Vesey

NATURE RESERVE

TEACHER RESOURCE GUIDE

THE BERMUDA NATIONAL TRUST

ACKNOWLEDGEMENTS

The Bermuda National Trust thanks AXIS Capital Holding Limited for sponsoring this publication. Some of the images, illustrations and information used in this publication were provided by the following individuals and organizations; their work is greatly appreciated: The Bermuda Zoological Society and Dr. Martin Thomas.

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

Learning with the Bermuda National Trust Education Programme

The Bermuda National Trust's teacher resources focus on nature reserves and historic homes owned and maintained by the Trust, offering comprehensive resources and creative learning experiences for visitors, teachers and students. We provide first-hand experiences that cannot be re-created in the classroom. Guided tours can be scheduled with a member of our education staff for preschool, primary, middle and senior level classes.

It is our hope that students will visit all the Trust properties, beginning at preschool or primary 1 - 2, and experience repeated visits throughout later primary, middle and senior years. Repeat visits help students build on their prior learning and develop a deeper understanding of the concepts and terms associated with each site. Senior students are encouraged to visit each site to learn about the care and preservation of nature reserves and historical homes. Opportunities are available for senior students to participate in our AIM Programme, allowing them to volunteer their time caring for Trust properties, which can be applied to required community service hours.

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Arranging a Class Trip/Teacher Resources

>Note to Teachers

Our goal is to make a visit to Vesey Nature Reserve valuable and meaningful to children and to stimulate a lifelong interest in the environment, their surroundings and some of the features that make Bermuda so unique. This resource was created to provide background information on the reserve along with suggested activities that you can conduct with your students before your class visit to the reserve and afterwards, to enhance your students' learning experience and help you achieve your curriculum goals.

There are a few options to support you before and after the field trip:

Teacher workshop

We can provide a "group teacher workshop" in our AXIS Education Classroom prior to a field trip with your students. A minimum of 10 teachers is required, maximum group size is 15. The time allotted for the work shop is 1.5 - 2 hours.

The overall focus of the workshop is to:

- Obtain a copy of the Vesey Nature Reserve resource booklet
- Review the history of the reserve, resources and suggested activities
- Obtain materials to create a map of Bermuda and labels to show the location of the Bermuda National Trust properties and other local landmarks which can be used in a classroom introductory lesson before taking the class tour
- Network with other teachers to brainstorm ideas for additional activities that can be offered to promote student learning before and after the class tour

Three-Part Learning Experience

We offer a three-part learning experience. After booking a field trip, a Bermuda National Trust educator can provide an introductory lesson for your students in your classroom, providing information about the site. This is an excellent preparation for the field trip which builds on students' prior knowledge and is helpful for engaged learning during the field trip. After the site visit a follow-up lesson can also be scheduled. Students will be guided in a review of their field trip and summarise their new knowledge.

1	2	3
PREPARATORY UNIT Introduction to site and target of learning	**FIELD TRIP** Informal engaged learning	**SUMMARY** Students will use their field trip experience towards new learning

Follow-up Visit

Teachers are welcome to schedule a follow up visit for their class at our AXIS Education Classroom at our Waterville site after the tour, preferably within two to three weeks. The goal is to review what students learned about the nature reserve and for them to share/ highlight the work they have completed. The time allotted for this student follow-up visit at Waterville is approximately 1.5 hours.

Tips for Using This Resource

Reading through the background information will assist teachers in answering the more probing questions from inquisitive students, and help create additional activities that extend the learning associated with Vesey Nature Reserve.

The activities provided focus on the Cambridge International Curriculum Key Stages 1 and 2, Primary Stages 1–6 and Secondary 1, Middle Stages 7-9. Curriculum links to activities are provided for integrating the Bermuda Ministry of Education's Science and Social Studies. While looking through the activities provided, teachers may also think of ways to integrate all other subject areas. The teacher's method of preparation and delivery will vary with students' needs and interests.

The activities presented here aim to engage young minds, foster observation skills and inquisitiveness about our environment, encourage respect and appreciation for nature and open spaces and promote knowledge and understanding of the unique features of this reserve.

We continue to seek ways to improve our educational programmes and welcome suggestions for enhancing this resource and the experience for the children. Please contact us with any suggestions or comments.

Enjoy yourselves,
The Education Team
Bermuda National Trust

education@bnt.bm
236-6483

Scheduling a field trip to Vesey Nature Reserve

To schedule a trip to Vesey Nature Reserve download and complete a school field trip booking form on our website, www.bnt.bm (found under the school tours heading) or copy the form in the back of this book. Return the form via email to: education@bnt.bm.

The ratio of guided tours is one adult for every ten children. Additional adults are welcome.

Ensuring a Safe and Enjoyable Visit

Before teachers come with their students they should be aware that the path through the reserve is very rugged and not suitable for wheelchairs. Individuals with physical limitations will need assistance. To ensure that students and adults have an enjoyable experience to the reserve, it essential for teachers to:

- Assume responsibility for the safety, behaviour, support and welfare of students. The reserve contains high cliffs and students will need to be supervised at all times
- Ensure that students are prepared with appropriate clothing and walking shoes
- Prepare and carry a register which includes the names of all students with emergency and medical information
- Ensure that each student has a completed the Bermuda National Trust parent/guardian consent to attend the tour, which includes our photo release policy. This form is included in the appendix. Teachers need to notify the Trust staff member leading the tour of any students who do not have prior consent to be photographed
- Provide necessary information for the Trust staff member about relevant student learning needs, behavioural support, allergies or health
- Bring a first aid kit and a cell phone to be used in the event of an emergency
- Refrain from using cell phones and texting for personal use during the tour
- We ask that teachers support students in their learning before, during the tour and after their visit

Before the Tour, Setting the Stage for Student Learning

After booking the tour, teachers are encouraged to review the information that follows:

- The history of Vesey Nature Reserve and map showing the location of the reserve
- The definitions of key terms relating to plant and animal life
- The animals and plant life that inhabit the reserve

In preparation for the tour, initial classroom activities are provided and meant to assist students in recalling their prior knowledge of nature reserves and open spaces, and to learn specific information about Vesey Nature Reserve. The scope of students' learning will depend on the grade level, their prior exposure to reserves, background knowledge and understanding of terms. Although the activities provided begin at the lower primary level, teachers of older students can modify the activities for the grade and developmental level of their students' abilities. We hope that teachers will generate new ideas for creating additional activities and share them with our education staff.

