

A Biodiversity Profile of St. Kitts and Nevis

PREPARED BY

Bruce Horwith and Kevel Lindsay

Revisions by Bruce Potter

Edited by Judith Towle

island resources
FOUNDATION

Eastern Caribbean Biodiversity Programme
PO Box 2103
St. John's, ANTIGUA

PREPARED FOR

Nevis Historical and Conservation Society
St. Christopher Heritage Society

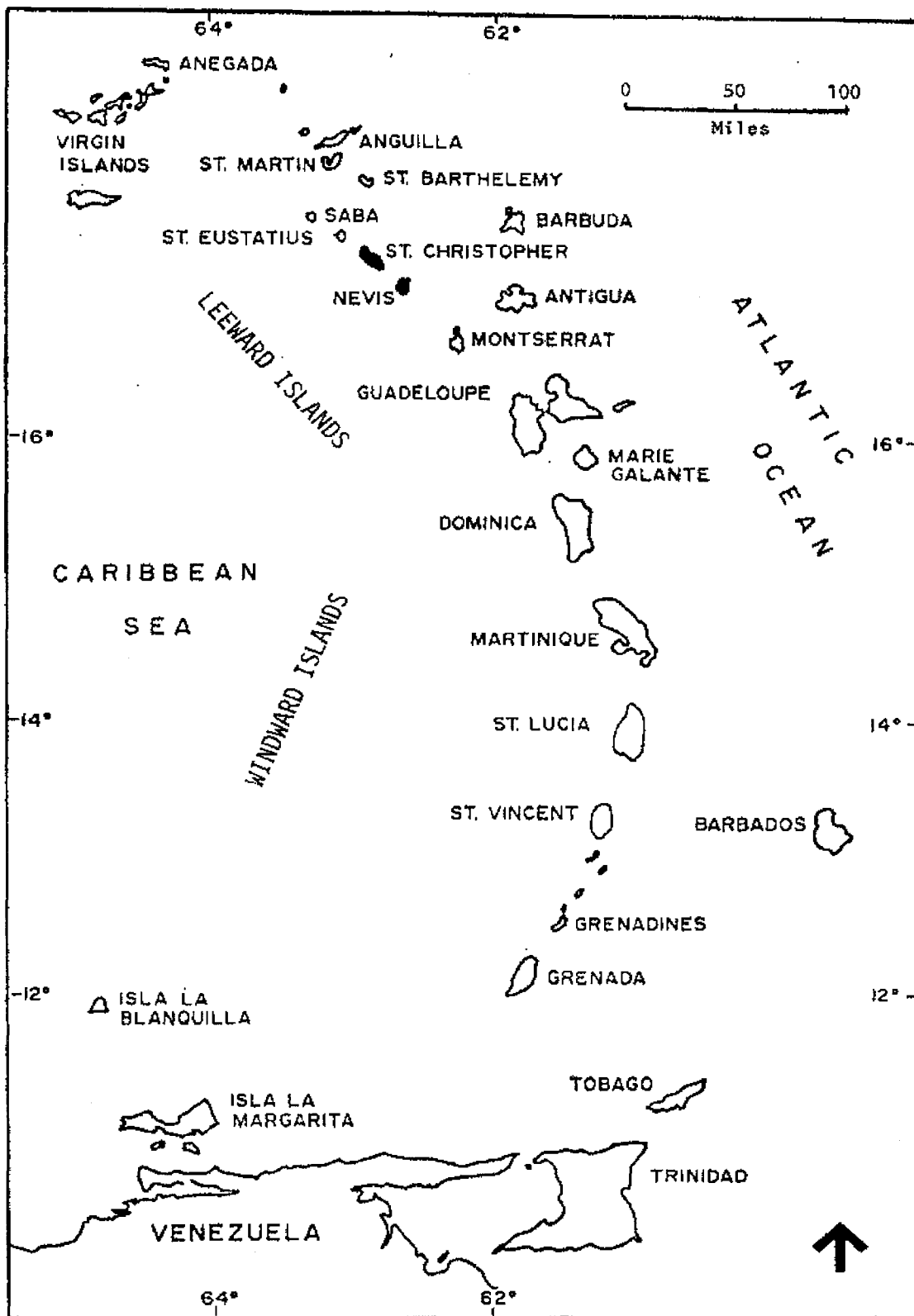
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Map of the Eastern Caribbean, showing the location of St. Christopher and Nevis.

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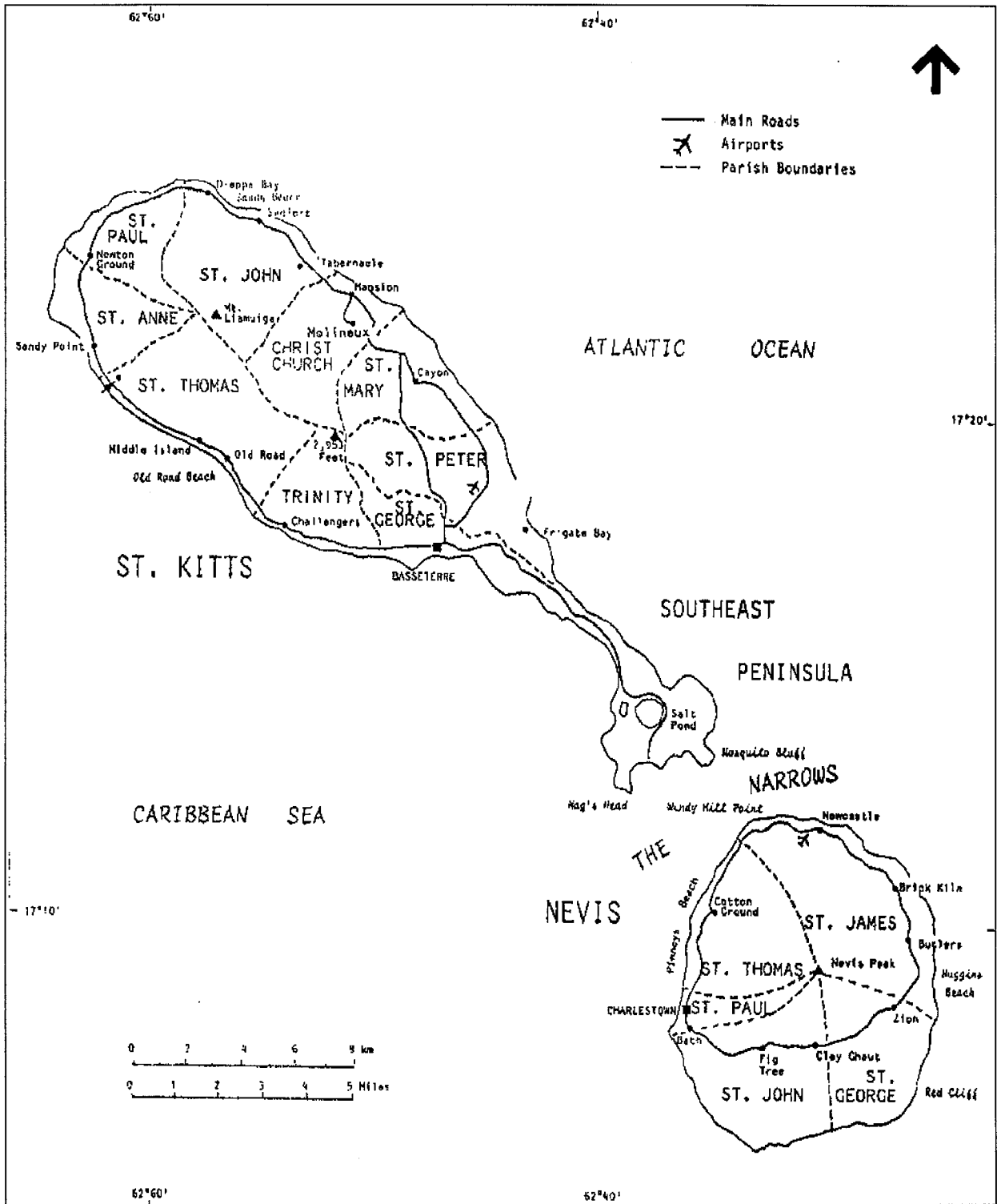
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Place Names and Parishes of St. Kitts and Nevis.

INTRODUCTION

This Biodiversity Profile is designed to highlight environmental conditions in St. Kitts-Nevis as they pertain to the conservation of terrestrial biological resources on the two islands. As such, this profile can be seen as a thematic refinement and partial updating of the 1990 *Country Environmental Profile: St. Kitts and Nevis*, by the Caribbean Conservation Association and Island Resources Foundation, which deals with a broader range of natural, historical, cultural, land use, pollution control, and institutional factors. This Biodiversity Profile is complemented by the concurrently published *A Vegetation Classification of St. Kitts and Nevis: Implications for Conservation*, which provides a scientifically up-to-date measure of the underlying vegetation communities and associations of the islands.

More than these other documents, *A Biodiversity Profile of St. Kitts and Nevis* is an unfinished and dynamic document which is necessarily incomplete and should be subject to constant revision and updating, expansion and extension. We have explicitly identified areas where we believe such growth is necessary or desirable, but the framework is open to incorporate all relevant new biodiversity knowledge.

First among these areas for growth of the biodiversity profile is a conservation assessment of the *marine and near coastal* conditions of St. Kitts-Nevis, with special attention to the reefs, sea grass beds and mangroves of the Sand Point Reef, the Southeast Peninsula, the Narrows and coastal Nevis. These resources are well exploited by local and regional fishers and dive tourism is a significant economic factor on both islands. In this version of the profile, we have only incorporated a small discussion of marine invertebrate species as a place marker for future research findings and to capture the significant elements of certain recent publications pertinent to studies of global and regional marine invertebrate biology.

In many respects the References section of the Profile should be its most valuable resource. As technology evolves, we assume that hypertext linking will enable this document to present both the overview of this profile, and link directly to many of the detailed background documents and scientific studies. An example of such detailed background information is presented in "Appendix A: List of Plants of St. Kitts and Nevis," which includes over 200 species newly identified as part of the researches conducted for this phase of biodiversity investigations.

A second, more difficult, task is linking the scientific information on species to common names. This simple sounding process is extremely difficult, subject to high error rates, and ultimately may be so ambiguous because of temporal and

geographic variations that it may be of dubious value except to etymologists, linguists and anthropologists. Island Resources Foundation does *not* recommend common language glossaries or indices as part of the biodiversity conservation planning process—such tools may, however, have value as environmental education tools, especially in communities with second languages or dialects.

Finally, this profile needs to link to constantly improving geographic knowledge of biodiversity, as expressed in maps of key biodiversity indicators, such as vegetative communities, species distribution, critical habitats, protected areas and so on. Biodiversity conservation is not solely a process of setting geographic reserves (*e.g.*, banning the pesticide *DDT* was very conserving for many species of waterfowl and raptors), but geography is indispensable for understanding many biodiversity *and* conservation issues.

In this profile we have newly incorporated the Nature Conservancy's 1999 re-interpretation of the 1980's ECNAMP (Eastern Caribbean Natural Areas Mapping Programme) vegetation maps. (See Appendix B for the detailed metadata of these maps, which are presented below.) These maps need to be corrected and updated.

- Are the actual vegetation classifications used correct? They have *not* been verified or ground-truthed by Nature Conservancy. Contact Jeff Parrish for details at <jparrish@tnc.org>),
- The maps also need to be updated with new mapping at finer geographic scales (*e.g.*, 1:20,000) and thematic resolution (*e.g.*, 25 classes, instead of six or eight). These finer scales are necessary for planning, policy making and resource management at national and local scales. (Usually even finer scales are necessary for management at the level of the individual reserve.)

GEOGRAPHY AND GEOLOGY

St. Kitts and Nevis are part of the Lesser Antillean Archipelago, a chain of islands separated from the Greater Antilles (Cuba, Jamaica, Hispaniola, Puerto Rico and the Virgin Islands) by the Anegada Passage and extending from Anguilla in the north (18°30'N) 850 km to Grenada in the south (12°N). North of Dominica (15°20'N), the Lesser Antillean Archipelago splits to form two chains. The outer (eastern) chain—Marie Galante, Grande Terre, La Desirade, Antigua, Barbuda, St. Barthelemy, St. Martin, Anguilla, and Sombrero—consists of low-elevation compositions of older volcanics overlain by carbonates. The inner (western) chain—Basse Terre, Montserrat, Redonda, **Nevis**, **St. Kitts**, St. Eustatius and Saba—consists of newer volcanic rock forming characteristically steep, mountainous islands (Martin-Kaye, 1959, 1969; Pregill *et al.*, 1994).

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The small size and insularity of the West Indies influence the number of terrestrial species that occur in the region, factors that contribute to the relatively high concentration of endemism and the vulnerability of its biota to disasters and longer term stressors such as human-caused habitat changes or climate change.

This report summarizes and sites much of the available data on the plant and animal species found in the dual-island nation of St. Kitts and Nevis. The data on the occurrence of vascular plants and vertebrates (reptiles, birds and mammals) are fairly complete, although field research—even during recent decades—has uncovered new species not previously known to exist in the country. This ability to still discover new vertebrate species or vascular plants is a strong argument for the country to support added field research in biology. In addition, such research is necessary because even for these supposedly well-known taxa, little is known about their *abundance, distribution or conservation status*.

Data on the most diverse group of organisms, the invertebrates, are much more limited. Even species presence/absence data—the most rudimentary level of information used in conservation planning—are lacking. Invertebrate research is a priority both to assess the nature of local invertebrate communities from the standpoint of evolutionary science and to better understand ecosystem dynamics in the various communities of the two islands. (St. Kitts-Nevis lies at the intersection of invertebrate migrations from North America and South America—understanding local community composition can contribute to broader understanding of how life has populated the Antilles over the eons.)

Fortunately, the primary approach used in invertebrate conservation is protection of habitat, and—if the country has the determination to do so—enough information already exists to protect immediately the diversity of vegetation communities and their associated invertebrates found in St. Kitts and Nevis.

CONSERVATION STATUS

In this profile we have applied the IUCN conservation status definitions. In this system, conservation status is defined in terms of a two-tier labeling system modified from the Red Data Book Categories of the World Conservation Union (IUCN).

- *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).

FLORA

VEGETATION TYPES

Island Resources Foundation describes 36 vegetation types in *A Vegetation Classification of St. Kitts and Nevis: Implications for Conservation* (Lindsay and Horwith, 1999), following the U.S. National Vegetation Classification System developed by the U.S. Federal Geographic Data Committee (FGDC, 1997).¹ The classification for St. Kitts and Nevis, which was developed as a conservation management tool, builds on, but differs from, the previous efforts of Rodrigues (1990), Beard (1949) and Britton (1901, published in the *Handbook of St. Kitts and Nevis*, 1920). Whereas the prior studies emphasized vegetation categories that were believed to have existed before Europeans disrupted the landscape, Island Resources Foundation documents existing vegetation communities.

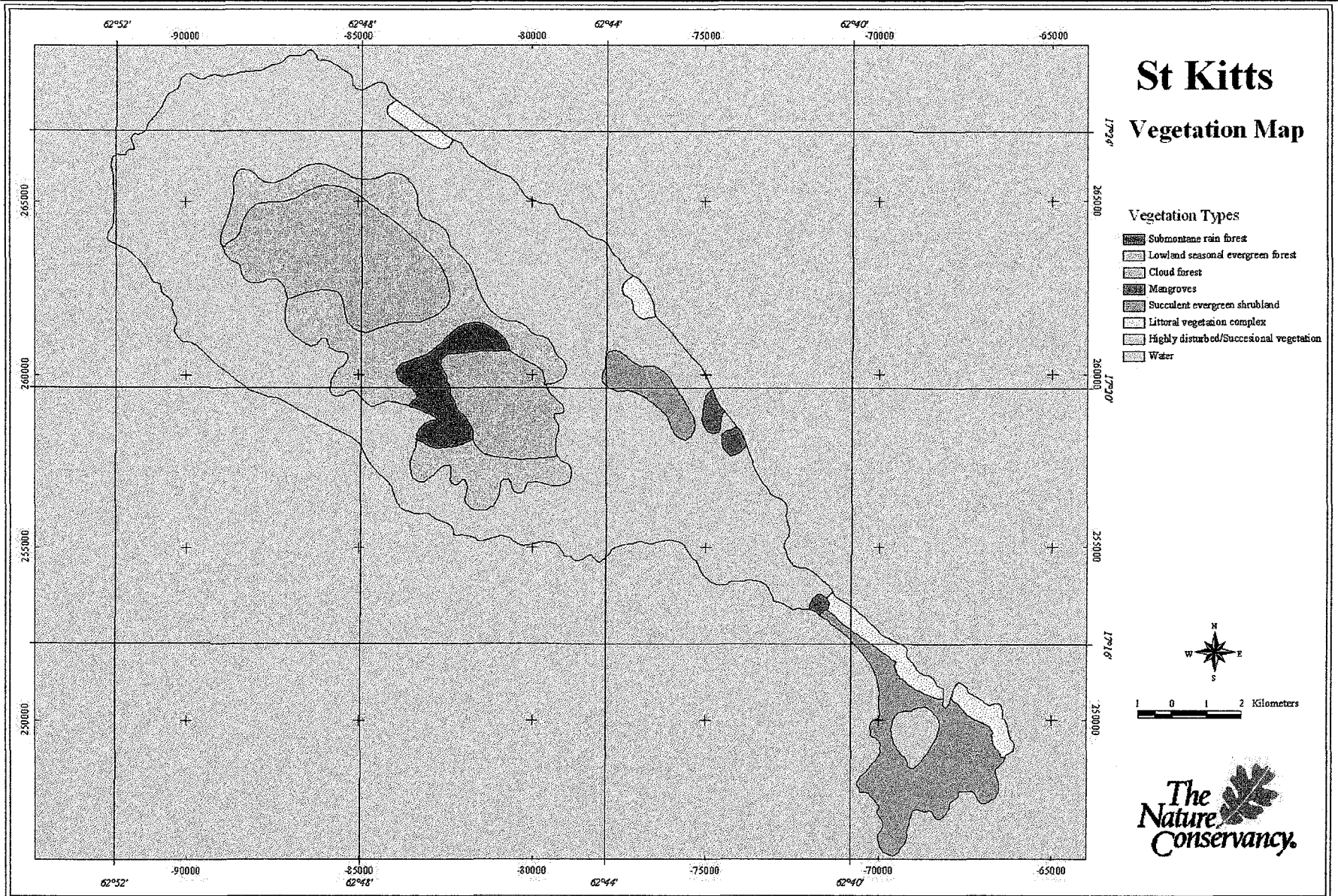
Information on all 36 of the vegetation communities—including descriptions, lists of many of the species, locations, and conservation status—is presented in Lindsay and Horwith (1999). A map, applying the same general classification scheme used by Lindsay and Horwith has been developed by The Nature Conservancy, using the geographic boundaries applied by the the Eastern Caribbean Natural Areas Mapping Project (now CANARI, the Caribbean Natural Areas Resource Institute). These maps are presented on the following two pages; full metadata for the background information of these maps, as presented by The Nature Conservancy is presented in Appendix B.

