



Community Based Adaptation Programme

Mangrove Workbook 1

Building Resilience to Climate Change

Understanding Mangroves

SACD

Sarteneja Alliance for
Conservation and Development

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MANGROVES

DISTRIBUTION OF MANGROVES

Mangrove

Key Facts

1. There are over seventy different species of mangroves found worldwide.
2. Mangroves can be found on five of the seven continents.
3. Mangroves naturally cover about 75% of tropical coastlines.
4. Mangroves are only found in tropical and sub-tropical climates.

Environmental Services of Mangroves

- Mangroves protect the coastline and act as a buffer zone during storms.
- The roots of mangroves help prevent erosion because they act as an anchor to the soil.
- Mangroves provide essential habitats for fish. Mangrove roots act as a feeding, breeding, and nursery ground for many different fish species.
- Mangrove trees provide a safe habitat for many waterbirds.
- Leaf litter from mangroves is broken down by microorganisms and is the beginning of some aquatic food chain.



The areas highlighted in green indicate where mangroves are present.

Where in the world are mangroves found?

Mangroves are present on coastlines and in estuaries worldwide. They are halophytes - plants that grow well in salty, or **SALINE**, conditions. Most other trees and plants find it difficult to live in saline conditions, so mangrove ecosystems play a very important role in the tropical coastal environment.

Mangroves in Belize:

Belize has the highest percentage of forest cover of all Central American countries. Mangrove forests and savannas cover about 184,500 acres of land in Belize — approximately 3.4% of the country.

Mangroves are found primarily on the coast and the cayes, their roots protecting the shorelines from erosion and providing important fish nursery areas. They also provide safe places for waterbirds such as the brown pelican and magnificent frigate bird to nest.

IDENTIFYING MANGROVES

SPECIES

There are three species of mangrove in Belize, each with different characteristics...different leaves, different bark and different flowers...

Red Mangrove

Points about red mangrove

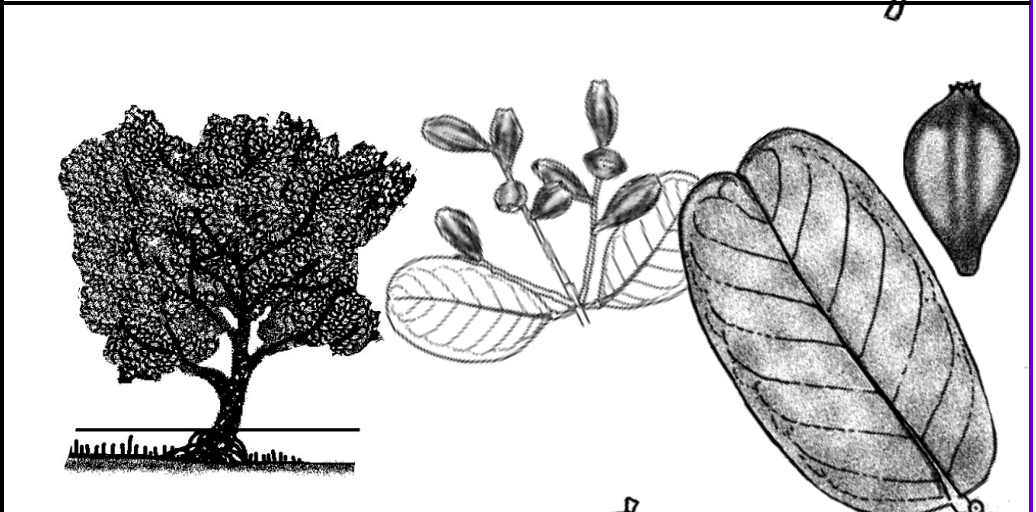
- Leaves are 5-15 cm long and 3-6 cm wide.
- Leaves are glossy above and dull green below.
- Often are black spots on leaves.
- Trees can grow up to 50 ft tall and have extensive prop roots and arching roots.



