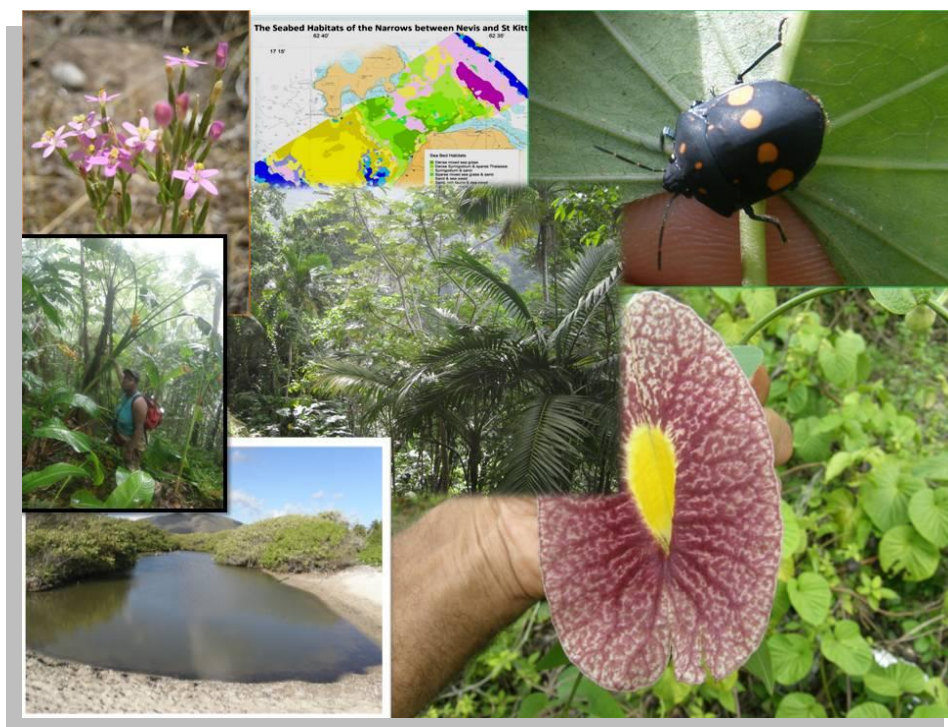




ORGANISATION OF EASTERN CARIBBEAN STATES (OECS) SECRETARIAT  
ENVIRONMENT AND SUSTAINABLE DEVELOPMENT UNIT (ESDU)  
PROTECTING THE EASTERN CARIBBEAN REGION'S BIODIVERSITY (PERB) PROJECT

## Terrestrial Biodiversity Inventory and Status Assessment for the Proposed Nevis Peak Protected Area



FEDERATION OF ST. KITTS AND NEVIS



JUNE 2009



ORGANISATION OF EASTERN CARIBBEAN STATES (OECS) SECRETARIAT  
ENVIRONMENT AND SUSTAINABLE DEVELOPMENT UNIT (ESDU)  
*PROTECTING THE EASTERN CARIBBEAN REGION'S BIODIVERSITY (PERB) PROJECT*

MINISTRY OF PHYSICAL PLANNING, INFRASTRUCTURAL DEVELOPMENT,  
ENVIRONMENT AND NATURAL RESOURCES

NEVIS ISLAND ADMINISTRATION



## **Terrestrial Biodiversity Inventory and Status Assessment for the Proposed Nevis Peak Protected Area**

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June 2009

This activity is funded by the United States Agency for International Development (USAID).  
The views expressed herein are those of the authors and do not necessarily reflect the views of  
the donor agencies supporting the activity or of the OECS Secretariat.





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# Terrestrial Biodiversity Inventory and Status Assessment for the Proposed Nevis Peak Protected Area

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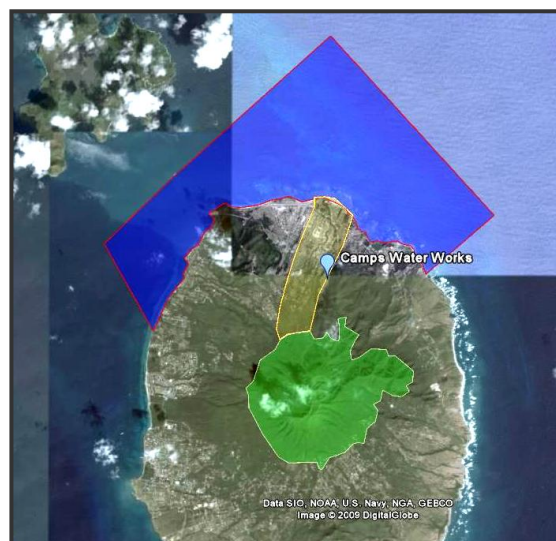
## BACKGROUND

This terrestrial biodiversity inventory and status assessment forms part of the Organisation of Eastern Caribbean States' (OECS) *Protecting the Eastern Caribbean Region's Biodiversity (PERB) Project*, undertaken through its Environment and Sustainable Development Unit (ESDU), in partnership with the United States Agency for International Development (USAID).

The larger goal of this particular initiative in Nevis is to develop a management plan for the proposed Nevis Peak Protected Area (NPPA). The objective of the biodiversity assessment for the proposed protected area is to provide findings that will inform and advise the preparation of a management plan for the site.

As part of the assessment effort, the survey team conducted extensive field surveys from January to April, 2009 (the most intensive in April), as well as carrying out literature reviews, discussions and interviews, and analyses over many months to inventory the biodiversity of the sites and to determine the status of species of plants, animals, ecosystems as well as threats and issues.

In the original Terms of Reference (ToR), the targeted areas to be surveyed and assessed were the Nevis Peak above 350 m (1,000 ft), and the Camps River Watershed (Figure 1). The Watershed also included a marine component, but this did not form part of the assessment. During the survey period and following discussions with residents, team members and Nevisian partners, the survey team concluded that efforts for the proposed Protected Area should also include additional sites such as Saddle Hill and selected coastal lagoons and wetlands. The assessment that follows articulates the reasons for and issues surrounding the decisions to include these additional sites.



**Figure 1.**

Image of the proposed Nevis Peak National Park  
(source: Google Earth, 23/04/09).

## INTRODUCTION

Much of the flora and fauna, the ecosystems and landscapes of the proposed NPPA are very specialised: exclusive to particular sites, habitats and situations on the island. Many of the species and ecosystems are limited to the moist upland forests and woodlands on the steep slopes of Nevis Peak. Plants such as the tree ferns and the Cabbage Palm, and animals such as the Brown Trembler and the Forest Bat, and the small area of rainforest, are all found high on the slopes of the Peak.

The coastal lagoons of Nevis are few, and the areas are relatively small, some only a few hundred metres square. Here the island's wetland birds, fish and invertebrates thrive, despite increased human activities.

Nevertheless, while some species and ecosystems are restricted, others are widely distributed throughout the island. Species such as the Mexican Free-tailed and the Jamaican Fruit Bats, the Lesser Antillean Bullfinch and the Thrashers are found across many habitats and zones. Many species, such as birds are transient, some staying as long as food and shelter are available, others only passing through the area on their way to more productive grounds. Some of these transients are seasonal migrants, while others are year-long residents.

For the survey team to provide the most representative and comprehensive assessment of the biodiversity within the environments of the Peak and other recommended protected areas, the surveys required going beyond the confines of the human-imposed boundaries and limits. The challenge was to assess the communities of plants and animals and not exclude or miss those features and assets that lay just beyond the immediate boundaries of the proposed NPPA, or those that only occupied the area during periods convenient to the resource, but not during our presence there.

The survey of the vegetation, flora and fauna of the proposed NPPA was done in three phases. The first comprised a review of the historical literature, extant reports and research notes, as well as discussions with key local individuals and experts. The second included field inventories of the proposed protected area, and the third focused on assessing and mapping the communities and other features.

The proposed protected area on Nevis Peak and the coastal lagoons/wetlands are quite extensive and complex, and it was impossible to conduct a comprehensive and detailed survey in the limited time span afforded for this effort, predicated on the available financial resources for the project. With this in mind, the team conducted targeted surveys of specific areas with the assistance of volunteers. Field surveys were carried out, most intensively for a five-day period in April 2009.

For terrestrial habitats and species, the team conducted assessments and searches on foot by using trails, natural access points, aerial imagery, random surveys, natural species congregation and aggregation points, flyways and existing roads.

The vegetation communities have been assessed and mapped using the classification of Lindsay and Horwith, 1997b and Beard, 1949b.

Also included are cultural and heritage resources, which have been broadly mapped.

For fauna, similar techniques were used, species were catalogued, and some statistical analysis provided.

## SUMMARY OF FINDINGS

### (1) Carried out Field Research and Status Assessment of the Biological Resources within the Proposed Nevis Peak Protected Area.

- From April 18 to 22, and May 17 to 20, 2009, Kevel Lindsay, Jean-Pierre Bacle, Carolyn Thomas and Melanie Pearson—assisted by local volunteers and island biodiversity specialists—carried out surveys throughout the proposed NPPA to assess the flora, vegetation communities, the fauna, water resources, erosion and sedimentation, invasive species and their impacts, and the outstanding features of the area.
- Over 365 species of plants have been identified for the area.
- Almost 90 species of birds and 14 species of reptiles and amphibians were recorded.
- Ten species of birds and three species of bats of “**special conservation concern**” were identified.
- Eight “**areas of special conservation concern**” were identified.
- Nineteen vegetation communities were identified.
- At least six key natural and cultural features were identified.
- Recommendations for action have been provided.

### (2) Prepared and Submitted a Final Project Report.

- A final Inventory and Status Assessment Report was prepared and submitted to the OECS Environment and Sustainable Development Unit. This report confirms the rich variety of biodiversity to be found within the proposed protected area and reaffirms the importance of aggressively moving forward with the current initiative to formally create a Nevis Peak Protected Area and implementing a sustainable management and conservation plan for the protected area.

## PHYSICAL CHARACTERISTICS OF PROPOSED NEVIS PARK PROTECTED AREA

### LOCATION

Nevis is located near the northern end of the Lesser Antilles archipelago, about 350 km southeast of Puerto Rico and 80 Km west of Antigua. Nevis along with the island of St. Kitts forms the Federation of St. Kitts and Nevis. The two islands are separated by a shallow 3.2 km channel known as The Narrows (Figure 2). Nevis is about 93 square km; 12.3 km long and 9.6 km wide. Its population is estimated at 12,100\*, mostly dense around Charlestown (St. Paul's Parish) and Gingerland (St. George's Parish) (Figure 3). Average population density is 130 per sq km. Nevis has a tropical maritime climate which is heavily influenced by steady northeast trade winds and tropical oceanic and cyclonic movements. The average temperature is about 27 degrees Celsius; average rainfall is 1,170 mm.

Nevis is of volcanic origin and is dominated by a central peak (Nevis Peak) usually covered by clouds. Deep ghauts (streams) dissect slopes from the Peak to the sea with no regular stream flow except during heavy rains. There are no bays, inlets or cays of significance, however long stretches of sandy beaches surround much of the island.



**Figure 2.**

General location map showing St. Kitts and Nevis separated by The Narrows (source: updated map of Saint Kitts and Nevis from the CIA World Factbook, January 2006).

\* Population figure from the Ministry of Finance, Nevis Financial Services Development and Marketing Department, August 2006.



**Figure 3.**  
Geographical names and features of Nevis.

## EXISTING CONDITIONS

Within the boundaries of the proposed Protected Area, a wide range of land uses, geological features, landscapes, aesthetics, ecological resources and vegetative zones can be found. The highest point on the island is Nevis Peak at 985 metres (3,232 ft).

Nevis Peak and the surrounding areas are composed of volcanic rocks that range in age from the mid-Pliocene to Pleistocene. Because the rocks are characteristic of various eruptive periods, this prevents any single model of the island's geological evolution. The geology of Nevis is highlighted by its volcanic centres surrounded by a thick cloak of volcanic sediments mostly comprised of pyroclastics and lahars. Fluvial and lacustrine sediments of more recent origin are also found throughout the landscape. The coastal lagoons and wetlands are composed of marine and upland sediment deposits.

The vegetation types of the Peak are mostly a mix of forests, much of it secondary.

Within the boundaries of the proposed protected area, there is only one major human settlement, the village of Rawlins. There are also many private in-holdings, as well as individual private homes. The coastal lagoons and wetlands are situated close to major communities and settlements, including the island's major town of Charlestown. The largest tourist resort on Nevis, The Four Seasons, is located just north of

Charlestown (see #1 on Figure 3).

The upper reaches of the Peak are, in many places, quite steep and erosion prone (Photo 1). These steep slopes are very prone to mass wasting, including landslides, rockfalls, and mudslides. Fortunately, most of these slopes, some of which were once part of vast sugarcane estates, are now covered in moist forest or woodland. On the lower slopes, where the slopes are far less steep, the vegetative cover is more variable and may be quite sparse with only grass and scattered trees or shrubs.



**Photo 1.**  
Nevis Peak, with Charlestown to the left  
(photo credit: Jean-Pierre Bacle).

## CLIMATE AND WEATHER

As with other islands in the Lesser Antilles, the island of Nevis experiences a tropical maritime climate with little variation in daily or seasonal temperatures. Average monthly minimum and maximum temperatures in Nevis stand at 22° and 29° C in January, increasing to 25° and 32° C in July. With increasing elevation, the trend is that there is a one degree Celsius ambient temperature drop per 100 metres in altitude.

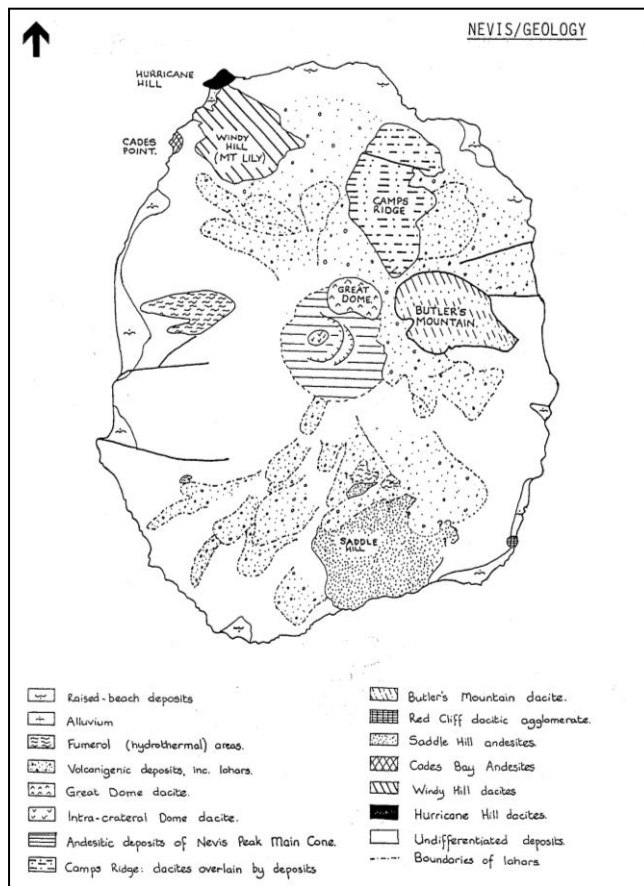
The prevailing winds hold fairly steady from the east, swinging seasonally between northeast and southeast with mean speeds ranging from 8.6 km/h (5.4 mph) in November to 14.6 km/h (9.1 mph) in July. The months with the stronger wind speed are the dry months from January to March.

The island's several peaks tend to generate their own localised weather, creating a range of micro-climates that vary greatly with height, location, and orientation. The dominant feature of Nevis Peak usually causes a marked upward deflection of westerly moving, moisture-laden air. This rising sea air is cooled by expansion, and moisture is condensed so that orogenic cloud formations and often heavy precipitation result. Cloud cover is common on the Peak, averaging between 40 and 50 percent of the time.

Rainfall is mainly influenced by orographic conditions and increases in amount and frequency with elevation. The average rainfall in Nevis is 1,199 mm (47.2 inches). The rainy season is from August to November with a wet spell in May, and the dry season is from mid-January to April.

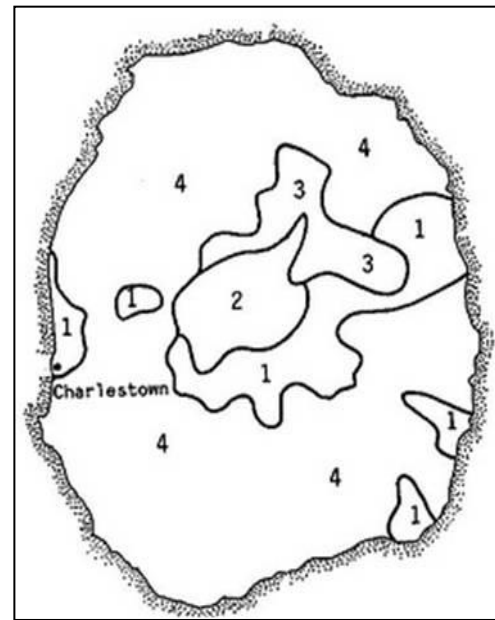
## GEOLOGY AND SOILS

Nevis lies on the inner volcanic arc of the Lesser Antilles and is comprised of nine distinctive volcanic centres strung out southwest to northeast along a parallel of inner volcanic arc. The central Nevis Peak is the most imposing of these centers rising to 985 metres, giving the island a conical appearance. The other



**Figure 4.**

The geology of Nevis (source: Wilson, 1990).



**Figure 5.**

Soils distribution of Nevis; see Table 1 for reference numbers (adapted from Atkins, 1983).

subsidiary peak of note is Butler's Mountain (580 m), which thickens the range in the central east of the island.

Nevis began its formation in mid-Pliocene times (approximately 3.45 million years ago). However, the island comprises a number of discrete eruptive centers that range in age from the mid-Pliocene to Pleistocene. Because the rocks are characteristic of various eruptive periods, this prevents any single model of the island's geological evolution.

The most recent geology map (Figure 4) was sketched by Wilson (1990), and adapted from Martin-Kaye, 1969, and Hutton and Nocholds, 1978.

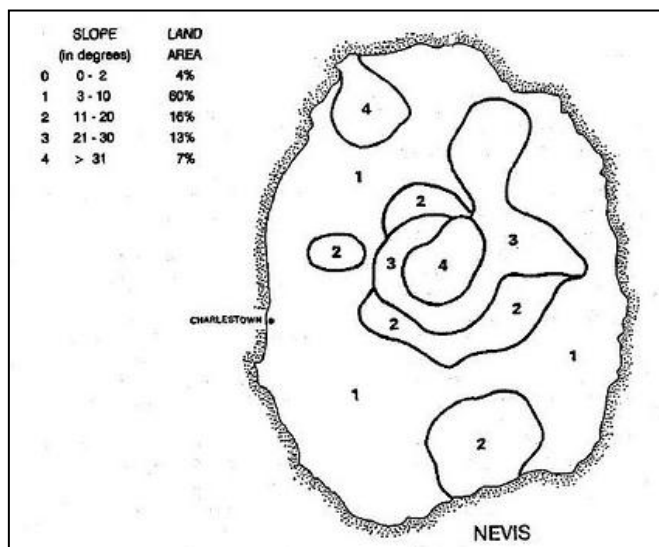
Nevis has few soil types, as well as more problem soils, less good soil for a single-crop economy like cane culture, and extensive areas where good soils become almost unusable because of a profusion of interlayered rocks, clasts, and boulders. Figure 5 displays the four primary soils types of Nevis (adapted from Atkins, 1983). Main soil types are described in Table 1.

