CHAPTER 2

STUDY AREA

2.1 LOCATION

The study was conducted in the Kalahari Gemsbok National Park, one of Africa's last unspoilt wilderness areas. Unlike the neighbouring Namib desert, the Kalahari Gemsbok National Park is not a true desert but belongs to the Savanna Biome and is quite densely covered with grasses, shrubs and trees (Leistner 1967). It is an arid, open landscape with the southern part mainly open shrub savanna and the northern part open woodland or tree savanna (Bothma & De Graaff 1973). The Kalahari Gemsbok National Park covers approximately 9 600 km^2 and is situated in the south-western corner of the Kalahari Desert between 24°15'S and 26°30'S and 20°00'E and 20°45'E (Figure 2.1). The altitude varies from 870 m at Twee Rivieren in the south to 1 080 m at Unie End in the north.

The river systems of the Kalahari Gemsbok National Park are the life blood of the ecosystem. The Nossob and Auob rivers both originate in the Auas mountains in Namibia and join at Twee Rivieren. Although covering only about 4% of the total area of the park, it sustains most of the animal life in terms of palatable grazing, potable water and habitat diversity (Van Rooyen *et al.* 1996). Tourist routes are mainly restricted to the riverine areas. The reason for this is twofold: from the perspective of the tourism industry these are the areas where wildlife is to be seen in abundance and from a conservation point of view, restricted access to the sand dunes is essential for the conservation of this unique and sensitive ecological system (Van Rooyen *et al.* 1996).

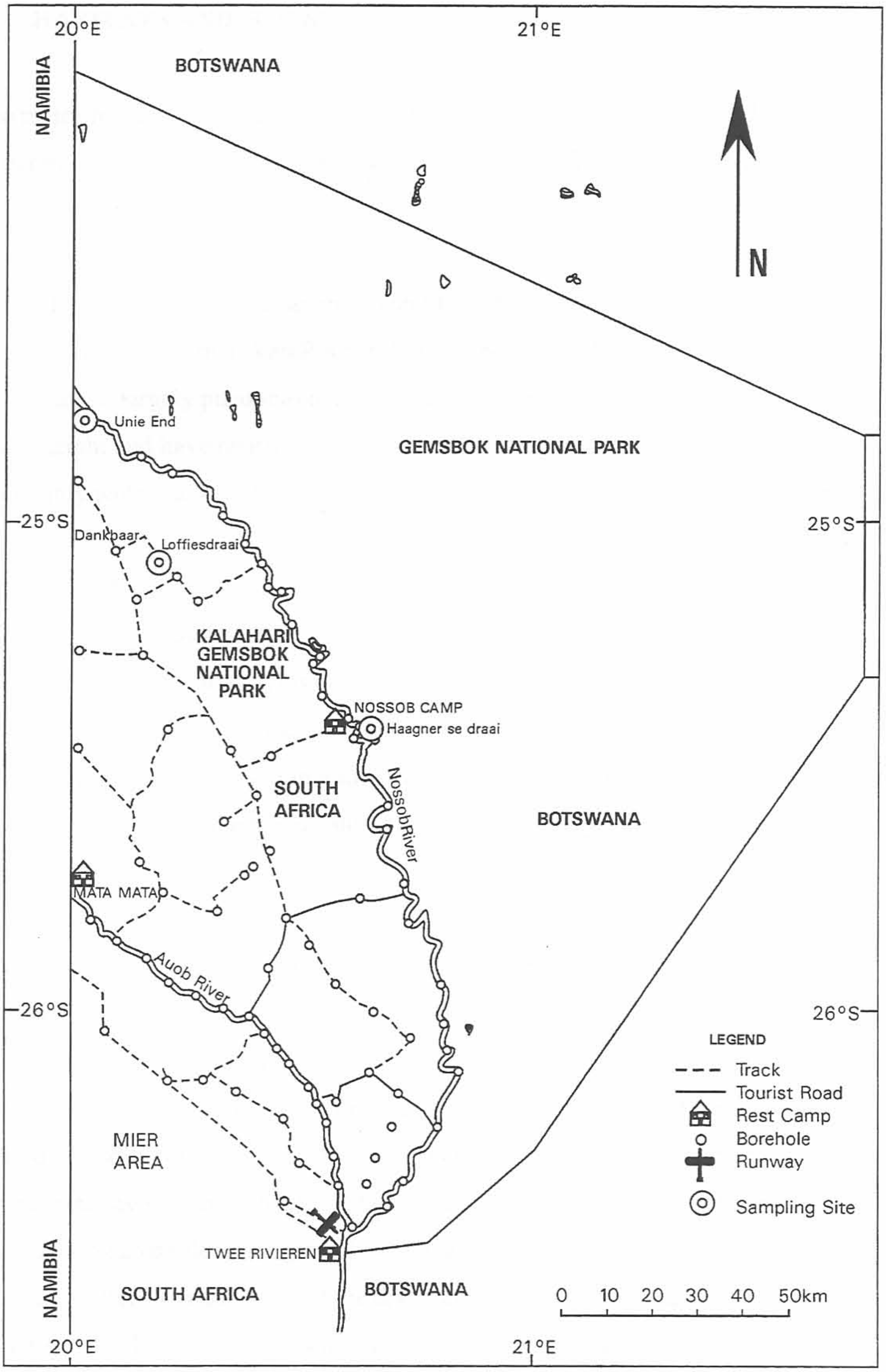

Figure 2.1 The Kalahari Gemsbok National Park and the location of the sampling sites (after Bothma *et al.* 1993).

2.2 HABITATS AND SOILS

Three major habitat types can be distinguished in the southern Kalahari, and these correspond to differences in soil types: (a) dunes and undulating sand flats; (b) dry riverbeds; and (c) pans (Van Rooyen 1984).

