Extracted from:

FLORA OF ST. JOHN, U.S. VIRGIN ISLANDS

by

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AND COLLABORATORS

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INTRODUCTION

The island of St. John, formerly known as St. Jan, (Map 1), belongs to the Virgin Island group, a natural appendage of the Puerto Rican bank. The islands making up the Virgin Islands group (St. Thomas, St. John, Tortola, Virgin Gorda, Anegada, and St. Croix) and Puerto Rico (Vieques, Culebra and Puerto Rico) form a geographical, geological, and biological province with many shared natural features.

St. John, like most of the other Virgin Islands has a mountainous topography with very small inter mountain valleys and coastal plains. The island has an approximate area of 31 square kilometers, with an east-west axis of 11 kilometers, and a maximum north-south axis of approximately 5 kilometers. The highest point on the island is Bordeaux Mountain which reaches 387 m in elevation. The island has no permanent rivers and possesses only a few intermittent streams, which either flow toward the north or south coasts. For the most part, the soil is volcanic in origin and well-drained, with depths to bedrock ranging from 25 to 50 cm.

Columbus discovered and named the Virgin Islands on his second trip to the New World in 1493. On November 14th, Columbus and his crew anchored on an island which he named Santa Cruz (St. Croix later by the French). They found the island to be inhabited by Carib Indians, but they did not record how densely populated the island was. They left St. Croix for a group of islands already within view to the north. Columbus named the largest of these islands Santa Ursula (probably the island known today as Virgin Gorda) and the remaining ones the Eleven Thousand Virgins, which later became the Virgin Islands (Knox, 1852). Columbus reported them uninhabited, but they may have been frequently visited by the Carib Indians, who traveled widely within the Caribbean. Columbus never set foot on any of these small islands but nevertheless claimed them for the Spanish Empire. The Spaniards neglected the Virgin Islands and the Lesser Antilles and never set permanent colonies on any of them, possibly because of their small size or because of their lack of adequate water supply or of precious metals.

Following its discovery, St. John was occupied for short periods by small bands of Indians who engaged in warfare with the Spanish, and by other Europeans engaged in modest agriculture or lumbering. During this period of low-level occupation, the island's natural resources were not severely affected.

When the Danes established the first European colony on St. John in 1718, the island had a dense forest cover (Tyson, 1984). The colonization brought about changes in the physiognomy of the vegetation and the utilization of natural resources on St. John, by relatively large populations of European planters and African slaves involved in the production of agricultural staples for export. A large percentage of the land was converted into lucrative plantations, especially for sugar cane and cotton or later into range lands. During the first ten years following the establishment of the colony, every large tree was harvested for building materials and only small trees remained on the island (Tyson, 1984). By 1760 all arable land was under cultivation,

and the settlements, woodcutters, and grazing livestock were encroaching upon the remaining natural vegetation. After 1765, sugar cane became the most important crop, and by the end of the century, 60% of the entire island was under sugar cultivation, with most of the remaining percentage devoted to secondary crops (cotton, tobacco, coffee). Such cultivation lasted until the 1830's when the regional sugar economy collapsed due to rising production costs and falling market prices.

After 1848, the downfall of the plantation system continued with the abolition of slavery in the Danish Virgin Islands. Most of the land devoted to sugar cane plantations was abandoned and agriculture shifted to secondary crops and livestock production. New small-scale forest industries were established, based on bay leaf harvesting and wood cutting for the production of charcoal. By 1879, St. John had regenerated an evident forest cover, and was one of the most forested islands of the Virgin Island group (Eggers, 1879). By the turn of the century, agriculture diminished further, allowing a sizable section of the landscape to revert to scrubland and secondary forests.

In 1917, the Danish Virgin Islands (St. John, St. Thomas, and St. Croix) were purchased by the Government of the United States. The territory was acquired to consolidate U.S. Navy control of the Caribbean, but soon became important for tourism. Much land was purchased by private parties from mainland U.S.A., as real estate or for vacation homes. In 1956, the Virgin Islands National Park was created from land donated by Laurence Rockefeller. Today, with subsequent purchases, the park occupies about 65% of St. John's territory (Map 3), and its vegetation shows differing degrees of recovery. The parkland is protected from the most immediate impacts of development, but it is still vulnerable to some of the direct and indirect changes brought about by tourism and by grazing of feral animals. This is especially true along the park boundaries and in the privately-owned inholdings within the limits of the park. The remaining 35% of the island is privately owned and has undergone a more marked deterioration of once recuperating natural resources due to an influx of tourists and year-round residents during the last several decades.

From the beginning of colonization, St. John was divided into quarters and these into numerous plantations. When agriculture reached its peak, the island was divided into eight quarters. These were later reduced to only five as agriculture deteriorated. Today, the quarter system is still in use, with Cruz Bay, Maho Bay, East End, Coral Bay and Reef Bay quarters representing the official political divisions on St. John (Map 3). Cruz Bay Quarter is most developed with the only town, port, numerous shops and the only hotels on the island. The other quarters are relatively undeveloped, but new housing is flourishing at Fish Bay (Reef Bay Quarter), Coral Bay (Coral Bay Quarter) and East End (East End Quarter), the latter being the most susceptible to disturbance because of the erosion associated with the steep hills. Most of the park land is contained within Maho Bay, Reef Bay, and Coral Bay quarters.