¹ The discussion in this Profile refers to terrestrial vegetation. In regard to marine plants, Humann (1993) lists 62 marine plants for the Caribbean region. This is probably a vast underestimate since this information is from a field guide targeted to the general public, and it is only included here for general comparative purposes. Little is known of the conservation status of this group, but the conservation of marine resources is discussed briefly in regard to corals in the section on invertebrates.

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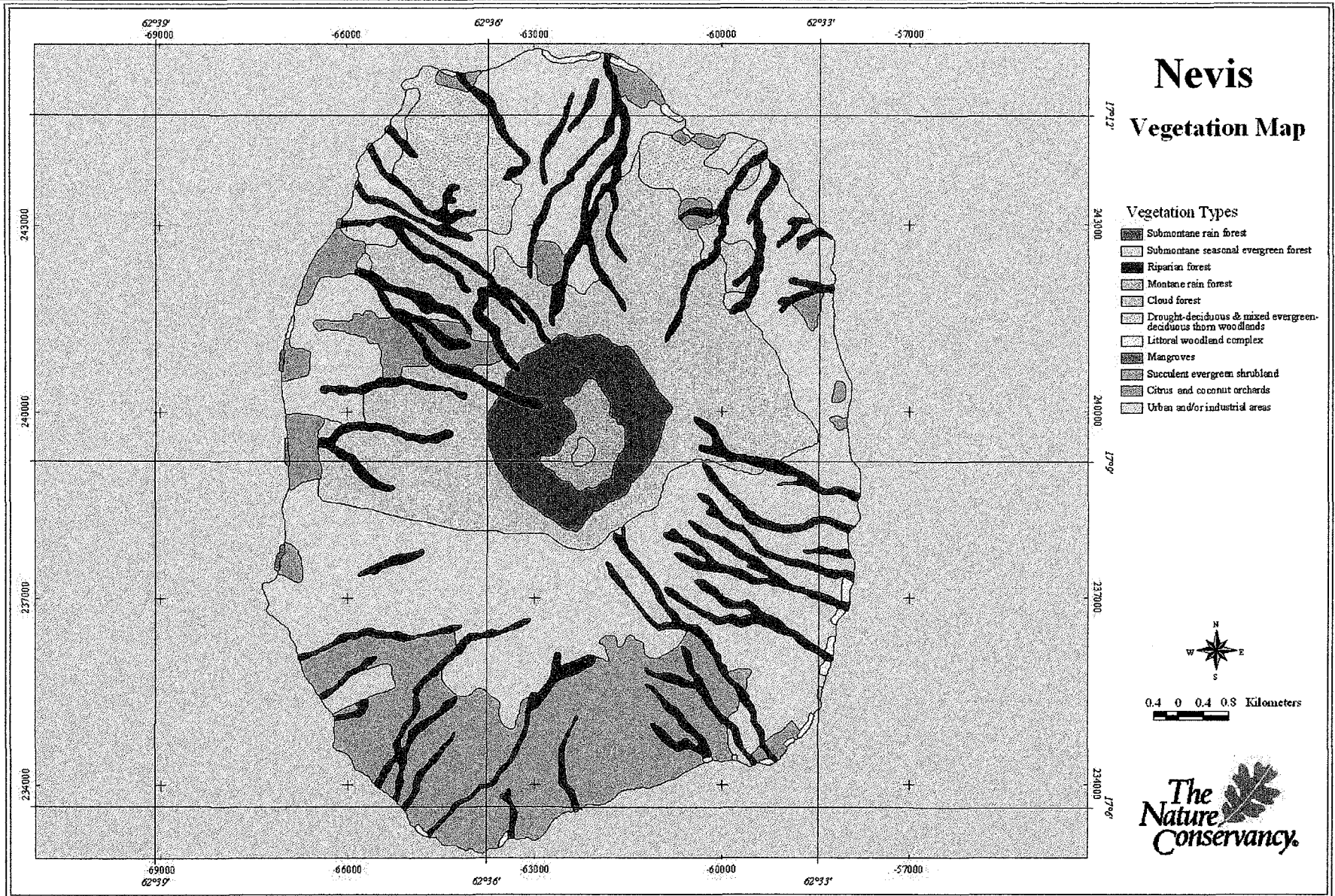
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FLORISTICS

Appendix A lists plant species recorded for each of the two islands. The primary source for the records is Howard's *Flora of the Lesser Antilles* (1974, 1977, 1979, 1988, 1989), supplemented by Rodrigues (1990), Huggins (1992), Meagher (1995, 1996), Roughgarden (1990), Hitchcock (1936), Graham and Rickard (1992), and Lowery and Lindsay (*pers. comm.*).

The list of plants in Appendix A contains 926 species (151 families and sub-families). Several species introduced for horticultural, fruit crop and agricultural purposes are included—some of which have escaped cultivation and become naturalized—but their coverage of cultivated crops is not comprehensive. The list is primarily the work of Kate Orchard of the St. Christopher Heritage Society. Recent efforts by Jennifer Lowery, a horticulturist who lives on Nevis, and Kevel Lindsay of Island Resources Foundation, resulted in approximately 200 additional records for the country. Given the topographic diversity of the islands, the list seems depauperate, suggesting that it suffers from the fact that few botanists have researched the islands within the last 20 to 30 years.

PTERIDOPHYTES

Pteridophytes (ferns), which in many parts of the world are poorly documented, are well documented in St. Kitts and Nevis. Therefore, they have been summarized in Table 1 and are listed in their entirety in the plant list found in Appendix A.

One hundred forty-five pteridophyte species (fern and fern-allies) are known for St. Kitts and Nevis (Table 1). Twenty-two species occur on Nevis but not St. Kitts, while 41 species occur on St. Kitts but not Nevis. Eighty-two species occur on both islands. The major collections are from Box in the 1930s and Proctor in the 1960s. St. Kitts has not been studied in detail for more than 30 years, but two recent efforts (1988 and 1990) led to the addition of 14 records for species new to Nevis. Seven of the 145 species are endemic to the Lesser Antilles; one is endemic to St. Kitts and two are endemic to Nevis. Little is known about the status of most of these species.

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Table 1. Summary of Pteridophytes of St. Kitts and Nevis.
St. Kitts (K); Nevis (N)

PSISOTACEAE	POLYPODIACEAE
<i>One species</i>	Five sub-families
	sub-family DAVALLIOIDEAE
LYCOPODIACEAE	<i>One species</i>
<i>Seven species</i>	sub-family PTERIDOIDEAE
	<i>Eight species</i>
SELAGINELLACEAE	sub-family BLENNOIDEAE
<i>Six species</i>	<i>Five species</i>
	sub-family ADIANTOIDEAE
MARATTIACEAE	<i>Eight species</i>
<i>One species</i>	Sub-family OLEANDROIDEAE
	<i>Twenty-five species</i>
SCHIZAEACEAE	
<i>Two Species</i>	THELYPTERIDOIDEAE
	<i>Twenty-two species</i>
GLEICHENIACEAE	Four sub-families
<i>Four species</i>	sub-family ASPLENIOIDEAE
	<i>Seven species</i>
HYMENOPHYLLACEAE	sub-family POLYPODIOIDEAE
<i>Nine species</i>	<i>Ten species</i>
	sub-family GRAMMITIDOIDEAE
TRICHOMANES	<i>Eleven species</i>
<i>Eleven species</i>	sub-family VITTARIOIDEAE
	<i>Four species</i>
CYATHEACEAE	
<i>Three species</i>	

PLANTS OF SPECIAL CONSERVATION CONCERN

Table 2 below lists the 45 plant species known to be endemic to the country or endemic to the Lesser Antilles and occurring in the country. While each of these merits special conservation concern, undoubtedly there are several non-endemic species that also should be considered endangered or vulnerable within St. Kitts and Nevis. However, the inadequacy of the botanical data on the country does not allow these other species of conservation concern to be identified at this time.

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Table 2. Plant Species Known To Be Endemic In St. Kitts and Nevis.*

“LA” = Lesser Antilles; “WI” = West Indies

<i>Acrocomia aculeata</i> , LA	<i>Thelypteris clypeolutata</i> LA
<i>Asplenium malcom-smithii</i> , BELIEVED TO REPRESENT A HYBRID ENDEMIC TO ST. KITTS	<i>Tibouchina ornata</i> , LA
<i>Begonia retusa</i> , LA	<i>Agave dussiana</i> , LA
<i>Charianthus purpureus</i> , LA	<i>Ayenia insulaecola</i> , WI
<i>Clidemia umbrosa</i> , LA	<i>Cestrum laurifolium</i> , WI
<i>Cybianthus parasiticus</i> , LA	<i>Chrysobalanus cuspidatus</i> , LA
<i>Eugenia chrysobalanoides</i> , LA	<i>Clusia major</i> , LA
<i>E. trigonscarpum</i> LA	<i>Epidendrum patens</i> , LA
<i>Freziera undulata</i> , LA	<i>E. macranthum</i> LA
<i>Galactia longifolia</i> , LA	<i>Eupatorium integrifolium</i> , LA
<i>Hymenophyllum hirtellum</i> var. <i>gratum</i> , LA	<i>Furcrea tuberosa</i> , LA
<i>Lobelia cirsiifolia</i> , LA	<i>Galactia rubra</i> , LA
<i>Macgravia umbrellata</i> , LA	<i>Ilex dioica</i> , LA
<i>Marila racemosa</i> , LA	<i>Malpighia linearis</i> , LA
<i>Peperomia dussii</i> , LA	<i>Oncidium urophyllum</i> , LA
<i>Prunus pleuradenia</i> , LA	<i>Peperomia pellucida</i> , LA
<i>Sapium caribeum</i> , LA	<i>Schefflera attenuata</i> , LA
<i>Selaginella flabellata</i> , LA	<i>Stelis cabrida</i> , LA
<i>Sloanea dentata</i> , LA	<i>Ternstroemia elliptica</i> , LA
<i>Sloanea massoni</i> , LA	<i>Thelypteris antillana</i> , LA
<i>S. berteriana</i> , WI	<i>Thelypteris muscicola</i> , ENDEMIC TO NEVIS
<i>Styrax glaber</i> , LA	<i>Vriesia guadelupensis</i> , LA
<i>Tetrazygia discolor</i> , LA	

* We include not only those species listed as endemic by Howard (1974; 1977, 1979, 1988, 1989), but also those for which the only entry under general distribution is the Lesser Antilles, even if Howard did not specify it as endemic.

BIODIVERSITY IMPLICATIONS

SERVICES AND BENEFITS

Most of the plant species that provide direct tangible benefits to the people of St. Kitts and Nevis are introduced species, with wide distributions throughout the world. Many of these were either carried for their food and medicinal values as part of the slave cargo to the New World or came as stowaways. With such wide geographical distribution, the survival of these species is secure.

The greatest contribution of the native flora is in the indirect ecological services that they provide (*e.g.*, storage and delivery of water). The direct economic and social benefits of the species of biodiversity concern are relatively unknown. The medicinal plant research of Dr. Milton Whittaker and his colleagues (Whittaker, 1997) has made a significant start toward filling this gap and will play an invaluable role in educating the public on biodiversity conservation issues.

HABITAT PROTECTION

The single most important tool for conserving the biodiversity of a country is *in situ* protection of habitat. By taking measures to preserve *representative tracts* of each identifiable ecosystem, biodiversity is conserved at this broadest level, while simultaneously safeguarding a complex of numerous associated plant, animal and microbial resources, many of which may not even have been identified, much less targeted for protection.

Although there is not yet an ecosystem classification of the country, the vegetation community analysis presented in *A Vegetation Classification of St. Kitts and Nevis: Implications for Conservation* (Lindsay and Horwith, 1999) offers a preliminary approach. Of the 36 vegetation communities identified for the country, 11 are Common, 9 are considered Rare and 16 are Uncommon. The Common communities, with the exception of one coastal community, are Stable and thus not of conservation concern (the exception is the *Sesuvium portulacastrum-Ipomea pes-caprae* strand vegetation Alliance, which is considered Vulnerable due to development pressure).

Fortunately, many of the Rare and Uncommon communities also can be considered Stable (10 of 25) because of their isolation and difficulty of access. The Forest Ordinance of 1904 provided protection for the forests of the central mountains, and this, combined with steep topography, has allowed good second-growth forest to develop. St. Kitts and Nevis are two of the few islands in the Caribbean that continue to experience increasing forest cover after centuries of agricultural-related deforestation. However, from a biodiversity perspective, neither the forest resources nor any of the individual plant species receive formal protection or management. Complicating matters is the widespread

development of small-scale marijuana production that has led to some forest clearing.

The remaining 15 Rare or Uncommon vegetation communities are at risk. Three of these are Endangered and represent conservation priorities:

***Acrostichium 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, *Acrostichium* sp.

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

Synonymy: Mangrove woodland (Rodrigues, 1990).

***Coccoloba uvifera*-*Hippomane mancinella*-*Thevetia peruviana*-*Cordia obliqua* lowland tropical or sub-tropical broad-leaved evergreen sclerophyllous forest Alliance.**

(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.

In St. Kitts, the main threats to the flora result from expanding residential and coastal development (primarily commercial resorts, with isolated impacts from sand mining). Coastal development is a conservation concern in Nevis as well, though it is more concentrated in specific areas.

A possible threat to the native flora is the presence of feral Green Monkeys (*Cercopithecus aethiops*), which have been on the islands since their introduction over 250 years ago. Although the monkeys have been studied to some extent, researchers have not investigated their impact on the flora (or fauna).

Protecting representatives of each of the vegetation communities identified for St. Kitts and Nevis would be the most efficient and effective approach to conserving the country's biodiversity. Unless such measures are taken, much of the flora (and fauna) is at risk based on existing trends. It is important to note that "parks" *per se* are only one of several possible types of protected areas. There are other categories or classes that provide varying levels of protection and resource use that could be pursued by the country.

Representative ecosystems for protection could be identified for:

- the central mountain range of St. Kitts, especially the dwarf montaine area surrounding Dos D'ane Pond at the top of Verchild's mountain,
- the Southeast Peninsula of St. Kitts,
- Nevis Peak,
- the small patches of dry forests in the southeast and southwest of Nevis, and
- ghauts on both islands which may serve as important channels of communication from one habitat to another for species which would otherwise be totally isolated by patterns of agricultural cultivation or human habitations.

The National Conservation and Environmental Act of 1987 provides "for the better management and development of the natural and historic resources of St. Christopher and Nevis for the purposes of conservation", including establishment of parks and protected areas. To date, only two areas have been legislated as protected, and while they are historical sites of local, regional and international significance, neither has a management plan in place to assess and protect its biodiversity. Special areas of conservation concern throughout the country will need to be better defined and then 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.

FAUNA

“The only solid piece of scientific truth about which I feel totally confident is that we are profoundly ignorant about nature”

Lewis Thomas, *The Medusa and the Snail*, 1979

INVERTEBRATES

The treatment of invertebrates in this report is weak, which is unfortunate given the document’s focus on biodiversity and the fact that worldwide invertebrates comprise more taxa than the better-studied vertebrate animals. For most of us, however, our knowledge of the “lower” forms of life is inadequate to even provide a perspective for evaluating the data and data gaps.

For example, there are some data on West Indian amphipods (small crustaceans) because of the work of a Dutch scientist who started collecting in the region in the 1930s and continued for nearly half a century. Many of the thousands of samples collected from Aruba to Florida during the Hummelinck expeditions have been sorted, but fewer have been thoroughly classified. So far five families have been identified. Is this a lot or a little? To rephrase the question more scientifically, issues such as the following need to be considered:

- How many families of amphipods are there globally, *i.e.*, how well represented are they in the Caribbean from a global perspective?
- Do the families contain many genera, and do the genera contain many species? Although biodiversity can be measured from the ecosystem level to the genetic level, the most intuitive measurement of biodiversity emphasizes numbers of species.
- Are any of the families, genera or species endemic to St. Kitts-Nevis, or to the Caribbean?
- What is an amphipod; and how does it fit into the tree of life?

In a sense, the last question is the starting point. For example, from our study of bird species, we know that St. Kitts-Nevis has approximately 130 species of birds, and we have an intuitive sense of what this means in terms of avian biodiversity. While most of us might not know that there are approximately 9,600 species of birds that are known to science, our guess would probably be within an order of magnitude in either direction; *i.e.*, between 1,000 and 100,000. Thus, we have a sense of what it means for St. Kitts and Nevis to have about 130 species of birds.

To be able to do the same sort of thing with amphipods would require that we know something not only about their diversity, but also about their taxonomic relationship to other organisms.

Amphipoda is an **order** containing some known 6,000 species that range in length from tiny 1-mm forms to deep sea benthic species reaching 25 cm. They have invaded most marine and freshwater habitats, but can also occur in moist forest leaf litter, gardens and sandy beaches. The order Amphipoda joins 15 other orders to form the **class** Malacostraca—a diverse grouping of some 20,000 species of organisms that include a planktonic shrimp-like creature smaller than 1 cm that lives more than a mile beneath the surface of the sea, as well as the economically important shrimp, crabs and lobsters. The Malacostraca are 1 of 5 classes, that together contain some 30,000 species comprising the **subphylum** Crustacea; within the **phylum** Arthropoda. There are several million species of arthropods known to science (and good reasons to believe that there may be 20-50 million more that remain to be discovered). And Arthropoda is just 1 of more than 20 phyla of invertebrates that along with the phylum Chordata (which contains all the vertebrates as well as a few invertebrate taxa) comprise the **kingdom** Metazoa (animals).

This basic traditional classification scheme—species, genus, family, order, class, phylum, kingdom—is still used today for convenience, such as in the discussion of amphipods above; but it implies a hierarchy that is more rigid than many taxonomists accept, and many use a wider range of taxonomic categories, referring to them variously as “taxa”, “modes”, “types”, “groups”, etc. The disagreements are not only over the names of the taxonomic units, but more importantly, over the relationships among the organisms (*i.e.*, their phylogeny). Differences that may seem esoteric in some contexts take on heightened importance within the realm of biodiversity conservation.