The Kalahari sands are of aeolian origin and form the parent materials of the red Hutton and yellow Clovelly soil forms (Van Rooyen 1984). Aeolian sand covers over 95% of the southern Kalahari and is largely piled into northwest- to southeast-running dunes. These dunes average 10 m in height and have relatively flat tops, often up to 9 m wide. The dunes are separated by considerably wider valleys (Werger 1978). The dunes that run parallel to each other consist of red or pink sand. Red sands are by far the commonest, the colour being due to a coating of ferric oxide around the particles. Only where the valleys between the dunes are so deep that the underlying calcrete stratum nears the surface, or in the vicinity of dry riverbeds and pans, does the sand have a paler colour. This can be due to mixing with calcrete particles, or to a mixture of red and white sand. No distinct horizons can be distinguished in these sandy soils. The sands, both red and pink, are also poor in nutrients. In the deep dune valleys the pink sands are somewhat richer in water-soluble calcium due to the calcrete layer being near the surface (Van Rooyen 1984).

The soils of the dry riverbeds are either silty, rocky or sandy. Silty or clayey soils cover the actual riverbeds. The soils of the riverbeds are compact, poorly drained and rich in nutrients. There are, however, considerable differences in ionic composition of the soils of the different rivers of the southern Kalahari. This probably related to the different areas of origin of these rivers. Rocky soils commonly occur on the banks of the dry riverbeds where these cut deep into thick calcrete layers. The calcrete surface is usually weathered and there are frequent small pockets and fissures filled with gravelly white sand. Belts of fairly shallow white sand typically occur on the slightly raised sides of the dry riverbeds, between the calcrete banks and the silty central riverbed. These soils of washed sand with compact underlying substrates possess a higher nutrient content than the pink and red sand (Werger 1978).

Pan soils consist either of white (washed) sand when the pans are shallow, rocky soils when the calcrete layer crops out, or most typically, clays or sandy clays. The latter soils are rich in minerals, particularly Na, K, and Mg ions, and have a high pH. Extensive pan-like areas occur in the slightly higher-lying portions of dry riverbeds where they are isolated from the river course by a raised, compact calcareous sand formation. These areas are therefore not influenced by the rare flood waters. This pan-like alluvium consists of sandy loam soils with a fairly high mineral content (Figure 2.2) (Werger 1978).

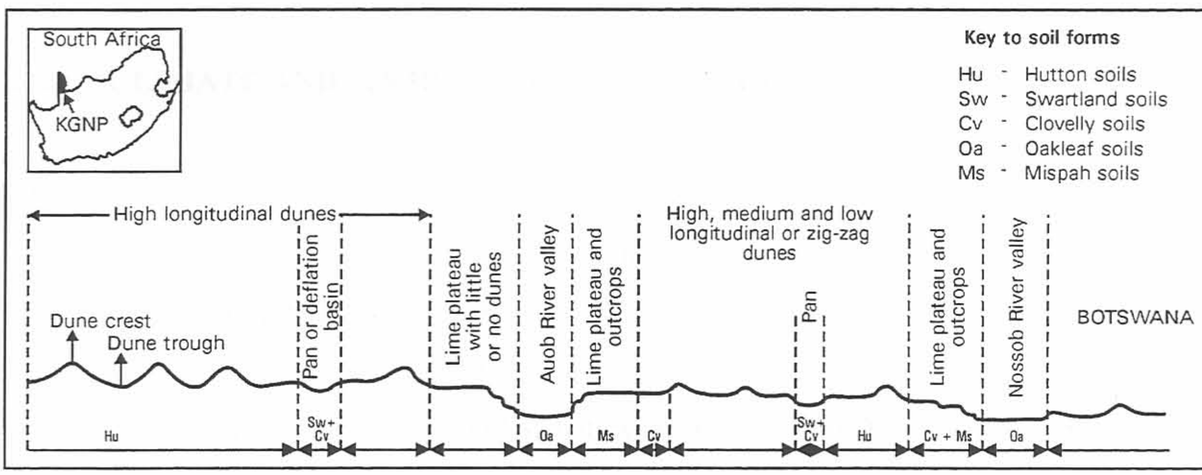

Figure 2.2 Locality and schematic cross section from west to east of the Kalahari Gemsbok National Park showing the relationship between landform and soils (after Van Rooyen 1984).

Alluvial soils along the Nossob River are loamy and alkaline (pH 7-9). The fine, sandy soils of the surrounding dunes are acid to neutral (pH 5-7) with a low conductivity. Total nitrogen and available phosphorus are generally low in all soils of the Kalahari Gemsbok National Park but higher in alluvial than dune soils (Van Rooyen 1984).

The soils of arid to semi-arid regions are, as a rule, well supplied with most of the essential plant nutrients. Such soils suffer little loss of solubilised nutrient compounds through leaching. In contrast to this, the sandy soils of the Hutton and Clovelly forms in the Kalahari Gemsbok National Park are inherently infertile. Hutton soil form is extremely deficient in available phosphate. The series of both soil forms have clay contents of less than 6% and are correspondingly poor in exchangeable cations. Potassium and magnesium availability is low to medium. It can thus be stated that these soils are in general free from soluble salts and especially exchangeable Na^+ and sodium salts as far as the major plant nutrients are concerned. Total nitrogen, which is mainly contained in the organic matter fraction, is generally low in all the soils of the Kalahari Gemsbok National Park (Van Rooyen 1984). It remains uncertain how the large *Acacia erioloba* trees are able to absorb sufficient phosphate from the extremely P-deficient Hutton soil form in the Kalahari. The higher phosphate and water levels in the alluvial soils of the Auob and Nossob Rivers may account for the large *Acacia erioloba* trees in these riverbeds (Van Rooyen 1984).