Provide students with the following information:

- There are several habitats in this nature reserve including the salt water pond, woodland valley, exposed hilltop and rocky shoreline. They provide the environments for a diversity of plant and animal life
- Nature reserves are important for our health and well-being
- The meaning of the terms native, endemic, introduced and invasive (see definition of terms)
- Ways that we can take care of nature reserves such as keeping the areas free of trash, leave the walking paths, trees, plants and flowers and the overall area as you found them
- Whether you are visiting as a student, teacher, with family or friends, it is important to be respectful of this beautiful public space

Bermuda National Trust
STEWARDSHIP PROPERTIES

- NATURE RESERVES
- HISTORIC PROPERTIES
- HISTORIC CEMETERIES

take only pictures

Please help us preserve & protect

Enjoy this reserve from dawn to dusk

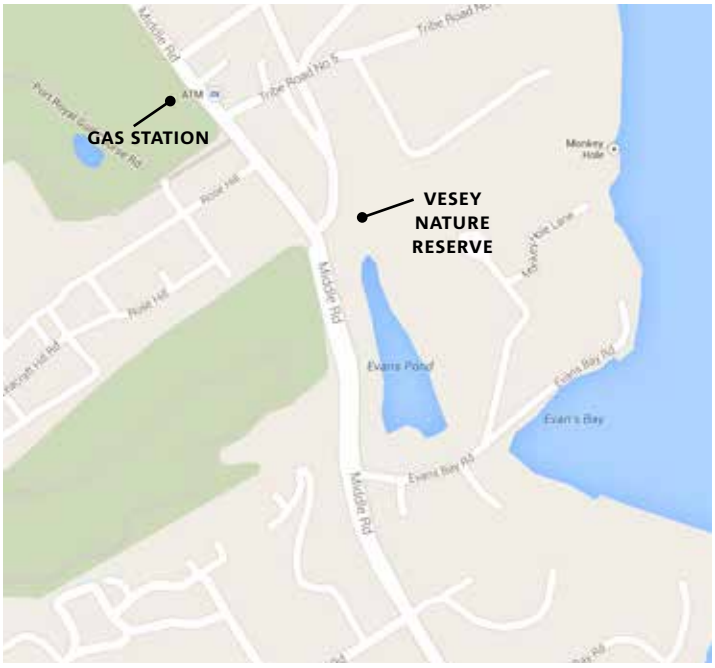
Respect the wildlife

Be considerate of others

No vehicles

Dogs must be on lead

leave only footprints



Directions

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

NATURE RESERVE





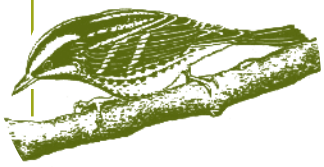






THIS 8-ACRE PROPERTY WAS DONATED TO BUY BACK BERMUDA BY Sharon Vesey in 2009 and was restored as a nature reserve with public donations to the Buy Back Bermuda Round 2 Campaign. Buy Back Bermuda is a joint initiative of the Bermuda National Trust and the Bermuda Audubon Society working together to conserve 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 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 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

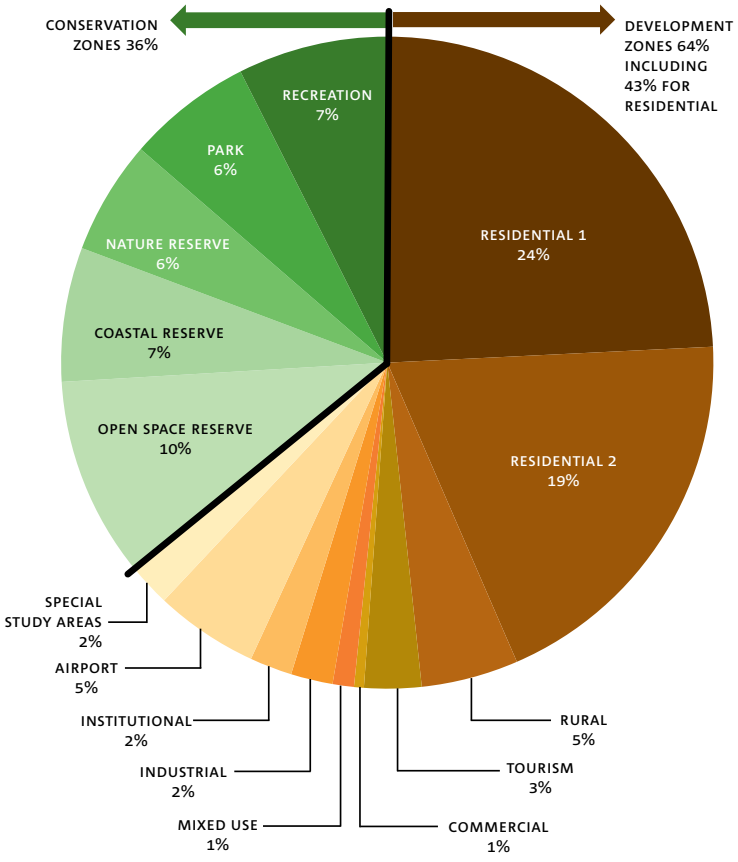
The chart below shows a breakdown of how Bermuda's land is used.

