

ECOLOGICAL STUDIES OF SAURASHTRA COAST AND NEIGHBOURING ISLANDS: 4. DIU ISLAND

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ABSTRACT

The plant ecology of Diu, an island of irregular outline, situated in 20°43' N. & 71°02' E. and separated from the southern extremity of the peninsula of Saurashtra by a narrow channel on western shore of India is presented in this paper. Several plant communities are grouped into three categories - *Rock-wood*, *Samud and Island* study plots. The community type is a sub-decussate or an evergreen, that is, it is recognized by the features of both its plant cover and its habitat. Plant communities under each of the three above-mentioned ecosystems are described and also analysis of rocks and soils possessed in tabular form to study soil features in relation to vegetation.

INTRODUCTION

Our knowledge about the terrestrial ecology of islands near the sea coast of India is still very limited. The few ecological investigations on island phanerogamic flora are from the islands of Wellington (Erianson, 1936), Bombay and Salsette (Bharucha, 1950), Elephanta (Satyanarayana, 1935), Church (Srinivasa, 1960), Ramnagar (Rao *et al.*, 1954 a) and Kavadli group of islands (Rao *et al.*, 1954 b). Recently these studies have been extended in Saurashtra coastal areas. The present account relates to the land ecology of Diu island.

GENERAL DESCRIPTION OF THE AREA

Diu, an island forming part of the former Portuguese possessions in western India is situated in 20°43' N. & 71°02' E. It is an island of irregular outline and is separated from the southern extremity of the peninsula of Saurashtra in Gujrat state by a narrow channel through a considerable swamp. Its extreme length from east to west is about 11 km and the greatest breadth from north to south is 3 km and covers an area of 71 sq. km. On the north the narrow channel separating it from the mainland is practicable only for fishing boats and small craft. On the southern face of the island deep water is close beneath and it has a small but excellent harbour where vessels can safely ride at anchor in 2 fathoms of water.

The town of Diu stands at the east end of the island. Besides Diu town there are three large villages on the island, namely, Morakbara, with a fort commanding the channel on the west; Bachawata, on the north; and Nagwa, with a small fort commanding the bay, on the south.

CLIMATE

Average annual rainfall referring to the nearest meteorological observatory at Jafarabad (Anon., 1884) is approximately 42 inches (1067 mm). Almost the whole of the annual rainfall which is due to the south-west monsoon comes during June to October, July being the rainiest month. Mean of daily maximum temperature is more than 80°F and that of daily minimum temperature more than

70°F. Mean of relative humidity figures are also very high (approximately 75%). The climatic accordingly is typical of humid subtropical with concentration of precipitation in the westerly season. The high humidity in conjunction with the high temperatures produces a sultry, oppressive condition in contrast to dry summer heat. Sensible temperatures, therefore, are commonly higher in the humid than in dry-summer subtropics even when the thermometer registers the same. Due to the sea-breeze, however, the severance of the weather is counteracted to a considerable extent and the climate of the island is generally known to be salubrious.

GEOLOGY AND SOILS

The island is made up of a marine member of the post-tertiary group (i.e. 1884), occurring in the shape of an earthy chalky grit, very porous and friable and of a dirty, mottled, coffee stained appearance and light ashy colour. Beds of this marine member first appear to the west of Diu island, where they form a narrow band along the coast with an increasing importance and development towards the west, though not probably attaining a much greater thickness than 20 m anywhere. This strata though porous is much esteemed along the coast for building purposes. These beds are seen resting on the shraided surface of the micolite or Portland stone, a somewhat coarse grit, highly chalky and abounding in foraminifera. The south face of the island presents a type of dolomitic limestone cliffs of moderate height washed and hollowed by the sea into caverns. The surface of the island is more or less honeycombed with quarries, the stone having been used in making the forts, churches, monasteries and other buildings of which the island is full.

It can hardly be said that any soil is present in the Diu island. Rock outcrop is visible generally in the island. Only in some small scattered patches a very thin cover of light brown loamy sand to sandy loam soil can be seen. Due to non-presence of the soil there is very little agriculture in the island. On the southern shore wind blown

white quartz derived sand in the form of sand hills is present adjacent to the rocky cliffs. This sand has extended inward forming covers of a few feet thick in some cases, which gives support to coconut palms and other trees.

METHOD

The island's Vascular flora was studied in different seasons during the years 1962-63 (Rao *et al.* 1964c). As the island is well inhabited the influence of human beings on the plant cover prevailing in the island was clearly understood and taken into consideration. Kasse's method (1957) of using Braun-Blanquet's (1935) method of description is adopted while describing plant communities grouped into three ecosystems: Rock strand, Strand and Inland sandy plain. Thus the natural vegetation is analysed into several plant communities grouped into the above three ecosystems. Each community type is recognised by its plant cover and habitat. The plant cover is identified by its dominant species and habitat by its edaphic features. For each community type five stands have been worked out. The species present in the stand are listed with indices of cover-abundance and Sociability as described by Braun-Blanquet (*loc.*). Throughout Braun-Blanquet's description is used but not his concept of 'association' nor his method of classification. Each stand is a uniform sample site with uniform distribution of the dominant species and uniform habitat. Two figures ranging from 1 to 5 were given to each species. The first indicated the dominance of the species in the stand according to the following scale:

1. Covering very little.
2. Species covering from 1/20 to 1/4 of the area studied.
3. Species covering from 1/4 to 1/2 of the area studied.
4. Species covering from 1/2 to 3/4 of the area studied.
5. Species covering more than 3/4 of the area studied.

