

A Vegetation Classification of St. Kitts and Nevis: Implications for Conservation

prepared by

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island resources

F O U N D A T I O N

Eastern Caribbean Biodiversity Programme

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ABSTRACT

This report presents a vegetation classification system for St. Kitts and Nevis to guide biodiversity conservation efforts in that country. Thirty-six Alliances and Associations were identified. These are based on the National Vegetation Classification System developed as a U.S. standard (proposed as a global standard) by the United States Federal Geographic Data Committee, which in turn is part of a larger worldwide initiative to characterize land cover and land use in a standardized manner.

The classification presented in this report differs from previous vegetation studies:

- (1) in emphasizing existing rather than potential vegetation, and*
- (2) by refining the coarser level classifications to produce a more detailed system intended for conservation management purposes.*

The report includes a table attempting to reconcile this classification with the major classifications that preceded it.

The conservation status of each of the 36 Alliances/Associations is identified using a two-tier labeling system modified from the Red Data Book Categories of the World Conservation Union (IUCN). 10 Alliances/Associations are classified as Rare (very restricted in distribution and/or size), and one of these is also considered Endangered (in danger of extirpation).

INTRODUCTION

This vegetation classification for St. Kitts and Nevis is designed to provide

- An overview of the environment of St. Kitts and Nevis;
- Background on previous studies of the natural environment of the area , with emphasis on forestry and vegetation; and
- A management tool to assist in classifying and assessing the country's biodiversity, based on the underlying vegetation communities.

Ideally, conservation efforts will be prioritized and guided by information on distribution and abundance at the species level; but, as a first step, a less resource-intensive approach, one that works at a community level, has been used in this report. The classification identifies 36 Alliances and Associations (defined below), which are sufficiently different from one another to be distinguishable in the field, and probably from aerial photos. The "*Location*" heading in the classification tables after page 27 identifies where to find particularly good examples of each vegetation type, which can be visited to reinforce the descriptions.

An obvious conservation priority that evolves directly from the classification is the importance of ensuring that at least a few sites of each of the natural communities are protected. Not only would this protect the country's biodiversity at the ecosystem level, but at the species level it should provide substantial protection of much of the flora and fauna. A conservation status summary is presented following the classification.

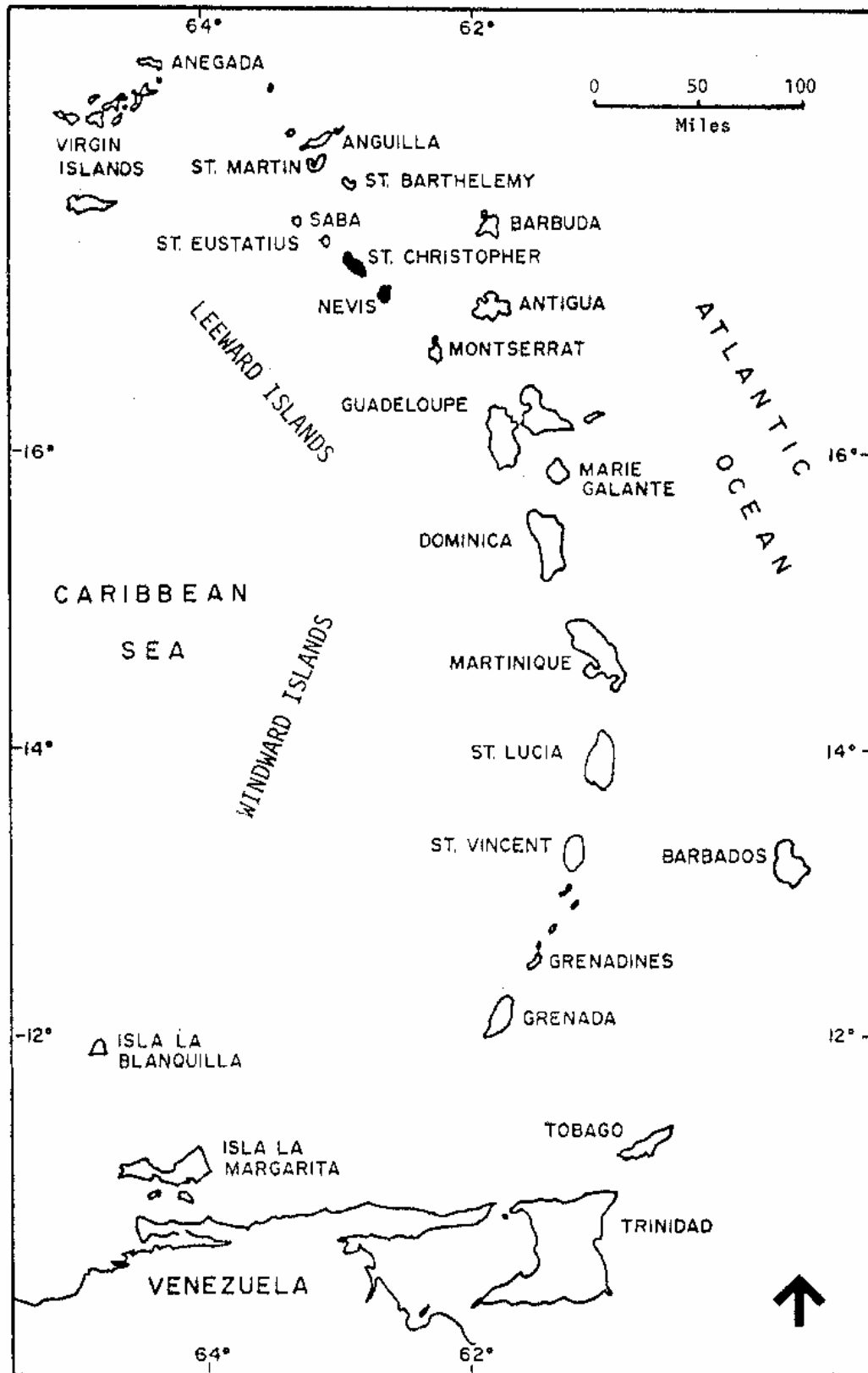
INTRODUCTION TO THE ENVIRONMENT OF ST. KITTS AND NEVIS¹

St. Christopher and Nevis are but two of an extended archipelagic clustering of oceanic islands in the Eastern Caribbean known collectively as the Lesser Antilles (Figure 1). This biogeographic grouping is notable among scholars and tourists alike for its cultural, environmental and geomorphological diversity.

Amidst the assembly of diverse island ecosystems that form the northeastern boundary of the Caribbean basin, St. Kitts (called this as a shortened version of St. Christopher since the eighteenth century) and Nevis have together succeeded in fashioning for themselves a national identity and a public image of uniqueness derived in part from

¹ This section is taken largely from the *St. Kitts and Nevis Environmental Profile*, published in 1991 by the Caribbean Conservation Association and Island Resources Foundation, to which the reader is referred for more detailed information including full citations and references.

the country's distinctive, dramatic and spacious landscape profile. Each island, one larger, one smaller, is dominated by a single, fairly youthful volcanic cone surrounded by fertile slopes, called glacis, falling away almost uniformly but always gracefully towards the sea in all directions. There is little of the flatness of a Barbados, only a touch of the dryness of an Antigua, and none of the mountainous irregularity of a Grenada, a



Map: Eastern Caribbean, showing the location of St. Kitts and Nevis.

St. Vincent, a St. Lucia or a Dominica — with their convoluted interior terrain and maze-like radiating ridges, spurs and deep, isolated valleys, bound together by a narrow coastal strip of densely-populated land which guards the few entries to less accessible hinterland.

By way of contrast, the so-called hinterland of St. Kitts and Nevis is open for all to see, from coastline to mountaintop in one continuously graceful sweep, a verdant display of microhabitat variation and altitudinally conditioned biodiversity. The whole is comprehensible, center to edge, core to periphery, the inside and the outside are one. Even the central massif is crossed by the old military road at Phillips Level in St. Kitts; while Nevis, two centuries ago, had an upper level, circular road around Nevis Peak at about the 1,000 foot contour level with open, cultivated land above this road (reopened in 1998 as a hiking trail). Perhaps this openness, this variable display of nature's vegetational splendor in the sunlight and the rain, is why Kittitians and Nevisians take obvious pride in what their separate but almost linked pair of islands looks like, from the air, from land and from the sea. They talk about it, and they are quite aware of its history. They seem to have an innate understanding that the assembled landscape features, both natural and man-made, really do constitute a remarkable resource, part of the national patrimony, and a thing of value that is priceless.

This distinguishing feature, the biogeographical face of the country that is called landscape, was shaped in its present form not just by nature but by the interaction of man and nature over time. In St. Kitts, several centuries of conscientious land husbandry on sugar estates have left an aesthetically pleasing, orderly, well-proportioned rural landscape or "countryside", disproving the universality of the customary argument about the damaging effects of plantation-based monoculture — or at least confirming a Kittitian exception to the rule. Meanwhile, the long, less satisfactory experience of Nevis with sugar, at least until the 1950s, and since then with free-grazing goats, sheep, cattle, and pigs, has scarred and ravaged a vegetation that would have otherwise helped stem wind and water erosion and reduced the impact of sediments transported by run-off to coastal waters and reefs.

The two islands are only separated physically by a modest ocean channel known appropriately as the "Narrows," which is neither wide nor deep but is nonetheless metaphorically profound (see Figure 2). This situation is reflected in the unique kind of binary "Federation" under which the two officially operate as one.

CLIMATE

Situated some six degrees south of the Tropic of Cancer with temperature-moderating areas of open ocean to the east, both islands have a tropical marine climate, heavily influenced by steady northeast trade winds, which produces an environment almost ideal for human comfort. There are only small variations in temperature throughout

the year, the average at Basseterre being 27.8 degrees C (79.6 F). Nevis temperatures and seasonal variations are similar. At lower elevations, maxima above 32 degrees C (90 F) and minima below 18 degrees C (65 F) are extremely rare. Only at higher elevations, where the rule of thumb is a one degree Celsius ambient temperature drop

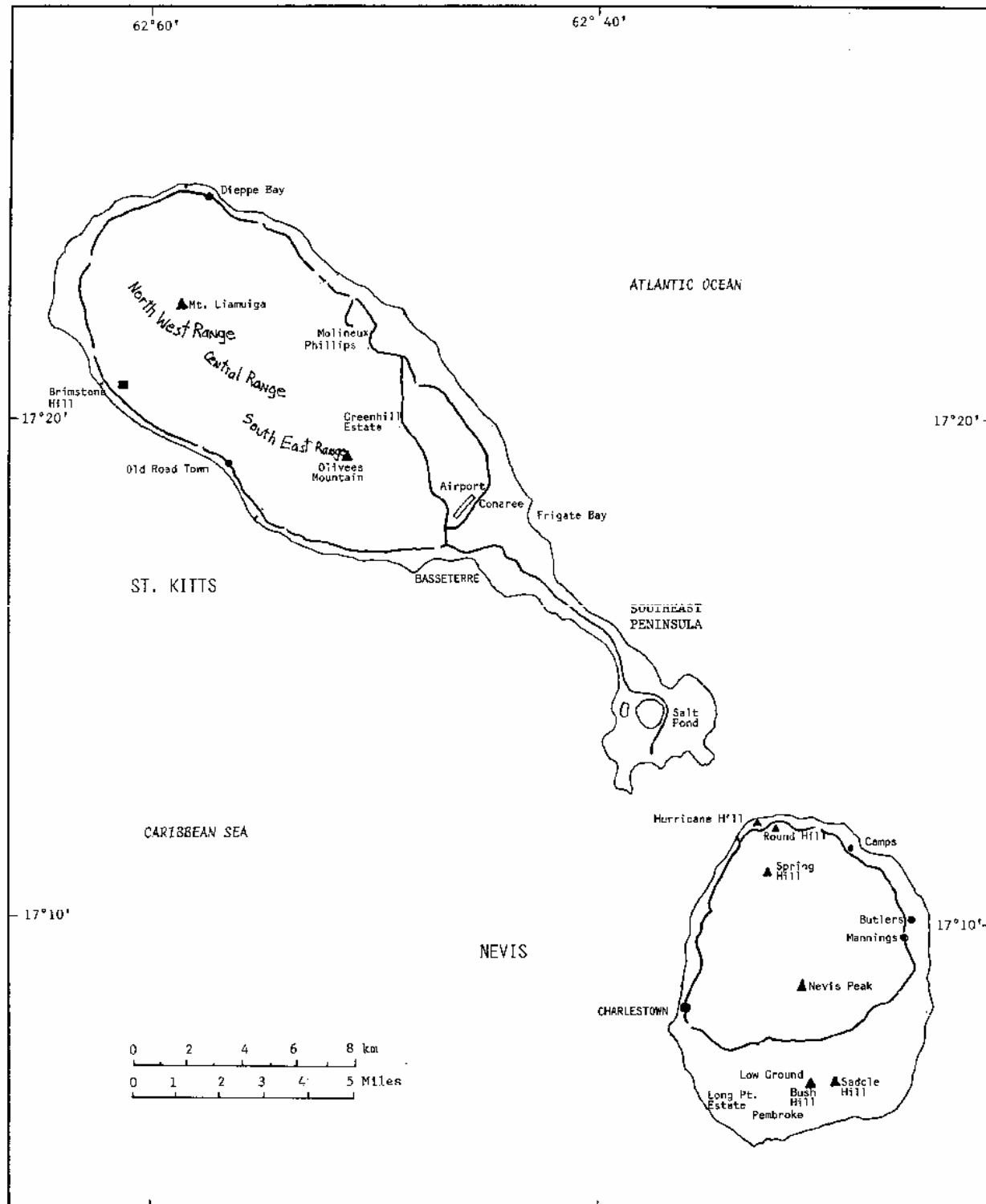


Figure 2. General location map for the islands of St. Kitts and Nevis,
highlighting locations and sites mentioned in the Vegetation
Classification.

per 100 meters in altitude above sea level, do temperatures drop below 17 degrees C (60 F).

The prevailing winds hold fairly steady from the east, swinging seasonally between northeast and southeast with mean speeds ranging from 5.4 mph in November to 9.1 in July. The months with the higher wind speeds are the dry months from January to March. Cloud cover is more common than would be expected, averaging between 40 and 50 percent, which helps account for the relatively low evapo-transpiration rate of around 40 inches per year.

Free water evaporation rates are about five inches per month or 60 inches per year, which explains the general absence of open water empoundments and the preference for tanks and cisterns for water storage. Relative humidity averages 76 percent but ranges from 70 percent in March to 78 percent in September, October, and November. The islands receive an average of nine hours of sunshine per day.

RAINFALL

ST. KITTS

Rainfall over the main landmass of St. Kitts is relatively plentiful. With its central mountain range extending from Mt. Liamuiga, at 3,792 feet (1,156 m) elevation to the peak of the South East Range at 2,953 feet (901 m), the uplift effect produces an annual average of 64 inches (1,625 mm).

Except for the Southeast Peninsula (SEP), rainfall is fairly well distributed throughout the island although there are some seasonal variations, with a wet period from August to November and dry period from mid-January to about April. The driest year on record recorded 33 inches (832 mm) from a dry area, while the island average for the same year was 45 inches (1,143 mm).

On the Southeast Peninsula precipitation varies from 39 inches (1,000 mm) on the peaks to 34 inches (864 mm) at Cockleshell. The remnant dry forest on the Peninsula reflects this relatively dry climate and high evaporation rates. There is some evidence, however, that individual rainstorms can be very intense and cause flash flooding.

