychnos decussata*, *Commiphora mollis*, *Manilkara mocharia*, *Euphorbia tirucalli*, *Pachypodium saundersii*, *Antidesma venosum*, *Hippocratea crenata*, *Urera tenax*, *Vepris reflexa*, *Hexalobus monopetalus*, *Ochna inermis*, *Croton menyhartii*, *Drypetes gerrardii*, *Adenium obesum* var. *multiflorum*, *Flacourtia indica*, *Cassia petersiana* and *Tinnea juttae*.

The herbaceous layer of the community on the koppies is sparse and includes among others the following: *Urginea epigea*, *Vahlia capensis*, *Coleochloa rehmanniana*, *Thunbergia hirta*, *Tinospora fragosa*, *Felicia bechuanica*, *Jatropha messinica*, *Ocimum canum*, *Gloriosa superba*, *Portulaca kermesina*, *Sida hoefnieri*, *Tephrosia virgata* and *Limeum fenestratum*.

A tall shrub savanna occurs on the deep sandy soils which is dominated by *Terminalia sericea* and *Dichrostachys cinerea* (Fig. 34). This community was named by Van Rooyen (1978) as *Terminalia sericea/Pogonarthria squarrosa*-tree savanna. Other woody species are *Cissus cornifolia*, *Cassia petersiana*, *Grewia hexamita*, *Lannea stuhlmannii*, *Combretum zeyheri*, *Strychnos madagascariensis*, *Maytenus heterophylla* and *Peltophorum africanum*. Dominant grasses and forbs are *Digitaria eriantha* var. *pentzii*, *Brachiaria serrata*, *Pogonarthria squarrosa*, *Perotis patens*, *Aristida graciliflora*, *Schmidtia pappophoroides*, *Aristida congesta* subsp. *barbicollis*, *Clerodendrum ternatum*, *Commelina africana*, *C. bengalensis*, *Vigna triloba*, *Talinum cafferum*, *Monsonia glauca*, *Limeum sulcatum*, *Merremia tridentata* and *Stylosanthes fruticosa*. Along certain dry slopes, dense stands of *Androstachys johnsonii* occur which will be discussed in more detail under Landscape 31.



Fig. 34. Landscape 16. Punda Maria Sandveld on Cave Sandstone.



Fig. 35. Landscape 16. Cave Sandstone outcrop.

#### Fauna

This landscape is relatively poor as far as numbers of large game is concerned. Elephant and buffalo are the most important animals with kudu and impala omnipresent. Steenbok, grysbok and nyala are also regularly found. Due to the hilly nature of the landscape, pairs of klipspringer regularly occur. Baboons are plentiful especially along the rivers.

#### 17. *Sclerocarya caffra*/*Acacia nigrescens* Savanna

##### Location and Geomorphology

This landscape extends from the Crocodile River in the south to just north of Satara with the Lebombo Mountains as the eastern and the Karoo sediments as the western boundary. It is one of the largest landscapes and occupies 1 411 km<sup>2</sup> or 7,2 percent of the KNP. A characteristic of this landscape is that it consists of reasonably flat plains with individual well defined drainage channels. All the larger rivers such as the Crocodile, Sabie, Nwaswitsonto, Nwanedzi and Sweni cut through the landscape while smaller spruits such as the Nhlowa, Mlondozi, Guweni, Mrunzuluku, Gudzane, and Mtomene drain this area. According to Bristow (1980) the underlying parent material of this landscape is Sabi River Basalts with a possibility of dolerite intrusions in the basalt.

The altitude varies from 170 metres in the vicinity of Crocodile Bridge to as much as 250 metres above sea level, just north of Satara.

### Climate

Gertenbach (1980) states that the rainfall of this landscape diminishes from south to north. The long-term average annual rainfall at Crocodile Bridge is 599,6 mm while the average for Satara is 548,2 mm. The temperature experienced in this landscape probably varies as well, but Table 3 gives the temperature for Satara which is probably applicable to this landscape as a whole. Frost is limited to the bottomlands along the rivers and even then on an irregular basis.

### Soil Pattern

The Sabi River Basalts weather to form a black, brown or red clayey soil. The soil depth does not normally exceed one metre and the dominant Forms are Bonheim, Shortlands, Swartland, Milkwood, Mayo, Glenrosa and Valsrivier. In the low lying areas vertisols of the Arcadia and Rensburg Forms can also be expected. The soil pattern is relatively homogeneous and no great changes in soil types occur over short distances. The clay contents in the soil varies between 25 and 50 percent and it is rich in plant nutrients. Table 8 indicates the quantity of exchangeable plant nutrients of a typical soil sample.

Table 8

*Exchangeable plant nutrients of a typical soil sample in Landscape 17*

Soil Form:	Bonheim	
Soil Series:	Bushman	
Parent Material:	Basalt	
	A-Horizon	B-Horizon
% Sand	42,4	43,0
% Silt	24,9	14,6
% Clay	25,2	30,4
pH (H <sub>2</sub> O)	7,4	7,4
P (ppm)	372	470
K (ppm)	160	60
Ca (ppm)	2 760	2 840
Mg (ppm)	1 260	1 510
Na (ppm)	80	160
Resistance (Ohm)	800	800

### Vegetation

Van Wyk (1973) divides the landscape in two, viz. Knobthorn/Maroela-veld and the Leadwood/Maroela/*Albizia*-veld. Pienaar (1963) calls it the *Sclerocarya caffra*/*Acacia nigrescens* savanna, while Van der Schijff (1957) referred to it as the Knoppiesdoring/Maroela bushveld with five associations of which only two have a direct bearing on this landscape. The other three associations belong to other landscapes. Coetzee (1983) describes this landscape as a non-vertic, tropical, semi-arid,



Fig. 36. Landscape 17. *Sclerocarya caffra*/*Acacia nigrescens* Savanna south of Tshokwane.



