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A Preliminary Account of the Dune Communities at Pennington Park, Mtunzini, Natal

by

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Abstract

A general description of Pennington Park is given, and some of the more important environmental factors affecting the plant communities are discussed. The structure, distribution and ecology of the various dune communities, from pioneers to Dune Forest, is given. The importance of Pennington Park as a conservation area is discussed in the light of the paucity of comparable sites and the human pressure on this type of environment.

Introduction

During 1960 and 1961 two parties of students from Natal University, Pietermaritzburg, visited Pennington Park, on the farm "Twinstreams" in Zululand, to study the dune vegetation. Various ecological surveys and physiological experiments were conducted on the dune vegetation, and two preliminary reports were compiled (Anon, 1960, 1961). These reports, which contain some interesting data, were not published so the results of this work have hitherto not been available. The area studied is the only place in Natal where there is significant active and extensive sand deposition, dune formation, dune stabilization and colonization. It was decided, therefore, to extract data from the two University reports and to add additional and recent observations in an attempt to describe, in reasonable detail, the ecology of the dune pioneers and their successors. There is a need for these observations to be generally available because, with the development of Richard's Bay harbour, 35 km to the north, Mtunzini has been ear-marked for considerable tourist development. Such development would certainly have a severe detrimental affect on the dune communities, which are highly susceptible to disturbance. Thus a unique kind of vegetation is threatened.

That the dune communities of the area are still well protected is due almost entirely to the conservation efforts of a local farmer, Mr. I. F. Garland, on whose farm "Twinstreams" most of the Dune Forests occurs. Also, part of the coastral strip, between the Dune Forest and the sea, is administered by the Natal Parks, Game and Fish Preservation Board and is included in the Umlalazi Nature Reserve (Fig. 1). This latter area is open to the public so the dune communities are threatened unless adequate measures can be taken to prevent inappropriate utilization of the dunes.

Location and Physiography

The area under consideration is situated on the east coast of Natal at the southern extremity of the Moçambique coast plain, approximately 130 km north-east of Durban, at lat. 28°58'S and long. 31°46'E. The beach profile slopes gently up from the sea to the extreme high tide mark, then rises sharply in a series of steeply undulating dunes (Plate 1), which are almost parallel to the coast and up to 10 m high. Sand is actively deposited off-shore and new dunes are continually being found. Under present conditions it takes approximately 10 years to stabilize a dune (Plate 2).

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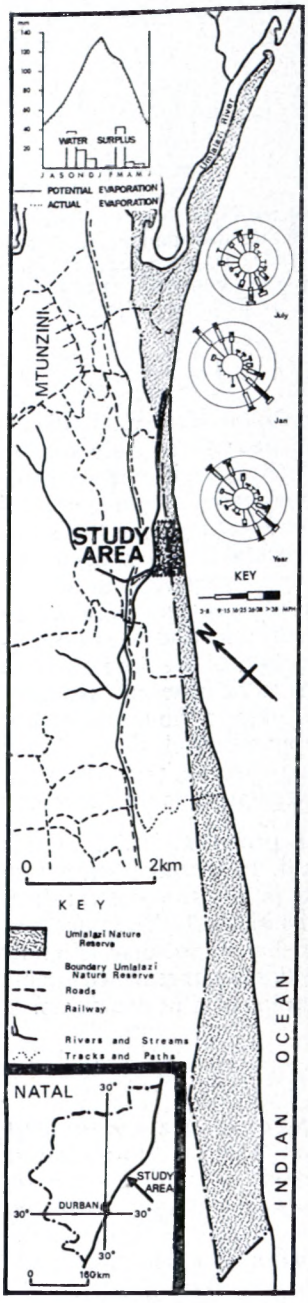

PLATE 1.—A general view of the beach showing the gently sloping beach and the line of steep, **Scaevola** covered, dunes. Note the **Scaevola** seeds at the foot of the dune in the foreground, and also the scattered **Scaevola** plants on the beach—these plants mark the line of the next new dune.

PLATE 2.—The stable dune in the foreground is mainly covered by **Scaevola,** but other dune pioneers also occur. The fore-dune shown, is about 10 years old and stabilized almost exclusively by **Scaevola.**

FIG. 1.—Map showing the location of the study area, the extent of the Umlalazi Nature Reserve, the important wind roses (Weather Bureau, 1960), and the water balance (Thornthwaite & Mather, 1962) for Mtunzini area.

