

## CHAPTER 2: THE STUDY AREA

### GENERAL

The KNP lies along the eastern borders of the Northern and Mpumalanga provinces (Figure 1) of the Republic of South Africa (RSA). The eastern boundary, which also comprises the international boundary between the RSA and Mozambique, lies along the Lebombo Mountains which are prominent in the south but disappear completely in the north. The northern and southern boundaries follow the courses of the Limpopo and Crocodile rivers respectively. The western boundary follows no natural features except in the extreme south where the Sigaas River constitutes the boundary, a small section north of the Letaba River where it follows the course of the Klein Letaba River and also in the far north where it follows the Luvuvhu and Limpopo rivers for some distance.

Although the KNP had been fenced along its entire periphery by 1978 (see Chapter 4), the fence between KNP and the private reserves on the western boundary between the Sabie and Olifants rivers was removed in 1994 to allow free movement of game. The fence along the Limpopo River has also recently been removed (1999) as it denied animals access to water in the dry season. These fences are not entirely "game-proof" as individuals of certain species manage to get through, under or to break them, but they have certainly curtailed all major movements of animals in or out of the KNP. These fences are discussed in more detail in Chapter 4.

In its entirety the KNP is situated in the area generally known as the "Lowveld" - i.e. the low-lying area below and to the east of the Drakensberg range. In total it covers an area of 18 992 km<sup>2</sup>, and lies between the latitudes 22° 20' and 25° 32' south and the longitudes 30° 53' and 32° 02' east. The highest lying land (approximately 835 m) is found near Malelane in the relatively mountainous southwest with a gradual decline to the east to relatively lower lying country varying between 180 m and 240 m above sea level.

For administrative purposes the KNP is divided into four regions (see Figure 1). The Far-northern Region lies between the Limpopo and Shingwedzi rivers the Northern Region between the Shingwedzi and the Olifants rivers, the Central Region has as its boundaries the Olifants River in the north and the Sabie River in the south, and the Southern Region which lies between the Sabie and Crocodile rivers.

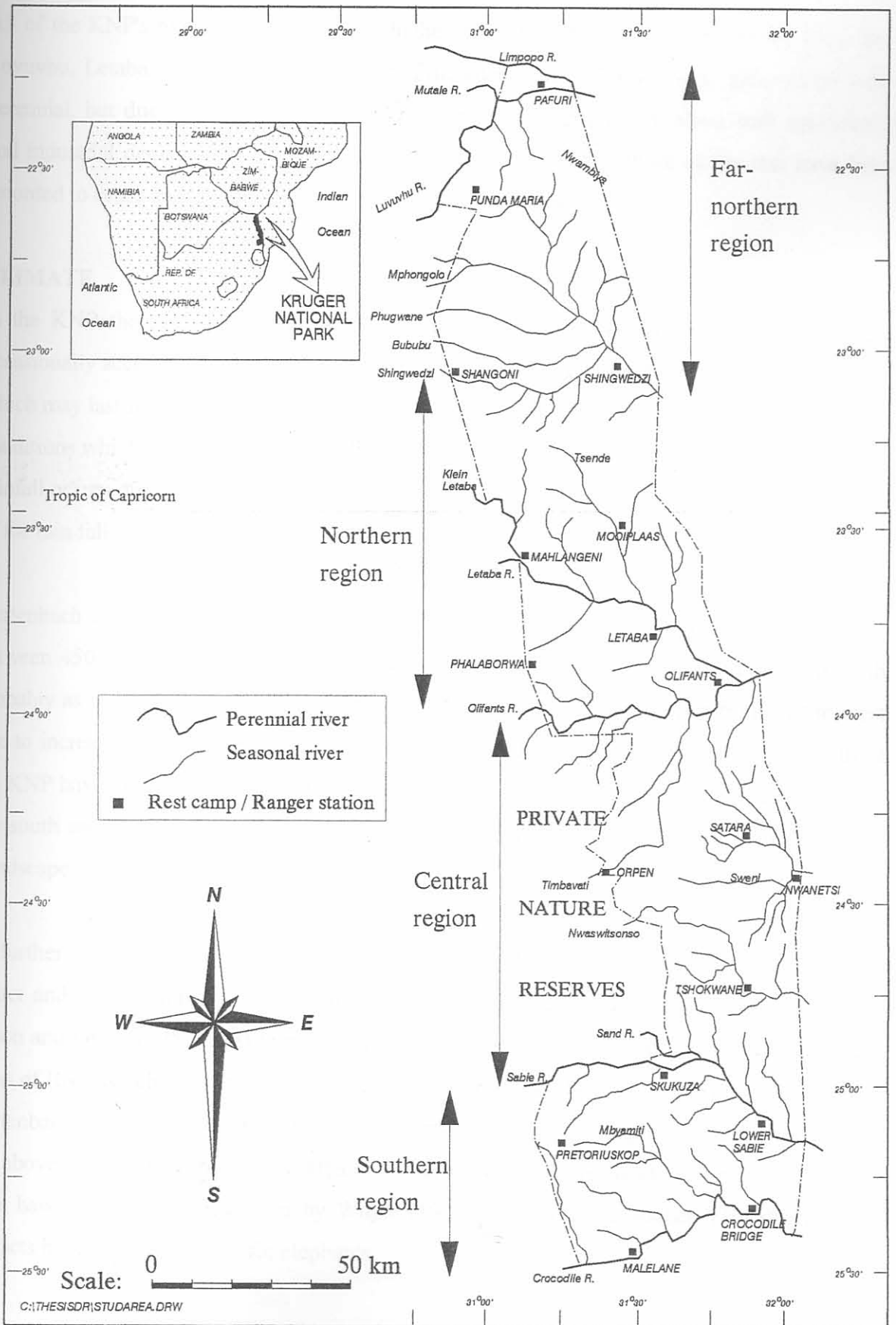


Figure 1: Locality map of the Kruger National Park and the four management regions.

All of the KNP's major rivers rise in the higher ground to the west. These are the Limpopo, Luvuvhu, Letaba, Olifants, Sabie and Crocodile rivers. In the past, all of these rivers were perennial, but due to the demands of an increasing human population along with agricultural and industrial demands, only the Sabie has remained so. Flows in all of the rest have been recorded to cease and in some, this is now an annual occurrence.

## CLIMATE

In the KNP the majority of the rainfall occurs in the form of thunder-showers which are occasionally accompanied by hail. Rainfall is also experienced in the form of gentle "mist-rain" which may last for several days, or occasionally as very heavy downpours as a result of cyclonic conditions which move inland off the Indian Ocean and the Mozambique Channel. Most of this rainfall occurs during the summer months (Figure 2, Table 1) between October and March (84% of the rain falls during these months).

Gertenbach (1980) compiled a rainfall map (Figure 2), showing that rainfall in KNP varies between 450 and 700 mm per annum. In general, precipitation decreases from south to north probably as a function of increasing distance from the sea and also increases from east to west due to increasing altitude (Figure 2). Thus the low-lying flat areas in the middle and north of the KNP have the lowest mean annual rainfall while the high-lying areas around Pretoriuskop in the south and Punda Maria in the north are relatively wetter. Rainfall figures for individual Landscape types are given below.

Of further interest from the data collated by Gertenbach (1980), is the emergence of a pattern of wetter and drier rainfall cycles. According to Dyer (1975, 1976), Dyer and Tyson (1977) and Tyson and Dyer (1975, 1978) there is a quasi 20 year rainfall oscillation in the summer rainfall areas of RSA which consists of respective 10 year periods of above and below average rainfall. Gertenbach (1980) found that the KNP cycle conformed to a large degree to those described by the above authors (Figure 3). The effects of these oscillations on wildebeest populations and their habitat in KNP was shown by Whyte (1985) and Whyte & Joubert (1988), but such impacts have not been shown for elephants.

Generally, temperatures vary from 0°C to 40°C though occasionally temperatures beyond these extremes have been recorded. Temperature data from Skukuza and Satara are given in Table 2.