Fig. 37. Landscape 17. *Sclerocarya caffra*/*Acacia nigrescens* Savanna north of Tshokwane.

basaltic lowveld. He distinguish 14 different plant communities that represent different variations of *Sclerocarya caffra*/*Acacia nigrescens*-veld.

The most important two components of this landscape are the *Sclerocarya caffra*/*Dichrostachys cinerea*/*Pterocarpus rotundifolius*/*Themeda triandra*-tree-veld south of Tshokwane (Fig. 36) and the *Sclerocarya caffra*/*Acacia nigrescens*/*Themeda triandra*/*Bothriochloa radicans*-tree-veld north of Tshokwane (Fig. 37). This larger division is mainly attributed to the higher rainfall in the southern and the lower rainfall in the northern section of this landscape, with the 550 mm isohyet as the reputed boundary. The other associations described by Coetzee (1983) for this landscape are either very local or are secondary communities as a result of overgrazing.

The *Sclerocarya caffra*/*Dichrostachys cinerea*/*Pterocarpus rotundifolius*/*Themeda triandra*-tree-veld south of Tshokwane is an open tree savanna with a moderate shrub layer, but with a dense field layer. Dominant trees in this association are *Sclerocarya caffra*, *Acacia nigrescens*, *Lannea stuhlmannii* and *Lonchocarpus capassa*. Species in the shrub layer are *Dichrostachys cinerea* subsp. *africana*, *Pterocarpus rotundifolius*, *Acacia nilotica*, *A. gerrardii*, *Albizia harveyi*, *Maytenus senegalensis*, *Ozoroa engleri*, *Ximenia caffra*, *Dalbergia melanoxylon*, *Maytenus heterophylla* and *Cissus cornifolia*. The two variations of the veld are best distinguished by the presence or absence of *Maytenus senegalensis*. The field layer is dense and the sequence of dominance is *Themeda triandra*, *Panicum coloratum*, *Digitaria eriantha* var. *pentzii*, *Bothriochloa radicans*, *Panicum maximum*, *Heteropogon contortus* and *Urochloa mosambicensis*.

The *Sclerocarya caffra*/*Acacia nigrescens*/*Themeda triandra*/*Bothriochloa radicans*-tree-veld north of Tshokwane is also an open tree savanna with a moderate to sparse shrub layer and a dense field layer. The dominant trees are *Sclerocarya caffra*, *Acacia nigrescens*, *Lannea stuhlmannii* and *Combretum imberbe*. The shrub layer is sparse to moderate and *Acacia nigrescens*, *Dichrostachys cinerea* subsp. *africana*, *Albizia harveyi*, *Acacia gerrardii*, *A. tortilis*, *Grewia bicolor*, *Dalbergia melanoxylon*, *Securinega virosa*, *Combretum hereroense*, *Ziziphus mucronata*, *Ormocarpum trichocarpum*, *Maerua parvifolia* and *Ehretia rigida* are usually present. The big difference between the two associations, nevertheless, lies in the composition of the field layer. The field layer of the latter association is also dense but the sequence of dominance is *Themeda triandra*, *Bothriochloa radicans*, *Digitaria eriantha* var. *pentzii*, *Panicum coloratum*, *Urochloa mosambicensis*, *Aristida congesta* subsp. *barbicollis* and *Eragrostis superba*. Other species that occur regularly are *Enneapogon cenchroides*, *Schmidtia pappophoroides*, *Panicum maximum*, *Heteropogon contortus* and *Sporobolus fimbriatus*. Everything indicates that the latter is a drier variation of the *Sclerocarya caffra*/*Acacia nigrescens* Savanna.

Forbs which commonly occur in both the variations of the *Sclerocarya caffra*/*Acacia nigrescens* Savanna are *Vernonia oligocephala*, *Rhynchosia minima*, *Chascanum hederaceum*, *Heliotropium steudneri*, *Crotalaria virgulata*, *Tephrosia polystachya*, *Rhynchosia densiflora* and *Cassia mimosoides*. A characteristic of this landscape is that forbs are fairly scarce in the stable undisturbed veld. Under conditions of moderate to heavy grazing the above-mentioned forbs show a marked increase and species such as *Solanum panduraeforme*, *Sericorema remotiflora*, *Pavonia patens*,

*Ipomoea obscura*, *Justicia flava*, *Hemmbstaedtia odorata*, *Corchorus asplenifolius*, *Barleria prionitis* and *Phyllanthus asperulatus* increase considerably.

On the floodplains along the Sweni spruit in this landscape a unique community which consists of a *Hyphaene natalensis*-savanna occurs (Fig. 38). Dominant woody species are *Hyphaene natalensis*, *Acacia tortilis*, *Euclea divinorum*, *Lonchocarpus capassa* and *Croton megalobotrys*. Dominant grasses are *Sporobolus nitens*, *S. smutsii*, *Dactyloctenium aegyptium*, *Chloris virgata* and *Schmidtia pappophoroides*. This stand of *Hyphaene natalensis* is the most southerly and impressive occurrence of this species in the KNP and is therefore given special attention and protection against fires.



