



DEERING ESTATE



SHARK RESEARCH & CONSERVATION PROGRAM



## Marine Conservation Science & Policy: Barrier Islands

### Grade Level:

4<sup>th</sup> – 12<sup>th</sup>

### Subject Area

Science

Biology

### Duration

1.5 Hrs.

### Benchmarks:

#### Body of Knowledge

Life Science

Nature of Science

Physical Science

#### Big Idea

Organization and Development of Living Organisms.

The Practice of Science

#### Standards

##### SC.4.L.17.4

Recognize ways that humans can impact the environment.

##### SC. 7.E.6.6

Identify the impact that humans have had on Earth, such as urbanization, erosion and changing flow of water.

##### SC.912L.17.16

Discuss the large-scale environmental impacts resulting from human activity.

### Focus Question

What are barrier islands? What are the main features of a barrier island and what organisms live there? Why are barrier islands important and how can we better protect them?

### Objectives

Students will explore the barrier islands and some of the habitats, animals and plants found on these formations. Students will learn to:

- Identify the main features of a barrier island.
- Identify the different habitats found on a barrier island and some of the organisms that live there.
- Explain the importance of the barrier islands and demonstrate knowledge by elaborating a visual representation.

Students will discuss how this habitat can be protected for future generations. This will be a project-based activity in which students will explore the various habitats of the barrier island.

### Background

**Barrier islands** are long, narrow deposits of sediment that run parallel to shore but are separated from the mainland by a calm, protected body of water called a bay or lagoon. Barrier islands form when sand from the weathering and **erosion** of rock is transported to the coast by rivers, and the force of the waves, tides and currents work the sediment into an island or a chain of islands. Current islands were formed about 4,000-6,000 years ago, when melting glaciers from the last ice age caused a rapid rise in sea level and tidal actions forced sediment shoreward. Barrier islands dynamic landforms, as the tides, wind and waves constantly shift their sediment and move them towards the mainland.

Each barrier island can be divided into four zones, including the ocean shoreline, the sand dunes, the back barrier and tidal inlets and deltas. The ocean shoreline, often called the **beach**, extends from the intertidal zone to the high tide line and bears the full force of the ocean waves, tides and currents. Sediment here can range from fine to coarse sand, pebbles, seashells, and sometimes even fossils. Despite the lack of fresh water, this area hosts a rich variety of species adapted to the tidal turbulence, including sea stars, hermit crabs, scavenging animals like the ghost crab and shorebirds such as seagulls, sand pipers and pelicans.

Just inland of the beach are **sand dunes**, formed by the wind blowing sediment into mounds and the first colonizing plants helping to anchor more sediment. The dunes provide a hostile environment due to high salinity, sandy soil and lack of fresh water, but they do receive moisture from rain, surf and occasional storm surges. Organisms found in the sand dune zone include sea oats, bitter panicum, crabs and birds. On wider barrier islands, the root systems of the plants provide stability and their leaves function as a windbreak, allowing sediment and nutrients to accumulate, sometimes forming soil rich enough to support trees. Some barrier islands are large enough to support **maritime forests**, with live oak, slash pine, raccoons, rabbits, even deer, while others may be little more than loose sand and a few stunted plants.

## Vocabulary:

### **Barrier Islands:**

Long, narrow deposits of sediment that run parallel to shore but are separated by a protected lagoon or bay.

### **Erosion:**

The natural process of the breaking down and movement of rocks and sediment by wind and water.

### **Beach:**

The oceanfront shore extending from the lower intertidal zone to the high tide line.

### **Sand Dunes:**

A sand hill or ridge that lies above the high tide line and is formed by accumulating sediment from wind and tide.

### **Maritime Forests:**

A coastal wooded habitat found on higher ground behind dunes, sheltered from the harshest winds and salt spray.

### **Back Barrier:**

The inner shore of barrier islands sheltered from the harshest ocean waves but still drained and flooded by the daily tide.

### **Tidal Inlets:**

A channel forged by the tidal flow connecting the ocean and lagoon.

### **Beach Replenishment:**

The process of pumping sand from offshore onto an eroding shoreline

## Background

Behind the sand dunes is the **back barrier**, an area to a certain extent sheltered by the dunes from the full force of the wind and waves, though still flooded and drained daily by the tide. This protected shoreline can include salt marsh, mangroves, sawgrass and mudflat communities depending on conditions, habitats teeming with flora and fauna thriving on the rich organic sediment of the back barrier. The variety of life supported in this zone can include clams, mussels, worms, snails, crabs, small fish, invertebrates and birds.

Finally, barrier islands often feature **tidal inlets** that allow tidal water to flow in and out of the lagoon. Inlets can be deeper and wider depending on the size of the lagoon and the variance in the tidal range, allowing for more water to flow between the ocean and the sheltered lagoon. The tides supply sustaining nutrients and carry away wastes from the barrier island system, and provide habitat for mussels, clams, and crabs.

