Koedoe 29: 139-148 (1986)

A Cursory Review of the Climate and Vegetation of the Kruger National Park

F.J. VENTER and W.P.D. GERTENBACH

F.J. Venter and W.P.D. Gertenbach, 1986. A cursory review of the climate and vegetation of the Kruger National Park. — *Koedoe* 29: 139-148 Pretoria. ISSN 0075-6458.

The main features of climate and vegetation of the Kruger National Park are discussed. The dry tropical climate induced lush deciduous savannas with a great variety of species and diverse vegetation structures. Variations in species composition and structural features are mainly regulated by soil type and fire regime.

Key words: Climate, rainfall, temperature, Kruger National Park, Lowveld, savanna, woodland.

F.J. Venter and W.P.D. Gertenbach, Department of Research and Information, Kruger National Park, Private Bag X402, Skukuza, 1350.

Introduction

The vegetation of the Kruger National Park (KNP) is one of its most valuable assets. Not only does it form the vital link between sun energy and available food resources for other biota in the KNP, but it also provides a wide range of habitats which form the basis for the distribution and relative densities of most animal populations.

The vegetation of the Transvaal Lowveld, in which the KNP is situated, consists of deciduous savannas. The correlation between vegetation and soil types is exceptionally good, and most of the plant communities can be described as edaphic climaxes which incorporate disclimaxes such as fire and zootic climaxes. On a regional scale the vegetation is a climatic climax. It has evolved in the sub-humid to arid, subtropical and tropical climate of the Lowveld (according to the Thornthwaite System as applied by Schulze & McGee 1978). None of these climaxes can be considered as completely stable, since changes in vegetation composition and structure occur gradually and almost unnoticeably.

Climate

1. General

Climatic conditions in the KNP vary from hot and humid in summer to mild and predominantly dry in winter. The Lowveld's climate is related to the regional climate of the sub-continent as a whole in that it is influenced by anticyclonic systems moving semi-rhythmically over southern Africa from west to east.

During the summer months the presence of anticyclonic conditions in the interior of South Africa give rise to extremely hot and dry conditions over the Lowveld which may persist for up to two weeks at a time. These conditions are normally followed by the development of a low-pressure cell over the interior, resulting in an influx of warm, moist equatorial air from the north and north-east, and subsequently thunder storms. The establishment of equatorial low-pressure troughs over the sub-continent normally give rise to widespread and continuous rain over the Lowveld. These showers are seldom accompanied by thunder (Schulze 1965).

Tropical cyclones occasionally enter the Lowveld in the late summer months. They originate in the equatorial areas of the Indian Ocean when the surface temperature of the sea rises above 27 °C, and move slowly down the Moçambique Channel, gaining moisture as they proceed (Schulze 1965). The extremely high rainfall associated with tropical cyclones moving overland usually causes extensive flooding and destruction of roads and bridges (*cf.* tropical cyclones Emily, 1978, and Demoina, 1984).

Winter months are normally characterised by the presence of anticyclonic conditions over the interior of South Africa, which result in fine and mild conditions over the Lowveld. These conditions intermittently give way to cooler, cloudy conditions when cold frontal systems of polar origin penetrate from the south.

2. Rainfall

The average rainfall of the KNP decreases from south to north, and from west to east (Gertenbach 1978, 1980), as is clear from the rainfall map presented in Fig. 1. Average rainfall data for selected stations in the KNP is presented in Table 1.

The average annual rainfall of the area ranges from approximately 740 mm at Pretoriuskop in the south-west, to about 440 mm per annum at Pafuri in the north-east. Most of this rain falls between November and March with a peak in January and February. Little precipitation in the period June to August is recorded.

The rainfall of the KNP oscillates between periods of above and below normal rainfall (Gertenbach 1980). Rainfall cycles last approximately 10 years each. This phenomenon was also pointed out, by Tyson & Dyer (1978), for the rest of the summer rainfall area. The difference between the average annual rainfall of wet and dry cycles is about 26 percent (Gertenbach 1980).

