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Las Cabezas de San Juan Reserve

A Natural Treasure in Northeastern Puerto Rico

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Abstract

This slide program highlights the natural resources of the area known as Las Cabezas de San Juan Reserve on the northeastern tip of Puerto Rico. The visual tour includes: (1) the scenic shorelines, wind-swept promontories, and lagoons; (2) points of historic, cultural, and human interest; (3) the fauna and flora in their natural habitat; and (4) the role of the Puerto Rican Conservation Trust in furthering conservation and environmental education of the island.

Keywords: Conservation Trust; fauna; flora; environmental education.

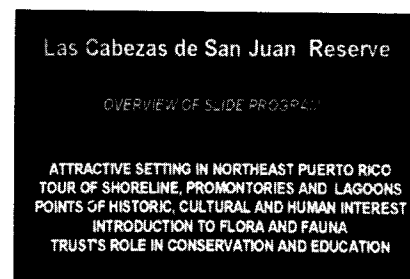
Introduction

Slide 1. Overview of slide program

This program of 80 slides is designed to familiarize visitors with the natural wonders of the Cabezas de San Juan Reserve (hereafter called the Reserve). Together they provide a tour of the Reserve in northeastern Puerto Rico, highlighting four themes:

- scenic shorelines, wind-swept promontories, and lagoons;
- points of historic, cultural, and human interest;
- fauna and flora in their natural habitat; and
- the role of the Puerto Rican Conservation Trust in furthering conservation and education on the island.

(slide: R. Medina)

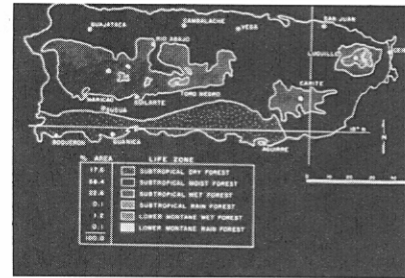


The Setting

Slide 2. Life zones of Puerto Rico

Puerto Rico has six major ecological life zones defined by their rainfall, temperature, and evapotranspiration. The island's driest areas are located in the Subtropical Dry Forest which includes Guánica and Cabo Rojo in the southwest, and the Reserve in the northeast. Rainfall on the Reserve fluctuates between 700 and 950 mm per year. The average temperature and wind speed are 25.5° C and 20 km per hour, respectively. Low rainfall, high temperatures, and persistent winds make the Reserve a dry environment.

(Slide: P.L. Weaver)



Slide 3. Panorama of northeastern Puerto Rico

The Reserve contains 178 ha of attractive landscape that ranges from sea level to 67 m in elevation and contains three rocky promontories, three lagoons, an attractive shoreline, and several types of coastal vegetation. Laguna Grande, dominating the central part of the Reserve, is connected to the sea at Las Croabas by a 1.5 km canal. Numerous vistas of aquatic and terrestrial systems can be seen from different vantage points on the Reserve.

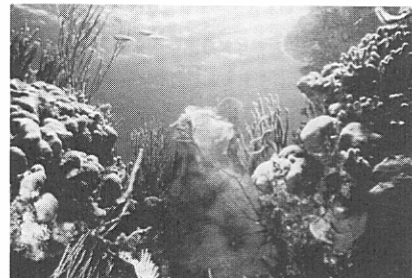
(Slide: R. Medina)



Slide 4. The ocean — coral reefs

The ocean, fringing the Reserve, varies with location ranging from the quiet waters of Ensenada Yegua to pounding surf along the rocky promontories known as Las Cabezas. The Reserve's fringing reefs contain about 30 species of coral that are arranged in regular patterns referred to as zonation. The corals protect the shoreline from wave action, redirect coastal currents, and provide habitat for numerous marine species with commercial or sport potential. Among the better known corals are the brain coral (*Diploria labyrinthifamis*) and the stag horn coral (*Acropora palmata*).

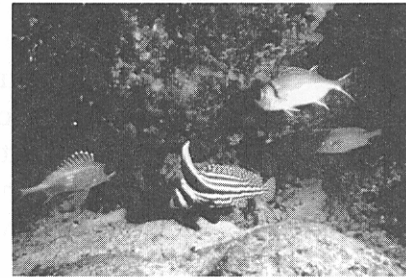
(slide: E. Martínez)



Slide 5. The ocean — reef fishes

Reef fishes are among the most colorful animals in the world. Four different species seen here in the waters off the Reserve are well known by snorklers: the spotted drum (*Equetus punctatus*), dressed in black and white; the Blue striped grunt (*Haemulon sciurus*); and the bright red fishes with prominent eyes, the blackbar soldierfish (*Myripristis jacobus*) to the left, the and squirrelfish (*Holocentrus adscensionis*) to the right. Several other colorful groups, some with intriguing names, include the parrotfishes, butterfly fishes, damselfishes, angelfishes, and wrasses.

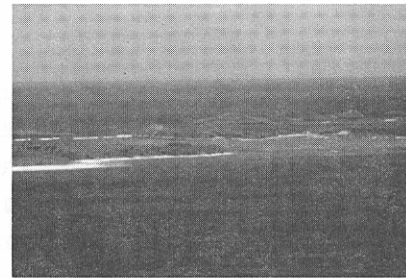
(slide: E. Martínez)



Slide 6. The offshore islands of the Cordillera

Offshore to the east, the Department of Natural and Environmental Resources manages the chain of islands known as the Cordillera. Icacos and Palominos are among the best known. The islands are underlain by a submarine ridge about 30 km long trending east-southeast between the northeastern tip of Puerto Rico and the island of Culebra. The numerous small islands support the best developed fringing reefs on Puerto Rico's northeast coast and are renowned for their variety of marine organisms, as tourist attractions, and as a sailor's paradise.

