GRENADA
THE SPICE OF TROPICAL LIFE

The incredible range of wild and domestic plant life makes this tiny island a botanical treasure

KEN BARBOUR AND JOHN H. MCANDREWS

Southernmost of the Caribbean Lesser Antilles, just 12 degrees north of the equator, Grenada is a tiny mountainous island of volcanic origin with a dynamic flora. Only 33 kilometres long and 19 kilometres wide, much of it still undeveloped, the island contains five distinct plant communities, as well as lakes formed in volcanic craters, and a thriving agricultural industry. (It is also known as Spice Island, primarily for its nutmeg, *Myristica fragrans*, which accounts for one-third of the world supply.)

Ecologically, Grenada is a microcosm of the Caribbean. Information on the climate and vegetation of the Caribbean during the Quaternary period (the last 2 million years) is meagre, but the ROM’s Botany Department is working in Grenada to reconstruct the vegetation history from fossils found in lake sediments and to collect authentic specimens of modern pollen, seeds, and other plant parts. Collections of modern plants are used to identify fossil pollen and seeds. The interpretation of the fossil record in turn can be used to explore the derivation of the modern flora.

Because of the island’s young age and proximity to South America, it is thought that Grenada possesses few if any endemic species and that it is botanically similar to Trinidad and St. Vincent and the Grenadines. The only comprehensive plant collection from Grenada was made a century ago by W. E. Broadway, a native West Indian colonial officer who sold plant collections to herbaria around the world. (The ROM holds one of his original collections from Trinidad.) R. A. Howard’s *Flora of the Lesser Antilles: Leeward and Windward Islands, 1974-1989*, the most recent treatment of the region’s flora, is partly based on Broadway’s work. ROM collections provide an opportunity to produce a more detailed account of the flora of Grenada. Despite Broadway’s extensive work, the ROM collecting team has found several species previously unknown for the island.

Documenting of Grenada’s flora is of critical importance because of

Ken Barbour is a technician and John McAndrews is a curator in the Botany Department, Royal Ontario Museum
expanding agricultural and forestry activity over the past decades. Such human activity is potentially far more destructive of the native vegetation than any of the natural phenomena that Grenada has witnessed over the past several thousand years. The native vegetation of Grenada has developed and adapted in response to natural disturbances. However, following Hurricane Janet in 1955, which severely damaged the native forest (as well as orchards and other agricultural land), extensive plantations of exotic timber species such as the blue mahoe and Caribbean pine were established in place of native forest. Growing tourism is another potential disturbance. The tropics are the world’s regions of greatest biodiversity and because of this concentration of plant life, long-term or permanent damage to even a small area can represent an enormous loss.

Since 1992, Jock McAndrews and Ken Barbour, botanists from the Royal Ontario Museum, have combined efforts with Winston Johnson and Yasmin Comeau of the National Herbarium of Trinidad and Tobago at the University of the West Indies, Trinidad, to reconstruct the modern vegetation history of Grenada and to document the present flora by collecting plant specimens. This project follows up work conducted in 1978 by McAndrews and ROM research associate Jim Eckenwalder of the Department of Botany, University of Toronto. To date, approximately 500 of the estimated 800 to 1000 species have been collected, and specimens are housed at the ROM’s Vascular Plant Herbarium, with duplicates at the National Herbarium of Trinidad and Tobago. Some of the more difficult plant identifications have been made by Dr. C. D. Adams of the British Museum of Natural History.

Although most islands of the Lesser Antilles were formed by volcanic eruptions during the past 20 million years, only Dominica and Grenada have crater lakes, the best source of the sediments that reveal prehistoric and historic vegetation changes. To collect the sediments, researchers extract successively deeper, metre-long core segments from the lake bottom. Back in the laboratory, pea-size bits of mud are taken at 20-centimetre intervals from the top of each core to its bottom, a backwards journey through time. Fossil pollen and fern spores are concentrated and then identified and counted under the microscope. Pollen and spore percentages are plotted as a time-series, calibrated by radiocarbon-dating of the mud core. This data presents a record of the historic and prehistoric changes in the environment around the lakes and can also lead to the identification of as many as 100 plant species.

