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THE NATURAL VEGETATION OF THE ISLAND OF TOBAGO, BRITISH WEST INDIES

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THE NATURAL VEGETATION OF THE ISLAND OF TOBAGO, BRITISH WEST INDIES

GROUNDWORK

The little West Indian island of Tobago, in contrast to its rich aunt Trinidad, has hitherto had practically no attention paid to ecological study of its vegetation. Ecological work has been limited to two short enumeration traverses run respectively by Forest Officers R. L. Brooks in 1932 and C. Swabey in 1933. Based on the data so provided, R. C. Marshall in his "Physiography and Vegetation of Trinidad and Tobago" (1934) described a "Crappo-Duckwood association (Carapa-Ocotea)" for Tobago as a climatic climax association under tropical rain forest and a "Galba-Balata type (Calophyllum-Mimusops)" which he considered to be a "deflected climax." The descriptions are quite short, consisting of little more than the names of the more important component species, for as the author states, "the vegetation of Tobago needs further study and there is little doubt that this will bring to light more than one association."

Fortunately, while the vegetation has received scant notice as vegetation, that is, ecologically, it has been well studied floristically: again, not so thoroughly as in Trinidad, but sufficiently so that "the flora of all regions except that of the Forest Reserve of the Main Ridge may now be regarded as comparatively well-known" (Sandwith 1938). The principal collecting was done by the late W. E. Broadway between 1908 and 1933. Other prominent contributors were R. O. Williams and E. E. Cheesman (authors of the "Flora of Trinidad and Tobago"), W. G. Freeman, and N. Y. Sandwith. Collections of forest trees have been contributed by R. C. Marshall, R. L. Brooks and C. Swabey. A considerable portion of the flora of Tobago has been dealt with in the published parts of the "Flora of Trinidad and Tobago," in Sandwith's "Notes on the Flora of Tobago" (1938) and in Broadway's "The Palms of Tobago" (1916). The writer has had access in addition to an unpublished paper by C. Swabey on "The Palms of Trinidad and Tobago." Grateful acknowledgment is made to all those above mentioned for the data which served as the groundwork for the present vegetation-study.

The work here described was confined to natural or more or less natural vegetation: that is to say, to those areas of virgin forest, woodland, and swamp which have not yet been destroyed or radically altered by human interference. These comprise the Forest Reserve on the Main Ridge and adjoining blocks of Crown Lands (in all about 14,570 acres), the small island of Little Tobago off the northeast coast, some small mangrove swamps and patches of littoral scrub. The remainder of the island has been so thoroughly cleared of forest that it is now difficult or almost impossible to reconstruct a picture of it. It will be seen that the forests of the Main Ridge, that is, of the mountainous and inaccessible interior, comprise by far the larger part of the vegetation studied, and here botanical collections have been least comprehensive. As Sandwith (1938) remarks, ". . . the impression gained is that there is a great deal more work to be done in what is, obviously, the most interesting and important region in the island, the Forest Reserve of the Main Ridge. . . . It is quite evident that repeated exploration of these forests will add many new trees, herbs and ferns to the known flora of the island." Little difficulty was experienced by the writer in identifying the trees and shrubs noted on Little Tobago and in littoral and mangrove areas, but a certain amount of trouble was encountered on the Main Ridge.

The writer was able to pay a visit of two weeks to Tobago from February 21 to March 7, 1942 as part of his duties as Assistant Conservator of Forests. The first and last named days being occupied by travelling, 13 working days were available, of which one day was spent examining littoral and mangrove vegetation, one day on Little Tobago and 11 days on the Main Ridge.

In examining the littoral and mangrove vegetation and also that of Little Tobago, the areas observed were relatively small and more or less the whole could be looked at and generally examined. General notes were taken of the species found, of their estimated relative frequency and of any other relevant data. Any unknown species were collected and photographs taken to show characteristic features of the vegetation. In studying the forests of the Main Ridge the large size of the area, the doubtful scope of botanical knowledge and the broken, inaccessible nature of the country were more formidable problems. Tobago is not an island well provided with motor roads. It is possible to drive all along the windward coast but the north side must be reached by sea, on horse, or afoot. In any case no driving road even approaches the Forest Reserve. The latter is traversed by two well-graded mule paths and a number of others run up to its boundaries. Using a map, a program was drawn up for the eleven available days aiming at covering as much ground as possible within the forest by utilizing all the available points of access. This was carried out as follows, the forest being entered from the St. George-Castara Road on 3 days, the Cardiff Road on 2 days, the Pulteney Hill Road on 1 day, the Roxborough-Parlatuvier Road on 2 days, the Louis d'or Road on 1 day, the Pigeon Hill Road on 1 day, and the Northside Road on 1 day from two different points.

The method of the enumeration traverse was employed as the basis of field work. The writer was

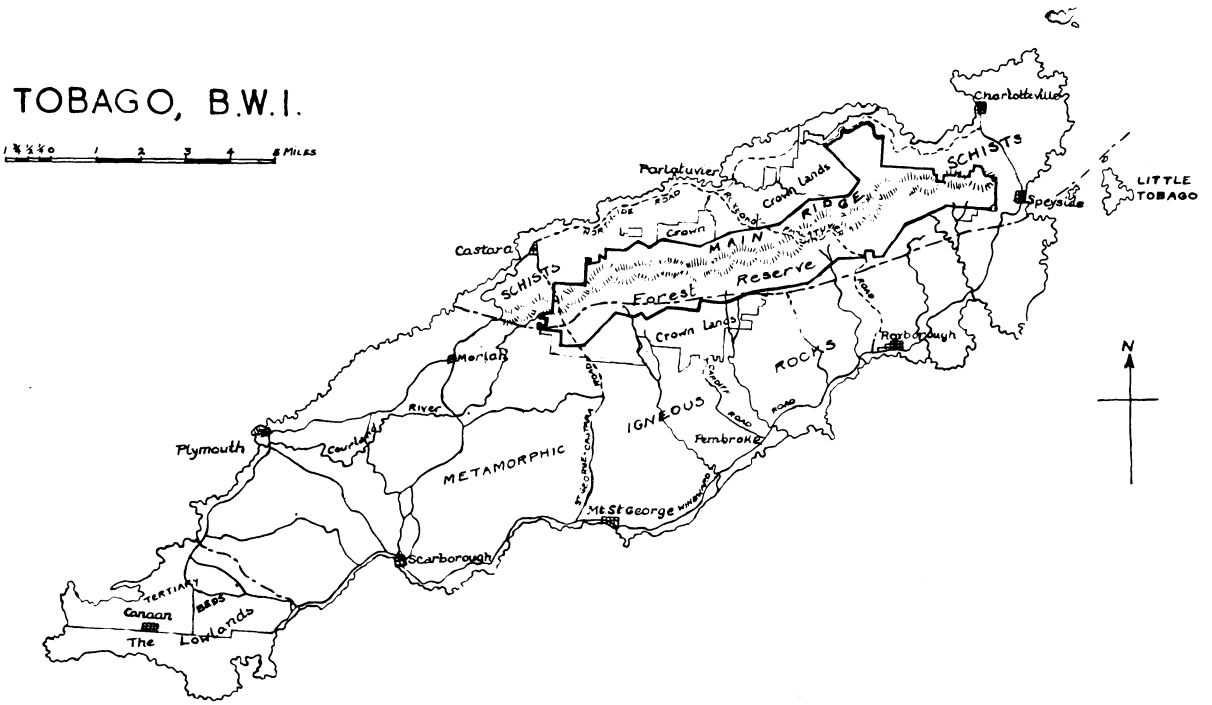

FIG. 1. Geological map of Tobago.

accompanied by two local woodcutters who had a fair knowledge of the local names of trees and who were accustomed to recognize the trees commonly cut for timber. They absorbed the idea of the enumeration fairly rapidly and after a couple of days became skilled in the work. On arriving at the point where it had been decided to run a traverse, a line was roughly set with a pocket compass and followed through by the same means, cutlassing passage where necessary. Lines were not cut in advance for enumeration and were not dead true on a bearing or straight or accurately measured. The length of each traverse was estimated subsequently by checking the measured length obtained from plotting on the map the points of beginning and ending against the number of trees recorded, since experience elsewhere had suggested the average number of trees to expect per acre in each type of forest. Working with a good topographic map at 1:50,000, in mountainous country, the writer found this method quite satisfactory.

In traversing the line the local name of every tree over 1 foot girth within ½ chain on either side of the line was called with its estimated girth and booked. In this way every 10 chains of traverse represents 10 square chains or 1 acre enumerated. At the same time notes were taken on ground vegetation, epiphytes, structure, soil types and other data of importance. In cases where a tree was known to the writer a note was taken correlating its botanical name with the local name given. Where the local name was of a tree not certainly known to the writer, leaves were collected and flowers if available. If the tree had no local name, that is was not known to the local men either, it was collected and was given a descriptive name such as "Stringybark," careful note being taken of its bark and blaze characters so that it would be recognized again. Specimens of 85 different species were collected in this way and brought back to Trinidad. Only a small proportion of these, unfortunately, possessed flowers or fruit. Seventy-one of them were, however, subsequently identified, most of them with certainty, in the Herbarium in Port of Spain. Of the remaining 14, 6 were subsequently named at the New York Botanical Garden.

Soil borings were made from time to time on the traverses, and two profiles considered typical of two main soil types distinguished were described and sampled. Similarly, once it became clear that two distinct plant formations existed on the Main Ridge, a sample forest profile was selected and measured in each. In each case a strip of forest 100 feet x 25 feet was selected as showing structure considered typical of the formation and was felled out and measured.

FACTORS OF THE ENVIRONMENT

Physiography

Tobago is an island having an area of some 114 square miles and lies in the Atlantic separated about 26 miles from the northeastern point of Trinidad between the latter island and Barbados and Grenada, southernmost of the Lesser Antilles. Structurally it is not related to the Antilles, but is in agreement with the neighboring portion of the South-American continent and is therefore mountainous with a central east-west backbone. The island itself is 26 miles in length and 7½ miles broad at its widest point, being roughly elliptical in shape with the main axis of the ellipse inclined at 30° to the east-west latitudes. The mountain backbone known as the Main Ridge is a chain tending 15° to east-west latitudes, that is, running slightly crosswise of the island, and is some 10 miles long, rising abruptly at either end. The highest point of the Main Ridge touches 1,890 feet, not in any well-defined peak, the crests running as a ridge about 1,600 to 1,700 feet high throughout. The adjacent country is all steeply broken land, a jumble of sharp ridges and deep gullies and there is no coastal plain except at the southwestern extremity where the country gradually evens off to form a flat plain known as the Lowlands some 10 square miles in area. Topography in general is young and drainage is by swift-flowing torrents rising in the Main Ridge.

Climate

The climate of Tobago differs slightly from that of the main part of Trinidad but is similar to that of the Toco district of the latter island, which is the part of Trinidad nearest to Tobago. To one accustomed to Trinidad there is a curiously different and more bracing "feel" to the air in Toco and Tobago: this may be connected with the constancy and force of the wind or with humidity. The climatic difference can be measured in rainfall, Toco and Tobago having a regime with maximum precipitation in November and the remainder of Trinidad in August.

RAINFALL

Due to the mountainous nature of the island, the rainfall varies rather widely from point to point. Table 1 shows a summary of records which have been kept at six different stations for periods of from 11 to 31 years. It will be seen that the average rainfall varies from 56.19 inches at the Government Farm in the southwest to 93.08 inches at Hermitage in the northeast. It is clear also that precipitation is by no means annually constant, the record driest and wettest years having a total at the Government Farm of 31.42 and 130.64 inches, respectively, and at Hermitage of 68.62 and 132.56 inches, respectively.

All the stations (Fig. 3) reveal a similar rainfall regime divided into a dry and a wet season, the former from January to May and the latter from June to December. There is a slight diminution of rainfall in October, showing a faint influence of the continental Guianese regime to the southward where the year is divided into two wet and two dry seasons. This phenomenon is scarcely appreciable in Tobago, however, being nothing like as distinct as in Trinidad. Climatically, Tobago belongs to the Lesser Antilles.

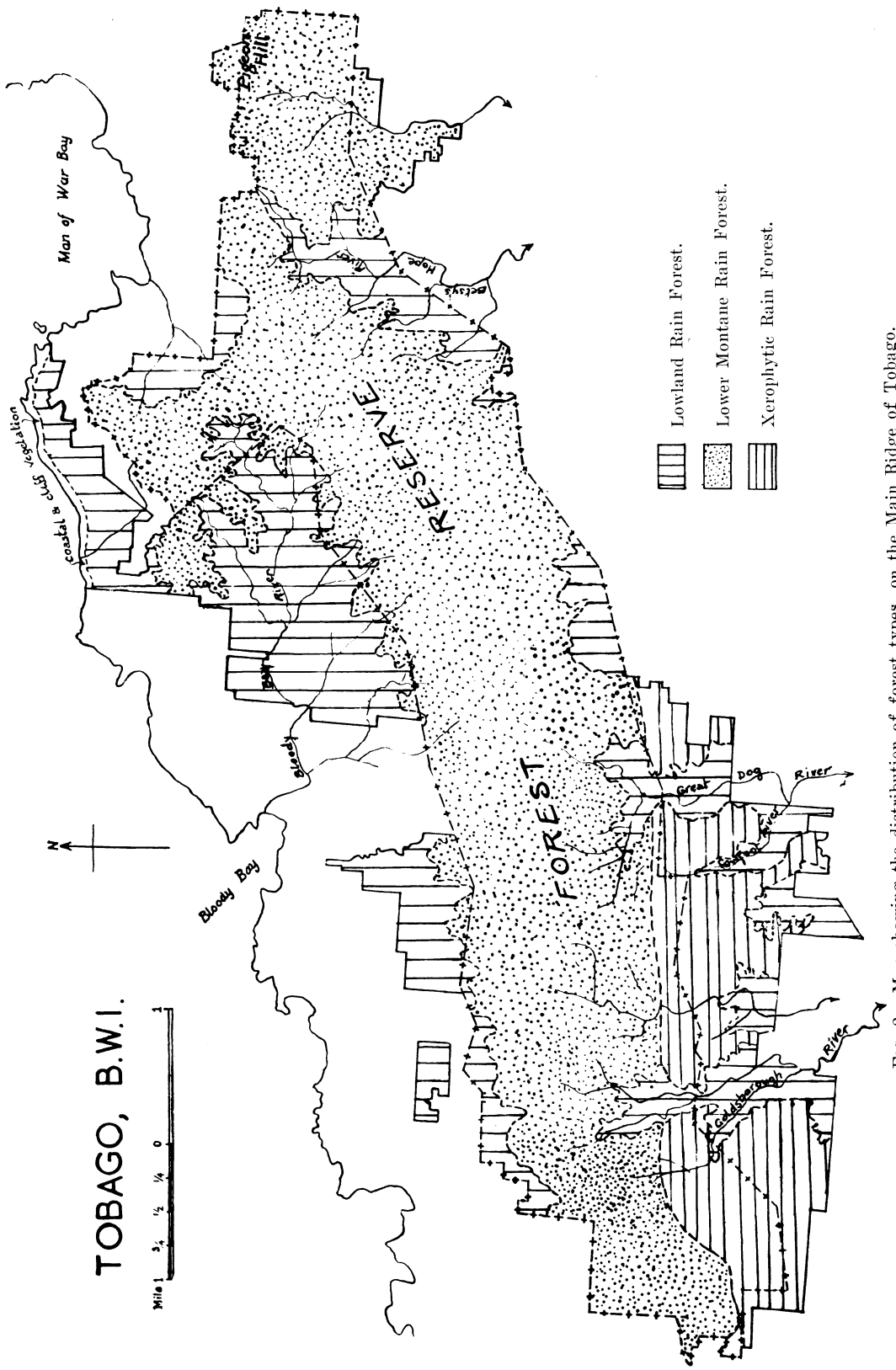

FIG. 2. Map showing the distribution of forest types on the Main Ridge of Tobago.