GEOLOGY

St. John belongs to the Puerto Rican bank which was created by volcanism during the Cretaceous and became emergent largely through orogenic movements in the lower Eocene (35-40 M years ago) (Meyerhoff, 1933). Subsequent sea-flooding occurred in the Oligocene followed by uplift during a middle Miocene orogenesis (Meyerhoff, 1933). The continuity of the original mountain axis of the Puerto Rican bank is interrupted on the eastern end of Puerto Rico and reaches lower elevations through the islands of Culebra, Vieques, St. Thomas, St. John, and Tortola to Virgin Gorda. According to Mitchell (1954), during the Pliocene (2-3 M years ago) this Cretaceous mountain axis underwent tilting to the northeast allowing the Atlantic and Caribbean to flood part of the platform, thereby isolating the Virgin Islands from Puerto Rico. This notion has been challenged, however, by Weaver (1961), who maintains that the Caribbean

area has been rather stable geologically since the Miocene and that the emergence of Puerto Rico and further isolation of the Virgin Islands resulted from eustatic sea-level changes.

Studies of sea-level changes in the Tertiary have shown it to be variable, with fluctuations above and below present day sea-level (Vail & Hardenbol, 1979). During the late Oligocene (29 M years ago), sea-level was 150 m lower than it is at the present. More recently, during the many glaciations of the Pleistocene (the most recent one being 14,000 years ago), sea-level dropped as much as 100 m below present-day sea-level (Vail & Hardenbol, 1979). Such a lowering would have been sufficient to enable Puerto Rico and the Virgin Islands (except for St. Croix, which is separated by a deep sea trench) to exist as a continuous landmass, with approximately twice the area of present-day Puerto Rico (Map 2). After the last glaciation, the sea-level rose, submerging once again a large portion of the Puerto Rican bank. As a result, many offshore islands disappeared, and this once continuous landmass became dissected into smaller islands. In the last 6,000 years, the sea level has fluctuated, varying the size of each island and the distances between the islands. Fragmentation of the ancestral biota may have fostered important changes in their populations by promoting local extinctions or speciation. However, since the isolation of the Puerto Rican bank fragments is relatively recent, very few new species are expected to have evolved from this event.

CLIMATE

The climate of St. John is typical of many windward Caribbean islands, where most precipitation is due to convection caused by physical obstruction of mountains to trade winds. Additionally, there is a considerable amount of rainfall that results from infrequent cold fronts and hurricanes. The precipitation in St. John ranges from 890 to 1400 mm per year, depending on the aspect and elevation of the site (Woodbury and Weaver, 1987). The eastern extreme of the island is the driest area, with an annual average rainfall of only 89 to 100 cm. This area is continuously swept by trade winds, which at low elevations have a drying effect. On the other hand, higher elevations are moister since most humidity is intercepted by the cooler mountains.

Mean annual rainfall for the weather station at Cruz Bay is 1130 mm, and the mean annual temperature is 26.9°C. These numbers are very similar for the station at Lameshur with a mean annual precipitation of 1190 mm and a mean annual temperature of 26.3°C (Woodbury and Weaver, 1987). Precipitation is most predominant from May through November. The driest months are February and March, and the wettest, September.

VEGETATION

The destruction of the natural vegetation on St. John has been extensive, spreading over nearly 90% of the island. Evidence of former cultivation is found in the half-buried stone terracing in much of the present day mountain forest. The first 130 years of colonization were particularly harsh on St. John's natural resources. As a result, some of the native and endemic plant species have become extinct, or nearly extinct with their populations reduced to a few individuals. Examples of these are *Solanum conocarpum*, *S. mucronatum*, *Malpighia infestissima*, *M. woodburyana*, and *Mammillaria nivosa*. Additionally, the invasion by aggressive exotic plants may have also contributed to the demise of some of St. John's native plants. Today the most immediate threat to the regeneration of natural vegetation is inflicted by development and by the growing population of feral pigs, goats, and donkeys. Goats and donkeys are imposing selective changes on regeneration by grazing on palatable species. Pigs on the other hand, are responsible for destroying shrubs and trees through rooting.

The present vegetation of St. John shows differing degrees of regeneration, ranging from recently disturbed to late-secondary successional forests, which may be as old as 100 years

(Reilly, 1992). The new vegetation cover contains numerous introduced plants that have become established in dense stands or more commonly intermixed with native species. Many of the weedy introduced species are particularly common in recently disturbed, open areas such as roadsides or waste grounds. Additionally, there are a few woody, adventive plants that are locally common, mostly because of their endurance of harsh environments or to their high degree of dispersibility. Examples of these are *Leucaena leucocephala*, *Melicoccus bijugatus*, *Calotropis procera*, and *Cryptostegia grandiflora*.