**Table 1. Soil types of Nevis (see Figure 5 for locations).**

Soil #	Soil Type	General location
1	Nevis Peak Silty Clay	Occupies the upper elevations of the Nevis Peak
2	Shallow Hilltop Sandy Loam	Mostly found along the northeast facing slopes of Nevis Peak
3	Deep, coarse-textured Rawlins Gravelly Loam	Found along the upper south facing slopes of Nevis Peak and extending eastward to Butlers
4	Montmorillonitic clay with silica pan: Charlestown Loam	Dominates the gently sloping lower elevations on Nevis

## DRAINAGE AND WATERSHEDS

The physiographic aspect of Nevis is that of a cone shape dominated by the central Nevis Peak at 985 m, followed by Butlers Mountain, 578 m, Saddle Hill, 381 m, and Round Hill (Windy Hill), 309 m. The terrain slopes steeply from the peaks, at approximately 40°, but it flattens out to gentle slopes and low cliffs towards the coastal fringe (Figure 6).

**Figure 6.**

Slope categories and percent of land area in each category (source: Atkins, 1983).

Water drains in a radial pattern from Nevis Peak to the ocean through at least ten major drainage basins and is interrupted only by the smaller volcanic cones such as Butlers Mountain, Saddle and Round Hills. These drainage basins, especially along the steeper slopes, are marked by deeply incised ghauts with steep sides, which act as primary channels for drainage. Most of the runoff through these ghauts ends up in the near-shore marine area. The remainder either infiltrates downward to recharge the underground aquifers, or collects in coastal lagoons or wetlands. Almost all of the ghauts are ephemeral except the Bath Stream, which flows year-round to the sea from springs less than 1.6 km inland. Most of the other ghauts flow intermittently, about 3 to 4 times annually, but more excessively after rainfall.

## CULTURAL CONTEXT

### THE FIXTURE OF NEVIS PEAK

The landscape of Nevis today is in large part shaped by thousands of years of human intervention, especially since the 1600s when Europeans arrived on its shore and began a process of colonisation. The



green fabric of Nevis Peak seems without human context and imprint, but it too is in part a product of past human activities. By 1687 most all of Nevis up to the Peak had been cultivated.

The Peak also embodies the culture of Nevis, insofar as the island's culture has been influenced by its landscape. It provided a centralising focus for the Nevisian society that evolved around the Peak; in a real sense, the island's history is its landscape and what its people have constructed upon it. Anyone who has grown up on Nevis views the central cone of the Peak as a fixture, an anchor so to speak, from which everything else seems to evolve. It forms the critical cog in the wheel of Nevis, and that is undeniable to the psyche of Nevisians.

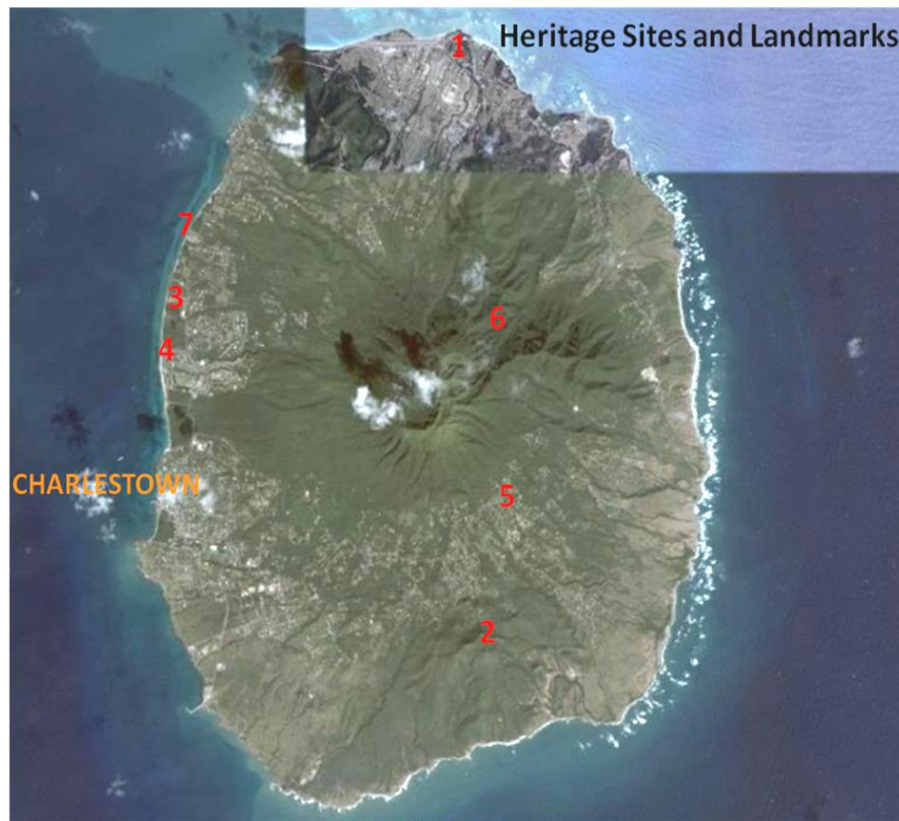
## HERITAGE RESOURCES

Heritage sites are scattered over the Nevisian landscape. Table 2 provides a summary of seven heritage sites and landmarks that are located within and just outside the proposed protected area boundaries (see Figure 7 for their locations). They are highlighted for their relevance and significance to the proposed protected area.

**Table 2. Heritage sites and landmarks, within and outside the proposed Nevis Peak Protected Area.**

HERITAGE SITE	LOCATION	DESCRIPTION	STATUS
<b>(1) Nisbet Plantation</b>	Located at Camps River, east of the Vance Amory Airport in the St. James' Windward Parish.	Nisbet Plantation was once the home of Frances "Fanny" Nisbet, a local socialite, widow, niece of the President of Nevis, and later wife of Sir Horatio Nelson.	The Plantation is now a hotel. The great house remains intact and is a centerpiece of the hotel's ambiance and attraction.
<b>(2) Saddle Hill Fortress</b>	Located on Saddle Hill on the southern side of the island, in the parish of St. George's Gingerland.	The Saddle Hill Fortress dates back to 1740s. It is also known as Nelson's Lookout and is reportedly the best preserved historical fort on the island.	The Fortress is located on public lands; however, one of the most important access trails is through private lands, and this may pose a challenge for long-term development of the site. There are currently no conservation or management initiatives for the ruins, although they are in need of care and protection.
<b>(3) Nelson Spring</b>	West of the village of Cotton Ground, St. Thomas Parish on the west coast of Nevis.	As a wetland and well, the site's reputation dates back hundreds of years. It is reported to be the second largest wetland on Nevis. According to the Nevis Historical and Conservation Society, in the 18 <sup>th</sup> and 19 <sup>th</sup> centuries, the spring was the area where most ships anchored when visiting the island; Sir Horatio Nelson, the decorated and much-celebrated 18 <sup>th</sup> Century British Naval hero, used the Spring periodically to supply his ships with freshwater.	The site is under immense pressure from coastal development and human traffic/activities, both directly and indirectly; alterations in drainage patterns, ground water use, land use, and pollution (chemical and solid waste) are changing the ecology of the wetland.

HERITAGE SITE	LOCATION	DESCRIPTION	STATUS
<b>(4) St. Thomas Anglican Church and School</b>	Located on the west coast, near Pinney's Beach and Nelson's Spring, St. Thomas Parish.	The oldest church in Nevis, the structure has undergone many alterations since the original construction in 1643. It is also believed to be the oldest surviving protestant church structure in the English-speaking Caribbean. It is still used today. It also houses a school.	The church sits on a small overlook with views of the Caribbean Sea, Nevis Peak, the surrounding slopes and St. Kitts. It is also within a stone's throw of Pinney's Beach, coastal wetlands, and two other very important heritage sites—Nelson's Spring and Fort Ashby.
<b>(5) Rawlins Village, Upper Rawlins, and Herbert's Height</b>	Located in the south of the island, southeast of Nevis Peak and to the north of Market Shop. Herbert's Heights and Upper Rawlins are located just above the village.	<p>Rawlins Village is the largest community above 350 m, and within the proposed boundary for the Nevis Peak Protected Area.</p> <p>Herbert's Heights is a commercial and nature experience venture centred around a 17<sup>th</sup> century sugar plantation ruin.</p> <p>Not much remains of the plantation, but archaeological work on the site during the summer of 2003 provided a great deal of information about the extent and use of the site.</p> <p>The area and people of Rawlins are often referred to as the "maroons" or the "maroon community", a reference to a community of runaway slaves that once existed up Rawlins close to the Source Trail. Not much is known about this important aspect of Nevisian history.</p>	
<b>(6) The Water Source</b>	Located in the upper reaches of Fountain Ghut.	A minor source of freshwater supply for the island; maintained for several reasons, including as a heritage site and freshwater provision reserve.	
<b>(7) Fort Ashby, Jamestown</b>		<p>Fort Ashby is also the site of Jamestown, the first settlement on Nevis that was destroyed by an earthquake and tidal wave in 1680.</p> <p>Due to subsequent rebuilding activities, not much remains of the original fort, which was built in 1701, but the site is of major significance given the original settlement that was once present as well as the fort itself.</p>	Most of the structures comprising the original fort are largely obliterated, and Jamestown is mostly underwater. However, the site is relatively secure.



**Figure 7.**

Heritage sites of Nevis.

See Table 2 for identification of the numbers displayed on Figure 7.

## **METHODOLOGIES**

Much of the flora and fauna and many of the ecosystems and landscapes of the proposed NPPA are specialised, exclusive to particular sites, habitats and situations on the island. Many of the species and ecosystems are limited to the moist upland forests and woodlands on the steep slopes of Nevis Peak. Plants such as the Tree Fern and the Cabbage Palm, and animals such as the Brown Trembler and the Forest Bat, and the small area of rainforest are all found high on the slopes of the Peak.

The coastal lagoons are few in numbers and size, with some only a few hundred metres square. Here the island's wetland birds, fish and invertebrates thrive despite increased human pressures.

Nevertheless, while some species and ecosystems are restricted, others are widely distributed throughout the island. Species such as the Mexican Free-tailed and the Jamaican Fruit Bats, the Lesser Antillean Bullfinch and the Thrashers are found across many habitats and zones. Many species, such as birds are transient, some staying as long as food and shelter are available, others only passing through the area on their way to more productive grounds. Some of these transients are seasonal migrants while others are year-long residents.

Prior to and during the period of surveys, extensive reviews of existing literature, aerial imagery and baseline information relevant to the island and surrounding area were carried out.

The research team was unable to undertake population estimates, including detailed distribution data, population dynamics or other systematic estimates, because the time, circumstances and resources of this exercise only allowed for a cursory study of the targeted areas. Eventually, there will be a need for more long-term population and habitat studies of specific taxa over a time span of several years. Where possible, the team made every effort to provide some information on species' status, but this is based on local knowledge, historical accounts, and reports on the species' biology. Species status is given as "rare, uncommon, common, and widespread".

For accurate population estimates, systematic multi-year surveys should be conducted, based on existing protocols, methodologies and statistical analyses that provide spatial, ecological, biological and structural data. Such critical information (on the status and habits of species and ecosystems) will equip park managers to make better informed resource management decisions.

The specific methods used to survey and assess the flora, fauna and environment of the proposed NPPA are discussed below.

## **SURVEY OF THE VEGETATION AND PLANTS**

The proposed Nevis Peak Protected Area consists of steep narrow valleys, rolling hills, rocky outcrops and cliffs, wetlands and beaches, streams, ghauts, small upland pools, forests, woodlands, grasslands, and villages. The sites are quite extensive, and due to limited survey time, the team undertook targeted surveys of specific areas, with the assistance of local experts, local guides, and volunteers.

The flora was assessed by traversing some of the main and secondary trails of forested areas, as well as by hiking along ghauts and drains, by targeting outstanding areas and features such as grasslands, rocky outcrops, and areas thought to hold significant potential to yield interesting species. The survey team also targeted specific plant communities and focused on the unique features and characteristics and species

makeup. Specimens were identified on site, and where and when necessary, photos and specimens were taken for further study and identification.

The team also used aerial imagery to help determine past and current land use, vegetation types and distribution, outstanding and special features, and the location of possible historical/archaeological sites. Where possible, the team used a GPS for rare species of plants and plants collected and pressed as specimens.

## **SURVEY OF TERRESTRIAL VERTEBRATES**

The terrestrial macro vertebrate fauna of the proposed NPPA is limited to native bats, introduced Black and Norway Rats (*Rattus rattus* and *R. norvegicus*), the House Mouse (*Mus musculus*), the introduced Indian Mongoose (*Herpestes javanicus*), the African Green Monkey (*Cercopithecus aethiops*), birds and reptiles.

Reptiles were surveyed and assessed using a combination of incidental observations and encounters, targeted searches of habitats and specific sites/features, from previous reports and records, and from expert knowledge and familiarity with the area.

Amphibians were similarly assessed.

Bats were surveyed by undertaking three nights of observations and mist-netting, and through incidental signs of bat activities. The three nights of netting produced four different species.

For birds, the survey team undertook roost surveys, targeting specific sites such as feeding areas, nesting areas and roosts. The team also employed incidental observations tactics and examined previous reports and records.

## **SURVEY OF TERRESTRIAL AND AQUATIC INVERTEBRATES**

No formal surveys of terrestrial and aquatic invertebrates were carried out. This was because of limited survey time available and the very rigorous demands of invertebrate surveys and species identification.

## **SURVEY OF MARINE ECOSYSTEMS AND ISSUES**

A survey of marine ecosystems was undertaken as a separate effort though unrelated to this project. The marine survey and map product were produced for the Federal Government by Nevis residents, Dr. Judith and Bob Foster-Smith, on behalf of Envision [www.envision.co.uk](http://www.envision.co.uk).

The proposed Marine Protected Area is illustrated in Figure 1 above. It is an area of approximately 35.25 km<sup>2</sup> (13.6 square miles) bound to the northeast by the outer edge of the stony coral reef, encompassing the 'drop-off' into deep water. The southeastern boundary is situated at right angles to the shore from Hick's Cove (to the south of St James's Church). The northwestern boundary is the mid-line between Nevis and St. Kitts, passing through Cow Rocks. The southwestern boundary coincides with the line taken between Nag's Head on St Kitts and St Thomas Church at Paradise. The site includes approximately 7 miles of coastline.

The coordinates of the principal points of the proposed marine protected area are as follows:

On the northwestern Nevis coast (low tide line) START at:

<b>17°10'20"</b>	<b>62°37'40"</b>	north northwest to the centre of the Narrows Channel;
<b>17°11'43"</b>	<b>62°38'30"</b>	north east up the Narrows, to the Cow Rocks
<b>17°12'53"</b>	<b>62°37'14.5"</b>	continuing on the same course, to the corner;
<b>17°15'0"</b>	<b>62°34'45"</b>	turning 90 degrees to the next corner;
<b>17°12'10"</b>	<b>62°32'0"</b>	turning 90 degrees to intersect the NE coast of Nevis at
<b>17°11'12.7"</b>	<b>62°33'7"</b>	

The boundary then follows the low-tide line of the coast to the START point.

## **SURVEY OF THREATENED, RARE AND ENDANGERED SPECIES AND HABITATS**

Special and particular care was taken to locate and identify any critical species of plants, animals and habitats and determine the particular threats and issues relating to their conservation status.

## **SURVEY OF HERITAGE AND CULTURAL RESOURCES**

Information for heritage and cultural resources was obtained from field visits, from discussions with local residents and experts, and from official documentary evidence and reports, including materials from the archives of the Nevis Historical and Conservation Society.

## **OBSERVATIONS: VEGETATION AND FLORA OF PROPOSED NEVIS PEAK PROTECTED AREA**

### **VEGETATION COMMUNITIES**

The survey team reported 19 vegetation communities that exist today in the proposed NPPA and coastal lagoons and wetlands. These communities are quite varied ranging from dry cactus – croton shrubland along lower elevation to rainforest “cloud forest” on Nevis Peak.

The Nevis landscape comprises a complex system of steep narrow valleys, rolling hills, rocky outcrops and cliffs, wetlands and beaches, streams, ghauts, small upland pools, forests, woodlands, and grasslands. This complexity creates environments for a diversity of ecosystems, habitats, climatic conditions and land uses. On Nevis Peak, and other lower summits, “cloud forest” and “montane forests” (among other types) thrive. On the lower sloping land, the vegetation is more open, fragmented, and drier. Here, various land uses are in play, and this helps to somewhat retard natural reforestation as farming, housing development, land clearing and other human activities keep the plant communities in check.

The coastal area is also quite varied in community types. It includes mangrove woodlands, open pools, small “lagoons,” marshes, mudflats, coconut groves and coastal woodlands.

During approximately the last 10 years, much of the characteristic Nevisian landscape—dominated by coconut groves and thousands of palms back-dropped by the dramatic ascendance of the Peak—has succumbed to a lethal “yellowing disease”, caused by a phytoplasma that is transmitted by a leafhopper. Today, thousands of palm dead boles stand stark and leafless.

Despite the loss of one of the island's most dramatic natural features, lagoons and wetlands, on the other hand, have benefited. Coconut groves were once part of a number of copra plantations on the island with the groves functioning as artificial ecosystems. Over hundreds of years, the shade provided by the palms dramatically changed the hydrology, species, and ecology of the wetlands. With the palms now mostly gone, sunlight has filtered back into the system, and this has allowed many of the former conditions to be restored. With further intervention, it may be possible to restore even more components and functions of the wetlands, as close to their original condition as is feasible.

The mini-profiles below provide information on the characteristics and compositions of the 19 vegetation communities found within the NPPA. Figure 8 is a generalised vegetation community map with legend description provided in Table 3.

### **1. EVERGREEN FOREST**

#### **1a. *Dacryodes excelsa*-*Sloanea* montane tropical or subtropical rainforest**

Much of the so-called rainforest on Nevis is secondary; this Alliance may represent the few patches of primary forest. *Dacryodes excelsa* is the most dominant species, sometimes making up more than 60 percent of the tree stems in the community, though this is usually about 40 percent. It shows a strong tendency to associate with *Sloanea* spp.

It is found near or along ghauts, streams, and in sheltered valleys descending to around 1,500 m elevation, especially near the so-called "crater" located on the northwestern slopes of the Peak.

The canopy species in this community may include *Sloanea* spp., *Dacryodes excelsa*, *Symplocos martinicensis*, *Sapium caribaeum*, *Ocotea floribunda*, *Cordia* spp. *Simarouba amaura*, *Euterpe globosa*, *Beilschmiedia pendula*, *Pouteria multiflora*, *Drypetes glauca*, *Cecropia peltata*, *Hymanea courbaril* and *Philodendron* spp. (growing on trees to the canopy).

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

The understory is usually quite open, but may include a few terrestrial ferns, the occasional shrub (including *Hedyosmum arborescens*, *Psychotria* spp.), a few seedlings of species from the canopy, and *Selaginella* spp.