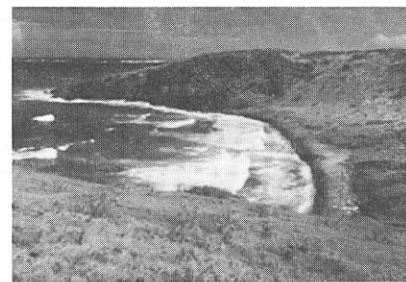
(slide: R. Medina)



Slide 7. The scenic shoreline

The Reserve's 8 km of scenic shoreline supports contrasting environmental conditions. Sandy beaches prevail at Ensenada Yegua, Playa Jayuya, Playa Mataballo, and Playa Canalejo, whereas rocky beaches are found at Playa Rincon and Playa Lirios. Waves crash onto the shoreline at the promontories, often splashing water several meters above sea level.

(slide: R. Medina)



Slide 8. Las Cabezas [promontories]

The oldest rocks of the Reserve are of volcanic origin and date from the upper Cretaceous period about 100 million years ago. The lava, reaching a thickness of 150 m, is more resistant to erosion than surrounding materials. Indians used the Cabezas as a landmark signalling the northeastern shores of Borinquen. In pre-Columbian times, the Reserve was covered with trees and its native wildlife, including birds, reptiles, fish, and crustaceans, served as a source of food. Artifacts of the Igneri culture, a group that migrated through the Lesser Antilles at the beginning of the Christian era, have been found on the Reserve.

(slide: R. Medina)



Slide 9. The Luquillo Mountains

The Luquillo rain forest, the wettest area in Puerto Rico, may be seen looking inland over the flamboyant trees [*Delonix regia* (Bojer) Raf.]. On clear days, the communication towers on El Yunque and East Peak are visible. Dwarf forest, a vegetation type made up of short, gnarled trees covered with mosses and bromeliads, grows on the mountain summits. The mountains also host the colorado tree (*Cyrilla racemiflora* L.), where the rare and endemic Puerto Rican Parrot (*Amazona vittata*) builds its nests. Patches of sierra palm [*Prestoea montana* (R. Grah.) Nichols] grow in ravines and on steep windward slopes.

(slide: R. Medina)



Slide 10. Past land use on the Reserve

When the Reserve was privately owned, a small guard house at its entrance was used to control access. All the Reserve's timber was cut long ago and the land was later used to graze livestock. By the late 1960s, the Reserve's attractive setting was noticed by developers interested in building homes. At that time, environmentalists took action to protect the Reserve.

(slide: R. Medina)



Slide 11. Succession during the past 30 years

Succession is a process by which the land recovers from past disturbance caused by natural events such as hurricanes or by human activity such as agriculture. Once burning and grazing were discontinued on the Reserve, secondary tree seeds germinated and grew in the grassy areas, providing organic matter to enrich the soil and shade to favor the regeneration of other plant species. The nectar, fruits, seeds, and cover provided by plants attracted wildlife which then helped spread plants throughout the Reserve. Gradually, the grasslands reverted to forest.

(slide: M. Schwartz)



A Tour of the Reserve

Entrance

Slide 12. Map of the Reserve

The Reserve has 3.5 km of paved or gravel roads and 2 km of foot or jeep trails. Visitors are first greeted at the Reception Center in the southwestern corner of the property. Traveling north, Ensenada beach lies to the west and an abandoned coconut stand to the east. Other beaches, including Rincon, Lirios, and Jayuya to the north, and Matacaballo and Canalejo to the east, fringe the remainder of the peninsular land mass. The Cabezas de San Juan, the elevated land in the northern part of the Reserve, contains the El Faro lighthouse. Three lagoons provide critical waterfowl habitat. Laguna Grande dominates the middle of the Reserve and drains into the ocean through a canal to the south. The remaining lagoons, Ruperto behind Rincon Beach and Laguna Colorada east of Laguna Grande, are much smaller; they virtually disappear during the dry season.

(slide: R. Medina and O. Ramos)



Slide 13. The Reception Center

The Reserve was purchased in 1975 and opened to the public on April 10, 1991. Visitors now number about 50,000 annually. The Reception Center includes a guard post, a parking lot with shade trees, a nursery for tree production, and a pavilion with leisure chairs and a small counter where souvenirs and books are sold. A covered wooden corridor extends to the beach and a scenic view of Ensenada Yegua.

(slide: M. Schwartz)



Slide 14. Ceiba tree at the pavilion

Majestic Ceiba trees reach 25 m or more in height and grow throughout the West Indies from Cuba to Trinidad, and from Mexico to Brazil. In Puerto Rico, the Ceiba, with its sinuous buttresses, is common along rivers in the coastal areas and on lower slopes in the mountainous interior. Ceiba wood is very light; it was used by the Indians to make drums and dugout canoes. Kapok, the silky hair from Ceiba seed pods, has been used as insulating material in sleeping bags and in life preservers. Nectar-feeding bats have been seen on the Reserve's Ceiba tree during December and January.

(slide: R. Medina)



Slide 15. Conservation Trust nursery

The Conservation Trust maintains a small nursery near the Reception Center where it grows seedlings of native and introduced tree species for planting on the Reserve and for sale to the public. Trees provide shade and cover for wildlife, reduce temperatures, and add to the aesthetic appeal of urban properties.

