

# Vesey

## NATURE RESERVE GUIDE



THE BERMUDA NATIONAL TRUST



**ACKNOWLEDGEMENTS**

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*To protect Bermuda's unique natural & cultural heritage forever*

## **Preface**

Ever since Bermuda was first settled 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 identify 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](http://www.bnt.bm) or contact us at 441 236 6483.

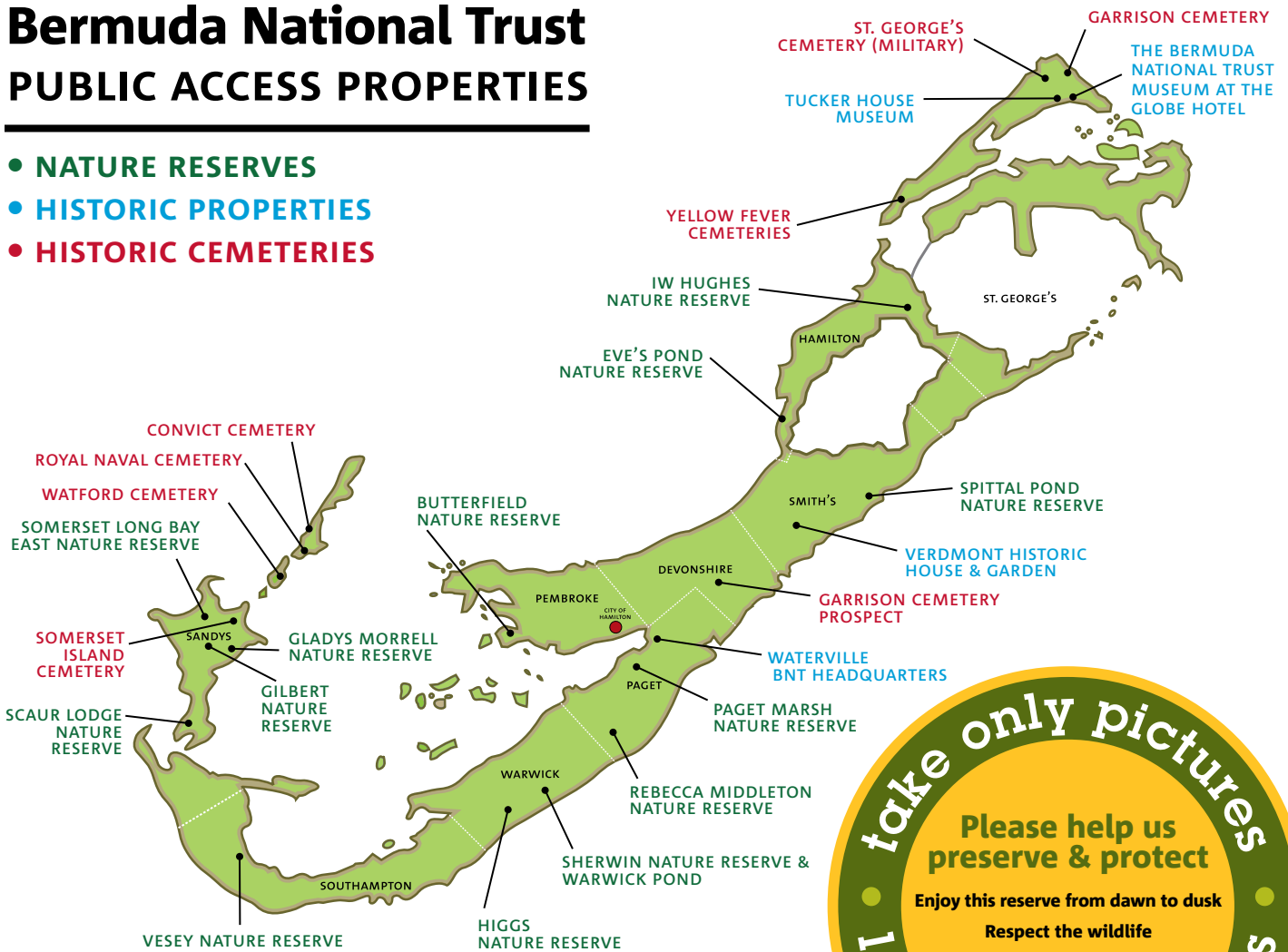
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# Bermuda National Trust PUBLIC ACCESS PROPERTIES

- NATURE RESERVES
- HISTORIC PROPERTIES
- HISTORIC CEMETERIES



## Directions

Vesey Nature Reserve is located on Middle Road in Southampton. If traveling by public transportation, take number 8 bus leaving the City of Hamilton for a 30 minute trip. Exit the bus at the Esso Gas Station at Rockaway. Walk back until you see the sign indicating the entrance to the nature reserve.



# Vesey

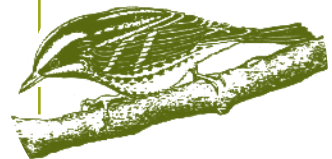
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## NATURE RESERVE



**THIS 8-ACRE PROPERTY WAS DONATED TO BUY BACK BERMUDA BY Sharon Vesey in 2009 and was restored as a nature reserve with public donations to the Buy Back Bermuda Round 2 Campaign. Buy Back Bermuda is a joint initiative of the Bermuda National Trust and the Bermuda Audubon Society working together to conserve the island's precious remaining open space, natural heritage and biodiversity for the benefit of present and future generations. Vesey Nature Reserve was opened to the public on Earth Day, 22nd April 2013.**

The reserve includes part of Evan's Pond and features two quarries (inland and coastal), a natural limestone sink hole and a variety of habitats, ranging from lush woodland valley to the rocky shoreline of the Little Sound. It extends from the west and north sides of Evan's Pond over the ridgeline of Skroggins Hill to the shoreline of the Little Sound. According to specific features it can be divided into six distinct habitats: Marine Pond, Woodland Valley, Exposed Hilltop, Coastal Hillside with Rocky Shoreline , Skroggins Hill Quarries and Sink Hole.



