

THE LARGE MAMMALS OF THE KRUGER NATIONAL PARK — THEIR DISTRIBUTION AND PRESENT-DAY STATUS

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INTRODUCTION

The Kruger National Park, one of the largest and the oldest in the Southern hemisphere occupies a vast area of some 7,340 square miles in the extreme north-east of the Transvaal Lowveld between 22°25' to 25°32' latitude south and between 30°50' to 32°2' longitude east.

The eastern boundary of the Park follows the Lebombo mountain ridge on the border between Transvaal and Mocambique, which is an important faunal barrier, separating to a greater or lesser extent the true tropical fauna of the Mocambique plains from the transitional fauna of the Eastern Transvaal Lowveld. The northern and southern boundaries are also natural i.e. the perennial Levubu and Crocodile Rivers, which act as less specific faunal barriers. The western boundary of the Park is for the most part artificial and had, at the time of proclamation, unfortunately not been demarcated with the object of creating an ecologically self-sufficient game sanctuary. It follows a more or less arbitrary line from south to north, has been subjected to considerable changes during the history of the Park and was finally entailed during 1960-1961 by a substantial barbed-wire game fence along the whole of its some 300 miles meandering course.

A portion of the eastern boundary as well as the northern and southern boundaries are also fenced, but being natural delimitations the fence here has a much less important bearing on the well-being and survival of the inhabitants of the Park than that along the western boundary, which cuts through established game habitats, excises important seasonal grazing grounds east of the Drakensberg escarpment and deprives migrating game of traditional watering points during the dry season or drought conditions. The fencing of the western boundary of the Park which had nevertheless become an urgent necessity because of agricultural and poaching pressure on the boundary has brought about the realization more than any other single factor that the Kruger Park despite its extensive area, is incapable of supporting and maintaining a large inherent game population without artifi-

cial aid in the form of a network of boreholes and dams and a policy of scientific veld management.

It is therefore safe to maintain that the Park would have attained the saturation point of its carrying capacity with respect to its ungulate fauna long ago had it not been for the provision of an ever increasing number of artificial watering points away from the perennial rivers and permanent natural waterholes through the years. Even today the most important limiting factor which stifles the population growth of many species in the Park is a lack of sufficient water supplies in their chosen habitats.

A carefully-planned program of purveyance of drinking facilities where such is still lacking will be continued with for quite a few years to come, always bearing in mind the dangers of overstocking and the importance of grazing areas which are only accessible to the game during the summer months. Had such a program not been embarked upon many years ago, there is little doubt that many species would today have been in danger of extinction and the ungulate community numerically much weaker than it is at present.

The lack or abundance of water in game habitats in the Park could be regarded as one of the most important factors governing the decline or growth of a particular population through the years. It is true for instance, that the actual carrying capacity of the northern mopaniveld with respect to elephants is enormous, but the limiting factor had always been a lack of water away from the perennial rivers, and was the causative factor instrumental in the southward migration of elephants from the original nucleus herds in the north since 1939. Other populations were again profoundly affected by changes or deterioration of the habitat, competition with more adaptable species, specific environmental affinities, selective grazing habits, severe droughts, parasitic diseases and epizootics, or in isolated instances by the excessive depredation by carnivores, thereby causing seasonal or protracted fluctuations in the growth curve of these populations. With the exception of black rhinoceros and oribi, both of which became extinct after the proclamation of the old Sabi Game reserve in 1898, and eland and tsessebe which disappeared from the southern district of the Park, all other populations have shown an undulating but inclining growth curve over the years. After the appalling slaughter of game perpetrated by indigenous Bantu tribes and pioneer white hunters during the last half of the 19th century and the heavy toll claimed by the great rinderpest epizootic of 1897-98, the Lowveld at the turn of the century carried but a pitiful remnant of the great herds of game of bygone years.

In 1912 the late Warden of the Park, Col. Stevenson-Hamilton, estimated the number of herbivores in the old Sabi Game reserve, which included a large tract of country between the Crocodile and Olifants Rivers outside the present western boundary as roughly 30,000. In 1925 the same author considered that the Sabi Game reserve contained no less than 100,000 head of

game and the Shingwedzi reserve a further 30,000. Despite a series of bad drought periods after the proclamation of the Kruger National Park in 1926, which caused temporary declines in the growth curves of many ungulate populations, the inhabitants of this unique sanctuary have reacted so favourably to the extensive improvement in game management schemes of recent years that the overall population figure have now well exceeded the 250,000 mark, and is still rising steadily in the case of the large majority of species. In some instances the increase in numbers over the last few years have been unprecedented and has been precipitated by various factors such as the western boundary fence, an adequate firebreak and veld-management system, the combat of epidemic diseases, and better distribution of watering points, so much so that this phenomenon is viewed with some concern in certain areas where there are already unmistakable signs of overstocking. In such areas there has already been embarked on a programme aimed at the diminution by artificial means (mass translocation) of game numbers in order to restore the natural balance. In the case of large animals such as elephant, hippopotamus, giraffe and even buffalo — all species with few or no natural predators, cropping or control of superfluous numbers will probably have to be considered within the not too distant future.

A species which became extinct before the proclamation of the old Sabi reserve — white rhinoceros, has been reintroduced into the southern section of the Park from the Umfolozi game reserve in Natal during 1961. Oribi were reintroduced during 1962 and the only species of large mammal still missing from its grazing grounds of yore in these parts is the black rhinoceros. A concerted effort will be made during the next few years to re-establish these rare beasts in their old haunts in the Kruger Park; thus making up the full complement of herbivorous species which existed in the Eastern Transvaal Lowveld within historical times.

Topographically the Kruger National Park presents an undulating aspect, although it appears rather flat generally. The highest altitudes are attained in the south-west (2750 ft. above sea level) and the country declines towards the Lebombo flats on the east, which are only 600-800 ft. above sea level. The Lebombo mountain range on the eastern boundary reaches its highest level at Shilowa poort in the north (1628 ft.). The Park is traversed from west to east by 5 perennial rivers, and drained by numerous dongas, dry water courses and seasonal rivers. The Olifants and Sabi Rivers divide the Park into three regions, which for administrative reasons are referred to as the northern, central and southern districts respectively. The rolling landscape is interrupted at frequent intervals by small rocky outcrops or koppies so typical of the Eastern Transvaal bushveld, and which consist of weather-resistant rock belonging to the Swaziland system, archaic granite or dolerite. There are no high mountain ranges in the Park, but the Lebombo ridge on the eastern boundary, the Malelane area and the country north of Punda Milia may be described as mountainous.

The mean annual rainfall varies from 27.8 inches around Pretoriuskop in the south-west to 15.67 inches in the extreme north-east at Pafuri. Precipitation is mainly encountered in the form of thundershowers during the summer months.

The 18°C mid-winter surface isothermal line which separates the tropical Mocambique plains from the climatically transitional Transvaal Lowveld follows for the greater part the Lebombo ridge in the south but cuts across to the west for some distance in the region of Olifants Gorge and again north of Shingwedzi River towards the Levubu-Motale junction. (Poynton, 1960).

Van der Schijff (1958) classified the vegetation of the Kruger National Park into the following six major veld types :

- (i) Large-leafed deciduous woodland with tall grass.
- (ii) Mixed *Combretum* veld.
- (iii) Knobthorn — Marula parkland.
- (iv) Communities of dolerite dykes.
- (v) Mopani woodland.
- (vi) The sandveld communities of Punda Milia and Nwambia.

In any treatise of the present-day status of the large mammals of the Kruger National Park and discussion of their distributional pattern, it is essential to consider such in the light of their respective environmental affinities and choice of habitat. Although the vegetation of the Park may therefore be arbitrarily sub-divided into six plant-communities or biomes in respect of dominant species, it is well to remember that each major veld-type encompasses a number of well defined areas of diverse vegetational and topographical aspect. Individually or in toto these areas afford sanctuary and provide in the ecological affinities of competing or co-existent large mammal species which occupy similar or different ecological niches.

An attempt has been made in fig. (i) to distinguish between the more important and distinctive game habitats differentiated from the vegetational milieu of the Kruger National Park. It is considered that an appreciation of the habitat preferences of the large mammal species in the Park may elucidate to some extent the overall distribution range and pattern of such species in Africa.

THE GAME HABITATS IN THE KRUGER NATIONAL PARK

The following brief description serves to indicate the ecological differentiation of the major game habitats in the Kruger National Park.

(i) *The Nyandu bush.*

This game habitat covers an area of some 70 square miles in the far north-east of the Park and is essentially similar in character to the 'Matheshi bush' and *Cryptosepalum* forests of the loose sands in Barotseland and parts of Northern Rhodesia (Fraser Darling, 1960). It is found on deep loose red sands of a Kalahari-like origin and is a spur of the vast sand-veld region

which covers most of the area between the Limpopo and Olifants Rivers in Portuguese East Africa. It is intensely sensitive to fire and inclined to extensive coppice growth after damage by fire. In certain areas these thickets are so dense as to preclude completely any grass growth. The tree and shrub flora is largely deciduous and the dominant species is *Baphia obovata*. Associated species of particular botanical significance are *Xylia africana*, *Ostryoderris stuhlmanni*, *Hugonia swynnertoni*, *Xylothea kraussiana* var. *kraussiana*, *Guibourtia conjugata* and *Clerodendrum pleiosciadium* — all representatives of the tropical flora of the Mocambique plains which are more or less restricted in their range and which confer a unique status to this area in the Republic of South Africa.

Other trees and shrubs commonly found in this plant community include *Ptaeroxylon obliquum*, *Leptactinia benguellensis*, *Monodora junodii*, *Combretum celastroides*, *Azelia cuanzensis*, *Spirostachys africana*, *Pteleopsis myrtifolia*, *Balanites maughamii*, *Dalbergia nitidula* and *Dalbergia melanoxylon*, *Strychnos decussata*, *Croton steenkampiana*, and *Euphorbia ingens*.

There are no water-courses or rivers draining this area — water being conserved only in a series of semi-permanent pans (after the wet season) which all contain a dense growth of the floating water grass *Paspalidium platyrachis*. The dominant species making up the discontinuous grass cover are *Digitaria* spp., *Eragrostis* spp., *Aristida uniplumis* var. *neesii* and *Urochloa rhodesiensis*, with *Panicum maximum*, *Tricholaena monachne* and *Perotis patens* less prominent.

The Nyandu bush is the exclusive habitat in the Park of Livingstone's suni, a typical inhabitant of the Mocambique plains and also of the Mocambique golden mole (*Amblysomus (Chrysotricha) obtusirostris limpopoensis*) and several lower vertebrate species. Spring hares are plentiful here and the resident ungulate fauna include buffalo, sable antelope, kudu, nyala, zebra, eland, roan antelope (rarely), steenbuck, Sharpe's steenbuck, grey duiker as well as elephants.

(ii) *Light Montane forest and overgrown valleys.*

A relatively open forest vegetation of evergreen and deciduous species with several strata, which covers the slopes of Numbi hill and most of the mountainous country north-west of Malelane and Punda Milia. In the Punda Milia area the sandy substratum is derived from the Dominion reef system. The tree stratum here is represented amongst others by *Burkea africana*, *Albizia versicolor*, *Anthocleista grandiflora*, *Adina microcephala* var. *galpinii*, *Albizia adianthifolia*, *Diospyros mespiliformis*, *Albizia amara* subsp. *sericocephala*, *Combretum mechowianum*, *Pterocarpus angolensis*, *Xylopia odoratissima*, *Tabernaemontana elegans*, *Markhamia acuminata*, *Azelia cuanzensis*, *Acacia polyacantha* subsp. *campylacantha*, *Pteleopsis myrtifolia*, *Guibourtia conjugata*, *Ficus* spp., *Phyllogeiton discolor*, *Lonchocarpus capassa*, *Pseudolachnostylis maprouneaefolia*, *Drypetes gerrardii*, *Commiphora marlothii* and

Crossopteryx febrifuga. Important species in the shrub-stratum include *Diplorrhynchus condylocarpus*, *Rothmannia fischeri*, *Cordia grandicalyx*, *Holarrhena febrifuga*, *Hymenocardia ulmoides*, *Heeria paniculosa*, *Artabotrys brachypetalus*, *Landolphia kirkii*, *Bauhinia galpinii*, *Ochna pulchra*, *Strychnos* spp., and *Securidaca longipedunculata*.

The grasses are predominantly sweet and palatable and include *Panicum maximum*, *Urochloa rhodesiensis*, *Digitaria* spp., *Schmidtia bulbosa*, *Andropogon amplexans*, *Cenchrus ciliaris*, *Setaria* spp., *Hyparrhenia* spp., *Brachiaria deflexa* and *Aristida meridionalis*.

The Malelane hills display a tree and shrub community infused by species from the surrounding mixed combretum savanna woodland, but with such characteristic species as *Adina microcephala* var. *galpinii*, *Piliostigma thoningii*, *Parinari curatellifolia* ssp. *mobola*, *Phyllogeiton zeyheri*, *Rauvolfia caffra*, *Olea africana*, *Phyllogeiton discolor*, *Ficus* spp., *Erythrina* spp., *Schotia brachypetala*, *Heteropyxis natalensis*, *Croton sylvaticus*, *Commiphora neglecta*, *Kirkia wilmsii*, *Pittosporum viridiflorum* and *Apodytes dimidiata*. Distinctive trees growing on Numbi hill are *Faurea saligna*, *Celtis kraussiana* and *Sterculia murex*.

The forest-clad slopes and glades of the mountainous areas of the Park are favourite haunts of bush-pig, bush-buck, kudu, nyala (in the north) and grey duiker. The Malelane hills constitute an important habitat of mountain reedbuck and the well-wooded kloofs of Numbi hill afford the last permanent sanctuary to Natal or red duiker in the Park. Wild dog more often than not return yearly to these mountainous areas to give birth and rear their young.

(iii) Riparian forest.

A narrow belt of closed forest along the banks of nearly all permanent and semi-permanent streams throughout the Park. Many fine, evergreen and deciduous trees are included in this community such as *Acacia albida*, *Acacia robusta*, *Croton megalobotrys*, *Bridelia micrantha*, *Diospyros mespiliformis*, *Ekebergia meyeri*, *Garcinia livingstonei*, *Acacia xanthophloea*, *Ficus* spp., *Kigelia pinnata*, *Mimusops zeyheri*, *Pseudocadia zambesiaca*, *Adina microcephala* var. *galpinii*, *Combretum imberbe*, *Schotia brachypetala*, *Strychnos stuhlmannii*, *Syzygium guineense*, *Syzygium cordatum*, *Trichilia roka* and *Trema guineensis*. Where they are protected from fire, palms — *Hyphaene crinita* and *Phoenix reclinata* grow to graceful size along the river banks.

The shrub stratum consists of species such as *Combretum erythrophyllum*, *Ficus capreaefolia*, *Grewia* spp., *Euclea* spp., *Kraussia schlechteri*, *Salix* spp., *Azima tetraantha*, *Anisotes sessiliflorus* and *Cardiogyne africana*.

Grasses are mostly shade-loving, and *Panicum deustum*, *Panicum maximum*, *Setaria chevalieri*, *Cynodon dactylon* and *Oplismenus hirtellus* are commonly found.

The dense reed beds (*Phragmites communis*) along the river banks and on the islands are inhabited by cane rats, otters and water mongooses and

also afford shelter and food to many other species during the dry season. The reed islands are favourite breeding sites of lions.

The riparian forest proper is the almost exclusive habitat of bushbuck and a favourite haunt of nyalas, but most other large mammalian species utilize it in some way or other during their daily or periodic drinking routines.

