# Paget Marsh

## NATURE RESERVE GUIDE

THE BERMUDA NATIONAL TRUST

**ACKNOWLEDGEMENTS**

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*To protect and promote Bermuda's unique natural and cultural heritage for everyone, forever*

## Preface

Ever since Bermuda was first settled over 400 years ago, its residents have been making an impact on these islands, for better and for worse. They have crafted and built beautiful things...houses, boats, furniture and silver spoons. They have also changed the landscape, using biodiversity-rich marshes as rubbish dumps, importing invasive plant and animal species that threaten the native species, over-developing this narrow strip of land in the ocean. The threat of losing valuable open spaces and historic treasures sparked the creation of the Bermuda Monuments Trust in 1937 by a group of Bermudians who wanted to ensure that future generations would have the opportunity to understand their past. In 1970 the Bermuda National Trust was founded and took over from the Monuments Trust. Since then it has grown to become one of the island's most respected institutions. It is an independent not-for-profit organization which promotes the preservation of the island's architectural, historic and environmental treasures, and encourages public access to and enjoyment of them. Its members and friends are from all walks of life, having in common a love of Bermuda and the desire that its special aspects should be safeguarded for everyone to enjoy now, and forever.

This guide provides information on the importance, history, geography and biology of this very special Bermuda National Trust property. It highlights individual habitats, the most common flora and fauna and offers images which will help you to identity species found within the reserve. We hope that this guide will enhance your visit to our nature reserve and encourage you to visit other Trust properties soon.

For more information on the Bermuda National Trust, the properties in its care, programmes, events, membership and volunteer opportunities please visit www.bnt.bm or contact us at 441 236 6483.

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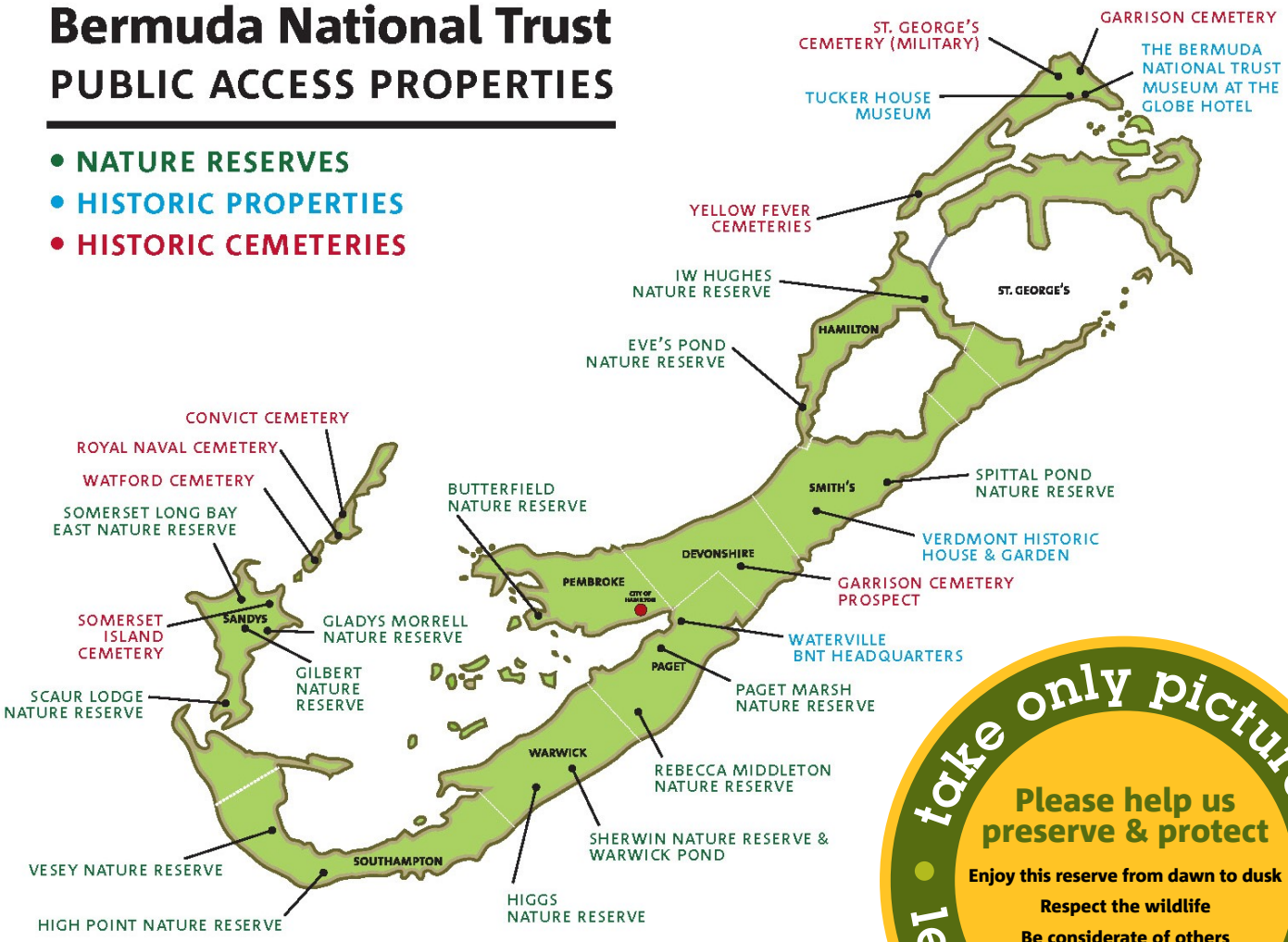