The soils on the more recent dunes are a light yellowish brown fine sand, with no humus and a pH of about 7,8. On the older dunes, which support a closed woody community of Dune Forest, the soils are very dark greyish-brown sands, with a relatively high humus content and a pH of between 7,2 and 7,4. Along the banks of the Siayi Lagoon the alluvial soils are a grey to black clay-loam, with a high gritty content and a pH of about 6,4.*

Climate

Detailed climatic data for the area are available only from Durban, which is on the coast, but is 130 km SW of Mtunzini. The only data available locally are rainfall records.

The prevailing winds are mainly from the NE and SW quarters. Winds are an important factor influencing plant growth, particularly those strong winds which blow off the sea, carrying salt-spray. The effect of this wind-borne salt-spray has been discussed frequently in the literature (e.g. Bews, 1920; Henkel, Ballenden & Bayer, 1936; Bayer, 1938, 1952; Hillary, 1947; Edwards, 1967; and Moll, 1968), but has not been studied in detail. It is generally considered that the wind-borne salt-spray is deposited on the windward side of plants killing growing points, resulting in the lopsided growth of woody plants and the pruned-hedge effect of the Dune Forest canopy (Plate 3).

Plate 3.—An example of the pruning effect of wind carried salt-spray on the Dune Forest canopy at Mapelana (about 90 km NE of Mtunzini), where old, steep dunes come right down to the beach.

* Soil descriptions follow the terminology of Loxton, 1962. Initial soil pH determinations were made using a Lovibond Colorimetric Comparator and checking these with a pH meter.

Winds which bring most salt-spray blow chiefly from September to January (see wind rose insets in Fig. 1) and often reach a speed of 16–25 MPH (26–40 km/h), gusts of up to 88 MPH (140 km/h) having been recorded (Weather Bureau, 1960). These strong winds usually blow between 8 a.m. and 10 p.m.

Rainfall data are available from Mtunzini and have been summarized in Table I.

TABLE I.—Mean monthly and annual rainfall recorded at Mtunzini over a 53 year period (Weather Bureau, 1954).

Month	J	F	M	A	M	J	J	A	S	O	N	D	Year
Rainfall in mm	134,8	146,2	141,0	98,8	79,8	59,7	51,7	49,2	85,2	103,9	112,9	141,3	1 204,5
Days with rain	8	7	7	5	4	3	3	4	5	8	8	7	69

Summer is the wettest season, although a reasonable amount of rain occurs throughout the year. Temperatures are relatively mild, and data available from Durban, covering a period of 76 years, record an absolute minimum of 4,1°C in July 1947 and an absolute maximum of 41,9°C in September 1946. The mean annual temperature is 20,5°C with a mean daily range of 8,3°C. Under this climatic régime of moderate temperatures and good rainfall there is seldom, if ever, a soil water deficit (see Thornthwaite & Mather, 1962; and diagram inset Fig. 1), so conditions for plant growth are very good. Mtunzini, being 130 km NE of Durban, is rather more subtropical, so minimum and maximum temperatures are probably higher.

VEGETATION

The most important first pioneer of the shifting sand on the beach is *Scaevola thunbergii*. Some other pioneers of minor importance are *Launnaea sarmentosa* and *Arctotheca populofolia*. The *Scaevola* colonies form an open, scattered community up to about one metre tall. *Scaevola* seeds are round and light, and roll down the dunes (Plate 1) from whence they are readily blown about. *Scaevola* is capable of continuous stem elongation and adventitious root production from sand-covered stems, and thrives where moving sand is continually covering existing communities. *Scaevola* is tolerant of salt-spray and at Mtunzini seldom occurs beyond the fourth dune. Healthy *Scaevola* colonies are dominant on the first and second dunes, and in areas on the third dunes where disturbance has caused shifting sand. On the third and fourth dunes, where *Scaevola* is also common, the plants are weak as a result of the dunes being relatively stable. This weakened community, where the lateral stems are usually exposed, is readily invaded by other pioneers such as *Ipomoea biloba* (Plate 4), *Canavalia pes-capre*, *Gazania rigens*, *Chrysanthemoides monilfera* and *Tephrosia canescens*, all species which require a relatively stable substrate.

