

# SAN DIEGO NATURAL HISTORY MUSEUM



## COAST to CACTUS IN SOUTHERN CALIFORNIA

### Curriculum and Lesson Plan Resource Guide Grade 5



[www.sdnat.org/coasttocactus](http://www.sdnat.org/coasttocactus)

# Coastal wetlands and estuaries

Estuaries are located where fresh water rivers meet salt water oceans. As ocean tides rise and fall, salt water and fresh water flow into the same area to create brackish water. Estuaries are home to a wide variety of animals. Some animals live in the water including fish and stingrays. Other animals, such as crabs and snails live in the mud that is covered by water during high tide and uncovered during low tide. These animals can adjust to the changing amount of salt in the water.



## Guiding Question: What is unique about the water in an estuary?

**Activity:** This activity can be done as a demonstration by the teacher or by students working in groups.

### Part one:

- 1) Ask each student to write a prediction to answer the guiding question.
- 2) Fill clear tub half full with fresh water and place where all students can observe it at eye level.
- 3) Slowly pour the salt water mixed with blue food coloring into one side of the tub.
- 4) After a few minutes of observation, have students check their predictions and record the actual results.
- 5) Have each student draw and label a diagram of the results.

### Part two:

- 1) To simulate the interaction of tides, gently move a spoon back and forth to move the water from one side of the tub to the other.
- 2) Explain that when fresh and salt water are mixed, the result is brackish water.
- 3) Again, have each student draw and label a diagram of the second part of the activity.
- 4) Ask students to write an explanation of what brackish water is and how it is made. Ask them to consider and respond to these questions: What would an organism need to survive the changing conditions in an estuary? A change in temperature? The change in availability of fresh water? Sometimes the area is flooded- sometimes it is dried out.

### Standards: Grade 5.

For details see page #6-7 of CA's NGSS for K -12  
<http://www.cde.ca.gov/pd/ca/sc/documents/ngss-ca-gr5-dci.doc>

**Performance expectation: 5-ESS2-1**

#### Science & Engineering Practices:

Developing and Using Models.

#### Disciplinary Core Ideas

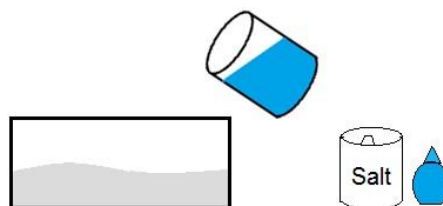
**ESS2.C:** The Roles of Water in Earth's Surface Processes.

#### Crosscutting Concepts:

Systems and System Models.

**Interdisciplinary Common Core Connections:**  
 SL.5.5 W.5.1

This is a pre-visit activity



**What's the point?** In this activity, students simulate what happens in estuaries where fresh water from streams and rivers meets salt water from the ocean. **Students learn** that when fresh water and salt water mix it is called brackish water. This understanding leads to concepts that animals must have adaptations that allow them to survive in changing conditions; in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

**Science Concepts:** Students should recognize that the two types of water do not mix at first. The salt water sinks to the bottom of the fresh water; this is because the salt water has a greater density. Something that has a higher density has more matter in the same amount of space. In this case, salt water has salt AND water in it; so it is denser and sinks below the fresh water. Forces such as wave-action will mix the two types of water creating brackish water, which has less salt than ocean water.

**Materials:**

- 1 vial of food coloring (blue is best for this activity)
- Room temperature water
- 1 clear plastic tub, approximately shoe box size
- Container, such as cup, to hold approximately 2 cups of water
- 1 canister salt
- Spoon

**Advance Preparation:**

- Fill plastic tub half full with water.
- Place 2 cups of water into container and add 10 drops of blue food coloring.
- Stir salt into container of water until no more salt will dissolve and some settles at the bottom.

**Key words:**

- |                      |                  |
|----------------------|------------------|
| • Wetlands           | • Estuary        |
| • Tides              | • Density        |
| • Salt water         | • Adaptations    |
| • Fresh water        | • Brackish water |
| • Ecosystem Services |                  |

**Supplemental materials** available from our

Nature to You Loan Program: 619.255.0236 or [loanprogram@sdnhm.org](mailto:loanprogram@sdnhm.org)

- |                    |                        |
|--------------------|------------------------|
| • Great Blue Heron | • Baby Halibut         |
| • Pocket Mouse     | • California Killifish |
| • Stink Beetle     | • Velvet Ant           |
| • Gray Fox         | • Arboreal Salamander  |