2.3 CLIMATE AND ITS RELATIONSHIP TO THE VEGETATION

The climate of the Kalahari Gemsbok National Park may be described as arid to semi-arid. The mean annual rainfall ranges from 200-250 mm and is unreliable and irregular. The rainy season usually extends from November to April with fifty percent of the precipitation occurring in mid to late summer (January to March). The rainfall can vary from less than a 100 mm up to more than 700 mm per annum. The rainfall statistics since 1975 at different sites in the Kalahari Gemsbok National Park are summarized in Figures 2.3 to 2.4 and Tables 2.1 to 2.2.

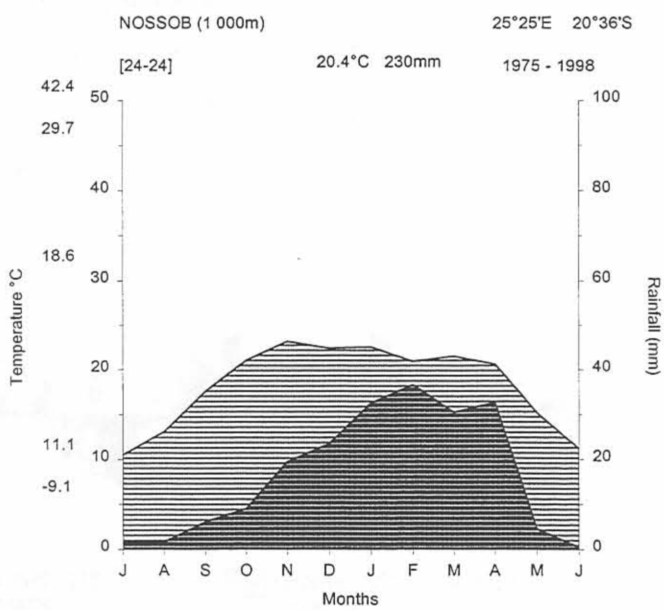

Figure 2.3 Climate diagram for Nossob Camp in the Kalahari Gemsbok National Park

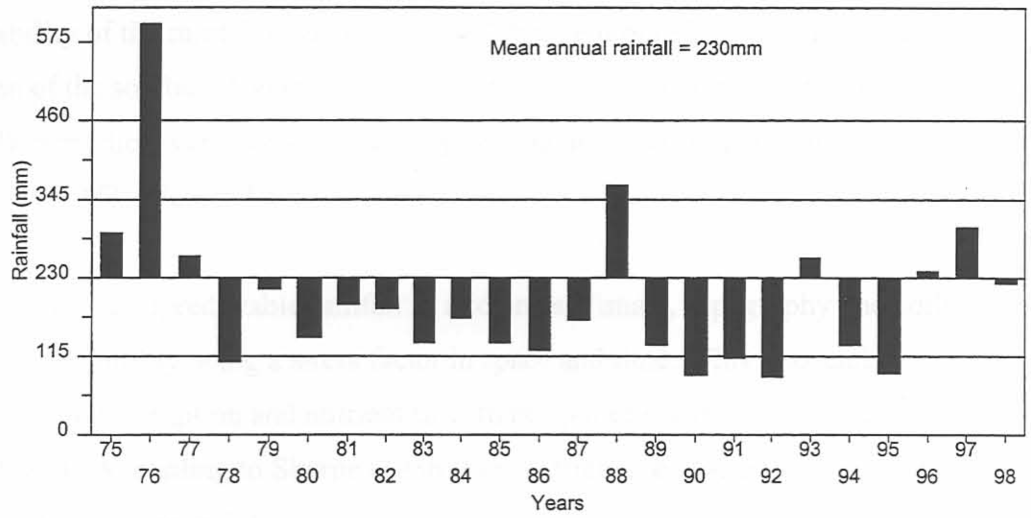

Figure 2.4 Rainfall deviation from the long-term average for Nossob Camp in the Kalahari Gemsbok National Park (1975-1998) (Weather Bureau 1998).

Dyer and Tyson (1977) analysed the long-term rainfall cycles for the summer rainfall region of southern Africa and estimated future extended wet and dry spells. It was suggested that the periods 1972-1981 and 1991-2000 would experience above normal rainfall and the period 1981-1990 would be drier than normal (Figure 2.5). According to Figure 2.4 it is obvious that except for 1976, 1988 and 1997, which experienced above mean annual rainfall, the Kalahari Gemsbok National Park experienced very dry years since 1978. The timing and amount of seasonal rainfall and the existence of relatively long-term wet and dry rainfall periods play a major role in the dynamics of the vegetation and should be incorporated in management strategies for the Kalahari Gemsbok National Park.

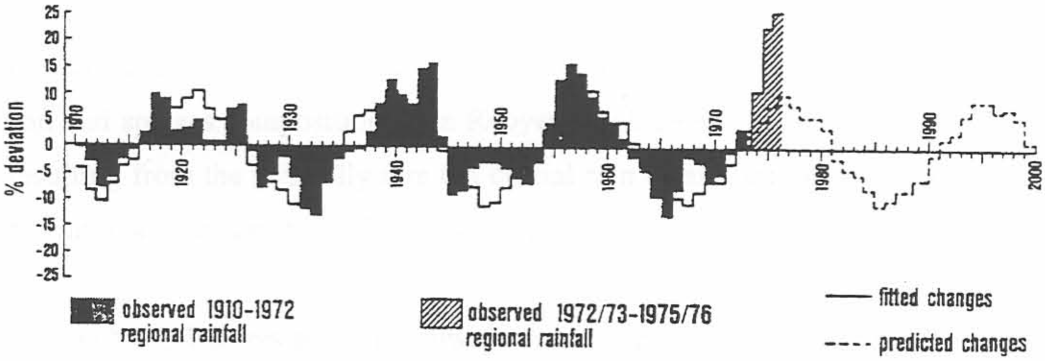

Figure 2.5 Observed, calculated and predicted regional rainfall changes (after Dyer & Tyson 1977).