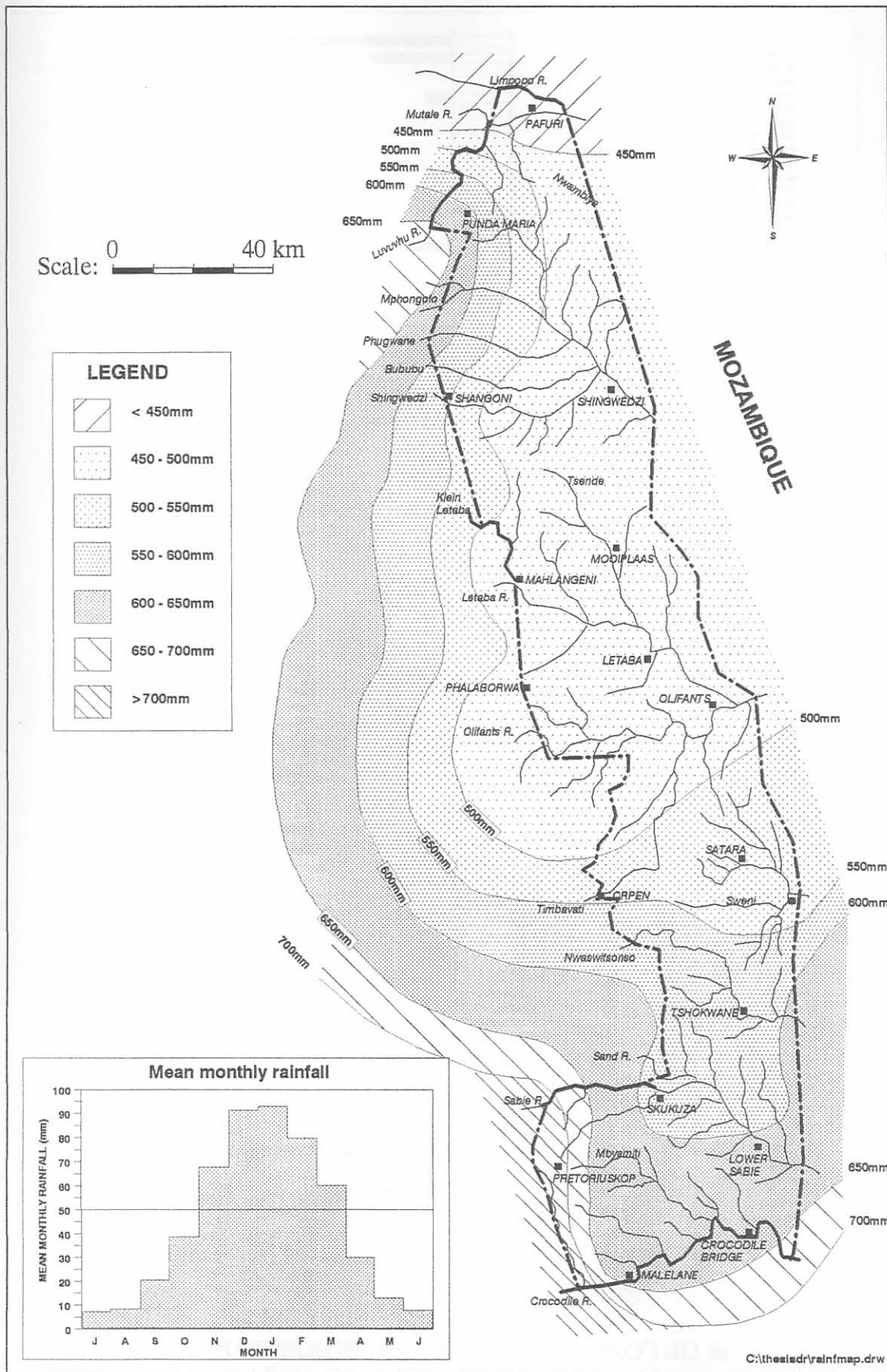


Figure 2: Rainfall map (after Gertenbach 1980) and mean monthly rainfall for all stations in the Kruger National Park.

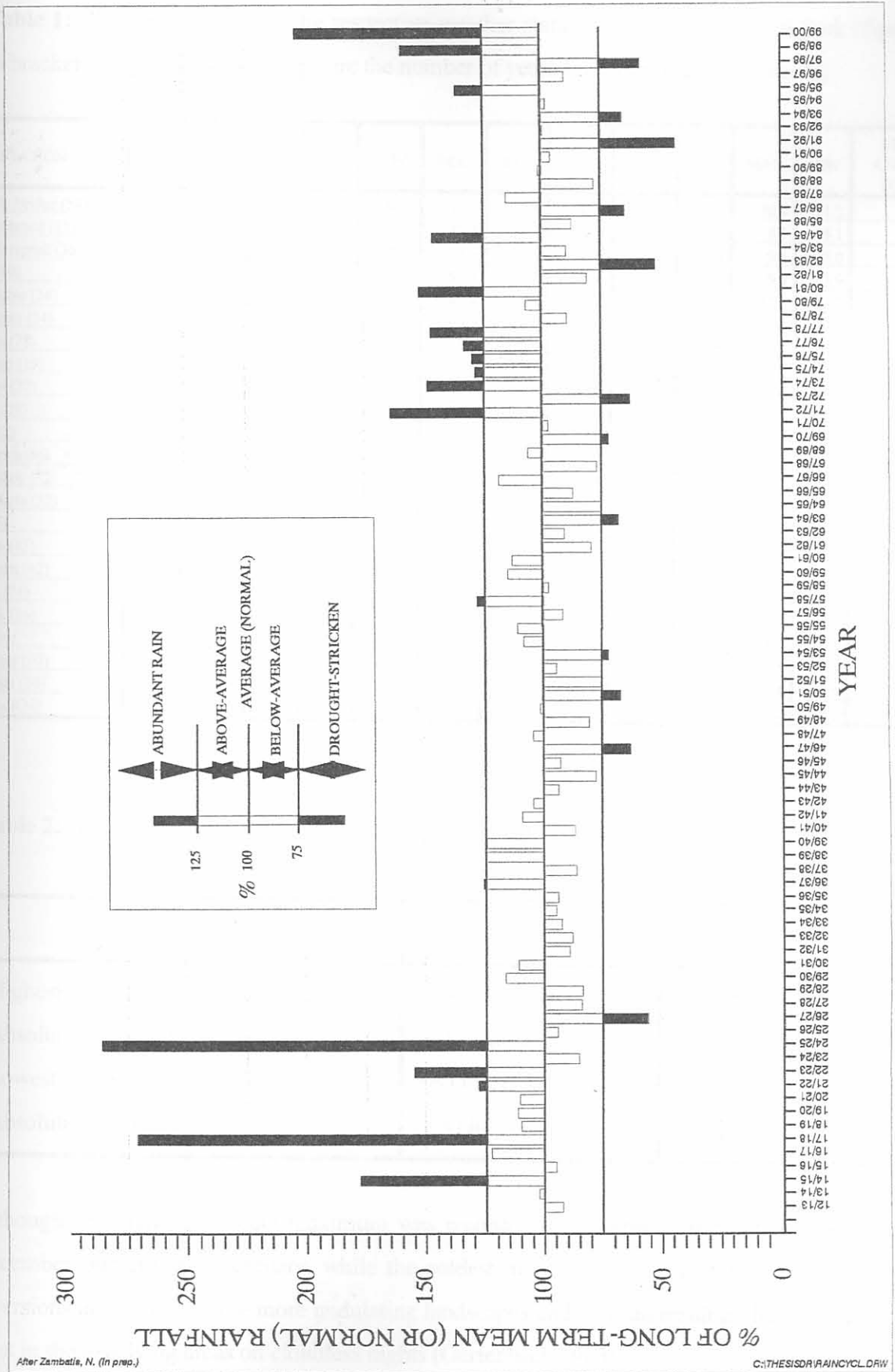


Figure 3: Long-term mean annual rainfall trends in the Kruger National Park between 1913 and 1997.

After Zambatis, N. (In prep.)

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**Table 1:** Rainfall (mm) from the respective weather stations in Kruger National Park (figures in brackets after the station's name are the number of years for which their are records).