The seasonal drought revealed by the records is of comparatively extreme severity. Even at the wettest station, Hermitage, there are on the average three months with less than 4 inches of rain, that is, in which evaporation may be assumed to exceed precipitation. At the Government Farm there are five such months.

When considering the rainfall, as shown from records, in relation to the natural vegetation, one meets the difficulty that all the stations are located at Estates round the coast and that there are none on the Main Ridge. It can be established that the coastal lands are exposed to a climatic regime with seasonal drought of from three to five months, but it is clear that the high, mountainous interior is somewhat differently watered. As with all such mountainous islands, the high ground catches a large quantity of rain while the coastal lowlands both to the windward and to leeward may be commonly quite arid. In the case of a large, high island like Puerto Rico, for example, there is an alternation from the most hygrophilous rain forest to cactus desert. Similarly in Tobago the vegetation of the Main Ridge leads one to expect both a higher and better distributed rainfall than on the coast. The writer worked in these forests in late February and early March—the driest time of the year: the soil was quite moist throughout and a heavy rain shower fell on one day; whereas coastally the ground was dry and parched and no rain fell. In the writer's opinion it would be safe to assume an annual rainfall of at least 150 inches for the Main Ridge, no month having less than 4 inches.

TEMPERATURE AND HUMIDITY

No meteorological data of this kind appear to be available for Tobago. In Port of Spain, Trinidad, about 60 miles to the southwest, the mean annual temperature is about 78° F. varying between about 65° F. and 90° F., and relative humidity is always high, seldom below 60 percent in the daytime and approaching saturation at night or in the day after rain. Temperatures for Tobago are probably very similar, but humidity may possibly be lower.

WIND AND SUNSHINE

The prevailing wind is the northeast Trade, which blows with considerable constancy of force and direction. There are no available data as to velocity, but this probably exceeds 6 miles per hour at any time, being higher in the dry season. The presence of a fresh, constant breeze is a noticeable feature of the Main Ridge, even when in dense forest. Wind velocity may frequently increase considerably just before a rainstorm, doing much damage to tree growth in exposed places. Tobago is outside the hurricane zone, but has been visited by one hurricane in historical times, in 1847, when considerable damage was done.

Hours of sunshine probably average about 6 per day.

GEOLOGY

Two reports exist on the Geology of the island, a general review by Cunningham-Craig (1907) and a study of the Tertiary and Quaternary beds by Trechmann (1934).

Tobago lies on the same continental shelf which also carries Trinidad, being separated from the latter island by relatively shallow water whereas deeps of several hundred fathoms divide it from Barbados and Grenada. The mountains of Tobago constitute the last and most easterly link in the great coastal cordillera of Venezuela. Tobago, the Northern Range of Trinidad, and the Paria Peninsula of Venezuela are three ridges of related structure arranged parallel and *en echelon*.

The geological data on the accompanying map are based on Cunningham-Craig, the boundary between igneous and sedimentary rocks being corrected inside the Forest Reserve according to the writer's own observations. The whole of the island north of a rough line running parallel to and about a mile south of the Main Ridge is formed of metamorphic rocks of sedimentary origin consisting chiefly of schistose grits, often very felspathic, with talcose and talc-mica shists. These resemble in a general degree strata in the Northern Range of Trinidad and are most likely of similar age, that is, lower cretaceous: but limestones are totally absent and quartz veins relatively rare. The flat plain of the lowlands is composed of Tertiary and Quaternary beds, mainly coral limestones which rise in a series of flat terraces. The remainder of the island is formed of a mass of basic igneous rock which has shared the metamorphism of the schists and grits and is highly shattered. It appears to have been originally intrusive and agrees with the similar patch of igneous rock at Sans Souci in Trinidad.

The schists appear to have been laid down in open sea and derived from the erosion of land lying to the northward. During late Eocene and Oligocene times this land foundered and the present mountain chains came into being. During the Oligocene, Tobago probably formed part of the continent but was separated by submergences during the Miocene. There is evidence of a Miocene shore-line at the southwestern end of the island. In Pliocene times it is probable that Tobago was once more united with the mainland, only to become detached again soon afterwards. Tobago has now probably led a separate existence for at least 500,000 years.

SOILS

Certain agricultural soils of Tobago were described by Hardy, Akhurst, and Griffith (1931), who distinguished four main soil-types for the cacao districts: residual soils derived from basic igneous rocks, residual soils derived from metamorphic sedimentary rocks, alluvial soils derived from igneous rocks, and alluvial soils derived from metamorphic sediments. All the soils examined appeared remarkably similar, being immature and without profound leaching

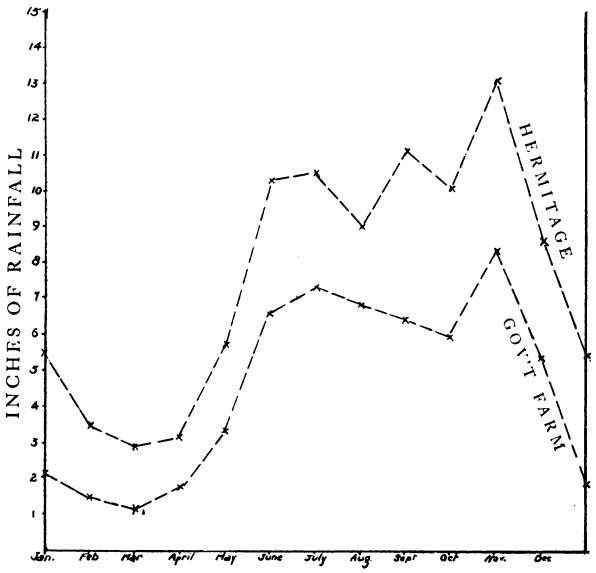

FIG. 3. Monthly distribution of rainfall on Tobago.

FIG. 4. Mangroves.

FIG. 5. Typical vegetation on Little Tobago—deciduous seasonal forest. A large leafless *Lonchocarpus domingensis* at right, abundant Coccothrinax palms in center, while the large leaves of *Anthurium Hookeri* show near the ground.

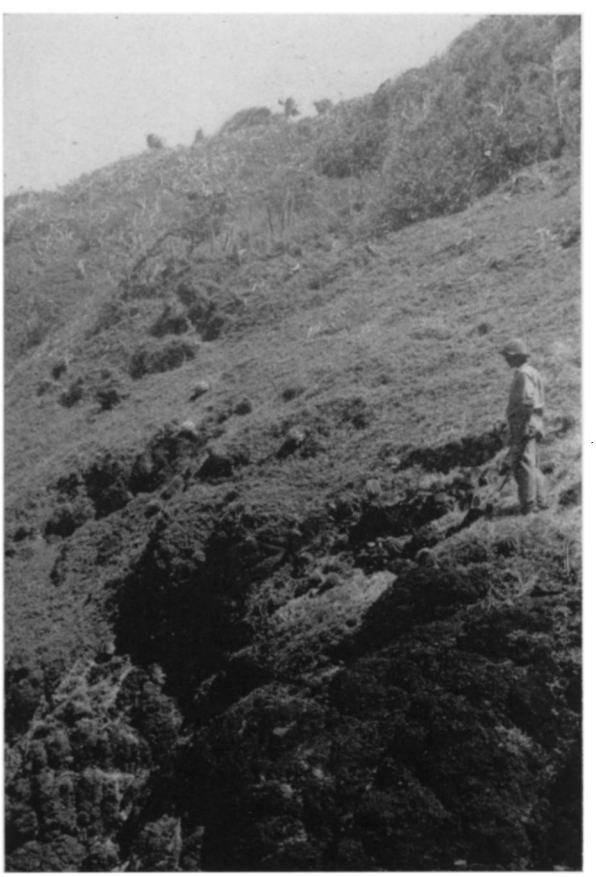

FIG. 6. Little Tobago; cliff vegetation of the windward shore. Windswept thicket at top containing *Cephalocereus moritzianus;* lower, turf of recumbent succulent herbs with *Cactus Broadwayi.*

effects; they were relatively shallow soils, seldom exceeding 36 inches in depth, light in texture, neutral in reaction and containing appreciable amounts of organic matter. A single profile was examined in a forest area, at King's Bay Estate, altitude 950 feet, over igneous rock. This soil was bright red throughout its whole depth and was highly leached and acidic in reaction. Parent rock had not appeared at 72 inches in depth.

Sporadic auger-borings were made by the writer on enumeration traverses in the Forest Reserve, from which two main soil-types could be distinguished generally corresponding to Hardy's "Residual soils derived from basic igneous rock" and "Residual soils derived from metamorphic sedimentary rocks." Owing to the nature of the country it is doubtful if the Reserve contains any alluvial soil. No red soil in any way resembling Hardy's King's Bay Estate profile was encountered at any time: igneous soils were found to be invariably speckled brown-green in color. A typical profile was selected, sampled, and described for each of the two soil types. Descriptions of the profiles are given in Tables 2 and 3. Samples were taken from the profiles at various depths and brought to Trinidad, where in kindness to the writer they were analysed by Professor F. Hardy at the Imperial College of Tropical Agriculture. The results of the laboratory analysis, together with Professor Hardy's comments, are given in Table 4. The same table contains also for comparative purposes data kindly furnished by Professor Hardy from partial analyses of two other forest soil profiles on igneous rock; the first set (T. B. 364-367) was collected by G. Milne and E. M. Chenery in March, 1938 at the 3½ M.P. on the Easterfield-Mason Hall Road in second growth forest not far from the Reserve, and the other (T. B. 368) was collected by F. Hardy in March, 1940 at the 6½ M.P. on the St. George-Castara Road in forest quite near the writer's profile No. 1. These soils are both much less acid than the writer's, but the surface samples agree in the small amount of available phosphate and the single potash value is very low. Deficiency of available phosphate and potash seems to be characteristic of these soils.

The most important features of these soils from the point of view of the forest vegetation are as follows:

No. 1 is a free-draining sandy soil where water percolates rapidly—shown by the deep penetration of organic matter and the absence of red mottling. Auger borings usually showed this soil to be quite dry at 24 inches in depth, though the surface was moist. It appears that the underlying igneous rock has been so shattered by dynamo-metamorphism that it permits very free downward percolation of soil water; this water does not lie for a sufficiently long time in contact with the surface of the rock to effect any intense hydrolysis, and red "lateritic" decomposition products do not occur. This is a shallow soil, rotten rock being encountered at only 18 inches depth, below which very few roots appeared to penetrate.

No. 2 is a heavy clay soil with impeded internal drainage, shown by the low penetration of organic matter and the appearance of crimson mottling at the base of the profile. There is probably little internal water movement. This is a deep soil into which roots penetrate to a considerable depth.

According to Charter's hypothesis (1941) the character of the profile shows it to have reached at least the initial stage in the maturity sequence for such a soil derived from sedimentary deposits.

Land Usage and Settlement

In pre-Columbian times Tobago was inhabited by Caribs, a coastal people who practised a small amount of shifting cultivation but relied mainly on hunting and collecting. The island was discovered for the western world by Columbus in 1498 but no European settlement took place until 1632. Much internecine fighting followed between English, French, and Dutch, the island changing hands many times until the close of the Napoleonic Wars. Since 1814 the island has been continuously under the British Crown, first enjoying separate government; declining prosperity led later to the union of Tobago politically with Trinidad.

The census of 1931 showed the population to be 25,358, a density of 222 to the square mile. The present-day population is almost wholly of African descent and composed largely of peasants.

In the old, unsettled days before 1814 Tobago was one of the most valuable pieces of territory in the world, because of the great wealth of sugar produced there. This was virtually the sole crop and was cultivated on all the available accessible land in the island in spite of the mountainous nature of the country. Old maps exist showing the boundaries of the sugar estates and listing the number of slaves kept on each. From these maps it appears that the areas which are now the Crown Lands and Forest Reserve were never cultivated, being too inaccessible, except possibly the top of Pigeon Hill, which has been in private hands. For many years the former importance of sugar continued. A government map of 1840 shows the boundaries of the old estates, a good many new blocks surveyed out in the interior on the Crown Lands as though these were being offered for sale and a "Rain Reserve" or strip of Crown Land to be retained as forest along the crest of the Main Ridge. Subsequently, however, sugar began to decline and it appears that no further Crown Lands were taken up. The nature of the island rendering rationalization of the industry impracticable, sugar cultivation has gradually disappeared from Tobago. The estates went over one by one to secondary bush and shifting cultivation by peasants. In the last 40 years cacao has been introduced to a large extent in the moister parts of the island.

TABLE 1. Rainfall of Tobago.

Stations and No. Years of Records		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Botanic Station (31 years)	Average	3.59	2.24	1.66	2.42	4.70	9.02	9.25	7.99	7.76	7.76	9.89	6.52	72.80
	Ave. no. days	16	12	10	12	15	23	23	20	19	18	22	20	210
Charlotteville Estate (11 years)	Average	5.97	2.92	2.01	3.70	5.12	8.37	8.23	8.46	8.90	8.81	14.73	9.34	86.56
	Ave. no. days	15	10	9	9	11	14	17	15	15	17	19	15	166
Government Farm (31 years)	Average	2.07	1.46	1.15	1.73	3.30	6.53	7.26	6.78	6.44	5.87	8.32	5.28	56.19
	Ave. no. days	7	6	5	6	10	15	16	14	13	12	15	13	132
King's Bay (31 years)	Average	4.89	3.63	2.61	3.01	5.04	8.91	9.11	7.69	9.38	8.31	11.01	7.65	81.24
	Ave. no. days	13	11	10	11	13	19	21	18	17	17	20	18	188
Hermitage Estate (31 years)	Average	5.40	3.42	2.84	3.14	5.70	10.27	10.49	9.00	11.12	10.02	13.08	8.60	93.08
	Ave. no. days	9	6	6	6	9	15	16	14	11	15	15	14	136
Kendal Estate (19 years)	Average	5.36	3.59	2.56	3.45	5.10	9.81	9.34	9.47	9.90	9.22	14.48	10.18	92.46
	Ave. no. days	24	19	17	16	19	25	26	24	22	24	27	26	269

Stations	Driest Month			Wettest Month			Driest Year			Wettest Year		
	Month and Year	Ins.	Days	Month and Year	Ins.	Days	Year	Ins.	Days	Year	Ins.	Days
Botanic Station	3/1934	0.11	3	11/1933	20.99	28	1914	51.74	—	1938	100.84	207
Charlotteville	5/1941 3/1924	0.0	—	11/1938	32.97	27	1934	66.03	112	1938	137.03	187
Government Farm	5/1930 3/1914	0.0	—	11/1938	24.10	22	1914	31.42	—	1938	130.64	154
King's Bay	3/1934	0.14	5	11/1938	24.61	27	1914	56.10	—	1933	120.19	215
Hermitage Estate	3/1934	0.0	—	11/1938	27.48	24	1914	68.62	—	1938	132.56	170
Kendal Estate	3/1924	0.0	—	11/1938	33.28	30	1930	63.67	—	1938	169.76	293

TABLE 2. Soil Profile No. 1 on St. George-Castara Road between 6¼ and 6½ M.P. in forest of the Gooseberry-Blue Copper type.