take only pictures

**Please help us preserve & protect**

**Enjoy this reserve from dawn to dusk**

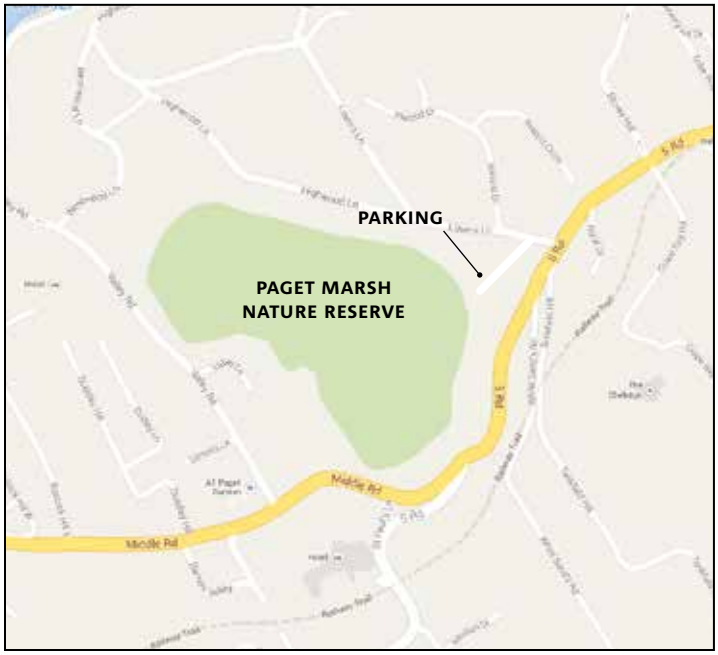
**Respect the wildlife**

**Be considerate of others**

**No vehicles**

**Dogs must be on lead**

leave only footprints




## Directions

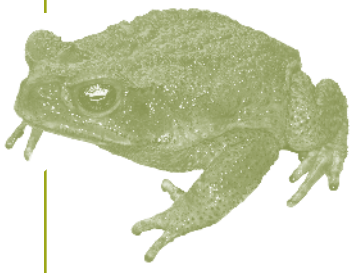
Paget Marsh is located off Middle Road on Lovers Lane in Paget. As you turn onto Lovers Lane from Middle Road, take the first left and drive down the lane into the nature reserve parking area. The boardwalk extending out over the marsh is adjacent to the parking lot.

# Paget Marsh
## NATURE RESERVE

**FROM THE MOMENT YOU ARRIVE, PAGET MARSH INVITES YOU TO come in and explore. This lush and leafy nature reserve, tucked in a low-lying valley, holds secrets about a way of life seldom seen. It is a time capsule preserving one of the last remnants of Bermuda's natural heritage – a native Bermudian ecological community.**

Jointly owned by the Bermuda National Trust and the Bermuda Audubon Society, Paget Marsh is a unique green space of 25 acres of original Bermuda, completely surrounded by homes, shops, roads and the hustle-bustle of our island life. It's also a walk back in time to life as it was 1,000 years ago. Thanks to creative and careful environmental work, people in Bermuda can see what life was like before there were people in Bermuda!

The Bermuda National Trust named the Paget Marsh boardwalk 'Dennis's Walk' and the freshwater area 'David's Pond' in recognition of the enormous contribution two great friends of the Trust have made to preserving the nature reserve and promoting its careful use. The boardwalk and improvements to the nature reserve were made possible by a donation from Dennis Sherwin, a very active member of the National Trust since 1976 and a former president. The pond and boardwalk were designed by Dr David Wingate, Bermuda's first conservation officer, a founding member of the Trust and former president of the Audubon Society.



# Paget Marsh

TOP PHOTO: © BERMUDA ZOOLOGICAL SOCIETY
BOTTOM PHOTOS: COURTESY OF THE MINISTRY OF WORKS & ENGINEERING, SURVEY SECTION

## The Human Impact on Paget Marsh

The National Trust has completed improvements to the marsh that enables everyone to visit and enjoy this tranquil setting. A wooden boardwalk winds through the pond, mangroves, grasslands and woods to the Bermuda of the 17th century. In the marsh, you see the island much as the first settlers found it, when it was covered with a cedar and palmetto forest.

This fragment of the original forest has survived through a combination of circumstance and conservation management. Its boggy nature made it difficult to build on, so it was bypassed during Bermuda's early colonisation and our more recent development boom. The natural resources of Cedar, Palmetto and Wax Myrtle (*Myrica cerifera*) would have been difficult to reach in this stretch of land and so have remained virtually untouched. When an official garbage collection system was implemented in the 1920s, Paget Marsh, like other marshes, became a community dumpsite. Dr Henry Wilkinson, recognising the value of Paget Marsh, stopped the dumping and arranged for the Historical Monuments Trust (predecessor of the Bermuda National Trust) to acquire much of the marsh from the Anglican Church and private landowners in the 1950s. Cattle grazing frequently occurred up until about 1990 at the western end of Paget Marsh.

