NOTES ON SEASHORE VEGETATION OF KENYA

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For plant species, as for human groups, the East African coast is an ancient meeting ground of maritime invaders and continental natives. The historically diverse floristic elements have deployed through a variety of coastal habitats: intertidal shores of quiet alluvial estuaries and marine inlets, spray swept cliffs and dry inland ridges of emerged fossil coral, sheltered and open beaches, active and stable dunes. Superimposed on the sharp contrasts in substrate and exposure are regional rainfall gradients and local differences in artificial disturbance. The resultant intricate vegetation patterns are worthy of more study than they have yet received.

Vegetation along the temperate southeast coast as far north as Lourenço Marques has been well described (Muir, 1937; Macnae, 1963) and there is a good informal description for Zanzibar (Werth, 1901), but the mainland tropical coast is very incompletely known. Engler's classic account of African vegetation (1908-21) treats the coast of Tanganyika but for Kenya mentions only the occurrence of mangroves at Lamu. The major study of East African mangrove ecology (Walter & Steiner, 1936) is based entirely on Tanganyika. The current Flora of East Tropical Africa gives only a single Kenya locality, usually Mombasa, for each of the major mangrove species (Lewis, 1956). Finally, Birch (1963) has provided a qualitative description of part of the Kenya coastal vegetation, emphasizing climax forests and inner bushland formations on stable substrates. The rather casual observations of outpost vegetation offered here are largely complementary to Birch's study. My acquaintance with this area was incidental to a field studies of the Seychelles, conducted by Dr. William McIntire and myself. For about a week in April, 1963, while waiting for our ship to sail, and again after our return in June, we reconnoitred accessible sites within a 50 mile radius of Mombasa.

Low mangrove forest was encountered in widely disjunct patches, the most extensive fringing the maze of tidal channels near Mida, Kilifi, Mtwapa, and Mombasa. Mangrove colonies occupy mud, sand, and coral shores, flooded by brackish and by sea water, the common denominator being simply an intertidal situation sheltered from wave action. Floristically and structurally, this vegetation is identical to that described for coastal swamps of Tanganyika and Zanzibar. The dominant species of *Rhizophora, Ceriops, Bruguiera Sonneratia,* and *Avicennia* (Table 1) are identical to those we found in Seychelles swamps. They all produce seedlings capable of long-range dispersal by ocean currents and have enormous natural ranges in the Indian and Pacific Oceans (Schimper, 1891). Presumably they originated in the Indo-Malayan region, the present center of diversity of these and other paleotropic mangroves (Hou, 1958). Closely related precursors are now being traced through palynological work in Tertiary swamp deposits of Borneo

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Table 1. Members of seashore vegetation in sites studies.[1]

Pandanaceae
Pandanus kirkii Rendle
Gramineae
Lepturus repens (Forst.) R. Br.
Sporobolus virginicus (L.) Kunth
Cyperaceae
Cyperus maritimus Poir.
Palmae
Cocos nucifera L.
Hyphaene coriacea Gaertn.
Liliaceae
Dipcadi longifolium (Lindl.) Bak.
Taccaceae
Tacca pinnatifida Forst.
Orchidaceae
Eulophia petersii Rchb. f.
Casuarinaceae
Casuarina equisetifolia L.
Chenopodiaceae
Suaeda monoica Forsk.
Amaranthaceae
Aerva lanata (L.) Juss.
Lauraceae
Cassytha filiformis L.
Capparidaceae
Capparis cartilaginea Decne.
Cleome strigosa (Boj.) Oliv.
Caesalpinaceae
Caesalpinia bonduc (L.) Roxb.
Fabaceae
Canavalia cathartica Thou.
C. maritima (Aubl.) Thou.
Crotalaria bagamoyoensis Bak. f.
Desmodium umbellatum DC.
Rhynchosia velutina Wight & Arn.
Stylosanthes hamata (L.) Taub.
Tephrosia purpurea (L.) Pers.
Zygophyllaceae
Tribulus cistoides L.
Euphorbiaceae
Dalechampia scandens L.
Celastraceae
Cassine schweinfurthiana Loes.
Sapindaceae
Dodonaea viscosa Jacq.
Rhamnaceae
Colubrina asiatica (L.) Brongn.
Vitaceae
Cissus sp.
Tiliaceae
Grewia glandulosa Vahl
Malvaceae
Hibiscus tiliaceus L.
Sonneratiaceae
Sonneratia caseolaris (L.) Engl.
Rhizophoraceae
Bruguiera gymnorhiza (L.) Lam.
Ceriops tagal (Perr.) C. B. Rob.
Rhizophora mucronata Lam.
Combretaceae
Terminalia catappa L.
Sapotaceae
Sideroxylon inerme L.
Oleaceae
Jasminum mauritianum Boj. ex DC.
Asclepiadaceae
Pergularia extensa (R. Br.) N. E. Br.
Convolvulaceae
Ipomoea pes-caprae (L.) Sweet
Boraginaceae
Cordia somalensis Bak.
Heliotropium gorinii Chiov.
Verbenaceae
Avicennia marina (Forsk.) Vierh.
Clerodendrum glabrum E. Mey.
Acanthaceae
Asystasia gangetica (L.) T. Anders. in Thwaites
Justicia flava Vahl
Rubiaceae
Guettarda speciosa L.
Oldenlandia amaniensis Krause
Psychotria punctata Vatke
Goodeniaceae
Scaevola plumieri (L.) Vahl
Compositae
Launea bellidifolia Cass.
Tridax procumbens L.
Wedelia biflora (L.) DC.