Eggers was probably the first to study the vegetation of the Virgin Islands. In 1876 he described the plant communities of St. Croix, and later in 1879 he expanded his work to include St. Thomas, St. John, Tortola, Vieques, and Culebra. In the latter work he considered all the Virgin Islands to have the same types of vegetation formations, i.e., littoral, scrub-land, forest, and cultivated areas that he observed on St. Croix. For each formation, he listed the predominant species, and in some cases he named the formation after the most common species (e.g., *Croton* vegetation and *Eriodendron* [=*Ceiba*] vegetation). His work of 1879 provides important information on land use history as well.

In 1923, Børgensen refined Eggers' vegetation descriptions, and recognized six sections (formations). His classification is similar to that of Eggers but elevates some of Eggers' hierarchical zones within the formations into sections. In summary, he recognized the following nine vegetation types: sea-grass (in sea); coastal; sandy shore; rocky coast; thicket; forest; fresh water (in temporary pools); and cultivated land.

A recent study by Woodbury and Weaver (1987) characterizes the vegetation of St. John under various formations that are highly influenced by humidity. These formations range from xerophytic cactus scrub to moist forests in the protected valleys and mountains. Woodbury and Weaver's study gives qualitative data with relative abundance of typical species, but does not present data regarding density or the importance value of species. They recognized ten formations within two life zones (moist and dry), which are strongly characterized by the physiognomy of the vegetation, but lack a distinctive floristic identity. Their formations seem artificial and at most, transitory. It seems that the recognition of two major vegetation types (one in the moist zone and one in the dry zone) seems preferable, because they show some degree of floristic distinctiveness. The moist forest is characterized by *Andira inermis*, *Buchenavia tetraphylla*, *Byrsonima spicata*, *Ceiba pentandra*, *Cestrum laurifolium*, *Cordia laevigata*, *Eugenia confusa*, *Eugenia pseudopsidium*, *Gonzalagunia hirsuta*, *Hymenaea courbaril*, *Ilex urbaniana*, *Inga laurina*, *Manilkara bidentata*, *Miconia laevigata*, *Myrcia citrifolia*, *Myrciaria floribunda*, *Palicourea croceoides*, *Psychotria spp*., and *Ternstroemia peduncularis*. The dry vegetation is characterized by *Amyris elemifera*, *Sideroxylon salicifolium*, *Sideroxylon obovatum*, *Coccoloba uvifera*, *Crossopetalum rhacoma*, *Cassine xylocarpa*, *Erithalis fruticosa*, *Jacquinia arborea*, *Jacquinia berterii*, and *Plumeria alba*.

The following classification has been modified from Woodbury and Weaver (1987) to reflect more natural vegetation types.

1. Dry formations. These were defined by Woodbury and Weaver as dry evergreen, and characterized under four types. They occupy 63% of the island territory, and are combined here into three types.

A. *Dry evergreen woodland*. This is a widespread formation that occupies 33% of the island. It is characterized by dense growth, with a layer of trees that reach to 10 meters tall, and bear thick, sclerophyllous, small leaves. A layer of shrubs and herbs is also present, with a few species of vines. This formation contains numerous coastal species that occur along the lower portion of the hillsides. When this formation reaches the upper portions of the mountains it grades into a forest with two strata that may contain additional species more characteristic of the uplands.

The only quantitative data for this type of formation are provided by the studies of Reilly *et al.* (1990) and Dallmeier *et al.* (1993) at two different sites. Differences in floristic

composition and relative density among the two sites is probably due to their individual land-use histories. The site studied by Reilly, Earhart, and Prance has a total basal area of 13.26 (m^2/ha) and was dominated by the introduced *Melicoccus bijugatus*, followed by *Guapira fragrans*, *Ocotea coriacea*, *Bursera simaruba*, and *Eugenia monticola*, in order of importance. This forested area was described as having two strata, one that is five to ten meters in height and another that is ten to twelve meters in height, with occasional emergents from fifteen to twenty meters tall. The site studies of Dallmeier, Comiskey, and Ray show a higher total basal area of 25.15 (m^2/ha), with dominance shared by *Coccoloba microstachya*, *Maytenus laevigata*, *Guapira fragrans*, *Bourreria succulenta*, and *Tabebuia heterophylla*. Their data show trees that vary from four to eleven meters without a clear distinction of strata.

B. *Dry evergreen thicket or scrub.* This is the second largest formation on St. John, occupying about 24% of the total land surface. This formation occupies similar, but moister habitats and contains similar species to the previous formation, but the trees do not reach more than five meters in height. In extremely severe environments subjected to the continuous action of winds, a stunted vegetation may develop. This usually has thicker or succulent leaves and may contain a few species of cacti (this area was defined by Woodbury and Weaver as rock pavement and coastal hedge). This formation has not been quantified yet and such studies are needed.

C. *Thorn and cactus scrub.* This is a formation occupying about 6% of St. John's land area. It contains a few thorny, woody species and cacti with a maximum height of 5 meters. This formation occurs in the driest areas of the island, which have poor, shallow soils. In many areas, this formation has an open aspect. There are no quantitative studies describing this type of formation.

2. Moist forest. The moist forest formations occupy only 16.5% of St. John, and were classified by Woodbury and Weaver (1987) as upland, gallery, and basin. These divisions seem unnecessary because the formations so defined share a great number of species. The area characterized by them as upland moist forest contains many more species than either the gallery or basin forests. This may be explained by the presence of more microhabitats and a larger elevational range. Most of the species found in gallery and basin forests can also be found in upland moist forests. This type of forest with local variations occurs throughout moist areas, in protected uplands, drainage areas (locally known as guts), and coastal protected valleys.