DRAINAGE: PROFILE—
Internally: Very free
Externally: Free
Site: Permanently moist

Parent material: Basic igneous rocks (epidiorite)
Topography: Mountain side
Aspect: East

Horizons	Color	Texture	Mineral Skeleton	Structure	Porosity	Consistency	Roots	Water condition
Surface 0″ - 12″	Very thick mat of humus and nutty soil containing most of roots Dark brown, slightly speckled, greenish-white	Clay-silt	Stoneless	Nutty	Spongy	Loose	Few, all sizes	Just moist
12″ - 18″	Brown, speckled greenish-white	Light loam	ditto	Crumb	Fissured	Compact	ditto	ditto
18″ - 66″	Olive-brown speckled yellow-brown	Parent rock, decomposed but retaining its structure	Parent rock, decomposed but hard	Structure of rock retained	ditto	Indurated	Very few	ditto
Below 66″	Olive-green speckled brown, white and green							

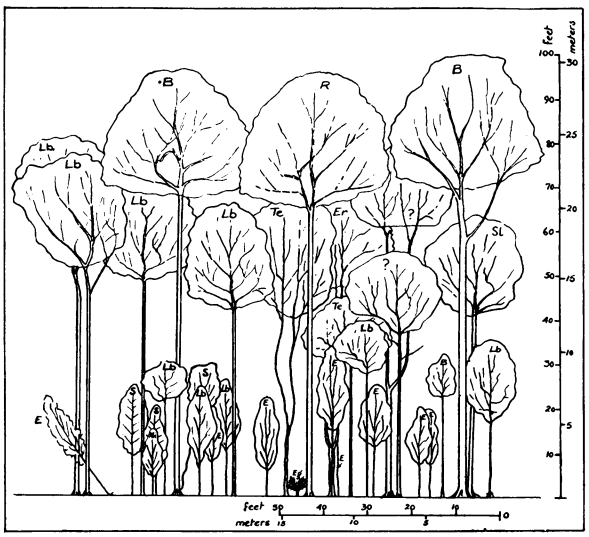

FIG. 7. Profile diagram of Lower Montane Rain Forest measured in the reserve near the Parlatuvier Road.

FIG. 8. Undergrowth in Lower Montane Rain Forest. The small buttresses are typical of the dominants in this type. The tree is *Erythroxylum impressum*.

FIG. 9. Lower Montane Rain Forest.
Note: (i) General impression of luxuriant forest.
(ii) Tall straight stems of the trees.
The large trees are *Sloanea trinitensis* and *Erythroxylum impressum*.

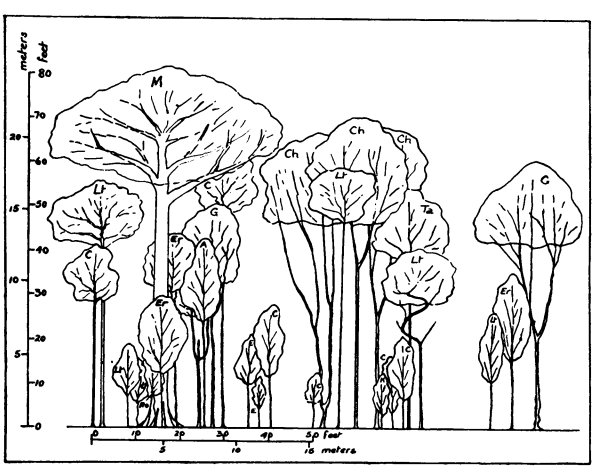

FIG. 10. Profile diagram of Xerophytic Rain Forest, measured in the reserve near the St. George-Castara Road.

TABLE 3. Soil Profile No. 2 on Roxborough-Parlatuvier Road between 4½-4¾ M.P. in forest of the Rosewood-Redwood type.

DRAINAGE: PROFILE—
Internally: Somewhat impeded
Externally: Free
Site: Permanently moist

Parent material: Schist
Topography: Mountain side
Aspect: West

Horizons	Color	Texture	Mineral Skeleton	Structure	Porosity	Consistency	Roots	Water condition
Surface 0″ - 9″	Good humus mat Yellow	Clay	Stoneless	Cloddy	Fissured	Tenacious	Many, all sizes	Wet
9″ - 30″	Yellow-orange	Silty clay	ditto	ditto	ditto	ditto	ditto	ditto
30″ - 50″	Orange, mottled crimson	Silty clay	ditto	Shows original structure	ditto	ditto	ditto	ditto
Below 50″	Predominently orange, mottled crimson, black and white	Silty weathered parent material	Parent rock, decomposed and soft but retaining its structure					

TABLE 4. Results of laboratory analysis of profile samples submitted by Mr. J. Beard, Asst. Conservator of Forests, March, 1942.
PROFILE No. 1: developed over *diorite*.
PROFILE No. 2: developed over *quartz-mica-schist*.

Soil No.		Depth (ins.)	M.P.S. %	Sand %	I.T.	Norm. pH	Reaction Exch. pH	Reaction O.M. %	Avail. P_2O_5 (p. p. m.)	Avail. K_2O
	PROFILE No. 1: *St. George – Castara Road.* (*Gooseberry – Blue Copper Association*)									
TB. 370	Mat; crumb	Surface	—	—	—	4.3	3.9	—	—	—
371	Brown	12	27.8	38.4	20	6.5	5.5	1.79	3	43
372	Speckled	18	41.2	60.7	29	6.4	5.4	2.70	3	—
373	Rotten rock (Igneous)	66	Sandy	83.4	—	7.1	5.7	0.70	4	—
	PROFILE No. 2: *Roxborough – Parlatuvier Road.* (*Rosewood-Redwood Association*)									
374	Mat; crumb	Surface	—	—	—	4.1	3.6	—	—	—
375	Yellow	9	69.3	9.9	67	4.5	3.8	4.23	3	53
376	Orange	30	53.8	19.5	50	4.6	3.8	1.46	3	—
377	Red mottled	50	49.1	20.2	45	4.6	3.9	1.57	3	—
378	Rotten rock (Schist)	Below 50	42.7	34.0	36	4.7	4.0	0.39	5	—

COMPARATIVE DATA:

Soil No.		Depth (ins.)	Coarse and fine sand %	I.T.	pH	O.M. %	Total N %	Avail. P_2O_5 (p.p.m.)	Avail. K_2O
TB. 367	Brown soil	12	16	—	6.1	—	—	6	—
365	Whitish clay	24	47	—	6.8	—	—	8	—
366	ditto	36	51	—	7.1	—	—	135	—
364	Rotten rock	54	74	—	6.4	—	—	240	—
368	Rotten rock	24—36	44	26	6.9	0.5	0.04	11	4.3

REMARKS.

PROFILE No. 1: This seems a typical diorite profile (see "Soils of Tobago"). It is a slightly acid loam, containing a medium-low content of organic matter which appears to penetrate deeply. The contents of available phosphates and of available potash are very low for an agricultural soil. The actual samples perhaps represent an infertile phase of this soil-type.

PROFILE No. 2: This is a heavy clay soil, and shows a marked physical contrast to No. 1. It is very highly acid at all depths; its contents of organic matter is medium-high in the surface 9 ins. layer, diminishing downwards, and insignificant below the 50-inch depth. As in No. 1 the contents of available phosphates and available potash are extremely low (for an agricultural soil), and the samples might be regarded as representing an infertile phase. The main differences between the two profiles are (a) the very high acidity of No. 2, (b) the sandy texture of No. 1 as compared with the clayey texture of No. 2. (Signed) F. HARDY.

In 1904 and subsequently, areas now totaling 9,776 acres comprising the old Rain Reserve and adjacent Crown Lands on the Main Ridge were proclaimed as Forest Reserve in perpetuity for the purpose of maintaining protective forest cover on the watersheds. The remaining Crown Lands (4,514 acres in 1938) are available for sale but there is very little pressure on the land and hardly any is ever applied for. The Forest Reserve and Crown Lands excepting Pigeon Hill represent, therefore, areas of forest which is probably almost all primeval, none of the land having been under either continuous or shifting cultivation. Forest fires appear to be unknown, so that the only human interference is in the form of sporadic felling of trees for timber. The forests are so inaccessible, however, that the effect of this is negligible, the average annual cut for the last 8 years, for example, having been only 150 trees from the Crown Lands, or 1 per 30 acres of forest, and 195 trees from the Reserve, or 1 per 50 acres.

The island of Little Tobago (280 acres) which is now Crown property was formely in private hands and much of it was cultivated for sea-island cotton. Early in the present century the owner—Sir William Ingram—discontinued cultivation and allowed the island to revert to bush. He made it a bird sanctuary and imported birds of paradise from New Guinea; on his death the island was presented to the government on condition that it be maintained as a Game Reserve. The island's vegetation today is homogenous and it is not possible to tell what parts were formerly under cultivation. No timber exploitation takes place there.

THE FLORA

The flora of Tobago is entirely continental in its affinities. Belonging structurally to the South American mainland and not to the Lesser Antilles, Tobago is no oceanic island, but received its flora during Eocene or Oligocene times when actually forming a part of the continent. For this reason the flora corresponds in a close degree with that of Trinidad. It is by no means as rich, due to the disparity in size of the two islands. Trinidad, twelve times as large, contains many plants of swamps, savannas, and high mountain woodland—among other formations—assemblages which are not found in Tobago. Table 8 gives a provisional list of trees native to Tobago, compiled from the published parts of the Flora of Trinidad and Tobago and from the Trinidad Herbarium in Port of Spain. The list contains 162 species in 121 genera and 50 families. The following trees appear to be endemic to Tobago:

Psychotria tobagensis Urb. A common understory tree in rain forest, almost a shrub.

Tresanthera pauciflora K. Schum. A most extraordinary plant: a large shrub with large leaves and long rambling branches sometimes almost recumbent. Abundant in rain forest understory.

Sloanea sp. (undescribed). A large tree very similar to *Sloanea trinitensis*, but differing mainly in that the fruit is white inside and not crimson.

Euterpe sp. (undescribed). "Mountain cabbage." Broadway (1916) lists this palm as *Euterpe globosa* Gaertn., almost certainly wrongly.

Bactris Sworderiana Becc. Doubtful. May be synonymous with *Bactris Cuesa* Crueg. of Trinidad.

Duguetia tobagensis Urb.

Myrcia tobagensis Urb.

Guettarda tobagensis Urb.

It is interesting to note that one of the commonest forest trees, *Ternstroemia oligostemon* Kr. & Urb. is an Antillean which is not found in Trinidad.

FIG. 11. Xerophytic Rain Forest.
Note: (i) General impression of a small pole forest.
(ii) Bark-peeling trees in the foreground—left, *Guettarda scabra;* right, *Amomis caryophyllata.*

Another such species is *Lonchocarpus domingensis* (Pers.) DC., but apart from a few coastal shrubs, this is the sum total of strictly Antillean affinity in the flora. Conversely, several species belonging to the mainland occur abundantly in Tobago but in Trinidad are absent or exceedingly rare. Among these are:

Amomis caryophyllata (Jacq.) Kr. & Urb.
Conomorpha peruviana DC.
Chione venosa (Sw.) Urban
Eschweilera decolorans Sandwith
Simaruba amara Aubl.
Guettarda scabra Lam.

This may appear somewhat peculiar. Amomis, Guettarda, and Chione belong to the formation xerophytic rain forest which is not represented in Trinidad. The identification of the tree "devilwood" as *Eschweilera decolorans* Sandwith is uncertain and the tree may prove to be a Tobago endemic. The case of Simaruba is a strange one. Similarly several species abundant in the Northern Range of Trinidad are almost absent from Tobago.

The local names of trees in Tobago are "Creole" names, those used by the aboriginal Caribs having

TABLE 5. Carapa-Andira Association (Crabwood-Angelin Forest). Average composition per 10 acres, as shown by enumeration.

Creole Name	Botanical Name	Abundance	Constancy	Exclusiveness	Number in Girth Classes: 6 - 7 ft.	7 - 8 ft.	8 - 9 ft.	9 - 10 ft.	Over 10 ft.	Total
1. UPPER STORY:										
1. Crabwood	*Carapa guianensis* Aubl.	v.a.	5	con.	22	4	10	2	10	48
2. Angelin	*Andira inermis* H. B. K.	a.	5	a.c.	18	4	8	....	....	30
3. Horseflesh	*Hieronyma caribaea* Urb.	a.	4	a.c.	12	....	6	....	6	24
4. Devilwood	*Eschweilera decolorans* Sandwith.	a.	5	ind.	12	4	4	....	....	20
5. Wild nutmeg	*Virola surinamensis* (Rol.) Warb.	f.	5	con.	6	2	4	....	2	14
6. Soapwood	*Pithecellobium jupunba* (Willd.) Urb.	f.	3	ind.	10	....	2	....	2	14
7. Duckwood	*Ocotea leucoxylon* (Sw.) Mez.	f.	5	ind.	8	....	2	2	....	12
8. Greenheart	*Tabebuia serratifolia* (Vahl.) Nichols.	o.	2	ind.	6	....	....	....	....	6
9. Redwood	*Ternstroemia oligostemon* Kr. & Urb.	o.	2	cas.	4	....	....	....	....	4
10. Lionwood	*Sloanea trinitensis* Sandwith.	o.	1	cas.	2	....	2	....	....	4
11. Timber Fiddlewood	*Vitex divaricata* Sw.	o.	2	ind.	2	....	2	....	....	4
12. Silk cotton	*Ceiba pentandra* (L.) Gaertn.	o.	2	ind.	....	....	....	....	4	4
13. Galba	*Calophyllum ludidum* Benth.	o.	2	cas.	4	....	....	....	....	4
14.	*Licania ternatensis* Hook f.	o.	3	cas.	4	....	....	....	....	4
15.	*Micropholis Cruegeriana* Pierre	o.	1	cas.	....	2	2	....	....	4
16. Bitter Quassia	*Simaruba amara* Aubl.	r.	3	cas.	....	....	2	....	....	2
17. Rosewood	*Byrsonima spicata* Rich.	r.	2	cas.	2	....	....	....	....	2
18. Hogplum	*Spondias mombin* L.	r.	1	ind.	2	....	....	....	....	2
19. Goatmeat	....?	r.	2	ind.	2	....	....	....	....	2
20. Yellow sanders	*Buchenavia capitata* (Vahl.) Eichl.	r.	1	ind.	....	....	2	....	....	2
21. Beefwood	*Pisonia* sp.	r.	1	ind.	2	....	....	....	....	2
22.	*Matayba arborescens* Radlk.	r.	2	ind.	....	....	2	....	....	2
23. Unknown	....	r.	....	....	2	....	....	....	....	2
					120	16	48	4	24	212

Creole Name	Botanical Name	Abundance	Constancy	Exclusiveness	Number in Girth Classes: 2 - 3 ft.	3 - 4 ft.	4 - 5 ft.	5 - 6 ft.	....	Total
2. MIDDLE STORY:										
1. Mountain Cabbage	*Euterpe* sp.	v.a.	5	ind.	220	....	....	....	....	220
2. Devilwood	*Eschweilera decolorans* Sandwith	a.	5	ind.	....	32	14	12	....	58
3. Angelin	*Andira inermis* H. B. K.	a.	5	a.c.	....	10	18	6	....	34
4. Wild cocoa (A)	*Licania biglandulosa* Griseb.	a.	5	ind.	....	18	8	2	....	28
5. Crabwood	*Carapa guianensis* Aubl.	a.	5	con.	....	8	16	4	....	28
6. Duckwood	*Ocotea leucoxylon* (Sw.) Mez.	a.	5	ind.	....	14	10	2	....	26
7. Wild nutmeg	*Virola surinamensis* (Rol.) Warb.	a.	5	con.	....	6	14	4	....	24
8. Wild cocoa (B)	*Marila grandiflora* Griseb.	l.a.	3	ind.	....	18	4	2	....	24
9. Myers	*Lauraceae* spp.	a.	5	ind.	....	16	4	2	....	22
10. Soapwood	*Pithecellobium jupunba* (Willd.) Urb.	f.	3	a.c.	....	4	4	4	....	12
11. Small-leaf	*Myrtaceae* spp.	f.	5	ind.	....	6	4	....	....	10
12. Horseflesh	*Hieronyma caribaea* Urb.	f.	4	a.c.	....	....	4	4	....	8
13. Bitter Quassia	*Simaruba amara* Aubl.	f.	3	cas.	....	2	6	....	....	8
14. Greenheart	*Tabebuia serratifolia* (Vahl.) Nichols.	f.	2	ind.	....	2	6	....	....	8
15. Timber Fiddlewood	*Vitex divaricata* Sw.	o.	2	ind.	....	4	2	....	....	6
16.	*Licania ternatensis* Hook f.	o.	3	cas.	....	2	4	....	....	6
17. Redwood	*Ternstroemia oligostemon* Kr.	o.	2	cas.	....	....	2	2	....	4
18.	*Alchornea glandulosa* Poepp.	o.	1	ind.	....	....	2	2	....	4
19. Rough palm	*Scheelea osmantha* Barb.	o.	1	con.	4	....	....	....	....	4
20.	*Matayba arborescens* Radlk.	o.	2	ind.	....	2	2	....	....	4
21. Bois flot	*Ochroma pyramidale* (Cav.) Urb.	o.	1	ind.	....	2	2	....	....	4
22. Wild manjack	*Cordia* spp.	o.	2	ind.	....	2	....	2	....	4
23. Pois doux	*Inga punctata* Willd.	o.	1	con.	....	4	....	....	....	4
24. Rosewood	*Byrsonima spicata* Rich.	r.	2	cas.	....	....	....	2	....	2
25. Lionwood	*Sloanea trinitensis* Sandwith.	r.	1	cas.	....	....	....	2	....	2
26. Goatmeat	....?	r.	2	ind.	....	2	....	....	....	2
27.	*Erythroxylum impressum* O. E. Schulz.	r.	1	cas.	....	2	....	....	....	2
28. Cabbage palm	*Roystonea oleracea* Cook	r.	2	con.	....	2	....	....	....	2
29. Beefwood	*Pisonia* sp.	r.	1	ind.	....	....	....	2	....	2
30. Unknown	....?	r.	....	....	....	....	2	....	....	2
					224	158	128	54	....	564