Once the dunes have been stabilized and there has been sufficient modification of the soil by the pioneer plants, shrub species, particularly *Passerina rigida*, invade the pioneer strand communities. The shrub species nearest the sea grow in the dune troughs, usually 60 to 70 m from the high tide mark (Plate 5). Other shrub species usually occur further inland, such as *Eugenia capensis*, *Colpoon compressum*, *Carissa bispinosa* and *Brachylaena discolor*. Certain Dune Forest canopy trees occur as shrubs in the Dune Scrub Community, especially *Mimusops caffra*, *Apodytes dimidiata*, *Allophylus natalensis* and *Canthium obovatum* (Plate 6). The Dune Scrub near the sea is up to 2 m high forming a widely scattered community, which becomes progressively denser and taller (up to 3,5 m) further inland towards the Dune Forest (Plate 7). This trend is well illustrated in Figs. 2 and 3.

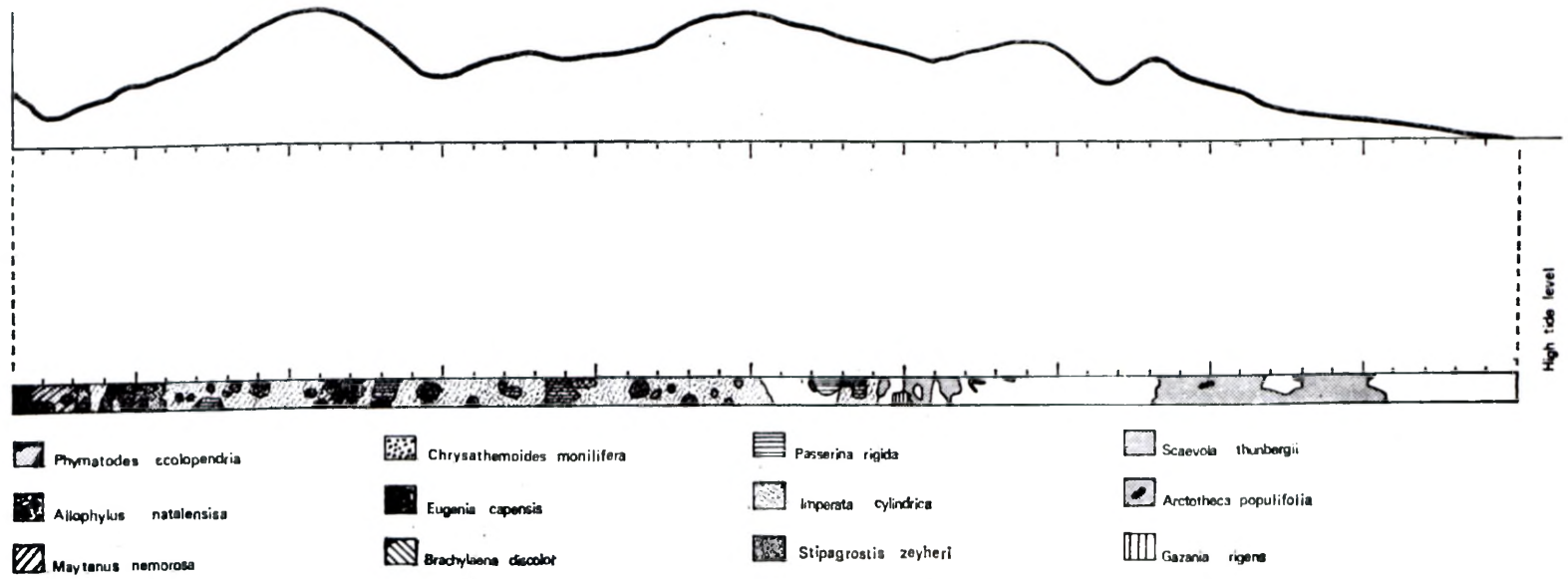

FIG. 2.—Land profile and extent of vegetation cover on a 3 m belt transect (Anon, 1960).