Fig. 38. Landscape 17. *Hyphaene natalensis* Savanna.

The vegetation on the Oakleaf-soils on the banks of spruits and rivers is a tall tree savanna and includes the following woody species: *Lonchocarpus capassa*, *Ficus sycomorus*, *Diospyros mespiliformis*, *Kigelia africana*, *Trichelia emetica*, *Croton megalobotrys*, *Acacia robusta*, *A. tortilis*, *Combretum hereroense*, *C. imberbe*, *Maytenus senegalensis*, *Acacia xanthophloea* and *Hyphaene natalensis*. *Phoenix reclinata* and *Cyperus sexangularis* occur in the stream beds, together with *Phragmites australis*. The stream banks of this landscape has a typical floodplain, dyke wall and stream bed (Fig. 39).

Local vegetation variations of this landscape were described by Coetzee (1983). Where soils become shallow the following species occur more commonly: *Combretum apiculatum*, *Acacia exuvialis*, *Terminalia prunioides*, *Grewia bicolor*, *Digitaria eriantha* var. *pentzii*, *Aristida congesta* subsp. *barbicollis* and *Heteropogon contortus*.



Fig. 39. Landscape 17. Sweni stream bank.



Fig. 40. Landscape 17. *Acacia gerrardii* Savanna.

In the vicinity of Rietpan/Mlondozi, *Acacia gerrardii* and *Pterocarpus rotundifolius* are dominant and *Sclerocarya caffra* is almost absent (Fig. 40). In certain low lying parts, species such as *Acacia tortilis*, *Combretum imberbe*, *Lannea stuhlmannii*, *Dalbergia melanoxylon* and *Lonchocarpus capassa* are more common. Where soils are very clayey and show vertic characteristics stunted *Acacia nigrescens* with

*Setaria woodii*-stands occur and where the soils show signs of sodium saturation, species such as *Acacia borleae* associated with *Chloris mossambicensis* and *Setaria woodii* occur (Fig. 41). The grass *Schoenefeldia transiens* is limited to this community and it is the only record of this grass being found in the Republic of South Africa. The latter vegetation variation will be discussed in more detail under Landscape 18.



Fig. 41. Landscape 17. *Acacia borleae* thickets.

#### Fauna

The *Sclerocarya caffra*/*Acacia nigrescens* savanna is the centre of the wildebeest and zebra habitat in the KNP. These animals migrate annually between the northern and southern parts of this landscape (Smuts 1974). In summer when water and grazing are plentiful the game congregates in the vicinity of Tsokwane/Lindanda/Guweni/Sweni to migrate southwards to the Mlondozi/Sabie River area in the dry season. It appears that the annual migrations take place between the two most important variations of the *Sclerocarya caffra*/*Acacia nigrescens* savanna as described above.

Buffalo, kudu, giraffe, waterbuck, steenbok and ostrich occur in large numbers but elephant are only represented by lone bulls. These elephant bulls have caused considerable damage to large trees near the tourist and firebreak roads. The role played by herds of buffalo in keeping the veld short and open for animals such as wildebeest and zebra is a feature which should be exploited in the management of buffalo. Tsessebe are present at Mlondozi. Individual reedbuck are regularly seen in the long grassveld north of Satara. Lions are abundant, and like the wildebeest and zebra, this landscape is probably the centre of their distribution in the KNP. Hyenas are plentiful, while cheetah are well represented.

The occurrence of impala in this relatively high grassveld is observed from time to

time. This phenomenon should be seen in a serious light considering that the occurrence of this game species, especially in the inner veld, indicates a deterioration of the field layer and suggests that bush encroachment is taking place. The use of such indicator species is of great value in monitoring natural phenomena in the KNP.

#### 18. Dwarf *Acacia nigrescens* Savanna

##### Location and Geomorphology

The basalts in the vicinity of the watershed between the Olifants and Nwanedzi Rivers north of Satara contain a lot of amygdaloids and olivine and decompose to form dark coloured soils. The area is reasonably flat to concave, high lying plains and is drained by the Mtomeni, Mapetane and Gudzane spruits. Shitsalaleni is a well known pan in this area. The altitude varies between 250 and 300 metres and the landscape is relatively small (356 km<sup>2</sup> or 1,8 percent of the KNP).

##### Climate

According to Gertenbach (1980) this area receives between 500 and 550 mm of rain annually and the temperature is comparable to that of Satara which is given in Table 3.

##### Soil Pattern

The catenary sequence of soils in this landscape include the occurrence of darkly coloured clayey soils on the uplands with dominant Forms Swartland, Bonheim, Milkwood and Mayo. The percentage of clay in the A-horizons varies between 15 and 35 percent and the pH between 5,6 and 6,8 (Coetzee 1983). The B-horizons contain between 35 and 55 percent clay and the pH varies between 6,1 and 7,7. In situations where there is a concave topography clayey soil of the Arcadia Form can be expected. These are soils with dark coloured vertic characteristics that sometimes granulate spontaneously on the surface.