# Definition of 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 accidentally 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

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**Abiotic Factors:** are the nonliving 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**



# Appreciating Our Open Spaces

In order to appreciate and take care of our open space, we need to understand what space is available, how it is being used, why it is important to maintain open space and what threats impact the environment.

## Land usage in Bermuda as of 2008

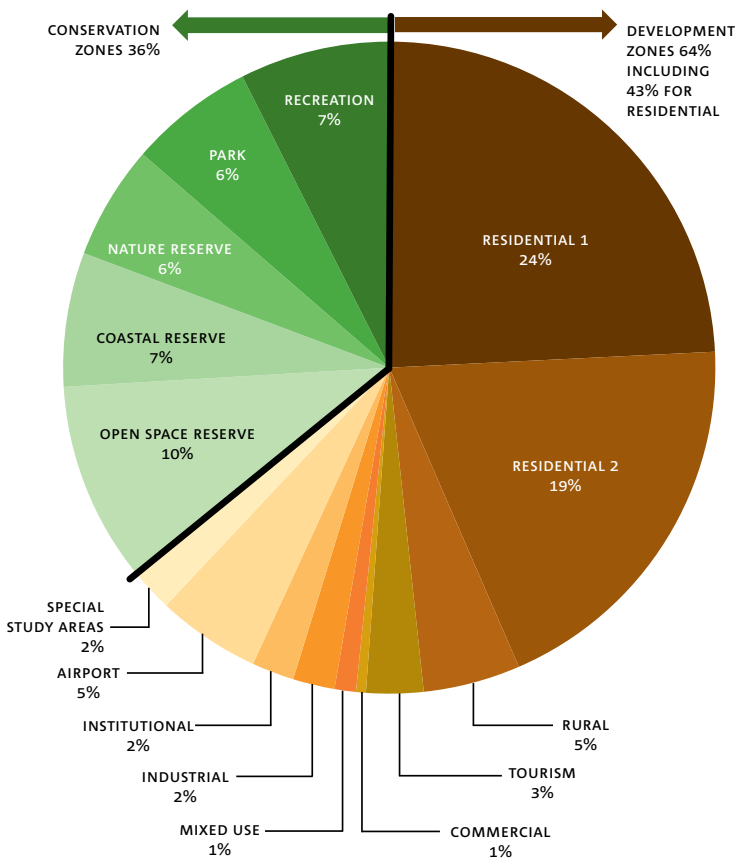
The chart below shows a breakdown of how Bermuda's land is used.

### Conservation Zones totalled = 36%

- 10% Open space reserve
- 6% Parks
- 7% Reserves - coastal
- 6% Reserves - nature
- 7% Recreation

### Development Zones totalled = 64%

- |                  |                    |
|------------------|--------------------|
| 5% Airport       | 5% Rural           |
| 1% Commercial    | 2% Special studies |
| 2% Industrial    | 1% Mixed use       |
| 2% Institutional | 3% Tourism         |
| 43% Residential  |                    |



## Open Space is Important Because

- Natural beauty attracts visitors and encourages tourism
- It provides recreational areas such as sports and playgrounds
- As amenity space, it enhances our psychological well-being
- It maintains our unique biodiversity

## Threats to Terrestrial Habitats

The key threats to terrestrial habitats in Bermuda are:

- Domination of existing open space by invasive species
- Loss of open space through development

The reasons for development include:

- Economic growth
- Housing
- Other individual requests – pools, large houses, upscale condos, driveways

Other threats to the environment include:

- Pollution
- Littering
- Vandalism
- Natural causes such as erosion and storm damage

It is every citizen's responsibility to protect the natural environment wherever we are in the world so that future generations will have clean air to breathe, unpolluted and abundant food, and water and energy sources

Sources: The Bermuda Zoological Society and the Bermuda Aquarium, Museum and Zoo, *Bermuda Biodiversity Country Study*, Bermuda, 2001, Bermuda Department of Planning – Forward Planning Branch, 2008

# Vesey Nature Reserve



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

**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 accidentally or intentionally by humans

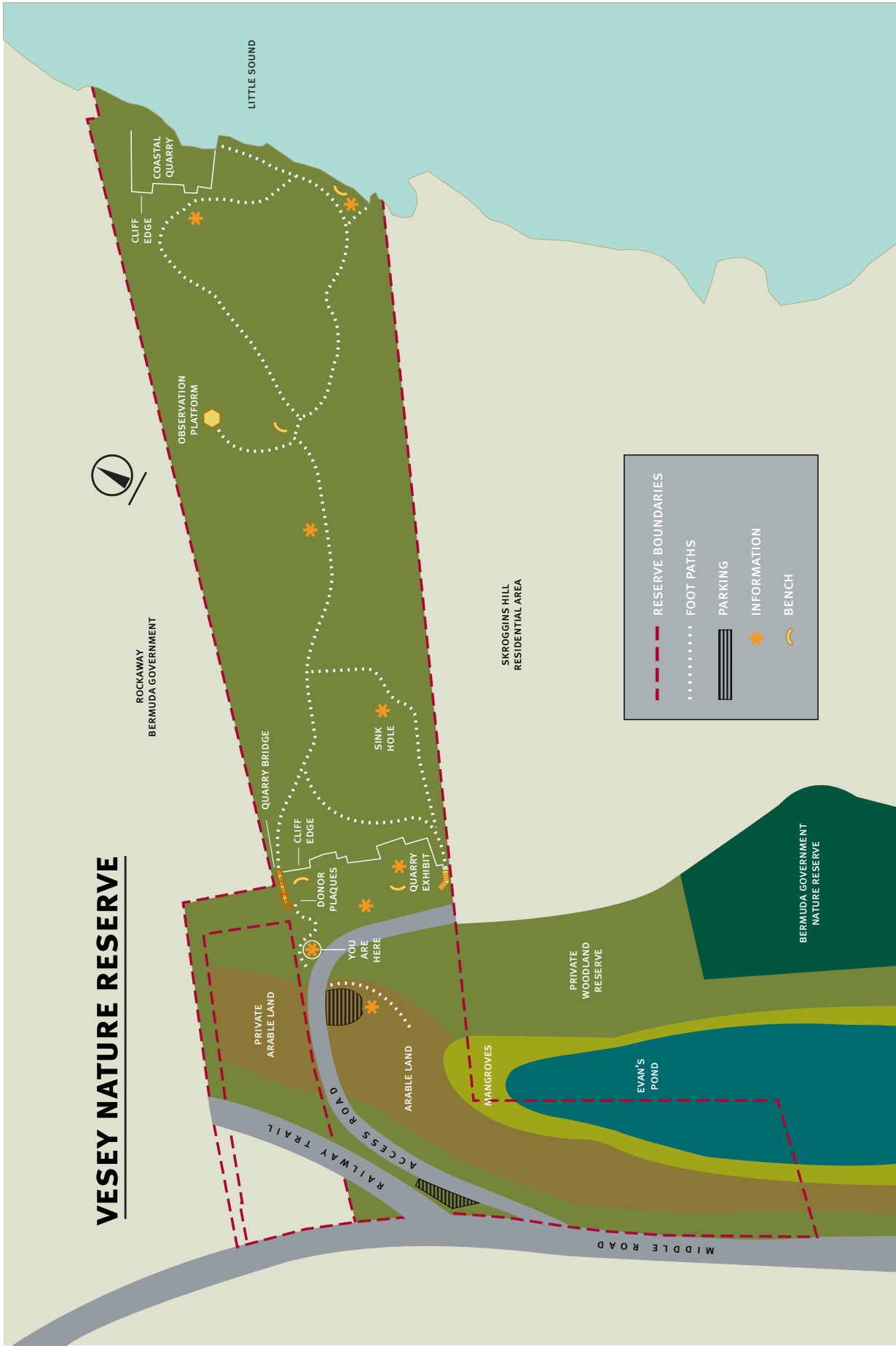
**INVASIVE:** An introduced self-propagating species which has a tendency to spread rapidly, overwhelming the native and endemic species and/or causing economic damage