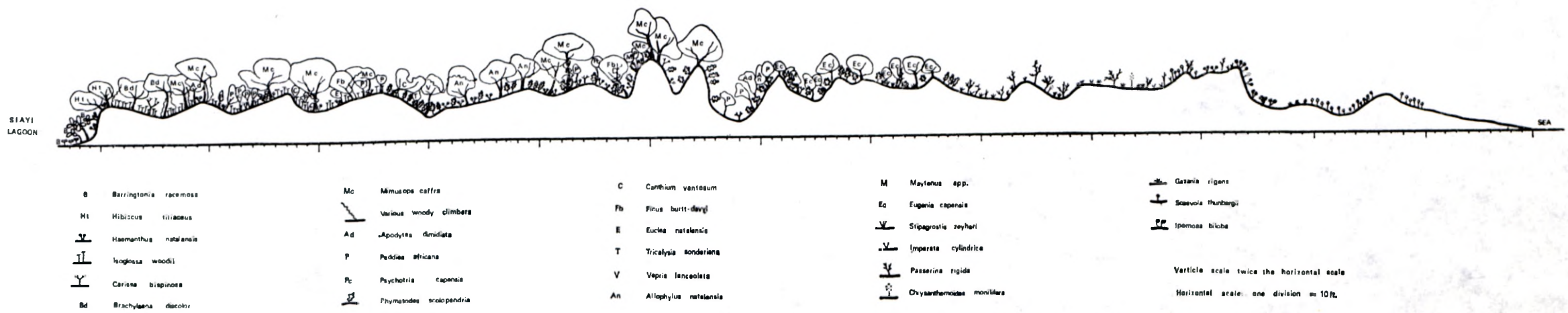

FIG. 3.—Profile diagram of the vegetation from the sea to the Siayi Lagoon. The depth of the profile was 1 m in the pioneer strand and Dune Scrub Communities, and 4,5 m in the Dune Forest (Anon, 1961).

PLATE 4.—Showing a healthy **Scaevola** community growing in shifting sand on the left. **Scaevola** is also common on the stable dune on the right, but many lateral stems are exposed; note the long runners of **Ipomoea** in the dune trough.

PLATE 5.—The first stage of Dune Scrub Community development is the invasion of the pioneer strand communities by **Stipagrostis** (the tuft grass pictured) and **Passerina** (right). Note the scattered **Scaevola** plants, particularly on the dune (left).

PLATE 6.—In the later stages of the Dune Scrub Community **Imperata** is the chief understorey species. The shrubs are more dense, with Dune Forest species, such as **Mimusops** (left), being more common. Note the dead **Passerina** (right-centre).

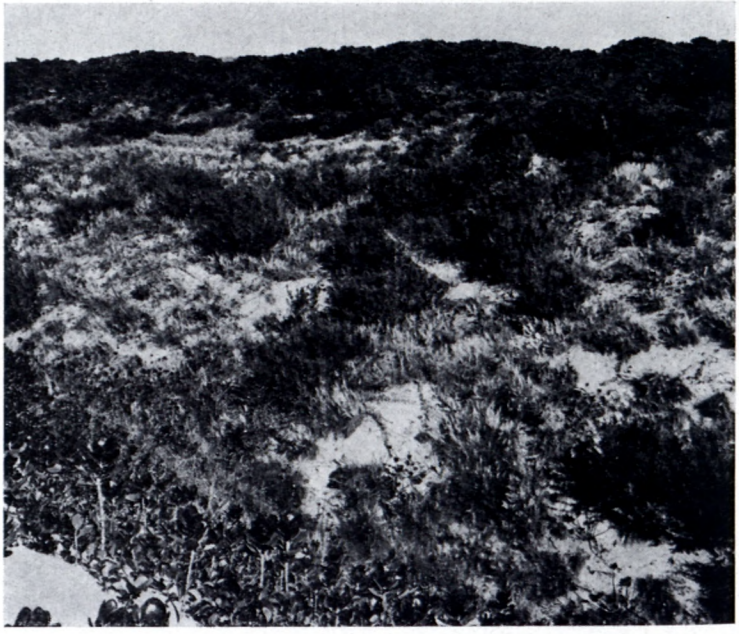

PLATE 7.—A general view of the Dune Scrub Community from the **Scaevola** dominated foredune, illustrating the invasion of the strand community by **Stipagrostis** and **Passerina,** followed by other shrub species and finally Dune Forest being established.

PLATE 8.—Dune Forest with **Phymatodes scolopendria** forming the dominant understorey herbaceous layer.

Another distinct change in the Dune Scrub Community, as one moves inland, is that first *Stipagrostis zeyheri* (Plate 5), and then *Imperata cylindrica*, both grasses, form a fairly dense understorey up to 0,75 m high, being most dense away from the sea. Various other herbaceous species occurring scattered through the Dune Scrub Community include *Helichrysum kraussii*, *Kalanchoe* sp., *Senecio* sp., *Carpobrotus dimidiata*, *Chironia baccifera* and *Gloriosa* sp. In addition, various lianes also occur, such as *Scutia myrtina*, *Dalbergia armata*, *Asparagus falcatus* and *Rhoicissus* spp., particularly *R. digitata*. In the shade of the shrubs on the dune just seaward of the Dune Forest, *Phymatodes scolopendria* is a common understorey herb.