The acidic peat soil of Paget Marsh is inhospitable to most of the plants imported to Bermuda over generations. Many of those species have become 'invasive' on other parts of the Island, choking out the native plants. The few invasive plants that do take hold in the marsh, notably **Guava** (*Psidium guajava*), **Chinese Fan Palm** ( *Livistona chinensis* ) and **Marlberry** (*Ardisea*) are culled out through a woodland management programme begun in the 1970s.

## Your Visit

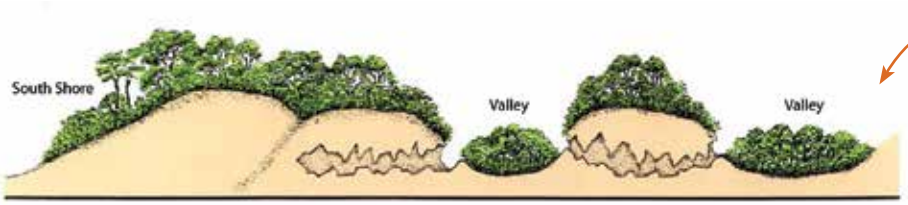
As you wander through the nature reserve, interpretive signs present the story of the marsh, from how it developed thousands of years ago to how it is being preserved today. Natural habitats are described and illustrated, making a visit to the marsh especially enjoyable by helping people to appreciate what they are seeing.

# The Formation of Paget Marsh

The low hills of Bermuda's landscape began as dunes of sand, building inland from coastal beaches. Over the course of 400,000 years, percolation of rain turned the oldest of these sandy hills into well-cemented rock with cave formations. Paget Marsh, an interdune low, is enclosed by older hills on the north and the south but connected by caves to Hamilton Harbour. Thus the marsh began as a tidal saltwater pond surrounded by mangroves.

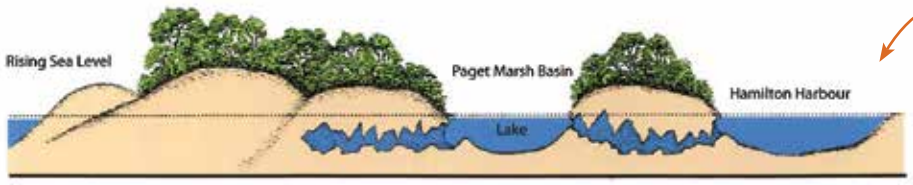
After the last Ice Age 10-12,000 years ago, valleys between these hills were filled by the rising sea level. About 4,000 years ago, the rapid sea level rise slowed down sufficiently to allow the accumulation of dead plant material from mangroves and other plants, thus forming peat. Peat forms when there is not enough oxygen to decompose the vegetation that falls into the pond and so it accumulates. This peat gradually built up to clog the underground tidal channels. This changed the marsh from a saltwater to a freshwater environment, leaving the mangroves isolated. The build-up of peat continued until it ultimately filled all of the open water areas and became firm enough to support a peat marsh forest. The peat ranges from 4-20 ft deep and may be up to 40 ft deep in some places.

Currently, there are several distinct sequential stages of peat accumulation in Paget Marsh resulting in several distinctly different habitats. These can all be seen from the boardwalk and range from an open water pond, where the peat has not yet built up to the water surface, through mangroves and Sawgrass (*Cladium jamaicense*) to the Cedar (*Juniperus bermudiana*) Palmetto (*Sabal bermudana*) forest hammock, where the peat has accumulated well above the water level. Noticeable from the parking area are two other distinct communities: the agricultural field bordered by banana trees and the wooded hillside dominated by introduced and invasive tree species.



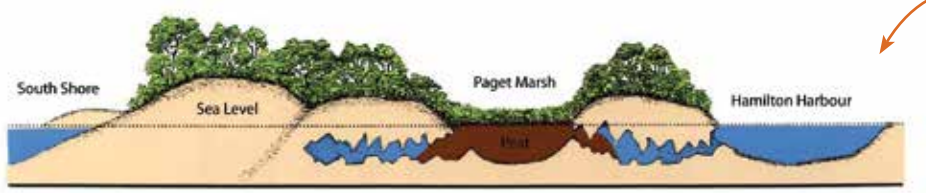

**20,000 years ago**

**Approximately 20,000 years** ago during the Ice Age, the sea level was lower and thus the areas which now form Hamilton Harbour and Paget Marsh were dry valleys.




**10,000 years ago**

**Approximately 10,000 years** ago, at the end of the Ice Age, a rapid rise in sea level began causing water to fill Hamilton Harbour and Paget Marsh through connecting caves.



