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A preliminary Vegetation Map of South West Africa

'n Voorlopige plantegroeikaart van Suidwes-Afrika

Eine vorläufige Vegetationskarte von Südwestafrika

mit Vorwort von L. E. Codd, Direktor des Botanischen Forschungsinstitutes, Pretoria, sowie **dreisprachiger** Einführung und Erläuterung der hauptsächlichsten Vegetationsgruppen und -typen durch Text (**Englisch** S. 3-14, **Afrikaans** S. 15-27, **Deutsch** S. 29-43) und Bild (S. 45-114). Die 70 Abbildungen wurden nach Aufnahmen des Verfassers gefertigt. **Die mehrfarbige Faltkarte befindet sich in einem Streifband** an der dritten Umschlagseite.

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ABSTRACT

A preliminary vegetation map of South West Africa has been compiled subdividing the vegetation into three main groups, viz.: DESERTS, SAVANNAS and WOODLANDS. 15 main vegetation types have been established, 5 of which belong to Deserts, 8 to Savannas and 2 to Woodlands. The winter rainfall area in the extreme south-western region of the territory, which is included amongst the deserts, range from Desert to Succulent Steppe; similarly the Etosha Pan is regarded as Saline Desert with a Dwarf Shrub Savanna Fringe. Also included under Savanna is a transitional zone leading from its western parts, which can still be considered as Semi-desert, to its eastern regions which may be regarded as Savanna. The woodlands include the Riverine Woodland of the rivers and dry rivers. On the accompanying map only 14 types of vegetation have been indicated as the 15th, the Riverine Woodland, could not be mapped satisfactorily on the present scale. The short descriptions of the vegetation types are accompanied by 70 illustrations. It has been endeavoured to indicate the boundaries of the different vegetation types as accurately as possible. As transitions from one type to another occur frequently, however, the depicted limits must be regarded as preliminary until a more intensive botanical survey of the whole territory is made.

INTRODUCTION

Although the need for a map showing the main vegetation types of South West Africa has often been expressed during the past years by farmers, lecturers, teachers, agricultural officers and scientists, very little work has been done so far in this direction. As far back as 1910 Professor Adolf Engler compiled a vegetation map of South West Africa which is still the most comprehensive in existence. Other maps were drawn up by Boss (1934), Pole Evans (1936), Range (1940), and Keet (1949), the latter showing 17 vegetation regions.

More recently a vegetation map for South West Africa was submitted by Giess and Tinley in 1966 to the 6th Plenary Meeting of the Association pour l'Etude Taxonomique de la Flore d'Afrique Tropicale (A.E.T.F.A.T.) at Uppsala, Sweden;

this map, compiled by the senior author, shows eight different vegetation types, and was adapted to fit in with the A.E.T.F.A.T. map of Africa (Keay, 1959).

The present publication deals only with the major vegetation types. Further subdivision of these types and more exact plotting of the boundaries will only be possible after the territory has been surveyed in greater detail.

BRIEF DESCRIPTION OF THE MAIN VEGETATION TYPES

Three major vegetation zones can be distinguished in South West Africa, namely *Deserts, Savannas* and *Woodlands*. These widely differing zones are determined primarily by the climate, especially by rainfall, while temperatures play a lesser rôle. The zones are again subdivided mainly on the basis of characteristic plant species. The numbers given to each vegetation type are used throughout the text and on the map.

DESERTS:
Northern Namib **(1)**
Central Namib **(2)**
Southern Namib **(3)**
Desert and Succulent Steppe
(Winter rainfall area) **(3a)**
Saline Desert with Dwarf Shrub Savanna Fringe **(10)**

SAVANNAS:
Semi-desert and Savanna Transition
(Escarpment Zone) **(4)**
Mopane Savanna **(5)**
Mountain Savanna and Karstveld **(6)**
Thornbush Savanna (Tree and Shrub Savanna) **(7)**
Highland Savanna **(8)**
Dwarf Shrub Savanna **(9)**
Camelthorn Savanna (Central Kalahari) **(12)**
Mixed Tree and Shrub Savanna (Southern Kalahari) **(13)**

WOODLANDS:
Tree Savanna and Woodland (Northern Kalahari) **(11)**
Riverine Woodland

The three main vegetation zones are each dealt with in more detail below.

