



TEACHER'S RESOURCE GUIDE

MANGROVE TREES



Department of Environment
Ministry of Health, Wellness & the Environment
Antigua & Barbuda

*Published with support from the Global Environment Facility (GEF) funded project:
"Monitoring & Assessment of Multilateral Environment Agreements Implementation and Environmental Trends in Antigua & Barbuda"*

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Foreword

Teacher's Resource Guides are tools for our educators to use in the classroom and contains information and activities on a specified topic. The point of these guides is to assist teachers with their curriculum in a creative manner. It is interactive, so all students will be able to participate and show what they have learned. This resource guide is accompanied by an Activity Booklet that will allow the students the opportunity to practice what they have learned here. The activities are meant to be fun and creative and to ensure that the learning process is smoother and most importantly, fun!

What are Mangroves?

Mangroves are typically described as a group of salt-tolerant trees and shrubs found along coastal areas, in tropical and subtropical areas ranging between 25 degrees North and 25 degrees South latitude (Figure 1). They make up about 75% of the coastal vegetation in the tropical and subtropical regions of the world. These organisms are Halophytes (salt loving) but do not require saltwater to live. Mangroves are believed to have adapted to thrive in salty (saline) habitats as a way to reduce competition from other plants. Mangrove forests can be recognized by their many adaptations to life in a saline environment, including prop roots, roots which “breathe air”, glands which emit salt, and leathery leaves.



Figure 1. World Map Mangrove Distribution (shaded green represents mangrove areas)
From Wikimedia Commons, the free media repository

New terms:

Ecosystem – a system or group of interconnected elements, formed by the interaction of a community of organisms with their environment

Viviparity – producing seeds that germinate on the plant; giving live birth

Propagule – a plant part, such as a bud, that becomes detached from the rest of the plant and grows into a new plant

Germinate – to develop into a plant or individual, as a seed, spore or bulb

Taxonomy - the branch of science concerned with classification, especially of organisms; systematics

Halophytes – salt-resistant or salt tolerant plants

“Mangrove” does not refer to a specific group of species in *taxonomy*, but a group of *halophytic* (salt tolerant) species of tropical/subtropical trees and shrubs which represent approximately 12 families. These trees/shrubs have adapted to areas that are usually not suitable for other plants like the loose, wet soil and salty habitats and periods of tidal submergence. Additionally, all these trees possess differing degrees of *viviparity* (giving live birth) with *propagule* (seedling) formation. This means that the seedlings reproduce and *germinate* on the parent tree.

Antigua & Barbuda is home to 30 plus mangrove sites; Fitches Creek, McKinnon's, Morris Bay, Darkwood Beach, Fryes Bay, Yeptons and the Codrington lagoon in Barbuda to name a few.

- **Fun Fact:**

Mangroves grow along the coast and create an ecosystem that is essential to the overall health of coastal communities. These trees are unique because:

- They must deal with high levels of salt in the water;
- They live in areas with low oxygen-soil;
- They can withstand waves breaking against the shore and storm surge. This feature offers protection inland from the devastating erosive effects of storm surge;
- They filter waste from surface runoff before it enters the ocean and affects marine ecosystems;
- Provide habitat to a variety of animals (birds, crabs, fish and more);
- They have roots that allow them to handle the rising and falling tides where they are entirely exposed to the air during low tide or totally submerged during the high tide.

Species of Mangroves found in Antigua & Barbuda

Antigua & Barbuda has four primary Mangrove species. They are:

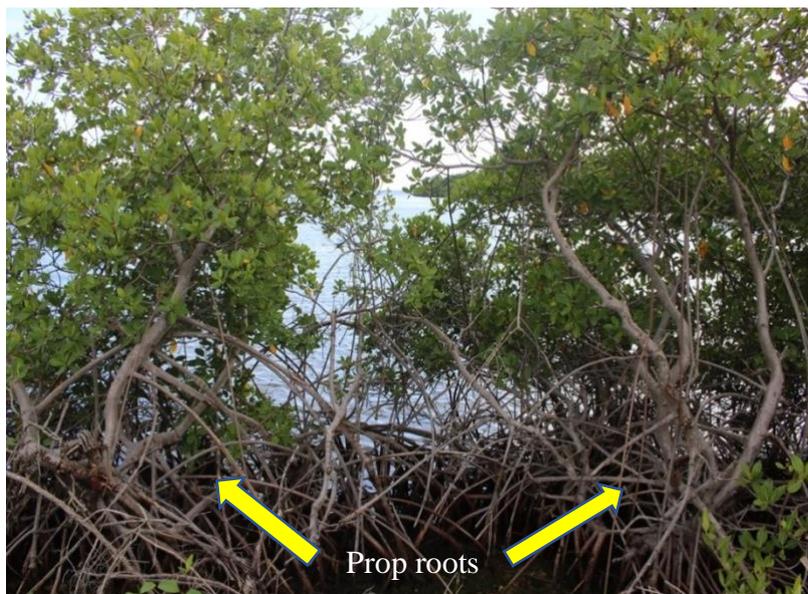
1. Red Mangroves (*Rhizophora mangle*)
2. Black Mangroves (*Avicennia germinans*)
3. White Mangroves (*Laguncularia racemosa*)
4. Buttonwood Mangroves (*Conocarpus erectus*)

Red Mangrove:



Figure 2. Red Mangroves in Fitches Creek

When a mangrove-rich shoreline is observed there is normally a mangrove zonation which is the progression of different species of mangroves from the shore moving towards land (Figure 2). Red mangroves (*Rhizophora mangle*) are found closest to the water's edge and is usually the most dominant species depending on the mangrove forest. They get their name from the tannin that normally occur within red mangroves giving the wood and inner bark a reddish colour. Red mangroves can grow up to 30ft in height. They produce dark green, oval shaped, leathery leaves with smooth edges that come to a point at their ends.



Red mangroves have adapted prop roots to help support the tree out of the water, helps to stabilize the plant in loose soil and assist with respiration when they are exposed to air (Figure 3). These roots also filter the salt out of the seawater that the plant takes up, allowing it to get the water it needs to survive, without the damaging salt. The prop roots also have openings that allow the tree to breath air.

Figure 3. Prop roots on red mangrove

They have small yellow bell-shaped flowers that bloom between June and December. The flowers are sweet smelling which attract bees and insects which help with pollination. Pollinated flowers develop into seeds while still attached to the parent tree. The Propagules (germinated seeds) have a green base and brown head. These can be seen during the summer. Once the seeds reach 8 inches long, they drop off and because, the base is heavy, they fall straight into the mud. If it is low tide it will sprout and grow; at high tide however, the seeds fall into the ocean and float on to grow in new areas, once that shoreline is suitable.



Figure 4. Red mangrove leaf

In Antigua, Red mangroves can be found in the Fitches Creek Swamp, McKinnon's Swamp, Darkwood Beach and the other sites around the country.



Physical Characteristics:

- Leaves are dark green, oval shaped and have a leathery feel with smooth edges
- Prop roots make the tree peak somewhat out the water and have openings for receiving air
- They have small yellow bell-shaped flowers
- The seeds or propagules are cigar shaped and green and brown in colour (Figure 5)

Figure 5. Propagules on red mangrove

Quick Facts:

- They are found closest to the water's edge and are the most dominant species found in mangroves.
- Roots help to filter out salt for the tree to receive sustenance and have openings allowing for the tree to receive air.
- The seeds are bottom heavy allowing for them to fall straight into the soil to grow at low tide.
- During high tide the seeds may fall into the ocean and float until they wash up on a suitable shoreline and grow; during low tide the seeds may fall into the soil, germinate and grow
- Bees and insects help to pollinate the flower
- Roots trap garbage/waste prior to it entering the marine environment
- The roots provide habitat for juvenile fish and other marine creatures, while the branches provide habitat for crustaceans and birds
- Roots help to stabilize the shoreline, and are a primary defense against the impact of waves and storm surge

Black Mangrove:

Black Mangrove (*Avicennia germinans*), is the most widespread neotropical (belonging to a geographical division comprising that part of the New World) mangrove and are second in the typically observed line of procession (mangrove zonation) of mangrove plants when looking from the sea. They tend to dominate zones near to open water and are particularly abundant around areas where there is a high tide. The leaves have the ability to take up saltwater, use the water and secrete the salt onto their leaves to regulate salt levels in the plant, thus leaving salt crystals on the surface. The seeds germinate when they fall off and float on the surface of the ocean and sprout when washed up on suitable shorelines. Its root system consists of a series of pneumatophores (air breathing roots) (Figure 6). These pneumatophores originate from underground horizontal roots that grow up and out from the soil around the trunk which provides oxygen to the underground and underwater root systems.