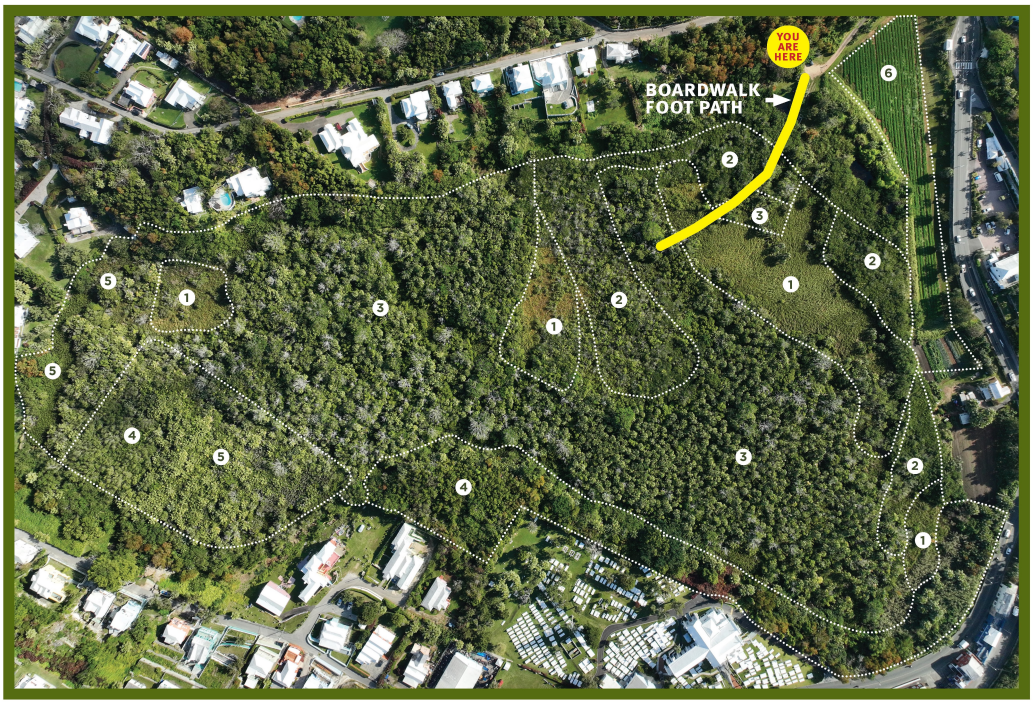

**4,000 years ago - present**

**Over the past 4,000 years** the rise in sea level has slowed down and the connecting caves have filled with peat, blocking the flow of water from Hamilton Harbour to Paget Marsh.

# Plant Communities

Paget Marsh has several plant communities in a small area determined by the water level relative to the peat surface.

Deep water areas result in an open water pond with submergent or floating plants. Large stands of red mangroves thrive in the permanently wet areas. Seasonally submerged peat supports Giant Ferns and a Sawgrass savannah and permanently dry peat surfaces support the Cedar, Palmetto and Wax Myrtle forest.




1. SAWGRASS
2. RED MANGROVE
3. CEDAR-PALMETTO FOREST
4. DRY LAND SECONDARY FOREST (FIDDLEWOOD-ALLSPICE)
5. GUAVA
6. AGRICULTURAL

# Low Species Diversity

The plant communities of Paget Marsh resemble those of the Florida Everglades because most of our species originated from that region via wind, ocean currents and migratory birds. However, only a few of the vast array of species found in the Everglades are capable of dispersing successfully across the 800-mile ocean barrier to Bermuda, so our peat marsh community is characterised by low species diversity.

# Reserve Management

Considering that Paget Marsh is unique as the last significant tract of land in Bermuda to have survived almost intact and unmodified by humans since prehistoric times, and given its location alongside the busiest traffic route from Hamilton to Somerset, it is imperative that the marsh is managed if it is to be maintained. In 1997, the Trust began the process of erecting a boardwalk to protect the rarer plant species and plant communities from being trampled. With the boardwalk in place, public usage is more carefully controlled, while allowing visitors and residents the opportunity to experience the diverse natural habitats at Paget Marsh. The informational signs enhance the educational value of the site.

At the same time, a pond was created by excavating an area previously used as a dump. The excavated soil was then used as an embankment around the pond. The pond was linked into the existing drainage canal system to assist the circulation of water and prevent stagnation. The pond serves as a sanctuary and feeding spot for resident and migratory birds.

Ecosystems change over time and ponds are no exception. Under stable sea level conditions, eutrophication continues and peat accumulates, filling in a pond. This has been the situation for the last 4,000 years. The grasses and mangroves bordering the edge encroach further and further over time until the entire marsh basin fills with peat. In Paget Marsh the present pond exists only because it was re-excavated by humans. Thus pond management is critical to maintaining the current state.

This situation has begun to change radically, however, as a result of a recent renewed trend of global warming which most scientists attribute to the greenhouse effect caused by man's industrial combustion of fossil fuels. One manifestation of this has been a resumption of sea level rise which exceeded seven inches during the 20th century and continues to accelerate. A period of prolonged high tides in September 2002 pushed up the water level in the marsh by nearly two feet and lasted so long that more than 50% of the cedars were drowned including most along the route of the boardwalk. This is the first real manifestation of an ecological catastrophe that may be expected if global warming continues. Dead trees are a natural part of the ecosystem so they will not be removed from the nature reserve.

The Bermuda National Trust does occasional plantings of native and endemics in the marsh but, more frequently, there is a need for extensive culling of invasives, notably **Guava** (*Psidium guajava*), **Marlberry, Murray Red Gum** (*Eucalyptus camaldulensis*), **Umbrella Tree** (*Schefflera actinophylla*) and **Indian Laurel** (*Ficus microcarpus*) which thrive on the acidic peat in the soil. The long-term goal of the Bermuda National Trust for this reserve is to maintain the various habitats as they were before human settlement insofar as changes due to global warming will permit.