A feature that is of great significance to the vegetation of the Kalahari is the variability and unreliability of the rainfall (Leistner 1967). Climate induced variations in the vegetation composition of the southern Kalahari is a result of seasonal variation (short-term and mostly phenological), periodical variations over a few years (medium-term) and long-term changes (Leistner & Werger 1973; Werger 1978).

Due to low and unpredictable rainfall in arid areas climate, topography and soils contribute to resource availability being a stress factor in space and time. This also leads to the processes of production, consumption and nutrient flow to be sporadic and difficult to predict (Crawford & Gosz 1982). According to Skarpe (1986) the coefficient of variation in rainfall between years in the Kalahari Gemsbok National Park is more than 80%.

Sala and Lauenroth (1982) hypothesised that short-term rainfall is an important and significant resource for ecosystems in semi-arid areas. An ecologically significant shower is one that changes the water status of the environment of a plant for a longer period, this is necessary for survival. Light showers regularly activate those processes related to nutrient cycles close to the soil surface which are controlled by water availability.

Rainfall in the southern Kalahari has a marked influence on the presence or dominance of annual species. Early summer rains promote growth of perennial grass species while late summer rains are beneficial to the woody component. Summer annuals are also different from the winter annuals (Leistner 1967). During drought periods annuals are virtually absent, while during particularly wet seasons numerous species, which are normally rare, will occur in great profusion (Van Rooyen *et al.* 1984).

The existence of long wet and dry periods therefore play a major role in the dynamics of the vegetation and species composition (Van Rooyen *et al.* 1990). The effect of competition for water, resulting from the generally rare but crucial rain events, on the dynamics of semi-arid savannas was also emphasized by Jeltsch *et al.* (1996).

The Auob and Nossob rivers are almost always dry and only flow during years of above average rains. The floods that occur play an important role in that they sustain the relatively low water-table of the rivers and ensure that the riverbed is not blocked by dune sand (Leistner 1967).

Table 2.1 Rainfall data (mm) for Nossob Camp for the period April 1975 to December 1998

Month	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	AVE
Jan	n/a	197.5	42.4	9.2	33.7	17.3	0.8	12.9	11.9	2.2	29.7	7.4	9.3	55.8	4.2	0.3	55.3	1.7	0	49	0	59.7	91.5	89.1	32.54
Feb	n/a	124.2	76.8	41.2	52.8	40	33.7	20.3	9.9	1.9	13.9	9.9	85.5	65.3	92	3	0	5	48.5	55.5	0	42.5	24	34	36.66
Mar	n/a	181.6	34.1	41.8	0.1	39.1	57	4	13.6	21.8	29.9	11.7	2.5	30.3	8.9	4.3	4.5	63	43.5	24.5	18.5	0	85.5	12.5	30.53
Apr	212	39.7	68.8	8.5	27.1	8.3	0	25.2	17.7	82.6	1.3	9.1	5.7	95.4	27.1	49.4	0	5.8	65.5	0	0	28.5	0	8	32.74
May	7.2	15.9	3.5	0	16.1	0	0	7.2	9	9.1	0	0	0	0	0.8	0	0	0	0	0	3	15	23	0	4.58
Jun	0	1.6	0	0.2	0.2	0	2.2	0	1.6	0	0	6.1	0	0	0	0	0	0	0	0	0	0	0	0	0.50
Jul	0.2	0	0	0.1	2	0	0	8	0	0	0	3.7	0.2	0	0	0	0	0	0	0	0	26	0	0	1.68
Aug	0	0.2	4.1	1.5	3.3	6	24.7	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1.70
Sep	0.1	32.4	2.2	0.1	0	7.3	1.2	7.3	0.5	0	0	0.4	1.7	0	0	0	0	0	0	1	4.3	23	56	10	6.15
Oct	4.7	6.7	6.2	0.2	16.1	1.4	8.1	31.2	4.7	20.9	5	8.4	6.5	6.5	0	0	0	6.8	32	0	0	0	11	41.5	9.08
Nov	36.4	0	13	0	29.1	1.5	41.4	40.8	31.1	32.3	5.5	65.6	46.4	20.5	0.3	24	2.9	3.4	22	4	40	9.5	0	0	19.57
Dec	36	2.5	11.4	4	32.9	24.3	23.3	28.1	34.2	0	51.9	3.4	10.8	93.2	0	7.2	51.7	0	47.6	0	26	36.2	14	26.3	23.54
Total	296.6	602.3	262.5	106.8	213.4	145.2	192.4	185	134.2	170.8	137.2	125.7	168.6	367	133.3	88.2	114.4	85.7	260.1	134	91.8	240.4	305	221.4	199.25

Table 2.2 Total rainfall (mm) per year for Unie End for the period 1981 to 1998

1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
57.2	n/a	n/a	178.2	132.4	128.4	113.9	565.3	279.9	245	315.6	33.2	283.8	171.9	85	100.5	256.5	91

Table 2.3 Mean monthly maximum temperature (°C) for Nossob Camp for the period April 1975 to December 1998