(iv) *Dry deciduous forest.*

Isolated patches of this type of forest cover the flat crown of many hills in the Punda Milia area, along the south bank of the Levubu, and the Lebombo between Pafuri and Malonga spring and north and south of the Olifants Gorge. The typical aspect is a closed stand of several strata with *Androstachys johnsonii* the dominant tree species. The latter is deciduous and with a wood of fantastic hardness and durability. Associated species are *Acokanthera oppositifolia*, *Albizia tanganyikensis*, *Ficus smutsii*, *Croton pseudopulchellus*, *Wrightia natalensis*, *Atalaya alata*, *Gyrocarpus americanus* and *Euphorbia cooperi*. Shrubs and climbers are *Strophanthus kombe*, *Cissus quadrangularis*, *Ipomoea* spp., *Cyphostemma schlechteri*, *Euclea schimperi* var. *daphnoides*, and *Hippocratea* sp. Ferns are common in the understory. Grass is generally discontinuous and include such species as *Enteropogon simplex*, *Tetrapogon tenellus*, *Setaria pallide-fusca*, *Sporobolus panicoides*, *Oplismenus hirtellus*, *Cymbosetaria sagittifolia*, *Chrysopogon montanus* and *Leptocarydion vulpiastrum*. The *Androstachys* forests in the Park are favourite retreats of bush pig, forest elephant shrews and crested guinea fowl but also receive periodic visits from elephant, kudu, nyala, bushbuck and Sharpe's steenbuck.

(v) *The Lebombo ridge.*

The skeletal soils of the Lebombo rhyolitic reef is covered by a characteristic vegetation which varies only slightly from north to south. *Colophospermum mopane* is an important constituent of the tree stratum in the zone above the Olifants River, and also extends southwards to within a few miles of the Pumbe sandveld. In the south *Pterocarpus rotundifolius* takes its place.

Associated trees, which are for the most part deciduous, are *Boscia albitrunca*, *Combretum apiculatum*, *Entandrophragma caudatum*, *Azelia cuanensis*, *Adansonia digitata*, *Stadmannia sideroxylon*, *Acacia nigrescens*, *Acacia erubescens*, *Acacia gerrardii*, *Albizia harveyi*, *Albizia brevifolia*, *Euphorbia confinalis*, *Euphorbia cooperi*, *Lannea kirkii*, *Combretum gueinzii*, *Cassia abbreviata* var. *granitica*, *Sterculia rogersii*, *Acacia tortilis*, *Commiphora* spp., and *Terminalia phanerophlebia*.

The more commonly occurring shrubs are *Hymenodictyon parvifolium*, *Bridelia mollis*, *Acacia ataxacantha*, *Acacia schweinfurthii* var. *schweinfurthii*, *Gardenia resiniflua*, *Elephantorrhiza* spp., *Portulacaria afra*, *Bauhinia kirkii*, *Pterocarpus rotundifolius*, *Heeria insignis*, *Holmskioldia speciosa*, *Dombeya kirkii* and *Monodora junodii* together with xerophytic species such as *Adenium obesum* var. *multiflorum*, *Pachypodium saundersii*, *Adenia spinosa*, *Aloe* spp.,

Euphorbia spp., *Caraluma*, *Huernia* and *Stapelia* spp., and *Sansevieria* and *Vellozia* spp.

The grasses are generally coarse and of a less palatable nature, and include *Andropogon gayanus* var. *squamulatus*, *Bothriochloa insculpta*, *Digitaria pentzii* var. *stolonifera*, *Cymbopogon excavatus*, *Heteropogon contortus*, *Aristida* spp., *Themeda triandra*, *Danthoniopsis dinteri* and *Schizachyrium exile*.

The Lebombo mountain range is the permanent habitat of many klip-springer, mountain reedbuck (south of the Nwanetzi poort), dassies (north of the Olifants Gorge) and Sharpe's steenbuck, but is also an important summer feeding ground of many species such as elephant, giraffe, kudu, wildebeest, zebra, waterbuck and impala.

(vi) *The Pumbe sandveld.*

This is a small extension of the Mocambique sandveld south of the Olifants River which penetrates the Lebombo plateau for a distance of some 2 miles along with the 24°15' latitude. It covers an area of not more than 20 square miles but is important from a botanical viewpoint in that it exhibits some affinities to the Punda Milia sandveld of the north; which is unique for the area south of the Olifants River. Arboreal species common to both these ecological isolates are *Azelia cuanzensis*, *Pseudolachnostylis maprouneae-folia* and *Combretum mechowianum*. Common associated trees in the Pumbe sandveld are *Terminalia sericea*, *Sclerocarya birrea*, *Acacia nigrescens* and *Combretum apiculatum*, with *Heeria insignis* prominent in the undergrowth. Indicator species in the shrub stratum are *Salacia kraussii* and *Eugenia zeyheri*, and amongst the grasses there are *Alloteropsis cimicima*, *Urochloa stolonifera* and *Digitaria didactyla*.

Although the Pumbe habitat does not give exclusive sanctuary to any specific large mammalian species, it is significant in respect of being the only spring hare habitat south of the Olifants River.

(vii) *Dense thornbush thickets.*

Extensive areas with heavy, petitic soils of poor drainage in the Kruger Park are covered by a vegetation which can only be described as thornbush thickets, although a scatter of trees occur in all these confines. Typical examples of such thornbush thickets are the well-known Nwathimiri bush, as well as that of Gomondwane, both traditional habitats of the black rhinoceros in bygone days. As the name implies, the vegetation consists predominantly of thorny varieties of which a few species such as *Acacia nigrescens*, *Acacia tortilis* and *Acacia delagoensis* reach tree status. The thorny undergrowth includes *Capparis tomentosa*, *Carissa bispinosa*, *Dalbergia melanoxylon*, *Dichrostachys cinerea*, *Dichrostachys cinerea* ssp. *nyassana*, *Gymnosporia senegalensis*, *Acacia grandicornuta*, *Acacia tortilis*, *Acacia nigrescens*, *Acacia delagoensis*, *Acacia nilotica* var. *kraussiana*, *Acacia borleae*, *Acacia senegal* var. *rostrata*, *Balanites australis*, *Ziziphus mucronata* and *Fagara humulis*.

Thornless forms often associated with this complex are *Cassine aethiopica*, *Euclea* spp., *Grewia* spp., *Securinea virosa*, *Gardenia spatulifolia*, *Combretum imberbe*, *Albizia evansii*, *Albizia forbesii*, *Manilkara mochisia*, *Pappea capensis*, *Pseudocassine transvaalensis*, *Rhigozum zambesiicum*, *Spirostachys africana*, *Cordia gharaf*, *Schotia capitata*, *Boscia mossambicensis*, *Adenium swazicum* (in the south) and *A. obesum* var. *multiflorum*.

Grasses are sparse and easily trampled out. The most common species include *Sporobolus* spp., *Chloris gayana*, *Chloris myriostachya*, *Tetrapogon mossambicensis*, *Dactyloctenium geminatum*, *Aristida* spp., *Cynodon dactylon* and *Schmidtia bulbosa*.

Elephant herds spend a considerable time in these thornbush thickets and other species such as buffalo, kudu, bushbuck (near rivers), giraffe, impala and warthog follow in their wake. Grey duiker are also very partial to this type of habitat and troops of baboons, banded mongoose and bush babies are a common sight. Of the carnivora leopards and lion particularly seem to favour such environs. *Queleas* utilize these thickets as breeding colonies.

(viii) *Bush-clad rocky outcrops.*

Apart from the mountainous areas already described the smaller rocky outcrops or koppies which form an integral part of the bushveld scene may be regarded as a habitat in its own right, and have a distinctive and peculiar vegetation which applies almost universally. Xerophytic species such as *Adenium obesum* var. *multiflorum*, *Pachypodium saundersii*, *Aloe* spp. and *Myrothamnus flabellifolius* are common. The most striking tree species growing on these koppies are *Ficus soldonella* and *Ficus ingens*, *Ptaeroxylon obliquum*, *Cussonia spicata*, *Combretum woodii*, *Dombeya rotundifolia*, *Erythrina* spp., *Steganotaenia araliacea*, *Kirkia acuminata*, *Olax dissitiflora*, *Schrebera argyrotricha*, and *Galpinia transvaalica*, with *Croton* spp., *Iboza riparia*, *Pavetta edentula*, *Vangueria infausta*, *Vepris reflexa*, *Grewia monticola*, *Ochna pretoriensis*, *Urera tenax* and *Euphorbia tirucalli* prominent in the shrub-stratum. Grasses include *Rhynchelytrum setifolium*, *Aristida* spp., *Andropogon gayanus* var. *squamulatus*, *Digitaria* spp., and *Heteropogon contortus*.

These koppies are the chosen habitats of klipspringer and dassies (in the area north of the Olifants River), the Natal red hare, the Namaqualand rock rat and often also of porcupines. Leopards are of common occurrence and predate on the large troops of baboons which seek the inaccessible rock ledges of many of these koppies to spend the night.

(ix) *Grassland plains and 'dambos'.*

There are no true grassland plains in the Kruger National Park which are comparable with the 'dambos' of Mocambique and the Rhodesias. This is doubly unfortunate, as these 'dambos' and their surrounding fringe of woodland are apparently the habitat of choice of many plains-loving species and here particularly of eland, roan antelope, tsessebe and ostriches.

The headwaters of the water-courses which drain the Babalala-flats as

well as the Tende-flats of the northern district however, form an extensive network of relatively wide, shallow and poorly drained grassy valleys, where trees and shrubs are more or less absent. The most typical example is the Shawu valley, which originates in the Lebombos and drains into the Tsende River. It simulates in most respects the typical 'dambo' or grassland plain of the north and east albeit on a much reduced scale, and is in fact one of the most outstanding tsessebe, roan, eland and wildebeest habitats of the northern district. Both the Hlamalala and Nwashitsumbe valleys are also excellent examples of this type of ecological environment, and portions bordering the banks of the Bubube River are somewhat similar in appearance. The Boye'a and Nkulumbene drainage systems have become somewhat overgrown with a scrub-form of Mlala-palm (*Hyphaene crinita*) but could be regarded also to fall in this category.

Trees are of rare occurrence in these grassland valleys and are primarily specimens of *Acacia xanthophloea*, *Acacia polyacantha* subsp. *campylacantha*, *Lonchocarpus capassa* and *Combretum imberbe*. Tree or scrub-forms of *Hyphaene crinita* are of common occurrence.

The grass covering of these valleys varies from tall, coarse varieties intermingled with sedges towards the lowest levels, where conditions ameliorate to marshiness during the wet season, to shorter and sparsely-scattered associations on the poorly drained alluvial soils towards the edges of the drainage system. Commonly recorded species are *Sporobolus robustus*, *Sporobolus nitens*, *Sporobolus panicoides*, *Sporobolus schlechteri*, *Setaria woodii*, *Ischaemum brachyaterum*, *Bothriochloa glabra*, *Dactyloctenium aegypticum*, *Eragrostis* spp., *Chloris virgata*, *Sorghum versicolor*, *Sorghum verticilliflorum*, *Cynodon dactylon*, *Chloris pycnotrix*, *Dinebra retroflexa*, *Cenchrus ciliaris*, *Themeda triandra* and *Lintonia nutans*, together with *Cyperus* spp., *Vernonia* spp., and *Sesbania* spp.

The taller grass patches along these valleys provide excellent cover for reedbuck, whereas the shorter and more palatable species are well grazed by roan antelope, tsessebe, wildebeest, eland and zebra.

(x) *Mopani climax forest.*

On the well-drained sandy soils between the Shisha and Mphongolo Rivers in the northern district and alluvial soils along the eastern bank of both rivers a true climax forest has developed which retains much of its pristine character. The factors responsible for this phenomenon are complex but the existence of a system of roads and natural barriers have contributed in no small measure to prevent the penetration of devastating veld-fires, which had for many years swept uncontrolled into the Park from the Portuguese territory in the east during the dry season. Fires which did enter the forest belt was checked to a degree by the sparse grass cover which developed in the shade of the closed tree and shrub strata. When conditions were particularly unfavourable i.e. during the peak of the dry season and with a high following

wind fires did in the past wreak havoc amongst the tree population, particularly along the eastern fringes. The dominant species of this substantial deciduous forest i.e. mopani (*Colophospermum mopane*) is also dominant over practically the whole of the northern district. The forest as such may therefore be regarded as one of the true edaphic climax plant communities still to be found in the Park. Associated tree species are collectively very much in the minority and include *Diospyros mespiliformis*, *Spirostachys africana*, *Acacia tortilis*, *Albizia harveyi*, *Lannea kirkii*, and *Sclerocarya birrea* — many fine specimens of which are nevertheless incorporated in the forest. The shrub-stratum is of *Courbonia glauca*, *Thylachium africanum*, *Salvadora angustifolia* var. *australis*, *Euclea divinorum*, *Dalbergia melanoxylon*, *Securinea virosa*, *Combretum mossambicense*, *Grewia* spp., *Capparis tomentosa* and *Maerua parvifolia*. The most prominent grasses are *Panicum maximum*, *Digitaria* spp., *Eragrostis* spp., *Cenchrus ciliaris*, *Sporobolus pyramidalis* and *Chloris myriostachya*.

The mopani climax forest is an important elephant habitat in the north during certain seasons and is in addition also colonized by large numbers of kudu, migratory buffalo herds, several herds of sable antelope, waterbuck (along the banks of the Shisha River), as well as numerous grey duiker, Sharpe's steenbuck and the large forest elephant shrew.

(xi) *The Pretoriuskop long grass savanna woodland and tree savanna.*

A distinctive and important game habitat which has developed on the light-coloured sandy loam soils with a mean annual precipitation of 28 inches in the area along the western boundary of the southern district, extending from the Sabi River to near the confluence of the Nsikazi and Crocodile Rivers. Although it seems clear that this veld-type had always been of a 'sour' nature (vide H. Glynn 1926, Annual reports of the Warden 1903-1913, Cohen 1875), it has undergone considerable changes in aspect and composition over the years and can now be regarded as a typical example of a fire climax community. The encroaching elements are mainly the tall, unpalatable thatch grass, *Hyparrhenia dissoluta* and several shrub species such as *Terminalia sericea*, *Parinari curatellifolia* ssp. *mobola* and *Dichrostachys cinerea* ssp. *nyassana*.

It is evident from early photographs that this habitat has changed progressively from an open tree savanna with sour grassveld of medium height to a more overgrown savanna woodland with tall grass. The factors contributing to this change will be discussed in a subsequent paper and has also been expounded by Van der Schijff (1958, 1959).

The dominant tree species of this veld-type is *Terminalia sericea* with *Dichrostachys cinerea* ssp. *nyassana* as the most important sub-dominant and associated species in *Sclerocarya birrea*, *Strychnos* spp., *Lannea discolor*, *Ziziphus mucronata*, *Combretum gueinzii*, *Peltophorum africanum*, *Parinari curatellifolia* ssp. *mobola*, *Ficus sycomorus*, *Ficus ingens*, *Trichilia roka*, *Syzy-*

gium guineense, *Diospyros mespiliformis*, *Albizia versicolor*, *Ficus capensis*, *Annona senegalensis*, *Antidesma venosum*, *Acacia karroo* and *Acacia sieberiana* var. *woodii*. Common shrubs in the tall grass veld are *Rhus* spp., *Heteropyxis natalensis*, *Lannea edulis*, *Euclea* spp., *Grewia* spp., *Ochna natalitia*, *Flacourtia hirtiuscula*, *Lippia javanica*, *Pavetta* spp., *Xeromphis* spp., *Ximenia* spp., *Ximenia caffra*, *Albizia harveyi*, *Ormocarpum trichocarpum*, *Gymnosporia* spp., *Mundulea sericea*, *Cassia petersiana* and *Dalbergia melanoxylon*. The grass cover is completely dominated by the tall *Hyparrhenia dissoluta*, although *Elyonurus argenteus* is the most abundant species. Associated species of importance are *Hyparrhenia fillipendula*, *Andropogon amplexans*, *Schizachyrium semiberbe*, *Pogonarthria squarrosa*, *Trachypogon capensis*, *Sporobolus pyramidalis*, *Loudetia simplex*, *Loudetia flavida*, *Digitaria* spp., *Eragrostis* spp., *Setaria flabellata*, *Setaria sphacelata*, *Panicum maximum* and *Microchloa caffra* together with several *Bulbostylis* and *Cyperus* spp.