TABLE 5 *(Continued)*

Creole Name	Botanical Name	Abundance	Constancy	Exclusiveness	Number in Girth Classes 1 - 2 ft.	2 - 3 ft.	3 - 4 ft.			Total
3. LOWER STORY:										
1. Mountain Cabbage	*Euterpe* sp.	v.a.	5	ind.	278	....	....	....	....	278
2. Small-leaf	*Myrtaceae* spp.	a.	5	ind.	42	52	....	....	....	94
3. Wild cocoa (A.)	*Licania biglandulosa* Griseb.	a.	5	ind.	44	28	....	....	....	72
4. Wild Waterwood	*Tresanthera pauciflora* K. Schum.	a.	4	a.c.	32	16	....	....	....	48
5. Crabwood	*Carapa guianensis* Aubl.	a.	5	con.	28	14	....	....	....	42
6. Duckwood	*Ocotea leucoxylon* (Sw.) Mez.	a.	5	ind.	16	26	....	....	....	42
7. Wild coffee	*Styrax glaber* Sw.	a.	4	ind.	30	8	2	....	....	40
8.	*Rudgea Freemani* Sprague & Williams	f.	4	ind.	18	16	2	....	....	36
9. Wild cocoa (B.)	*Marila grandiflora* Griseb.	f.	3	ind.	16	18	....	....	....	34
10. Devilwood	*Eschweilera decolorans* Sandwith.	f.	5	ind.	10	18	....	....	....	28
11. Myers	*Lauraceae* spp.	f.	5	ind.	6	20	....	....	....	26
12.	*Stylogyne lateriflora* (Sw.) Mez.	f.	3	a.c.	12	10	2	....	....	24
13. Trumpet	*Cecropia peltata* L.	o.	1	ind.	4	8	....	....	....	12
14. Wild nutmeg	*Virola surinamensis* (Rol.) Warb.	o.	5	con.	4	6	....	....	....	10
15.	*Matayba arborescens* Radlk.	o.	2	ind.	2	6	....	....	....	8
16. Parrot apple	*Clusia rosea* Jacq.	o.	1	cas.	....	8	....	....	....	8
17. Bitter Quassia	*Simaruba amara* Aubl.	o.	3	cas.	4	2	....	....	....	6
18. Yellow Wattle	*Vismia falcata* Rusby	o.	1	ind.	2	4	....	....	....	6
19. Angelin	*Andira inermis* H. B. K.	o.	5	a.c.	4	....	....	....	....	4
20. Soapwood	*Pithecellobium jupunba* (Willd.) Urb.	o.	3	a.c.	2	2	....	....	....	4
21.	*Licania ternatensis* Hook f.	o.	3	cas.	....	4	....	....	....	4
22. Galba	*Calophyllum lucidum* Benth.	r.	2	cas.	....	2	....	....	....	2
23. Wild manjack	*Cordia* spp.	r.	2	ind.	....	2	....	....	....	2
24. Burn-nose	?*Anaxagorea acuminata* St. Hil.	r.	1	ind.	1	1	....	....	....	2
25. Unknown	....	r.	....	....	2	....	....	....	....	2
					557	271	6	....	....	834
	Total all individuals	....	....	....	....	....	....	....	....	1,610

disappeared. Since Tobago has never been an island in which Creole-French was spoken, the "Creole-English" West Indian tree vocabulary is in use. Names therefore differ from those now in common use in Trinidad and Grenada but agree to a considerable extent with those current in St. Vincent. This English vocabulary is very poor compared with the Creole-French. Plants of the coast and cultivated lands are well known and recognized, but up on the Main Ridge only the most conspicuous trees or those which are worked for their timber are dignified with local names. The remainder are classed vaguely as "wild trees." In Trinidad almost every tree is named. Of the 84 tree species the writer recorded on enumeration traverses on the Main Ridge, local names were obtained for 60, the remaining 24 apparently not being distinguished. Local nomenclature agrees with common West Indian practice in using group terms for certain closely allied or similar groups of plants. Thus:

"Myers" for Lauraceae (Trinidad and Grenada "laurier," St. Vincent "sweetwood").

"Small-leaf" for Myrtaceae (Trinidad "wild guava," Grenada "guyavier," St. Vincent "bashie guava").

"Wild spice" for Melastomaceae (Trinidad "sardine," Grenada "bois cendre," St. Vincent "ashes wood").

"Wild manjack" for *Cordia* spp. (Trinidad "lay-lay" or "manjack," Grenada and St. Vincent "manjack").

Secondary differentiation of the group term such as occurs in Creole-French (laurier canelle, laurier 'zaboca, laurier mama 'zenfants) is not, however, practiced in Tobago, in common with the general poverty of names.

In the lists of species names appearing in inverted commas are those invented for convenience by the writer.

In the lists of species for the various associations (Tables 5, 6, and 7), an endeavor has been made to indicate degree of abundance, constancy, and exclusiveness, the following symbols being used:

Abundance: in 5 degrees—v.a. = very abundant, a = abundant, f = frequent, o = occasional, r = rare.

Constancy: in 5 degrees—5 = occurs in over 80 percent of the areas enumerated, 4 = occurs in 60 to 80 percent, 3 = in 40 to 60 percent, 2 = in 20 to 40 percent, 1 = in below 20 percent.

Exclusiveness: in 4 degrees—con. = confined to the association, characteristic of it and occurring only casually elsewhere; a.c. = almost confined, occurring more commonly in the association than elsewhere; ind. = indifferent, occurring as readily elsewhere; and cas. = casual, an intruder characteristic of some other type.

THE PLANT COMMUNITIES

The Formations

The plant formations found on this island are an expression of the interplay of the environmental factors of climate, topography, and soil. They will be arranged into four groups—the mangrove woodland, the littoral woodland, the seasonal forests, and the rain forests—following, with some slight modifications made for greater convenience in this particular study, the system of nomenclature and classification advocated by Beard (1942, 1944).

Mangrove woodland. Mangrove is found on tidal mudflats or shallow lagoons where fresh and salt water mingle. There is no need to detail the well-known specializations of mangrove species.

Littoral woodland is found fringing the sea coasts, on beaches, sandbanks, and cliffs, where salt spray is frequently deposited on the vegetation. Many plants composing this formation are adapted to withstand the effects of a salt coating on their leaves, which are thick and fleshy and have a waxy covering.

Seasonal forests. In the small, climatically oceanic and mountainous islands of the Caribbean the vegetation between the coast and a point varying between some 400 and 1,200 feet elevation in the mountains is primarily influenced by the rainfall regime. Coastal areas are always dry, with an annual precipitation as low as 40 inches in places and a most severe season of drought during a part of the year. The available moisture, however, steadily increases from the coast toward the central mountains until a point is reached on the lower slopes where a dry season to all intents and purposes has ceased to exist. The seasonal forests vary from low to tall and from deciduous to evergreen and represent the decreasing influence of drought between the arid coast and the rain forest zone. In Tobago nearly all seasonal vegetation has been destroyed by the cultivator.

Rain forests. In the mountainous interior rainfall still fluctuates seasonally but is adequate to sustain growth during the dry season months. Rain forest, the optimum tropical vegetation, is found here, and covers the whole of the Main Ridge. The summits in Tobago do not ascend sufficiently high for any very adverse effects of exposure and lowered temperature to be felt, so that the more specialized montane formations do not appear. Local variations in the

TABLE 6. Byrsonima-Licania Association. Ternstroemia Faciation (Rosewood-Redwood Forests). Average composition per 10 acres, as shown by enumeration.

Creole Name	Botonical Name	Abundance	Constancy	Exclusiveness	Number in Girth Classes							
					4 - 5 ft.	5 - 6 ft.	6 - 7 ft.	7 - 8 ft.	8 - 9 ft.	9 - 10 ft.	Over 10 ft.	Total
1. UPPER STORY:												
1. Rosewood	*Byrsonima spicata* Rich.	v.a.	5	a.c.	15	7	16	4	2	....	1	45
2. Wild cocoa	*Licania biglandulosa* Griseb.	a.	5	ind.	22	3	5	....	1	....	....	31
3. Redwood	*Ternstroemia oligostemon* Kr. & Urb.	a.	5	a.c.	14	5	8	1	1	....	....	29
4. Devilwood	*Eschweilera decolorans* Sandwith.	a.	5	ind.	12	4	8	1	2	....	1	28
5. "Red" Lionwood	*Sloanea trinitensis* Sandwith.	a.	4	a.c.	3	5	5	3	6	2	1	25
6. Bitter Quassia	*Simaruba amara* Aubl.	f.	5	a.c.	7	5	4	1	1	....	....	18
7. Duckwood	*Ocotea leucoxylon* (Sw.) Mez.	f.	4	ind.	6	1	2	....	1	....	....	10
8. Soapwood	*Pithecellobium jupunba* (Willd.) Urb.	f.	3	ind.	2	1	2	1	4	....	....	10
9.	*Erythroxylum impressum* O.E. Schulz.	f.	4	ind.	5	2	2	....	....	....	....	9
10. Angelin	*Andira inermis* H. B. K.	f.	3	cas.	3	1	1	1	1	1	1	9
11. "White" Lionwood	*Sloanea* sp.	f.	2	a.c.	2	1	2	1	1	....	1	8
12. Horseflesh	*Hieronyma caribaea* Urb.	o.	4	cas.	1	1	2	1	1	1	....	7
13.	*Richeria grandis* Vahl.	l.f.	2	con.	3	1	2	....	....	....	....	6
14. Myers	*Lauraceae* sp.	o.	4	ind.	3	1	2	....	....	....	....	6
15.	*Matayba arborescens* Radlk.	o.	3	ind.	2	1	1	....	....	....	....	4
16. Galba	*Calophyllum lucidum* Benth.	o.	2	cas.	....	....	1	1	1	1	....	4
17. Goatmeat	.....?	r.	2	ind.	1	....	1	....	1	....	....	3
18. Yellow Sanders	*Buchenavia capitata* (Vahl.) Eichl.	r.	1	ind.	....	1	....	1	....	1	....	3
19. Crabwood	*Carapa guianensis* Aubl.	r.	1	cas.	1	1	1	....	....	....	....	3
20. Wild nutmeg	*Virola surinamensis* (Rol.) Warb.	r.	1	cas.	1	1	1	....	....	....	....	3
21.	*Roupala montana* Aubl.	r.	1	ind.	1	2	....	....	....	....	....	3
22. "Redbark"	.....?	r.	1	con.	1	....	1	....	....	....	....	2
23. Bowldish	*Ficus* sp.	r.	2	ind.	....	1	1	....	....	....	....	2
24. Timber Fiddlewood	*Vitex divaricata* Sw.	r.	1	ind.	1	....	....	....	1	....	....	2
25. "Warty-bark"	.....?	r.	2	con.	1	....	....	....	....	....	....	1
26. Cabbage palm	*Roystonea oleracea* Cook	r.	1	cas.	1	....	....	....	....	....	....	1
27. "Red Polish"	.....?	r.	1	con.	....	....	....	1	....	....	....	1
28. Tobago Yoke	*Sloanea Purdiaei* Griseb.	r.	1	con.	....	....	1	....	....	....	....	1
29.	*Sapotaceae* sp.	r.	1	con.	1	....	....	....	....	....	....	1
30.	*Alchornea glandulosa*	r.	1	ind.	....	....	....	....	1	....	....	1
					109	45	69	17	25	6	5	276

TABLE 6 *(Continued)*

Creole Name	Botonical Name	Abundance	Constancy	Exclusiveness	Number in Girth Classes 1 - 2 ft.	2 - 3 ft.	3 - 4 ft.	4 - 5 ft.				Total
2. LOWER STORY:												
1. Mountain Cabbage	*Euterpe* sp.	l.v.a	3	ind.	137	88	....	....	....	....	....	225
2. Wild cocoa (A)	*Licania biglandulosa* Griseb.	v.a.	5	ind.	57	69	52	....	....	....	....	178
3. Small-leaf	*Myrtaceae* spp.	a.	5	ind.	52	28	7	....	....	....	....	87
4. Mountain Cabbage	*Euterpe Broadwayana* Becc.	l.v.a	3	ind.	63	11	....	....	....	....	....	74
5. Wild coffee	*Sytrax glaber* Sw.	a.	5	ind.	44	17	2	....	....	....	....	63
6. Devilwood	*Eschweilera decolorans* Sandwith.	a.	5	ind.	17	23	22	....	....	....	....	62
7. Myers	*Lauraceae* spp.	f.	4	ind.	15	15	7	....	....	....	....	37
8. Bitter Quassia	*Simaruba amara* Aubl.	f.	5	a.c.	9	13	9	....	....	....	....	31
9. Duckwood	*Ocotea leucoxylon* (Sw.) Mez.	f.	4	ind.	8	11	10	....	....	....	....	29
10.	*Erythroxylum impressum* O. E. Schulz.	f.	4	ind.	3	14	10	....	....	....	....	27
11. Redwood	*Ternstroemia oligostemon* Kr. & Urb.	f.	5	a.c.	2	10	15	....	....	....	....	27
12. Rosewood	*Byrsonima spicata* Rich.	f.	5	a.c.	3	4	7	....	....	....	....	14
13.	*Rudgea Freemani* Sprague & Williams	o.	3	ind.	6	4	1	....	....	....	....	11
14. Wild cocoa (B)	*Marila grandiflora* Griseb.	l.f.	2	ind.	3	2	3	1	....	....	....	9
15. Goatmeat	.....?	o.	2	ind.	2	3	3	....	....	....	....	8
16.	*Matayba arborescens* Radlk.	o.	3	ind.	2	4	2	....	....	....	....	8
17. "Red" Lionwood	*Sloanea trinitensis* Sandwith.	o.	4	a.c.	1	1	4	....	....	....	....	6
18.	*Richeria grandis* Vahl.	l.f.	2	con.	2	1	3	....	....	....	....	6
19.	*Psychotria tobagensis* Urb.	o.	1	ind.	6	....	....	....	....	....	....	6
20. Wild manjack	*Cordia* spp.	o.	2	ind.	1	4	1	....	....	....	....	6
21. Yellow wattle	*Vismia falcata* Rusby	o.	2	ind.	2	2	1	1	....	....	....	6
22.	*Cassipourea latifolia* Alston	o.	2	cas.	2	1	1	....	....	....	....	4
23. Wild nutmeg	*Virola surinamensis* (Rol.) Warb.	o.	1	cas.	1	2	1	....	....	....	....	4
24. Parrot-Apple	*Clusia rosea* Jacq.	r.	1	cas.	....	3	....	....	....	....	....	3
25.	*Eugenia confusa* DC.	r.	1	cas.	1	1	....	1	....	....	....	3
26. Tobago beau	*Brownea latifolia* Jacq.	r.	2	ind.	3	....	....	....	....	....	....	3
27.	*Roupala montana* Aubl.	r.	2	cas.	2	1	....	....	....	....	....	3
28. "Warty-bark"	.....?	r.	2	con.	1	1	....	....	....	....	....	2
29. Galba	*Calophyllum lucidum* Benth.	r.	2	cas.	1	....	1	....	....	....	....	2
30. Timber Fiddle-wood	*Vitex divaricata* Sw.	r.	1	ind.	1	....	1	....	....	....	....	2
31. "Redbark"	.....?	r.	1	con.	....	....	2	....	....	....	....	2
32.	*Stylogyne lateriflora* (Sw.) Mez.	r.	1	cas.	1	1	....	....	....	....	....	2
33. Field No. 78	.....?	r.	1	cas.	1	1	....	....	....	....	....	2
34. Angelin	*Andira inermis* H. B. K.	r.	3	cas.	....	....	2	....	....	....	....	2
35. "White" Lion-wood	*Sloanea* sp.	r.	2	a.c.	....	1	1	....	....	....	....	2
36. Soapwood	*Pithecellobium jupunba* (Willd.) Urb.	r.	3	ind.	1	....	....	....	....	....	....	1
37. Bowldish	*Ficus* sp.	r.	2	ind.	....	....	1	....	....	....	....	1
38. Crabwood	*Carapa guianensis* Aubl.	r.	1	cas.	1	....	....	....	....	....	....	1
39. Greenheart	*Tabebuia serratifolia* (Vahl.) Nichols.	r.	1	cas.	....	....	1	....	....	....	....	1
40. W. Waterwood	*Tresanthera pauciflora* K. Schum.	r.	1	cas.	1	....	....	....	....	....	....	1
41. Horseflesh	*Hieronyma caribaea* Urb.	r.	4	cas.	....	....	1	....	....	....	....	1
42. "Red Polish"	.....?	r.	1	con.	....	1	....	....	....	....	....	1
43.	*Alchornea glandulosa* Poepp.	r.	1	ind.	....	1	....	....	....	....	....	1
44. Beefwood	*Pisonia* sp. ?*eggersiana* Heimerl.	r.	1	ind.	....	....	1	....	....	....	....	1
45. Yellow prickle	*Fagara* sp.	r.	1	cas.	1	....	....	....	....	....	....	1
46. Wild spice	*Miconia* sp.	r.	1	ind.	1	....	....	....	....	....	....	1
					454	338	172	3	....	....	....	967
	Total all individuals	....	....	....	....	....	....	....	....	....	....	1,243