| STATION               | JUL  | AUG  | SEP  | OCT  | NOV  | DEC   | JAN   | FEB   | MAR  | APR  | MAY  | JUN  | MEAN ANNUAL TOTAL |
|-----------------------|------|------|------|------|------|-------|-------|-------|------|------|------|------|-------------------|
| Crocodile Bridge (54) | 9.6  | 7.8  | 24.3 | 44.1 | 80.2 | 87.7  | 107.6 | 100.0 | 65.2 | 43.2 | 18.2 | 11.2 | 599.1             |
| Houtboschrand (11)    | 9.7  | 10.6 | 8.8  | 33.4 | 66.2 | 83.0  | 59.7  | 48.4  | 55.7 | 12.9 | 8.7  | 5.1  | 402.2             |
| Kingfisherspruit (36) | 8.3  | 7.8  | 20.6 | 40.4 | 74.3 | 93.6  | 83.8  | 101.3 | 62.5 | 33.8 | 9.4  | 8.0  | 543.8             |
| Letaba (49)           | 7.6  | 5.0  | 18.2 | 31.9 | 55.3 | 91.9  | 81.0  | 81.6  | 38.6 | 30.3 | 9.4  | 3.9  | 454.7             |
| Lower Sabie (24)      | 8.7  | 7.9  | 24.7 | 44.3 | 56.4 | 86.8  | 119.8 | 107.6 | 62.8 | 34.2 | 17.2 | 11.2 | 581.6             |
| Mahlangeni (34)       | 5.8  | 6.7  | 4.8  | 35.8 | 53.0 | 90.3  | 74.7  | 84.0  | 46.7 | 20.2 | 13.0 | 4.2  | 449.2             |
| Malelane (78)         | 7.6  | 8.3  | 21.8 | 49.6 | 90.7 | 93.4  | 112.1 | 102.5 | 89.0 | 39.3 | 16.7 | 7.6  | 638.6             |
| Mooiplaas (19)        | 5.7  | 6.2  | 15.3 | 31.1 | 56.1 | 77.5  | 86.9  | 97.2  | 45.1 | 22.2 | 12.9 | 2.5  | 458.7             |
| Nwanetsi (27)         | 7.4  | 9.6  | 22.5 | 37.0 | 54.9 | 90.5  | 94.6  | 93.6  | 63.3 | 27.0 | 13.0 | 7.6  | 521.0             |
| Olifants (19)         | 8.6  | 8.8  | 16.9 | 38.3 | 75.6 | 75.4  | 88.5  | 85.5  | 47.7 | 22.4 | 14.2 | 3.1  | 485.0             |
| Pafuri (62)           | 1.6  | 4.3  | 12.3 | 21.7 | 52.9 | 81.3  | 84.1  | 83.1  | 44.7 | 21.7 | 8.5  | 4.7  | 420.9             |
| Phalaborwa (66)       | 8.8  | 5.0  | 13.5 | 30.1 | 63.6 | 87.6  | 87.3  | 79.2  | 60.7 | 28.6 | 8.9  | 6.8  | 480.1             |
| Pretoriuskop (52)     | 9.9  | 13.3 | 29.4 | 53.8 | 97.8 | 119.1 | 125.9 | 101.0 | 90.9 | 51.3 | 19.0 | 11.0 | 722.4             |
| Punda Maria (52)      | 3.9  | 4.6  | 17.1 | 26.2 | 70.9 | 92.3  | 113.3 | 104.5 | 69.7 | 28.6 | 12.9 | 4.6  | 548.6             |
| Satara (6)            | 8.6  | 8.1  | 21.3 | 33.9 | 71.4 | 89.5  | 92.6  | 95.5  | 66.7 | 28.2 | 12.4 | 9.6  | 537.8             |
| Shangoni (43)         | 4.5  | 3.7  | 15.0 | 34.6 | 63.5 | 94.0  | 101.7 | 98.5  | 64.6 | 27.0 | 12.3 | 5.4  | 524.8             |
| Shingwedzi (42)       | 3.9  | 4.9  | 22.6 | 30.2 | 54.1 | 90.6  | 76.2  | 91.1  | 42.8 | 27.4 | 11.4 | 6.3  | 461.4             |
| Skukuza (74)          | 10.4 | 6.2  | 25.7 | 34.9 | 75.9 | 84.3  | 92.9  | 87.4  | 73.2 | 33.2 | 13.5 | 9.5  | 547.1             |
| Stols Nek (16)        | 8.6  | 11.1 | 21.2 | 50.3 | 85.3 | 112.4 | 97.3  | 96.3  | 88.3 | 41.4 | 8.3  | 5.7  | 626.2             |
| Tshokwane             | 8.0  | 7.4  | 21.6 | 37.9 | 69.2 | 103.8 | 88.8  | 94.6  | 68.9 | 34.6 | 11.0 | 9.8  | 555.6             |
| Vlakteplaas (10)      | 4.5  | 8.4  | 27.1 | 48.4 | 64.4 | 80.3  | 81.2  | 71.4  | 36.7 | 19.1 | 6.5  | 7.1  | 455.1             |
| Woodlands (10)        | 3.6  | 8.8  | 14.3 | 39.4 | 49.8 | 82.9  | 74.5  | 61.9  | 22.4 | 19.4 | 10.4 | 12.5 | 399.9             |
| Means for KNP         | 7.1  | 7.5  | 19.5 | 37.6 | 67.3 | 90.4  | 92.0  | 89.4  | 59.4 | 29.4 | 12.2 | 7.2  | 519.0             |

**Table 2:** Temperature ( $^{\circ}\text{C}$ ) parameters from Skukuza and Satara in Kruger National Park.

| PARAMETER                       | SKUKUZA         | SATARA          |
|---------------------------------|-----------------|-----------------|
| Highest average monthly maximum | 32.3 (January)  | 33.6 (February) |
| Absolute maximum                | 44.5 (November) | 41.6 (January)  |
| Lowest average monthly minimum  | 5.6 (July)      | 8.9 (June)      |
| Absolute minimum                | -2.5 (July)     | 8.0 (June)      |

Although the highest absolute maximum was recorded in November, the hottest months are December, January and February, while the coldest months are June and July. Temperature inversions are distinct in the more undulating landscapes and this can result in the occurrence of frost in the low-lying areas on cloudless nights (Gertenbach 1983).

Summers (October to March) are generally hot and humid while the winters (April to September) are cool and dry and relative percentage humidity may vary between 100% and less than 10% (Young, 1970). At 25°S, photoperiod varies between 14 hours and 11 hours at the summer and winter solstices.

## **GEOLOGY AND SOILS**

The geology and soils have been well studied (see Bristow *et al.* 1986; Bristow & Venter 1986; Venter 1986; Venter 1990 and references therein).

Broadly speaking, the underlying geology of the KNP, consists of granitic soils in the western half of the Park and basaltic soils in the east, separated in the middle by a narrow belt of sandy Karoo sediments. To the east of the basalts lie the Lebombo Mountains.

## **DRAINAGE AND WATER**

A detailed account of the geomorphology and drainage in the KNP was given by Venter & Bristow (1986).

## **VEGETATION**

Generally speaking, all of the soils in the KNP give rise mainly to deciduous woodlands or savannas. On the granites in the west, broadleaved woodlands occur on the crests of the hills and thornveld in the valleys, while the basalts in the east are much flatter, giving rise to grassy savanna plains with a greater or lesser extent of tree cover - from open grassland to well-wooded savannas. A total of 1982 vascular plants have been collected and identified in the KNP (van Wyk 1984; Zambatis 1997e).

## **THE LANDSCAPE TYPES AND INCORPORATED ZONATION OF THE KNP**

The various landscapes of the KNP have been accepted as the most appropriate ecological units for the consideration and determination of management strategies for the KNP. From this point of view the composition, natural attributes and qualities of the various landscapes, and their perpetuation, are of primary concern in the management of the KNP (Joubert 1986). Detailed descriptions of all the landscapes, including their biotic and abiotic components, boundaries, management priorities and state of development, are therefore considered an essential component of the Masterplan for the Management of the KNP. The Landscapes of the KNP

were described by Gertenbach 1983.

### THE LANDSCAPE TYPES OF THE KNP

This description of the 35 landscapes of the KNP has been summarised from more detailed earlier studies (Coetzee 1983; Gertenbach 1983; Joubert 1986). A brief description of the major ecological features and the zonation of the various landscapes is given to provide a perspective of the ecological diversity of the KNP (see Figure 4).

#### Landscape 1: Lowveld Sour Bushveld: 336 km<sup>2</sup> (1.8%)

Moderately undulating granitoid plains with *Terminalia sericea* tree savanna.

The annual rainfall for Pretoriuskop is 743.6mm (n = 40 years) range between 600 - 1 000 mm. The vegetation is predominantly large-leaved deciduous woodland and tall ( $\pm 1.5$ m) field layer. In spite of a large variety of species in all the strata the dominants of the various strata include: upper woody strata - *Sclerocarya birrea*, *Terminalia sericea*, *Lannea discolor*, *Piliostigma thonningii*; intermediate strata - *Dichrostachys cinerea* subsp. *nyassana*, *Strychnos madagascariensis*, *Ehretia amoena*, *Peltophorum africanum*; field layer - *Hyperthelia dissoluta*, *Hyparrhenia* spp., *Diheteropogon amplexens*, *Loudetia simplex*. Physiognomically the vegetation changed from open savanna to a relatively densely wooded savanna between circa 1935 to 1950.

#### Landscape 2: Malelane Mountain Bushveld: 452 km<sup>2</sup> (2.4%)

Low granitoid mountains with *Combretum apiculatum* bushveld.

Rainfall varies between 600 - 700 mm per annum, but will probably be as high as 1 000 mm in the higher altitude regions of the mountains. The most common and widely distributed woody plants include *Combretum apiculatum*, *Acacia nigrescens*, *Terminalia prunioides* and *T. sericea*. A wide variety of woody plants are present in the landscape, many of which are largely or entirely restricted to the area, e.g. *Kirkia wilmsii*, *Celtis africana*, *Aloe bainesii*, *Tarchonanthus camphorates*, *Faurea speciosa*, *Acacia davyii*, *Calodendrum capense*, *Strychnos henningsii*, *Apodytes dimidiata*, *Homalium dentatum* and several more. A variety of shrubs are common, the most widespread being *Dichrostachys cinerea* subsp. *africana*.