The section on invertebrates that follows is illustrative, but obviously it cannot be comprehensive. Interested readers are referred to Brusca and Brusca’s (1990) text *Invertebrates*, which provides a taxonomic system that is used in Table 5. Note that Brusca and Brusca (1990) differentiate 29 phyla or equivalent taxa comprising the Metozoa; but there are several other classification schemes that also have large followings within the scientific community (one interesting scheme that is particularly “user-friendly” is Maddison and Maddison’s Tree of Life website <<http://phylogeny.arizona.edu/tree/phylogeny.html>>). The reasons for these different viewpoints are as informative to our understanding of biology as the information they present, but clearly it is beyond the scope of this document to elaborate on this theme.

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Table 3. Invertebrates: Global and Country Estimates.

Taxa	G.S.E.¹	Country Estimate² (and notes)
Porifera (sponges)	9,000	56 (Humann, 1993)
Cnidaria (includes corals, hydroids, jellyfish and anemones)	9,000	148 corals plus another 62 Cnidarians in various other taxa (Humann, 1993)
Ctenophora (comb-jellies or sea walnuts)	100	9 (Humann, 1993)
Platyhelminthes (flatworms)	20,000	5 (Humann, 1993)
Nemertea [= Rhynchocoela] (ribbon worms)	900	1 (Humann, 1993)
Pseudocoelomates (10 phyla: Rotifera, Gastrotricha, Kinorhyncha, Nematoda, Nematomorpha, Acanthocephala, Entoprocta, Pripula, Gnathostomulida and Loricifera)	16,000 (12,000 of which are nematodes)	
Annelida (segmented worms: earthworms, fireworms, feather duster worms, calcareous tube worms, spaghetti worms)	10,000	23 (Humann, 1993)
Coelomate Worms (4 phyla: Sipuncula, Echiura, Pogonophora, Vestimentifera)	600	
Arthropoda (4 subphyla, 1 of which—Trilobitomorpha—is extinct)		
Cheliceriformes (this subphylum includes horseshoe crabs, spiders, scorpions, mites)	>65,000	
Arachnida (subclass containing 10 orders, including spiders [35,000 spp], scorpions [1,200 spp], mites and ticks [30,000])	65,000	Kohls (1969) lists 17 species of ticks in the L.A:
<i>Uniramia</i>		
Myriapoda	13,120	
Chilopoda (centipedes) and Diplopoda (millipedes)	2,500 10,000	
Insecta (class containing 32 orders, only some of which are included below)	>850,000	

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Table 3 (continued). Invertebrates: Global and Country Estimates.

Taxa	G.S.E.¹	Country Estimate² (and notes)
Odonata (Dragonflies and Damselflies)	5,500	86 species of dragonflies and 44 species of damselflies are recorded for Florida (Dunkle, 1989)
Isoptera (Termites)	2,000	94 species recorded for the Caribbean (Collins, unpublished)
Orthoptera (grasshoppers, crickets and locusts)	20,000	
<i>Hemiptera</i>	35,000	
Homoptera	33,000	
Coleoptera (beetles)	300,000 350,000 ²	>1,200 species recorded in the USVI, which has been relatively well-studied (Ivie, reported by Chadwick, 1998)
Hymenoptera (ants, bees, wasps)	125,000	
Diptera (flies, mosquitoes)	150,000	
Lepidoptera (Butterflies and Moths)	120-180,000	292 species of butterflies in the West Indies (Stiling, 1986), over half endemic (following Miller and Miller's (1989) inclusion of the southern tip of Florida and the Keys as Antillean); 69 in the Lesser Antilles: 9 of which occur in the Leeward Islands but not the Windward Islands and 19 that occur in the Windwards but not the Leewards (Riley, 1975). Barnes' (1996) identification guide lists just over 500 (moth) species for the Lesser Antilles ³ .
Crustacea (includes crayfish, lobster, crab, shrimp, barnacles)	30,000	64 marine (Humann, 1993)
Mollusca (includes chitons; clams, oysters, mussels; snails, slugs, whelks; tooth shell; squid, octopus)	50,000	100 marine (Humann, 1993)
Lophophorates (3 phyla: Phoronida, Ectoprocta [=Bryozoa] and Brachiopoda)	5,000	13 (Humann, 1993)
Echinodermata (includes starfish, brittle stars, sea urchins, sea cucumbers and feather stars)	6,000	14 starfish, 9 brittle stars, 11 sea urchins, 7 sea cucumbers, 4 feather stars (Humann, 1993)
Invertebrate Chordates and kin: 3 phyla—Chaetognatha, Hemichordata and some of the Chordata	3,200	23 (Humann, 1993)

Notes for Table 3:

- ¹ Global Species Estimates (G.S.E.) are from Brusca and Brusca (1990). This tome on invertebrate biology is the source of much of the information presented in Table 3.
- ² For most taxa, no country-specific accounts exist for St. Kitts-Nevis. The estimates referenced as Humann (1993) are for the Caribbean and are probably vast underestimates, in part because the emphasis of his guide presumably is on the most conspicuous species likely to be seen by divers and snorkelers, but also because these taxa remain inadequately researched. Young's data (unpublished from research in the early 1990s, on file at the NHCS) identify a few marine invertebrate species as part of a research effort focusing on ecological, not taxonomic issues, and have limited value in assessing the marine biodiversity of Nevis. Bass (unpublished data from research in Nevis and St. Kitts in 1996 and 1997, on file at the NHCS and the SCHS) sampled invertebrates from 12 freshwater sites. The 56 taxa of macroinvertebrates collected include 1 species of sponge, 1 species of aquatic earthworm, 1 species of leech, 4 species of snails, 1 species of clam, 1 species of seed shrimp, 3 species of mayflies, 11 species of dragonflies and damselflies, 10 species of true bugs, 13 species of beetles, and 8 species of two-winged flies. He noted that more species were collected from Nevis than St. Kitts even though the former is smaller and had fewer sampling sites. Termites have been investigated by Majarajh and Chase (unpublished data from 6 days of collecting on St. Kitts and Nevis in 1997, on file at the NHCS), but the data on file do not allow us to assess the biodiversity of this taxa without interpretation by the researchers.
- ³ Barnes produced a report of his work on the moths of St. Kitts-Nevis (on file at the SCHS).

One of the few invertebrate groups that has received substantial attention in the Caribbean is the Coleoptera. The notes that follow, paraphrased from discussions with Dr. Michael Ivie, an entomologist who has worked extensively in the Virgin Islands, offer an interesting and valuable perspective:

Beetles (Order Coleoptera) are the single largest group of organisms on earth. For the West Indies, it is even more dominant than elsewhere because so many other groups are relatively underrepresented or already extinct. Beetles occupy the largest number of trophic levels, have the largest size range, and the greatest ecological diversity of any group of West Indian organisms. Yet, we know very little about them. Further, our knowledge is very uneven geographically, with the best data existing for the Virgin Islands and Guadeloupe.

Based on data from the better-studied islands [Table 4], we know that the area and elevation of an island seem to be the best predictors of its species diversity. Thus, St. Kitts, which is larger and higher than St. Thomas, should have more beetle species, yet it has less than 10% of the number known for St. Thomas. Redonda, with 1 known species, would be expected to have more species than Guana, BVI, which has 250 catalogued species.

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In the Virgin Islands, we have identified some 1400 species; 50% or more of the species on each island are endemic to that island, or at least to that island bank (i.e., the land mass that would have been exposed above sea level during the low-water maximum of the Pleistocene period; i.e., ~200m contour). The Northern Leewards area (from Sombrero, Anguilla to Montserrat) probably contains well over 1,000 undescribed, undiscovered species (and many genera) of beetles alone on the 8 separate Pleistocene banks.

Table 4. Data from Beetle Studies in the West Indies.

(M. Ivie, University of Montana, unpublished data).

Island Group	Area (km ²)	Max. Elev. (m)	Known spp Beetles	Estimate of Completeness
Puerto Rico	8897	1333	ca. 1300	< 30%
Virgin Islands	500	527	ca. 1450	ca. 70%
N. Leeward Is.	1045	1307	< 250	ca. 10%
Guadeloupe	1434	898	ca. 1400	ca. 70%
Sombrero	5	12	0	
Anguilla	91	65	7	
St. Martin	91	424	23	
St. Barths	18	281	54	
Barbuda	161	62	9	
Antigua	280	403	87	
Saba	13	864	4	
Statia	21	599	7	
St. Kitts	166	1307	37	
Nevis	93	979	10	
Redonda	5	295	1	
Montserrat	101	909	74	
St. Croix	230	353	>450	
St. Thomas	77	470	>400	
St. John	52	387	>400	
Guana (BVI)	3	245	>250	

TERRESTRIAL BIODIVERSITY IMPLICATIONS

Given the impossibility of knowing the population size and distribution of every species found in the country, an effective approach to identifying some of the critical biodiversity conservation priorities might be to concentrate research on selected taxa. Ivie's data imply that the best candidates are the vascular plants and at least one of the insect orders. Given the well-established evolutionary and ecological relationship between plants and insects, the inventories would target as many different plant communities as could be identified. Our most effective measure to safeguard the biodiversity of plant species and terrestrial invertebrate biodiversity would be to protect, to the fullest extent possible, representatives of all the different vegetation communities.

MARINE INVERTEBRATE BIODIVERSITY

Virtually all aspects of marine biodiversity are much more poorly understood than for terrestrial biodiversity (de Fontaubert *et al.*, 1996), including the central issue of conservation priorities. We know that while the marine environment is home to only 250,000 of the 1.7 million species catalogued to date, it has been much less explored. Although there probably are fewer species in the marine environment than on land, marine animals show more diversity at the evolutionary and taxonomic level. Of the approximately 30 animal phyla, all but one have some species members in the sea (in contrast, only about half of the phyla have any representative species on the land; de Fontaubert *et al.*, 1996; World Resources Institute, 1996).

A recent publication of the annual stocktaking of natural resources, *World Resources: A Guide to the Global Environment*, has this to say about marine biodiversity:

Because only about 7% of the oceans have been sampled, the current state of knowledge regarding species distribution and hot spots is poor... Patterns of marine endemism are generally not well known. Most marine species appear to have much larger ranges than terrestrial species because of their life cycles. Many species, including sedimentary organisms such as mussels and coral, produce free-floating planktonic larvae. Their young may drift for as little as a few hours or up to 6 months or more—depending on the species—before changing into their adult forms. This free-floating stage permits these species to disperse well beyond spawning areas.

Beyond simply looking at areas with high levels of species richness and endemism, several other criteria can be applied to define conservation priorities. These include protecting ecosystem diversity (preserving representative samples of all habitats and unique ecosystems) and

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conserving areas noted for their high levels of biological productivity (because they are rich fishing areas) as well as areas that serve as breeding grounds and nurseries (such as estuaries and mangroves) for marine species. (World Resources Institute, 1996).

Coral reefs are considered the mega-diversity areas of the oceans, often compared to tropical rainforests in terms of their biodiversity. They contain an estimated 25% of all marine species and 20% of catalogued marine fish species; yet, they comprise only about 0.1% of the earth's surface. The tropical Atlantic is believed to contain approximately 15% of global coral coverage, the majority of which (9% of global coral coverage) occurs in the Caribbean (de Fontaubert *et al.*, 1996; World Resources Institute, 1996).

By some estimates, 10% of the world's coral reefs has already been destroyed, and another 60% is in danger of being lost within the next 20 to 40 years (de Fontaubert *et al.*, 1996). These grave projections may be even worse for the Eastern Caribbean, which faces unprecedented development pressures (Island Resources Foundation, 1991 and 1998).

The World Resources Institute prepared a global assessment of threats to reefs (Bryant *et al.*, 1998) that identifies four major threats:

- Sediment and land-based pollution
- Exploitation
- Marine sources of pollution
- Coastal development.

These data on "threat conditions" were translated into a "reefs at risk" assessment, with disturbing findings: the coastal and near shore waters of the following eight sites in the Eastern Caribbean all received *high* or *very high* risk assessments (see also Table 5):

- Antigua-Barbuda,
- **St. Kitts,**
- the leeward (west) side of Dominica
- the leeward (west) side of St. Lucia,
- south and west coasts of Barbados,
- St. Vincent and Bequia,
- Grenada and Carriacou, and
- portions of Tobago.

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Table 5. Summary Coral Reef Threats for Eastern Caribbean States.

	Sediments	Exploitation	Marine Pollution	Coastal Development	Composite Threat
Antigua-Barbuda		High		Medium	High
ST. KITTS/NEVIS		High		Medium	Medium
Dominica		High			High
St. Lucia	Medium	High	High	Medium	High
Barbados	Medium	High		Medium	High
St. Vincent and Grenadines	High	High		Medium	Medium
Grenada	Medium	High			High
Trinidad-Tobago	Medium	High	Medium	Medium	High

The authors are not aware of specific studies assessing the distribution and health of the reefs of St. Kitts and Nevis. Considerable work has been done on the neighboring island of Antigua and these methods should be applied to an assessment of marine conditions in other areas of the Eastern Caribbean, including St. Kitts and Nevis.

MARINE BIODIVERSITY IMPLICATIONS

The high risk ranking given to the reefs of the Eastern Caribbean has special global significance given that its reefs are upstream of all other reef systems in the Wider Caribbean. The dynamics of large marine ecosystems in general, and the Caribbean specifically, are not well known. (IOCARIBE has been coordinating a research proposal on this subject.) In the absence of such knowledge, prudence dictates that the biodiversity of Eastern Caribbean reefs should be especially cared for. For example, it is a reasonable assumption that Eastern Caribbean reefs are a source of both "seed stock" and potential water-borne pathogens that may in turn affect all reef systems in the path of wider Caribbean circulatory systems, including coastal U.S. areas, all of the Bahamas Bank, Bermuda, and the Azores (Ogden, 1997).

The country can support international agreements to reduce agents contributing to global warming and chemical contamination of the world's oceans (see Table 6). More direct actions include reducing land-based sources of pollution and sedimentation runoff.

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Table 6. Status of Strategic Environmental Treaties in St. Kitts-Nevis.

Date Signed by SK-N	Date Ratified by SK-N	Title of Environmental Treaty
14-FEB-94		Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
12-JUN-92	7-JAN-93	Convention on Biological Diversity
12-JUN-92	7-JAN-93	Framework Convention on Climate Change
	24-DEC-97	International Convention for the Prevention of Pollution from Ships (MARPOL)
	Not ratified	Protocol Concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (SPAW Protocol)
Not signatory		Ramsar Convention on Wetlands of International Importance

Source: Director of Environment, Ministry of Tourism, Culture and Environment.

VERTEBRATES

FRESHWATER FISH

Although the freshwater fish fauna of the Antilles consists of 71 "mostly endemic" species (primarily in Cuba and Hispaniola), the Lesser Antilles apparently has only 1 endemic species, *Rivulus cryptocallus*, from Martinique (Burgess and Franz, 1989). Lee *et al.* (1983) list 5 native species, but Burgess and Franz (1989) think that three of these—*Poecilia vivipara*, *P. reticulata* and *Synbranchus marmoratus* (swamp eel)—are introduced.

Bauchot (1959) lists 8 families occurring in the Lesser Antilles—Poeciliidae, Anguillidae, Gobiidae, Eleotridae, Mugilidae, Gerridae, Centropomidae, and Carangidae—all of which can move between fresh and salt water, and some of which spawn at sea.

The freshwater fish fauna of St. Kitts-Nevis—and the rest of the Lesser Antilles—is not well studied. There are local reports of 9 species for St. Kitts, and about 5 species for Nevis. Though Mountain mullet (*Agonostomus monticola*) and mudfish (Gobiidae) are cited as occurring in ephemeral pools or streams after prolonged periods of rains (CCA/IRF, 1991), these seem to be very uncommon. *Poecelia reticulata* can be found in the streams on the southwestern side of St. Kitts. There is a *Gambusia* species, which was introduced to Dos D'ane Pond by Campbell Evelyn earlier this century. There was some attempt to introduce a trout species to estate ponds, but although they survived for a short time, they are believed to have died out after the divestment of the estates and the subsequent deterioration of the ponds due to lack of maintenance (C. Evelyn, *pers. comm.*). *Tilapia* species (perhaps several) also were introduced to the island (C. Evelyn, *pers. comm.*), but their current status is not known. Goldfish were introduced by the Water Authority in an attempt to keep the water inlet tanks on estates clean.

Nevis is known to have a *Gambusia* species, a mudfish (Goebidae) and one or two species of *Tilapia* (K. Lindsay, *pers. comm.*). There is mention of Mountain mullets (Smith, 1745), but their current status is not known.

Although the number of native species occurring in the country is low, it is likely that investigations would reveal the presence of several additional exotic species. Collections in Antigua resulted in more than 20 possible species (most of which are probably lesser taxonomic categories, possibly even polymorphic variations). Several of the species are known to have been deliberately introduced for aquaculture, while several others appear to be "aquaria" fish that have been naturalized in ponds and waterways after being discarded (Lindsay and Blackman, 1997).

BIODIVERSITY IMPLICATIONS

For both islands, the major issue affecting the biodiversity of freshwater fish (and invertebrates) is the harvesting of waters in the upper watersheds for domestic use. The waters are not always managed in a way that maintains system integrity by ensuring enough of the supply stays in or returns to the rivers. Priority freshwater sites should be identified, mapped and protected. Such steps would be very valuable for the conservation of many species of birds, as well as freshwater invertebrates and fish.

MARINE FISH

A comprehensive list of the marine fish that occur in the waters of St. Kitts-Nevis does not exist, but for comparative purposes, there are some 400 species included in fish guides for the Caribbean (Humann, 1993; Stokes, 1984). Data on the status of any marine fish species occurring in national waters are sparse (Beaulieu *et al.*, 1990) and lack a baseline to suggest trends.

AMPHIBIANS

There are two species of amphibians known for St. Kitts:

- (1) a tree frog (*Eleutherodactylus johnstonei*), a Lesser Antillean endemic (although introduced to Jamaica and parts of South America); and
- (2) the marine toad (*Bufo marinus*), widespread in the Caribbean, introduced from South America early this century to rid sugar cane of the agricultural pest, Cane Beetle.

The crapaud, or mountain chicken, *Leptodactylus fallax*, is recorded for St. Kitts, but is presumed to have succumbed to the mongoose. The crapaud still exists in Dominica and Montserrat, but several attempts to reintroduce the frog to St. Kitts have failed (C. Evelyn, *pers. comm.*).

Three species of amphibians are known from Nevis:

- (1) the tree frog, (*Eleutherodactylus johnstonei*),
- (2) the recently introduced Cuban Tree Frog (*Osteopilus septentrionalis*), and
- (3) the marine toad.