The second figure indicated sociability. Five degrees of sociability are recognised as follows:

1. Shoots growing singly.
2. Shoots growing singly in smaller groups.
3. Shoots growing singly in greater groups.
4. Shoots growing singly in small colonies.
5. Shoots growing singly in pure colonies.

The + sign indicated that species in the area were represented by one or two individuals only.

To study soil features in relation to plant communities soil samples were analysed for mechanical composition, pH, organic matter content, total dissolved solids, sodium chloride and calcium carbonate contents by the methods referred to by Rao

et al. (1974a) except that pH determinations were made by the Cambridge direct reading pH indicator on 1:5 soil: water suspensions.

VEGETATION AND SOIL

The existing vegetation based upon the ecosystem is studied under the following heads:

1. Rock-strand
2. Strand
3. Inland sandy plain

ROCK-STRAND

General features:

Exposed flat rocks with holes and crevices often filled up with sandy soil are very often seen near the sea shore. Such a habitat occurs only in the crevices a limited number of annuals or perennials. The dominating plants exhibit xerophilous habit. On exposed creviced rocks near the fore shore above the tidal level *Statis stockii* forms the dominant pure association closely followed by a mixed population of *Lepidogathis trinervis* and *Sarcostoma pauciflorum* exhibiting dome shaped hemispherical mounds on the rocks. Plants of prostrate or stunted habit such as *Portulaca quadrifida*, *Andrographis echinoides*, *Lindenbergia indica* and *Polycarpha spicata* are very frequently found in this habitat especially in the small crevices. The above plants develop either creeping or stunted life-form due to constant exposure to wind and insolation and at no time do they form a thick vegetal cover on the rocky surface.

Under rock-strand ecosystem six subdivisions or community types have been recognised (Table 1)

1. Community of *Statis stockii*
2. Community of *Fagonia cretica*
3. Community of *Palicourea wightiana*
4. Community of *Sarcostoma pauciflorum*
5. Community of *Lepidogathis trinervis*
6. Community of *Atriplex stockii*

1. Community of *Statis stockii* (Stand 1-5)

Stand 1-5 represent typical rock-strand vegetation. On exposed creviced rocks near the foreshore above the tidal level *Statis stockii* forms the dominant pure association. Sometimes they are found mixed up with *Atriplex stockii* and *Polycarpha spicata*. Landward creviced rocks exhibit a mixed population of *Fagonia cretica*, *Palicourea wightiana*, *Lepidogathis trinervis*, *Sarcostoma pauciflorum*, *Andrographis echinoides*, *Lindenbergia indica*, *Encostemma verticillatum* and *Portulaca quadrifida*. Slight interior, not far off from the foreshore where the soil is more sandy than rocky one can see a limited number of *Statis stockii* mixed up with *Heliotropium* spp., *Dipterocanthus panilus*, *Crocodendrum palmatis*, *Leucas aspera*, *Celosia argentea*, *Aerva lanata*, *Hibiscus micranthus*, *Crotalaria retusa*, *Glinus oppositifolius*, *Trianthema daniellii*

and *Echinops chinatus*. The shrubby species are represented by *Clerodendron philomida*, *Zizyphus nummularia* and *Cakilepis procera* found scattered here and there.

2. Community of *Egonia cretica* (Stands 6-10): Stands 6-10 represent the next best community well represented on the creviced rocks. They have a wide range of habitat. From lowshore to inland there are found growing often mixed up with *Sarcocotyle pauciflorum*, *Andropogon echinoides*, *Eriosema verticillatum* and *Aerva lanata*.

3. Community of *Panicum nightiana* (Stands 11-15)

A community which thrives well on gravelly sandy soil. Found scattered all over the area. Often they are found in association with *Portulaca quadrifida*, *Andropogon echinoides*, *Ternstroemia divaricata*, *Heliotropium* spp. and *Dypteroctenium patula*.

4. Community of *Sarcocotyle pauciflorum* (Stands 16-20):

Sarcocotyle pauciflorum exhibits calcitolerant habit and often found mixed up with *Lepidogathis trinervis*, *Lindenbergia urticae* and *Portulaca quadrifida*. Towards the seaward side the other common associates are *Stizace stocksii* and *Atriplex stocksii*.

5. Community of *Lepidogathis trinervis* (Stands 21-25):

Pure formation of *Lepidogathis trinervis* was noticed towards the landward side. Together with *Sarcocotyle pauciflorum* they form a conspicuous feature of the landscape. The other commonly associated plants are *Trichodesma indicum*, *Halimolobos* spp. and the shrubby *Cakilepis procera*. The other interesting associate is the parasitic *Singa genivoides*.

6. Community of *Atriplex stocksii* (Stands 26-30):

The seaward creviced rocks harbour *Atriplex stocksii* in pure stands. They form extensive patches and occupy inhospitable areas. Sometimes they are found mixed up with *Portulaca quadrifida*, *Eriosema verticillatum* and *Panicum spina*.