##### Vegetation

The vegetation of this landscape varies from a pure grass veld on the vertisols and calcrete soils, to a stunted *Acacia nigrescens* savanna on the middleslopes (Fig. 42). Where pure grass veld occurs on the uplands it is dominated by *Themeda triandra*, *Bothriochloa radicans*, *Digitaria eriantha* var. *pentzii*, *Panicum coloratum*, *P. maximum*, *Enneapogon cenchroides*, *Ischaemum brachyatherum*, *Sorghum versicolor*, *Schmidtia pappophoroides*, *Urochloa mosambicensis* and *Cenchrus ciliaris*. Shrubs that sporadically occur are *Acacia nigrescens*, *Ehretia rigida*, *Cordia sinensis*, *Ormocarpum trichocarpum*, *Securinega virosa*, *Acacia tortilis*, *Dichrostachys cinerea* subsp. *africana* and *Ziziphus mucronata*.

On the slopes where the soil is less clayey the above-mentioned woody plants occur more commonly and a dense low tree savanna dominated by *Acacia nigrescens* is characteristic. These small trees have a single stem and are usually between two and four metres high. The stunted growth form of the trees can be attributed to slow growth as a result of high moisture retention in the soil, combined with the high grass cover and regular occurrence of hot fires. The same limiting factors probably



Fig. 42. Landscape 18. Dwarf *Acacia nigrescens* Savanna.

play a role in *Colophospermum mopane* becoming a shrub in Landscape 23. A characteristic of this landscape is the occurrence of many upright dead tree trunks. The reason for this phenomenon is not clear, but drought probably played an important role.

Vertisols of the Arcadia Form develop in the bottomlands and they contain a large amount of soluble salts. Grasses such as *Setaria woodii*, *Ischaemum brachyatherum*, *Panicum maximum*, *Digitaria eriantha* var. *pentzii*, *Brachiaria eruciformis* and *Urochloa mosambicensis* usually occur here. Close to the spruit *Sporobolus consimilis* occur generally and can reach a height of two metres.

A unique component of this landscape are stands of *Acacia borleae* which occur on the brackish vertisols. The dense stands are approximately one to two metres high and almost impenetrable. *Acacia borleae* is the sole dominant and the following woody species occur sporadically: *Azima tetracantha*, *Cadaba natalensis*, *Maerua parvifolia*, *Capparis tomentosa*, *Boscia mossambicensis* and *Cordia ovalis*. The following plants occur in the field layer: *Cenchrus ciliaris*, *Sporobolus smutsii*, *Sansevieria hyacinthoides*, *Cyathula crista*, *Neuracanthus africanus*, *Asparagus minutiflorus*, *Abutilon guineense* and *Cienfuegosia hildebrandtii*.

#### Fauna

The largest concentration of kudu in the KNP is present in this landscape and the role they play in stunting the small knobthorn trees should not be disregarded. A few groups of sable antelope occur in this part of the KNP. Zebra, impala, wildebeest, giraffe, waterbuck and warthog occur regularly but in lower densities. Elephants are relatively scarce but herds of buffalo are constantly moving through this area. Lion, hyaena and cheetah occur regularly but not in large numbers.

## 19. Thornveld on Gabbro

### Location and Geomorphology

The park's "Gabbro intrusion" (Brandt 1948; Gertenbach 1978; Schutte 1982) extends from Malelane in the south of the KNP to Phondaheuwels west of Shingwedzi. The southernmost section of this intrusion in the vicinity of Orpen, is characterised by a thorn savanna with a dense grass cover. This landscape is a series of islands of gabbro origin, sometimes linked by narrow dykes. It extends from Malelane including koppies such as Ship Mountain and Sithlave, extending beyond the borders of the KNP at Mkhuhlu Station. A number of sub-units of this landscape occur between the Sabie and Nwawitsontso Rivers and at Orpen it forms extensive outcrops. Coetzee (1983) describes the geology of this landscape as dolerite, but evidence indicates that it is gabbro (Brandt 1948; Schutte 1974; Gertenbach 1978).

The landscape generally has a higher altitude than the surrounding granite (between 550 and 600 metres a.s.l.) and it is flat to slightly undulating with prominent koppies such as Ship Mountain and Sithlave. North of Orpen the thornveld on the gabbro is replaced by a shrub *Colophospermum mopane* community (Landscape 24). This landscape covers 685 km<sup>2</sup> or 3,5 percent of the KNP.

### Climate

The rainfall of this landscape varies considerably from south to north. At Malelane in the south an average rainfall of 620 mm prevails while that of Kingfisherspruit is 582 mm. Temperature data from Pretoriuskop (Table 1), Skukuza (Table 2) and Satara (Table 3) are applicable to this landscape.

### Soil Pattern

The soils that develop from gabbro are usually dark in colour and clayey. Where the terrain is flat to slightly concave, the soil becomes deeper and the following soil Forms can be expected: Bonheim, Mayo, Shortlands, Arcadia and Swartland. On the middleslopes, Mayo, Milkwood, Glenrosa and even Hutton soil Forms can be expected. In the southern parts of this landscape the soils are darker in colour and the grass cover more dense. Loose rock is often present on the surface and there is little soil development on the koppies and it can be classified as lithosols.

Where the gabbro and surrounding granite are in contact a mixed soil sometimes develops. It frequently happens that the A-horizon originates from gabbro that has spilled over the B-horizon (which originated from granite).

### Vegetation

In certain areas of the landscape the vegetation is dominated by stands of *Acacia nigrescens* trees which vary in height from three to seven metres. Where the knobthorn trees become dense, the trees are usually lower. Otherwise the landscape is characterised by an open savanna with a dense grass cover.