DESERTS

Two main desert regions are distinguished: a) the Namib Desert and b) Saline Desert with Dwarf Shrub Savanna Fringe:

(a) The Namib desert extends along the coast of the Atlantic ocean from the Kunene River in the north to the Orange River in the south. This long desert strip has been divided into four different areas on the basis of the different plant elements which predominate.

Northern Namib (1) Plates 1—5

The Northern Namib extends from the Kunene River, the northern boundary of the territory, to the Huab River. Two main dune areas can be distinguished in this region. In the north between the Kunene River mouth and Angra Fria sand-dunes occur from the coast to about 40 km inland. Further south a much narrower and interrupted dune belt occurs between the Koichab and Khumib Rivers. Large tracts of the Northern Namib, especially in the vicinity of the coast, are covered by white sand on which the vegetation is sparse. The following plants are typical of the Northern Namib: *Barleria solitaria, Ectadium virgatum* var. *rotundifolium, Indigofera cunenensis, Merremia multisecta, Petalidium angustitubum, Petalidium giessii* and *Stipagrostis ramulosa.*

Eragrostis cyperoides is fairly common in the northern parts and occurs even on the white sand dunes. The grassland or grass plains of the "Vornamib" to the east are mostly covered by *Stipagrostis* spp., although *Kaokochloa nigrirostris* also occurs in pure stands. *Balanites welwitschii,* a small tree or shrub, follows the river-beds almost to the coast.

Central Namib (2) Plates 6—12

The Central Namib lies between the Huab and the Kuiseb Rivers. Along the coast north of the Swakop River a narrow strip of vegetation of varying width (up to 200 m) is found. Small hummock dunes have formed over and around specimens of *Zygophyllum clavatum, Psilocaulon salicornioides* and *Salsola* spp. In the eastern parts of this region *Zygophyllum stapffii* as well as *Arthraerua leubnitziae* occur as single specimens. In some areas *Hypertelis caespitosa* is also found. The large gypsum and gravel flats, further inland, but still close to the coast, are in places densely covered by lichens, such as *Parmelia* spp., *Telochistes capensis, Usnea* spp. and others. *Arthraerua leubnitziae* and *Zygophyllum stapffii* sometimes occur widely spaced on the wide gravel flats. *A. leubnitziae* often forms relatively dense stands in depressions as well as on the undulating sandy gravel ridges near the coast and further inland.

Further inland the vegetation found in shallow depressions such as water courses and small river-beds, becomes progressively denser. *Acacia reficiens* occurs as a shrub only about 30 km from the coast near the Rössing Mountains; *Asclepias buchenaviana* flowers and bears fruit almost throughout the year. The yellow fruits of the perennial *Citrullus ecirrhosus* lie in clusters on the otherwise barren ground looking like ostrich eggs in a nest.

The annual white desert grasses are especially plentiful, *Stipagrostis* species being the most conspicuous and common. These include: *S. namibensis, S. hirtigluma* subsp. *hirtigluma, S. hirtigluma* var. *pearsonii, S. uniplumis* var. *intermedia* and *S. uniplumis* var. *uniplumis,* all of which occur in an annual form. *Aristida parvula, Triraphis pumilio* and *Sporobolus nebulosus* are also found. The genus *Eragrostis* is very scarce. The grass plains between the true desert and the Escarpment are covered mainly by *Stipagrostis obtusa* with *S. ciliata* on the more sandy parts, and *Eragrostis nindensis,* a perennial grass, on the more stony, gravelly and limestone areas.

The naras, *Acanthosicyos horrida,* occurs mostly in or near river-beds, and is especially common at the mouth of the Kuiseb River. Each plant forms a little sanddune by continually growing through the sand that blows onto it.

The naras is still found some 100 km inland in the bed of the Kuiseb River. The species is not widely distributed in the Central Namib, but it is locally abundant in the Northern Namib and in southern Angola.

Welwitschia mirabilis occurs here, the limit of its southern distribution being the bend of the Kuiseb River near Natab. Populations of *Welwitschia* are found near the Hope/Gorob Mines, at the Haigamkab flats south of the Swakop River, and across the Swakop River on the Welwitschia Flats in the Khan-Swakop River triangle. Further north, the first population is found east of Strathford Mine, somewhat south of Cape Cross; the species is then seen again at the Messum Mountains, north of Cape Cross, after which it occurs further inland to the west and south of the Brandberg and from there through the Northern Namib to Angola.

