

Dune Movement

Teacher's Guide

Subject: Integrated Science (Life; Earth-Space; Physical)

Topics: Longitudinal Sand Dune Study: Accretion and Erosion, Wind

Summary: Students will examine the dunes and measure the movement of sand dunes along a portion of the boardwalk trail. Students will discover the importance of preserving the dune vegetation, by realizing that the vegetation provides an obstacle for the sand and “holds” the sand in place.

After completing the field lab, students will be able to:

Objective(s):

1. Explain the environmental causes of dune formation
2. Define erosion and accretion
3. Pinpoint dune movement via comparative data and measurement

Ecosystem(s): Coastal, Beaches/Dunes

Equipment:

- 100 meter Tape Measure
- Compass
- Tide chart
- Binoculars
- Digital camera
- GPS Units

Background:

- **Vocabulary:** accretion, erosion, vegetation
- **Reference Material:** *The Beaches are Moving* (Video), Science Voyages (Green Glencoe) Chapters on Ocean Shoreline (354-358); Ocean Waves (379-381); and Dunes (323-325);
Creating Sand Dunes: http://www.eduref.org/Virtual/Lessons/Science/Earth_Science/EAR0007.html
Barrier Island Ecology (How stuff Works): <http://www.howstuffworks.com/barrier-island2.htm>
(Post-Activity) Students create a graph with the data from Lab #3 (Dune Movement) and compare it to previously recorded data (when available).
- **Equipment Training:** Using/reading a metric measuring tape

Procedure (Engage; Explore; Explain)

1. What forces in the environment move sand? (wind and water)
2. Begin activity as one group at the north end of the parking lot. Explain that barrier islands are dynamic places. Their size, shape and location are constantly changing. Define **erosion** as the removal of material and **accretion** as the addition of material. Explain that sand movement is not always in the same direction, but in general there is a net movement in one direction over time. Changes are most noticeable on the gulf side where sand blown from the beach forms dune ridges, lines of dunes perpendicular to the prevailing wind.
3. Review with students the “recipe” for dune formation.
 - Abundant supply of **sand**. Where does the sand that makes up our barrier islands come from? The river carries huge amounts of sediments that are the result of erosion of mountains to the north (quartz sand comes from the breakdown of granite). Sand travels across the bay and into the Gulf to create offshore sandbars. Waves deposit sand onshore during calm weather and wind moves the sand landward forming dunes. During storms, sand erodes from the dunes and is moved back offshore. This means dunes serve as sand reservoirs for the barrier island system.

- **Wind** energy. Sand can only be moved by fairly strong winds (>15mph) and is only lifted a few feet off the ground. How then can dunes form that are over 30 feet high? As sand carried by the wind drops, it bumps into other grains. This “leapfrog” effect pushes sand up the dune front and eventually over the top. On the back of the dune many inclined layers of sand form called cross-beds. This rolling over action explains how dunes migrate down wind.
 - **Obstacles.** Objects reduce wind speed causing sand to accumulate. Ask students to list objects they observe (plants, shells, man-made items such as sand fencing, boardwalks, etc). Other than objects, what else might impede sand movement? (Compaction, moisture, large grain size)
4. Use a tide chart to record tide
 5. Divide the group in to pairs. Assign each two transect where they will measure two of 10 measurements. The transect will be along a compass bearing perpendicular to the shoreline.
 6. One student positions the measuring tape so it lines up with a pre-marked spot on the parking lot. The students will measure the width of the beach from the parking lot to the shoreline. Do not disturb the dune by moving or pressing down on the measuring Tape. Other team members record the measurements. After all teams have completed their measurements the group shares their data.
 7. Take a picture of the group standing on the north side of the bath house with out vegetation and one at the south side of the bathhouse with vegetation.

Part 2.

1. The groups will walk along the trail cut and read (using binoculars) where the sand reaches on the poles set within the vegetation.
2. The poles will be pre set and marked in metric increments.
3. The students will the draw a cross section of the dune area using the measurements from the poles.
4. The accretion or erosion will be documented over time using the students data.

Sunshine State Standards:

Science: SC.B.1.3.1; SC.B.2.3.1; SC.D.1.3.1; SC.D.1.3.4; SC.D.2.3.2; SC.G.2.3.2; SC.H.1.3.4; SC.H.2.3.1

Language Arts: LA.A.1.3.3; LA.B.2.3.1; LA.C.1.3.1

Mathematics: MA.B.2.3.1; MA.B.3.3.1; MA.E.3.3.1

Social Studies: SS.A.6.3.2; SS.B.2.3.6;

Dune Movement

Student Data Sheet

General Information

Full Name:		Date:	
School (teacher):		Time:	
Latitude:		Longitude:	

Student Hypothesis and Rationale

If water or waves is the main force in dune erosion, than I hypothesize most of the measurements on the north side of the bath house vegetation will show (choose one: erosion/ accretion) because..._____.