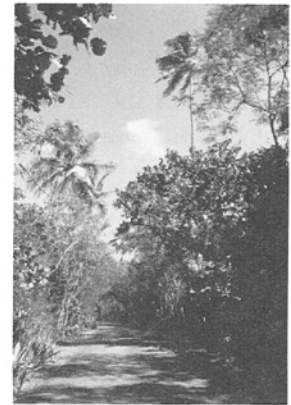
(slide: P.L. Weaver)



Slide 16. Abandoned coconut stand

Lying between Ensenada Yegua and Laguna Grande, an abandoned coconut stand extends for about 1 km from Highway 987 to a pathway known as the fisherman's passage. Tall coconut palms (*Cocos nucifera* L.), thought to have originated in southeast Asia, rise into the canopy. The surrounding secondary forest is dominated by leucaena [*Leucaena leucocephala* (Lam.) DeWit], an aggressive tree that invades open sites. Coconuts are very nutritious and at one time coconut plantations covered nearly 4,000 ha in Puerto Rico.

(slide: R. Medina)



Slide 17. Restoration of native forest

Experimental work is currently underway in the coconut stand to gradually restore the native vegetation. In this instance, restoration is aimed at creating a forest similar in species composition and structure to the one the Indians knew. Seedlings of six native species, including this cabbage angelin [*Andira inermis* (W. Wright) H.B.K.], have been planted on 1 ha of secondary forest. Tree survival and growth are being monitored.

(slide: P.L. Weaver)



Slide 18. The mongoose

Only three species of mammals have been identified in the Reserve: the mongoose (*Herpestes javanicus*), the black rat (*Rattus rattus*), and the Greater Bulldog Bat (*Noctilio leporinus*), which catches fish. The mongoose, introduced from Asia during the late 1870's, is often seen running across the Reserve's trails or roadways. Unfortunately, the mongoose, originally imported to control rats in sugar cane fields, has been the major cause of endangerment to many of Puerto Rico's ground-nesting bird species.

(slide: J.A. Colón)



Slide 19. Large green iguana

Another introduced species, the large green iguana (*Iguana iguana*), is most frequently seen crossing the Reserve's main road or climbing trees. Originally from Central America, the species entered Puerto Rico in the pet trade. Reaching 1.5 m in length, iguanas freely roam the Reserve where they spend much of their time in trees eating fruits. An iguana may be seen in the cages located in the lighthouse atrium.

(slide: J.A. Colón)



The Shoreline

Slide 20. Fishermen's passage (Paseo de los Pescadores)

The fishermen's passage, stretching between Ensenada Yegua and Laguna Grande at the narrowest point, is occasionally used by local folks to move boats back and forth. Fishermen from the surrounding communities frequently traverse the Reserve's canals and lagoons in quest of fish and crustaceans. They also harvest leucaena stems to make fish traps.

(slide: R. Medina)



Slide 21. Bromeliads at the western edge of the corridor

Bromeliads (*Bromelia pinguin* L.) with their uncomfortable spines grow just above the northern extreme of Ensenada Beach, where the lower slopes of the western corridor meet the beach. This species is one of three species of bromeliads known to grow on the Reserve.

(slide: R. Medina)



Slide 22. Sedimentary rocks

Sedimentary rocks just north of Playa Rincon display prominent layering. The rocks are breccias (sediments of fragmented material derived from preexisting rocks), or tuffaceous (fine- to coarse-grained consolidated rocks) composed of pyroclastic fragments (those hurled into the air during volcanic eruptions) and siltstone (rocks consolidated from clayey materials).

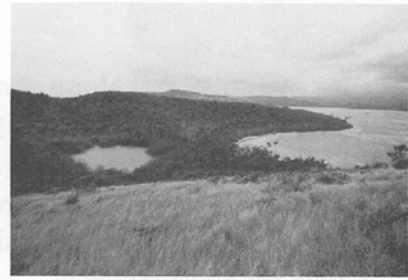
(slide: R. Medina)



Slide 23. Ruperto Lagoon

Ruperto lagoon, located behind Rincon Beach, is small and subject to fluctuating water levels during the year. Rainfall and runoff from the surrounding slopes fill the lagoon during the rainy season. In the dry season, the water evaporates leaving the lagoon bottom white with salt deposits. Rincon beach, just inside the coral reef protecting Ensenada Yegua, has very calm waters.

(slide: R. Medina)



Slide 24. Black-necked stilt at Playa Rincon

The black-necked stilt (*Himantopus mexicanus*), widespread in the western hemisphere, is a common resident in Puerto Rico from March through October. Stilts frequent the borders of salt ponds and mangrove swamps where they build platform nests of grass and twigs. They breed from April to August, laying three to seven olive-green eggs with irregular spots.

(slide: R. Medina)



Slide 25. Collage of beach treasures

Just a few minutes of searching on any of the Reserve's sandy beaches would yield a collage of finds similar to this one. Visible are several species of bleached corals and shells along with sponges of various sizes and shapes. Attractive sea fans (*Gorgania ventralina*) may be found along most of the Reserve's beaches.

(slide: P.L. Weaver)



Slide 26. Round cactus on rock outcrop

The western promontory supports populations of the stately, round cactus [*Melocactus intortus* (Miller) Urban]. Often transplanted to home gardens, a few individuals still survive in the wild on exposed outcrops a few meters above sea level.

(slide: R. Medina)



Slide 27. Waves crash along shoreline

A surge of water covers the shoreline giving the impression that the exposed rocks are devoid of vegetation. Actually, the shoreline, characterized by the continual advance and recession of waves, creates a habitat for attached algae.