There are two quantitative studies of this formation; one by Reilly *et al.* (1990), and another by Forman and Hahn (1980). Reilly *et al.* studied two sites. The first was characterized as upland moist forest and the second as gallery moist forest. The first site was located on the northwestern side of the Bordeaux Mountains and had a total basal area of 30.90 m^2/ha. The ten most important species in order of importance were: *Guapira fragrans*, *Pimenta racemosa*, *Inga laurina*, *Byrsonima spicata*, *Acacia muricata*, *Ocotea coriacea*, *Tabebuia heterophylla*, *Faramea occidentalis*, *Chionanthus compacta*, and *Guazuma ulmifolia*. This forested area was described as having four strata: the lowest one less than ten meters in height; a mid-height layer 10-15 m tall; a continuous canopy from about 15-20 m tall; and a top layer of a few emergent trees, reaching about 28 m in height. The second site, at L'Esperance had a total basal area of 15.6 m^2/ha. The ten most important species in order of importance were: *Ardisia obovata*, *Guapira fragrans*, *Andira inermis*, *Inga laurina*, *Ocotea coriacea*, *Chrysophyllum pauciflorum*, *Guettarda scabra*, *Guettarda odorata*, *Tabebuia heterophylla*, and *Hymenaea courbaril*. According to Reilly *et al.* (1990), there were three distinct strata in this site; the lower stratum was less than 10 m tall, the middle one was made of a continuous canopy, and the highest consisted of emergent trees. There were no measurements given for the two latter strata, but they stated that trees were shorter than those of the first site.

The study by Forman and Hahn (1980) described a site located in the upper part of the Reef Bay valley. The forest was described as having a canopy from 25 to 30 m in height, and a continuous understory layer ranging from two to 25 m tall. The most important species in order of importance: *Andira inermis*, *Amyris elemifera*, *Swietenia mahagoni*, *Melicoccus bijugatus*,

Casearia guianensis, *Eugenia monticola*, *Eugenia rhombea*, *Zanthoxylum monophyllum*, *Adenanthera pavonina*, and *Acacia muricata*.

The floristic composition and relative density in the three sites show differences that are probably the result of the particular land use history of the site and not necessarily differences indicating two different types of formations. For instance, the abundance of the introduced bay rum trees (*Pimenta racemosa*) in the Bordeaux study area may represent the remains of previous plantations. Selective logging for charcoal production and lumbering undoubtedly has played an important role in the composition of today's forests. In addition, these forests are too young to be considered a climax community.

3. Early successional vegetation. This successional stage was classified by Woodbury and Weaver (1987) as secondary vegetation. However, this term is inappropriate since all vegetation formations on St. John are secondary in nature. Early successional vegetation covers about 15.4% of St. John and is found in areas subject to recent disturbance by humans. These include areas recently used for agriculture, pastures, areas along roadsides, trails, and dump sites.

4. Coastal wetlands. This zone occupies approximately 2.3% of St. John, and was classified by Woodbury and Weaver (1987) into mangroves, salt flats, and lagoons. These formations are subject to prolonged, seasonal or tidal flooding by saline waters or by fresh waters after prolonged rains. Mangrove swamps on St. John, although containing the four typical Caribbean species of mangroves (*Rhizophora mangle*, *Avicennia germinans*, *Conocarpus erectus*, and *Laguncularia racemosa*) and associated halophytes, are poorly represented by a narrow strip of vegetation occurring in protected, shallow waters. Salt flats (seasonally or tidal flooded areas in the surroundings of the mangroves) and sandy coastal areas contain a number of annual salt-loving species and a few other succulent annuals. The lagoon areas are seasonally flooded due to heavy downpours during the wet months of the year. These lagoons, usually lasting for a few months before drying up commonly contain the aquatic species *Lemna aequinoctialis* and *Ruppia maritima*.

FLORA AND FLORISTIC AFFINITIES

The flora of St. John consists of 747 species of vascular plants (native and naturalized), of which 642 (86% of the total flora) are native to the island. There are 117 families of vascular plants represented on St. John (12 of which are introduced), with a total of 469 genera (55 of which are introduced). The Pteridophytes (ferns and fern allies) are represented by 5 families and 16 genera, the Dicots by 93 families and 372 genera, and the Monocots by 19 families and 81 genera.

About 50% of the families are represented by two to 13 species; 39% of the families (46 families) are represented by a single species; and the remaining families (about 11%) have more than 15 species. The largest families are as follows;

Fabaceae-- 74 species
Poaceae-- 52 species
Euphorbiaceae-- 40 species
Asteraceae-- 37 species
Convolvulaceae-- 27 species
Malvaceae-- 24 species
Rubiaceae-- 26 species
Polypodiaceae-- 25 species
Cyperaceae-- 20 species
Boraginaceae-- 19 species
Myrtaceae-- 19 species
Solanaceae-- 16 species
Acanthaceae-- 16 species

Practically every species (99.7%) on St. John is also found on other islands of the Virgin Islands, with the exception of two endemic flowering plants (see Endemism below). Saint John's flora may be viewed as a subset of the Greater Puerto Rican flora, since (97.0%) of its species also occur on Puerto Rico.