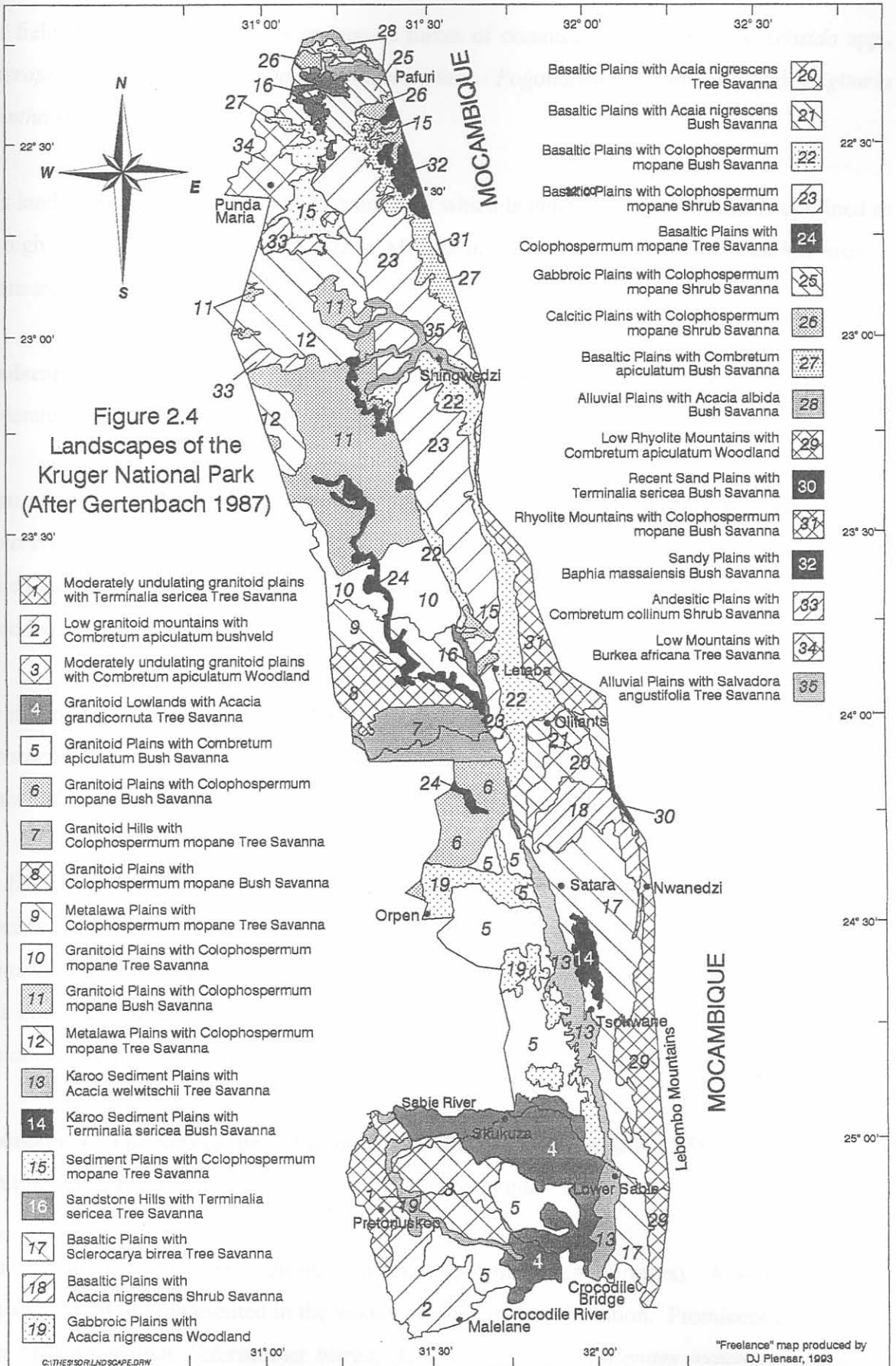


Figure 4: Landscapes of the Kruger National Park (after Gertenbach 1983)

The field layer is represented by numerous mixes of common grasses, such as *Aristida* spp., *Heteropogon contortus*, *Cymbopogon plurinoides*, *Pogonarthria squarrosa* and *Digitaria eriantha* subsp. *pentzi*.

The shrub layer over large areas is a distinguishing feature

This landscape also includes a plant community which is unique to the KNP and is confined to the high-altitude plateau of the Khandizwe Mountain, i.e. the *Acacia davyii* - *Tristachya hispida* community

The field

### **Landscape 3: *Combretum collinum*/*C. zeyheri* woodland: 537 km<sup>2</sup> (2.8%)**

Moderately undulating granitoid plains with *Combretum apiculatum* woodland.

The shrub

Mean annual rainfall is 600 - 700 mm. The major dominants of the woody vegetation are *Combretum collinum* subsp. *suluense* and *C. zeyheri*. These species, together with a relatively limited number of associated species give the vegetation the general physiognomic character of a wooded, short tree ( $\pm 5$  m) savanna character.

Granitoid

The intermediate shrub stratum is dominated by species such as *Strychnos madagascariensis*, *Pterocarpus rotundifolius* and *Dichrostachys cinerea* subsp. *nyassana* in association with a number of other species.

The field

The field layer is generally relatively short ( $\pm 1.0$ m) and is represented by species commonly associated with sandy soils, e.g. *Pogonarthria squarrosa*, *Perotis patens*, *Hyperthelia dissoluta*, *Digitaria eriantha* subsp. *pentzi*, *Tricholaena monachne*, and others. On the clayey lower-lying areas *Themeda triandra*, *Heteropogon contortus*, *Urochloa mosambicensis*, *Enneapogon cenchroides*, and others, are common.

The field

### **Landscape 4: Thickets of the Sabie and Crocodile rivers: 1 236 km<sup>2</sup> (6.5%)**

Granitoid lowlands with *Acacia grandicornuta* tree savanna.

The field

Mean annual rainfall is 500 - 550 mm (Skukuza: 546 mm; n = 60 years). A wide variety of trees and shrubs are represented in the woody element of the vegetation. Prominent trees in the upper stratum include *Sclerocarya birrea*, *Acacia nigrescens*, *Balanites maughami*, *Lannea stuhlmanni*, *Combretum apiculatum*, *Spirostachys africana* and *Ziziphus mucronata*. On the

brackish, clayey soils *Acacia grandicornuta* and *Terminalia prunioides* are common, while *Acacia nigrescens* is the dominant tree on the soils of the dolerite intrusions.

The dense thorn thickets formed by the shrub layer over large areas is a distinguishing feature of the landscape. Common species include *Dichrostachys cinerea* subsp. *africana*, *Acacia tortilis*, *Grewia* spp. and shrub forms of most of the tree species referred to above.

The field layer is well developed on the deeper sandy soils of the watershed areas, but is generally short and relatively sparse in the lower-lying depressions. Common grasses include *Panicum maximum*, *Pogonarthria squarrosa*, *Schmidtia pappophoroides* and *Digitaria eriantha* subsp. *pentzii* on the deeper soils and *Urochloa mosambicensis*, *Chloris virgata* and *Sporobolus nitens* in the depressions. On the dolerite soils rank stands of *Themeda triandra* are common.

#### **Landscape 5: Mixed *Combretum* spp/*Terminalia sericea* Woodland: 1 570 km<sup>2</sup> (8.3%)**

Granitoid plains with *Combretum apiculatum* bush savanna.

The mean annual rainfall is 550 - 600 mm. The vegetation generally consists of predominantly low ( $\pm 5$  m) trees, of which the most common are *Combretum apiculatum*, *C. zeyheri* and *Terminalia sericea*. Other common trees in the same size group are *Lannea stuhlmanni*, *Peltophorum africanum* and *Ziziphus mucronata*. The most conspicuous large trees are *Sclerocarya birrea* and *Acacia nigrescens*. Common shrubs in the intermediate stratum include *Strychnos madagascariensis*, *Dichrostachys cinerea* subsp. *africana*, *Pterocarpus rotundifolius*, *Dalbergia melanoxylon* and *Ormocarpum trichocarpum*.

On the watersheds the relatively sparse field layer ( $\pm 1.0$  m tall) is comprised of grasses common to sandy soils, e.g. *Pogonarthria squarrosa*, *Digitaria eriantha* subsp. *pentzii*, *Panicum maximum*, *Perotis patens*, *Tricholaena monachne* and *Brachiaria* spp. In the lower-lying depressions grass species such as *Urochloa mosambicensis*, *Schmidtia pappophoroides*, *Heteropogon contortus* and *Enneapogon cenchroides* are common.

Over extensive areas of this landscape a characteristic feature is a clearly defined corollary of *Terminalia sericea* trees along the seepline on the lower slopes, presenting a clear divide be-

tween the watershed plant communities and those of drainage valleys.

**Landscape 6: *Combretum* spp./*Colophospermum mopane* Woodland of the Timbavati area: 467 km<sup>2</sup> (2.5%)**

Granitoid plains with *Colophospermum mopane* bush savanna.

Mean annual precipitation is between 450 and 550 mm. The vegetation on the higher-lying areas of the watersheds is dominated by *Combretum apiculatum*, while associated species include *Terminalia sericea*, *Sclerocarya birrea*, *Albizia harveyi*, *Acacia exuvialis*, *Dalbergia melanoxylon* and *Dichrostachys cinerea* subsp. *africana*. On the lower slopes, and in association with the higher clay content of the soils, *Colophospermum mopane* becomes more dominant. Other associated trees and shrubs include *Combretum apiculatum*, *C. hereroense*, *Acacia nigrescens*, *A. gerrardi*, *Euclea divinorum*, *Bolusanthus speciosus* and *Terminalia prunioides*.

In the higher-lying areas grasses typical of more sandy soils are common, including *Pogonarthria squarrosa*, *Digitaria eriantha* var. *pentzii*, *Brachiaria serrata*, *Rhynchelytrum repens* and *Tricholaena monachne*. Other common grasses are *Heteropogon contortus*, *Enneapogon cenchroides*, *Schmidtia pappophoroides* and *Panicum maximum*. In the more clayey areas *Themeda triandra*, *Urochloa mosambicensis*, *Cymbopogon plurinodis*, *Panicum coloratum* and *Bothriochloa radicans* are common.

**Landscape 7: Olifants River Rugged Veld: 358 km<sup>2</sup> (1.9%)**

Granitoid hills with *Colophospermum mopane* tree savanna.

Mean annual rainfall is approximately 450 - 500 mm. Composition - The woody vegetation is dominated by *Colophospermum mopane* and *Combretum apiculatum*. Common associated species include *Terminalia prunioides*, *Boscia albitrunca*, *Acacia nigrescens*, *Sclerocarya birrea*, *Commiphora mollis*, *C. africana* and *Dalbergia melanoxylon*.

Common grasses include *Rhynchelytrum repens*, *Sporobolus panicoides*, *Enneapogon cenchroides*, *Bothriochloa radicans*, *Digitaria eriantha* var. *pentzii*, *Aristida* spp., *Cymbopogon plurinodis* and *Panicum maximum*.