(slide: P.L. Weaver)



Slide 28. Water recedes from shoreline

As the water recedes, algae are visible covering the rocky shoreline. The white tinge on the rocks above the algae are salt deposits left by evaporation.

(slide: P.L. Weaver)



Slide 29. Shoreline erosion on the western promontory

The continual pounding of waves has eroded the shoreline and over time has separated large boulders that ultimately form a string of islets offshore. A natural barricade has also formed above the shoreline. The barricade channels water for several meters before it descends back into the ocean.

(slide: R. Medina)



Slide 30. The harsh environment

The rocky shoreline is a rigorous habitat for plant growth. Seaside morning glory [*Ipomoea pes-capre* (L.) R. Br.], growing laterally on the rock, and the isolated barbasco (*Jaquinea arborea* Vahl) tree are the only dicotyledonous plants surviving on this exposed site. Seaside morning glory, common on Puerto Rico's beaches and rocky shorelines, is a relative of the sweet potato whose numerous varieties are cultivated for food throughout the tropics.

(slide: P.L. Weaver)



Slide 31. Caterpillar

Brightly colored black and yellow, Plumeria caterpillars (*Pseudospinx tetrio*) completely defoliate the leaves of the native Frangipani or milk tree (*Plumeria alba* L.) in a day or two. Despite its readily visible colors, the caterpillar is avoided by birds because it is poisonous. After four moltings in 2 weeks, the caterpillar attaches itself to a stalk for about 10 days (nymphosis) after which it emerges as a butterfly. Frangipani is a common tree on the promontories.

(slide: P.L. Weaver)



Slide 32. Monarch on milkweed

After metamorphosis, the monarch butterfly emerges and deposits its eggs on the giant milkweed [*Calotropus procera* (Ait.) R. Br.], an introduced species common in most of the Reserve. The monarch butterfly originated in North America but is now found throughout the Western Hemisphere. Adults live for 2 years and are capable of migrating more than 1,000 km. During their migrations north and south, they use the same trees as rest stops. From 30 to 100 million monarchs converge on one small, 2 ha patch of conifer forest in northern Mexico to spend the winter months.

(slide: R. Medina)



Slide 33. The western promontory in 1969

In the late 1960s, the Reserve was covered principally by grass and used to graze livestock. This scene shows typical grass cover in the foreground, breakers entering Ensenada Lagoon in the middle, and Puerto Rico's northern shoreline and lower slopes in the background.

(slide: P.L. Weaver)



Slide 34. The western promontory in 1996

This slide was taken from approximately the same position 27 years later. By the mid-1990s, many trees had invaded the grassland. Succession not only occurred on the western promontory but in most of the Reserve.

(slide: P.L. Weaver)



Slide 35. Past fires on the western promontory

Emergent dead stems in a thicket of brush and small trees highlight one of the major management problems facing the Conservation Trust. When discovered by the Indians, and later by the Spaniards, the promontories were covered by native trees. After clearing, burning, and grazing had taken place during the 19th and 20th centuries, the Conservation Trust purchased the Reserve and initiated a program of fire protection. However, the grasses on the windswept slopes of all the promontories are still prone to fires set by careless individuals during the dry season. Occasional fires eliminate woody regrowth and prolong the recovery of native trees.

(slide: R. Medina)



Slide 36. Visitors at Lirios Beach

Bus tours begin at the Reception Center and proceed to the mangrove boardwalk, Lirios Beach, and the lighthouse. All stops are accompanied by talks about the Reserve's natural attractions. During this stop at Lirios Beach, located between the western and central promontories, visitors are treated to a pleasant breeze on a beach of pebbles and stones while a sailing vessel passes on the distant horizon.

(slide: P.L. Weaver)



Slide 37. Eolianite rock at Lirios Beach

The shoreline at Lirios Beach contains a small eolianite platform. The dark colored rock platform, formed relatively recently, is made up of sand that was deposited by the wind. The sand was later cemented by calcium carbonate derived from land snail shells and blue-green algae. Eroding platforms are also seen at Rincon and Jayuya beaches.

(slide: R. Medina)



Slide 38. Splash pools on the central promontory

Splash pools are common on the western and central promontories. Waves breaking on surrounding rocks cast water into pools above the waterline. These microcosms contain small fishes, particularly clinids (Clinidae) and gobbies (Gobiidae), and occasionally wrasses (Labridae). Algae, sea urchins, sea cucumbers, snails, and crabs are also found. Deeper pools in contact with the ocean contain greater numbers of species and individuals.

(slide: P.L. Weaver)



Slide 39. The frigate bird

The magnificent frigate bird (*Fregata magnificens*), Puerto Rico's largest bird, is frequently seen buoyed by coastal winds over the central promontory. The species, nesting on small islands, searches the ocean surface for its food and also pursues other birds to steal captured prey. Common outside of Puerto Rico, the frigate bird is a native resident that is endangered locally.

(slide: B. Payne)



Slide 40. Jayuya Beach

Lying between the central and eastern promontories, Jayuya Beach has an extensive area of eroding beach rock. The brisk breeze that characterizes the sandy beach contrasts with quieter conditions of the mangroves growing in the tidal swamp behind the shoreline.

(slide: R. Medina)



Slide 41. Opuntia cactus on the eastern promontory

Clumps of cactus (*Opuntia dilenii* Ker-Gawl. Haw.) cling to the wall of the eastern promontory. Cactus plants are well adapted to windswept areas where shallow soils and limited rainfall are the norm. The cactus has a superficial root system and stores water in its fleshy stems.

