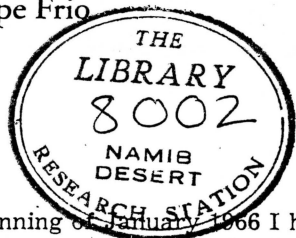


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A short report on the vegetation of the Namib coastal area from Swakopmund to Cape Frio

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(6 plates)



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In the beginning of January 1966 I had the opportunity of making an investigation trip along the coast from Swakopmund to Cape Frio. As it was probably the first time that this coastal area of the Northern Namib had been visited by a botanist, it is most certainly of interest to give a short summary of the vegetation and plants encountered.

To explain the colloquial term, Northern Namib; one can subdivide the South West African Namib Desert area into three parts:

1. The Southern Namib: From the Orange River to the Kuiseb River, including the large sand-dune belt from north of Lüderitzbucht to the Kuiseb River.
2. The Central Namib from the Kuiseb River to the Huab River.
3. The Northern Namib, from the Huab River to the Kunene River.

Due to the fact that some components of the vegetation of the Northern Namib area can be found as far south as the Koichab River (some of them will probably be found still farther south), I agree that the Huab River is the northern boundary of the Central Namib as pointed out by Spreitzer. (H. Spreitzer, Beobachtungen zur Geomorphologie der Zentralen Namib und ihrer Randgebiete, Sonderveröffentlichung Nr. 4, S.W.A. Scientific Society, Windhoek, 1965).

We drove northwards all along the coast close to the shore, at times going short distances farther inland, but not farther than 4.5 miles from the coast. During the first part of the journey from Swakopmund almost to the Koichab River in the Southern Kaokoveld south of Torra Bay, we found no coastal dune belt as found between Walvis Bay and Swakopmund, and farther north of the Koichab River. On the beach we always found a coastal vegetation strip of changing widths at times 100 metre wide, with the following species:

Psilocaulon salicornioides
Zygophyllum clavatum
Salsola aphylla
and at some places *Salsola nollothensis*.

All plants had a cushionlike form due to the effect of wind and sand which forms small secondary dunes of different heights. On the more or less gravelly flats to the east, farther away from the coast, the vegetation is very scanty, only *Zygophyllum stapffii* and *Arthroa leubnitziae* can be found. Large parts of these flats are quite barren, probably caused by the saline or gypsum content of the soil. At Wlotzka's Baken (about 24 miles north of Swakopmund) between great Diorite boulders and stones the following species were found:

Drosanthemum parianum
Ruschia sp. prob. *R. sedoides*
Tetragonia arbusculoides

When these parts receive sufficient precipitation a lot of annual plants come up, such as:

Stipagrostis hermannii
S. namibensis
S. subacaulis
Hermannia solaniflora
etc., to mention only a few.

Some of the gypsum plains, otherwise quite barren, are densely covered with *Lichens*. In the early mornings when these *Lichens* are still fresh due to the previous nights mist it is a beautiful sight to observe the different changes in the colours, varying from yellow and greygreen (mostly by *Telochyistes flavicans*) to dark green (prob. by *Parmelia* spp.).

At Cape Cross this Lichen flora was quite plentiful. Near the border of a saltpan north of Cape Cross we came upon a little "spring garden" of beautiful colours and flowers consisting of:

Hydrodea bossiana, on the whole a very sappy and succulent plant of brilliant red colour with very small yellow flowers that are hidden in the swollen sepals,

Zygophyllum simplex, deep yellow mats about 1 metre in diameter,

Pentzia hereroensis, roundish cushions up to 50 cm in diameter covered by their yellow capitula, and with very succulent, almost roundish leaves (due to the salt concentration of the soil),

Sesuvium sesuvioides, also in flat mats with purple flowers and dark green leaves which are usually folded, and

Osteospermum microcarpum ssp. *septentrionale*, upright, to 50 cm high and more with showy glossy-yellow flowers.

While the Omaruru River was almost without any vegetation except for *Nicotiana glauca* and *Datura innoxia* (both introduced weeds), the bed of the Ugab River was densely covered with plants, mostly with *Sporobolus robustus*.

At the Koichab River we met again with a coastal dune belt and we found the first specimens of *Merremia multisecta* (a Convolvulaceae), of which some plants had creamy-white flowers and some others white flowers with a dark purple centre, but the two types of flower colour never could be seen intermingled on the same plant.