**Websites with activities and more information on this topic:**

- <http://estuaries.noaa.gov/Teachers/estuaries.aspx>
- <http://www.amnh.org/explore/ology/water>



# Humans share the land with nature—or do they?

Once upon a time, natural habitat covered our coast and foothills. People moved into this area then built roads and houses which transformed this natural place. The area is now fragmented, or divided into sections. The hills and canyons in our neighborhoods used to be open natural areas where wildlife thrived. Changes humans made to the natural landscape pushed a lot of the wildlife out of the city. Humans have lowered the amount of space available for wild animals, such as coyotes, lizards, and bats, which still live in many of the canyons in southern California. These animals have developed ways to live alongside humans; often, they visit our backyards! Individual people and communities can do things to help protect Earth's resources and environments.

## Guiding Question: How do human activities affect the land, plants, animals, and rivers?

**Activity:** This activity can be done by individual students or by students working in groups.

- 1) Explain to students that models are not perfect examples of events; they are imitations that help us understand science concepts and how things relate to each other.
- 2) Ask students to design and draw a grassy area with hills, trees, wildlife and streams. (Example, see figure 1)
- 3) Ask students to write an explanation of how the design of their wilderness provides food, water, shelter, and other resources for wildlife in the area.
- 3) When the drawings and explanations are complete, place 2 – 3 long strands of black yarn across the entire page to represent how an area is divided and fragmented when roads are built by humans (Figure 2).
- 4) Place pieces of construction paper on the drawing to represent houses and other buildings to demonstrate changes that humans make to the natural landscape when they move into an area (Figure 2).
- 5) Ask students to consider: How will natural processes, such as water flow, be affected by the roads and buildings? How will animals move from place to place in search of food and water now that their land is fragmented (divided into sections). Will trees need to be cut down to make room for buildings?
- 6) Ask students to use their drawing to write answers to the questions in #5 and to the guiding question.
- 7) Have students re-arrange roads and houses to have as small an impact as possible on the natural area.
- 8) Ask students to write an explanation for the changes they made and how they think the changes will help protect natural area.

This is a  
pre-visit activity



### Standards: Grade 5.

For details see page #8-9 of CA's NGSS for K -12  
<http://www.cde.ca.gov/pd/ca/sc/documents/ngss-ca-gr5-dci.doc>

### Performance expectation: 5-ESS3-1.

Science & Engineering Practices:	Disciplinary Core Ideas	Crosscutting Concepts:
Obtaining, Evaluating, and Communicating Information	ESS3.C: Human Impacts on Earth Systems	Systems and System Models Cause and Effect
Interdisciplinary Common Core Connections:		
SL.5.5	W.5.8	MP.2

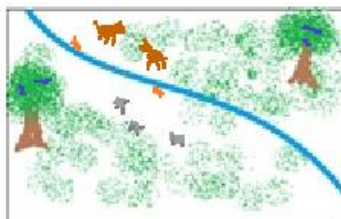


Figure 1



Figure 2

**What's the point? In this activity** students examine how the land and wildlife in natural areas are affected by changes humans make. **Students learn how** to design a solution to minimize the impacts that human structures can have on natural areas and they explore different ways to arrange man-made structures to lessen the impact that human activities have on the natural areas.

**Science Concepts:** Human activities have had major effects on the land, vegetation, streams, and wildlife. Individuals and communities can do things to help protect Earth's resources and environments. Through careful consideration of the needs of the environment and how it is used by nature, humans can lower the negative impact they have on an area when they move into it. Instead of displacing nature, humans can design communities in a way that works with nature.

**Materials:**

- Drawing paper. Poster size is best if students are working in groups.
- Colored pencils, markers, etc
- Writing paper
- Black yarn or long strips of black paper
- Construction paper

**Advance Preparation:**

- Place students into groups
- Cut lengths of yarn or paper long enough to cross posters or the size of the paper used
- Cut shapes to represent buildings

**Key words:**

- Habitat
- Fragmentation
- Foothills
- Canyons
- Wildlife
- Natural processes

**FOLLOW UP ACTIVITY:** Ask students to write about changes to the natural landscape in their school yard or neighborhood that they have noticed.