The Cuban Tree Frog, discovered on the property of the Four Seasons Resort in Nevis, most probably arrived with plants imported from South Florida, where this species has also been introduced. The frog is confined to areas of permanent

freshwater. Reports indicate that it may have colonized Jessops, just above the Resort.

REPTILES: TERRESTRIAL

Ten, possibly eleven, terrestrial reptile species or sub-species have been recorded, two of which are extinct.

The tortoise (*Geochelone carbonaria*) occurs throughout much of tropical America. Presumed to have been introduced from South America by Amerindians, it occurs on both islands, though it is very rare in the wild.

Four species of gecko occur on St. Kitts:

- the Common Woodslave (*Hemidactylus mabouia*) and the Giant Woodslave (*Thecadactylus rapicauda*) occur throughout the Lesser Antilles;
- *Sphaerodactylus sabanus* and *S. sputator* are endemic to St. Kitts-Nevis, and St. Eustatius.

A large lizard (*Iguana rhinolopna*) is listed as from the fossil record in one source, (Arendt, 1985); it is not known whether the omission of this record from a more recent and comprehensive treatment of the fossil history (Pregill *et al.*, 1994) refutes the finding or is just an oversight. The Lesser Antillean Iguana (*Iguana delicatissima*) is known from middens on St. Kitts, and a specimen was taken on Nevis earlier this century (Hoffman, 1973). Currently, this species is extant on the St. Kitts-Nevis-St. Eustatius Bank only on the island of St. Eustatius where the Indian Mongoose (*Herpestes javanicus*) is absent. In recent years, specimens of the Green Iguana (*Iguana iguana*) have been seen or collected at various parts of St. Kitts. About four years ago, one was killed on the road to Old Road Town. That specimen is being kept frozen for future study.

There are two Anolis lizards:

- (1) the green lizard (*Anolis bimaculatus bimaculatus*), a subspecies endemic to St. Kitts, Nevis and St. Eustatius; and
- (2) *A. wattsi schwartzi*, also endemic to these three islands.

A ground lizard (*Ameiva erythrocephala*) is endemic to St. Kitts, Nevis and St. Eustatius). Burdon (1920) reported a shiny, bronze lizard (possibly *Mabouia mabouya*) that appears to have gone extinct since there have been no recent reports of this or any similar species from St. Kitts.

The country has two snakes:

- (1) a blind snake (*Typhlops monastus*) is fairly common, even if not commonly seen, in both St. Kitts and Nevis. The species occurs in Montserrat, Barbuda, Antigua, St. Kitts and Nevis—*T. monastus geotomus* being the subspecies occurring in this country, as well as in Antigua and Barbuda. There are local reports of a second species or morph of blind snake on St. Kitts, though no similar reports are known from Nevis. It is described as silvery-grey in color, versus the brownish pink coloration of *T. monastus*. In addition to color differences, *T. monastus* is found in wetter habitat on the slopes and in the moist forests, while the grey snake occurs in drier habitat, especially in the coastal areas. Specimens of both taxa should be collected for comparative taxonomic study.

- (2) A Racer snake, *Alsophis rufiventris* has been recorded for both islands; however, there have not been any confirmed sightings for several years and it may have been extirpated by mongoose. There have been interesting reports within the last four years of the occasional sighting of a small brown snake in the village of Cayon, located on the northeast coast of St. Kitts (K. Orchard, *pers. comm.*). As with the blind snake, specimens of this unidentified snake should be collected for further study. *A. rufiventris* is extant on St. Eustatius and Saba.

Mention of the reptiles of what was then considered the French Antilles occurs in *The History of the Caribby Islands* by Cesar deRochefort, published in 1666. Several taxa are described, which cannot be found in the Antilles today. It is difficult to determine the exact distribution of the species mentioned, since they are just attributed to the Antilles. If it is an accurate record of the fauna at that time, many of the species described in this old book may have gone extinct.

BIODIVERSITY IMPLICATIONS

With the exception of the snakes mentioned above, the terrestrial herpetofauna of St. Kitts and Nevis could be considered secure from a conservation perspective. All species are either common and/or occur in habitat that is not at risk.

REPTILES: MARINE

Three species of sea turtle, all internationally classified as endangered, are known to nest in St. Kitts-Nevis:

- (1) the hawksbill (*Eretmochelys imbricata*),
- (2) the green (*Chelonia mydas*), and
- (3) the leatherback (*Dermochelys coriacea*).

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The loggerhead (*Caretta caretta*), considered globally vulnerable, is not known to nest here, but is occasionally caught in open waters. According to Widecast (1992), neither of the remaining two species of sea turtle occurring in the Caribbean—the Kemp's Ridley (*Lepidochelys kempi*) and the Olive Ridley (*Lepidochelys olivacea*)—has ever been documented in St. Kitts-Nevis waters.

Although historically leatherback nests have been found on nearly all of the beaches of St. Kitts, recent data from field observations by Joe Butler (*pers. comm.*, 1999) indicate that several sites are critically important. The northern beach from just northwest of the Cayon River southeastward to the village of Key hosts most nests. North Friar's Bay beach is smaller but has a large number of leatherback nests, and the southeastern-most 2 km of North Frigate Bay is also a favored nesting area.

Butler reports that the most concentrated nesting of hawksbills occurs on the Southeast Peninsula, with the beaches at Major's, Banana, and Cockleshell Bays being most important. Occasional hawksbill nesting occurs on most other beaches, and those at Belle Tete and Turtle Bay may be important.

Green turtles appear to prefer beaches at North Frigate Bay, Half Moon Bay, and around Conaree (J. Butler, *pers. comm.*).

While all species of sea turtles common to St. Kitts are reported to also nest on beaches in Nevis (CCA/IRF, 1991), at present such nesting is limited. According to Butler (*pers. comm.*, 1999), hawksbills and a few leatherbacks have nested on the southeastern beaches near Red Cliff and Indian Castle.

BIODIVERSITY IMPLICATIONS

Probably the greatest threat facing sea turtles is the loss of nesting habitat, primarily due to human disturbance for development activities such as vegetation clearing, destruction of sand dunes, erection of structures too close to the shoreline, and construction of seawalls, all of which can disturb nesting. Other threats include hunting (primarily collecting of eggs, but some hunting of adults), pollution of coastal waters, and deterioration of the country's reefs and seagrass beds. Poaching by humans is particularly a problem for leatherback and green turtles, while a high percentage of hawksbill nests are depredated by the Indian mongoose, an introduced species (J. Butler, *pers. comm.*).

These threats, and recommendations for viable remedies, are presented in the comprehensive *Sea Turtle Recovery Action Plan for St. Kitts and Nevis* (Widecast, 1992), which should be used as the blueprint for conserving these animals.

The steps needed to protect these endangered species are known at a level of detail not yet available for the majority of the country's biota. In terms of legislative steps, St. Kitts and Nevis should ratify:

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- the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and
- the Protocol Concerning Specially Protected Areas and Wildlife (SPA), which includes protection for all six species of Caribbean-occurring sea turtles in Annex II.

A new convention—the Inter-American Convention for the Protection and Conservation of Sea Turtles—may provide additional protection, as it would prohibit the intentional capture, killing or sale of all sea turtles. It would also promote the conservation and restoration of sea turtle habitat and nesting beaches, and the reduction of, to the greatest practicable extent, accidental harm to sea turtles in the course of fishing and water sports activities.

BIRDS

The islands of the Lesser Antilles have a particularly distinct avifauna², including seven endemic genera (Birdlife International, 1998):

- *Catharopeza*,
- *Cichltherminia*,
- *Cinclocerthia*,
- *Cyanophaia*
- *Leucopeza*,
- *Melanospiza*,
- *Ramphocinclus*.

Collectively, these islands support 25 endemic bird species and an additional 11 subspecies. Some of the latter are expected to be elevated to species status after additional research, and at least 23 of these taxa are likely vulnerable or known to be highly endangered (C. Hunter, U.S. Fish and Wildlife Service, *pers. comm.*).

Using slightly different criteria, Birdlife International has prepared an account of “restricted-range species”. Restricted-range species are inherently vulnerable by

² There is an ongoing effort to identify similarities and reconcile differences if they exist between Partners in Flight and Birdlife International regarding regional avian conservation concerns in the Caribbean. Both these initiatives treat Trinidad and Tobago separately from the rest of the Eastern Caribbean. Contacts for these organizations:

David Wege; Americas Programme Manager; Birdlife International; Wellbrook Court; Girton Road; Cambridge, CB3 0NA, UK; e-mail: <david.wege@birdlife.org.uk>.

Chuck Hunter; U.S. Fish and Wildlife Service; Division of Refuges and Wildlife; 1875 Century Boulevard, Suite 420; Atlanta, GA 30345; e-mail: <chuck_hunter@mail.fws.gov>.

virtue of their limited distribution, regardless of other factors—globally, they account for 75% of all threatened bird species. Birdlife International identifies 2,600 restricted-range species globally, 130 of which are in the Caribbean and 24 of these are in the Lesser Antilles Endemic Bird Area. Details on endemism—single-island, multi-island, and regional—are provided in Table 7 (page 35), which lists Bird Species of Special Conservation Concern in St. Kitts and Nevis.

In addition to supporting these restricted range species, the Eastern Caribbean is known to serve as an important link in the seasonal migrations of numerous birds. For example, most of the total world population of the Blackpoll Warbler is believed to use this area for stopover sites during fall migration. Several species of thrushes, vireos, cuckoos and warblers migrate through the Eastern Caribbean in large numbers at this time of year, as do numerous shorebirds (see discussion below). This period overlaps the late summer-autumn tropical storm season, and migrants forced to land are completely dependent upon habitat provided by these Lesser Antillean islands. Some of these species, including Bicknell's Thrush, which is considered a high priority migrant by the U.S. Fish and Wildlife Service, may overwinter in the Lesser Antilles—often in the same habitats supporting highly vulnerable endemic species.

Research during the past decade has increased the number of bird species in the recorded literature for St. Kitts and Nevis from less than 100 (Danforth, 1936; Morris and Lemon, 1984; Hilder, 1989) to 116 species (Steadman *et al.* 1997; but see below for additions, especially migrants). The fieldwork sponsored under the St. Kitts and Nevis Biodiversity Project in 1997-98, and coordinated by Hugh McGuinness, led to several new sightings.

In St. Kitts:

- Sandwich Tern,
- Blue Grosbeak, and
- House Sparrow.

In Nevis:

- Pied-bill Grebe,
- American Wigeon,
- Purple Gallinule,
- Magnolia Warbler,
- Prothonotary Warbler,
- Kentucky Warbler, and
- Summer Tanager.

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John Wilson's research (unpublished data) identifies 15-20 species not included in Steadman *et al.* (1997), mostly migratory, non-resident species. He also adds new nesting records for 5 species of seabirds (see discussion below).

LANDBIRDS

Two species of landbirds no longer found on the island of St. Kitts are known from historical records: Burrowing Owl and St. Kitts Bullfinch (but see discussion below on the possibility that this species may be extant). Furthermore, Steadman *et al.* (1997) point out that other species have "almost certainly been lost on St. Kitts, an island that lacks records of, for example, species of parrots, barn owls, mockingbirds, or resident thrushes" (all of which occur, or used to occur, elsewhere in the Lesser Antilles).

The St. Kitts Bullfinch deserves special mention. This relative of the Lesser Antillean Bullfinch is believed to be either a separate species or a subspecies of the Puerto Rican Bullfinch (*Loxigilla portoricensis grandis*). Last collected in 1929, it had been considered rare since the turn of the century (Bond and Danforth, searching independently in the 1920s and 1930s, failed to locate any). Bond (1935, 1956) attributed the presumed extinction to predation by green monkeys. This is questioned by Greenway (1958; cited in Steadman *et al.*, 1997) and Raffaele (1977), who note that the birds co-existed with the monkeys for several hundred years before their demise; and furthermore, a related congener, the Lesser Antillean Bullfinch, coexists with monkeys in St. Kitts-Nevis and Barbados. Raffaele (1977) suggests that a devastating hurricane on August 7, 1899, followed by another hurricane later that month, may have eliminated *L. p. grandis*. Steadman *et al.* (1997) offer a further clarification that seems most likely: the demise of the bullfinch was due to a combination of factors, including habitat loss, exacerbated by forest-damaging hurricanes, and predation by non-native mammals, especially monkeys, mongoose, cats and rats.

However, even though the scientific community has labeled the St. Kitts Bullfinch as extinct for over half a century, a possible sighting was reported this decade. The report comes from St. Kitts' eminent naturalist, Campbell Evelyn, who has hunted and traversed the country for over 60 years (Campbell boasts of being able to identify many birds by taste, as well as by more traditional means). Campbell and his wife, Joyce, saw the bird while hiking in the forest in Stonefort Ghaut. They described the bird, which they saw clearly from a distance of 30-35 feet, as almost entirely black with red on top of the head and on the throat below the chin. It was larger than the Lesser Antillean Bullfinch, a species with which they are quite familiar.

Other interesting local reports of species of birds that may have been extirpated include an owl, the Broad-winged Hawk and the Lesser Antillean Pewee. There are at least three separate accounts of owls from St. Kitts. Peter Malleliu recounts the story of an owl killed in the village of Sandy Point about 90 years

ago. The story is repeated that three boys crept up into the church steeple to smoke cigarettes and drink liquor, only to be startled by two piercing yellow eyes. The boys quickly abandoned the steeple and reported what they saw to their families. The owl was promptly destroyed. Mallelieu says his uncle described the owl as having a greyish color with brown spots on the underside. Campbell Evelyn and "Benjie" Farrell recount stories from older family members of owls that lived in the avenue of cedar trees that once existed along the road to Canada Estate. These accounts suggest that some owls, most probably the Barn Owl (*Tyto alba*), were members of the St. Kitts avifauna.

There are several accounts of the Broad-winged Hawk (*Buteo platypterus*), although no records appear in the scientific literature (P. Mallelieu and C. Evelyn, *pers. comm.*). These reports are substantiated by the sighting of a broad-tailed hawk in 1994 by Nathan Gricks, a researcher who became very familiar with the species during his residence in Antigua in the 1990s, and John Wilson during his fieldwork in St. Kitts from 1997 to 1999.

The Lesser Antillean Pewee remains an enigma. Ronald Bruce Todd, a naturalist and hunter who frequented the mountains of the interior of St. Kitts in the early part of the century, reports it in his notes (papers now on file at the St. Christopher Heritage Society). Bond, who was familiar with Todd's notes, seems to have believed that Todd was referring to the Lesser Antillean Flycatcher. However, Morris and Lemon (1982) state they observed the species in their research, and Gricks, an ornithologist familiar with the species, reported a "possible" sighting (or audio identification) in 1993/94. If it does exist on St. Kitts, the island would have the most northerly population recorded for the species.

SHOREBIRDS AND OTHER WATERBIRD SPECIES

The Eastern Caribbean also provides critical stopover sites for numerous migratory shorebirds. Several species migrate along the Trans-Atlantic route between their breeding grounds in the temperate zones to overwintering areas in Central and South America, but many birds actually overwinter in the Caribbean rather than travelling further south (C. Hunter, U.S. Fish and Wildlife Service, *pers. comm.*).

Because a relatively small number of sites are key to the health of the entire shorebird population of the Western Hemisphere, many organizations have come together to identify and protect significant sites throughout the Americas.³ After a two-day survey of coastal ponds on the Southeast Peninsula, Norton

³ Several extremely informative Internet web sites describe these efforts:

- USFWS/National Shorebird Conservation Plan — <http://www.manomet.org/USSCP.html>;
- Western Hemisphere Shorebird Reserve Network — <http://www.wetlands.ca/wia/whsrn/overview.html>;
- Ramsar Convention on Wetlands — <http://www.iucn.org/themes/ramsar>.

(1989) described the pond system of St. Kitts as extremely important to shorebirds relying on the Lesser Antilles. He wrote that based on the abundance (2,300 birds) and diversity of species (25) observed, the pond system of St. Kitts should be recognized as having international significance.

The rest of this section draws extensively on the notes in manuscript of SCHS member John Wilson, who from 1997-1999 carried out over 100 days of research on the birds of St. Kitts (Wilson, 1999a, 1999b). Wilson observed that the ponds in St. Kitts receive the greatest use during fall and spring passage (these terms refer to climate conditions in temperate and arctic nesting areas). Shorebirds were particularly concentrated at Half Moon Pond and Little Salt Pond, where Wilson (1999a) observed 2,000 – 3,000 birds on some days.

Winter residents (birds arriving in July/August, but remaining until April/May before leaving for breeding grounds further north) use a slightly different set of ponds than those of the fall migration. Half Moon Pond continued to have the highest wintering shorebird diversity and abundance of all the ponds, with Friars Bay Pond, the eastern shore of Great Salt Pond, and Mosquito Pond also supporting large numbers of wintering shorebirds. Frigate Bay, Muddy, Little Salt, the remaining area of Great Salt, Cockleshell, and Majors Bay Ponds all had lower numbers of wintering shorebirds.

Three nesting species of shorebirds have been documented for St. Kitts:

- black-necked stilt,
- wilson's plover, and
- snowy plover.

Another group of waterbirds—ducks and coots—was observed to use primarily three ponds as wintering habitat. During fall migration, waterbirds were observed for a few weeks at many of the ponds, but by November Mosquito Bay Pond, Friar's Bay Pond, and the eastern shore of Great Salt Pond (to a lesser extent) became their wintering sites. Between Mosquito and Friars Bay Ponds up to 400 blue-winged teal (*Anas discors*) were regularly observed, with perhaps an equal number hidden among the vegetation. American and Caribbean coots (*Fulica americana* and *F. caribaea*) were among the eight species of waterbirds occasionally seen wintering at these ponds.

SEABIRDS.

From 1997-99, five species were added to the three species of seabirds previously known to nest in the country (Wilson, 1999b). In addition to brown pelican, magnificent frigatebird and least tern, the following species have been added to the list of those found to breed here:

- sooty tern,
- bridled tern,
- laughing gull,
- brown noddy, and
- roseate tern.

BIODIVERSITY IMPLICATIONS

The major threat to the birds of St. Kitts and Nevis is deterioration and conversion of habitat, although the most critical sites differ for each of three groups: landbirds, shorebirds and waterbirds, and seabirds.

Landbirds.

As noted previously in this report, a key to protecting the country's fauna is to ensure that at least some representatives of each of the vegetation types are preserved. In addition to this broad recommendation, special attention should be directed to protecting:

- *all remaining patches of dry forests on the Southeast Peninsula, and*
- *freshwater springs and the wetter ghauts, particularly on Nevis.*

The moist forests provide extremely valuable habitat for landbirds, but face limited development pressure.