Conservation Zones totalled = 36%

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

Development Zones totalled = 64%

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



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

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

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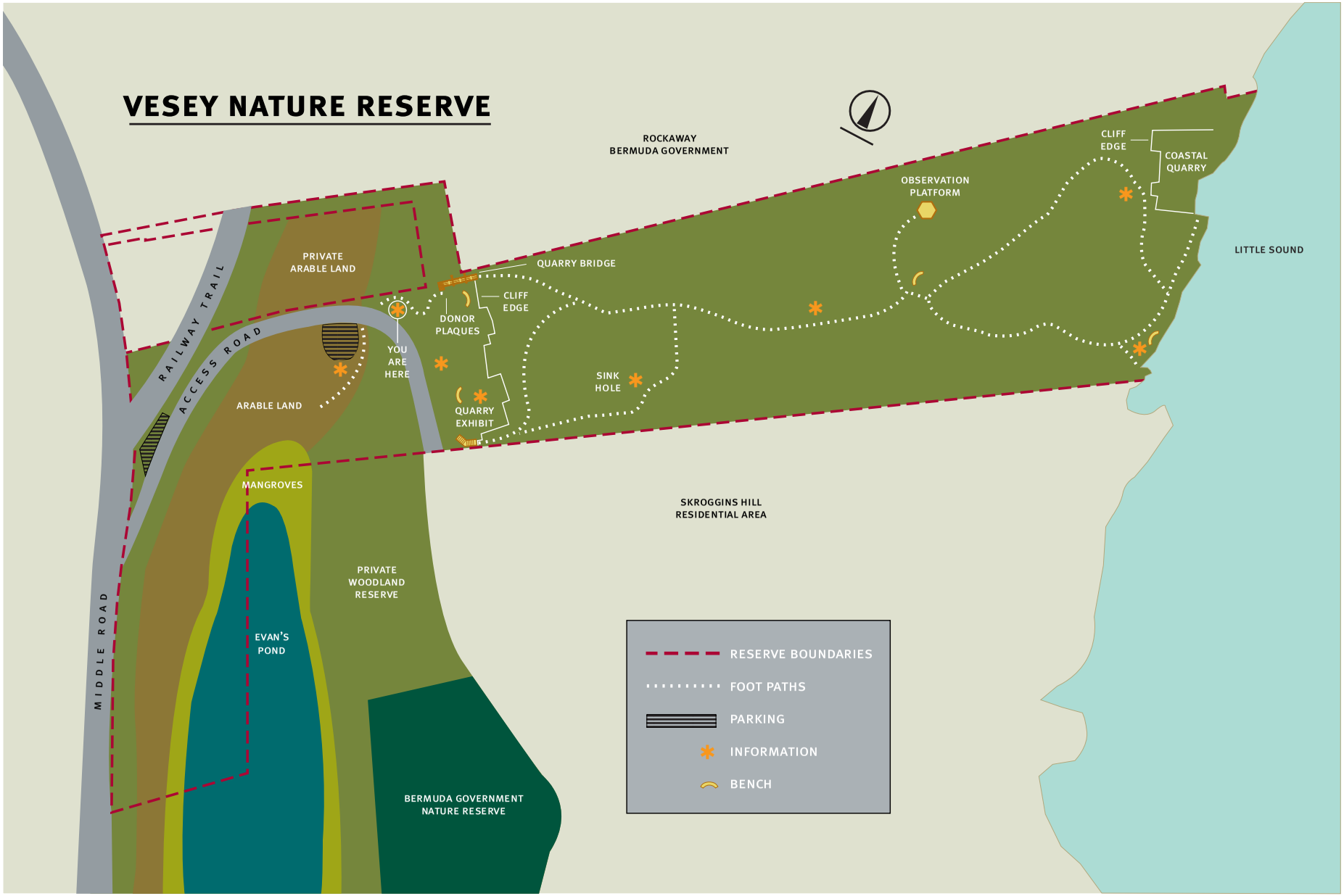


Map showing key features of the Vesey Nature Reserve

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 NATIVE ENDANGERED
Coenobita clypeatus

Coffee Bean Snail NATIVE
Melampus coffeus

Giant Land Crab NATIVE ENDANGERED
Cardisoma guanhumi

Snowy Egret MIGRANT
Egretta thula

Mangrove crab NATIVE
Goniopsis cruentata

Osprey WINTER MIGRANT
Pandion haliaetus

Yellow-Crowned Night Heron NATIVE RESIDENT
Nyctanassa violacea

Bermuda Killifish ENDEMIC
Fundulus bermudae

Green Heron NATIVE RESIDENT
Butorides virescens

Black-and-white Warbler WINTER MIGRANT
Mniotilta varia

Northern Waterthrush WINTER MIGRANT
Seiurus noveboracensis

Great Blue Heron MIGRANT
Ardea herodias

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 ENDEMIC
Sabal bermudana

Palmetto leaf

Bermuda Olivewood ENDEMIC
Cassine laneana

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 INVASIVE
Citharexylum spinosum

Brazil Pepper INTRODUCED INVASIVE
Schinus terebinthifolius

Chinese Fan Palm INTRODUCED INVASIVE
Livistona chinensis

Lucky Nut INTRODUCED INVASIVE
Thevetia neriifolia

Jumbie Bean INTRODUCED INVASIVE
Leucaena leucocephala

Allspice INTRODUCED INVASIVE
Pimenta dioica

Animal Life of the Woodland Valley

Bermuda White-Eyed Vireo
Vireo griseus bermudianus
ENDEMIC

Grey Catbird NATIVE
Dumetella carolinensis

Great Kiskadee INTRODUCED INVASIVE
Pitangus sulphuratus

Barbados Anole INTRODUCED
Anolis roquet extremis

Antiguan Anole INTRODUCED
Anolis bimaculatus leachii

Jamaican Anole INTRODUCED INVASIVE
Anolis grahami

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
Dodonaea 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 on-going 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 INVASIVE
Eugenia uniflora

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 MIGRANT
Danaus plexippus

Red Admiral MIGRANT
Vanessa atalantarubria

Painted Lady MIGRANT
Vanessa cardui

Frangipani Hawkmoth NATIVE
Pseudosphinx tetrio

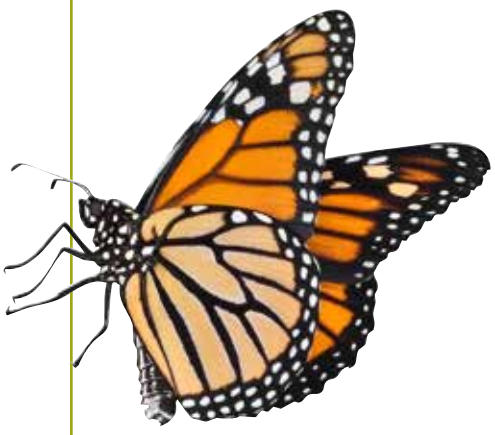
Moth Mania

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.

Butterflies

Butterflies and moths together form a single group (Lepidoptera) of about 200,000 known species within the insects (Phylum: Arthropoda, Class: Insecta, Sub-class Endoperygota). 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.