After sporadic rains numerous species of annuals develop. These include: *Aizoanthemum galenioides* near the coast and further inland, *A. dinteri* and *A. membrum-connectens, Corbichonia rubriviolacaeae, Helichrysum* spp., *Hydrodea bossii; Limeum* spp., *Mesembryanthemum* spp., *Osteospermum* spp., *Pentzia hereroensis* (sometimes very near the coast), *Senecio engleranum, Tribulus terrestris* and *Zygophyllum simplex.* Also typical are *Aloe asperifolia, A. namibensis, Celosia spathulifolia, Euphorbia phylloclada, Hoodia currorii* (in the area up to 80 km east of the coast), *Hoodia macrantha* (further inland in the transition to the Escarpment Zone), *Lithops gracilidelineata, L. ruschiorum, Trichocaulon pedicellatum* and many others.

Southern Namib **(3)** Plates 13—15

The Southern Namib begins at the Kuiseb River and extends southwards to the edge of the winter rainfall area. Between the Kuiseb River and Lüderitzbucht a sand dune belt of about 320 km long and 120 km wide occurs which, botanically speaking, is practically unexplored. South of the Kuiseb we find plants such as *Monsonia ignorata, Hexacyrtis dickiana, Stipagrostis gonatostachys, S. sabulicola, Trianthema hereroensis* and *S. lutescens* which are fairly common in the Lüderitz area, and which are characteristic of this region. The vegetation of this area merges into that of the vegetation type mentioned below.

Desert and Succulent Steppe (Winterrainfall area) **(3a)** Plates 16—21

Vegetation typical of Desert and Succulent Steppe covers the winter rainfall area which extends from Namaqualand along the Orange River to north of Lüderitzbucht (see map). In the western parts of this area near the coast fairly large barren desert plains with sand dunes are encountered. The stony hills and also the higher mountains further inland, such as the Buchu Mountains and Klinghardt Mountains, are fairly densely covered by succulents of different families. Further to the east, where some rain also falls during summer, the perennial vegetation

becomes denser. Annuals grow and flower only in the winter months after rain. Apart from species which this area has in common with Namaqualand, a great number of plants is indigenous to this area. Stem, leaf and root succulents belonging to the following families are typical of this vegetation: Mesembryanthemaceae (many genera), Portulacaceae, (genera *Anacampseros, Portulacaria, Ceraria),* Crassulaceae (genera *Crassula, Cotyledon* and *Adromischus),* Geraniaceae (genera *Pelargonium, Sarcocaulon* and *Monsonia*), *Zygophyllaceae,* (genera *Zygophyllum, Augea* and *Sisyndite*), *Euphorbiaceae* (genera *Euphorbia* and *Jatropha*), Periplocaceae (genus *Ectadium*) and *Asclepiadaceae* (genera *Caralluma, Duvalia, Hoodia, Microloma, Piaranthus, Stapelia* and *Trichocaulon*). Trees and shrubs are confined to river courses. As mentioned before, the desert areas of the Namib zone merge eastwards into grassland. These grass plains extend northwards from near Aus, along the eastern desert margin as far as the Kunene River. In the southern parts, *Stipagrostis ciliata* is the predominant species, sometimes intermixed with *Stipagrostis obtusa,* though the latter can also occur in pure stands. The occurence of these species is dependent on precipitation. Towards the east these grasslands merge into the Escarpment Zone **(4).**

b) Saline Desert with Dwarf Shrub Savanna Fringe **(10)** Plates 46—50

Only the very small area of the Etosha Pan and the surrounding flats is representative of this vegetation type. The Pan itself is quite barren, but it has a fringe of halophytic vegetation consisting of species such as *Suaeda articulata, Sporobolus spicatus* and *Odyssea paucinervis.* The Dwarf Shrub Savanna Fringe is composed of *Acacia nebrownii* which forms more or less thick stands in places, *Monechma tonsum, M. genistifolium, Leucospaera bainesii, Petalidium engleranum* and *Salsola tuberculata* which covers wide areas around the pan where the limey soil is more or less brackish. To the north of the pan are extensive grass flats (Andoni Flats); on the eastern side sandveld vegetation encroaches, and on the southern side, Mopane Savanna reaches this area sometimes as a dense woodland. From a sandveld transition zone east of the Etosha Pan with *Acacia* spp., *Terminalia prunioides, Lonchocarpus nelsii* and others, the vegetation gradually changes in the northeast into Tree Savanna or Woodland on Kalahari sands **(11).**