Month	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	AVE
Jan	n/a	30.2	35.9	34.8	34.3	36.1	n/a	36.5	37.3	37.1	36.3	36.8	37.5	35.9	33.2	37.5	34.1	38.5	36.6	33	39.6	34.1	32.9	34.7	26.27
Feb	n/a	30	n/a	32.6	33.4	34.4	n/a	36.4	36.4	37.4	34.7	35	34.1	32.9	29.8	34.4	n/a	37.2	33	n/a	n/a	34.4	35.1	36.9	25.75
Mar	n/a	29.4	n/a	32.6	33.4	31.8	n/a	33.2	34.1	33.7	32.1	33	34.3	32.8	33	33.7	n/a	34.7	33.4	35	33.4	34.6	30.9	35.1	27.68
Apr	28.6	29.4	28.8	27.5	31.4	29.5	29.4	26.7	30.8	28	28.8	30.7	32	28.1	28.7	28.5	30	31.8	27.9	30.8	30.1	29.6	27.3	33.1	29.48
May	24.7	24.5	25.1	26.6	25.2	26.4	24.9	26.6	23.7	24.1	25.6	28.5	28.6	n/a	28.1	24.9	27.7	26.6	26.4	27.7	25.5	25.7	24.3	26.7	24.92
Jun	24	21.7	23.8	21.6	21.9	22.6	21.7	22	23	21.9	23.8	22.8	22.1	21.4	22.1	22.7	22.2	n/a	22.9	22	22.7	24.1	22.9	25.5	21.73
Jul	22.8	22.2	23.4	23.6	21.5	22.9	23	20.4	22.5	22.6	23	22.5	21.9	23.4	22.9	23.1	22.4	n/a	24.3	n/a	22.4	19.4	23.5	23.3	20.71
Aug	24.7	24.1	25	25.6	25	25.4	22	26	24	26.4	27.4	24.8	24.3	26.7	26.9	26.5	25.4	n/a	25.6	26.4	25.8	n/a	27.1	25.4	23.35
Sep	31.1	29.6	28.8	27	28.2	n/a	26.6	30.3	30.4	29.9	29	28.4	26	28.8	29.5	29	28.5	29.8	32.3	31.6	30.4	n/a	30.4	29.1	26.86
Oct	31.3	30.2	33.2	30.8	31.7	n/a	29.5	30.7	31.6	31.4	33.2	31	32.5	31.2	31.4	32.3	32.9	32.7	34.4	31.9	30.4	n/a	32.6	31.8	29.11
Nov	32.6	33.1	35.7	35.3	34.2	n/a	34.9	34.3	32.7	33.4	33.7	32.3	34.9	33.9	34.5	36.5	34.8	34	32.7	34.5	34.1	n/a	34	34.3	31.27
Dec	33.1	n/a	35.6	35.8	36.1	n/a	36.7	33.7	33.8	35.5	33.9	37.8	36	33.9	37.8	34.8	33.6	37.3	36.6	n/a	n/a	n/a	36.4	35.3	28.07
Y-AVE	21.08	25.37	24.61	29.48	29.69	19.09	20.73	29.73	30.03	30.12	30.13	30.30	30.35	27.42	29.83	30.33	24.30	25.22	30.51	22.74	24.53	16.83	29.78	30.93	26.27

Table 2.4 Mean monthly minimum temperature (°C) for Nossob Camp for the period April 1975 to December 1998

Month	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	AVE
Jan	n/a	18.90	19.60	19.40	19.30	19.00	20.70	18.80	21.70	18.80	21.30	20.80	19.10	20.20	18.60	19.00	18.80	19.20	19.10	17.80	21.70	20.00	19.90	19.60	18.80
Feb	n/a	17.20	19.80	19.10	21.10	20.10	20.10	21.00	17.70	20.30	21.00	17.90	22.30	19.20	16.80	17.00	n/a	19.20	19.40	n/a	n/a	18.60	18.00	20.70	16.10
Mar	n/a	15.60	15.40	17.70	14.00	18.60	15.50	17.40	17.30	18.90	16.60	16.70	17.80	17.30	14.10	17.70	n/a	16.50	17.60	14.50	18.70	16.70	16.30	17.70	15.36
Apr	10.30	11.20	14.00	11.80	13.70	9.70	12.10	11.60	13.90	12.70	10.80	12.40	13.70	12.40	9.30	12.40	9.00	13.00	10.90	10.30	11.80	12.60	7.10	14.60	11.72
May	3.30	6.60	3.60	5.50	7.30	5.00	6.40	6.00	5.80	6.90	6.30	7.70	7.90	n/a	6.70	3.80	n/a	3.90	2.80	3.30	7.80	10.50	7.00	5.30	5.39
Jun	1.80	0.60	0.90	-1.30	3.20	1.70	0.20	2.80	1.90	1.90	-0.20	3.30	0.50	-0.30	-1.40	0.60	-0.40	-0.20	-2.40	-2.00	0.70	1.70	1.70	1.40	0.70
Jul	0.20	-3.10	-0.70	3.40	2.10	2.10	1.20	1.60	1.30	0.50	0.00	1.20	0.20	-1.70	-2.00	-1.50	-1.60	-0.70	1.70	n/a	-0.80	-0.40	1.10	3.30	0.31
Aug	1.30	-0.50	2.70	2.10	4.60	5.50	2.40	3.20	1.10	3.30	5.10	3.20	0.90	2.30	2.80	3.40	0.40	2.30	3.10	1.80	3.40	2.80	3.60	7.10	2.83
Sep	7.70	6.50	6.80	7.20	7.80	6.80	6.80	11.20	8.90	7.90	8.00	9.20	7.30	5.90	4.90	14.40	7.20	8.70	7.30	7.40	11.20	7.10	10.70	9.80	8.20
Oct	9.50	12.50	13.30	8.40	13.00	13.30	10.60	14.70	13.70	14.60	16.10	14.60	14.00	11.40	10.20	18.70	13.20	11.70	17.60	9.00	10.30	13.50	14.40	14.40	13.03
Nov	15.80	12.20	14.70	16.60	16.40	13.20	16.60	14.80	15.80	n/a	16.40	16.60	19.20	16.80	14.40	19.20	16.70	14.70	15.30	14.50	17.70	15.20	13.90	15.50	15.09
Dec	18.40	16.90	17.80	18.00	18.60	18.20	19.20	17.40	19.30	16.60	17.70	20.20	19.60	19.40	18.50	17.50	18.80	18.20	17.30	n/a	n/a	17.80	18.30	19.10	16.78
AVE	5.69	9.55	10.66	10.66	11.76	11.10	10.98	11.71	11.53	10.20	11.59	11.98	11.88	10.24	9.41	11.85	6.84	10.54	10.81	6.38	16.86	11.34	11.00	12.37	10.36

Large temperature fluctuations, both on a daily and seasonal basis, are also characteristic of the climate. Mean maximum and minimum temperatures are 37.4°C and 19.5°C in January and 22.2°C and 1.2°C in July (Tables 2.3 and 2.4). Temperatures reach extreme values with winter lows reaching -9.1°C and summer highs of up to 42.4°C (Figure 2.3) (Weather Bureau 1998).