The sourveld of Pretoriuskop and the surrounding country was the traditional habitat of oribi and white rhinoceros (Vaughan-Kirby, 1896), both of which became extinct and have recently been re-introduced in their old home ranges. Eland, tsessebe and ostriches were all prominent members of the animal community together with large herds of wildebeest and zebra, either before or during the early years following the proclamation of the old Sabi game reserve. Eland disappeared during the great rinderpest epidemic of 1897-98 (Yates, 1935), but tsessebe and ostriches survived here in small numbers until fairly recently, during which time the insidious encroachment of the veld by thatch grass and a number of shrub species rendered the habitat unacceptable and hastened their final disappearance. The same period on the other hand heralded a steady rise in the population curve of reedbuck, which are partial to long grass veld, as well as browsing species like giraffe, kudu and impala.

At present it may be said that the Pretoriuskop long grass is the principal reedbuck habitat in the Park and affords sanctuary to many more kudu and impala than at any time within living memory. Since a policy of biennial rotational burning has been implemented in this veld type there has been a slow but steady increase also of zebra and wildebeest populations and the area has also developed into an important sable habitat, harbouring no less than 150 of these noble animals.

Until comparatively recently elephants shunned the long grass veld but wandering bulls often visit the area nowadays during the summer months. Warthog and waterbuck are encountered in satisfactory numbers and the only small herd of roan antelope which still roam about in the southern district periodically enters the area from the east.

(xii) *Mixed Combretum savanna woodland.*

The grey to reddish sandy granitic soils west of the great Karroo sandstone reef and between the Timbavati and Crocodile Rivers is covered by a

mixed *Combretum* savanna woodland which blends imperceptibly in areas with what may be more aptly described as a mixed *Combretum*-*Acacia* tree savanna. For the purpose of this paper the latter may be considered merely as a gradation of the major veld-type, although *Acacia* spp. such as *Acacia delagoensis*, *Acacia swazica*, *Acacia burkei* and *Acacia gerrardii* are rather more abundant in this association.

Combretum spp., including *Combretum apiculatum*, *Combretum suluense*, *Combretum zeyheri*, *Combretum hereroense* and *Combretum imberbe* are the dominant species in the tree and shrub strata of the savanna woodland. *Terminalia sericea*, *Sclerocarya birrea*, *Acacia nigrescens*, *Lonchocarpus capassa*, *Bolusanthus speciosus*, *Terminalia prunioides*, *Lananea discolor*, *Lananea kirkii*, *Commiphora* spp., *Pterocarpus angolensis*, *Acacia gerrardii*, *Dombeya rotundifolia*, *Ziziphus mucronata*, *Albizia harveyi*, and *Peltophorum africanum* also contribute to the arboreal community. The other prominent species in the shrub stratum are *Strychnos innocua* subsp. *dysophylla*, *Xeromphis* spp., *Ehretia* spp., *Pterocarpus rotundifolius*, *Ormocarpum trichocarpum*, *Acacia exuvialis*, *Albizia harveyi*, *Heeria reticulata*, *Euclea divinorum*, *Grewia* spp., *Dalbergia melanoxylon* and *Gymnosporia* spp.

The grazing is predominantly sweet and of excellent quality with the following grass species most obvious: *Digitaria eriantha*, *Setaria flabellata*, *Schmidtia bulbosa*, *Panicum maximum*, *Heteropogon contortus*, *Trichoneura grandiglumis*, *Loudetia simplex*, *Andropogon amplexans*, *Brachiaria serrata*, *Perotis patens*, *Aristida* spp., *Eustachys paspaloides*, *Pogonarthria squarrosa*, *Themeda triandra* and *Eragrostis* spp.

The mixed *Combretum* savanna woodland is the outstanding game habitat, and supports the largest ungulate community of any one area in the Park. That part covering the western half of the Central district particularly includes the home ranges and seasonal grazing grounds of the great migratory herds of wildebeest and zebra, besides large numbers of kudu, giraffe, warthog, impala, waterbuck and steenbuck as well as several large herds of buffalo, sable, a sprinkling of tsessebe and reedbuck and a few wandering herds of elephant. In the Southern district the only substantial herd of roan antelope south of the Sabi River also inhabits this veld-type.

(xiii) *Acacia nigrescens* — *Sclerocarya birrea* tree savanna.

The heavy basaltic soils of the Lebombo flats east of the Karroo sandstone reef and south of the Olifants River are covered by a typical tree savanna intermingled in parts with a more heavily overgrown woodland, particularly in the more broken country bordering the Lebombo foothills. This major game habitat is characterised by its parkland aspect and is heavily grassed.

Acacia nigrescens is the dominant tree in the community with *Sclerocarya birrea* the obvious subdominant. Associated species of note are *Acacia tortilis*, *Lananea kirkii*, *Lonchocarpus capassa*, *Combretum imberbe*, *Phoenix reclinata* and *Acacia xanthophloea* (along the banks of water courses), *Albizia*

harveyi, *Ziziphus mucronata*, *Ficus stuhlmannii*, *Combretum hereroense*, *Balanites maughamii*, *Terminalia prunioides*, *Acacia gerrardii* and *Diospyros mespiliformis*. The shrub stratum giving rise to thickets in parts includes such species as *Pterocarpus rotundifolius*, *Securinea virosa*, *Dichrostachys cinerea*, *Albizia harveyi*, *Commiphora* spp., *Dalbergia melanoxylon*, *Heeria insignis*, *Ximenia caffra* var. *natalensis*, *Grewia* spp., *Euclea divinorum*, *Ehretia amoena*, *Acacia exuvialis*, *Maerua parvifolia*, *Combretum mossambicense* and *Gymnosporia senegalensis*.

The grazing is inherently sweet veld but has become progressively infested by the unpalatable 'stinkgrass', *Bothriochloa insculpta*, which is now dominant over large tracts of this parkland community. This grass is very poorly utilized by most grazing species except zebra and wildebeest and is particularly favoured in its competitive association with other more palatable species — a situation which lends itself to selective grazing and deterioration of the habitat. The *Bothriochloa insculpta* infestation is so far advanced in certain areas of this veld-type that the habitat has been rendered unsuitable for selective grazing species such as tsessebe. They are today practically non-existent in favourite haunts of former years, such as the area immediately surrounding Satara.

Important grazing grasses associated with *Bothriochloa* in the grassveld community are *Digitaria* spp., *Panicum* spp., *Themeda triandra*, *Cenchrus ciliaris*, *Urochloa mossambicensis*, *Eragrostis superba*, *Setaria woodii* and *Heteropogon contortus*.

The vegetation of this habitat may also be regarded as a relatively stable pyrophyllous climax community, but although the grazing is of poor quality over large areas, most of the ungulate species found in the mixed *Combretum* savanna woodland to the west seem to thrive here and it also carries the largest giraffe population in the whole of the Park.

(xiv) *The mopani scrub and tree savanna of the northern Lebombo flats.*

The Lebombo flats north of the Letaba River are covered by a savanna vegetation in which mopani (*Colophospermum mopane*) either in scrub or tree form is the dominant species. In areas where the tree stratum has not yet been drastically lowered, such as that immediately north and south of the Shingwidzi River, the vegetation is perhaps better described as a savanna woodland, but the indications are that these areas have become overgrown in recent years, with fire depredation as the main causative factor.

Excavation studies of the root systems of mopani coppices in the scrub savanna also seem to indicate that the extensive areas covered by scrub mopani on the Tsende and Babalala flats today presented a much more open tree savanna aspect in bygone days, before man-made fires became a destructive factor of importance.

Apart from mopani, other trees are very sparsely scattered in this habitat and the only species of importance are *Combretum imberbe*, *Acacia*

nigrescens, *Acacia tortilis*, *Sclerocarya birrea*, *Lonchocarpus capassa* and *Acacia xanthophloea* (along the poorly drained depressions).

The shrub stratum is richer in variety and includes *Dalbergia melanoxylon*, *Commiphora* spp., *Dichrostachys cinerea*, *Grewia* spp., *Ormocarpum trichocarpum*, *Albizia harveyi*, *Gymnosporia senegalensis*, *Acacia exuvialis*, *Securinea virosa*, *Gossypium herbaceum* var. *africanum*, *Heeria insignis*, *Combretum mossambicense*, *Euclea divinorum*, *Ximenia americana* var. *microphylla*, *Terminalia prunioides*, *Rhigozum zambesiaceum*, *Cissus lonicerifolius* and *Hyphaene crinita* (along the water courses and depressions).

The grass cover of this habitat is very heavy and dense in parts and although it is generally undergrazed, this is not due to the poor quality of the constituent grass species, as these are for the most part palatable and well loved by grazing species. *Panicum coloratum*, *Themeda triandra* and *Cenchrus ciliaris* are dominant species in the grass veld with associated species such as *Digitaria* spp., *Bothriochloa insculpta*, *Urochloa rhodesiensis*, *Heteropogon contortus*, *Schmidtia bulbosa*, *Setaria woodii*, *Eragrostis* spp., *Aristida* spp., *Enneapogon cenchroides*, *Panicum maximum*, *Fingerhuthia africana*, *Cymbopogon excavatus* and *Ischaemum brachyatherum*.

The dominant ungulate species in this habitat is Burchell's zebra but the mopani scrub and tree savanna of the Lebombo flats is also an important subsidiary habitat of eland, roan antelope, tsessebe, wildebeest and sable. Kudu, grey duiker, Sharpe's steenbuck and ostriches are fairly abundant. Steenbuck are particularly well represented and considerable herds of elephant and buffalo move into the flat country during the wet season.

(xv) *The mixed mopani-Combretum veld of the dry north-western zone.*

The vegetation of the relatively poorly-watered western half of the Park north of the Timbavati River is a mixed mopani-combretum veld which is preponderately a rather dense savanna woodland intermingled with patches of a more open tree savanna. *Colophospermum mopane* is the dominant in both the tree and shrub strata, particularly on the heavier loam soils. *Combretum apiculatum* is sub-dominant but often also the most prominent species on the poorer gravelly soils. Other species forming an integral part of the tree community include *Terminalia sericea* (on sandy, well drained soils), *Combretum imberbe*, *Sclerocarya birrea*, *Bolusanthus speciosus*, *Cassia abbreviata* var. *granitica*, *Phyllogeiton discolor*, *Ziziphus mucronata*, *Gardenia spatulifolia*, *Albizia harveyi*, *Spirostachys africana*, *Lannea kirkii*, *Acacia tortilis*, and *Diospyros mespiliformis*. The shrub stratum and thickets are of *Mundulea sericea*, *Heeria insignis*, *Cissus lonicerifolius*, *Strychnos innocua*, *Grewia* spp., *Euclea divinorum*, *Securinea virosa*, *Dichrostachys* spp., and *Albizia harveyi*.

The grass cover is shorter and much less dense than on the adjoining Lebombo flats but of excellent variety and quality. *Digitaria* spp. are dominant with associated species such as *Aristida graciliflora*, *Tricholaena mo-*

nachne, *Bothriochloa insculpta*, *Cymbopogon excavatus*, *Hyparrhenia dissoluta*, *Heteropogon contortus*, *Andropogon amplexans*, *Enneapogon cenchroides*, *Eragrostis rigidior*, *Rhynchelytrum repens*, *Schmidtia bulbosa*, *Pogonarthria squarrosa*, *Panicum maximum*, *Sporobolus* spp., and *Microchloa caffra*.




















Potentially this vast territory is one of the best game habitats in the Park — the only limiting factor being the lack of permanent drinking facilities in the sparsely populated areas away from the perennial rivers. As it is this area constitutes the most important elephant habitat in the whole Park. The triangle between the Tsende and Great Letaba Rivers and the western boundary, an area of some 500 square miles is the permanent habitat of almost half the total elephant population of the Park, and provides adequately in all their ecological needs. It would be safe to maintain that their number may be doubled with ease without their adversely affecting the habitat, if the latter had only been better watered. Apart from elephants the western half of this vegetational zone, particularly, is inhabited by splendid resident herds of sable antelope and eland. Wildebeest and tsessebe are progressing favourably. Kudu, zebra, impala, waterbuck and buffalo are relatively abundant, whereas reedbuck, steenbuck, duiker, Sharpe's steenbuck and warthog occur in gratifying numbers. Even a few small herds of roan antelope have found a safe retreat in this area and were unaffected by the awful anthrax epidemic of 1960, which took such heavy toll of their numbers to the north and east.

SYSTEMATIC LIST OF THE LARGE MAMMALS OF THE KRUGER NATIONAL PARK AND DISCUSSION OF THEIR DISTRIBUTION AND PRESENT-DAY STATUS

The mammals of the Kruger National Park are of tropical affinity and endemic in the East and South African subregion of the primary zoogeographical division known as the Ethiopian region. Roberts (1951) subdivided the East and South African subregion south of the Zambezi and Cunene Rivers into 26 zoogeographically distinct districts. The Kruger National Park lies in, what is designated by him, the Eastern Low Country. The mammals here are largely akin to those of the Eastern Bechuanaland area (absentees being the Gemsbok and Red Hartebeest), being connected therewith through the Limpopo valley. Several species inherently resident in the southern tropical littoral however, have invaded the Park from the east, notably Nyala, Livingstone's Suni and smaller mammals such as the forest elephant shrew (*Petrodromus tetradactylus*), the Mocambique scrub hare (*Lepus capensis aquilo*), and Mocambique golden mole (*Amblysomus (Chrysotricha) obtusirostris limpopoensis*).

South African genera which inhabit the Natal and south-eastern Transvaal midlands have two representatives in the higher-lying south-western area of the Park — the reddish golden mole (*Chlorotalpa* cf. *C. sclateri guillarmodi*) and oribi (*Ourebia oribi*). The Natal or red duiker is typically an inhabitant of the eastern side of the Drakensberg escarpment and eastern Transvaal

LEGEND

-  Pumbe Sandveld
 -  Deciduous Shrub Thickets (Nyandu Bush)
 -  Bush or Forest Clad Mountainous or Rocky Outcrops
 -  Lebombo Mountain Range
 -  Light Montane Forest and Overgrown Valleys
 -  Riparian Forest
 -  Mopani Scrub Savanna of Lebombo Flats
 -  Mopani Tree Savanna of Lebombo Flats
 -  Grassland Plains and Dambo
 -  Mixed Mopani-Combretum Savanna Woodland
 -  Mixed Mopani-Combretum Tree Savanna
 -  Climax Mopani Woodland
 -  Dense Thornbush Thickets
-
-  Mixed Combretum Savanna Woodland
 -  Mixed Combretum-Acacia Tree Savanna
 -  Long Grass Savanna Woodland and Tree Savanna
 -  Dry Deciduous Forest
 -  Acacia nigrescens-Sclerocarya birrea Tree Savanna
 -  Acacia nigrescens-Sclerocarya birrea Savanna Woodland

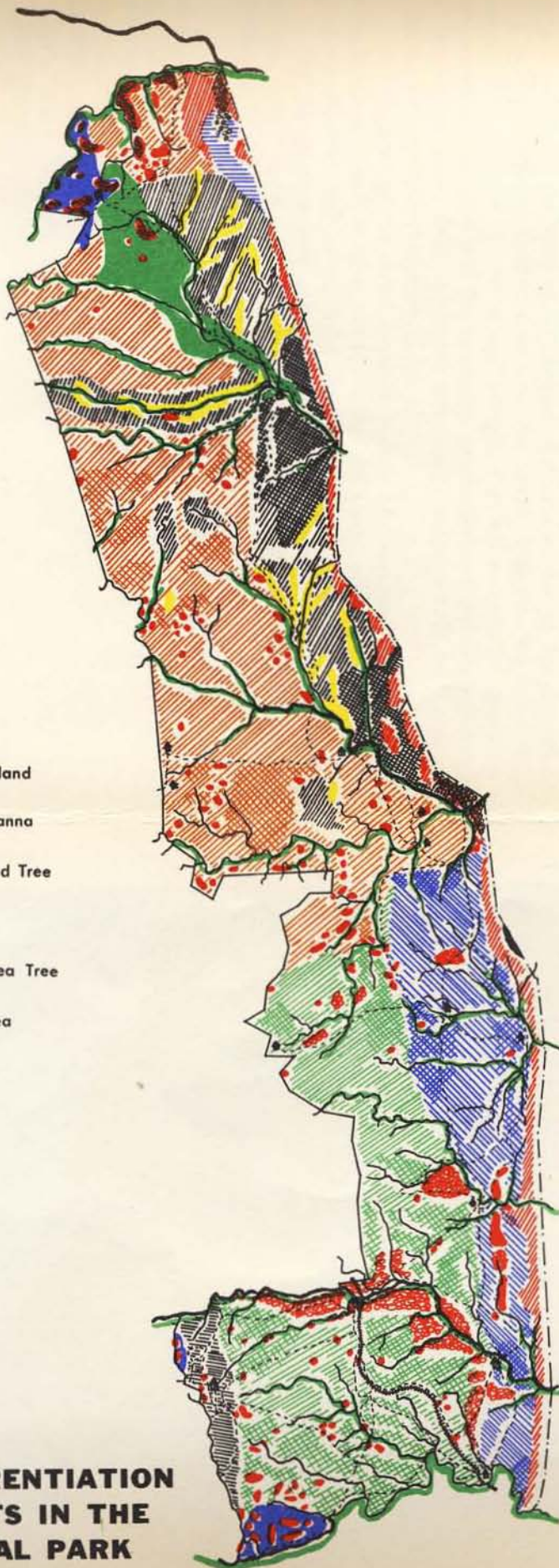


FIG. 1

ECOLOGICAL DIFFERENTIATION OF GAME HABITATS IN THE KRUGER NATIONAL PARK

forested areas but are found in small numbers in the extreme south-western corner of the Park.