SAVANNAS

Semi-desert and Savanna Transition (Escarpment Zone) **(4)** Plates 22—27

This vegetation type is characterized by a great variety of species, many of which are endemic. Typical of the whole area from the Maltahöhe district to the Kaokoveld is *Euphorbia guerichiana,* a shrub or small tree with a conspicuous, shiny, brownish-yellow, papery bark growing up to a height of 5 m. *Cyphostemma* spp. with succulent stems and *Moringa ovalifolia* also find optimum conditions here. *Adenolobus garipensis* occurs from the Orange to the Kunene Rivers, whereas *A. pechuelii,* like *Euphorbia guerichina,* is found from the Maltahöhe district

northwards. Two species of *Acacia* which are confined to this vegetation type, *A. montis-ustii* and *A. robynsiana,* are found from the Brandberg to the southern Kaokoveld. *Acacia senegal* var. *rostrata* and *A. tortilis* subsp. *heteracantha* also occur mainly in the west, but may occasionally be seen further inland.

Particularly characteristic of this zone are the various species of *Commiphora* such as *C. virgata; C.* sp. nov. (aff. *C. virgata* from the Kaokoveld); *C. saxicola,* which is also found in the desert parts of the Central Namib and *C. anacardiifolia, C. glaucescens, C. kraeuseliana, C. multijuga, C. oblanceolata* and *C. wildii.*

It is noteworthy that a number of woody species occurring in this region, which receives an annual rainfall of 100 mm or less, are also found as far to the north-east as the Otavi Mountains, Grootfontein and Tsumeb where the rainfall may be as high as 500 mm per year. On the map the Escarpment Zone has not been indicated in the Kaokoveld, the northwestern part of South West Africa. Since this part of the country is very mountainous and the transitions are less sharply defined than in the central and southern parts, this area is included in the Mopane Savanna until a more detailed survey is undertaken.

Mopane Savanna **(5)** Plates 28—31

As the name suggests, *Colophospermum mopane* is the characteristic species of this vegetation type. The mopane occurs either as a shrub or a tree depending on local conditions. In some areas it forms dense woodland whereas in others it grows as a short-stemmed shrub intermingled with scattered trees. In the western parts toward the Namib Desert, which receive an annual rainfall of 50—100 mm, mopane is largely confined to depressions and small river-beds where it often grows together with *Balanites welwitschii.* The distribution area of mopane extends eastwards to the Grootfontein district and Ovamboland which receive an annual rainfall of 500—600 mm. Other components of Mopane Savanna are two species of *Sesamothamnus, S. benguellensis,* which occurs only along the Kunene River in the north-west and *S. guerichii* which is fairly well distributed over the western, central and southern parts of the Kaokoveld. The latter species, just as mopane, reaches the southernmost limits of its distribution in the Omaruru district. *Ceraria longipedunculata* is typical of the mountainous areas of the western Kaokoveld, and occurs in the Escarpment Zone as well as further inland. The genus *Commiphora* is well represented by the following species: *C. africana, C. angolensis, C. anacardiifolia, C. crenato-serrata, C. discolor, C. glaucescens, C. kraeuseliana, C. mollis, C. multijuga, C. pyracanthoides, C. tenuipetiolata, C. virgata, C. wildii* and *C.* sp. aff. *C. virgata.* Also well represented is the family Acanthaceae, the following species being common: *Barleria cyanea, B. meeusiana, B. rogersii, Blepharis ferox, B. gerlindae, Dicliptera micranthes, Ecbolium clarkei, Lepidagathis scariosa, Monechma cleomoides, M. salsoloides, Petalidium angustitubum, P. bracteatum, P. cirrhiferum, P. coccineum, P. crispum, P. giessii, P. halimoides, P. luteo-album, P. physaloides, P. rossmannianum, P. subcrispum, P. welwitschii* and *Ruellia currorii,* to name only a few.