In spite of St. John (and the Virgin Islands) being a natural appendage of the Greater Antilles, it shares about the same percentage of its flora with the Lesser Antilles (86.7%) as it does with the Greater Antilles (87.3%). These numbers are not totally surprising since St. John (and the Virgin Islands) are located at the boundary between the Greater and the Lesser Antilles, two groups of islands often considered to have different floristic affinities. A slightly smaller percentage (80%) of St. John's flora is found throughout the Greater Antilles and the Lesser Antilles. The percentage is even smaller when St. John's flora is compared to the pan Caribbean region, with only 70% of its species found throughout the region. The percentage of St. John's flora shared with other areas beyond the Caribbean region drops sharply, with 29.5% found throughout the Neotropics and 15.6% with pantropical distribution.

Endemism

Saint John has two endemic species, representing only 0.3% of its flora. They are *Eugenia earhartii* in the Myrtle family and *Machaonia woodburyana* in the Coffee family. Additionally, St. John contains six species that are endemic to it and the other Virgin Islands, accounting for 0.9% of its native flora. These are *Anthurium* x *selloum*, *Croton fishlockii*, *Galactia eggersii*, *Malpighia infestissima*, *Solanum conocarpum*, and *Tillandsia lineatispica*.

The percentage of endemism increases when the whole phytogeographical province of Greater Puerto Rico, i.e., Puerto Rico and the Virgin Islands, is considered. There are twenty-five species of flowering plants that are present only on St. John, the Virgin Islands, and Puerto Rico, accounting for 3.8% of St. John's flora. These species are *Agave missionum*, *Argythamnia stahlii*, *Calyptranthes thomasiana*, *Chrysophyllum bicolor*, *Chrysophyllum pauciflorum*, *Coccothrinax alta*, *Crescentia linearifolia*, *Erythrina eggersii*, *Eugenia sessiliflora*, *Eugenia xerophytica*, *Forestiera eggersiana*, *Malpighia woodburyana*, *Neea buxifolia*, *Opuntia repens*, *Ouratea litoralis*, *Pilea sanctae-crucis*, *Poitea florida*, *Psidium amplexicaule*, *Reynosia guama*, *Rondeletia pilosa*, *Roystonea borinquena*, *Scolosanthus versicolor*, *Solanum mucronatum*, *Stigmaphyllon floribundum*, and *Zanthoxylum thomasianum*.

It is not surprising for St. John and the Virgin Islands to have a very low percentage of endemism since their isolation from Puerto Rico has been only for short and intermittent periods, followed by dry land connections. To start with, Puerto Rico has a very low percentage (12%) of endemic plants compared to other islands of the Greater Antilles (20-50%; fide Howard, 1973). It is not clear whether this low percentage of endemism is due to recent land use history (last three to four hundred years of intensive deforestation) or to its smaller size, fewer habitats and greater distance from continental areas. It seems that if the latter factors are responsible for the less diverse nature of the Puerto Rican flora, this certainly would have an effect on the outcome of speciation events in the Virgin Islands.

Rare and Endangered species

The only species on St. John listed as endangered by the Federal Register of the U.S. Fish and Wildlife Service (Aug., 1993) is *Zanthoxylum thomasianum*. The remaining known populations of this species on St. John have less than twenty individuals, all of which are mature. This species does not seem to propagate: no juveniles have been seen. In addition, there is a parasitic insect that deposits its eggs in the seeds of *Z. thomasianum* destroying most of its seed crop. The main culprit for the decline of this species may be habitat destruction. This has

certainly reduced genetic variability, and with it, the ability of the species to cope with new challenges brought about by the changing environment.

There are other species, that although not listed in the Federal Register, deserve the attention and prompt assessment of their populations. Some of the endemic species seem to be the most vulnerable because of their scarcity and restricted ranges. The destruction of their habitat would certainly mean their extinction, because they occur nowhere else. The Virgin Island endemics *Erythrina eggersii*, *Galactia eggersii*, *Tillandsia lineatispica*, *Ilex urbaniana*, *Malpighia woodburyana*, and *Calyptranthes thomasiana* are examples of this. None of these species is common on St. John or elsewhere in the Virgin Islands. *Erythrina eggersii* and *Malpighia woodburyana* have the smallest populations, with very few individuals remaining on St. John.

The narrowly endemic *Machaonia woodburyana* and *Eugenia earhartii*, confined to St. John, could be characterized as threatened, especially the former, since its largest populations occur outside of park boundaries where no protection exists. *Eugenia earhartii* is known only from two populations of very few individuals, which fortunately occur within the park limits.

The most endangered species on St. John seems to be *Solanum conocarpum*, which at present, is know only from two individuals. This species was previously known only from the type specimen collected at Coral Bay in April of 1787 until recently when it was recollected. This species certainly needs to be studied and protected.