Between the dunes, consisting of a greyish to almost white sand, and the coast to about 2-4 miles inland, we found huge solitary dunes, built of and covered by *Salsola nollothensis*. *Ectadium virgatum* var. *rotundifolium*, a shrub up to 1 metre high, for the first time collected in 1961 in this area by myself, grows in association with *Merremia*, *Citrullus ecirrhosus* and to the east of Torra Bay with *Welwitschia mirabilis*. *Merremia* and *Ectadium* probably have here their southernmost distribution limit.

In the Delta of the Unjab River we saw several water holes or vleis (with brakish water) which were densely grown with

Phragmites australis
Thypha latifolia var. *capensis*
Scirpus dioicus
Scirpus littoralis
Juncellus laevigatus

The last one grew in dense mats around and partly in the vleis. In 1961 noticed *Zygophyllum stapffii* growing right into the brakish water here.

In the dry river beds a dense cushionlike vegetation of *Salsola* sp., *Zygophyllum clavatum* and *Zygophyllum stapffii* was seen.

North of the Unjab River we found a change in the sparse vegetation *Stipagrostis ramulosa*, for the first time collected in 1963 by B. de Winter and D. Hardy, Pretoria, was scattered in the sandy flat riverbeds. On brakish flats with some underground moisture more or less dense stands of *Odyssea paucinervis* were seen, surrounded by small cushions of *Zygophyllum clavatum* in the drier zone. Before reaching the Hoanib River the first tufts of *Eragrostis cyperoides* were seen. The northern limit of *E. cyperoides* was formerly considered to be Sandwich Harbour, south of Walvis Bay. On red granite hills *Othonna lasiocarpa* as well as a Gramineae species, not identified yet, were seen growing. Farther inland *Lithops ruschiorum* could also be found together with *Sarcocaulon mossamedense* and *Othonna lasiocarpa*.

Crossing the higher white dunes at the Hoanib River we found solitary specimens of *Eragrostis cyperoides* growing high up on the dunes.

North of Rocky Point our route passed the Mining Camp of Sarusas which lies north of the Khumib River and where Amethyst and Agates are mined. The tracks to the north were now between 2-7 miles away from the coast. The vegetation to Cape Frio remained the same and was mostly found in the sandy water courses coming from the low or high ridges or mountains about 5-8 miles inland.

Merremia multisecta formed mats or cushions of 2 and more metre in diameter,

Zygophyllum stapffii, at some places in bigger communities,
Z. clavatum, growing farther inland than before,
Psilocaulon sp. prob. *P. salicornioides*
Indigofera cunensis

Hermannia sp., a yellowish-greygreen flat shrub of about 50 cm in height and about 1 metre in diameter,

Stipagrostis ramulosa together with *Eragrostis cyperoides* were the two most common grasses in this coastal region.

Odyssea paucinervis was found only locally on low wet places where the underground waterlevel was higher, e.g. near a very small waterhole north of the Cape Frio Camp.

Ectadium virgatum var. *rotundifolium* became quite abundant and was the only shrubby plant of this area. This shrub is covered by sand and then grows out again through the covering. Almost all these shrubs were in flower. The flowers are small with a yellowish-olive colour and a very sweet scent.

At the waterhole Okau (which has brackish water), about 8 miles south of the Cape Frio Camp where the Kumundum River comes out of the granite ridges covered by white sand, we found *Tamarix usneoides* and a solitary *Salvadora persica*. On solitary dunes, up to 5 metre high, *Acanthosicyos horrida*, the Naras, was found. It is perhaps of interest to mention that *A. horrida* grew eastwards with the Kumundum River for about 20 miles in the direction of Orupembe. About 15 miles East of Okau in the same river the first small trees of *Balanites welwitschii* were found. In the very sandy riverbed, where the waterlevel was very high, *Phragmites australis* was abundant and grew in the vicinity of the waterhole.

At Camp Cape Frio, the most northern point we visited, we found nearly the same composition of vegetation as at Okau, but here *Stipagrostis ramulosa* grew more abundantly on the sandy and more open parts of the different riverbeds and flats in the vicinity. *Ectadium virgatum* var. *rotundifolium* and *Salsola* sp. were, besides a few larger shrubs of *Tamarix usneoides* in the Nadas River, the main shrubby components.