The chemical composition of the hard rock exposed near the sea shore is as under:

Loss on ignition	34.61%
SiO ₂ + I.R.	15.25%
R ₂ O ₃	6.48%
CaO	17.25%
MgO	18.52%

The above analysis indicates that the nature of the rock is dolomitic limestone with impurities of SiO₂ and R₂O₃, etc.

On the old fort walls built of rock especially in the crevices the following plants are found:

Lindenbergia urticae, *Panicum angustifolium*, *Cissua quadrangularis*, *Andropogon echinoides*, *Ipomoea pes-caprae*, *Dichrochloa annulata*, *Euphorbia heterophylla* and *Heliotropium scyrosium*.

The nature of the rock from fort walls is sand stone containing impurities of CaCO₃, MgCO₃, and R₂O₃ with the chemical analysis as under:

Loss on ignition	25.76%
SiO ₂ + I.R.	41.00%
R ₂ O ₃	8.57%
CaO	14.77%
MgO	11.92%

STRAND VEGETATION

Sandy beaches of limited extension are sometimes interceded in between rocky shore line. The foreshore is free from vegetation. However, on the beach ridges or sandy bars a pure stand of *Ipomoea pes-caprae* or *Halimolobos micronatum* is frequently found growing almost to the exclusion of other local strand plants. Closely situated to sandy beaches are the sandy spots or flats extending inland with a mixed population of local strand flora. They are not true halophytes or psammophytes. But they are inland plants found growing on sandy situations.

Under strand mesosystem four subdivisions or community types have been recognized (Table 2):

1. Community of *Ipomoea pes-caprae*
2. Community of *Halimolobos micronatum*
3. Community of *Cyperus arenarius*
4. Community of *Convolvulus microphyllus*

1. Community of *Ipomoea pes-caprae* (Stands 1-5):

This tropical sand binder is almost the only well established plant found on the foreshore. It forms extensive patches all over the foreshore. The other common associates are *Cyperus arenarius*, *Halimolobos micronatum* and *Linnæa saponifera*.

2. Community of *Halimolobos micronatum* (Stands 6-10):

Large clumps of this grass on the sandy bars forms a significant feature of the strand flora. They form gregarious patches and sometimes extend towards the landward areas also. Towards the landward side they are found mixed up with *Convolvulus microphyllus* and *Heylandia lutebrisa*.

3. Community of *Cyperus arenarius* (Stands 11-15):

This community type is fairly common all over the sandy bars. Towards the sea side they are found growing along with *Ipomoea pes-caprae* or *Halimolobos micronatum* and towards the landward side their main associates are *Linnæa saponifera* and *Heylandia lutebrisa*.

Floral composition of 30 stands representing Rocky-wood
of *Paspalis indica*, III. Community of *Panicum capillare*,
of *Lophoglossis tricornis*, VI. Community

Rocky-Sandy spp.	I						II					
	1	2	3	4	5	Fr	6	7	8	9	10	Fr
<i>Dactyloctenium aegyptium</i>	5.2	4.4	4.2	5.1	4.1	100	—	—	1.1	—	2.1	40
<i>Eragrostis indica</i>	1.1	—	3.1	2.1	1.1	60	3.4	3.5	4.3	3.5	5.1	102
<i>Panicum capillare</i>	1.1	2.1	—	—	—	40	2.1	2.1	—	—	—	41
<i>Setaria pterisantha</i>	—	3.1	—	—	2.2	40	3.1	2.1	3.1	—	—	60
<i>Lophoglossis tricornis</i>	1.1	1.5	—	—	—	20	—	1.1	—	2.1	—	40
<i>Stylosanthes trifoliate</i>	—	—	1.1	+3	—	40	—	—	1.1	—	2.3	21
<i>Pennisetum polystachyon</i>	1.1	—	2.4	—	1.1	60	2.2	—	—	—	1.1	40
<i>Andropogon squarrosus</i>	—	2.2	—	—	—	20	—	2.1	2.1	—	2.3	40
<i>Eleusine indica</i>	+1	—	4.1	—	2.5	60	—	—	1.3	—	2.1	40
<i>Panicum spissum</i>	2.4	—	2.4	—	3.1	60	2.1	1.1	—	—	—	30
<i>Echinochloa crusgalli</i>	+1	—	1.2	—	—	40	—	—	+1	2.1	4.2	31
<i>Trichostema indicum</i>	2.1	—	1.1	—	—	40	—	—	—	1.1	—	21
<i>Heteropogon zosterifolius</i>	—	4.4	—	—	2.3	40	+1	2.1	+1	—	—	14
<i>H. umbellatus</i>	+2	—	3.1	—	—	40	—	—	1.1	—	2.1	41
<i>Diploschloa patula</i>	4.4	2.1	—	—	—	10	—	—	—	—	1.1	21
<i>Cenchrus plicatus</i>	—	2.1	3.1	2.1	—	60	—	1.1	—	—	—	20
<i>Leucaena leucocarpa</i>	—	—	1.2	—	—	30	1.1	—	—	—	—	20
<i>Calanthe auriculata</i>	—	1.1	—	—	—	20	—	—	3.1	—	—	30
<i>Azadirachta indica</i>	+3	3.1	2.1	—	—	60	+1	1.1	—	+1	—	31
<i>Hibiscus sabdariffa</i>	—	—	1.1	—	—	30	—	—	—	—	—	—
<i>Zizania tenuifolia</i>	1.2	—	—	—	—	30	—	—	1.1	—	—	21
<i>Oxalis sp.</i>	—	3.1	—	1.1	—	40	—	—	—	—	—	—
<i>Cissampelos grandifolia</i>	1.1	—	1.2	—	+1	60	—	—	—	—	1.1	20
<i>Trichostema discolor</i>	—	1.1	—	—	—	20	—	—	—	—	—	—
<i>Cathartocarpus cuneatus</i>	—	—	—	—	—	—	—	—	—	—	—	—
<i>Calanthe pinnatifida</i>	—	—	3.1	—	—	20	1.2	—	—	—	—	20
<i>Mimosa pudica</i>	1.1	—	2.1	—	1.1	60	—	—	—	—	—	—
<i>Cissampelos grandifolia</i>	2.1	—	3.1	—	1.2	60	1.1	2.1	3.1	—	—	14
<i>Panicum rugosifolium</i>	2.2	2.1	3.1	—	4.1	80	1.3	—	—	2.1	—	40
<i>Trichostema discolor</i>	—	3.2	—	3.1	—	40	—	3.4	—	1.2	—	40
<i>Echinochloa crusgalli</i>	—	—	—	1.2	—	20	—	—	—	—	—	—
<i>Stylosanthes trifoliate</i>	1.1	1.1	—	—	—	40	—	1.1	—	3.1	—	20