Physiognomy - The woody vegetation generally attains a height of approximately 5.0m, with a sparse distribution of tall prominent trees. The density of trees is relatively high, resulting in a relatively densely wooded savanna. The field layer is generally sparse with a relatively low ground cover (50 - 70%) and approximately 0.5 to 1.0 m tall.

#### **Landscape 8: Phalaborwa Sandveld: 394 km<sup>2</sup> (2.1%)**

Granitoid plains with *Terminalia sericea*/*Colophospermum mopane* bush savanna.

Mean annual rainfall is approximately 450 - 500 mm. The long term mean for Phalaborwa is 481 mm (n = 54 years). Due to the deep sandy nature of the soils the distinctive woody plant of the landscape is *Terminalia sericea*. Other common woody plants include *Colophospermum mopane*, *Combretum apiculatum*, *C. zeyheri*, *C. imberbe*, *Sclerocarya birrea*, *Acacia nigrescens*, *Peltophorum africanum*, *Pseudolachnostylis maprouneifolia* and *Bolusanthus speciosus*.

Common grasses include *Andropogon gayanus*, *Digitaria eriantha* var. *pentzii*, *Pogonarthria squarrosa*, *Brachiaria nigropedata*, *Heteropogon contortus*, *Aristida* spp., *Panicum maximum*, *Rhynchelytrum repens*, *Urochloa mosambicensis*, *Cymbopogon plurinodis*, *Themeda triandra*, *Enneapogon cenchroides* and *Bothriochloa radicans*.

#### **Landscape 9: *Colophospermum mopane* Savanna on Basic Soils: 543 km<sup>2</sup> (2.9%)**

Metalava plains with *Colophospermum mopane* tree savanna.

Mean annual rainfall is approximately 450 - 500 mm. The dominant woody plant is *Colophospermum mopane*, which occurs in almost homogeneous stands over large areas. Other associated trees and shrubs include *Combretum apiculatum*, *Acacia nigrescens*, *Albizia harveyi*, *Combretum imberbe*, *Lannea stuhlmanni*, *Ozoroa engleri* and *Mundulea sericea*.

Common grasses in the field layer are *Themeda triandra*, *Digitaria eriantha* var. *pentzii*, *Schmidtia pappaphoroides*, *Bothriochloa radicans*, *Panicum coloratum*, *P. maximum* and *Urochloa mosambicensis*.

**Landscape 10: Letaba River Rugged Veld: 697 km<sup>2</sup> (3.7%.)**

Granitoid plains with *Colophospermum mopane* bush savanna.

The mean annual rainfall is approximately 450 - 500 mm with the long term mean for Mahlangeni 490 mm (n = 20 years). Composition - The vegetation largely resembles that of the Olifants River Rugged Veld (Landscape 7). Predominant trees and shrubs include *Colophospermum mopane*, *Combretum apiculatum*, *Terminalia prunioides*, *Acacia nigrescens*, *Combretum imberbe*, *Dichrostachys cinerea* subsp. *africana*, *Grewia* spp. and *Mundulea sericea*.

Common grasses in the field layer include *Bothriochloa radicans*, *Aristida* spp., *Enneapogon cenchroides* and *Urochloa mosambicensis*. The forb, *Hemizygia elliotii*, is a prominent feature in the field layer of this landscape.

**Landscape 11: Tsende Sandveld: 1 150 km<sup>2</sup> (5.5%.)**

Granitoid plains with *Colophospermum mopane* bush savanna.

The mean annual precipitation is approximately 450 - 500 mm, with the long term mean for Shangoni 572 mm (n = 37 years). The dominant woody plants are *Colophospermum mopane* and *Combretum apiculatum*, the former being most dominant on the watersheds. Due to deep sandy soils *Terminalia sericea* is also locally conspicuous. Other common associated trees and shrubs include *Acacia nigrescens*, *Sclerocarya birrea*, *Combretum hereroense*, *Peltophorum africanum*, *Dichrostachys cinerea* subsp. *africana*, *Albizia harveyi*, *Strychnos madagascariensis* and *Dalbergia melanoxylon*.

Common grasses in the field layer include: *Cymbopogon plurinodis*, *Digitaria eriantha* var. *pentzii*, *Panicum maximum*, *Heteropogon contortus*, *Bothriochloa radicans*, *Urochloa mosambicensis*, *Eragrostis superba*, *Brachiaria nigropedata* and *Andropogon gayanus*.

**Landscape 12: *Colophospermum mopane*/Acacia nigrescens Savanna: 1 037 km<sup>2</sup> (5.5%)**

Metalava plains with *Colophospermum mopane* tree savanna.

The mean annual rainfall is approximately 500 - 600 mm. Common trees and shrubs include

*Colophospermum mopane*, *Combretum apiculatum*, *Acacia nigrescens* *A. gerrardii*, *Euclea divinorum*, *Combretum hereroense*, *C. collinum* subsp. *suluense* and *Maytenus heterophylla*. In Landscape 33 *Pterocarpus rotundifolius* is dominant, with other distinctive species including *Combretum collinum* subsp. *suluense*, *C. molle*, *C. apiculatum*, *Lananea discolor*, *Dombeya rotundifolia*, *Lonchocarpus capassa* and *Ozoroa engleri*.

#### Landscape 12: Acacia welwitschii Thickets on Karoo Sediments: 517 km<sup>2</sup> (2.7%)

Common grasses in the field layer include: *Themeda triandra*, *Bothriochloa radicans*, *Digitaria eriantha* var. *pentzii*, *Panicum maximum*, *Setaria holstii*, *Urochloa mosambicensis*, *Brachiaria nigropedata*, *Eragrostis rigidior*, *Panicum coloratum* and *Heteropogon contortus*.

#### Landscape 13: Acacia welwitschii Thickets on Karoo Sediments: 517 km<sup>2</sup> (2.7%)

#### Landscape 13: *Acacia welwitschii* Thickets on Karoo Sediments: 517 km<sup>2</sup> (2.7%)

Karoo sediment plains with *Acacia welwitschii* tree savanna

There is no measuring station in this Landscape but the mean is expected to be approximately 500 - 600 mm. The major woody plant species include *Acacia welwitschii* subsp. *delagoensis*, *Albizia petersiana* subsp. *evansii*, *Euclea divinorum*, *Boscia mossambicensis*, *Dichrostachys cinerea* subsp. *africana*, *Grewia bicolor*, *Capparis tomentosa* and *Spirostachys africana*. In the more sandy areas *Terminalia sericea*, *Albizia forbesii*, *A. harveyi*, *Peltophorum africanum*, *Lananea stuhlmanni* and *Schotia brachypetala* are conspicuous. Common grasses of the field layer include: *Urochloa mosambicensis*, *Enteropogon macrostachyus*, *Sporobolus nitens*, *S. smutsii*, *Bothriochloa radicans*, *Tragus berteronianus*, *Chloris virgata*, *Dactyloctenium aegyptium*, *Digitaria eriantha* var. *pentzii*, *Pogonarthria squarrosa*, *Eragrostis rigidior* and *Schmidtia pappaphoroides*.

#### Landscape 14: Kumana Sandveld: 193 km<sup>2</sup> (1.0%)

#### Landscape 14: Kumana Sandveld: 193 km<sup>2</sup> (1.0%)

Karoo sediment plains with *Terminalia sericea* bush savanna.

#### Landscape 15: Acacia welwitschii Thickets on Karoo Sediments: 517 km<sup>2</sup> (2.7%)

There is no measuring station in this Landscape but the mean is expected to be approximately 500 - 600 mm. The major woody plant species include *Acacia welwitschii* subsp. *delagoensis*, *Albizia petersiana* subsp. *evansii*, *Euclea divinorum*, *Boscia mossambicensis*, *Dichrostachys cinerea* subsp. *africana*, *Grewia bicolor*, *Capparis tomentosa* and *Spirostachys africana*. In the more sandy areas *Terminalia sericea*, *Albizia forbesii*, *A. harveyi*, *Peltophorum africanum*, *Lananea stuhlmanni* and *Schotia brachypetala* are conspicuous. Common grasses of the field

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layer include: *Urochloa mosambicensis*, *Enteropogon macrostachyus*, *Sporobolus nitens*, *S. smutsii*, *Bothriochloa radicans*, *Tragus berteronianus*, *Chloris virgata*, *Dactyloctenium aegyptium*, *Digitaria eriantha* var. *pentzii*, *Pogonarthria squarrosa*, *Eragrostis rigidior* and *Schmidtia pappaphoroides*.

**Landscape 15: *Colophospermum mopane* Forest: 267 km<sup>2</sup> (1.4%)**

Sedimentary plains with *Colophospermum mopane* tree savanna.

There is no measuring station in this Landscape but the mean is expected to be approximately 500 - 550mm. The major trees and shrubs include *Colophospermum mopane*, *Spirostachys africana*, *Acacia nigrescens*, *Euclea divinorum*, *Tilachium africanum*, *Acacia tortilis*, *Combretum imberbe* and *C. hereroense*.

Common grasses in the field layer include: *Enteropogon macrostachyus*, *Enneapogon cenchroides*, *Panicum maximum*, *Urochloa mosambicensis*, *Digitaria eriantha* var. *pentzii* and *Schmidtia pappophoroides*.