[1] Collections made of all species except the pandanus and palms, mainly deposited in EA and WIS, duplicates of some in F, MO, UC.

(Muller, 1964). In the history of human activity on the Kenya coast, mangroves have played a long and important role. Mangrove exploitation for tanbark and timber is the traditional livelihood of the Bajun Islanders of the Lamu region. Since ancient times, Arab house construction has depended on mangrove poles brought by dhows from Lamu and the Tana delta in Kenya and from the Rufiji delta in Tanganyika (Rawlins, 1957; Villiers, 1940).

The dry coastal vegetation is floristically distinct, with only a few mangrove

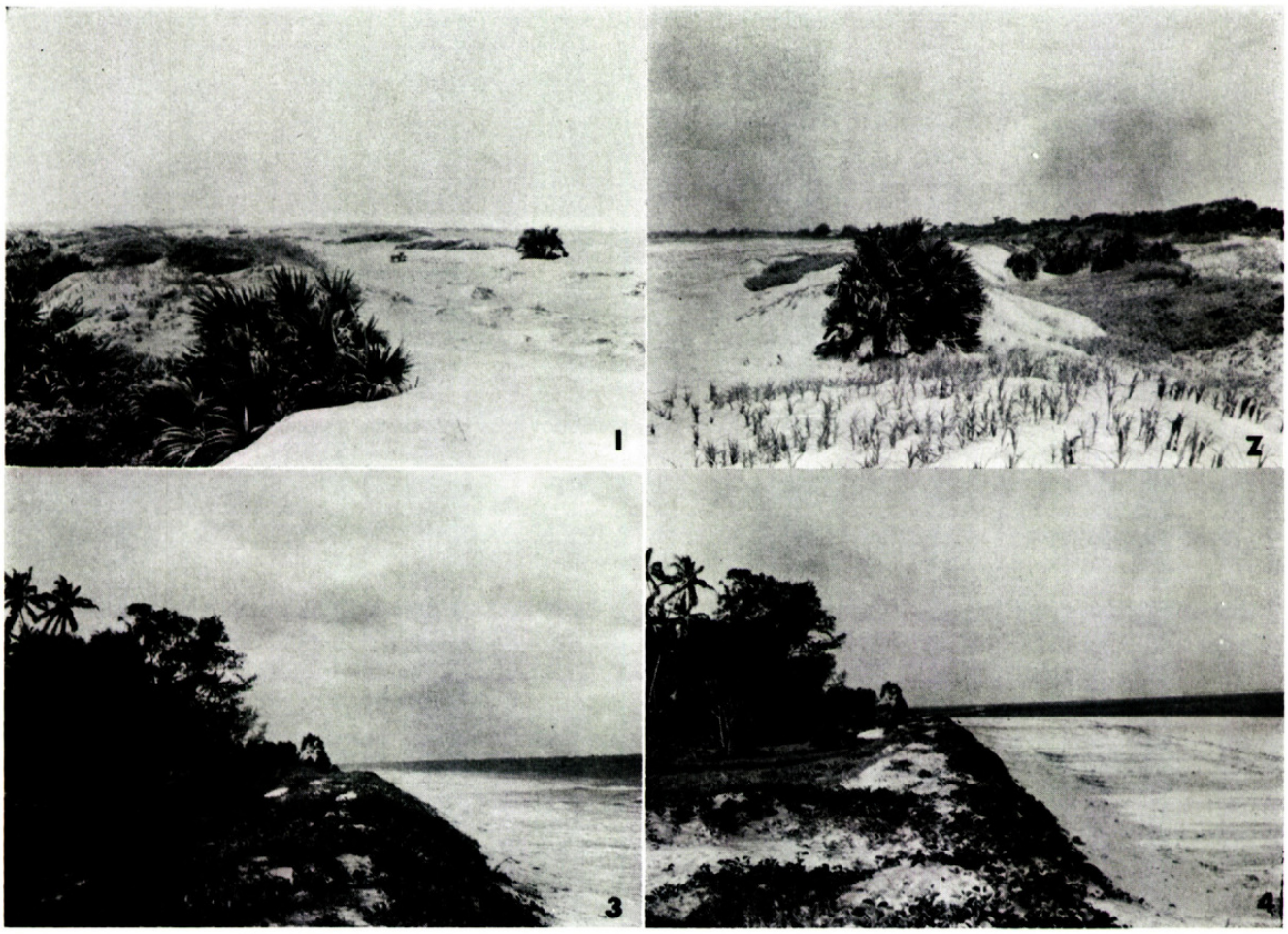

Plate A. Fig. 1-2. Views northward and southward at site of transect shown in Fig. 1, June 16, 1963. Doum palms (*Hyphaene*) forming scattered outposts in active dunes and solid thickets in stabilized dunes. Fig. 3-4. View northward at site of transect shown in Fig. 2, April 24, 1963 and June 15, 1963. The change in luxuriance of the outpost vegetation in the interim between the pictures is due to increased wave attack with the onset of the southeast Trades.

associates such as *Hibiscus tiliaceus* and *Suaeda monoica* ranging into supratidal habitats. The great Pleistocene coral reef, generally about 15 m above present sea level, is a conspicuous feature of the coastal landscape in Kenya, just as in Tanganyika and Zanzibar. Where it is now being cut by the sea, as at Mtwapa, Nyali, and south of Likoni, the roughly pitted spray zone bears a prostrate, evergreen scrub dominated by a spiny caper bush. This is *Capparis spinosa* in the broad sense, usually segregated as *C. cartilaginea* in African floras. We found very similar caper bushes on emerged coral in the Houtman Abrolhos Islands off Western Australia (Sauer, 1965). A closely related variety in Timor and certain Pacific islands is suspected of having escaped from early Portuguese introductions (Jacobs, 1960). Starting with Vasco da Gama's first voyage, Portuguese ships regularly called at Malindi or Mombasa en route to India, so the suspicion is plausible. This species complex holds various remarkable geographic and historic patterns awaiting systematic study.