# Definition of Terms

**Native:** A species which colonised Bermuda naturally without human help. Most arrived long before human settlement and are found in other countries too

**Endemic:** A native species which has been isolated in Bermuda long enough to have evolved into a unique species

**Introduced:** A species which is not found naturally in Bermuda, but has been brought here either accidently or intentionally by humans

**Invasive:** An introduced self-propagating species which has a tendency to spread rapidly, overwhelming the native and endemic species and/or causing economic damage

**Resident:** A bird that nests in Bermuda and does not make seasonal journeys off-island

**Migrant:** A bird that makes regular seasonal journeys to Bermuda from elsewhere for the purpose of feeding or breeding

**Vagrant:** A bird very rarely seen in Bermuda, probably blown off course

**Abiotic Factors:** are the non-living factors in an ecosystem that affect the population growth of a species. Such factors include:

- Water (e.g. salinity, oxygen content, level, pollution)
- Soil (e.g. pH, humus content, moisture, depth)
- Sunlight (e.g. light intensity)
- Wind exposure
- Temperature

**Biotic Factors:** are the living components in an ecosystem. These include members from all five kingdoms – plants, animals, bacteria, fungi and protists. The members of an ecosystem live in dynamic interaction with each other and with their environment. Hence, one species may affect the population growth of another species through:

- Competition with other species
- Predation
- Grazing by herbivores
- Food supply
- Population density
- Symbiotic relationships (e.g. where several organisms depend on each other)

  Symbiotic relationships include:

  **Mutualism:** in which each organism benefits

  **Parasitism:** in which one organism benefits and the other is generally harmed

  **Commensalism:** in which one organism benefits whilst causing little or no harm to the other

  **Disease**

# Pond Life

At the entrance to the marsh, the half-acre pond, created by the Bermuda Audubon Society in 1998, has become home to an amazing array of wildlife.

The freshwater pond sits on a layer of peat. Because the peat is in turn layered on salt water that is connected to Hamilton Harbour, the pond is subject to daily tidal fluctuation of approximately half an inch. Long term tidal fluctuation, averaging higher or lower than normal, can range up to 18 inches.

The dark colour of the water results from tannic acid released from decomposing plants and is a by-product of peat formation.

All of Bermuda's ponds are threatened by invasive species as well as with run-off pollution from roads and neighbouring farmland. Reducing pollutants in the pond is an ongoing and long-term problem.

## Know Your Terms

**NATIVE:** Species which colonised Bermuda naturally without human help. Most arrived long before human settlement and are found in other countries too.

**ENDEMIC:** A native species which has been isolated in Bermuda long enough to have evolved into a unique species.

**INTRODUCED:** A species which is not found naturally in Bermuda, but has been brought here either accidently or intentionally by humans.

**INVASIVE:** An introduced self-propagating species which has a tendency to spread rapidly, overwhelming the native and endemic species and/or causing economic damage

**RESIDENT:** A bird that nests in Bermuda and does not make seasonal journeys off-island

**MIGRANT:** A bird that makes regular seasonal journeys to Bermuda from elsewhere for the purpose of feeding or breeding

**VAGRANT:** A bird very rarely seen in Bermuda, probably blown off course

# Animal & Bird Life

Wildlife abounds at Paget Marsh. The **Yellow-crowned Night Heron** (*Nyctanassa violacea*) is a frequent visitor. The **Great Egret** (*Ardea albus*), **Greater and Lesser Yellowlegs** (*Tringa melanoleuca*) and (*Tringa flavipes*), **Belted Kingfisher** (*Ceryle alcyon*), **Wood Duck** (*Aix sponsa*) and **Merganser** (North American) are among the many water birds often spotted there. The resident common native marsh bird, the **Moorhen** (*Gallinula chloropus*), is certainly at home here on the pond as it is at Warwick and Spittal Ponds. Less obvious are the **damselfly** suborder and **dragonflies** that make their home in the marsh. Below the surface, **toads**, **tadpoles** and **Mosquito Fish** (*Gambusia holbrooki*) lurk. The invasive **Red-eared Terrapin** (*Trachemys scripta elegans*) is common and a recent introduction to the pond.

**Red-eared Terrapin**
*Trachemys scripta elegans*
INTRODUCED
INVASIVE

**Blue Dasher Dragonfly**
*Pachydiplax longipennis*
NATIVE

**Marine/Cane Toad**
*Bufo marinus* INTRODUCED

**Yellow-crowned Night Heron**
*Nyctanassa violacea* RESIDENT

**Great Egret** MIGRANT
*Ardea alba*

**Common Moorhen** MIGRANT
*Gallinula chloropus*


**Greater Yellowlegs** MIGRANT
*Tringa melanoleuca*


**Lesser Yellowlegs**
*Tringa flavipes* MIGRANT

**Green Heron** RESIDENT
*Butorides virescens*

# Mangrove Habitat

The first forested habitat you enter on the boardwalk is an area dominated by Red Mangroves (*Rhizophora mangle*), with its distinctive hanging prop roots. It is one of two mangrove species that occur in Bermuda. It's unusual to see mangroves in an area of fresh water and their presence in Paget Marsh has to do with how the marsh was formed.

## Red Mangroves

The prop roots of Red Mangroves not only serve to stabilise the growing tree, but, in salt water, usually become home to many marine organisms like algae, sponges and crustaceans that require a stationary support. Most of the saltwater creatures that once inhabited the mangroves, such as crabs, snails and oysters, died out long ago, but the mangroves remain a favourite habitat for migrant birds.

Mangroves worldwide are recognised for their ability to reclaim land, or at least prevent erosion of coastline, providing that they can accumulate peat at a rate greater than the rate at which sea level rises. In other parts of the world, the bark of the tree is used for tannin and salt may be collected from the leaves.