**Landscape 16: Punda Maria Sandveld on cave Sandstone: 116 km<sup>2</sup> (0.6%)**

There is no measuring station in this Landscape but the mean is expected to be approximately 450 - 550 mm.

Distinctive trees and shrubs of this landscape include: *Adansonia digitata*, *Colophospermum mopane*, *Combretum apiculatum*, *Boscia albitrunca*, *B. angustifolia*, *Terminalia sericea*, *Acacia nigrescens*, in addition to species characteristic of kopjies and rocky ridges, e.g. *Steganotaenia araliacea*, *Kirkia acuminata*, *Ficus soldanella*, *Maerua angolensis*, *Sterculea rogersii*, *Entandrophragma caudatum*, *Acokanthera schimperi* var. *rotundata*, *Boscia foetida* subsp. *rehmanniana*, *Androstachys johnsonii*, *Markhamia acuminata* and *Gyrocarpus americanus*. In terms of the relative species composition of the various landscapes of the KNP, Landscape 16 is particularly rich in species diversity. The variety of *Commiphora* spp. is a distinctive feature. *C. merkeri*, *C. tenuipetiolata* and *C. marlothii* are distinctive.

A particularly prominent feature of this landscape is the numerous conspicuous, almost homogeneous stands of *Androstachys johnsonii*.



Common grasses of the field layer include: *Digitaria eriantha* var. *pentzii*, *Brachiaria serrata*, *Pogonarthria squarrosa*, *Perotis patens*, *Schmidtia pappaphoroides*, *Aristida* spp., *Bothriochloa radicans*, *Enneapogon cenchroides*, *Heteropogon contortus* and *Fingerhutia africana*.

#### **Landscape 17: *Sclerocarya birrea*/Acacia nigrescens Savanna: 1 404 km<sup>2</sup> (7.4%)**

The mean annual rainfall diminishes from south to north and is generally approximately 500 - 600 mm. Recorded mean annual rainfall for stations within this landscape is: Crocodile Bridge 599 mm (n = 40 years), Tshokwane 561 mm (n = 43 years) and Satara 548 mm (n = 46 years). Trees and shrubs characteristic of this landscape include *Sclerocarya birrea*, *Acacia nigrescens*, *A. gerrardi*, *Lonchocarpus capassa*, *Dichrostachys cinerea* subsp. *africana*, *Lannea stuhlmanni*, *Maytenus heterophylla* and *Pterocarpus rotundifolius*.

Common grasses in the field layer include: *Themeda triandra*, *Bothriochloa radicans*, *Panicum coloratum*, *P. maximum*, *Digitaria eriantha* var. *pentzii*, *Heteropogon contortus* and *Urochloa mosambicensis*.

#### **Landscape 18: Dwarf *Acacia nigrescens* Savanna: 354 km<sup>2</sup> (1.9%)**

The mean annual rainfall is approximately 500 - 550 mm. Composition - The dominant woody plant species is *Acacia nigrescens*, in association with, amongst others, *Cordia sinensis*, *Ehretia rigida*, *Dichrostachys cinerea* subsp. *africana* and *Securinega virosa*. Common grasses in the field layer include: *Themeda triandra*, *Ischaemum brachyatherum*, *Setaria woodii*, *Panicum coloratum*, *P. maximum*, *Sorghum versicolor*, *Digitaria eriantha* var. *pentzii* and *Urochloa mosambicensis*. The landscape is also noted for a number of dense shrub stands, consisting primarily of *Acacia borleae*.

#### **Landscape 19: Thornveld on Gabbro: 682 km<sup>2</sup> (3.6%)**

The mean annual rainfall in the area to the south of the Olifants River is approximately 500 - 600 mm (with the rainfall diminishing from south to north) and north of the Olifants River it is 450 - 500 mm.

Composition - In the area to the south of Red Gortien the woody vegetation is comprised predominantly of *Acacia nigrescens*, while other important trees and shrubs include *Sclerocarya*

*birrea*, *Ziziphus mucronata*, *Bolusanthus speciosus*, *Securinega virosa*, *Ormocarpum trichocarpum*, *Dalbergia melanoxylon* and *Acacia tortilis*. In the northern areas the dominant woody species is *Colophospermum mopane* in association with most of the species mentioned above.

Common grasses in the field layer include: *Themeda triandra*, *Cenchrus ciliaris*, *Bothriochloa radicans*, *Digitaria eriantha* var. *pentzii*, *Enneapogon cenchroides*, *Chloris virgata*, *Heteropogon contortus*, *Cymbopogon plurinodis*, *Schmidtia pappophoroides*, *Panicum coloratum* and *Eragrostis superba*.

#### **Landscape 20: Bangu Rugged Veld: 203 km<sup>2</sup> (1.1%)**

Basaltic plains with *Acacia nigrescens* tree savanna.

The mean annual rainfall is believed to be slightly higher in Landscape 20, i.e. 500 - 550 mm, than in Landscape 21, i.e. 450 - 500 mm. Composition - common trees and shrubs for these landscapes include *Acacia nigrescens*, *Acacia senegal* var. *leiorhachis* *Grewia bicolor*, *Combretum apiculatum*, *Terminalia prunioides*, *Acacia exuviales*, *A. tortilis*, *Dichrostachys cinerea* subsp. *africana*, *Combretum mossambicense*, *Sterculea rogersii*, *Manilkara mochisia*, *Kirkia acuminata*, *Boscia albitrunca*, *Commiphora africana* and *C. glandulosa*.

Common grasses of the field layer include: *Panicum coloratum*, *Enneapogon cenchroides*, *Bothriochloa radicans*, *Schmidtia papophoroides*, *Heteropogon contortus*, *Sporobolus nitens* and *Aristida* spp.

#### **Landscape 21: *Combretum* spp./*Acacia* spp. Rugged Veld: 269 km<sup>2</sup> (1.4%)**

Basaltic plains with *Acacia nigrescens* bush savanna.

The mean annual rainfall is believed to be slightly higher in Landscape 20, i.e. 500 - 550 mm, than in Landscape 21, i.e. 450 - 500 mm. Composition - common trees and shrubs for these landscapes include *Acacia nigrescens*, *Acacia senegal* var. *leiorhachis* *Grewia bicolor*, *Combretum apiculatum*, *Terminalia prunioides*, *Acacia exuviales*, *A. tortilis*, *Dichrostachys cinerea* subsp. *africana*, *Combretum mossambicense*, *Sterculea rogersii*, *Manilkara mochisia*, *Kirkia acuminata*, *Boscia albitrunca*, *Commiphora africana* and *C. glandulosa*.

Common grasses of the field layer include: *Panicum coloratum*, *Enneapogon cenchroides*, *Bothriochloa radicans*, *Schmidtia pappophoroides*, *Heteropogon contortus*, *Sporobolus nitens* and *Aristida* spp.

**Landscape 22: *Combretum* spp./*Colophospermum mopane* Rugged Veld: 890 km<sup>2</sup> (4.7%).**

Basaltic plains with *Colophospermum mopane* bush savanna.

The mean annual rainfall is approximately 450 - 500 mm. The long term means for two recording stations within the landscape are: Letaba - 462 mm (n = 51 years) and Shingwedzi - 472 mm (n = 37 years). The major trees and shrubs include *Colophospermum mopane*, *Combretum apiculatum*, *C. imberbe*, *C. mossambicense*, *Terminalia prunioides*, *Acacia nigrescens*, *Albizia harveyi*, *Sterculea rogersii*, *Sclerocarya birrea*, *Securinega virosa* and *Hymenodictyon parvifolium*.

Common grasses of the field layer include: *Enneapogon cenchroides*, *Bothriochloa radicans*, *Aristida* spp., *Urochloa mosambicensis*, *Schmidtia pappophoroides*, *Digitaria eriantha* var. *pentzii*, *Heteropogon contortus* and *Cenchrus ciliaris*.

**Landscape 23: *Colophospermum mopane* Shrubveld on Basalt: 1 983 km<sup>2</sup> (10.4%)**

Basaltic plains with *Colophospermum mopane* shrub savanna.

There is no measuring station in this Landscape but the mean is expected to be approximately 450 - 500 mm. The woody vegetation is dominated by *Colophospermum mopane*, in association with *Combretum imberbe*, *Acacia nigrescens*, *Dichrostachys cinerea* subsp. *africana*, *Securinega virosa*, *Commiphora glandulosa*, *Sclerocarya birrea*, *Lonchocarpus capassa*, *Dalbergia melanoxylon* and *Gossypium herbaceum*.

Common grasses in the field layer include: *Themeda triandra*, *Panicum coloratum*, *Cenchrus ciliaris*, *Eragrostis superba*, *Bothriochloa radicans*, *Setaria woodii*, *Schmidtia pappophoroides* and *Heteropogon contortus*.

**Landscape 24: *Colophospermum mopane* Shrubveld on Gabbro: 283 km<sup>2</sup> (1.5%)**

The mean annual rainfall in the area to the south of the Olifants River is approximately 500 - 600 mm (with the rainfall diminishing from south to north) and north of the Olifants River it is 450 - 500 mm. In the area to the south of Red Gortien the woody vegetation is comprised predominantly of *Acacia nigrescens*, while other important trees and shrubs include *Sclerocarya birrea*, *Ziziphus mucronata*, *Bolusanthus speciosus*, *Securinega virosa*, *Ormocarpum trichocarpum*, *Dalbergia melanoxylon* and *Acacia tortilis*. In the northern areas the dominant woody species is *Colophospermum mopane* in association with the species mentioned above.