For the purpose of this paper only the larger ungulate species and carnivores larger than jackals will be considered. A check-list with distribution data for the small mammals of the Park will form the substance of a subsequent paper.

The distribution data presented below is based on the results of a five-year survey period, and an attempt has been made to provide an indication in the maps of seasonal variation in the habitats of migratory populations. In most instances the limits of distribution of a species during the dry season are indicated by the shaded areas on the maps, whereas the lined areas denote their summer or wet season ranges. For the purpose of elucidating environmental selection and the ecological relationships of mammalian species in the Kruger Park, their respective distribution maps should be correlated with the cartographical scheme in fig. (i).

A discussion of the developmental history of individual animal populations in the Kruger Park does not fall within the scope of this paper and only passing reference will be made to historical data.

The classification and nomenclature adopted in the systematic list which follows is with some exception that of Ellerman, Hayman and Morrison-Scott (1953).

SYSTEMATIC LIST

CLASS — MAMMALIA.

SUB-CLASS — THERIA.

INFRA-CLASS — EUTHERIA (PLACENTALIA).

SUPER-ORDER — FERAE.

ORDER — CARNIVORA.

SUB-ORDER — FISSIPEDIA.

SUPER-FAMILY — CANOIDEA.

Family — CANIDAE.

Canis mesomelas mesomelas Schreber.
Saddle-backed Jackal.

Distributed throughout the Park (fig. (ii)) but only in parts of the central district may they be described as of common occurrence. As is the case with wild dogs this species seem to be susceptible to parasitic epizootics of a Rickettsial nature which have caused sharp declines in the growth curve of the population. In the southern and northern districts they are decidedly rare today, and there is at present probably less than 500 of these carnivores in the Park as a whole.

Diet: Carrion, small mammals such as hares, squirrels, mice and rats, the young and eggs of ground-nesting birds, small reptiles such as lizards and tortoises, and insects such as termites and locusts. They have been

seen to eat young grass shoots like domestic dogs and where the opportunity presents itself will predate on the newly-born young of the smaller antelope species.

Breeding : Pups (1-2 months old) have been recorded during October and others have been seen during July-August.

Canis adustus adustus Sundevall.

Side-striped Jackal.

Distributed throughout the Park but nowhere common. (Fig. (iii)). They may be met with singly or in pairs in open country or woodlands but seem to avoid forests.

Diet : Not entirely carnivorous, and in addition to locusts and other insects will eat certain wild fruits. They probably only rarely attack any mammal of larger size than a hare.

Breeding : No records to date but Ansell (1960) mentions that pups have been found during the period September-November.

Latest estimation of numbers : Probably not more than 300 in the Park as a whole.

Lycaon pictus pictus Temminck.

Wild dog or Cape hunting dog.

Gregarious carnivores which roam in packs of variable size over extensive areas of the Park (Fig. iv), with the focal point of population density in the mountainous areas of the southern district and the western half of the northern district. The wild dog population of the Park has suffered notable fluctuation in numbers primarily due to Rickettsial epizootics, which all but wiped them out in the Low Country during the period 1927-1933. (Stevenson-Hamilton, 1939).

Diet : Exclusively carnivorous, killing medium to fairly large ungulates. Impala are first on the list of prey species in the Park.

Breeding : Pups (2-8 in a litter) have been recorded from March to September with a peak period during late fall and winter. The same breeding sites, particularly in the mountainous areas, are often resorted to during the whelping season.

Latest estimation of numbers : 150-160 in the northern district, 65-80 in the central district and 100-120 in the southern district.

SUPER-FAMILY — FELOIDEA.

Family — HYAENIDAE.

Crocuta crocuta Erxleben.

Spotted Hyaena.

Solitary or semi-gregarious nocturnal scavengers which are generally distributed throughout the Park (Fig. v). In the southern, and particularly the

central districts, they are very common and often a nuisance around the rest camps. During recent years they have taken to begging along the road sides. In the northern district they are much less common and their numbers were at one time seriously decimated by a mysterious disease during the 1950's. Hyaeas south of the Olifants River suffered a similar fate during the period 1912-1930. (Stevenson-Hamilton, 1939).

Diet: Mainly carrion, being a frequent scavenger at lion kills. On occasion they may however kill their own prey — often disabled or sick animals, and usually not larger in size than kudu.

Breeding: Most young are reared during the winter months when food supplies are more abundant, but pups (2-4 in a litter) have been recorded throughout the year so that they probably do not have a definite breeding season.

Latest estimation of numbers: Several thousand.

Hyaena brunnea Thunberg.

Brown hyaena.

These interesting animals are rare in the southern and central districts of the Park but are found in appreciable numbers north of the Letaba River, especially in the area along the western boundary. (Fig. vi).

Diet: They will feed on carrion but the hunting instinct is more strongly developed in these beasts than in their spotted kin, and they will often attack and kill even large antelopes such as kudu and waterbuck. Alleged to raid the lairs of lion and carry off the young cubs. The undigested nails of young lions have been found in their droppings.

Breeding: No records to date. According to Stevenson-Hamilton (1947) 2-4 pups are born in a litter.

Latest estimation of numbers: Less than 200 in the Park as a whole.

Family — FELIDAE.

Acinonyx jubatus jubatus Schreber.

Cheetah.

These sleek and graceful hunters were never abundant in the Lowveld country within historical times, and control measures that have been applied in the past were completely unjustified — a practice which has been discontinued since 1958. These animals are today decidedly rare in the Kruger National Park, and although their present distribution covers the whole area it is only in certain parts of the southern section where they may still be found in reasonable numbers, either singly, in pairs or family groups. (Fig. vii).

Diet: Carnivorous. Mainly preys on medium and small antelopes (particularly impala, which is the most abundant prey species), smaller mammals and the young of larger species. Are known to kill also ostriches and certain game-bird species.

Breeding : 2-5 Cubs are born in a litter usually during fall and the winter months.

Latest estimation of numbers : Southern district 81. Central district 93. Northern district 45. Total 219.

Panthera pardus Linnaeus.

Leopard.

Leopards are common in the Park and widely distributed, (Fig. viii), but in view of their timid nature and nocturnal habits they are not very often seen, a fact which also complicates the estimation of their numbers. They may be encountered in all types of country, including montane areas and are usually seen singly or in pairs.

Diet : Carnivorous but may on occasion feed on carrion. Small to medium-sized antelope are killed (impala, bushbuck and steenbuck being important prey species), along with the young of larger antelope, small mammals such as cane rats, hares, rock hyrax, aardvark and porcupines and ground-nesting birds.

Breeding : Apparently no fixed breeding season and litter size usually varies from 2-3. Most breeding records have been obtained during the winter months and fall.

Latest estimation of numbers : 650 (probably more) in the Park as a whole.

Panthera (Leo) leo krugeri Roberts.

Lion.

Irrespective of whether control measures to limit their numbers had been severe or relaxed, the population curve of lion in the Kruger Park fluctuated primarily as a result of favourable or adverse hunting conditions. During periods of prolonged drought such as from 1926-1935, 1944-1948 and 1950-1954 when large concentrations of game around the available watering points created conditions which favoured the predator species, the lion population increased rapidly. Conversely, during a series of successive very wet years which caused a dispersal of prey, the lion population suffered and there was a sharp decline in their numbers, such as during 1936-1943. It is significant that during 1938 and 1939 more lions had to be destroyed because of man-eating tendencies than the total number during the whole of the preceding and subsequent period, and the mortality rate amongst young cubs was particularly high. In general, however, it is quite clear that apart from these periodic fluctuations the growth curve of the lion population exhibit a steady incline over the years which simulates that of their prey species; so that there are at present more lions in the Kruger Park than at any stage within historical times. The large numbers of lion in the Park is however no cause for concern as it is evident that their prey populations retain that advanced level in relative abundance which is true of all natural communities.

The realization of this basic ecological truth has brought about the end of lion control on an organized scale — a practice which, viewed in the light of the results achieved, must be regarded with considerable misgiving.

Lions are at present to be found throughout the Park (Fig. ix), ranging from the extreme north-east at Pafuri (where their absence for about a decade since 1950 was one of the principal factors contributing to the population outburst of prey-species and the overstocked conditions which exist today) to the Crocodile River in the south, with focal points of population density in the Tshokwane area and the Sabi- and Timbavati River belts.

Diets : Carnivorous. Medium to large mammals are preyed upon with wildebeest, impala, zebra, waterbuck, kudu, giraffe and buffalo (in order of preference) featuring most prominently in kills. Records of hippopotami and young elephants being attacked by lions are rare in the Kruger Park, but crocodiles have been reported killed by these powerful beasts of prey.

Breeding : Cubs (2-5 per litter) may be born at any time of the year although the majority seem again to be reared during the dry season.

Latest estimation of numbers : 200 Inhabiting the southern district, 488 in the central and 347 in the northern districts respectively. Total 1035.

SUPER-ORDER — PAENUNGULATA.

ORDER — PROBOSCIDEA.

Family — ELEPHANTIDAE.

Loxodonta africana africana Blumenbach.

African Elephant.

At the turn of the 19th century only about a score of elephants had escaped the guns of ivory hunters in the Eastern Transvaal Lowveld and their presence in the remote and secluded forested area near the Olifants Gorge was only discovered in 1905. In 1912 their numbers were estimated at 25, but so well did this original nucleus herd react to the absolute sanctuary afforded them, that they more than doubled that number by 1936. Considerable immigration by elephants from the adjoining Portuguese territory increased the elephant population to about 100 in 1926 and to 250 in 1936. By this time there had already occurred since 1931 a recolonization of the northern mopani-veld, a process which was to be re-enacted in a southerly direction during 1939-41. Both movements were preceded in characteristic fashion by the extensive scouting patrols of a few old bulls. By the end of 1941 elephants had crossed the Sabi River for the first time in almost a hundred years and during the summer of 1952, two elephant bulls had also re-entered the last area in the Park (the long grass veld around Pretoriuskop) as yet without a wandering or established elephant population.

The official estimate of elephant numbers in 1958 was 995, which was an underestimation as was proved by subsequent aerial surveys.

At present there is no area in the Park not inhabited by resident or migratory elephant herds, although the population in the southern district is relatively small and augmented annually by an influx from the central district during the dry season. (Fig. x). The northern mopani veld is still the principal habitat of elephants in the Park and here the area between the Tsende and Great Letaba Rivers and the western boundary affords permanent sanctuary to almost half the total number of elephants in the Park!

Feeding habits : Rough in habit of grazing, browsing, peeling of bark and digging of roots, but delicate when picking pods and wild fruits.

Breeding : Single calves are born at any time of the year. Twins are rare. Cows become sexually mature at 12-13 years of age. Calves are normally dropped every fourth year (gestation period 22 months) during the sexually active life of the cow.

Latest estimation of numbers : 1750 (1601 were counted during an aerial survey in April 1962) of which 1266 were counted in the area north of the Olifants River.

SUPER-ORDER — MESAXONIA.

ORDER — PERISSODACTYLA.

SUB-ORDER — CERATOMORPHA

SUPER-FAMILY — RHINOCEROTOIDEA.

Family — RHINOCEROTIDAE.

Diceros bicornis bicornis Linnaeus.

Black Rhinoceros.

The only large mammalian species which became extinct in the Eastern Transvaal Lowveld during historical times, not at present represented in the fauna of the Kruger National Park. The last living specimen was seen by ex-ranger Kirkman along the Nwatiwambo spruit in the famous Nwatifhiri bush east of Skukuza during October 1936. Formerly these great beasts roamed throughout the whole of the Low country east of the Drakensberg escarpment and according to Vaughan-Kirby (1896) were particularly abundant in the Nwatifhiri bush, the Gomondwane thickets, along the Timbavati river and the Nyandu bush on the eastern boundary north of Shingwidzi. The indiscriminate slaughter and persecution by hunters during the latter half of the 19th century reduced their numbers to the brink of extinction. Three were reported soon after the proclamation of the Shingwidzi Reserve in 1903 along the headwaters of the Tsende River and during the 1920's solitary specimens were seen on the Lebombo south-east of Tshokwane and along the Bubube

River in the north. These were the last of the few however, and even the last survivors in the Nwamihiri bush had disappeared forever by 1945.

An attempt will be made to re-introduce sufficient numbers of these animals during the next few years to build up a breeding population within their selected habitats in the Kruger National Park.

Diceros (Ceratotherium) simus simus Burchell.

Square-lipped or White Rhinoceros.

The square-lipped rhinoceros was at one time an inhabitant of the present Kruger National Park, although there is no evidence that it ever occurred in the area north of the Sabi River.

It had been exterminated many years before the proclamation of the old Sabi Game Reserve in 1898 by native, half-caste and other hunters from the east coast. According to Glynn (1926) a few remained near Lower Sabi until the later 'seventies'. Stevenson-Hamilton (1947) thought it possible that the earliest white hunters and pioneers may have encountered it in these regions; but it certainly did not exist after the seventies of the last century. Their habitat of choice seems to have been the higher lying regions around Nelspruit, White River and Pretoriuskop and possibly also the open country of the Lebombo Flats south of the Sabi.

Having been extinct for 80 years or more, it was therefore an achievement of considerable merit of the National Parks Board of Trustees in translocating 4 fully mature square-lipped rhinoceros, with the aid of officials of the Natal Park's Board from the Umfolozi reserve in Natal, to a specially constructed enclosure along the Faai spruit near Pretoriuskop, during October 1961. These newcomers have settled down amicably in their new habitat and will form the nucleus of a breeding herd in one of their favourite haunts of old. (Vide fig. xi). Two more were added to their number during 1962, so that there are now 4 cows and 2 bulls in the Kruger Park. More are to follow during the coming year not only to augment the Pretoriuskop population but also to establish a breeding herd in some other suitable area in the southern district.

Feeding habits: Grazing although a few herbaceous species are browsed upon.

Breeding: According to Player and Feely (1960) a single calf is born after an eighteen months gestation period. There is no fixed breeding season although females in oestrus are most frequently encountered during the period July to September. Calves are born at three-yearly intervals. The young calf begins to graze when only about a week old but suckles for at least a year. One case of twins has been recorded.

Latest estimation of numbers: 6 Adults. One female may be pregnant.

SUB-ORDER — HIPPOMORPHA.

SUPER-FAMILY — EQUOIDEA.

Family — EQUIDAE.

Equus (Hippotigris) burchelli antiquorum H. Smith.

Burchell's Zebra.

One of the most common grazing species in the Park with great migratory herds inhabiting the central district (particularly the western mixed *Combretum* veld) as well as the whole length of the Lebombo flats. Substantial herds may be encountered however, in the majority of the other habitats, these animals being of catholic taste in their grazing habits and highly adaptable to changing environmental conditions. (Vide fig. xii).

Feeding habits: Grazing close and able to subsist in areas with poor or coarse grass cover. Some browsing and digging of corms and rhizomes particularly during dry periods.

