



Mangroves: Protectors of the Coast

Teacher's Guide

Florida NGSSS

SC.6.E.7.8- Describe ways human beings protect themselves from hazardous weather and sun exposure.

SC.7.E.6.6- Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.

SC.5.E.7.2- Recognize that the ocean is an integral part of the water cycle and is connected to all of Earth's water reservoirs via evaporation and precipitation processes.

SC.5.E.7.6- Describe characteristics (temperature and precipitation) of different climate zones as they relate to latitude, elevation, and proximity to bodies of water.

SC.4.L.17.4 - Recognize ways plants and animals, including humans, can impact the environment.

SC.4.L.16.1- Identify processes of sexual reproduction in flowering plants, including pollination, fertilization (seed production), seed dispersal, and germination.

SC.4.L.16.2 - Explain that although characteristics of plants and animals are inherited, some characteristics can be affected by the environment.

SC.3.L.17.2- Recognize that plants use energy from the Sun, air, and water to make their own food.

Objectives

- Identify different types of mangrove trees and notice key characteristics between species.
- Understand the importance of mangrove forests and the ecosystem services they provide.
- Understand climate and weather conditions of these habitats and how this affects the wildlife.
- Explain the role mangroves play in reducing climate change effects.
- Give multiple examples of organisms that rely on mangrove habitats.

Link to Feature Video: The content of this lesson coincides with the content from the video ***Mangroves: Protectors of the Coast***. Watch it here before diving deeper in the content in this teacher guide.

<https://odysseyearth.org/videos/mangroves-protectors-of-the-coast>

Introduction

The term **mangrove** is used to describe salt-tolerant trees or shrubs that grow in coastal or tidal areas. There are about 80 species that are considered mangroves, and they are not all closely related.

Along our coastlines, around the globe, we find mangrove forests. A mangrove forest is called a **mangal**. The arching, tangled root systems (called **prop-roots**) of red mangroves along the shoreline are easiest to spot. Different species of mangroves grow within different elevation zones of the coast. Mangroves prefer subtropical warm climates. There are 4 species found in Florida: red mangrove, white mangrove, black mangrove, and buttonwood.

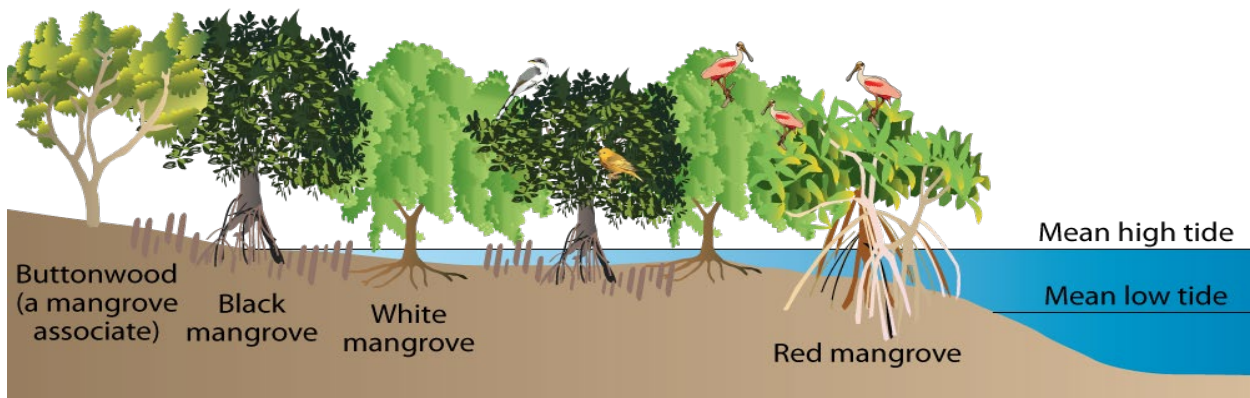
Mangrove forests provide many ecosystem services for local wildlife and humans. The tangled root systems and narrow passages provide the perfect nursery grounds for juvenile fish. Some species swim into the narrow passages of roots for protection, to safely feed and grow. Some example species that use mangroves as a nursery are the goliath grouper and rainbow parrot fish.