Common grasses in the field layer include: *Themeda triandra*, *Cenchrus ciliaris*, *Bothriochloa radicans*, *Digitaria eriantha* var. *pentzii*, *Enneapogon cenchroides*, *Chloris virgata*, *Heteropogon contortus*, *Cymbopogon plurinodis*, *Schmidtia pappophoroides*, *Panicum coloratum* and *Eragrostis superba*.

**Landscape 25: *Adansonia digitata/Colophospermum mopane* Rugged veld: 323 km<sup>2</sup> (1.7%)**

Gabbroic plains with *Colophospermum mopane* shrub savanna.

There is no measuring station in this Landscape but the mean is expected to be approximately 450 - 550 mm. Distinctive trees and shrubs in this landscape include: *Adansonia digitata*, *Colophospermum mopane*, *Combretum apiculatum*, *Boscia albitrunca*, *B. angustifolia*, *Terminalia sericea*, *Acacia nigrescens*, in addition to species characteristic of kopjes and rocky ridges, e.g. *Steganotaenia araliacea*, *Kirkia acuminata*, *Ficus soldanella*, *Maerua angolensis*, *Sterculea rogersii*, *Entandrophragma caudatum*, *Acokanthera schimperi* var. *rotundata*, *Boscia foetida* subsp. *rehmanniana*, *Androstachys johnsonii*, *Markhamia acuminata* and *Gyrocarpus americanus*.

A prominent feature of this landscape is the numerous conspicuous, almost homogeneous stands of *Androstachys johnsonii*.

Common grasses of the field layer include: *Digitaria eriantha* var. *pentzii*, *Brachiaria serrata*, *Pogonarthria squarrosa*, *Perotis patens*, *Schmidtia pappaphoroides*, *Aristida* spp., *Bothriochloa radicans*, *Enneapogon cenchroides*, *Heteropogon contortus* and *Fingerhutia africana*.

**Landscape 26: *Colophospermum mopane* Shrubveld on Calcrete: 116 km<sup>2</sup> (0.6%)**

Calclitic plains with *Colophospermum mopane* shrub savanna.

There is no measuring station in this Landscape but the mean is expected to be approximately 450 - 550 mm. Distinctive trees and shrubs in this landscape include: *Adansonia digitata*, *Colophospermum mopane*, *Combretum apiculatum*, *Boscia albitrunca*, *B. angustifolia*, *Terminalia sericea*, *Acacia nigrescens*, in addition to species characteristic of kopjes and rocky ridges, e.g. *Steganotaenia araliacea*, *Kirkia acuminata*, *Ficus soldanella*, *Maerua angolensis*, *Sterculea rogersii*, *Entandrophragma caudatum*, *Acokanthera schimperi* var. *rotundata*, *Boscia foetida* subsp. *rehmanniana*, *Androstachys johnsonii*, *Markhamia acuminata* and *Gyrocarpus americanus*.

A particularly prominent feature of this landscape is the numerous conspicuous, almost homogeneous stands of *Androstachys johnsonii*.

Common grasses of the field layer include: *Digitaria eriantha* var. *pentzii*, *Brachiaria serrata*, *Pogonarthria squarrosa*, *Perotis patens*, *Schmidtia pappaphoroides*, *Aristida* spp., *Bothriochloa radicans*, *Enneapogon cenchroides*, *Heteropogon contortus* and *Fingerhutia africana*.

**Landscape 27: Mixed *Combretum/Colophospermum mopane* Woodland: 327 km<sup>2</sup> (1.7%)**

Basaltic plains with *Combretum apiculatum* bush savanna.

The mean annual rainfall is approximately 450 - 500 mm. Dominant trees and shrubs include: *Colophospermum mopane*, *Sclerocarya birrea*, *Combretum apiculatum*, *C. zeyheri*, *C. mossambicense*, *Securinega virosa*, *Dichrostachys cinerea* subsp. *africana*, *Grewia bicolor*, *Acacia nigrescens* and *Lonchocarpus capassa*.

Common grasses in the field layer include: *Digitaria eriantha* var. *pentzii*, *Schmidtia pappaphoroides*, *Aristida* spp., *Urochloa mosambicensis*, *Panicum maximum* and *Heteropogon contortus*.

**Landscape 28: The Luvuvhu - Limpopo Complex: 89 km<sup>2</sup> (0.5%)**

Alluvial plains with *Acacia albida* bush savanna.

This area represents the most arid part of the KNP with a mean annual rainfall at Pafuri of 438 mm (n = 50 years). Other than for the floodplains, the composition and physiognomy of the vegetation is similar to that of landscapes 16, 25 and 27. For the floodplains the vegetation is comprised of the following: Composition - The major trees and shrubs include: *Acacia albida*, *A. xanthophloea*, *A. tortilis*, *Ficus sycomorus*, *Hyphaene natalensis*, *Azima tetracantha*, *Thilachium africanum*, *Gardenia resiniflua*, *Garcinia livingstonei*, *Trichilia emetica*, *Xanthocercis zambesiaca*, *Acacia robusta*, *A. ataxacantha*, *Kigelia africana*, *Breonadia microcephala*, *Tabernaemontana elegans*, *Ficus capreifolia*, *Lonchocarpus capassa*, *Strychnos potatorum*, *Mimusops zeyheri*, *Diospyros mespiliformis* and *Boscia albitrunca*.

Common grasses in the field layer include: *Panicum meyerianum*, *Echinochloa pyramidalis*, *Chloris gayana*, *Sporobolus consimilis*, *Ischaemum afrum*, *Setaria sphacelata*, *Dactyloctenium aegyptium*, *Sporobolus smutsii* and *Enneapogon cenchroides*.

#### **Landscape 29: Lebombo South: 761 km<sup>2</sup> (4.0%)**

Low rhyolite mountains with *Combretum apiculatum* woodland.

The mean annual rainfall diminishes from south to north and is approximately 650 - 700 mm in the southern areas and 450 - 550 mm in the north. A number of distinctive plant communities are apparent and on a general basis the following trees and shrubs are common: *Combretum apiculatum*, *Pterocarpus rotundifolius*, *Sclerocarya birrea*, *Acacia nigrescens*, *Dichrostachys cinerea* subsp. *africana*, *Albizia harveyi*, *Securinega virosa*, *Ozoroa engleri*, *Acacia exuvialis*, *Euphorbia confinalis*, *E. cooperi*, *Terminalia phanerophlebia*, *Acacia erubescens*, *Galpinia transvaalica*, *Sideroxylon inerme*, *Ziziphus rivularis* and *Portulacaria afra*.

Common grasses in the field layer include: *Digitaria eriantha* var. *pentzii*, *Andropogon gayanus*, *Themeda triandra*, *Enneapogon cenchroides*, *Panicum maximum*, *Schmidtia pappophoroides*, *Aristida* spp., *Brachiaria xantholeuca*, *B. nigropedata* and *Bothriochloa radicans*.

#### **Landscape 30: Pumbe Sandveld: 176 km<sup>2</sup> (0.6%)**

Recent sand plains with *Terminalia sericea* bush savanna.

There is no measuring station in this Landscape but the mean is expected to be approximately 450 - 550 mm. The common trees and shrubs include *Combretum zeyheri*, *C. apiculatum*, *C. molle*, *Terminalia sericea*, *Cassia abbreviata*, *Lonchocarpus capassa*, *Lannea stuhlmanni*, *Diospyros natalensis*, *Azelia cuanzensis* and *Pseudolachnostylis maprouneifolia*.

Common grasses in the field layer include: *Digitaria eriantha* var. *pentzii*, *Andropogon gayanus*, *Themeda triandra*, *Enneapogon cenchroides*, *Panicum maximum*, *Schmidtia pappophoroides*, *Aristida* spp., *Brachiaria xantholeuca*, *B. nigropedata* and *Bothriochloa radicans*.

### **Landscape 31: Lebombo North: 478 km<sup>2</sup> (2.5%)**

Rhyolite mountains with *Colophospermum mopane* bush savanna.

The distinguishing feature between the northern and southern Lebombo landscapes is the lower rainfall in the former. The mean annual rainfall is approximately 450 - 500 mm. In general the composition of the vegetation is similar to that of Landscape 29. Due to the lower rainfall there are, however, more zeric elements. One of the main distinguishing features is the presence of *Colophospermum mopane* and the numerous *Androstachys johnsonii* thickets, especially in the rugged areas to the south and north of the Olifants River. Rare trees and shrubs that occur in the Bangu Gorge area and to the north of the Olifants River include *Newtonia hildebrandtii*, *Atalaya alata*, *Stadmannia oppositifolia*, *Sesamothamnus lugardii* and *Euphorbia grandicornis*.

In the field layer grasses such as *Enneapogon cenchroides*, *Schmidtia pappophoroides*, *Digitaria eriantha* var. *pentzii*, *Andropogon gayanus*, *Bothriochloa radicans*, *Aristida* spp. and *Heteropogon contortus* are common.

### **Landscape 32: Nwambiya Sandveld: 138 km<sup>2</sup> (0.7%)**

Sandy plains with *Bafia massaiensis* bush savanna.