This vegetation type is closely related to the Mountain Savanna with which it has many species in common.

Mountain Savanna and Karstveld **(6)** Plates 32—34

The Mountain Savanna has a very wide distribution and embraces the whole Karstveld, excluding the areas covered by mopane. Sandveld patches occur in this vegetation. The Mountain Savanna is characterized by *Kirkia acuminata, Gyrocarpus americanus, Fockea multiflora, Berchemia discolor, Pachypodium lealii, Croton* spp., *Cyphostemma juttae, Securidaca longepedunculata, Cissus nymphaeifolia, Euphorbia venenata, Olea africana, Moringa ovalifolia* and many others. The flats between mountains and mountain ridges are covered with shrubs and small trees of *Combretum apiculatum, Dichrostachys cinerea,* as well as species of *Croton* and *Acacia.* The tree stratum consists mainly of *Sclerocarya caffra, Spirostachys africana, Peltophorum africanum, Ficus cordata, F. sycomorus, F. petersii* and *Combretum imberbe,* the omumborombonga of the Herero, which occurs on soils with outcrops of recent surface limestone. On sandveld patches *Lonchocarpus nelsii, Terminalia sericea* and *Acacia* spp. are common. *Terminalia prunioides* also occurs quite frequently in this region. To the east, where the Mountain Savanna passes over into the flats, a palm savanna is found, in which *Hyphaene ventricosa* is conspicuous. To the south this vegetation type merges into Thornbush Savanna.

Thornbush Savanna (Tree and Shrub Savanna) **(7)** Plates 35—38

Thornbush Savanna is the dominant vegetation type over the central region of South West Africa. The vegetation varies in different parts of the area, but the characteristic feature is grassland with trees and bigger shrubs in dense or open clumps of varying size. Over large parts of this region *Acacia* spp. are very dominant and in some places bush encroachment by *Acacia mellifera* subsp. *detinens* is taking place. The vegetation is composed of *Acacia reficiens, A. hebeclada, A. mellifera* subsp. *detinens, A. erubescens, A. fleckii,* and in some areas *A. tortilis* subsp. *heteracantha. Acacia giraffae* occurs mostly in Riverine Woodland on the alluvial banks of rivers. *Boscia albitrunca* is quite frequent in some localities. *Lonchocarpus nelsii* is common in the more sandy areas, while *Combretum apiculatum* often predominates on limestone and rocky outcrops. *Ziziphus mucronata* is found throughout most of this zone.

Highland Savanna (Bergthorn Savanna) **(8)** Plates 39—42

This veld type which characterizes the central, mountainous areas of the territory, namely the Khomas Hochland, and Windhoek Bergland, reaches south as far as Rehoboth. It is characterized by *Acacia hereroensis,* the bergthorn, together with *Combretum apiculatum, Acacia reficiens, A. hebeclada* (tree form), *Euclea undulata* var. *myrtina, Dombeya rotundifolia, Tarchonanthus camphoratus, Rhus marlothii* and *R. dinteri, Albizia anthelmintica* and *Ozoroa crassinervia.* Along the riverbeds on alluvial banks *Acacia giraffae, Rhus lancea, Ziziphus mucronata, Acacia karroo* and *Olea africana* are found. The original grass cover consists of *Anthephora pubescens, Brachiaria nigropedata, Cymbopogon* spp., *Heteropogon contortus, Hyparrhenia hirta, Digitaria dinteri, Sporobolus* spp. and others. In many parts these valuable grasses are becoming sparse either because of overgrazing or injudicious selective grazing.

Dwarf Shrub Savanna (9) Plates 43—45

This vegetation type coincides with the area marked type 29 on Keay's (1959) vegetation map of Africa. It is dominated by Karoo shrubs and grasses and is found in the vast, arid, monotonous regions of southern South West Africa. Arborescent species such as *Acacia giraffae, A. karroo, Tamarix usneoides, Euclea pseudebenus, Rhus lancea,* and others are found only along rivers. Characteristic for the greatest part is *Rhigozum trichotomum* (Giess, 1968b). *Parkinsonia africana, Acacia nebrownii, Boscia foetida, B. albitrunca* and *Catophractes alexandri* as well as smaller Karoo bushes such as *Pentzia* spp., *Eriocephalus* spp. and others are typical of this vegetation type.