PHOTO: ALISON COPELAND

**Red Mangrove** NATIVE
*Rhizophora mangle*

**Propagule**

**Leaf & flower**

**Prop roots**

# Migrant Birds

Red Mangroves create a supportive habitat for migrant birds. The **Northern Water Thrush** (*Parkesia noveboracensis*) feeds in the dead leaves. The **Black and White Warbler** (*Mniotilta varia*) feeds on the mangrove stems. The **American Redstart** (*Setophaga ruticilla*) feeds in the canopy. In total, 38 species of wood warbler visit Bermuda from North America each fall, and 20 spend the winter here.

**Northern Water Thrush**
*Parkesia noveboracensis*
MIGRANT

**Black and White Warbler**
*Mniotilta varia* MIGRANT

**American Redstart**
*Setophaga ruticilla* MIGRANT

# Giant Fern

Adjacent to the mangroves is the home of Bermuda's largest native fern, the **Giant Fern** (*Acrostichum danaeifolium*), which grows only where the ground is permanently flooded. It grows to 8 feet in height. The fern thirves under the shaded canopy.

**Giant Fern** NATIVE
*Acrostichum danaeifolium*

# Ferns in Bermuda

Bermuda has 25 (possibly 26) fern species including three endemic ferns: **Bermuda Maidenhair Fern**, **Bermuda Shield Fern** and **Governor Laffan's Fern**. The latter is extinct in the wild. Six of the ferns are critically endangered or endangered and a fern recovery plan for these species is recommended at www.conservation.bm.

**Bermuda Maidenhair Fern**
*Adiantum bellum*
ENDEMIC

**Sword Fern** NATIVE
*Nephrolepis exaltata*

**Southern Braken** NATIVE
*Pteridium caudatum*

| COMMON NAME | LATIN NAME | DESIGNATION |
|---|---|---|
| Bermuda Maidenhair Fern | *Adiantum bellum* | ENDEMIC |
| Governor Laffan's Fern | *Diplazium laffanianum* | ENDEMIC, CRITICALLY ENDANGERED |
| Bermuda Shield Fern | *Goniopteris bermudiana 9syn. Dryopteris bermudiana)* | ENDEMIC, CRITICALLY ENDANGERED |
| Plume Polypody | *Pecluma plumula (syn. Polypodium plumula)* | NATIVE, CRITICALLY ENDANGERED |
| Bermuda Cave Fern | *Ctenitis sloanei* | NATIVE, CRITICALLY ENDANGERED |
| Marsh Shield Fern | *Thelypteris kunthii (syn. Dryopteris normalis)* | NATIVE |
| Royal Fern | *Osmunda regalis* | NATIVE |
| Cinnamon Fern | *Osmunda cinnamomea* | NATIVE |
| Southern Bracken | *Pteridium caudatum (syn. Aequilinum var. caudatum)* | NATIVE |
| Ten Day Fern | *Rumohra andiantiformis* | NATIVE |
| Virginia Chain Fern | *Woodwardia virginica* | NATIVE |
| Giant Leather Fern | *Acrostichum danaeifolium* | NATIVE |
| Sword Fern (Boston Fern) | *Nephrolepsis exaltata* | NATIVE |
| Cut-Leaved Brake | *Anopterus hexagona* | NATIVE |
| Toothed Spleenwort | *Asplenium trichomanes-dentatum* | NATIVE, ENDANGERED |
| Parsley Fern | *Asplenium myriophyllum* | NATIVE |
| Long Spleenwort | *Asplenium heterochroum* | NATIVE, ENDANGERED |
| Holly Fern | *Cyrtomium falcatum* | INTRODUCED |
| Creeping Fern | *Phymatosaurus scolopendria* | INTRODUCED |
| Long-Leaved Brake | *Pteris longifolia* | NATURALIZED, INTRODUCED 1875 |
| Water Fern | *Salvinia minima* | INTRODUCED |
| New York Fern | *Thelypteris noveboracensis* | NATIVE |
| Psilotum | *Psilotum nudum* | NATIVE |
| Olfer's Salvinia | *Salvinia olfersiana* | INTRODUCED |

## Fern Growth & Reproduction

Ferns belong together with the mosses, algae and horsetails to the group of flowerless plants (see taxonomy chart). They do not produce flowers or seeds and in many cases reproduce by asexual reproduction.

There are more than 10,000 species of ferns. They predominantly grow in moist and shady places. Ferns have true leaves, stems and roots, and also have horizontal rhizomes that grow in the soil helping the fern to spread over its surroundings.

The reproduction of most flowerless plants differs from the usual reproduction of flowering plants. They go through a two-stage reproduction known as alternation of generations. In this, a type of asexual reproduction alternates with true sexual reproduction, involving male and female sex cells. At other times, the plants may reproduce by asexual reproduction alone, for instance by producing new bud-like plants called gemmae.

Ferns evolved when the only other plants around were mosses and fungi. Many ferns live in symbiotic relationships with fungi. Some ferns cannot survive without their accompanying fungi. These fungi are most likely growing around the roots of the ferns.

Most ferns have specialised habitat requirements and this makes them particularly vulnerable to familiar threats such as invasive plants, human activities and climate change.