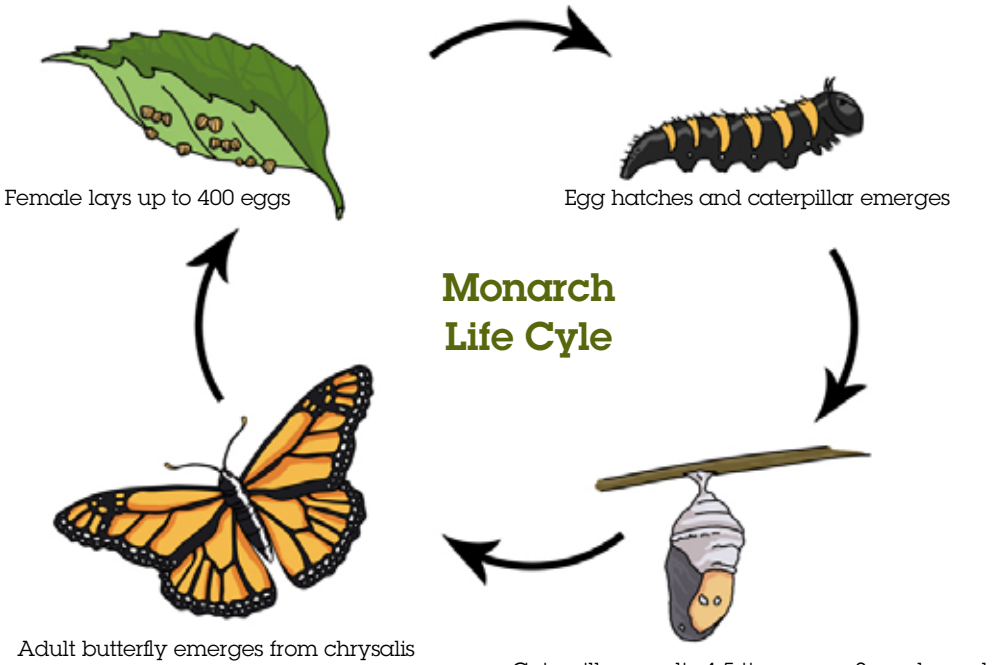
Monarchs are famous for their extraordinary migration spread over 4 generations. They travel up to three thousand miles and, they fly in masses to the same winter roosts, often to the exact same trees. In the fall their migration takes them from Canada to Mexico or to Baja California if they are located 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.

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 Metamorphism



- Caterpillar moults 4-5 times over 2 weeks and attaches itself with its cremaster to a leaf
- It stays in a chrysalis for about 15 days

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.

Butterfly Friendly Plants

Introducing these plants to your garden will invite butterflies to thrive

Milkweed INTRODUCED
Asclepias subulata

Egyptian Star Flower
Pentas lanceolata INTRODUCED

Lantana INTRODUCED
Lantana camara

Coastal Hillside & Rocky Shoreline

White Cedar INTRODUCED
Tabebuia pallida

Bermudiana ENDEMIC
Sisyrinchium bermudiana

Bay Grape NATIVE
Coccoloba uvifera

Coast Spurge NATIVE
Euphorbia buxifolia

Buttonwood NATIVE
Conocarpus erectus

Sea Oxeye NATIVE
Borrichia 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. **Buttonwood**, **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 NATIVE
Nephrolepis exaltata

Southern Braken NATIVE
Pteridium caudatum

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://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.

Teacher Resources/Activities

Before your visit/

Introducing Students to Vesey Nature Reserve

The activities included aspire to engage young minds and foster observation skills and inquisitiveness about our environment. We encourage respect and appreciation for nature and open spaces, and promote knowledge and understanding of the unique features of the reserve. Curriculum links to all activities are provided in the appendix.

OBJECTIVES

The objective of the four suggested activities is to introduce students to the Vesey Nature Reserve and to encourage the use of the correct terminology when describing nature reserves in general. Students will also learn how to read maps to locate properties such as the Bermuda National Trust reserves.

✱ACTIVITY 1/PRIMARY 1-3
Science Vocabulary

Primary and middle level students should be introduced to, and /or review, the vocabulary as it applies to the reserve before their visit. Refer to the glossary for the terms that are within this resource.

Fauna: animals (insects, birds, amphibians, mammals etc.)

Flora: flowers, plants, bushes, trees

Forest: a dense area of trees, also known as woodland, wood or woods. A typical forest is composed of the overstorey (canopy or upper tree layer) and the understorey

Habitat: the natural conditions and environment in which a plant or animal lives.

Mangroves: an evergreen tree found growing along shorelines or pond edges with its roots exposed at low tide

Marsh: low-lying waterlogged land that is poorly drained and liable to flood when it rains

Nature reserve: a managed and protected area of land, usually containing rare or endangered plants or animals

Pond: a small still body of water formed naturally or created artificially

Rocky coast: a form of cliffed coast where the action of marine waves has formed cliffs that may or may not be steep

✱ACTIVITY 2/PRIMARY 1,2 & 3

Geography/Where is Vesey Nature Reserve?

Having a visual sense of the reserve's location and where students will be traveling for the upcoming tour helps to build excitement before the visit. This activity provides a springboard for visiting other Trust reserves – Paget Marsh, Somerset Long Bay, Sherwin Reserve at Warwick Pond and Spittal Pond.

THIS ACTIVITY ALSO FOCUSES ON:

- The location of parishes
- Bodies of water in and around our island
- Learning directional terms, north, south, east, west
- The location of other Trust properties, lighthouses, caves, tribe roads, forts, the airport, etc.
- A key, which displays symbols that correlate to areas on the map

MATERIALS

- Access to a Smartboard, a computer and printer are needed
- Images of Bermuda maps and Bermuda National Trust properties are available on our website under our Teacher Resources heading
- Print both maps – one with Trust property locations and one without
- Print images of Trust nature reserves

To expand the activity, teachers can print images available on our website of other Trust properties and find other images of island landmarks online through Google/Images.

Additional Materials: poster board, self-adhesive Velcro, glue sticks and access to a poster size laminator. Local copy stores can enlarge/laminate the map and laminate landmark images.