environmental factors determine two sub-types of the main Rain Forest, which will be entitled respectively Lower Montane Rain Forest and Xerophytic Rain Forest.

THE ASSOCIATIONS

Since the flora of Tobago is basically identical with that of Trinidad it may be expected that the floristic groups or associations in the two islands will correspond in a like manner. Such occurs, however, only up to a point, beyond which the associations bear in many cases a curiously Antillean stamp. This is a fact which must presumably be explained on climatic grounds, since the climate of Tobago resembles that of the Lesser Antilles more closely than that of Trinidad.

TABLE 7. Manilkara-Guettarda Association (Gooseberry-Blue Copper Forest). Average composition per 10 acres, as shown by enumeration.

Creole Name	Botanical Name	Abundance	Constancy	Exclusiveness	Number in Girth Classes: 4 - 5 ft.	5 - 6 ft.	6 - 7 ft.	7 - 8 ft.	8 - 9 ft.	9 - 10 ft.	Over 10 ft.	Total
1. Emergent trees:												
1. Gooseberry	*Manilkara bidentata* (A.DC.) Chev.	l.v.a	3	con.	20	2	7	....	7	1	4	41
2.	*Podocarpus coriaceus* Rich.	l.a.	3	con.	14	2	1	....	....	....	....	17
3. Parrot Apple	*Clusia rosea* Jacq.	f.	5	a.c.	7	1	....	....	....	....	....	8
4.	*Micropholis Cruegeriana* Pierre	f.	4	a.c.	5	3	....	....	....	....	....	8
5. Galba	*Calophyllum lucidum* Benth.	l.a.	2	a.c.	3	2	2	....	....	....	....	7
6.	*Licania ternatensis* Hook f.	l.f.	2	con.	4	....	....	....	....	....	....	4
7.	*Roupala montana* Aubl.	o.	5	a.c.	3	....	....	....	1	....	....	4
8. Bitter Quassia	*Simaruba amara* Aubl.	o.	2	cas.	4	....	....	....	....	....	....	4
9. Rosewood	*Byrsonima spicata* Rich.	r.	1	cas.	1	1	....	....	1	....	....	3
10. Lionwood	*Sloanea trinitensis* Sandwith.	r.	1	cas.	....	....	1	....	....	....	....	1
11. Yellow Sanders	*Buchenavia capitata* (Vahl.) Eichl.	r.	1	ind.	....	....	....	....	1	....	....	1
					61	11	11	....	10	1	4	98

					1 - 2 ft.	2 - 3 ft.	3 - 4 ft.	4 - 5 ft.				Total
2. Trees forming the lower levels of the forest:												
1. Blue Copper	*Guettarda scabra* Lam.	l.v.a	3	con.	109	117	25	4	....	....	....	255
2. Small-leaf	*Myrtaceae* spp.	v.a.	5	ind.	155	50	9	....	....	....	....	214
3.	*Roupala montana* Aubl.	a.	5	a.c.	67	52	13	....	....	....	....	132
4. Parrot apple	*Clusia rosea* Jacq.	f.	5	a.c.	20	52	17	....	....	....	....	89
5.	*Cassipourea latifolia* Alston.	f.	4	a.c.	63	23	1	....	....	....	....	87
6.	*Licania ternatensis* Hook f.	l.f.	2	con.	16	40	19	....	....	....	....	75
7. Bayleaf	*Amomis caryophyllata*(Jacq.)Kr.& Urb.	l.a.	3	con.	30	13	6	5	....	....	....	60
8. Mountain Cabbage.	*Euterpe Broadwayana* Becc.	l.a.	2	ind.	51	9	....	....	....	....	....	60
9. Gooseberry	*Manilkara bidentata* (A.DC.) Chev.	l.a.	3	con.	12	20	27	....	....	....	....	59
10.	*Micropholis Cruegeriana* Pierre	l.f.	4	a.c.	19	31	8	....	....	....	....	58
11.	*Podocarpus coriaceus* Rich.	l.a.	3	con.	21	17	15	....	....	....	....	53
12.	*Erythroxylum impressum* O.E.Schulz.	o.	2	ind.	29	4	4	1	....	....	....	38
13. "Pinkbark"	.....?	l.f.	2	con.	15	15	5	....	....	....	....	35
14.	*Chione venosa* (Sw.) Urb.	l.f.	3	con.	8	11	4	....	....	....	....	23
15. Bitter Quassia	*Simaruba amara* Aubl.	l.o.	2	cas.	2	9	10	....	....	....	....	21
16. Wild cocoa	*Licania biglandulosa* Griseb.	o.	2	ind.	8	4	4	1	....	....	....	17
17. Mountain Cabbage.	*Euterpe* sp.	l.f.	2	ind.	9	5	....	....	....	....	....	14
18. Redwood	*Ternstroemia oligostemon* Kr. & Urb.	r.	2	cas.	3	5	4	....	....	....	....	12
19. Galba	*Calophyllum lucidum* Benth.	r.	2	a.c.	2	2	1	....	....	....	....	5
20. Rosewood	*Byrsonima spicata* Rich.	r.	1	cas.	1	1	2	....	....	....	....	4
21. Greenheart	*Tabebuia serratifolia* (Vahl.) Nichols.	r.	1	cas.	2	2	....	....	....	....	....	4
22. Tobago beau	*Brownea latifolia* Jacq.	r.	2	ind.	4	....	....	....	....	....	....	4
23. Goatmeat	.....?	r.	1	ind.	1	1	1	....	....	....	....	3
24. Wild spice	*Miconia* sp.	r.	1	ind.	2	....	....	....	....	....	....	2
25. Wild coffee	*Eugenia confusa* DC.	l.o.	2	a.c.	....	2	....	....	....	....	....	2
26. Beefwood	*Pisonia* sp. ?*eggersiana* Heimerl.	r.	1	ind.	1	1	....	....	....	....	....	2
27. Wild manjack	*Cordia* sp.	r.	1	ind.	1	1	....	....	....	....	....	2
28. Duckwood	*Ocotea leucoxylon* (Sw.) Mez.	r.	1	cas.	....	....	1	....	....	....	....	1
29. Trumpet	*Cecropia peltata* L.	r.	1	ind.	1	....	....	....	....	....	....	1
30. Wild milking	*Ficus* sp.	r.	1	ind.	1	....	....	....	....	....	....	1
31.	*Mouriri rhizophoraefolia* DC.	l.r.	1	con.	....	1	....	....	....	....	....	1
32.	*Psychotria tobagensis* Urb.	r.	1	ind.	1	....	....	....	....	....	....	1
33. Unknown		r.	....	.....	1	....	....	....	....	....	....	1
					661	487	176	11	....	....	....	1,335
	Total all individuals	....	....	.....	....	....	....	....	....	....	....	1,433

The association of littoral woodland may be named from *Coccoloba uvifera* and *Hippomane mancinella.* This association is probably common to all the shores of the Caribbean. The mangrove (Rhizophora-Avicennia-Laguncularia) association has an even wider range and occupies the entire intertropical Atlantic seaboard of Africa and America. Deciduous seasonal forest is represented by the Bursera-Lonchocarpus association which is found, somewhat ruinate, in Trinidad and well developed throughout the Lesser Antilles. It is in the case of the rain forest associations that the convergence to Antillean pattern becomes noticeable. Xerophytic rain forest is not a formation which the writer has encountered elsewhere and its association, named from *Manilkara bidentata* and *Guettarda scabra,* is therefore at present unique but it contains several abundant species which while absent to very rare in Trinidad are common in the Lesser Antilles. The Carapa-Andira association of rain forest proper is not found in Trinidad, but we may conjecture from relics in Grenada and St. Vincent that it formerly occurred there. *Andira inermis* is a common tree in the islands but is rare in Trinidad and the mainland. The composition of lower montane rain forest is sufficiently homologous with that in the Northern Range of Trinidad to be considered as belonging to the same association, which may be named from *Byrsonima spicata* and *Licania biglandulosa.* The lower montane rain forest of Tobago is impressed with an Antillean physiognomy by several features, which may be purely coincidental but may equally be related to climate. First is the abundance (20 to 30 percent) in the lower story of a Euterpe palm, a feature of the Dacryodes-Sloanea association in the Windward Islands; large palms are virtually absent in the mountain forests of Trinidad. A second feature is the tendency to dominance of the genus Sloanea embracing several conspicuous trees with their large buttresses. All these Sloaneas are species endemic to Trinidad and Tobago and thus are not the same as those which are so prominent further north; but the effect is the same. As a third feature may be selected the abundance of *Ternstroemia oligostemon,* a tree of Antillean origin.

Trinidad possesses a very large number of species which are not found in Tobago; this may be largely ascribed to differences of habitat, for Trinidad contains numerous different types of vegetation, each with its characteristic species. The flora of freshwater swamp forest, of herbaceous swamp, palm swamp, marsh forests, woodland, and savannas is naturally not represented in Tobago, nor is that of montane rain forest and elfin woodland. Considering formations which exist in both islands, in the case of deciduous seasonal forest Tobago lacks notably *Machaerium robinifolium* (DC.) Vogel, *Capparis* spp., *Oliganthes condensata* Schulz., and *Lonchocarpus punctatus* H.B.K., the latter being replaced by *L. domingensis* (Pers.) DC. In the case of the rain forests, conspicuous absentees in Tobago are: *Sterculia caribaea* R. Br., *Terminalia obovata* (R. & P.) Steud., *Symphonia globulifera* L. Fil., *Tapirira guianensis* Aubl., *Lucuma Hartii* Hemsl., *Didymopanax morototoni* Dene & Planch., *Calliandra guildingii* Benth., and *Tabebuia stenocalyx* Sprague & Stapf. Further, a number of species abundant in the mountains of Trinidad are rare or localized in Tobago. *Licania ternatensis* Hook f., principal cropformer in lower montane rain forest in Trinidad is rare in the same formation in Tobago, being practically confined to xerophytic rain forest where it is frequent. *Chimarrhis cymosa* Jacq. is extremely rare in Tobago and though the writer collected the species it was not encountered on enumeration lines. *Manilkara bidentata* (A.DC.) Chev. is a most widespread tree in Trinidad occurring in almost every forest type; as an individual tree it reaches its finest development in rain forest, but it becomes gregarious in coastal woodland. In Tobago it is sharply confined to xerophytic rain forest. So also is *Podocarpus coriaceus* Rich. which is rare to occasional throughout evergreen types of forest in the north of Trinidad.

Conversely, several species common in Tobago become rare in Trinidad. *Simaruba amara* Aubl., *Matayba arborescens* Radlk., *Sloanea Purdiaei* Griseb., and *Ocotea leucoxylon* (Sw.) Mez. are examples in point.

DESCRIPTIONS OF COMMUNITIES

MANGROVE WOODLANDS

Nearly all the coastal swamps in Tobago have been drained or reclaimed and cultivated but certain relatively small areas remain where the necessary combination of tidal mudflats and brackish water permits the establishment of mangrove vegetation. The mangrove woodland of Tobago exhibits no unusual features. It corresponds with the general type so often and fully described already in the Caribbean and therefore merits no special treatment here. *Rhizophora mangle* L. is dominant nearest the open sea. Further into the swamp it is joined by *Avicennia nitida* Jacq. and *Laguncularia racemosa* (L.) Gaertn., while *Conocarpus erectus* L. is somewhat abundant at the landward fringes, occasionally with *Dodonaea viscosa* L. The fern *Acrostichum aureum* L. is virtually the only other component.

LITTORAL WOODLAND

The original sea-shore vegetation has persisted on cliffs, rocks, sandbanks, and small islets off the coast. Littoral woodland occurs frequently in localities where there is sufficient rainfall to promote a luxuriant growth, but structurally it exhibits always a dwarfed and windswept character—crowns distorted, branches gnarled, and pointing away from the wind—caused by the strong and constant sea-wind to which it is exposed and to the destructive effect of a coating of salt deposited on the leaves by spray. Some of the components are thorny, others laticiferous. The majority have fleshy and thickly cutinized leaves. According to exposure the stature of the woodland varies from shrubby to taller growth 20 or 30 feet

high. The component species of littoral woodland are frequently distributed by ocean currents. In Tobago as with mangrove, the littoral vegetation follows the general Caribbean pattern. The principal components of the Coccoloba-Hippomane association were noted as follows:

Coccoloba uvifera L.	Sea-grape
Hippomane mancinella L.	Manchineel
Citharexylum spinosum L.	Fiddlewood
Bursera simaruba (L.) Sarg.	Naked Boy
Pithecellobium unguis-cati (L.) Mart.	Black Jessie
Terminalia catappa L.	Almond
Chrysobalanus icaco L.	Fat pork
Pariti tiliaceum (L.) Juss.	Mahoe
Thespesia populnea (L.) Soland.	Mahoe
Jacquinia barbasco (Loefl.) Mez.	Torchwood
Bourreria succulenta Jacq.	
Ficus Hartii Warb.	
Randia aculeata L.	
Bumelia buxifolia Willd.	
Trichilia trifolia L.	

SEASONAL FORESTS

Nearly all of the lower land in Tobago which was formerly clothed with seasonal forest has long since been taken up for agriculture and it is now only possible to reconstruct a conjectural picture of the original vegetation from a few relics. There is one exception to this. The small island of Little Tobago —some 280 acres—lying off the northeast coast has been protected from disturbance for over 40 years and while it is known that parts of the island were formerly cultivated it is entirely covered today with a vegetation which has all the appearance of being a climax.