In the east the Weisskalk Plateau forms the boundary to the sand dunes area of the Southern Kalahari. Here the composition of the vegetation remains more or less the same, but Karoo bushes dominate the landscape. Typical of this area is *Salsola tuberculata* var. *tomentosa* with *Aizoon schellenbergii, Petalidium linifolium, Leucosphaera bainesii, Hermannia spinosa, Monechma australe, Aptosimum lineare* and *Sarcostemma viminale.*

In the depressions, which have a thicker layer of red Kalahari sand, *Boscia albitrunca, B. foetida, Acacia nebrownii, Phaeoptilum spinosum, Rhigozum trichotomum* and *Catophractes alexandri* are found.

The mountainous Schwarzrand region to the west has a similar vegetation, but here *Petalidium linifolium* is typical and not *Salsola* as on the Weisskalk Plateau. The following plant species can be observed on the western side of Schwarzrand: *Aizoon schellenbergii, Phaeoptilum spinosum, Barleria lancifolia, Otoptera burchellii, Rhigozum trichotomum, R. obovatum, Carissa haematocarpa, Pteronia lucilioides, Montinia caryophyllacea, Dyerophytum africanum, Diospyros lycioides, Thesium lineatum,* and many others. Some grass species which the Weisskalk Plateau and the Schwarzrand have in common are *Eragrostis nindensis, Enneapogon brachystachyus, Stipagrostis ciliata* and *S. obtusa.* In addition to these we find elements of the Escarpment Zone such as *Panicum arbusculum, Setaria appendiculata, Digitaria dinteri, Anthephora ramosa, A. pubescens, Triraphis ramosissima* and *Aristida engleri.* These may be regarded as climax species. In some parts *Aloe dichotoma* is quite common and dominates the landscape, often being the only arborescent species.

Camelthorn Savanna (Central Kalahari) (12) Plates 62—64

Camelthorn Savanna is an open savanna or sometimes parkland with the trees in small groups, the typical tree being *Acacia giraffae.* Small or large shrubs of *Acacia mellifera* subsp. *detinens* sometimes form dense thickets. Young trees of *Acacia giraffae* may be very common in places. Common shrubs are *Acacia hebeclada* subsp. *hebeclada* (mostly in the stoloniferous form), *Ziziphus mucronata, Tarchonanthus camphoratus, Grewia flava, Rhus ciliata* and *Ozoroa paniculosa.* Interspersed in the Camelthorn Savanna are stands of *Terminalia sericea* which occur commonly on white sand and may form woodland patches. These white sand areas are mainly the habitat of hard grasses such as *Eragrostis pallens* and *Aristida stipitata. Terminalia sericea* not only grows in light sand, but also in red loamy sand, where it occurs together with *Acacia giraffae.*

Tarchonanthus-Grewia veld is found mostly on open flats where the shrubs attain a height of only 3—4 m. *Acacia hebeclada* subsp. *hebeclada* occurs in the form of either a shrub or a small tree and these two forms may be found growing together. The vegetation dominated by shrubs is closely related to the Camelthorn Savanna and the two grade into each other. In the west of the region a vegetation type intermediate between Camelthorn Savanna and Highland Savanna is encountered.

Mixed Tree and Shrub Savanna (Southern Kalahari) (13) Plates 65—69

The greater part of this area is covered by longitudinal red sand dunes trending north-west to south-east. Harder soils are encountered in the dune valleys or "strate", on riverbanks and in pans. Typical for this region is *Acacia haematoxylon,* which grows mostly as a shrub, but may also develop into a tree. Other trees are *Acacia giraffae, Boscia albitrunca, Acacia reficiens, Albizia anthelmintica,* and in the northern parts *Terminalia sericea.* This species occurs either as a shrub growing in dense stands or it grows as a tree in open savanna, the growth form apparently depending mainly on the rainfall. On harder soils, which occur in the "strate" between the dunes and on riverbanks, *Rhigozum trichotomum* is characteristic and dominant. *Boscia foetida, Grewia deserticola, G. flava* and *Rhus tenuinervis* occur on sand. In undisturbed veld the grasses are mostly perennials such as *Astenatherum glaucum, Stipagrostis uniplumis, Eragrostis lehmanniana, Stipagrostis ciliata* and on the dune crests *Stipagrostis amabilis.* In the southern parts, where *A. giraffae* and *A. reficiens* occur together in a Tree Savanna, *Megaloprotachne albescens* may be a very common pioneer, whereas in disturbed areas in drier regions *Schmidtia kalahariensis* is dominant.