The phenomenon of high and low rainfall cycles results in cyclic changes in grass height, and consequently also in the population trends and distribution patterns of many animals (Joubert 1978 to 1985). Wet cycles are

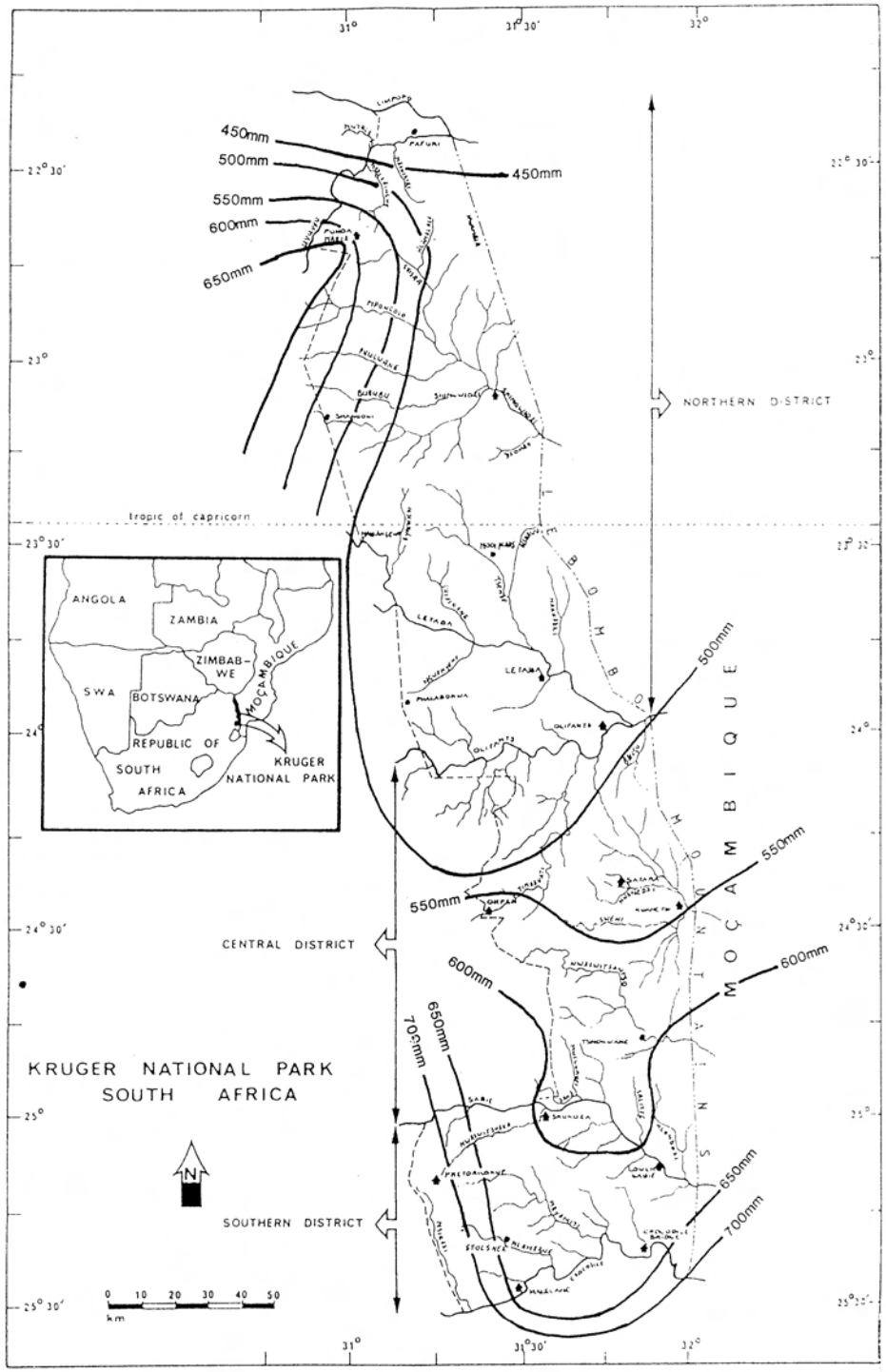

Fig. 1. Rainfall map of the Kruger National Park.