Shorebirds and Other Waterbird Species

Although there are no quantitative data, historical records and the observations of long-time residents all point to significant declines in the populations of shorebirds and waterfowl found in the country. Although the value of the ponds and wetlands that support these fauna is well documented (*e.g.*, CCA and IRF, 1991; Brown, 1989), development pressures continue to threaten such critical coastal habitats.

The mangroves of St. Kitts have been severely impacted, even during this decade. The construction of the Southeast Peninsula Road, where most of the island's wetlands are located, has opened this once isolated area to development activity and other human impacts. Many of the white sandy beaches in this area

are earmarked for tourism, and unfortunately these same beaches are adjacent to wetlands. While some degradation of the wetland is inevitable if beach development occurs, much can be done to mitigate negative impacts on wildlife. The destruction of any wetland site should only be allowed if justified by a careful cost-benefit analysis. Furthermore, it is the *cumulative* impacts of the loss of these sites that is the most serious cause for concern and the reason for requiring a different approach to site-specific evaluation (Bacon, 1993).

In Nevis, the wetlands fare much better, although in recent years those near to Charlestown, the capital, have been impacted by the growth and development of the town. Fortunately for these wetlands, mitigating steps can still be taken for their protection.

Neither economists nor ecologists pretend that they can reasonably quantify all of the direct and indirect benefits that result from healthy functioning wetlands—but most responsible people in both disciplines acknowledge that these values exist and that there may be a steep price to pay if these ecosystems are destroyed. In areas where mangroves can exist (not all coastline provides the appropriate requirements), they are considered essential to the wellbeing of nearshore fisheries, seagrass beds and coral reefs. The leading mangrove specialists of the Western Hemisphere identified the mangroves of the Lesser Antilles, from among all of those of Latin America and the Caribbean, as being the most impacted by development and the ones at the greatest conservation risk (WWF, 1996).

Seabirds

The numerous islands of the West Indies, some little more than rocky outcrops, contain globally significant breeding sites for approximately 25 species of seabirds, many of which are endemic species, sub-species or races. The Society for Caribbean Ornithology (SCO) is identifying all known sites in the region, with estimates of the numbers of individuals they support. Preliminary findings highlight the following:

- seven “high priority” species with 4,000 or fewer breeding pairs;
- six “priority” species with between 4,000-8,000 breeding pairs; and
- in at least two cases, Roseate Tern and Magnificent Frigatebird, these small breeding populations represent a substantial percentage of their global populations.

The final report is expected to convey the concern shared by the specialists participating in a 1997 SCO workshop, who noted that

- global populations of most seabirds are on the decline;

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- generally, the populations of nesting seabirds tend to be fairly isolated from one another; so that
- the deterioration or demise of nesting sites may significantly diminish the genetic pool of any given species (Dr. David Lee, North Carolina State University, *pers. comm.*; Dr. Betty Ann Shreiber, Ornithological Society, *pers. comm.*).

The most important seabird nesting sites for St. Kitts and Nevis are:

Booby Island. Eight species of seabirds nest on this 126-foot high, cone-shaped islet in the channel between St. Kitts and Nevis. During 1997, Wilson (1999a) observed 400 - 600 nesting pairs. In order of abundance, these are sooty tern, bridled tern, laughing gull, roseate tern, brown noddy.

Approximately half the roseate tern population, designated as threatened by the U.S. Fish and Wildlife Service, nests in the West Indies; Booby Island supported 15 pairs in 1997 and 2 pairs in 1998. The nesting season varies for each species, with most birds arriving from April to May and leaving from August to October.

Although Booby Island is not threatened by habitat degradation, there are several other conservation concerns. Disturbance by commercial and sports fishers, and by tourists who are brought by guides to dive and snorkel off the islet, can drive adults from their nests. Even short absences can lead to overheating of eggs/chicks, plus increased susceptibility to predation (in 1998, Wilson recorded nearly two-thirds mortality from combined factors). Predation by humans is also a problem, even though it is believed to have decreased from historical levels (when "buckets were filled"). But even one person can seriously impact the populations because of the accessibility of the eggs on this small islet. Fortunately, the island does not seem to have mongoose, rats or other introduced predators.

Green Point to Nags Head. This area of the Southeast Peninsula supports nesting brown pelicans and magnificent frigatebirds, but neither is as abundant as it once was (Todd, circa 1920; Burden, 1920; Morris and Lemon, 1982; Arendt, 1985; Wilson, 1999a).

The factors affecting, and threatening, these species are similar to those noted for other seabirds:

- habitat loss (colony sites are not endangered, but may be affected by the conversion of nearby lands that lost trees and shrubs to guinea grass as a result of fire and overgrazing);

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- disturbance by commercial and sports fishing boats, as well as diving and snorkeling operations;⁴ and
- predation by people, rats, mongoose, feral cats, and monkeys.

Ponds and Beaches. In addition to their importance for shorebirds, ponds and beaches support several species of seabirds, most notably the endangered least tern. Wilson (1999a) identifies several sites used by least terns for nesting, and Hilder (1989) notes that they nest at White House Bay on Nevis.

Table 7. St. Kitts and Nevis Bird Species of Special Conservation Concern.

(Rare; Vulnerable or Endangered; and/or Endemic.

? = species suspected to exist in the country, but not documented).

Brown Pelican (<i>Pelecanus occidentalis</i>)	Uncommon, Vulnerable due to threats to nesting habitat
Magnificent Frigatebird (<i>Fregata magnificens</i>)	Rare nester in St Kitts-Nevis (not observed to nest during either 1997 or 1998)
? West Indian Whistling Duck (<i>Dendrocygna arborea</i>)	West Indian endemic; Rare, Endangered in Lesser Antilles due to habitat loss and hunting
? White-cheeked Pintail (<i>Anas bahamensis</i>)	Uncommon, Vulnerable in Lesser Antilles due to habitat loss and hunting
Ruddy Duck (<i>Oxyura jamaicensis</i>)	Rare, Vulnerable in Lesser Antilles due to habitat loss
Osprey (<i>Pandion haliaetus</i>)	Rare winter visitor
? Broad-winged Hawk (<i>Buteo platypterus insulicola</i>)	Lesser Antillean endemic sub-species (Antigua to Grenada)
Peregrine Falcon (<i>Falco peregrinus</i>)	Rare, Endangered globally
Clapper Rail (<i>Rallus longirostris</i>)	Rare, Vulnerable to habitat loss; historical records of nesting on St. Kitts
Caribbean Coot (<i>Fulica caribaea</i>)	West Indies and northwestern Venezuela
Laughing Gull (<i>Larus artricilla</i>)	Rare nester in St. Kitts-Nevis, restricted to Booby Island
Roseate Tern (<i>Sterna dougallii</i>)	Rare nester in St. Kitts-Nevis, restricted to Booby Island (designated as Threatened by the USFWS).
Least Tern (<i>Sterna antillarum</i>)	Rare nester in St. Kitts-Nevis (the only species of seabird known to nest in Nevis; considered Endangered by the SCO and USFWS)

(Table continued on next page)

⁴ Because of the noise of tour boats, it has been recommended that they remain at least 100 - 150 meters from the colonies. Frigatebirds and pelicans are known to be very sensitive to disturbance (van Halewyn and Norton 1984; Raffaele 1998).

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Table 7 (continued). St. Kitts and Nevis Bird Species of Special Conservation Concern.

Bridled Tern (<i>Sterna anaethetus</i>)	Rare nester in the LA; in St. Kitts-Nevis, restricted to Booby Is.
Sooty Tern (<i>Sterna fuscata</i>)	Rare nester in St. Kitts-Nevis, restricted to Booby Island
Brown Noddy (<i>Anous stolidus</i>)	Rare nester in St. Kitts-Nevis, restricted to Booby Island
Red-necked pigeon (<i>Columba squamosa</i>)	West Indies endemic
White-crowned pigeon (<i>Columba leucocephala</i>)	West Indies (and Florida Keys) endemic
Zenaida Dove (<i>Zenaida aurita</i>)	West Indies (and Yucatan Peninsula) endemic
Bridled Quail-Dove (<i>Geotrygon mystacea</i>)	Lesser Antilles (and Puerto Rico) endemic
? Ruddy Quail-Dove (<i>Geotrygon montana</i>)	West Indies (and Central and South America) endemic; based on 1 sight record and may be extirpated
? Burrowing Owl	Fossil record only
? Barn Owl	Anecdotal evidence only
Mangrove cuckoo (<i>Coccyzus minor</i>)	Lesser Antillean endemic sub-species
Purple-throated Carib (<i>Eulampis jugularis</i>)	Lesser Antillean endemic (Saba to Grenada)
Green-throated Carib (<i>Sericotetes holosericeus</i>)	Lesser Antilles (Virgin Islands and Puerto Rico) endemic
Antillean Crested Hummingbird (<i>Orthorhynchus cristatus</i>)	Lesser Antilles (Virgin Islands & Puerto Rico) endemic
Caribbean Elaenia (<i>Elaenia martinica rissii</i>)	West Indies endemic
Lesser Antillean Flycatcher (<i>Myiarchus oberi</i>)	Lesser Antillean endemic (St. Kitts to St. Lucia)
Caribbean Martin (<i>Progne dominicensis</i>)	West Indies. Rare (nests in St. Kitts-Nevis); winters in South America
Scaly-breasted Thrasher (<i>Margarops fuscus</i>)	Lesser Antillean endemic (Saba to St. Vincent)
Brown Tumbler (<i>Cinclocerthia ruficauda</i>)	Lesser Antillean endemic (Saba to St. Vincent)
Yellow Warbler (<i>Dendroica petechia bartholemica</i>)	Lesser Antillean endemic sub-species (Anguilla to Montserrat)
? Antillean (Blue-headed) Euphonia (<i>Euphonia musica</i>)	Lesser Antillean endemic sub-species; anecdotal evidence only
St. Kitts Bullfinch (<i>Loxigilla portoricensis grandis</i>)	Endemic to St. Kitts; but may be extinct
Lesser Antillean Bullfinch (<i>Loxigilla noctis</i>)	Lesser Antillean endemic

Note: This list follows the order and nomenclature adopted by the American Ornithologists' Union Check-list of North American Birds (1983, 6th edition), which includes the Caribbean.

MAMMALS: TERRESTRIAL

Bats are the only native terrestrial mammals extant in the country today, and as is the case throughout the Lesser Antilles, they constitute the largest mammalian group. Morton and Courts (1999, unpublished data) have conducted the most recent and comprehensive research on the bat fauna of St. Kitts and Nevis. They found six species in total for the country (see Table 8 below). All six had been previously recorded from St. Kitts, although they did not find *Tadarida brasiliensis* in St. Kitts during this survey. Only two species had been known from Nevis, and their research added another two.

Additional information on bats will be added as the 1999 research is published.

Table 8. Bats of St. Kitts-Nevis

Common Fruit, or Leaf-nosed, Bat <i>(Artibeus jamaicensis)</i>	Recorded for St. Kitts and Nevis, but uncommon on both islands. Widespread in the Caribbean and Tropical.
Pig-faced, Rat, or Brown Flower, Bat <i>(Brachyphylla cavernarum)</i>	Antillean endemic, primarily Lesser Antilles, but also Puerto Rico and the Virgin Islands. Common on both St. Kitts and Nevis. Vulnerable at their few roosting sites.
? Long-tongued fruit Bat <i>(Monophyllus plethodon)</i>	Lesser Antillean endemic. Listed in CCA/IRF (1991), but not found (or listed as ever having been found) by Morton <i>et al.</i> (1999). See note for species below.
Brazilian Free-tailed Bat <i>(Tadarida brasiliensis)</i>	Widely distributed in Neo and Tropical America, but low numbers in the country. Morton <i>et al.</i> (1999) did not find the species on St. Kitts, but did on Nevis. The listing in CCA/IRF (1991) of <i>M. plethodon</i> for St. Kitts probably is incorrect and should be for <i>T. brasiliensis</i> .
Fishing Bat <i>(Noctilio leporinus)</i>	Uncommon, Vulnerable. Listed for St. Kitts (CCA/IRF, 1991); not found by Morton <i>et al.</i> (1999), but believed by them to exist on both islands based on descriptions from residents.
Lesser Antillean Tree Bat <i>(Ardops nichollsi)</i>	Endemic to the LA. Found on St. Kitts in the 1999 survey, although its status is unknown; never recorded from Nevis.
? <i>Myotis dominicensis</i>	Not found (or listed as ever having been found) by Morton <i>et al.</i> (1999); but listed for St. Kitts in CCA/IRF (1991).
Velvety House Bat <i>(Molossus molossus)</i>	Recorded for both St. Kitts and Nevis. Common, found under the roofing of houses. Can be seeking early at dusk and dawn hawking for insects over residential areas. Widespread in Tropical America.

Mammalian introductions include:

Agouti (*Dasyprocta agouti*): believed to be an Amerindian introduction, but extirpated within historical times.

White-tailed deer (*Odocoileus virginianus*): introduced from Puerto Rico (originally from North America) in 1931 to the Lodge Estate in St. Kitts. When the herd reached seven animals it was released at Frigate Bay.

Indian mongoose (*Herpestes javanicus*): introduced in the late 1800s to control rats that infested sugar cane plantations.

Rats (*Rattus rattus* and *R. norvegicus*) and Mouse (*Mus muscalus*) have been inadvertently introduced since the 1600s, or earlier.

African Green (or Vervet) monkey (*Cercopithecus aethiops*): Introduced from West Africa approximately 300 years ago as a pet, escaped and naturalized. This species occurs on both St. Kitts and Nevis, and otherwise only in Barbados within the West Indies (a con-generic, *C. mona* occurs in Grenada). Population estimates for St. Kitts vary widely. Sade and Hildrich (1965) estimated 1,200, based on their assumptions of 15 individuals/troop, 2 troops occupying each of the 40 major ravines, plus 300 more individuals on the Southeast Peninsula. Poirier (1972) estimated 5,600–8,400, based on his assumption of 20-30 individuals/troop, 4 troops occupying each of the 40 major ravines and another 110 troops in the minor ravines and in the areas outside of the ravines, plus 200-300 individuals in the Southeast Peninsula. Young (*pers. comm.* cited in CCA/IRF, 1991) estimated the Nevis population to be 2,000 based on 100 troops mostly located in ravines around the island's central mountain.

Primarily fruit and leaf eaters, but known to be generalists that eat insects as well. McGuire (1974) stated that the vervet did not seem to impact wildlife, but some researchers hold it responsible for the extinction of the St. Kitts endemic subspecies of the Puerto Rican Bullfinch (but see notes for *Loxigilla portoricensis grandis* in the "Birds" sub-section of this document).

BIODIVERSITY IMPLICATIONS

As noted above, bats are the only native mammals and the only mammalian group of biodiversity conservation concern. The three-month investigation of Morton and Courts (1999) resulted in detailed information on each of the species encountered, a field identification guide, and excellent recommendations regarding conservation.

MAMMALS: MARINE

Twenty-six species of cetaceans have been recorded for the Caribbean; probably a third of these have been sighted (or are expected to occur) in Kittitian-Nevisian waters, at least during migrations (Gricks, 1994; CCA/IRF, 1991).

BIODIVERSITY IMPLICATIONS

There is no whaling done by Kittitians or Nevisians. If whales are taken by foreign operators in national waters (and it is unlikely that any are), there are no official records. However, the country has the opportunity to protect these species through its representation on the International Whaling Commission. Many cetacean species are endangered throughout their range by hunting and/or over-fishing of their prey. An equally great threat is chemical pollution of the world's oceans. Bioaccumulation of PCBs and other toxins in the animals' fat reserves are suspected of contributing to breeding difficulties and illnesses associated with pollution-suppressed immune systems.

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APPENDIX A: LIST OF PLANTS OF ST. KITTS AND NEVIS

The list of plants below represents two years of effort to compile the known species of plants from St. Kitts and Nevis. It is primarily the work of Kate Orchard of the St. Christopher Heritage Society, with additions by Jennifer Lowery of the Nevis Historical and Conservation Society, and Kevel Lindsay of Island Resources Foundation.

The primary source for the records is Richard Howard's monumental *Flora of the Lesser Antilles* (1974-1989), with other records from Jonathan Roughgarden (1990), Walter Meagher (1995 and 1996), the *St. Kitts and Nevis Environmental Profile* (CCA/IRF, 1991), Thomas Huggins (1992), A.S. Hitchcock (1936), D. Rodriques (1990), and Graham and Rickard (1992). Some additions are a result of the observations of Lowery and Lindsay.

Although the list includes over 900 species, it is by no means complete. Many species of plants have been introduced to the islands since the arrival of the first inhabitants. However, the majority of introductions have occurred since the arrival of Europeans and Africans over 300 years ago. Many of these species have been previously overlooked even though they have been on these islands for over a hundred years. Species such as *Carica papaya* and *Tamarindus indica* are not new introductions, but represent new records for one or both islands. It is expected that the current list will be revisited on numerous occasions as efforts to record and document the biodiversity of St. Kitts and Nevis increase.

The List of Plants of St. Kitts and Nevis will serve several purposes:

- to increase awareness of the importance of the country's biodiversity,
- as a reference point to facilitate maintenance of up-to-date information on the occurrence of exotic species, and
- as a tool for management of the country's native and endangered flora.

Exotic species have been identified as a significant threat to native biodiversity throughout the world. Therefore, continued expansion of the existing database is necessary to prevent further loss of native flora in St. Kitts and Nevis.