WOODLANDS

Tree Savanna and Woodland (Northern Kalahari) (11) Plates 51—61

From eastern Ovamboland to the Okavango River and thence southwards to the Waterberg Plateau we find the only Tree Savanna or Woodland in South West Africa. In the northern and north-eastern parts are fine stands of *Baikiaea plurijuga, Pterocarpus angolensis, Dialium engleranum, Burkea africana, Ricinodendron rautanenii, Lonchocarpus capassa, Guibourtia coleosperma, Strychnos cocculoides, S. pungens, Ochna pulchra, Combretum* spp., *Grewia* spp., *Bauhinia macrantha* and *B. urbaniana* to name only a few of the most characteristic trees and shrubs. The palm, *Hyphaene ventricosa* occurs in omurambas and on open flats. On the harder soils in sand dune areas *Acacia giraffae* is found together with *Lonchocarpus nelsii* and *Boscia albitrunca.* Vegetation of the same composition occurs along the alluvial banks of the Okavango River where *Peltophorum africanum, Lonchocarpus nelsii, Boscia albitrunca, Acacia hebeclada* subsp. *hebeclada* and other *Acacia* spp. occur. Along the banks of the Okavango grow *Phoenix reclinata* and *Acacia hebeclada* subsp. *chobiensis.*

Further to the south near Tsumkwe the woodland merges into open savanna with *Combretum imberbe, Acacia mellifera* subsp. *detinens, Peltophorum africanum, Lonchocarpus nelsii, Acacia reficiens, Combretum apiculatum, Tarchonanthus camphoratus, Ziziphus mucronata, Catophractes alexandri, Combretum hereroense, Albizia harveyi* and *Adansonia digitata.*

Towards the south in the direction of the Eiseb and Epukiro Omurambas the savanna becomes even more open with *Burkea africana, Acacia spp., Lonchocarpus nelsii, Combretum mechowianum, C. engleri, Boscia albitrunca, Ochna pulchra* and *Bauhinia macrantha,* and the deciduous trees of the northern woodlands are almost absent.

Riverine Woodland Plates 13, 56, 70

Along all larger river-beds such as the Kuiseb, Swakop, Omaruru and others a more or less dense, but narrow stand of trees is found on the alluvial soils of the river-banks. The camelthorn (*Acacia giraffae*) is the most common tree in this association in the central parts. It also occurs far to the west in pure and open stands in the smaller river-beds of the Namib. In the major river-beds from the Gaub in the south right up to the Kunene River in the north of the territory the ana tree (*Acacia albida*) is fairly common. This tree extends eastwards in the river-beds until frost halts its further spread.

In the western parts *Acacia tortilis* subsp. *heteracantha* develops into huge trees e.g. in the Khan River near the Erongo Mountains; in association with it is found the ancestor tree of the Herero, *Combretum imberbe,* as well as *Tamarix usneoides* and *Euclea pseudebenus. Salvadora persica* often forms dense stands in river-beds in the Namib. Although this species grows mainly as a shrub it may also develop into a climber on larger trees such as *Combretum imberbe.*

Acacia karroo is quite common in the central inland regions along the river-beds where it grows with *Rhus lancea, Acacia giraffae* and *Ziziphus mucronata* (which can here develop into large, thick-stemmed trees). In the more north-westerly parts of the Kaokoveld *Hyphaene ventricosa* together with *Tamarix usneoides* occurs along the river-beds, extending far into the Namib Desert area. The smaller river-beds and watercourses show only a very sparse woody vegetation of *Colophospermum mopane, Balanites welwitschii* and *Maerua schinzii.* One of the common trees on the banks of the Kunene River is *Acacia sieberana* var. *vermoesenii,* while *Phoenix reclinata, Salix subserrata, Acacia nigrescens* and *A. hebeclada* subsp. *chobiensis* are principle components of the Riverine Woodland of the Okavango River.

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