Breeding: Foaling occurs mainly during the period September-February, with a peak in November-February. Occasional foals are dropped during the intervening period however.

Latest estimation of numbers: 12,500-13,000 of which 9,000 inhabit the central district and 1,000 the area south of the Sabi River.

SUPER-ORDER — PARAXONIA.

ORDER — ARTIODACTYLA.

SUB-ORDER — SUIFORMES.

Family — SUIDAE.

Potamochoerus porcus mashona Lönnberg.

Bush Pig.

Of limited distribution in the Kruger Park, inhabiting the broken country along the southern border of the Levubu river, the *Androstachys* forests of the Olifants Gorge area and some mountainous isolates in the southern district. (Fig. xiii). Secretive by nature and seldom seen abroad by day.

Feeding habits: Shallow digging and browsing in valley and plateau woodlands.

Breeding: No records to date in the Kruger Park. Ansell (1960) sets the farrowing season as from October to March, during the rains in Northern Rhodesia. Litters are usually 3-4 but may be as many as 6.

Latest estimation of numbers: Several hundred. May be more or less, population data being exceedingly difficult to obtain.

Phacochoerus aethiopicus Pallas.

Warthog.

Warthogs are very numerous in certain areas of the central and southern districts but of more limited distribution and number in the northern district,

although nowhere scarce. (Fig. xiv). Although warthogs are essentially water-loving animals and very partial to regular mud-baths, it is remarkable how well they are able to survive severe drought conditions. They are often encountered considerable distances away from permanent water during the dry season and subsist entirely on the juicy rhizomes, corms and grass roots which they dig.

Feeding habits : Shallow digging and close grazing.

Breeding : Farrowing is from November to December but occasional litters (2-6) are dropped during January to April.

Latest estimation of numbers : 3,500 (probably more) of which at least 2,000 inhabit the central district.

Family — HIPPOPOTAMIDAE.

Hippopotamus amphibius Linnaeus.

Hippopotamus.

All the perennial rivers of the Kruger Park and many permanent pools and dams in the seasonal rivers are inhabited by hippopotami, and they are today one of the most firmly established and thriving ungulate communities in the whole area. (Vide fig. xv). During the wet season wandering hippopotami are often encountered many miles from the nearest permanent water and great distances are covered by these animals during their lonely sojourns.

Feeding habits : Very close grazing and a little browsing.

Breeding : Calves are born singly (very rarely twins) at any time of the year.

Latest estimation of numbers : 3,200 (1,567 Olifants River; 643 Letaba River; 417 Sabi River; 364 Crocodile River; 150 Levubu River; seasonal rivers and dams 40).

SUB-ORDER — RUMINANTIA.

Family — GIRAFFIDAE.

Giraffa camelopardalis wardi Lydekker.

Giraffe.

At the time of proclamation of the old Sabi and Shingwidzi Reserves the position of the giraffe population in the Lowveld was critical. Not more than 15 survived in the Sabi Reserve and north of the Olifants River their number was even more deplorable.

Absolute protection in the Reserves however, soon paid handsome dividends, in the area south of the Olifants River particularly. In 1911 they were frequently encountered along the Timbavati and Olifants Rivers and the number south of the Sabi had increased to about 30 or 40. By 1912 giraffe had already recolonized the area along the present western boundary between the Olifants and Nwaswitsontso Rivers. In 1918 the number in the Sabi Reserve were estimated at 150 and in 1938 the Warden considered the whole Park to contain some 200 of these animals. The annual reports of the

Warden since that period make general mention of a rapid progress and population growth.

The area between the Olifants and Sabi Rivers had always been the centre of population density, and radiation and population dissemination occurred from here. The Pretoriuskop long grass veld was first re-entered by giraffe in 1933. By this time the Olifants River had also been crossed and in 1953 the Letaba River was also forded for the first time from the south.

The group along the eastern boundary north of the Shingwidzi River which had always been there, seemed to have been overlooked or forgotten for a considerable period, but in 1925 it was reported that they were also slowly increasing in numbers.

The present distribution of giraffe in the Kruger Park is depicted in fig. xvi. It is obvious that the central district is still the dominant giraffe habitat in the Park. A limiting factor which stifles population growth north of the Olifants River is the relative scarcity of fodder trees (particularly *Acacia* spp.) in this area.

Feeding habits: Delicate high browsing. Have on occasion been recorded to take grass (*Bothriochloa insculpta*).

Breeding: Calves are born singly at any time throughout the year with a peak period during September-October and again in February-April. Twins have been recorded.

Latest estimation of numbers: 2,850 (2,200 in the central district and 400 in the southern district).

Family — BOVIDAE.

Cephalophus natalensis amoenus Wroughton.

Natal or Red duiker.

The status of these tiny buck in the Kruger National Park is doubtful at present. A large portion of their chosen habitat (forest-clad mountain slopes and ravines) in the Boulders block was excised from the Park by the western boundary fence in 1960, west of the Nsikazi-Crocodile River junction. There are still a few in the densely wooded kloofs of Numbi hill but their numbers will have to be augmented to ensure survival in this area. (Vide fig. xvii).

Feeding habits: Delicate low browsing in thickly wooded areas.

Breeding: No records in the Park. Lambing season October-November (Asdell, 1946).

Latest estimation of numbers: Doubtful.

Sylvicapra grimmia caffra Fitzinger.

Common or grey duiker.

Generally distributed throughout the Park but relatively more abundant in the Punda Milia sandveld, the Nyandu bush, the western boundary area of Tshokwane section, the Pretoriuskop area and the Sabi River belt. (Fig. xviii).

Feeding habits : Delicate browsing and grazing, and scavenging round human habitations.

Breeding : Young lambs have been recorded during March, April and June but there is probably no definite breeding season.

Latest estimation of numbers : Several hundred. May even be a thousand and more.

Raphicerus campestris zuluensis Roberts.

Steenbuck.

A common species in the Kruger Park and widely distributed over most of the flat country. More abundant in the savanna woodlands and tree savannas but is frequently encountered even in the densely wooded Nyandu bush. (Fig. xix). Steenbuck were exceedingly numerous before 1914. After 1920, for a good many years they were hardly seen at all, and only increased again in numbers during the 1930's. (Stevenson-Hamilton, 1939).

Feeding habits : Delicate browsing and a little grazing. Independent of surface water.

Breeding : Young lambs have been recorded from April-June and also in October and January.

Latest estimation of numbers : Several thousand.

Raphicerus sharpei colonicus Thomas and Schwann.

Sharpe's or Tropical Grysbok.

Fairly common and widespread in the mopani and mixed mopani-*Combretum* veld. Also inhabits the whole of the Lebombo range between the Olifants and Sabi Rivers but has not yet been recorded south of the latter river. (Fig. xx).

Feeding habits : Delicate low browsing and some grazing.

Breeding : A lamb of some two months old was encountered during September. Lambing season probably extends from July to October (Ansell, 1960).

Latest estimation of numbers : Several hundred of which some 150 inhabit the selected habitats in the central district.

Nesotragus moschatus zuluensis Thomas.

Livingstone's Suni.

A typical inhabitant of the southern tropical littoral, the distributional range of which is strictly confined in the Park, to the thickly wooded Nyandu bush on the eastern boundary north of the Shingwidzi River. (Fig. xxi).

Feeding habits : Delicate browsing and some grazing.

Breeding : No local records. Lambing season from November-December in Central Africa (Asdell, 1946).

Latest estimation of numbers : Doubtful. Spoor, droppings and other signs indicating their presence are commonly found in the Nyandu bush but in view of their nocturnal grazing habits these tiny and secretive animals are rarely seen. An adult female was observed during the late afternoon in August, 1962.

Ourebia ourebi Zimmerman.

Oribi.

This species became extinct locally in 1943 when the last individual was seen near Ship Mountain, north east of Pretoriuskop. A few of these timid little buck survived in the Pretoriuskop area until the late 1930's. A single specimen was seen by the Warden on the Lebombo flats near Mlondozi in September, 1925. According to Stevenson-Hamilton (1929) they were never common in the Low country and appeared here by force of circumstances rather than as willing visitors. This may well be true as it was found to our dismay that a group of 29 which were captured in the Badplaas district during July and August, 1962, and released in a special enclosure near Pretoriuskop, adapted themselves very poorly to their new habitat, and within three months more than half their number had died — in most instances for no apparent reason. (Fig. xxii).

Feeding habits : Delicate grazing and browsing in open anthill country.

Breeding : Lambs are dropped from September-November.

Latest estimation of numbers : 10.

Oreotragus oreotragus transvaalensis Roberts.

Klipspringer.

Widespread and relatively abundant in their chosen rocky habitats throughout the Park. (Fig. xxiii).

Feeding habits : Browsing and a little grazing in their specialised habitats.

Breeding : Lambs have been recorded in November and December.

Latest estimation of numbers : Several hundred.

Redunca arundinum arundinum Boddaert.

Reedbuck.

A species with specialised habitat requirements but widely distributed throughout the Park where environmental conditions are favourable. They are particularly common in the long grass veld of Pretoriuskop section, the grassland plains and dambo-like depressions of the northern Lebombo flats and the Mlondozi headwaters of the central district. (Fig. xxiv). The growth curve of the Pretoriuskop population indicates considerable irregular fluctuations over the years, often associated with periods of prolonged drought and series of wet years, but has shown a progressive inclining trend during the past decade. (Stevenson-Hamilton, 1939).

Feeding habits : Grazing and a little browsing. Very partial to burnt veld.

Breeding : Lambs have been recorded during March, July, November and December and there is probably no definite breeding season.

Latest estimation of numbers : 850-900 of which 350-400 south of the Sabi River and some 200 in the central district.

Redunca fulvorufula fulvorufula Afzelius.

Mountain Reedbuck.

At one time a rare species in the Park, being limited by strict environmental selection, but has exhibited steady progress during recent times in their chosen habitats. At present fair numbers inhabit the mountainous area west of Malelane, Ship Mountain, Stungwane and Sithlabe hills in Pretoriuskop section, as well as the Lebombo ridge between the 24°30' and 25°15' latitudes. (Fig. xxv).

Feeding habits : Grazing on mountain slopes and valleys.

Breeding : The lambing season probably extends from September to February.

Latest estimation of numbers : 180-200 of which some 50 occur north of the Sabi River.

Kobus ellipsiprymnus Ogilby.

Waterbuck.

A gregarious species steadily increasing in numbers and widely distributed in woodlands near permanent water throughout the Park. Very partial to rupicolous surroundings. The population south of the Sabi River had been more or less stagnant for years, but satisfactory reports have been received of late of flourishing herds, particularly in the Crocodile Bridge section. Centres of heaviest population density are the lower reaches of the Orami Spruit, the Mlondozi area of Tshokwane section, Nwaswitsontso River, Nwanetzi catchment area, Timbavati river, the broken country along the Olifants River as well as the whole length of the Shisha-, Mphongolo-, Pukwane- and Shingwidzi Rivers in the northern district. (Fig. xxvi).

Feeding habits : Grazing and a little browsing. Certain species of coarse grasses are relished.

Breeding : With the exception of the winter months calves are born throughout the year, with peaks during October and from February to March.

Latest estimation of numbers : 3,000-3,500. Of these some 400 occur south of the Sabi River and 1,500-1,600 in the central district.

Aepyceros melampus melampus Lichtenstein.

Impala.

The most abundant ungulate species in the Park which may at present be encountered in herds of varying size anywhere in the southern and central districts during the summer months. It is however, only recently that

the Pretoriuskop long grass veld and the mixed mopani-*Combretum* veld north of the Timbavati River have been colonised by these antelope. During the dry season they do not venture far from permanent water and although they do not exhibit very specialised habitat preferences, they are very partial to riparian forests and thornbush thickets near water. In the northern district there are still large tracts of country where impala are never found, mainly because of a lack of permanent water or other deficiency of the habitat. They seem to avoid particularly the more open portions of the Tsende and Babalala flats. (Fig. xxvii).

Feeding habits : Browsing and grazing.

Breeding season : A sharply defined lambing season from the first week of November to the end of December. Early lambs are sometimes born in October and others arrive in January and February and even as late as April during particularly dry summer seasons.

Latest estimation of numbers : 180,000 (possibly more) with 60,000 in the southern district, 85,000 in the central and 35,000 in the northern district respectively.

Hippotragus equinus equinus Desmarest.

Roan Antelope.

The only large ungulate species of which the population growth curve has remained relatively stagnant through the years, and which has not yet reacted favourably to the stringent protection afforded them. The factors responsible for the present unsatisfactory status of these animals are complex, but largely centred in the fact that the habitat range which really suits their ecological requirements is strictly limited in the Park, and has deteriorated considerably through the years. The roan antelope is a plains-loving ungulate, frequenting also the woodland-fringes of such open grassland plains and dambos which they choose as their home ranges. They are highly selective feeders and can not compete in the same area with species with less fastidious or more adaptable grazing habits. It is also particularly susceptible to epizootic diseases such as anthrax. (Pienaar, 1960 and '61).

The survival of the species in the Kruger Park is at present a matter of some concern and pending the results of an intensive investigation of their bio-ecology, which is well under way, certain provisional measures have been applied in an attempt to annul some of the limiting factors stifling their progress.

The bulk of the roan population in the Kruger Park today inhabit the grassland plains and more open parts of the mopani and mixed mopani-*Combretum* woodland and tree savannas north of the Olifants River.

Three isolated herds have also survived in the Batavia and Munweni areas of the central district and around the headwaters of the Mbyamiti and Mtsawu Rivers in the southern district. (Vide Fig. xxviii).

Feeding habits : Selective grazing and some browsing.

Breeding : Reproduction data accumulated to date are inconclusive but seem to indicate that calving takes place during the dry season (May-October).

Most recent estimation of numbers : 200-220 in the northern district, 31 in the central district and 35 south of the Sabi River. Total 266-286.

Hippotragus niger niger Harris.

Sable Antelope.

The sable is one of the antelope species most susceptible to drought conditions and suffer severely during prolonged dry periods. Before the great drought of 1926-'35 sable antelope were of common occurrence in the area west of the Skukuza-Malelane main road and substantial herds frequented the Lwakahle and Randspruit sections. By the end of 1935 they had disappeared completely from this area which was so severely trampled out that there was hardly a blade of grass left (Stevenson-Hamilton, 1939). It is only very recently that there have been conclusive signs that these noble beasts are again attempting to recolonise this old favourite haunt of theirs. Elsewhere in the Park the sable antelope population also suffered heavy losses during the droughts of 1926-'35, 1944-'48 and 1950-'54, giving rise to a decidedly undulating population growth curve. Following a series of favourable years and sound conservation policies however, the sable population in sharp contrast to the roan antelope, is at present experiencing an unprecedented golden age — a state which is reflected by the large numbers of calves which reach maturity in all breeding herds.

The mixed *Combretum* veld and long grass veld of the western half of the Park carry the largest number of sable but the more open woodlands and tree savannas of the eastern zone are also inhabited by large growing herds. Even the relatively dense perimeter of the Nyandu bush has its own resident herds of sable. (Fig. xxix). The southern limit of their distributional range within the Lowveld during historical times was the Komati River. (Fernandes das Neves, 1879).

Feeding habits : Grazing and some browsing.

Breeding : A well-defined calving period extending from late January to the middle of March.

Most recent estimation of numbers : South of the Sabi River 180-200. Central district 340-360. North of the Olifants River 560-580. Total 1,080-1,140.

Damaliscus lunatus lunatus Burchell.

Tsessebe.

Tsessebe were still of common occurrence in the Pretoriuskop area and on the Lebombo flats south of Sabi River during the 'eighties' of the previous century. (Glynn, 1926; Vos, 1890). Their numbers were however so seriously decimated by hunters that the few small herds remaining in the area south

of the Sabi between Paben and Mtsawu and in the Randspruit zone, could not maintain themselves and the last survivors were seen during 1937.

In the central district the progressive infestation of a favourite habitat by the unpalatable grass, *Bothriochloa insculpta*, had a detrimental effect on the local tsessebe population, eventually causing their evacuation from this area and a south-easterly migration to the Mlondozi area where substantial herds are found today in a more favourable habitat. A few scattered herds also remain in the mixed *Combretum* savanna woodland which covers the western half of the central district.