While there is no rain gauge upon Little Tobago, there is no doubt that the dry season from January to May is exceedingly severe; this is clear from the most casual observation. Further the underlying geological formation is an igenous rock which has not decayed deeply and the soil is very shallow. The vegetation corresponds fairly closely in physiognomy with that of the island of Chacachacare, off Trinidad, where records show the average annual rainfall to be 48 inches, the minimum recorded annual rainfall 33 inches and the dry season to be of 5 months with under 4 inches of rain each, of which 2 have less than 1 inch.

Deciduous seasonal forest. The vegetation of Little Tobago is a deciduous seasonal forest, a formation expressing a marked deciduous period coincidental with the dry season. An unusual feature in it is the very high abundance of silver thatch palm *Coccothrinax barbadensis* (Lodd) Becc. which forms about 30 percent of the crop in both stories. This feature is absent from the formation in neighboring islands.

The forest is in two strata of which the upper is open and the lower closed. The lower story ranges from 10 to 20 feet in height and the upper story between 30 and 40 feet. The large trees branch low down and have large spreading crowns, and many shrubs of the lower story grow in clumps.

Lianes are somewhat rare though several cactaceous climbers are prominent, notably *Hylocereus Lemairei* Br. & Rose. Ground vegetation is extraordinarily sparse; grass is absent and almost the only plant is *Anthurium Hookeri* Kunth, which is also the most abundant and again almost the sole epiphyte. No trees develop buttresses normally. Only two species have thorns or spines (*Chlorophora tinctoria* and *Pithecellobium unguis-cati*); *Bursera simaruba* has a bark containing an aromatic gum.

The following are the more conspicuous components of this type, which belongs to the *Bursera-Lonchocarpus* Association (Naked Boy-Dogroot) and may be described as the Coccothrinax faciation thereof.

Upper Story.		*Abundance*	*Evergreen or Deciduous*
Silverthatch	**Coccothrinax barbadensis* (Lodd.) Becc.	v.a.	palm
Naked Boy	*Bursera simaruba* (L.) Sarg.	v.a.	D.
Dogroot	*Lonchocarpus domingensis* (Pers.) DC.	a.	D.
Banana wood	*Pisonia* sp. ? *cuspidata* Heimerl.	o.	E.
Common Cherry	*Cordia collococca* L.	o.	D.
Fiddlewood	*Citharexylum spinosum* L.	o.	D.
Parrot Apple	*Clusia* sp.	r.	E.
Hogplum	*Spondias mombin* L.	r.	D.
Fustic	*Chlorophora tinctoria* Gaud.	r.	D.

*Indentification uncertain. *C. barbadensis* is nomen confusum.

Lower Story. (the following species in addition to young individuals of the above list.)		*Abundance*	*Evergreen or Deciduous*
Cleanteeth	*Diospyros inconstans* Jacq.	a.	E.
Black Jessie	*Pithecellobium unguis-cati* (L.) Mart.	a.	E.
Small leaf	*Eugenia ligustrina* (Sw.) Willd. and other *Myrtaceae*	a.	E.
	Trichilia trifolia L.	i.a.	E.
Wild grape	*Coccoloba* sp.	o.	E.
San Maria	*Mayepea caribaea* (Jacq.)Kuntze	o.	E.
Doctor bar	*Picramnia pentandra* Sw.	o.	E.
Rockwood	?	o.	E.
Christmas bush	*Cassia bacillaris* L. fil.	o.	E.
Torchwood	*Jacquinia barbasco* (Loefl.) Mez.	r.	E.
Money bush	*Cassia bicapsularis* L.	r.	E.
Ironwood	*Erythroxylum cumanense* H.B.K.	r.	E.
	Croton sp.	r.	D.
	Ouratea Guildingi (Planch) Urb.	r.	E.

Coccothrinax is the only palm but it forms about 30 percent of the crop in both stories. Leaving this palm out of consideration, the forest is almost entirely deciduous in the upper story and evergreen in the lower. With the bulk of the deciduous species, leaffall is always complete and takes places early in the dry season; new leaves develop at the onset of the rains. Flowering and fruiting may or may not take place during the leafless period. With *Cordia collococca* and *Citharexylum spinosum* leaffall is frequently incomplete; the crowns become less and less dense as the dry weather advances and the trees are usually almost bare just before the rains. The degree of deciduousness varies with the intensity of the

drought and in a wet year no marked leaffall may take place. Of the eight species of the upper story, the two commonest and two least common have compound leaves, the other four species simple leaves. All the species have "mesophyllous" leaves, according to Raunkiaer's leaf-size classes. In the lower story simple leaves predominate and about one-third of the species are microphyllous.

There are no local variations in the present vegetation by which one can distinguish parts of the island that were formerly cultivated from those not formerly cultivated. Evidently the succession on the formerly cleared areas is complete and the vegetation type may be described as an association rather than as an associes. Some interesting variations are, however, encountered on approaching the edge of the sea on the windward coast of the island. Among the first visible effects of exposure to the sea wind is the progressively lowering of the canopy, and the cactus *Cephalocereus moritzianus* Br. & Rose appears. Within 100 yards of the water the bush becomes windswept, neatly planed off into tables and domes, and the leaves of the palms are scorched at the edges. For the last 20 yards in many places woody plants are absent and there is a close turf of succulent herbs such as *Batis maritima* L. interspersed with clans of the Turk's Cap cactus, *Cactus Broadwayi* Br. & Rose.

Other seasonal forests. The coastal lands of Tobago are seasonally very dry and the Main Ridge is consistently wet; the intervening lands experience conditions gradually merging from one extreme to the other. It is clear therefore that before man came upon the scene, a corresponding series of transitional vegetation types must have existed, merging from the deciduous seasonal forest of Little Tobago to the lowland rain forest on the lower slopes of the Main Ridge. Such intermediate vegetation, unfortunately, has by now been almost completely destroyed, being represented only by a few small and isolated relics, mostly ruined by fellings. From these relics, however, and from assessment of habitat factors one is still able to deduce in a general way the main features of the vanished forests. On schist soil and on the alluvial soils encountered at low altitudes whether of igneous or schistose derivation, it appears that the zonation was: deciduous seasonal forest→semi-evergreen seasonal forest→evergreen seasonal forest→rain forest, which is a tropophytic climax following the gradually diminishing severity of the seasonal drought. On leaving the coast with its deciduous seasonal forest, the canopy would rise to 60 or 80 feet and evergreen species begin to come into the upper story more prominently. This semi-evergreen seasonal forest seems to have contained *Brosimum alicastrum* Sw. (moussara), *Cedrela mexicana* Roem. (red cedar), *Cordia alliodora* (R. & P.) Cham. (cypress), *Apeiba Schomburgkii* Szyszyl. (Wild bread-nut), *Tabebuia rufescens* J. R. Johnst. and *T. serratifolia* (Vahl.) Nichols (greenheart), *Fagara martinicensis* Lam. (yellow prickle), *Citharexylum spinosum* L. (fiddlewood), *Pisonia* spp. (beefwood), *Genipa americana* L. (ibo-ink), *Spondias mombin* L. (hogplum), *Chlorophora tinctoria* Gaud. (fustic) *Erythrina pallida* Br. & Rose (beau 'mortel), *Hura crepitans* L. (sandbox) and *Coccoloba* spp. (wild grape). *Coccothrinax barbadensis* (Lodd.) Becc. may have occurred in the lower story. The next stage, evergreen seasonal forest, would be characterized by the emergence of tall outstanding trees to 120 feet above the 80 feet canopy, and the appearance of large numbers of evergreen species of the rain forest, deciduous species still being present but becoming rarer. The components here probably were *Carapa guianensis* Aubl. (crabwood), *Pachira insignis* Sw., *Licania biglandulosa* Griseb. (wild cocoa), *Lauraceae* spp. (Myers), *Cedrela mexicana* Roem. (red cedar), *Tabebuia* spp. (greenheart), *Lonchocarpus sericeus* (Poir) H. B. K. (wild yoke), *Trichilia Smithii* C.DC., *Hieronyma caribaea* Urb. (horseflesh), *Andira inermis* H. B. K. (angelin), *Spondias mombin* L. (hogplum), *Virola surinamensis* (Rol.) Warb. (wild nutmeg), *Pithecellobium jupunba* (Willd.) Urb. (soapwood), *Cordia alliodora* (R. & P.) Cham. (cypress), *Hymenaea courbaril* L. (locust), *Guarea glabra* Vahl., and *Inga* spp. (pois doux). Palms would have been represented by *Scheelea osmantha* Barb., *Roystonea oleracea* Cook and *Euterpe* sp.

On residual igneous soils the zonation was probably deciduous seasonal forest→semi-evergreen seasonal forest→xerophytic rain forest. The semi-evergreen type here seems from relics to have contained *Amomis caryophyllata* (Jacq.) Kr. & Urb. (bayleaf), *Citharexylum spinosum* L. (fiddlewood), *Tabebuia* spp. (greenheart), "Naked boy" (a large myrtaceous sp.), *Bursera simaruba* (L.) Sarg. (also called "naked boy"), *Micropholis* sp., *Fagara* spp. (yellow prickle), *Buchenavia capitata* (Vahl.) Eichl., *Cedrela mexicana* Roem. (red cedar), *Sideroxylon quadriloculare* Pierre (mastic), *Guettarda scabra* Lam. (blue copper), *Coccoloba* spp. (wild grape) and numerous myrtaceous shrubs. Palms were probably absent.

The flat plain of the lowlands was probably clothed entirely with a deciduous seasonal forest.

RAIN FORESTS

The forests on the Main Ridge are all rain forests: that is to stay they are tall evergreen forests under a climatic regime where rainfall is never scarce but is well distributed throughout the year. Further they express a habitat fairly close to the available soil-moisture optimum in the tropics, liable neither to waterlogging nor inundation nor seasonal drought. Floristically and physiognomically three distinct types can be recognized, of which one is rain forest proper, while the other two may be most conveniently regarded for the purpose of this work as belonging to sub-formations of it. In any work dealing with a larger area and including more types, lower montane rain forest would be placed in a series of montane formations and xerophytic rain forest in a group of "dry evergreen" formations which would include the littoral woodland. The three types of rain forest are:

(a) Carapa-Andira Association: rain forest proper (or more fully, tropical lowland rain forest) as described by Davis & Richards (1934) in British Guiana.

(b) Byrsonima-Licania Association: belongs to the sub-formation tropical lower montane rain forest, as described by Beard in Trinidad (1942).

(c) Manilkara-Guettarda Association: belongs to a sub-formation not hitherto described, which will be termed xerophytic rain forest.

Lowland Rain Forest

The Association is *Carapa guianensis* Aubl.-*Andira inermis* H.B.K. (Crabwood-Angelin). This is the type described by Marshall (1934) as the Carapa-Ocotea association, further information on the floristic composition having rendered the change of title desirable. This is essentially a lowland type forest and ascends only to an altitude of 800 to 1,200 feet according to exposure, so that there is relatively little of it in the Forest Reserve (see Fig. 2).

Structure. The structure is that of typical rain forest: a crowded community with large trees forming a closed canopy about 120 feet above the ground, below which two lower strata can be vaguely distinguished. Occasional outstanding trees emergent above the canopy layer such as are known in Guiana are not found here. The trees of the canopy layer, all of which have girths of 5 feet and upwards, are closely spaced and have typically very long clean straight boles, the lowest branch being usually over 60 feet from the ground. A very dense shade is cast by the canopy, so that the lower strata are not continuous and not well defined. A middle story of the forest can be vaguely distinguished between 40 and 80 feet and a lower story between 10 and 40 feet. Below this there are shrub and ground layers. Enumeration showed an average for 10 acres of 212 trees forming the canopy (the crown of each covers on the average 2,055 square feet, trees averaging 45 feet apart), 564 trees in the middle story and 834 in the lower story.

The structure is closely similar to that of rain forest in the Guianas described by Davis and Richards (1934) and by Benoist (1924).

Physiognomy and Life-form. No special study has yet been made of lianes and epiphytes in Tobago. Lianes are not particularly abundant; though every tree will have several in its crown, these are not readily noted from the ground. Epiphytes occur mainly in the crowns and do not descend lower. The greater part of the epiphytes are Bromeliaceae, of which *Aechmea dichlamydea* and *Gravisia aquilega* appear to be the most abundant. Other conspicuous species include *Guzmania lingulata* and *Vriesia longibracteata*. Most of the large trees have plank buttresses, particularly the species most characteristic of the association. There are no other peculiarities of growth to remark; no species are thorny, succulent, stilt-rooted or have peculiar bark.

The palm "mountain cabbage" (*Euterpe* sp.) is an extremely conspicuous constituent of the lower strata, representing 40 percent of the individuals in the middle story and 33 percent of those in the lower story.

Scheelea osmantha Barb. and *Roystonea oleracea* Cook. occur also but are rare to occasional. There are other palms in the shrub layer, *Bactris sworderiana* Becc. and *Geonoma* sp. The abundance of Euterpe distinguishes this association from rain forest in Trinidad and Guiana where palms are rare and found usually as immature specimens. No other special life-forms are present.

The forest is entirely evergreen save for three rare species: *Tabebuia serratifolia* (Vahl.) Nichols. (greenheart), *Ceiba pentandra* (L.) Gaertn. (silk-cotton) and *Spondias mombin* L. (hogplum), which are evidently intruders.

The commonest and most characteristic species in the upper story have compound leaves so that 55 percent of the individual trees possess this character. Pinnate arrangement is the rule. Species confined to lower strata have simple leaves.

Using Raunkiaer's leaf-size classes "mesophyllous" leaves are overwhelmingly predominant. The predominant type of mature leaf is thin and papery, dark green and shiny above with a drip-tip; that of the young leaf is pink to red-brown, limply drooping. Shrub and ground layers of the forest are only moderately dense, due to the heavy shade. There are many typical shrubs, mainly of the Rubiaceae and Melastomaceae, and ground vegetation consists of ferns and many species of herbaceous plants.

Floristic Composition. From enumeration traverses 43 species were listed in this association, counting group terms such as "small leaf" as only one species.

A list of average composition per 10 acres has been compiled from the enumeration records and appear as Table 5. In compiling this list by stories it was assumed on the basis of field observation that trees over 6 feet in girth belong to the middle story and those below 3 feet to the lower story. Twenty-three species, or just over half present, attain the canopy layer on maturity; of these the principal are:

Crabwood	*Carapa guianensis* Aubl.	v.a.	confined
Angelin	*Andira inermis* H. B. K.	a.	almost confined
Hogflesh	*Hieronyma caribaea* Urb.	a.	do
Devilwood	*Eschweilera decolorans* Sandwith.	a.	indifferent
Wild nutmeg	*Virola surinamensis* (Rol.) Warb.	f.	confined
Soapwood	*Pithecellobium jupunba* (Willd.) Urb.	f.	indifferent
Duckwood	*Ocotea leucoxylon* (Sw.) Mez.	f.	indifferent

Carapa provides 22 percent of the trees in this story and Andira 14 percent. Of the middle story, Euterpe provides 40 percent of the trees. Young individuals of the above 7 important species of the upper story account for a further 32 percent. Important species which do not attain the upper story but are confined to this and the lower stratum are:

Wild cocoa (A)	*Licania biglandulosa* Griseb.	a.	indifferent
Wild cocoa (B)	*Marila grandiflora* Griseb.	l.a.	do
Myers	*Lauraceae* spp.	a.	do
Small-leaf	*Myrtaceae* spp.	f.	do

Species confined to the lower story are:

Wild Water-wood	*Tresanthera pauciflora* K. Schum.	a.	almost confined
Wild coffee	*Styrax glaber* Sw.	a.	indifferent
	Rudgea Freemani Sprague and Williams	f.	do
	Stylogyne lateriflora (Sw.) Mez	f.	almost confined

It will be noted that almost all the characteristic species of the association, that is, those which are confined or almost confined to it, become large trees and form part of the canopy. Components of lower strata are mostly less restricted in distribution, due probably to the uniform conditions of forest interiors. No one family of plants is predominant here. The Leguminosae comprise only 6 percent of the individuals, in distribution to lowland Guiana and Trinidad, where the figure is from 14 to 59 percent.