The most common winds, which are northwesterly with accompanying dust (sand) storms, occur during September to November. During winter southwesterly winds can bring cold weather for short periods. Frost is common in winter (Van Rooyen 1984).

Phenologically the annual cycle in the Kalahari lacks a clear demarcation into four calender seasons, instead, it essentially has only two seasons (summer and winter), linked by transitional periods (Leistner 1967).

2.4 VEGETATION

Names of plants from the literature discussed below conform to the nomenclature of Arnold and De Wet (1993).

The vegetation of the southern Kalahari is described by Acocks (1953, 1988), Leistner and Werger (1973) and Leistner (1979). Twelve plant communities were distinguished and described in detail by Leistner and Werger (1973). Each of these communities is floristically clearly distinct and is correlated with specific habitat conditions. The different plant communities of the southern Kalahari are grouped by Werger (1978) according to the four main habitats namely communities on sand, calcrete, pans and riverbeds.

The vegetation structure of the Kalahari is described by Leistner (1979) as 'savanna or "bushveld", and grassland with interspersed tall shrubs and/or trees'. The dunes and sandy flats are largely covered by an open shrub or tree savanna, sparse dwarf shrub formations occur on calcrete outcrops, while riverbeds and pans support open grass communities.

Bothma and De Graaff (1973) recognized six major habitat categories in the Kalahari Gemsbok National Park *viz*. (1) the riverbeds of the Auob and the Nossob, (2) pans, (3) tree savanna,

(4) dunes with tree- or shrub-covered crests, (5) dunes superficially devoid of trees and shrubs and (6) flat, open grassy plains (Figure 2.6). Within these categories some smaller subdivisions occur in different localities. Only two of the major habitat categories are applicable to the sampling sites and will be discussed in more detail:

(1) The riverbeds

Nossob riverbed

The Nossob riverbed varies considerably in width. It tends to form a relatively narrow channel (100-500 m across), flanked with steep limestone banks in the south, changing to a wide, shallow, sandy bed up to one kilometre and more in width in the north. The latter is typical of the area from Nossob Camp northwards to Unie End. From the Nossob Camp to Unie End the vegetation in the riverbed has a savanna appearance with large *Acacia erioloba* trees in a grass-land dominated by *Panicum coloratum* and *Eragrostis bicolor*. The banks have no calcrete outcrops and are dominated by *Stipagrostis obtusa*, mixed in some areas with *Rhigozum tricho-tomum*. The transition area between the riverbed and the sandveld interior is covered by grasses such as *Schmidtia kalihariensis*, *Stipagrostis ciliata*, *Eragrostis lehmanniana*, and by the shrubs *Rhigozum trichotomum* and *Monechma genistifolium* (= *Monechma australe*) and by the dominant tree, *Acacia erioloba*. The river dunes of the northern Nossob are characterized by denser stands of shrubs and trees.

(2) Tree savanna

A tree savanna typically develops in Kalahari areas with an annual rainfall exceeding 250 mm (Leistner 1967). In the Kalahari Gemsbok National Park tree savanna is found in the area adja-cent to the Nossob and Auob Rivers and in the immediate proximity of Dankbaar and Loffies-draai in the far north (Figure 2.6).

The vicinity of Dankbaar consists of scattered irregular dunes interspersed with long, wide valleys or flats. In the valleys the dominant tree is *Acacia erioloba*. On the dune slopes and crests specimens of *Boscia albitrunca* are encountered, with a fair scattering of trees and shrubs such as *Rhus tenuinervis*, *Terminalia sericea*, *Albizia anthelmintica* and *Grewia retinervis*. Also pre-sent are *Acacia mellifera*, *Grewia flava* and *Lycium bosciifolium*. The area between the dunes is grassland consisting of *Eragrostis lehmanniana*, *Stipagrostis uniplumis* var. *uniplumis*, *Centropodia glauca* (= *Asthenatherum glaucum*) and *Stipagrostis amabilis*.

Previously the Thorny and Shrubby Kalahari Dune Bushveld were classified by Acocks (1953, 1988) as one vegetation type, i.e. Kalahari Thornveld [A16] (Low & Rebelo 1998). According to the new classification and vegetation map of South Africa (Low & Rebelo 1998) the Thorny Kalahari Dune Bushveld occurs on deep sand in the Kalahari Gemsbok National Park at more or less 1 000 m altitude. The area is characterised by parallel dunes with dune valleys (streets). This bushveld vegetation type is encountered on aeolian sandy to loamy sand, underlain by calcrete. It is characterised by sparsely scattered trees, mainly *Acacia erioloba*, including a few individuals of *Acacia luederitzii* and *Boscia albitrunca*. *Terminalia sericea* is conspicuous on some dune crests. The shrub layer is poorly developed and individuals of *Lycium bosciifolium*, *Grewia retinervis* and *Rhus tenuinervis* occur widely scattered. Depending on the amount of rainfall, the grass layer is moderately developed. Grasses such as *Eragrostis lehmanniana* and *Schmidtia kalihariensis* are conspicuous in the dune valleys and *Stipagrostis amabilis* is abundant on the dunes. This vegetation type is almost totally contained within the Kalahari Gemsbok National Park.

The Shrubby Kalahari Dune Bushveld covers most of the Kalahari Gemsbok National Park. The landscape comprises of gently undulating dunes with pans scattered throughout this vegetation type at an altitude between 1 000 m and 1 100 m. This shrubby bushveld is encountered on deep aeolian sandy soils underlain by calcrete. The area is characterised by scattered shrubs of mainly *Acacia haematoxylon* including a few individuals of *Acacia erioloba* and *Boscia albitrunca*. The shrub layer is poorly developed and individuals of *Grewia retinervis* and *Rhus tenuinervis* occur widely scattered. The grass layer is well developed and resembles a grassland. Grasses such as *Stipagrostis amabilis*, *Eragrostis lehmanniana*, *Aristida meridionalis* and *Centropodia glauca* are conspicuous on these plains.