White Mangrove

Points about white mangrove

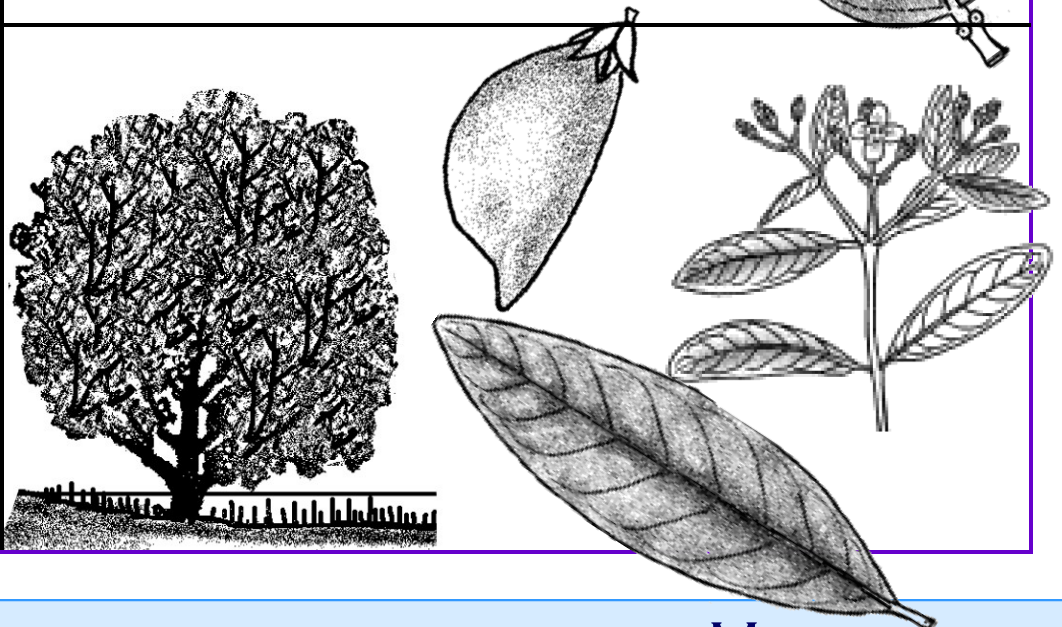
- Leaves are 2-7 cm long and up to 5 cm wide.
- Leaves are opposite of each other.
- The tip of the leaf is often notched.
- Trees can grow up to 50 ft tall.



Black Mangrove

Points about black mangrove

- Leaves are 5-8 cm long and 2-5 cm wide.
- Upper surface of the leaf often has salt grains and the lower surface is often pale gray in color.
- Upright roots are produced called pneumatophores.
- Bark is dark grayish-brown to black.



Mangrove

Key Facts

- Here are three different types of mangrove we will be studying:
 - Red mangrove
 - Black mangrove
 - White mangrove
- Each of the three types of mangrove are very different.
- Mangroves are home to a variety of wildlife including land-dwelling and marine animals.
- Mangroves play an important role in protecting the coast from storms.
- Although the red, black, and white mangroves all live in brackish water, different types of mangroves can live in pure sea water, which is much saltier.



MANGROVES

Today you are going to be looking at three trees that live together, close to the lagoon and sea, forming a distinct ecosystem- Red Mangrove, White Mangrove and Black Mangrove.

Mangroves are rare and important ecosystems, especially to Belize. They protect the coastline from storms, as well as helping to prevent coastal erosion. Mangroves also provide shelter to a variety of different types of wildlife such as birds, mammals, fish, and invertebrates.

Activity 1: Exploring Mangrove Bark

Find an example of each of the three species. Look closely at them. Feel the bark - the outer protective layer that covers the trunk. Now answer the following questions, ticking the appropriate box:

	Red Mangrove	Black Mangrove	White Mangrove
Which one has the smoothest bark?			
Which one has the roughest bark?			

Activity 2: Bark Rubbings

Take the following loose sheet of paper from your workbook and do a rubbing of the bark on a red mangrove. To do this you need one person to hold the paper in place against the tree while the other person rubs over the piece of paper with the side of a crayon, held lengthways with the paper removed, so that the pattern of the bark shows up.

When you have finished, carefully glue the bark rubbing onto the next page of your work book. Using the same process, now do a bark rubbing of the black mangrove and the white mangrove.

SPECIES	BARK RUBBINGS
Red Mangrove	
White Mangrove	
Black Mangrove	

LEAVES

Mangrove

Key Facts

1. The black, red, and white mangrove all have very different leaves.
2. Red mangrove leaves have a salty taste.
3. The roots of mangroves trap debris and detritus brought in by tides.
4. This provides a feeding, breeding, and nursery grounds for many different types of fish.