Table 1

Average rainfall (mm) at 15 stations in the Kruger National Park up to June 1985

Station	Altitude (m)	No. of years	Annual average	Monthly average											
				Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Pretoriuskop	600	46	737,3	132,3	103,4	92,9	51,4	20,6	10,6	12,6	11,5	28,9	53,8	103,6	115,7
Malelane	305	45	615,1	111,7	94,6	75,4	39,1	16,5	8,2	8,6	7,3	21,8	44,9	95,8	91,0
Crocodile Bridge	217	46	604,1	111,7	100,3	61,4	45,3	18,9	10,7	11,0	8,2	25,2	46,1	84,5	80,9
Punda Maria	462	58	578,6	120,1	108,1	74,9	32,6	11,8	5,5	4,6	4,9	18,8	24,9	74,2	97,9
Kingfisherspruit	427	28	565,2	90,2	106,6	59,7	36,5	12,1	7,8	10,6	6,7	25,7	40,3	78,7	90,5
Tshokwane	245	49	560,4	93,8	97,0	67,0	35,8	13,7	8,2	9,2	6,8	22,9	35,6	74,0	96,3
Satara	275	49	557,8	101,0	103,5	71,8	27,0	14,1	8,8	9,1	6,6	22,7	33,8	72,1	87,5
Nwanedzi	257	19	557,6	116,6	114,7	67,9	24,4	17,1	6,9	9,6	7,4	26,8	33,3	50,2	82,6
Shangoni	427	36	556,7	112,3	110,4	72,3	27,6	15,0	5,7	4,7	3,3	14,6	27,8	70,9	92,1
Skukuza	262	60	554,5	95,8	94,3	70,8	35,5	15,5	9,1	11,2	5,7	27,0	34,3	76,9	78,4
Phalaborwa	366	53	495,4	95,7	86,5	58,1	31,1	10,9	7,4	9,4	5,5	15,6	27,6	63,7	83,9
Mahlangene	274	26	484,6	86,5	92,9	51,9	24,1	16,4	4,1	6,5	6,1	18,4	30,7	57,5	89,5
Shingwedzi	215	38	478,7	86,8	93,7	48,2	31,1	12,8	6,0	4,4	4,3	20,7	27,9	58,3	84,5
Letaba	215	47	469,1	86,2	80,7	57,1	25,5	13,7	4,7	9,9	3,4	17,4	29,0	61,3	80,0
Pafuri	232	56	430,4	82,8	86,4	45,5	21,2	9,0	4,6	2,3	3,4	11,4	18,3	58,1	87,3
AVERAGE	319	43,7	556,4	101,6	98,2	64,9	32,5	14,5	7,2	8,2	6,1	21,2	33,8	72,0	89,2

characterised by tall grass conditions favouring herbivores (*i.e.* sable *Hippotragus niger,* and roan antelope *H. equinus*) which prefer tall grass conditions. Dry cycles have an inverse effect on the vegetation, and favour the herbivore such as blue wildebeest *Connochaetis taurinus* and zebra *Equus burchelli* which prefer short grass conditions (Joubert 1978 to 1985).

3. Temperature

The Lowveld, with its sub-tropical climate, experiences hot summers and mild winters. Temperatures may reach 44 °C or even more in summer, though seldom fall below freezing point in winter. Frost is a rare phenomenon in the Kruger National Park. Average monthly maximum and minimum temperatures for six stations in the KNP are given in Table 2.

Vegetation

The flora of the KNP consists of approximately 1 968 different plant species which include 457 trees or shrubs, 235 grasses, 27 ferns, 16 woody lianes, 20 aloes and 1 213 forbs (including hydrophytes, and the like). The botanical diversity of the KNP is not only manifested in a large number of species, but also in the large variety of structural features ranging from dense forest to open, shrubby grassland.

Several detailed floristic studies have been conducted in the KNP (Codd 1951; Van der Schijff 1957; Pienaar 1963; Van Wyk 1972, 1974, 1984; Gertenbach 1978; Van Rooyen 1978; and Coetzee 1983). These studies were condensed into Gertenbach's (1983) "Landscapes of the Kruger National Park" which gives a detailed description of the vegetation, its association with abiotic factors, and influence on animal populations. For the purpose of this paper only a broad outline of the main vegetation zones is given (Fig. 2).