as *fert. nulli*

habitat: I. Community of *Sesuvium stolonifera*, II. Community
IV. Community of *Sesuvium portulacastrum*, V. Community
of *Amphicarpum*. (Fr. = percent)

III						IV						V						VI						
11	12	13	14	15	Fr	16	17	18	19	20	Fr	21	22	23	24	25	Fr	26	27	28	29	30	Fr	
—	1.1	—	—	—	20	—	3.1	—	+1	—	20	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	2.5	—	—	30	—	1.1	—	2.1	—	40	—	—	—	—	—	—	—	—	—	—	—	—	
3.1	4.1	3.1	4.4	4.5	100	—	—	—	1.1	—	20	—	—	—	—	—	—	—	1.2	—	3.1	—	40	
—	2.2	1.1	—	—	40	4.3	4.5	3.4	5.2	2.3	100	1.1	1.2	2.2	—	—	60	2.1	2.1	—	—	—	40	
—	—	3.1	—	2.5	40	3.2	—	—	1.1	—	40	5.4	5.5	4.5	2.4	3.2	100	—	1.1	—	2.1	—	40	
—	—	—	—	—	—	—	—	—	2.4	—	30	1.1	—	—	—	—	20	3.2	4.1	5.1	3.1	3.4	100	
—	2.1	—	1.1	3.2	60	—	1.1	—	2.1	—	40	—	1.1	—	++	—	80	1.1	2.1	3.1	2.1	—	30	
—	—	—	—	—	—	—	—	—	1.5	—	20	—	—	2.5	—	—	20	—	—	—	—	—	2.1	20
—	2.1	—	2.1	—	40	—	—	2.1	1.1	1.1	60	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	—	1.5	1.2	90	—	—	—	—	—	—	—	—	—	—	—	—	1.1	++	—	—	—	40	
2.1	—	—	—	—	20	—	1.1	—	—	++	40	—	—	1.1	—	2.1	40	—	—	1.1	3.2	—	40	
+1	—	—	2.1	—	40	—	—	—	1.1	—	20	1.1	—	2.1	—	1.1	60	—	—	+1	—	—	20	
—	—	1.3	—	2.4	40	1.1	—	2.5	—	—	40	—	—	2.1	—	1.1	40	—	2.3	—	—	1.2	40	
—	1.1	—	2.1	—	40	—	—	—	—	—	—	—	1.1	—	—	2.5	40	—	—	+1	—	—	20	
—	—	1.1	—	++	40	—	—	1.1	—	—	20	—	—	—	—	—	—	—	2.1	—	—	—	20	
—	—	—	1.1	—	20	—	2.5	—	—	—	20	—	—	1.1	—	—	20	—	—	—	—	—	—	
—	—	1.1	—	—	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	2.1	2.1	—	—	40	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	—	3.1	—	20	—	—	—	1.1	—	20	—	—	—	—	—	—	—	1.1	—	—	—	20	
—	2.1	—	—	—	20	—	—	—	—	—	—	—	—	1.2	—	—	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.1	—	2.1	40	
—	—	2.2	—	—	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	—	—	++	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	2.1	—	1.1	—	40	—	1.1	—	—	—	20	—	—	—	1.1	—	20	—	—	—	—	—	—	
—	—	—	1.1	—	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
1.1	—	—	—	—	20	—	1.2	—	—	—	20	1.1	—	—	—	—	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	1.3	—	—	2.1	40	—	—	2.1	—	—	20	—	—	—	—	—	—	—	—	—	—	—	—	
1.1	—	—	—	—	20	1.1	2.1	—	—	—	40	—	—	—	—	—	—	—	—	—	—	1.2	20	
1.1	1.2	—	—	—	40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	—	1.2	1.1	40	1.2	—	—	1.1	—	40	1.1	2.1	2.1	1.1	—	80	—	1.1	—	2.1	—	20	

4. Community of *Convolvulus microphyllus* (Stand 16-20):

This creeper commonly occupies a borderline between pure strand flora and inland flora. They can tolerate sandy habitat to certain extent. This community type is often found in association with the other local strand flora viz. *Lotus geraniifolius*, *Lourea surinensis* and *Hydrocotyle latifolia*.