Despite the fact that volcanic islands such as Nevis are stereotyped for possessing great stands of tropical rainforests, true rainforest, as defined by Beard (1949) is primarily limited to the western and southwestern slopes of the Peak above 400 to 500 m elevations. However, there are smaller patches throughout the area above this elevation, usually in sheltered ghauts and valleys.

#### **1b. *Podocarpus coriaceus*-*Euterpe globosa* montane tropical or subtropical rainforest**

This community was identified by Beard (1949) as occupying a narrow belt intermediate between the rainforest (see above) and the "palm brake" on the Jessups side of the mountain. *Podocarpus* composes, in some cases, more than 60 percent of the community, though it grows in close association with the *Euterpe* or Mountain Cabbage Palm. However, this species usually represents about 40 to 50 percent of the tree stems in the forest.

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

The canopy species may include *Podocarpus coriaceus*, stunted trees of *Sloanea* spp., *Dacryodes excelsa* and *Euterpe globosa*, as well as others.

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

#### **1c. *Euterpe globosa* montane tropical or subtropical rainforest**

This community alliance is found at elevations above 450 m on steep slopes with thin soil cover and/or disturbed areas such as land slips, over-cut montane rainforest and/or areas opened as a result of tropical storms.

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



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

Besides the palm, tree ferns make up the single most common species of "tree" (Photo 2).

In canopy, species may include *Euterpe globosa*, *Cyathea arborea*, the occasional *Dacryodes excelsa*, *Podocarpus coriaceus* and *Sloanea* spp.

In the understory, species may include immature individuals of *Euterpe globosa*, *Cyathea arborea*, *Heliconia* spp., *Miconia* spp., *Miconia* spp., *Hedysmum arborescens*, *Hirtella triandra*, and "dwarfed" individuals of *Sloanea* sp., *Dacryodes excelsa* and *Sapium caribaeum*.



**Photo 2.**  
Tree Fern, Nevis Peak area  
(photo credit: Jean-Pierre Bacle).

The ground cover may consist of *Selaginella* spp., *Lycopodium* spp., ground orchids, and other species of terrestrial and epiphytic ferns, mosses and lichens.

### **1d. *Miconia* spp. montane tropical or subtropical cloud forest**

This community is typical at high elevations and has also been referred to as "cloud forest" or "elfin woodland" in past studies. It is found on the summit of Nevis Peak from around 900 m. It is associated with high rainfall, high humidity conditions, extremely high moisture levels, frequent overcast conditions, and high winds. The soil is often waterlogged, but due to the gradient of the slope, runoff is high.

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

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

The tree layer consists of *Euterpe globosa*, *Weinmannia pinnata*, *Cyathea arborea*, *Ilex sideroxyloides*, *Miconia* spp., *Hedysmum arborescens*, *Podocarpus coriaceus*, *Clusia rosea*, *Myrsine coriacea*, *Cyathea arborea*, *Clidemia* spp., *Philodendron* spp., orchids, bromeliads, *Utricularia alpine* (an epiphyte on trees), *Chorizanthe purpureus*, *Freziera undulata* and many unidentified species of vines.

In the herbaceous layer, species may include *Rubus* sp., many fern species, mosses, lichens, *Lycopodium* spp., *Selaginella* spp., orchids (especially the terrestrial orchid *Erythrodes plantaginea*), *Pitcairnia*

*angustifolia*, *Aechmea* sp., *Anthurium* sp., *Philodendron giganteum*, *Lobelia circiifolia*, *Relbunium guadelupense*, *Sauvagesia erecta*, *Viola stipularis*. Grasses - *Isachne angustifolia* and *I. rigidifolia*, *Alloplectus cristatus*, *Psychotria* sp., *Peperomia* sp., the Sedge, and *Scleria* sp.

This community is to be found at the summit of Nevis Peak above 800 to 900 m. There is a lower peak east of Nevis Peak (above Butlers and Mannings) that has a small tract on the summit.

### **1e. *Mangifera indica*-*Bambusa vulgaris* lowland tropical**

This community (also referred to as Subtropical Broad-leaved Evergreen Closed Tree Canopy) can be divided into three distinct strata, namely, the canopy, the mid-story and the ground layers. The canopy may achieve heights of up to about 35 metres and the mid-story reaches 20 metres. In some places, there is an abundance of lianas. The community is largely secondary and occurs in sheltered valleys and slopes at and above 600 m. This community may occur at lower elevations in sheltered valleys.

In Nevis, it occurs at Butlers and in other similar conditions on the slopes of Nevis Peak.

Canopy species may include: *Inga laurina*, *Clusia rosea*, *Ceiba pentandra*, *Dacryodes excels*, *Sapium caribaeum*, *Cecropia peltata*, *Cordia* spp., *Terminalia catappa*, *Mangifera indica*, *Cyathea arborea*, *Acrocomia aculeata*, *Ficus* spp., *Tabebuia heterophylla*, *Coccoloba* spp., among others.

Mid-story species include: *Euterpe globosa*, *Citrus* spp., numerous members of the Melastomataceae, numerous members of the Piperaceae, *Coccoloba* spp., *Pouteria multiflora*, *Ficus* spp. and *Guapira fragrans*.

The understory species include: *Heliconia* spp., *Anthurium* spp., numerous ferns (including primitive ferns), *Philodendron* and *Monstera* spp., orchids, and members of the Piperaceae.

## **2. MIXED EVERGREEN-DECIDUOUS FOREST**

### **2a. *Coccoloba pubescens*-*Guettarda scabra* lowland tropical or subtropical semi-deciduous forest**

This community is found below rainforests on the slopes of Nevis Peak from about 300 m (found lower down in wet ghauts). This is the most extensive forest type on the island. It is highly secondary in nature with a number of exotic species; the Logwood (*Haematoxylum campechianum*), and *Acacia* spp. are the most common. Emergents are not uncommon. The trees may achieve heights of 15 m. However, individual emergents of *Ceiba pentandra*, *Bursera simaruba* and *Hura crepitans* may achieve heights of over 18 m. There is a canopy and a mid-story layer.

The so-called canopy may contain such species as *Coccoloba pubescens*, *C. diversifolia*, *Canella winterana*, *Ceiba pentandra*, *Pimenta racemosa*, *Acacia* spp., *Bourreria succulenta*, *Hura crepitans*, (*Agave* spp.), *Guettarda scabra*, *Haematoxylum campechianum*, *Guapira fragrans*, *Psidium guajava*, *Bursera simaruba*, *Ficus citrifolia*, *Tabebuia heterophylla*, *Inga laurina*, *Acacia* spp., *Cordia obliqua*, *Cocos nucifera*, *Zanthoxylum* spp., *Mangifera indica*, and *Terminalia catappa*.

The mid-story species may include *Capparis* spp., *Randia aculeata*, *Daphnopsis americana* (more common on Nevis), *Jacquinia amillaris*, *Lantana* spp., *Eugenia* spp., *Haematoxylum campechianum*,

*Leucaena leucocephala*, *Annona squamosa*, *A. muricata*, *Erythroxylum havanense*, *Croton astroites*, *Bourreria succulenta*, *Miconia* spp., and *Caesalpinia bonduc*.

On Nevis, this community is found on the lower slopes of Nevis Peak, Butlers Mountain and parts of Camps Ridge.

### **3. EVERGREEN WOODLAND**

#### **3a. *Cocos nucifera* grove**

Extensive coconut plantations were developed for the copra industry in the early years of 20th century, but have been abandoned within the last 20 to 30 years.

The species usually include *Cocos nucifera*. Occasional trees of *Acacia* sp., *Tabebuia heterophylla* and the shrub *Lantana involucrata* also occur.

However, in the last 10 years, the great stands of the adult coconut palms, which was so characteristic of this area of Nevis, have succumbed to lethal yellowing, or palm blight (also known by many other names throughout the world), a disease caused by a phytoplasma (an unculturable cell wall-less bacterium); in the Caribbean, it is reportedly transmitted by a leafhopper *Myndus crudus*.

The disease has brought about the death of thousands of palms across the island; on the west and north coast where great stands of the palm had once seemed to define the landscape of Nevis, only dead boles now remain, which stand like ghostly shells of a cataclysmic event.

This community is found on the west coast of Nevis, north of Charlestown; also on the western lower slopes of Nevis Peak.

#### **3b. Gardens, including, farms, orchards and groves**

This community is a mixture of various species of plants, most imported to the island over the last 500 years. This would include the Amerindian contributions as well as European arrivals and present inhabitants.

This community occupies areas in and around human settlements that are deliberately planted with carefully selected species or, in some rare instances, local species whose growth is encouraged. Owners of these properties derive certain benefits from these species including shelter, shade, food, medicine, fuelwood, security and aesthetics. There is no canopy and mid-level understory.

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

It is found around homes and settlements throughout Nevis, including Charlestown and Rawlins, and around human settlements along the coast.

**3c. *Acacia* sp.-*Haematoxylon campechianum* tropical or subtropical broad-leaved evergreen woodland**

This community occupies areas that were former pastures. It is a successional stage. There are patches of woodland, but the community consists primarily of scattered individual trees and shrubs.

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

The community is found throughout Nevis at abandoned pastures and agricultural fields.

**3d. *Cyathea arborea* tropical or subtropical broad-leaved evergreen woodland**

Found at elevations above 600 to 700 m on steep slopes (may be found at lower elevations, but in very moist areas). This is primarily considered a community in a successional stage since it usually occurs on disturbed sites such as land slips, on deforested areas and exposed slopes. However, in areas too steep to maintain large trees, the vegetation may consist of tree ferns with a few *Euterpe globosa*. Most of the tree ferns do not exceed heights of up to 5 m.

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

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

The community is found on the steep exposed slopes of Nevis Peak.

**3e. *Philodendron giganteum* elephant ear tropical or subtropical broad-leaved evergreen woodland**

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

This community never occupies extensive areas. It may cover small patches with a few trees to areas that may cover just a few hectares, and may integrate with the above community.

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

The community is found on the steep exposed slopes of Nevis Peak.

#### 4. MIXED EVERGREEN DECIDUOUS WOODLAND

##### **4a. *Pisonia subcordata*-*Bursera simarouba* tropical or subtropical semi-deciduous woodland**

Trees grow to about 5-10 m. There are two strata: canopy and mid-level, with little or no herbaceous vegetation. There are many species of vines found growing on the trees.

This community may in fact be an earlier stage in the succession towards the ***Coccoloba pubescens*-*Guettarda scabrasemi-deciduous forest***, although this is not conclusive. Some of these areas have reverted to "natural" vegetation, yet other areas are still heavily managed and maintained using fire.

The canopy may consist of *Pisonia subcordata*, *Plumeria alba*, *Tabebuia heterophylla*, *Bursera simarouba*, *Piscidia carthagenensis*, *Haematoxylon campechianum*, *Canella winterana*, *Acacia* spp., *Capparis* spp., and *Amyris elemifera*.

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

The community is found on Round Hill, Hurricane Hill and the lower part of Camps Ridge.

#### 5. EVERGREEN SHRUBLAND

##### **5a. *Pilosocereus royeri*-*Croton flavens* extremely xeromorphic evergreen shrubland with sparse tree layer**

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

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

The community is found on Round Hill.

##### **5b. *Erithalis fruticosa*-*Pilosocereus royeri* tropical or subtropical broad-leaved evergreen shrubland**

The vegetation community consists of small shrubs and stunted trees. There is no distinct strata. It is found on dry exposed slopes with thin soils at Saddle Hill, though small patches may be found at Round Hill. However, here the shrubland is somewhat taller and denser, and the species composition may vary slightly. The community at Round Hill warrants further study and assessment to clarify the differences between the two sites.

Species include: *Erithalis fruticosa*, *Acacia* spp., *Coccoloba* spp., *Chamaecrista glandulosa*, *Randia aculeata*, *Eugenia* spp., *Plumeria alba*, *Croton* spp., *Pisonia subcordata*, *Piscidia carthagenensis*, *Capparis* spp., *Krugiodendron ferreum*, *Pilosocereus royeri*, *Agave* sp., *Jacquinia amillaris*, the ground orchid *Tetramicra caniculata* and numerous vines growing on shrubs and trees.

## **6. PERRENIAL GRAMMINOID (HERBACEOUS) VEGETATION**

### **6a. *Acrostichum aureum* seasonally flooded tropical or subtropical grassland**

This community is associated with estuarine mangrove systems. These low-lying areas become flooded during rainy seasons or after heavy downpours. There is little or no shrub or tree cover.

Sedges, and *Achrostichum* sp. are common.

The community is found on the west coast north of Charlestown.

### **6b. *Bothriochloa pertusa* medium-tall tropical or subtropical grassland with sparse tree layer**

This is a secondary grassland community found mostly at Low Ground, but with small patches throughout the island, including the Round Hill and Camps River area, although species composition may also vary. It is dominated by *B. pertusa* and other forb species, though scattered shrubs and trees persist. It may be kept open by livestock and occasional fires.

## **7. HYDROMORPHIC ROOTED VEGETATION**

### **7a. *Laguncularia racemosa* - *Conocarpus erectus* permanently flooded tropical or subtropical hydromorphic rooted vegetation**

This community is associated with estuarine systems. It is permanently flooded, and the vegetation is rooted in the water.

Species include: sedges, grasses and with *Laguncularia racemosa*, *Annona glabra* and *Conocarpus erectus* along the edges.

A number of examples are located on the west coast of Nevis, north and south of the capital, Charlestown.

## **8. SPARSELY VEGETATED AND CONSOLIDATED ROCK COMMUNITIES**

### **8a. Sparsely vegetated cliffs**

This community is defined by plants covering 1-10 percent of the surface area. Although the vegetation cover is sparse, several species occur, including trees.

Species of plants include: *Ficus citrifolia*, *Pilea microphylla*, *Boerhavia coccinea*, *Talinum paniculatum*, *Trianthema portulacastrum*, *Jatropha gossypifolia*, *Pilosocereus royeri*, *Melocactus intortus*, *Opuntia* spp., *Plumbago scandens*, *Metastelma parviflorum*, *Wedelia calycina* and *Chamaecrista glandulosa* var. *swartzii*.

This community is found along the coast of upper New Division, Hermitage and Pearn's.

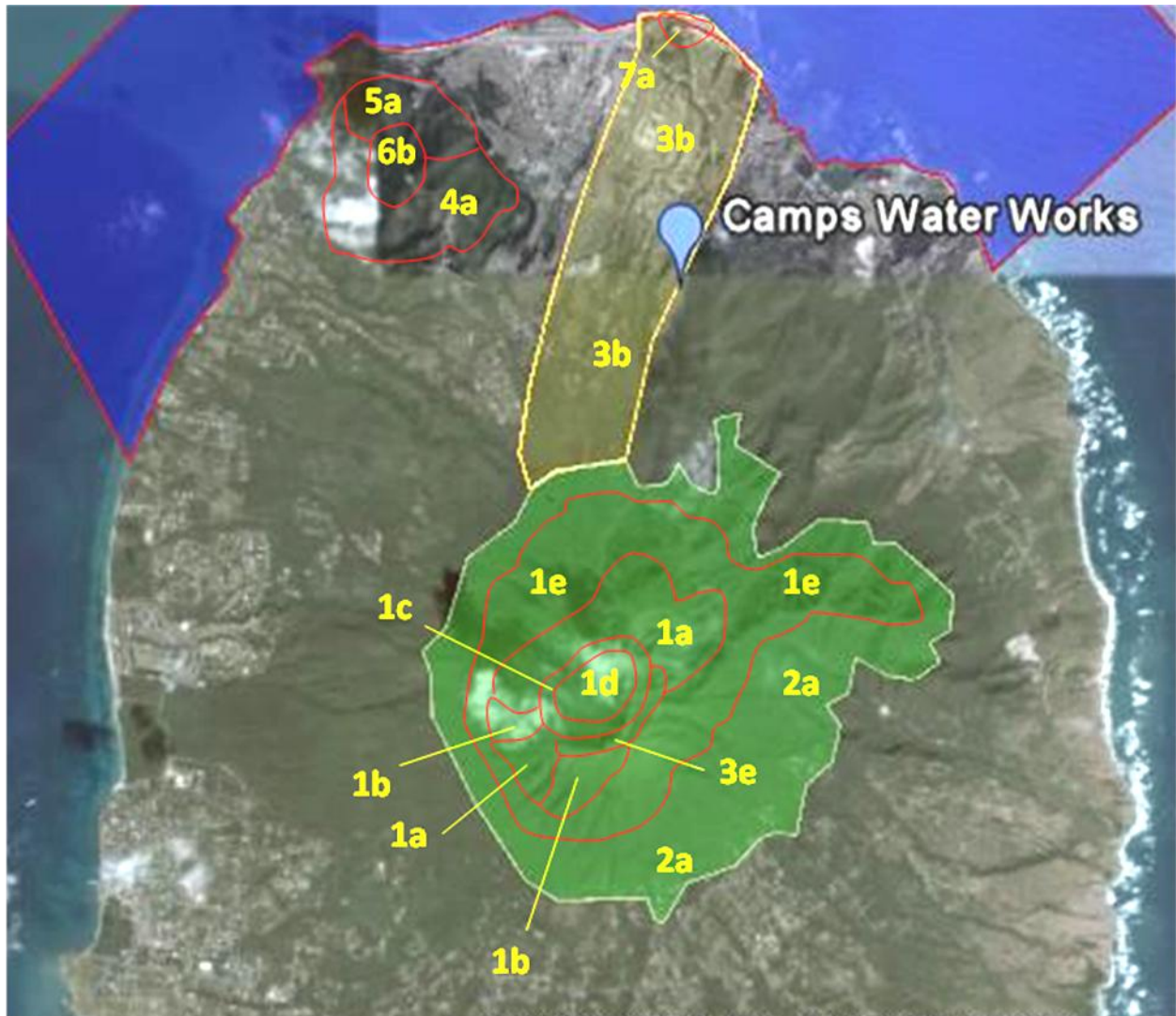
### **8b. Beaches**

This community is defined by a substrate of marine sand, sparsely vegetated by forbs and the occasional shrub. Species include: *Ipomoea pes-caprae*, *Canavalia rosea*, *Chamaesyce* spp., *Sporobolus virginicus*, *Scaevola plumieri*, among others.