New Terms:

Neotropical - also called South American region, one of the six major biogeographic (the branch of biology that deals with the geographical distribution of plants and animals) areas of the world defined on the basis of its characteristic animal life. It extends south from the Mexican desert into **South America** as far as the sub Antarctic zone

Pneumatophores – air breathing roots

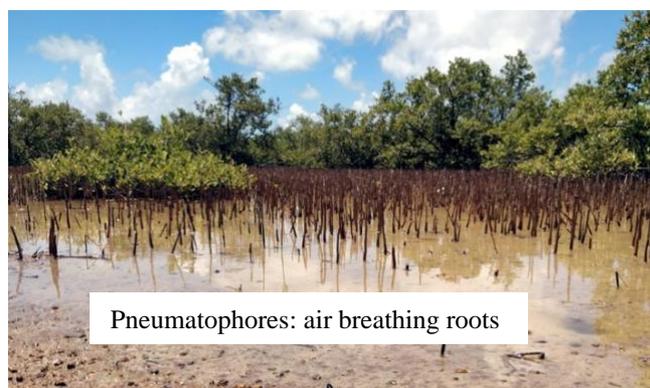


Figure 6. Pneumatophores on black mangroves

Physical Characteristics

- The bark is dark and scaly
- Trees can grow 30 - 40 ft tall (Figure 7)
- They have silvery green leaves with a salty residue
- Black mangrove leaves occur opposite of each other along the branches with shiny upper sides and undersides are densely covered with hairs (Figure 7)
- The seeds are shaped like tear drops.
- Black mangroves have white flowers that bloom in spring and summer
- Have root systems consisting of pneumatophores or air breathing roots that originate underground



Figure 7. Leaf of black mangrove (left) and full-grown tree (right)

Quick Facts:

- Black mangroves are second in the typically observed line of procession of mangrove plants when looking from the sea.
- Absorbs saltwater and excretes salt onto leaves and uses the fresh water for sustenance
- Pneumatophores provide the tree with oxygen.
- The seeds germinate when they fall off the tree and float out to wash up on suitable shorelines.
- Pneumatophores trap garbage/waste prior to entering the marine environment.
- Pneumatophores also help to further stabilize the soil sediment.

White Mangrove:

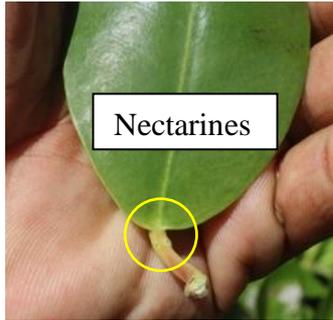
White Mangrove (*Laguncularia racemosa*) is mostly found upland and is more prominent in high marsh areas. They may also be found in lagoons and in areas with a high tide. They reach to about 50 ft - 60 ft in height; are easily distinguished by their leaves. The leaves have two glands, each called nectarines that secrete sugar. Many insects feed on this sugar. These glands serve a regulatory function similar to the glands on the leaves of the black mangrove. Their leaves are rounded at the base and tip and are flat; are also smooth underneath. The tree produces propagules which measure 3/10's of an inch.

New Terms:

Drupe – a fruit in which the outer layer of the ovary wall is a thin skin, the middle layer is thick and usually fleshy and the inner layer, known as the pit, or putamen, is hard and stony



Figure 8. Fruits on the white mangrove



White mangroves produce a leathery **Drupe** (fruit with varying layers from inside to outside), with a dark red seed inside (Figure 8).