Gertenbach (1978) divided the vegetation on gabbro, in the vicinity of Orpen, into two communities viz. *Chloris virgata*/*Acacia nigrescens*-shrubveld (Fig. 43) and a *Sclerocarya caffra*/*Acacia nigrescens*-savanna (Fig. 44). The first mentioned commu-



Fig. 43. Landscape 19. Dwarf *Acacia nigrescens* Thornveld on Gabbro.



Fig. 44. Landscape 19. *Sclerocarya caffra*/*Acacia nigrescens* Savanna on Gabbro.

nity occurs on shallow soil and normally has a sparser grass cover and is grazed more intensively. It is a low tree veld to a shrub veld with *Acacia nigrescens*, *Ziziphus mucronata*, *Acacia tortilis*, *Ormocarpum trichocarpum*, *Bolusanthus speciosus*, *Securinega virosa* and *Grewia bicolor*, as the most important woody species with *Chloris virgata*, *Cenchrus ciliaris*, *Sporobolus nitens*, *Enneapogon cenchroides*, *Schmidtia pappophoroides*, *Digitaria eriantha* var. *pentzii*, *Bothriochloa radicans*, *Eragrostis superba*, *Panicum maximum* and *Urochloa mosambicensis* as the dominant grasses. Forbs present are *Cyphocarpa angustifolia*, *Sida rhombifolia*, *Solanum panduraeforme*, *Corchorus asplenifolius*, *Seddera suffruticosa*, *Heliotropium steudneri* and *Abutilon austro-africanum* (Gertenbach 1978).

The *Sclerocarya caffra*/*Acacia nigrescens*-savanna occurs on deeper soils and has a dense grass cover which is not intensively grazed. It is an open tree savanna with *Acacia nigrescens*, *Sclerocarya caffra*, *Acacia tortilis*, *Combretum apiculatum*, *Albizia harveyi*, *Dalbergia melanoxylon*, *Bolusanthus speciosus*, *Lannea stuhlmannii* and *Grewia bicolor* as the dominant woody species. *Themeda triandra*, *Digitaria eriantha* var. *pentzii*, *Bothriochloa radicans*, *Cymbopogon plurinodis*, *Panicum maximum* and *Urochloa mosambicensis*, are the dominant grasses with a few forbs of which *Heliotropium steudneri*, *Pavonia patens*, *Ipomoea crassipes*, *Lantana rugosa* and *Tephrosia polystachya* are the most important.

Coetzee (1983) distinguishes another vegetation variation on gabbro between Skukuza and Tshokwane and he referred to it as a *Lannea stuhlmannii*/*Pterocarpus rotundifolius*/*Themeda triandra* dominant shrubby tree veld (Fig. 45). The same



Fig. 45. Landscape 19. *Pterocarpus rotundifolius*/*Themeda triandra* Savanna on Gabbro.



Fig 46. Landscape 19. Ship Mountain, a gabbro outcrop.



Fig. 47. Landscape 19. Open thornveld on gabbro near Pretoriuskop.

woody species that occur in the *Sclerocarya caffra*/*Acacia nigrescens*-savanna described by Gertenbach (1978) also occur here, but woody species such as *Lannea stuhlmannii*, *Pterocarpus rotundifolius* and *Combretum hereroense* are prominent dominants. *Themeda triandra*, *Digitaria eriantha* var. *pentzii*, *Panicum maximum*, *P. coloratum* and *Urochloa mosambicensis* are the dominant grasses. Where the topography is very flat or concave *Setaria woodii* can be expected.

Where soils originating from gabbro and granite mix, a situation is encountered where the woody species correspond to the adjacent granite landscape, while the field layer corresponds very much to the gabbro landscape (Gertenbach 1978; Coetzee 1983).

On gabbro koppies such as Ship Mountain and Sithlave unique vegetation occurs (Fig. 46). Woody species worth mentioning are: *Aloe marlothii*, *Ficus soldanella*, *Balanites maughamii*, *Spirotachys africana*, *Ozoroa paniculosa*, *Maytenus heterophylla*, *Cassine transvaalensis*, *Hippocratea longipetiolata*, *Grewia subspathulata*, *Sterculia rogersii*, *S. murex*, *Vangueria infausta*, *Erythrina lysistemon*, *E. latissima*, *Urea tenax* and *Cussonia natalensis*.

Coetzee (1983) distinguished nine different vegetation variations on gabbro in the Central District of the KNP. This includes the two variations of Gertenbach (1978). In the vicinity south of the Sabie River where there is a slight increase in the rainfall a further variation of the landscape occurs. This is an open shrub savanna with a dense field layer (Fig. 47). Between Skukuza and Pretoriuskop the tarred road crosses this variation and the common woody species are *Dichrostachys cinerea* subsp. *nyassana*, *Dalbergia melanoxylon*, *Albizia harveyi*, *Lannea discolor*, *Acacia nigrescens*, *Pterocarpus rotundifolius*, *Combretum collinum* subsp. *suluense*, *Acacia gerrardii* and *Bolusanthus speciosus*. Dominant grasses are *Themeda triandra*, *Cymbopogon plurinodis*, *Urochloa mosambicensis* and *Heteropogon contortus*.