Odysea paucinervis grew mostly on moist places and formed dense mats at times, also emerging from windblown sanddunes. *Hermannia* sp., *Indigofera cunenensis* and *Merremia multisecta* are low growing perennials also mostly emerging through small sanddunes of 2 metres or more in diameter. A small perennial *Crotalaria* sp. which was occasionally found was browsed to a height of 15-20 cm by game.

Eragrostis cyperioides was also abundant (inland to 5 miles to the east). Farther towards and in the vicinity of the coast at False Cape Frio and Cape Frio only a *Salsola* sp., prob. *S. nollothensis*, could be found.

On our return route from Sarusas to Swakopmund we took a more inland route with a distance of about 30 miles from the coast. In the riverbed of the Khumib, in which we drove up for about 12 miles, we found *Acanthosicyos horrida* far inland. The Omumborombonga, *Combretum imberbe*, comes down with the river to within 15 miles from the coast, where it grew as a very low shrub.

Lastly I should like to mention *Petalidium angustitubum* which is quite new for South West Africa. I found it from South of the Khumib River on our way to the Hoarusib River and on the barren country almost to the Unjab River.

Sometimes it was the only plant, but South of the Unjab it was not seen again.

Welwitschia mirabilis Hook. f. in association with *Calicorema capitata* formed a small population about 10 miles south of the Hoarusib River and about 15 miles from the coast while further to the south they grew as scattered specimens on the barren undulating flats.

At Torra Bay, south of the Unjab River there was another population very widely spaced, coming down from the escarpment with a river bed, at least right up to the east of the coastal dunes about 8 miles from the coast. It was most interesting to observe that the *Welwitschia* plants nearest to the coast were the largest and gradually became smaller farther inland.

Concluding one can say that the Northern Namib has a different composition of the vegetation due to the Angolan elements such as *Merremia multisecta*, *Indigofera cunenensis* as well as the newly described endemits as *Stipagrostis ramulosa*, *Petalidium angustitubum*, *Barleria solitaria* (farther inland to the East of Torra Bay) and the variety *rotundifolium* of *Ectadium virgatum*. Besides these plants, which are characteristic for the Northern Namib, we find plants of the Central Namib going up into the area of the Northern Namib.

In the same way in the Central Namib numerous genera which grow in the Southern Namib appear again north of the great sanddune barrier and reach as far as Cape Cross. They are *Othonna protecta*, *Drosanthemum paxianum*, *Ruschia* sp. near *R. sedoides* (from Lüderitz) and *Crassula mesembrianthemopsis* collected recently not far South of Cape Cross, to mention only a few.

More collecting in the area of the Northern Namib must be done, especially after rain to get a better survey on the whole vegetation.

It can be seen in the following check-list that only perennial plants were collected on this short reconnaissance trip. That means that only those plants which are adapted to the extremely dry conditions and strong winds can stay alive with the little moisture they receive by the fog or the very irregular precipitation.

ACKNOWLEDGEMENTS

The Author is much indebted to the Sarusas Development Co-operation who made it possible for him to visit the area. A special word of thanks to Mr. Ernst Karlowa for his hospitality and for all the help he gave in making a success of the excursion.

ZUSAMMENFASSUNG

Ein kurzer Bericht wird über die Vegetationsverhältnisse der Küsten-Namib von Swakopmund bis Kap Frio gegeben. Wegen der in dem nördlichen Teil der Namib vorkommenden Florenelemente, die zum Teil von Angola hereinstrahlen, zum anderen Endemiten dieses Gebietes sind, wird eine Unterteilung der Namib in eine Nördliche, Zentrale und Südliche Namib vorgenommen. Diese Unterteilung stimmt mit den Spreitzerschen Beobachtungen aus dem Jahr 1961 überein, die in seiner Arbeit 1965 niedergelegt sind. Eine Liste der während der Fahrt gesammelten Pflanzen ist dieser kurzen Uebersicht beigelegt.