(slide: R. Medina)



Slide 42. Arborescent skeletons on the eastern promontory

Stunted, wind-pruned trees succumb in the harsh environment of the eastern promontory. These trees, growing in thin soils on a rocky outcrop, are not only exposed to the occasional force of hurricane winds but also to the continual threat of prolonged drought.

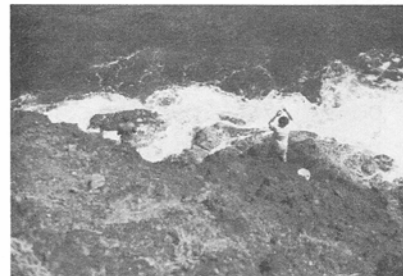
(slide: R. Medina)



Slide 43. Fishermen on the eastern promontory

Local fishermen still frequent the shores of the Reserve to practice their trade. Among the favored species that are regularly caught are the lined sole (*Achirus lineatus*), snook (*Centropomus undecimalis*), Lana snapper (*Lutjanus synagris*), tarpon (*Megalops atlanticus*), and the great barracuda (*Sphyraena barracuda*).

(slide: P.L. Weaver)



Slide 44. Matacaballo Beach

Matacaballo Beach lies between the eastern promontory and the edge of the corridor below the lighthouse. The rocky shoreline was formed by the erosion of boulders along the ocean.

(slide: R. Medina)



Slide 45. Brown pelicans at Canelejo Beach

The brown pelican (*Pelecanus occidentalis*) is common throughout the West Indies and in most coastal areas of North, Central, and South America where the water is warm. The pelican dives for its prey, which it captures live in a sack-like membrane on its lower jaw. It nests in colonies, making its nest from sticks mounted in trees. The species is listed as threatened and endangered in Puerto Rico.

(slide: R. Medina)



Slide 46. Sandwich terns at Canelejo Beach

The sandwich tern (*Sterna sandvicensis*), a permanent although relatively uncommon resident of Puerto Rico's offshore islands, has a nearly worldwide distribution. The breeding colonies of sandwich terns closest to the Reserve are situated on small islets near Culebra. The birds commonly lay 2 variously colored eggs in the sand during the late spring.

(slide: R. Medina)



Slide 47. Laguna Colorada (Red Lagoon)

Looking south from the lighthouse observation deck, the red lagoon is visible surrounded by a fringe of mangrove forest just west of Playa Canelejo. The barge stranded by Hurricane Hugo can be seen offshore.

(slide: Conservation Trust archives)



Slide 48. Manatees, whales, and other sea mammals

Manatees (*Trichechus latirostris*) have been sighted from aircraft in waters around the Reserve. Whales also frequent Caribbean waters because of the abundance of squid and fish. Among those seen in waters near the Reserve are the sperm (*Physeter catodon*), humpback (*Megoptera novaengliae*), and pilot (*Globicephala melaena*) whales, and speckled dolphins (*Tursiops truncatus*).

(slide: Conservation Trust archives)



Slide 49. Sperm whale

The most numerous of the great whales, the sperm whale (*Physeter catodon*), roams all ice-free oceanic waters including those off the Reserve. During the early years of Spanish exploration, whales were known to overturn ships. Moby Dick, perhaps the most famous sperm whale, was part of the adventurous 19th century when hunting decreased the populations of many whales. Whale hunting continues today in Caribbean waters off the island of St. Vincent.

(slide: Conservation Trust archives)



Slide 50. Littoral woodland

The best example of littoral woodland on the Reserve lies along the shore between Canalejo Beach and the stranded barge where sea grape [*Coccoloba uvifera* (L.) L.] grows out over the water's edge. Sea grape, ranging from Central Florida through the West Indies to northern South America, tolerates salt and is often the first species to become established on sandy shores. Turtle grass (*Thalassia testudinum* Banks x Köning), recently washed ashore, covers the beach. *Thalassia*, probably the most common marine plant in the Caribbean, has true flowers and seeds. Often spreading by well-anchored runners, it forms "meadows" in shallow, sandy waters where numerous marine animals including the manatee may be found.

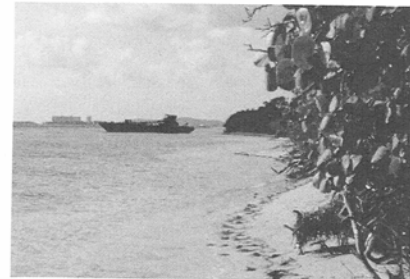
(slide: P.L. Weaver)



Slide 51. Shipwreck

A total of 10 shipwrecks are recorded in the waters around the Reserve, among them a warship near Palominos in 1649; a flagship, the Admiral de Grasse, in 1782; and two Danish schooners in 1825 and 1841. The 20th century witnessed five additional mishaps including an iron barge in 1907, and three schooners in 1921, 1960, and 1968; and this barge stranded by Hurricane Hugo in 1989, south of Canelejo beach. The story of the oldest shipwreck, a Spanish caravel dating back to 1553, is the most interesting. Anchored for 3 days near Vieques because of a storm, it was attacked by more than 600 Carib Indians on the fourth day. The struggle lasted until sunset with the death of most of the sailors. The few survivors were delivered to the Carib chief as slaves.

(slide: R. Medina)



The Interior Corridor, Lighthouse, and Nature Trail

Slide 52. Lighthouse history

Of Puerto Rico's 20 lighthouses that were built between 1846 and 1926, El Faro is the second oldest and best preserved. The Spanish began construction of El Faro in 1878 and had the lighthouse operating by 1882. In 1907, President Theodore Roosevelt declared the Reserve for public use. The lands were transferred to the U.S. Coast Guard in 1937, and in 1981 the lighthouse was recorded in the National Register of Historic Sites.