NEVIS

Islands like Nevis with one or more high peaks manufacture their own local weather, creating a range of micro-climates which vary greatly with height, location and orientation. Nevis has several projecting masses, with Nevis Peak at 3,232 feet (985 m) the dominant feature, which cause a marked upward deflection of westerly moving, moisture-laden air. This rising sea air is cooled by expansion, and the moisture is

condensed so that orogenic cloud formations and often heavy precipitation result. A typical feature of central mountain peaks in the Eastern Caribbean islands is a cap of "trade wind clouds" which masks their summits day after day and is only occasionally dissipated in very still or very dry weather.

Rainfall records for Nevis are more consistent than other climatic data. More than one-half the island receives less than 50 inches (1,270 mm) of rainfall per year, with the average rainfall being 46 inches (1,170 mm), as compared to the average for St. Kitts of 64 inches (1,625 mm). Mean annual rainfall varies from 29.66 inches (753 mm) at New River on the windward side to 51.60 inches (1,310 mm) at Hamilton's Estate on the western slope of Nevis Peak. Rainfall is lowest along the eastern side and increases with altitude. Monthly data show that most rain falls between July and January with a lesser monthly peak occurring in May. However, there is considerable variation from

St. Kitts "Vital Statistics"

LOCATION	Latitude: 17 degrees 15 minutes North; Longitude: 62 degrees 45 minutes West. 3 km (2 miles) northwest of Nevis.
AREA	176 sq. km (68 sq. mi.); 36.8 km (23 mi.) long, roughly oval in shape with a narrow neck of land extending like a handle from the southeastern end
CAPITAL	Basseterre
HIGHEST POINT	Mount Liamuiga, 1,156 m (3,792 ft)
CLIMATE	Tropical and maritime, heavily influenced by steady northeast trade winds with an average temperature of about 81 degrees F (27 degrees C)
RAINFALL	Annual average is 64 inches (1,625 mm)
PHYSICAL FEATURES	Central mountain range dominated by Mount Liamuiga surrounded by cane-covered slopes, dissected by ghauts, reaching to the sea. The southern branch of the range encloses a spacious fertile valley and the capital of Basseterre. Golden sandy beaches surround the Southeast Peninsula, although most island beaches are of gray to brown volcanic sand.
ECONOMY	Until recently, the only remaining sugar monoculture in the Eastern Caribbean; faced with continuing reductions in sugar market, Government has embarked on a program to diversify the agriculture sector and stimulate development of other sectors, especially tourism and light manufacturing and crafts.
TOURISM	Tourism is gradually replacing agriculture as the major economic sector and is an important source of foreign exchange. Prior to development of Frigate Bay resort area in 1972, tourism focused on small, locally-owned hotels and guest houses.

Nevis "Vital Statistics"

LOCATION	Latitude: 17 degrees 10 minutes North; Longitude: 62 degrees 35 minutes West; 3 km (2 mi.) southeast of St. Kitts
AREA	93 sq. km (36 sq. mi.); 12.3 km (7.64 mi.) long and 9.6 km (5.96 mi.) wide
CAPITAL	Charlestown
HIGHEST POINT	Nevis Peak, 985 m (3,232 ft)
CLIMATE	Tropical and maritime, heavily influenced by steady northeast trade winds with an average temperature of about 81 degrees F (27 degrees C)
RAINFALL	Annual average is 46 in (1,170 mm)
PHYSICAL FEATURES	Nevis is of volcanic origin and is dominated by a central peak (Nevis Peak) usually embraced by clouds. Deep ghauts (guts) dissect slopes from below the Peak to the sea with no regular stream flow except during heavy rains. There are no bays, inlets or cays of significance, but long stretches of golden, sandy beaches surround much of the island. Growth cover is extensive but not dense, and many wetlands occur along the leeward coast.
ECONOMY	Agriculture, tourism, fisheries, boat building, commercial trading, construction trades and a very small manufacturing sector
AGRICULTURE	Vegetable crops, citrus (variety of both with no dominant crop); cattle, sheep, goats, pigs (many free-grazing)
TOURISM	Concentrated along Pinneys Beach area from Charlestown to Newcastle and in the Gingerland area between approximately 800 and 1,000 feet

year to year and month to month. While short periods of drought can occur at any time throughout the year, the months of February through April are most susceptible to extended droughts.

TOPOGRAPHY AND GEOLOGY

ST. KITTS

Topography. At 176 square kilometers (68 square miles), St. Kitts is the larger of the two islands comprising the Federation of St. Kitts and Nevis. The entire island is perched midway on a submerged ridge or bank some ten miles wide with a northwest to southeast axis from which both Nevis and neighboring St. Eustatius also arise. The main part of St. Kitts has a rugged backbone dominated by the Northwest Range that includes three linked volcanoes, with the largest (and youngest) of these – Mt. Liamuiga (Mt. Misery until independence in 1983) – rising with a pronounced crater to 3,792 ft (1,156 m). Southeast of Liamuiga, the now dormant volcanic chain continues with the Central Range and the Southeast Range (dominated by Verchild's Mountain and Camp Crater, respectively) after which the land descends into the Basseterre Valley. The steeper part of St. Kitts' central, mountainous interior is surrounded by an upland forest belt blending into a gradually sloping coastal plain sweeping gracefully seaward, covered primarily by sugar cane with expanding patches of diversified agricultural crops and some pasture land. Minor domes protrude from these lower slopes at Brimstone Hill, Ottley's Mountain, Sandy Point Hill, and Monkey Hill.

The coastline of the island's main landmass consists primarily of cliffs, some 50 to 100 feet high. At the foot of these cliffs are narrow beaches comprised of coarse "black" (volcanic) sand and numerous pebbles and boulders. In the northwest, however, the cliffs are lower, and some of the beaches are wider and comprised of yellow sand. Coastal erosion, caused by various factors such as reef damage due to excessive sediment loads, biocide run-off and other land-based sources of pollution, is a continuous and ubiquitous problem for the state.

Except at the eastern (Fort Tyson) and western (Fort Thomas) headlands, there are no cliffs along the Basseterre Harbour shoreline nor in the area extending from Cayon to the Atlantic side of Frigate Bay where there is a very long but rugged, high-energy beach. Nearby, and pointing off in the direction of Nevis, the rugged Southeast Peninsula contains the island's best swimming beaches except perhaps for the Caribbean side of the Frigate Bay development area.

Only made accessible in the last decade by an access road, the Southeast Peninsula is actually a cluster of seven older, small rocky islands linked by more recent beach and saline marsh deposits, originally tombolos, now broadened into flat sedimentary plains and marsh land tying the seven islets together. At Frigate Bay they are linked to the base of the older volcanics of the Conaree Hills. All the residual hills on the Peninsula are smoothly rounded with slightly convex peaks, once heavily forested but now covered mostly with dry scrub woodland vegetation – principally, acacia, agave, and columnar and Turks Head cacti on the hills, with guinea grass on open, burned-over

areas and with Manchineel, mangrove, Seagrape and beach strand vegetation occurring intermittently at the base of the hills along the shoreline or the salt pond margins.

Excluding the Frigate Bay area, which is the actual base of the Peninsula and which has 380 hectares (850 acres), the Southeast Peninsula proper embraces over six square miles (1,600 hectares/4,000 acres) and eight saline ponds that vary in size from 160 ha (400 ac) to 1.6 ha (4 ac).

The topography of the Peninsula consists of two quite distinct features: (1) a narrow, isthmus-like, rock spine slightly more than 0.5 km in width and about 4.5 km in length, extending in a southeasterly direction from Timothy Hill at Frigate Bay to Salt Pond Hill and (2) a larger, roughly triangular area shaped like a grand amphitheater with a cluster of hills surrounding the 440 acre Great Salt Pond which has a watershed catchment area of about 380 ha (940 ac). The highest hill on the Peninsula is St. Anthony's Peak at 319 m (1,047 ft).

Geology. The island, which remains seismically active, has a core of older (Eocene) volcanic material comprised largely of andesite. This material is exposed in the Canada Hills and Conaree Hills to the north and east, respectively, of Basseterre and in the Southeast Peninsula. Three younger volcanic centers are found along the island's central spine, which were active during the Pleistocene period when they yielded andesitic pyroclastics. The latter are retained as ash, reworked sands and gravels, cobbles, and boulders. Mud flows or lahars are common in the northwest, characterized by a silt or clay grade matrix. Mt. Liamuiga is a relatively simple strato-volcano with a deep summit crater about 1,000 yards in diameter. The earliest subaerial eruptions probably occurred about one million years ago and a much larger cone than the present one was built up at that time. The present steep central cone is made up of andesitic and basaltic lava flows, agglomerates and pyroclastics.

Evidence of a basalt flow from Mt. Liamuiga can be seen at Black Rocks and above Profit Estate, and a small area of older limestone can be found on the sides of Brimstone Hill and at Godwin Ghaut above 1,000 feet. Recent marsh deposits are present in low areas of the Southeast Peninsula, and some alluvial outwash deposits can be found in ghaut floors by the coast.

No obvious geologic faults have been recorded, but several observed lineations may be deeper faults that have been masked by volcanic ejecta.

NEVIS

Topography. At the northern end of the Lesser Antilles archipelago, where Nevis and its sister island are located, the Leeward Islands comprise a double arc, with an older, elementary arc to the east and a younger volcanic arc to the west. Nevis lies on the inner arc, near the southeastern border of the St. Eustatius bank, and comprises

some ten distinct volcanic centres. These are strung out along a line trending approximately southeast to northwest, parallel to the trend of the inner, volcanic arc. These centres are flanked by and, in some cases, almost overwhelmed by volcanogenic deposits.

Topographically Nevis is approximately circular and dominated by the central Nevis Peak, some 985 m (3,232 ft) high. Nevis Peak is such a dominant feature that, especially when viewed from the west, the peak overshadows other topographic features, giving the island the appearance of a textbook volcano. In plan view, however, Windy Hill (309 m) and Saddle Hill (381 m) at the head and tail of the island, respectively, align with Nevis Peak to form a north-northwest/south-southeast trending spine comparable to the more pronounced spine of St. Kitts. To the east the spine is thickened by the bulge of Butlers Mountain. (578 m). Slopes vary from almost zero near the sea, to over 40 percent in the vicinity of Saddle Hill, Butlers Mountain, Nevis Peak and Windy Hill.

Geology. The thick cloak of volcanogenic sediment, together with the dense carapace of vegetation sported by the island, for many years encouraged geologists to adopt a sketchy approach to Nevisian geology; and for a long time it was assumed that Nevis comprised simply one volcano. Two factors served to alter this view:

- The application of aerial photography, especially in the 1950s;
- The appointment in the 1950s of a geologist, based in St. Lucia, responsible for geological matters in the Lesser Antillean region.

This geologist, Dr. P. H. A. Martin-Kaye, accumulated considerable data, although only a little of it was published. Among his unpublished works is the first geological map of Nevis, copies of which were lodged with the Institute of Geological Sciences in the UK (now the British Geological Survey). Although only a sketch map, Martin-Kaye's map remains unchallenged to this day and has formed the basis for subsequent sketch maps.

Although Nevis is primarily a volcanic island, the oldest rocks are of marine origin. On the southern slopes of Saddle Hill an obscure outcrop of conglomerate yields blocks of recrystallized limestone that contain foraminiferids of mid-Eocene age. The next oldest rocks are volcanic, and much younger, being erupted during Pliocene time. The older volcanics crop out on the northwestern coast, while the youngest form Nevis Peak; Saddle Hill to the southeast is of intermediate age.

SOILS

The agricultural soils of St. Kitts and Nevis have been used extensively and intensively for over three hundred continuous years. Although the lowland soils of Nevis, in particular, show the ill effects of this and of other uses, in general the soils of both islands have stood up amazingly well to the long period of cultivation.

This is largely the result of the quality of the locally available parent material provided by recent volcanism in the islands. The fragmented volcanic ejecta (rock and ash) is rich in mineral elements required by plants. The physical qualities, in addition to the chemical qualities, are such that the parent material weathers rapidly into soil. It is known from other studies done in the region that fresh volcanic ash soils can give rise to truly fertile soil within ten to twenty years after the time of deposition or fresh exposure to weather. Therefore, it can be assumed that, to some degree, the ill effects of soil erosion on the cultivated slopes of St. Kitts, and to a lesser degree on Nevis, have been somewhat offset by the rapid rate of soil formation.

Chemical analysis of the country's soils as early as 1947 confirmed certain deficiencies. Low nitrogen and organic matter figures for the non-forest cane fields tend to confirm the negative impact of long continued cultivation. Although not shown in the table, potash levels were low, averaging only 112 ppm as opposed to a needed 120 ppm minimum. This potash deficiency accounts for the attention of colonial planters to collecting and applying pen manure to their lands and also explains the more recent shift to commercial fertilizers containing potash when working cattle and horses were replaced by tractors.

There are very marked differences between the soils of St. Kitts and the soils of Nevis. This is reflected in equally notable differences in the agriculture of the two islands and the effects that agriculture has had on the landscape and on the environment of each. It is noteworthy that the standard St. Kitts and Nevis 1966 Soil and Land-Use Surveys by Lang and Carroll, although published together as one document under the aegis of the Imperial College of Tropical Agriculture, were in fact prepared separately by two investigators who wrote individual reports that differ significantly in map detail. Mr. D. M. Lang was responsible for the survey of Nevis and Mr. D. M. Carroll carried out the work on St. Kitts. One of the few things that they had in common was a shared preference for a pedogenetic soil classification system based on the degree of maturity and weathering. This made their reports useful as a guide to the nature of the soil types but not very helpful as an inventory of the resource or for soil management and conservation purposes. Under these circumstances, soil issues in the state have tended to remain separated. Following independence under the Federation, two separate agencies for agriculture emerged – one for (and in) St. Kitts and one for (and in) Nevis.

ST. KITTS

G. Merrill, in his 1958 monograph on the historical geography of St. Kitts and Nevis, identified four primary soil types on the larger island:

Yellow. An ash-based, porous, well-aerated soil that makes the best agricultural soil, for example, the fine ash deposits on the Olivees Range which weather into "yellow earth," the color due to limonite particles.

Brown-Yellow. Good for crops, weathers from small stones, angular boulders, sand (mixed), covers much of the well-watered western slopes and lowlands (except the peninsular), low nitrogen (N) and Potassium (K), low organics, needs animal or chemical fertilizer.

Red-Brown. Soils of the upper slopes, higher in nitrogen and organic matter but leached by high rainfall in areas far too steep for agriculture, under forest cover.

Shoal. Montmorillonitic clay with silica pan, as on the Southeast Peninsular, difficult to farm lowland, similar to Nevis lowland soils.

Subsequently, in 1963, two visiting soil scientists (Lang and Carroll), carried out the necessary field investigations, one on each island, and completed a greatly expanded pedogenetic profile of the soils of both St. Kitts and Nevis. A new soil map for each island, at 1:25,000 scale, was prepared at the same time.

Although the new classification system involved 33 different soil types, they have been divided and summarized into five main groups as follows:

1. Shallow soils over volcanic materials (12%);
2. Deep, strongly weathered kaolinitic and allophanic clay and silt soils from volcanic materials with good physical properties (Latosolics) (22%);
3. Deep, little weathered, sandy soils from volcanic materials (Protosols, Young soils) (45%)
4. Montmorillonitic clay soils, usually shallow and with a silica pan (shoal soils) (19%);
5. Alluvial soils (1%) and other (1%).

NEVIS

In brief, Nevis has fewer soil types, more problem soils, less good cane soil, and extensive areas where good soil was rendered almost unusable because of a profusion of interlayered rocks, clasts, and boulders.