Field Observations/Measurements/Data

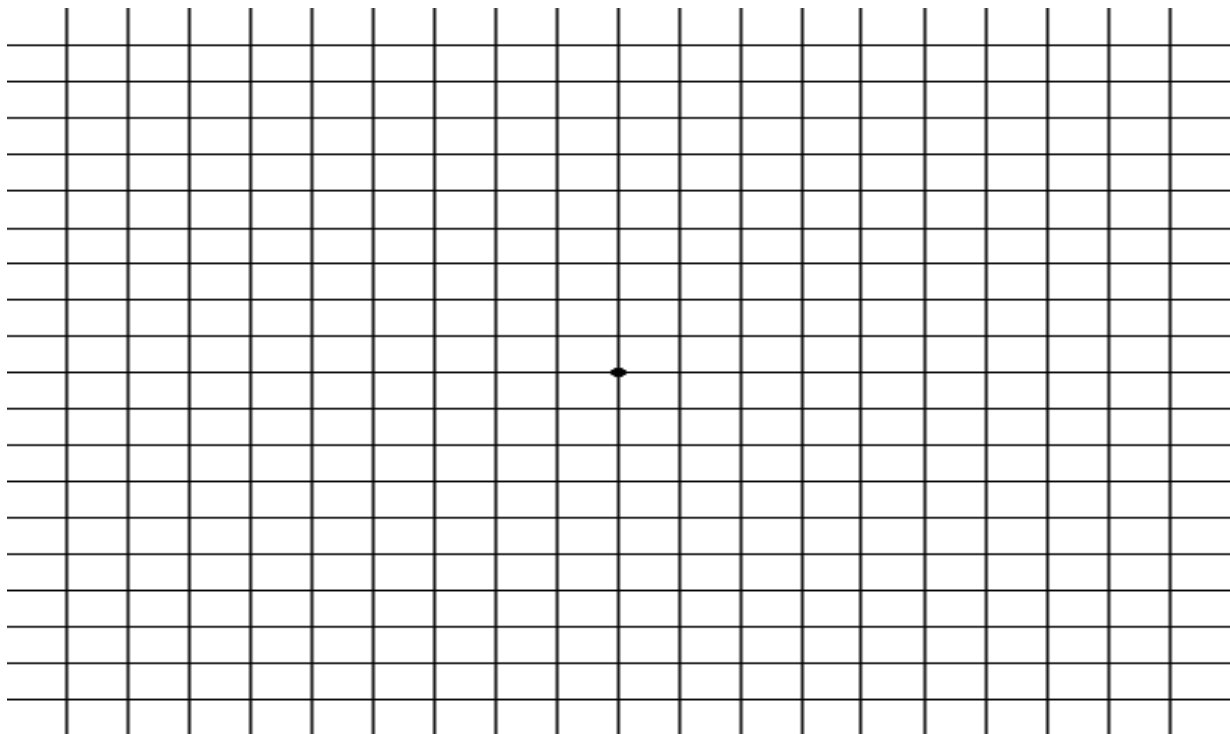
Transect : Width of Beach

Tide:		Compass Bearing:		
T R A N S E C T #	<u>1st Year's Data</u> (2008)	<u>This Year's Data</u>	<u>Change</u> difference in measurements (cm)	<u>Erosion (E)</u> space increased so sand lost or <u>Accretion (A)</u> space decreased so sand added
	N 1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	S 10			

Dune Vegetation

P O S T #	<u>1st Year's Data</u> (2008)	<u>This Year's Data</u>	<u>Change</u> difference in measurements (cm)	<u>Erosion (E)</u> space increased so sand lost or <u>Accretion (A)</u> space decreased so sand added
1				
2				
3				
4				
5				
6				

Draw the Beach Profile



Dune Movement

Assessment

1. What is the measurement for post # 3?

2. Compare transect #2 and Transect #9. What is the difference in measurements? Was there accretion or erosion at transect #2?

3. Transect # 2 is on the North side of bath house. Was your hypothesis supported by your data? Whether your hypothesis is supported or not, what can you infer from your observations, measurements, and results?

4. What are the three key “ingredients” necessary for dune formation?

5. Why is it important to stay off the dunes? What would happen if you walked on the dune vegetation?

Portfolio Journal Prompt

The wind erosion can shape and move landscapes, like the sand dunes explored during the lab. Before you begin writing think about how the wind moves around the earth, and the factors that cause the air to move. Describe the process that causes the air to move. Explain how energy and heat are a part of this process.