✱ACTIVITY 3/PRIMARY 1-3

Preparation Activity

- Print the maps of Bermuda. Enlarge the map without nature reserve locations to suit a size large enough for a whole group introductory lesson and laminate for durability. Back the laminated map on a display board
- Print pictures of the nature reserves, back them with poster board and laminate – the recommended size of images 2" x 2"
- Create and print names of parishes, tribe roads, etc. Google images of local landmarks and print as well
- Attach Velcro to the laminated images and the display map in the appropriate locations of Trust properties and refer to the map in this guide showing the nature reserve locations as a reference
- Have the display map and images ready for the Vesey Nature Reserve introductory lesson
- Log on to the Trust website/education section and display the digital images of Vesey Nature Reserve and other Trust nature reserves on a Smartboard; or print 8½ " x 11" size to share with students

✱ ACTIVITY 4/PRIMARY 4-6

Introduction to Vesey Nature Reserve

MATERIALS

• Access to a Smartboard, a computer and printer are needed

Teachers of Upper Primary should assess their students' prior knowledge of nature reserves and the science vocabulary (see Lower Primary Introduction) and glossary terms in preparation for their introduction to Vesey Nature Reserve. Creating a classroom map will also benefit students who have not developed an understanding of the reserve's location as well as other important landmarks.

Log on to our website/education section and display the digital images of Vesey Nature Reserve and other Trust nature reserves on a Smartboard, or print 8½" x 11" size to share with students.

Review the importance of Vesey Nature Reserve with students and create:
A table to show the overall importance of Vesey Nature Reserve (possible headings: environmental and educational values, mangroves, nesting areas for birds, open space, learning about quarrying).

During your visit/Class Field Trip Activities

The following is a selection of suggested activities for investigation while visiting Vesey Nature Reserve.

OBJECTIVES

- To develop observation skills
- To learn about flora and fauna of Bermuda and natural habitats
- To learn about limestone and quarrying

✱ ACTIVITY 1/PRIMARY 1-2

Natural & Man-made Environments

To explore students' awareness of natural and man-made environments, they will identify and categorise items in their immediate surroundings (including things they brought with them). In pairs, they will then investigate and discuss their classmates' selections. A group discussion will conclude the activity to confirm or challenge the classifications.

✱ ACTIVITY 2/PRIMARY 1-2

Exploring Plant & Animal Habitats Through the Senses

Vesey Nature Reserve habitats are a focus for students as they explore individual areas that support life for plants and animals. Students will tour different habitats in the reserve and draw animals and plants that they see and describe the different sounds and smells of each area.

✱ ACTIVITY 3/PRIMARY 3-4

Hunting for Specific Trees

Students will go on a walk in the reserve and will be introduced to specific trees and discover their unique characteristics. They will talk about the importance of protecting trees in nature, draw the trees they see, label them with their correct names, and point out the characteristics of each that make them similar or different.

✱ ACTIVITY 4/PRIMARY 3-4

The Influence of Physical Environments

Students will create and interpret simple maps of Vesey Nature Reserve and describe how physical environments influence human activity. By illustrating their interpretation of their nature walk experience with pictures and symbols on the map, the group explores how the outdoors can be a source of experiential education and recreation.

✱ ACTIVITY 5/PRIMARY 5-6

Mangroves in Vesey Nature Reserve

Students will learn to distinguish between the two mangrove species present in Bermuda based on their vegetative and reproductive characteristics. They will also become familiar with the common mangroves by examining leaves, stems, trunks, aerial roots, flowers, flints, and propagules of Rhizophora mangle (red mangrove) and Avicennia germinans (black mangrove). They will also examine and record vascular plant species that are associated with mangrove species.

✱ ACTIVITY 6/PRIMARY 5-6

Understanding Ferns & Mosses

Plants that are often ignored because they lack big, showy flowers are ferns and mosses, which do not produce seeds, but produce spores instead. Students will hunt for these plants to see if they can spot any of them. They will record where they see these special plants and describe their surrounding environment.

✱ ACTIVITY 7/MIDDLE 1-3

Measuring a Limestone Block

The inland quarry area at Vesey Nature Reserve exhibits stone cutting marks in the limestone made by previous individuals who worked in the quarry. Students will learn about inland quarrying and will be able to measure one of the large stones left in the area, calculating the volume and weight of a large block of limestone. They will discuss the dangers associated with the old style quarry, the tools that were used and the advantages and disadvantages of using Bermuda limestone for buildings.

✱ ACTIVITY 8/MIDDLE 1-3

Classifying Plants

Plants have different flowers, leaves, roots, stems and seeds. All of these features are important for the classification fo plants. Students will learn the different ways in which we can classify plants by hunting for plants in the nature reserve and recognising similarities and differences between them.

After your visit/Additional Information & Activities

Activities listed in this section encourage students to learn further with the help of seven fun and engaging activities.

OBJECTIVES

The following activities will enable students to summarise their learning and to reflect on their visit.

✱ ACTIVITY 1/PRIMARY 1-2

Outdoor Classroom: Creating Different Habitats

The school playground can be the perfect location to attract and support wildlife by creating ideal habitats for particular species. Ask each student to bring to school a rock or piece of tile. Create a rock garden in a quiet location on your school property. The moisture and somewhat controlled temperature of the rocks will attract frogs, toads and lizards. Alternatively plant flowers that attract, feed and create a habitat for caterpillars and butterflies, such as Milkweed, Lantana, Pentas, Marigolds and Plumbago or collect a large pile of sticks to be home to creatures such as beetles, millipedes, ants and lizards. Invite the class to visit the habitats often and take a few moments to observe, discuss and learn outside the classroom.

✱ ACTIVITY 2/PRIMARY 1-2

Habitat Poster

Learning about different habitats and the animals that live in them is fun when students can design their own poster showing at least 6 different animals and the habitat they live in. Students can collect pictures of animals from magazines or draw them. Their finished work can include materials that enhance their poster, such as feathers from a bird, shells, sand, dirt, etc.

✱ ACTIVITY 3/PRIMARY 2-6

Rock-On Fizzy Fun

Students will discuss the effect of acid rain on limestone used in buildings and monuments and then observe what happens when a small limestone rock is added to vinegar in a glass. After a few minutes the rock will start to fizz. They can then perform the same test with other rocks and minerals. You may not see any bubbles. Vinegar, an acid, dissolves bits of calcium carbonate in the limestone. This releases carbon dioxide, a gas that rises to the surface as a stream of bubbles. Rocks that don't contain calcium carbonate won't fizz.