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**Know  
Your  
Terms**



**Map showing key features of the Veseley Nature Reserve**

# Habitats of Vesey Nature Reserve

## Marine Pond

The deep valley enclosing Evan's Pond is highly visible from Middle Road and the Railway Trail which border it on the west side. (See aerial photo). It is predominantly rural with lush woodland containing many live cedars and rare native flora. Evan's Pond in the bottom of the valley is a tidal saltwater pond connected to the Little Sound via a drowned cave system. Seawater is denser than freshwater because of its dissolved salts, and the two will not mix readily. The result is that in rainy periods there is a layer of freshwater on the surface of the pond, overlying almost pure seawater below. The endemic **Bermuda Killifish** and native **Mullet**, which attracts the fish-eating **Osprey**, thrive in this habitat.

All of Bermuda's ponds are threatened by invasive species as well as run-off pollution from roads and neighbouring farmland, ground water enrichment through sewage and trash debris from continued illegal dumping. Reducing pollutants in the pond is an ongoing and long term problem.



left:  
**Evan's Pond**

PHOTO: THE MINISTRY OF ENVIRONMENT AND PLANNING



# Animal Life of the Marine Pond

Like most of the island's marine ponds, Evan's Pond is fringed by mangroves which shelter the pond and provide a nutrient-rich environment. Many species of heron and egrets roost here and various Wood Warblers, notably the **Northern Waterthrush** and **Black-and-white Warbler**, feed in the mangroves.



**Land Hermit Crab**  
*Coenobita clypeatus* **NATIVE**  
**ENDANGERED**



**Coffee Bean Snail**  
*Melampus coffeus* **NATIVE**



**Giant Land Crab**  
*Cardisoma guanhum* **NATIVE**  
**ENDANGERED**



**Snowy Egret**  
*Egretta thula* **MIGRANT**



**Mangrove crab**  
*Goniopsis cruentata* **NATIVE**



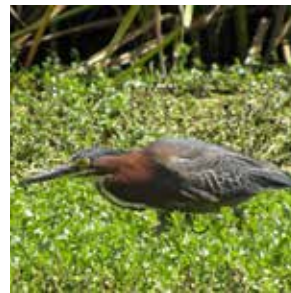
**Osprey**  
*Pandion haliaetus* **WINTER**  
**MIGRANT**



**Yellow-Crowned Night Heron**  
*Nyctanassa violacea* **NATIVE**  
**RESIDENT**



**Bermuda Killifish**  
*Fundulus bermudae* **ENDEMIC**



**Green Heron**  
*Butorides virescens* **NATIVE**  
**RESIDENT**



**Black-and-white Warbler**  
*Mniotilta varia* **WINTER**  
**MIGRANT**



**Northern Waterthrush**  
*Seiurus noveboracensis* **WINTER**  
**MIGRANT**



**Great Blue Heron**  
*Ardea herodias* **MIGRANT**



# Mangroves



The mangroves growing on the edge of Evans Pond belong to two species: **Red Mangrove** and **Black Mangrove**. They are growing side by side and are intertwined with each other creating a complex swamp habitat made up of roots, branches, tree trunks, leaves and mud. Lichens grow on their branches and a diverse invertebrate community makes the submerged roots its home.

Mangroves grow in warm sub-tropical and tropical climates around the world from about 25° north to 25° south. They generally grow along the borders of

shores, lagoons and saltwater ponds where wave action is limited. Worldwide there are about 70 different species of mangrove. They are from different families but are grouped as mangroves due to their distinctive root system. These roots create a tangled system which acts as a sediment trap and allows accumulation of sand and debris, eventually creating new land masses.

## **There are 4 basic adaptations exhibited by mangroves:**

- 1.** Mangroves have physiological adaptations which allow them to tolerate extreme **fluctuations of water and salinity levels**. Red mangroves are able to filter salt at their roots. Other species are able to excrete salt through their leaves or store salt in special compartments of their cells (vacuoles).
- 2.** Mangroves are also able to limit the loss of water from their cells by having leathery and thick **leaves**. The opening of the stomata can be regulated and used in the most economic way. Some mangroves have the ability to orientate their leaves to limit water loss from sunshine and heat.
- 3.** The **roots** of mangroves have adapted for anchoring in soft muddy substrates. They adapt to shifting conditions and spread extensively to increase firm hold and uptake of oxygen.
- 4.** Mangrove **seeds** are adapted for a wet and muddy environment. They are buoyant and can be dispersed by water. The fertilised seeds germinate while still attached to the tree and, when dropped, fall into the water where they can float and drift for a very long time. These floating seeds, also known as propagules are able to photosynthesise, thus generating enough energy to survive until they reach a suitable substrate to grow in.