The vegetation in the south-western part of the KNP (*i.e.* the area underlain by granitoid rocks south of the Timbavati River) is characterised by relatively dense woodland. It is an undulating terrain where the dominant tree species associated with sandy soils on crests and middleslopes are *Combretum apiculatum* Sond., *C. zeyheri* Sond., *C. collinum* Fresen. subsp. *suluense* (Engl. & Diels) Okafor and *Terminalia sericea* Burch. ex DC. Along footslopes where clayey duplex soils occur, the dominant woody species are *Acacia gerrardii* Benth. var. *gerrardii, A. nigrescens* Oliv., *Dichrostachys cinerea* (L.) Wight & Arn. and *Euclea divinorum* Hiern. Grass cover on crests is sparse with species such as *Pogonarthria squarrosa* Roem. & Schult.) Pilg. and *Digitaria eriantha* Steud dominant. The grass cover along footslopes is dense, palatable and more susceptible to overgrazing. Dominant species are *Themeda triandra* Forssk. and *Panicum maximum* Jacq. where A-horizons are thick (> 15 cm) and *Sporobolus nitens* Stent and *Dactyloctenium aegyptium* (L.) Beauv. where A-horizons are thin (< 15 cm). In the Pretoriuskop area where the rainfall is above 700 mm per annum, the vegetation is largely mesic. *Terminalia sericea* and *Dichrostachys cinerea* are the dominant woody species, while tall grasses such as *Hyperthelia dissoluta* (Nees ex Steud.) Clayton and *Elyonurus argenteus* are characteristic of the field layer. Inselbergs and low mountains usually sustain a heterogeneous and

Table 2

Average monthly temperatures (°C) at six stations in the Kruger National Park (from Gertenbach 1983)

Month	PRETORIUSKOP		SKUKUZA		SATARA		LETABA		SHINGWEDZI		PUNDA MARIA	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
January	29,2	18,8	32,3	19,6	33,0	21,0	34,0	22,0	34,3	21,7	34,4	21,2
February	31,0	18,3	32,2	19,4	33,6	20,8	34,9	21,5	33,9	21,2	31,7	19,8
March	32,1	17,8	31,2	17,9	33,3	19,8	34,3	20,5	33,2	20,0	31,7	19,8
April	27,8	15,1	29,8	14,8	29,6	17,4	33,4	19,4	30,4	17,4	29,3	16,6
May	25,1	12,7	27,4	10,2	28,0	13,0	28,6	12,6	26,8	11,5	26,2	12,7
June	23,9	8,8	25,6	6,1	25,8	8,9	26,7	8,0	25,8	6,7	24,6	9,8
July	24,8	9,3	25,4	5,6	26,8	10,7	26,7	10,4	25,9	9,2	25,0	12,8
August	26,7	11,0	27,7	7,6	27,6	11,9	28,9	11,3	28,3	10,6	26,4	14,1
September	26,9	14,4	29,4	11,6	28,1	14,3	27,8	12,9	27,8	12,9	27,1	14,5
October	23,7	13,2	30,8	15,1	26,3	13,7	27,3	14,0	27,3	14,0	29,0	17,0
November	30,1	17,6	31,8	17,5	31,4	18,7	33,3	19,0	33,3	19,0	32,7	19,7
December	28,6	17,4	32,3	19,2	30,7	19,0	32,4	19,1	32,4	19,1	31,1	19,0