The three primary soil types of Nevis are as follows:

- *A Red-Brown Earth* at the summit of Nevis Peak. This soil is mature, but strongly acidic and of little agricultural importance.
- *A Brown-Yellow Earth*, which encircles the area of the Red-Brown Earth type. This is a good agricultural soil but contains many boulders that limit mechanized methods of cultivation.
- *A "shoal" soil*, which occurs in low-lying areas. Lying on volcanigenic sediments, this soil is loamy but clayey and difficult to cultivate.

Lang and Carroll (1966) recognized 24 soil series, of which four are variously subdivided into stony, rocky, and stone-free phases. The soils recognized vary in area from 16 acres, for both the Clay Ghaut clay and the Sulphur Ghaut clay loam and clay, to 7,400 acres for the bouldery phase of the Charlestown clay loam and clay. Individual areas of soils recognized are as small as two acres, and many are smaller than 40 acres.

VEGETATION

Within the climatic belt south of the Tropic of Cancer, moisture-laden trade winds are commonly forced upwards when they confront the landmass of even small tropical islands with prominent central peaks like St. Kitts and Nevis. The cooled moisture in the air precipitates as rain, falling most consistently on the upper slopes. Therefore, island vegetation at higher elevations receives the highest rainfall, and the leeward side of the island customarily receives slightly more rain than the windward side because the air masses and clouds formed at the peak move in a westerly direction under the influence of the prevailing winds.

A second factor, additional to rainfall, that influences vegetational distribution within islands like St. Kitts and Nevis is the extraordinary variety of "micro-climates" which can prevail in small island systems. Altitude, temperature, humidity, saltiness of the air, the intensity and incidence of sunshine, wind exposure, and soil type(s) all interact and conspire to create numerous locally site-specific, variable "climates" within each island. This suggests how impossible it is to speak accurately about the "climate" of any one island or even cluster of islands. Beard (1949) exaggerates only a little when he says, "Scarcely a single acre in the islands has exactly the same climate as its neighbour." Anyone who looks closely can see evidence of these variations because they are mirrored by each island's mosaic-like overlay of diverse combinations of natural vegetation. They are the very substance of the habitat side of biodiversity. Without them, the landscape would be less interesting, less colorful, and less productive. It would also be more uniform and therefore more at risk.

The flora of the Lesser Antilles embraces about 2,000 species of flowering plants, of which, according to Beard (1949), 243 are trees (a tree being a woody plant capable of attaining a height of five meters at maturity). Of these 243 species of trees, St. Kitts and Nevis have approximately half or 121 species.

The present vegetation of St. Kitts and Nevis gives evidence of great disturbance by human activity. In the lowland areas intensive land use has removed all vestiges of the natural vegetation and everywhere – except in urban Basseterre, Bird Rock, Frigate Bay and on the Southeast Peninsula – agricultural crops prevail. The mountain peaks are still covered by forest, but it is quite unlikely any extensive virgin forest remains intact. However, the so-called Palm break, Elfin woodland, *Podocarpus* stands, and other small patches of native vegetation are all that remain of "virgin forests". Most of the forest at

lower reaches of the mountainous areas are secondary growth on previously cleared, once farmed but now abandoned upland marginal cane land or provision grounds. There are few places where charcoal burners have not been; and undisturbed rain forest, not a large area to begin with, is relatively rare on both islands.

ST. KITTS

The so-called travel literature of the seventeenth, eighteenth and nineteenth centuries contain a wide assortment of descriptive accounts of the vegetation of St. Kitts and Nevis. St. Christopher was described by one of the original settlers as being all "... overgrown with palmetos, cottontrees, lignum vitae and divers other sorts but none like any in Christendom".¹ But human occupation had its price, and the forests were not only cleared for cane but also were regularly used as a source of fuel in the production of sugar. As a result, before the end of the seventeenth century, planters on St. Kitts were complaining to visitors about the shortage of timber (Merrill, 1958).

Two hundred years later, at the beginning of this century, Dr. N. L. Britton, Director in Chief of the New York Botanic Gardens, visited St. Kitts and undertook a local survey, reporting on it in the Garden's *Journal* of 1901 just two years prior to passage of St. Kitts' milestone Forestry Act. Britton's report later was to become a key segment of the very popular 1920 *St. Kitts-Nevis Handbook* written by Katherine Burdon, wife of the Government Administrator at the time. Burdon's useful book included, beyond vegetation, a wide variety of information on health, geology, flora, fauna, agriculture, and climate. Based on Britton's fieldwork, the Handbook identified five major vegetation types, occupying distinctive zones, which had obviously been affected by several hundred years of colonial occupation:

Littoral Vegetative Belt— A halophytic (salt tolerant) shoreline zone composed of such species as Seagrape (*Coccoloba uvifera*) and three mangrove species (*Rhizophora mangle*, *Avicennia nitida*, and *Laguncularia racemosa*).

Xerophytic Vegetative Belt— Dry vegetation occupying low rocky hills and principally composed of cacti (*Cereus* and *Opuntia* spp.), *Plumeria alba*, *Acacia farnesiana*, and species of *Rauvolfia* and *Euphorbia*.

Cultivated Belt— Composed of agricultural crops, such as sugar cane and exotic weeds.

Mesophytic Flora— A forested zone at mid-elevations, characterized by a variety of forest trees.

¹ Churchill, A. and J., 1944-46. A Collection of Voyages and Travels ..., 6 vols. Liverpool.

Mountain Summit Vegetation—The windswept zone along ridge lines and associated windward slopes.

Britton's work included preparation of a list of interesting and useful trees and shrubs. A total of 77 species were included in that list (Burdon, 1920).

Some forty years later, as World War Two was distracting some, other public servants in the Caribbean were not so easily diverted from their appointed ways. First, the Assistant Conservator of Forests for Trinidad and Tobago, J. C. Cater, made a brief visit to St. Kitts in the early 1940s in conjunction with an evaluation of forestry practices and associated issues in the Leeward Islands. Cater's recommendations for a regional research effort led to the most significant assessment of the vegetation of St. Kitts (and Nevis) ever undertaken. Under the aegis of the Colonial Forest Service, J. S. Beard, as part of a larger regional survey that had begun in 1943, visited St. Kitts and Nevis in 1946 for necessary fieldwork and mapping. His classification scheme lists five major forest type remnants in St. Kitts of the original vegetative cover. Beard identified these five forest associations:

Rain Forest—of which Beard says, "Only two relatively small areas of first-class undamaged rain forest were located in St. Kitts, the one lying in the head-waters of the Wingfields River and the other above Mansion Estate." Where relatively undisturbed, Gommier (*Dacryodes excelsa*) was the principal species, with an understory of regenerating Gommier, and palms. Where disturbance was in evidence, which Beard attributes to hurricanes, there is less gommier in the overstory. Palms were reported to compose 55 percent of the stems counted in Beard's sample plot, at the disturbed Mansion Estate site.

Dry Evergreen Forest—Beard identified this as secondary forest occupying lands below the rain forest. Twenty-one species were enumerated by Beard and included many intolerant, pioneer species.

Palm Brake—This type was found above elevations ranging from 1,200 to 1,800 feet. Beard reported, "The forest is dominated by palms (always the Mountain cabbage, *Euterpe globosa*) which form over 60 percent of the total crop." Tree ferns (15 percent) and small trees (25 percent) made up the balance of the stems in Beard's sample. Approximately 10 tree species were shown to grow in association with palms, and Beard reported 800 stems per acre.

Elfin Woodland—This is the tropical alpine meadow reported by Cater. Beard indicates this type occurring above 2,000 feet elevation. He describes it as "a low, gnarled tangled growth, usually about 12 feet high, loaded with moss and epiphytes and matted with lianes." Beard identified about 10 woody plants in this type.

Dry Scrub Woodland—Beard suggests this is principally isolated to the Southeast Peninsula and has been heavily impacted by past use. Beard

identified 39 species and indicates this to have been originally a deciduous seasonal forest.

In the vicinity of the summit of Mt. Misery (Liamuiga), Beard reported a pioneer community characteristic of volcanic ejecta and observed also in Martinique, Guadeloupe, St. Vincent and Dominica. In St. Kitts, this vegetation, composed of mosses, lichens, ferns and dwarf woody plants, covers the peak. Beard suggested this unique vegetation is a sub-climax type resulting from development on volcanic material where soil is lacking.

A distinguishing feature noted by Beard in describing the vegetation of St. Kitts was the surprising lack of well-developed rain forest. This he attributed to periodic stand damage from passing hurricanes that cause breakage and subsequent forking of larger specimen trees. The resulting uneven forest canopy allows additional light to penetrate and encourages growth in adventitious or second growth species that may not be part of the climax forest type. Beard contrasts the disturbed Mansion Estate plot with a more developed plot at Wingfield, and concludes that hurricanes play a major role in controlling composition and complexity of forest vegetation and that periodic disruption is variable due to storm direction and intensity. The effect of storms is undoubtedly an impact that continually molds the forest cover and maintains much of the forest in a pre-climax condition.

NEVIS

The vegetative zones of Nevis follow the pattern typical of small, volcanic Caribbean islands. Beard's 1949 vegetation report on St. Kitts-Nevis included a distinct, separate section on Nevis, in which he took note of the extensive secondary scrub woodlands and thornbush amidst the cultivated acreage in the lowlands. He further observed:

Good high forest is only seen on the north-western face of the main mountain above Jessup's, where protection from the prevailing wind has enabled a good stand of rain forest to develop. At the head of the Stapleton River on the north-east there is also some high forest but it is somewhat ruinate. Elsewhere on the mountains the slopes are so steep and exposed that the belt of low secondary woodland adjoining cultivated lands at the foot is very quickly succeeded by palm brake which continues right up to the summit (Beard, 1949).

Nevis has, according to the Beard system of classification, six vegetation zones. They are: rain forest, dry evergreen forest, montane thicket, palm brake, elfin woodland and dry scrub woodland.

Rain Forest and Humid Forest — The only substantial stand of tall forest is on the northwestern side of the mountain above Jessops. Abundant rainfall and protection from the prevailing winds allow the trees to grow to a considerable height and form a dense canopy. The dominant species are the

Mountain cabbage palm (*Euterpe globosa*), Gumlin (*Dacryodes excelsa*), and Burrwood (*Sloanea truncata*).

The humid forest zone surrounds the mountain and resembles the rain forest in species content. However, due to the steepness of the slope and high wind exposure, the trees are smaller and do not form a dense canopy. This allows more luxuriant herbaceous ground vegetation to form. Redwood (*Coccoloba diversifolia*) is more prominent here possibly due to the drier conditions.

In both the humid and rain forest zones, the species diversity is low (approximately 25 distinct species). However, this feature is not uncommon in the Lesser Antilles (Beard, 1949).

Elfin Woodland – The summit of Nevis Peak is covered with low, gnarled, tangled growth. This forest is usually under three meters high and laden with moss and epiphytes and matted with lianas.

Woody plants are very low growing due to very high wind exposure, and herbaceous plants are quite common. The most common plant is a bromeliad that appears to be an undescribed species of *Guzmania*. Orchids, mosses, ferns, anoids and grasses are also abundant (Beard, 1949).

Montane Thicket – Beard discovered only a thin belt of montane thicket on Nevis, located just above the rain forest on the west side of the mountain. This area is dominated by Weedee (*Podocarpus coriaceus*) and Mountain cabbage palm. This pole stage forest contains no large trees except for an occasional large Weedee, usually bent and gnarled.

Palm Brake – Palm brake is a band of montane forest located on very steep slopes or in areas exposed to high winds. This zone is dominated by Mountain cabbage palm, and the rest of the forest consists of tree ferns (*Cyathea arborea*) and small trees.

On Nevis, palm brake occurs on the mountain slopes above 550 m on the eastern and southern slopes and above 700 m on the northern and western slopes; this band extends almost to the summit where it is replaced by elfin woodland. In some places slopes are so steep that even palms cannot persist, and they give way to patches of tree ferns (Beard, 1949). The limiting factor in tree growth here may be wind exposure. Palms and tree ferns are dominant because their trunks are flexible and can bend with heavy winds. Other more rigid trees must remain small or be blown over.

Dry Scrub Woodlands – The low hills of Nevis (e.g., Round Hill and Saddle Hill) consist of a patchy, scrub woodland. The prominent trees are various species of *Acacia* and *Cassia*. Also present are century plant (*Agave americana*), Prickly pear cactus (*Opuntia rubescens*), and Pope's head or Barrel cactus (*Euphorbia pulcherrima*) (Merrill, 1958). Most of the southern coast of

the island from the Bath Plain to Indian Castle consists of cactus scrub woodland.

Dry Evergreen Forest—The lower slopes of Nevis Peak that extend north and east are covered with an evergreen forest of small trees. The most prominent trees are white cedar (*Tabebuia heterophylla*), black mast (*Diospyros ebenaster*) and loblolly (*Pisonia fragrans*) (Beard, 1949).

MAPPING THE VEGETATION OF ST. KITTS AND NEVIS

The development of a vegetation classification for St. Kitts and Nevis is the first step in a process that could logically lead to preparation of a vegetation map for each island. It is important to keep in mind that the classification system only provides a detailed description of vegetation types occurring in both islands. It does not indicate their location and extent. Current country- or island-wide mapping is coarse in geographic scale and limited in the number of classes or themes. (See the two Vegetation Maps from the Nature Conservancy in *A Biodiversity Profile of St. Kitts and Nevis*.)

Mapping vegetation distribution will therefore require an additional level of effort. To achieve this, the following four steps are necessary:

- air photo acquisition,
- air photo interpretation and field verification,
- preparation of manuscript maps for
- final map production.

The acquisition cost for air photos will depend on whether good quality and contemporary coverage is available. If not, the cost to commission a new coverage will be significant. The level of effort for air photo interpretation and field verification is intensive and will be directly related to the number of air photos needed for interpretation as well as the extent of fieldwork required to confirm both the applicability of the classification and the accuracy of air photo interpretation. An experienced interpreter should be able to cover three to five air photos a day depending on scale and classification levels. An estimated two-to-three weeks (for two persons) is required to complete the fieldwork phase. Following this, it should take an additional two-to-three weeks to prepare a manuscript map original ready for reproduction.

Estimated mapping costs for the two islands could total US\$35,000 to US\$40,000, assuming that aerial photos are available at around 1:12,000 scale. These figures are based on Island Resources Foundation's actual experience in 1998 preparing a vegetation map for the island of St. Croix, using the standardized methods described above.

The ultimate cost for the entire effort, including final map production, will depend on the desired level of detail and precision and which options are selected, *e.g.*, color maps printed in large quantity or maps produced with a GIS.

CLASSIFICATION METHODOLOGY

This investigation was undertaken with the expectation that the task would be to update one of several earlier vegetation studies of the country. However, researchers found that none of these classification systems was adequate to meet current local needs. One important difference between this classification system and the previous efforts of most of the others (except for Rodrigues, 1990) is that the earlier efforts emphasize vegetation categories that were believed to exist before Europeans disrupted the landscape. In a country whose landscape has been as severely impacted as it is in St. Kitts and Nevis, this emphasis obscures the biological realities of both islands today (although their work does raise interesting possibilities for restoration efforts).

Another shortcoming, for purposes of the current study, of these previous vegetation studies, and other influential regional-level studies such as Beard (1955), Stehle (1945) and Howard (1973) is that their categories are defined at too coarse a level (floristically and geographically) to address national biodiversity conservation and management objectives.

The system that is used in this report is based on the National Vegetation Classification System of the U.S. Federal Geographic Data Committee (FGDC, 1997); and, in particular, the application of this system to the Caribbean by the Southeast Regional Office of the Nature Conservancy (Weakley, 1996).