The Plants of St. Kitts and Nevis

K = St. Kitts
N = Nevis

end. L.A. = endemic to Lesser Antilles
rest. L.A. = restricted to Lesser Antilles

FAMILY	SPECIES	DISTRIBUTION		NOTES
	PTERIDOPHYTA			
PSISOTACEAE				
	<i>Psilotum nudum</i>		N	
LYCOPODIACEAE				
	<i>Lycopodium sieberianum</i>	K		
	<i>L. cernuum</i> var. <i>cernuum</i>	K	N	
	<i>L. cernuum</i> var. <i>dussii</i>	K	N	
	<i>L. clavatum</i>	K		
	<i>L. dichotomum</i>	K		
	<i>L. linifolium</i> var. <i>linifolium</i>	K		
	<i>L. taxifolium</i>	K	N	
SELAGINELLACEAE				
	<i>Selaginella flabellata</i>	K	N	end. L.A.
	<i>S. plana</i>	K		
	<i>S. rotundifolia</i>	K		
	<i>S. serpens</i>		N	
	<i>S. substipitata</i>	K	N	
	<i>S. tenella</i>	K		
MARATTIACEAE				
	<i>Danaea nodosa</i>	K		
SCHIZAEACEAE				
	<i>Anemia hirta</i>	K		
	<i>A. adiantifolia</i>	K	N	
GLEICHENIACEAE				
	<i>Dicranopteris pectinata</i>	K	N	
	<i>Gleichenia farinosa</i>	K		
	<i>G. bifida</i>	K		
	<i>G. furcata</i>	K	N	
HYMENOPHYLLACEAE				
	<i>Hymenophyllum fucoides</i>	K		
	<i>H. elegans</i>	K	N	
	<i>H. hirsutum</i>	K	N	
	<i>H. hirtellum</i> var. <i>gratum</i>	K	N	end. L.A.
	<i>H. lanatum</i>	K		

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>H. lineare</i>	K	N	
	<i>H. macrothecum</i>	K	N	
	<i>H. polyanthes</i> var. <i>polyanthes</i>	K	N	
	<i>H. seiberi</i>	K		
TRICHOMANES				
	<i>Trichomanes hymenophylloides</i>	K	N	
	<i>T. alatum</i>	K	N	
	<i>T. angustifrons</i>	K	N	
	<i>T. crispum</i>	K	N	
	<i>T. kapplerionum</i>	K		
	<i>T. krausii</i>	K	N	
	<i>T. membranaceum</i>	K	N	
	<i>T. polypodioides</i>	K	N	
	<i>T. punctatum</i>	K	N	
	<i>T. rigidum</i>	K	N	
	<i>T. trigonum</i> var. <i>trigonum</i>	K	N	
CYATHEACEAE				
	Cyathea muricata	K	N	
	<i>C. arborea</i>	K	N	
	<i>Cnemidaria grandifolia</i> var. <i>grandifolia</i>	K	N	
POLYPODIACEAE				
sub-family DAVALLIOIDEAE	<i>Lindsaea quadrangularis</i> subs. <i>antillensis</i>	K	N	
sub-family PTERIDOIDEAE				
	<i>Acrostichum danaeifolium</i>		N	
	<i>Anisosoru hirsutus</i>		N	
	<i>Hypolepis repens</i>	K		
	<i>Pteris longifolia</i>	K		
	<i>P. altissima</i>		N	
	<i>P. biaurita</i>	K		
	<i>P. multifida</i>	K		
	<i>P. vittata</i>	K	N	
sub-family BLENNIOIDEAE				
	<i>Blechnum occidentale</i>	K	N	
	<i>B. binervatum</i>	K	N	
	<i>B. divergens</i>	K		
	<i>B. insularum</i>	K	N	
	<i>B. ryanii</i>	K	N	
sub-family ADIANTOIDEAE				
	<i>Adiantum villo</i>		N	
	<i>A. caudatum</i>		N	
	<i>A. latifolium</i>	K	N	

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>A. tenerum</i>	K	N	
	<i>A. tetraphyllum</i>	K		
	<i>Cheilanthes microphylla</i>		N	
	<i>Pityrogramma calomelanos</i>	K	N	
	<i>P. chrysophylla</i>	K	N	
sub-family OLEANDROIDEAE	<i>Bolbitis portoricensis</i>	K		
	<i>Ctenitis meridionalis</i>	K	N	
	<i>Diplazium limbatum</i>	K	N	
	<i>D. christatum</i>	K	N	
	<i>D. striatum</i>	K	N	
	<i>Elaphoglossum petiolatum</i>	K	N	
	<i>E. apodum</i>	K	N	
	<i>E. boryanum</i>	K		
	<i>E. hirtum</i>	K		
	<i>E. impressum</i>	K	N	
	<i>E. martinicense</i>	K	N	
	<i>E. plumieri</i>	K	N	
	<i>E. schomburgkii</i>	K	N	
	<i>Hymenodium crinitum</i>	K	N	
	<i>Lomariopsis sorbifolia</i>	K	N	
	<i>Nephrolepis falcata</i>		N	
	<i>N. cordifolia</i>		N	
	<i>N. hirsutula</i>		N	
	<i>N. rivularis</i>	K	N	
	<i>Polybortrya cervina</i>		N	
	<i>Tectaria plantaginea</i>	K	N	
	<i>T. heracleifolia</i>	K		
	<i>T. incisa</i>	K	N	
	<i>T. incisa x trifoliata</i>		N	<i>A hybrid believed unique to Nevis</i>
	<i>T. trifoliata</i>	K	N	
THELYPTERIDOIDEAE				
	<i>Thelypteris opposita</i>	K		
	<i>T. antillana</i>	K		end. L.A.
	<i>T. balbisii</i>	K	N	
	<i>T. clypeolutata</i>	K	N	end. L.A.
	<i>T. decussata</i>	K	N	
	<i>T. dentata</i>		N	
	<i>T. germaniana</i>	K	N	
	<i>T. glandulosa</i>	K	N	
	<i>T. grandis</i>	K		
	<i>T. limbata</i>	K	N	
	<i>T. muscicola</i>		N	Endemic to Nevis
	<i>T. nephrodioides</i>		N	
	<i>T. normalis</i>		N	
	<i>T. patens</i> var. <i>inconstans</i>	K		
	<i>T. patens</i> var. <i>scabriscula</i>		N	
	<i>T. pennata</i>	K		

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>T. poiteana</i>	K	N	
	<i>T. reptans</i>	K	N	
	<i>T. reticulata</i>	K	N	
	<i>T. sancta</i>		N	
	<i>T. tetragona</i> var. <i>nephrodiodes</i>		N	
	<i>T. tetragona</i> var. <i>tetragona</i>	K	N	
sub-family ASPLENIOIDEAE	<i>Asplenium laetum</i>	K	N	
	<i>A. abscissum</i>	K	N	
	<i>A. auritum</i> var. <i>rigidum</i>	K	N	
	<i>A. cristatum</i>	K	N	
	<i>A. malcolm-smithii</i>	K		Believed to be endemic to St. Kitts
	<i>A. pteropus</i>	K		
	<i>A. salicifolium</i> var. <i>salicifolium</i>	K		
sub-family POLYPODIOIDEAE	<i>Polypodium pectinatum</i>	K	N	
	<i>P. astrolepsis</i>	K	N	
	<i>P. aureum</i> var. <i>aureum</i>	K	N	
	<i>P. loricum</i>	K	N	
	<i>P. lycopodioides</i>	K	N	
	<i>P. phyllitidis</i>	K	N	
	<i>P. piloselloides</i>	K	N	
	<i>P. polypodioides</i>	K	N	
	<i>P. sectifrons</i>	K		
	<i>P. triseriale</i>		N	
sub-family GRAMMITIDOIDEAE	<i>Cochlidium seminudum</i>	K	N	
	<i>Grammitis serrulata</i>	K	N	
	<i>G. asplenifolia</i>	K	N	
	<i>G. eggertii</i>	K		
	<i>G. flabelliformis</i>		N	
	<i>G. mollissima</i>	K		
	<i>G. serricula</i>	K	N	
	<i>G. suspensa</i>	K	N	
	<i>G. taenifolia</i>	K	N	
	<i>G. taxifolia</i>	K		
	<i>G. trifurcata</i>	K		
sub-family VITTARIOIDEAE	<i>Anetium citrifolium</i>	K		
	<i>Polytaenium feei</i>	K		
	<i>P. dussianum</i>	K		
	<i>Vittaria lineata</i>	K	N	
	ORCHIDOIDEAE			
	<i>Chranichis muscosa</i>	K	N	
	<i>Ponthieva petiolata</i>	K		
	<i>Erythroides plantaginea</i>	K		

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>Stelis scabrada</i>		N	end. L.A.
	<i>Brachionidium sherringii</i>	K		
	<i>Malaxis massonii</i>	K		
	<i>M. umbelliflora</i>	K		
	<i>Jacquiiniella globosa</i>	K	N	
	<i>Epidendrum ciliare</i>		N	
	<i>E. difforme</i>	K		
	<i>E. patens</i>	K	N	end. L.A.
	<i>E. secundum</i>	K		
	<i>Polystachya concreta</i>	K		
	<i>Maxillaria coccinea</i>	K	N	
	<i>Oncidium urophyllum</i>	K	N	end. L.A.
	<i>Cranichis muscosa</i>		N	
	<i>Pleurothallis ruscifolia</i>		N	
GYMNOSPERMAE				
	<i>Podocarpus coriaceus</i>	K	N	
	MONOCOTYLEDONEAE			
PANDANACEAE				
	<i>Pandanus vetchii</i>		N	
RUPPIACEAE				
	<i>Ruppia maritima</i>		N	
	<i>R. cirrhosa</i>	K	N	
CYMODOCEACEAE				
	<i>Syringodium filiforme</i>	K	N	
NAJADACEAE				
	<i>Najas guadalupensis</i>	K	N	
	<i>N. marina</i>	K	N	
HYDROCHARITACEAE				
	<i>Thalassia testudinum</i>	K	N	
POACEAE				
	<i>Bambusa vulgaris</i>	K	N	
sub-family ARTHROSTYLIDIUM				
	<i>Andropogon glomeratus</i>	K	N	
	<i>A. bicornis</i>	K		
	<i>Anthephora hermaphrodita</i>			
	<i>Aristida adscensionis</i>		N	
	<i>Arthrostylidium venezuelae</i>	K		
	<i>Arundo donax</i>	K		
	<i>Axonopus compressus</i>		N	

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>Brachiaria reptans</i>	K		
	<i>B. adspersa</i>	K	N	
	<i>B. echinulata</i>	K	N	
	<i>B. fasciculata</i>	K		
	<i>Bothriochloa pertusa</i>		N	
	<i>B. saccharoides</i>	K		
	<i>Bouteloua americana</i>	K	N	
	<i>Chloris inflata</i>		N	
	<i>C. ciliata</i>		N	
	<i>C. radiata</i>	K		
	<i>C. sagraeana</i>		N	
	<i>Cenchrus echinatus</i>	K	N	
	<i>C. inceratus</i>	K	N	
	<i>Coix lachryma-jobi</i>	K	N	
	<i>Cymbopogon citratus</i>		N	
	<i>Cynodon dactylon</i>	K	N	
	<i>Digitaria ciliaris</i>	K		
	<i>D. Bicornis</i>		N	
	<i>D. horizontalis</i>	K		
	<i>D. insularis</i>	K	N	
	<i>D. longiflora</i>		N	
	<i>Dactyloctenium aegyptium</i>	K	N	
	<i>Dicanthium aristatum</i>		N	
	<i>Eragrostis ciliaris</i>	K		
	<i>E. pilosa</i>	K		
	<i>E. tenella</i>	K		
	<i>E. tephrosanthes</i>	K		
	<i>Echinochloa colona</i>		N	
	<i>Eleusine indica</i>	K	N	
	<i>Hackelochloa granularis</i>	K		
	<i>Heteropogon contortus</i>	K		
	<i>Hyparrhenia rufa</i>	K		
	<i>Isachne angustifolia</i>	K		
	<i>I. arundinacea</i>	K	N	
	<i>I. disperma</i>	K	N	
	<i>I. rigidifolia</i>	K		
	<i>Ichnanthus nemorosus</i>	K	N	
	<i>I. pallens</i>	K		
	<i>Lasiacis divaricata</i>	K		
	<i>L. sorghoidea</i>	K		
	<i>Leptochloa virgata</i>	K		
	<i>L. filiformis</i>	K		
	<i>Oplismenus hirtellus</i>	K		
	<i>Panicum maximum</i>	K	N	
	<i>P. pilosum</i>	K		
	<i>P. trichoides</i>	K		
	<i>Pappophorum pappiferum</i>	K		
	<i>Paspalidium germinatum</i>	K		
	<i>Paspalum conjugatum</i>	K		

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>P. fimbriatum</i>	K	N	
	<i>P. laxum</i>	K	N	
	<i>P. paniculatum</i>	K		
	<i>P. plicatulum</i>	K	N	
	<i>P. saccharoides</i>	K		
	<i>P. vaginatum</i>		N	
	<i>P. virgatum</i>	K		
	<i>P. nutans</i>	K		
	<i>Pennisetum setosum</i>	K		
	<i>Rhynchelytrum repens</i>	K		
	<i>Rottboellia exaltata</i>	K	N	
	<i>Saccharum officinarum</i>		N	
	<i>Setaria utonacaea</i>	K		
	<i>S. geniculata</i>	K	N	
	<i>S. glauca</i>	K	N	
	<i>S. rariflora</i>	K		
	<i>S. setosa</i> var. <i>setosa</i>	K		
	<i>Sorghum halepense</i>	K	N	
	<i>Spartina patens</i>	K	N	
	<i>Sporobolus virginicus</i>	K	N	
	<i>S. jacquemontii</i>	K		
	<i>S. pyramidatus</i>		N	
	<i>Stenotaphrum secundatum</i>	K		
	<i>Tragus berteronianus</i>	K		
	<i>Vetiveria zizanoides</i>	K	N	
	<i>Zea mays</i>	N	N	
CYPERACEAE				
	<i>Acrocomia aculeata</i>	K	N	
	<i>Bulbostylis capillaris</i>	K		
	<i>Carex polystachya</i>	K		
	<i>Cocos nucifera</i>	K	N	
	<i>Cyperus articulatus</i>		N	
	<i>C. alopecuroides</i>		N	
	<i>C. distans</i>	K		
	<i>C. elegans</i>		N	
	<i>C. laevigatus</i>		N	
	<i>C. planifolius</i>	K	N	
	<i>C. rotundus</i>		N	
	<i>C. sphacelatus</i>	K		
	<i>Eleocharis mutata</i>		N	
	<i>E. geniculata</i>		N	
	<i>E. interstincta</i>		N	
	<i>E. liogiera</i>		N	
	<i>E. montana</i>		N	
	<i>F. cymosa</i>	K	N	
	<i>Frimbristylis ferruginea</i>		N	
	<i>Machaerina restioides</i>		N	
	<i>Prestoea montana</i>	K	N	

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>Roystonea oleracea</i>		N	
	<i>Rynchospora rugosa</i>		N	
	<i>R. holoschoenoides</i>	K		
	<i>R. polyphylla</i>	K	N	
	<i>Schoenoplectus americanus</i>		N	
	<i>Scleria secans</i>	K		
	<i>S. latifolia</i>	K	N	
	<i>S. pterota</i>	K	N	
	<i>S. scindens</i>	K		
	<i>Torulinum odoratum</i>		N	
CYCLANTHACEAE				
	<i>Asplundia insignis</i>	K		
	<i>A. rigida</i>	K		
	<i>Anthurium acaule</i>	K	N	
	<i>A. cordatum</i>	K		
	<i>A. grandifolium</i>	K		
	<i>Caladium bicolor</i>		N	
	<i>Colocasia esculenta</i>		N	
	<i>Dieffenbachia seguine</i>	K		
	<i>Monstera adansonii</i>	K		
	<i>Philodendron giganteum</i>	K	N	
	<i>P. linulatum</i>	K		
	<i>P. scandens</i>	K		
	<i>Pistia stratiotes</i>		N	
BROMELIACEAE				
	<i>Ananas comosus</i>	K	N	
	<i>Guzmania dussii</i>		N	
	<i>G. plumieri</i>	K	N	
	<i>Pitcairnia angustifolia</i>	K		
	<i>P. bifrons</i>	K		
	<i>Tillandsia recurvata</i>	K	N	
	<i>T. usneoides</i>	K		
	<i>T. utriculata</i>	K	N	
	<i>Vriesia antillana</i>	K		
	<i>V. capituligera</i>		N	
	<i>V. conellii</i>	K		
COMMELINACEAE				
	<i>Commelina diffusa</i>	K		
	<i>C. elegans</i>	K	N	
	<i>Rhoeo spathacea</i>		N	
	<i>Zebrina pendula</i>		N	
PONTEDERIACEAE				
	<i>Eichornia crassipes</i>		N	
LILIACEAE				

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>Aloe vera</i>	K	N	
	<i>Asparagus desifloris</i>		N	
	<i>A. setaceus</i>		N	
HYPOXIDACEAE				
	<i>Hypoxis decumbens</i>	K		
HAEMODORACEAE				
	<i>Xiphidium caeruleum</i>	K	N	
AMARYLLIDACEAE				
	<i>Crinum bulbispermum</i>	K		
	<i>Euchris grandis</i>		N	
	<i>Hymenocallis caribaeae</i>	K	N	
	<i>H. fragrans</i>		N	
AGAVACEAE				
	<i>Agave caribaeicola</i>	K		
	<i>A. karatto</i>	K		
	<i>A. sisalana</i>	K	N	
	<i>A. van grolae</i>	K	N	
	<i>Cordylone fruticosa</i>		N	
	<i>Furcraea tuberosa</i>	K	N	end. L.A.
DIOSCOREACEAE				
	<i>Dioscorea bulbifera</i>	K		
	<i>D. alata</i>		N	
	<i>Rajania cordata</i>	K		
IRIDACEAE				
	<i>Belamcanda chinensis</i>	K		
	<i>Trimezia martinicensis</i>		N	
MUSACEAE				
	<i>Musa spp.</i>	N	N	
HELICONIACEAE				
	<i>Heliconia bihai</i>	K		
	<i>H. psittacorum</i>	K	N	
	<i>H. caribaea</i>		N	
BURMANNIACEAE				
	<i>Apteria aphylla</i>	K		
STRELITZIACEAE				
	<i>Ravenala madagascariensis</i>		N	
ZINGEBERACEAE				
	<i>Hedychium coronarium</i>		N	
	<i>Alpinia zerumbet</i>		N	

FAMILY	SPECIES	DISTRIBUTION		NOTES
MARANTACEAE				
	<i>Maranta arundinaceae</i>		N	
	DICOTYLEDONEAE			
CASUARINACEAE				
	<i>Casuarina equisetifolia</i>	K	N	
PIPERACEAE				
	<i>Lepianthes peltato</i>	K		
	<i>Peperomia emarginella</i>	K	N	
	<i>P. glabella</i>	K		
	<i>P. hernandiifolia</i>	K	N	
	<i>P. humilis</i>	K		
	<i>P. magnoliifolia</i>		N	
	<i>P. myrtifolia</i>	K		
	<i>P. nigropunctata</i>	K	N	
	<i>P. pellucida</i>	K		
	<i>P. trifolia</i>	K	N	end. L.A.
	<i>P. urocarpa</i>	K		
	<i>Piper aequale</i>	K		
	<i>P. dilatatum</i>	K	N	
	<i>P. dussii</i>		N	rest. L.A.
CHLORANTHACEAE				
	<i>Hedyosmum arborescens</i>	K	N	
BATAACEAE				
	<i>Batis maritima</i>	K		
ULMACEAE				
	<i>Celtis iguanaea</i>	K		
	<i>Trema lamarkiana</i>	K	N	
MORACEAE				
	<i>Artocarpus altilis</i>	K	N	
	<i>Cecropia schreberiana</i>	K	N	
	<i>C. peltata</i>	K	N	
	<i>Ficus americana</i>	K	N	
	<i>F. benamina</i>		N	
	<i>F. citrifolia</i>	K	N	
	<i>F. elastica</i>	K	N	
	<i>F. microcarpa</i>	K		
	<i>F. nymphaeifolia</i>	K	N	
	<i>F. pumila</i>	K	N	
	<i>F. trigonata</i>	K	N	

