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CARIBBEAN COASTAL AND HILLSIDE VEGETATION OF ST. KITTS, WEST INDIES

Walter L. Meagher

The Orchards, Hopcraft Lane, Deddington, Oxon. OX15 OTD, England, UNITED KINGDOM

ABSTRACT

Forest types of the island of St. Kitts are summarized. Species content and current condition of each forest type are examined, along with climatic and edaphic variables affecting forest cover.

KEY WORDS: floristics, St. Kitts, West Indies

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Part I

INTRODUCTION

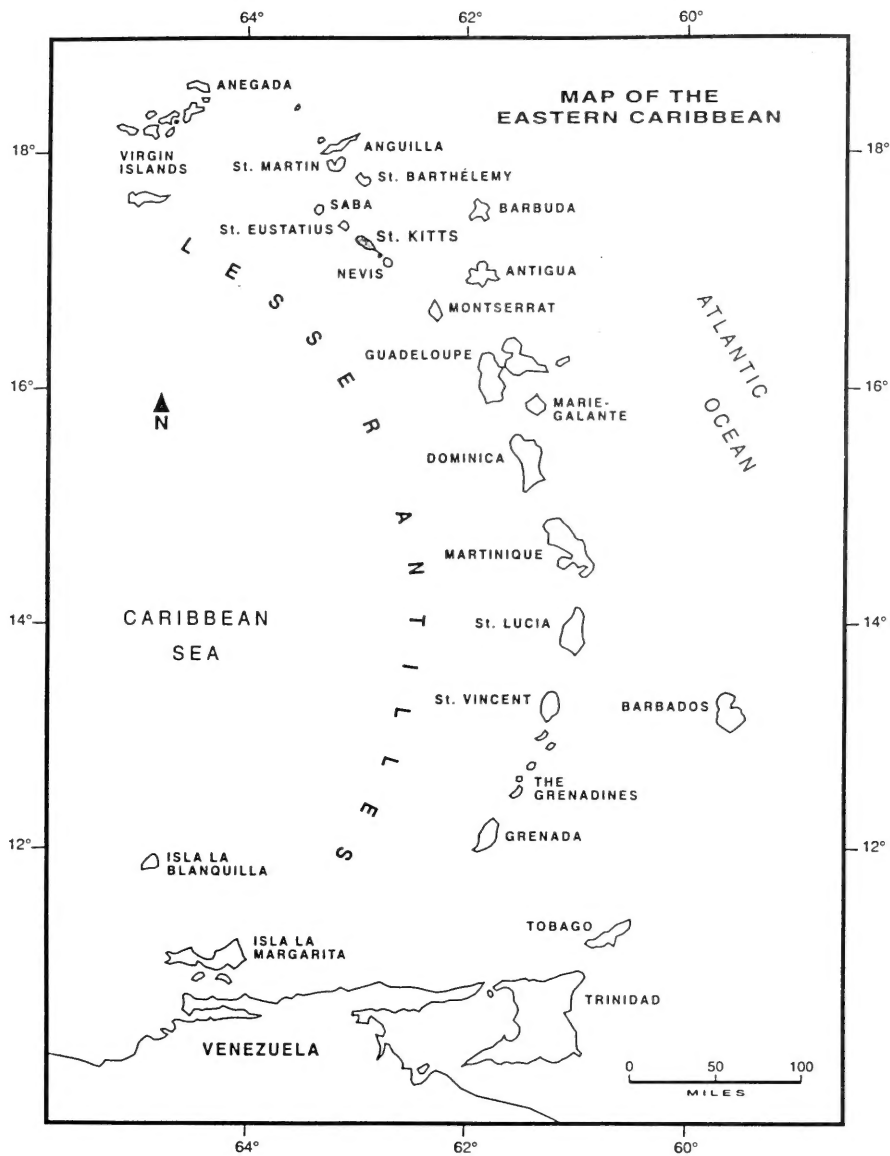
St. Kitts is a volcanic island (lat. 17° 20' N, long. 62° 45' W) belonging to an arc of islands stretching from Saba and Sombbrero in the north to Trinidad and Tobago in the south, called the Lesser Antilles (Figure 1). The shape of St. Kitts has been likened to a cricket bat (Figure 2). There is no single term in current usage for the main part of the island, but the handle of the bat is called "the Southeast Peninsula" (SEP). The length of the main part of the island, bisected longitudinally from Helden's Point to the Power Station near Basseterre, is 17.5 km (11 mi); the average width of the island, regular in its shape above Frigate Bay, is 8 km (5 mi).

A spine of mountains, comprising three ranges (the North West, Central, and South East), forms the body of the island: Mt. Liamuiga at 1,156 m (3,742 ft), of the North West Range, is the tallest and youngest of the mountains; Verchild Mountain, of the Central Range, is 914 m (3,000 ft); and the South East Range with its highest point at 792 m (2,600 ft). These mountains capture most of the rainfall on St. Kitts. The highest hills in the SEP are St. Anthony's Peak, 319 m (1,047 ft) and Salt Pond Hill, 268 m (878 ft); and the steep hills are Sir Timothy Hill, 122 m (400 ft), and Mt. St. Michael, 122 m (400 ft).

The handle of the bat, which is attached at the quarry in Upper Conaree, and extends to Scotch Bonnet at the southeastern end of the island, is approximately 13 km (8 mi). For much of its length the peninsula is narrow: 8 km (5 mi) at the base of Sir Timothy Hill on its western side; and 8.5 km (5.3 mi) at Friar's Bay. While overall the SEP is not flat, it contains the two largest flat surfaces on the island. Northernmost of these is the area known as Frigate Bay, including the Royal St. Kitts Golf Club. The beach, dune, and scrub vegetation of this part of the island is examined in Part 2 of this paper. Toward the southern end of the peninsula is the Great Salt Pond. Adjoining the pond are other flat areas, as well as all of the hills on which dry forest and windswept scrub woodlands occur. These are examined in Part 3. Examination of these habitats has led to the documentation of the species composition of scrub and dry forest associations on the SEP of St. Kitts.

Defining the Southeast Peninsula (SEP)

The common view is that the SEP begins at Sir Timothy Hill, a view reinforced by the construction, in 1989, of a highway that opened for the first time the SEP to motor traffic. This highway starts at the bottom of Sir Timothy Hill on its northwestern side, and departs there from Frigate Bay. Merrill (1958) argues that the SEP starts at and includes the Conaree Hills and the Morne Hills. All of Frigate Bay belongs to the SEP. Hills low and worn have eroded over a longer period of time, and therefore are older than the taller and sharper mountains to the north. Baker (1996) includes the Canada Hills, north of Conaree, as part of "everything that is older than the South East Range". While it is agreed that the oldest rocks are on Booby Island, there is not a strict linear series from Booby Island to Mt. Misery, each successive hill and mountain taking its place in an ordered rank of antiquity.



Important Details

This study was begun in October 1994, and concluded in May 1996. Identifications of collections were made by Dr. George R. Proctor, Department of Natural Resources, Commonwealth of Puerto Rico. Nomenclature is based on Howard, *Flora of the Lesser Antilles* (1978-89). Collections were sent to the herbaria of the Missouri Botanical Garden, Harvard University, c/o Dr. Richard A. Howard, and to the Smithsonian Institution, c/o Dr. Pedro Acevedo-Rodriguez.

Wind, Rainfall, and Solar Input

The following discussions are based on data on air temperature, rainfall, relative humidity, wind velocity, wind direction, and hours of sunshine kept since 1989 by the Golden Rock Airport, St. Kitts, with additional data drawn from records of other Caribbean islands having conditions similar to those of St. Kitts.

Trade Winds

Despite the large area over which the Caribbean islands are scattered, there is a strong similarity of weather and climate everywhere. In these latitudes, the waters of the Caribbean Sea and the Atlantic Ocean are warm at all times of the year, lying within a range from 16°-36° C (61°-97° F). The climate of St. Kitts is tropical, humid, and maritime; heat and humidity are moderated by the steady and cooling northeast trade winds. Varying from east-north-east to east-south-east, these winds blow with only slightly diminished force even during the night, rendering the heat less oppressive than the high daily temperatures would suggest. Mean wind speed varies from 8.7 kmh (5.4 mph) in November to 14.6 kmh (9.1 mph) in July, the annual average being 12.2 kmh (7.6 mph); but in 1994, mean wind velocity was 22.2 kmh (13.8 mph), and its direction east-north-east. We know that turtle grass beds form where there is protection from wind-driven currents and surf (Kaplan 1988). On the SEP, where the sand dunes are greatest, turtle grass beds are least; but at Major's Bay, where there is an extensive bed of turtle grass, there is also a woodland of the tallest trees of any such woodland on the peninsula. Exposure to these winds, which are constant in their pruning and shearing effect, is greatest on the Atlantic side of the island, on which side "scrubland" vegetation of the windswept hills achieves its greatest extent.

Hurricane Winds

Hurricanes occur with sufficient frequency that it might be presumed plants prospering in sites of greatest exposure to hurricane forces of high winds and salt-spray are selectively adapted to these recurrent extremities of physical forces at work in their environment. In 1995, hurricanes Luis and Marilyn struck St. Kitts, undercutting roadways, knocking down trees, removing roof tiles, and much more; but damage to the plant life of the SEP, though marked at first by leaves lost, leaf tips wind-burnt, and *Acacia* uprooted, was negligible. Both storms did more damage to the vegetation of the northwest slopes of Mt. Misery, and that vegetation has been slow to recover. But on the SEP, within a month, many plants put out new leaves,

and *Calotropis procera* (Aiton) W. Aiton and *Leucanea leucocephala* (Lam.) de Wit began flowering shortly thereafter. On the other hand, *Tamarindus indica* L., in the same sites, sustained what seems to be permanent damage to twigs at the tips of its upper branches. Vegetation on the most exposed slopes (windswept hill scrubland) of the SEP seaside hills, and *Coccoloba uvifera* (L.) L. on the barrier dunes, was little damaged. Hurricane Luis began as a Category 4 storm, but struck the island with winds at 120 mph, arriving as a Category 3 storm; Marilyn began as a Category 1, but by the time it struck the island, the winds blew at 120 mph making it a Category 3 hurricane.

It is difficult to maintain the view that plants of the barrier dune and coastal strand of the dry woodlands, and especially of the windswept hills, are not selectively adapted to such large-scale but infrequent and irregular events as hurricane winds. As to the periodicity of these violent storms, there is reliable data for St. Kitts from 1623 to 1800. During 277 years, there were 49 hurricanes, resulting on all occasions in property loss, injury, or death. In the hurricane of 1650, 28 ships were shattered in the roadstead of Basseterre. Most destructive was the hurricane of 1667. And nearly so, as memorialized in the folk memory of the island, were the storms of 1772, 1827, 1871, and 1880. The year of Luis and Marilyn was unusual: two hurricanes striking within one year. Such a conjunction occurred four times in the period 1623 to 1800. Much more often than hurricanes are gales, in which the vegetation of the island must sustain high winds, often for two or three days at a time.

Rainfall

Total rainfall, measured at Golden Rock Airport in 1994, was 15.7 cm. The average annual rainfall in St. Kitts - excluding the SEP - for 22 years of record-keeping, was 25.2 cm. Before Independence (September, 1983), the average annual rainfall measured at sugar factory stations was: 17.1, 19.5, 23.0, 23.2, 24.6, 27.5, and 28.7 cm. The wettest station for which records were kept before 1983, well above the area of the cultivation of sugar-cane, had an annual average rainfall of 59.1 cm. In contrast, 15.8 cm is the amount of rainfall recorded as the annual average for the SEP. At Cockleshell Bay, located at the far end of the peninsula, as high as 14.8 cm of rainfall was recorded in one year. From the same source, we know that there was an average of 17.8 cm of rainfall for the driest year in the recorded history of St. Kitts prior to 1966; at Cockleshell Bay, in that year, there were 13 cm of rainfall. Although there is some rain throughout the year, the wet season occurs from August to November (or May to October, as the start and finish of the season varies), and the dry season (tourist season) from mid-January to April. On September 5, 1995 the rainfall from Luis, according to the meteorological records kept at Golden Rock Airport, was 8.3 cm, which is 20% of the annual average rainfall for the SEP!

Temperature/Hours of Sunshine

In 1994, the mean air temperature recorded at Golden Rock Airport was 26.9° C (80° F). From other records, and for longer periods, we know that the average temperature in Basseterre is 26.4° C (79.6° F), varying from average values of 24.8° C (76.7° F) in January and February to 27.7° C (81.9° F) in August. The maximum temperature may reach 33.9° C (93° F) and the minimum temperature may fall to 15.6°

C (60° F). In 1994, the highest temperature was 30° C (86° F); the lowest was 22° C (72° F). Extrapolating from records kept by the United States Weather Bureau for Puerto Rico suggests that overall annual cloud cover might ordinarily be between 40% and 50%. With data from the St. Kitts' meteorological records for the period 1983-93 it has been possible to construct Tables 1 and 2:

Table 1: Mean monthly sunshine in percent of the possible for a tropical and maritime climate (St. Kitts).

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
63	69	68	64	60	61	64	67	62	64	62	53

Table 2: Meteorological summary for 1994, Golden Rock Airport, Basseterre, St. Kitts. In the last column, daily mean sunshine in hours is shown.