As stated in the Federal Geographic Data Committee document, the

overall objective . . . is to support the production of uniform statistics on vegetation resources at the national level [as] part of a larger effort . . . to create a global system to characterize land cover and land use.

The hierarchy for the National Vegetation Classification System is as follows:

DIVISION

ORDER

PHYSIOGNOMIC CLASS

PHYSIOGNOMIC SUBCLASS

PHYSIOGNOMIC GROUP

SUBGROUP

physiognomic level FORMATION

floristic level ALLIANCE

COMMUNITY ASSOCIATION

There are seven upper levels:

Division. This separates Earth cover into either vegetated or non-vegetated categories based on whether the vegetation cover is less than or greater than 1%.

Order. This describes the dominant life form (*i.e.*, tree, shrub, dwarf-shrub, herb, non-vascular).

Class. This refers to the relative percent canopy cover of the life form in the uppermost strata during the peak of the growing season. The Classes include:

- I. **Closed tree canopy.** Trees with their crowns interlocking (generally forming 60-100% cover).
- II. **Open tree canopy.** Open stands of trees with crowns usually not touching (generally forming 25-60% cover). Canopy tree cover (rarely) may be less than 25% but it exceeds that of the other life-forms.
- III. **Shrubland.** Shrubs generally greater than 0.5m tall with individuals or clumps not touching to interlocking (generally forming >25% canopy cover, and tree cover generally <25%). Shrub cover (rarely) over) may be less than 25% but it exceeds that of the other life-forms.
- IV. **Dwarf-shrubland.** Low growing shrubs and/or trees usually under 0.5m tall. Individuals or clumps not touching to interlocking (generally forming >25% cover, and trees and shrubs generally <25% cover). Dwarf-shrub cover (rarely) may be less than 25% but it exceeds that of the other life-forms.
- V. **Herbaceous.** Herbs (graminoids, forbs and ferns) dominant (generally forming >25% cover and trees, shrubs and dwarf-shrubs generally <25% cover). Herbaceous cover (rarely) may be less than 25% but it exceeds that of the other life-forms.
- VI. **Non-vascular.** Non-vascular cover (bryophytes and lichens) dominant (generally forming >25% cover; and trees, shrubs, dwarf-shrubs and herbs generally <25% cover). Non-vascular cover (rarely) may be less than 25% but it exceeds that of the other life-forms. Crustose lichen-dominated areas should be placed in the Sparsely Vegetated Class.
- VII. **Sparsely Vegetated.** Vegetation is scattered or nearly absent, between 1-10% cover.

Subclass. This is determined by the predominant leaf phenology (evergreen, deciduous, mixed evergreen-deciduous), and the average height of the herbaceous stratum. Different variables are applied to this hierarchical level in the Sparsely Vegetated Class.

Group. This is defined by a combination of climate, leaf morphology and leaf phenology. Different variables are applied to this hierarchical level in the Sparsely Vegetated Class.

Subgroup. A level of the hierarchy that splits Natural/Semi-Natural vegetation types from Planted/Cultivated vegetation types.

Formation. This is based on ecological groupings of vegetation units with broadly defined environmental and additional physiognomic factors in common.

There are two lower levels:

Alliance. This is the first floristic level and includes data on height of vegetation strata. The Alliance typically includes one or more characteristic species in its title and together with the description under “*Concept*”, it provides an operational definition that allows it to serve as the basic unit for conservation management concerns.

Community Association: In some, but not all cases, an Alliance may contain several Community Associations, which differ in species composition. The separation of Alliances into Associations is subject to the same prejudices that affect the “splitter versus lumper” debate in taxonomy. In general, this report probably errs in the direction of splitting Alliances because the resulting Community Associations provide more information at the species level and thus improve biodiversity conservation efforts.

It is interesting to note that the FGDC system proposes that the lower levels (*i.e.*, the Alliances and Associations) be based on data collected in the field using standard documented sampling methods. However, even though these have not yet been defined, investigators in the current study had little difficulty in using the system to prepare the St. Kitts and Nevis classification. Perhaps this experience may be an artifact of working on a small island and the familiarity with the landscape that this process allows, but the existing level of detail in the FGDC system already provides adequate criteria to identify Alliances and Associations.

ST. KITTS AND NEVIS VEGETATION CLASSIFICATION¹

I. Closed Tree Canopy

I.A. Evergreen Forest

I.A.1. Tropical or Subtropical broad-leaved evergreen rainforest

I.A.1.N Natural/Semi-natural

I.A.1.N.a. Lowland tropical or subtropical broad-leaved evergreen closed tree canopy

I.A.1.N.a. (1). *Siamea saman*-*Mangifera indica*-*Bambusa vulgaris* lowland tropical or subtropical broad-leaved evergreen closed tree canopy Alliance

I.A.1.N.a. (1). (a). *Siamea saman*-*Mangifera indica* Association

(b). *Bambusa vulgaris*-*Mangifera indica* Association

CONCEPT:

This alliance contains one association on Nevis and one on St. Kitts. In both Associations, the forest can be divided into three distinct strata—the canopy, the middle and the ground layers. The canopy reaches a height of between 33 and 40 m; the mid-level story reaches up to 20 m. The Association in St. Kitts differs from the one in Nevis (i) in containing *Siamea saman* rather than *Bambusa vulgaris*, (ii) by occurring at elevations of just above 330 m as compared to Nevis where it occurs primarily above 660 m, and (iii) by having more open understory.

Found near or along the banks of ghauts and streams, slopes and sheltered valleys at and above 330 m (St. Kitts) to about 660 m and above (Nevis). The forest is highly secondary in nature, occupying abandoned tree-fruit plantations and small subsistence plots on both islands. In St. Kitts, the forest is relatively more open as compared to moist forests at higher elevations, perhaps due to selective removal of the undergrowth to allow fruit trees to succeed. There is some evidence of limited management, whereby the mature fruit trees are maintained, and the fruits are harvested. The undergrowth is occasionally removed and/or "pruned" to reduce competition with the fruit trees. In St. Kitts, the pole saplings are collected to construct the frames of fish traps.

In Nevis, the forest is less open. The mature trees are somewhat shorter, and the undergrowth is more tangled, suggesting that there has been less interference by man in recent years. In both St. Kitts and Nevis this vegetation community has an abundance of lianas.

¹ For list of plant species included in this classification, see Table 1 (page 57).

SPECIES:

Canopy: *Siamaea saman*, *Delonix regia*, *Sapium caribaeum*, *Dacryodes excelsa*, *Mangifera indica*, *Hura crepitans*, *Ficus* spp., *Clusia rosea*, *Ceiba pentandra*, *Guazuma ulmifolia* and *Cecropia peltata*, *Mamea americana*, *Bambusa* sp., *Artocarpus altilis*, *Cocos nucifera* (occasional), *Cordia* sp., *Hymanea courbaril*, *Terminalia catappa*, *Ficus* spp., *Spondias mombin*, *Buchenavia capitata*, *Bambusa vulgaris* and, *Cedrela odorata*.

Mid-level understory: *Eurterpe globosa*, *Inga laurina*, *Clusia rosea*, *Mangifera indica*, *Cyathea arborea*, *Accrocomia aculeata*, *Musa* spp., *Citrus* spp., members of the Melastomataceae., *Ficus* spp., *Tabebuia heterophylla*, *Inga laurina*, *Drypetes piriformis*, *Pouteria multiflora*, *Theobroma cacao*, *Coccoloba pubescens*, *C. diversifolia*, and *Pisonia fragrans*.

Understory: *Heliconia* spp., *Anthurium* sp., a number of fern spp., *Cyathea arborea*, *Musa* spp., *Miconia* spp., *Tabernamontana citrifolia*, *Justica* sp., *Piper* sp., *Annona muricata*, *Philodendron* spp.

LOCATION:

In St. Kitts, at lower elevations in areas such as the lower Wingfields River, above the village; along the stream above Molineux and in many areas at the lower reaches of the slopes. This system is most common on the southern and the southwestern sides of St. Kitts.

SYNONYMY:

None known.

I. Closed Tree Canopy

I.A. Evergreen Forest

I.A.1. Tropical or Subtropical broad-leaved evergreen rainforest

I.A.1.N. Natural/Semi-natural

I.A.1.N.c. Montane tropical or subtropical rainforest

I.A.1.N.c. (1). *Dacryodes excelsa*-*Sloanea* montane tropical or subtropical rainforest

CONCEPT:

Similar to **I.A.1.N.a.** (above), but is found at somewhat higher elevations. Much of the so-called rainforest on both Nevis and St. Kitts are secondary; this Alliance may represent the few patches of primary forest. *Dacryodes excelsa* is the most dominant species, sometimes making up more than 60% of the tree species in the community. It shows a strong affinity to associate with *Sloanea* spp. The species composition is similar in Nevis and St. Kitts, with *Euterpe globosa* somewhat more abundant in Nevis.

Found near or along ghauts, streams, and in sheltered valleys descending to around 250 m elevation. The emergent trees achieve heights of over 36 m, but the canopy is between 30 and 34 m. There are three distinct strata— canopy, mid-level understory, and understory.

SPECIES:

Canopy: *Sloanea* spp., *Dacryodes excelsa*, *Symplocos martinicensis*, *Sapium caribaeum*, *Ocotea floribunda*, *Cordia* spp. *Simarouba amaura*, *Euterpe globosa*, *Simarouba amaura*, *Beilschmiedia pendula*, *Pouteria multiflora*, *Drypetes glauca*, *Cecropia peltata*, *Hymanea courbaril*, *Philodendron* spp. (growing on trees to the canopy) and *Buchenavia capitata*.

Mid-level understory: *Bambusa* sp., *Ormosia monosperma*, *Aniba bracteata*, *Cyathea arborea*, *Heliconia* spp., *Faramea occidentalis*, *Cecropia peltata*, *Hedysmum arborescens*, *Hirtella triandra*, *Miconia* spp. and other members of the Melastomataceae, *Faramea occidentalis*, *Philodendron* spp. (in trees) and *Euterpe globosa*.

Understory: The understory is usually quite open and only a few terrestrial ferns, the occasional shrub (including *Hedysmum arborescens*, *Psychotria* spp.), a few seedlings of the species of the canopy and *Selaginella* spp.

LOCATION:

The central mountains of St. Kitts, usually above 250 m, especially in sheltered valleys, gullies and west-facing slopes. In Nevis, most abundant on the southwest slope of Nevis Peak and, on rare occasions, in sheltered valleys even below the 250 m elevation contour.

SYNONYMY:

Rainforest (Beard, 1949), Montane forest (Rodrigues, 1990).

I. Closed Tree Canopy

I.A. Evergreen Forest

I.A.1. Tropical or Subtropical broad-leaved evergreen rainforest

I.A.1.N. Natural/Semi-natural

I.A.1.N.c. Montane tropical or subtropical rainforest

I.A.1.N.c. (2). *Podocarpus coriaceus-Euterpe globosa* montane tropical or subtropical rainforest

CONCEPT:

According to Beard (1945), on Nevis this community occupies "a narrow belt intermediate between the rainforest and the palm brake" on the Jessops side of the mountain at around 630 m. On St. Kitts, a similar community can be found, though it often occupies relatively small patches. *Podocarpus* composes, in some cases, more than 60% of the community, though it grows in close association with the *Euterpe* or Mountain cabbage palm.

There is no mid-level understory, but a low ground cover is often present. The branches of the *Podocarpus* are often festooned with mosses, lichens, orchids and small delicate ferns.

SPECIES:

Canopy: *Podocarpus coriaceus*, stunted trees of *Sloanea* spp., *Dacryodes excelsa* and *Euterpe globosa*.

Understory: The understory consists of terrestrial Ferns, *Selaginella* spp. and *Lycopodium* spp.

LOCATION:

Usually above 600 m, especially on sheltered ridges both on St. Kitts and Nevis.

SYNONYMY:

Montane thicket (Beard, 1949).

I. Closed Tree Canopy

I.A. Evergreen Forest

I.A.1. Tropical or Subtropical broad-leaved evergreen rainforest

I.A.1.N. Natural/Semi-natural

I.A.1.N.c. Montane tropical or subtropical rainforest

I.A.1.N.c. (3). *Euterpe globosa* montane tropical or subtropical rainforest

CONCEPT:

This alliance is found at elevations above 400 m to 600 m on steep slopes with thin soil cover and/or disturbed areas such as land slips, over-cut montane rainforest, areas opened as a result of tropical storms, or abandoned agricultural fields. It is not clear whether this vegetation type should be considered a climax community or whether in some instances it may be a successional stage that “matures” to the so-called Elfin Woodland (see **I.A.1.N.d.** below)

Euterpe globosa may compose as much as 60% of the stems with the community. They achieve heights of up to 19 m or less, and this seems dependent on the exposure to wind and the slope. In fact, in some areas, the palms may appear to be somewhat stunted, achieving heights of just over 4 m.

There is no regular canopy or the arrangement of the community into strata as in the rainforest. However, an irregular understory is somewhat discernible, where the emergent palms achieve heights of over 15 m or so.

Besides the palm, tree ferns make up the single most common species of “tree”.

SPECIES:

Canopy: *Euterpe globosa*, *Cyathea arborea*, and the occasional *Dacryodes excelsa*, *Podocarpus coriaceus* and *Sloanea* spp.

Understory: Immature individuals of *Euterpe globosa*, *Cyathea arborea*, *Heliconia* spp., *Miconia* spp., *Hedyssum arborescens*, *Hirtella triandra*, and “dwarfed” individuals of *Sloanea* sp., *Dacryodes excelsa* and *Sapium caribaeum*.

Ground cover: *Selaginella* spp., *Lycopodium* spp., two species of ground orchids, other species of terrestrial and epiphytic ferns, mosses and lichens.

LOCATION:

On St. Kitts, found on the peaks of the three central mountains usually above 400 m. In Nevis, it is found at Nevis Peak generally above 500 m.

SYNONYMY:

Palm brake (Beard, 1949).

I. Closed Tree Canopy

I.A. Evergreen Forest

I.A.1. Tropical or Subtropical broad-leaved evergreen rainforest

I.A.1.N. Natural/Semi-natural

I.A.1.N.d. (1). *Miconia* spp. montane tropical or subtropical cloud forest

CONCEPT:

This community is typical at high elevations from around 600m. However, this is not a defining characteristic, since this growth pattern is also dependent on the slope, the orientation and the substrate for its unique features. Associated with high rainfall, extremely high moisture levels, frequent overcast conditions, and high winds. The soil is often waterlogged, but due to the gradient of the slope, run-off is high.

The trees and shrubs are generally relatively low in stature (sometimes may assume a shrub-like growth form), but may achieve heights of just over 7m, except in sheltered conditions, where the trees are protected from the constant high winds. The branches and twigs of the trees are covered in epiphytic mosses, lichens, ferns, orchids and bromeliads.

There is no distinct stratification, but for this classification system, the forest is divided into the tree layer and the herbaceous layer.

SPECIES:

Tree Layer: On St. Kitts, *Euterpe globosa*, *Weinmannia pinnata*, *Cyathea arborea*, *Ilex sideroxyloides*, *Miconia* spp., *Hedyosmum arborescens*, *Podocarpus coriaceus*, *Clusia rosea*, *Myrsine coriacea*, *Cyathea arborea*, *Clidemia* spp., *Philodendron* spp., orchids (*Maxillaria coccinea* is particularly common as an epiphyte on the trees and shrubs on Dos d'Ane Peak), bromeliads, *Utricularia alpina* (an epiphyte on trees), *Charianthus purpureus*, *Freziera undulata* and many unidentified species of vines.