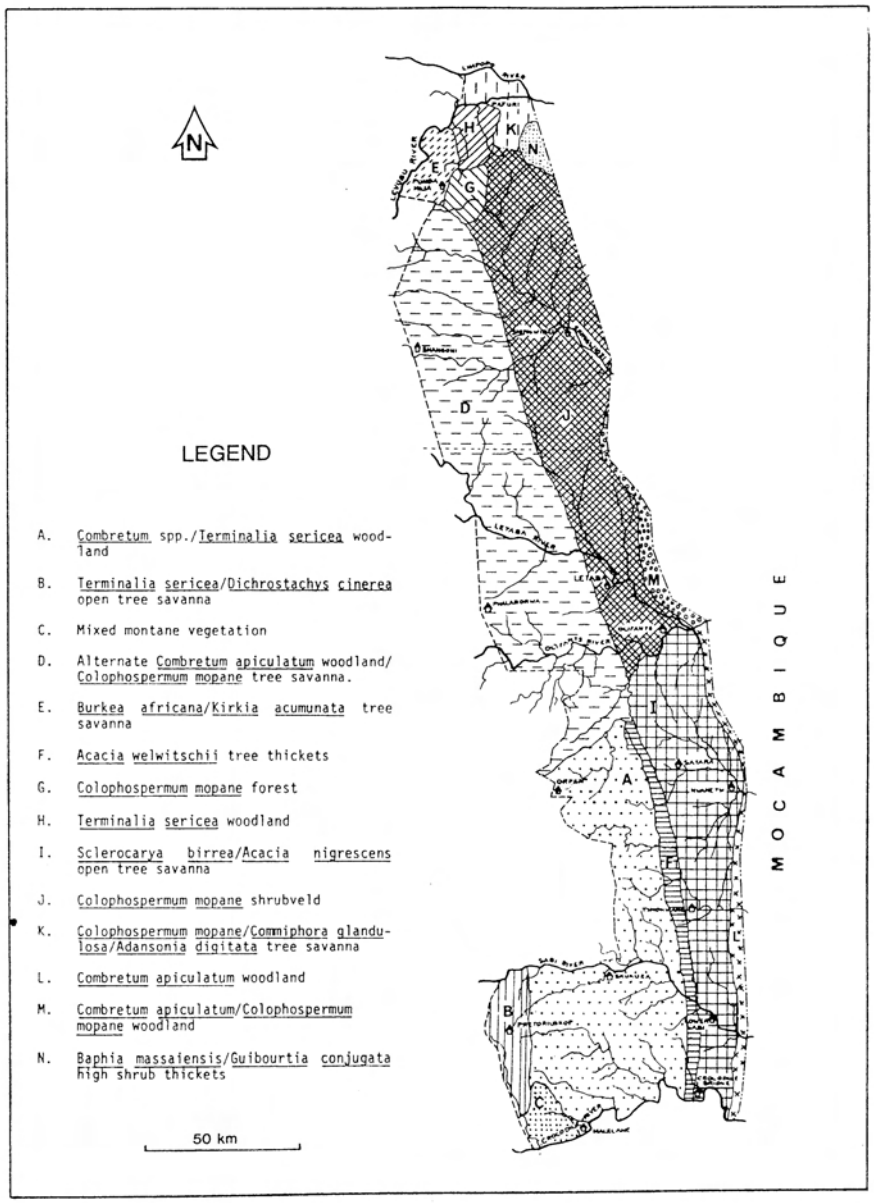

Fig. 2. Generalised vegetation map of the Kruger National Park.

unique vegetation, and many species are confined to these habitats.

The granitic areas north of the Timbavati River consist mainly of undulating landscape with *Colophospermum mopane* (Kirk ex Benth.) Kirk ex J. Leonard/*Combretum apiculatum* woodland. Mopane dominates the more clayey soils derived from greenstones and dolerite dykes, as well as the duplex soils along footslopes. *Combretum apiculatum* is confined to the shallow gravelly and sandy soils of crests.

The area around Punda Maria, which is underlain by argillaceous sediments of the Soutpansberg Group, is rugged terrain with *Burkea africana* Hook. / *Pseudolachnostylis maprouneifolia* Pax savanna on sandy crests and lower footslopes, *Kirkia acuminata* Oliv. / *Afzelia quanzensis* Welw. / *Combretum apiculatum* savanna on upper footslopes, and *Androstachys johnsonii* Prain / *Croton pseudopulchellus* Pax woodland on talus slopes and scarps. The grasses are usually tall, but the cover is moderate.

The area underlain by Ecca sediments in the southern KNP are dominated by thickets of *Acacia welwitschii* Oliv subsp. *delagoensis* and *Euclea divinorum*. On similar rocks east of Punda Maria dense stands of tall *Colophospermum mopane* trees with a sparse grass cover occur. The vegetation occurring on the soils derived from the Clarens Formation is dominated by *Terminalia sericea* with *Perotis patens* Gand. as the dominant grass.

The area underlain by basalt south of the Olifants River consists mainly of *Acacia nigrescens* / *Sclerocarya birrea* (A. Rich.) Hochst. subsp. *caffra* (Sond.) Kokwaro savanna. North of this river the basaltic plains are characterised by *Colophospermum mopane* shrubveld with *Combretum imberbe* Wawra as a conspicuous component. A lush grass cover consisting mainly of *Themeda triandra, Panicum coloratum* L. and *Bothriochloa radicans* (Lehm.) A. Camus is characteristic of the basaltic areas.

The Lebombo Mountains are characterised by woodland consisting of a great variety of species, of which *Combretum apiculatum* is the dominant species south of the Olifants River and *C. apiculatum* and *Colophospermum mopane* the dominant species north of this river. Several species are endemic to the Lebombo Mountains.