**Table 3. Vegetation community types for the proposed Nevis Peak Protected Area.**

NO.	CURRENT CHARACTERIZATION (2009)
<b>1</b>	<b>EVERGREEN FOREST</b>
1a.	<i>Dacryodes excelsa</i> - <i>Sloanea</i> montane tropical or subtropical rainforest
1b.	<i>Podocarpus coraceus</i> - <i>Euterpe globosa</i> montane tropical or subtropical rainforest
1c.	<i>Euterpe globosa</i> montane tropical or subtropical rainforest
1d.	<i>Miconia</i> spp. Montane tropical or subtropical cloud forest
1e.	<i>Mangifera indica</i> - <i>Bambusa vulgaris</i> lowland tropical
<b>2</b>	<b>MIXED EVERGREEN-DECIDUOUS FOREST</b>
2a.	<i>Coccoloba pubescens</i> - <i>Guettarda scabra</i> lowland tropical or subtropical semi-deciduous forest
<b>3</b>	<b>EVERGREEN WOODLAND</b>
3a.	<i>Cocos nucifera</i> grove
3b.	Gardens, including farms, orchards and groves
3c.	<i>Acacia</i> spp.- <i>Haematoxylon campechianum</i> tropical or subtropical broad-leaved evergreen woodland
3d.	<i>Cyathea arborea</i> tropical or subtropical broad-leaved evergreen woodland
3e.	<i>Philodendron giganthum</i> elephant ear tropical or subtropical broad-leaves evergreen woodland
<b>4</b>	<b>MIXED EVERGREEN DECIDUOUS WOODLAND</b>
4a.	<i>Pisonia subcordata</i> - <i>Bursera simarouba</i> tropical or subtropical semi-deciduous woodland
<b>5</b>	<b>EVERGREEN SHRUBLAND</b>
5a.	<i>Pilosocereus royeri</i> - <i>Croton flavens</i> extremely xeromorphic evergreen shrubland with sparse tree layer
5b.	<i>Erithalis fruticosa</i> - <i>Pilosocereus royeri</i> tropical or subtropical broad-leaved evergreen shrubland
<b>6</b>	<b>PERENNIAL GRAMMINOID (HERBACEOUS) VEGETATION</b>
6a.	<i>Acrostichum aureum</i> seasonally flooded tropical or subtropical grassland
6b.	<i>Bothriochloa pertusa</i> medium-tall tropical or subtropical grassland with sparse tree layer
<b>7</b>	<b>HYDROMORPHIC ROOTED VEGETATION</b>
7a.	<i>Laguncularia racemosa</i> - <i>Conocarpus erectus</i> permanently flooded tropical or subtropical hydromorphic rooted vegetation
<b>8</b>	<b>SPARSELY VEGETATED AND CONSOLIDATED ROCK COMMUNITIES</b>
8a.	Sparsely vegetated cliffs
8b.	Beaches





**Figure 8.**

Primary vegetation communities for the NPPA and Round Hill.  
See Table 3 for identification of the numbers displayed on Figure 8  
(note that some communities are too small to map).

## THE FLORA OF THE PROPOSED NPPA

The flora of the proposed NPPA is representative of the once diverse and rich biodiversity of Nevis. Soon after the island was colonised in the 1600s, almost all of the native forests and woodlands were cleared, leaving only the steep slopes—where soils were too thin and prone to severe erosion—still clothed in vegetation. Much of the valuable timber was harvested for construction and to provide fuelwood, as well as other uses.

Widespread and indiscriminate land-clearing has ultimately affected the flora of the island, although, surprisingly, very few studies of the island's plants have been undertaken. What this means is that the magnitude and extent of the loss of floral biodiversity is largely anecdotal, even though strong comparisons can be made to similar situations and conditions on nearby Caribbean islands.

Much of the vegetation of today is secondary and, in some places, highly disturbed as occasional fires, wood harvesting, feral and free-roaming livestock, land clearing and development have fragmented and reduced the quality of the communities, and disrupted ecosystem functions and services. As one ascends from the coast up the slopes to the Peak, the environment becomes wetter and wetter, and as the humidity increases, ferns begin to appear, the forests become taller, and the environment appears more lush and verdant. The island has over 100 species and varieties of ferns and fern allies, most of which are limited to the higher slopes above 300 m (1,000 ft), where the environment is more moist and cool. Many species of plants are found throughout the valleys, plains and upland areas of the Peak and lower summits, although the species of upland moist forests and woodlands are restricted to these areas and **are found nowhere else on the island.**

Plant species compositions were assessed during the fieldwork for the current project. Over 365 species of plants belonging to 102 different families (with three sub-families) were recorded. Appendix I provides a listing of the species recorded to date.

Out of the total number of species recorded, about 337 species (92 percent) are considered native; 28 species or 8 percent are introduced (or exotics). However, the team's findings represent only a cursory study of the true number of species of plants found on Nevis today. Compared to Antigua, the current list of plants is very low.

Given the fact that the island has rainforests and other related vegetative communities, it is to be expected that the number would be closer to 1,500 species. **Nevis is very under-surveyed in terms of vegetation studies and specimen collection.** Much more work is needed, especially if rare, threatened, endangered and endemic species are to be conserved and protected.

## OBSERVATIONS: FAUNA OF PROPOSED NEVIS PEAK PROTECTED AREA

### GENERAL OBSERVATIONS

At the time of colonisation in the 1600s, the island was home to several key faunal species, including the Red-bellied Racer, *Alsophis rufiventris*, the Lesser Antillean Iguana (*I. delicatissima*), the Agouti (*Dasyprocta* sp.) and the Antigua Burrowing Owl (*Athene cunicularia amaura*). These species quickly went extinct after the introduction of the mongoose. The dramatic diminishment of the island's biodiversity is testament to the adverse impacts of introduced invasive species on native fauna.

Faunal species and populations within the proposed NPPA, especially its birds, fluctuate depending on the season, the amount of rain, the availability of food, and on available nesting habitat. North American migrant birds arrive in full force in late October and early November, some only stopping to gorge themselves on the fresh flush of insects, foliage, flowers, nectar, pollen and fruit, which are available in abundance as a result of the rains at that time of the year. Many of the birds continue southward along the Lesser Antillean chain to Trinidad and South America—Nevis a stepping stone on the way.

Many bird species of the proposed NPPA are some of the country's rarest, and many are West Indian regional endemic species. These include the Scaly-naped Pigeon (*P. squamosa*), the Brown Trembler (*C. rauficauda*), the Antillean Euphonia (*E. musica*), the Scaly-breasted Thrasher (*A. fusca*), the Purple-throated Carib (*E. jugularis*), and the Lesser Antillean Flycatcher (*M. oberi*).

Among the sedges and reeds of the coastal wetlands of the west coast and at Camps River, one may hear the ghostly call of the Black or Yellow-crowned Night Herons (*N. nycticorax* & *N. violacea*) as they move about in search of fish. Then the sudden alarm call of the Green Heron (*B. viriscens*), emitted as it is startled from its fishing endeavors, will send any person into flight, or the cackling call of the Clapper Rail (*Rallus longirostris*).

For reptiles, the species include the small snake *Typhlops monastus*, or the Blind Worm/Coffin Borer as it is commonly known. This species is not often observed because it lives in leaf litter, in soil, below logs, and other decaying matter. There are two Anoles on the island: *Anolis bimaculatus* and *A. schwartzi*, both relatively common throughout the island, except in the very wet humid forests on the Peak.

The St. Kitts Ground Lizard (*Ameiva erythrocephala*) is very scarce to rare on Nevis, limited to towns and villages, including Charlestown. It is also found in coastal areas around the wetlands that are adjacent to these marshes and mangrove habitats. The limiting factor for this species is the mongoose.

There are two dwarf geckos present in the proposed NPPA. These small geckos, which are among the smallest lizards in the world, are relatively common in drier habitats on the island and do occur at elevations above 300 m, though in much smaller numbers.

At least two species of frogs, the Whistling Frog (*Eleutherodactylus johnstonei*) and the introduced Cuban Tree Frog (*Osteopilus septentrionalis*), and one toad, the introduced Marine Toad (*B. marinus*), are present.

There are four species of sea turtles reported for Nevisian waters. Of these, the Hawksbill (*Eretmochelys imbricata*), the Green (*Chelonia mydas*) and the Leatherback (*Dermochelys coriacea*), are known to nest on the island. Table 4 below provides a list of the beaches and the species of turtles that nest. The Loggerhead Turtle (*Caretta caretta*) is found in Nevis and St. Kitts waters as well, though it is not known to nest.

**Table 4. Sea turtles of Nevis.**

Species	Location	Notes
Hawksbill ( <i>Eretmochelys imbricata</i> )	White Bay, Landing Bay, Newcastle area (pocket beaches), Pinney's Bay, Indian Castle and Red Cliff	Pinney's Beach is now heavily trafficked and the most developed on Nevis. This is believed to be the major cause of the decline of nesting activity on this beach. Other areas are threatened by sand mining, especially Indian Castle.
Green ( <i>Chelonia mydas</i> )	Pinney's Bay, Red Cliff, Indian Castle, Newcastle	The status situation is very similar to that of the Hawksbill..
Leatherback ( <i>Dermochelys coriacea</i> )	Red Cliff, Indian Castle, Cades Bay, Oualie Beach/Mosquito Bay, Hurricane Hill	Indian Castle has lost much of its sand due to sand mining.

Nevis has lost most of its native terrestrial mammals, and only eight species of bats are known to occur there. After the introduction of the mongoose, an Agouti (*Dasyprocta* sp.) and a native rice or muskrat (*Megalomys* sp.) very quickly went extinct.

In recent years, there have been intriguing reports that the muskrat persists on the Peak where it has escaped the mongoose. However, these reports have not been substantiated.

Other species of terrestrial mammals were introduced and include the Indian Mongoose, the Brown and Black Rats (*R. norvegicus* and *R. rattus*), and the House Mouse (*M. musculus*).

No observations and assessments were carried out on terrestrial and aquatic invertebrates.

A number of species of marine mammals migrate through the waters of Nevis and St. Kitts, although a survey of these species is outside of the scope of work for this project. As an interesting note, the West Indian Manatee (*Trichechus manatus*) is believed to have become extinct soon after European colonisation. Fossil bones of this species have been recovered from Amerindian middens on the island.

## BIRDS

Bird surveys were done along trails, ghauts, bird flyways and wherever the team ventured into the forest. The focal points for bird activity were along trails, pathways, forest edges, open patches in the forest, and wherever fruiting trees and large invertebrate populations occurred.

Almost 90 species of terrestrial, wetland and seabirds were observed during the field surveys for this project and from previous surveys and reports (see Appendix II).

It is important to note that the number of species seen during field operations reflects a short time frame during day light hours and within the season of survey, and therefore offers only a sample of the numbers of species that may occur there throughout the year. The list will undoubtedly expand considerably when surveys are done more frequently, cover all seasons and are a part of a systematic, longer-term study.

Bird numbers and species fluctuate greatly, depending on the season, the amount of rain, the availability of food, and nesting habitat. The arrival of North American migrants on the island during the fall usually coincides with the heaviest rains of the year when there is an explosion of insects, foliage, young plant

shoots, fruits and flowers.

On the northward migration in the spring, when species fly up the Lesser Antillean chain from South America, birds arrive at the end of the dry season, a period when the short but sustaining spring rains usually begin.

Ten species of birds of “**special conservation concern**” have been identified. These species are primarily regional endemics, and are relatively rare on island and throughout the Caribbean region. The species are:

- (1) The **White-crowned Pigeon (*Patagioenas leucocephala*)**: This species is locally common to rare on Nevis, and in the rest of the region it is quite rare and declining. White-crowns are a regional migrant, and disperse widely through the region. Birds born on Nevis may travel far afield to eventually colonize other islands from which it has disappeared due to over-hunting.
- (2) The **Scaly-naped Pigeon (*Patagioenas squamosa*)**: This species is the more common of the two native large columbids found on Nevis today. It may often be mistaken for its close relative, the White-crowned Pigeon (see above), which—from a distance—it closely resembles. It is found in most forests and tall woodlands on Nevis.
- (3) The **Ruddy Quail Dove (*Geotrygon montana*)**: The presence of this species is yet to be confirmed, but a brief sighting of a quail dove along the Source Trail may be of this species. It is easily mistaken for its close relative, the Bridled Quail Dove and so is often overlooked. Though it is not a regional endemic, this species is a shy and retiring bird, rarely ever seen by anyone.
- (4) The **Bridled Quail Dove (*Geotrygon mystacea*)**: This species of bird closely resembles the above species, but has far more color in its plumage. The calls are somewhat similar, although this West Indian endemic bird seems somewhat more common than the former. In habits and needs, these two species are very similar.
- (5) The **Purple-throated Carib (*Eulampis jugularis*)**: This is Nevis's largest and most colorful hummingbird, with a black back and an iridescent scarlet throat. In the upland forests and woodlands, it is the most common large hummingbird (Photo 3).



**Photo 3.**

Purple-throated Carib (*Eulampis jugularis*)  
(photo credit: Jean-Pierre Bacle).

- (6) The **Antillean Euphonia (*Euphonia musica*)**: The Euphonia is Nevis's only resident tanager. Quite colourful in its yellows, greens and blues, the species is extremely difficult to observe. Very little is known about the population numbers and habits of this species.
- (7) The **Scaly-breasted Thrasher (*Allenia fusca*)**: The Scaly-breasted Thrasher and its close cousin, the Pearly-eyed Thrasher (*Margarops fuscatus*), are probably the most well known forest birds on Nevis. They are mimids, relatives of the mockingbirds, and are intelligent, noisy, boisterous and inquisitive. They can often be heard as they tumble around in the trees, fight amongst themselves, and call from the tree-tops; they may peer closely into an observer's face who is likely to squeal like a mouse. The Thrasher is a Lesser Antillean endemic.
- (8) The **Brown Trembler (*Cinclocerthia ruficauda*)**: The Trembler is known from its habit of "trembling" hence the common name. This species is a very rare Lesser Antillean endemic and is locally common, though not often observed, in the forests and woodlands of the Peak. It is also a close relative of *A. fusca* and *M. fuscatus*, although it does not have the boisterous personalities of these other species.
- (9) The **Lesser Antillean Saltator (*Saltator albicollis*)**: Even though this species was not recorded on Nevis during the field survey for the current project, there are past reports of this species on the island. However, it may only occur there as an occasional migrant. It is a species of forests and woodlands, as well as coastal habitats. Nevertheless, it is a rare Lesser Antillean endemic and requires protection if it is present on the island.
- (10) The **Lesser Antillean Pewee (*Contopus latirostris*)**: This Lesser Antillean endemic is a species of high mountain forests and woodlands. Though not confirmed for St. Kitts or Nevis, there are sporadic reports of this very shy flycatcher from both islands. The survey team did not encounter this species in the field, but if it is indeed resident on the island it is noteworthy and is further reason to protect the upland forests of Nevis.

## MAMMALS

Bats are the only native mammals extant on Nevis today. Relatively little is known about them. Previous to this survey, reports have recorded eight species on the island. All eight species are recorded for areas within the proposed protected area, including the coastal wetlands/lagoons. Four of the eight species are Lesser Antillean endemics. During the survey period for this assessment, the team encountered five of the eight species. The bats of Nevis include:

- (1) The **Velvety Free-tailed Bat (*Molossus molossus*)**, a widespread and relatively common species throughout Nevis, especially at lower elevations around settlements and ruins, but it will forage at higher elevations, especially above the forest canopy.
- (2) The **Mexican Free-tailed Bat (*Tadarida brasiliensis*)**, a relatively uncommon small insectivorous species found mostly in lowland areas of Nevis, although sometimes it can be encountered in high elevations in appropriate habitats such as forest edges, open patches and high above the forest canopy.
- (3) The **Funnel-eared Bat (*Natalus stramineus*)** is a Lesser Antillean endemic insectivorous bat. It is very small and prefers caves and large dark cavities in ruins for roosting. It is usually found in very small

colonies of just a handful of individuals. It is uncommon to rare on Nevis.

- (4) The **Jamaican Fruit Bat (*Artibeus jamaicensis*)** is one of the most common bats on Nevis, found throughout most habitats of the island.
- (5) The **Cave Bat (*Brachyphylla cavernarum*)**, a rare, highly gregarious species that seems limited by the availability of hot humid caves. It is a Lesser Antillean endemic.
- (6) The **Forest Bat (*Ardops nicholsi*)** is surprising very common in the upland forests of Nevis. It is a Lesser Antillean endemic.
- (7) The **Insular Single Leaf Bat (*Monophyllus plethodon*)** is a flower and nectar bat of forests and woodland. It is rare and only encountered singly or a handful. It is rare on Nevis as it is throughout most of its range in the Lesser Antilles, where it is endemic;
- (8) The **Fishing or Bulldog Bat (*Noctilio leporinus*)**. This species is the largest bat of the Americas with a wingspan that can extend to over 61 cm (2 ft). It is a very rare species on Nevis and has only been recorded once, and this was in the early 1980s at the Bath Spring area;

Bats are critical to the forest's ecosystem health and wellbeing. These mammals are the primary pollinators, seed dispersers, and beneficial in controlling insect population.

The survey team carried out visual, roost (see Photo 4), and mist netting surveys during the field work period. Mist-netting surveys allowed for a closer examination on individual bats. Observations on gender, breeding status, and general health conditions of the specimens were recorded, along with wing measurements and weight.

Further work is needed assess the bat species of Nevis: including an examination of how they are using the forest, their diets, impact on plant communities, population features, roosting habits, and the importance of a healthy forest to the sustainability of the bats.

Other species of mammals known to occur within the proposed protected area are the introduced and invasive Black Rat (*Rattus rattus*), the Norway or Brown Rat (*R. norvegicus*), the House Mouse (*Mus musculus*), the Indian Mongoose (*Herpestes javanicus*), and the African Green (or Vervet) Monkey (*Chlorocebus sabaeus*). These introduced species move throughout the proposed park area and undoubtedly have a major impact on the ecology of the forest.

The Indian Mongoose, introduced in the late 1800s to control rats that infested sugar cane plantations, is now known to prey on birds, amphibians, reptiles and invertebrates. The rats have similar habits to the mongoose, but operate mostly at nights, while the mongoose is a diurnal forager. The African Green (Vervet) Monkey, introduced from West African approximately 300 years ago as pet, escaped and naturalized. From surveys on Nevis, Young (1990) estimated the population to be around 2,000 monkeys residing mostly in ravines around the island's central mountain. Primarily a fruit and leaf eater, they are also known to eat insects from time to time.

Domestic animals have also caused some level of nuisance on Nevis. These include stray dogs and cats that pose a threat to wildlife, feral goats, sheep, and pigs that overgraze grasslands and contribute to erosion and sediment runoff.





**Photo 4.**

Colony of about 60 bats (*Artibeus jamaicensis*) roosting in an abandoned ruin  
(photo credit: Jean-Pierre Bacle).

## REPTILES AND AMPHIBIANS

There are at least 14 species of terrestrial reptiles and amphibians recorded for Nevis. Of these four are extinct. These include: Lesser Antillean Iguana (*I. delicatissima*), the Slippery-back Skink (*Mabuya bistriata*), the Red-bellied Racer (*A. rufiventris*) and the Giant Ditch Frog or Mountain Chicken (*L. fallax*).

Two species are human-assisted introductions, both amphibians: the Marine Toad *Bufo marinus* and the Cuban Tree Frog *Osteopilus septentrionalis*.

The Lesser Antillean endemic Leptodactylid frog, the legendary Mountain Chicken (*Leptodactylus fallax*), has been reported for Nevis, but soon became extinct after the introduction of the mongoose. This frog, the second largest in the Americas, has gone extinct on Guadeloupe, St. Kitts, Nevis and Antigua, and its last remaining populations on Dominica and Montserrat (the only places on Earth where it is now found) have declined precipitously (the mongoose is absent from these islands). Interestingly enough, anecdotal reports suggest that this species may have persisted on Nevis into the twentieth century. It thrives in wet ghauts and streams and may have found refuge on the slopes of Nevis Peak long after it had disappeared from the lowlands, where the mongoose is very common.

Future efforts should explore the possibility of reintroducing this remarkable species to the island, if the mongoose can be severely controlled and even eradicated. It would go a very long way toward ensuring that this species is not lost.

The dwarf geckos *S. sputator* and *S. sabanus* are locally common, though this apparent abundance is deceptive. Dwarf geckos are amongst the most common of vertebrates in the world, can achieve super



abundance in the leaf litter, and in many islands—such as on Guana Island in the British Virgin Islands—related species achieve densities of about 67,600 ha. But when the mongoose is present, the species declines and is kept in check by this very voracious and opportunistic predator.