Figure 9. Leaf showing nectarines in white mangroves

Physical Characteristics:

- The leaves are rounded at the base and tip and are flat; smooth underneath
- The bark tends to have a white-ish colour, which gives it its name
- They produce a fruit drupe with a dark red seed inside
- The leaves have two glands called nectarines (Figure 9)
- They reach 50ft – 60ft in height

Quick facts:

- They are found mostly upland in lagoons and areas with high tide
- Easily distinguished by their leaves (rounded at the base and tip and are flat; smooth underneath)
- Leaves have two glands called nectarines that secrete sugar
- The glands have functions similar to black mangrove

Buttonwood Mangrove:

Buttonwood Mangrove (*Conocarpus erectus*) is an associated mangrove species; it is a dryer type of vegetation that grows furthest from the shoreline. The species get the name “Button” from the button-like appearance of the dense flower heads that grow in branched clusters that produce non-edible cone-like berries (Figure 10). The flowers appear in cone-like heads and are greenish in colour. It grows as a shrub that can reach up to 20ft or more in height and has both silver and green morphs.

When rain falls the salt on the leaves gets washed away and this process continues as long as the plant is healthy and thriving. The Petioles (leaf stems) are **Semi Succulent** and have two red notches at the base of the leaves (Figure 11). Salt is ejected through these notches. Unlike the other species of mangroves, this plant does not reproduce via propagules but produces seed cases instead.

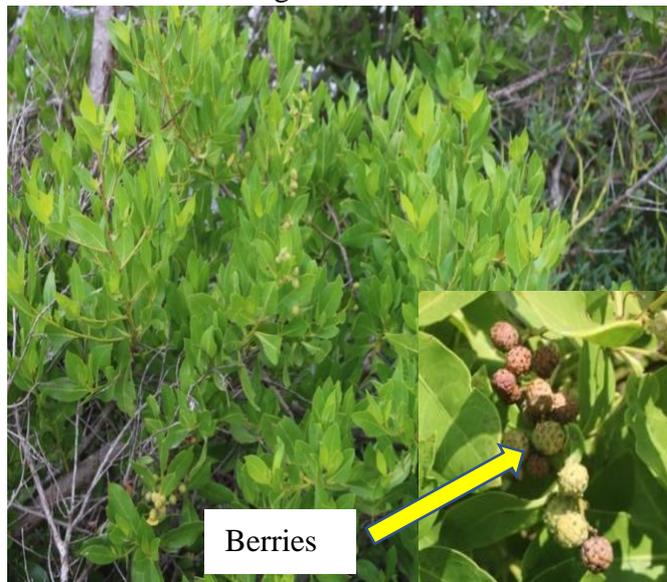


Figure 10. Berries on buttonwood mangroves

New Terms:

Petioles – leaf stems

Semi-succulent – partially thick

Figure 11. Semi-succulent petioles of the buttonwood mangrove



Physical Characteristics:

- The tree has petioles (leaf stems) that bear a distinctive pair of bulging glands and the petioles has two red notches at the base of the leaves
- Buttonwood has alternately arranged leaves and are leathery with pointed tips and smooth edges
- Grows to 20ft or more in height
- They have dense flower heads that grow in branch clusters that produce non-edible cone like berries
- The flower heads have a button like appearance, which give its name

Quick Facts:

- Buttonwood is not necessarily a mangrove but is mostly associated with them
- Gets its name from the button shape of their flower heads
- The Petioles are Semi Succulent
- Compared to other mangrove leaves, it has alternate facing leaves
- Reproduces via production of seed cases
- Their fruit is red when mature and non-edible

Activity:

- Take a field trip to a mangrove (South Coast Horizon in the Cades Bay Marine Protected Area is a good place to start)
- Identify the species of mangroves you found (Indicate how many you found)
 - Ensure to use the pictures provided in your booklets when identifying each of the different species.
 - Take note of as many animals/birds/fish that you may have seen in the mangrove as you can.

Importance of Mangroves

Mangrove forests have roles and functions that are essential to the environment.