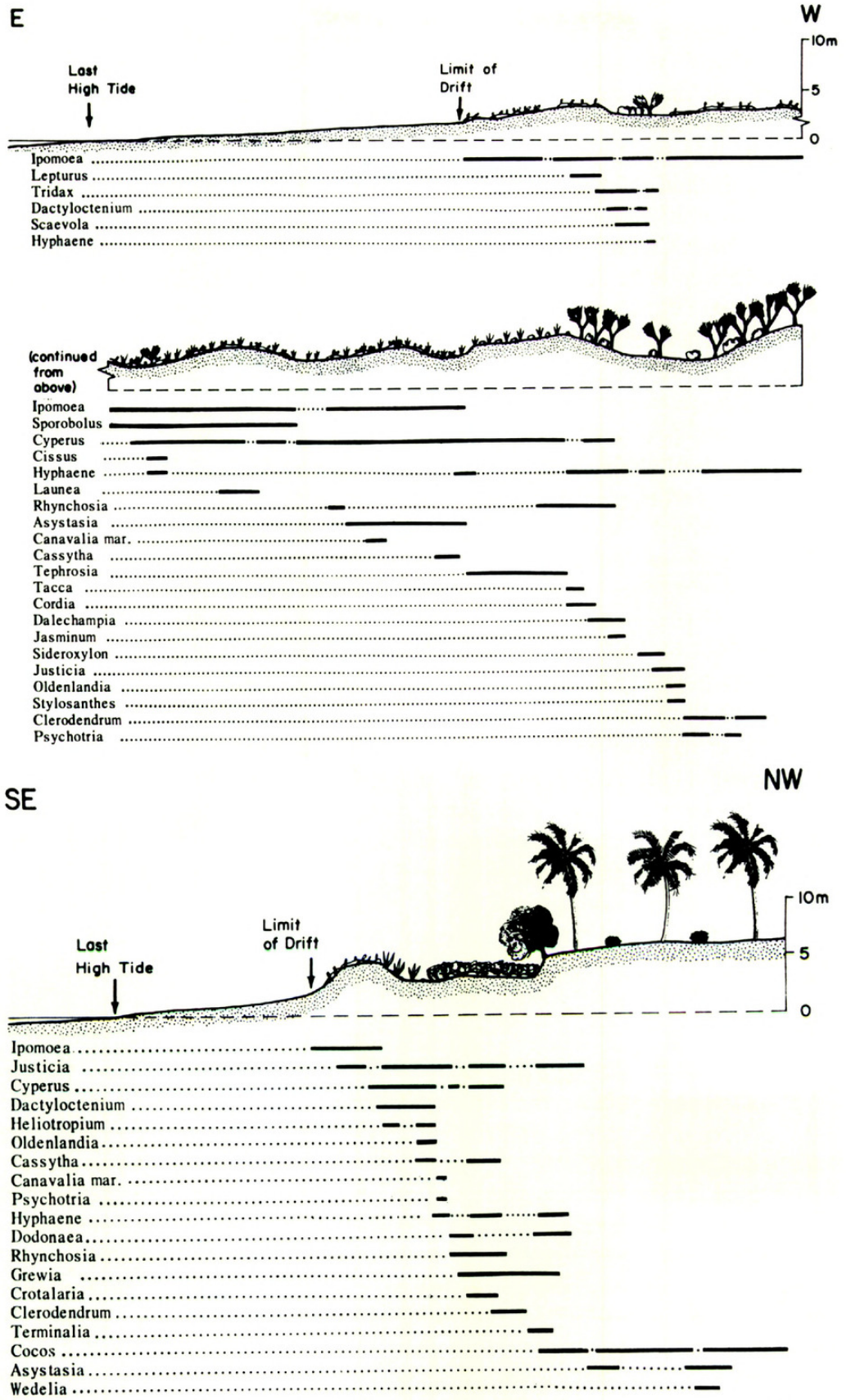

Fig. 1 (top). Transect on mineral sand beach exposed to heavy surf and spray, between Malindi and Galana River mouth, Kenya. Fig. 2 (bottom). Transect on partially reef-protected coral sand beach at Nyali, nr Mombasa, Kenya. (Horizontal and vertical scales identical).

Weathered or sand-covered coral ridges behind the spray zone bear a complex evergreen scrub vegetation, dominated by peculiar native species (Birch, 1963). Much of this inner coastal zone has been cleared for garden patches or plantations of *Cocos* and *Casuarina*. It is obscure how and when these trees reached East Africa. Both had wide prehistoric ranges in the Indo-Pacific region, partly artificial and party natural. The *Casuarina* is less well adapted for long-range sea dispersal than the coconut. Ancient Malay voyagers may be responsible for its early presence in Madagascar. There is historical evidence that coconuts were growing on the East African coast in the 1st Century A.D. (Hourani, 1951). Islands near Lamu on the Kenya coast were said to be celebrated for their coconuts in the 13th Century (Freeman-Grenville 1962). The classical Arab sailing ship was carvel built of coconut planks sewn together with coir, rigged with coir cordage, often with coconut trunk masts and coconut leaf fiber sails (Hourani, 1951).

The pioneer vegetation of storm beaches and active dunes is different from that of the coral. The outpost fringe is formed by sprawling beach vines, mostly *Ipomoea pes-caprae*, prostrate grasses, sedges, and scattered low herbs. These plants undergo perpetual micromigrations as wave reach changes with monsoonal wind shifts and with seasonal tide levels (Plate A: Fig. 3-4). The outpost zone is much wider on beaches open to heavy surf than where there is a reef offshore (Fig. 1-2) but the flora is very uniform on all the beaches seen, in spite of differences in exposure, kind of