FAMILY	SPECIES	DISTRIBUTION		NOTES
CANNABACEAE				
	<i>Cannabis sativa</i>	K	N	
URTICACEAE				
	<i>Boehmeria ramiflora</i>	K	N	
	<i>Laportea aestuans</i>	K	N	
	<i>Pilea hyalina</i>	K		
	<i>P. inaequalis</i>	K	N	
	<i>P. microphylla</i>		N	
	<i>P. nummulariifolia</i>	K	N	
	<i>P. rivoirae</i>	K	N	
	<i>P. semidentata</i>	K		
	<i>Urera carasana</i>	K		
OLACACEAE				
	<i>Schoepfia schreberi</i>	K	N	
ARISTOLOCHIACEAE				
	<i>Aristolochia littoralis</i>	K		
POLYGONACEAE				
	<i>Antigonon leptopus</i>	K	N	
	<i>Coccoloba pubescens</i>		N	
	<i>C. diversifolia</i>		N	
	<i>C. swartzii</i>	K	N	
	<i>C. uviflora</i>	K	N	
CHENOPODIACEAE				
	<i>Chenopodium ambrosioides</i>	K		
	<i>C. murrale</i>	K		
AMARANTHACEAE				
	<i>Achyranthes aspera</i> var. <i>aspera</i>	K		
	<i>Alternanthera sessilis</i>	K	N	
	<i>Amaranthus dubius</i>	K		
	<i>A. hybridus</i>	K		
	<i>A. spinosus</i>	K		
	<i>Blutaparon vermiculata</i>	K		
	<i>Celosia argentea</i>	K		
	<i>C. nitida</i>	K		
	<i>Chamissoa altissima</i>	K		
	<i>Gomphrena globosa</i>	K		
	<i>G. serrata</i>	K		
	<i>Iresine angustifolia</i>	K		
	<i>I. diffusa</i>	K		
	<i>Lithophila muscoides</i>	K	N	
NYCTAGINACEAE				

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>Boerhavia coccinea</i>	K		
	<i>B. erecta</i>	K		
	<i>B. scandens</i>	K		
	<i>Bougainvillea glabra</i>		N	
	<i>B. spectabilis</i>		N	
	<i>Mirabilis jalapa</i>		N	
	<i>Pisonia aculeata</i>	K	N	
	<i>P. fragrans</i>	K		
	<i>P. subcordata</i>		N	
PHYTOLACCACEAE				
	<i>Microtea debilis</i>	K		
	<i>Petiveria alliacea</i>	K		
	<i>Phytolacca rivinoides</i>	K		
	<i>Rivina humilis</i>	K		
AIZOACEAE				
	<i>Mullago verticillata</i>	K		
	<i>Sesuvium portulacastrum</i>	K	N	
	<i>Trianthema portulacastrum</i>	K		
PORTULACACEAE				
	<i>Portulaca oleracea</i>	K	N	
	<i>P. quadrifida</i>	K		
	<i>Talinum fruticosum</i>	K	N	
	<i>T. paniculatum</i>		N	
CARYOPHYLLACEAE				
	<i>Drymaria cordata</i>	K		
NYMPHACEAE				
	<i>Nymphaea ampla</i> var. <i>speciosa</i>		N	
ANNONACEAE				
	<i>Annona montana</i>		N	
	<i>A. glabra</i>		N	
	<i>A. muricata</i>	K		
	<i>A. reticulata</i>		N	
	<i>A. squamosa</i>		N	
	<i>Guatteria caribaea</i>	K	N	
	<i>Oxandra laurifolia</i>	K	N	
MYRISTICACEAE				
	<i>Myristica fragrans</i>	K		
LAURACEAE				
	<i>Aniba bracteata</i>		N	
	<i>Beilschmieda pendula</i>	K	N	
	<i>Cassytha filiformis</i>	K		
	<i>Ocotea alpina</i>	K	N	

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>O. floribunda</i>		N ?	
	<i>O. leucoxyton</i>	K	N	
	<i>O. membranacea</i>	K		
	<i>Persea americana</i>	K	N	
PAPAVERACEAE				
	<i>Argemone mexicana</i>	K		
	<i>Bocconia frutescens</i>	K		
CRUCIFERAE				
	<i>Brassica juncea</i>	K	N	
	<i>B. oleracea</i>		N	
	<i>Cakile lanceolata</i>	K	N	
	<i>Lepidium virginicum</i>	K	N	
CAPPARACEAE				
	<i>Capparis baducca</i>	K		
	<i>C. cynophallophora</i>	K	N	
	<i>C. hastata</i>	K		
	<i>C. indica</i>	K		
	<i>Cleome gynandra</i>	K		
	<i>C. rutidosperma</i>	K		
	<i>C. viscosa</i>	K	N	
MORINGACEAE				
	<i>Moringa oleifera</i>	K	N	
CUNONIACEAE				
	<i>Weinmannia pinnata</i>	K		
ROSACEAE				
	<i>Prunus pleuradenia</i>	K		
	<i>Rubus coronarius</i>	K		
	<i>R. rosifolius</i>	K		
CHRYSOBALANACEAE				
	<i>Chrysobalanus cuspidatus</i>	K		
	<i>C. icaco</i>	K	N	
	<i>Hirtella triandra</i>	K	N	
CONNARACEAE				
	<i>Connarus grandifolius</i>	K		
LEGUMINOSAE				
sub-family MIMOSOIDEAE				
	<i>Acacia farnesiana</i>	K		
	<i>Adenantha pavonina</i>	K		
	<i>Calliandra purpurea</i>	K		
	<i>Desmanthus virgatus</i>	K		

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>Inga laurina</i>	K	N	
	<i>Leucaena leucocephala</i>	K	N	
	<i>Mimosa pudica</i>	K		
	<i>Pithecellobium unguis-cati</i>	K	N	
sub-family CAESALPINIOIDEAE	<i>Bauhinia divaricata</i>	K		
	<i>B. multinervia</i>	K		
	<i>B. tomentosa</i>	K		
	<i>Caesalpinia bonduc</i>	K	N	
	<i>C. ciliata</i>	K		
	<i>C. pulcherrima</i>	K	N	
	<i>Chamaecrista diphylla</i>	K		
	<i>C. glandulosa</i> var. <i>swartzii</i>	K		
	<i>C. nictitans</i> var. <i>diffusa</i>	K	N	
	<i>Cassia fistula</i>		N	
	<i>Chamaecrista glandulosa</i> var. <i>swartzii</i>	K	N	
	<i>Delonix regia</i>	K		
	<i>Haematoxylon campechianum</i>		N	
	<i>Hymenacaea courbril</i>		N	
	<i>Parkinsonia aculeata</i>		N	
	<i>Senna alata</i>	K	N	
	<i>S. bacillaris</i> var. <i>bacillaris</i>	K		
	<i>S. bicapularis</i> var. <i>bicapularis</i>	K		
	<i>S. nitida</i>	K		
	<i>S. occidentalis</i>	K		
	<i>S. siamea</i>		N	
	<i>Tamarindus indica</i>	K	N	
sub-family FABOIDEAE	<i>Abrus precatorius</i>	K	N	
	<i>Aeschynomene villosa</i>	K		
	<i>Alysicarpus vaginalis</i>	K	N	
	<i>Arachis hypogaea</i>		N ?	
	<i>Cajanus cajan</i>	K	N	
	<i>Canavalia rosea</i>		N	
	<i>Centrosema virginianum</i>	K		
	<i>Christia vespertilionis</i>	K		
	<i>Clitoria ternatea</i>	K	N	
	<i>Crotalaria incana</i>	K		
	<i>C. micans</i>	K		
	<i>C. pallida</i>	K		
	<i>C. pumila</i>	K		
	<i>C. retusa</i>	K		
	<i>C. verrucosa</i>	K		
	<i>Desmodium ascendens</i>	K		
	<i>D. axillare</i> var. <i>axillare</i>	K	N	
	<i>D. incanum</i>	K	N	
	<i>D. scorpiarus</i>	K		

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>D. triflorum</i>	K		
	<i>Erythrina corallodendrum</i>	K		
	<i>Flemingia strobilifera</i>	K		
	<i>Galactia longifolia</i>	K		
	<i>G. rubra</i>	K		
	<i>Gliricidia sepium</i>		N	
	<i>Indigofera suffruticosa</i>		N	
	<i>I. tinctoria</i>	K	N	
	<i>Lablab purpurea</i>	K	N	
	<i>Lonchocarpus pentaphyllus</i>	K		
	<i>L. violaceus</i>		N	
	<i>Macroptilium lathyroides</i>	K		
	<i>Mucuna pruriens</i>		N	
	<i>M. sloanei</i>	K		
	<i>M. urens</i>	K		
	<i>Ormosia monosperma</i>	K	N	
	<i>Phaseolus lunatus</i>	K	N	
	<i>P. coccineus</i>	K	N	
	<i>P. vulgaris</i>	K	N	
	<i>Piscidia carthagenensis</i>	K	N	
	<i>Rhynchosia minima</i>	K		
	<i>R. reticulata</i>	K		
	<i>Sesbania grandiflora</i>	K	N	
	<i>S. sesbum</i>	K		
	<i>Stylosanthes hemata</i>	K	N	
	<i>Tephrosia candida</i>	K		
	<i>T. cinerea</i>	K		
	<i>T. senna</i>	K	N	
	<i>Vigna luteola</i>		N	
	<i>V. unguiculata</i>	K	N	
	<i>Zornia reticulata</i>	K		
OXALIDACEAE				
	<i>Oxalis corniculata</i>	K		
	<i>O. debilis</i> var. <i>corymbosa</i>		N	
ERYTHROXYLACEAE				
	<i>Erythroxylum havanense</i>	K		
	<i>E. oxycarpum</i>	K		
	<i>E. squamatum</i>		N	
ZYGOPHYLLACEAE				
	<i>Kallstroemia pubescens</i>	K		
	<i>Guaiacum officinale</i>		N	
RUTACEAE				
	<i>Amyris elemifera</i>	K	N	
	<i>Citrus limon</i>	K	N	
	<i>C. aurantifolia</i>	K	N	

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>C. grandis</i>	K	N	
	<i>C. maxima</i>	K	N	
	<i>C. paradisi</i>	K	N	
	<i>C. aurantium</i>	K	N	
	<i>C. reticulata</i>	K	N	
	<i>C. sinensis</i>	K	N	
	<i>Murraya exotica</i>	K	N	
	<i>Triphasia trifolia</i>		N	
	<i>Zanthoxylum spinifex</i>	K	N	
SIMAROUBACEAE				
	<i>Picrasma excelsa</i>	K	N	
	<i>Simarouba amara</i>	K		
SURIANACEAE				
	<i>Suriana maritima</i>		N	
BURSERACEAE				
	<i>Bursera simaruba</i>	K		
	<i>Dacryodes excelsa</i>	K	N	
MELIACEAE				
	<i>Azadirachta indica</i>	K	N	
	<i>Guarea glabra</i>	K	N	
	<i>Melia azadarach</i>	K	N	
	<i>Swietenia mahagoni</i>	K	N	
MALPIGHIACEAE				
	<i>Bunchosia polystachia</i>	K	N	
	<i>Byrsonima spicata</i>	K		
	<i>Galphimia gracilis</i>	K		
	<i>Heteropterys purpurea</i>	K		
	<i>Malpighia emarginata</i>	K		
	<i>M. linearis</i>	K	N	
	<i>Stigmaphyllon diversifolium</i>	K		
	<i>S. emarginatum</i>		N	
KRAMERIACEAE				
	<i>Krameria ixine</i>	K		
EUPHORBIACEAE				
	<i>Acalypha poiretii</i>	K		
	<i>A. hispida</i>		N	
	<i>A. wilkensiana</i>		N	
	<i>Breynia disticha</i>	K		
	<i>Chamaesyce articulata</i>	K		
	<i>C. hirta</i>	K		
	<i>C. hypericifolia</i>	K		
	<i>C. mesembrianthemifolia</i>	K		
	<i>C. serpens</i>	K		

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>C. prostata</i>	K		
	<i>Cnidocolus urens</i>	K	N	
	<i>Codiaeum variegatum</i>		N	
	<i>Croton astroites</i>	K		
	<i>C. flavens</i>	K	N	
	<i>C. lobatus</i>		N	
	<i>Dalechampia scandens</i>	K		
	<i>Drypetas glauca</i>	K	N	
	<i>D. piriformis</i>		N	
	<i>Euphorbia cotonifolia</i>		N	
	<i>Hyppomane mancinella</i>	K	N	
	<i>Hura crepitans</i>		N	
	<i>Jatropha gossypifolia</i>	K	N	
	<i>J. integerrima</i>	K		
	<i>Manihot esculenta</i>		N	
	<i>Pedilanthus tithymaloides</i>	K	N	
	<i>Phyllanthus caroliniensis</i>		N	
	<i>P. urinaria</i>		N	
	<i>P. acidus</i>		N	
	<i>Sapium caribaeum</i>	K		end. L.A.
	<i>Tragia volubilis</i>	K		
ANACARDIACEAE				
	<i>Comocladia dodonaea</i>	K	N	
	<i>Mangifera indica</i>	K	N	
	<i>Spondias mombin</i>	K	N	
	<i>S. cytherea</i>		N	
	<i>S. purpurea</i>		N	
AQUIFOLIACEAE				
	<i>Ilex macfadyenii</i>	K	N	
	<i>I. dioica</i>		N	
	<i>I. sideroxyloides</i>	K	N	
CELASTRACEAE				
	<i>Cassine xylocarpa</i>	K	N	
	<i>Crosspetalum rhacoma</i>	K		
	<i>Gyminda latifolia</i>	K		
	<i>Schaefferia frutescens</i>	K		
STAPHYLEACEAE				
	<i>Allophylus racemosus</i>		N	
	<i>Blighia sapida</i>		N	
	<i>Cardiospermum corindum</i>	K		
	<i>C. microcarpum</i>	K	N	
	<i>Melicoccus bijugatus</i>	K	N	
	<i>Paullinia vespertilis</i>	K		
	<i>Sapindus saponaria</i>	K		

FAMILY	SPECIES	DISTRIBUTION		NOTES
SABIACEAE				
	<i>Meliosma herbertii</i>	K		
BALSAMINACEAE				
	<i>Impatiens balsamina</i>		N	
	<i>I. walleriana</i>		N	
VITACEAE				
	<i>Cissus verticillata</i>	K	N	
ELAEOCARPACEAE				
	<i>Sloanea berteriana</i>	K	N	
	<i>S. dentata</i>	K		end. L.A.
	<i>S. massoni</i>	K		end. L.A.
TILIACEAE				
	<i>Corchorus aestuans</i>	K		
	<i>C. hirtus</i>	K		
	<i>C. siliquosus</i>	K		
MALVACEAE				
	<i>Abelmoschus esculentus</i>	K	N	
	<i>Abutilon hirtum</i>	K		
	<i>A. indicum</i>	K		
	<i>Floria vitifolia</i>	K		
	<i>Gossypium hirsutum</i>	K		
	<i>G. barbadense</i>		N	
	<i>Hibiscus cannabinus</i>	K		
	<i>H. phoeniceus</i>	K		
	<i>H. sabdariffa</i>	K	N	
	<i>H. rosa-sinensis</i>	K	N	
	<i>H. rosa-sinensis</i> var. <i>schizopetallum</i>		N	
	<i>Malachra capitata</i>	K		
	<i>Malvastrum americanum</i>	K		
	<i>Pavonia spinifex</i>	K		
	<i>Sida acuta</i>	K		
	<i>S. cordifolia</i>	K		
	<i>S. rhombifolia</i>	K		
	<i>Sidastrum multiflorum</i>	K		
	<i>Thespesia populneua</i>	K	N	
	<i>Urena lobata</i>	K		
BOMBACEAE				
	<i>Ceiba pentandra</i>		N	
	<i>Ochroma pyramadale</i>	K	N	
	<i>Pachira insignis</i>	K		
	<i>Quaribea turbinata</i>	K	N	

FAMILY	SPECIES	DISTRIBUTION		NOTES
STERCULIACEAE				
	<i>Ayenia insulaecola</i>	K		
	<i>Guazuma ulmifolia</i>	K	N	
	<i>Melochia nodiflora</i>		N	
	<i>M. pyramidata</i>	K		
	<i>M. tomentosa</i>	K	N	
	<i>Theobroma cacao</i>	K	N	
OCHNACEAE				
	<i>Sauvagesia erecta</i>	K	N	
MARCGRAVIACEAE				
	<i>Marcgravia umbellata</i>	K		
	<i>Norantea guianensis</i>		N	
THEACEAE				
	<i>Freziera undulata</i>	K	N	end. L.A.
	<i>Ternstroemia elliptica</i>	K	N	end. L.A.
	<i>T. peduncularis</i>	K		
CLUSIACEAE				
	<i>Clusia major</i>	K	N	end. L.A.
	<i>Mammea americana</i>	K	N	
	<i>Marila racemosa</i>	K		end. L.A.
TAMARIACEAE				
	<i>Tamarix gallica</i>		N	
BIXACEAE				
	<i>Bixa orellana</i>	K	N	
COCHLOSPERMACEAE				
	<i>Cochlospermum vitifolius</i>		N	
CANELLACEAE				
	<i>Viola stipularis</i>	K	N	
FLACOURTIACEAE				
	<i>Caeseria decandra</i>	K		
	<i>C. sylvestris</i>	K		
	<i>Prokia crucis</i>		N	
	<i>Samyda dodecandra</i>	K	N	
TURNERACEAE				
	<i>Turnera ulmifolia</i>		N	
PASSIFLORACEAE				
	<i>Passiflora foetida</i>	K		