Month	Air Temperature		Rainfall (cm)	Relative humidity (%)	Wind		Mean sunshine
	C°	F°			Knots	km/hr	
January	25.6	78	5.66	74	070-13	24.13	7.5
February	25.2	77	6.65	73	110-13	24.13	8.9
March	25.8	78	2.10	72	090-10	18.50	8.6
April	26.6	80	2.90	71	100-11	20.43	8.2
May	27.2	81	7.82	74	090-11	20.43	6.5
June	27.7	82	7.82	76	080-13	24.13	7.3
July	28.2	83	3.65	72	060-14	25.90	8.3
August	28.4	83	3.65	73	060-14	25.90	8.6
September	27.6	82	25.75	77	070-12	22.20	6.9
October	27.5	81	16.02	79	080-09	16.15	7.5
November	27.0	81	10.13	79	060-09	16.15	8.6
December	29.9	86	9.11	76	070-10	18.50	8.3

Part 2

SCRUB VEGETATION

The vegetation of St. Kitts may be divided into three parts. The first of these, giving to the island a special beauty, are the mountain woods. Few roads lead to

them, inaccessibility contributing to their preservation. Variety of habitats in the high mountains - palm brake, "tropical rain forest", elfin forest - is not distinguishable from the lowlands, where people mostly live and work. The second part of the vegetation of St. Kitts, sugar-cane, forms an apron of greenery from the edge of land on either side of the island to 330 m (1,000 ft) above sea level. The vegetation known to the original "Indian" inhabitants of the island - Carib and Arawak - was cleared by European settlers first for tobacco, then cotton, and at last for the crop that made island fortunes: sugar; clearing timber, ever higher on the mountain slopes, continued as long as the sugar mills required wood for fuel. The third part of the vegetation of St. Kitts is communities of plants low in stature and without special distinction of form or color. They are shrubs (i.e., woody plants with several main stems), short and solitary trees, and patches of grass and weed over which cattle graze at liberty - in short, "scrubland".

According to Beard (1949), 37% of the total area of St. Kitts was forested. According to the *Country Environmental Profile* (1991), there are 2,300 ha of rain and cloud forest, 2,100 ha of moist forest, and 2,000 ha of dry forest. In a map of its vegetation, Beard showed the extent of six types of vegetation for the island. Of the six types, "savanna & grazing land" and "dry scrub-woodlands" appertain exclusively to the SEP and the Canada Hills. Beard gave a species list for the peninsula, in which he concentrates on the woodlands of taller trees and shrubs than those of scrub. Of the entire SEP he takes the view that "it is barren and covered with poor scrub woodlands". This view was echoed by Merrill (1958), who writes, "The peninsula of St. Christopher . . . support(s) a scrub woodland. It provides a poor pasture for cattle, some of which run wild. Various species of *Acacia* and *Cassia* are common, along with seaside grape. The dry, rocky slopes support *Agave americana* L., and various cacti". In truth, there is only one species of *Acacia* common and none of *Cassia*. However, what Merrill saw, and Beard ignored, is that the SEP extends from north of Sir Timothy Hill, and is an area including the Conaree and Morne Hills. Finally, Howard, in a well-known classification of the vegetation of all the Lesser Antilles (*The Flora of the Lesser Antilles*, vol. 1: Orchidaceae, 1974) gives "thorn scrub" as a "lowland formation". Plants of this formation are "well protected with thorns or spines on the stems, or with modified spine-tipped leaves". "The vegetation is usually dense, although not tall, and on windward slopes the plants are commonly distorted by the prevailing winds".

It is difficult to know whether Howard's "thorn scrub" is the same community as Beard's "scrub woodland". Howard's definition has the advantage that he lists what plant genera predominate in "thorn scrub". St. Kitts conforms a little to this list, but not enough to consider Howard's definition binding. For instance, *Randia aculeata* L., in the SEP, occurs most often in windswept hillside sites, and occasionally in what Brown (see below) calls "dry forest". *Acacia tortuosa* (L.) Willd. seldom or never occurs in either site, except in spaces disturbed, such as edges and margins. Representatives of Cactaceae occur predominantly in one site, on the eastward face of the seaward portion of Sir Timothy Hill. *Croton astroites* Dryander is dominant in areas of mixed grass and *Acacia*, and occurs occasionally on dry and windswept slopes, but predominates in neither habitat. *Pithecellobium unguis-cati* (L.) Benth. is a rarely-occurring species of dunal thickets; *Jatropha gossypifolia* L. is ruderal. Other genera, in Howard's list, are without representation in St. Kitts.

Brown (1989), examining the vegetation of the SEP south of Sir Timothy Hill, finds that it most usefully may be classified in these categories: dune, mangrove, guinea grass, grass/*Acacia*, thorn scrub, dry forest, and agriculture. The distinction between "thorn scrub" and "dry forest" is a major improvement in the perception of SEP vegetation. But, as shown in the first paper in this series (Meagher 1996a), "thorn scrub" is partly an inaccurate representation of the scrub vegetation of the SEP south of Sir Timothy Hill. Brown is the first author to use consistently the term "dry forest", a category which is equivalent to Beard's "scrub woodlands". There is greater dignity, and also greater accuracy, in "dry forest", for the trees of this formation, as will be demonstrated in the second part of this paper, are different in composition and taller in stature than the woody vegetation of "scrub" sites. Brown's excellent map, based on aerial photography, is printed on pages 300-301 of Meagher (1996b), and might usefully be consulted at any time.

As the word is often used, "scrub" is any non-wooded or non-forested area with extensive parts or dense patches of bushy woody vegetation, the rest being grasses wild and leggy, with a few associated herbaceous and weedy plants. While scrub may, in this usage, have thorny species, they are not essential to its meaning. "Scrub" often suggests vegetation of little value, except to be cleared, and given to housing or other amenity use. Scrub vegetation of this kind dominates the SEP north of Sir Timothy Hill, and much south of it.

Cactus Scrub

St. Kitts is not as dry as neighboring islands, such as Saba and Saint Eustatius. On those islands are found more species of cactus. Of the eight species of *Opuntia* found throughout the Lesser Antilles, four may be found on St. Kitts, and only two on the SEP. Those two, far from predominating in their sites, are rare occurrences. Of the ten genera of Cactaceae represented in the flora of the Lesser Antilles, five are unrepresented on St. Kitts. Of a total of twenty-four species in that flora, St. Kitts has eight. But of eight, a few of which have been collected as garden "escapes", only four are found on the SEP. In Cuba, according to Borhidi (1991), "dry cactus scrub" forms an unbroken stretch "along the coast from Guantanamo to Imias", but in St. Kitts there are sites of "mixed cactus scrub", but not in any place continuous for a great distance. Only on the eastern slope of the seaward segment of Sir Timothy Hill is mixed cactus scrub continuous over a wide area (the entire hillside, in this case); for the rest, cactus scrub is unmixed, being of only one species, and a fragment within a large scrubland association.

Site 1: *Pilosocereus* of Muddy Point

The least extensive site of cactus scrub is a flat dry sandy spit of land with Muddy Pond to the west and Muddy Point to the east. Muddy Pond is not shown on the D.O.S. 443 map of 1979; but it is shown, unlabelled, on the D.O.S. 343 map of 1984. The road to the site passes west from the Jack Tar Hotel, and borders the western edge of the long thicket of North Frigate Bay. The edge of the thicket is a ruderal site for *Gossypium barbadense* L., *Indigofera tinctoria* L., *Leucanthea leucocephala*, *Melanthera aspera* (Jacq.) Small, *Pluchea carolinensis* G. Don, and *Tridax procumbens* L. Where the ground is lower by a few centimeters rainwater

collects, and clumps of *Fimbristylis cymosa* R. Br. are common. In the area where *Pilosocereus* grows, *Sporobolus virginicus* (L.) Kunth covers more ground than any other plant.

Columnar cacti at Muddy Point are highly visible. The scrub in which *Pilosocereus* stands spreads across all the land parallel to the beach, ending to the west at the ring of mangroves edging the easternmost arm of Muddy Salt Pond. There are fourteen plants of *Pilosocereus royeri* (L.) Byles & G. Rowley spread over a distance of 45 m (585 ft), four of which are dead. Living plants support an array of branching arms (between 24 and 32 per plant in this area). The ground cover of the areas in its vicinity include *Sporobolus virginicus* and patches, sometimes of an amazing profligacy and cover, of three succulents: *Blutaparion vermiculare* (L.) Mears and *Heliotropium curassavicum* L. (least abundant), and *Sesuvium portulacastrum* (L.) L. (most abundant).

A curious feature of this Muddy Pond/Muddy Point "scrubland" are its mounds. There are three of them, each standing apart from the other, like densely vegetated tumuli, remnants of older dunes. On the summit of one, grows a *Pilosocereus*, towering over its countryside, and with it a *Hippomane mancinella* L. Covering the mounds in an interlocking web of spiny arching branches and zigzagging thorny arms, is a "thorn scrub" of *Acacia tortuosa*, *Caesalpinia bonduc* (L.) Roxb., *Clerodendrum aculeatum* (L.) Schlecht., and *Pithecellobium unguis-cati*, to which poison is added by the cooperation of *Hippomane*. But thorn scrub is no more dominant in the bush at this site than *Pilosocereus*. There are (1) wide grassy spaces in which *Fimbristylis cymosa* grows in association with *Sporobolus virginicus*; (2) patches of *Chamaesyce articulata* (Aubl.) Britton (3) and even larger expanses of goatweed, *Capraria biflora* L., (4) *Convolvulus alba* creeping far and wide on thorn and non-thorn alike; and (5) mangroves, both *Avicennia germinans* (L.) L. and *Laguncularia racemosa* (L.) Gaertn., occurring as tall (3.0-3.5 m/10-12 ft) "bushes", forming the boundary to the expansion of the shrubs of the drier and less salty land.

Site 2: *Pilosocereus* of Half Moon Bay

A dirt track beside the salt pond at Half Moon Bay connects Frigate Bay with Conaree. The Conaree Hills face the Atlantic Ocean where they rise west of the salt pond. There is a *Leucanea* thicket in a declivity of a far slope. Below the *Leucanea*, the vegetation has an aspect of higgledy-piggledy: *Acacia*, *Caesalpinia*, *Capraria*, *Clerodendrum*, *Sesuvium*, *Sporobolus*, *Thespesia*, and *Trianthema*. Ten *Pilosocereus*, a single *Agave caribaeicola* Trel. and, on a rocky outcrop, a clump of *Hymenocallis caribaea* L. A feature of these two sites is their accessibility to cattle and horses. *Pilosocereus royeri* is perhaps a colonist of dry-land so abused by cattle that only a well-armed plant can live a long life without being masticated.

Site 3: Seaward Segment of Sir Timothy Hill

The third site is exempt from the attentions of domesticated grazing herbivores. It is the sun-facing seaward flank of Sir Timothy Hill. This is a rocky and steep hill descending to the rocky headland of the northwestern end of the beach at North Friar's Bay. On this slope there are found more cactus than anywhere else on the island, not

only *Pilosocereus*, but the handsome and unusual *Melocactus intortus* (Miller) Urban. Neither *Pilosocereus* nor *Agave* are confined to one portion of the hill, but grow from top to bottom. *Acacia* is common at the top, as is *Krameria ixine* L. Although *Pilosocereus* is plentiful at this site, many are bruised, injured, or dead.

Cactus at Other Locations on the SEP

While cactus plants occur at other locations, they are not a numerous component of the habitats they elsewhere populate. This is most true of *Opuntia*. Howard mentions *Opuntia* as a genus predominating in "thorn scrub", but of *Opuntia* on the SEP, where it occurs as an occasional, and not at all in most scrubland sites, this cannot be said. For instance, in all of the sites where *Opuntia rubescens* Salm-Dyck. ex Forest has been found, only a few plants grow: in the wide grassland adjoining the Great Salt Pond on its northwestern side, in the dry forest of *Bursera* and *Thespesia* on the highland above Shitten Bay, and on the *Conocarpus*-dominated headland of North Friar's Bay. A solitary plant, rather than a group or cluster, of *Opuntia rubescens* was found in the dry forest of St. Anthony's Peak, and in the ghat on the eastern slope of Sir Timothy Hill. In the same way, *Opuntia dillenii* (Ker Gawler) Haw was found in the grassland by Great Salt Pond, as was one specimen on the leeward side of Sir Timothy Hill Seaward. On the other hand, in all sites where *Melocactus intortus* occurs, it occurs more numerous, and often, as on the windswept hill above Canoe Bay, and on the windswept ocean-facing slope of Sir Timothy Hill (opposite the south end of Friar's Bay Salt Pond), it contributes towards a definition of the association. Nevertheless, there are sites too, where it is less plentiful, and these include the very brow of the rocky headland at North Friar's Bay, where young plants grow inconspicuously with *Lithophila muscoides* Sw. and *Sesuvium portulacastrum*.

Two Thickets: *Leucanea* and *Croton*

In common usage, plants of a "thicket" tend to be taller than those of "scrub". In *Webster's New World Dictionary* (Third College Edition 1991) a thicket is "a thick growth of shrubs, underbrush, or small trees". Scrub, on the other hand, "is short, stunted trees, bushes, or shrubs growing thickly together". When Satan enters Paradise, in the Fourth Book of Milton's *Paradise Lost*, he finds:

". . . a steep wilderness, whose hairy sides
With thicket overgrown, grotesque and wild,
access denied."

Common to thicket and scrub are the elements of woody vegetation of low stature growing thickly together. But scrub includes stunted trees, and, in this more restricted sense of "scrub", the bush of Frigate Bay is not scrub.