Herbaceous Layer: *Rubus* spp., many fern species, mosses, lichens, *Lycopodium* spp., *Selaginella* spp., orchids (especially the terrestrial orchid *Erythroides plantaginea*), *Pitcairnia angustifolia*, *Aechmea* sp., *Anthurium* sp., *Philodendron giganteum*, *Lobelia circiifolia*, *Relbunium guadelupense*, *Sauvagesia erecta*, *Viola stipularis*. Grasses— *Isachne angustifolia* and *I. rigidifolia*, *Alloplectus cristatus*, *Psychotria* sp., *Pepperomia* sp., the Sedge, *Scleria* sp. On Nevis, similar to St. Kitts.

LOCATION:

On St. Kitts, found at the summit of the three main mountain ranges— the Eastern range, the Central range and the Southwestern range. Some of these ranges, such as the eastern range, have minor peaks that harbour small tracts of this community type.

On Nevis, found at the summit of Nevis Peak above 600m. There is a lower peak east of Nevis Peak (above Butlers and Mannings) that has a small tract on the summit.

SYNONYMY:

Elfin woodland (Beard, 1949).

I. Closed Tree Canopy

I.A. Evergreen Forest

I.A.5. Tropical or Subtropical broad-leaved seasonal evergreen closed tree canopy

I.A.5.N Natural/Semi-natural

I.A.5.N.b. Tropical or sub-tropical broad-leaved evergreen sclerophyllous forest

I.A.5.N.b. (1). *Coccoloba uvifera*-*Hippomane mancinella*-*Thevetia peruviana*-*Cordia obliqua* lowland tropical or subtropical broad-leaved evergreen sclerophyllous forest Alliance

I.A.5.N.b. (1). (a). *Coccoloba uvifera*-*Thevetia peruviana* Association

(b). *Hippomane mancinella*-*Cordia obliqua* Association

CONCEPT:

This community is windswept and exposed to constant salt spray from the Atlantic Ocean. The species are wind tolerant. There is no stratification of the system into canopy, mid-level and understory layers. Instead, the tops of the trees have been sheared and sculpted, taking on the general configurations of the dune upon which they exist. In sheltered areas, the species may achieve normal growth.

SPECIES:

On St. Kitts, *Coccoloba uvifera*, *Hippomane mancinella* and *Thevetia peruviana*.

In Nevis, *C. uvifera*, *Cordia obliqua* and *H. mancinella* (*H. mancinella* may often form almost pure stands).

LOCATION:

On St. Kitts, found at Conaree, Frigate Bay and parts of the Southeast Peninsula, especially on the Atlantic coast.

SYNONYMY:

None known.

I. Closed Tree Canopy

I.A. Evergreen Forest

I.A.5. Tropical or subtropical broad-leaved evergreen sclerophyllous forest

I.A.5.N. Natural/Semi-natural

I.A.5.N.d. Seasonally flooded/saturated tropical or subtropical broad-leaved evergreen sclerophyllous closed tree canopy

I.A.5.N.d. (1). *Rhizophora mangle* seasonally flooded/saturated tropical or subtropical broad-leaved evergreen sclerophyllous closed tree canopy

CONCEPT:

This Alliance consists of land-locked mangrove systems and is therefore free of the direct influence of the sea.

SPECIES:

Rhizophora mangle, *Avicennia germinans*, *Laguncularia racemosa*, *Conocarpus erectus*.

LOCATION:

In St. Kitts, the Southeast Peninsula. On Nevis, the west coast, north of Charlestown.

SYNONYMY:

Mangroves (Rodrigues, 1990; Nevis), Littoral vegetative belt (Britton, 1901; St. Kitts).

I. Forest

I.C. Mixed evergreen-deciduous forest

I.C.1. Tropical or subtropical semi-deciduous forest

I.C.1.N. Natural/Semi-natural

I.C.1.N.a. (1). *Coccoloba pubescens*-*Guettarda scabra* lowland tropical or subtropical semi-deciduous forest

CONCEPT:

An Alliance found below rainforests on the slopes of Nevis Peak from about 180 m, the most extensive forest type on the island. It is highly secondary in nature with a number of exotic species; the Logwood (*Haematoxylum campechianum*), and *Acacia* spp. are the most common. Emergents are not uncommon. The trees may achieve heights of 15 m. However, individual emergents of *Ceiba pentandra*, *Bursera simaruba* and *Hura crepitans* may achieve heights of over 18 m. There is a canopy and a mid-story layer.

SPECIES:

Canopy: *Coccoloba pubescens*, *C. diversifolia*, *Canella winterana*, *Ceiba pentandra*, *Pimenta racemosa*, *Acacia* spp., *Bourreria succulenta*, *Hura crepitans*, (*Agave* spp.), *Guettarda scabra*, *Haematoxylum campechianum*, *Pisonia fragrans*, *Psidium guajava*, *Bursera simaruba*, *Ficus citrifolia*, *Tabebuia heterophylla*, *Inga laurina*, *Acacia* spp., *Cordia obliqua*, *Cocos nucifera*, *Zanthoxylum* spp., *Mangifera indica*, and *Terminalia catappa*

Mid-story: *Capparis* spp., *Randia aculeata*, *Daphnopsis americana* (more common on Nevis), *Jacquinnia amillaris*, *Lantana* spp., *Eugenia* spp., *Haematoxylum campechianum*, *Leucaena leucocephala*, *Annona squamosa*, *A. muricata*, *Erythroxylum havanense*, *Croton astroites*, *Bourreria succulenta*, *Miconia* spp., and *Caesalpinia bonduc*.

LOCATION:

On St. Kitts, found on the Southeast Peninsula and at Brimstone Hill. On Nevis, found on the lower slopes of Nevis Peak, Butlers Mountain and parts of Camps Ridge.

SYNONYMY:

Dry evergreen forest (Beard, 1949).

II. Woodland

II.A. Evergreen Woodland

II.A.1 Tropical or subtropical broad-leaved evergreen woodland

II.A.1.C. Planted/Cultivated

II.A.1.C.a. (1). *Cocos nucifera* Grove

CONCEPT:

Extensive coconut plantations were developed for the copra industry in the early years of 20th century, but have been abandoned within the last 20 to 30 years. However, islanders harvest the fruits for the "water" and copra for local consumption.

SPECIES:

Cocos nucifera. Occasional trees of *Acacia* sp., *Tabebuia heterophylla* and the shrub *Lantana involucrata*.

LOCATION:

West coast of Nevis, north Charlestown; also on the western lower slopes of Nevis Peak. On St. Kitts, at Conaree, Dieppe Bay, and above Olivees Mountain.

SYNONYMY:

None known.

II. Woodland

II.A. Evergreen Woodland

II.A.1. Tropical or subtropical broad-leaved evergreen woodland

II.A.1.C. Planted/Cultivated

II.A.1.C.a. (2). Orchards and groves

CONCEPT:

Areas in and around human settlements that are deliberately planted with carefully selected species or, in some instances, local species whose growth is encouraged. Owners of these properties derive certain benefits from these species including shelter, shade, food, medicine, fuelwood, security and aesthetics.

The community is not divided in canopy and mid-level understory. No such stratification is discernible, especially since the community is so highly “artificial”.

SPECIES:

Melicoccus bejugatus, *Azadirachta indica*, *Cordia* spp. (numerous cultivars), *Hibiscus rosa-sinensis*, *Gliricidia sepium*, *Acacia* spp., *Tabebuia heterophylla*, *Swietenia mahogany*, *Cocos nucifera*, *Mangifera indica*,

LOCATION:

Throughout St. Kitts and Nevis around human settlements, including Charlestown, Nevis and Basseterre, St. Kitts.

SYNONYMY:

None known.

II. Woodland

II.A. Evergreen Woodland

II.A.1 Tropical or subtropical broad-leaved evergreen woodland

II.A.1.N. Natural/Semi-natural

II.A.1.N.a. (1). *Acacia* sp.-*Haematoxylon campechianum* tropical or subtropical broad-leaved evergreen woodland

CONCEPT:

Former pasture in successional stage. There are patches of woodland, but the community consists primarily of scattered individual trees and shrubs.

SPECIES:

Acacia spp. *Haematoxylon campechianum*, *Lantana camara* and *Lantana involucrata*, *Rauvolfia nitida*, *Tabebuia heterophylla*, *Leucaena leucocephala*, *Capparis* spp., *Croton* spp., *Cnidoscolus urens*, *Psidium guajava*, grasses and sedges.

LOCATION:

Found throughout St. Kitts and Nevis at abandoned pastures and agricultural fields. On St. Kitts, north and northwest of the airport, east of Brimstone Hill and small patches on the Southeast Peninsula.

SYNONYMY:

None known.

II. Woodland

II.A. Evergreen Woodland

II.A.1 Tropical or subtropical broad-leaved evergreen woodland

II.A.1.N. Natural/Semi-natural

II.A.1.N.a. Tropical or sub-tropical broad-leaved evergreen woodland

II.A.1.N.a. (2). *Cyathea arborea* tropical or subtropical broad-leaved evergreen woodland

CONCEPT:

Found at elevations above 450 m on steep slopes (may be found at lower elevations, but in very moist areas). This is primarily considered a community in a successional stage since it usually occurs on disturbed sites such as land slips, on deforested areas and exposed soils. However, in areas too steep to maintain large trees, the vegetation may consist of tree ferns with a few *Euterpe globosa*. Most of the ferns do not exceed heights of up to 5 m.

This community never covers extensive areas. It may consist of a small patch with a few trees, to areas covering one or two acres.

SPECIES:

Cyathea arborea, *Euterpe globosa*, *Podocarpus coriaceus* (usually a shrub and quite gnarled), other terrestrial ferns, *Lycopodium* and *Selaginella* covering the ground.

LOCATION:

Found on the steep slopes of the three mountain ranges of St. Kitts and the exposed steep slopes of Nevis Peak on Nevis.

SYNONYMY:

Palm brake (Beard, 1949).

II. Woodland

II.A. Evergreen Woodland

II.A.1 Tropical or subtropical broad-leaved evergreen woodland

II.A.1.N. Natural/Semi-natural

II.A.1.N.a. Tropical or sub-tropical broad-leaved evergreen woodland

II.A.1.N.a. (3). *Philodendron giganteum* elephant ear tropical or subtropical broad-leaved evergreen woodland

CONCEPT:

Found on exposed slopes at elevations above 660 m on steep slopes. The conditions that allow for this type of growth are constant high winds, steep slopes and thin soils. It consists of a thick tangled mass of small shrubs, ferns and vines. Most plants do not exceed heights of up to 1.5 m. The branches of the shrubs may be festooned with mosses and lichens.

This community never covers extensive areas. It may cover small patches with a few trees, to areas that may cover just a few hectares.

SPECIES:

Miconia spp., terrestrial ferns, *Cyathea arborea*, *Euterpe globosa*, *Lycopodium* and *Selaginella*.

LOCATION:

Found on the steep slopes of the three mountain ranges of St. Kitts and the exposed steep slopes of Nevis Peak on Nevis.

SYNONYMY:

None known.

II. Woodland

II.A. Evergreen Woodland

II.A.1 Tropical or subtropical broad-leaved evergreen woodland

II.A.1.N. Natural/Semi-natural

II.A.1.N.d. Semipermanently flooded tropical or subtropical broad-leaved evergreen woodland

II.A.1.N.d. (1) *Rhizophora-Avicennia-Laguncularia* semi-permanently flooded tropical or subtropical broad-leaved evergreen woodland

CONCEPT:

Similar to **I.A.5.N.d**, but with a more open tree canopy.

SPECIES:

Rhizophora mangle, *Avicennia germinans*, *Laguncularia racemosa*, *Conocarpus erectus*.

LOCATION:

In St. Kitts, the Southeast Peninsula. Not found in Nevis.

SYNONYMY:

Littoral vegetative belt (Britton, 1901 in Burdon, 1920).

II. Woodland

II.C. Mixed evergreen deciduous woodland

II.C.1. Tropical or sub-tropical semi-deciduous woodland

II.C.1.N. Natural/Semi-natural

II.C.1.N.a. (1). *Pisonia subcordata*-*Bursera simarouba* tropical or subtropical semi-deciduous woodland

CONCEPT:

Found both on St. Kitts and Nevis, with relatively extensive areas on the Southeast Peninsula of St. Kitts. Trees to about 5-10 m. There are two strata— canopy and mid-level, with little or no herbaceous vegetation. There are many species of vines found growing on the trees.

This community may in fact be an earlier stage in the succession towards **I.C.1.N.a.** (above), although this is not conclusive. Much of the land on the Southeast Peninsula of St. Kitts was once heavily cultivated, then turned into pasture for livestock, and also fairly regularly burned to induce fresh grass growth. Some of these areas have reverted to "natural" vegetation, yet other areas are still heavily managed and maintained using fire.

SPECIES:

Canopy: *Pisonia subcordata*, *Plumeria alba*, *Tabebuia heterophylla*, *Bursera simarouba*, *Piscidia carthagenensis* [= *P. piscipula*], *Haematoxylon campechianum*, *Canella winterana*, *Acacia* spp., *Capparis* spp., and *Amyris elemifera*.

Mid-story: *Bourreria succulenta*, *Randia aculeata*, *Pithecellobium unguis-cati*, *Croton flavens*, *Capparis* spp., *Comocladia dodonaea*, *Plumeria alba*, *Tecoma stans*, *Phyllanthus epiphyllanthus*, *Pilosocereus royeri*, *Acacia* spp., *Jacquinnia amillaris*, *Guettarda parviflora*, *Zanthoxylum spinifex*, *Cuscuta americana* (a parasitic plant that grows on other plants) and *Erithalis fruticosa*.

LOCATION:

Southeast Peninsula on St. Kitts. On Nevis, at Round Hill, Hurricane Hill and the lower part of Camps Ridge.

SYNONYMY:

Dry scrub woodland (Beard, 1945 and Rodrigues, 1990); Xerophytic vegetative belt (Britton, 1901 in Burdon, 1920).

II. Woodland

II.C. Mixed evergreen deciduous woodland

II.C.1. Tropical or sub-tropical semi-deciduous woodland

II.C.1.N. Natural/Semi-natural

II.C.1.N.a. (2). *Hippomane mancinella-Cordia obliqua* tropical or subtropical semi-deciduous woodland

CONCEPT:

Found along the banks of dry ghauts and streams at sea level. There is usually no permanent water.

SPECIES:

Cordia obliqua, *Hippomane mancinella*, *Azadirachta indica* and the vine *Cissus verticillata*.

LOCATION:

Streams and ghauts at Long Point and Low Ground, Nevis.

SYNONYMY:

None known.

III. Shrubland

III.A. Evergreen shrubland

III.A.1. Tropical or subtropical broad-leaved evergreen shrubland

III.A.1.N. Natural/Semi-natural

III.A.1.N.a. (1). *Erithalis fruticosa*-*Pilosocereus royeri* tropical or subtropical broad-leaved evergreen shrubland

CONCEPT:

This system consists of low shrubs and stunted trees usually found growing on exposed hillsides and slopes at elevations of 130 m, and or in harsh restrictive conditions such as poor thin soils and/or rocky slopes, and areas of low rainfall. It is fairly open with some exposed substrate or herbaceous/grassy cover.

Most common on St. Kitts although a few small areas can be found on Nevis as well.