Activity 3:

Look closely at the leaves of the three trees. Look at the color, both on the top and bottom surface. Look at their shape. Describe the leaves of these three trees in the boxes below.



Red Mangrove	
White Mangrove	
Black Mangrove	

Activity 4: Leaf Rubbing

Take the following loose sheet of paper from your workbook and do a leaf rubbing. Pick one leaf from the red mangrove. Place it underside-up beneath a blank sheet of paper. Create a leaf print by gently rubbing the side of a green crayon over the surface of the paper. Cut out the leaf rubbing and glue it into the appropriate box on the page entitled "Leaf Rubbing." Then do the same for the black mangrove and the white mangrove.

SPECIES	LEAF RUBBING
Red Mangrove	
White Mangrove	
Black Mangrove	

Mangrove Key Facts

1. Mangroves grow best in waterlogged soil.
2. Areas with waterlogged soil are called wetlands.
3. Wetlands can also be called swamps or bogs.
4. The red mangrove has prop roots.
5. Mangrove roots have special breathing holes called lenticels.



Red Mangrove

The red mangrove has **PROP** roots (also known as **AERIAL** roots), which curve into the water like fingers.

The lenticels are found on the prop roots, above the normal water level.

Activity 5: Lenticels

If you look closely at the underneath of these roots you can see little holes. These are the **LENTICELS**. Look closely, and draw them in the box:

Lenticels of Red Mangrove

SOIL AND BREATHING

Soil that is very wet is called **WATERLOGGED**. Waterlogged soils have very little air, as all the spaces between soil particles are taken up by water. Normally, plant roots need to be able to breathe, taking in air from the soil, and therefore can't survive very long in waterlogged soils.

Mangroves, however, have developed roots above the surface of the soil, with special breathing holes called **LENTICELS**.



Mangrove

Key Facts

1. Both red and black mangroves have lenticels, but they are not found in the same place.
2. Pneumatophores are used as a breathing tube.
3. Mangroves do not require salty water to grow, but are most often found in salt water environments.
4. The red, black, and white mangroves all create small flowers during the summer months.
5. Seeds are dropped from the trees into the water. This is how seeds are spread.

SOIL AND BREATHING

Black mangroves also have **LENTICELS**, but not in the same place as red mangroves. Can you see lots of small things sticking up by the black mangrove tree? These are called **PNEUMATAPHORES**. Black mangroves send up the **PNEUMATAPHORES** from their roots under the soil so that they can act as a breathing tube. Look at the diagram below:



Left
Black mangrove, pneumataphores - finger-like roots structures sticking above the surface.

Activity 6:

Black mangroves have their **LENTICELS** on the tips of **PNEUMATAPHORES**. Can you see them? In the box below, draw a **PNEUMATAPHORE**.

Activity 7: Soil Sample

Take the following loose sheet of paper from your workbook and do a soil sample. Take a small amount of soil from the roots of a red mangrove. Rub it between your fingers and then rub your fingers in the appropriate box on the page entitled "Soil Sample." Then do the same for the black and white mangrove.