The margin of the Dune Forest is sharply demarcated, beginning just behind the crest of a dune (see Figs 2 and 3). When walking at right angles to the sea one is inside the forest one instant and then outside within a couple of paces. The tree species forming the closed canopy (some 7 to 8 m high) nearest the sea are *Mimusops caffra*, *Allophylus natalensis*, *Eugenia capensis*, *Maytenus nemorosa*, *Euclea natalensis* and *Canthium obovatum*. Shrub species beneath the closed canopy are not common, nor are lianes. What is apparent, forming a very dense field layer, is *Phymatodes scolopendria* (Plate 8), up to 0,5 m high, which is the dominant field layer species over the next four dunes, when it suddenly gives way to a dense community of *Isoglossa woodii* (Plate 9)*. Further from the sea, and to a very limited extent in the dune troughs, the canopy tree species are taller, reaching a maximum height of about 15 to 17 m. An unexpected feature of the forest is that the external appearance of the canopy does not exhibit the usual dense, pruned-hedge effect of the Dune Forest as in other parts of Natal, because the forest is a fair distance from the sea and the salt-spray effect is much reduced.

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* The soil pH where *Phymatodes* dominates is the same as under Dune Scrub Communities, namely, 7,4, while the soil pH where *Isoglossa* dominates is 7,2.

PLATE 9.—Dune Forest with **Isoglossa** forming the dominant understorey herbaceous layer.

The older the Dune Forest, the more complex is the structure and the richer is the floristic composition. Some canopy tree species which occur further away from the sea are *Dovyalis longispina*, *Olea woodiana*, *Vepris lanceolata*, *Scolopia zeyheri*, *Trichilia emetica* and *Ekebergia capensis*. Beneath the continuous canopy is a rather ill-defined intermediate small tree and shrub layer of scattered individuals such as *Carissa bispinosa*, *Peddiea africana*, *Turraea floribunda*, *Psychotria capensis*, *Bersama lucens*, *Acokanthera oblongifolia*, *Tricalysia capensis* and *Teclea gerrardii*. Additional species which may occur scattered through the herbaceous field layer are *Haemanthus*, *Crocosmia aurea*, *Eulophidium* sp. and various species of Acanthaceae. Where *Isoglossa* occurs there are usually few herbaceous or intermediate species present due to the performance of *Isoglossa*. This species grows in extremely dense stands up to 3 m high, the whole population then flowers in the same year, dies off, and then regrows over a period of approximately seven years to complete the cycle. Thus Dune Forest with *Isoglossa* understorey can look either extremely dense, when the *Isoglossa* us 2 to 3 m high, or extremely open, when the *Isoglossa* seedlings carpet the ground.

The presence of the Dune Forest means that there is a great enrichment of the soil by humus, which is usually 10 cm and more thick. In this subtropical climate the rate of breakdown of vegetable matter on the forest floor is rapid, and numerous species of saprophytic fungi occur.

Lianes are not common in old, established Dune Forest, except where a natural tree fall has created a gap. In such gaps there develops a dense tangled mass of vegetation, but eventually a canopy tree grows through this to close the canopy. Lianes that do occur fairly frequently in the forest are *Dalbergia armata*, *Rhoicissus* sp., *Cyphostemma* sp., *Acacia kraussiana* and *Scutia myrtina*. The absence of *Flagellaria guineensis* is worthy of note.

Running through the Dune Forest at Pennington Park, almost parallel to the coast, is the Siayi Lagoon (Fig. 1). On either bank there is a dense fringing tree community of mainly *Barringtonia racemosa* and *Hibiscus tiliaceus* (Plate 10). Climbers such as *Derris uliginosa* and *Dalbergia armata* are particularly common in this community, the former growing in the wet muddy soils of the lagoon bank.

PLATE 10.—A view of the Siayi Lagoon where the fringing tree community of **Barringtonia** forms an arch over the water.

DISCUSSION

In Natal there are no examples of viable Dune Forest communities represented in a Nature Reserve, except for this example in the Umlalazi Nature Reserve and the adjoining farm "Twinstreams". With the development of Richard's Bay and the proposed development of a giant marina on the Umlalazi River, with a possible link to the Siayi Lagoon, this area is threatened. It has been demonstrated in other parts of Natal that the Dune Forest and pioneer strand communities are highly susceptible to human interference. Therefore, a special attempt should be made by conservationists to preserve a viable representative of this community. It should also be the aim of conservationists to preserve other examples of dune vegetation to the north and south of Mtunzini to include the full spectrum of types occurring. Much of this type of community has already disappeared in Natal, and the time to act is now.

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