SPECIES:

Erithalis fruticosa, *Acacia* spp., *Chamaecrista glandulosa* var. *swartzii*, *Randia aculeata*, *Eugenia* spp., *Coccoloba swartzii*, *Plumeria alba*, *Croton flavens*, *Croton* sp., *Phyllanthus epiphyllanthus*, *Pilosocereus royeri*, *Agave* sp. *Clerodendrum aculeatum*, *Jacquinnia amillaris*, *Stigmaphyllon* sp. (vines grow onto shrubs and trees), and the occasional patches of grasses and some herbaceous growth.

LOCATION:

Southeast Peninsula, St. Kitts; on the southern part of Nevis.

SYNONYMY:

Dry scrub woodlands (Beard, 1949); Cactus scrub (Rodrigues, 1990).

III. Shrubland

III.A. Evergreen shrubland

III.A.1. Tropical or subtropical broad-leaved evergreen shrubland

III.A.1.N. Natural/Semi-natural

III.A.1.N.g. Semipermanently flooded tropical or subtropical broad-leaved evergreen shrubland

III.A.1.N.g. (1). *Rhizophora-Avicennia-Laguncularia* semi-permanently flooded tropical or subtropical broad-leaved evergreen shrubland

CONCEPT:

Similar to **I.A.5.N.d.**, but mangroves occur more as shrubs.

SPECIES:

Rhizophora mangle, *Avicennia germinans*, *Laguncularia racemosa*, *Conocarpus erectus*.

LOCATION:

Southeast Peninsula, St. Kitts.

SYNONYMY:

Littoral vegetative belt (Britton, 1901 in Burdon, 1920); Mangrove woodland (Rodrigues, 1990).

III. Shrubland

III.A. Evergreen shrubland

III.A.4. Microphyllus evergreen shrubland

III.A.4.N. Natural/Semi-natural

III.A.4.N.i. (1). *Clusia* sp.-*Philodendron giganteum* tropical or subtropical broad-leaved evergreen montane shrubland

CONCEPT:

Montane microphyllous shrubland of the active volcanic Lesser Antilles. Occurring in proximity to fumeroles. Beard considers this a subclimax community due to a lack of soil development or as he calls it "pioneer communities of volcanic ejecta".

SPECIES:

Clusia sp., *Pitcairnia* spp., *Guzmania* sp., grasses, sedges, *Ilex* sp., *Lobelia* sp. and *Philodendron giganteum*.

LOCATION:

Mt. Liamuiga crater on St. Kitts.

SYNONYMY:

Pioneer communities of volcanic ejecta (Beard, 1949).

III. Shrubland

III.A. Evergreen shrubland

III.A.5. Extremely xeromorphic evergreen shrubland

III.A.5.N. Natural/Semi-natural

III.A.5.N.e. (1). *Pilosocereus royeri*-*Croton flavens* extremely xeromorphic evergreen shrubland with a sparse tree layer

CONCEPT:

Found growing on thin shallow dry soils, usually in exposed, windy conditions. This community may result from overgrazing or from severely eroded soils on hillsides.

SPECIES:

Pilosocereus royeri, *Mammillaria nivosa*, *Melocactus intortus*, *Opuntia* spp., *Lantana involucrata*, *Croton flavens*, *Croton* spp., *Coccoloba swartzii*, *Plumeria alba*, *Acacia* spp., *Erithalis fruticosa*, *Wedelia* sp., *Pisonia subcordata* (found growing as a shrub or small tree), *Randia aculeata*, *Agave karatto*, grasses, sedges and *Portulaca* sp.

LOCATION:

Dry exposed headlands on the Southeast Peninsula on St. Kitts and Round Hill on Nevis.

SYNONYMY:

Cactus scrub (Rodrigues, 1990); Xerophytic vegetative belt (Britton, 1901 in Burdon, 1920).

V. Herbaceous Vegetation

V.A. Perennial graminoid vegetation

V.A.1. Tropical or subtropical grassland

V.A.1. C. Planted/Cultivated

V.A.1. C.a. Tall tropical or subtropical grassland

V.A.1. C.a. (1). *Saccharum officinarum* tall tropical or subtropical grassland

CONCEPT:

This is the most obvious and dominant plant community on the St. Kitts landscape. Extensive areas of the island starting at the coast to an elevation of nearly 333 m in some areas are under cultivation of this species of grass from which cane sugar is manufactured. The crop is planted as a monoculture.

SPECIES:

Saccharum officinarum.

LOCATION:

Cultivated throughout St. Kitts. This community is now absent from Nevis. Extensive areas of Nevis were once cultivated, but commercial cultivation ceased in the 1950s. Cane, as it is called locally, may still be cultivated by some farmers for subsistence purposes, but nowhere near the extent of previous years.

SYNONYMY:

None known.

V. Herbaceous Vegetation

V.A. Perennial graminoid vegetation

V.A.1. Tropical or subtropical grassland

V.A.1.N. Natural/Semi-natural

V.A.1.N.g. (1). *Acrostichum aureum* seasonally flooded tropical or subtropical grassland

CONCEPT:

Associated with estuarine mangrove systems. Becomes flooded during rainy season or after heavy downpours. However, there is little or no shrub or tree cover.

SPECIES:

Sedges, *Achrostichum* sp.

LOCATION:

On Nevis, found on the west coast north of Charlestown. Not found on St. Kitts.

SYNONYMY:

Mangrove woodland (Rodrigues, 1990).

V. Herbaceous Vegetation

V.A. Perennial graminoid vegetation

V.A.2. Tropical or subtropical grassland with a sparse tree layer

V.A.2.N. Natural or semi-natural

V.A.2.N.c. Medium-tall tropical or sub-tropical grassland with as sparse broad-leaved evergreen tree layer

V.A.2.N.c. (1). *Panicum maximum* medium-tall tropical or sub-tropical grassland with a sparse broad-leaved evergreen tree layer

CONCEPT:

A savanna community dominated by Guinea grass (*Panicum maximum*). There are other grasses, sedge and herbaceous plants found growing in this community, *P. maximum* being by far the most dominant plant. Can achieve heights of over 1.5 m.

There are a number of savanna types on both St. Kitts and Nevis.

SPECIES:

Panicum maximum, occasional trees of *Bursera simaruba*, *Pisonia subcordata*, *Tamarindus indica*, *Capparis* spp. and *Leucaena leucocephala*. There are also the occasional shrub of *Lantana* spp, *Croton* spp., *Clerodendrum aculeatum* and *Pisonia aculeata*.

LOCATION:

On St. Kitts, there are savannas on the Southeast Peninsula, at Conaree Hills, around Greenhill Estate, at Phillips, Brimstone Hill, and some abandoned sugarcane lands. On Nevis, found in the south and southeast, below Pembroke, Bush Hill, Saddle Hill, and some parts of Spring Hill in the north.

SYNONYMY:

None known.

V. Herbaceous Vegetation

V.A. Perennial graminoid vegetation

V.A.2. Tropical or subtropical grassland with a sparse tree layer

V.A.2.N. Natural or semi-natural

**V.A.2.N.c. (2). *Bothriochloa pertusa* medium-tall tropical or subtropical grassland
with a sparse broad-leaved evergreen tree layer**

CONCEPT:

A savanna community dominated by *Bothriochloa pertusa* and *Jatropha gossypifolia*.

SPECIES:

Bothriochloa pertusa and *Jatropha gossypifolia*.

LOCATION:

Low Ground, Nevis.

SYNONYMY:

None known.

V. Herbaceous Vegetation

V.A. Perennial graminoid vegetation

V.A.2. Tropical or subtropical grassland with a sparse tree layer

V.A.2.N. Natural or semi-natural

V.A.2.N.c. Medium-tall tropical or sub-tropical grassland with as sparse broad-leaved evergreen tree layer

V.A.2.N.c. (3). *Selaginella-Lycopodium* medium-tall tropical or subtropical grassland with a sparse broad-leaved evergreen tree layer

CONCEPT:

At upper elevations on steep hillsides where the soil is too thin to support trees grows a type of low herbaceous/sedge community. It consists primarily of ferns, sedges, herbaceous growth, *Anthurium* sp. and bromeliads.

SPECIES:

Anthurium spp., sedges, grasses, *Selaginella* spp. and *Lycopodium* spp., bromeliads, *Podocarpus coriaceus*.

LOCATION:

On steep hillsides at upper elevations above 660 m, St. Kitts.

SYNONYMY:

None known.

V. Herbaceous Vegetation

V.B. Perennial Forb Vegetation

V.B.1. Tropical or subtropical perennial forb vegetation

V.B.1.N. Natural/semi-natural

V.B.1.N.b. Tall tropical or sub-tropical perennial forb vegetation

V.B.1.N.b. (1). *Cyathea arborea*-*Selaginella* sp. tall tropical or subtropical perennial forb* vegetation

CONCEPT:

A herbaceous community has colonized the unstable slopes at the crater and side of the walls of Mt. Liamuiga. Though Mt. Liamuiga has not erupted anytime during the last 500 years, regular tremors and the steep crater walls make for a constantly changing environment. As a result, only low herbaceous plants will grow in some of these areas.

SPECIES:

Cyathea arborea, bromeliads, *Philodendron* spp., other terrestrial ferns, *Lycopodium* spp., *Selaginella* sp., sedges, *Rubus* sp. and *Miconia* spp.

LOCATION:

On the upper slopes of Mount Liamuiga, towards the summit.

SYNONYMY:

None known.

* A forb refers to low herbaceous and/or grassy growth. In some instances it may be perennial or annual.

V. Herbaceous Vegetation

V.C. Hydromorphic rooted vegetation

V.C.1. Tropical or subtropical hydromorphic rooted vegetation

V.C.1.N.a. Non-tidal tropical or subtropical hydromorphic rooted vegetation

V.C.1.N.a. (1). *Ruppia-Najas* non-tidal tropical or subtropical hydromorphic rooted vegetation

CONCEPT:

This Alliance refers to saltwater/brackish ponds; surprisingly, the FGDC includes both freshwater ponds and saltwater/brackish ponds under the same “formation”.

SPECIES:

Ruppia cirrhosa [formerly called *R. spiralis*], *R. maritima*, *Najas guadalupensis*, *N. marina*, *Nymphaea ampla* var. *speciosa*, *Cyperus articulatus*, and algae species.

LOCATION:

Salt ponds and pools throughout both islands.

SYNONYMY:

None known.

V. Herbaceous Vegetation

V.C. Hydromorphic rooted vegetation

V.C.1. Tropical or subtropical hydromorphic rooted vegetation

V.C.1.N. Natural/Semi-natural

**V.C.1.N.a. (2). *Laguncularia racemosa* - *Conocarpus erectus* permanently flooded
tropical or subtropical hydromorphic rooted vegetation**

CONCEPT:

Associated with estuarine systems. Differs from **V.A.1.N.g**, above, in that it is permanently flooded and the vegetation is rooted in the water.

SPECIES:

Sedges, grasses and with *Laguncularia racemosa*, *Annona glabra* and *Conocarpus erectus* along the edges.

LOCATION:

A number of examples are located on the west coast of Nevis, north and south of the capital, Charlestown. Not found on St. Kitts.

SYNONYMY:

Mangrove woodland (Rodrigues, 1990).

V. Herbaceous Vegetation

V.C. Hydromorphic rooted vegetation

V.C.1. Tropical or subtropical hydromorphic rooted vegetation

V.C.1.N. Natural Vegetation

**V.C.1.N.a. (3). *Lycopodium* spp. permanently flooded tropical or subtropical
hydromorphic rooted vegetation**

CONCEPT:

A relatively small, shallow, circular pond (just over 100m at its widest point, and about 60 cm at its deepest point) in a seemingly ancient crater, located on Dos d'Ane peak. No evidence of volcanic activity is discernible.

There are no true aquatic species found growing in the pond. However, surrounding the pond is a deep dark peat, colonized by a low, tangled, herbaceous growth with a few individual emergent shrubs, forming a bog. The most extensive areas of bog are on the eastern shore, while on the south, west and northwest, the bog narrows considerably, grading quickly into elfin woodland.

SPECIES:

Herbaceous— *Gyneria* sp. (common around the shoreline of the pond, even growing in water in some parts), Orchids, bromeliads, sedges, *Lycopodium* sp. and an unidentified shrub.

SYNONYMY:

None known.

V. Herbaceous Vegetation

V.C. Hydromorphic rooted vegetation

V.C.1. Tropical or subtropical hydromorphic rooted vegetation

V.C.1.N. Natural/Semi-natural

V.C.1.N.b. (1). Permanently flooded tidal tropical or subtropical hydromorphic rooted vegetation

CONCEPT:

Seagrass savannas are marine-based vegetative communities. Seagrass exists in shallow waters just a few centimeters deep to waters of around 20 to 30 m where conditions are ideal (*i.e.*, where water elements permit maximum light transmission). There are two species found in St. Kitts and Nevis. Some are of mixed communities, while some are almost pure stands.

SPECIES:

Primarily *Thalassia testudinum* and *Syringodium filiforme*.

LOCATION:

Found in shallow waters up to around 30 m, around St. Kitts and Nevis.

SYNONYMY:

None known.

VII. Sparse Vegetation

VII.A. Consolidated Rocky Sparse Vegetation

VII.A.1. Sparsely Vegetated Cliffs

VII.A.1.N. Natural/Semi-natural

VII.A.1.N.a. (1). *Strumphia maritima-Erithalis fruticosa* cliffs with sparse vascular vegetation

CONCEPT:

A community that has colonized rocky exposed shorelines and low cliff faces. Vegetation may be very limited or almost non-existent.

SPECIES:

Conocarpus erectus, *Strumphia maritima*, *Erithalis fruticosa*, *Jacquinnia amillaris*, some grasses and/or sedges.

LOCATION:

On St. Kitts, found on the northeastern coast and on the Southeast Peninsula. On Nevis, found on the north, west and south coasts.

SYNONYMY:

Littoral vegetation belt (Britton, 1901 in Burdon, 1920); Coastal vegetation (Rodrigues, 1990).

VII. Sparse Vegetation

VII.A. Consolidated Rocky Sparse Vegetation

VII.A.2. Sparsely vegetated rock flats

VII.A.2.N. Natural/Semi-natural

VII.A.2.N.a. (1). *Jacquinnia arborea-Strumphia maritima* pavement with sparse vascular vegetation

CONCEPT:

Similar to prior entry, but found on more gently sloping or leveled rocky/pavement areas. The pavement is sparsely vegetated.

SPECIES:

Jacquinnia amillaris, *Strumphia maritima*, *Mammillaria nivosa*, *Melocactus intortus*, *Opuntia* spp., and grasses and sedges.

LOCATION:

On St. Kitts, found along the coast; at similar sites on Nevis.

SYNONYMY:

Littoral vegetation belt (Britton, 1901 in Burdon, 1920); Coastal vegetation (Rodrigues, 1990).

VII. Sparse Vegetation

VII.C. Unconsolidated material sparse vegetation

VII.C.2. Sparsely vegetated sand flats

VII.C.2.N. Natural/Semi-natural

VII.C.2.N.b. (1). *Sesuvium portulacastrum*-*Ipomaea pes-caprae* beach strand vegetation

CONCEPT:

On undisturbed beaches on both islands, just above the high water mark, the sand is often colonized by a low herbaceous community that consists primarily of many annuals and vines. However, there are a few perennial shrubs. The substrate is highly unstable, often swept bare by strong surf and high winds, especially during the Atlantic hurricane season from June to November.

SPECIES:

Cenchrus incertus, *Spartina patens*, *Sporobolus virginicus*, *Cyperus planifolius*, *Fimbristylis cymosa*, *Sesuvium portulacastrum*, *Ipomaea pes-caprae*, *Heliotropium curassavicum*, *Argusia gnaphalodes*, *Borrchia arborescens*, *Strumphia maritima* and *Scaevola plumieri*

Location:

On Nevis, beaches on south, west and north coasts. On St. Kitts, from Conaree south and on Southeast Peninsula beaches.