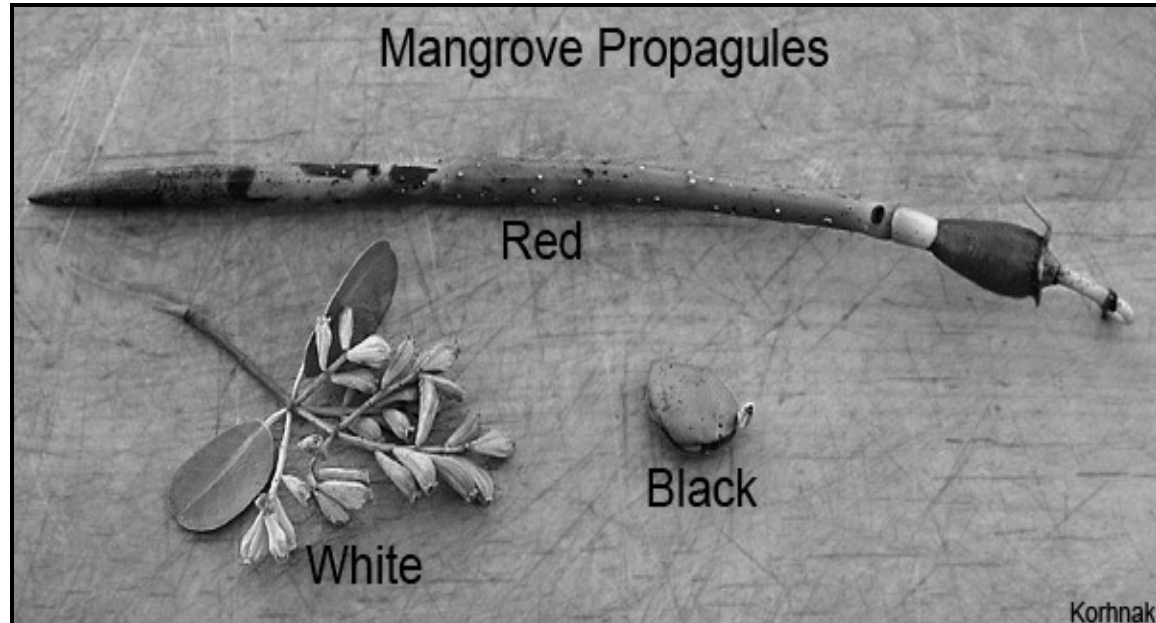
SPECIES	SOIL SAMPLE
<p>Red Mangrove</p> <p>What is the soil like? (tick the correct box).</p> <p><input type="checkbox"/> <input type="checkbox"/> very wet wet</p> <p><input type="checkbox"/> <input type="checkbox"/> dry very dry</p>	
<p>White Mangrove</p> <p>What is the soil like? (tick the correct box).</p> <p><input type="checkbox"/> <input type="checkbox"/> very wet wet</p> <p><input type="checkbox"/> <input type="checkbox"/> dry very dry</p>	
<p>Black Mangrove</p> <p>What is the soil like? (tick the correct box).</p> <p><input type="checkbox"/> <input type="checkbox"/> very wet wet</p> <p><input type="checkbox"/> <input type="checkbox"/> dry very dry</p>	

Mangrove Key Facts

1. Mangroves live in environments where other trees cannot.
2. Most other trees and plants cannot survive in an environment with so much water.
3. Mangroves have adaptations to help them survive in their environment.
4. The seeds of most plants germinate while they are in soil. The seeds of mangroves germinate while they are still attached to the parent tree.
5. A propagule is a type of seed.
6. Propagules provide their own food through the process of photosynthesis.
7. Once the propagule is mature enough it is dropped in the water to disperse.
8. The seeds for the red, white, and black mangrove all look very different but they are all propagules.



SEED DISPERSAL



How do mangroves spread their seeds?

Mangroves live in a somewhat harsh environment where many other plants cannot, so they have **ADAPTATIONS** to help their offspring survive. An adaptation is when something undergoes a change over many thousands of years in order to be better suited for their environment. Mangrove seeds buoyant, which means they float in water.



The seeds of most plants germinate while they are in soil but the red, white, and black mangroves have seeds that germinate while they are still attached to the parent tree. Once the seedlings are germinated they grow to form a **PROPAGULE**. A propagule is a type of seed. A propagule can produce its own food through the process of photosynthesis. The propagule is then dropped into the water and can be transported great distances.