# Classification of Ferns

**PLANTS**
Kingdom: Plantae

**DO THEY HAVE FLOWERS?**

**YES**

Flowering Plants

**GYMNOSPERMAE** (naked seed)

**ANGIOSPERMAE** (seeds in fruit)

**NO**

Non-Flowering Plants

**MOSSES** **FERNS** **HORSETAILS** **THALLOPHYTA**

**ALGAE** **LICHENS** **FUNGI**

# Sawgrass Habitat

This wet grassland is similar to huge areas of the Florida Everglades, but because the sawgrass is so dominant, few other species can compete. For plant communities it has become a 'monoculture habitat' - a sort of one-plant town. Serrated leaves, which can cut like a razor, give Sawgrass its name.

**Sawgrass** NATIVE
*Cladium jamaicense*

## Other Plants

Though Sawgrass dominates, look for **Cinnamon Fern** (O*smunda cinnamomea*), **Doc Bush** (*Baccharis glomeruliflora*), **Morning Glory** (*Ipomoea indica*) and **Poison Ivy** (*Toxicodendron radicans*) interspersed in this habitat.

**Cinnamon Fern** NATIVE
*Osmunda cinnamomea*

**Doc Bush** NATIVE
*Baccharis glomeruliflora*

**Morning Glory** INTRODUCED INVASIVE
*Ipomoea indica*

## Birds

The sawgrass habitat attracts a variety of birds and is a favourite spot for the migratory **Black and White Warbler** (*Mniotilta varia*), the **Yellowthroat** (*Geothlypis trichas*) and the **Sora Rail** (*Porzana carolina*). 'Rails' hide protected in the Sawgrass.

**Black and White Warbler**
*Mniotilta varia* MIGRANT

**Common Yellowthroat**
*Geothlypis trichas* MIGRANT

**Sora Rail** MIGRANT
*Porzana carolina*

# Cedar-Palmetto Forest

**Near the end of the boardwalk, you reach an area where the peat is firm and dry enough to support a forest of Bermuda Cedar, Palmetto and the native Wax Myrtle.**

Since the first settlers arrived nearly 400 years ago, **Bermuda Cedar** (*Juniperus bermudiana*), with its rich red wood and resistance to decay, has been valued for its many uses – in shipbuilding, house building and furniture making. So valued was it that sometimes plots of Cedar forests were given as a dowry. Additionally, the Cedar berries had a variety of uses including the production of Cedar berry wine or liqueur and cough syrup.

The first settlers also recognised the value of another of Bermuda's endemics, the **Palmetto** (*Sabal bermudana*). The leaves have been used for everything from thatching roofs to making umbrellas, baskets, mats, hats and rope. The hearts may be eaten and the berries are enjoyed by a number of birds and mammals. The sap of the trunk was once tapped and used to make a very strong alcoholic drink called 'Bibby'.

**Wax Myrtle** (*Morella cerifera*), a native woody bush, is common in peat marshes. In other parts of the world it is called Bayberry and candles are made from the waxy berries of this tree.

**Bermuda Cedar** ENDEMIC
*Juniperus bermudiana*

**Palmetto** ENDEMIC
*Sabal bermudana*

**Wax Myrtle** NATIVE
*Morella cerifera*

# Other Plants

In the shade of these trees, ferns – **Cinnamon** (*Osmunda cinnamomea*), **Royal** (*Osmunda regalis*), **Sword** (*Nephrolepis exaltata*) and **Southern Bracken** (*Pteridium caudatum*) dominate the undergrowth. **Virginia Creeper** (*Parthenocissus quinquefolia*), an introduced vine resembling poison ivy, winds its way up many of the Cedars.

**Royal Fern** NATIVE
*Osmunda regalis*

**Sword Fern** NATIVE
*Nephrolepis exaltata*

**Virginia Creeper** NATIVE
*Parthenocissus quinquefolia*

# Rare Plants

Two very rare plants grown in the shaded ground cover, though they are very rare and hard to find. The **Bermuda Sedge** (*Carex bermudiana*), which looks like a fountain of grass stems, is unique to Bermuda and virtually confined to Paget Marsh. The second is **Psilotum** (*Psilotum nudum*), an extremely primitive rootless plant that looks like a sprig of **Casuarina** (*Casuarina equisetifolia*) foliage.

**Bermuda Sedge** NATIVE
*Carex bermudiana*

**Psilotum** NATIVE
*Psilotum nudum*

# Birds

While you're trying to spot these elusive plants, you may hear a **White-eyed Vireo** (*Vireo griseus*), the bird Bermudians call "Chick-of-the-Village", announce its presence in song. Or a **Myrtle Warbler** (*Dendroica coronata*), the most abundant wintering bird in the marsh, may be flitting and feeding on the Wax Myrtle berries.

**Bermuda White-eyed Vireo**
*Vireo griseus bermudianus*
ENDEMIC

**Myrtle Warbler** MIGRANT
*Dendroica coronata*

# Invasive Species

**Invasive species now dominate the flora and fauna of Bermuda so completely that it is impossible for our original heritage to survive without human assistance.**

Invasive birds have played a major role in spreading **Brazil Pepper** (*Schinus terebinthifolius*), **Chinese Fan Palm** (*Livistonia chinensis*), **Japanese Pittosporum** (*Pittosporum undulatum*), **Surinam Cherry** (*Eugenia uniflora*) and other species. Chief culprits are the highly mobile **Starling** (*Sturnus vulgaris*), which colonised Bermuda in the 1960s, and the **Great Kiskadee** (*Pitangus sulphuratus*), which was introduced in 1957 as a misguided biological control for the introduced **Anole Lizards** (*Anolis carolinensis*).