The House Gecko or Wood Slave is believed to be a West African immigrant, arriving in the region via slave ships within the last 400 years.

The reptiles and amphibians of the NPPA:

- (1) *Anolis bimaculatus* — Tree Anole is endemic to Nevis, St. Kitts and St. Eustatius. This species is locally common throughout Nevis.
- (2) *Anolis wattsi* — The Brown or Watts Anole is also endemic to these three islands. This species is rather common.
- (3) *Sphaerodactylus sputator* — The Banded Sphero is endemic to Nevis, St. Kitts, St. Eustatius, St. Barts, St. Martin and its satellites, Anguilla and its satellites and Sombrero. Widely distributed across Nevis, but nowhere common, the species seems to show greater affinity to drier lowland habitats, though it is found in upland forests and woodlands and amongst the leaf litter of the forest floor.
- (4) *Sphaerodactylus sabanus* — Northern Leeward Sphero is endemic to Nevis, St. Kitts and St. Eustatius. As with its relative above, the species is widely distributed across Nevis, but is also nowhere common. The species seems to show greater affinity to drier lowland habitats, even though it can be found in upland forests and woodlands, where it is even less common than *S. sputator*, and occurs among rocks piles, piles and chunks of detritus such as dead Agave and the like. It directly competes with *S. sputator*.
- (5) *Hemidactylus mabouia* — The House Gecko/Woodslave is introduced. This species is not officially recorded for Nevis, but is found throughout the island and is relatively common.
- (6) *Thecadactylus rapicauda* — The Forest or Tree Gecko, also called “woodslave” locally. Its population status is unknown, but given its biology and ecological habits, it is believed to be locally common.
- (7) *Typhlops monastus* — The Blind Snake is believed to be locally common, though this conclusion is based on knowledge of the species’ habits throughout most of Nevis.
- (8) *E. johnstonei* — The Whistling Frog is common throughout most of Nevis, even in high elevations of the island.
- (9) *O. septentrionalis* — The Cuban Tree Frog was first introduced to Nevis in the 1990s and has very quickly spread throughout most of the island. It is found high up on the slopes of the Peak.
- (10) *B. marinus* — The Marine Toad was introduced to Nevis, as in most of the West Indies and other part of the world, in the late 1800s to early 1900s. It is a voracious species that will eat just about anything. It is quite adaptable, but prefers moist forests. It is found throughout most of Nevis.

As indicated above, there are four sea turtles reported for Nevis, three of which nest there. These are:

- (1) The Hawksbill Turtle (*Eretmochelys imbricata*) — Nesting
- (2) The Green Turtle (*Chelonia mydas*) — Nesting
- (3) The Leatherback Turtle (*Dermochelys coriacea*) — Nesting
- (4) The Loggerhead Turtle (*Caretta caretta*) — Non-nesting

## **TERRESTRIAL AND AQUATIC INVERTEBRATES**

No surveys of terrestrial invertebrates were carried out, due to the limited timeframe for the project and the very demanding protocols required for invertebrate surveys and species identification.

## LOSS OF NATIVE BIODIVERSITY AND ECOLOGICAL INTEGRITY: HISTORICAL CONTEXT

### NEW SPECIES ARRIVE ON NEVIS

The arrival of Europeans and subsequently African slaves to the shores of Nevis nearly 400 years ago was accompanied by the appearance of many new species of animals and plants, with new challenges for the island's native biodiversity. The colonists soon began clearing native forests and woodlands, using fire and human labour to eliminate, in just a few years, what took nature thousands of years to perfect.

Green or Vervet Monkeys (*Chlorocebus sabaeus*) (Photo 5) were first introduced to nearby St. Kitts, reportedly by French sailors; from neighbouring St. Kitts, the animals were transported to Nevis. By the eighteenth century, with much of Nevis cleared of its native vegetation, and without any natural predators to keep population numbers in check, the Monkey quickly spread across the island.



Photo 5  
A Green (or Vervet) Monkey, near Golden Rock Estate  
(photo credit: Kevel C. Lindsay).

Green Monkeys are native to West Africa. It is now found on St. Kitts, Nevis and Barbados. The species is part of a complex genus, the taxonomy of which was revised (Rowe 1996; Groves 2001). The species was formerly considered to be *Cercopithecus aethiops*.

But Green Monkeys were not the only new arrivals. The colonists soon introduced other faunal species, plus new plants and land practices, including Indigo and the species of grass that, for a time, dominated the society, culture and environment of the island—sugar cane.

The Europeans also introduced the Black or Tree Rat (*Rattus rattus*), the Brown or Roof Rat (*R. norvegicus*) and the House Mouse (*Mus musculus*), species usually associated with human habitations in towns and villages, but

which can quite easily survive in wild environments. These Old World rodents first came to Nevis on sailing ships with the first colonists.

At the height of the sugar industry on Nevis, many wealthy landowners clamored for the deliberate introduction of the small Indian Mongoose (*Herpestes javanicus*), a species that had been successfully introduced in Jamaica to rid that island's cane fields of native and introduced rodents that destroyed crops and devastated the monoculture economy. The introduction of the Mongoose in Jamaica soon had quick success in reducing rat populations, and it was with this success in mind that the species was introduced to Nevis and other islands in the West Indies.

Local Nevisian planters easily brushed aside critics' arguments that the Mongoose was a dangerous pest that would do more harm than good. For them, their livelihood was at stake, and they saw salvation in this animal, given its apparent success in Jamaica.

However, soon after its introduction, the early warnings of critics proved all too accurate. There was an early reduction in the population of rats, wrought by the presence of the Mongoose. However, the rodents quickly adjusted to its presence by retiring to trees and by moving higher into the upland forest, aided by the fact that rats are habitually nocturnal while the Mongoose is a diurnal or daytime animal. Because the rats were able to quickly adapt, their impact on native fauna steadily increased.

Another deliberate introduction was the Marine Toad (*Bufo marinus*) in the nineteenth century from Central America to rid the island of the sugar cane boring beetle. The Toad ignored the beetle and instead quickly began devouring native species.

In the mid-1990s, the Cuban Tree Frog (*Osteopilus septentrionalis*) was unwittingly introduced around the Four Season's Resort (site no. 1, Figure 3) through the importation of potted plants, from which location it quickly spread throughout the island. The Cuban Tree Frog is a mildly toxic species native to the island of Cuba and has been widely introduced throughout the Caribbean and south Florida.

But mammals and amphibians are not the only invasives to have been introduced in Nevis. Like the Cuban Tree Frog, other introductions may have been accidental and may have appeared, at least initially, to be benign. For example, in the last 10 years, great stands of adult coconut palms, which were so characteristic of the Nevisian landscape, have succumbed to lethal yellowing, caused by a phytoplasma that was reportedly transmitted by a leafhopper *Myndus crudus*. The result of this disease has been the death of thousands of palms across the island. On the west and north coast where great stands of the palm once stood, there now remain only dead boles.

The introduction of lethal yellowing highlights the need for a stringent plant quarantine structure and treatment; both are critical to preventing the arrival and spread of invasive species in Nevis, especially invertebrates and plants. Lethal yellowing has extracted an enormous financial cost and other economic burdens in Nevis; there are no figures available to support the extent of these costs and losses, which is unfortunate given the significance of the disease and its impacts. Palms are an important aesthetic and food resource for the island. Homes and businesses, particularly hotels, expend considerable resources (financial, human, infrastructure and time) on sourcing, growing and maintaining these plants. Some businesses also spend thousands of dollars on disease treatment.

Amerindians too had a role in introducing new species to the islands of the Caribbean. In fact, many of the species now believed native might have had assistance from the region's first settlers. Species such as the Red-footed Tortoise (*Geochelone carbonaria*), the Green Iguana (*Iguana iguana*), the Lesser Antillean Iguana (*I. delicatissima*), the Agouti or Coney (*Dasyprocta* sp.), rodents (*Megalomys*, formerly *Oryzomys*), snakes (*Boa constrictor*) and many plants such as the pineapple, wild peppers, papaya, grasses and sedges, sour sop, sugar apple, tobacco and roucou (*Bixa* sp.) were undoubtedly moved from island to island by Amerindians throughout the Caribbean, including Nevis.

But the impact of these "new" species is thought to be very limited, and, in fact, these animals and plants are now considered important components of the native fauna and flora. They easily moved from island to island, assisted by storms, the ocean currents and Amerindians. However, the species that the European colonists brought were entirely new and are far more voracious and invasive.

## INTRODUCTIONS = REDUCTIONS

The introduction of new species to Nevis from the Old World had far-reaching effects. Combined with the wholesale clearing of the forests and woodlands, the new arrivals soon invaded most of the habitats on the island, and many species and ecosystems succumbed to them or were permanently altered.

On St. Kitts, the introduction of the Monkey is believed to have played some role in the decline of the St. Kitts Bullfinch (*Loxigilla grandis*). The species soon became confined to the higher elevations where the Monkey was largely absent. The Bullfinch is now believed to be extinct, disappearing after a severe hurricane devastated St. Kitts in the 1930s and wiped out what is believed to have been the last population of this bird. The Bullfinch may also have been present on Nevis, but the early introduction of the Monkey to the island and the felling of the native forests likely wiped out the species before anyone recognised its presence. Fossils believed to be of this species have been found as far away as Barbuda, giving credence to the suggestion that it was once more widespread in the Leeward Islands.

The adverse impact of the Green Monkey on native ecology has largely been dismissed because the animal is believed to be a vegetarian for the most part. However, the animal's habits and impacts are far more complex—and sometimes more subtle. It is known to consume a large amount of plant matter and invertebrates, and to be an opportunistic predator of birds, eggs, nestlings, small reptiles and amphibians. Not only does its diet have a major impact on native biodiversity, but the Monkey also impacts vegetation by chewing on plants and stripping bark and by removing fertile materials. We have come to assume that the landscape of Nevis we see today has always been or is largely a native process that has proceeded unchanged for millennia. But the Monkey has had a dramatic effect on this landscape, and has helped weave the fabric of the island's natural history ever since it first came to these shores.

The impact of the Mongoose has been more dramatic and obvious. Soon after its introduction, the animal was blamed for the decline of ground nesting birds, especially doves and seed eaters. The animal decimated the Coneys (*Dasyprocta* sp.), the Iguana (believed to be *I. delicatissima*), the large Leptodactylid Frog, the Mountain Chicken (*Leptodactylus fallax*), the second largest amphibian in the Americas, a native rat (*Megalomys* sp.), the Slipperyback Skink (*Mabouya mabouia*), the Red-footed Tortoise (*G. carbonaria*) and the Colubrid Snake (*Alsophis rufiventris*). Most of these species are still to be found on other islands in the Lesser Antilles, and a few stragglers of the Tortoise and the Skink may hold out on Nevis. *L. fallax* is now threatened by a global fungal disease, habitat destruction, natural disasters and over-hunting. The native rat is now believed extinct.

The Cuban Tree Frog is a recent introduction, and no studies have been done on its impacts; however, it is known to predate on small birds, invertebrates, other amphibians and reptiles. It also excludes other amphibians from ecosystems by its sheer numbers—it out-competes them. It is also a pest in freshwater ponds, reservoirs, pools and cisterns, and is mildly toxic and difficult to control. Much the same can be said for the Marine Toad, although it never achieved the population numbers that the Cuban does.

## INVASIVE SPECIES AND CHANGING ATTITUDES

Attitudes toward invasive species are often contradictory. For example, even though the Mongoose was introduced as a popular response to rodent plundering of sugar crops, it also engendered very negative reactions. In fact, soon after the species was introduced in the West Indies, the Leeward Islands governments went on the offensive and set up a programme to eradicate the animal by paying local

residents for the tails they procured. The programme had only limited success by reducing the animals in localised areas.

As to the Monkey, many residents and visitors see the species as an integral part of the fabric of island life, both natural and cultural. It has become a "heritage symbol" for some. For a small minority, the animal is food and is hunted and eaten, while, for others, it is a pest and is persecuted where and when possible. Many international groups have strongly protested attempts to use culling as a means of controlling its numbers.

A major factor that may have softened public opinion about the Monkey has been the decline of large-scale agriculture and the state's role in the sugar industry. As sugar cane land reverted to shrub land and as farming declined, the animal was no longer a threat to economic well being; instead, it assumed the identity of minor pest and curiosity. As this viewpoint prevailed, and as local monkey-control measures were relaxed, the animal's population exploded across the island of Nevis.

This diversity of views and attitudes toward the Monkey also creates a dilemma for local biodiversity management efforts. It becomes even harder to arrive at a consensus on how to manage the Monkey and safeguard native biodiversity. As the negative impacts of the Monkey and Mongoose began to fade, and as foreign visitors continued to influence and even change local perspectives on the aesthetic value of these species, many residents have accepted the animals as now fundamentally "Nevisian". Today, some tour groups highlight the Monkey as an important part of the "native fauna". The species has come to symbolize "nature" in many respects. But the Monkey is an invasive species that has adverse impacts on the ecology and species of the island, and it is essential that measures be taken to control its populations.

## REEF TO PEAK AND A FRAGMENTED LANDSCAPE

### ENSURING ECOLOGICAL INTEGRITY

As Nevisians move about their island home, they may be oblivious both to the disparity and the connectedness of their island's ecology. Nevis Peak rises in the centre and the sea surrounds on all sides, separate pieces of Nevis's ecological system that could not be more different. Even so, Nevis—as an ecological entity—cannot be sectioned into discrete, independently functioning, self-sustaining units.

Nevis Peak and the surrounding summits are as connected to the sea as the heart is to the lungs of a human being. The rhythms of life beat up and down the corridors of the ghauts that connect the forests and the steep wooded slopes down to the bottomless depths of the ocean where coral reefs and seagrass beds, sand and mud bottoms lay. The island pulses with life and energy because water from rain storms rushes downhill to the coast, and species move quickly and easily back and forth between the two environments, taking with them sediments, nutrients, seeds, pollen, and other vital matter. The seemingly fragmented landscape is largely what Nevisians see, but nature does not operate in this way—in fragments. For Nevis Peak to function as a thriving system, it needs the coastal lagoons, ghauts and ocean, the upland pools and springs, and the species of birds, invertebrates and other fauna and flora that depend on them for survival.

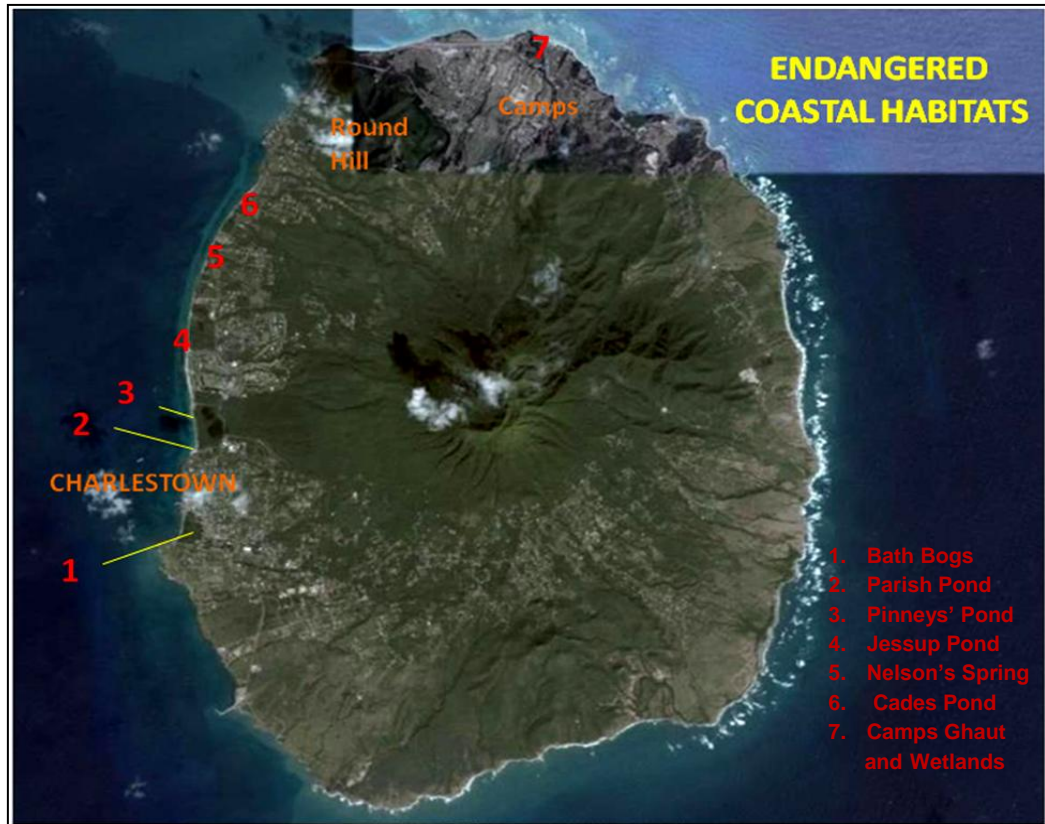
On the northern and western coastlines lay some of the island's most critically endangered habitats—the coastal “lagoon” communities (Figure 9), many of which are either brackish or fresh water. Most of these sites are situated between the capital of Charlestown and the Round Hill swath of the coastline, and a few are between Round Hill and Camps. There are smaller sites east and south of Charlestown. The most famous and well known of these is the Bath Spring located just south of central Charlestown.

Being so close to major towns and urban areas, and located on the coast where significant human and natural forces are at work, means that these wetland habitats have undergone severe alterations over the last 400 years. However, they are still of tremendous ecological value and are a unique part of Nevis's natural heritage which, if degraded or lost, cannot easily be replaced.

Although the coastal lagoons are relatively small aquatic habitats, some of the island's more uncommon species are found only in these areas. Species such as the White-cheeked Pintail (*Anas bahamensis*), the Common Moorhen (*Gallinula chloropus*), herons, pipers, plovers, and many other species are dependent on these wetlands for survival.

In addition, bats, the only extant native terrestrial mammal taxa known on Nevis today, use the wetlands for freshwater and for prey while using the upland forest for cover, shelter and food. They move easily between both environments under the sanctuary of the riparian corridors. In similar ways, forest birds also depend on these habitats. During severe dry periods, as occurred between February and early May 2009, many species abandon the drier areas, lower down slope and along the coast, and move up into the steeper and wetter hinterlands to find shelter, water, food and sanctuary.

These coastal lagoons should be part of a protected areas system, managed for their biodiversity richness and representative uniqueness. The lagoons are connective circuits between the sea and the Peak—a ridge-to-reef network of wetlands and riparian corridors that interact with marine communities and with the wet foggy peaks of the interior. These sites should be offered some form of formal protection and careful management as part of an inclusive Nevis Peak Protected Area.



**Figure 9.**  
Endangered coastal habitats.



## INVASIVE SPECIES

As highlighted above (see "*Loss of Native Biodiversity and Ecological Integrity*"), introducing new species to an area, especially an enclosed island, can have far-reaching adverse consequences. Nevis has experienced its share of deliberate and accidental introductions dating back to the earliest pre-European settlers. However, it is the introductions that have occurred over the last 500 years that have had the most significant impacts.