Nature's Natural Defence

During hurricanes/storms, red mangroves absorb the force of the winds and waves during heavy weather with their prop roots, while the pneumatophores of the black mangrove keep the soil stable. The mangrove plants, which together form a mangrove wetland, preserve the coastline and protect it from erosion by acting as buffers between heavy winds/waves and the shoreline to stop soil from land from being carried into the ocean (A visual demonstration of how they do this can be found by clicking [here](#)¹). The root systems help to filter nutrients and pollutants and also play a role by trapping, holding, and stabilizing sediments and maintain water clarity and quality.

¹ <https://www.youtube.com/watch?v=aoMrLYJ0dA4>

If the shorelines were not protected by mangroves during times of bad weather the land would erode and carry sediments into the ocean thus creating negative outcomes such as destruction to coral reefs. Health of coral reefs are largely dependent on coastal mangrove forests. If the fisheries are degraded due to destruction of habitats, then the coral reefs will be adversely affected.

New Terms:
Carbons (*Carbon Dioxide*) – compounds that are emitted into the atmosphere and cause rising temperatures

Home to many animals and fishes

Mangroves are habitats for various fish, crustaceans, mollusks and aquatic/migrating birds who nest in the trees. Algae and marine invertebrates like sponges, corals and anemone can be found attached to the prop roots, while snails, crustaceans, etc. use them to shelter and forage for food. Smaller fish use the mangrove to hide from larger marine predators, and the larger fish use the prop roots as a nursery to give their young protection.

Carbon sequestration

Mangroves are especially good at trapping and storing **Carbon** (compounds that are emitted into the atmosphere) 2 - 4 times greater than mature tropical forests. They absorb carbon dioxide (a greenhouse gas) which in turn assists in mitigating the future negative impacts of climate change.

They can store 3-5 times more carbon per equivalent than tropical rainforests. Dead leaves, branches and roots containing carbon buried in the soil break down at a slower rate due to low oxygen in the environment which in turn traps a considerable amount of carbon.

- *Function of Mangroves in Antigua and Barbuda by local video production*
ABS did a 'You For a Day' show along with the Environmental Awareness Group (EAG) where they toured and discussed the Northeast Marine Management Area (NEMMA). This informative video can be found by clicking [here](#)². In this video they also talk about all that the mangrove does (providing shelter etc.)

Quick Facts:

- Red mangroves absorb the force of the waves during heavy weather with their prop roots.
- Pneumatophores of the black mangrove keep the soil stable.
- They preserve the coastline and protect it from erosion.
- Trap sediments; filters out pollutants and run off from land.
- Create ecosystems consisting of species of Aquarian birds and is home to a variety of species of fish, crustaceans, mollusks etc.
- Provide food, shelter and protection from larger marine predators.
- Trap carbon thus mitigating the future negative impacts of climate change.

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https://www.facebook.com/abstvradio/videos/2010325842378657/?hc_ref=ARS2Ik2WYFoSm2Vh6Mu4GuoJxpWP4LZ2AHPV4hITR11j_g-c9ol1vM3nAa7xcxzO0IE&fref=gs&dti=183015981765780&hc_location=group

Activity:

- What does a healthy mangrove environment/ecosystem look like?
 - o Draw on two separate manila papers a healthy and thriving mangrove on one and an unhealthy one on the other. (Be sure to indicate in each drawing the healthy parts and why it is and point out what factors may have played a part in causing the unhealthy mangrove to get to that state).
 - o Create a skit based on what you have learned about mangroves; this play should pass on this knowledge to your audience.
- Discuss: How do humans and other living things benefit from mangrove ecosystems?

Here are some links ([one](#)³ and [two](#)⁴) with visual illustrations and explanations of why Mangroves are important

Threats to Mangroves

While mangroves have many benefits, they are declining due to human intervention.

Fisheries

In recent years mangrove habitats are being used for aquaculture such as shrimping, fishing with nets, etc. With shrimping being a cash crop, the mangroves are being cleared to create artificial ponds. The farmers feed these shrimps with specially made food that often contains harmful chemicals. Excess nutrients from the concentration of food and animal waste cause **eutrophication** (excessive richness of nutrients in a lake or other body of water, frequently due to run-off from the land, which causes a dense growth of plant life). This negatively affects the surrounding marine habitats by lowering the oxygen levels and changing species distribution and polluting the water. Shrimping also alters the natural water flow. It interrupts dispersion of seeds via seawater and kills trees by cutting off the fresh water supply. Fishing with nets destroys the ocean floor and catches other species besides shrimp, leaving the habitats destroyed and the fisheries depleted.