There are at least five distinct volcanic craters on Grenada—the harbour of St. George’s, Lake Grand Etang, Lake Antoine, Levera Pond, and the pastured wetland called Dig-Me-Out (a reference to mired cattle)—and there may be more. From Lake Grand Etang, in the central mountain chain, a 13-metre core was extracted and radiocarbon-dated to 25,000 years ago. Fossilized pollen analysis by Eugene Ramcharan shows that rainforest has persisted here for at least this length of time. This refutes a theory that during the peak of the last ice age, 8000 years ago, the tropics would have been arid while much of the northern hemisphere was covered by the polar glacier.

Levera Pond, in Levera National Park, is a brackish lake on the northeast corner of the island adjacent to the Atlantic Ocean. Melanie Sharman, a University of Toronto graduate student, discovered that 2000
There are five distinct plant communities on Grenada. This page shows seasonal deciduous (top left), cloud forest (top right), and mangrove swamp (bottom). On the facing page there is dry scrub (top) and a beach community (bottom).

Years ago the pond was an open bay that was subsequently cut off from the sea by a sand bar. A mangrove swamp grew along the shore of the pond and endured for the next 1700 years. About 200 years ago, massive soil erosion from the surrounding slopes was caused by forest clearing and the planting of sugar cane. Erosional deposits rapidly filled in the pond, creating the modern-day mix of vegetation—red, white, and black mangroves, buttonwood, manchineel, and dry scrub forest.

The five different plant communities of Grenada range from the cloud forest located on mountain tops down to the beach community.

Located in the central mountains of Grenada, the cloud forest is similar to a rainforest, but it does not create its own hydrological cycle. Instead the mountains deflect upwards the westerly moist trade winds that cool as they rise, thereby losing their ability to hold water, which then falls as rain at high altitudes. The mountains also trap clouds as they pass over the island.
Grenada’s flora is an exotic blend of native and domesticated plants, making the island an outstanding place to study tropical biodiversity.

Characteristic plants include the tree fern Cyathea, the mountain palm Euterpe dominica, and large canopy trees such as Sloanea, Dacryodes, and forest plantation species such as the blue mahoe (Hybiscus elatus) and the caribbean pine (Pinus caribbena).

Plant collecting in the mountainous cloud forest presents special challenges. Most large trees bear flowers and fruit high in the canopy and many epiphytic plants and climbing vines are also found only in the upper branches of trees. To collect specimens a 9-metre (30-foot) pole pruner was used. However, at the very top of the mountains, along the ridges, the trees are sheared by the persistent trade winds that blow across the island. While the species composition remains largely the same as in the conventional cloud forest, the areas of shorter trees are known as elfin woodlands.

The stereotypic image of lush green tropical forests is shattered by the appearance of bare trees and dry ground characteristic of the seasonal deciduous forest, the second community. Deciduous plants shed their leaves, flower, or drop seeds in response to changes in environmental conditions such as the onset of the dry or rainy seasons. Among the plants in this com-
munity are *Haematoxylon*, a logwood that is a source of a histological dye used in medical laboratories; *Genipa americana*, weedy species such as *Cassia*; and parasitic plants such as *Cascaya americana*. There are also some plants that are adapted to several different communities. The deciduous cliff-dwelling bromeliads (air plants) and ferns found along the island's west coast persist in spite of a lack of soil and soil nutrients.

Dry scrub forest, located primarily along the perpetually dry and hot south and east coast of the island, almost at sea level, forms the third community. It comprises small trees and large shrubs, weedy plants, drought-tolerant grasses and sedges, euphorbs such as the manchineel, *Hippomane*, *Pithecellobium* (a legume with spectacular fruits that are attractive to birds), the thorny legume *Acacia*, and cacti such as *Acanthocalyptra*.

Mangrove swamps, the fourth community, are found along the coast and at Levera National Park. They contain plants that are adapted to wet soils, periodic flooding, and saline conditions. Vegetation lying just outside the swamp is usually salt-tolerant as well. There are three types of mangrove—red or *Rhizophora mangle*, black or *Avicennia*, and white or *Lagunculina*—and the buttonwood *Conocarpus*. Red mangrove produces long aerial roots that descend from the upper stem and branches and buttresses to help stabilize the plant in the soft swamp soil. At Levera National Park, the red mangrove is found in a zone surrounding the pond, with many stems and roots submerged in its water. Instead of aerial roots, the black mangrove produces pneumatophores, which are underground roots that poke up through the soil to take in oxygen. Black mangroves are in a zone next to the red mangroves, away from the pond. There is a mixed black mangrove and buttonwood zone.