MATERIALS

- Vinegar
- Glass
- Small chunk of limestone rock
- Several different rock types

ACTIVITY 4/PRIMARY 3

Student Plant Hunters

Students should take a guided walk around the outside of their school and take along clip boards, pencils and paper. Their mission is to record what they notice about different plants.. They may write or draw. Allow your 'Plant Hunters' to use a magnifying glass to help them search for plant parts and then draw different parts of the plants they find. As a homework assignment ask parents to supervise their children using a digital camera to take pictures of different parts of plants they find around their home. Parents can email you a few pictures to display on the classroom Smartboard.

ACTIVITY 5/PRIMARY 4

Mini Habitats Near You

Habitats are all around us. They can be found in small rock gardens, in a tree stump and even a potted plant. Students are given the task of hunting for habitats around their homes and making a list of those they have found. They should choose one and draw a diagram of the community that exists within this habitat, including the animals that reside there and the overall structure of their home.

ACTIVITY 6/PRIMARY 5

Junior Scavenger Hunt

Walk around your school property or nature reserve. Have students identify and record an example of each of the following items without disturbing them. See the worksheet on page 39 that can be used.

ACTIVITY 7/MIDDLE 1-3

Senior Scavenger Hunt

Walk around your school property or nature reserve. Have students identify and record an example of each of the following items listed on the worksheet on page 40 without disturbing them.Identify the specimen; note the date, location and 'collector'. Label and describe each specimen on a separate index card.

✱ACTIVITY 6/VESEY NATURE RESERVE/PRIMARY 5

Junior Scavenger Hunt

Walk around your school property or nature reserve. Identify and record an example of each of the following items on an idex card.

Name: _____

Date: _____

	ITEMS TO FIND	NOTES LOCATION, NAME, ETC.
☐	The largest thing	
☐	The smallest thing	
☐	The coldest place	
☐	The warmest place	
☐	A seed, spore or new shoot	
☐	Something that can be recycled	
☐	Something alive that is camouflaged	
☐	Something with six legs	
☐	Something with wings	
☐	Something that swims	
☐	Something alive that makes a noise	
☐	Something that pollutes	
☐	A home for an animal	
☐	Something that hurts the environment	
☐	Something that helps the environment	
☐	The beginning of something	
☐	A stem, leaf, root	
☐	An interaction between a living and a non-living thing	
☐	An introduced organism	
☐	An invasive organism	

✱ACTIVITY 7/VESEY NATURE RESERVE/MIDDLE 1-3

Senior Scavenger Hunt

Walk around your school property or nature reserve. Have students identify and record an example of each of the following items listed on the worksheet on page 42 without disturbing them. Identify the specimen, note the date, location and 'collector'. Label and describe each specimen on a separate index card.

WORTH 1 POINT EACH

- ☐ an arthropod
- ☐ an insect
- ☐ an arachnid
- ☐ a reptile
- ☐ an amphibian
- ☐ a mollusk
- ☐ a dicot plant (plant with two leaves at germination)
- ☐ a monocot plant (plant with a single seed leaf)
- ☐ a fungus
- ☐ a resident bird
- ☐ a migratory bird
- ☐ a mammal
- ☐ an organism's home
- ☐ the reproductive structure of a plant
- ☐ a gymnosperm (woody cone-bearing plant)
- ☐ an angiosperm (flowering plant)
- ☐ a bryophyte (non-flowering simple plant)
- ☐ a fern
- ☐ seed dispersal by animals
- ☐ seed dispersal by wind or water
- ☐ an animal larva or pupa

WORTH 2 POINTS EACH

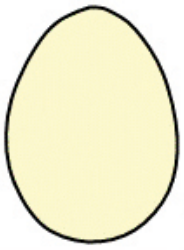
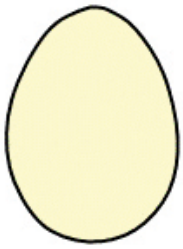
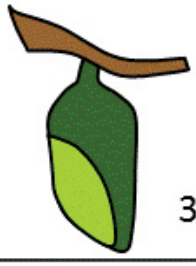
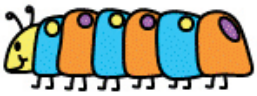
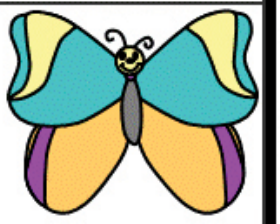
- ☐ a food chain
- ☐ a food web
- ☐ two different life stages of the same organism
- ☐ the interaction between an invasive animal and invasive plant
- ☐ an environmental disaster
- ☐ an environmental success
- ☐ genetic variation within a population
- ☐ sporophyte and gametophyte (generations of the same plant)
- ☐ example of a plant adaptation
- ☐ example of an animal adaptation
- ☐ an example of asexual reproduction
- ☐ territorial behaviour in animals
- ☐ mating behaviour in animals
- ☐ an example of mutualism (advantageous relationship between species)
- ☐ an example of commensalism
- ☐ relationship between two different species, in which one benefits, while the other remains unharmed and unaffected
- ☐ a parasite and host
- ☐ a population
- ☐ a community

Appendix

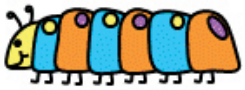
✤ APPENDIX · ACTIVITY 1/PRIMARY 3-5
Butterfly Life Cycle Sudoku

Name: _____

Date: _____

 4			
	 3		 1
 1		 3	 2
	 2		 4

Each row, each column and each of the large four squares should have one of each image. Fill in the blanks!

 1  2  3  4

Egg to Adult Butterfly Mini Book

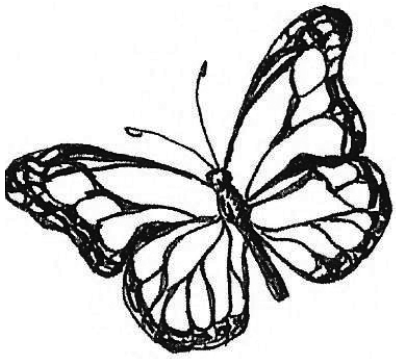
Students can create an 'Egg to Adult Butterfly' mini book. When it is completed the children can practice reading their book to a friend and then take this special book home to read to a family member.

