



## Marine Conservation Science & Policy: Sandy Beaches

### 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.8. G.5.2

Describe the impact of human modifications on the environment and ecosystems.

##### SC.912L.17.16

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

### Focus Question

What features form a beach? What animals and plants live in this ecosystem and why is it important? What are some of the threats to this habitat and how can we protect it?

### Overview

Students will explore the features of sandy beaches and some of its habitats, reflecting on the importance of this ecosystem as well as threats and conservation efforts. Students will learn to:

- Identify some features that form a beach and some animals that inhabit this community.
- Explain the importance of this ecosystem and some threats that it faces.
- Elaborate a visual representation of the beach habitat in small groups.

This will be a project-based activity in which students will discuss how this habitat can be protected for future generations.

### Background

A **beach** is a sloping coastal landform covered in loose sand, gravel, pebbles or seashell fragments. Most beaches are products of weathering and erosion, which have worn away land to create sediment, which is then carried by ocean currents and deposited on land by the tide. Sediment can drift only a few feet or be carried hundreds of miles before landing on the shoreline. The sediment on beaches varies depending on origin, changing in size from fine white sand to fertile mud along an estuary to pebbles, shingles and cobbles, which are common near cliff sides. Sandy beaches may feature sediment from eroded coral reefs just offshore, or they may be covered in jet-black volcanic sand, made from lava that eroded long ago.

Beaches are constantly shifting, changing daily with the tide and seasonally by storms and wind. They often feature sandbars, narrow, exposed areas of sand just off the beach, and can be divided into four subzones including: the swash zone, which is flooded and drained by the waves; the beach face, the sloping section below the berm; the wrack line which marks the highest reach of the daily tide with debris left by waves; and the berm, the higher area that usually remains dry and can feature **sand dunes**. Beach temperatures range from frigid to balmy and feature a variety of organisms depending on its features.

Though beaches form a harsh habitat, many animals and plants have adapted to the salt spray, shifting and infertile sands, baking sun and abrasive waves. Some specialized dune plants have adapted to the lack of nutrient-rich soil by absorbing essential elements like potassium, sodium, calcium and magnesium from the salt spray, including species such as sea oats, panic grass, and seagrape. As these plants stabilize the sediment, more plants can move in and form shelter for crabs, mollusks and small mammals like the red fox and beach mice. Seaweed, seagrass and other organic materials can also wash up on the beach to form **wrack**, which provides food and habitat to many insects, birds and small crustaceans while incubating the beach plants that help anchor the dune. Beaches also provide vital feeding grounds for

## Vocabulary:

### Beach:

A sloping coastal landform covered in loose gravel, pebbles sand or fragmented seashells.

### Dunes:

A sand hill or ridge formed by wind that lies above the tide line and helps prevent flooding further inland during storm surges

### Dune Plants:

Species that have adapted to the infertile and droughty conditions of sandy beaches, anchoring sediment with their roots and providing habitat for animals.

### Wrack:

Seaweed, seagrass, and other organic material that wash on shore and mark the high tide line, providing food and shelter for many birds, insects and small crustaceans.

### Beach Pollution:

Contaminating wastes that wash up on shores including chemicals from runoff, litter, sewage and medical debris that can be hazardous to human and ecosystem health.

### Coastal Erosion:

The natural process of the moving of beach sediment due to wind, waves, and storms.

### Sea Level Rise:

The increased height of the ocean surface due to many factors including climate change and glacier melting, causing increased flooding, erosion, and salt intrusion.

## Background

many migrating birds, and shorebirds that include the pelican, piping plover and sand piper. Some birds feed on invertebrates that burrow in the sand like beach hoppers, beach pillbugs and bloodworms. Beaches are also essential nesting habitats for endangered sea turtles, which emerge from the surf only at night to dig a nest in the dry sand and lay their eggs before returning to sea. Aside from forming important habitat, beaches play crucial roles in preventing erosion and flooding, provide jobs by increasing tourism, and are popular sites for recreation, as people of all ages enjoy the sandy shores to fish, build sand castles, and frolic in the waves.

Despite their importance, beaches face many threats, including erosion, **pollution** and **sea level rise**. **Coastal erosion** is the natural process of the moving of the beach due to waves, wind and storms. Some coastal erosion is natural, and can be influenced by weather systems that cause more intense storms and storm surges, but some erosion is anthropogenic, or human-caused.