A definition of "thicket" more particular than Webster, is provided by Lindsay & Horwith (1995). A "*Leucanea* Thicket" is a formation "more than 5 meters and less than 20 meters"; and in which "more than 50% of the area (is) covered by *Leucanea leucocephala*". Just such a thicket adjoins the road descending the hill from the site of Horizons Villas and to its bottom below the Frigate Bay Beach Hotel. With *Leucanea* are a few *Acacia tortuosa*, *Cordia obliqua* Willd., and *Tamarindus indica*. *Leucanea*

grows thickly on the other side of the road with *Capraria*, *Croton*, *Gossypium*, *Tecoma*, and *Thespesia*. Above *Leucanea*, on both sides of the road, is a steep slope on which *Croton astroites* is the dominant woody plant species. In these spaces, *Leucanea* appears not at all; nor does *Croton* maintain its dominance to the crest of the hill. Instead, near the summit, the hill becomes a grassland.

The Barrier Dune and the Backdune Thicket

Few plant species find a satisfactory opportunity for seeding, growth, and prosperity where trade winds blow on to a sandy shore. The one woody plant that does find opportunity is *Coccoloba uvifera*. Its dominance on the barrier dune, in many places, is nearly 100%; often it extends inland for as much as half the width or more of the dunal thicket, but it is not usually rooted at the base of the dune on the seaward side. That position is most bravely held by the beach colonists, especially *Sporobolus virginicus*. The highest dunes enjoy the greatest expanses of *Coccoloba uvifera*. These are at North Friar's Bay and Sand Bank Bay. Where the dune is very low to nearly negligible, as it is along the shore of Half Moon Bay and Major's Bay, *Coccoloba* is a minor component of the vegetation. Often it seems that *Coccoloba*'s dominance in these Atlantic-facing dunes is 100%, but on closer inspection, portions are found where patches of shrubby seaside succulents thrive: *Argusia gnaphalodes* (L.) Heine, *Scaevola plumieri* (L.) Vahl, and *Suriana maritima*. Of these, the most abundant in St. Kitts is *Argusia gnaphalodes*.

While the first dune (also called "foredune" and "barrier dune" in the literature of beach morphology) has a distinctive shape and simple conformation, the thicket behind it is a jumble of spaces (eroded old dunes, cuts in these with various distributions of wind-blown sands) and a confusion of vegetation. There are many more species in the thicket than on the barrier dune, and none arrayed in a neat line as the barrier dune allows. *Caesalpinia bonduc* is co-dominant or sub-dominant in all the large backdune thickets of the SEP.

The longest thicket is the one stretching from Muddy Point to Sealofts, nearly the full distance of North Frigate Bay, measuring 1,500 m (4,921 ft) long by 250 m (820 ft) wide. The thicket at North Friar's Bay is 500 m (1,640 ft) long by 125 m (410 ft) wide; at Sand Bank Bay, 2,000 m (6,561 ft) long by 220 m (721 ft) wide; and the last, at Mosquito Bay, measuring approximately 250 m (820 ft) long by 100 m (328 ft) wide.

Thickets commonly grade into woodland. But the long thicket back of North Frigate Bay is dominated for its whole length, and fully half its width, by *Coccoloba uvifera*; it has not evolved, on its inland edges, as one would expect, a coastal woodland. In contrast, the thicket at Sand Bank Bay does grade into woodland. A sign of this transition is the occurrence of small tree species scattered in the back parts and more shaded edges of the thicket. Most commonly occurring in this role are *Capparis cynophallophora* L. and *Jacquinia amillararis* Jacq. Thicket "common elements" are listed in Table 3. Of the species occurring in all four thickets examined, *Caesalpinia bonduc* is the most abundant.

Hippomane mancinella is common in backdune thickets. At North Frigate Bay, *Hippomane* is least abundant, and of the smallest stature; while at Sand Bank Bay, the

thicket grades into a woodland, having large and impressive specimens of *Hippomane*. In patches where tall shrubs and small trees were destroyed by the hurricanes of 1995, *Hippomane* seedlings are more numerous than any other kind. At Mosquito Bay, *Hippomane* is short in the middle of the thicket, but taller, and more numerous, to the far eastern side, where the thicket comes into the lee of Scotch Bonnet. By contrast,

Table 3: Plants of the coastal thickets. A composite chart in which the capital letters stand for different sites as follows: A = North Frigate Bay; B = North Friar's Bay; C = Sand Bank Bay; D = Mosquito Bay

Species	A	B	C	D
<i>Acacia tortuosa</i>	+	+	+	+
<i>Caesalpinia bonduc</i>	+	+	+	+
<i>Capparis cynophallophora</i>	o	o	+	+
<i>Cassytha filiformis</i> L.	+	o	o	o
<i>Celtis iguanaea</i> (Jacq.) Sarg.	o	o	+	o
<i>Chamaecrista glandulosa</i> (L.) Greene var. <i>swartzii</i> (Wikström) Irwin & Barneby	+	o	o	+
<i>Chrysobalanus icaco</i> L.	+	o	o	o
<i>Clerodendrum aculeatum</i>	+	+	o	+
<i>Coccoloba uvifera</i>	+	+	+	+
<i>Corchorus hirsutus</i> L.	o	+	o	o
<i>Cordia obliqua</i>	+	+	+	+
<i>Croton astroites</i>	+	+	+	+
<i>Dalbergia ecastaphyllum</i> (L.) Taubert	+	o	o	o
<i>Erihalis fruticosa</i> L.	+	+	+	+
<i>Heliotropium angiospermum</i> Murray	o	o	o	+
<i>Hippomane mancinella</i>	+	+	+	+
<i>Jacquinia armillaris</i>	+	o	o	+
<i>Justicia eustaciana</i> Jacq.	o	o	o	+
<i>Krameria ixine</i>	+	o	o	+
<i>Lantana camara</i> L.	+	+	+	+
<i>Lithopha muscoides</i>	+	o	o	o
<i>Malvastrum americanum</i> (L.) Torr.	o	o	o	+
<i>Pedilanthus tithymaloides</i> (L.) Poit.	+	o	o	o
<i>Pithecellobium unguis-cati</i>	+	o	o	o
<i>Randia aculeata</i>	+	o	o	o
<i>Spermacoce bahamensis</i> (Britton) Howard	+	o	o	o
<i>Thespesia populnea</i> (L.) Sol.	+	o	+	+
<i>Tephrosia cinerea</i> (L.) Pers.	o	+	o	o
<i>Wedelia calycina</i> Rich.	+	o	o	o

on shores where there is no or little barrier dune, such as at Major's Bay and Muddy Pond's seaside, *Hippomane* grows on the shore itself, as a tree of the beach.

The Frigate Bay Salt Pond: Plant Life on Its Edges

Of all the nine salt ponds of the SEP, the Frigate Bay Salt Pond is most prominently an amenity feature of a populous landscape, and the only pond without an edge continuous on at least one side with mangrove. Indeed, there is only a dotting of *Laguncularia racemosa*, of low stature, and none at all on fully half the edges of the pond. Located within the one area of the island designated exclusively for development of the "tourist industry", the pond edge is habitat to more weedy species of vascular plants than any other site in the SEP.

A few species belong to the sometimes wet, sometimes dry salty sands: *Batis maritima* L., *Laguncularia racemosa*, and *Sesuvium portulacastrum*. The largest subhabitat of the site is dry sandy "bush" with woody plants typical of other sites, such as the "Sandy Plain" at Friar's Bay. This is a scrub without a dominant species. There is a scattering of *Calotropis procera*, *Citharexylum spinosum* L., *Gossypium barbadense*, *Heliotropium ternatum* Vahl, *Solanum racemosum* Jacq., *Spermacoce bahamensis*, and *Urechites lutea* (L.) Britton & Rose. On the north edge, there is the *Leucanea leucocephala* thicket, and along the roadside, where pass the visitors to South Frigate Bay beach, there is the largest variety of weeds. On the edge closest to the Caribbean shore are solitary specimens of *Albizia caribaea* (Urban) Britton & Rose, *Casuarina equisetifolia* L., and *Thespesia populnea*.

Collections on which the following species list is based were made in October-December 1994. Species collected more than once at other sites on the SEP have not been collected at Frigate Bay Salt Pond, and are noted with an "nc" after the specific epithet. With accession to government of the Labour Party in Autumn 1995, new initiatives were put in place for tidying the roadsides, and depriving muggers of concealment in "the bush": the land around the pond has been scraped clean of its vegetation, and grass planted. The one habitat to escape cleansing are the salty sands of the pond edge, unique habitat of the succulent herb *Batis maritima*.

Species Composition of Frigate Bay Salt Pond

Trees: *Albizia caribaea*, *Casuarina equisetifolia*, *Randia aculeata* (nc), and *Thespesia populnea*. Trees/Shrubs: *Coccoloba uvifera* (nc) and *Laguncularia racemosa*. Arborescent Shrub: *Cordia obliqua* (nc). Shrubs: *Calotropis procera* (treelike), *Citharexylum spinosum*, *Gossypium barbadense*, *Heliotropium ternatum*, *Jatropha gossypifolia*, *Leucanea leucocephala*, *Sida cordifolia* L. (or subshrub), *Solanum racemosum* (nc), *Spermacoce bahamensis*, and *Urechites lutea* (vinelike). Vines: *Canavalia rosea* (Sw.) DC., *Centrosema virginianum* (L.) Benth., *Ipomoea tiliacea* (Willd.) Choisy in A. DC. (thin climber), and *Merremia dissecta* (Jacq.) Hallier f. Herbs: *Catharanthus roseus* (L.) Don (subwoody), *Cenchrus tribuloides* L., *Chamaesyce hypericifolia* (L.) Millsp., *Cleome gynandra* L. (nc), *Crotalaria retusa* L., *Croton lobatus* L., *Cynodon dactylon* (L.) Pers., *Desmodium glabrum* (Mill.) DC., *D. tortuosum* (Sw.) DC. (or shrub), *Emilia fosbergii* Nicolson, *Euphorbia heterophylla*

L., *Fimbristylis cymosa* ssp. *spathacea* (Roth) T. Koyama, *Heliotropium curassavicum* (succulent), *Ipomoea pes-caprae* (L.) R. Br. (prostrate seashore plant) (nc), *Melochia pyramidata* L., *Panicum maximum* Jacq., *Paspalum laxum* Lam., *Portulaca oleracea* L. (succulent), *Rhynchelytrum repens* (Willd.) C.E. Hubb., *Sesuvium portulacastrum* (succulent), *Setaria setosa* (Sw.) Beauv. (nc), *Spigelia anthelmia* L., *Sporobolus virginicus* (nc), *Trianthema portulacastrum* L. (nc), *Tridax procumbens*, and *Vernonia cinerea* (L.) Less.

Part 3

INTRODUCTION TO OTHER TYPES OF WOODY VEGETATION

Four distinct formations of woody vegetation characterize the SEP south of Sir Timothy Hill: (1) coastal or littoral woodland; (2) scrub vegetation of windswept hills; (3) dry forest of the hillsides; and (4) mangrove. Mangrove is treated in detail in a previous paper (Meagher 1996b); here, only a very general overview is given.

One or more mangrove species occurs at five of the nine salt ponds on the SEP. *Rhizophora mangle* L. is dominant at two ponds, Greatheeds and Friar's Bay. At Greatheeds, specimens have the stature of trees. *Avicennia germinans* is the only species occurring at Half Moon Bay Salt Pond, while at Muddy Pond and Cocksleshell Bay Pond, *LAGuncularia racemosa* is dominant.

Hippomane occurs as part of the barrier dune at beaches with low dunes, at Major's Bay, for instance, but not where the winds are strong and persistent, and so the dunes are high, as at North Friar's Bay. It grows back of the dune, or to the corners of backdune thickets on beaches with medium to high barrier dunes. In none of these sites is it as abundant as it may once have been.

While "littoral woodland" has an accepted status in the literature of Caribbean vegetation, for the sake of emphasis in dealing with the singularity of such a community on St. Kitts, it is here called the *Bursera*-dominated coastal woodland. While "forests" are often defined as having continuous tree cover with at least two strata of trees over 4 m (13 ft) in height, none of the sites of woody vegetation of the SEP conform to this definition. "Woodlands", on the other hand, are often defined as having generally a continuous tree cover of a single story at least 4 m (13 ft) or more in height. Into this category fit the *Bursera*-dominated coastal woodlands.

Part 4

COASTAL WOODLAND

1: *Bursera*-dominated Coastal Woodland

The tallest trees of native woodland in the SEP are *Bursera simaruba* (L.) Sarg., *Hippomane mancinella*, and *Thespesia populnea*. Not only is *Bursera* dominant in

associations of these species in the coastal wood, but it is prominent in other habitats as well. Its habitat occurrence ratings are: 2, 2, 1, 0. Known colloquially as "gum", its odd shape, unusual color, and undeniable hardihood are insufficient to overcome the popular view that if a tree's wood is not of high commercial value, the tree is "rubbish". Perhaps this reputation saves the gum, allowing it to prosper in a variety of habitats in the SEP: (1) ghut woodlands; (2) hillside dry forests; and (3) interdunal thickets.

Hippomane is more restricted in its range, occurring at the edges of salt ponds in association with mangrove, and growing on protected sites at the corners or toward the back of beaches. Its profile, seen in the Checklist, is 2, 0, 1, 0. *Thespesia*, on the other hand, is much less numerous than *Bursera*, achieving dominance in none of the habitats it occupies; but it is more widely distributed than *Bursera*, occurring not only in "littoral habitats", such as protected beach sites on the Caribbean shore and backdunal thickets on the Atlantic shore, but also on windswept hillsides, as a member of the scrub vegetation communities, and in the dry forest, abundantly at lower levels on St. Anthony's Peak. Its profile is 2, 1, 1, 2.