New Terms:

Eutrophication - excessive richness of nutrients in a lake or other body of water, frequently due to run-off from the land, which causes a dense growth of plant life

Inundation – to flood, cover or overspread with water; to overwhelm

Development

During development, land is cleared down to be urbanized and eventually man-made structures are built in its place. When constructing the infrastructure (hotels, beach-front properties etc.), mangroves are dug up or backfilled essentially destroying them and their ecosystems. Water flow is disrupted, and rivers are either blocked or re-routed disrupting the balance, causing changes in filtration, sedimentation, temperature and salinity. Often times policies and laws

³ https://www.youtube.com/watch?v=KhLlqdB_Rs

⁴ <https://www.youtube.com/watch?v=1bs84fFnN9E>

that are in place to protect the environment are circumvented for the sake of development. When plans are drawn for new structures to be built, especially in protected areas, all policies and laws in place must be enforced, and the proper authorities notified before development begins.

Cottage Industries

Wood and leaves from mangroves are also valuable to the charcoal and timber cottage industry. People use the wood and leaves for timber and charcoal. The timber is used to build structures, fences and fuel. Traditionally, mangroves have been an excellent source of charcoal and is used within local markets.

Climate Change

Through climate change, rising sea levels will have the greatest impact on mangroves. Most mangrove sediment surface elevations are not keeping pace with sea level rise. Mangroves are known to be sensitive to changes in **inundation** (to flood, cover or overspread with water; to overwhelm) duration and frequency as well as salinity levels that exceed a species-specific physiological threshold of tolerance. With the rising of the sea levels, flooding can lead to plant death at the seaward mangrove margins, as well as shifts in species composition. This will ultimately lead to reduction in productivity and ecosystem services.

[“Champion of the Mangrove: The Nature Conservancy”⁵](#)

The video linked in the above title was taken in St. Vincent and the Grenadines on Union Island. It is the story of “Cinder” and how the mangroves at the back of her school (“Cinder’s Creative Nest Pre-School”) protected the structure from being destroyed by Hurricane Ivan.

The purpose of this video is to demonstrate how climate change affects people and how nature (in this case the mangroves, and by extension showing why mangroves are important and why we need to protect them at all costs) can help fight against that. It shows how vital mangroves are and why they should be protected and preserved.

Tourism

Tourism is the main industry for Antigua and Barbuda and while it is not a major threat, it is a contributing factor. Tourists pay to tour the mangroves, hike paths and sightsee. Unfortunately, in many instances’ guides may not provide their visitors with the adequate guidelines to interact with the environment. These guidelines include:

- No littering in the mangrove wetland
- Try not to disturb the organisms you see
- Be cautious of your impact. Use binoculars, etc., rather than walking through the mangrove wetland

⁵ <https://www.youtube.com/watch?v=Ev0dY8flztc>

Activity:

- What kinds of things can harm mangrove ecosystems? Write an essay describing the various threats to mangroves ecosystems and explain why they need to be protected.
- How would you educate the public about the importance of mangroves?
 - o Discussion: What mediums would you use to help them understand their importance?
 - o Create a Public Awareness campaign using the mediums discussed. Come up with slogans and hashtags for social media.
 - Identify ways that mangroves can be saved.
 - Make sure to include the importance of mangroves in your campaign.

Quick Facts:

- o Shrimping is a cash crop and one of the biggest threats to mangroves because they require sections of the mangrove to be cleared to build artificial ponds to raise chemically fed shrimp polluting the surrounding areas.
- o If not properly handled, tourists can play a part because they do not have proper mangrove etiquette and bring on noise pollution, fumes from boats permeate the air, garbage collects, reef are damaged and so on.
- o Mangrove guidelines include: No littering in the mangrove wetland; try not to disturb the organisms you see; be cautious of your impact. Use binoculars, etc., rather than walking through the mangrove wetland.
- o Mangroves are being cleared down for urban development and as a result, ecosystems are destroyed, rivers are blocked, erosion, changes in filtration, sedimentation, temperature and salinity occurs.
- o The wood and leaves are being used for building materials, fencing, fuel and charcoal.
- o Rising water levels resulting from climate change recently became a threat.