The flora of St. John has faced probable extinctions of some of its species. For example, *Solanum mucronatum* and *Malpighia infestissima* are species that have not been located on St. John in recent times. Their populations outside St. John are rather small and restricted to some of the Virgin Islands and Puerto Rico.

BOTANICAL HISTORY

Previous Work

Botanical exploration (Millspaugh, 1902; Urban, 1902) of St. John started later than that of many other West Indian islands. The oldest record is dated from 1767 by Gesch Oldendorp, who lived in the Danish West Indies until 1769. During this period of time he studied different aspects of the colonies including the natural history of these islands. His studies were published in 1777 in his book *History of the Mission of the Evangelical Brethren on the Caribbean Islands of St. Thomas, St. Croix, and St. John*. (in German, translated into English in 1987). In his botanical section, Oldendorp mentioned numerous edible and useful plants present in the Danish West Indies. From that date to the beginning of the nineteenth century, St. John was visited by only a handful of plant collectors. One of the earliest collectors to visit the Danish West Indies was von Rohr who lived on the islands in 1757-1791. However, it is not clear whether he collected on St. John. Hans West may have visited and collected plants on St. John prior to 1793, the year in which he published (in Danish) *An Enumeration of Plants from the islands of St. Croix, St. Thomas, St. John, Tortola and Vieques*. This publication contains partial descriptions for some of the many new species described therein by him and Vahl.

During the nineteenth century, there was an increase in the number of botanists visiting St. John and the Virgin Islands. The plants collected by them were the basis for many new species described for the Caribbean Region. Schlechtendal (1828-1831) published a series of papers on the flora of St. Thomas. In this work he provided descriptions for 369 species of plants occurring on St. Thomas and the other Virgin Islands. In 1847, Krebs published a general description of the vegetation of St. Thomas. The most notable botanical work produced during this time period was Eggers'(1879) *The Flora of St. Croix and the Virgin Islands*. Although it primarily concentrates on the then Danish Virgin Islands, it contains general information as well as descriptions of vegetation formations common to the islands. Eggers' flora contains brief diagnoses, phenological data, and common names for the vascular plants.

The twentieth century brought more interest in the floristics of the region. In 1902, Millspaugh published a new flora for St. Croix, including not only vascular plants but also marine algae. This work provided information on the abundance and distribution of species and contained new records of vascular plants based on more recent collections. In 1918, Britton published *The Flora of the American Virgin Islands*, previously the Danish West Indies, but the islands had recently been purchased by the United States in 1917. This work constituted a checklist for all vascular plants, cryptogams, and fungi for the newly acquired territory, with new records and descriptions of a few new species. A few years later, Britton and Wilson (1923-1926) published a complete flora for Puerto Rico and the Virgin Islands, under the title *Botany of Porto Rico and the Virgin Islands*. This publication, although outdated, is the most comprehensive floristic work published for the Greater Puerto Rican area, and is a basic reference still widely used.

During the second half of this century, there has been a series of publications dealing with the Virgin Islands flora. These include works by Little and Wadsworth (1964) and Little *et al.* (1974) on the trees of Puerto Rico and the Virgin Islands. Furthermore, Liogier (1965) and Liogier and Martorell (1982) produced a series of publications updating the names of plants found in Puerto Rico and the Virgin Islands. Liogier also is engaged in the production of a new flora of Puerto Rico and adjacent islands, having completed, three of the projected five volumes (Liogier 1985, 1988, & 1994). In 1985, Acevedo-Rodríguez and Woodbury published a field guide to the common vines of Puerto Rico, which includes numerous species also occurring in the Virgin Islands. An enlarged and comprehensive revision of this work is underway and should be ready in a few years. The most recent publication dealing with the flora of the Virgin Islands is *Ferns of Puerto Rico and the Virgin Islands* (Proctor, 1989). Currently, Proctor is working on a revision of the monocots of Puerto Rico and the Virgin Islands, a work that should be ready within the next few years.

Numerous species have been described from specimens collected from the Virgin Islands over many decades of work. Although the scope of this book is St. John's flora, a listing of these names reveals the high level of scientific activity in the Virgin Islands during the last two centuries. The following table (Table 1) lists only species currently considered valid that are typified by Virgin Islands material. This listing represents only a fraction of the names typified by Virgin Islands material, since there are numerous names that have fallen under synonymy. Eighty species and one genus (*Fishlockia*) described from Virgin Islands material are currently accepted.

Plant Collectors

The following section lists the most prominent plant collectors, both past and present, active on St. John. This list is based on literature records and on searches of material in the U.S. National Herbarium and the herbarium of The New York Botanical Garden. Undoubtedly there are additional collectors who worked in St. John, but their specimens would be deposited in smaller herbaria.

John Ryan (?-1800). A physician and plantation owner on Monserrat during the second half of the eighteenth century. He was probably the first to collect and preserve plants from the island of St. John. In 1780, he made many collections on St. John; these are deposited at the Botanical Museum of Copenhagen (C).

Louis Claude M. Richard (1754-1821)**.** French botanist, went to some of the French colonies in the New World to study useful plants with potential for introduction into the Old World. He made numerous collections in the New World (mostly Caribbean). During most of 1787, he visited St. John and some of the other Virgin Islands. His collections are deposited at the Museum of Natural History in Paris (P), with duplicates at C.