Leaves of these three species of tree are not microphyllous, testimony that the dry woodlands of the SEP could be drier, and that hardship has not reached its furthest limit. On *Bursera simaruba*, leaflets range in size from $4\text{-}7 \times 2.5\text{-}4.0$ cm ($1.5\text{-}2.7 \times 1.0\text{-}1.5$ ins); leaves on *Hippomane mancinella* range from $5\text{-}14 \times 4\text{-}8$ cm ($2.0\text{-}5.5 \times 1.5\text{-}3.0$ ins); and on *Thespesia populnea* from $5\text{-}18 \times 3\text{-}11$ cm ($2\text{-}7 \times 1\text{-}4$ ins). *Bursera* exudes a gum from cut bark or broken branch; *Hippomane*, with a gland at the junction of the blade and petiole, exudes a toxin. Laminar characters associated with habitats of water stress - small leaves, revolute margins, rugose surface, coriaceous texture, and thorns - are found among trees and shrubs of other habitats on the SEP, especially those of the Hillside Dry Woodland.

There are two *Bursera*-dominated coastal woodland sites on the SEP, one at Major's Bay and the other at Sand Bank Bay. At both sites the ground is flat and free of rocks, and the vegetation is protected from salt-spray and sea-wind. There are few, or, for great distances, no herbaceous plants; of the few, *Rivina humilis* L. and *Commelina diffusa* Burm. occur most often. In both sites *Pisonia aculeata* L. and *Capparis flexuosa* (L.) L. are present at both sites, but other vines are not. While *Stigmaphyllon* is the dominant groundcover in many sites of windswept scrub, it is at Major's Bay and Sand Bank Bay. There are few low shrubs, *Pedilanthus tithymaloides* being the principal representative in this strata. *Bursera* and *Hippomane*, of heights not seen anywhere else on the island, form a canopy providing deep shade - much to the liking of cattle from the adjoining grassland - and dominate the site. Although small trees and tall shrubs are plentiful, *Bursera*-dominated coastal woodland is not a species-rich association. In Table 4, a summary of a few gross morphological characters of the blades of *Bursera*, *Hippomane*, and *Thespesia* are given, followed by data from the *Bursera*-dominated sites.

Site 1: Sand Bank Bay

Of all the beaches and bays on St. Kitts, Sand Bank Bay is the most private: hidden at the end of a dirt track, often impassable in the wet and rainy season, and bordered on both sides by coastal woodland. Tall trees dominating the woodland

range in size between 9-15 m (29.5-49.0 ft). A single *Ficus citrifolia* Miller grows in a portion of the wood. *Tabebuia heterophylla* (DC.) Britton is frequent on the edges of the wood along the sandy dirt track connecting the bay to the Dr. Kennedy A. Simmonds highway 300 m (984 ft) from it. Shrubs, ranging in size between 2.0 and 4.5 m (6.5-14 ft), include *Bourreria succulenta* Jacq. 2 m (6.5 ft), *Capparis cynophallophora* 2-3 m (6.5-10.0 ft), *Capparis flexuosa* 3.0-4.5 m (10-15 ft), and *Citharexylum spinosum* 2.1-3.0 m (7-10 ft). At a lower story ca. 1 m (3.28 ft) are *Erythroxylum havanense* Jacq. and *Randia aculeata*, each of which has potential for greater height in better habitat. *Pisonia aculeata* is common near the base of Salt Pond Hill, less common on the eastern side of the track. On an outcrop of shingly rocks on the dry hill above Sand Bank Bay, and looking from it out to the lovely bay itself, is the only stand so far found of *Tetramicra canaliculata* (Aubl.) Urban.

Table 4: Leaf and blade - tall trees of the coastal woodland. 1 = leaves deciduous (d) vs. evergreen (g); 2 = leaves simple (s) or compound (c); 3 = leaf margin entire (e) or not (no); 4 = laminar surface characteristics

Species	1	2	3	4
<i>Bursera simaruba</i>	d	c	e	smooth
<i>Hippomane mancinella</i>	d	s	e*	slightly fleshy, sub-coriaceous
<i>Thespesia populnea</i>	d	s	e	glabrous above, glabrate below

* Margins slightly serrate

Site 2: Major's Bay Salt Pond

South of the road from Great Salt Pond to Major's Bay, and sweeping up the hill that rises steeply to a height from which the entire western shore of Nevis is visible, is a grassland of *Panicum maximum*, dotted with *Acacia tortuosa*, grazed by goats and cattle. At the foot of this hill, is a *Bursera*-dominated coastal dry forest, protected from the afternoon sun by the hill at its back, and from the wind and salt-spray by the orientation and depth of the indentation of Major's Bay.

Using transects, a survey was made of the *Bursera* wood at Major's Bay Salt Pond. Six transects were laid out at 20 m (65.5 ft) intervals. Each tree along the transect, and its nearest neighbor, was recorded, and a record was made of the "diameter breast high" (dbh). The dirt road at the base of the wood, and adjoining the western edge of the salt pond, was made the base line for the transects. Each was drawn at 294°, running from base to the western limit of the dry forest, at the bottom of the steep hill. Transects varied in length as follows: 30, 83, 69, 71, 87.5, and 55 m (98, 272, 226, 233, 287, 180 ft respectively). A summary of the data is presented in Tables 4 and 5.

Table 5: Distribution of woody species by station in the *Bursera*-dominated coastal woodland. t = transect; s = station; nn = nearest neighbor. Species are abbreviated as follows: BU = *Bursera simaruba*; CA = *Capparis cynophallophora*; CI = *Citharexylum spinosum*; CO = *Eugenia cordata* (Sw.) DC., ER = *Erythroxylum havanense*; EU = *Eugenia ligustrina*; GL = *Gliciridia sepium*; HI = *Hippomane mancinella*; JA = *Jacquinia armillaris*; RA = *Randia aculeata*; SA = *Samyda dodonaea*; TH = *Thespesia populnea*; ZI = *Ziziphus reticulata* (M. Vahl) DC.

	t1	nn	t2	nn	t3	nn	t4	nn	t5	nn	t6	nn
s1	ZI	BU	BU	BU	BU	ZI	ZI	BU	RA	ER	BU	JA
s2	BU	BU	BU	TH	BU	EU	BU	SA	BU	RA	CA	TH
s3	BU	BU	BU	BU	HI	BU	BU	ER	BU	ER	BU	BU
s4	BU	BU	TH	BU	BU	HI	BU	ER	EU	BU	BU	BU
s5	BU	TH	BU	BU	BU	ER	BU	CI	BU	BU	---	---
s6	BU	BU	TH	BU	BU	BU	BU	BU	BU	EU	---	---
s7	BU	BU	BU	BU	HI	EU	BU	BU	TH	BU	---	---
s8	HI	BU	BU	---	HI	---	BU	BU	CO	GL	---	---
s9	BU	BU	---	---	---	---	TH	TH	CO	BU	---	---
s10	BU	BU	---	---	---	---	---	---	---	---	---	---

Table 6: Diameter breast high (DBH) in inches.

	t1	nn	t2	nn	t3	nn	t4	nn	t5	nn	t6	nn
s1	2.50	4.00	3.25	7.00	6.00	1.75	2.00	7.00	3.00	1.50	12.25	2.66
s2	9.33	6.00	8.50	4.50	9.00	12.00	3.00	1.00	9.00	2.00	2.00	9.50
s3	8.33	7.00	17.00	8.50	13.50	4.50	13.00	1.00	9.00	2.00	7.00	7.00
s4	3.33	7.00	4.00	6.00	13.00	6.00	8.00	2.00	2.00	2.00	9.50	8.00
s5	4.66	7.50	7.00	10.00	11.00	2.00	5.00	5.00	11.00	17.50	---	---
s6	1.50	14.00	6.00	6.00	9.00	2.00	3.00	15.00	10.50	5.00	---	---
s7	7.00	4.00	10.00	10.50	7.00	8.00	10.50	9.50	2.50	8.50	---	---
s8	54.00	2.50	11.00	---	11.00	---	11.50	5.00	2.00	2.00	---	---
s9	28.00	32.00	---	---	---	---	4.50	3.00	2.00	10.00	---	---
s10	43.00	4.00	---	---	---	---	---	---	---	---	---	---

Of 89 trees measured, 60 (67%) were *Bursera simaruba*, eight were *Thespesia populnea*, and five were *Hippomane mancinella*. Although *Hippomane* was the least common large tree, it was the largest of the three, with its dbh at 54 cm (1.8 ft). The average dbh of the three largest trees, in rank order, are: *Hippomane* 18.30 cm (.6 ft), *Bursera* 15.72 cm (.5 ft), and *Thespesia* 5.12 cm (.16 ft). Without counting small trees, *Bursera* makes up 60 of the 73 trees (82%). Nine other species of woody plant

(mostly small trees, often thin and shrub-like, extending to .3 m (.09 ft) high, with the exception of *Ziziphus*) were represented as follows: *Capparis cynophallophora* (two individuals counted), *Erythroxylum* sp. (4), *Eugenia ligustrina* (Sw.) Willd. (1), *Gliciridia sepium* (Jacq.) Kunth ex Walp. (1), *Gyminda latifolia* Urban (1), *Jacquinia armillaris* (1), *Randia aculeata* (2), *Samyda dodecandra* Jacq. (1), and *Ziziphus reticulata* (M. Vahl) DC. (3). Not recorded at any of the stations, but seen in the woodland, was *Krugiodendron ferreum* (M. Vahl) Urban (2 individuals observed), and *Melicoccus bijugatus* Jacq. (one individual).

Part 5

HILLSIDE DRY FOREST

Hillside dry woodland is what Beard (1949) calls "dry scrub-woodlands", listing for its composition 39 species of woody plants, what Brown (1989) calls "dry forest", what Nicolson (1993) calls, in Dominica, "dry scrub woodland", and what Lindsay & Horwith (1995), in writing of Antigua, characterize as "Dry Evergreen Formation-Mixed Woodland". It is, they say, and just as accurately of the SEP as Antigua, "dense, fairly impenetrable thickets with at least 75% ground covering of woody species. No species dominates". Dry forest on the SEP has a continuous tree cover of a single story at least 4 m (13 ft) or more in height. Prime sites of this woodland, everywhere in retreat, are St. Anthony's Peak and its adjoining hills; hills above Great Salt Pond on the Shitten Bay side of the peninsula to Nag's Head; Salt Pond Hill, especially its western face; Mt. St. Michael; and the western side of Sir Timothy Hill. Only the last site has not been examined.

"Barren" is Beard's adjective for a landscape rich in woody plants (54 species identified for this study), no doubt a justifiable response to the disappointment of a landscape more and more lost to *Panicum maximum*. "I suspect a lot of these islands were wetter previously than they are now, and that species were found there that no longer can survive. In most cases, I think the change took place in the 18th and 19th centuries, and resulted from the cultivation of sugar. This caused the deforestation of the islands, which in turn reduced their capacities to retain the water that does fall. If this was a factor on St. Kitts, it may easily have also had the effect of drying up the peninsula, which along with increased disturbance could be responsible for the loss of species" (Taylor 1995).

Location and Characteristics of Hillside Woodland Sites

Site 2 (a): Cockleshell Bay Hill

This hill (162 m/ 531 ft high) faces The Narrows at Cockleshell Bay, and is the eastern side of Rupert's Hill. At the base of the hill, a grassland borders the dirt road to Turtle Beach (known officially as Mosquito Bay). The grassland, which extends far up the hill, clearly suggesting that the dry woodland is relictual, is dotted with *Acacia tortuosa*, and coves of *Cordia obliqua*. At 108 m (354 ft) elevation the grass gives way to the woodland. Trees, bunched together, occupy the crest of the hill,

then, wherever there are infoldings, no matter how shallow, or how narrow, the venturesome trees reach further down the hill.

Of eighteen species of woody plants at this site, three are 9.0 m (30 ft) or more in height, three are 6.1 m (20 ft) or more in height, and four range between 3.0 m (10 ft) and 6.1 m (20 ft) tall. Shrubs and trees are slender, close together, and interlacing, forming a tangle of stems and branches. There is a "gradient of decreasing leaf persistence", underlying the "mixed" character of the woodland: trees and shrubs with persistent, evergreen leaves; semi-deciduous species with leaves persistent through less severe dry seasons but not more severe ones; and deciduous trees and shrubs. By a slight majority, most of the woody plants are evergreen, five are semi-deciduous, and three are deciduous. *Bursera simaruba* and *Thespesia manicinella*, while represented at this site, were uncommon. *Acacia tortuosa* was represented in the entire area by only one specimen; and no species is dominant.