## **The mangrove areas of Bermuda are habitats for the following species:**

- **Coffee Bean Snail** (*Melampus coffeus*)
- **Giant Land Crab** (*Cardisoma guanhumi*)
- **Great Blue Herons** (*Ardea Herodias*)
- **Land Hermit Crab** (*Coenobita clypeatus*)
- **Mangrove Crab** (*Goniopsis cruentata*)
- **Snowy Egret** (*Egretta thula*)

The mangrove fringes of Bermuda are favoured by fish for breeding, because **a)** the water is calm, **b)** the water is less salty than the ocean and **c)** there is a good food supply from the mangrove leaves

## Threat to Mangroves

Mangroves are the most endangered habitats in the tropics and are disappearing because throughout history people have regarded them as sinister, malarial wastelands. From their travels in the Gulf of California in the 1940s, John Steinbeck and Edward Ricketts reported that the locals avoided these tidal swamps. In *Sea of Cortez* they wrote: “[In the mangroves] it was like stalking, quiet murder. The roots gave off clicking sounds, and the odor was disgusting. We felt that we were watching something horrible. No one likes the mangroves.” Mangroves are being used for fire wood, pulp and animal fodder. They are cleared to make space for tourist developments, residential development and aquacultures such as shrimp farms. Destruction of coral reefs represents a problem for the mangroves as coral reefs act as a barrier to reduce wave action and thus protect the mangrove roots. Climate change causing rising sea levels will be a major threat to the long term survival of mangrove trees around the world because mangroves require stable sea levels in order to thrive.

### **RED** Red Mangrove *Rhizophora mangle* NATIVE



Prop roots



Propagule



Leaf & flower

### **BLACK** Black Mangrove *Avicennia nitida* NATIVE



Pneumatophores



Seed



Leaf & flower

# Woodland Valley

Bermuda's woodland now largely comprises species introduced by humans, which have become naturalised or invasive. The valley on the western part of the reserve is a mixed secondary woodland dominated by invasive **Fiddlewood**, **Allspice**, **Brazil Pepper**, **Loquat**, **Surinam Cherry**, **Pittosporum**, **Chinese Fan Palm**, **Lucky Nut**, **Australian Umbrella Tree** and **Jumbie Bean**. However there are also a number of original surviving **Bermuda Cedars**. The nature reserve is being restored to emphasise the original native and endemic flora which characterised Bermuda before human settlement. **Palmetto**, **Olivewood**, **Southern Hackberry** and **Red Mulberry** have all been planted in this area, along with smaller shrubs including **Snowberry**, **White Stopper** and **Forestiera**.



## Native & Endemic Trees & Shrubs of the Woodland Valley



**Bermuda Palmetto**  
*Sabal bermudana* **ENDEMIC**



**Palmetto leaf**



**Bermuda Olivewood**  
*Cassine laneana* **ENDEMIC**



**Bermuda Cedar** **ENDEMIC**  
*Juniperus bermudiana*



**Red Mulberry** **NATIVE**  
*Morus rubra*



**Southern Hackberry** **NATIVE**  
*Celtis laevigata*



**White Stopper** **NATIVE**  
*Eugenia axillaris*



**Bermuda Snowberry** **ENDEMIC**  
*Chiococca bermudiana*



**Forestiera** **NATIVE**  
*Forestiera segregata*



# Introduced & Invasive Trees of the Woodland Valley



**Fiddlewood** **INTRODUCED**  
*Citharexylum spinosum* **INVASIVE**



**Brazil Pepper** **INTRODUCED**  
*Schinus terebinthifolius* **INVASIVE**



**Chinese Fan Palm** **INTRODUCED**  
*Livistona chinensis* **INVASIVE**



**Lucky Nut** **INTRODUCED**  
*Thevetia nerifolia* **INVASIVE**



**Jumbie Bean** **INTRODUCED**  
*Leucaena leucocephala* **INVASIVE**



**Allspice** **INTRODUCED**  
*Pimenta dioica* **INVASIVE**

# Animal Life of the Woodland Valley



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



**Grey Catbird** **NATIVE**  
*Dumetella carolinensis*



**Great Kiskadee** **INTRODUCED**  
*Pitangus sulphuratus* **INVASIVE**



**Barbados Anole** **INTRODUCED**  
*Anolis roquet extremis*



**Antiguan Anole** **INTRODUCED**  
*Anolis bimaculatus leachii*



**Jamaican Anole** **INTRODUCED**  
*Anolis grahami* **INVASIVE**

The woodland habitat is favoured by the endemic **Bermuda White-Eyed Vireo** or **Chick-of-the-Village** and the native **Grey Catbird**. Both are still fairly common, but loss of open space and woodland poses a threat.

Bermuda has several introduced lizards and four are present in this area. The **Jamaican Anole** is the most common. Adult males can be seen staking their territory by extending a colourful throat fan while bobbing up and down. The **Antiguan Anole (Warwick Lizard)** is the largest of the four. The **Brown Anole** is a very recent introduction.

# Exposed Hilltop

The exposed hilltop is the crest of an ancient dune. Like all Bermuda hilltops, the soil is thin and there is great exposure to the wind, stunting vegetation growth. This is an extreme example, probably exaggerated by overgrazing and soil erosion in former years. This habitat enables certain low-stature native shrubs such as the **Rhacoma**, **Waltheria** and **Pavonia** (all found only in Southampton) to survive without being overshadowed by more aggressive invasives.

Sunny hilltops and coastal hillsides are likewise the only places where the **Bermuda Cedar** and **Palmetto** are still capable of self-seeding and surviving as the dominant trees. Further reforestation with these two species is planned for this area.