OPSOMMING

'n Kort oorsig word gegee oor die plantegroei van die Namib-Kus vanaf Swakopmund tot by Kaap Frio. Aangesien die samestelling van die plantegroei

in die noordelike dele van die Namib verander, veroorsaak gedeeltelik deur plantelemente vanaf Angola en gedeeltelik deur endemiete van hierdie gebied, word 'n onderverdeling van die Namib in die volgende: die Noordelike, Sentrale en Suidelike Namib voorgestel. Hierdie onderverdeling stem teen nouste ooreen met die observasies wat Prof. H. Spreitzer gedurende sy studieverblyf in 1961 gemaak het en wat in 1965 gepubliseer is. 'n Lys van die versamelde plante is aangeheg.

CHECK-LIST

The list includes only the plants which were collected or seen during January 1966. The plants were all collected by the author (G) and have the collector's number. The abbreviation "not." stands for noted and are the plants which were seen during the journey.

The families and genera have been arranged according to Phillips, The Genera of South African Flowering Plants, 1951, and the species are arranged alphabetically.

WELWITSCHIACEAE

Welwitschia mirabilis Hook. f.

Between the Hoarusib and Hoanib River, from about 10 miles south of the Hoarusib and 15 miles from the coast, G. not. — East of Torra Bay, about 8 miles from the coast (coll. 1961), G. not.

TYPHACEAE

Typha latifolia L. ssp. *capensis* Rohrb.

In waterholes of the Unjab, Hoanib and Hoarusib rivers near the coast, G. not.

POTAMOGETONACEAE

Potamogeton pectinatus L.

Submerged waterplant in the brakish water of the waterholes in the Unjab River, G. not.

GRAMINEAE

Stipagrostis ramulosa de Winter

The type-locality is the Unjab river-bed (coll. by B. de Winter & D. Hardy in 1963). It was seen also about 12 miles from the coast on the gravelly banks of the Unjab River. From the Unjab River to the north it becomes more abundant at places. It was also collected north of Cape Frio. G. 9066, 9072, 9083, 9084.

Stipagrostis sp.

Very dry perennial tufts. Between Okau waterhole and the Camp of Cape Frio, (to poor for identification), G. not.

Sporobolus virginicus (L.) Kunth

Forming dense mats near the waterholes in the Unjab river-bed, G. not.

S. robustus Kunth

Large coarse tufts up to 2 m high; very dense in the Ugab river-bed, G. not.

Polypogon monspeliensis Desf.

On moist sand not very far from a small running stream in the Unjab river-bed, G. not.

Asthenatherum glaucum (Nees) Newski var. *lasiophyllum* (Pilger) Covert

Coastal-Namib: North of Okau on coarse wind-blown sand between rocks. Only a few small living plants were seen, G. 9037.

Chloris sp.

Perennial plant with long stolons which root at the nodes. In moist river-bed of the Unjab, near Möwe Bucht on dry granite outcrops and to the east of Sarusas also on dry granite hills, G. not.

Phragmites australis (Cav.) Trin. ex Steudel.

Near waterholes or small running streams in the river-beds of the Unjab, Hoanib and Hoarusib, and the waterhole at Okau, G. not.

Odyssea paucinervis (Nees) Stapf

In the Ugab river-bed, in moist brakish depressions in the delta of the Unjab River and north of the delta. Also in the Nadas River near the waterhole north of the Camp of Cape Frio, G. 9082 and not.

Eragrostis cyperoides (Thunb.) Beauv.

From the white dunes at the Hoanib River to the north becoming more abundant between Sarusas and Cape Frio, G. 9074 and not.

Eragrostis walteri Pilger

In the Unjab river-bed near a small waterstream, G. not.

CYPERACEAE

Juncellus laevigatus (L.) C. B. Clarke

In dense mats near the waterholes in the Unjab River and along a small waterstream farther west, G. not.

Scirpus dioicus (Kunth) Boeck.

Forming dense stands near the waterholes and in wide spaced tufts along the small waterstream in moist sand in the Unjab river-bed, G. not.

S. littoralis Schrader

Near the waterholes in the Unjab and Hoanib rivers, G. not.

JUNCACEAE

Juncus arabicus (Ascherson & Buchenau) Adanson

In dense stands in and around waterholes in the Unjab river-bed, G. not.

LORANTHACEAE

Loranthus sp.

Parasitic on a *Balanites welwitschii* tree in the Kumundum river-bed about 25 miles from the coast, G. 9093.