Paul E. Isert (1756-1789). Danish physician, collected plants on St. John, other Virgin Islands, and in the Lesser Antilles in 1787. His collections are deposited at C.

Peder Eggert Benzon (1788-1848). Danish pharmacist, lived on St. Croix from 1817 to 1848. He made numerous collections from the island of St. Croix, but also collected on St. John and St. Thomas during his stay in that region. His collections are deposited at C with duplicates at the Museum of Natural History at Stockholm (S) and at the New York Botanical Garden (NY). The duplicates at NY were examined by Britton during his preparatory studies for the *Flora of the American Virgin Islands*.

Peter Ravn (1783-1839). Norwegian surgeon, lived on St. Thomas from 1819 to 1839. During this time, he collected plants on St. John, St. Croix, St. Thomas, and Vieques. His collections are deposited at C with duplicates at S, and at the herbarium of the Botanical Garden of Geneva (G). Some of his collections were studied by de Candolle and by Krebs.

Hans B. Hornbeck (1800-1870). Danish physician, lived on St. John from 1825 to 1844. During his stay on St. John he collected numerous plants and other natural history specimens from St. John, St. Croix, St. Thomas, and Puerto Rico. His specimens are deposited at C with duplicates at S and NY. The NY collections were studied by Britton for his *Flora of the American Virgin Islands*.

Johann C. Breutel (1788-1875). Born in Germany, became a steward of the Moravian church, later became a member of its board of directors. From December 1840 to July 1841 he visited the islands of St. John, St. Croix, St. Thomas, St. Kitts, and Antigua and made numerous collections (mostly cryptogams). His fern collections are deposited at the Leipzig herbarium (LZ), the liverworts and mosses at Berlin (B, probably destroyed) with duplicates (mosses) at the British Museum (BM).

Henrik J. Krebs (1821-1907). Danish pharmacist, later became Swedish-Norwegian consul, and finally president of the Colonial Assembly in St. Thomas. He lived on St. Thomas from 1843 to 1870. From there he made numerous collecting trips to St. John, St. Croix and throughout the Caribbean and northern South America. His collections are deposited at C with duplicates at NY and the Field Museum of Natural History (F). He published some contributions (1847) towards a flora of St. Thomas.

Henrik F.A. Baron **von Eggers** (1844-1903) Danish soldier and botanist, lived in the Virgin Islands (St. Croix and St. Thomas) from 1869 to 1887 from where he collected plants extensively throughout the Caribbean. His collections from 1870 to 1874 are from the Virgin Islands, and those dating from 1880 to 1899 are mostly from the Greater Antilles, Bahamas, Dominica, Grenada, Tobago, Trinidad, but also include collections from the Virgin Islands. Eggers collected on St. John in 1873 and in 1887. His first set of specimens are deposited at C with duplicates distributed to many herbaria. His collections, the basis for his flora of St. Croix and the Virgin Islands, have been studied by numerous West Indian botanists, including Urban and Britton.

Johannes E. B. Warming (1841-1924). Danish botanist and naturalist, lecturer at the Copenhagen University and later director of the Botanical Garden of Copenhagen. He visited the Caribbean from October 1891 until March 1892. He made a few collections on St. John, St. Croix, and St. Thomas. His specimens are deposited at C, with duplicates in numerous herbaria.

Frederick C. E. Børgensen (1866-1956). Danish botanist, collected algae specimens in the Virgin Islands in January to April 1892, from 1895 to 1896, and 1905 to 1906. He published an article (1923) about the vegetation of the Danish West Indies and an account of their marine algae. His collections are deposited at C with duplicates at F and at Munich (M).

Ove W. Paulsen (1874-1947). Danish botanist, curator at the Botanical Museum in Copenhagen, later professor of botany at the Danish pharmaceutical college. He visited the Danish Virgin Islands from December 1895 to February 1896, where he collected numerous specimens. His collections are deposited at C with duplicates in numerous herbaria. The duplicates at NY were studied by Britton for his *Flora of the American Virgin Islands*.

Nathaniel L. Britton (1859-1934). American botanist, founder and first director of The New York Botanical Garden. He made about forty expeditions throughout the West Indies,

collected in the Virgin Islands starting in 1900 in St. Croix, and later in 1913 on St. Thomas, St. John, Tortola, Anegada and nearby islands. His collections, deposited at NY with duplicates at the US National Herbarium (US), form the basis for his *Flora of the American Virgin Islands* (1918), *Botany of Porto Rico and the Virgin Islands* (1923-1926), and *The vegetation of Anegada* (1916).

Christen C. Raunkiær (1860-1938). Danish botanist, professor of botany and director of the Botanical Garden of Copenhagen. He collected plants in the former Danish West Indies (St. Croix, St. Thomas, and St. John) during 1905 to 1906, which are deposited at C with duplicates at NY and US.

C.F. Morrow (?). American ?, director of public schools in St. Thomas and hobbyist plant collector, one of the few women to collect plants in the U.S. Virgin Islands (St. John and St. Thomas). She collected on St. John from December 1920 to August 1921. Her flowering plant collections are deposited at US, and the fern collections are at C.