## Trees & Plants of the Exposed Hilltop



**Rhacoma** NATIVE  
*Crossopetalum rhacoma*



**Common Sage Bush** NATIVE  
*Lantana involucrata*



**Bermuda Bedstraw** ENDEMIC  
*Galium bermudense*



**Jamaican Vervain** NATIVE  
*Stachytarpheta jamaicensis*



**Jamaica Dogwood** NATIVE  
*Dodonea viscosa*



**Pavonia** NATIVE  
*Pavonia spinifex*



**Bermuda Cedar** ENDEMIC  
*Juniperus bermudiana*



**Casuarina** INTRODUCED  
*Casuarina equisetifolia*



**White Cedar** INTRODUCED  
*Tabebuia pallida*

## Management Goals for Vesey Nature Reserve

Selective culling of Brazil Pepper and Casuarinas to preserve the Rhacoma is ongoing by the Bermuda National Trust, the Bermuda Audubon Society and volunteers. Both organisations continue to seek donations, endowments and UK Overseas Territory grants for the control of invasive species and interpretive management of their reserves for the public benefit. In addition, the removal of **Chinese Fan Palms** would leave most of the better quality woodland intact, and would open up better vistas of the pond from the main road and Railway Trail. This would also create new areas for additional tree plantings such as the **Bermuda Palmetto** and **Mulberry**.

**Rhacoma** (*Crossopetalum rhacoma*) is a three to eight foot tall native shrub with a fountain-like growth of arching stems. Small red berries occur most of the year. This plant is found in Florida in some of the Keys and Miami rocklands in lime rock or sand. It is not tolerant of salt air or water, yet grows near the edge of salt marshes just above the high water line. At the Vesey Nature Reserve, the wind and lack of soil in the upper woodland areas gives this plant a bonsai-like shape. Rhacoma is a tough plant that grows well in full sun and rich soil. The red berries are eaten by birds and are not poisonous or particularly tasty either.





Allspice **INTRODUCED**  
*Pimenta dioica*



Fiddlewood **INTRODUCED**  
*Citharexylum spinosum*



Surinam Cherry **INTRODUCED**  
*Eugenia uniflora* **INVASIVE**



Japanese Pittosporum **INVASIVE**  
*Pittosporum undulatum*



Brazil Pepper **INVASIVE**  
*Schinus terebinthifolius*



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

## Insects, Spiders & Butterflies

Bermuda is home to a wide variety of insects and spiders. More than 1,100 kinds of insects and spiders have been found on Bermuda, including 41 endemic insects and possibly one endemic spider. Vesey Nature Reserve offers the perfect habitat for many of Bermuda's butterfly species and the following focuses on their biology and taxonomy.

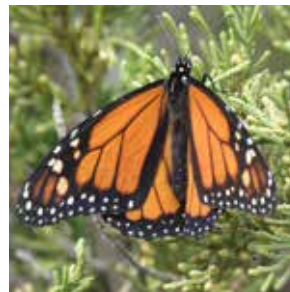
Several different species of butterflies occur in Bermuda. The two most common resident butterflies seen at this reserve are the Gulf Fritillary and the endemic **Bermuda Buckeye**. Migratory species include the **Monarch**, **Red Admiral** and the **Painted Lady**.



Gulf Fritillary **NATIVE**  
*Agraulis vanillae*



Bermuda Buckeye **ENDEMIC**  
*Junonia coenia bergi*



Monarch **NATIVE**  
*Danaus plexippus* **MIGRANT**



Red Admiral **MIGRANT**  
*Vanessa atalanta rubria*



Painted Lady **MIGRANT**  
*Vanessa cardui*



Frangipani Hawkmoth **NATIVE**  
*Pseudosphinx tetrio*

### Moth Mania

More than 200 different moths have been recorded in Bermuda. One of the most conspicuous is the **Frangipani Hawkmoth** (*Pseudosphinx tetrio*), which can reach 9 cm (3.5 in) in length.

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# Butterflies

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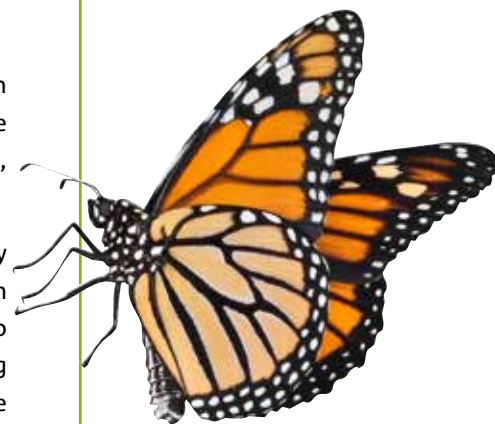
Butterflies and moths together form a single group (Lepidoptera) of about 200,000 known species within the insects (Phylum: Arthropoda, Class: Insecta, Sub-class Endopterygota). There is not one single feature that separates all moths from butterflies. It is an artificial separation. The unique features of the Lepidoptera are scales that cover their body and a proboscis that coils up. Adult butterflies and moths feed on liquids, which they suck up through a long, coiled proboscis. Their wings and body are covered in tiny scales, which are really flattened and ridged hairs. All species undergo complete metamorphosis and the larvae, or caterpillars, are as varied in colour and shape as the adults.

## Monarch Butterfly

Monarch butterflies are widely distributed across North America, particularly near corn and soybean fields rich in milkweed, their food of choice. They lay their eggs on the milkweed plants, and caterpillars feed on the weed during their larva stage. As adults, butterflies feed on the nectar of flowers.

Monarchs are famous for their extraordinary migration spread over 4 generations. They travel up to three thousand miles and, they fly in masses to the same winter roosts, often to the exact same trees. In the fall their migration takes them from Canada to Mexico or to Baja California if they are located west of the Rocky Mountains. In the spring Monarchs return north, mate and lay eggs on milkweed plants along their route. The next generation of Monarchs will continue with the journey north and again produce offspring. This fourth generation will mature without developing their reproductive organs. This allows them to live much longer than the previous generations which live an average of 2 months. This generation can live up to 9 months and is able to fly the long way back to their winter roosts where they stay until spring when they develop their reproductive organs and start with the next migration north.