CHENOPODIACEAE

Arthrocnemum natalense (Ung.-Sternb.) Moss var. *affine* (Moss) Tölken

Near the waterholes in the Unjab river-bed, G. not.

Suaeda sp.

Sterile shrubs in the Ugab and Unjab river-beds, G. not.

Salsola aphylla L. f.

One of the components of the coastal vegetation strip near the beach in association with *Zygophyllum clavatum* and *Psilocaulon salicornioides*. Coll. 20 miles north of Cape Cross, G. 9139. Also found farther north on the banks of the Hoanib River, G. 9068.

S. nollothensis Aellen

On both banks of the Omaruru River, in a depression 33 miles north of Cape Cross and farther north to Cape Frio, G. 9059 and not.

S. arborea C. A. Smith ex Aellen

Shrubs on small dunes (up to 3 m high). Those on the banks and in the river-bed are smaller. At the Hoanib River, G. 9067.

AMARANTHACEAE

Celosia spathulifolia Engler

Near a saltpan, 36 miles north of Cape Cross, G. 9061.

Arthroerua leubnitziae (O. Kuntze) Schinz

On Namib gravel-flats from Swakopmund to Cape Frio sporadically in the vicinity of the coast, but never in the more sandy areas, G. not.

Calicorema capitata (Moq.) Hook. fil.

Between the Hoarusib and Hoanib rivers, about 20 miles from the coast in association with *Welwitschia mirabilis*, G. not.

AIZOACEAE

Hypertelis caespitosa Friedrich

Near a saltpan 36 miles north of Cape Cross in association with *Sesuvium sesuvioides*, *Pentzia hereroensis* and *Celosia spathulifolia*, also in the coastal vegetation strip near Wlotzka's Baken, G. 9062, 9136.

Sesuvium sesuvioides (Fenzl) Verdc.

36 miles north of Cape Cross on very saline soil near a salt pan, G. not.

Hydrodea bossiana Dinter

Near a saltpan north of Cape Cross and in the Unjab river-bed, G. not.

Lithops ruschiorum (Dinter & Schwantes) N.E. Br.

Granite hills east of Sarusas, G. not.

Psilocaulon sp. cf. *P. arenosum* (Schinz) Bol.

36 miles north of Cape Cross, G. 9063.

P. salicornioides (Pax) Schwantes

In the coastal vegetation strip from north of Swakopmund to the north of Cape Cross, G. not.

Drosanthemum paxianum (Schltr. & Diels) Schwantes

At Wlotzka's Baken and Cape Cross in sandy gravel between rocks, G. not.

Ruschia sp. cf. *R. sedoides* (Dinter & Berger) Friedrich

Between rocks at Wlotzka's Baken and Cape Cross, G. not.

CAPPARACEAE

Capparis hereroensis Schinz

In the sand of the Unjab river-bed, G. not.

CRASSULACEAE

Crassula mesembrianthemopsis Dinter

On rocky quartzite outcrops and in depressions sometimes covered by sand south of Cape Cross, G. not.

LEGUMINOSAE

Crotalaria sp.

In the sandy parts of the Nadas River north of the Camp Cape Frio; mostly browsed by game. (Near one of the plants we found a snake, the Side-windin Adder, *Bitis peringueyi*). G. 9081.

Indigofera cuneneensis Torre

New for South West Africa. From Okau to Camp Cape Frio. Help in building up small dunes of — 60 cm high and 1.50 m in diameter, G. 9071, 9080.

ZYGOPHYLLACEAE

Zygophyllum clavatum Schlechter & Diels

Component of the coastal vegetation strip from north of Swakopmund to north of Cape Cross. Also found in the delta of the Unjab River and near Okau, G. not.

Z. simplex L.

North of Cape Cross near a salt pan, G. not.

Z. stapffii Schinz

In the Unjab River near the waterholes. Farther to the north it is abundant near the Okau waterhole, G. 9065.

Balanites welwitschii (Tieghe) Exell & Mendonca

A small tree in the Kumundum River about 15 miles to the East of Okau waterhole, G. 9092.

EUPHORBIACEAE

Euphorbia sp.

In the mountains (Lagunenber) near Cape Cross, G. not. (This species which also occurs in the Zwartbank-mountains near the Kuiseb River has not yet been identified).