Because people like living near the beach, and many tourists like to visit, increases in construction near beaches are evident worldwide. However, this development can actually speed up the natural process of erosion, removing dune plants, leaving narrower spaces for beaches as buildings move closer to the waterfront, and inhibiting the natural, seasonal movement of beach sediment. As sediment is removed it is lost rather than constantly replaced naturally, so communities are forced to spend millions digging or dredging sand from elsewhere to replenish their own beach (often causing further erosion with the dredging). The beach reduction also exposes buildings to the pummeling of wind, waves and storm surges that would otherwise have been reduced by the former beachfront. Miami Beach has already experienced extreme flooding that would have been alleviated by former beaches and barrier islands that have been consistently dredged, dammed and developed, and as sea levels rise this damage will become even more costly.

**Sea level rise** is the increased height of the ocean surface due to many factors including climate change, glacier melting, and some weather patterns. As sea levels rise, they can damage coastal plants, animals and human developments, with increases in erosion, storm damage and salt water encroaching in aquifers. Beaches are also affected by pollution, which can include garbage that can entangle animals, chemicals from runoff, medical waste and even raw sewage, which can cause algae blooms that can be hazardous to human health.

Despite the many threats to beaches, there are movements by governments, organizations and individuals to protect beaches. Important actions to take include: reducing pollution by always throwing trash in a bin; leaving wildlife alone and taking pictures rather than specimens; limiting beachfront development; helping to replant dune plants; and educating others on the importance of protecting this ecosystem for future generations.

## Resources

“Beach Ecosystem.” National Geographic Education.

<http://education.nationalgeographic.org/encyclopedia/beach/>

“Treading Water.” Climate Change Economics. National Geographic.

<http://ngm.nationalgeographic.com/2015/02/climate-change-economics/parker-text>

Coastal Care Flora and Fauna.

<http://coastalcare.org/educate/flora-and-fauna/>

## Vocabulary:

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### Environmental Stewardship

The responsible use and protection of the natural environment through conservation and sustainable practices.

## Extension Activity:

Have students write an advertisement for a beach near them to encourage new visitors, and include good habits to teach newcomers how to protect beaches.

## Assessment:

Have students complete the beach worksheet during class and reflect upon a time they've visited a beach. Next time they visit, what can they do to protect beaches for future generations?

## Program Partner:

## Beach Blanket

### Materials

- 12x12 swatches of un-dyed muslin (or paper if fabric not available)
- Watercolors, pastels, markers (or crayons or colored pencils if using paper)
- Brushes
- Embroidery thread and needle (optional)
- Books and magazines with beach habitat examples to inspire the artists
- Hole puncher
- Ribbons to tie all the squares into a quilt

### Procedure

1. Demonstrate some quilts and explain to students that each will paint or color a square with one main idea from today's lessons, including good beach stewardship, beach importance as habitat or recreation, animals and plants from this habitat, etc.
2. Divide the students into small groups so that they may share ideas while still elaborating individual quilt squares.
3. They may surround their central square with smaller squares that demonstrate other beach features, (i.e. wrack, dune grass, dolphins, etc.) or they may draw patterns surrounding their center square, depending on preference. (Ideas will generate from examples shown)
4. If using muslin, older students may wish to outline their squares in embroidery thread while younger students may use marker
5. Students may present their squares, explaining how they incorporated today's lesson, and all the squares may be collected and joined together by ribbon (or staples if ribbon not available) to display in the classroom.

### Worksheet Answer Key

1. Physical characteristics of this beach include: the swash zone which is daily washed by the tide, the beach face that slopes upward, and the berm, which features sand dunes and dune plants.
2. Some animals that may live here include: crabs, shorebirds, mollusks, beach mice, and insects like beach hoppers.
3. The activities that are harmful include dune buggies, which cause erosion, and sewage dumping, which causes point source pollution. Activities that are examples of environmental stewardship, enjoying nature while conserving it for future use, include beach cleanups, dune planting, photography, windsurfing, and building sand castles.

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## Sandy Beaches

Sandy beaches form an essential habitat for many organisms including shorebirds, crustaceans, mollusks and even sea turtles that lay their eggs in the dry sand. This habitat also provides many important services to humans, including erosion and flood control, recreation, and jobs. Despite their importance, beaches face many threats from human activity, including pollution and overdevelopment that causes erosion. We can help prevent this damage by taking photos not specimens, replanting dune plants, depositing trash in trash bins, and educating others to help maintain beautiful, healthy beaches!



Use the above diagram to answer the following questions:

1. Describe some of the physical characteristics of this beach. \_\_\_\_\_

2. Which animals may make their home in this habitat? \_\_\_\_\_

3. Many human beach activities are pictured here. Which can be harmful and which are examples of environmental stewardship? \_\_\_\_\_