Synonymy:

Littoral vegetation belt (Britton, 1901 in Burdon, 1920); Coastal vegetation (Rodrigues, 1990).

VII. Sparse Vegetation

VII.C. Unconsolidated material sparse vegetation

VII.C.4.N. Natural/Semi-natural

VII.C.4.N.d. Tidally flooded mudflats

VII.C.4.N.d. (1) *Rhizophora-Avicennia-Laguncularia-Conocarpus* tidally flooded mudflats

CONCEPT:

This Alliance is characterized by sparse mangrove vegetation and either bare ground or shallow water over bare ground.

SPECIES:

Rhizophora mangle, *Avicennia germinans*, *Laguncularia racemosa*, *Conocarpus erectus*.

LOCATION:

Southeast Peninsula, St. Kitts.

SYNONYMY:

Littoral vegetative belt (Britton, 1901 in Burdon, 1920).

Table 1. Plant species included in the St. Kitts and Nevis vegetation classification.

<i>Acacia</i> sp.	<i>Comocladia dodonaea</i>	<i>Jacquinnia amillaris</i>	<i>Randia aculeata</i>
<i>Acacia</i> spp.		<i>Jatropha gossypifolia</i>	<i>Rauvolfia nitida</i>
<i>Acacia muricata</i>	<i>Conocarpus erectus</i>	<i>Laguncularia racemosa</i>	<i>Relbunium guadelupense</i>
<i>Acrocomia aculeata</i>	<i>Cordia obliqua</i>	<i>Lantana camara</i>	
	<i>Cordia</i> sp.	<i>Lantana involucrata</i>	<i>Rhizophora mangle</i>
<i>Acrostichum danaeifolium</i>	<i>Cordia</i> spp.	<i>Lantana</i> spp.	<i>Rubus</i> sp.
<i>Aechmea</i> sp.	<i>Croton astroites</i>	<i>Leucaena leucocephala</i>	<i>Rubus</i> spp.
<i>Agave</i> spp.	<i>Croton flavens</i>	Lichens	<i>Ruppia cirrhosa</i> [formerly <i>R. spiralis</i>]
<i>Alloplectus cristatus</i>	<i>Croton</i> sp.	<i>Liconia</i> sp.	<i>R. maritima</i>
<i>Amyris elemifera</i>	<i>Croton</i> spp.	<i>Lobelia circiifolia</i>	<i>Sapium caribaeum</i>
<i>Aniba bracteata</i>	<i>Cuscuta americana</i>	<i>Lobelia</i> sp.	<i>Sauvagesia erecta</i>
	<i>Cyathea arborea</i>	<i>Lycopodium</i> sp.	<i>Scaevola plumieri</i>
<i>Annona glabra</i>	<i>Cyperus articulatus</i>	<i>Lycopodium</i> spp.	<i>Scleria</i> sp.
<i>Annona squamosa</i>	<i>Cyperus planifolius</i>	<i>Mamea americana</i>	Sedges
<i>Anthurium</i> sp.	<i>Dacryodes excelsa</i>	<i>Mammillaria nivosa</i>	<i>Selaginella</i> sp.,
<i>Anthurium</i> spp.	<i>Daphnopsis americana</i>	<i>Mangifera indica</i>	<i>Selaginella</i> spp.
<i>Argusia gnaphalodes</i>	<i>Drypetes glauca</i>	<i>Maxillaria coccinea</i>	<i>Sesuvium portulacastrum</i>
<i>Artocarpus altilis</i>	<i>Drypetes piriformis</i>	<i>Melocactus intortus</i>	<i>Siamaea saman</i>
<i>Avicennia germinans</i>	<i>Erithalis fruticosa</i>	<i>Miconia</i> spp.	<i>Simarouba amaura</i>
<i>Azadirachta indica</i>	<i>Erythroides plantaginea</i>	Mosses	<i>Sloanea</i> sp.
<i>Bambusa</i> sp.	<i>Erythroxylum havanense</i>	<i>Musa</i> spp.	<i>Sloanea</i> spp.
<i>Bambusa vulgaris</i>	<i>Eugenia</i> spp.	<i>Myrsine coriacea</i>	<i>Spartina patens</i>
<i>Beilschmiedia pendula</i>	<i>Eurterpe globosa</i>	<i>Najas guadalupensis</i>	<i>Sporobolus virginicus</i>
<i>Borrichia arborescens</i>	<i>Faramea occidentalis</i>	<i>N. marina</i>	<i>Stigmaphyllon</i> sp.
<i>Bothriochloa pertusa</i>	<i>Fern</i> spp.	<i>Nymphaea ampla</i> var. <i>speciosa</i>	<i>Strumphia maritima</i>
<i>Bourreria succulenta</i>	<i>Ficus citrifolia</i>	<i>Ocotea floribunda</i>	<i>Swietenia mahogani</i>
<i>Buchenavia capitata</i>	<i>Ficus</i> sp.	<i>Opuntia</i> spp.	<i>Symplocos martinicensis</i>
<i>Bursera simaruba</i>	<i>Ficus</i> spp.	<i>Ormosia monosperma</i>	<i>Syringodium filiforme</i>
<i>Coccoloba diversifolia</i>	<i>Freziera undulata</i>	<i>Panicum maximum</i>	<i>Tabebuia heterophylla</i>
<i>Coccoloba uvifera</i>	<i>Frimbristylis cymosa</i>	<i>Peperomia</i> sp.	<i>Tabernamontana citrifolia</i>
<i>Caesalpinia bonduc</i>	Grasses	<i>Philodendron</i> spp.	<i>Tamarindus indica</i>
<i>Canella winterana</i>	<i>Guatteria caribaea</i>	<i>Philodendron giganteum</i>	<i>Tecoma stans</i>
<i>Capparis</i> spp.	<i>Guazuma ulmifolia</i>	<i>Phyllanthus epiphyllanthus</i>	<i>Terminalia catappa</i>
<i>Cecropia peltata</i>	<i>Guettarda scabra</i>	<i>Pilosocereus royeri</i>	<i>Thalassia testudinum</i>
<i>Cedrela odorata</i>	<i>Guettarda parviflora</i>	<i>Pimenta racemosa</i>	<i>Theobroma cacao</i>
<i>Ceiba pentandra</i>	<i>Guzmania</i> sp.	<i>Piscidia carthagenensis</i> [= <i>P. piscipula</i>]	<i>Thevetia peruviana</i>
<i>Cenchrus incertus</i>	<i>Gymanea</i> sp.	<i>Pisonia aculeata</i>	<i>Utricularia alpina</i>
<i>Chamaecrista glandulosa</i> var. <i>swartzii</i>	<i>Haematoxylon campechianum</i>	<i>Pisonia fragrans</i>	<i>Viola stipularis</i>
<i>Charianthus purpureus</i>	<i>Hedyosmum arborescens</i>	<i>Pisonia subcordata</i>	<i>Wedelia</i> sp.
<i>Citrus</i> spp.	<i>Heliconia</i> spp.	<i>Pitcairnia angustifolia</i>	<i>Weinmannia pinnata</i>
<i>Clerodendrum aculeatum</i>	<i>Heliotropium curassavicum</i>	<i>Pitcairnia</i> spp.	<i>Zanthoxylum</i> spp.
<i>Clidemia</i> spp.	<i>Hippomane mancinella</i>	<i>Pithecellobium unguis-cati</i>	<i>Zanthoxylum spinifex</i>
<i>Clusia rosea</i>	<i>Hirtella triandra</i>	<i>Plumeria alba</i>	
<i>Clusia</i> sp.	<i>Hura crepitans</i>	<i>Podocarpus coriaceus</i>	
<i>Cnidocolus urens</i>	<i>Hymanea courbaril</i>	<i>Portulaca</i> sp.	
<i>Coccoloba diversifolia</i>	<i>Ilex siderexiloides</i>	<i>Pouteria multiflora</i>	
<i>Coccoloba pubescens</i>	<i>Ilex</i> sp.	<i>Psidium guajava</i>	
<i>Coccoloba swartzii</i>	<i>I. rigidifolia</i>	<i>Psychotria</i> sp.	
<i>Coccoloba uvifera</i>	<i>Inga laurina</i>	<i>Psychotria</i> spp.	
<i>Cocos nucifera</i>	<i>Ipomaea pes-caprae</i>		
	<i>Isachne angustifolia</i>		

CONSERVATION IMPLICATIONS

Table 2 (page 60) compares the current vegetation classification with three major efforts that preceded it: Britton (1901 in Burdon, 1920), Beard (1949) and Rodrigues (1990). The earlier researchers identified 5, 6, and 11 vegetation categories, respectively; in comparison, the 36 identified in the current study substantially refine the level of detail of earlier systems.

An attempt was made to identify the conservation status of each Alliance and Association (Table 3, page 61), using a two-tier labeling system that was modified from the Red Data Book Categories of the World Conservation Union (IUCN). Each Alliance or Association is classified as:

Common (widespread in distribution and/or large size), or

Uncommon (moderately restricted in distribution and/or size), or

Rare (very restricted in distribution and/or size)

and

Stable (no apparent danger), or

Endangered (danger of extirpation), or

Vulnerable (likely to move into Endangered category if causal factors continue to operate), or

Not known (suspected, but not known, to belong to Vulnerable category).

Subjective rather than quantitative measures were used in this categorization. In order to aggregate data from different countries to compile transboundary statistics (whether at the Caribbean regional level, or any other level, including global), it would be necessary to have quantitative criteria. However, even if this is eventually attempted, it still will be useful to have national classifications based either on subjective criteria such as those used herein, or nationally defined (rather than globally defined) quantitative criteria.

The first situation in which nationally defined criteria are useful would be when a vegetation type that is common globally is “Uncommon” or “Rare” within the country. For example, we label the *Rhizophora mangle* seasonally flooded/saturated tropical or subtropical broad-leaved evergreen sclerophyllous closed tree canopy Alliance [I.A.5.N.d. (1).] as “Uncommon, Vulnerable” in St. Kitts and Nevis. Globally, this might be considered “Common, Stable”. Conversely, if a vegetation type occupied 10,000 hectares in St. Kitts or Nevis, it might seem “Common, Stable”; but to have so small an area in a large country might make that vegetation type “Rare and Endangered. We

argue that despite its subjectivity — or perhaps, in part, because of it — the “conservation status” categorization can make a significant contribution to biodiversity management efforts in St. Kitts and Nevis.

Of the 36 vegetation communities identified for the country,

- 9 are Rare,
- 16 are Uncommon, and
- 11 are Common.

Three of the Rare communities are considered Stable because of their isolation and inaccessibility. Five other Rare communities are Vulnerable, and one — an aquatic community near the coast in Nevis — is considered Endangered. One Uncommon Alliance, the natural coastal dunes of St. Kitts and Nevis, is also considered Endangered, primarily due to the impact of coastal development. All of the Common vegetation communities are Stable with the exception of another coastal community which is disappearing and is considered Vulnerable because of coastal development (Table 3, page 61).

In St. Kitts, the main threats to vegetation (Table 4, page 63) result from expanding residential and coastal development (primarily commercial tourist resorts, with isolated impacts from sand mining). Coastal development is a conservation threat in Nevis as well, but its impact is not as extensive as in St. Kitts. An additional factor modifying the vegetation of both islands is widespread and uncontrolled livestock grazing, especially on the Southeast Peninsula of St. Kitts and throughout the lowland areas of Nevis.

A further threat for both islands is the presence of feral Green Monkeys (*Cercopithecus aethiops*). The introduction of the Green Monkey has been attributed to the French at a time when the French and British jointly ruled St. Kitts in the seventeenth and eighteenth centuries. It is more likely, however, that the British were responsible since the Green and other species of monkeys introduced to other islands are known only from former British territories, including Nevis.

In any event, monkeys have been on St. Kitts and Nevis for over 250 years. During this time, no study has been undertaken to determine their impact on the flora and fauna of each island. The native species and ecosystems evolved prior to the presence of monkeys, and their introduction no doubt has seriously impacted and altered the natural environment. To what extent their feeding habits, their physical presence, and their nature changed the ecosystems of St. Kitts and Nevis — and to what extent these impacts are detrimental to biodiversity — is not known. The conservation of many of the country's ecosystems and species of plants may depend to some extent on the answers to these questions.

Table 2. Comparison of vegetation classifications for St. Kitts and Nevis.

(The first column refers to "Formations" defined by the U.S. Federal Geographic Data Committee, as applied by Island Resources Foundation.)

Island Resources Foundation, 1999	Britton, 1901 (in Burdon, 1920)	Beard, 1955	Rodrigues, 1990 (Nevis only)
I.A.1.N.a. (1.a), I.A.1.N.a. (1.b), I.A.1.N.c. (1), I.A.1.N.c. (2) I.C.1.N.a. (1), II.A.1.N.a. (1)	Mesophytic Flora	Rain Forest Dry Evergreen Forest Montane Thicket (Nevis)	Montane Forest Dry Evergreen Forest
I.A.1.N.c. (3) II.A.1.N.a. (2), II.C.1.N.a. (1), III.A.1.N.a. (1), III.A.4.N.i. (1), III.A.5.N.e. (1)	Mountain Summit Vegetation Xerophytic Vegetative Belt	Palm Brake Elfin Woodland Dry Scrub Woodlands	Palm Brake Elfin woodland Dry Scrub Woodland
I.A.5.N.b. (1.a), I.A.5.N.b. (1.b) I.A.5.N.d. (1), II.A.1.N.d. (1), III.A.1.N.g. (1), VII.C.4.N.d. (1)	Littoral Vegetative Belt		Littoral Vegetation Cactus Scrub Mangrove Woodland
			Riparian Forest
II.A.1.C.a. (1)			Coconut Plantation
	Cultivated Belt		Urban, Suburban and Agriculture
I.A.1.N.d. (1), II.A.1.C.a. (2), II.A.1.N.a. (3), II.C.1.N.a. (2), V.A.1.C.a. (1), V.A.1.N.g. (1), V.A.2.N.c. (1), V.A.2.N.c. (2), V.A.2.N.c. (3), V.B.1.N.b. (1), V.C.1.N.a. (1), V.C.1.N.a. (2), V.C.1.N.a. (3), V.C.1.N.b. (1), VII.A.1.N.a. (1), VII.A.2.N.a. (1), VII.C.2.N.b. (1)			

I.A.1.N.a. (1). *Siamea saman-Mangifera indica-Bambusa vulgaris* lowland tropical or subtropical broad-leaved evergreen closed tree canopy Alliance

I.A.1.N.a. (1.a). *Siamea saman-mangifera indica* Association

I.A.1.N.a. (1.b). *Bambusa vulgaris-Mangifera indica* Association

I.A.1.N.c. (1). *Dacryodes excelsa-Sloanea* montane tropical or subtropical rainforest

I.A.1.N.c. (2). *Podocarpus coriaceus-Euterpe globosa* montane tropical or subtropical rainforest

I.A.1.N.c. (3). *Euterpe globosa* montane tropical or subtropical rainforest

I.A.1.N.d. (1). *Miconia* spp. montane tropical or subtropical cloud forest

I.A.5.N.b. (1). *Coccoloba uvifera-Hippomane mancinella-Thevetia peruviana-Cordia obliqua* lowland tropical or subtropical broad-leaved evergreen sclerophyllous forest Alliance