Another service mangroves provide is shoreline protection from erosion. Their root systems stabilize coastal sediment during storms and other hazardous weather conditions. Without mangroves, our shorelines would shrink and disappear.

Another important service mangrove forests provide is carbon sequestration. Similar to terrestrial forests, mangroves “sequester”, or store carbon within the trees and sediment for long periods of time. The storage of this carbon off-balances climate change effects. If mangrove habitats are disturbed or destroyed, the carbon stores within these systems are released into the atmosphere. This increases carbon dioxide levels in the atmosphere and ultimately contributes to climate change.

Mangrove Species found in Florida

Species Name	Location	Description
<i>Red Mangrove</i>	<ul style="list-style-type: none"> • Closest to shoreline. - • Experience constant flooding • Located along the shoreline 	<ul style="list-style-type: none"> • Leaves have an <u>elliptical</u> shape, meaning a narrow oval with rounded tip • Tangled root systems
<i>Black Mangrove</i>	<ul style="list-style-type: none"> • More inland than the red mangroves. • Experience intermediate flooding 	<ul style="list-style-type: none"> • Leaves are oval shaped but wider than the red mangrove leaves • Leaves are also <u>acuminate</u>, meaning it gradually tapers to a point • Distinct salt crystals on the backside of the leaves • Use pneumatophores for their root system.
<i>White Mangrove</i>	<ul style="list-style-type: none"> • Found in the same areas as black mangroves, experiencing intermediate flooding. 	<ul style="list-style-type: none"> • <u>Obovate</u> shape leaf (wide oval shape) with rounded tip • Excrete salt, but it's less distinct on the White leaves
<i>Buttonwood</i>	<ul style="list-style-type: none"> • Farthest inland away from the shoreline. 	<ul style="list-style-type: none"> • <u>Elliptical</u> shaped leaf with an <u>acuminate</u> tip • Lack above ground root system

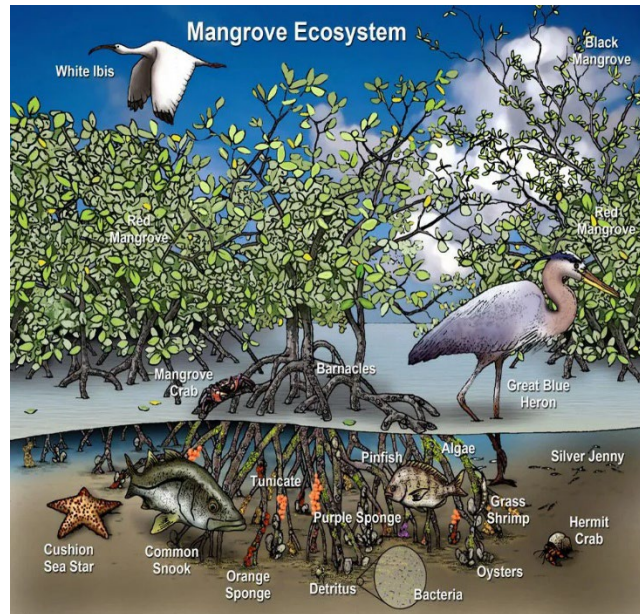


Conceptual diagram illustrating the dominant mangrove species of south Florida. Diagram courtesy of the Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source: Kruczynski, W.L., and P.J. Fletcher (eds.). 2012. Tropical Connections: South Florida's marine environment. IAN Press, University of Maryland Center for Environmental Science, Cambridge, Maryland. 492 pp.

Discussion Questions

1. Which mangrove species does not have visible root systems above ground?
2. Why is it an important adaptation for mangrove trees to excrete salt from their leaves?

Wildlife Found in Mangrove Forests



A variety of wildlife depend on mangrove ecosystems from snails and crabs egrets and American crocodiles. Tangled root systems along the shoreline create complex habitats to support all kinds of life. Different organisms utilize different parts of the mangrove forest. Smaller organisms, such as species of shellfish, take advantage of the muddy sediment below, which is rich in organic matter, to bury themselves. Barnacles and tunicates anchor onto the submerged roots of red mangroves, filtering nutrients from the water as the tides come in and out. Birds and lizards use the mangrove canopy to sunbathe or hunt for fish below.