(slide: R. Medina)



Slide 53. Lighthouse interior

In the 1980s, the Conservation Trust began to manage the lighthouse for educational purposes. By 1991 the Trust had constructed an aquarium and a terrarium, a small research laboratory, and overnight facilities for investigators. Today, the lighthouse contains a herbarium of specimens collected on the Reserve and serves as a center for cooperative research activities with the University College at Humacao.

(slide: P.L. Weaver)



Slide 54. Young visitors to the lighthouse laboratory

Most of the Reserve's visitors are adults, including researchers, teachers, senior citizens, and students. About 10% are students. These youngsters are engaged in a hands-on experience in the lighthouse laboratory where marine research has been underway since the late 1980s.

(slide: M. Schwartz)



Slide 55. Large fig tree at nature trail entrance

The nature trail begins at the large fig tree (*Ficus citrifolia* Mill.) just below the lighthouse road. Visitors enter the trail by passing through the fig's long aerial roots and gradually descend to the main road near Laguna Grande. A leisurely hike on the 0.5 km trail lasts about 30 to 45 minutes.

(slide: R. Medina)



Slide 56. Nature trail on the corridor

The main corridor of the Reserve extends in an east-west direction with the lighthouse at the eastern highpoint. Originally in semievergreen woodland, the corridor is dominated today by leucaena scrub. Other easily recognizable species on the trail include the native terpentine tree [*Bursera simaruba* (L.) Sarg.] and the exotic tamarind (*Tamarindus indica* L.). Hemp [*Furcraea tuberosa* (Miller) Ait.f.] plants are also visible.

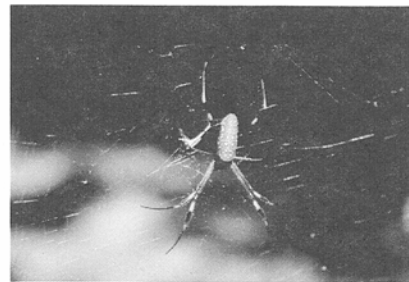
(slide: R. Medina)



Slide 57. Spiderwebs

Visitors hiking through the dense vegetation of the Reserve take note of the ubiquitous spiderwebs when they walk into them. Spiders are voracious predators. They weave their webs at all levels in the canopy, capturing myriad insects. This web, occupied by the golden orb spider (*Nephila claribes*) glistens in the morning sun.

(slide: R. Medina)



Slide 58. Termites

Termites (*Nasutitermes* sp.) construct their nests in the shape of a ball fastened to a vine or, in a more diffuse form, in the fork of a tree. They also construct tunnels that allow them to avoid light as they move along the bark of trees. Their society is organized around a queen that lays eggs and workers that seek provisions, maintain structures, and care for the eggs and larvae. Termites have a critical role in the ecosystem; they help to decompose wood into simpler compounds which are returned to the soil. They are capable of digesting cellulose, thanks to intestinal flagellates without which they would starve.

(slide: R. Medina)



Slide 59. Fungi

Fungi such as these *Pycnoporus sanguineus*, seen growing on a fallen log, may be found throughout terrestrial communities but are particularly prevalent in the upper layers of the soil. They play a role similar to that of termites in breaking down wood and other organisms and recycling their nutrients. During decomposition, a special habitat is created for a variety of microorganisms whose populations continually change with different stages of decay.

(slide: J.L. Coll Rivera)



Slide 60. Boulders along trail

Some of the Reserve's largest boulders, exposed after ages of erosion, are situated midway along the hiking trail. A climb to the top provides scenic vistas north to the promontories (Cabezas) and south to Laguna Grande.

(slide: R. Medina)



Slide 61. Ucar at trail's end

The trail ends on the main road at the edge of Laguna Grande where shade is provided by a contorted ucar [*Bucida buceras* (Vahl) Eichl.] tree. The ucar's natural range extends from the Florida Keys, Cuba, and Jamaica through Guadeloupe in the Lesser Antilles and from southern Mexico to northern South America. The wood is very hard, durable, and resistant to attack by dry wood termites. Common in basin forests above mangroves throughout much of its range, the ucar tree is often used as a roadside ornamental in Puerto Rico.

(slide: P.L. Weaver)



Slide 62. Research demonstration plot

A small research plot has been set up along the main road where 34 trees of 8 species are tagged. The purpose of this study is to determine how fast the Reserve's trees grow in diameter and height, and to observe changes in species composition over time — particularly in response to major climatic events such as hurricanes. Previous studies in similar habitats elsewhere in Puerto Rico have shown that diameter growth is not likely to exceed 0.10 cm per year for most stems. Forestry researchers have made similar measurements in most of Puerto Rico's forests.

(slide: P.L. Weaver)



Laguna Grande, Mangroves, and the Boardwalk

Slide 63. Laguna Grande [Large Lagoon]

Laguna Grande, occupying nearly 50 ha and reaching a depth of 1.4 m, is one of the most transparent lagoons in Puerto Rico. Clear brackish waters with favorable temperatures and adequate levels of dissolved oxygen support large populations of benthic (attached) and planktonic (floating) organisms. Among them, the dinoflagellate *Pyrodinium bahamense*, a bioluminescent microorganism (often called phosphorescent), emits light when the water is stirred. This same alga is found at Parguera in southwestern Puerto Rico where many tourists visit the famous Phosphorescent Bay.