### Fauna

An interesting association exists between this landscape and the most southern distribution of the roan antelope. Gertenbach (1978) has already referred to this association and it would appear as if this applies to the whole landscape. The last group of roan antelope at Pretoriuskop occurs on the gabbro intrusion and until quite recently there were still some of these animals present at Orpen, associated with the gabbro. Other species of game occurring in this landscape are kudu, impala, giraffe, waterbuck, warthog, buffalo and elephant bulls. Zebra and wildebeest usually occur in the largest parts of this landscape shortly after a fire, but the *Chloris virgata*/*Acacia nigrescens*-shrubveld near Orpen is an area highly preferred by wildebeest.

## 20. Bangu Rugged Veld

### Location and Geomorphology

This landscape occurs as a strip that extends from the Timbavati picnic area up to the Lebombo Mountains at the Olifants River. It covers 204 km<sup>2</sup> or one percent of the KNP. This area is lightly undulating to undulating basalt terrain and is drained

via the Bangu and Ngotsa spruits into the Olifants River. This landscape occupies the middleslopes to the Olifants and Timbavati Rivers and varies in altitude between 250 and 300 metres.

#### Climate

The area is relatively dry, not only because of the low rainfall but also as a result of shallow stony soils and steep slopes. The landscape receives between 500 and 550 mm rain annually and the temperature is high in summer and mild in winter (Tables 3 and 5 for Satara and Letaba).

#### Soil Pattern

The soils of this landscape are shallow, dark brown to grey in colour, melanic to orthic and contains a reasonable amount of weathered basalt in the profile. Lime concretions are common and the dominant soil Forms are Milkwood, Mispah, Mayo and Glenrosa. The shallow soils and steep slopes cause the area to be relatively dry and prone to erosion.

#### Vegetation

The vegetation of this area is described by Coetzee (1983) as an *Acacia nigrescens*/*Grewia bicolor*-dominated shrub veld (Fig. 48). The area was severely overgrazed in the past and shows distinct signs of retrogressive succession. With the exception of *Acacia nigrescens* and *Grewia bicolor* the following woody species also occur: *Terminalia prunioides*, *Acacia exuvialis*, *A. tortilis*, *Maerua parvifolia*, *Dichrostachys cinerea* subsp. *africana*, *Commiphora africana*, *Grewia villosa* and *Securinega virosa*. The field layer is sparse to moderate and the grasses are mostly



Fig. 48. Landscape 20. Bangu Rugged Veld.

annual species with a great variety of forbs present. *Panicum coloratum*, *Aristida congesta* subsp. *barbicollis*, *Enneapogon cenchroides*, *Brachiaria xantholeuca*, *Bothriochloa radicans*, *Schmidtia pappophoroides*, *Heliotropium steudneri*, *Solanum panduraeforme*, *Indigofera floribunda* and *Barleria prionitis* are the dominant species.

Gertenbach (*in prep.*) classifies this landscape as a *Panicum coloratum/Bothriochloa radicans/Acacia nigrescens* sub-association and it shows great similarity to the vegetation of Landscape 21.

#### Fauna

This shrub veld is ideal habitat for wildebeest and zebra. These species were mainly responsible for overgrazing in this area in the past. Impala are less common but kudu and giraffe are plentiful. The area is preferred to a lesser extent by buffalo and elephant, but carnivores such as lion and hyaena are abundant.

### 21. *Combretum* spp./*Acacia* spp. Rugged Veld

#### Location and Geomorphology

The eastern slopes to the lower Timbavati River and the slopes to the Olifants River where it cuts through the basalt is an undulating landscape with shallow stony soils. It is an arid veld and is known as the *Combretum* spp./*Acacia* spp. Rugged Veld. It occupies only 270 km<sup>2</sup> or 1,4 percent of the area of the KNP. The area is drained by a great number of small spruits that empty into the Timbavati and Olifants Rivers and the altitude varies between 180 and 300 metres. The above-mentioned two rivers comprise a large component of the landscape. One of the most permanent springs in the south of the KNP also occurs in this landscape *viz.* Nyamari spring.

#### Climate

According to Gertenbach (1980) the 500 mm isohyet passes just south of the landscape. The area thus receives between 450 and 500 mm of rain annually. The average rainfall for Letaba is 462 mm per year and is comparable to that of this landscape. Table 5 presents the temperature data for Letaba and is applicable to this landscape.

#### Soil Pattern

The soils of this landscape is shallow and low outcrops and rocky ridges are commonly found. The soils can hardly be classified into soil Forms, but when possible Mispah and Milkwood are the dominant Forms. Alluvial soils which occur on the banks of the Olifants and Timbavati Rivers mainly belong to Oakleaf and Inhoek Forms.

#### Vegetation

Coetzee (1983) describes the vegetation of this landscape under the name "Tropical, Basaltic Lowveld of the Olifants River Valley". This landscape basically con-

sists of three components viz. the koppies, the undulating middleslopes and the riverine vegetation.

Dominant woody species on the koppies are *Combretum apiculatum*, *C. mossambicense*, *Sterculia rogersii*, *Ptaeroxylon obliquum*, *Hippocratea longipetiolata*, *Manilkara mocharia*, *Boscia albitrunca*, *Pappea capensis*, *Commiphora glandulosa*, *Spirostachys africana*, *Kirkia acuminata* and *Terminalia prunioides*. Lianes such as *Cissus quadrangularis*, *C. rotundifolia* and *Sarcostemma viminale* are plentiful while *Sansevieria hyacinthoides* is common in the field layer. *Sesamothamnus lugardii* which is typical of arid areas also occur in this landscape.