STERCULIACEAE

Hermannia solaniflora K. Schum.

Near Torra Bay in sandy depressions, G. not.

Hermannia sp.

Shrubby yellow-greygreen plants, sometimes on little dunes near Möwe Bucht and east of Sarusas in a fairly dense population, G. not.

TAMARICACEAE

Tamarix usneoides E. Meyer ex Bunge

East of and near the waterhole Okau and at the small waterhole in the Nadas River near Camp Cape Frio, G. not.

COMBRETACEAE

Combretum imberbe wauera

Cushionlike shrubs up to 3 metre in diameter in the Kumundum river-bed east of Sarusas, G. not.

SALVADORACEAE

Salvadora persica L.

Only one shrub was seen near the waterhole Okau, G. not.

ASCLEPIADACEAE

Ectadium virgatum E. Mey. var. *rotundifolium* H. Huber

The type-locality of this variety is the river-bed east of Torra Bay. From there onwards the shrub becomes more abundant and is very characteristic for the area around Camp Cape Frio, G. 9069, 9078, 9089.

Trichocaulon pedicellatum Schinz

Frequent in the mountains (Lagunenber) near Cape Cross, G. not.

CONVOLVULACEAE

Merremia multisecta Hall. fil.

This plant was first collected in 1961 in a river-bed 8 miles to the East of Torra Bay. From Torra Bay northwards to Cape Frio it becomes more abundant, G. 9076.

SOLANACEAE

Lycium sp.

Near the beach at Henties Bay and in the mountains of Cape Cross, G. not.

Datura innoxia Mill.

An introduced weed in the river-beds of the Omaruru, Ugab and Huab, G. not.

Nicotiana glauca Graham

An introduced shrub-like weed, frequent in the river-beds of the Omaruru and Ugab, G. not.

ACANTHACEAE

Petalidium angustitubum P. G. Meyer

A newly described species of *Petalidium* occurring from south of the Kumundum River to the Hoarusib River and further south to the Unjab River. G. 9095 (Type). It was only collected once before by Giess & Leippert in 1963 in the Kaokoveld between Orupembe and Sarusas.

Petalidium giessii P. G. Meyer

Another new species from the area. The type locality is the escarpment about 21 miles east of Torra Bay, G. not.

Barleria solitaria P. G. Meyer

The third plant which was newly described from this area. It occurs together with *Petalidium giessii* at the escarpment east of Torra Bay, G. not.

CUCURBITACEAE

Citrullus ecirrhosus Cogn.

In a shallow river-bed east of Torra Bay, G. not.

Acanthosicyos horrida Welw.

Fairly old plants on huge solitary dunes near Okau waterhole. In the river-beds of the Kumundum and Khumib the plants were seen fairly far inland, G. not.

COMPOSITAE

Pentzia hereroensis O. Hoffm.

Small annual and perennial plants near a salt-pan 36 miles north of Cape Cross, G. 9060, 9060a.

Othonna lasiocarpa (DC.) Schultz-Bip.

On stony outcrops near Möwe Bucht and east of Sarusas, G. not.

Osteospermum microcarpum (Harv.) T. Norl. ssp. *septentrionale* (T. Norl.) T. Norl.

Fairly frequent in shallow depressions from Cape Cross to the north but from the Ugab River it was no longer seen in the vicinity of the coast, G. not.

Plate 1:

Tufts of *Stipagrostis ramulosa de Winter* on gravel plains north of the Unjab River, growing flat on the ground due to the strong south-western wind, and showing the typical small sand dunes on the leeseide.

Die weit zerstreut stehenden kleinen Horste von *Stipagrostis ramulosa de Winter* auf der Namibkiesfläche nördlich des Unjab Riviers sind durch den starken Südwestwind flach an den Boden gepreßt. Auf der Leeseite sind die typischen kleinen Sanddünen zu sehen.

Namibgruisvlakte noord van die Unjab rivier met klein polle van die gras *Stipagrostis ramulosa de Winter* wat meestal plat op die grond groei. Dit is veroorsaak deur die sterk suidweste wind. Op die lykant van die plante kan die tipiese duintjies gesien word.