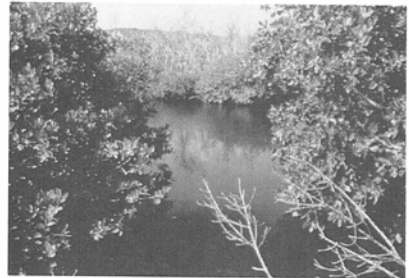
(slide: R. Medina)



Slide 64. Mangrove woodland

Mangroves, reaching 10 to 12 m in height, are dominated by four tree species adapted to brackish water conditions characteristic of coastal areas. Red mangroves (*Rhizophora mangle* L.) are found in areas of permanent water or at the water's edge. Black mangroves [*Avicennia germinans* (L.) L.] and white mangroves [*Laguncularia racemosa* (L.) Gaertn. f.] grow in mud flats behind the red mangroves. Button mangroves (*Conocarpus erectus* L.) grow on the landward edge of the tidal swamps. Numerous species of birds and fish live in mangrove swamps.

(slide: R. Medina)



Slide 65. Red mangrove

Red mangroves have stilt roots that form an impenetrable thicket at high tide. Red mangrove seed germinates inside a conical fruit, forming a long, heavy, narrow first radicle (the first root of the new seedling) which, when reaching about 30 cm in length, drops from the tree into the water. After floating for a time, it becomes firmly rooted in the substrate and begins to grow into a new plant.

(slide: R. Medina)



Slide 66. Black mangrove

Black mangroves have many fleshy, pencil-like projections known as pneumatophores that rise vertically from the tree's long lateral roots. The pneumatophores, reaching above water level, help exchange oxygen. The black mangrove is an important honey plant in coastal areas. Its flowers are rich in nectar and attract bees.

(slide: R. Medina)



Slide 67. Fiddler crab

Common along Puerto Rico's coastal areas from Carolina to Ceiba, fiddler crabs (*Uca* spp.) are often seen scurrying on mangrove tidal flats where they excavate tunnels in the mud. The tunnels serve to protect them against high temperatures and terrestrial predators at low tide. The crabs remain in the tunnels at high tide where they are sheltered from aquatic predators. The name "fiddler" comes from the crab's habit of waving its large claw, ranging from 2 to 4 times its body length, in the air like a violin.

(slide: R. Medina)



Slide 68. Boardwalk in mangroves

The boardwalk, about 1 km long, leads visitors on a 45-minute stroll through the mangrove swamp and along the open waters of Laguna Grande. Twenty-five interpretative signs provide information on the vegetation and wildlife visible from the boardwalk, as follows: eight on birds, three on crabs, two each on fish and lizards, one each on snails, spiders, dragonflies, and bees, and five on mangrove vegetation and its recovery after Hurricane Hugo.

(slide: M. Schwartz)



Slide 69. Great barracuda

The great barracuda (*Sphyraena barracuda*), the most aggressive fish inhabiting Laguna Grande, feeds mainly on other fish. When the prey are large, the barracuda may slice them into two pieces before retrieving them. Known to grow to 2 m in length and 45 kg in weight, the barracuda is reported to be in all tropical seas except the eastern Pacific. It is known to attack humans, and is also responsible for more cases of ciguatera (fish poisoning) in Florida and the Caribbean than any other fish.

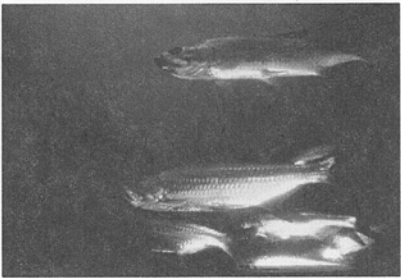
(slide: E. Martínez)



Slide 70. Tarpon

The tarpon (*Megalops atlanticus*), a prime game fish that reaches 2.4 m in length and 90 kg in weight, feeds mainly on smaller fish. Prized for its fighting habits, it often breaks water in quest of prey. Tarpons are spread throughout the tropical and subtropical Atlantic Ocean and may inhabit either salt or fresh water. Moreover, due to a lung-like air bladder that allows them to use atmospheric air, tarpon are tolerant of oxygen-poor environments.

(slide: E. Martínez)



Slide 71. Mangrove after Hurricane Hugo

Puerto Rico has experienced the effects of about 80 hurricanes since the early 1700s. Many of these storms had trajectories over the ocean but high winds and heavy rainfall were felt on the island as well. Hurricanes San Narciso of 1867, San Nicolas of 1931, and San Cipriano of 1932 passed close to the Reserve and must have affected its vegetation. Hurricane Hugo of 1989, the most recent with sustained winds in excess of 225 km per hour, caused major damage to the mangroves.

(slide: R. Medina)



Slide 72. Hermit crab

The hermit crab (*Coenobita clypeatus*), after an initial marine larval period, migrates to shore where it selects an empty shell in which to live. Occasionally returning to sea when young, or as an adult to release new larvae, the crab becomes mainly terrestrial; at times it is found at elevations more than 500 m above sea level. The crab's large purple claw blocks the entrance to its shell.

(slide: R. Medina)



Slide 73. Yellow warbler

The yellow warbler (*Dendroica petechia*), also called the mangrove canary in Spanish, is found from North America to northern South America, and throughout the West Indies. It is a common permanent resident in the Reserve where it inhabits the mangroves and dry scrub vegetation near water. It breeds mainly from February to June when it lays three heavily spotted, greenish-white eggs.