The bulk of the tsessebe population of the Kruger Park is located north of the Letaba River however, and local herds are progressing favourably in both the eastern and western zones. (Fig. xxx).

Feeding habits : Selective grazing and very little browsing.

Breeding : The calving season starts during mid-September and extends to the first or second week in November.

Most recent estimation of numbers : Central district 100-120, north of the Letaba River 500-550. Total 600-670.

Connochaetes (Gorgon) taurinus taurinus Burchell.

Blue Wildebeest.

Apart from impala, blue wildebeest is at present the most common and prolific ungulate species in the Kruger National Park. Their rapid increase in numbers in certain parts of the central district has already caused considerable trampling out and overgrazing of the habitat, particularly in the area adjoining the western boundary after completion of the game fence, and various methods are being considered to effect a mass translocation of excessive animals to understocked areas north of the Olifants River.

The central district supports the vast bulk of the wildebeest population, which includes great migratory herds in the western as well as eastern zones, all of which exhibit well defined and rythmical seasonal movements, concentrations and dissemination.

The long grass veld of Pretoriuskop area was an important wildebeest habitat south of the Sabi River but the progressive encroachment of tall thatch grass, *Hyparrhenia dissoluta*, rendered the area unsuitable and large numbers were lost from this area. A policy of biennial rotational burning which had been implemented during recent years has improved conditions in this habitat and the local wildebeest population has reacted favourably. Considerable numbers inhabit the southern Lebombo flats and smaller herds are scattered through the remainder of the district.

The northern mopani veld never carried a large wildebeest population, but recent indications are that the resident herds here are also slowly increasing in numbers. (Fig. xxxi).

Feeding habits : Primarily grazing with very little browsing. Very partial to burnt veld.

Breeding: The calving season extends from the last week of November to the end of January. During drought periods particularly, young calves have been recorded also during the months February-May. Single young per birth, perhaps rarely twins.

Most recent estimation of numbers: 14,500-14,600 of which about 13,000 inhabit the central district, and some 600 are found north of the Olifants River.

Tragelaphus scriptus sylvaticus Sparrman.

Bushbuck.

An inhabitant of riparian and the light montane forests and overgrown valleys in the Kruger National Park. Usually solitary, but may be in two's and three's, or even small family groups. They are not particularly common anywhere and are not often seen, in view of their timid disposition and the overgrown nature of their chosen environments. Bushbuck are most often encountered along the Sabi and Levubu riverine forests, the mountainous area around Punda Milia and west of Malelane, and in the long grass veld around Pretoriuskop. (Fig. xxxii).

Feeding habits: Primarily browsing and some grazing.

Breeding: Young lambs have been recorded during July, October and November and Stevenson-Hamilton (1947) sets the breeding season as from October to February for this species.

Most recent estimation of numbers: 700-800. May be appreciably higher.

Tragelaphus (Nyala) angasi Gray.

Nyala.

Primarily an inhabitant of the southern tropical littoral and its presence within the boundaries of the Kruger National Park only became known in 1929, when a small troop was discovered in the gallery forest along the Levubu River at Pafuri. So well has the species adapted itself to local conditions however, that it has in the relatively short span of 30 years colonised the whole of the Levubu riparian forest, the montane forests and valleys around Punda Milia and on Dzundwene hill and the Nyandu bush. The riparian forests along the Shingwidzi-, Mphongolo- and Great Letaba Rivers have also been infiltrated and today boast with substantial populations. The *Androstachys* forests north and immediately south of the Olifants Gorge have also become a favourite habitat of these beautiful creatures and they are regularly encountered along the lower reaches of the Bangu spruit. (Fig. xxxiii).

Feeding habits: Delicate browsing in shaded environs and some grazing.

Breeding: The lambing season extends from July to November with a peak during August-October. Young lambs have been recorded at Pafuri during April and May.

Latest estimation of numbers : 600-650 (possibly more), of which some 50 occur south of the Olifants River in the Gorge area.

Tragelaphus strepsiceros strepsiceros Pallas.

Kudu.

A ubiquitous and adaptable ungulate species with no specialised habitat preferences, and widely distributed throughout the Park. (Fig. xxxiv). In certain areas it is exceedingly common — to a degree of becoming the dominant member of the local ungulate communities. Kudu are able to survive prolonged periods without water, and are often encountered considerable distances from permanent water during the dry season. They are however, very susceptible to epizootic diseases such as rinderpest and anthrax and the population north of the Olifants River suffered a severe setback during the serious anthrax outbreaks of 1959 and '60. (Pienaar, 1960, 1961).

Feeding habits : Non-selective browsing and a little grazing.

Breeding : The calving season commences early in January and extends to late February. Young calves have been recorded during November.

Latest estimation of numbers : 5,500-6,000 (probably more). More than 700 were lost during the anthrax epidemics of 1959-'60, north of the Olifants River.

Taurotragus oryx oryx Pallas.

Eland.

Eland were at one time widespread and abundant along the Drakensberg foothills and on the Pretoriuskop flats (Glynn, 1926), but unfortunately also a trophy of the chase much in demand by native and pioneer white hunters. Their numbers had therefore already been sadly reduced at the turn of the century when the great rinderpest epidemic of 1897-98 swept through the Lowveld and wiped out the remaining eland. The last survivor south of the Sabi was shot in the Barberton district in 1897 (Yates).

A few eland survived in the country south of the Olifants River to the west of the present western boundary of the Park, and to this day scattered small herds roam on the private farms Rietvlei, Nederland, Ceylon, Rotshay and Addger.

North of the Olifants River eland were accepted as extinct by the Warden in 1902. Fortunately, however, some eland escaped the depredation of the rinderpest epidemic and survived in the vast sandveld country in Portuguese East Africa along the eastern boundary of the old Shingwidzi Reserve, from where they re-entered the Park.

In 1905 rumours circulated that an eland cow had been seen running with a herd of impala near Shingwidzi, but it was not until 1920 that the first small eland herds were again encountered by European rangers in the northern districts. The first immigrants obviously found the country west of

the Lebombos to their liking, and have steadily increased in numbers through the years, contributing to the flourishing eland population of the northern district, which is at present still growing from strength to strength. Except for the mountainous area north and east of Punda Milia and the relatively waterless country between the Shipikane and Tsende Rivers, eland have colonised most of the remaining area north of the Letaba River. Mixed breeding herds numbering as many as 100 and more are today not infrequently encountered in both the western zone and on the Babalala- and Tsende flats. Their numbers fluctuate seasonally with migratory herds crossing to and fro from the adjoining Portuguese territory.

A lone eland cow crossed the border from Mocambique south of Nwanetzi River during June 1961 and has been seen on several occasions since in the Mbadze-Makonkolwine block. (Fig. xxxv).

An attempt will be made to re-introduce eland into both the central and southern districts from the north within the next few years.

Feeding habits : Browsing of coarser kind and some grazing. May go without water for long periods.

Breeding : Available records indicate a prolonged calving season which extends from May to November with a definite peak during August and September. Calves may however, be born throughout the year.

Latest estimation of numbers : 400-450 (sporadically more during the dry season).

Syncerus caffer caffer Sparrman.

Buffalo.

Stevenson-Hamilton (1925) relates that after the havoc created by the rinderpest epidemic of 1897-'98, there were probably not more than about a dozen buffalo left in the old Sabi Reserve in 1902. Although the buffalo population north of the Olifants River and also that of the central district was largely built up from Portuguese East African immigrants, the great herds which at present roam through most of the Kruger National Park attest well indeed for the inherent recuperative powers of this species after a natural catastrophe. The largest single herd, numbering well over 1,500 animals exist on the Lebombo flats between Lower Sabi and the Crocodile River — a magnificent sight anywhere in Africa today. Many other herds of several hundred individuals up to 800 and more inhabit diverse vegetational environments and practically all types of country throughout the Park, and the population curve is rising steadily. (Fig. xxxvi).

Feeding habits : Coarse grazing and some browsing. Young and old grass grazed equally well.

Breeding : Calving occurs throughout the year with a possible peak during early spring.

Latest estimation of numbers : South of the Sabi River 2,000-2,250; central district 3,600-3,800; northern district 4,000-4,500. Total 9,600-10,550.

RESUMÉ

The distribution of the large mammals of the Kruger National Park is considered. The most important features of the zoogeography of each species are discussed in the light of their specific ecological affinities. Distribution data and locality records compiled over a period of five years are presented in a series of distribution maps, and an indication of the present-day status of each species, based on population data accumulated over a long period, is provided.

ACKNOWLEDGEMENTS

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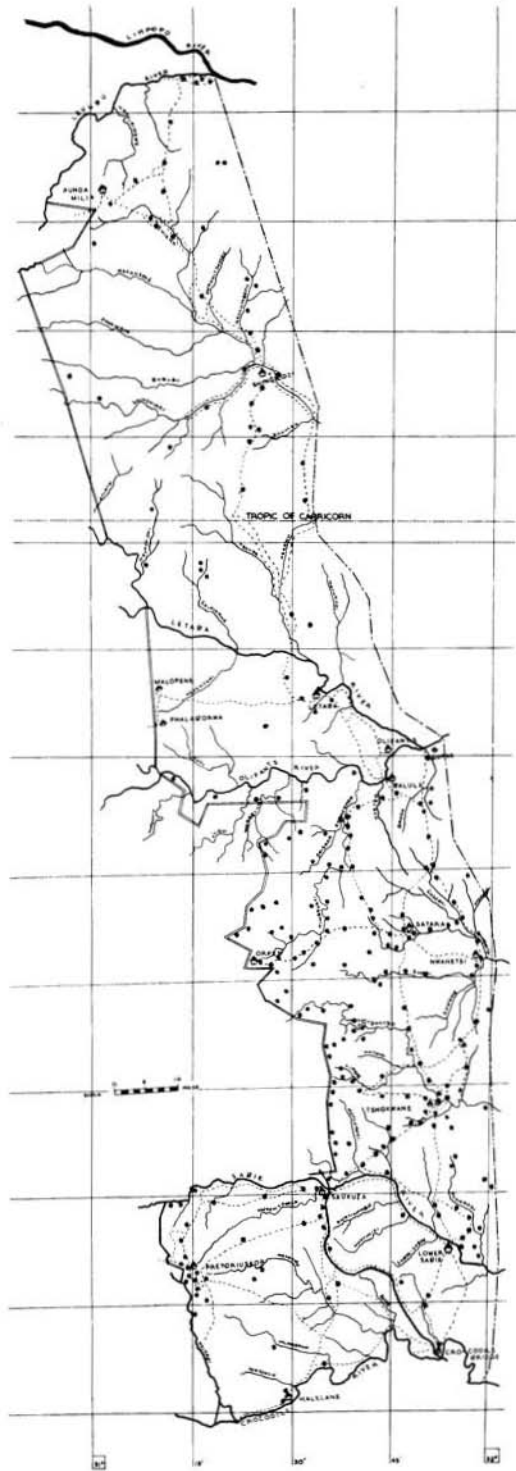


FIG. 2. *Canis mesomelas mesomelas* Schreber.



FIG. 3. *Canis adustus adustus* Sundevall.



FIG. 4. *Lycaon pictus pictus* Temminck.

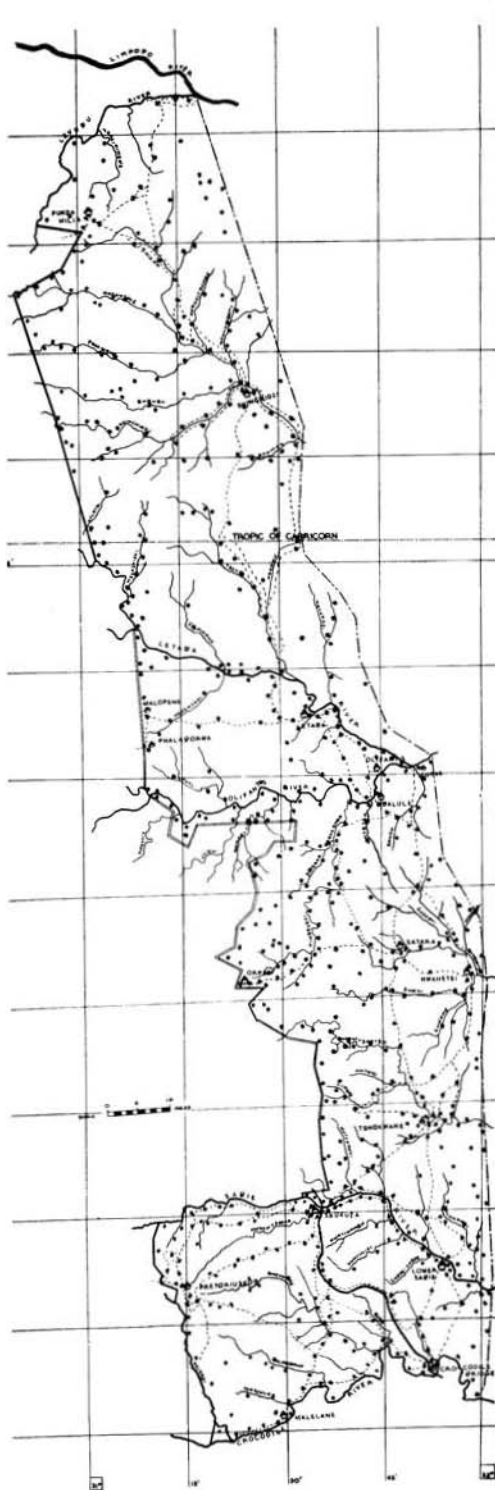


FIG. 5. *Crocuta crocuta* Erxleben.



FIG. 6. *Hyaena brunnea* Thunberg.



FIG. 7. *Acinonyx jubatus jubatus* Schreber.



FIG. 8. *Panthera pardus* Linnaeus.

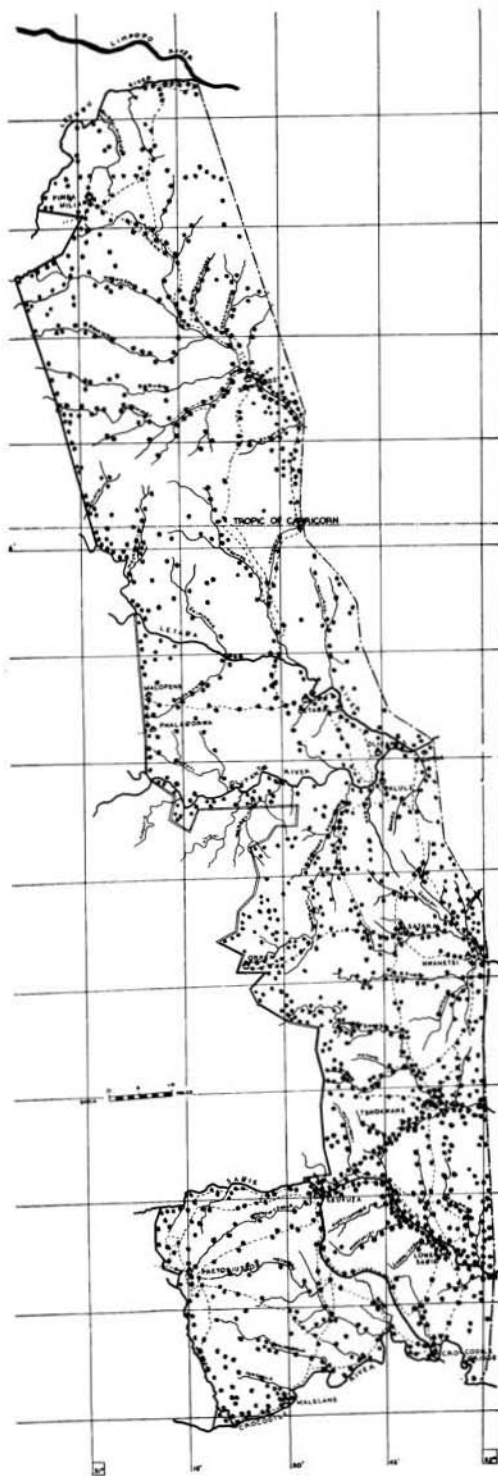


FIG. 9. *Panthera (Leo) leo krugeri* Roberts.