The population of the Monarch butterflies of Bermuda consists of residents and migratory individuals possibly blown off their normal migratory route.

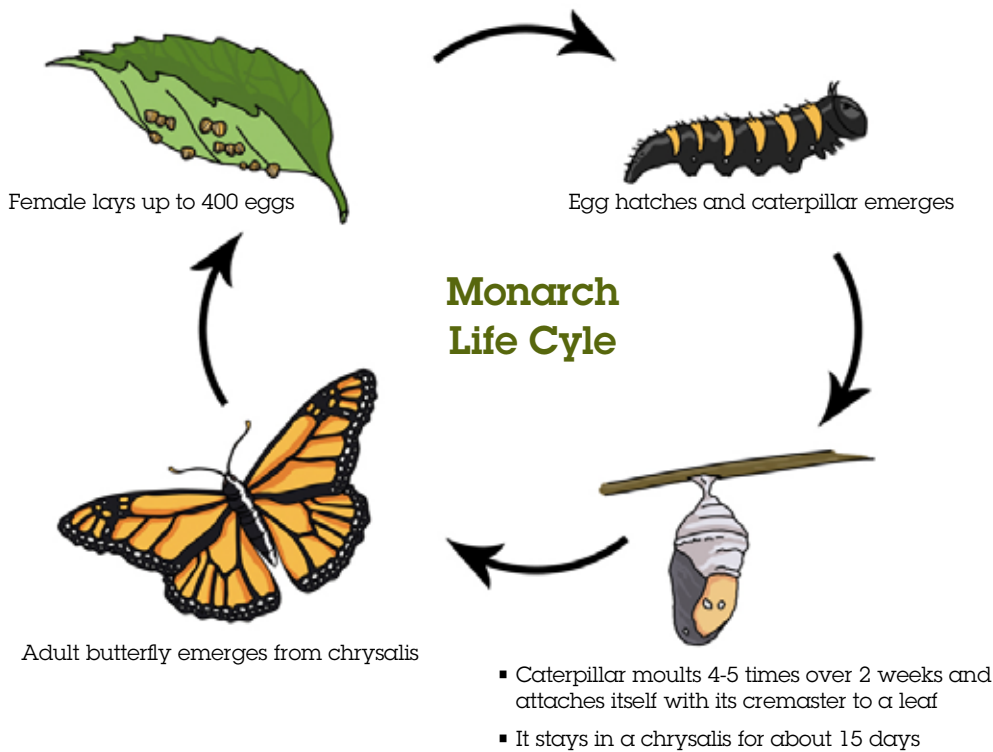


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## Monarch Life Cycle

The adult female can attach up to 400 eggs on the underside of the leaves of the milkweed plant. The eggs hatch after a few days and a tiny caterpillar (one twenty-fifth of an inch) with 8 pairs of legs will emerge ready to eat the leaves of the milkweed plant. The caterpillar moults 4 to 5 times and after 2 weeks it is about 2 inches long and more than 2,700 times its original weight. This is about the time that the caterpillar attaches itself onto a leaf using a hook-covered appendage called a cremaster. The caterpillar will undergo a final moult when its skin dissolves into a milky green sheath called a chrysalis. This is the pupa stage of the life cycle. It will take approximately 15 days from the chrysalis to the emerging of the adult butterfly. This life cycle is known as Holometabolism, which is a monophyletic trait that all insects in the sub-class Endopterygota have. This type of development gives the offspring the unique advantage of not competing with adults because they inhabit different ecological niches.

## Complete Metamorphosis



## Threats to Bermuda's Butterflies

The threats to butterflies are due to a loss of space to residential, commercial and agricultural development and loss of host plants. Many of these plants are considered to be weeds and have thus disappeared from the manicured residential garden. In order for the species to survive, it is vital to plant beneficial plants for them. Small pockets with butterfly garden plants should be incorporated into most of our gardens. This will bring enjoyment for the gardener and insects alike. Butterflies themselves are a good food source, thus more butterflies will result in a larger number of birds, lizards and toads in the garden.

An additional threat is climate change. In Europe and America scientists have reported changes in migratory patterns and range of distribution due to warmer climates.



**Milkweed** **INTRODUCED**  
*Asclepias subulata*



**Egyptian Star Flower** **INTRODUCED**  
*Pentas lanceolata*



**Lantana** **INTRODUCED**  
*Lantana camara*

## Butterfly Friendly Plants

Introducing these plants to your garden will invite butterflies to thrive



# Coastal Hillside & Rocky Shoreline



**White Cedar** **INTRODUCED**  
*Tabebuia pallida*



**Bermudiana** **ENDEMIC**  
*Sisyrinchium bermudiana*



**Bay Grape** **NATIVE**  
*Coccoloba uvifera*



**Coast Spurge** **NATIVE**  
*Euphorbia buxifolia*



**Buttwood** **NATIVE**  
*Conocarpus erectus*



**Sea Oxeye** **NATIVE**  
*Borrchia arborescens*

Some native plants have evolved unique features, such as tough, fleshy leaves covered with silky hairs, to survive harsh coastal conditions including poor soil and exposure to wind and salt spray. The **White Cedar** common on hillsides is a naturalised coastal tree from the West Indies. **Buttwood**, **Sea Oxeye** and **Coast Spurge** are native shrubs along the rocky shoreline and the endemic **Bermudiana** can be seen flowering here in the spring.

**Casuarinas** have become a threat to the coastal habitat. These fast-growing trees shade out the more prostrate native flora and uproot readily in hurricanes, causing cliff falls. The dead stumps visible are of **Casuarinas** culled as part of the reserve management programme.