Plate 2:

East of the waterhole Okau. High up the rocky ridges or hills are covered by white sand. In the foreground a dead shrub of *Salsola*, with *Zygophyllum stapffii* to the left and further back *Salsola* tussocks intergrown and building up small dunes.

Östlich der Wasserstelle Okau, etwa 8 Meilen südlich des Kamps von Kap Frio. Die Felsrücken der höher gelegenen Hügel sind mit weißem Sand überweht. Im Vordergrund ein abgestorbener *Salsola*-Strauch und links auf der Südwestseite der kleinen Düne *Zygophyllum stapffii*. Im Hintergrund sind die, die kleinen Dünen aufbauenden *Salsola*-Sträucher zu sehen.

Oos van die waterplek Okau, wat omtrent 8 myl suid van die Kamp van Kaap Frio geleë is, is al die rante en heuwels met wit sand oorwaai. In die voorgrond is 'n dooie struik van *Salsola* en links *Zygophyllum stapffii*. Die klein wit duine word meestal deur *Salsola* struikie opgebou.

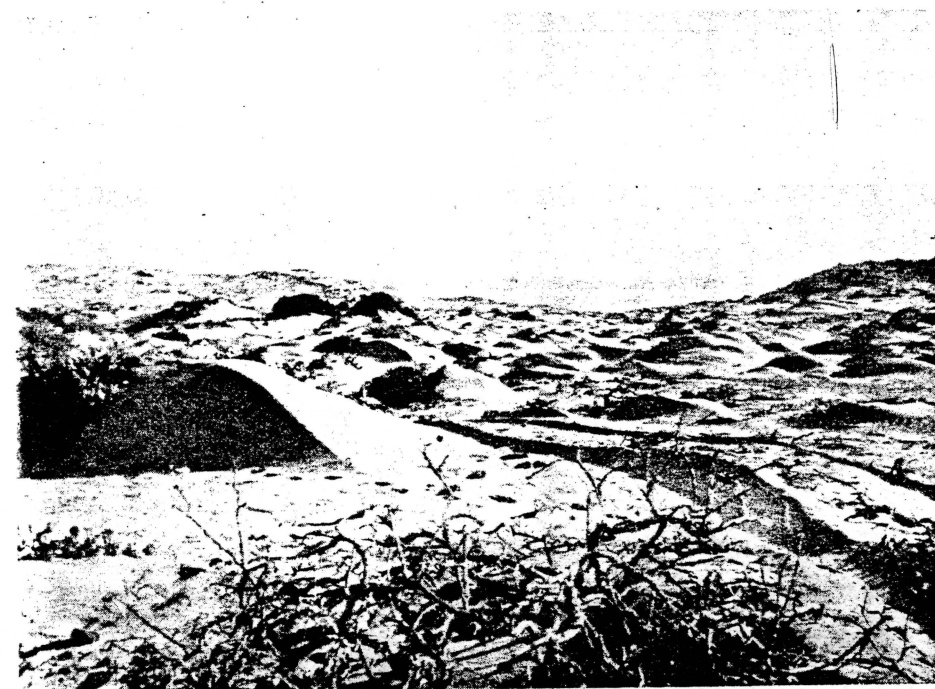


Plate 3:

The waterhole Okau with very brak water. The vegetation consists of *Salsola nollothensis*, *Zygophyllum stapffii*, *Z. clavatum*, *Psilocaulon sp.*, *Tamarix usneoides* and *Phragmites australis*. Only one plant of *Salvadora persica* could be found in the whole area.

Die Wasserstelle Okau hat nur sehr brackiges Wasser. Die Vegetation besteht aus *Salsola nollothensis*, *Zygophyllum stapffii*, *Z. clavatum*, *Psilocaulon sp.*, *Tamarix usneoides* und *Phragmites australis*. Nur ein Strauch von *Salvadora persica* konnte in dem ganzen Gebiet festgestellt werden.

Die waterplek Okau het net brakwater. Die plantegroei bestaan uit *Salsola nollothensis*, *Zygophyllum stapffii*, *Z. clavatum*, *Psilocaulon sp.*, *Tamarix usneoides* en *Phragmites australis*. Net een enkele *Salvadora persica* struik kon in die area opgemerk word.