**Brazil Pepper** INVASIVE
*Schinus terebinthifolius*

**Chinese Fan Palm** INVASIVE
*Livistonia chinensis*

**Japanese Pittosporum** INVASIVE
*Pittosporum undulatum*

**Surinam Cherry** INVASIVE
*Eugenia uniflora*

**Starling** INVASIVE
*Sturnus vulgaris*

**Great Kiskadee** INVASIVE
*Pitangus sulphuratus*

Three introduced trees – the **Guava** (*Psidium guajava*), the **Marlberry** (*Ardisia sp.*) and the **Chinese Fan Palm** (*Livistonia chinensis*) – were threatening to replace the native plant community with monocultures. Conservation management to cull invasive species and restore the marsh began in 1976. More recent culprits are the **Indian Laurel** (*Ficus microcarpa*), the **Australian Murray Red Gum Tree** (*Eucalyptus camaldulensis*) and the **Australian Umbrella Tree** (*Schefflera actinophylla*). Routine culling ensures that invasive plants, such as these, rarely grow beyond the seedling stage.

**Indian Laurel** INVASIVE
*Ficus microcarpa*

**Australian Murray Red Gum** INVASIVE
*Eucalyptus camaldulensis*

**Australian Umbrella Tree** INVASIVE
*Schefflera actinophylla*

# The Red-eared Slider

**Red-eared Terrapin**
*Trachemys scripta elegans*

INTRODUCED
INVASIVE

An introduced terrapin – the **Red-eared Slider,** (*Trachemys scripta elegans*) – has been enjoying the pond at Paget Marsh. Red-eared Sliders have devastating impacts on pond ecosystems because they eat almost anything including water plants, molluscs, insects and small fish. In Bermuda they eat the **Killifish** (*Fundulus bermudae*) and the **Mosquito Fish** (*Gambusia holbrooki*) which keep the mosquito numbers down. This has serious implications for human health because of mosquito-bourne disease and general wellbeing – no one likes mosquito bites! The Killifish are also endemic to Bermuda and endangered. Like all reptiles, Red-eared Sliders are cold blooded, so they must pull themselves out of the ponds and bask in the sun to warm up their bodies so they can properly digest their food. Unfortunately one of the sliders preferred basking places is on top of the water level nests of wetland birds such as the **American Coot** and **Moorhen**. Sliders are known to crush bird eggs in this way; they also have been known to eat the chicks. The impact of the introduction of Red-eared Sliders on other pond species, like the native **Diamondback Terrapin** (*Malaclemys terrapin*), is unknown. However it is clear that with no predators to keep the population in check, the Red-eared Sliders are significantly upsetting the ecology of Bermuda's ponds.

Most of the Red-eared Sliders in Bermuda's parks and nature reserves were released there by pet owners who no longer wanted them. If you no longer want your terrapin, make the responsible choice and have it put down by your veterinarian or take it to the Department of Conservation Services at 'Shorelands' located adjacent to the Bermuda Aquarium Museum and Zoo parking area.

# Glossary

**Abundant:** present in great quantity; more than adequate; oversufficient

**Biological control:** the use of living organisms to control pests

**Bog:** freshwater wetland dominated by moss

**Conservation management:** a procedure for maintaining a species or habitat in a particular state. It is a means whereby humankind secures wildlife in a favourable condition for contemplation, education or research

**Dominant:** The most important organism in a community. Usually taken as the one contributing the greatest biomass

**Ecological community:** a naturally occurring group of organisms

**Ecology:** the external surroundings in which a plant or animal lives which tend to influence its development and behaviour

**Ecosystem:** a system involving the interactions between a community and its non-living environment

**Endemic species:** a species which evolves to a new species after colonisation of a new area

**Eutrophication:** an abundant accumulation of nutrients that support dense growth of algae and other organisms, the decay of which depletes the shallow waters of oxygen in summer

**Global warming:** an increase in the earth's average atmospheric temperature that causes corresponding changes in climate resulting from the greenhouse effect

**Habitat:** the place or type of place where a plant or animal naturally or normally lives or grows.

**Introduced species:** a species transferred to a new location by man, either accidentally or on purpose

**Invasive:** spreads aggressively by itself

**Migratory/Migration:** going from one country, region, or place to another

**Native species:** a species which arrived in a new area by natural means and subsequently reproduced and survived

**Peat:** an organic material in marshy regions, composed or partially decayed vegetation

**Percolation:** the slow movement of water through the pores in soil or permeable rock

**Prop roots:** a root that supports the plant

**Vegetation:** all the plant life of a place, taken as a whole.

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http://seawifs.gsfc.nasa.gov/OCEAN_PLANET/HTML/peril_wetlands.html

US Fish & Wildlife Service, National Wetlands Inventory
http://www.nwi.fws.gov/

US Fish & Wildlife Service, National Wetlands Inventory Kids & Teachers Page
http://www.nwi.fws.gov/educator.htm

Wetlands - National Wildlife Federation
http://www.nwf.org/wetlands/

EPA Office of Water Wetlands
http://www.epa.gov/owow/wetlands/

For more information on educational tours and activities see the full Teacher Resource Guide at www.bnt.bm