# Seabirds



**Belted Kingfisher** **WINTER MIGRANT**  
*Magaceryl alcyon*



**Great Blue Heron** **WINTER MIGRANT**  
*Ardea herodias*



**Common Tern** **SUMMER MIGRANT**  
*Sterna hirundo*



**Double-crested Cormorant** **WINTER MIGRANT**  
*Phalacrocorax auritus*



**Lesser Black-backed Gull** **WINTER MIGRANT**  
*Larus fuscus*



**Ring-billed Gull** **WINTER MIGRANT**  
*Larus delawarensis*

The **Belted Kingfisher** and **Great Blue Heron** can be seen along the shoreline in winter. Further out in the Sound, **White-tailed Tropicbirds** (Longtails) and **Common Terns** can be seen in the spring and summer. **Double-crested cormorants**, **Lesser Black-backed gulls**, **Herring gulls**, **Ring-billed gulls** and **Great black-backed gulls** are frequent winter visitors.

# Limestone Sink Hole



Bermuda is made up of limestone (calcium carbonate) which when dissolved by fresh rainwater over very long periods of time eventually forms caves underground.

The concentration of caves in Bermuda is among the highest in the world. As caves take a very long time to form, the greatest density is found in the oldest limestone formations. Vesey Nature Reserve is in the Town Hill formation, the second oldest on the island.

Sometimes the roof of a cave collapses, forming a sink hole – a natural depression in the ground that often exposes cave formations such as stalactites and stalagmites.

Caves are among the most fragile habitats on our planet. Formed thousands of years ago at a time when the seawater level was lower than today, the limestone structures inside caves have been deposited at a very slow pace. Today most of Bermuda's caves are submerged and only a few are accessible to a hiker. The majority of these can be found in the Walsingham Pond area.

Currently the most widely accepted theory of cave formation in Bermuda holds that the caves were formed, contemporaneously with enclosing rock, by a solution below the water-table during low stands of sea-level. Continued collapse of overlying rock into large voids, created the irregular 'rooms' and fissure entrances that are commonly seen in Bermuda caves.

The sink hole in Vesey Nature Reserve is clear evidence that caves are present in the Southampton area. Here the roof of a cave has collapsed and has fallen in. This created a partially open cave now filled with rubble from the collapsed roof. Due to the lower temperature and higher humidity inside the caves, cave entrances are unique habitats for many rare ferns, moss and other shade loving plants. The endemic **Bermuda Maidenhair Fern** (*Adiantum bellum*) is often found attached to the cool and moist limestone rock on the sides of the sink hole.

## Ferns & Caves

Cave openings breathe warm moist air in winter and cool moist air in summer, maintaining an optimum sheltered habitat for native ferns such as the Bermuda Maidenhair Fern and the Sword Fern.



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



**Sword Fern**  
*Nephrolepis exaltata*  
NATIVE



**Southern Braken**  
*Pteridium caudatum*  
NATIVE



# Skroggins Hill Quarries



## Inland Quarry

The Inland Quarry represents the foundation industry from which the unique architectural heritage of Bermuda arose. Bermuda's early fortifications, wharves, official buildings and homes were made possible by the labour-intensive quarrying of limestone bedrock into building stones.

It is perhaps fair to say that the first industrial activity to take place on the island was the quarrying of the soft limestone and the burning of limestone to produce lime for mortar and paint. While for many years homes were built in timber, the construction of stone forts in Bermuda began almost immediately after the arrival of settlers in the *Plough* in late July 1612.

Rising some 30 feet above the existing ground level these vertical rock faces, interposed with projections of uncut rock, were created by the stonecutters. The faces of this escarpment show evidence of the early methods of quarrying. The long vertical channels, about 3 inches wide are evidence of grooves that were created behind a quarry block. These grooves were painstakingly cut many feet into the bedrock by a chisel on a long pole with each groove in the making having to be emptied of the sand by a rake. The groove provided just enough space for the end of a long stone saw to move. Without the channels it would have been impossible to cut the stone into massive blocks. The faces of the escarpment also show evidence of saw and chisel marks.

Large blocks brought down from the escarpment and left uncut are now mostly buried and suggest this quarry was abandoned suddenly, without cutting up the blocks that had taken such labour to detach from the bedrock.

Limestone is one of the earliest rocks to be used by people in the construction of monuments, official buildings, homes and many other structures. It is relatively easy to cut, bears up well to the elements, can be burnt to produce lime for mixing with sand to produce mortar to cement the building block together and also to make lime or whitewash, for thousands of years the paint of choice. In modern times, limestone is still widely used for building and other purposes, and is prevalent throughout the world.



**Saw and chisel marks in the quarry wall**



## Costal Quarry

The Coastal Quarry is likely one of a number of sites on Bermuda's coast from which 'wharf block' was acquired. The rock was removed following the bedding planes suggesting it may have been broken out partly by chiseling. There is clear evidence of cutting the block as well, in standing portions of stone, as well as the vertical rock faces on the sides and rear of the quarry. The rock from such cuttings was used for wharves, but it is also possible that the quarry also provided building stone, as sea transportation was paramount in the days before decent roads were built throughout Bermuda.

# What is Limestone?



The rocks beneath the pathways and the ones that are exposed in the quarries are limestone. Limestone is a sedimentary rock which was formed in earlier geological times through two different processes. It formed either through accumulation of the skeletal fragments of marine organisms such as foraminifera, coral, worm snails, sea urchins and sponges or through crystallisation from seawater. Most limestone is made up of the mineral calcite (calcium carbonate) and forms in shallow, calm,

warm marine waters. Here organisms capable of forming calcium carbonate shells and skeletons can extract the needed ingredients from ocean water. When these animals die, their shell and skeletal debris accumulates as sediment. With time and pressure this sediment can turn into limestone.

The other way limestone forms is through the crystallisation process in which calcium ions combine with carbon dioxide to form calcium carbonate. Calcium carbonate is insoluble, so it precipitates out into layers, which turns into limestone, again as a result of time and pressure.

Today Earth has many limestone-forming environments. Most of them are found in shallow water areas between 30 degrees north latitude and 30 degrees south latitude. Limestone is forming in the Caribbean Sea, Indian Ocean, Persian Gulf, Gulf of Mexico, around Pacific Ocean islands and within the Indonesian archipelago.

Limestone is desired by builders because it is durable, long-lasting and comes in a variety of colours, including white, buff, gray and variegated. Many historic buildings or monuments are made out of limestone. European medieval churches and castles feature gargoyles carved out of the material. Another example is the Great Pyramid of Khufu at Giza, Egypt which is made of 2.3 million blocks of limestone.