MANGROVES

Mangrove Key Facts

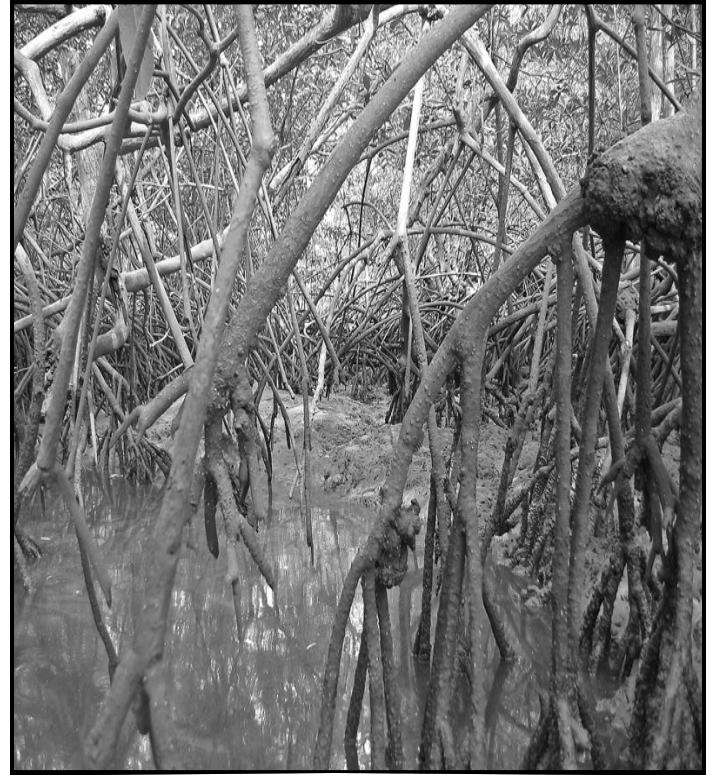
1. Mangrove roots help trap soil in the water.
2. Trapping the soil helps prevent excess erosion and eventually creates dry land.
3. Mangrove roots serve as shelter for many different types of marine organisms.
4. Shrimp, lobster, crab, and fish are some of the marine organisms found in mangrove roots.
5. Birds such as pelicans also make their homes in mangroves.
6. Ecological succession is the gradual and orderly process of change in an ecosystem.
7. Of the three types of mangroves we are studying, red mangroves grown the tallest. Because of this, they intercept most of the sunlight.



MANGROVE ROOTS

Mangroves roots don't just help the mangrove to breathe, they have other very important jobs to do as well as that.

Look at the red mangrove roots. Do you see the way they curve into the water? These roots help to catch some of the soil in the water. It takes a long time for these roots to trap a lot of soil, but eventually they catch enough to make some dry land. At the same time the roots keep on growing out into the lagoon like fingers, trying to catch more soil. Because this process keeps going on and on, it is called **SUCCESSION**.



Do you see any black mangroves with their trunks growing in the water?
(tick the correct box).

YES

NO

The black mangrove likes to grow on dry land that the red mangrove has helped to make. The roots of the black mangrove help to stop soil caught by the red mangrove from washing away during heavy storms.

Mangrove Key Facts

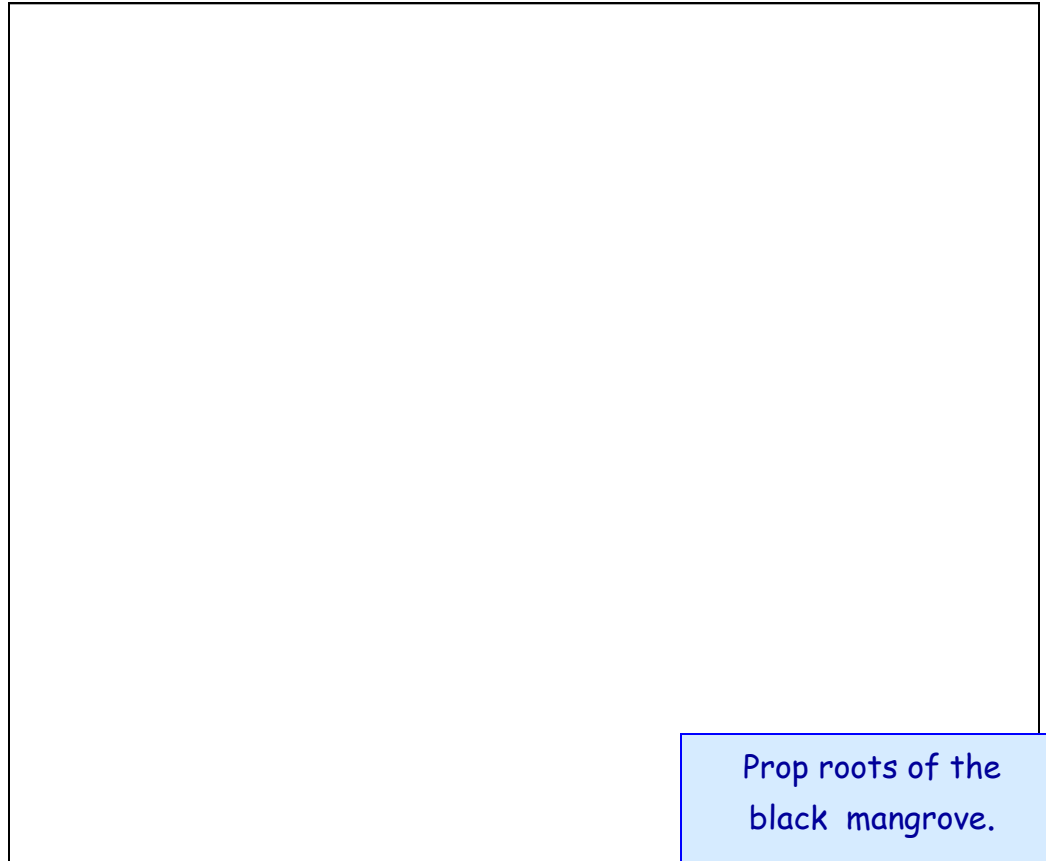
1. Red mangroves have roots that go into the water.
2. These are called prop roots.
3. The red mangrove is the only type of mangrove with prop roots.
4. Decomposing plant matter, or leaves, is called detritus.
5. Not very many animals feed directly on mangrove leaves.
6. Some animals eat the detritus produced by mangroves.
7. Animals that eat the plant litter are known as decomposers.
8. Bacteria is an example of a decomposer.