Mean annual rainfall is probably approximately 500 mm. The Nwambiya Sandveld is noted for its wide variety of woody plant species, and also for a number of species which show affinities with the more tropical vegetation to the north. Common and important species include: *Baphia*

*massaiensis*, *Guibourtia conjugata*, *Xeroderris stuhlmanni*, *Xylia torreana*, *Combretum cela-stroides*, *Spirostachys africana*, *Pteleopsis myrtifolia*, *Strychnos madagascariensis*, *Azelia quanzensis*, *Terminalia sericea*, *Balanites maughamii* and *Sclerocarya birrea*. Some rarer species also include *Wrightia natalensis*, *Dalbergia nitidula*, *Pterocarpus lucans* subsp. *antunesii*, *Cleistanthus schlechteri*, *Drypetes mossambicensis*, *Xylothea kraussiana*, *Leptactinia benguelensis*, *Hugonia orientalis* and *Monodora junodii*.

Common grasses in the field layer include *Digitaria eriantha* var. *pentzii*, *Pogonarthria squarrosa*, *Panicum maximum*, *Aristida* spp., *Schmidtia pappophoroides*, *Tricholaena monachne*, *Eragrostis pallens* and *Perotis patens*.

### **Landscape 33: *Pterocarpus rotundifolius*/Combretum collinum Woodland: 279 km<sup>2</sup> (1.5%)**

Andesitic plains with *Combretum collinum* shrub savanna, this Landscape is comprised of two discontinuous sections to the north and south of Landscape 12.

The mean annual rainfall is approximately 500 - 600 mm. Common trees and shrubs include *Colophospermum mopane*, *Combretum apiculatum*, *Acacia nigrescens* A. *gerrardii*, *Euclea divinorum*, *Combretum hereroense*, *C. collinum* subsp. *suluense* and *Maytenus heterophylla*. In Landscape 33 *Pterocarpus rotundifolius* is dominant, with other distinctive species including *Combretum collinum* subsp. *suluense*, *C. molle*, *C. apiculatum*, *Lannea discolor*, *Dombeya rotundifolia*, *Lonchocarpus capassa* and *Ozoroa engleri*.

Common grasses in the field layer include: *Themeda triandra*, *Bothriochloa radicans*, *Digitaria eriantha* var. *pentzii*, *Panicum maximum*, *Setaria holstii*, *Urochloa mosambicensis*, *Brachiaria nigropedata*, *Eragrostis rigidior*, *Panicum coloratum* and *Heteropogon contortus*.

### **Landscape 34: Punda Maria Sandveld on Waterberg Sandstone: 296 km<sup>2</sup> (1.6%)**

Low mountains with *Burkea africana* tree savanna.

There is no measuring station in this Landscape but the mean is expected to be approximately 600 mm. The long term mean for Punda Maria is 587 mm (n = 51 years). Important trees and shrubs include: *Burkea africana*, *Pseudolachnostylis maprounaeifolia*, *Pteleopsis myrtifolia*, *Hymenocardia ulmoides*, *Holarrhena pubescens*, *Diplorrhynchus condylocarpon*, *Peltophorum*



*africanum*, *Hexalobus monopetalus*, *Guibourtia conjugata*, *Combretum collinum*, *C. zeyheri*, *C. apiculatum*, *Azelia quanzensis*, *Bridelia mollis*, *Brachylaena huillensis*, *Ficus sansibarica*, *F. capensis*, *Xylopi odoratissima*, *Gyrocarpus americanus*, *Albizia adiantifolia*, *A. tanganyicensis*, *Acacia polyacantha* subsp. *campylacantha*, *A. sieberiana* var. *woodii*, *Piliostigma thonningii*, *Xanthocercis zambeziaca*, *Kirkia acuminata*, *Entandrophragma caudatum*, *Ekebergia capensis*, *Trichilia emetica*, *Drypetes gerrardii*, *Bridelia micrantha*, *Warburgia salutaris*, *Diplorrhynchus condylocarpon*, *Tabernaemontanum elegans*, *Rauvolfia caffra*, *Cordia grandicalyx*, *Markhamia acuminata*, *Breonadia microcephala*, *Kigelia africana* and *Rothmannia fischeri*.

Common grasses of the field layer include: *Andropogon gayanus*, *Panicum maximum*, *Digitaria eriantha* var. *pentzii*, *Pogonarthria squarrosa*, *Panicum deustum*, *Cymbopogon excavatus*, *Setaria sphacelata* and *Themeda triandra*.

### **Landscape 35: *Salvadora angustifolia* Floodplains: 132 km<sup>2</sup> (0.7%)**

Alluvial plains with *Salvadora angustifolia* tree savanna.

This landscape is largely confined to the lower reaches of the Shingwedzi, Bububu, Mphongolo and Phugwane rivers. As it is restricted to the deep alluvial soils it represents relatively narrow strips on the banks of the rivers, and can best be included incorporated with Landscapes 11, 12, 22 and 23. Although not as well developed as in the areas mentioned above, this landscape is also represented along the Madzaringwe River.

The vegetation is characterised by tall *Colophospermum mopane* trees ( $\pm 10.0\text{m}$ ) and a well-developed shrub stratum with conspicuous species including *Salvadora angustifolia*, *Capparis tomentosa*, *Thilachium africanum*, *Acacia tortilis*, *Euclea divinorum* and *Hyphaene natalensis*. The field layer is sparse, short and relatively poorly developed.

The landscape represents an important winter refuge for elephants, buffalo and a wide variety of larger mammals attracted to the rivers.

### **FIRE**

Fire management practices have undergone radical changes in the KNP since the arrival of the

first warden in 1903. This has varied from attempts at total protection from fire to rigid burning frequencies regardless of the condition of the field layer in terms of either species composition or fuel loads (Joubert 1986). The reasons for this are that fire is, and has always been, a contentious issue in conservation as a result of the obvious short-term "damage" they cause and a misunderstanding or ignorance of the longer-term beneficial effects. In many ways this ignorance persists, as little is yet known of the much longer-term potential impacts of fire on biodiversity (Viljoen 1988), or how to best manage fire to maximise biodiversity.

Considerable research has been conducted into the various aspects of fires in KNP in order to address these issues. Earlier research results (Van der Schijff 1958; van Wyk 1971; Trollope 1994) gave rise to more modern thinking and stimulated much additional research effort (Trollope *et al.* 1996; Trollope *et al.* 1998; Trollope *et al.* 1999).

The forty-year era of rotational block burning was replaced by a lightning-driven fire policy in 1992 in which lightning fires were allowed to burn while man made (anthropomorphic) fires were extinguished. The recent revision of the management plan (Braack, van Wilgen, Biggs & Potgieter 1997) condoned the lightning based approach, but stressed the necessity of maximising research to allow for other approaches in future changes to the fire policy. A major landscape-scale fire management trial was thus implemented in 2000 (Biggs & Potgieter 1999).

## FAUNA

When the Sabi Game Reserve (the forerunner of the KNP) was proclaimed in 1898, the faunal populations were decimated by excessive hunting and the rinderpest pan-zootic which swept through southern Africa in 1896 and 1897. Some species (such as elephant and white rhino) were even locally extinct (Stevenson-Hamilton, 1903a & b).

The following is a summary of the faunal diversity of KNP.

- Fish: 53 species - includes 2 exotic carp species (Pienaar 1978; Zambatis 1997b)
- Birds: 505 species (Newman 1980; Sinclair & Whyte 1991; Whyte & Zambatis 1997)
- Amphibians: 35 species (Pienaar *et al.* 1976; Zambatis 1997a)
- Reptiles: 120 species (Pienaar *et al.* 1978; Zambatis 1997d)
- Mammals: 147 species (Pienaar *et al.* 1987; Zambatis 1997c) including the following:

| Order                           | No. of Species                     |
|---------------------------------|------------------------------------|
| Insectivora (shrews etc)        | 9                                  |
| Chiroptera (bats)               | 43                                 |
| Primates                        | 5                                  |
| Carnivora                       | 27                                 |
| Perissodactyla                  | 3 (2 rhinos, 1 zebra)              |
| Hyracoidea (dassies)            | 2                                  |
| Tubulidentata (Aardvark)        | 1                                  |
| Artiodactyla                    | 25 (2 pigs, 1 hippo, 22 antelopes) |
| Pholidota (pangolin)            | 1                                  |
| Rodentia (rodents)              | 25                                 |
| Lagomorpha (hares)              | 3                                  |
| Macroscelidae (elephant shrews) | 3                                  |

The most recent estimates of the numbers of mammals are as follows:

|                   |          |                    |       |
|-------------------|----------|--------------------|-------|
| Lion:             | 1 500    | Leopard:           | 1 000 |
| Cheetah:          | 200      | Wild dog:          | 350   |
| Spotted hyaena:   | 2 000    | Elephant:          | 9 152 |
| White rhinoceros: | 3 000    | Black rhinoceros:  | 300   |
| Burchell's zebra: | 32 000   | Hippopotamus:      | 3 000 |
| Warthog:          | 1 500    | Giraffe:           | 5 000 |
| Buffalo:          | 21 095   | Eland:             | 500   |
| Roan antelope:    | 50       | Sable antelope:    | 880   |
| Greater kudu:     | 3 500    | Nyala:             | >300  |
| Bushbuck:         | >500     | Waterbuck:         | 1 500 |
| Reedbuck:         | 300      | Mountain reedbuck: | 150   |
| Blue wildebeest:  | 14 000   | Tsessebe           | 360   |
| Impala:           | >150 000 |                    |       |

Insect species have as yet not been comprehensively studied (Braack 1991), though an earlier survey of butterflies yielded 219 species (Kloppers & van Son 1978).