## Read more:

The Properties of Limestone That Make it Good to Use in Buildings | eHow.com [http://www.ehow.com/info\\_7835500\\_properties-make-good-use-buildings.html#ixzz2RyGfeNyJ](http://www.ehow.com/info_7835500_properties-make-good-use-buildings.html#ixzz2RyGfeNyJ) (<http://geology.com/rocks/limestone.shtml>).

# Quarrying in Bermuda

***“It is a great advantage when you can dig your house out of your own backyard.”*** – Carveth Wells, 1935

Bermuda’s sedimentary stone was formed over the ages from wind-drifted coral sand, which settled onto a base of volcanic rock. Though it all looks rather similar, there are different varieties of Bermuda stone. The oldest, known as Walsingham limestone, is the hardest. It has been hardened over time by minerals from the seepage of water and its main component is calcium carbonate. More recently formed limestone, often called ‘sandstone’ in Bermuda, is softer and more crumbly.

Bermuda’s stone was used from the early days of settlement for building, first for forts and public buildings and later for houses. Walls were made of soft stone sawn into building blocks with long iron hand saws. At that time, it was common for blocks to be obtained from the site where the building was to be erected. Part of the sloping hillside was cut away and a house put in the space created, which formed the cellar. Many



COURTESY OF THE BERMUDA ARCHIVES

A skilled stonecutter masters his tools cutting large limestone blocks. The chisel in the background would have been used to create primary channels in the rock face.

old properties have quarry 'starts' which show that additional quarrying was also done on site. There were also large commercial quarries, and blocks sometimes had to be transported to building sites or floated along the shore in small boats.

To begin the quarrying process, stonecutters would determine how the stone was bedded. They would select a suitable starting point and chisel and rake out a three inch trough around the first stone to cut. This first stone, called the head stone or key block, was like the first piece of a pie. Getting it out was the hardest part of the job. The rest of blocks were much easier to remove. The bottom of the blocks were 'riven' with hardwood wedges or undermined in a wedge shape with chisels, and pried loose. They were allowed to fall to the ground where they landed on a bed of scrap stones, called 'jacks' or 'slipes'. These absorbed the impact of the fall. The blocks, which were as large as 12 to 15 feet high, were then sawn or riven along the grain into building stones of different sizes. Sound stone with a very even grain was reserved for roofing slates. This was selected by eye or tapping with the knuckles to hear what kind of ring it had. Inferior stone and off-cuts were used as slipes or for dry stone walls. There was never any waste.

Bermuda's first stonecutters were often enslaved people or indentured labourers. After emancipation, the trade was often in the hands of working immigrants, both West Indian and Portuguese.

Many years later stonecutting was revolutionised by British-born engineer Rex Horsfield who came to Bermuda in 1948. He planned to build a house in Bermuda, but was so shocked by the labour-intensive and dangerous method of quarrying stone that he came up with his own patented production process that used engine-mounted chainsaws to cut as many as 1,700 blocks in a day. In 1957, he founded the Bermuda Stone Company with his son Colin, which grew into a major supplier of stone on the island throughout the 1960s and 1970s.

## Traditional Lime Mortars

Mortars are used to bond together blocks of stone and to help form a level bed on which to build. Mortars were based on lime, which may be the single most important element in Bermuda though it was costly because of the fuel and the labour required. It was made by burning hard stone in a limekiln. Some countries were not so lucky. They had to find alternative sources, such as shells from oyster middens or dumps. Some places even imported limestone and Bermuda was often happy to send this as ballast in its ships' holds.

Lime is created by slowly burning limestone at high temperatures until its chemical composition has changed. Two kinds of limekiln seem to have been used in Bermuda. The earliest kilns, and by far the commonest, were simple, cylindrical furnaces, generally cut into hillsides. They were about 10 feet high, tapering towards the top. Some later kilns, constructed in the 19th century by British engineers, were freestanding stone buildings lined with fireproof yellow brick. A good example of a simple limekiln can be viewed at Hog Bay Park in Southampton.

Today lime is replaced by cement or mortar plasticisers. Lime's proper use is so little understood today that it is often shunned because of its caustic qualities. Some builders will not even allow it on site.





COURTESY OF KEVIN R. HORSFIELD

A typical stone saw weighed more than eight pounds and was five and a half feet long. Stonecutters most often worked from the sitting position to protect their backs and apply weight behind their saws. A second handle was sometimes added to the saw which was then used with one man on each end.



COURTESY OF THE BERMUDA ARCHIVES

Proficiently cut and stacked stone blocks await pickup and delivery.

# Glossary

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

**Acquired:** to come into possession or ownership of

**Anoxic:** lacking oxygen

**Biodiversity:** the number of different species present at a location

**Calcareous:** containing or composed of calcium

**Community:** a naturally occurring group of organisms

**Conservationist:** a person who advocates or strongly promotes preservation and careful management of natural resources and the environment

**Development:** the act or process of growing or progressing

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

**Domination:** the act of ruling or taking over, controlling

**Earmarked:** set aside for a specific purpose, use or recipient

**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

**Endangered:** threatened with extinction

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

**Ferns:** type of flowerless plant growing in shady and moist places. Ferns produce spores

**Habitat:** a small area of environment where plants or animals live

**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

**Moss:** low-growing flowerless plants that live in shady and damp places

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

**Predator:** an organism that exists by preying upon other organisms

**Replicate:** to repeat, duplicate, or reproduce

**Reproduction:** the process by which new 'offspring' individual organisms are produced by their 'parents'

**Restore:** to bring back into existence or use, to a former or original condition; to bring back to a state of health or vigour

**Salinity:** the total dissolved salt content of sea water

**Threat:** an indication of warning or probable trouble

**Windbreak:** a structure, wall, or growth of trees serving as a shelter from the wind



## References

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<http://www.learnaboutbutterflies.com/Taxonomy.htm>

*The Traditional Building Guide*, Bermuda National Trust & Department of Planning, Island Press, 2002

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