Habitat. There is no doubt from general inference that the localities where this type is found represent the optimum habitat available to plant growth in Tobago. Moisture is plentiful and sufficiently abundant during the dry season to sustain growth. The association is no longer found wherever any markedly adverse factors come into play, such as on high mountain slopes exposed to wind and on shallow soils.

Lower Montane Rain Forest

Floristically the type belonging to this formation in Tobago is a faciation—which may be named the *Ternstroemia oligostemon* faciation—of the *Byrsonima spicata-Licania biglandulosa* association found also in Trinidad. The Tobago type may be referred to colloquially as Rosewood-Redwood Forest. It has not been previously described. The formation is typical of the basal regions of mountains in the tropics, representing a zone where the effects of altitude and exposure are just beginning to be felt. It has been described and defined by Beard from the mountain forests of Trinidad (1942) and the Tobago type here described is homologous. The general limits of the formation are between 400 and 2,500 feet in the Caribbean; here from 800 to 1,200 feet up to the summit of the Main Ridge, on schist soil only. The vegetation on areas of igneous soil at this altitude is the xerophytic rain forest, for reasons which will be discussed later.

Structure, Physiognomy, and Life Form. Figure 4 is a diagramatic representation of the structure in profile of this type of forest, drawn from actual measurement in the field of a suitable strip 100 feet x 25 feet. The principal respects in which it differs from lowland rain forest are:

1. The canopy is lower as a result of exposure.
2. The lowering of the canopy brings the upper and middle stories to the same height, so that there are now two strata only, an upper and a lower.
3. Buttressing is virtually absent.
4. Trees with simple leaves are predominant.

Exposure to wind has resulted in a lower canopy and a preponderance of species with simple leaves. Absence of buttresses is apparently due to better surface drainage on steeper slopes, and appears to be unconnected with the factor of wind.

The lower story, discontinuous, ranges from 10 to 40 feet and the continuous upper story from 40 to 100 feet. Trees of 4 feet girth and upwards are among those forming the canopy. Crown and stem form the same as in lowland rain forest. Enumeration showed an average for 10 acres of 276 trees forming the canopy (the crown of each covers on the average 1,580 square feet; trees averaging 40 feet apart), and 967 trees in the lower story.

The position with lianes and epiphytes is the same as in lowland rain forest, except that at high elevations, particularly along the summit of the Main Ridge, bromeliads become somewhat abundant. These have not been studied floristically. Large plank buttresses are absent. One species, *Licania biglandulosa* Griseb. may have stilt roots, particularly at higher elevations.

The palm "mountain cabbage" (*Euterpe* sp.) is still conspicuous, making up 23 percent of the lower story. In high, exposed places it is less abundant and its place is taken by *Euterpe Broadwayana* Becc.

The forest is entirely evergreen save for the rare occurrence of *Tabebuia.* Except in the case of *Simaruba amara* Aubl. which is a genuine denizen of this association, compound leaves belong only to casual intruders. Of the trees in the upper story 82 percent have simple leaves. There is considerable variation in leaf size on the same tree, leaves low down on the tree being considerably larger than those at the very top which are fully exposed to the atmosphere. The predominant size of sheltered leaves is "mesophyllous" but exposed leaves are more frequently in the "microphyll" class. The type leaf is still thin and papery though somewhat more leathery than in lowland rain forest.

The shrub layer consists mostly of Melastomes. Ground vegetation is usually fairly sparse, consisting of seedlings, a few ferns and herbaceous plants. Tree ferns are not represented in Tobago except by a few small Alsophilas.

Along the summits of the Main Ridge and its lateral ridges, the added exposure reduces the canopy to some 60 feet, the forest becoming more open, mossy, with abundance of *Euterpe Broadwayana* and bromeliads, the latter frequently terrestrial, and a lush ground vegetation.

Floristic Composition. In passing from lowland to lower montane rain forest there is no radical change of flora. Much the same species occur, but their relative abundance is different. From enumera-

tion traverses in the Byrsonima-Licania association a total of 50 species was recorded, counting group terms as one each, of which six could not be identified at least as far as genus. The flora high up in the mountains has not been so well collected and is not so well known locally; no creole names could be elicited for 16 of the 50 component species. A list of average composition per 10 acres appears as Table 6. Thirty species may on maturity attain the upper story, of which the principal are:

Rosewood	*Byrsonima spicata* Rich.	v.a.	almost confined
Wild cocoa (A)	*Licania biglandulosa* Griseb.	a.	indifferent
Redwood	*Ternstroemia oligostemon* Kr. & Urb.	a.	almost confined
Devilwood	*Eschweilera decolorans* Sandwith.	a.	indifferent
"Red" Lionwood	*Sloanea trinitensis* Sandwith.	a.	almost confined
Bitter Quassia	*Simaruba amara* Aubl.	f.	almost confined

Licania and Eschweilera are conspicuous constituents of the Carapa-Andira association, but the four other species above occur only casually elsewhere. Other species characteristic of this association are a *Sloanea* sp. close to *S. trinitensis* ("White" Lionwood), *Richeria grandis* Vahl., *Sloanea Purdiaei* Griseb., and three unknown species referred to as "Redbark," "Wartybark," and "Red polish."

Twenty species are small trees which do not rise above the lower story. The principal of these are:

Mountain cabbage (A)	*Euterpe* sp.	l.v.a.	indifferent
Small-leaf	*Myrtaceae* spp.	a.	do
Mountain cabbage (B)	*Euterpe Broadwayana* Becc.	l.v.a.	do
Wild coffee	*Styrax glaber* Sw.	a.	do
	Rudgea Freemani Sprague and Williams	o.	do
Wild cocoa (B)	*Marila grandiflora* Griseb.	l.f.	do

All the above are "indifferent" species; several are of localized distribution. The Euterpe "mountain cabbage" is the only palm in sheltered situations, but is replaced by *E. Broadwayana* in exposed places. The former often gregariously occurs in patches which probably have been gaps in the forest caused by wind damage. Marila keeps to the banks of watercourses.

The characteristic species of the Carapa-Andira association (*Carapa guianensis, Andira inermis, Hieronyma caribaea,* and *Virola surinamensis*) are here only casuals, usually in sheltered situations on the banks of streams. The change-over from the one association to the other is usually fairly abrupt.

At the lower levels, Byrsonima and Ternstroemia are clearly dominant, but high up their abundance is reduced somewhat relative to *Eschweilera, Licania, Ocotea,* and *Sloanea* spp. *Richeria grandis* is a prominent species confined to upper altitudes. On the crest of the Main Ridge and similar places of maximum exposure, *Licania biglandulosa* is dominant with *Euterpe Broadwayana, Richeria grandis,* and *Erythroxylum impressum.*

There is no predominant family, Leguminosae comprising less than 2 percent of the trees.

Habitat. It has already been shown how the habitat of this type differs from that of lowland rain forest, namely in respect to greater exposure to wind, lower temperature, and higher and more constant rainfall.

It should be noted that lower montane rain forest in Tobago occurs only on soil derived from schist and not on igneous soil. The schist soil is a deep clay, parent rock having decayed usually to a depth of several feet. Igneous soil at a like altitude is extremely shallow and apparently for this reason xerophytic rain forest is found upon it.

Xerophytic Rain Forest

The association is characterized by *Manilkara bidentata* (A.DC.) Chev. and *Guettarda scabra* Lam. (Gooseberry-Blue Copper). Marshall (1934) notes this type as a Calophyllum-Mimusops (Manilkara) associes and regards it as a "deflected climax," whereas the writer prefers to regard it as virgin forest; this question is discussed below under "habitat."

This formation is found on igneous soil only, above 800 feet altitude; in high places where the soil is shallow and externally well drained and where there is the maximum exposure to wind.

Structure. The structure differs rather radically from that of the other rain forests (Fig. 5). Two tree strata can be defined. A more or less continuous canopy is found between 40 and 60 feet; below this the smaller trees are not arranged in any definable layers, but above the canopy occasional solitary large emergent trees stand out up to 90 feet in height.

The emergents occur at the average rate of 10 per acre (98 per 10 acres, from enumeration)—equal to 66 feet apart—though the distribution is not constant. They may attain very large sizes of over 12 feet in girth. Trees of the canopy layer and lower levels occur at the rate of 1,335 per 10 acres and seldom attain girths of over 3 feet. The overwhelming proportion of the forest, therefore, is composed of trees not exceeding 12 inches in diameter, which gives the impression of a small pole crop. Many of these trees have long, thin, straight boles and restricted crowns; others branch or fork low down.

The most regular structure is found on southern and eastern slopes and on the tops of ridges (except at the highest altitudes). Here the largest emergents are found and the canopy is quite regular. On western aspects a combination of windthrow and soil creep has frequently destroyed any regular structure, the canopy being full of gaps; emergents are usually absent.

Physiognomy and Life-Form. This formation exhibits a number of somewhat peculiar features which seem indicative of a general xerophytism. These are not, however, the features associated with the xerophytism of seasonal scarcity of rainfall: deciduousness, microphylly, thorniness and succulence. None of these is present. The forest is entirely evergreen —except for one rare species, *Tabebuia serratifolia*

in the lower layers—predominantly mesophyllous and without thorns or succulents. The actual features referred to appear in the leaves and bark, the predominant species possessing leaves which are thick and fleshy or thickly cutinized or contain an essential oil, and having the habit of shedding their bark. The former character belongs particularly to the emergents and the latter to the lower layers. This may be demonstrated mathematically as follows:

Character	Emergent Trees		Lower Layers	
	Number of Species	Percentage of Individuals	Number of Species	Percentage of Individuals
1. Leaf with thick cuticle or waxy indumentum	3	57	9	28
2. Leaf containing aromatic oil	..	0	1	5
3. Coniferous type leaf	1	17	1	4
4. Leaf thick and fleshy	1	8	2	13
Total with specialized leaves	5	82	13	50
5. Bark shedding	..	0	6	42

The 9 species with cutinized leaves are *Manilkara bidentata*, *Micropholis cruegeriana*, *Calophyllum lucidum*, *Myrtaceae* spp. (small-leaf), *Ternstroemia oligostemon*, *Eugenia confusa*, *Ficus* sp., and *Mouriri rhizophoraefolia*. *Amomis caryophyllata* and several other Myrtaceae contain an essential oil in their leaves. *Podocarpus coriaceus* is the conifer. *Clusia rosea* and *Cassipourea latifolia* have thick fleshy leaves.

The bark-shedders are *Guettarda scabra*, *Myrtaceae* spp., *Amomis caryophyllata*, *Chione venosa*, *Eugenia confusa*, and *Mouriri rhizophoraefolia*. All these species have a very smooth thin bark which peels off in papery sheets. Species of the family *Myrtaceae* (except *Amomis*) peels off in small flakes, but Guettarda, Amomis, and Chione peel in quite large sheets. In all cases the bark has a shaggy appearance and piles of shed bark accumulate around the base of the tree. The striking appearance of this phenomenon is increased by the color effects; peeling sheets of bark are often whitish or pale-brown whereas newly exposed underbark shows, according to species, all colors from greenish-white to purple or brilliant fleshy orange. The whole effect is bizarre in the extreme, heightened by the strange stem-form of the bark-shedding species whose trunks are seldom cylindrical but irregularly lobed, often to an exaggerated degree in old trees.

The combination of the small stature of the forest, the peculiarities of leaf and the bark-shedding habit is strongly suggestive of xerophytism, representing lack of available moisture. It is impossible to say what actual effects these structural phenomena have. We do not know whether they effectively reduce transpiration or assist by any other means toward the endurance of an unfavorable habitat. The association of so many of these strange trees in a dwarf forest in this locality is at any rate highly suggestive.

Lianes are virtually absent here and epiphytes relatively scarce, bromeliads only being noticed. Razor grass (Scleria) is abundant in windfall gaps, particularly in the poorer forest of the eastern aspects.

Palms are confined to the phase of eastern aspects where they appear in gaps. As is found elsewhere, *Euterpe Broadwayana* occurs at high and the other Euterpe at low levels.

Only three species here have compound leaves, constituting 4 percent of the emergents and 2 percent of the lower strata; they are all casuals. The predominant leaf type is simple, mesophyllous and in some manner specialized.

There is no shrub layer here and ground vegetation is typically sparse; a thick humus mat, a few seedlings and some coarse grass.

Floristic Composition. The association contains a number of interesting floristic features, due to the specialization of the habitat. In Table 7 is given a list of average composition per 10 acres, from enumeration records. Counting as usual group terms as one each, 36 species only were recorded, of which 6 "eluded" even approximate identification. The figure of 36 species seems to indicate a poor flora. The bulk of the Myrtaceae, however, have been counted under a group-term as one (small-leaf), but they are a particularly well developed group here and if later they can be further differentiated in the field the total of species will be substantially added to. Eleven of the component species may grow as emergents, the balance of 25 being confined to lower levels.

This association is of rather more variable composition than the others described. There are in fact two distinct phases, the more widespread of which occurs on ridge tops and on south and east aspect slopes (that is, wherever most exposed to the wind) and the other on westerly aspects where to some extent sheltered. In the former case, the principal emergent trees are:

Gooseberry	*Manilkara bidentata* (A.DC.) Chev.	v.a.
Galba	*Calophyllum lucidum* Benth.	a.
Parrot apple	*Clusia rosea* Jacq.	f.
	Micropholis Cruegeriana Pierre	f.
	Licania ternatensis Hook f.	f.
	Roupala montana Aubl.	o.

The lower strata are additionally composed of:

Blue Copper	*Guettarda scabra* Lam.	v.a.
Small-leaf	*Myrtaceae* spp.	a.
Bayleaf	*Amomis caryophyllata* (Jacq.) Kr. & Urb.	a.
	Cassipourea latifolia Alston	f.
	Chione venosa (Sw.) Urban	f.
	Erythroxylum impressum O. E. Schultz	o.

Podocarpus coriaceus Rich. is absent except at very high levels where it may become occasional. In this phase bark-shedding trees are particularly prominent.

On western aspects, the principal emergents are:

.....	*Podocarpus coriaceus* Rich.	a.
Parrot apple	*Clusia rosea* Jacq.	f.
.....	*Roupala montana* Aubl.	f.
Bitter Quassia	*Simaruba amara* Aubl.	o.
.....	*Licania ternatensis* Hook f.	o.

and additionally in the lower levels,

Small-leaf	*Myrtaceae* spp.	a.
.....	*Cassipourea latifolia* Alston.	f.
"Pinkbark"	?	f.
Mountain cabbage (B)	*Euterpe Broadwayana* Beec.	l.a.
Mountain cabbage (A)	*Euterpe* sp.	l.f.

Conspicuous absentees here are Manilkara, Calophyllum, Guettarda, and Amomis. Bark-shedding trees are inconspicuous and palms are present.

Licania biglandulosa Griseb. (wild cocoa) becomes abundant in zones of transition to adjoining forest of the Carapa-Andira type.

A conspicuous feature of the association in general is the high degree of exclusiveness among the more abundant species. Of the emergent trees, *Manilkara bidentata, Podocarpus coriaceus,* and *Licania ternatensis* were not recorded elsewhere in Tobago and appear confined to the association, while *Clusia rosea, Micropholis Cruegeriana, Calophyllum lucidum,* and *Roupala montana* are virtually confined to it. Similarly in the lower strata *Guettarda scabra, Amomis calyophyllata,* "Pinkbark," *Chione venosa,* and *Mouriri rhizophoraefolia* are confined to the association, and *Cassipourea latifolia* and *Eugenia confusa* virtually confined.

There is no predominant plant family. Only one leguminous species was recorded and that as rare. The bark-shedding trees do not belong to any one family but are distributed among the Myrtaceae, Rubiaceae, and Melastomaceae.