The undulating middleslopes of this landscape is *Terminalia prunioides*/*Combretum apiculatum*/*Acacia nigrescens*-shrub bushveld with only small trees (Fig. 49). Other woody species in this community are *Acacia exuvialis*, *Grewia bicolor*, *Commiphora glandulosa*, *Maerua parvifolia*, *Combretum mossambicense*, *Securinega virosa*, *Dichrostachys cinerea* subsp. *africana* and *Acacia senegal* var. *leiorhachis*. Except for the mountains at Malelane and Punda Maria the distribution of the latter species in the KNP is limited to this landscape.

The field layer of the undulating middleslopes is sparse to absent and is dominated by *Aristida congesta* subsp. *barbicollis*, *Enneapogon cenchroides*, *Urochloa mosambicensis*, *Schmidtia pappophoroides*, *Sporobolus nitens*, *Bothriochloa radicans*, *Fingerhutia africana* with *Panicum coloratum*, *Themeda triandra*, *Panicum maximum*, *Heteropogon contortus* and *Digitaria eriantha* var. *pentzii* less common. Forbs are relatively plentiful with the following species as the most common: *Hibiscus micranthus*, *Seddera capense*, *Melhania rehmannii*, *Neuracanthus africanus*, *Pavonia patens*, *Lantana rugosa*, *Heliotropium steudneri*, *Tephrosia polystachya* and *Rhynchosia totta*.



Fig. 49. Landscape 21. *Combretum* spp./*Acacia* spp. Rugged Veld.

The river banks are characterised by the relatively open tree veld with the following as the species most commonly present: *Ficus sycomorus*, *Breonadia microcephala*, *Trichilia emetica*, *Combretum imberbe*, *Lonchocarpus capassa*, *Diospyros mespiliformis*, *Acacia nigrescens*, *A. robusta*, *A. senegal* var. *leiorhachis*, *A. xanthophloea*, *Schotia brachypetala*, *Xanthocercis zambesiaca*, *Croton megalobotrys*, *Berchemia discolor* and *Galpinia transvaalica*.

Shrubs such as *Maytenus senegalensis*, *Acacia tortilis*, *Combretum paniculatum* subsp. *microphyllum*, *Cordia ovalis*, *Acokanthera oppositifolia*, *Maerua machonica*, *Gardenia spatulifolia*, *Combretum mossambicense*, *Securinea virosa*, *Combretum hereroense* and *Capparis tomentosa* occur regularly. The grass layer is dominated by *Panicum maximum* with grasses such as *Cynodon dactylon*, *Schmidtia pappophoroides* and *Sporobolus smutsii* present. *Phragmites australis* is present on the sand in the riverbeds. The seed of the alien species *Xanthium strumarium* washes down with the water of the Olifants River continuously. This species also occurs in dense stands on the banks of the river. River sand is spread over the tarred roads mechanically after resealing and consequently dense stands of *Xanthium strumarium* are established on the shoulders of the roads.

#### Fauna

The sparse veld along the Olifants River is mainly utilized by impala, kudu, waterbuck and giraffe. The numbers of wildebeest and zebra are relatively low probably as a result of the denser woody component. Elephant bulls are regularly present along the river, but breeding herds are scarce. At least one herd of buffalo can regularly be seen at the Nyamari spring. Buffalo bulls are often found in the reeds along the river beds. Warthog are scarce, but troops of baboons occur regularly in the river. Carnivores are restricted to lion, leopard and hyaena. A large portion of this landscape is utilized for the Olifants Wilderness Trail.

#### 22. *Combretum* spp./*Colophospermum mopane* Rugged Veld

##### Location and Geomorphology

This landscape extends from the confluence of the Timbavati and Shisakashangondo spruits, northwards as a narrow strip up to the rhyolites of the Lebombo Mountains. To the north it follows the lower lying areas of the Lebombo Mountains and widens again at the Shingwedzi River as far west as the Nkokodzi spruit. The slopes of the Tsende River are also reckoned as part of this landscape. The underlying parent material of this area is basalt with a large amount of outcrops of tuff and breccia in the vicinity of Shamiriri and rhyolite along the Timbavati and Olifants Rivers. Outcrops of limburgyte (Schutte 1974) also occur north of the Letaba River. The narrow strip along the pediment of the Lebombo Mountains originates from colluvium of rhyolite.

The landscape is characterised as flat plains, interchanging with a series of outcrops as described above. Koppies such as Shamiriri and Shithaburi, are very conspicuous in the Olifants/Letaba area and the slopes are much steeper. The outcrops around Mooiplaas viz. Bowkerkop and Shipandani are limburgyte.

The area is low lying (between 200 and 300 metres a.s.l.) and therefore it usually forms the lower slopes of the Olifants, Timbavati, Letaba and Shingwedzi Rivers and larger spruits including the Tsende, Mkhadzi, Hlamfu and Nkokodzi.

The landscape covers 894 km<sup>2</sup> or 4.6 percent of the area of the KNP.

#### Climate

The average rainfall for this landscape is low and varies between 450 and 500 mm per annum. The averages for Letaba and Shingwedzi are 462 and 471 mm respectively. The temperature is high in summer with no frost in winter. Tables 5 and 6 provide the temperature data for Letaba and Shingwedzi which is applicable to this landscape.