As noted earlier, in addition to the introduced Black and Brown Rats (*Rattus* sp.) and the House Mouse (*Mus musculus*), the two most significant introduced species are the small Indian Mongoose (*Herpestes javanicus*) and the Green Monkey (*Chlorocebus sabaeus*).

The rat and mouse species were introduced throughout the Caribbean sometime in the fifteenth century, transported aboard European sailing ships. Ecologically, the species are quite adaptable, thriving in a wide variety of habitats and able to exploit many types of food sources, including vegetable and animal matter. However, the rats and mouse are extremely difficult to control given their ecological habits, population numbers, size and difficulty in locating.

The Indian Mongoose was introduced sometime in the 1800s to control rodent damage in cane fields. As in Jamaica and nearby Antigua, this introduction soon had a disastrous effect on native animals. Unfortunately, in those earlier times, relatively little was known or understood about the biodiversity of the island. The Mongoose is now quite common throughout Nevis. During the current survey in April 2009, the animal was even observed in humid cloud forest above 800 m (2,400 ft). There are no estimates of population numbers. In the past, the government of the Leeward Islands paid a bounty on the Mongoose and encouraged residents to kill any specimens captured. This practice has long since been discontinued, but it was effective in localised areas in controlling the species' population numbers, thereby reducing its impact on biodiversity.

The Mongoose is an aggressive and voracious predator, eating just about any vertebrate or invertebrate. Ground-nesting birds and reptiles are especially vulnerable to this species. This is the reason that the endemic St. Kitts Ground Lizard (*Ameiva erythrocephala*) is now rare on the island and limited to Charlestown and large villages. There are a number of other species that have disappeared since the introduction of the Mongoose (and whose disappearance is linked to the introduction of this species). These include: the Lesser Antillean Iguana (*Iguana delicatissima*), last collected on Nevis early in the last century; the Red-legged Tortoise (*Geochelone carbonaria*), a species that may persist on the island, albeit in very low numbers (the Mongoose eats the eggs and young); and the Slippery-back Skink (*Mabouia* sp.), not seen in over 100 years.

The Green or Vervet Monkey, more commonly referred to as the African Green Monkey, was introduced to both St. Kitts and Nevis during the 1600s. The animals have become so much a part of the local psyche that many residents believe they have always been present. The species is known to eat both plant and animal matter, although studies suggest that a large part of its diet is plant based. However, this may be somewhat misleading and does not adequately and accurately paint a true picture of its impact. The animal consumes many invertebrates, which, along with bacteria, fungi and other micro-fauna and flora, make up the bulk of Nevis's biodiversity. It also eats birds, their young and their eggs, and consumes considerable amounts of seeds, flowers, and fresh shoots from native plants, and can also retard their growth. As well, the animals spread non-native species across the island and considerably disrupt natural regeneration.

This means that the impact of this species is complex and far-reaching; it is also little understood. These animals are not only difficult to see and study, but they are easily overlooked and their significance to the loss of biodiversity is often dismissed.

Another invasive species of concern is the Donkey or Burro, introduced to the island as an animal of labour. Feral donkeys have been and continue to be a threat to property, pedestrians and motorists, landscapes, native species, ecosystems, and ecological services throughout the island of Nevis, including areas of the proposed NPPA, especially on the southern and eastern parts of the island. They cause considerable damage to the landscape and biodiversity. They strip trees and other plants of foliage, prevent regeneration, and, as vegetation dies back, the soil becomes exposed and easily erodes. Previous attempts at controlling the animals had resulted in reduced numbers for a time, but, in recent years, the numbers have once again increased dramatically and are again posing serious challenges.

During the current biodiversity assessment, many residents highlighted the uncontrolled presence of feral and free-roaming animals, including donkeys, goats, sheep and monkeys, as one of the most pressing problems confronting residents and one of the most challenging issues limiting the long-term ecological health of the proposed protected area.

## SPECIES OF SPECIAL CONSERVATION CONCERN

There are several **species of special conservation concern** in the proposed protected area.

For birds, these species are listed below (additional information on these species can be found in the section entitled "Observations on the Fauna of Proposed Nevis Peak Protected Area"):

- The **White-crowned Pigeon** (*Patagioenas leucocephala*) – locally common.
- The **Scaly-naped Pigeon** (*Patagioenas squamosa*) – uncommon to rare and restricted.
- The **Ruddy Quail Dove** (*Geotrygon montana*) – rare and restricted.
- The **Bridled Quail Dove** (*Geotrygon mystacea*) – rare and restricted.
- The **Purple-throated Carib** (*Eulampis jugularis*) – rare and restricted.
- The **Antillean Euphonia** (*Euphonia musica*) - very rare and restricted.
- The **Scaly-breasted Thrasher** (*Allenia fusca*) – uncommon and relatively restricted.
- The **Brown Trembler** (*Cinclocerthia ruficauda*) – very rare and restricted.
- The **Lesser Antillean Saltator** (*Saltator albicollis*) – very rare and possibly an occasional vagrant.
- The **Lesser Antillean Pewee** (*Contopus latirostris*) – extremely rare and possibly an occasional vagrant.

For the mammals, the species of conservation concern are:

- The **Funnel-eared Bat** (*Natalus stramineus*) – very rare and restricted.
- The **Cave Bat** (*Brachyphylla cavernarum*) – rare and very restricted.
- The **Fishing Bat** (*Noctilio leporinus*) – extremely rare. Collected only once on Nevis.

Details on these three and other bat species are discussed above in the section on fauna observations.

Though no formal surveys of the invertebrates were undertaken, we are concerned about the native *Macrobrachium* shrimp and prawns in small freshwater pools in the high upland forests. An assessment needs to be carried out to determine the species and ecological status of these animals.

The only reptile that is of major concern is the Ground Lizard. Efforts to control the mongoose would most definitely improve survival of this species.

No invertebrates have been assessed during this survey effort; however, some unpublished data on the micro-invertebrate fauna is available (Bass, 1996 and 1997).


For plants, too little is known about the true conservation status of the species on Nevis for a comprehensive review and status report to be provided at this time. Despite the relatively long history of colonisation, very few experts have actually paid formal attention to the native and naturalised plants of Nevis (except for some orchids and ferns), and, as a result, the number of recorded species is remarkably low, and specimens are under-represented in herbarium collections. It is therefore important that new efforts be undertaken to document the native and naturalised plant species of Nevis, to determine their conservation status, and to design management and conservation options for critical species.

## AREAS OF SPECIAL CONSERVATION CONCERN

The areas of concern include natural plant communities, natural areas, and historical, aesthetic and aquatic resources. Areas of special conservation concern are summarized in Table 5.

**Table 5. Areas of Special Conservation Concern.**

AREA OF SPECIAL CONCERN	RATIONAL FOR SELECTION	STATUS
<b>THE SOURCE</b>	<p>The Source, as it is locally known, is a natural rainwater runoff and spring situated on the southeastern slopes of Nevis Peak above Romney Estate. It is tapped for potable water provisions. Local residents attach an almost cultural mystique to the high-elevation catchment and feel that it requires special recognition as a site of national significance. The area is also important for its montane forests, palm brake and small tracts of rainforests, as well as trails, steep valleys, and wildly dramatic vistas.</p> <p>Wildlife on the upper steep slopes is alive with the whistles of tree frogs (<i>Eleutherodactylus johnstonei</i>), the calls of the Lesser Antillean Flycatcher (<i>Myiarchus oberi</i>), the Brown Trembler (<i>Cinchlocertia ruficauda</i>) and the ghostly Bridled-quail Dove (<i>Geotrygon mystacea</i>), some of the island's most enigmatic species. All are regional endemics.</p>	There are no major threats to The Source and surrounding area. However, excess freshwater exploitation for whatever applications has the potential to produce adverse impacts on the area's environment and species and on the ecological benefits that are linked to the natural runoff of water.
<b>THE CRATER</b>	<p>The Crater offers dramatic vistas, which harken back to a distant past when the slopes of Nevis Peak smoked and rumbled from immense volcanic activities.</p> <p>Today, the Crater walls are clothed in verdant forest cover, which is the best example of rainforest remaining on Nevis.</p>	No major threats known.
<b>FOUNTAIN GHAUT AND BUTLERS</b>	<p>Local residents have identified this area as one of the important sites in need of protection.</p> <p>The ghaat drains a deeply indented and steep valley and is also the location of the Madden's Spring, which provides portable water for parts of the island. Several lower volcanic peaks are located on both sides of this valley. These peaks are little explored and their biodiversity remains largely unknown.</p> <p>On the lower slopes below 300 m, evergreen-deciduous forest quickly gives way to montane, rainforest and palm break. This area provides a dramatic backdrop and is quite popular with hikers.</p>	No specific threats are known.
<b>CAMPS GHAUT AND ASSOCIATED WETLANDS</b>	<p>The land area of the Camps River Ghaat and Wetland is approximately 3.9 km<sup>2</sup> (1.5 square miles). The ghaat is designated for protected status both because of the newly recognised role of ghauts in providing "communication lanes" from upland areas to the coast and as a "slice" through the variety of environments lying between the shore and the 300 m (1,000 ft) elevation. In addition, the Camps River Ghaat is readily accessible, and the springs that feed the water system are a well-known and frequently used recreational site.</p>	The wetland system of Camps is threatened by development on the eastern side and by agriculture on its western side. Pollution (solid waste) and sedimentation from upland areas seems a common, although minor, occurrence.

AREA OF SPECIAL CONCERN	RATIONAL FOR SELECTION	STATUS
<b>COASTAL LAGOONS:</b> Bath Bogs, Pinney's Pond, Parish Pond, Cades Pond and Nelson's Spring	<p>These areas are connective circuits between the sea and the Peak, a reef-to-ridge network of wetlands and riparian corridors which interacts with the marine communities in the sea and the wet foggy peaks of the interior.</p> <p>They are habitats for both resident and migrant shore birds, crustaceans, adult and juvenile fish, and myriad other invertebrates. A very important feature of these coastal systems, as pointed out in the <i>Draft Nevis Physical Development Plan</i> of 2008, is their function as a nursery and sanctuary for juvenile fish.</p>	<p>All of these coastal lagoons and wetlands are under significant development pressure and experience severe pollution impacts.</p> <p>In particular, the Bath Bogs and Spring is reportedly threatened by groundwater harvesting, which affects the level of runoff from the spring.</p>
<b>ROUND HILL</b>	<p>Round Hill displays some of the best remaining examples of Lesser Antillean Caribbean dry forest on the island, especially on the northern, northeastern and northwestern slopes of the Hill. These areas are critically endangered and much of the steeper upland areas of the hill are already being developed. Protecting the remaining areas of this unique forest community is a priority and should be included in the protection offered by the NPPA.</p>	<p>The forest of Round Hill is fast disappearing, and on the upper slopes of the southern, western and northeastern upper areas, much of the forest is now fragmented and targeted for development.</p>
<b>MARINE PROTECTED AREA</b>	<p>The area contains a wide range of marine habitats, namely, robust stony coral reefs, a distinctive patch of shallow-water Elkhorn Coral (<i>Acropora palmata</i>)—considered to be one of the most important reef-building corals in the Caribbean and recently declared an endangered species in the USA—soft coral and algal communities, two types of seagrass, and a variety of marine sediment types.</p> <p>Certain marine organisms are dependent on different types of habitat during the course of their life cycle, and so it is essential to include the whole “mix” of sandy beaches, rocky shore and mangrove communities from the intertidal zone, further increasing the habitat diversity within the proposed protected area. Significantly, the site also includes a range of exposure levels, from very exposed to sheltered. Together, these factors create the foundation of a highly diverse marine life.</p> <p>The outer reef is important for reducing coastal erosion. It acts as a barrier, protecting the island from the impacts of northerly ground swells and waves.</p>	<p>Status information currently being compiled by the Fisheries Office of the Nevis Island Administration.</p>
<b>MOUNT PLEASANT ESTATE</b>	<p>The area offers a variety of historical and wildlife attractions, as well as recreational activity. A network of public footpaths and narrow trails provides access to old ruins and underground chambers, scenic vistas, and a forested atmosphere that hosts a variety of wildlife.</p> <p>An additional attraction is the numerous bat roosts that are easily accessed by the public. At least four different species of bats can be found in the area.</p>  <p><b>Photo 6.</b>            Stones completely removed from the ruin's exterior wall, Mt. Pleasant Estate (photo credit: Jean-Pierre Bacle).</p>	<p>A significant number of stones are currently been removed from the structures of the old ruins, to be used for stone work elsewhere (see Photo 6).</p> <p>Another issue is the growing impact (i.e., roost disturbance) that visitors have when visiting bat roosts.</p>

## **CONSERVATION CHALLENGES FOR PROPOSED NEVIS PEAK PROTECTED AREA**

The conservation challenge for the proposed NPPA will be to define how best to protect, and how much to protect, of the island's biodiversity, landscape, and ecological services within a specifically defined area and doing this as sustainably and effectively as possible. How many critical habitats, representative ecosystems, historical resources and unique and special landscapes of Nevis should be included within the proposed protected area? And how can this be accomplished without causing undue anxiety and even open opposition by residents and other stakeholders?

### **WHERE TO PARK AND WHAT TO PROTECT**

Using the 300 metre (1,000 ft) contour as the basic boundary for a future Nevis Peak Protected Area has major limitations for the protection of biodiversity and other natural and cultural resources. As expected, any boundary so arbitrarily chosen will exclude key habitats and resources that should be included in a system approach to park management. However, extending the proposed boundary further down slope may present other challenges since it could include many communities, settlements and commercial activities and would dramatically increase the size of the area requiring management and oversight.

If the NPPA boundary were to be based on a more fluid approach, it could be designed to follow more nature-defined lines of demarcation, rather than more rigidly defined contour lines, and would more likely include key habitats and resources, while recognising and creatively addressing the needs and concerns of residents and their communities.

### **THE NEW RIVER AND EDEN BOWEN ESTATES AREA**

On the eastern slopes of the island between New River and Eden Brown Estates, the boundary could be adjusted downward to the 167 metre (500 ft) contour to include many of the lower peaks and forest types that are contiguous with the montane and riparian forests above the 300 metre (1,000 ft) contour.

### **THE ROUND HILL AREA**

Round Hill, a dry coastal volcanic remnant located on the northern end of the island (Photo 7), has on its slopes some of the best examples of Lesser Antillean Caribbean dry forest on Nevis (its summits are grassland). This ecologically important forest is potentially endangered by creeping development in the vicinity of Round Hill. Protecting the remaining acreage of this unique forest community from any further encroachment should be a priority conservation goal, and the Round Hill area should be included in the protection offered by the NPPA.

### **COASTAL LAGOONS AND WETLANDS**

On the northern and western coastlines are additional endangered habitats. These are coastal wetlands or "lagoon" communities, many of which are either brackish or freshwater. Most of these sites are situated between the capital Charlestown and the Round Hill swath of the coastline, and a few are between Round Hill and Camps. There are smaller sites east and south of Charlestown. The most famous and well known of these is the Bath Spring located just south of central Charlestown.

The lagoons should be part of a watershed management system for Nevis, protected for their biodiversity richness and representative uniqueness. As part of a national watershed management planning strategy, the lagoons could be developed under the auspices of the NPPA, with the intention of protecting and managing the island's remaining lagoon habitats and riparian corridors.

Table 6 provides a list of wetlands that are recommended for protection. These sites have been recommended by local residents, government officials and the draft *Nevis Physical Development Plan* (2008).

**Table 6. List of coastal wetlands and lagoons for the NPPA.**

WETLAND SITE	LOCATION	STATUS
BATH BOGS	West coast, immediately south of Charlestown near Fort Charles.	Being so close to Charlestown, the wetland is prone to solid waste dumping and other forms of pollution, and the hot springs are affected by groundwater removal for domestic use.
PARISH POND	West coast, at Pinney's Beach, north of Charlestown.	Pinney's Beach has traditionally been an important sea turtle nesting site, but nesting activity has declined over the years as development and human traffic in the area have increased.  Development pressure has also affected this wetland.  The lethal yellowing disease that has been so destructive to coconut plantations elsewhere on Nevis has also wiped out many stands of palms at this location. This has however reduced some stress on the wetland and allowed it to be restored to some of its original functions.
PINNEY'S POND	West coast, at Pinney's Beach, north of Charlestown.	The area has periodically been a target for illegal sand mining.  The lethal yellowing disease has also wiped out many palm stands here.
JESSUP'S POND	West coast, immediately north of the Four Season's Resort.	As with other wetlands situated close to human settlements and major developments along this stretch of coastline, this wetland is vulnerable to adverse impacts from these activities.
NELSON'S SPRING	West coast, located near the village of Cotton Ground.	This wetland is a primary historic heritage sites on Nevis. Like other wetlands close to human activities and settlements, the spring is susceptible to solid waste dumping and chemical pollution (e.g., sewage).
FORT ASHBY WETLAND	West coast, north of the village of Cotton Ground.	Although less affected by human activities than other wetland sites on the west coast, this wetland is still vulnerable to adverse impacts from these activities.
CADES BAY	Northwest coast at Cades Bay.	No major threats known.
NEWCASTLE	North coast at the mouth of Camps River.	This site is already included in originally proposed boundaries for the Nevis Peak Protected Area and Camps River Watershed.



**Photo 7.**

View of Round Hill taken from Mt. Pleasant Estate  
(photo credit: Kevel C. Lindsay).



## RECOMMENDATIONS FOR ACTION

The greatest loss of biodiversity is occurring outside of the boundaries of the originally proposed protected area, although the areas in which these losses are occurring are in many ways directly connected to the integrity of the upland environments of Nevis Peak, and the integrity of the Peak and lower slopes is connected to that of the coastal wetlands and beaches. For a detailed discussion on this subject, see the section above entitled "*Loss of Native Biodiversity and Ecological Integrity*".

Within this context, the biodiversity study team has provided the following recommendations for action.

1. Further initiatives should be immediately undertaken **to document native and naturalised plant species and to determine their conservation status**; such efforts should include management and conservation options for critical species.
2. **Protection and management strategies for surviving coastal wetlands and riparian corridors should be implemented** as part of a national watershed management and conservation plan under the framework of the NPPA.
3. **A study of the impact that domestic water source capture has on Nevis's biodiversity and landscape should be undertaken**; a plan to help offset the adverse impacts of these practices should be developed and implemented (this could include creation of permanent pools in the uplands and reduction of water harvesting in some areas).
4. **Coastal wetland areas should be restored to include native invertebrate fauna** such as freshwater prawns, fish, and micro-invertebrate species.
5. **A mongoose control programme should be undertaken in localised areas** to reduce the adverse impact of the species, especially in coastal areas where sea turtles nest.
6. **Similarly, efforts are needed to manage and control Green Monkey populations throughout the island** to reduce their impact on biodiversity.
7. **Additional systematic surveys of the flora and fauna of the proposed protected area need to be carried out.** The current biodiversity assessment was not comprehensive enough to fully identify and document many of the species that occur within proposed NPPA. Further survey efforts need to expand on the current biodiversity assessment for the NPPA, with sufficient resources to provide for a long-term study that examines in more detail species' population, biology, distribution and ecology and repeats surveys over a two-to-three-year period.
8. **A survey of the spread of the Cuban Tree Frog and its impact on native species needs to be undertaken.** The assessment should determine effective ways to manage and control the species.
9. **A wildlife conservation plan and strategy for wildlife management within the proposed NPPA needs to be developed.**
10. **A similar plan for plant species and critical plant habitats needs to be prepared.** This could include coordination with the ongoing plant project in Antigua carried out under the auspices of the Environmental Awareness Group (EAG); this effort, which has achieved considerable success thus far, is ongoing and will result in publication of a book on the native and naturalised plants of that country.