1. Colour the pages of the book and the cover (located below).

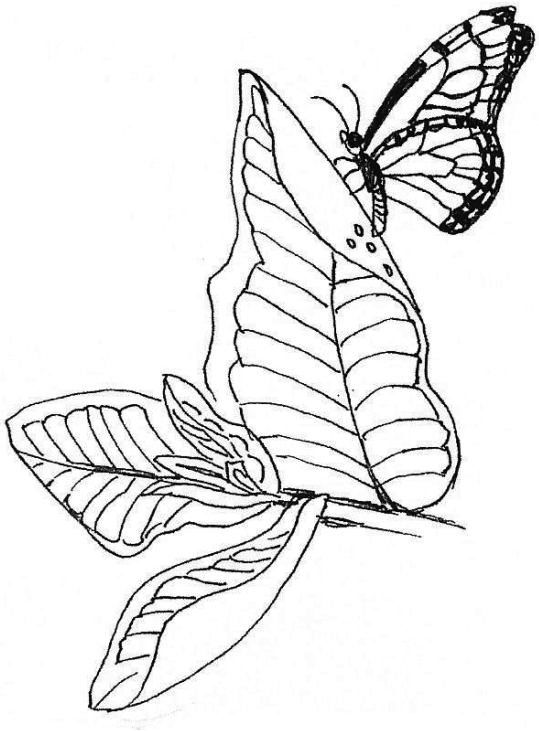
2. Cut along the lines of each page and cover.

3. Staple the pages and cover together in their correct order (egg laying to butterfly).

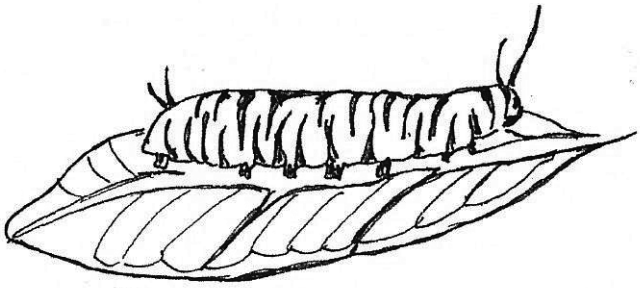
A Caterpillar Grows to a Butterfly



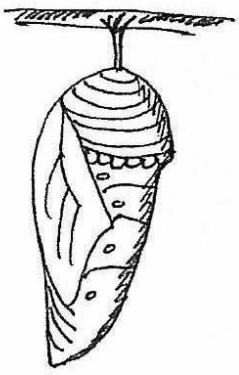
By _____



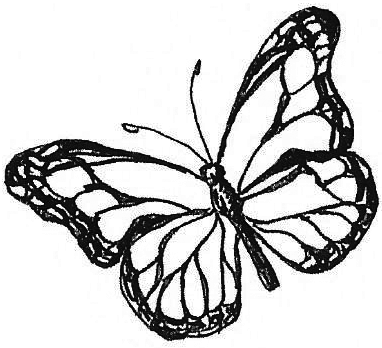
A butterfly lays many eggs on a milkweed plant.



One egg grows into a caterpillar.



A caterpillar turns into a chrysalis.

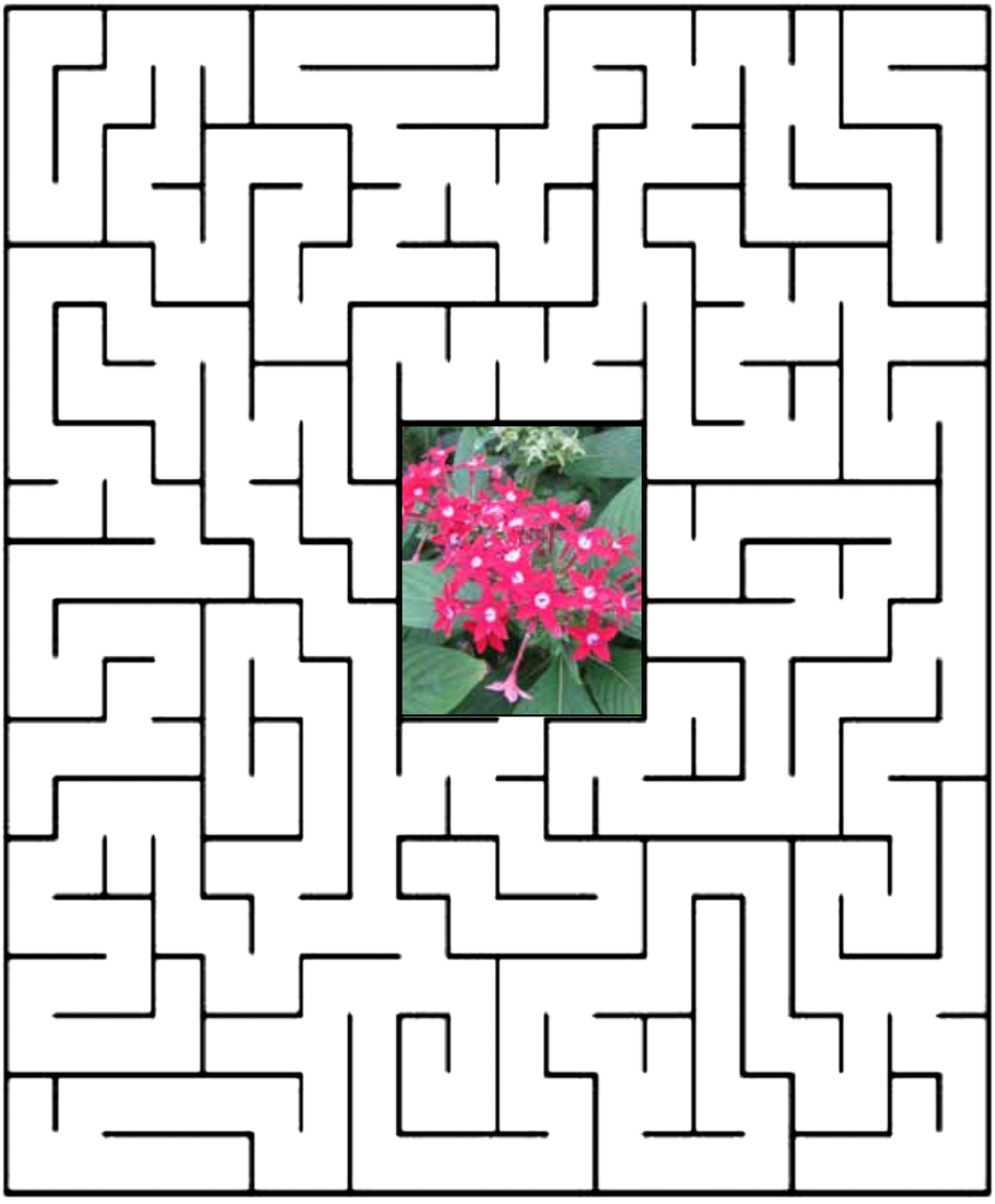


A butterfly emerges from a chrysalis after 15 days.