Baphia massaiensis Taub. / *Guibourtia conjugata* (Bolle) J. Leonard thickets occur on deep Tertiary and Quaternary sands in the Nwambia area. Similar soils of the Pumbe Sandveld accommodate a psammophytic woodland dominated by *Terminalia sericea* and *Pseudolachnostylis maprouneifolia*.

Riparian thickets occur along all the major drainage lines. They differ in species composition and structure according to the size of drainage lines and the type of alluvial deposits present. These thickets are generally denser in the higher granitic areas than in basaltic areas. This phenomenon is especially conspicuous along the Sabie River. The riparian vegetation of the Luvuvhu and Limpopo rivers is unique in that it consists of huge (up to 30 m tall) specimens of *Ficus sycomorus* L., *Acacia albida* Del. and *Xanthosercis zambesiaca* (Bak.) Dumaz-le-Grand trees occurring in dense forests in association with a host of other smaller species.

An excellent correlation exists between vegetation and soil types in the KNP,

and several plants may be regarded as indicator species of specific soil conditions. In conclusion it is suggested that this fine correlation reflects the distinctive role of physical and chemical soil properties in genetic adaptation under humid to semi-arid conditions. To the individual plant, water is life, and the availability of water is determined by a complex of soil properties, and the genetic ability of the plant to overcome soil related obstacles in order to utilize groundwater.

Acknowledgements

We thank Prof. T.H. van Rooyen, Drs. S.C.J. Joubert, M.G.L. Mills and J.W. Bristow, and Messrs. I.J. Whyte and A.J. Viljoen for making valuable criticisms on the manuscript. The work was done under the auspices of the National Parks Board of Trustees.

REFERENCES

CODD, L.E.W. 1951. Bome en struike van die Nasionale Krugerwildtuin. *Mem. bot. Surv. S. Afr.* 26: 1-192.

COETZEE, B.J. 1983. *Phytosociology, vegetation structure and landscapes of the Central District, Kruger National Park, South Africa.* Dissertationes Botanicae. Cramer and Vaduz.

GERTENBACH, W.P.D. 1978. *Plantgemeenskappe van die Gabbro-kompleks in die noordweste van die Sentrale Distrik van die Nasionale Krugerwildtuin.* M.Sc. thesis, University of Potchefstroom for C.H.E., Potchefstroom.

GERTENBACH, W.P.D. 1980. Rainfall patterns in the Kruger National Park. *Koedoe* 26: 9-121.

GERTENBACH, W.P.D. 1983. Landscapes of the Kruger National Park. *Koedoe* 26: 9-121.

JOUBERT, S.C.J. 1978 – 1985. Census results for the large herbivore species in the Kruger National Park. Unpublished Annual Reports. National Parks Board of Trustees, South Africa.

PIENAAR, U. DE V. 1963. The large mammals of the Kruger National Park – their distribution and present-day status. *Koedoe* 6: 1-137.

SCHULZE, B.R. 1965. *Climate of South Africa. 8. General Survey.* Pretoria: Government Printer and Weather Bureau.

SCHULZE, R.E. and O.S. McGEE. 1978. Climatic indices and classifications in relation to the biogeography of southern Africa. pp. 19-52. *In:* WERGER, M.J.A. (ed.). *Biogeography and Ecology of Southern Africa.* The Hague: Junk.

TYSON, P.D. and T.G.J. DYER. 1978. The predicted above-normal rainfall of the seventies and the likelihood of droughts in the eighties in South Africa. *S. Afr. J. Sci.* 74: 372-377.,

VAN DER SCHIJFF, H.P. 1957. *Ekologiese studie van die flora van die Nasionale Krugerwildtuin.* D.Sc. thesis, University of Potchefstroom for C.H.E., Potchefstroom.

VAN ROOYEN, N. 1978. *'n Ekologiese studie van die plantgemeenskappe van die Punda Milia-Pafuri-Wambiyagebied in die Nasionale Krugerwild-*

tuin. M.Sc. thesis, University of Pretoria, Pretoria.
VAN WYK, P. 1972, 1974. *Trees of the Kruger National Park*. Vol. I & II. Cape Town: Purnell.
VAN WYK, P. 1984. *Field Guide to the Trees of the Kruger National Park*. Cape Town: C. Struik.