The beach community, sometimes referred to as the strand line, contains salt-tolerant grasses, herbs, and shrubs. Because the coastline of Grenada is very rocky, sandy beaches are not as numerous as they are on other Caribbean islands. It is common for these beaches to have a sand fringe leading up to stabilizing ground cover such as *Coccoloba* and Nickernut, *Caesalpinia bonduc*, and grasses and sedges. Either seasonal deciduous forest or dry scrub grows beyond the ground cover. Many of Grenada's beaches remain unspoiled, and the collection team was often alone on the small, beautiful, golden sand beach at Levera National Park. Yet large resorts have had an impact on the beaches at Grand Anse near St. George's while some other beaches support coconut plantations.

Christopher Columbus was the first European to see Grenada. He named it Conception and later Granada. Although claimed as Spanish territory, the island was never settled by the Spanish. Its inhabitants, the Carib Indians, were able to repel all attempts at outside settlement for
about 150 years. In 1609 a colony of English merchants was established, only to be abandoned a year later. Then in 1650, French colonists were successfully established and they renamed the island Le Grenade. After most of the Caribs were killed by the French, the last group committed suicide by throwing themselves from a high cliff now known as Le Morne de Sauteurs or Leapers’ Hill. The island remained a French possession until 1762 when it was taken by the British who called it Grenada. In 1779, the French recaptured the island but it became British once again as part of the Treaty of Versailles in 1783. The two powers fought over their Caribbean colonies because African slaves made sugar production very lucrative. A mixed African, British, and French heritage is evident throughout Grenada.

The Grenadians have developed agricultural practices that can cope with the rough, hilly terrain of the central mountain chain. Crops are grown in all but the most remote areas. Sugar cane, labour-intensive and once the most important crop, diminished with the abolition of slavery in 1838. Today cane fields are found only in the southwest part of the island, mostly grown for limited amounts of raw sugar and local rum production. Around 1840, sugar plantations gave way to tree crops, most of which are now naturalized and an intrinsic part of Grenada’s flora.

The main export crops are cocoa, *Theobroma cacao* ("food of the gods"), nutmeg, and bananas. Crops are mixed to utilize all areas of arable land. Hillsides are cleared and planted with bananas, nutmeg, cocoa, and other spices, including cinnamon, cloves, bay leaf, black pepper, chili pepper, ginger, and vanilla (an orchid). Many tourist guides say that you can smell the spices all over the island. On the main roads this spicy aroma must compete with the smell of diesel fuel from trucks.

Nutmeg is grown at higher altitudes, cocoa at lower altitudes, and bananas in both areas. Cash crops such as carrots, cabbage, and onions are becoming more common although they are planted in a manner that causes serious soil erosion from steep hillsides. On one occasion, while hiking through the dry scrub forest near Levera Pond, the collection team stumbled across a watermelon patch.

Other food crops include coconuts, guava, sapodilla (a source of chicle for chewing gum), mangos, mammee apples, sour sop, papaya, and breadfruit. Breadfruit is reputed to have been introduced by Captain Bligh of HMS *Bounty*.

The open-air market at St. George’s bustles with activity every Saturday morning as local farmers sell their goods. After a morning stroll, with temperatures reaching 30°C, the juice from an unripe coconut makes a refreshing drink. The fresh, strong spices make those sold in North American supermarkets pale by comparison.

The Grenadian flora is an exotic blend of native and domesticated plants, making the island an outstanding place to study tropical biodiversity. While the tropics contain regions with the greatest biodiversity on Earth, destruction in certain locales has been rampant. Plants are important resources for everything from food to air, soil, and climate control. More than 80 per cent of pharmaceuticals are derived from botanical compounds. The ROM Grenada project has provided a model for combining the study of vegetation history with documentation of modern flora, and is providing data valuable for the creation of effective resource management.