Help the Monarch Butterfly Find the Pentas

Name: _____

Date: _____



APPENDIX · ACTIVITY 4

My Visit to Vesey Nature Reserve

Name: _____

Date: _____

1. Vesey Nature Reserve is located in ..... parish.

2. I visited on (date) .....

3. Three interesting plants I saw were: .....

4. Three interesting animals I saw were:

5. While I was at Vesey Nature Reserve I learned about different habitats. Here are a few that are in the reserve:

6. My favourite experience at Vesey Nature Reserve was ...

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

Vesey Nature Reserve
Teacher Resources

Activities & Curriculum Links

Before your visit/ Introducing Students to Spittal Pond Nature Reserve

Activity	Grade Level	Subject	Curriculum Link
Activity 1 Science Vocabulary **Activity 2** Geography **Activity 3** Preparation Activity	Primary 1, 2, 3	Social Studies	**P1** – Understand the concept of a map, identify a map of the island of Bermuda. **P2** – Be able to connect places with their correct parish. **P3** – Create and interpret simple maps. Indentify, draw or model and describe Bermuda's landforms, bodies of water, identify bridges, parishes and places as noted in the P1 and P2 curriculum.
Activity 4 Introduction to Vesey Nature Reserve	Primary 4-6	Social Studies Information Technology	**P4** – Create and interpret maps of Bermuda, using cardinal signs, symbols and simple legends, identify and describe major land forms and water bodies in Bermuda. **P5** – Use cardinal and intermediate directions latitude and longitude to locate specific points on the island **P6** – Use physical and thematic maps to make comparisons about natural resources and vegetation. **P4, 5, 6** – Manage computer generated documents. Format text using a word.

During your visit/Class Field Trip Activities

Activity	Grade Level	Subject	Curriculum Link
Activity 1 Natural & Man-made Environments **Activity 2** Exploring Plant & Animal Habitats Through Senses	Primary 1-2	English Science Social Studies	**P1, 2** – Understand the difference and give examples of natural and man-made environments. **P1** – Know that animals and plants are living things. Explore ways that different animals and plants inhabit local environments. **P2** – Explore how human senses enable humans and other animals to be aware of the world around them.
Activity 3 Hunting for Specific Trees **Activity 4** The Influence of Physical Environments	Primary 3-4	English Science	**P3** – Reading and writing non-fiction. **P3** – Create and interpret simple maps. Identify, draw or model and describe Bermuda's landforms and bodies of water, identify bridges, parishes and places as noted in the P1 and P2 curriculum. **P4** – Create and interpret maps of Bermuda, using cardinal signs, symbols and simple legends, identify and describe major land forms and bodies of water in Bermuda. **P3** – Describe differences between living and non living things using knowledge of life processes. Know life processes common to humans and animals including nutrition (water and food), movement, growth and reproduction. **P4** – Investigate how different animals are found in different habitats and are suited to the environment in which they live.
Activity 5 Mangroves in Vesey Nature Reserve **Activity 6** Understanding Ferns and Mosses	Primary 5-6	Social Studies Science	**P5** – Explain the impact of population increase on the environment. Explain how people in Bermuda have adapted to and changed the environment over time. **P6** – Explain how the human and natural alteration of the physical environment has produced positive and negative effects on the environment. Demonstrate how people can work together to solve /prevent environmental problems and prevent future ones. **P5** – Know that plants need energy from light to grow. **P6** – Explore a number of ways of caring for the environment.
Activity 7 Measuring a Limestone Block **Activity 8** Classifying Plants	Middle 1 & 3	Science Math	**M1** – Describe how organisms are adapted to their habitat, Discuss positive and negative influences of humans on the environment. **M3** – Explain the ways in which living things are adapted to their habitats, Describe and investigate some effects of human influences on the environment. **M1** – Choose suitable units of measurement to estimate, measure, calculate and solve problems in everyday contexts. **M3** – Solve problems involving measurements in a variety of contexts.

After your visit/Additional Information & Activities

Activity	Grade Level	Subject	Curriculum Link
Activity 1 Outdoor Classroom: Habitat and Plant Study **Activity 2** Habitat Poster **Activity 3** Egg to Adult Mini Butterfly Book	Primary 1-2	Science	**P1** – Explore ways that different animals and plants inhabit local environments. Can name the major parts of a plant looking at real plants. **P2** – Can identify similarities and differences between local environments and know about some of the ways in which these affect the animals and plants found there.
		Social Studies	**P1-2** – Understand the difference and give examples of natural and man-made environments.
Activity 4 Rock-On Fizzy Fun	Primary 2, 3, 4 & 6	Science	**P2** – Can recognise some types of rocks and the uses of different rocks. Know that some materials occur naturally and some are man-made. **P3** – Know that everyday material has specific properties, e.g. hard, soft, shiny. Sort materials into their properties. Discuss why materials are chosen for specific purposes on the basis of their properties. **P4** – Know that matter can be solid, liquid or gas. Can recognise ways that human activity affects the environment. **P6** – Explore how humans have positive and negative effects on the environment e.g. loss of species, protection of habitats.
		Social Studies	**P2** – Demonstrate awareness of natural and man-made environments. **P3** – Describe how the physical environment influences human activity (geographical influences) **P4** – Describe Bermuda's industries in relation to its location and availability of resources. **P5** – Explain how people in Bermuda have adapted to and changed the environment over time. **P6** – Explain how human and natural alterations of the physical environment have produced positive and negative consequences.
Activity 5 Student Plant Hunters	Primary 3	Science	**P3** – Can sort things into groups using simple features and describe rationale for groupings. Know that plants have roots, leaves, stems and flowers.
Activity 6 Mini Habitats Near You	Primary 4	Science	**P4** – Reading and writing non-fiction. **P4** – Investigate how animals are found in different habitats and are suited to the environment in which they are found.

References

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

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