Table 7: Species composition of the woody plant association at Cockleshell Bay Hill. t = tree; st = small tree; s = shrub

Species	Habit	Height (m)	Deciduous/ Evergreen
<i>Acacia tortuosa</i>	t	9.1	deciduous
<i>Amyris elemifera</i> L.	st	3.0	semi-deciduous
<i>Bourreria succulenta</i>	t	10.6	evergreen
<i>Bursera simaruba</i>	t	3.2	deciduous
<i>Chamaesyce articulata</i>	s	4.6	semi-deciduous
<i>Coccoloba diversifolia</i> Jacq.	s	4.6	evergreen
<i>Comocladia dodonaea</i> (L.) Urban	s	1.5	deciduous
<i>Croton astroites</i>	s	1.5	semi-deciduous
<i>Erythroxylum areolatum</i> L.	s	0.5	evergreen
<i>Erythroxylum havanense</i>	s	2.1	evergreen
<i>Eugenia ligustrina</i>	s	1.5	semi-deciduous
<i>Gymnanthes lucida</i> Sw.	s	3.3	evergreen
<i>Jacquinia armillaris</i>	t	1.8	evergreen
<i>Pedilanthus tithymaloides</i>	s	0.9	evergreen
<i>Randia aculeata</i>	s	1.2	evergreen
<i>Samyda dodecandra</i>	t	4.6	semi-deciduous
<i>Thespesia populnea</i>	t	6.1	deciduous
<i>Ziziphus reticulata</i>	t	8.5	evergreen

Site 2 (b): Salt Pond Hill

Brown (1989) classifies Salt Pond Hill (268 m/879 ft) as both dry forest and thorn scrub. Vegetation of Salt Pond Hill is similar to the Cockleshell Bay site, but there are fewer trees, and the trees are smaller. At Salt Pond Hill, occur species more characteristic of windswept hill woodland, for instance *Wedelia calycina*, *Stigmaphyllon* sp., and *Krameria ixine*, which occurs in isolated patches of ground cleared for a track through the woodland. Some intergradation of scrubland with hillside dry forest is suggested by presence of *Conocarpus erectus* L. and *Spermacoce bahamensis*.

Table 8: Species composition of the woody plant associations at Salt Pond Hill. v = vine; t = tree; st = shrub/tree; s = shrub; ps = prostrate

Species	Habit	Height	Deciduous	Thorns	Abundance
<i>Acacia tortuosa</i>	t	1.5	evergreen	yes	rare
<i>Capparis cynophallophora</i>	t	1.5-3.0	evergreen	no	some
<i>Chamaesyce articulata</i>	s	0.9-1.5	deciduous	no	some
<i>Coccoloba diversifolia</i>	s-t	0.9-1.5	semi-decid.	no	some
<i>Conocarpus erectus</i>	s-t	1.2-2.7	semi-decid.	no	some
<i>Croton astroites</i>	s	1.2-1.8	semi-decid.	no	common
<i>Erythroxylum havanense</i>	t	2.1-3.0	evergreen	no	common
<i>Eugenia ligustrina</i>	s	1.5-1.8	semi-decid.	no	some
<i>Gymnanthes lucida</i>	t	1.5-3.0	semi-decid.	no	few
<i>Jacquinia armillaris</i>	t	1.5-2.1	evergreen	no	few
<i>Krameria ixine</i>	s	0.2	semi-decid.	no	some
<i>Pedilanthus tithymaloides</i>	s	0.9-1.2	evergreen	no	common
<i>Randia aculeata</i>	t	1.2-6.0	deciduous	yes	few
<i>Spermacoce bahamensis</i>	ps	0.2	deciduous	no	common
<i>Stigmaphyllon diversifolium</i> (Kunth) A. Juss.	v	0.2-1.5	evergreen	no	common
<i>Tabebuia heterophylla</i>	t	3.7	deciduous	no	some-few
<i>Thespesia populnea</i>	t	3.7	deciduous	no	some-few
<i>Wedelia calycina</i>	s	0.9-1.8	semi-decid.	no	common
<i>Ziziphus reticulata</i>	t	1.5-4.5	evergreen	yes	some

Summary of Table 8: nineteen species of woody vegetation are distributed by habit as follows:

v	t	st	s	ps
1	9	2	6	2

Site 2 (c): Rupert's Hill

Rupert's Hill (107 m/351 ft) is wooded from top to bottom, faces west-northwest, and is shaded each morning during the early hours of the day. No other site has so many woody species. These are not distributed equally throughout the site. Some occur only on the higher and drier slope of the hill, others only at the bottom, where it is moister and shadier, and some on both. Table 8 is arranged to show these distributions.

The tallest trees at the bottom of the hill, on a nearly flat, rock-free surface, are *Bursera simaruba*, *Piscidia carthagenensis* Jacq., *Plumeria alba* L., and *Tamarindus indica*. *Tamarindus* is tallest, estimated at 12 m (39 ft). Vines are common, not only at the bottom of the hill, where there are more species of them, but above, where they are more abundant; *Agave caribaeicola* is abundant above too. In places, there are dense and crowded nursery beds of *Agave*, and occasionally a very large - even giant - specimen. *Agave*, on the SEP, is a plant of both open windswept sites and of dry forest shade; but where the site is windswept, *Agave* is more likely to grow where the slope is uncovered by *Stigmaphyllon* or other woody vines. *Pisonia aculeata*, which grows not at all in dry upland, grows to a great size at the bottom of Rupert's Hill, where the shade of the big trees is habitually visited by cattle from the neighboring grassland. Four species of flowering plants, of which three are vines, occur at Rupert's Hill, and nowhere else in the SEP: *Cissus verticillata* (L.) Nicolson & Jarvis, *Eugenia cordata*, *Passiflora suberosa* L., and *Tragia volubilis* L.

Species common to both the slope of the hill and the bottom of the hill include: *Bursera simaruba*, *Chamaesyce articulata*, *Citharexylum spinosum*, *Erythroxylum havanense*, *Eugenia ligustrina*, *Jacquinia armillaris*, *Pedilanthus tithymaloides*, *Plumeria alba*, *Thespesia populnea*, and *Zanthoxylum spinifex* (Jacq.) DC.

Seven species occur above but not below: *Cissus verticillata*, *Comocladia dodonaea*, *Eugenia cordata*, *Passiflora suberosa*, *Rourea glabra* Kunth, *Tragia volubilis*, and *Stigmaphyllon diversifolium*. Table 9 shows the occurrence and relative abundance of woody plants on Rupert's Hill. In Table 9, the following notations are used: plants are (+) occurring but not plentifully or commonly; (++) common in their locale; (+++) abundant. All the plants occurring as abundant were either locally so or otherwise. Plants with thorns or spines are marked "yes" in the column marked "spines".

Site 2(d): Above Shitten Bay

Above Shitten Bay, woodland extends from the southwestern side of Great Salt Pond to Nag's Head, a distance of approximately 3.2 km (2 mi). The highest point, in the undulating hills above Shitten Bay, is 168 m (551 ft). Grassland dominates the vegetation in places closest to the cliffs, while hillside dry woodland is the characteristic vegetation of the steep western slopes, and most of the tableland above the slopes. Plants of the more open and lower sites include: *Acacia tortuosa*, *Agave caribaeicola*, *Capparis cynophallophora*, *Comocladia dodonea*, *Croton astroites*, *Jacquinia armillaris*, *Plumeria alba*, and *Stigmaphyllon diversifolium*. On flatter surfaces, hillside dry woodland takes on the character of *Bursera*-dominated coastal

woodland, with 80% of the trees being *Bursera simaruba* and 20% *Thespesia populnea*. The dbh of three *Bursera* trees measured were: 12.7 cm (5 in), 25 cm (10 in), 42.9 cm (19.6 in) and they were approximately 4.5-8.0 m (14.7-26.0 ft) high.

Table 9: Occurrence and abundance of woody plants on Rupert's Hill.

Species	Base	Slope	Abundance	Spines
<i>Agave caribaeicola</i>	0	+	+++	yes
<i>Amyris elemifera</i>	+	0	+	no
<i>Bourreria succulenta</i>	+	0	+	no
<i>Bursera simaruba</i>	+	+	++	no
<i>Capparis cynophallophora</i>	+	0	+	no
<i>Capparis flexuosa</i>	+	0	++	no
<i>Capparis hastata</i> Jacq.	+	0	+	no
<i>Chamaesyce articulata</i>	+	+	+	no
<i>Cissus verticillata</i>	0	+	+	no
<i>Citharexylum spinosum</i>	+	+	+	no
<i>Clerodendrum aculeatum</i>	+	0	+	yes
<i>Comocladia dodonaea</i>	0	+	++	yes
<i>Connarus grandifolius</i> Planchon	+	0	+	no
<i>Erythroxylum havanense</i>	+	+	++	no
<i>Eugenia cordata</i>	0	+	+	no
<i>Eugenia ligustrina</i>	+	+	+++	no
<i>Guettarda odorata</i> (Jacq.) Lamarck	+	0	+	no
<i>Gyminda latifolia</i>	+	0	+	no
<i>Gymnanthes lucida</i>	+	0	++	no
<i>Jacquinia armillaris</i>	+	+	+	no
<i>Krugiodendron ferreum</i>	+	0	+	no
<i>Passiflora suberosa</i>	+	-	+	no
<i>Pedilanthus tithymaloides</i>	+	+	+++	no
<i>Piscidia carthagenensis</i>	+	0	++	no
<i>Pisonia aculeata</i>	+	0	+++	yes
<i>Plumeria alba</i>	+	+	++	no
<i>Randia aculeata</i>	+	0	++	yes
<i>Rourea surinamensis</i> Miquel	0	+	+	no
<i>Samyda dodecandra</i>	+	0	++	no
<i>Stigmaphyllon diversifolium</i>	0	+	+++	no
<i>Tamarindus indica</i>	+	0	+	no
<i>Thespesia populnea</i>	+	+	+++	no
<i>Tragia volubilis</i>	+	0	++	yes
<i>Zanthoxylum spinifex</i>	+	+	++	yes
<i>Ziziphus reticulata</i>	+	0	++	yes

On the southern side of the *Bursera*-dominated portion of the woodland, occurs the principal association of vegetation above Shitten Bay. It is hillside dry forest, tall shrubs, and small trees, ranging in height from 1.5 to 4.6 m (5.0 to 16.0 ft). The herbaceous story is sparse, and the only low shrub is *Pedilanthus tithymaloides*. Particular to this association are: *Agave caribaeicola*, *Amyris elemifera*, *Capparis cynophallophora*, *Capparis flexuosa*, *Chamaesyce articulata* (abundant), *Coccoloba swartzii* Meisner, *Erythroxylum havanense*, *Krugiodendron ferreum*, *Piscidia carthagenensis*, *Randia aculeata*, *Samyda dodecandra*, *Schoepfia schreberi* J. Gmelin, and *Ziziphus reticulata*.

Site 2(e): Scotch Bonnet

Scotch Bonnet is an oval knob of land forming a junction with the beach of Mosquito Bay on one side and the beach of Cockleshell Bay on the other. It is 86 m (282 ft) high, partly wooded, less so than formerly, its main vegetation being grassland, with *Acacia tortuosa*, *Agave caribaeicola*, *Croton astroites*, and *Randia aculeata*. Brown (1989) shows Scotch Bonnet on his map as a dry forest site of special interest, but our survey indicates it is a fragment of woodland, and that the variety of woody species is less than at any of the other sites. Species are: *Agave caribaeicola*, *Bursera simaruba*, *Capparis baducca* L., *Capparis cynophallophora*, *Croton astroites*, *Citharexylum spinosum*, *Erythroxylum havanense*, *Eugenia ligustrina*, *Samyda dodecandra*, and *Thespesia populnea*.

Part 6

GHUT WOODLAND

There are fewer ghuts on the SEP than on the main landmass of St. Kitts. Many are deep and wide; breadfruit and mango grow in them near settlements. On the SEP, the vegetation they nourish is much the same as the vegetation of the hillside dry woodlands. The ghut is a habitat of greater moisture and of deeper and richer soil than the land adjoining it. Lindsay & Horwith (1995) recognize this in their designation: "Moist Forest Formation - Stream and Ghaut". Dry most of the year, ghuts become raging torrents of water transporting sediment, rock, gravel, and refuse when the pounding rains of tropical cyclones pummel the island.

In the three ghut woodland sites studied, *Ficus citrifolia* was found in two; found lower in the ghut, where soil and leaf litter is deepest, and runoff waters are held longest. One plant of *Ficus citrifolia* was found in the *Bursera*-dominated coastal woodland back of Sand Bank Bay. In all cases *Ficus citrifolia* trees are solitary individuals.

The deepest and longest ghut drains St. Anthony's Peak into the Great Salt Pond. At Canoe Bay, the ghut drains into the Atlantic Ocean, is of short length, cuts through the vegetation of a backdune thicket, and is on a surface that is nearly flat and boulder-free. The ghut on the eastern side of Sir Timothy Hill empties into Friar's Bay Salt

Pond, is on a steep slope, of short length, and with large boulders. On St. Anthony Peak, the ghut, while wider and deeper than others, is not therefore more richly diversified in its woody plant composition.

Site 3(a): Canoe Bay

There is no path or road to Canoe Bay. From the highway, the bay, with its narrow crescent beach, glistens in the sun, and faces Atlantic waves in splendid solitude. Descent from the highway, over the steep convex surface of a rocky windswept slope, on which woody plants are exceptionally short, or stunted, starts at 107 m (351 ft) above sea-level. *Spermacoce bahamensis*, a sub-shrub species, is abundant. Other species of the slope are *Coccoloba uvifera*, *Krameria ixine*, *Randia aculeata*, *Stigmaphyllon diversifolium*, *Tabebuia heterophylla*, and *Wedelia calycina*; not one is taller than 0.9 m (2.9 ft) high. Lower on the slope, and closer to the sea-spray, the ground is more sparsely vegetated, *Spermacoce* disappears, and *Melocactus intortus* becomes common.