Analysis of the soil samples collected from the strand habitat under different plant communities is given in Table 3.

The texture of the white to dull white wind blown quartz derived sand from the sandy strand

habitat on the southern shore of the island is fine sand. It contains many shell fragments and is sand. It contains many shell fragments and is highly calcareous with CaCO_3 contents of 23.38-29.65%. The pH values of sands under different plant communities vary between 7.7-8.0 and indicate moderate alkalinity. Organic matter contents (0.28-0.41%) are low. Total dissolved solids (0.065-0.026%) and Sodium chloride contents (0.015-0.026%) are also low indicating some sea water spray only but no inundation with the same. The above data shows that there is not appreciable difference in the characteristics of sand under different plant communities of this habitat.

TABLE 2

Floric composition of 20 stands representing strand vegetation: I. Community of *Ipomoea pes-caprae*, II. Community of *Halcyon surinensis*, III. Community of the *Cyperus amabilis*, IV. Community of *Convolvulus microphyllus*. [Pv. = percent]

Strand spp.	I					II					III					IV												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20								
<i>Ipomoea pes-caprae</i>	6.1	3.1	3.1	6.1	4.4	100	+	+	1.2	3.1	3.1	—	96	—	—	1.1	—	—	29	—	—	—	1.2	—	29			
<i>Halcyon surinensis</i>	—	1.1	—	—	—	20	1.1	5.1	4.2	3.1	3.1	100	—	2.1	—	—	—	—	29	—	1.3	—	2.1	—	49			
<i>Cyperus amabilis</i>	3.1	—	+1	—	—	49	—	—	—	—	—	—	—	29	2.1	3.1	3.1	3.2	3.1	100	—	—	—	—				
<i>Convolvulus microphyllus</i>	1.1	—	1.1	—	2.5	60	—	—	—	—	—	—	—	3.2	—	29	2.1	2.1	2.1	—	1.1	90	2.1	3.2	4.1	3.5	1.1	1.0
<i>Lourea surinensis</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
<i>Hydrocotyle latifolia</i>	—	2.1	—	—	—	29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
<i>Lotus geraniifolius</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
<i>Hydrocotyle latifolia</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			

TABLE 3

Soil sample No.	467	468	442	459
Location	Southern shore sandy strand habitat	Southern shore sandy strand habitat	Southern shore sandy strand habitat	Southern shore sandy strand habitat
Depth of sampling in cm	0-10	0-10	0-10	0-10
Vegetation cover	<i>Ipomoea pes-caprae</i>	<i>Halcyon surinensis</i> and <i>Ipomoea pes-caprae</i>	<i>Cyperus amabilis</i> and <i>Convolvulus microphyllus</i>	<i>Convolvulus microphyllus</i> and <i>Lotus geraniifolius</i>
Soil colour	white	dull white	dull white	white
Clay %	1.1	1.4	2.4	1.9
Silt %	2.3	3.0	1.5	3.1
Fine sand %	92.7	84.6	87.2	79.0
Coarse sand %	2.9	10.2	8.9	15.2
Soil texture	Fine sand	Fine sand	Fine sand	Fine sand
pH	7.8	8.0	7.8	7.7
Organic matter %	0.43	0.37	0.29	0.31
Total dissolved solids %	0.105	0.050	0.069	0.084
Sodium chloride %	0.018	0.015	0.024	0.016
Calcium carbonate %	28.32	26.71	23.39	29.16

INLAND SANDY PLAIN

Towards the inland on a thin mantle of sand deposited on gravelly soil one could see a mixed population of herbaceous plants like *Epicostemma verticillatum*, *Lotus gortini*, *Cassia italica*, *Euphor-*

bia hirta, *Heylandia ciliolata*, *Pedicularis murex*, *Heliotropium zeylanicum*, *Leucas aspera* and *Jatropha gossypifolia*. The scrubs are represented by *Calotropis gigantea*, *Euphorbia nerifolia*, *Clerodendrum phlomidis* and *Capparis dioecia*. They are

TABLE 4
Floristic composition of 10 stands representing the inland sandy plain vegetation.
(N. = per cent.)