sand, and rainfall. More intensive distribution studies in other areas, involving many of the same species, also indicate little sensitivity to coastwise variation in these factors (Sauer, 1961, 1965). In the beach and active dune flora, slightly over half the species have wide Indo-Pacific ranges, like the mangroves, or are pantropical. A few cosmopolitan species, such as the *Dalechampia* and *Dodonaea* (Table 1) present migrational puzzles and a few weedy ones, such as the *Tribulus* and *Tridax*, are probably artificially dispersed, but the great majority are adapted for regular long-range dispersal by ocean currents. These sea-dispersed species, particularly the pantropical ones, tend to concentrate in the zone closest to the sea. Only a few African species, notably the endemic coastal *Cleome*, grow as extreme outpost plants. Native species become predominant back where the pioneer fringe of woody plants begins to colonize and stabilize accretion beach surfaces and outer dunes (Fig. 1-2). Many of these African pioneer species, including the conspicuous *Hyphaene* or doum palm, are not strictly coastal but range inland in open habitats. The predominance of African species in the back beach and outer dune zone may be attributed to superior adaptation to the local habitat rather than default of seaborne competitors. The Indo-Pacific strand flora includes a wealth of shrubs and trees which occupy comparable sites in oceanic islands, including the Seychelles. Their drift seeds regularly reach the East African coast in sound condition and scattered mainland colonies are known for many species (Muir, 1937). On the Kenya beaches a few Indo-Pacific shrubs and trees were encountered, e.g. *Colubrina*, *Terminalia*, *Guettarda*, and *Scaevola*, but they are quantitatively unimportant among the native woody plants. About a dozen of the wide-ranging Indo-Pacific species have closely related congeners on this coast or