In the ghut itself, *Capparis flexuosa* is 2.1 m (7 ft), *Coccoloba uvifera* is 3.0-4.6 m (11-15 ft), and *Tabebuia heterophylla* is 2.1-2.4 m (7-8 ft) tall. The low shrub, *Pedilanthus tithymaloides*, is the only species in its strata. As in all the woodlands of the SEP, herbaceous species are scarce. Large individuals of three trees grow in the middle of the ghut: *Ficus citrifolia*, *Hippomane mancinella*, and *Thespesia populnea*. *Pisonia aculeata*, the spiny vine, is common. *Dalbergia ecastaphyllum*, not previously recorded from St. Kitts, grows in association with *Coccoloba uvifera*. In the ghut of Canoe Bay *Dalbergia* grows in the shade and is uncommon; it grows more abundantly in full sunlight, for instance, in the dunal thicket at North Frigate Bay. *Panicum maximum* mixed with *Caesalpinia bonduc*, *Melochia tomentosa* L., and *Randia aculeata* thrive in the open spaces on the far side of the ghut.

Site 3(b): Sir Timothy Hill

Of all the ghuts on the SEP, this, on the eastern face of Sir Timothy Hill - studied for the flora of Friar's Bay (Meagher 1996b) - is the most attractive to the aesthetic sensibility. On a steep slope, it has collected, in their passage down it, big boulders. On both sides is dry open grassland. Species not seen in other ghuts are underlined in the species list following. There are no dominants, but the tallest tree is *Bursera simaruba* (7.6 m/25 ft), which grows in association with *Piscidia carthagenensis*, and *Plumeria alba*.

Species Composition of Sir Timothy Hill

Trees: *Bursera simaruba*, *Hippomane mancinella*, *Piscidia carthagenensis*, *Plumeria alba*, *Randia aculeata*, and *Thespesia populnea*. Small Tree: *Cordia obliqua*. Shrubs/Small Trees: *Bourreria succulenta*, *Capparis cynophallophora*, *Erithalis fruticosa*, *Erythroxylum havanense*, *Eugenia ligustrina*, *Gymnanthes lucida*. Shrubs: *Chamaesyce articulata*, *Citharexylum spinosum*, *Clerodendrum aculeata*, *Croton astroites*, *Pedilanthus tithymaloides*, and *Solanum racemosum*. Vines: *Celtis*



Close view of the vegetation of Rupert's Hill. *Bursaria simaruba*, without its leaves, in the lower right foreground.







Rupert's Hill from a distance.

iguanaea, *Pisonia aculeata*, and *Rauvolfia viridis* Willd. ex Roem. & Schult. Acaulescent Herb: *Agave caribaeicola*. As in other ghuts, the herbaceous strata is sparsely vegetated; but *Commelina diffusa* is common.

Site 3(c): St. Anthony's Peak

The tallest mountain on the SEP, St. Anthony's Peak, is drier than the Canada Hills, which form the northern limit of the SEP, and are lower in altitude than the peak. Fern species grow abundantly in the Canada Hills, but none grow on St. Anthony's Peak. The slopes of the peak are principally hillside dry woodland (not thorn scrub as indicated on Brown's map). Although the ghut is the longest and widest on the SEP, for most of its length the vegetation in the ghut is the same as that beside it. But between 25 and 35 m (82-115 ft) elevation the ghut is wider and deeper, as deep as 2.2 m (7.2 ft), more moist, and the site of the only *Ficus citrifolia* in the ghut. Also growing here are *Capparis baducca*, *Capparis cynophallophora*, *Chamaesyce articulata*, and *Eugenia ligustrina*. And on the side of the ghut, a little further above the site of the *Ficus*, is a marijuana patch.

The woody species of the land immediately adjoining the ghut are: *Amyris elemifera*, *Gymnanthes lucida*, *Krugiodendron ferreum*, *Pedilanthus tithymaloides*, *Piscidia carthagenensis*, *Samyda dodecandra*, *Stigmaphyllon diversifolium*, *Zanthoxylum spinifex*, and *Ziziphus reticulata*. Less common, but frequent to occasional, is *Agave caribaeicola*. As at other such sites, there are few herbaceous species, *Commelina diffusa* being the most common; *Rivina humilis* is also present. At 20 m (98 ft), and leading on to the grassland that descends from that height to the highway near the Great Salt Pond, are wide patches of *Bursera simaruba* and *Thespesia populnea*, with *Croton astroites*, *Erythroxylum areolatum*, and *Gliciridia sepium*.

Part 7

WINDSWEPT HILLS

"Scrub", as we have seen, is often shorthand for a variety of vegetation sites no one of which is a forest or a grassland. Bushy roadside places, both *Croton* and *Leucaena* thickets, "mixed cactus scrub", disturbed places near sites of construction, verges, and the edges of salt ponds, all are "scrub" sites. The reputation of scrub for thorniness often depends on one or two members of the Fabaceae, *Acacia* and *Prosopis*. *Prosopis* has not been found in the SEP. *Acacia* is present throughout wherever ground has been disturbed, but it is almost never a component of windswept hillside scrubland.

Such scrubland, facing the full blast of the trade winds on steep slopes above the Atlantic Ocean, has no weedy species; shrubs grow less closely together than in thickets and lowland "scrub" sites, with the useful result, for the walker, that there is no tangle and snare of shrubbery; unlike hillside dry forest sites, there is no

groundcover of woody vines. Rocks and boulders are lichen-covered. There are more tree species than in other kinds of scrub site; and trees are stunted. Above Canoe Bay, there is an aged specimen of *Randia aculeata* less than 30 cm (1 ft) tall. As well as stunted, woody plants in this habitat are often wind-pruned and shaped into "hedges". One author cites these hedges as a characteristic of littoral woodland (Nicolson 1991). Of a wind-pruned tree, the best example is a *Thespesia* on windswept scrubland west of Sand Bank Bay. On this same hill, where there is a shaly outcrop, *Tetramicra canaliculata* is growing. All the branches and the main trunk of the *Thespesia* are bent parallel to the ground, compacted in roughly parallel lines, and no higher than 1.4 m (4.6 ft).

In this section of the paper, we report on three scrub sites: a hill above Canoe Bay (Canoe Bay Hill), a hill above Turtle Bay (Turtle Bay Hill), and Mt. St. Michael. Canoe Bay Hill is closest to the sea, and has the least cover of vegetation. Mt. St. Michael is farthest from the sea and faces the setting more than the rising sun. There is no groundcover of *Stigmaphyllon* at the first, some at the second, and almost a continuous cover of it at the third site. Prostrate plants, such as *Spermacoce bahamensis*, are most numerous at Canoe Bay Hill. At all sites, the ground is rocky, the soil shallow, and there is very little accumulation of leaf litter.

Site 4(a): Canoe Bay Hill

On this hill, which descends in a NNE direction from the Dr. Kennedy A. Simmonds Highway, low and prostrate woody plant life includes *Heliotropium ternatum*, *Spermacoce bahamensis*, *Spermacoce verticillata* L., *Stachytarpheta jamaicensis*, and *Stigmaphyllon emarginatum*. *Bursera simaruba*, *Jacquinia armillaris*, and *Plumeria alba* - trees of the hillside dry woodlands - are absent from the site, while more xeric species, notably *Melocactus intortus*, are present, and in localities alone. There are more herbaceous species, and there is less cover, than on either of the two following sites of the windswept hill scrubland: *Bulbostylis capillaris* (L.) Kunth ex C.B. Clarke, *Eragrostis* sp., and *Heteropogon contortus* (L.) Beauv. ex Roem. & Schult. were all abundant high on the hill. Half way down the hill, bushy plants become taller, and representative individuals more numerous, as a result of which the vegetation becomes a "thicket", and more difficult to penetrate.

Species Composition of the Windswept Scrub Vegetation on Canoe Bay Hill.

Trees: *Comocladia dodonaea*, *Erithalis fruticosa*, *Jacquinia armillaris* (only one individual), *Randia aculeata*, *Tabebuia heterophylla*, and *Thespesia populnea*. Shrubs: *Chamaecrista glandulosa* var. *swartzii*, *Coccoloba diversifolia*, *Coccoloba uvifera*, *Croton astroites*, *Erythroxylum havanense*, *Lantana involucrata*, *Solanum racemosum*, and *Wedelia calycina*. Climbing Shrub: *Urechites lutea*. Vine: *Metastelma grisebachianum* Schltr. in Urban.

Site 4(b): Turtle Bay Hill

On the steep and rocky hill above Turtle Bay, where soil is generally hard and dry, except that when it is wet it is slick and clayey, the sparse vegetation, in which no

species is dominant, faces directly into the trade winds. Thorniness is not generally an attribute of the plants here: *Acacia* is the least common of all species in the association. Grass is not abundant; but at the crest of the hill, habitat changes from windswept hill to grassland. Shrubs make up 69% of the woody species. Trees of any kind are infrequent, and the tallest (a single individual of *Jacquinia armillaris*), is 3 m (9.8 ft).

Table 10: Species composition of the woody plant associations at Turtle Bay Hill. habit: s = shrub; st = small tree; t = tree. relative height: L = low; M = medium; T = tall. 3 = height in 5 specimens; nm = not measured. 4 = Y(es) or N(o) to question: Is it spiny, thorny, or armed with prickles? 5 = Y(es) or N(o) to question: Are the blades coriaceous? 6 = Y(es) or N(o) to question: Is species common component of SEP dry forest sites?

Species	habit	height	3	4	5	6
<i>Acacia tortuosa</i>	s	L	1.2	Y	N	N
<i>Capparis flexuosa</i>	s	M	nm	N	Y	Y
<i>Chamaecrista glandulosa</i> var. <i>swartzii</i>	s	L	0.3	N	N	N
<i>Coccoloba diversifolia</i>	s/t	M	nm	N	Y	N
<i>Croton astroites</i>	s	M	0.6	N	N	N
<i>Erithalis fruticosa</i>	s/t	M	nm	N	Y	Y
<i>Jacquinia armillaris</i>	t	T	1.5	N	Y	Y
<i>Krameria ixine</i>	s	L	3.4	N	N	N
<i>Pedilanthus tithymaloides</i>	s	L/M	nm	N	N	Y
<i>Randia aculeata</i>	s/t	M	0.9	Y	N	Y
<i>Spermacoce bahamensis</i>	s	L	3.4	N	N	N
<i>Tabebuia heterophylla</i>	t	M	nm	N	N	Y
<i>Thespesia populnea</i>	t	T	nm	N	N	Y

Site 4(c): Mt. St. Michael

Mt. St. Michael is a perfectly formed cone-shaped hill on the eastern side of Friar's Bay Salt Pond. It is the first hill one sees on surmounting Sir Timothy Hill from Frigate Bay. It is more densely wooded than any other hill in the SEP. The hill facing the Atlantic tends more to a vegetation of windswept slopes, while that toward the Caribbean more to hillside dry woodland in which *Bursera* is dominant.

Species Composition of Mt. St. Michael

Trees: *Bursera simaruba* and *Plumeria alba*. Small Trees: *Bourreria succulenta*, *Capparis cynophallophora*, *Coccoloba diversifolia*, *Randia aculeata*, and *Tabebuia heterophylla*. Shrubs: *Capparis flexuosa*, *Cassine xylocarpa* Vent., *Chamaecrista obcordata* (Wikström) Britton, *Clerodendrum aculeatum*, *Croton astroites*, *Erithalis fruticosa*, *Galactia dubia* DC, *Jatropha gossypifolia*, *Lantana involucrata*, and *Melochia tomentosa*. Low to Prostrate Shrub: *Spermacoce bahamensis*. Vines:

Galactia dubia and *Stigmaphyllon diversifolium*. Woody Herb: *Stachytarpheta jamaicensis*. Acaulescent Herb: *Agave caribaeicola*.

Part 8

CHECKLIST OF WOODY PLANTS

From the dry-lands of the SEP are recorded in the following Checklist 59 species in 53 genera of 30 families of woody plants; 5 species from the families Agavaceae and Cactaceae; and 4 species from Cyperaceae, Orchidaceae, and Poaceae. In total, there are 68 species of flowering plants, from 59 genera, and 35 families.

Formations ("habitats", "associations", "communities") are indicated by the following abbreviations: Coastal (*Bursera*-dominated coastal woodland); Dry (hillside dry woodland); Ghut; Wind (windswept hillside scrubland).

Of the four habitats, the richest in species of woody plants is the hillside dry woodland (13). Of species, three occur in all four habitats: *Capparis cynophallophora*, *Randia aculeata*, and *Thespesia populnea*.

Numbers in columns indicate the number of sites at which a given species has been located for each site. The number of sites possible per formation are: 2, 5, 3, 3. A profile of *Bursera simaruba*, for example would be: 4, 2, 1, 0, indicating that *Bursera* dominates the first habitat, is a common component of the second, is an occasional in the third, and is absent from the last.

Woody plant sites of the SEP are populated by trees and shrubs less than 10 m (33 ft) high. There is no site with species predominantly spinescent, but there are thorny species in both "dry" and "ghut". These two sites, "coastal" and "wind", are usually lumped together under the heading "littoral woodland", but on the SEP, as we have seen, they are sufficiently different to merit the separate treatment they have been given.

Families with the largest number of species (five each) are Euphorbiaceae, Fabaceae, and Rubiaceae. In some cases, a species may occur as a shrub (s) or a small tree (st), and this is notated 's/st'.

Checklist of the Mainly Woody Flora of the Southeast Peninsula South of Frigate Bay. Coastal (*Bursera*-dominated coastal woodland); Dry (hillside dry woodland); Ghut; Wind (windswept hillside scrubland).