Case Study:

South Coast Horizon, found on the southern side of Antigua, is an excellent example of how tourism and sustainable environmental management can be merged (Figure 12).



Figure 12. South Coast Horizon

The Case of South Coast Horizon in the Cades Bay Marine Protected Area: Realizing the benefits of Ecosystems in preventing Ecological Disaster

Identify the ecosystem: Cades Bay Marine Protected Area

The ecosystem within this area is quite extensive. There's a rich combination of coastal wetlands with mudflats salt ponds, mangroves and an estuary. There are healthy seagrass beds and a barrier reef system.

How does the system reduce risk?

Seaward to Landward

- Cades reef system is an offshore barrier reef system dependent on the coastal wetland system to provide its function of reducing wave energy (seagrass and mangrove system also reduce wave energy)

Landward to Seaward

- Mudflats/Mangroves systems slow run off from the land and serves as depositories for sediments

Identify the Perceptions:

Urlings and Old Road communities are fishing communities and take ownership of the ecosystem. Outer communities do not hold the same opinion. They think it breeds mosquitos and is seen as an area for dumping. Tourism development has been characterized by disregard and destruction of the ecological services

Scenario:

A developer wanted to build a resort. He intended to build over the mangrove to create a path to the beach. When work began, the community realized the damage being done and contacted relevant authorities to put a stop to it. After having a conversation with the developer, he realized the importance and an opportunity.

He developed a boardwalk allowing for persons to walk through the mangrove forest creating access to the beach. He left the basin open allowing for kayaking tours.

South Coast Horizon currently stands as one of the most important ecotourism properties in Antigua.

Schools and camps have used it as an educational exercise to teach about ecosystem services, and benefits of building with nature in mind.

Conservation and Protection of Mangroves:

In order to protect and preserve mangroves, there have been rules and regulations along with penalties put in place by the Government of Antigua and Barbuda. These rules are there to ensure that anyone who violates the integrity of the environment will be held accountable for their actions. Below are a few examples.

Convention on Wetlands (Ramsar 1971)

An intergovernmental treaty that helps with the preservation of mangroves is "*The Convention on Wetlands*". It was entered into Antigua & Barbuda on October 2nd, 2005. There is currently one site designated as wetlands of International Importance with a surface area of 3,600 hectares; this is the Codrington Lagoon.

According to the Ramsar Convention (Article 1.1), wetlands are defined as: "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that

is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres”.

The Convention provides the framework for national action and international cooperation for conservation and wise use of wetlands, including rivers, lakes, coastal lagoons, **mangroves**, peatlands and coral reefs. It also covers man made wetlands like farm ponds, fishponds etc. At this time, 118 nations have joined the convention as Contracting Parties.

Since 1997, the Ramsar secretariat has provided outreach materials to help with raising public awareness about the value of wetlands.

A “*World Wetland Day*” is held every year on February 2nd. It is celebrated on this day to pay homage to the adoption of the Convention on Wetlands on February 2nd, 1971 in Ramsar (a city in Iran where the treaty was signed by 18 countries).

Physical Planning Act 2003

The *Physical Planning Act* protects and conserves mangroves in a number of ways. Firstly, mangroves can be declared an Environmental Protected Area. The Act also requires that persons wishing to construct buildings observe buffer zones (setbacks) for waterways and water courses which includes mangroves. These buffer zones allow for seasonal flooding and building within these zones may encourage erosion and habitat destruction. Zoning, which is the act of identifying specific development activities as being suitable for certain environments (see *Sustainable Island Resource Zoning Management Plan*, “SIRMZP”), can be done and development guides and restrictions for your zoned areas can be set which could include mangroves. Furthermore, if mangroves are involved, an Environmental Impact Assessment can be done to assess possible damage to and identifies mitigation measures and will make recommendations. Finally, the *Physical Planning Act* can order a developer to undo environmental damage in sensitive areas such as mangroves.