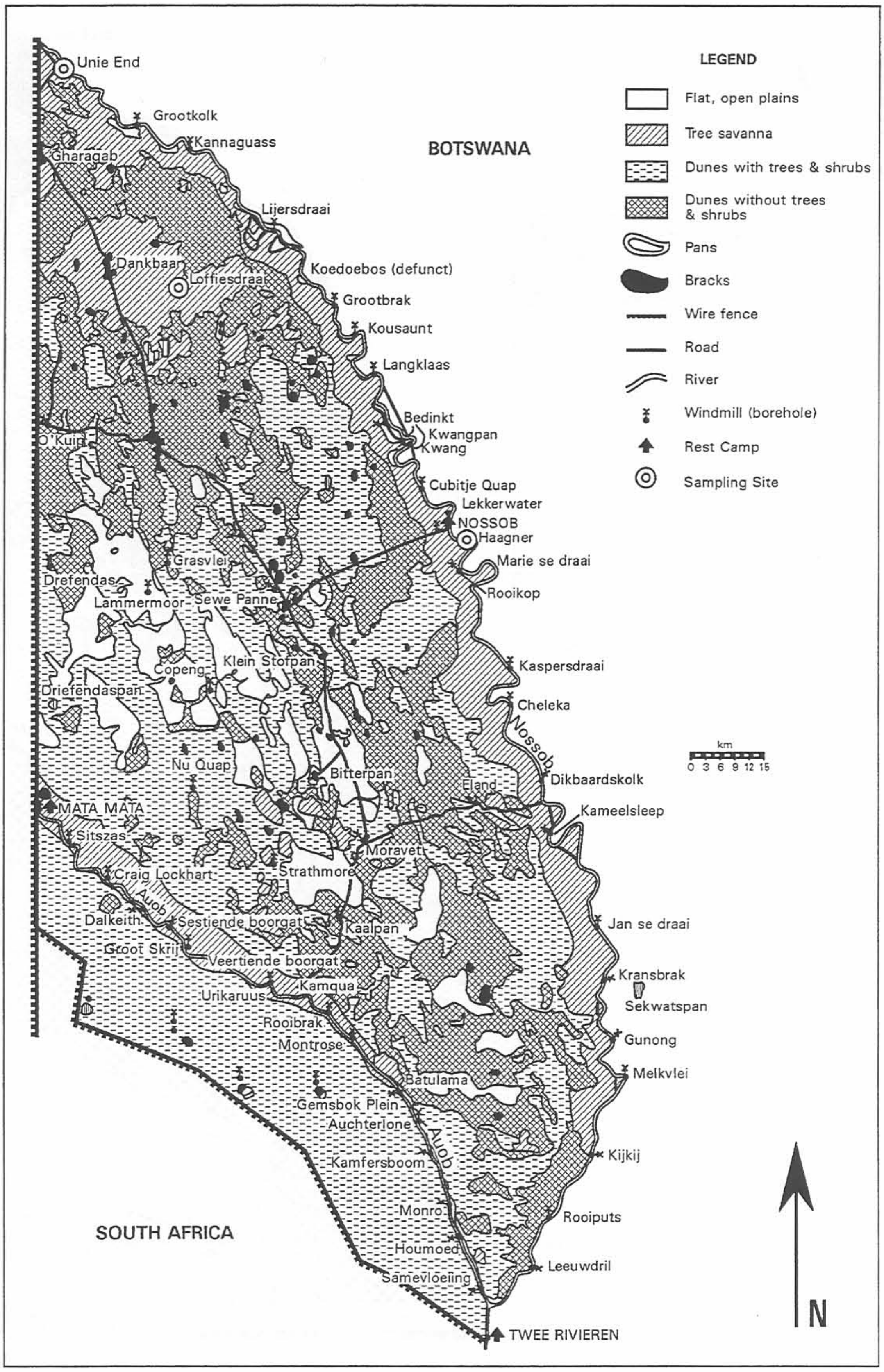

Figure 2.6 Habitat map of the Kalahari Gemsbok National Park (after Bothma & De Graaff 1973).