Plate 4:

Filling up the water-tanks for the Camp of Cape Frio at the waterhole Okau. The water can only be used for washing due to its brackishness. In the foreground cushions of *Psilocaulon sp.*

Die Wassertanks für den Kamp von Kap Frio werden gefüllt. Das sehr brackige Wasser kann nur zum Waschen verwendet werden. Im Vordergrund sind Polster einer *Psilocaulon* Art.

Die watertanks vir die Kamp Kaap Frio word vol gemaak. Die water is so brak dat dit net vir was kan gebruik word. In die voorgrond is plante van 'n *Psilocaulon* soort.

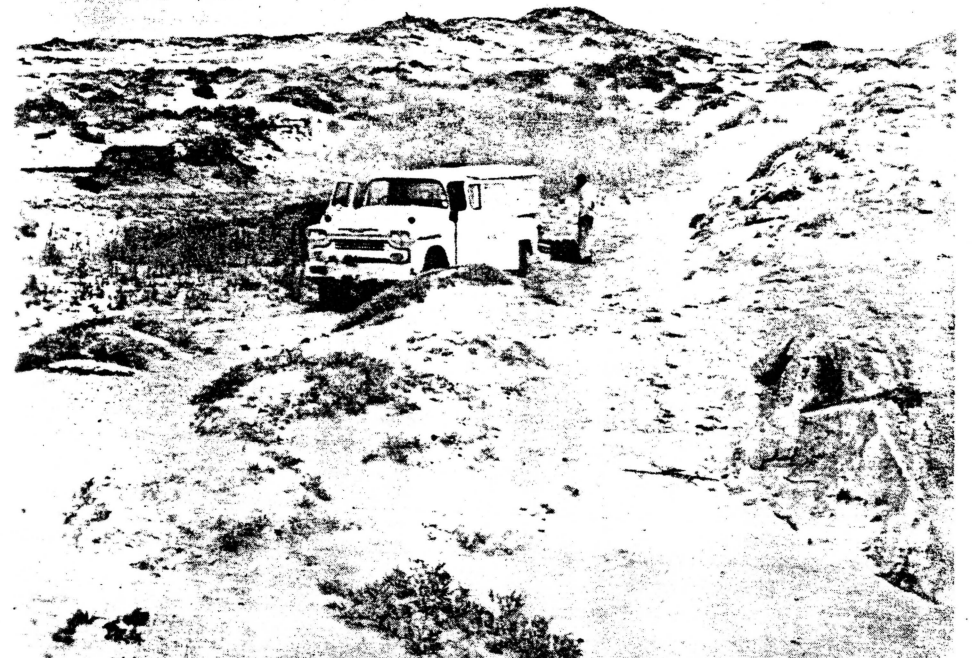


Plate 5:

Solitary small dunes up to 5 metre high, intergrown, built up and covered by *Acanthosicyos horrida* found between the waterhole Okau and the salt pans in the background.

Einzelstehende, bis 5 Meter hohe, kleine Dünen, die von der Naras (*Acanthosicyos horrida*) aufgebaut und von ihr gekrönt sind, stehen zwischen der Wasserstelle Okau und den Salzpfannen im Hintergrund.

Enkele duine, tot 5 meter hoog, wat deur die Narasplant (*Acanthosicyos horrida*) opgebou en begroei is, staan tussen die waterplek Okau en die soutpanne in die agtergrond.



Plate 6:

Ectadium virgatum E. Meyer var. *rotundifolium* H. Huber on sandy gravel plains north of the Unjab River, about 20 miles inland from the coast. The white sand-dunes which stretch along the coast can be seen in the background.

Ein Strauch von *Ectadium virgatum* var. *rotundifolium* auf einer etwas sandigen Namibkiesfläche nördlich des Unjab Riviers, etwa 20 Meilen Inland von der Küste. Der weiße Sanddüngürtel, der sich entlang der Küste hinzieht, ist im Hintergrund zu sehen.

'n Struik van *Ectadium virgatum* var. *rotundifolium* op 'n sanderige Namibgruisvlakte noord van die Unjab rivier, omtrent 20 myl van die kus af binnelands. Die wit sandduine wat langs die kus geleë is, is op die agtergrond te sien.



Lesley:

River flow data: for at least 5 yrs to the variation in flow.
We have the data for 2002.

Water logger data:

D: \- NTFS \ users \ helmut \ windows \ system