I.A.5.N.b. (1.a). *Coccoloba uvifera-Thevetia peruviana* Association

I.A.5.N.b. (1.b). *Hippomane mancinella-Cordia obliqua* Association

I.A.5.N.d. (1). *Rhizophora mangle* seasonally flooded/saturated tropical or subtropical broad-leaved evergreen sclerophyllous closed tree canopy

I.C.1.N.a. (1). *Coccoloba pubescens-Guettarda scabra* lowland tropical or subtropical semi-deciduous forest

II.A.1.C.a. (1). *Cocos nucifera* Grove

II.A.1.C.a. (2). Orchards and groves

II.A.1.N.a. (1). *Acacia* sp.-*Haematoxylon campechianum* tropical or subtropical broad-leaved evergreen woodland

II.A.1.N.a.(2). <i>Cyathea arborea</i> tropical or subtropical broad-leaved evergreen woodland	V.B.1.N.b.(1). <i>Cyathea arborea</i> - <i>Selaginella</i> sp. tall tropical or subtropical perennial forb vegetation
II.A.1.N.a.(3). <i>Philodendron giganteum</i> elephant ear tropical or subtropical broad-leaved evergreen woodland	V.C.1.N.a.(1). <i>Ruppia-Najas</i> non-tidal tropical or subtropical hydromorphic rooted vegetation
II.A.1.N.d.(1). <i>Rhizophora-Avicennia-Laguncularia</i> semi-permanently flooded tropical or subtropical broad-leaved evergreen woodland	V.C.1.N.a.(2). <i>Laguncularia racemosa-Conocarpus erectus</i> permanently flooded tropical or subtropical hydromorphic rooted vegetation
II.C.1.N.a.(1). <i>Pisonia subcordata-Bursera simarouba</i> tropical or subtropical semi-deciduous woodland	V.C.1.N.a.(3). <i>Lycopodium</i> spp. permanently flooded tropical or subtropical hydromorphic rooted vegetation
II.C.1.N.a.(2). <i>Hippomane mancinella-Cordia obliqua</i> tropical or subtropical semi-deciduous woodland	V.C.1.N.b.(1). Permanently flooded tidal tropical or subtropical hydromorphic rooted vegetation
III.A.1.N.a.(1). <i>Erithalis fruticosa-Pilosocereus royeri</i> tropical or subtropical broad-leaved evergreen shrubland	VII.A.1.N.a.(1). <i>Strumphia maritima-Erithalis fruticosa</i> cliffs with sparse vascular vegetation
III.A.1.N.g.(1). <i>Rhizophora-Avicennia-Laguncularia</i> semi-permanently flooded tropical or subtropical broad-leaved evergreen shrubland	VII.A.2.N.a.(1). <i>Jacquinnia arborea-Strumphia maritima</i> pavement with sparse vascular vegetation
III.A.4.N.i.(1). <i>Clusia</i> sp.- <i>Philodendron giganteum</i> tropical or subtropical broad-leaved evergreen montane shrubland	VII.C.2.N.b.(1). <i>Sesuvium portulacastrum-Ipomaea pes-caprae</i> beach strand vegetation
III.A.5.N.e.(1). <i>Pilosocereus royeri-Croton flavens</i> extremely xeromorphic evergreen shrubland with a sparse tree layer	VII.C.4.N.d.(1). <i>Rhizophora-Avicennia-Laguncularia-Conocarpus</i> tidally flooded mudflats
V.A.1.C.a.(1). <i>Saccharum officinarum</i> tall tropical or subtropical grassland	
V.A.1.N.g.(1). <i>Acrostichum aureum</i> seasonally flooded tropical or subtropical grassland	
V.A.2.N.c.(1). <i>Panicum maximum</i> medium-tall tropical or subtropical grassland with a sparse broad-leaved evergreen tree layer	
V.A.2.N.c.(2). <i>Bothriochloa pertusa</i> medium-tall tropical or subtropical grassland with a sparse broad-leaved evergreen tree layer	
V.A.2.N.c.(3). <i>Selaginella-Lycopodium</i> medium-tall tropical or subtropical grassland with a sparse broad-leaved evergreen tree layer	

Table 3. Conservation status of vegetation Alliances/Associations in St. Kitts and Nevis.

Conservation Status:

Rare, (very restricted in distribution and/or size) **or**
 Uncommon, (moderately restricted in distribution and/or size) **or**
 Common, (widespread in distribution and/or large size)

and

Endangered (danger of extirpation) **or**
 Vulnerable (likely to move into Endangered category if causal factors continue to operate) **or**
 Not known (suspected, but not known, to belong to Vulnerable category) **or**
 Stable (no apparent danger)

	Stable	Not Known	Vulnerable	Endangered
Rare	V.A.2.N.c. (3) V.B.1.N.b. (1) VII.C.4.N.d. (1)		I.A.1.N.d. (1) III.A.4.N.i. (1) V.C.1.N.a. (1) V.C.1.N.a. (2) V.C.1.N.a. (3)	V.A.1.N.g. (1)
Uncommon	I.A.1.N.c. (1) I.A.1.N.c. (2) I.A.1.N.c. (3) II.A.1.N.a. (1) II.A.1.N.a. (2) VII.A.1.N.a. (1) VII.A.2.N.a. (1)		I.A.5.N.d. (1) II.A.1.N.d. (1) II.C.1.N.a. (1) II.C.1.N.a. (2) III.A.1.N.a.(1) III.A.1.N.g.(1) V.C.1.N.b. (1)	I.A.5.N.b. (1.a) I.A.5.N.b. (1.b)
Common	I.A.1.N.a. (1.a) I.A.1.N.a. (1.b) I.C.1.N.a. (1) II.A.1.C.a. (1) II.A.1.C.a. (2) II.A.1.N.a. (3) III.A.5.N.e. (1) V.A.1.C.a. (1) V.A.2.N.c. (1) V.A.2.N.c. (2)		VII.C.2.N.b. (1)	

See Table 2 for description of numbered Alliances/Associations used in this table.

CONSERVATION OBJECTIVES

A primary conservation objective for the country should be:

To ensure the continued existence of representatives of each of the vegetation types. Clearly, the endangered communities have the highest conservation priority.

Nearly one-half of all the vegetation communities in the country are considered Endangered or Vulnerable (16 of 36); and the task of conserving these represents a significant challenge for St. Kitts and Nevis, especially through the existing institutional framework.

The National Conservation and Environmental Act (1987) provides "for the better management and development of the natural and historic resources of St. Christopher and Nevis for the purposes of conservation". This comprehensive piece of legislation sanctions the establishment of parks and protected areas, including nature reserves, for the protection of biodiversity. To date, however, only two areas have been protected *under the legislation*, and both are historic sites.

The 1904 Forest Ordinance, the first for St. Kitts-Nevis and the first for the Caribbean, legislated protection for the forests of the central mountains and resulted in the establishment of good second-growth forests, a legacy that remains to this day. St. Kitts and Nevis are among the few islands in the Caribbean that continue to experience increasing forest cover after centuries of deforestation for intensive and extensive agricultural development.

Nevertheless, the forest resources and the plant species that comprise these communities are not formally managed. Additionally, no plant species (or plant community) is formally protected. Special areas of conservation concern throughout the country will need to be better defined and targeted for conservation if a protected areas system that truly safeguards the national biological heritage is to be fully developed. Given the financial constraints facing the public sector, and the fact that several biologically important areas are under private ownership, it is clear that this challenge will require new alliances and the participation of many people and institutions to be successful.

**Table 4. Conservation status of vegetation types in St. Kitts and Nevis
by Alliance/Association and primary factors threatening biodiversity.**

Columns 1, 4: Alliance/Association

Columns 2, 5: Conservation Status:

Common, (widespread in distribution and/or large size)
Uncommon, (moderately restricted in distribution and/or size)
Rare, (very restricted in distribution and/or size)
Stable (no apparent danger)
Endangered (danger of extirpation)
Vulnerable (likely to move into Endangered category if causal factors continue to operate)
Not known (suspected, but not known, to belong to Vulnerable category)

Columns 3, 6: Primary conservation concerns threatening biodiversity

① ALLIANCE/ ASSOCIATION	② STATUS	③ CONSERVATION CONCERNS	④ ALLIANCE/ ASSOCIATION	⑤ STATUS	⑥ CONSERVATION CONCERNS
I.A.1.N.a. (1.a)	C. S.		V.C.1.N.a. (1).	R. V.	pollution, coastal development, sedimentation
I.A.1.N.a. (1.b)	C. S.		V.C.1.N.a. (2).	R. V.	pollution, coastal development
I.A.1.N.c. (1)	U. S.	feral monkeys?	V.C.1.N.a. (3).	R. V.	development
I.A.1.N.c. (2)	U. S.	feral monkeys?	V.C.1.N.b. (1).	U. V.	pollution, coastal development, sedimentation
I.A.1.N.c. (3)	U. S.	feral monkeys?	VII.A.1.N.a. (1).	U. S.	coastal development and erosion
I.A.1.N.d. (1)	R. V.	unknown	VII.A.2.N.a. (1).	U. S.	coastal development and erosion
I.A.5.N.b. (1.a)	U. E.	sand mining, coastal and residential development	VII.C.2.N.b. (1).	C. V.	coastal development, erosion, sand mining
I.A.5.N.b. (1.b)	U. E.	sand mining, coastal and residential development	VII.C.4.N.d. (1).	R. S.	coastal development
I.A.5.N.d. (1)	U. V.	coastal development			
I.C.1.N.a. (1)	C. S.				
II.A.1.C.a. (1)	C. S.				
II.A.1.C.a. (2)	C. S.				
II.A.1.N.a. (1)	U. S.				
II.A.1.N.a. (2)	U. S.				
II.A.1.N.a. (3)	C. S.				
II.A.1.N.d. (1)	U. V.	coastal development			
II.C.1.N.a. (1)	U. V.	erosion, overgrazing, feral monkeys?, fires			
II.C.1.N.a. (2)	U. V.	overgrazing, coastal erosion			
III.A.1.N.a. (1)	U. V.	erosion, overgrazing, feral monkeys?, fires			
III.A.1.N.g. (1)	U. V.	coastal development			
III.A.4.N.i. (1)	R. V.	erosion			
III.A.5.N.e. (1)	C. S.				
V.A.1.C.a. (1)	C. S.				
V.A.1.N.g. (1)	R. E.	coastal development, erosion			
V.A.2.N.c. (1)	C. S.				
V.A.2.N.c. (2)	C. S.				
V.A.2.N.c. (3)	R. S.				

V.B.I.N.b. (1)	R. S.				
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See Table 2 for description of numbered Alliances/Associations used in this table.

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REFERENCES

- Alexander, William H. (publication date unknown). The flora of St. Christopher. American Geological Society.
- Bacon, P. R., 1991. The Status of Mangrove Conservation in the CARICOM Islands of the Eastern Caribbean. Report to the Commission of the European Communities as part of the Tropical Forestry Action Plan for the Caribbean Region.
- Beard, J. S. 1949. *The natural vegetation of the Windward and Leeward Islands*. Clarendon Press. Oxford, UK.
- Beard, J. S. 1955. The classification of tropical American vegetation-types. *Ecology* 36:89-100.
- Burdon, K. 1920. A handbook of St. Kitts-Nevis. The West India Committee. London.
- Caribbean Conservation Association and Island Resources Foundation. 1991. *St. Kitts and Nevis Environmental Profile*. St. Michael, Barbados and St. Thomas, VI.
- Coppinger, Raymond C., Coppinger, Lorna L. and Kobner, Lorna L. 1971. St. Kitts: Ecology.
- De Athe, Rhonda. 1990. Wildlife description and nature program proposals for Brimstone Hill, St. Kitts. Vanier College, Canada.
- Eastern Caribbean Natural Area Management Programme. 1980. Survey of Conservation Priorities in the Lesser Antilles-Nevis.
- Federal Geographic Data Committee. 1997. *FGDC Vegetation Classification and Information Standards*. Washington, DC.
- Graham, B. M. and M. H. Richard. 1992. A revised list of the Pteridophytes of Nevis. The Fern Gazette, 1992. British Pteridological Society.
- Harris, D. R. 1965. *Plants, Animals, and Man in the Outer Leeward Islands, West Indies: An Ecological Study of Antigua, Barbuda and Anguilla*. University of California Press. Berkeley and Los Angeles.
- Henderson, A, G. Galeano and R. Bernal. 1995. Field Guide to the Palms of the Americas. Princeton University Press.
- Horwith, B. and Lindsay, K. 1997. A biodiversity profile of Antigua, Barbuda and Redonda. Island Resources Foundation. St. John's, Antigua

- Howard, R. 1973. The Vegetation of the Antilles. In A. Graham (ed.), *Vegetation and Vegetational History of Northern Latin America*, pp. 1-38. Elsevier Scientific Publishing Company. New York.
- Howard, R. 1974. *Flora of the Lesser Antilles: Leeward and Windward Islands. Volume 1. Orchidaceae* by L Garay and H Sweet. Arnold Arboretum, Harvard University.
- Howard, R. 1977. *Flora of the Lesser Antilles: Leeward and Windward Islands. Volume 2. Pteridophyta* by G Proctor. Arnold Arboretum, Harvard University.
- Howard, R. 1979. *Flora of the Lesser Antilles: Leeward and Windward Islands. Volume 3. Monocotyledoneae*. Arnold Arboretum, Harvard University.
- Howard, R. 1988. *Flora of the Lesser Antilles: Leeward and Windward Islands. Volume 4. Dicotyledoneae – Part 1*. Arnold Arboretum, Harvard University.
- Howard, R. 1989. *Flora of the Lesser Antilles: Leeward and Windward Islands. Volume 5. Dicotyledoneae – Part 2*. Arnold Arboretum, Harvard University.
- Howard, R. 1989. *Flora of the Lesser Antilles: Leeward and Windward Islands. Volume 6. Dicotyledoneae – Part 3*. Arnold Arboretum, Harvard University.
- Lindsay, K. and Horwith, B. 1997. *A vegetation classification of Antigua, Barbuda and Redonda*. Island Resources Foundation. St. John's, Antigua.
- Little, E. L. and F. H. Wadsworth. 1964. *Common Trees of Puerto Rico and the Virgin Islands*. Agri. Handbook 49, USDA Forest Service. Washington, DC.
- Little, E. L. and F. H. Wadsworth. 1989. *Common Trees of Puerto Rico and the Virgin Islands. Vol. 2*. USDA Forest Service. Washington, DC.
- Meagher, Walter L. 1995. *Caribbean coastal and hillside vegetation*, St. Kitts, West Indies.
- Meagher, Walter L. 1996. Vegetation and habitat on a Caribbean island. The Friar's Bay Salt Pond and adjoining habitats on the Southeast Peninsular of St. Kitts.
- Merrill, Gordon C. 1958. The historical geography of St. Kitts and Nevis, the West Indies. Instituto Panamericano de Geografia e Historia. Mexico.
- Morello, J. 1983. Ecological diagnosis of Antigua and Barbuda. Organization of American States, Dept. Reg. Dev., Washington, DC.
- Owen, Patrick. 1992. Vegetation analysis of the Bath Bog, Nevis, West Indies. Vanier College, Canada.

Rodrigues, Dean. 1990. The vegetation zones of Nevis, West Indies. Vanier College, Canada.

Skerritt, R. and Campbell Evelyn. 1982. An introduction to the forests of St. Kitts. Presented at the AGM of the Caribbean Conservation Association in Nevis.

Stehle, H. 1945. Forest types of the Caribbean Islands. *Caribb. For.* 7(supplement): 273-408.

Weakley, A. S. 1996. Vegetation of the West Indies (Cuba, the Greater Antilles, the Lesser Antilles, and the Bahamas). The Nature Conservancy.