	1	2	3	4	5	6	7	8	9	10	Pt.
<i>Theopista populnea</i>	3.1	—	1.1	—	—	—	1.1	—	—	—	30
<i>Delonix regia</i>	—	—	—	2.1	—	—	—	—	—	—	10
<i>Pongamia pinnata</i>	—	1.3	—	—	3.1	—	—	1.1	—	—	30
<i>Nalanda persica</i>	1.1	—	—	3.1	—	—	1.1	—	—	—	30
<i>Coela fruticosa</i>	—	2.3	3.1	2.1	—	—	—	1.1	—	1.2	30
<i>Hyphane indica</i>	1.1	—	—	—	—	2.1	—	2.1	—	—	30
<i>Podocarpus aculeata</i>	—	—	—	—	—	—	1.2	—	—	—	10
<i>Cassia italica</i>	—	2.1	—	—	—	1.1	—	—	—	—	27
<i>Cordia alliodora</i>	—	1.2	—	1.1	—	—	—	—	1.1	—	40
<i>Tournefortia cordifolia</i>	—	1.1	1.1	—	—	—	1.1	—	—	—	30
<i>Capparis septaria</i>	—	—	—	—	—	—	1.1	—	—	—	10
<i>Borcia alata</i>	—	—	1.1	—	—	—	—	2.1	—	—	27
<i>Passiflora foetida</i>	—	—	—	—	—	—	3.2	—	1.2	—	40
<i>Cordia alliodora</i>	—	—	2.1	—	—	—	—	—	—	—	10
<i>Cyperus tenuis</i>	—	—	1.1	—	—	—	—	—	—	—	10
<i>Fouquieria indica</i>	1.1	—	3.2	—	—	2.3	—	1.1	—	—	40
<i>Euphorbia nerifolia</i>	3.1	2.1	1.1	—	—	—	2.1	3.1	—	—	50
<i>Jatropha gossypifolia</i>	1.1	1.1	2.1	3.1	—	—	—	3.2	—	—	50
<i>Euphorbia hirta</i>	3.1	2.1	3.2	1.1	—	—	—	—	1.1	—	30
<i>E. thymifolia</i>	—	1.1	—	1.1	—	3.1	2.1	—	—	—	40
<i>E. heterophylla</i>	2.1	1.2	2.3	3.2	—	—	3.1	2.1	—	—	40
<i>Antyphis indica</i>	1.1	2.1	1.1	1.1	—	1.1	2.1	—	—	—	40
<i>Dactyloctenium aegyptium</i>	—	—	—	1.1	—	—	—	1.2	2.1	—	30
<i>Erigeron filiformis</i>	—	—	—	1.1	—	1.1	1.5	3.1	—	—	40
<i>Commelina Asiatica</i>	—	—	—	—	—	—	1.1	—	—	1.1	20
<i>Anacardium occidentale</i>	1.1	—	2.3	—	—	2.1	—	—	—	—	30

widely scattered and at no place they were found to form thickets of considerable significance. Sometimes, occasionally though not frequently one could see *Ficus* sp., *Salvadora persica* and *Theopista populnea*. Other plants of tree habit are the palms chiefly *Hyphane* sp. and *Cocos nucifera* found scattered all over the island. (Table 4).

In the interior the vegetation is very much disturbed. Most of the available areas have been

cleared for cultivation or for construction of fast walls, townshipment and big buildings for the maintenance of the military installations. The commonly seen hedge plants are *Lantana indica*, *Murraya stenocarpa* var. *scabrida*, *Cordia rostrata*, *Cordia myxa*, *Coela fruticosa*, *Clerodendrum phlomidis*, *Capparis septaria*, *Pongamia pinnata* and *Euphorbia nerifolia*. Amongst their shade the following plants are met with: *Bastaria pruriens*,

Alternanthera versata, *Paspalum leppaceum* and *Aphania*
nutans.

Analysis of soil samples from a profile in the inland sandy plain is given in Table 5.

TABLE 5

Soil sample No.	431	432	433
Location	Inland sandy plain	Inland sandy plain	Inland sandy plain
Depth of sampling	0-10	15-20	30-50
Vegetation cover	<i>Jatropha gossypifolia</i> , <i>Calotropis gigantea</i> , <i>Euphorbia corollata</i> , <i>Eleusine indica</i> and <i>Cyperus debilis</i>		
Soil colour	light brown with fibrous spots	light brown	light brown
Clay %	7.5	4.1	9.7
Silt %	15.4	29.5	27.1
Fine sand %	75.1	62.3	49.5
Coarse sand %	5.3	4.1	4.2
Soil texture	loamy sand	sandy loam	sandy loam
pH	7.5	7.6	7.6
Organic matter %	2.79	0.87	0.67
Total dissolved solids %	0.178	0.195	0.170
Sodium chloride %	0.076	0.031	0.076
Calcium carbonate %	1.33	1.82	2.75

The soil from the inland sandy plain present in layers upto about 30 cm deep over the under-lying rock is different from the sand of the beach habitat. It is light brown with blackish tinge in colour. The surface soil from the profile studied in the inland is loamy sand but downwards the soil changes to sandy loam in texture. The CaCO_3 content of the samples from the profile increasing from 1.30% from surface to 3.75% downwards is much lower in comparison to the beach sands. The organic matter content of the surface soil (2.79%) is fairly high and decreases to 0.87% and 0.67% downwards. The pH value at 7.6 remains constant throughout the profile and at such no relationship between organic matter and pH is indicated. Total dissolved solids and sodium chloride decrease from top to bottom. The values of total dissolved solids and sodium chloride contents 0.178% and 0.076% in the surface soil fall to 0.130% and 0.026% downwards. Their concentration is fairly low. Soils at the surface and upto 30 cm depth were absolutely dry but after that they were found to be a little moist.