Habitat. The specialized features exhibited by the vegetation may assist one in deducing the essential features of the habitat. "Xerophytic Rain Forest" may at first sight appear to be a contradiction in terms; however, while the forest is "rain" forest—for rainfall in this zone has been observed to be more or less consistently plentiful all the year round—yet it seems that there is a scarcity of available soil moisture. We may probably legitimately infer a scarcity of moisture from the low, poor growth of the trees and the concentration of species with certain structural peculiarities may imply this. To attempt to decide the cause of this lack of moisture is not altogether easy. Most likely the shallowness of the soil is responsible. The writer observed that tree roots seldom penetrate much below 18 inches in depth, which may be because the rotten rock below is too hard and resistant or because some factor of chemical toxicity is present. On the steep mountain slopes the shallow upper layer to which the roots are confined must dry out very rapidly between rain showers, particularly as the soil is porous and the area exposed and windy.

Marshall (1934), while admitting the lack of precise knowledge, tentatively classified this type as a deflected or biotic climax because it is "dissimilar from the other forests found in the vicinity" and because "from the history of Tobago it is more than likely that this zone was once under cultivation." The present writer finds no evidence to support the latter statement; rather does it appear that the bulk at any rate of this zone never has been under cultivation. Pigeon Hill, now included in the Forest Reserve, was private land up to 1912 and was very probably cultivated at one time but is covered today with forest belonging quite characteristically to the Byrsonima-Licania association. This consideration apart, the conception of the "biotic climax" embraces a type of secondary vegetation which is prevented from returning to the original virgin type by the continual operation of some human factor or by some permanent alteration of the habitat caused by human interference. The active human factor may be fire, grazing, or felling: here fires appear to be unknown, there is no grazing, nor is there felling because this association contains virtually none of the timber trees now commonly worked in Tobago. Soil erosion might have caused a permanent change in conditions, but none of the soil profiles examined were truncated. The evidence certainly suggests that this is no biotic climax.

It might, on the other hand, be contended that this is a seral community in a state of development after human destruction. It contains, however, a number of very large trees, which must be of great age, perhaps 200 years, belonging to species absolutely confined to this area. It seems easier, having regard to all the facts, to explain this type as a natural community.

SUMMARY

The communities of natural vegetation in Tobago have been described and classified as follows:

Formation	Association	Area on C.I.(acs.)
1. Mangrove Woodland.	*Rhizophora mangle-Avicennia nitida-Laguncularia racemosa* .	—
2. Littoral Woodland...	*Hippomane mancinella-Coccoloba uvifera*	60
3. Deciduous Seasonal Forest.....	*Bursera simaruba-Lonchocarpus domingensis*	280
4. Rain Forest:		
(a) Lowland Rain Forest.....	*Carapa guianensis-Andira inermis*	3,920
(b) Lower Montane Rain Forest...	*Byrsonima spicata-Licania biglandulosa*	8,330
(c) Xerophytic Rain Forest.....	*Manilkara bidentata-Guettarda scabra*	1,980
		14,570

The following summarizes the habitat moisture relations of the above types:

EDAPHIC

Swamp formation:

Mangrove woodland. Soil tidally inundated with brackish water (physiological drought).

CLIMATIC

Seasonal formation:

Deciduous seasonal forest. Severe lack of soil moisture during 5 months of dry season due to irregular precipitation.

Dry evergreen formations:

Littoral woodland, xerophytic rain forest. Available moisture inadequate due to shallow rocky soil and very high atmospheric evaporation.

Montane formation:

Lower montane rain forest. Available moisture to some extent inadequate due to lowered temperature and high atmospheric evaporation on clear days.

Optimum formation:

(Lowland) rain forest. Moisture conditions ideally favorable.

TABLE 8. Provisional list of native trees recorded from Tobago.

NOTE: For the purposes of this list, a tree is assumed to be a woody plant growing on maturity to a height of over 15 feet and a diameter of over 4 inches. Creole names are given where known and are of local origin except where shown in brackets: these indicate a Trinidad name which has crept into use in default of a Tobago name. The families are arranged in Bentham and Hooker order so as to follow the Flora of of Trinidad and Tobago. The symbol ! indicates that the species has not been previously recorded in the Flora or represented in the Trinidad Herbarium.

GYMNOSPERMAE.

CONIFERAE

Podocarpaceae

Podocarpus coriaceus Rich.

ANGIOSPERMAE.

I. DICOTYLEDONES

1. Annonaceae
   - *Anaxagorea acuminata* St. Hil. — Burn-nose
   - *Duguetia tobagensis* (Urb.) R.E. Fr.
2. Hypericaceae
   - *Vismia cayennensis* Pers. — Yellow wattle
   - *Vismia falcata* Rusby. — Yellow wattle
3. Guttiferae
   - *Calophyllum lucidum* Benth. — Galba
   - *Clusia minor* L. — Parrot apple
   - *Clusia palmicida* Rich. — Parrot apple
   - *Clusia rosea* Jacq. — Parrot apple
   - *Marila grandiflora* Gr. — Wild cocoa
4. Theaceae
   - *Ternstroemia oligostemon* Kr. & Urb. — Redwood
5. Malvaceae
   - *Pariti tiliaceum* (L.) Juss. — Seaside mahoe
   - *Thespesia populnea* (L.) Soland. — Seaside mahoe
6. Bombacaceae
   - *Ceiba pentandra* (L.) Gaertn. — Silk Cotton
   - *Ochroma pyramidale* (Cav.) Urb. — Bois flot
   - *Pachira insignis* Sw. — Wild breadnut
7. Sterculiaceae
   - *Guazuma ulmifolia* Lam. — Pigeon wood
8. Tiliaceae
   - *Apeiba Schomburgkii* Szyszyl. — Wild breadnut
   - ! *Sloanea Purdiaei* Gr. — Tobago yoke
   - ! *Sloanea trinitensis* Sandwith — "Red" Lionwood
   - *Sloanea* sp. — "White" Lionwood
9. Ochnaceae
   - *Ouratea Guildingi* (Planch.) Urb.
10. Erythroxylaceae
    - ! *Erthroxylum cumanense* H.B.K. — Ironwood
    - ! *Erythroxylum impressum* O. E. Schultz.
    - *Erythroxylum ovatum* Cav.
11. Malpighiaceae
    - *Byrsonima spicata* Rich. — Rosewood
12. Rutaceae
    - *Esenbeckia pilocarpoides* H.B.K.
    - ! *Fagara martinicensis* Lam. — Yellow prickle
13. Burseraceae
    - *Bursera Simaruba* (L.) Sarg. — Naked boy
14. Simarubaceae
    - *Picramnia pentandra* Sw. — Doctor bar
    - *Simaruba amara* Aubl. — Bitter Quassia, Marouba, Boardwood
15. Meliaceae
    - ! *Carapa guianensis* Aubl. — Crabwood
    - *Cedrela mexicana* Roem. — Red cedar
    - ! *Guarea glabra* Vahl.
    - *Trichilia trifolia* L.
    - *Trichilia Smithii* DC. (*T. oblanceolata* Rusby)
16. Sapindaceae
    - *Cupania americana* L.
    - ! *Dodonaea viscosa* L.
    - *Matayba arborescens* Radlk.
17. Anacardiaceae
    - *Spondias Mombin* L. — Hogplum
18. Papilionatae
    - *Andira inermis* H.B.K. — Angelin, Black plum
    - *Erythrina pallida* Br. & Rose — Beau 'mortel
    - *Lonchocarpus domingensis* (Pers.) DC. — Dogroot
    - *Lonchocarpus sericeus* (Poir.) H.B.K. — Wild yoke
19. Caesalpinieae
    - *Brownea latifolia* Jacq. — Tobago beau
    - *Cassia bacillaris* L. fil. — Cocrico bush
    - *Cassia bicapsularis* L. — Money bush
    - *Crudia obliqua* Gr.
    - *Hymenaea courbaril* L. — Locust
20. Mimoseae
    - *Albizzia caribaea* (Urb.) Br. & Rose — Tantacayo
    - *Inga edulis* Mart. — (Pois doux)
    - *Inga macrophylla* H. & B. — (Pois doux)
    - *Inga punctata* Willd. — (Pois doux)
    - *Pithecellobium jupunba* (Willd.) Urb. — Soapwood
    - *Pithecellobium unguis-cati* (L.) Mart. — Black Jessie
21. Rosaceae
    - *Chrysobalanus icaco* L. — Fat pork
    - *Hirtella racemosa* Lam.
    - *Hirtella silicea* Gr.
    - *Licania biglandulosa* Gr. — Wild Cocoa
    - *Licania Cruegeriana* Urb.
    - *Licania ternatensis* Hook f.
    - *Moquilea leucosepala* (Gr.) R. O. Williams
22. Rhizophoraceae
    - *Cassipourea latifolia* Alston
    - *Rhizophora Mangle* L. — Mangrove
23. Combretaceae
    - ! *Buchenavia capitata* (Vahl.) Eichl. — Yellow sanders
    - *Conocarpus erectus* L. — Mangrove
    - *Laguncularia racemosa* (L.) Gaertn. — Mangrove
24. Myrtaceae
    - *Amomis caryophyllata* (Jacq.) Kr. & Urb. — Bay leaf
    - *Calyptranthes sericea* Gr.
    - *Eugenia albicans* (Berg.) Kr. & Urb. — Small-leaf
    - *Eugenia confusa* DC. — Small-leaf
    - *Eugenia Cruegeri* Kr. & Urb. — Small-leaf
    - *Eugenia ligustrina* (Sw.) Willd. — Small-leaf
    - *Eugenia monticola* (Sw.) DC. — Small-leaf
    - ! *Krugia ferruginea* (Poir.) Urb. — Small-leaf
    - *Myrcia Berberis* DC. — Small-leaf
    - *Myrcia dumosa* (Berg.) Kr. & Urb. — Small-leaf
    - *Myrcia leptoclada* DC. — Small-leaf
    - *Myrcia splendens* (Sw.) DC. — Small-leaf
    - *Myrcia tobagensis* (Kr. & Urb.) Urb. — Small-leaf
25. Lecythidaceae
    - *Eschweilera decolorans* Sandwith. — Devilwood
26. Melastomaceae
    - *Miconia guianensis* (Aubl.) Cogn. — Wild spice
    - *Miconia laevigata* (L.) DC. — Wild spice
    - *Miconia racemosa* (Aubl.) DC. — Wild spice
    - *Mouriri rhizophoraefolia* (DC.) Triana

TABLE 8. *(Continued)*

27. Samydaceae	
Casearia decandra Jacq.	
Casearia guianensis (Aubl.) Urb.	
Casearia spinescens (Sw.) Gr.	
Casearia sylvestris Sw.	
28. Cactaceae	
Cephalocereus Moritzianus (Otto.) Br. & Rose	
29. Rubiaceae	
Basanacantha phyllosepala Sprague & Williams	
! *Chimarrhis cymosa* Jacq.	Waterwood
Chione venosa (Sw.) Urban	
Faramea occidentalis (L.) A. Rich.	
Genipa americana L.	Ibo-ink
Guettarda parviflora Vahl.	Blue copper, Poor man candle
Guettarda scabra Lam.	
Guettarda tobagensis Urb.	
Psychotria pinnularis Moç. & Sessé	
Psychotria tobagensis Urb.	
Psychotria uliginosa Sw.	
Randia aculeata L.	
Rudgea Freemani Sprague & Williams	
Tresanthera pauciflora K. Schum.	Wild waterwood
30. Myrsinaceae	
Conomorpha peruviana DC.	
Stylogyne lateriflora (Sw.) Mez.	
Weigeltia antillana Mez.	
31. Theophastaceae	
Jacquinia barbasco (Loefl.) Mez.	Torchwood
Jacquinia revoluta Jacq.	
32. Sapotaceae	
! *Bumelia buxifolia* Willd.	
Chrysophyllum argenteum Jacq.	
! *Manilkara bidentata* (A.DC.) Chev.	Gooseberry, (Balata)
Micropholis Cruegeriana Pierre	
Sideroxylon quadriloculare Pierre	Mastic
33. Ebenaceae	
Diospyros inconstans Jacq.	Clean-teeth
34. Styracaceae	
! *Symplocos martiricensis* Jacq.	
! *Styrax glaber* Sw.	
35. Oleraceae	
Linociera caribaea (Jacq.) Knobl.	San Maria
36. Apocynaceae	
Tabernaemontana oppositifolia (Spreng.) Urb.	
37. Boraginaceae	
Bourreria succulenta Jacq.	
Cordia alliodora (R. & P.) Cham.	Cypress
Cordia collococca L.	Common cherry
Cordia spp.	Wild manjack
38. Bignonaceae	
Tabebuia rufescens J. R. Johnst.	Greenheart, Cogwood
Tabebuia serratifolia (Vahl.) Nichols	
39. Verbenaceae	
Avicennia nitida Jacq.	Mangrove
Citharexylum spinosum L.	Fiddlewood
Vitex divaricata Sw.	Timber fiddlewood
40. Nyctaginaceae	
! *Pisonia cuspidata* Heimerl.	Beefwood
Pisonia Eggersiana Heimerl.	Banana wood
41. Polygonaceae	
Coccoloba latifolia Lam.	Wild grape
Coccoloba urifera L.	Sea grape
42. Myristicaceae	
Virola surinamensis (Rol.) Warb.	Wild nutmeg
43. Lauraceae	
Aniba panurensis Mez.	
Nectandra membranacea (Sw.) Griseb.	
Ocotea leucoxylon (Sw.) Mez.	Duckwood, Black cedar
Phoebe elongata (Vahl.) Nees.	
44. Thymeleaceae	
Daphnopsis caribaea Griseb.	
45. Hernandiaceae	
! *Hernandia sonora* L.	
46. Proteaceae	
Roupala montana Aubl.	
47. Euphorbiaceae	
Alchornea glandulosa Poepp.	
Croton gossypifolius Vahl.	Bloodwood
Hieronyma caribaea Urb.	Horseflesh
Hippomane mancinella L.	Manchineel
Hura crepitans L.	Sandbox
Richeria grandis Vahl.	
Sapium aucuparium Jacq.	
48. Moraceae	
Brosimum alicastrum Sw.	Moussara
Cecropia peltata L.	Trumpet tree
Chlorophora tinctoria Gaud.	Fustic
Ficus tobagensis Urb.	Bowldish, Wild milking
Ficus grenadensis Warb.	
Ficus Hartii Warb.	
Trema micranthum (L.) Blume	
II. MONOCOTYLEDONES	
Palmae	
Acrocomia ierensis L. H. Bailey	Shac-shac tree
Bactris Sworderiana Becc.	Samson wood
Coccothrinax barbadensis (Lodd) Becc.	Tobago fan palm, silverthatch
Euterpe Broadwayana Becc.	Mountain cabbage
Euterpe sp.	
Geonoma sp.	Anaré, Gully palm
Roystonea oleracea Cook	Cabbage palm
Scheelea osmantha Barb.	Rough palm, One man

TABLE 9. Key to index letters on profile diagrams in Figures 7 and 10.

Index letter	Species	No. in X.R.F.	No. in L.M.R.F.
A	*Amomis caryophyllata* (Jacq.) Kr. & Urb.	1	–
B	*Byrsonima spicata* Rich.	–	3
C	*Cassipourea latifolia* Alston	6	–
Ch	*Chione venosa* (Sw.) Urban	3	–
E	*Eugenia* and *Myrcia* spp.	2	7
Eg	*Euterpe* sp.	–	1
Er	*Erythroxylum impressum* O. E. Schulz.	3	1
G	*Guettarda scabra* Lam.	2	–
K	*Krugia ferruginea* (Poir.) Urb.	1	–
Lb	*Licania biglandulosa* Griseb.	–	10
Lt	*Licania ternatensis* Hook f.	7	–
M	*Manilkara bidentata* (A.DC.) Chev.	1	–
Mi	*Miconia* sp.	–	1
R	*Richeria grandis* Vahl.	–	1
Ro	*Roupala montana* Aubl.	1	–
Sl	*Sloanea trinitensis* Sandwith	–	1
S	*Styrax glaber* Sw.	–	3
Ta	*Tabebuia serratifolia* (Vahl.) Nichols	1	–
Te	*Ternstroemia oligostemon* Kr. & Urb.	–	2
?	Unknown	–	2

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