MANGROVE ROOTS

Mangroves have very strong roots. Red mangrove has the roots that curve into the water like fingers that are clinging to something. These are called **PROP ROOTS**.

Draw some **PROP ROOTS** in the box below:



Prop roots of the
black mangrove.

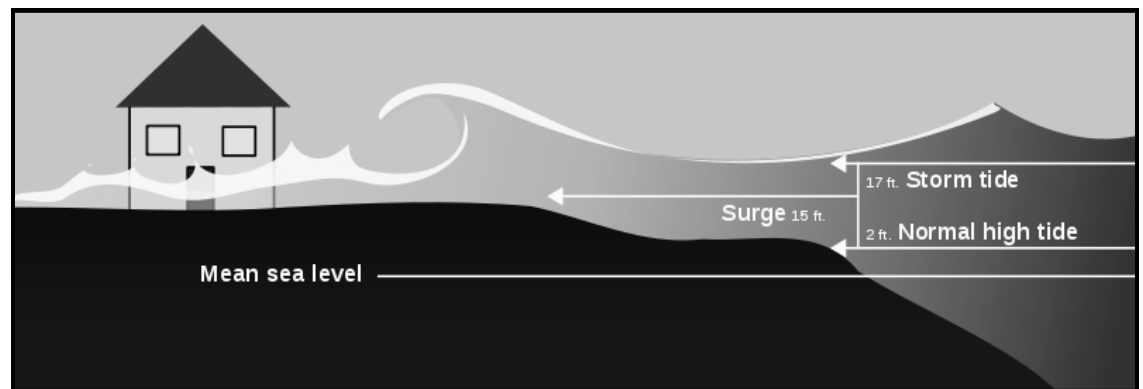
Because both types of mangrove have such strong roots they help to shelter things behind them from storms and big waves. In this way they act as a **BUFFER ZONE** because they take the worst of the weather and act as a layer of protection and so help to shelter the things behind them from the bad weather.

Mangrove

Key Facts

- Hurricane Richard: October 2010; category 1. Estimated \$49.4 million (BZD) of total damage; 2 deaths. About 200 homes were destroyed. Belize City had minor flooding and a significant amount of fallen trees.
- Hurricane Dean: August 2007; category 5. Estimated \$3 billion (BZD) of total damage; 45 deaths. Agriculture suffered extensive damage, particularly sugar cane and papaya crops. Belize had minor flooding and a significant amount of trees down.
- Hurricane Iris: October 2001; category 4. Estimated \$300 million (BZD) of total damage; 49 deaths. Over 3,700 homes were destroyed and large areas of farmland were inundated by flooding.
- Hurricane Keith: September 2000; category 4. Estimated \$638 million (BZD) of total damage; 40 deaths. Causes a negative surge, which drained many waterways.
- Hurricane Mitch: October 1998; category 5. Estimated \$12.4 billion (BZD) of total damage; 19,325 deaths. Heavy flooding and damages throughout Central

PROTECTION



Mangroves in Belize:

Belize lies in a hurricane belt which means that it is very prone to being hit by hurricanes and tropical storms. Coral reefs are the first line of defense in protecting the coastline during storms and mangroves are the second.

How do mangroves offer protection?