Fisheries Act 2006

A license is required to construct, reconstruct, adapt acquire or operate an aquaculture facility in waters or territory in Antigua and Barbuda. This means that you can’t build or alter these protected areas unless you have proper authorization to do so. This protects the preserved areas from being destroyed so that the habitat/ecosystem etc. is able to thrive.

Marine Reserves and Conservation Measures under the Fisheries Act:

- *The Minister may declare an area of Antigua and Barbuda waters, and any adjacent or surrounding land, to be a marine reserve when he considers the special measures listed below are necessary:*
 - *To afford special protection to the plants and animals of such areas;*
 - *To protect and preserve the natural breeding grounds and habitats of aquatic life, with particular regard to plants and animals in danger of extinction;*
 - *To allow for the natural regeneration of aquatic life in areas where such life has been depleted or threatened;*
 - *To promote scientific study and research in respect of such areas;*
 - *To preserve and enhance the natural beauty of such areas.*

Note: Mangroves present within Marine Reserves are protected under the Fisheries Act

Environmental Protection and Management Act 2019

Section 50 prohibits the alteration or backfilling of any wetland without permission, where violators are liable to penalties under Schedule XIII.

Section 65 Schedule IX lists all the plants and animals that are protected. This list includes Mangroves - All mangrove species including:

Species	Family	Common Name
Avicennia germinans (L.) L.	Acanthaceae	Black Mangrove
Avicennia schaueriana	Acanthaceae	Black Mangrove
Conocarpus erectus L.	Combretaceae	Button Mangrove
Laguncularia racemosa (L.) Gaertn. F.	Combretaceae	White Mangrove
Rhizophora mangle L.	Rhizophoraceae	Red Mangrove

Discuss:

Imagine that Antigua and Barbuda is hit by a hurricane with Category 5 gale force winds.

- Discussion: If there were no mangroves in the Old Road and Urlings communities, what level of destruction do you think would occur with this high-risk hurricane?
- Do you think that the members of these communities would be able to survive the destruction that comes with this level hurricane?

Debate

Scenario:

The Government of Antigua and Barbuda is hoping to build three new hotels to boost tourism in the country. The areas they wish to build upon are all filled with mangroves. The general public are all concerned that they are going to destroy these mangroves in favour of a few new fancy buildings and forgetting that the mangroves are important parts of nature. The people have come together and decided that they want a law passed stating that any and all mangroves and their surrounding areas are to be protected and can never be destroyed for the purpose of development.

- Divide your class into two teams.
 - o One side will represent the public who are in favour of passing a law against the destruction of mangroves to build more hotels.
 - o Using the knowledge gained from this resource guide, come up with reasons why the mangroves should be saved. List out and give clear explanations on the importance of mangroves, their benefits etc.
 - o The other side will represent members of Government who are pushing for these hotels. List out reasons why these hotels should be built and the benefits that will arise from building them.
- Each side should have clear and concise reasons for and against the topic.

Acknowledgement

This resource guide on mangroves was developed to assist teachers by providing additional information to deliver their curriculum in fun and creative ways. Thank you to all those who contributed to this effort and made this resource guide a success. Special mention goes out to the Monitoring, Evaluation & Data Management Unit (DMU) of the Department of Environment, especially Ruleo Camacho for his input and assistance with taking pictures, Ezra Christopher who provided support in developing the activity book to this resource guide and Aaliyah Tuitt for her input and helping with the formatting and providing her artistic views. To members of the Environmental Awareness Group, to include Shanna Challenger for her input on the activities and Arica Hill also for her input and for reviewing the product in its draft stage. Thank you also goes out to Ato Lewis and Dr. Helena Jeffery Brown for their review and ideas. To the Public Information, Education and Training (PIET) Unit of the DOE including Daryl George and D’Kaboo Brann for their input and support also with the activity book. Finally, special acknowledgement to Amira McDonald for taking up the challenge of developing this resource guide and for leading this project. With the help and feedback of all those mentioned, this guide has become a colourful and exciting source of information.

THANK YOU!

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