## DEFINITION OF TERMS

### **Alliance** (as in vegetation community)

Refers to a plant or vegetation community and is the first floristic level in the classification of the community. The Alliance typically includes one or more characteristic species in its title and provides an operational definition that allows it to serve as the basic unit for conservation management concerns.

### **Biodiversity**

Refers to the natural diversity of animals, plants, ecosystems, ecosystem functions, genetic diversity and landscapes in a given area.

### **Common**

Refers to a species of animal, plant or plant community that is widespread in distribution or size.

### **Community** (as in plants, vegetation and ecosystems)

An association of plant species that form the vegetation (sometimes loosely called habitat type as well) of a given area. A "community association" is in some cases, though not all "... an Alliance that may contain several Community Associations, which differ in species composition. The separation of Alliances into Associations is subject to the same prejudices that affect the "splitter versus lumper" debate in taxonomy; in general, we probably erred in the direction of splitting Alliances because the resulting Community Associations provide more information at the species level, and thus improve biodiversity conservation efforts" (Lindsay and Horwith, 1997b).

### **Declining**

A species, ecosystem, habitat or landscape component that is reduced in numbers, capacity and ability over time, from a position of previous stability or optimum capacity.

### **Endangered**

A species, ecosystem, habitat or landscape component that is in danger of becoming extinct in the wild.

### **Endemic**

Native only to a restricted area.

### **Exotic invasive**

A species that has been introduced within historic times that has adverse effects on other species and/or human ecosystems and economies.

### **Introduced**

As opposed to native and indigenous, this term refers to species that have been aided by human intervention during recent historical times. Introduced species are often referred to as exotic, alien or non-indigenous, and may become an invasive at some point.

### **Invasive species**

Usually referred to as an introduced species that has adverse effects on other species and/or on human ecosystems and economies. However, an invasive species can also refer to a native species that has adverse or negative effects on other species, ecosystems, human systems and economies. Invasive species usually result from direct human activity and interference that cause a disruption in the habits and functions of a species and/or its habitat.

**Landscape**

The visible elements of plants, animals, vegetation communities, ecosystem functions, weather and climate, and human activities and functions that define the features of an area of land.

**Least concern**

A species that is of low conservation and/or management needs.

**Marine**

Of or relating to the sea, and usually means species of animals, plants and natural systems that are primarily based in the sea.

**Native**

A species of plant, animal, ecosystem or landscape component that has naturally developed, evolved or occurred naturally.

**Natural Disaster**

A natural hazard that affects human activities and has adverse effects on human ecosystems.

**Rare**

Severely restricted in distribution or size.

**Special conservation concern**

Species of animals and plants, ecosystems, landscapes and habitat that are of greatest conservation priority and in need of management intervention.

**Systematic surveys/sampling**

Refers to the undertaking and use of individual observations intended to provide information on the population and habits of a species and/or ecosystem and ecosystem functions. Several properties or components are measured, including location, species, species composition, weight, habit, time, weather and climate, date, genetics, sex, vocalization, etc.

**Terrestrial**

Refers to primarily land-based species of animals and plants and to the ecosystems that are primarily based there (as opposed to aquatic/marine).

**Threatened**

Refers to the status of a species, ecosystem or landscape component that occurs when the best scientific evidence suggests that the species or habitat is facing threats that may push it toward extinction.

**Uncommon**

Moderately distributed in numbers or size.

## ACKNOWLEDGEMENTS

The Island Resources Foundation (IRF) team for the NPPA biodiversity inventory project consisted of the following:

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The Foundation's team is grateful for extraordinary support and assistance in researching and preparing this report. We may omit contributors in this acknowledgement page, for which we apologize. The sequence of persons identified is not intended to indicate any significance with reference to the importance of their contribution to the project.

The "*Protecting The Eastern Caribbean Region's Biodiversity (PERB) Project*" and the Environment and Sustainable Development Unit (ESDU) of the Organisation Of Eastern Caribbean States (OECS) Secretariat have been more than contract managers for this project—they have been real partners, assisting us to adjust the formal contract terms to the production of products and services that best serve the needs of the people and government of Nevis. Our thanks to: Susanna De Beauville-Scott, Project Coordinator for the PERB Project at OECS/ESDU in St. Lucia, and to Keith Nichols, Director of the ESDU.

The Ministry Of Physical Planning, Infrastructural Development, Environment and Natural Resources and the Nevis Island Administration (NIA) have been helpful and accommodating above and beyond our expectations. Our thanks to Ms. M.W. René Walters, of the Department of Physical Planning and the NIA project manager for this endeavor, who answered every e-mail and every request promptly and thoroughly. And to the other members of the Ministry and the Nevis Island Administration who assisted, especially Ernie Stapleton, Permanent Secretary in the Ministry of Planning, who took time from a busy schedule to help explain local issues and conditions and attend key public meetings, and to Ms. Angela Walters-Delpeche, Director of Physical Planning, and Lemuel Pemberton, Fisheries Officer.

Many knowledgeable conservationists and local biodiversity experts participated in the field work phase of the project and made significant contributions to the scientific and technical aspects of the project, including: Jim Johnson, local naturalist and tour guide, Violet Clarke of the Rawlins Maroon Community Group, and—from the Nevis Historical and Conservation Society (NHCS) and its biodiversity advisory committee—Jennifer Lowery, Paul Diamond, Erin Haney, and John Guilbert, the Society's Executive Director. We also thank Yasmin Baksh-Comeau, Curator of the National Herbarium of Trinidad and Tobago (University of the West Indies-St. Augustine), for advisory support and archiving of plant specimens, and acknowledge the marine survey and map product produced by Nevis residents Dr. Judith and Bob Foster-Smith of Envision, Ltd., which study was used to inform the marine components of the NPPA project.

Our appreciation also to Beverly Parry of Windfall, who facilitated arrangements for accommodations, and the Golden Rock Plantation Inn, who were generous in the use of facilities for meetings and free access to their high-speed wireless connections at all hours of the day and night.

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## APPENDIX I

## PLANT SPECIES OF THE PROPOSED NEVIS PEAK PROTECTED AREA

Table A. Dicotyledon Trees and Shrubs of the Proposed NPPA.

FAMILY	DICOTYLEDON TREES and SHRUBS		FORM	NOTES
	TAXON	COMMON NAME		
Acanthaceae	<i>Odontenema nitidum</i>		Shrub	
	<i>Anacardium occidentale</i>		Tree	
	<i>Comocladia dodonaea</i>	Mango	Shrub	
	<i>Mangifera indica</i>		Tree	Introd
Annonaceae	<i>Annona glabra</i>	Ghaut apple	Tree	
	<i>Annona muricata</i>	Soursap	Tree	
	<i>Annona squamosa</i>	Sugar apple	Tree	
Apocynaceae	<i>Cryptostegia grandiflora</i>	Purple allamanda	Shrub/Climber	Introd
	<i>Plumeria alba</i>	Frangipani	Shrub	
	<i>Rauvolfia viridis</i>		Shrub	
	<i>Tabernaemontana citrifolia</i>		Tree	
	<i>Calotropis procera</i>	Giant milkweed	Shrub	
Araliaceae	<i>Polyscias</i> sp.		Shrub	
Lobeliaceae	<i>Lobelia circifolia</i>		Herb	
Asteraceae	<i>Pluchea carolinensis</i>		Shrub	
Bignoniaceae	<i>Bourreria succulenta</i>		Tree	
	<i>Crescentia cujete</i>	Calabash	Tree	
	<i>Tabebuia heterophylla</i>		Tree	
	<i>Tecoma stans</i> (?)		Shrub	
Burseraceae	<i>Bursera simaruba</i>	Turpentine	Tree	
	<i>Dacryodes excelsa</i>	Incense tree	Tree	
Capparaceae	<i>Capparis baducca</i>		Shrub	
	<i>Capparis cynophallophora</i>		Tree	
	<i>Capparis flexuosa</i>		Tree	
Cunoniaceae	<i>Weinmannia pinnata</i> (?)		Tree	
Caricaceae	<i>Carica papaya</i>	Papaya, papoy	Tree	
Casuarinaceae	<i>Casuarina</i> sp.		Tree	
Celastaceae	<i>Cassine xylocarpa</i>		Tree	
Chrysobalanaceae	<i>Hirtella triandra</i>		Tree	
Theaceae	<i>Freziera undulata</i>	Mountain parrot, pigeon berry	Tree	
Clusiaceae	<i>Clusia major</i>		Tree	
	<i>Mammea americana</i>		Tree	
Combretaceae	<i>Conocarpus erectus</i>	Button mangrove	Tree	
Euphorbiaceae	<i>Croton astroites</i>		Shrub	
	<i>Croton flavens</i>		Shrub	

	DICOTYLEDON TREES and SHRUBS			
FAMILY	TAXON	COMMON NAME	FORM	NOTES
	<i>Codiaeum variegatum</i>		Shrub	Introd
	<i>Euphorbia triloba</i>	Milk cactus	Shrub	Introd
	<i>Hippomane mancinella</i>	Manchineel	Tree	
	<i>Hura crepitans</i>	Sandbox	Tree	
	<i>Sapium caribaeum</i>		Tree	
	<i>Drypetes glauca</i>		Tree	
Goodeniaceae	<i>Scaevola sericea</i>		Shrub	
Lauraceae	<i>Aniba bracteata</i>	Red sweetwood	Tree	
	<i>Beilschmiedia pendula</i>	Sweetwood	Tree	
	<i>Licaria salicifolia</i>		Tree	
	<i>Ocotea floribunda</i>		Tree	
Leguminosae-Caesalpinioideae	<i>Delonix regia</i>		Tree	Introd
	<i>Haematoxylon campechianum</i>	Logwood	Tree	
	<i>Hymenaea courbaril</i>		Tree	
	<i>Senna alata</i>		Shrub	
	<i>Senna bicapsularis</i>		Shrub	
	<i>Senna obtusifolia</i>		Shrub	
	<i>Chamaecrista glandulosa</i>		Shrub	
	<i>Tamarindus indica</i>		Tree	Introd
Leguminosae-Faboidea	<i>Dalbergia ecastaphyllum</i>		Shrub	
	<i>Flemingia strobilifera</i>	Wild hops	Shrub	Introd
	<i>Gliricidia sepium</i>		Tree	Introd
	<i>Indigofera suffruticosa</i>		Shrub	
	<i>Indigofera tinctoria</i>		Shrub	Introd
	<i>Piscidia carthagenensis</i>		Tree	
	<i>Ormosia monosperma</i>	Snakewood	Tree	
	<i>Sesbania</i> sp.		Shrub	
	<i>Sesbania</i> sp.		Shrub	
	<i>Sesbania</i> sp.		Shrub	
Leguminosae-Mimosoideae	<i>Acacia</i> spp.	Acacia	Tree	Introd
	<i>Adenanthura pavonia</i>	Sandal wood	Tree	Introd
	<i>Albizia lebbek</i>		Tree	Introd
	<i>Inga laurina</i>		Tree	
	<i>Leucaena leucocephala</i>		Tree	Introd
	<i>Pithecellobium unguis-cati</i>		Tree	
Erythroxylaceae	<i>Erythroxylum havanense</i>		Tree	
Malpighiaceae	<i>Brysonima spicata</i>		Tree	
Malvaceae	<i>Malachra alceifolia</i>		Shrub	
	<i>Pavonia spinifex</i>		Shrub	
	<i>Sidastrum multiflorum</i>		Shrub	
	<i>Urena lobata</i>		Shrub	
Malvaceae/Bombacaceae	<i>Ceiba pentandra</i>	Silk cotton	Tree	

DICOTYLEDON TREES and SHRUBS				
FAMILY	TAXON	COMMON NAME	FORM	NOTES
Malvaceae/Sterculiaceae	<i>Guazuma ulmifolia</i>		Tree	
	<i>Melochia nodiflora</i>		Shrub	
	<i>Melochia tomentosa</i>		Shrub	
	<i>Waltheria indica</i>		Shrub	
	<i>Hibiscus rosa-sinensis</i>	Hibiscus	Shrub	Introd
Malvaceae/Tiliaceae	<i>Triumfetta lappula</i>		Shrub	
Theophrastaceae	<i>Jacquinia amillar</i>	Torchwood	Shrub	
Myrsinaceae	<i>Myrsine coriacea</i> (?)		Tree	
Sapotaceae	<i>Pouterua multiflora</i>	Penny piece	Tree	
Symplocacaceae	<i>Symplocos martinicensis</i>		Tree	
Melastomataceae	<i>Charianthus purpureus</i> (?)		Shrub	
	<i>Clidemia hirta</i>		Shrub	
	<i>Miconia impetolaris</i>		Shrub	
	<i>Miconia laevigata</i>		Shrub	
Meliaceae	<i>Swietenia mahogani</i>		Tree	
	<i>Cecropia schreberiana</i>	Trumpet tree	Tree	
	<i>Ficus americana</i>		Tree	
	<i>Ficus citrifolia</i>		Tree	
	<i>Ficus obtusifolia</i>		Tree	
Thymelaeaceae	<i>Daphnopsis americana</i>	Mahoe	Tree	
Rhizophoraceae	<i>Rhizophora mangle</i> (?)	Red mangrove	Tree	
Combretaceae	<i>Conocarpus erectus</i>	Buttonwood	Tree	
	<i>Laguncularia racemosa</i>	White mangrove	Tree	
	<i>Terminalia catappa</i>	Almond	Tree	Introd
Myrtaceae	<i>Eugenia biflora</i>		Tree	
	<i>Eugenia axillaris</i>		Tree	
	<i>Eugenia ligustrina</i>		Tree	
	<i>Eugenia uniflora</i>		Tree	
	<i>Myrcia citrifolia</i>		Tree	
	<i>Myrcia deflexa</i>		Tree	
	<i>Pimenta racemosa</i>	Cinnamon	Tree	
	<i>Psidium guajava</i>	Guava	Tree	
Olacaceae	<i>Schoepfia schreberi</i>		Tree	
Nyctaginaceae	<i>Pisonia aculeata</i>		Tree	
	<i>Pisonia subcordata</i>	White loblolly, White mampoo	Tree	
	<i>Guapira fragrans</i>	Black loblolly, Black mampoo	Tree	
Phyllanthaceae	<i>Phyllanthus epiphyllanathus</i>		Shrub	
Piperaceae	<i>Piper dilatatum</i>		Shrub	
	<i>Piper reticulatum</i>		Shrub	
Chloranthaceae	<i>Hedyosmum arborescens</i>		Tree	
Plumbaginaceae	<i>Plumbago scandens</i>		Shrub	
Polygonaceae	<i>Coccoloba diversifolia</i>		Tree	
	<i>Coccoloba pubescens</i>		Tree	



DICOTYLEDON TREES and SHRUBS				
FAMILY	TAXON	COMMON NAME	FORM	NOTES
	<i>Coccoloba swartzii</i>		Tree	
	<i>Coccoloba uvifera</i>		Tree	
	<i>Coccoloba venosa</i>		Tree	
Rhamnaceae	<i>Ziziphus mauritiana</i>	Pommesarat, dunks	Tree	Introd
Rubiaceae	<i>Chiococca parviflora</i>		Tree	
	<i>Erithalis fruticosa</i>		Tree	
	<i>Faramea occidentalis</i>	Wild coffee	Tree	
	<i>Gonzalagunia hirsuta</i>		Tree	
	<i>Guettarda scabra</i>		Tree	
	<i>Guettarda odorata</i>		Tree	
	<i>Palicourea crocea</i>		Shrub	
	<i>Psychotria nervosa</i>		Shrub	
	<i>Psychotria tenuifolia</i>		Shrub	
	<i>Randia aculeata</i>		Shrub	
Rutaceae	<i>Citrus aurantium</i>			
	<i>Amyris elemifera</i>		Tree	
	<i>Triphasia trifolia</i>	Myrtle lime	Shrub	
	<i>Zanthoxylum martinicense</i>		Tree	
	<i>Zanthoxylum punctatum</i>		Tree	
	<i>Zanthoxylum monophyllum</i>		Tree	
	<i>Zanthoxylum spinifex(?)</i>		Shrub	
Salicaceae	<i>Samyda dodecandra</i>	Wild guava	Tree	
Sapindaceae	<i>Melicoccus bijugatus</i>	Guinep	Tree	Introd
Simaroubiaceae	<i>Simarouba amara</i>		Tree	
	<i>Picrasma excelsa</i>		Tree	
Sapotaceae	<i>Chrysophyllum argenteum</i>		Tree	
	<i>Sideroxylon obavatum</i>		Tree	
Solanaceae	<i>Solanum sp.</i>		Shrub	
	<i>Solanum racemosum</i>	Dolly tomato	Shrub	
	<i>Solanum torvum</i>		Shrub	
Theophrastaceae	<i>Jacquinia armillaris</i>		Tree	
	<i>Jacquinia berterii</i>		Tree	
Ulmaceae	<i>Trema macracantha</i>		Tree	
Verbenaceae	<i>Citharexylum fruticosum</i>		Tree	
	<i>Clerodendrum aculeatum</i>		Shrub/Climber	
	<i>Lantana camara</i>	Sage	Shrub	
	<i>Lantana involucrata</i>	Sage	Shrub	

**Table B. Vines and Climbers of the Proposed NPPA.**

	VINES AND CLIMBERS			
FAMILY	TAXON	COMMON NAME	FORM	NOTES
Asclepiadaceae	<i>Metastelma parviflorum</i>		Vine	
Boraginaceae	<i>Tournefortia microphylla</i>		Vine	
Convolvulaceae	<i>Cuscuta americana</i>		Vine	
	<i>Ipomoea obscura</i>		Vine	
	<i>Ipomoea pes-capre</i>	Beach morning glory	Vine	
	<i>Ipomoea tiliaceae</i>		Vine	
	<i>Argyreia nervosa</i>		Vine	Introd
	<i>Jacquemontia cumenensis</i>		Vine	
	<i>Merremia aegyptia</i>		Vine	
	<i>Merremia dissecta</i>		Vine	
	<i>Merremia quinquefolia</i>		Vine	
	<i>Merremia umbellata</i>		Vine	
	<i>Stictocardia tiliifolia</i>		Vine	
	<i>Turbina corymbosa</i>		Vine	
	<i>Poranopsis paniculata</i>		Vine	
Cucurbitaceae	<i>Cayaponia americana</i>		Vine	
	<i>Cayaponia racemosa</i>		Vine	
	<i>Melothria pendula</i>		Vine	
	<i>Momordica charantia</i>	Wash woman, lizard food	Vine	Cult
Euphorbiaceae	<i>Tragia volubilis</i>	Stinging nettle	Vine	
Leguminosae-Caesalpinioideae	<i>Caesalpinia bonduc</i>	Warri	Climber	
Leguminosae-Faboideae	<i>Abrus precatorius</i>	Jumbie bead	Vine	
	<i>Centrosema virginianum</i>		Vine	
	<i>Canavalia rosea</i>	Beach bean	Vine	
	<i>Clitoria ternatea</i>		Vine	
	<i>Galactia dubia</i>		Vine	
	<i>Galactia rubra</i>		Vine	
	<i>Galactia striata</i>		Vine	
	<i>Lablab purpureus</i>		Vine	
	<i>Mucuna pruriens</i>		Vine	
	<i>Mucuna urens</i>		Vine	
	<i>Rhynchosia minima</i>		Vine	
	<i>Rhynchosia reticulata</i>		Vine	
	<i>Teramnus labialis</i>		Vine	
Malpighiaceae	<i>Heteropterys purpurea</i>		Vine	
	<i>Stigmaphyllon emarginatum</i>		Vine	
Menispermaceae	<i>Cissampelos pareira</i>	Velvet leaf	Vine	
Oleaceae	<i>Jasminum fluminense</i>		Vine	Introd
Passifloraceae	<i>Passiflora edulis</i>		Vine	
	<i>Passiflora laurifolia</i>		Vine	
	<i>Passiflora rubra</i>		Vine	