#### Soil Pattern

The soils of this landscape are relatively shallow. On the numerous koppies and outcrops shallow, stony soil of the Mispah Form occurs. In the low lying areas the soil is deeper and the following soil Forms can be expected: Milkwood, Mayo, Bonheim, Glenrosa and Swartland. The skeletal soils of the rhyolite of the Lebombo Mountains contains much sodium and soils with a strong structure in the B-horizon normally develop. This is the case with this part of the landscape situated at the pediment of the Lebombo range. Dominant soil Forms in this case are Valsrivier, Swartland, Sterkspruit and Estcourt.

#### Vegetation

The vegetation of this landscape can basically be divided into three components. The first occurring on stony outcrops, the second in bottomlands and finally along the Lebombo pediment. The woody plant species that occur on the shallow soil on the koppies is comparable to those of Landscape 21. The following species are very common: *Combretum apiculatum*, *Colophospermum mopane*, *Kirkia acuminata*, *Sterculia rogersii*, *Boscia albitrunca*, *Combretum mossambicense*, *Commiphora mollis*, *Manilkara mocharia*, *Terminalia prunioides*, *Pappea capensis*, *Ptaeroxylon obliquum* and *Spirostachys africana*. *Panicum maximum* is the dominant grass.

The vegetation of the plains between the outcrops is an open shrub savanna that is dominated by *Colophospermum mopane* (Fig. 50). Other woody plants that occur are *Combretum apiculatum*, *Terminalia prunioides*, *Maerua parvifolia*, *Combretum mossambicense*, *Acacia nigrescens*, *A. tortilis*, *A. exuvialis*, *Grewia bicolor* and *Dichrostachys cinerea* subsp. *africana*. The field layer is dense and the dominant grasses are the following: *Panicum maximum*, *Aristida congesta* subsp. *barbicollis*, *Bothriochloa radicans*, *Urochloa mosambicensis*, *Tragus berteronianus*, *Heteropogon contortus*, *Rhynchelytrum repens*, *Enneapogon cenchroides*, *Schmidtia pappophoroides*, *Cenchrus ciliaris*, *Digitaria eriantha* var. *pentzii*, *Eragrostis superba* and *Fingerhutia africana*. Forbs are very abundant and the following deserve mentioning: *Heliotropium steudneri*, *Tephrosia polystachya*, *Phyllanthus asperulatus*, *Asparagus plumosus*, *Ceratotheca triloba*, *Euphorbia neopolycnemoides*, *Dicoma tomentosa*, *Crabbea velutina*, *Cyphocarpa angustifolia*, *Hibiscus micranthus*, *Seddera capense*, *Sansevieria hyacinthoides*, *Rhynchosia totta*, *Melhanie rehmannii*, *Clerodendrum ternatum*, *Leucas glabrata* and *Indigofera bainesii*.



Fig. 50. Landscape 22. *Combretum* spp./*Colophospermum mopane* Rugged Veld.



Fig. 51. Landscape 22. *Colophospermum mopane* trees along the foot of the Lebombo Mountains.

The vegetation on the skeletal soils of the Lebombo Mountain is comparable to the vegetation of the *Colophospermum mopane* Forest (Landscape 15). Two variations can be distinguished. On the soils with a strong structure (Sterkspruit Form) the mopane are severely stunted and the field layer is almost absent (Fig. 52). The structure of the woody vegetation is simple, to such an extent that the 0,5 to 2 metres layer dominates with a 35-50 percent crown cover. No taller plants occur. The mopane is therefore stunted due to the strong structure of the soils. Woody species associated with *Colophospermum mopane* are *Salvadora angustifolia*, *Maerua parvifolia*, *Euclea divinorum*, *Cissus cornifolia*, *Rhigozum zambesiaceum*, *Albizia harveyi*, *Ormocarpum trichocarpum*, *Acacia exuvialis* and *Ehretia rigida*. In the vicinity of the Shawu-plots dense stands of *Acacia borleae* also occur in this landscape.

Dense mopane forest similar to Landscape 15 develops on the soils with pedocutanic structure (Valsrivier and Swartland). Once again *Colophospermum mopane* dominates, but both as trees and shrubs (Fig. 51). Other woody species occurring are *Euclea divinorum*, *Zanthoxylum humilis*, *Salvadora angustifolia*, *Grewia bicolor*, *Acacia exuvialis*, *Securinega virosa*, *Maerua parvifolia*, *Ehretia rigida*, *Dalbergia melanoxylon*, *Acacia nigrescens*, *Combretum imberbe* and *Sclerocarya caffra*. *Adansonia digitata* occurs on the koppies near Mooiplaas, but they currently suffer from bad damage by elephant.

The field layer of both these variations is sparse and the following grass species occur constantly: *Urochloa mosambicensis*, *Panicum maximum*, *Bothriochloa radicans*, *Aristida congesta* subsp. *barbicollis*, *Chloris roxburghiana*, *Digitaria eriantha* var. *pentzii*, *Eragrostis superba*, *E. rigidior*, *Urochloa brachyura*, *Schmidtia pappophoroides*, *Sporobolus fimbriatus*, *Panicum coloratum*, *Heteropogon*



Fig. 52. Landscape 22. *Colophospermum mopane* shrubs along the foot of the Lebombo Mountains.