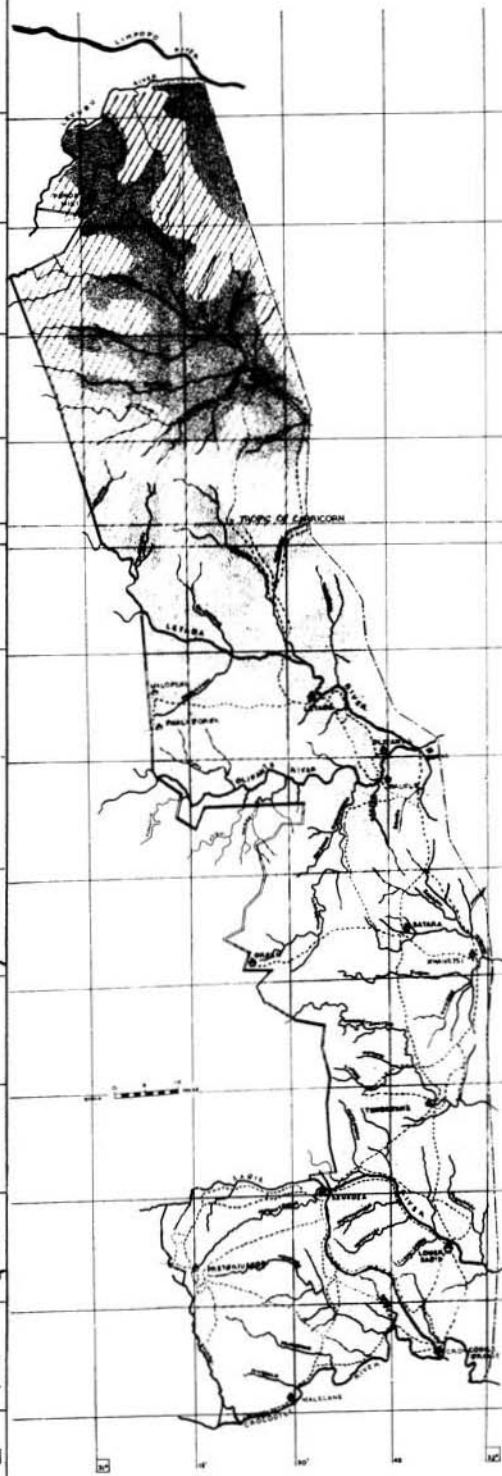


FIG. 10. *Loxodonta africana africana* Blumenbach.

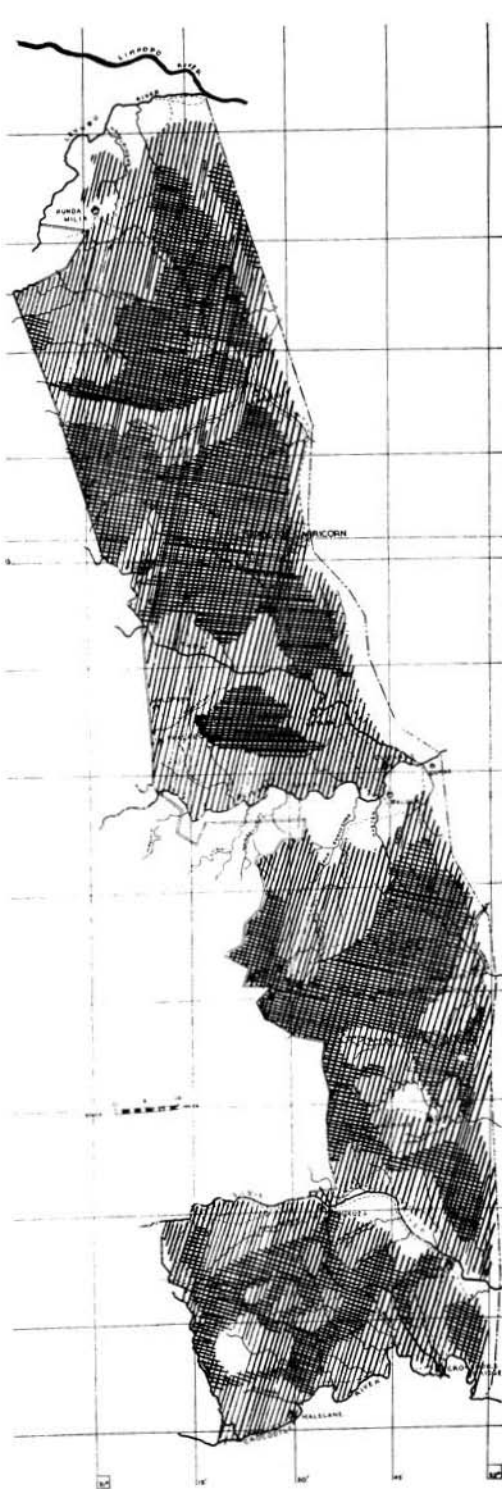


FIG. 19. *Raphicerus campestris zuluensis* Roberts.



FIG. 20. *Raphicerus sharpei colonicus* Thomas & Schwann.



FIG. 21. *Nesotragus moschatus zuluensis* Thomas.

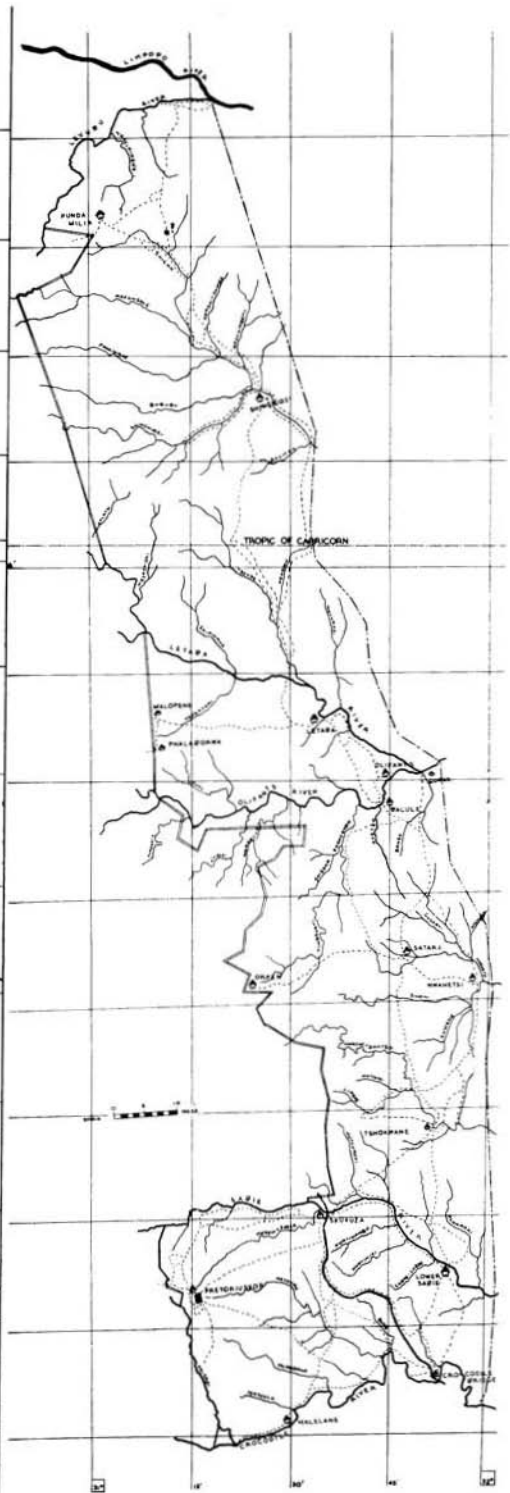


FIG. 22. *Ourebia ourebi* Zimmerman.

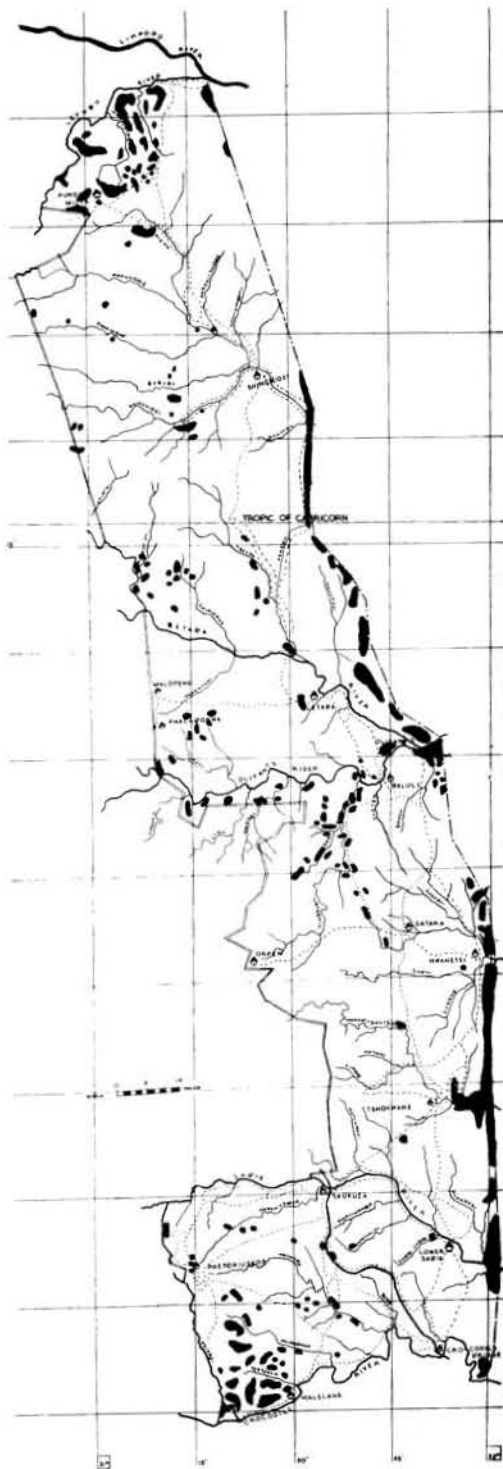


FIG. 23. *Oreotragus oreotragus transvaalensis* Roberts.

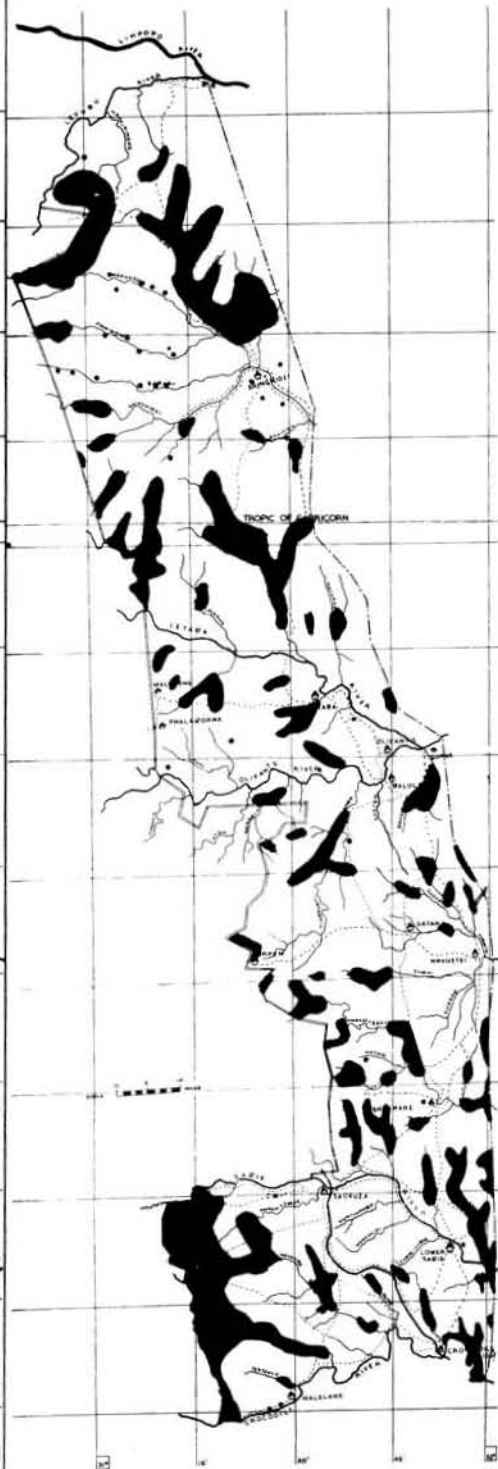


FIG. 24. *Redunca arundinum arundinum* Boddart.



FIG. 25. *Redunca fulvorufula fulvorufula* Afzelius.

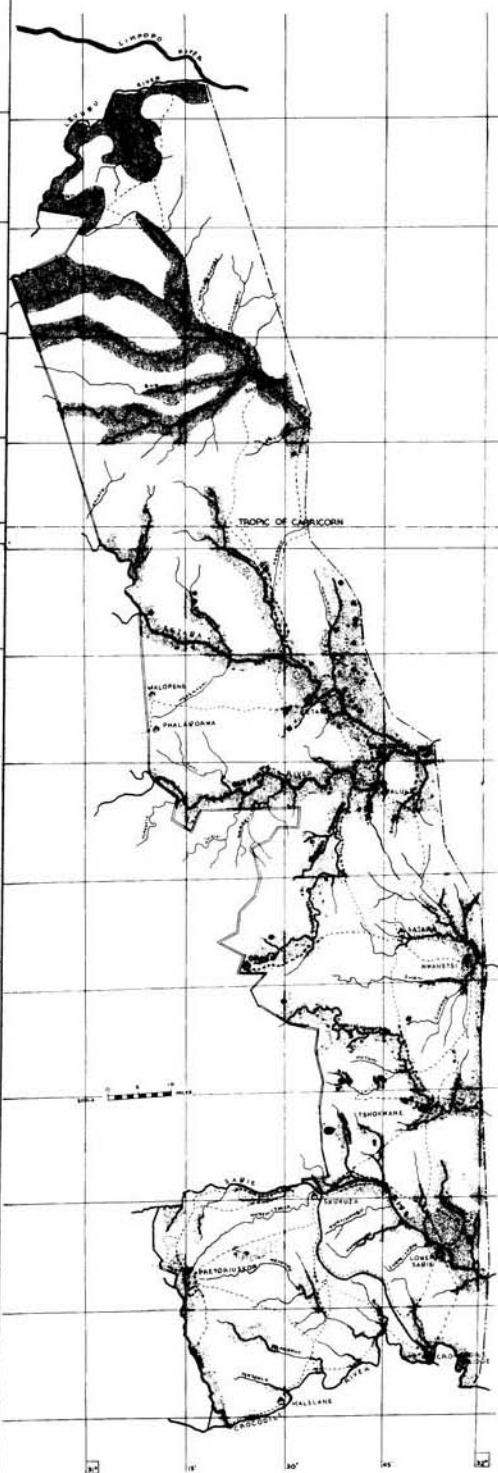


FIG. 26. *Kobus ellipsiprymnus* Ogilby.

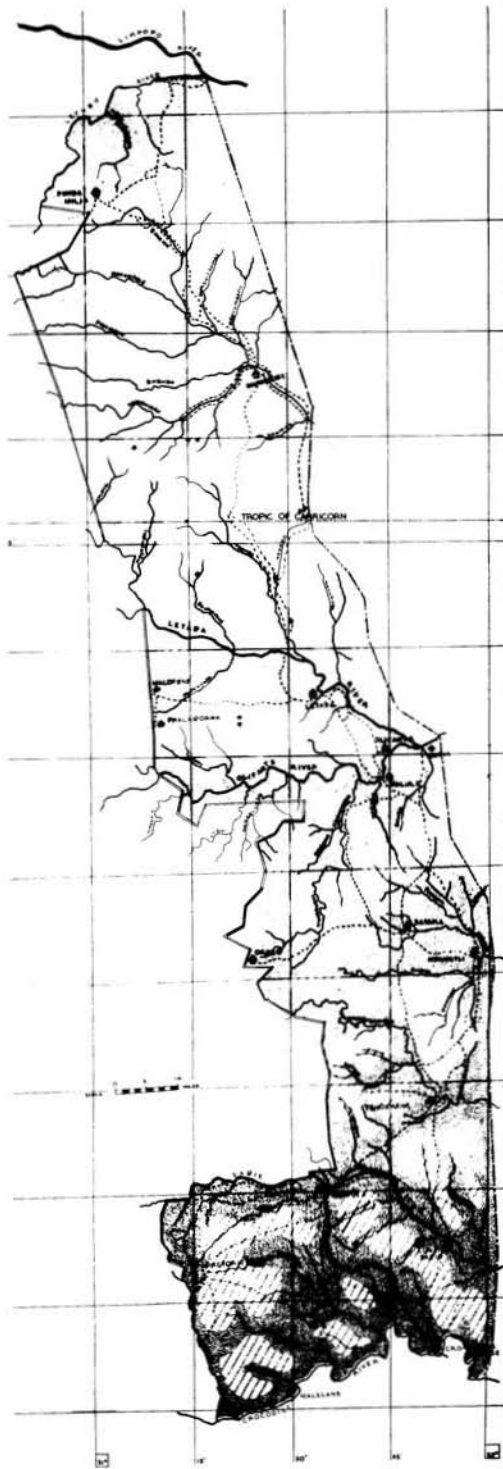


FIG. 27. *Aepyceros melampus melampus* Lichtenstein.