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>P. edulis</i>		N	
	<i>P. quadrangularis</i>		N	
	<i>P. rubra</i>	K		
	<i>P. sexflora</i>	K		
CARICACEAE				
	<i>Carica papaya</i>	K	N	
BEGONIACEAE				
	<i>Begonia retusa</i>	K	N	rest. L.A.
CACTACEAE				
	<i>Cereus hexagonus</i>	K		
	<i>Hylocereus trigonus</i>		N	
	<i>Melocactus intortus</i>	K	N	
	<i>Opuntia cochenillifera</i>	K		
	<i>O. dillenii</i>	K	N	
	<i>O. rubescens</i>	K		
	<i>O. triancantha</i>	K	N	
	<i>Pereskia bleo</i>	K		
	<i>P. grandiflora</i>	K		
	<i>Pilosocereus royeri</i>	K	N	
THYMELAEACEAE				
	<i>Ammania latifolia</i>	K	N	
	<i>Daphnopsis americana</i>		N	
	<i>Lagerstroemia indica</i>	K		
	<i>Lawsonia inermis</i>	K	N	
LYTHRACEAE				
	<i>Ammania latifolia</i>		N	
	<i>Cuphea hyssopifolia</i>		N	
	<i>Lagerstroemia indica</i>		N	
	<i>Lawsonia inermis</i>		N	
PUNICACEAE				
	<i>Punica gratum</i>		N	
RHIZOPHORACEAE				
	<i>Rhizophora mangle</i>	K		
COMBRETACEAE				
	<i>Buchenavia capitata</i>	K	N	
	<i>Laguncularia racemosa</i>	K		
	<i>Conocarpus erectus</i>		N	
	<i>Terminalia catappa</i>	K	N	
MYRTACEAE				
	<i>Eugenia chrosobalanoides</i>		N	

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>E. cordata</i>	K	N	
	<i>E. ligustrina</i>	K		
	<i>E. uniflora</i>	K	N	
	<i>Gomidesia lindeniana</i>	K		
	<i>Myrcia citrifolia</i>	K	N	
	<i>M. splendens</i>	K		
	<i>Myrcianthus fragrans</i>	K		
	<i>Myrciaria floribunda</i>	K		
	<i>Pimenta racemosa</i>		N	
	<i>Psidium amplexicaule</i>		N	<i>P. cordatum</i> originally from Nevis
	<i>P. cattleianum</i>		N	
	<i>P. guajava</i>	K	N	
	<i>Syzygium jambos</i>	K		
MELASTOMATACEAE				
	<i>Charianthus purpureus</i>	K	N	end. L.A.
	<i>Climimia hirta</i>	K	N	
	<i>C. umbrosa</i>	K		end. L.A.
	<i>Miconia globuliflora</i> var. <i>dominicae</i>	K	N	
	<i>M. impetiolearis</i>	K		
	<i>M. laevigata</i>	K	N	
	<i>M. mirabilis</i>	K	N	
	<i>Tibouchina longifolia</i>	K		
	<i>T. ornata</i>	K		end. L.A.
	<i>Tetrazygia discolor</i>		N	
	<i>Vespera aquatica</i>	K		
ARALIACEAE				
	<i>Schefflera attenuata</i>	K		end. L.A.
UMBELLIFERAE				
	<i>Eryngium foetidum</i>	K	N	
THEOPHRASTACEAE				
	<i>Jacquinia armillaris</i>	K		
MYRSINACEAE				
	<i>Ardisia obovata</i>		N	
	<i>Cybianthus parasiticus</i>		N	end. L.A.
	<i>Myrsine coriacea</i>		N	
PLUMBAGINACEAE				
	<i>Plumbago scandens</i>	K	N	
SAPOTACEAE				
	<i>Manilkara zapota</i>		N	
	<i>Micropholis guyanensis</i>		N	
	<i>Pouteria multiflora</i>		N	

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>Sideroxylon cubense</i>	K		
	<i>Sideroxylon obovatum</i>	K		
	<i>S. salicifolium</i>		N	
STYRACACEAE				
	<i>Styrax glaber</i>	K		end. L.A.
SYMPLOCACEAE				
	<i>Symplocos martinicensis</i>	K	N	
OLEACEAE				
	<i>Jasminum multiflorum</i>	K		
LOGANACEAE				
	<i>Spigelia anthelmia</i>	K		
GENTIANACEAE				
	<i>Centaurium pulchellum</i>		N	
	<i>Enicostema verticillatum</i>	K		
	<i>Voyria aphylla</i>	K	N	
APOCYNACEAE				
	<i>Allamanda blanchetti</i>		N	
	<i>Allamanda cathartica</i>	K	N	
	<i>Catharanthus roseus</i>	K	N	
	<i>Nerium oleander</i>		N	
	<i>Plumeria alba</i>	K		
	<i>P. rubra</i>	K	N	
	<i>Rauvolfia nitida</i>	K		
	<i>Rauvolfia tetraphylla</i>	K		
	<i>Rauvolfia viridis</i>	K		
	<i>Tabernaemontana citrifolia</i>	K		
	<i>Thevetia peruviana</i>	K		
	<i>Urechites lutea</i>	K		
ASCLEPIADACEAE				
	<i>Calotropis procera</i>	K	N	
	<i>Matelia maritima</i>	K		
CONVOLVULACEAE				
	<i>Cuscuta americana</i>	K	N	
	<i>Evolvulus convolvuloides</i>	K		
	<i>E. tenuis</i>	K		
	<i>Ipomoea hederifolia</i>	K		
	<i>I. asarifolia</i>		N	
	<i>I. batatas</i>		N	
	<i>I. indica</i>	K		
	<i>I. pes-caprae</i>	K		
	<i>I. phyllomega</i>	K		

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>I. quamoclit</i>	K	N	
	<i>I. tiliacea</i>	K		
	<i>I. triloba</i>	K		
	<i>I. violacea</i>	K		
	<i>Jacquemontia cumanensis</i>	K		
	<i>J. pentantha</i>	K	N	
	<i>J. solanifolia</i>	K		
	<i>J. tamnifolia</i>		N	
	<i>Merremia aegyptia</i>	K		
	<i>M. dissecta</i>	K		
	<i>Poranopsis paniculata</i>	K		
	<i>Turbina corymbosa</i>		N	
HYDROPHYLLACEAE				
	<i>Nama jamaicensis</i>	K		
BORAGINACEAE				
	<i>Argusia gnaphalodes (spelling)</i>	K	N	
	<i>Bouyeria succulenta</i>	K	N	
	<i>Cordia globosa</i>	K		
	<i>C. nesophila</i>	K		
	<i>C. obliqua</i>	K	N	
	<i>C. polycephala</i>	K		
	<i>C. sebestena</i>	K	N	
	<i>C. sulcata</i>	K		
	<i>C. collococca</i>		N	
	<i>Heliotropium angiospermum</i>	K		
	<i>H. curassavicum</i>	K	N	
	<i>H. indicum</i>	K		
	<i>H. ternatum</i>	K		
	<i>Tournefortia bicolor</i>	K		
	<i>T. hirsutissima</i>	K		
	<i>T. maculata</i>		N	
	<i>T. volubilis</i>	K	N	
AVICENNIACEAE				
	<i>Avicennia germinans</i>	K		
VERBENACEAE				
	<i>Aegiphila martinicensis</i>	K		
	<i>Citharexylum spinosum</i>	K		
	<i>Clerodendron aculeatum</i>	K	N	
	<i>C. speciosissimum</i>	K		
	<i>Duranta erecta</i>	K	N	
	<i>Hyptis pectinata</i>	K		
	<i>Lantana camara</i>	K	N	
	<i>L. involucrata</i>	K		
	<i>L. urticifolia</i>	K		
	<i>Leonotis nepetifolia</i>	K	N	

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>Leucas martinicensis</i>	K		
	<i>Petrea kohautiana</i>	K		
	<i>Plectranthus amboinicus</i>	K	N	
	<i>Salvia micrantha</i>	K		
	<i>S. serotina</i>	K		
	<i>Stachytarpheta cayennensis</i>	K		
	<i>S. jamaicensis</i>	K		
	<i>Tectona grandis</i>	K	N	
SOLANACEAE				
	<i>Brunfelsia americana</i>	K	N	
	<i>Capsicum annum</i>		N	
	<i>Cestrum laurifolium</i>	K	N	
	<i>Datura straemonium</i>	K		
	<i>Nicotiana tabacum</i>	K		
	<i>Physalis angulata</i>	K		
	<i>P. philadelphica</i>		N	
	<i>Solandra grandiflora</i>	K	N	
	<i>S. americanum</i>	K		
	<i>S. bicolor</i>	K		
	<i>S. capsicoides</i>	K		
	<i>S. racemosum</i>	K	N	
	<i>S. torvum</i>	K		
SCROPHULARIACEAE				
	<i>Copraria biflora</i>	K		
	<i>Lindernia diffusa</i>		N	
	<i>Scoparis dulcis</i>	K		
BIGNONIACEAE				
	<i>Crescentia cujete</i>	K	N	
	<i>Macfadyena unguis-cati</i>	K ?	N ?	
	<i>Tecoma stans</i>	K	N	
GESNERIACEAE				
	<i>Alloplectus cristatus</i>	K	N	
	<i>Besleria lutea</i>	K		
	<i>Gesneria ventricosa</i>	K		
ACANTHACEAE				
	<i>Asystasia gangetica</i>		N	
	<i>Blechum pyramidatum</i>	K		
	<i>Dicliptera martinicensis</i>	K		
	<i>Justicia pectoralis</i>	K		
	<i>J. secunda</i>	K		
	<i>J. sessilis</i>	K		
	<i>Odontonema nitidum</i>	K	N	
	<i>Pseuderanthemum carruthersii</i>		N	
	<i>Ruellia tuberosa</i>	K	N	
	<i>Thunbergia fragrans</i>	K	N	

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>T. alata</i>		N	
	<i>T. erecta</i>		N	
	<i>T. grandiflora</i>		N	
	<i>T. laurifolia</i>		N	
RUBIACEAE				
	<i>Chiococca alba</i>	K		
	<i>Chione venosa</i>	K		
	<i>Diodia ocymifolia</i>	K		
	<i>Erithalis fruticosa</i>	K	N	
	<i>E. odorifera</i>	K		
	<i>Faramea occidentalis</i>	K		
	<i>Gonzalagunia hirsuta</i>	K		
	<i>Guettarda odorata</i>	K		
	<i>G. parviflora</i>	K	N	
	<i>G. scabra</i>	K	N	
	<i>Hamelia axillaris</i>	K		
	<i>Hillia parasitica</i>	K		
	<i>Ixora ferrea</i>	K	N	
	<i>Melothria pendula</i>	K		
	<i>Mitracarpus hirtus</i>	K		
	<i>Morinda citrifolia</i>	K		
	<i>Palicourea crocea</i>		N	
	<i>Psychotria aubletiana</i>	K	N	
	<i>P. berteriana</i>	K	N	
	<i>P. guadalupensis</i>	K	N	
	<i>P. microdon</i>	K		
	<i>P. nervosa</i>		N	
	<i>P. pubescens</i>	K		
	<i>Randia aculeata</i>	K	N	
	<i>Relbunium guadalupense</i>	K	N	
	<i>Spermacoce assurgens</i>	K		
	<i>S. bahamensis</i>	K		
	<i>S. confusa</i>	K		
	<i>S. densiflora</i>	K		
	<i>S. verticillata</i>	K		
	<i>Strumphia maritima</i>	K		
CUCURBITACEAE				
	<i>Momordica charantia</i>	K	N	
LOBELIACEAE				
	<i>Lobelia circiifolia</i>	K		end. L.A.
	<i>L. stricta</i>	K	N	
COMPOSITAE				
	<i>Acanthospermum hispidum</i>	K		
	<i>Acmella uliginosa</i>	K		
	<i>Adenostemma verbesina</i>	K		

FAMILY	SPECIES	DISTRIBUTION		NOTES
	<i>Ageratum conyzoides</i>	K		
	<i>Ambrosia hispida</i>	K		
	<i>Baccharis pedunculata</i>	K		
	<i>B. dioica</i>		N	
	<i>Bidens pilosa</i>	K		
	<i>Centratherum punctatum</i>		N	
	<i>Chaptalia nutans</i>	K	N	
	<i>Clibadium erosum</i>	K	N	
	<i>Conzya apurensis</i>	K		
	<i>C. bonariensis</i>	K		
	<i>C. canadensis</i>	K		
	<i>Eclipta prostrata</i>	K		
	<i>Egletes prostrata</i>	K		
	<i>Emilia fosbergii</i>	K		
	<i>E. sonchifolia</i>	K	N	
	<i>Erechtites hieracifolia</i>	K		
	<i>E. valerianifolia</i>	K		
	<i>Eupatorium corymbosum</i>	K		
	<i>E. integrifolium</i>	K		
	<i>E. macranthum</i>	K	N	
	<i>E. macrophyllum</i>	K		
	<i>E. microstemon</i>	K		
	<i>E. odoratum</i>	K		
	<i>E. trigonocarpum</i>	K		
	<i>Lagascea mollis</i>	K		
	<i>Mikania hookeriana</i>	K		
	<i>Neurolepa lobata</i>	K		
	<i>Parthenium hysterophorus</i>	K	N	
	<i>Pectis humifusa</i>	K		
	<i>P. linearis</i>	K		
	<i>P. linifolia</i>	K		
	<i>Pluchea carolinensis</i>	K		
	<i>Porophyllum ruderale</i>	K		
	<i>Scaevola plumieri</i>	K	N	
	<i>S. sericea</i>		N	
	<i>Tagetes erecta</i>	K		
	<i>Tithonia diversifolia</i>	K		
	<i>Tridax procumbens</i>	K		
	<i>Verbesina alata</i>	K		
	<i>Vernonia albicaulis</i>	K		
	<i>V. cinerea</i>	K		
	<i>Wedelia trilobata</i>	K	N	
	<i>W. calycina</i>		N	
	<i>Xanthium strumarium</i>		N	

APPENDIX B:

METADATA FOR ST. KITTS-NEVIS VEGETATION MAPS

PREPARED BY THE NATURE CONSERVANCY

Map graphics and metadata served at
<http://edcintl.cr.usgs.gov/igdn/tnc/metadata.html>, down loaded 20 January 2000.

ST KITTS VEGETATION MAP METADATA

Metadata:

- * Identification_Information
- * Spatial_Data_Organization_Information
- * Distribution_Information
- * Metadata_Reference_Information

 Identification_Information:

Citation:

Citation_Information:

Originator: Eastern Caribbean Natural Area Management Program

Publication_Date: 1990 Title: St Kitts Geospatial_Data_Presentation_Form:
 atlas

Description:

Abstract:

Eastern Caribbean Natural Area Management Program, vegetation of
 Grenada, Vegetation of St Kitts

Purpose:

Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 1949

Ending_Date: 1979

Currentness_Reference:

Status:

Progress: Complete Maintenance_and_Update_Frequency:

Spatial_Domain:

Bounding_Coordinates:

West_Bounding_Coordinate: -62.95 East_Bounding_Coordinate: -62.58

North_Bounding_Coordinate: 17.46 South_Bounding_Coordinate: 17.2

Keywords:

Theme:

Theme_Keyword_Thesaurus: Vegetation Theme_Keyword: Vegetation

Place:

Place_Keyword_Thesaurus: St Kitts Place_Keyword: St Kitts

Access_Constraints: Use_Constraints: Browse_Graphic:

Browse_Graphic_File_Name:

<http://edcintl.cr.usgs.gov/igdn/tnc/browsegraphics/st_kitts.jpg>

Browse_Graphic_File_Description: none Browse_Graphic_File_Type: JPEG - Joint
 Photographic Experts Group format

Spatial_Data_Organization_Information:
 Direct_Spatial_Reference_Method: Point

 Distribution_Information:

Distributor:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Xiaojun Li Contact_Organization: The Nature Conservancy

Contact_Address:

Address_Type: mailing and physical address Address: 4245 North Fairfax Drive,
 Suite 100 City: Arlington State_or_Province: VA Postal_Code: 22203 Country:
 USA

Contact_Voice_Telephone: 703-247-3745 Contact_Electronic_Mail_Address:

xli@tnc.org

Distribution_Liability:

 Metadata_Reference_Information:

Metadata_Date: 19990303 Metadata_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Xiaojun Li Contact_Organization: The Nature Conservancy

Contact_Address:

Address_Type: mailing and physical address Address: 4245 North Fairfax Drive,
 Suite 100 City: Arlington State_or_Province: VA Postal_Code: 22203 Country:
 USA

Contact_Voice_Telephone: 703-247-3745 Contact_Electronic_Mail_Address:

xli@tnc.org

Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata

Metadata_Standard_Version: FGDC-STD-001-1998

 Generated by mp version 2.2.0 on Mon Jun 14 15:33:39 1999

NEVIS VEGETATION MAP METADATA

Metadata:

- * Identification_Information
- * Spatial_Data_Organization_Information
- * Distribution_Information
- * Metadata_Reference_Information

 Identification_Information:

Citation:

Citation_Information:

Originator: Eastern Caribbean Natural Area Management Program

Publication_Date: 1990 Title: Nevis Geospatial_Data_Presentation_Form: atlas

Description:

Abstract:

Eastern Caribbean Natural Area Management Program, Vegetation 1990

Purpose:

Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 1990 Ending_Date: 1990

Currentness_Reference:

Status:

Progress: Complete Maintenance_and_Update_Frequency:

Spatial_Domain:

Bounding_Coordinates:

West_Bounding_Coordinate: -62.65 East_Bounding_Coordinate: -62.5

North_Bounding_Coordinate: 17.2 South_Bounding_Coordinate: 17.1

Keywords:

Theme:

Theme_Keyword_Thesaurus: Vegetation Theme_Keyword: Vegetation

Place:

Place_Keyword_Thesaurus: Nevis Place_Keyword: Nevis

Access_Constraints: Use_Constraints: Browse_Graphic:

Browse_Graphic_File_Name:

<<http://edcintl.cr.usgs.gov/igdn/tnc/browsegraphics/nevis.jpg>>

Browse_Graphic_File_Description: none Browse_Graphic_File_Type: JPEG - Joint
Photographic Experts Group format

Spatial_Data_Organization_Information:

Direct_Spatial_Reference_Method: Point

Distribution_Information:

Distributor:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Xiaojun Li Contact_Organization: The Nature Conservancy

Contact_Address:

Address_Type: mailing and physical address Address: 4245 North Fairfax Drive,
Suite 100 City: Arlington State_or_Province: VA Postal_Code: 22203 Country:
USA

Contact_Voice_Telephone: 703-247-3745 Contact_Electronic_Mail_Address:
xli@tnc.org

Distribution_Liability:

Metadata_Reference_Information:

Metadata_Date: 19990303 Metadata_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Xiaojun Li Contact_Organization: The Nature Conservancy

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Suite 100 City: Arlington State_or_Province: VA Postal_Code: 22203 Country:
USA

Contact_Voice_Telephone: 703-247-3745 Contact_Electronic_Mail_Address:
xli@tnc.org

Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata

Metadata_Standard_Version: FGDC-STD-001-1998

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