Barrier islands form essential marine habitat for many organisms, including birds, manatees, endangered sea turtles, commercially important fish species and many more. Both the Atlantic and Gulf coasts of Florida feature extensive barrier islands including Key Biscayne, Caladesi Island, and Sand Key, which are home to more than a million residents and provide beautiful locations for tourism and recreation. Most importantly, barrier islands are the first line of defense against the powerful storms that threaten coastal communities, reducing the devastating effects of wind and waves and absorbing some of the storm's energy. Much of Hurricane Katrina's disastrous effects on Louisiana could have been avoided had the coastal wetlands and barrier islands been restored to their natural state.

Unfortunately, the ability of many barrier islands to deliver these important environmental services has been compromised due to anthropogenic damages. Many barrier islands have been paved with roads, parking lots and buildings that inhibit the natural movement of sediment and make the islands more prone to erosion. Because many rivers and estuaries have been dammed, the supply of sediments that would usually replenish barrier islands has been diminished, further reducing their ability to withstand the naturally erosive force of the waves. Rising sea levels and stronger storms due to climate change are also subjecting barrier islands to more wave action, and the accumulating effects of these factors are leaving them more vulnerable and less able to protect coastal communities.

In order to restore barrier islands to their former health, many cities and organizations are working together to find solutions. Some cities are investing in **beach replenishment**, dredging sand from the ocean bottom, pumping it onto the beach and shaping it into new sand dunes. However, these expensive solutions are only temporary, while allowing barrier islands to be protected as wild seashores can help restore the natural movement of the sediment. Solutions must be made on a case-by-case basis, examining the environmental and social factors of each region and taking appropriate action to protect this critical habitat.

## Supplemental Resources

1- "Nature's Coast Guard." Science New for Kids.

<https://student.societyforscience.org/article/natures-coast-guards>

2- "How Barrier Islands Work." How Stuff Works Science.

<http://science.howstuffworks.com/environmental/conservation/issues/barrier-island.htm>

3- "What will climate change and sea level rise mean to barrier islands?" NASA.

<http://www.nasa.gov/topics/earth/features/barrier-islands.html>

## Vocabulary:

### Barrier Islands:

Long, narrow deposits of sediment that run parallel to shore but are separated by a protected lagoon or bay.

## Extension Activity:

Have students interview a parent about our local barrier islands. Students should plan for the interview by writing questions about which they are curious prior to the interview, questions that may include: how many barrier islands shelter the bay, have they been damaged by development, have you ever visited one, etc. Parents should be encouraged to help their child locate barrier islands on a map and reflect on their importance to local communities.

## Assessment:

Have students complete the Barrier Island worksheet after class and write a brief paragraph on what they learned during today's lesson and how it applies to their daily lives.

## Program Partner:

## Drawing a Barrier Island

### Materials

- White paper
- Coloring utensils (i.e. crayons, markers, or colored pencils)
- Tape to hang illustrations
- Fact sheets and maps of different Florida barrier islands

### Procedure

1. Divide students into pairs and assign each pair a different Florida barrier island. Explain that each pair will explore their barrier island using their fact sheet and map, and then create an illustration of their assigned island.
2. Pass each pair one sheet of paper and coloring utensils and explain that each barrier island should include and label the following features:
  - Beach                      -Sand dunes                      -Ocean
  - Back barrier                      -Tidal inlets                      -Lagoon or bay
3. Have students illustrate some of the animals and plants that can be found in the different areas of the barrier island habitat.
4. Allow each pair to present their island and briefly explain the features. Conduct a class discussion analyzing the importance of these coastal landforms and ways in which they can be protected.

## Worksheet Answer Key

1. Bay
2. Marsh
3. Back barrier (including maritime forest on Elliott Key)
4. Sand Dunes
5. Beach
6. Ocean
7. Like most barrier islands, both are long and narrow, and are characterized by all of the above listed features.
8. While Elliott Key can support a maritime forest with trees, the back barrier of Assateague island is more barren, hosting just smaller vegetation.
9. The different latitudes and climates of the two islands, as Assateague Island is so much further North, has probably resulted in their different ecosystems.
10. Some suggested species: Elliott Key hosts live oaks, raccoons, opossums, mice, the endangered Schaus swallowtail butterfly, and even sea turtles use the island to nest. Both islands support many birds, including egrets, gulls, osprey, herons, sandpipers, and Assateague island also supports eagles, ducks, and geese, as well as whitetail and silka deer, mud turtles, sea stars, sea scallops, sea cucumbers, spider crabs, and even wild horses.
11. These examples, like all barrier islands, are constantly shifting, gaining and losing sediment and slowly being rolled over towards the mainland by winds, currents and tides.



## Barrier Islands



Assateague Island, North Carolina



Elliot Key, Florida

Referring to the two figures above, label the main features of a barrier island.

Bay    Back Barrier    Beach    Sand Dunes    Marsh    Ocean

1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_  
 4. \_\_\_\_\_ 5. \_\_\_\_\_ 6. \_\_\_\_\_

7. Carefully observe the two barrier islands featured above. What are some of the similarities? \_\_\_\_\_

8. What are some differences? \_\_\_\_\_

9. Consider the locations of these islands. Why might they demonstrate some differences? \_\_\_\_\_

10. What animals might live on these islands? \_\_\_\_\_

11. Will these islands always be shaped this way? Why or why not? \_\_\_\_\_