Mangroves are an essential habitat for migratory birds and act as prime nesting locations. Bird species, such as herons and egrets, stop by mangroves along their migration routes for food and rest. Mudflat areas along the shore provide the perfect feeding grounds for wading birds such as roseate spoonbills, reddish egrets, and wood storks. Most wading birds prefer to feed on fish, crabs, frogs, and mollusks. The entire Everglades population of spoonbills only nest in mangroves.

Birds found in Mangrove Forests



Blue Heron



Yellow Crowned
Night Heron



Reddish Egret



Great Frigate Bird



Wood Stork



Spoonbill

Many fish species rely on mangrove forests as safe nursing grounds for juveniles to grow. Specifically, two species on the Red List of Endangered species (IUCN) rely on mangroves as nurseries- the rainbow parrotfish and the goliath grouper. Scientists have directly linked the decline of goliath grouper populations with the decline of mangrove ecosystems, since the grouper uses these habitats as a nursing ground for the first 6 years of its life. The grouper leaves the safety of the mangroves and heads into the open ocean once they have reached about 1 meter in length. The herbivorous rainbow parrotfish relies on mangroves as well to forage for food and complete their life cycle. The role mangrove forests play in fish life cycles highlights the importance of conserving these ecosystems to ensure the persistence of these species.

Discussion Questions:

1. Name an animal that is found in mangrove forests and the area of the forest they inhabit.
2. Why do mangrove forests act as great nursery grounds?

How do mangroves protect from erosion?

Mangroves protect shorelines around the globe from storms, hurricanes, floods, and waves. The network of roots stabilize sediment and prevent erosion. Wave forces are rapidly reduced as they pass through the mangrove trees, decreasing the amount of potential damage from tropical storm surge. Wide ranges of mangrove trees also reduce the impacts of flooding damage from tsunamis. Over time, mangroves also build up the thickness of soil by trapping sediment. This can be crucial as sea level continues to rise.

Discussion Questions:

1. How do mangroves reduce the effects of coastal erosion?
2. If the number of mangrove trees on our coasts continue to decrease, what will eventually happen to our shorelines?

Mangroves' Role in Climate Change

Like all plant species, mangrove trees take in carbon dioxide and release oxygen through the process of photosynthesis. Scientists have discovered that mangrove trees, since they thrive in aquatic environments, take in and store 10x more carbon dioxide than trees in terrestrial forests. Since mangroves grow in aquatic ecosystems that are constantly flooded with water, leaves fall from the trees and sink to the seafloor. This leads to an accumulation of leaves and other plant matter on the seafloor, causing a buildup of organic matter. The thick layer of organic matter on the seafloor leads to carbon rich sediment beneath the mangrove trees. This contributes to the amount of carbon stored within the ecosystems. If mangrove forests are destroyed, the stored carbon dioxide will be emitted into the atmosphere, which in turn contributes to global warming. Therefore, it is necessary to protect mangrove forests from land use changes to avoid increased levels of carbon dioxide in our atmosphere and negative climate change effects.

Discussion Question:

1. Why are mangrove forests sediments rich in carbon?
2. Why are mangrove trees capable of storing more carbon than terrestrial trees?
3. What is the result of increased carbon dioxide levels in the atmosphere? How will this affect our environment?

How do humans benefit from mangroves?

Mangroves forests provide a multitude of ecosystem services other than the services it provides to the wildlife that inhabit the forests. Humans rely on mangrove forests to stabilize our coastlines, provide global food sources, and reduce the effects of global warming.

We rely on the tangled root systems along shorelines to stabilize and protect the coast from erosion, and the inland from storm surge and flooding. Mangrove ecosystems are also a large contributor to the global seafood industry. These nursery grounds source a variety of fish and shellfish that can be harvested and sold in grocery stores. Another notable service mangrove trees provide is their role in reducing global warming. We need to protect these ecosystems to ensure stored carbon dioxide is not emitted into the atmosphere. Considering all of the ecosystem services mangrove forests provide for us, it's important to ensure these ecosystems remain a protected treasure for generations to come.

Discussion Questions

1. What is an example of an ecosystem service that mangrove forests provide?
2. If mangrove forests were destroyed, how will this affect the seafood industry for humans?

Assessment

Refer to the *Mangroves: Protectors of the Coast* worksheet to test your class's knowledge on the contents of this lesson.