SYSTEMATIC CENSUS

MENISPERMACEAE

- Coccoloba hirsuta* (L.) Diels
A climber on hedges. *Rao* 1964.
- Tinospora cordifolia* (L.) Miess
A climber on bushes. *Safui* 2530.

CAPPARIDACEAE

- Cleome viscosa* L.
An erect herb in waste places. *Rao* 1992.
- Cadaba fruticosa* (L.) Diels
A wiry shrub along the hedges. *Rao* 1966.
- Capparis decidua* (Forsk.) Edgew.
A bushy shrub found in the rocky crevices along the road sides. *Safui* 2528.
- C. sepiaria* L.
A climbing shrub. *Rao* 1946.

CARYOPHYLLACEAE

- Polycarpon spicatum* W. & Arn.
A herb on sandy areas and rocky crevices. *Rao* 2507.

PORTULACACEAE

- Portulaca quadrifida* L.
A prostrate herb in the rocky crevices. *Rao* 2509.

FLATINACEAE

- Bergia odorata* Edgew.
A woody prostrate plant spreading on moist places especially cultivated areas. *Rao* 1961.

MALVACEAE

- Thespesia populnea* Soland. ex Correa
A branched tree on road side, planted. *Rao* 1939.
- Albizia indicum* Sweet
A shrub near hedges. *Rao* 1945.

- Pavonia patens* (Andr.) Chiov.
A semi-erect herb near hedges. *Safui* 2522.
- Hibiscus microanthus* L.
An undershrub in rocky crevices near shore. *Rao* 1953.

TILIACEAE

- Conchocarpus trilobularis* L.
An erect undershrub near hedges. *Rao* 1991.
- C. depressus* (L.) Stocks
A prostrate shrub on sand mixed rocky area. *Rao* 1948.

ZYGOPHYLLAGAE

- Fagonia cretica* L.
An undershrub near sandy rocks and slacks. *Safui* 2524.

RHAMNACEAE

- Zizyphus nummularia* (Burm. f.) Wt. & Arn.
A shrub near rocky places. *Safui* 2524.

VITACEAE

- Cissus quadrangularis* L.
A climber especially on left walls. *Rao* 1956.
- Cayratia carnosa* (Lamk.) Gagnop.
A climber on hedges. *Rao* 1937.

LEGUMINOSAE

- Heylandia latebrosa* DC.
A prostrate herb on the slacks. *Safui* 2525.
- Crotalaria retusa* L.
A sub-erect herb on hard sandy grounds. *Safui* 2497.
- Lotus garcini* DC.
A semi-erect herb on sandy banks near sea shore. *Rao* 2301.

- Indigofera tinctoria* All.
A semi-erect plant on sandy areas. *Rao* 1978 & 1999.

- L. linifolia* Retz.
A sub-erect herb on hard sandy grounds. *Safui* 2534.

- Parkinsonia aculeata* L.
A tree on road sides. *Safui* 2493.

- Delonix elata* (L.) Gamble
A tree on sea-shore. *Safui* 2465.

- Cassia italica* (Mill.) Lamk. ex F. W. Andrews
A diffuse herb in open grounds. *Rao* 1960.

- Fragaria pinnata* (L.) Pierre
A branching tree near shore. *Safui* 2507.

AIZOACEAE

- Gilvus oppositifolius* (L.) A. DC.
A semi-erect herb in rocky crevices. *Rao* 2305.

- Trianthema decandra* L.
A prostrate herb near sandy rocky places. *Rao* 1952.

COMPOSITAE

- Vernonia cinerea* Less.
A herb found in abundance. *Rao* 1939.
- Policaria wightiana* (DC.) Benth. ex Clarke
A herb found in rocky crevices & fort walls. *Rao* 1956.

- P. angustifolia* DC.
A herb found in rocky crevices and fort walls. *Rao* 1942.

- Tridax procumbens* L.
A herb found all over the island. *Rao* 1988.

- Echinops echinatus* Roxb.
A thistle like herb found in abundance along rocky and sandy shores. *Rao* 1954.

- Launea sarmatensis* (Willd.) Alston
A prostrate herb on sandy areas. *Safui* 2526.

PLUMBAGINACEAE

- Statice stocksii* Bolle
A suffruticose herb in rocky crevices near the seashore. *Rao* 1965.

SALVADORACEAE

- Salvadora persica* L.
A spined tree near seashore. *Rao* 1944.

APOCYNACEAE

- Catharanthus roseus* (L.) G. Don (= *Lochnera rosea* Reichb.)
An undershrub in rocky crevices. *Rao* 1998.

ASCLEPIADACEAE

- Calotropis gigantea* R. Br.
A shrub found all over island. *Rao* 1949.

- Pargularia daemia* (Forsk.) Chiov.
A climber on hedges all over the island. *Rao* 1957.

GENTIANACEAE

- Enicostemma verticillatum* (L.) Engelm. (= *E. littorale* Bunge)
A herb on rocky and sandy shores. *Rao* 1953.