FIG. 28. *Hippotragus equinus equinus* Desmarest.

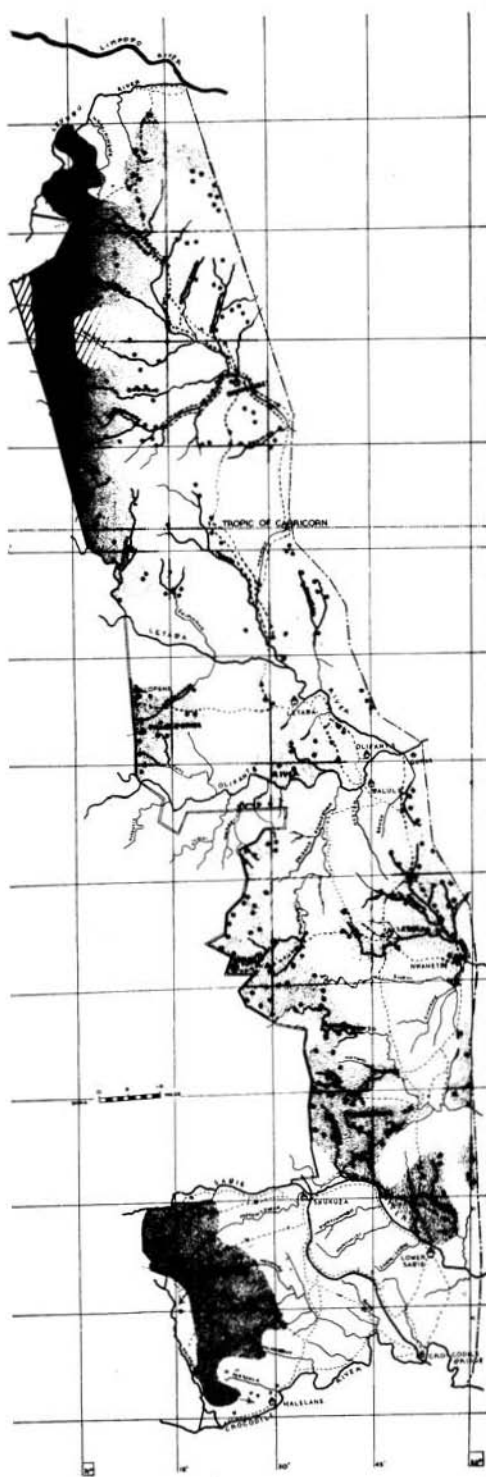


FIG. 29. *Hippotragus niger niger* Harris.



FIG. 30. *Damaliscus lunatus lunatus* Burchell.



FIG. 31. *Connochaetes (Gorgon) taurinus taurinus* Burchell.

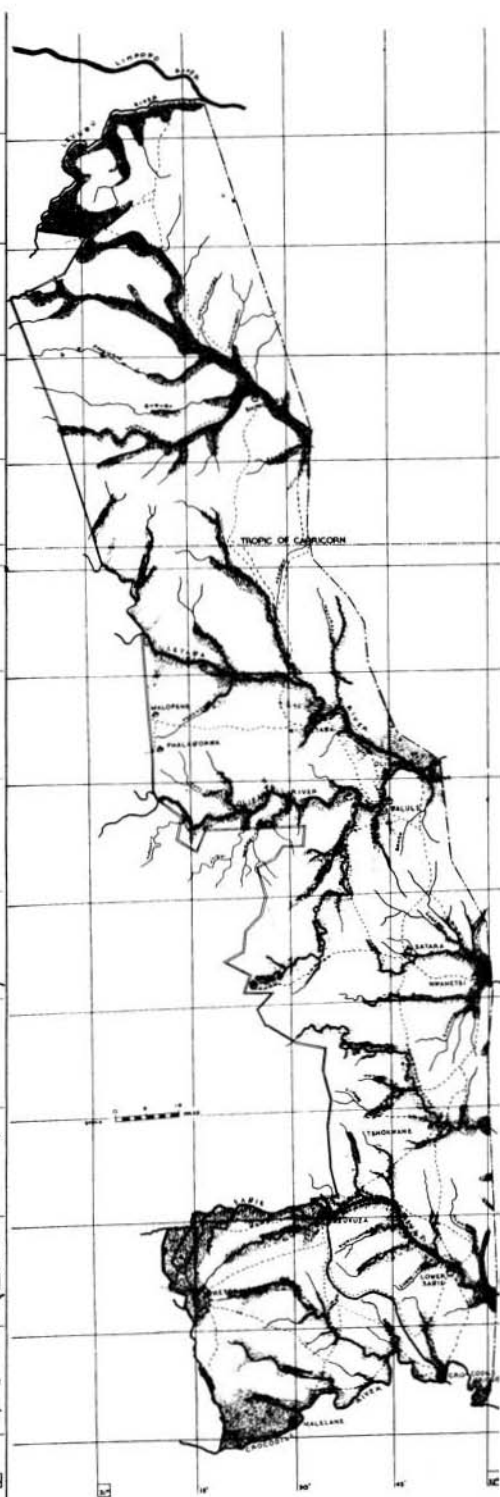


FIG. 32. *Tragelaphus scriptus sylvaticus* Sparman.

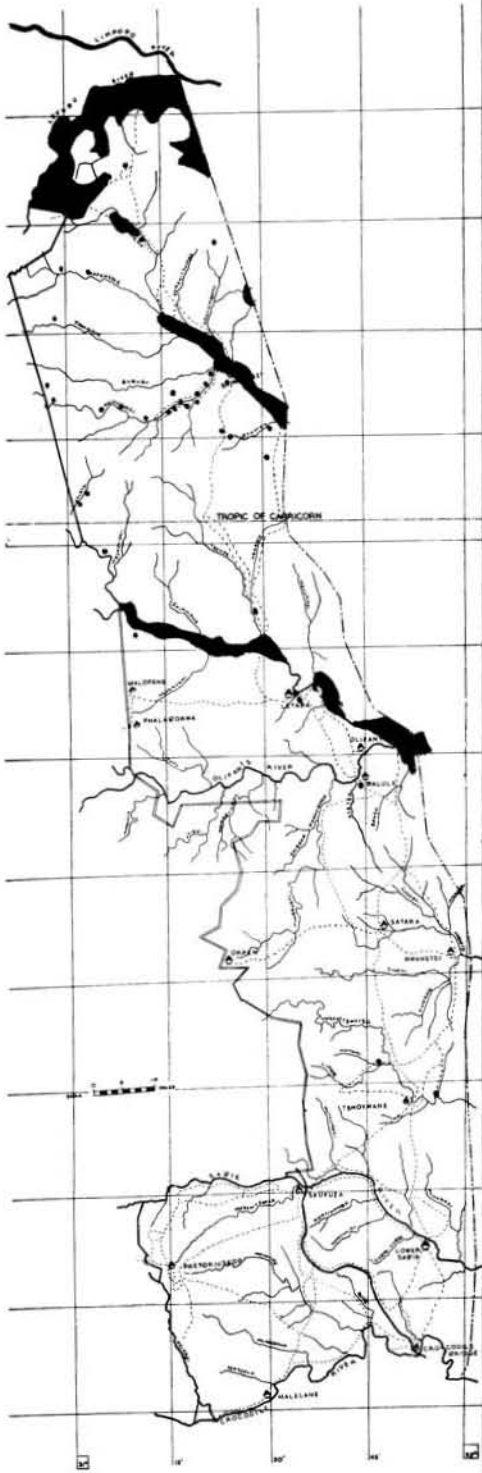


FIG. 33. *Tragelaphus (Nyalá) angasi* Gray.

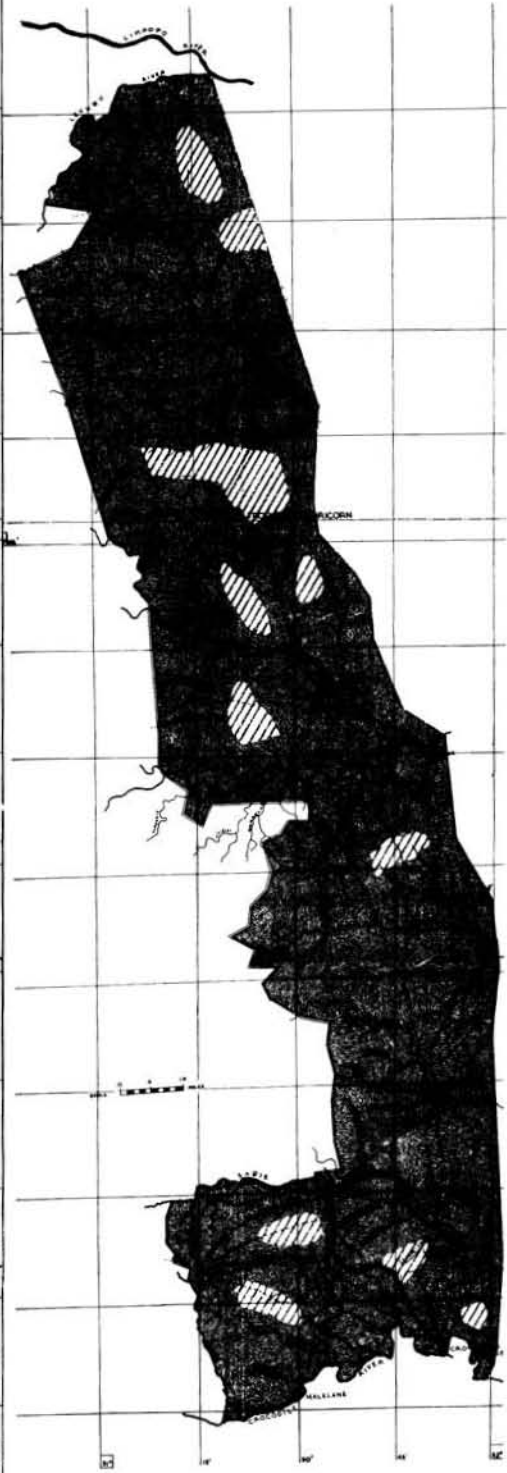


FIG. 34. *Tragelaphus strepsiceros strepsiceros* Pallas.

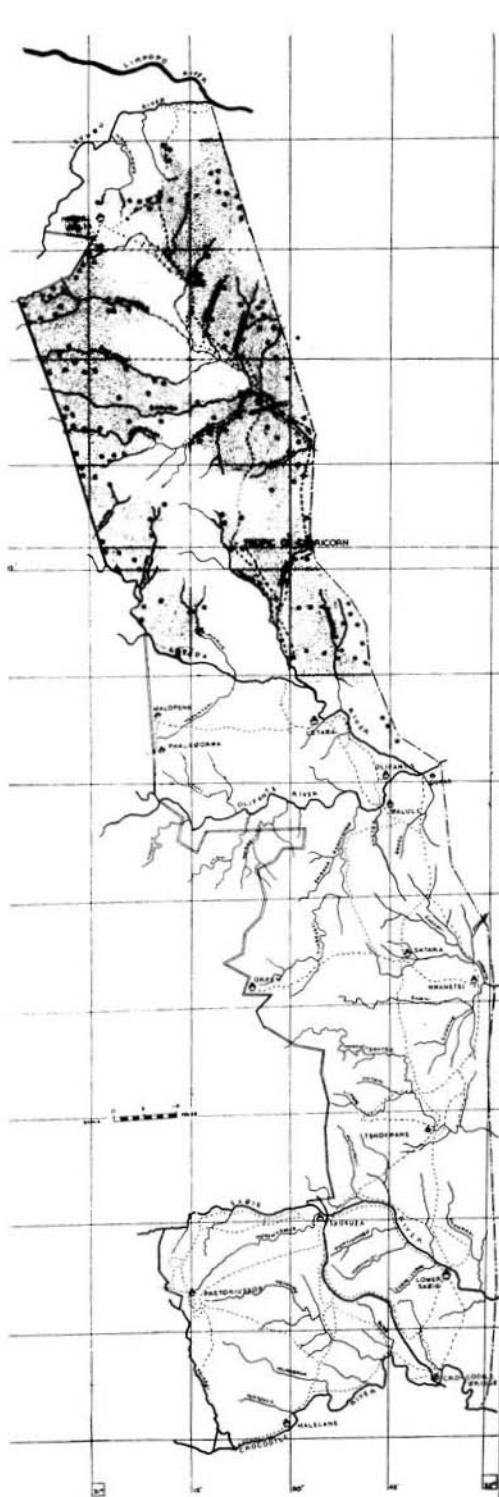


FIG. 35. *Turotragus oryx oryx* Pallas.

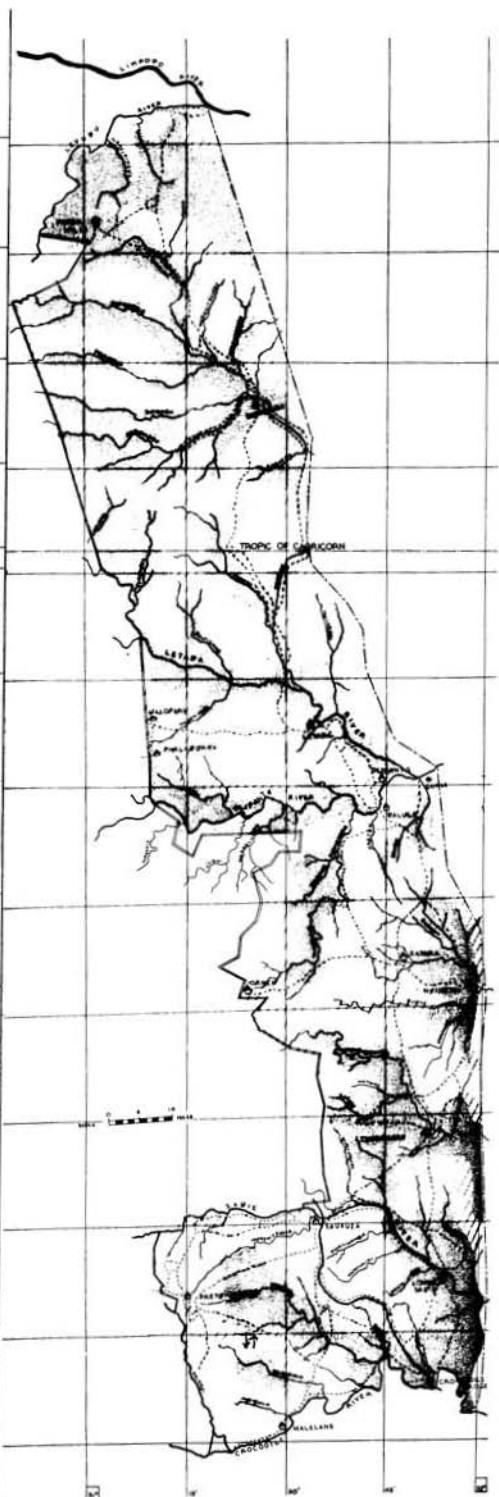


FIG. 36. *Syncerus caffer caffer* Sparman.

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