	VINES AND CLIMBERS			
FAMILY	TAXON	COMMON NAME	FORM	NOTES
	<i>Passiflora suberosa</i>		Vine	
Polygonaceae	<i>Antigonon leptopus</i>	Coralita	Vine	Introd
Rhamnaceae	<i>Gouania lupuloides</i>		Vine	
Rubiaceae	<i>Chiococca alba</i>		Vine	
Ulmaceae	<i>Celtis iguanaea</i>		Vine	
Verbenaceae	<i>Petrea kahautiana</i>		Vine	
Vitaceae	<i>Cissus verticillata</i>		Vine	

**Table C. Herbaceous Plants of the Proposed NPPA.**

	HERBACEOUS PLANTS			
FAMILY	TAXON	COMMON NAME	FORM	NOTES
Gesneriaceae	<i>Alloplectus cristatus</i>		Herb	
Lentibulariaceae	<i>Utricularia alpine</i> (?)		Herb	
Acanthaceae	<i>Asystasia gangetica</i>	Chinese Violet	Herb	Introd
	<i>Blechum pyramidatum</i>		Herb	
	<i>Justicia pectoralis</i>		Herb	
	<i>Justicia sessilis</i>		Herb	
	<i>Justicia sp.</i>		Herb	
	<i>Ruellia tuberosa</i>		Herb	
Aizoaceae	<i>Sesuvium portulacastrum</i>		Herb	
	<i>Trianthema portulacastrum</i> (?)		Herb	
Portulacaceae	<i>Talinum paniculatum</i> (?)		Herb	
Urticaeae	<i>Pilea microphylla</i>		Herb	
Amaranthaceae	<i>Achyranthes aspera</i>	Man better one	Herb	
Apocynaceae	<i>Asclepias curassavicum</i>		Herb	
	<i>Catharanthus roseus</i>	Periwinkle	Herb	Introd
Asteraceae	<i>Ageratum conyzoides</i>		Herb	
	<i>Bidens cynapiifolia</i>		Herb	
	<i>Bidens pilosa</i>		Herb	
	<i>Centratherum punctatum</i>		Herb	
	<i>Lagascea mollis</i>		Herb	
	<i>Tithonia diversifolia</i>		Herb	
	<i>Wedelia calycina</i>		Herb	
	<i>Xanthium strumarium</i>		Herb	
Boraginaceae	<i>Heliotropium angiospermum</i>		Herb	
	<i>Heliotropium curassavicum</i>		Herb	
	<i>Heliotropium indicum</i>		Herb	
Brassicaceae/Cruciferae	<i>Cakile lanceolata</i>		Herb	
	<i>Lepidum virginicum</i>		Herb	
Capparaceae	<i>Cleome viscosa</i>		Herb	
Caryophyllaceae	<i>Drymaria cordata</i>		Herb	
Crassulaceae	<i>Bryophyllum pinnatum</i>	love bush	Herb	
Euphorbiaceae	<i>Croton lobatus</i>		Herb	
	<i>Chamaesyce spp.</i>		Herb	
	<i>Jatropha gossypifolia</i>		Herb	
Phyllanthaceae	<i>Phyllanthus amarus</i>		Herb	
	<i>Phyllanthus niruri</i>		Herb	
	<i>Phyllanthus urinaria</i>		Herb	
Lamiaceae	<i>Leonotis nepetifolia</i>		Herb	
	<i>Salvia occidentalis</i>		Herb	
Leguminosae-Faboideae	<i>Alysicapus vaginalis</i>	Moneywort	Herb	
	<i>Desmodium axillare</i>		Herb	

	HERBACEOUS PLANTS			
FAMILY	TAXON	COMMON NAME	FORM	NOTES
	<i>Macroptilium atropurpureum</i>		Herb	
	<i>Vigna lutea</i>	Cow pea	Herb	
Leguminosae-Mimosioidea	<i>Mimosa pudica</i>	Sensitive plant	Herb	
	<i>Desmanthus virgatus</i>		Herb	
Malvaceae/Sterculiaceae	<i>Melochia pyramidata</i>		Herb	
Malvaceae/Tiliaceae	<i>Corchorus aestuans</i>		Herb	
Rubiaceae	<i>Relbunium guadalupense</i>		Herb	
Ochnaceae	<i>Sauvagesia erecta</i>		Herb	
Violaceae	<i>Viola stipularis</i>		Herb	
Onagraceae	<i>Ludwigia erecta</i>		Herb	
	<i>Ludwigia octovalis</i>		Herb	
Oxalidaceae	<i>Oxalis barrelieri</i>		Herb	
	<i>Oxalis corniculata</i>		Herb	
Papaveraceae	<i>Argemone americana</i>	Prickly poppy	Herb	
Nyctaginaceae	<i>Boerhavia coccinea</i> (?)		Herb	
Phytolaccaceae	<i>Petiveria alliacea</i>	Stinking bush	Herb	
	<i>Rivina humilis</i>		Herb	
Piperaceae	<i>Peperomia</i> sp.		Herb	
Solanaceae	<i>Datura innoxia</i>		Herb	
	<i>Datura metel</i>		Herb	
	<i>Nicotiana tabacum</i>	Tobacco	Herb	
	<i>Solanum americanum</i>		Herb	
Turneraceae	<i>Turnera ulmifolia</i>	Yellow alder	Herb	
Umbelliferae	<i>Eryngium foetidum</i>	Clacra	Herb	
Boraginaceae	<i>Cordia curiassavica</i>		Shrub	
	<i>Cordia globosa</i>		Shrub	
	<i>Cordia</i> sp.		Tree	
	<i>Cordia obliqua</i>		Tree	
	<i>Cordia reticulata</i>		Tree	
	<i>Cordia sulcata</i>		Tree	
	<i>Cordia</i> sp.		Tree	
	<i>Cordia curiassavica</i>		Shrub	
Verbenaceae	<i>Priva lappulacea</i>		Herb	
	<i>Stachytarpheta cayennensis</i>		Herb	
	<i>Stachytarpheta jamaicensis</i>	Vervain	Herb	
Zygollaceae	<i>Kallstroemia maxima</i>		Herb	

**Table D. Monocots of the Proposed NPPA.**

	MONOCOTS			
FAMILY	TAXON	COMMON NAME	FORM	NOTES
Agavaceae	<i>Agave karrato</i>		Shrub	
	<i>Agave</i> sp.		Shrub	
	<i>Furcraea tuberosa</i>		Shrub	
	<i>Sansevieria</i> sp.		Herb	Introd
Amaryllidaceae	<i>Hippeastrum punctatum</i>	Lily	Herb	Introd
	<i>Hymenocallis caribaea</i>	Lily	Herb	
Araceae	<i>Anthurium grandifolium</i>	Anthurium	Herb	
	<i>Anthurium</i> sp.		Herb	
	<i>Anthurium</i> sp.		Herb	
	<i>Dieffenbachia seguine</i>	Dumbcane	Herb	
	<i>Monstera adansonii</i>		Herb	
	<i>Philodendron scandens</i>		Herb	
	<i>Philodendron giganteum</i>		Shrub	
	<i>Bromelia pinguin</i>		Herb	
Bromeliaceae	<i>Tillandsia utriculata</i>		Herb	
	<i>Aechmea</i> sp.		Herb	
	<i>Pitcairnia angustifolia</i>		Herb	
	<i>Canna indica</i>	Lily	Herb	
Commelinaceae	<i>Commelina</i> sp.	Water grass, French weed	Herb	
	<i>Callisia repens</i>		Herb	
	<i>Rhoeo spathacea</i>		Herb	
Dioscoreaceae	<i>Dioscorea polygonoides</i>		Vine	
Heliconiaceae	<i>Heliconia caribaea</i>		Shrub	
Maranthaceae	<i>Marantha arundinacea</i>	Arrowroot	Herb	
Orchidaceae	<i>Tolumnia urophyllum</i>		Herb	
	<i>Vanilla planifolia</i>	Vanilla	Vine	
	<i>Erythroides plantaginea</i> (?)		Herb	
Palmae	<i>Acrocromia aculeata</i>		Tree	
	<i>Coccoloba nucifera</i>	Coconut	Tree	Introd
	<i>Euterpe globosa</i>	Mountain cabbage palm	Tree	
	<i>Roystonea oleracea</i>		Tree	
Podocarpaceae	<i>Podocarpus coriaceus</i>		Tree	

**Table E. Ferns, Cacti and Grasses of the Proposed NPPA.**

	FERNS			
FAMILY	TAXON	COMMON NAME	FORM	NOTES
Lycopodiaceae	<i>Lycopodium</i> spp.	Clubmoss	Herb	
Selaginellaceae	<i>Selaginella</i> sp.	Spikemoss	Herb	
Cyatheaceae	<i>Cyathea arborea</i>	West Indian tree fern	Tree-like	
Hymenophyllaceae	<i>Trichomanes krugii</i>		Herb	
Hymenophyllaceae	<i>Trichomanes membranaceum</i>		Herb	
	<i>Campylaneurum latum</i>		Herb	
Polypodiaceae	<i>Blechnum occidentale</i>		Herb	
	<i>Acrostichum danaeifolium</i>	Leather fern	Herb	
	<i>Adiantum tenerum</i>		Herb	
	<i>Asplenium cristatum</i>		Herb	
	<i>Asplenium</i> sp.		Herb	
	<i>Tectaria incisa</i>		Herb	
	<i>Microgramma lycopodioides</i>		Herb	
	<i>Microgramma piloselloides</i>		Herb	
	<i>Nephrolepis hispatula</i>		Herb	
	<i>Pteris biaurita</i>		Herb	
	<i>Thelypteris kunthii</i>		Herb	
	<i>Thelypteris tetragona</i>		Herb	
	<i>Thelypteris</i> sp.	Pepper fern	Herb	
	CACTI			
FAMILY	TAXON	COMMON NAME	FORM	NOTES
Cactaceae	<i>Hylocereus trigonatus</i>	Night blooming cacti	Climber	
	<i>Pilosocereus royeri</i>		Tree	
	<i>Mammillaria nivosa</i>		Herb	
	<i>Melocactus intortus</i>		Herb	
	<i>Opuntia</i> spp.(?)		Shrub	
	GRASSES			
FAMILY	TAXON	COMMON NAME	FORM	NOTES
Poaceae/Graminaceae	<i>Bambusa vulgaris</i>	Bamboo	Tree-like	Introd
	<i>Vetiveria zizanioides</i>	Veteveria	Herb	Introd
	<i>Lasiacis</i> sp.	Bamboo grass	Herb	
	<i>Sporobolus virginicus</i>	Beach grass	Herb	

	GRASSES			
FAMILY	TAXON	COMMON NAME	FORM	NOTES
	<i>Scleria</i> sp.		Herb	
	<i>Isachne angustifolia</i>		Herb	
	<i>Isachne rigidifolia</i>		Herb	

**Key:**

**Introd** = Introduced; **(?)** = questionable record



## APPENDIX II

### BIRDS OF THE PROPOSED NPPA AND SURROUNDING AREAS

Common Name	Species	Status and Range
Pied-billed Grebe	<i>Podilymbus podiceps</i>	
Brown Booby	<i>Sula leucogaster</i>	Tropical & subtropical oceans of the world, Mig, UnC
White-tailed Tropicbird	<i>Phaethon lepturus</i>	Tropical & sub-tropical oceans of the world, N, Rare to possibly extinct
Red-billed Tropicbird	<i>Phaethon aethereus</i>	Atlantic, Indian & Pacific Oceans, Very Rare
Brown Pelican	<i>Pelicanus occidentalis</i>	Tropical America, Lc, N
Magnificent Frigatebird	<i>Fregata magnificens</i>	Tropical Atlantic & West Africa, Comm, N
Snowy Egret	<i>Egretta thula</i>	Western Hemisphere, Rare, breeding?
Great Blue Heron	<i>Ardea herodias</i>	Americas, UnC
Great Egret	<i>Ardea alba</i>	Americas & worldwide , Lc, breeding?
Little Blue Heron	<i>Egretta caerulea</i>	Americas, Lc, breeding?
Cattle Egret	<i>Bubulcus ibis</i>	Tropical America, Africa, Asia and Pacific, Decl
Green Heron	<i>Butorides virescens</i>	Americas, Lc, breeding
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	Worldwide, Rare, breeding
Yellow-crowned Night Heron	<i>Nycticorax violacea</i>	Americas, Lc, breeding?
Fulvous Whistling Duck	<i>Dendrocygna bicolor</i>	Americas, East Africa & India
West Indian Whistling Duck	<i>Dendrocygna arborea</i>	West Indian endemic
Green-winged Teal	<i>Anas crecca</i>	Northern Hemisphere
White-cheeked Pintail	<i>Anas bahamensis</i>	Americas, Lc
Osprey	<i>Pandion haliaetus</i>	Worldwide, Rare
Broad-winged Hawk	<i>Buteo platypterus insulicola</i>	Endemic subspecies
American Kestrel	<i>Falco sparverius</i>	Americas, Lc
Merlin	<i>Falco columbarius</i>	America, Eurasia, Rare
Peregrine Falcon	<i>Falco peregrinus</i>	Worldwide, Rare
Sora	<i>Porzana carolina</i>	Americas, very Rare
Clapper Rail	<i>Rallus longirostris</i>	Americas, UnC to Rare
Common Gallinule	<i>Gallinula chloropus</i>	Americas, Lc
Semipalmated Plover	<i>Charadrius semipalmatus</i>	Western Hemisphere, Lc
Wilson's Plover	<i>Charadrius wilsonia</i>	Western Hemisphere, breeds, UnC
Snowy Plover	<i>Charadrius alexandrinus</i>	Worldwide, UnC
Killdeer	<i>Charadrius vociferus</i>	Worldwide, UnC to Rare
Black-bellied Plover	<i>Pluvialis dominicus</i>	North & South America, Rare
American Oystercatcher	<i>Haemantopus palliatus</i>	Americas, resident, breeds? Rare
Black-necked Stilt	<i>Himantopus mexicanus</i>	Western Hemisphere, Lc
Ruddy Turnstone	<i>Arenaria interpres</i>	Worldwide, UnC, breeds?
Solitary Sandpiper	<i>Tringa solitaria</i>	Americas, UnC

Common Name	Species	Status and Range
Spotted Sandpiper	<i>Actitis macularia</i>	Western Hemisphere, UnC
Lesser Yellowlegs	<i>Tringa flavipes</i>	Western Hemisphere, UnC
Greater Yellowlegs	<i>Tringa melanoleuca</i>	Western Hemisphere, Lc
Willet	<i>Catoptrophorus semipalmatus</i>	Western Hemisphere, UnC to Rare, breeds
Whimbrel	<i>Numenius phaeopus</i>	Worldwide, UnC to Rare
Hudsonian Godwit	<i>Limosa haemastica</i>	Western Hemisphere, Rare
Sanderling	<i>Calidris alba</i>	Worldwide, Rare
Least Sandpiper	<i>Calidris minutilla</i>	Americas, UnC
White-crowned Pigeon	<i>Patagioenas leucocephala</i>	WI, Lc
Scaly-naped Pigeon	<i>Patagioenas squamosa</i>	WI, UnC
Zenaida Dove	<i>Zenaida aurita</i>	WI, Comm
Common Ground Dove	<i>Columbina passerina</i>	NT, Comm
Bridled Quail Dove	<i>Geotrygon mystacea</i>	LA, Rare
Ruddy Quail Dove	<i>Geotrygon montana</i>	NT, Rare
Mangrove Cuckoo	<i>Coccyzus minor</i>	WI, Comm
Purple-throated Carib	<i>Eulampis jugularis</i>	LA, Rare
Green-throated Carib	<i>Eulampis holosericeus</i>	LA, Comm
Antillean Crested Hummingbird	<i>Orthorhyncus cristatus</i>	LA, Comm
Belted Kingfisher	<i>Ceryle alcyon</i>	Americas, UnC
Caribbean Elaenia	<i>Elaenia martinica</i>	WI, Comm
Gray Kingbird	<i>Tyrannus dominicensis</i>	WI, Comm
Caribbean Martin	<i>Progne dominicensis</i>	WI, UnC
Barn Swallow	<i>Hirundo rustica</i>	Americas, Lc
Scaly-breasted Thrasher	<i>Allenia fusca</i>	WI, UnC
Pearly-eyed Thrasher	<i>Margarops fuscatus</i>	LA, Unc
Brown Tumbler	<i>Cinclocerthia ruficauda</i>	LA, Rare
Yellow-throated Vireo	<i>Vireo flavifrons</i>	Americas, Rare
Black-whiskered Vireo	<i>Vireo altiloquus</i>	WI, Comm
Black and White Warbler	<i>Miniotilta varia</i>	Americas, Rare
Northern Parula	<i>Parula americana</i>	Americas, Rare
Yellow Warbler	<i>Dendroica petechia</i>	Americas, Rare
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Americas, Rare
Magnolia Warbler	<i>Dendroica magnolia</i>	Americas, Rare
Cape May Warbler	<i>Dendroica tigrina</i>	Americas, Rare
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>	Americas, Rare
Black-throated Green Warbler	<i>Dendroica virens</i>	Americas, Rare
Bay-breasted Warbler	<i>Dendroica castanea</i>	Americas, Rare
Blackpoll Warbler	<i>Dendroica striata</i>	Americas, Rare
American Redstart	<i>Setophaga ruticilla</i>	Americas, Rare
Worm-eating Warbler	<i>Helminthophila vermivorus</i>	Americas, Rare

Common Name	Species	Status and Range
Ovenbird	<i>Seiurus aurocapillus</i>	Americas, Rare
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Americas, Rare
Lousiana Waterthrush	<i>Seirus motacilla</i>	Americas, Rare
Kentucky Warbler	<i>Oporonis formosus</i>	Americas, Rare
Hooded Warbler	<i>Wilsonia citrina</i>	Americas, Rare
Bananaquit	<i>Coereba flaveola</i>	Americas, Comm
Antillean Euphonia	<i>Euphonia musica</i>	LA, Rare
Black-faced Grassquit	<i>Tiaris bicolor</i>	WI, Comm
Lesser Antillean Bullfinch	<i>Loxigilla noctis</i>	LA, Comm
Carib Grackle	<i>Quiscalus lugubris</i>	LA, UnC

**KEY:**

**Comm**=Common; **Decl**=Declining; **LA**=Lesser Antilles; **Lc**=Least Common; **UnC**=Uncommon, **WI**=West Indian