BORAGINACEAE

- Cordia rothii* Roem. & Schult.
A tree along hedges. *Rao* 1947.

- Trichodesma indicum* R. Br.
A herb on sandy places. *Rao* 1975.

- Heliotropium zeylanicum* Lam.
A herb in rocky crevices. *Rao* 1956.

- H. undulatum* Vahl
A herb in rocky crevices. *Safui* 2532.

- Sericostoma pauciflorum* Stocks
A spined shrub in abundance all along rocky sandy places. *Rao* 1937.

CONVOLVULACEAE

- Convolvulus microphyllus* Sieb.
A prostrate herb spreading on sandy areas. *Rao* 1962.

Mercouria quinquefolia (L.) Hall. f.
A climber along hedges and also on fort walls.
Rao 1997.

Ipomoea pes-caprae (L.) Sweet
A prostrate herb on sandy beaches. *Rao* 2310.

Cresia cretina L.
An erect herb on rocky-sandy moist fields. *Rao* 2302.

SOLANACEAE

Datura suaveolens HBK.
A shrub near waste places. *Rao* 1941.

Solanum arundo Martel
A shrub with flowers. *Rao* 1949.

SCROPHULARIACEAE

Lindenbergia indica (L.) O. Ktze.
A herb found in abundance in rocky crevices near the exposed rocks and also in fort walls. *Rao* 1973 & 2371.

Siviga gesnerioides (Willd.) Vahl.
A parasitic herb on *Lepidogathis trinervis* Nees.
Rao 1985.

PEDALIACEAE

Pedaliium murex L.
A herb found in abundance along sandy wastes.
Rao 1955.

MEANTHACEAE

Bartiera prionitis L.
A shrub found in abundance all along shady hedges. *Rao* 1971.

Andrographis echinoides (L.) Nees
A stunted herb in rocky crevices near sea-shore and also on fort walls. *Rao* 1984.

Lepidogathis trinervis Nees
A stunted diffuse plant on rocky coastal area; found in abundance. *Rao* 1986.

Dipterocanthus patulus (Jacq.) Nees
Erect herb; sometimes prostrate on rocky fields.
Rao 1955.

VERBENACEAE

Lantana indica Roxb.
A fast spreading shrub along the road side.
Rao 1933 & 2304.

Clerodendrum phlomidis L. f.
A shrub in abundance on rocky soil. *Rao* 1942.

LABIATAE

Leucas aspera Spr.
A herb on sandy rocky areas all over the island.
Rao 1958.

NYCTAGINACEAE

Boerhavia diffusa L.
A trailing herb all over the island. *Rao* 2302.

B. verticillata Poir.
A trailer and climber along hedges. *Safai* 2533.

AMARANTHACEAE

Aerva lanata Jus.
A herb all along rocky-sandy areas. *Rao* 1990.

Celosia argentea L.
An erect herb on rocky wastes. *Rao* 1997.

Digera muricata (L.) Mart.
A semi-erect herb abundant in sandy waste fields. *Rao* 1989.

Amaranthus tricolor L.
A more or less prostrate herb on the sandy slacks. *Rao* 1975.

Pupalia lappacea Maq.
A herb found along the hedges. *Rao* 1974.

Achyranthes aspera L.
A herb all along the hedges. *Rao* 1981.

CHENOPODIACEAE

Atriplex stocksii Boiss.
A semi-erect herb in abundance in rocky crevices along the sea shore and also near the fort walls. *Rao* 1979.

EUPHORBIAEAE

Euphorbia hirta L.
A semi-procumbent herb in abundance all over the island. *Rao* 1977.

E. nerifolia L.
A shrubby thicket much used by local people for fuel purpose. *Safai* 2508.

E. thymifolia L.
A prostrate herb on sandy-rocky wastes. *Safai* 2499.

E. bombaiensis Santapau
A herb in abundance near fort area. *Rao* 2306.

E. heterophylla L.
A herb in abundance near fort area. *Rao* 1975.
A new record (*Rao* 1963).

Jatropha gossypifolia L.
A common plant throughout the island. *Rao* 1969.

Acalypha indica L.
A common herb in shade near rocky build up.
Rao 2306.

COMMELINACEAE

Commelina hasskarlii C.B. Cl.
A prostrate herb in sandy waste fields. *Rao* 1994.

CYPREACEAE

Cyperus arenarius Retz.
A sedge on sandy areas near the sea-shore.
Rao 1967.

GRAMINAE

Dactyloctenium aegyptium (L.) P. Beauv.
A stunted grass in rocky crevices. *Rao* 1967.

Eragrostis ciliaris (L.) R. Br.
Found common in rocky crevices and sandy wastes. *Rao* 1982.

- Haloxyrum mucronatum** Stapf
A sand binder found on sandy sea-shore. *Ran* 1966.
- Dichanthium annularum** (Forsk.) Stapf
A common grass.
- Urochorda setulosa** (Trin.) C. E. Hubbard
An erect grass on salt-water creeks. *Sajni* 2529.
- Aeluropus lagopoides** (L.) Trin.
A runner found abundant in salty creeks. *Sajni* 2527.

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