Mangroves play a very important role in protecting tropical coastlines. Their roots help stabilize the soil which in turn stops erosion and protects coastal areas from storm surge during hurricanes, tropical storms and tsunamis. Mangroves act as a buffer zone because they protect inland areas from the worst weather in storms.

MANGROVES AND FISH

Mangrove Key Facts

1. Mangroves are used as a feeding, breeding, and nursery grounds for many different types of fish.
2. The intricate root systems provide shelter for fish against larger predators.
3. There are over 70 different species of fish in Belize.
4. Catfish, striped mojarra, and grey snapper are three fish that use mangroves for breeding and nursery grounds.

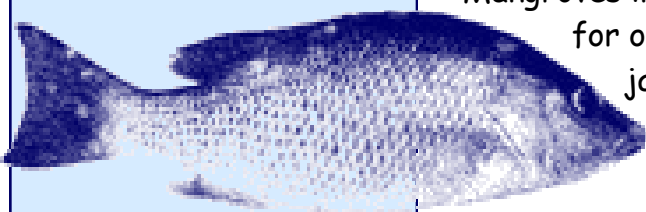
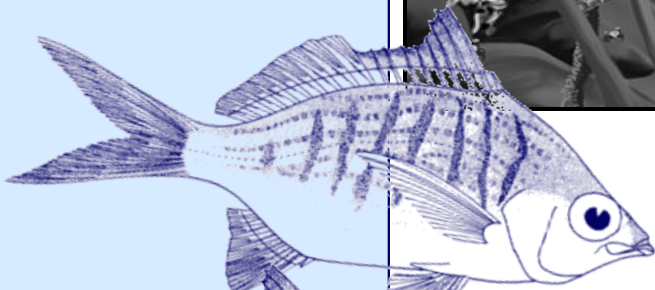


Why are mangrove roots important?

Mangrove roots serve as very important habitats for fish. The roots provide shelter for a variety of different fish species and offer a safe haven for young fish. Mangrove roots provide a somewhat protected area from larger predators, making the intricate root systems ideal for fish breeding grounds and nurseries.

Mangroves in Belize:

Mangroves in Belize serve as a feeding and nursery grounds for over 70 different species of fish. Catfish, striped mojarra, and grey snapper are just a few of the fish whose habitat is in mangroves.



REVIEW

Circle each correct answer below:

1. Black mangrove roots send shoots up to the air to help them breathe called:

- A. lenticels B. aerals C. pneumatophores

2. Mangrove roots aren't just used for breathing. Red mangrove roots also:

- A. help catch soil to make land dry B. help catch fish for the trees to eat C. help catch insects

3. Red mangrove roots, which curve into water like fingers, are called:

- A. soil roots B. prop roots C. water roots

4. Black mangrove likes to grow:

- A. in the water B. a bit further back from the water C. in the desert

5. Mangrove roots are very:

- A. strong B. weak C. small

6. Mangroves help to protect the land behind them when the storms come, acting as a:

- A. storm zone B. buffer zone C. crash zone

7. If the soil is WATERLOGGED it means that the soil is:

- A. very dry B. very wet C. very smelly

8. How many types of mangroves did you study?

- A. one B. two C. three

9. Mangroves like to live in:

- A. dry soil B. smelly soil

C. waterlogged soil

10. Mangroves do a lot of breathing through their:

- A. flowers B. bark C. roots

11. Mangroves have special breathing holes called:

- A. lenticels B. aerals C. pneumatophores

12. On red mangroves you can find lenticels on its:

- A. roots B. leaves C. flowers

WORD SEARCH

How many words can you find below that you have used in the mangrove lesson?

M A D B E S L G H J S D I L C T A P F P
A H J N S E E D F S X Z Q B F N O G L N
N E R F B H N A U S G H A L O P H Y T E
G A Z X B N T J T F S D E A T K B C V U
R Q E S A L I N E A S W Q C V B D M E M
O A S Q B N C M X Z T J F K H A S N T A
V P O U T L E A V E S A S V G E S Z N T
E G N M B Q L F A S C G H U E A Z B M A
Q H T S R Z A V U P R O P R O O T S O P
W E T L A N D W A R E C V B N T H D V H
A S D V K F G T A S D A G B D F A D E O
Q W G H T S D B N D A I O P T H D N P R
B U F F E R Z O N E A Q I M N W H I T E
A S D V B M T H I D S D B J Q E T I L S
F W A T E R L O G G E D J L O F E D S A