Ismael Vélez (1908-1970). Puerto Rican botanist, professor of botany at the Inter American University of Puerto Rico in San Germán. He collected plants on St. John and most of the other Virgin Islands from July to September of 1949 for his vegetation studies of the Lesser Antilles and Puerto Rico (1950, 1957). His collections are deposited at Louisiana State University herbarium (LSU) with duplicates at GH, K, NY and US. Duplicates of his collections at the Inter American University in San Germán, Puerto Rico were mostly destroyed by pests, the surviving specimens were recently transferred to the San Juan campus of the Inter American University.

Elbert L. Little Jr. (1907-). American dendrologist, while employed by the U.S. Department of Agriculture, collected numerous woody specimens from the Virgin Islands and Puerto Rico for his preparatory studies for his monumental two volumes on trees of Puerto Rico and the Virgin Islands. He collected a few specimens from St. John during July, 1954 and April, 1967.

Roy O. Woodbury (1913-) American botanist, professor of botany and plant ecology at the University of Puerto Rico, Río Piedras. He made numerous collections of St. John plants from May 1982 through July 1983 for his preparatory studies for a checklist published by him and Weaver (1987). His collections are very important because, in many instances, they constitute records of the first specimens collected in this century for many earlier records. His collections also contain new records and new species. His work represents the starting point for the present Flora of St. John. His specimens are deposited at the Biosphere Research Center at the Virgin Island National Park Service (VINPS) on St. John, with a few duplicates at the herbarium of the Extension Service at the University of the Virgin Islands, St. Thomas Campus.

Scott A. Mori (1941-). American botanist, curator at The New York Botanical Garden. He visited St. John as an advisor for the new Flora of St. John project. He collected many plants in June and November, 1984. His specimens are deposited at NY and contain fine examples of the flora of St. John. They have been essential in the preparation of this book.

Ghillean T. Prance (1937-). British botanist, formerly curator and vice-president for Science at The New York Botanical Garden, and currently director of The Royal Botanic Gardens at Kew. He visited St. John as an advisor for the projected new Flora of St. John and collected many specimens in June 1984 and March 1985. His collections are deposited at NY and have been examined during the preparatory studies for this book.

George R. Proctor (1920-). American botanist, a long-time employee of the Institute of Jamaica, presently director of the herbarium at the Department of Natural Resources in Puerto Rico. He visited St. John in 1983 while working on *Ferns of Puerto Rico and the Virgin Islands* (1989). His collections are deposited at the herbarium of the Department of Natural Resources in Puerto Rico (SJ), with duplicates at the Institute of Jamaica (IJ) and US.

HISTORY OF THE PROJECT

I first visited the Virgin Islands in March 1985 when I joined a team from The New York Botanical Garden (NY), the University of Puerto Rico (UPR), and Yale University to do field work on the island of St. John. The main purpose of the trip was to establish permanent vegetation study plots in order to monitor vegetation changes in three different watersheds. The plots were marked and every tree or woody plant over 10 cm dbh, was identified and vouchered with a specimen deposited at NY. We also had the opportunity to explore most of the island and to collect numerous specimens, familiarizing ourselves with the flora of the island. Identifications of plants, both at the study sites and the material collected, were provided by Roy O. Woodbury who at the time was working on a checklist of plants of St. John, commissioned by the National Park Service.

There was much enthusiasm by me and other members of the team about being able to work on this important monitoring project. Early on, the importance of producing a full-fledged flora for the island became evident. Such a flora would be a cornerstone for further biological studies on this and nearby islands. We committed ourselves to this project and planned on pursuing the much needed field work. Numerous trips followed, and many people helped in this nascent project. Among them, John and Anne Earhart, and Dr. Ghillean T. Prance have been very important in getting this new project off the ground through the financial support of the Homeland Foundation and The New York Botanical Garden. Initially, the project was to be a collaborative effort with Ghillean Prance, Roy Woodbury, John Earhart, Anne Reilly and me, but eventually I took on full responsibility. After nine years of fieldwork and research, the manuscript for the flora of St. John has been completed with the continuous support from the Homeland Foundation. This work also has been possible through the support of the Smithsonian Institution and the collaborative efforts of many botanists who provided treatments for some of the families.

SCOPE OF THE FLORA

The flora treats all native plant species from St. John, as well as naturalized, persistent and common exotics found on the island of St. John. The distinction between naturalized and persistent is not readily apparent, and in many cases may not be clear. For the purpose of the flora, only plants growing in the wild are considered naturalized (if spreading) or persistent (not spreading). Common ornamentals growing along roads are treated in full in this flora. However, ornamentals with restricted distributions are only mentioned after the last species of their genus in order to document their presence and their current status on the island. Species reported by previous workers but not documented by a voucher specimen are listed as dubious records or are excluded from the flora.

The flora is intended to be useful for both amateurs and students of the West Indian flora. In order to facilitate its usage, especially by less experienced people, the flora uses when possible, non-technical terms and includes numerous illustrations and a glossary for the technical terms. The complete descriptions and references to the species on St. John, and detailed distribution information, should render the work useful for the Virgin Islands as a whole and for the identification of plants in the adjacent dry districts of Puerto Rico as well.

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