(slide: J.A. Colón)



Slide 74. Great Egret

The Great Egret (*Casmerodius albus*), a permanent resident of Puerto Rico, is found throughout the world. The egret is common in swamps and lagoons where it feeds mainly on fish. The egret breeds mainly in the spring, nesting in wooded swamps with other herons. Its nest, a platform of sticks, contains from two to five blue eggs.

(slide: J.A. Colón)

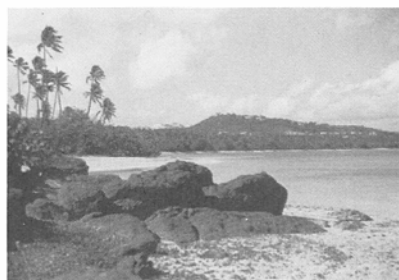


Conservation and Use

Slide 75. Hotels and development

The northeastern coast of Puerto Rico is experiencing rapid development due to domestic demands and increased interest in tourism. Multistory condominiums, hotels, boat docks, roads, and sprawling urban developments represent progress in the eyes of the island's economists, politicians, and developers. Nestled in all this turmoil, the Reserve remains a place of beauty and tranquility, much as pre-Columbian Indians or Columbus himself may have perceived it.

(slide: P.L. Weaver)



Slide 76. The Puerto Rico Conservation Trust, Casa Ramón, San Juan

The Puerto Rican Conservation Trust, a private, nonprofit institution created in 1970, is dedicated to the conservation of the island's natural resources and scenic areas. The Trust purchased the Reserve in 1976 and today manages it as wildlife habitat. It also emphasizes environmental education, interpretation, and research. The Trust maintains good relations with the surrounding communities while implementing its management program.

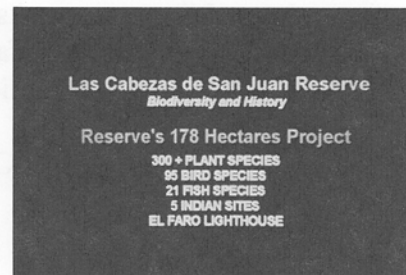
(slide: R. Medina)



Slide 77. Protection - biodiversity and history

Research on the Reserve's fauna and flora has shown that 95 species of birds, more than 20 species of fish, and more than 300 species of plants are found within its boundaries. Further, surveys and excavations have disclosed that five separate sites within the Reserve were used by Indians during the pre-Columbian era. Its historic features include a lighthouse built by the Spanish in the 19th century. These facts highlight the importance of the Reserve in the protection of the island's biodiversity and its cultural past.

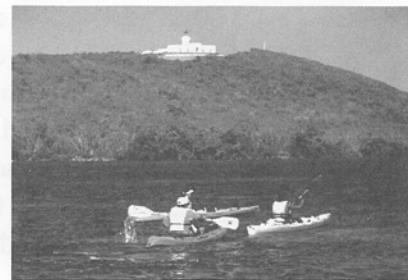
(slide: R. Medina)



Slide 78. Educational programs

The Conservation Trust receives 100,000 students annually at its numerous facilities throughout the island including the Reserve. The Trust also sponsors a 5-day summer camp where 40 students between 9 and 15 years old learn basic outdoor skills using the Reserve as an environmental laboratory. Trust leaders visit schools to train teachers and help design and present environmental programs — an activity with ample benefits to all participants.

(slide: R. Medina)

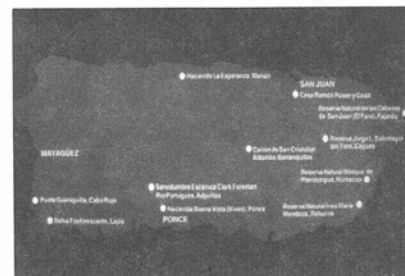


Slide 79. Other Conservation Trust properties

The Trust has purchased and manages about 1,950 ha of property in Puerto Rico and has an easement on another 27 ha. These properties include:

- Phosphorescent Bay, mangrove, and surrounding lands near Parguera;
- Sotomayor Natural Reserve, a mountainside tract in the headwaters of the Turabo River;
- Rio Portugues Forest, a scenic and conservation easement protecting a palm forest in the headwaters of the Portugues River;
- San Cristobal Canyon, the northern rim of a volcanic rift in the central mountains;
- Punta Yegua Reserve, rolling pasture land and steep limestone cliffs;
- Punta Guaniquilla Reserve, a tract overlooking the historic Spanish Main with promontories, dense forest, two lagoons, caves, mangroves, and naturally sculptured limestone rocks; and
- Hacienda La Esperanza, farmlands on an alluvial plain bordering the Atlantic Ocean with coves and cemented dunes.

(slide: Conservation Trust archives)



Slide 80. Planning for additional protected areas

The Reserve exists solely because concerned citizens, environmental groups, university professors, and their students rallied to protect it in the late 1960s. Without that concern for the environment, the Reserve would have been developed into a residential and resort complex. Today, the Reserve, under the direction of the Conservation Trust, represents an important local contribution to international efforts aimed at environmental education and the conservation of the world's flora and fauna. As the island's population continues to grow, protected areas like the Reserve will become ever more critical.

(slide: J. Rosario)



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This slide program highlights the natural resources of the area known as Las Cabezas de San Juan Reserve on the northeastern tip of Puerto Rico. The visual tour includes: (1) the scenic shorelines, wind-swept promontories, and lagoons; (2) points of historic, cultural, and human interest; (3) the fauna and flora in their natural habitat; and (4) the role of the Puerto Rican Conservation Trust in furthering conservation and environmental education of the island.

Keywords: Conservation Trust; fauna; flora; environmental education.

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