**Websites with activities and more information on this topic:**

Students can calculate their ecological footprint (how their everyday actions affect nature and the planet in general) by using this simulation:

<http://earthday.net/footprint2/flash.html>

<http://myfootprint.org>

# Rain shadow deserts

When storms from the Pacific Ocean move east and rise over mountains, the clouds lose most of their moisture as precipitation before they cross over the top of the mountain. Very little precipitation makes it to the deserts that lie beyond the mountains. This is called the rain shadow effect. The Anza-Borrego Desert is a rain shadow desert. The amount of water in the mountain ecosystem is much higher than the amount of water in the desert ecosystem. When the Earth's geosphere (landforms) interacts with the atmosphere (air and moisture) these two systems interact in ways that affect Earth's surface. Two different ecosystems are created; one that is moist and one that is dry.

## Guiding Question: How is the surface of the land affected as clouds over the ocean move from the west to the east and over mountains?

**Activity:** This activity can be done as a demonstration by the teacher or by students working in groups.

- 1) Explain to students that models are not perfect examples of events; they are imitations that help us understand science concepts and how things relate to each other.
- 2) Set up bowl and plate to make a model of a mountain.
- 3) Place 1 piece of each of the following colors of construction paper under the plate and label as follows (See diagram below). Blue= "Pacific Ocean," Green= "Hills/valleys," and Tan= "Rain shadow area/Desert."
- 4) Label the side of the model next to the Pacific Ocean "west" and the desert side "east."
- 5) Fill sponge with water then explain that water evaporates from the ocean and creates clouds.
- 6) Hold the sponge low and over the paper labeled "Pacific Ocean."
- 7) Squeeze the sponge while moving your hand from "west" to "east," also move up and over the bowl.
- 8) Be certain to release most of the water on the "west" side of the mountain.
- 9) Little to no water should fall on the east side of the mountain as you move the sponge over the "desert."
- 10) Have students draw a diagram of the demonstration and label the parts that represent mountains (bowl), clouds (sponge), rain (water), Pacific Ocean (blue paper), Desert (tan paper) and hills/valleys (green paper).
- 11) Ask students to write an explanation of how land and air masses work together to create moist conditions on one side of a mountain and dry conditions on the other side.



This activity can be done pre-visit or post-visit

**What's the point? In this activity** students use a model to illustrate one way that the geosphere and atmosphere interact. **Students learn how** one type of desert, a rain shadow desert, is created. Mountain ranges, clouds in the atmosphere and winds interact to create dry desert conditions. Moisture in the air falls on one side of the mountain making the land in the area moist while the land on the other side of the mountain is very dry. In this model, 1) the sponge represents a cloud 2) the bowl represents a mountain 3) the movement of the hand represents the movement of the winds and clouds from west to east 4) squeezing the sponge represents the release of moisture from a cloud as it passes through cooler higher altitudes.

**Science concepts:** When air masses and clouds approach mountain ranges the air masses rise up the side of the mountain. As clouds are pushed up by winds to higher elevations in the atmosphere, they pass through cooler air. Cooler air cannot hold as much moisture as warm air. As clouds are blown higher into cooler and cooler air, water falls out of the clouds in the form of rain or snow (precipitation). After the air mass crosses over the peak of the mountain and moves down the other side, the air warms and the clouds dissipate because there is little to no moisture in them. Since warm air can hold more moisture than cool air, as the warm air travels across the desert it picks up moisture which adds to the drying effect.

**Materials:**

- Sponge
- Room temperature water in a container
- 1 bowl
- 1 plate or tray to put under bowl
- Paper to label east and west side of model
- Paper towels for clean up
- Construction paper: blue, green and tan

**Advance Preparation:**

- Turn bowl upside down on plate or tray.
- Prepare container of room temperature water.
- Label sides of model I "east" and "west."
- Place 1 piece of each of the following colors of construction paper under the plate (see diagram and label blue as "Pacific Ocean," Green as "hills/valleys," and the tan as "Rain shadow area."

**Key words:**

- Precipitation
- Mountain ecosystem
- Desert (rain shadow desert)
- Atmosphere (air )
- Hydrosphere (all water on earth)
- Geosphere - Landforms
- Elevation

**\*\*FOLLOW UP ACTIVITY:** Students can research the different types of deserts found around the world. Students should be able to describe what geographical features (land features) and weather patterns created each type of desert. Challenge students to create a model that demonstrates how the type of desert they chose is created.

**Websites with activities and more information on this topic:**

<http://www.mrphome.net/mrp/rainshadow.swf> Brief animation (Narrated) of how water falls from clouds as they travel from the Pacific Ocean across the Sierra Nevada Mountains.

<http://bcs.whfreeman.com/thelifewire/content/chp56/5602001.html> Narrated animation with more detail of the rain shadow effect is created.

<http://pubs.usgs.gov/gip/deserts/types/> Information from the U.S. Geological Survey on different types of