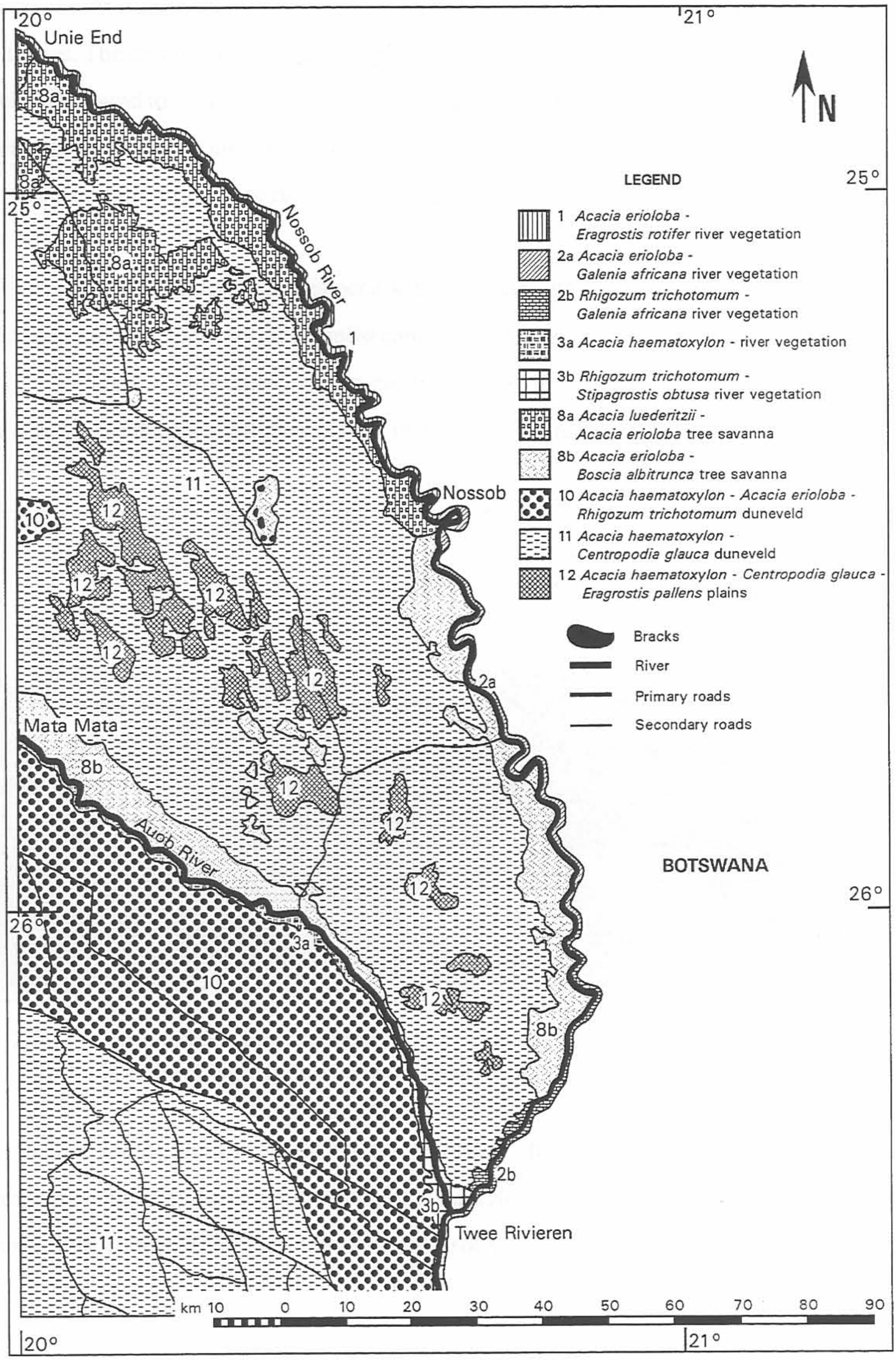

Figure 2.7 Vegetation types of the Kalahari Gemsbok National Park (after Lubbinge 1998).

Lubbinge (1998) subdivided the vegetation of the southern Kalahari duneveld into 33 plant communities. The duneveld consists of 17 plant communities and the rivers and pans of 16. The duneveld was found to be more species rich than the rivers and pans, but the rivers and pans have a higher species diversity/unit area than the duneveld. In the Kalahari Gemsbok National Park 10 of these vegetation types are represented (Figure 2.7).

The greatest diversity of communities occurs in those habitats where competition apparently is least. These habitats are also by far the most common and extensive ones in the southern Kalahari and are all savanna communities. In the northern parts of the park, a tree savanna of which *Acacia erioloba* is the most prominent tree, is present (Figure 2.8).

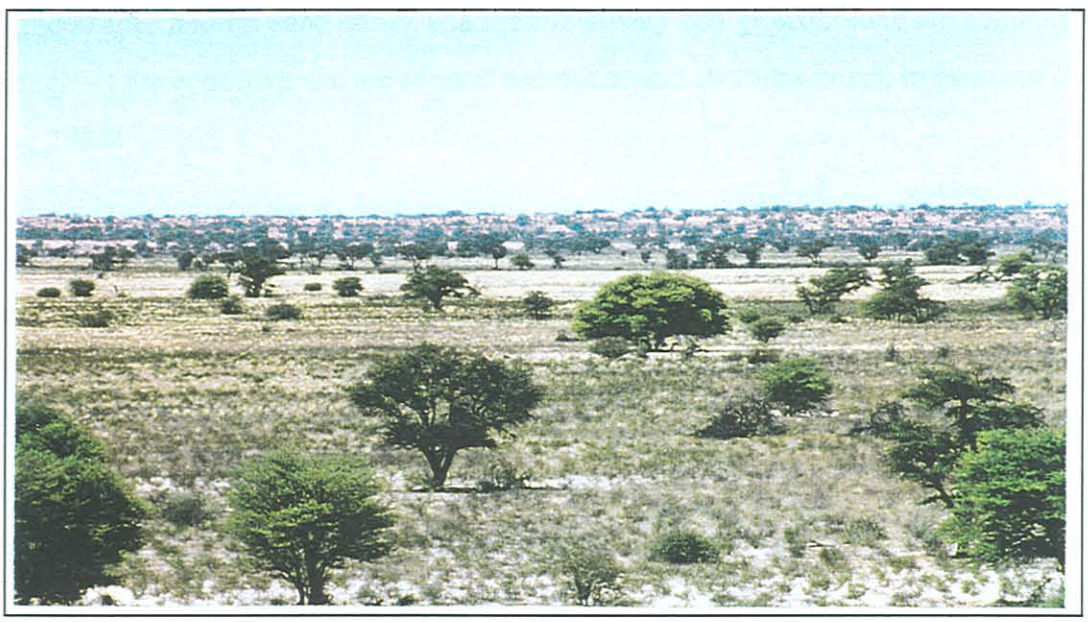

Figure 2.8 ***Acacia erioloba*, the dominant tree in the tree savanna in the northern parts of the Kalahari Gemsbok National Park.**

Huge *Acacia erioloba* trees are a distinctive feature of the riverine areas. In the central and southern parts of the Kalahari Gemsbok National Park *Acacia haematoxylon* becomes dominant and Karoo flora elements increase on the shallow soils.