Species	Coastal	Dry	Ghut	Wind	Habit
Agavaceae					
<i>Agave caribaeicola</i> Trel.	0	3	1	0	acaulescent herb

Species	Coastal	Dry	Ghut	Wind	Habit
Anacardiaceae					
<i>Comocladia dodonaea</i> (L.) Urban	0	3	0	1	small tree
Apocynaceae					
<i>Plumeria alba</i> L.	0	1	1	2	tree
<i>Urechites lutea</i> (L.) Britton	0	0	0	1	woody climber
Asclepiadaceae					
<i>Metastelma grisebachianum</i> Schltr. in Urban	0	0	0	1	vine
Asteraceae					
<i>Wedelia calycina</i> Rich.	0	2	0	3	shrub
Bignoniaceae					
<i>Tabebuia heterophylla</i> (DC.) Britton	1	1	0	2	small tree
Boraginaceae					
<i>Bouyeria succulenta</i> Jacq.	0	2	1	2	s/st
<i>Cordia obliqua</i> Willd.	0	0	1	0	arborescent shrub
Burseraceae					
<i>Bursera simaruba</i> (L.) Sarg.	4	2	1	0	tree
Cactaceae					
<i>Melocactus intortus</i> (Miller) Urban	0	0	0	2	woody herb
<i>Opuntia dillenii</i> (Ker Gawler) Haw	0	1	0	0	woody herb
<i>Opuntia rubescens</i> Salm-Dyck. ex Forest	0	0	1	0	woody herb
<i>Pilosocereus royeri</i> (L.) Byles & G. Rowley	1	0	0	1	tree
Capparaceae					
<i>Capparis baducca</i> L.	0	1	0	0	shrub
<i>Capparis cynophallophora</i> L.	1	2	2	1	small tree
<i>Capparis flexuosa</i> (L.) L.	1	0	1	1	scrambling shrub
<i>Capparis hastata</i> Jacq.	0	1	0	0	shrub
Combretaceae					
<i>Conocarpus erectus</i> L.	0	1	0	0	shrub/tree
Connaraceae					
<i>Connarus grandifolius</i> Planchon	0	1	0	0	vine
<i>Rourea surinamensis</i> Miquel	0	0	1	0	vine
Cyperaceae					
<i>Bulbostylis capillaris</i> (L.) Kunth ex C.B. Clarke	0	0	0	1	herb

Species	Coastal	Dry	Ghut	Wind	Habit
Erythroxylaceae					
<i>Erythroxylum areolatum</i> L.	0	2	3	1	shrub
<i>Erythroxylum havanense</i> Jacq.	0	1	0	0	shrub/tree
Euphorbiaceae					
<i>Chamaesyce articulata</i> (Aubl.) Britton	0	3	1	0	shrub
<i>Croton astroites</i> Dryander	0	2	1	2	shrub
<i>Gymnanthes lucida</i> Sw.	1	3	0	0	shrub/tree
<i>Hippomane mancinella</i> L.	2	0	1	0	tree
<i>Pedilanthus tithymaloides</i> (L.) Poit.	1	3	1	0	shrub
Fabaceae					
<i>Acacia tortuosa</i> (L.) Willd.	0	1	0	1	small tree
<i>Chamaecrista glandulosa</i> (L.) Greene var. <i>swartzii</i> (Wikström) Irwin & Barneby	0	0	0	1	shrub
<i>Dalbergia ecastaphyllum</i> (L.) Taubert	0	0	1	0	shrubby vine
<i>Gliciridia sepium</i> (Jacq.) Kunth ex Walp.	1	0	0	0	tree
<i>Piscidia carthagenensis</i> Jacq.	0	2	1	0	tree
<i>Tamarindus indica</i> L.	0	1	0	0	tree
Flacourtiaceae					
<i>Samyda dodecandra</i> Jacq.	1	2	0	0	small tree
Krameriaceae					
<i>Krameria ixine</i> L.	0	1	0	1	shrub
Malpighiaceae					
<i>Stigmaphyllon diversifolium</i> (Kunth) Adr. Juss.	0	2	0	4	vine
<i>Stigmaphyllon emarginatum</i> (Cav.) Adr. Juss.	0	1	0	0	vine
Malvaceae					
<i>Thespesia populnea</i> (L.) Sol. ex Corr. Serr.	2	1	1	2	tree
Moraceae					
<i>Ficus citrifolia</i> Miller	0	0	1	0	tree
Myrtaceae					
<i>Eugenia cordata</i> (Sw.) DC.	0	1	0	0	shrub
<i>Eugenia ligustrina</i> (Sw.) Willd.	1	3	1	0	s/st
Nyctaginaceae					
<i>Pisonia aculeata</i> L.	2	2	1	0	vine
Olcaceae					
<i>Schoepfia schreberi</i> J. Gmelin	0	1	0	0	shrub

Species	Coastal	Dry	Ghut	Wind	Habit
Orchidaceae					
<i>Tetramicra canaliculata</i> (Aubl.) Urb.	0	0	0	0	herb
Passifloraceae					
<i>Passiflora suberosa</i> L.	0	1	0	0	vine
Poaceae					
<i>Eragrostis</i> sp.	-	-	-	-	-
<i>Heteropogon contortus</i> (L.) Beauv. ex Roem. & Schult.	0	0	0	1	herb
Polygonaceae					
<i>Coccoloba diversifolia</i> Jacq.	0	1	0	1	s/t
<i>Coccoloba swartzii</i> Meisner	0	1	0	0	tree
<i>Coccoloba uvifera</i> (L.) L.	0	0	1	1	s/t
Rhamnaceae					
<i>Krugiodendron ferreum</i> (M. Vahl) Urban	0	2	0	0	small tree
<i>Ziziphus reticulata</i> (M. Vahl) DC.	2	3	0	0	s/st
Rubiaceae					
<i>Eriihalis fruticosa</i> L.	0	0	1	2	s/st
<i>Guettarda odorata</i> (Jacq.) Lamarck	0	2	0	0	shrub
<i>Randia aculeata</i> L.	1	2	1	2	s/t
<i>Spermacoce bahamensis</i> (Britton) Howard	0	1	0	3	sub-shrub
<i>Spermacoce verticillata</i> L.	0	0	0	2	woody herb
Rutaceae					
<i>Amyris elemifera</i> L.	0	2	0	0	s/st
<i>Zanthoxylum punctatum</i> Vahl in West	0	1	0	0	s/st
<i>Zanthoxylum spinifex</i> (Jacq.) DC.	0	2	0	0	s/st
Sapindaceae					
<i>Melicococcus bijugatus</i> Jacq.	1	0	0	0	small tree
Solanaceae					
<i>Solanum racemosum</i> Jacq.	0	0	1	0	shrub
Verbenaceae					
<i>Citharexylum spinosum</i> L.	1	2	1	0	shrub
<i>Clerodendrum aculeatum</i> (L.) Schlectendal	0	0	1	0	shrub
<i>Stachytarpheta jamaicensis</i> (L.) Vahl	0	1	0	1	woody herb
Vitaceae					
<i>Cissus verticillata</i> (L.) Nicolson & Jarvis	0	1	0	0	vine

APPENDIX

Of the woody plants collected in a variety of dry-land habitats on the SEP for this study, twelve species have not been seen in a voucher specimen by R.A. Howard for *The Flora of the Lesser Antilles* (1988, 1989a, 1989b). These are: *Amyris elemifera* (St. Anthony's Peak) 16/29/03/95; *Cissus verticillata* (Rupert's Hill) 21/13/02/95; *Eugenia cordata* var. *cordata* (Rupert's Hill) 11/04/30/95; *Melicoccus bijugatus* (Major's Bay) 04/14/02/95; *Metastelma grisebachianum* (Major's Bay) 23/04/30/95; *Pisonia subcordata* Sw. (Major's Bay) 05/26/03/95; *Rourea surinamensis* (Rupert's Hill) 08/30/03/95; *Sida urens* L. (Major's Bay) 24/04/30/95; *Waltheria indica* L. (Shitten Bay) 10/11/03/95; *Zanthoxylum spinifex* (St. Anthony's Peak) 05/04/05/95.

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A RECONSIDERATION OF THE GENUS *PROSTHECHEA* (ORCHIDACEAE)

Wesley E. Higgins

Department of Environmental Horticulture, University of Florida, P.O. Box 110670,
Gainesville, Florida 32611-0670 U.S.A.

ABSTRACT

The genus *Encyclia* is currently divided into three subgenera: *Encyclia* subgenus *Osmophytum*, *Encyclia* subgenus *Encyclia*, and *Encyclia* subgenus *Dinema*. A parsimony based cladistic analysis of the morphological characteristics of the subgenera and two outgroup genera was performed. The morphology of the subgenera supports a new generic delimitation. *Encyclia* subgenus *Osmophytum* is raised to generic level and treated as *Prosthechea*.

KEY WORDS: *Anacheilium*, *Epithecia*, *Encyclia*, *Hormidium*, *Prosthechea*, Orchidaceae, systematics, classification, taxonomy

The previous taxonomic treatments of *Prosthechea* are a complex succession of invalid and misapplied nomenclature involving the following seven generic names: *Epidendrum* L. (1763), *Encyclia* Hook. (1828), *Dichaea* Lindl. (1833), *Prosthechea* Knowles & Westc. (1838), *Epithecia* Knowles & Westc. (1839), *Hormidium* Lindl. ex Heynhold (1841), and *Anacheilium* Hoffmanns. (1842). This classical case of nomenclatural confusion has resulted in a problematic taxonomic classification of the overlooked genus *Prosthechea*.

When Swartz described the taxon *Epidendrum glaucum* Sw. in 1788 he placed it in *Epidendrum* sensu Linnaeus. Lindley transferred the taxon to *Dichaea glauca* (Sw.) Lindl. in 1833, thus establishing the genus *Dichaea*. Rudolf Schlechter (1914-15) transferred 20 *Dichaea* taxa to *Epithecia*, an invalid name for a different taxon. Schlechter listed *Dichaea glauca* (Sw.) Lindl. as a synonym for *Epithecia glauca* of Knowles & Westcott. This was incorrect because the genus *Dichaea* was based on *Epidendrum glaucum* Sw. not *Epidendrum glaucum* (Knowles & Westc.) Lindl. Schlechter's treatment must be rejected not only because *Epithecia* is a superfluous name, but also because all of the species placed in *Epithecia* by Schlechter are now members of the Maxillarieae, not the Epidendreae, i.e., *Epithecia* as circumscribed by Schlechter is polyphyletic. Schlechter was probably confused by Lindley's treatment of *Epidendrum glaucum* (Knowles & Westc.) Lindley not *Epidendrum glaucum* of Swartz.

Hooker described the genus *Encyclia* based on *Encyclia viridiflora* in 1828. Subsequently, Lindley sunk the genus into *Epidendrum* subgenus *Encyclium* in 1852. *Encyclia* was unused until Schlechter (1914) revived it. Other taxonomist then started placing various taxa in the genus. Lemée (1955) inexplicably transferred five taxa from *Epidendrum* subg. *Aulizeum* Lindl. to *Encyclia*, enlarging the circumscription of *Encyclia* by Schlechter. However, it was not until 1961 that Dressler circumscribed *Encyclia* describing two sections, sect. *Encyclia* and sect. *Osmophytum*. Subsequently, Dressler (1971) revised the genus to include six sections and three subgenera of *Encyclia*. Pabst, Moutinho, & Pinto (1981) transferred two taxa in *Encyclia* sect. *Hormidium* Dressler to *Hormidium* raising the group to generic level and placing the taxa in *Encyclia* section *Euchile* into *Hormidium* Lindl. ex Heynh. Pabst, Moutinho, & Pinto (1981) transferred the taxa in *Encyclia* section *Osmophytum* to *Anacheilium*. I agree with Dressler that *Encyclia* sections *Osmophytum* and *Hormidium* are not sharply differentiated (Dressler 1970). Pabst was correct in his removal of *Encyclia* subgenus *Osmophytum* from *Encyclia*, but splitting the clade into two genera is unjustified.

After the description of *Hormidium uniflorum* (Lindl.) Heynh. in 1841, the generic name was unused until it was revived by Cogniaux (1898). Schlechter & Brieger had already began transferring plants into the genus when Pabst, Moutinho, & Pinto (1981) presented their revision of *Hormidium*. Although the genus *Hormidium* Lindl. ex Heynh. is validly published (Brieger & Hunt 1969), this group of over 100 species, treated as *Hormidium* by Brieger, includes *Prosthechea glauca* and the generic name *Prosthechea* has priority.

Following the publication of *Anacheilium cochleatum* (L.) Hoffmanns (1842), the generic name had only been used for one other taxon, *A. fragrans* (Sw.) Acuña (1939), until it was applied to 22 of the species in *Encyclia* sect. *Osmophytum* by Pabst, Moutinho, & Pinto (1981). However, *Anacheilium* does not have priority for this group of taxa. This clade of 90 taxa includes *Prosthechea glauca* and the generic name *Prosthechea* has priority.

Knowles & Westcott (1838) first published the genus *Prosthechea* to include only *P. glauca*. However, the following year (1839) they changed the generic name to *Epiethecia* because they felt that *Prosthechea* was too similar to another unspecified generic name. Examination of the generic names published in *Index Kewensis* reveals the very similar previously published generic name *Prosthesia* Blume (1826) (Violation). This may be the unspecified name that induced Knowles & Westcott (1839) to change the generic name from *Prosthechea* to *Epiethecia*. Since *Prosthechea* is not a homonym of *Prosthesia*, the original publication is valid (ICBN 1994). The new name *Epiethecia* is illegitimate (*nomen illegitimum*) since the previous name had been validly published and ought to have been accepted by the authors.

Epidendrum section *Osmophytum* was described by Lindley (1839) for plants with usually scented flowers. Subsequently, Lindley (1840a) transferred *Prosthechea glauca* to *Epidendrum*, making the combination *Epidendrum glaucum* (Knowles & Westc.) Lindl. thus recognizing *Epiethecia glauca* Knowles & Westc. as a synonym and placing it in *Epidendrum* section *Osmophytum*. This combination is a *nomen illegitimum* since it is later homonym of *Epidendrum glaucum* Sw. which was transferred to *Dichaea* by Lindley himself. When Lindley (1853) published *Folia*

Orchidaceae, he placed *Epidendrum glaucum* (Knowles & Westc.) Lindl. in *Epidendrum* subgenus *Encyclium* section *Sarcochila*, and not as previously classified in *Epidendrum* subgenus *Osmophytum*. *Prosthechea glauca* was subsequently transferred to *Encyclia* as *Encyclia glauca* (Knowles & Westc.) Dressler & Pollard (1971) and assigned to *Encyclia* subgenus *Osmophytum* (Lindl.) Dressler.¹

An ongoing systematic study of the genus *Encyclia* based on holomorphology has determined that the genus is neither morphologically cohesive nor monophyletic (Higgins, unpublished). In a preliminary molecular study, analysis of the internal transcribed spacer (ITS) sequences of nuclear ribosomal DNA supports the morphological conclusion that the *Encyclia* subgenus *Osmophytum* clade should be raised to the generic level because these species are sister to the *Cattleya-Laelia* clade not to *Encyclia* subgenus *Encyclia*. However, the monophyly of the three currently recognized subgenera of *Encyclia* i.e., *Encyclia* subg. *Osmophytum*, *Encyclia* subg. *Encyclia*, and *Encyclia* subg. *Dinema*, is supported by cladistic analysis of both morphological and molecular data.

The morphological matrix was constructed using MacClade (Maddison & Maddison 1992). Parsimony analysis using PAUP (Swofford 1993) of the morphological data set places *Cattleya* as sister to *Encyclia* subgenus *Osmophytum* (= *Prosthechea*) and *Encyclia* subgenus *Dinema* as sister to that combined clade (Figure 1). The "branch and bound" analysis of a morphological matrix (Table 1) produced two equally parsimonious trees. The topology of the presented tree (Figure 1) is the same as the tree produced by Autodecay (Eriksson 1997). The *Prosthechea*—*Cattleya* clade has bootstrap support. All characters (Table 2) were analyzed as unweighted and the character states were unordered. Taxa with two character states were coded and analyzed as polymorphic.

Characters that distinguish *Prosthechea* (= *Encyclia* subg. *Osmophytum*), *Encyclia sensu stricto* (= *Encyclia* subg. *Encyclia*), and *Dinema* (= *Encyclia* subg. *Dinema*), are listed in Table 3; generic synapomorphies are indicated in boldface type.

In the interest of nomenclatural stability, the current *International Code of Botanical Nomenclature* (ICBN 1994) suggests in the preamble that names should only be changed for a compelling biological reason. The treatment of this taxon, *Prosthechea*, at the generic level will lead to a more predictive classification because the *Encyclia* subgenus *Osmophytum* group is morphologically very distinct from *Encyclia* subgenus *Encyclia*. Additionally the two taxa are not each others closest relatives and the genus *Encyclia* as currently circumscribed is not monophyletic. Because the oldest available generic name used in this clade is *Prosthechea*, this name has priority according to the ICBN. Conservation of *Anacheilium* is inappropriate because of its limited usage and previous application to only a few members of the clade. Conservation of *Epithecia* is not considered because it has not been used.

¹ NOTES: The note in *Index Kewensis* under *Epithecia* (Knowles and Westc.), listing it as equal to *Dichaea* Lindl. is incorrect, and the note under genus *Dichaea* listing *Epithecia* Knowles and Westc. as a synonym is incorrect, because the genus *Dichaea* Lindl. is based on *Epidendrum glaucum* Sw. not *P. glauca* Knowles & Westcott.

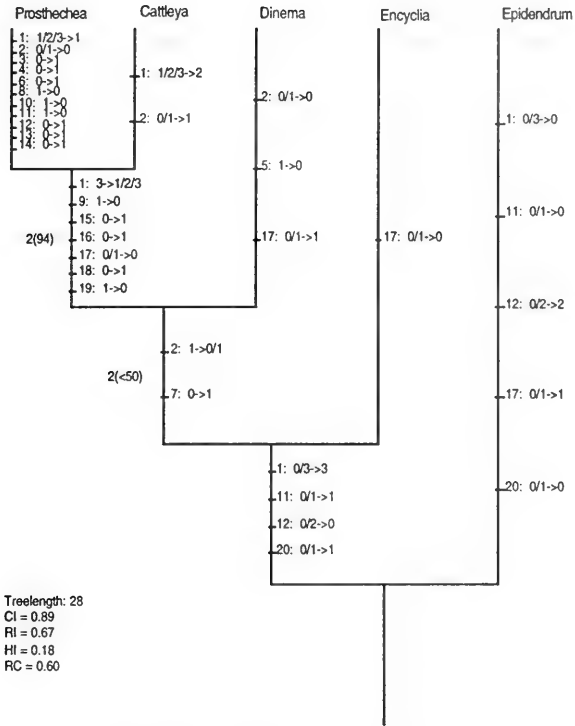


Figure 1. Selected Morphological Generic Phylogenetic Tree. The characters supporting a clade are shown on the right of the vertical line and the numbers to the left are decay (bootstrap) values.

Table 1. Morphological Matrix.

Character	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<i>Epidendrum</i>	{01}	1	{01}	0	1	0	0	1	1	1	0	2	0	0	0	0	1	0	-	0
<i>Dinema</i>	3	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	1	0	1	1
<i>Encyclia</i>	3	1	0	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	1	1
<i>Cattleya</i>	2	1	0	0	1	2	1	1	0	1	1	0	0	0	1	1	0	1	0	1
<i>Prosthechea</i>	1	0	1	1	{01}	1	1	0	0	0	0	1	1	1	1	1	0	1	0	1

Table 2. Character States.

Character	States
1. Pseudobulb	absent(0), fusiform(1), cylindrical(2), ovoid(3)
2. Leaf thickness	thick(0), thin(1)
3. Druse-type crystals	absent(0), present(1)
4. Capsule strap	absent(0), present(1)
5. Inflorescence	sessile(0), scape(1)
6. Capsule shape	ellipsoid(0), 3-winged/angled(1), 9-ribbed(2)
7. Spathe	absent(0), present(1)
8. Flower	non-resupinate(0), resupinate(1)
9. Column sinuses	shallow(0), deep(1)
10. Callus shape	pad(0), ridges(1)
11. Anther cap	not appressed(0), appressed(1)
12. Labellum fusion	basal(0), partial(1), fused(2)
13. Column shape	not gibbous(0), gibbous(1)
14. Midtooth appendage	absent(0), present(1)
15. Midtooth shape	stout(0), ligulate(1)
16. Midtooth relative size	small(0), large(1)
17. Lateral teeth shape	stout(0), petaloid(1)
18. Midtooth to lateral teeth length	shorter(0), equal(1)
19. Column wings	absent(0), present(1)
20. Rostellum	cleft(0), individed(1)

Table 3. Characters distinguishing *Prosthechea*, *Encyclia s. s.* and *Dinema* (Hooker 1841; Dressler & Pollard 1971; Pabst, Moutinho, & Pinto 1981).

	<i>Prosthechea</i>	<i>Encyclia s. s.</i>	<i>Dinema</i>
Pseudobulbs	fusiform, often flattened	usually ovoid or conic-ovoid	ovoid
Leaves	usually thin	thick	thin
Glycoside crystals	usually present	absent	absent
Inflorescence	prominent spathe, with scape or sessile	without spathe, with scape	conspicuous spathe, sessile
Flower	usually non-resupinate	resupinate	resupinate
Labellum callus	usually a thick pad	2 fleshy ridges	2 parallel ridges
Labellum adnate	half of column	usually at base	near base
Column	usually gibbous, never winged	not gibbous, often winged	not gibbous, winged
Column midtooth	large, narrowly deltoid, ligulate, or subflabellate	short, usually broadly deltoid	short, rounded, shorter than lateral teeth
Midtooth appendage	fleshy, knob-like, obtuse or truncate	absent	absent
Midtooth to anther	not appressed	appressed	appressed
Column sinuses	deep usually acute	broad shallow	shallow
Lateral teeth	stout	stout	petaloid
Seed capsule	3-winged or sharply 3-angled	fusiform	ellipsoid
Capsule suture	covered by strap of tissue	strap absent	strap absent

TAXONOMY

Prosthechea Knowles & Westc., Fl. Cab. 2:111. 1838. TYPE: *Prosthechea glauca* Knowles & Westc., Fl. Cab. 2:111. 1838.

Synonyms: *Anacheilium* Rchb. ex Hoffmanns., *Verz. Orchid.* 21. 1842.
Epithecia Knowles & Westc., Fl. Cab. 2:167. Jan 1839.
Hormidium Lindl. ex Heynh., *Nom. Bot. Hort.* 1:888. 1841.

Pseudobulbs fusiform, often flattened. **Leaves** 1-5, thin. **Inflorescence** scapose or sessile, often with a prominent spathe. **Flowers** usually non-resupinate. **Labellum** adnate to approximately one half of the column, the callus typically a thickened pad. **Column** usually gibbous, lacking wings; midtooth, usually large, erect at apex of column, often covered by a fleshy knob-like, obtuse or truncate appendage, ligulate (connected to the anther cap by a thin flap of tissue), deltoid, subquadrate, or subflabellate, and sometimes fimbriate; anther cap not appressed by

the midtooth; lateral teeth separated from the midtooth by deep narrow sinuses; rostellum undivided but not cleft. **Capsule** three-winged or sharply three-angled, the suture covered by a strap of tissue that lifts upon dehiscence. **Glycoside crystals** large, druse-type, usually present throughout the plant.

ETYMOLOGY: From *prostheke* (Gr., appendage), in reference to the appendage of tissue on the back of the column of *Prosthechea glauca* (Schultes & Pease 1963).

Only new combinations and basionyms are enumerated in the species list. Consideration of sectional placement is beyond the scope of this paper.

Prosthechea abbreviata (Schltr.) W.E. Higgins, *comb. nov.* **BASIONYM:** *Epidendrum abbreviatum* Schltr., *Repert. Spec. Nov. Regni Veg.* 3:107, n. 64. 1906.

Prosthechea aemula (Lindl.) W.E. Higgins, *comb. nov.* **BASIONYM:** *Epidendrum aemulum* Lindl., *Bot. Reg.* 22: f. 1898. 1836.

Prosthechea alagoensis (Pabst) W.E. Higgins, *comb. nov.* **BASIONYM:** *Epidendrum alagoense* Pabst, *An. XIV Congr. Soc. Bot. Bras.* 18, n. 43. 24, t. 1, fig. B. 1964.

Prosthechea allemanii (Barb. Rodr.) W.E. Higgins, *comb. nov.* **BASIONYM:** *Epidendrum allemanii* Barb. Rodr., *Genera et Species Orchidearum Novarum* 1:54, n. 10. t. 400. 1877.

Prosthechea allemanoides (Hoehne) W.E. Higgins, *comb. nov.* **BASIONYM:** *Epidendrum allemanoides* Hoehne, *Bol. Agric. (São Paulo)* 2(4):84. 1947.

Prosthechea baculus (Rchb. f.) W.E. Higgins, *comb. nov.* **BASIONYM:** *Epidendrum baculus* Rchb. f., *Bonplandia* 4:214, n. 97. 1856.

Prosthechea bennettii (E. Christenson) W.E. Higgins, *comb. nov.* **BASIONYM:** *Encyclia bennetti* E. Christenson, *Brittonia* 46(1):29. 31, fig. 5. 1994.

Prosthechea bicamerata (Rchb. f.) W.E. Higgins, *comb. nov.* **BASIONYM:** *Epidendrum bicameratum* Rchb. f., *Gard. Chron.* 1194. 1871.

Prosthechea boothiana (Lindl.) W.E. Higgins, *comb. nov.* **BASIONYM:** *Epidendrum boothianum* Lindl., *Bot. Reg.* 24: misc. 5, n. 7. 1838.

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Epidendrum bulbosum Vell., *Florae Fluminensis* 9: t. 11. 1829.
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Epidendrum chacaoense Rchb. f., *Bonplandia* 2:20, n. 119. 1854.
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BASIONYM: *Epidendrum chimborazoensis* Schltr., *Repert. Spec. Nov. Regni.*
Veg. 14:389, n. 470. 1916.
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BASIONYM: *Epidendrum chondylobulbon* A. Rich & Galeotti, *Ann. Sci. Nat.*
Bot. III 3:20. 1845.
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Sobralia citrina La Llave & Lex., *Nov. Veg. Descr.* 21. 1825.
- Prosthechea cochleata* (L.) W.E. Higgins, *comb. nov.* BASIONYM:
Epidendrum cochleatum L., *Sp. Pl.* (ed. 2) 1351. 1763.
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BASIONYM: *Epidendrum concolor* La Llave & Lex., *Nov. Veg. Descr.* 25.
1825.
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