



Chapter 5 – Sand Dunes and Sandy Beaches - *Seaway Trail Wildguide*

Lesson #1 Sand Dunes

Grade 4 – 6

Subject: Science

Irene F Sullivan

Anticipatory Set:

What is a sand dune? How are they created? Where will you find a sand dune?

NYS Learning Standards:

Mathematics, Science, and Technology Standard 4: Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.

Objectives: Have students understand how a dune is created and the importance of the sand dunes are in preventing erosion by having the students create a drawing of the stages of a sand dune.

Purpose: To have students understand the importance of sand dunes in our area.

Summary: Sand Dunes

Storms out on the lakes will produce waves similar to those you see out on the seacoast. You can find beaten cliffs and broad sand or cobble beaches along the Seaway Trail. Along the southern shores of Lake Ontario you find rocks in various sizes from gravel to boulders. They will be smooth and rounded from the water and ice abrasion. The glacial deposits were eroded by the wave action over the years and have formed beaches. In Niagara and Orleans counties you can find many homes made with cobblestones. Lake Erie and Lake Ontario have winds that generally blow from the southwest to the northeast. This causes a system of barrier beaches and sand dunes on the eastern shore of the lake. These dunes are the largest and most extensive fresh water dunes in New York State; in some areas they are as high as 70 feet.

As the wind blows the sand and bounces along the surface, the wind dislodges other grains of sand. Rocks, logs and plants in the path will reduce the speed of the sand and the sand will drop around the object blocking it. This small pile of sand forms the basis of a sand dune. As other mounds merge a hillock is formed with a ridge that has one sloping windward side and a very steep leeward side. With steady winds, dunes will continue to grow continue to grow up to a few feet per year. If the dune does not become stabilized, the sand will bury everything in its path. Dunes become stabilized by the natural growth of plants. Beach grass reduces the velocity of the wind so the sand grains deposit around the plants. Once a dune becomes stabilized the dune no longer moves. One of the largest dunes on the Seaway Trail is located on the eastern margin of Lake Ontario and is bordered by the mouth of the Salmon River and on the north by Stony Point along Route 3. It is believed that the water level of the lake must have been 30 feet lower than it is today in order to expose enough beach sand to create today's sand dunes.

Plants do not survive on the shoreline because of the periodic erosion caused by waves. Above the wave line, sand can begin to form dunes. The sand is moved inland by



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the wind until it hits plant coverage, which binds the sand and anchors the dune. Wave action is the strongest during spring after the ice has melted and the water level is at its peak. Erosion is high during high winds when the water is pushed up on the eastern end of the lake and the water level becomes higher than normal.

Today, these fragile ecosystems are managed for preservation. New York State has acquired several areas of land along the eastern shore of Lake Ontario to preserve this unique sand dune environment and the wetlands that are behind the dunes. These areas have limited public access. One way to protect the dunes is by strategic placement of snow fences to stop erosion. A notch in the top of a dune can funnel the wind and cause the wind to double its velocity. This can cause an increase of erosion and cause the dune to start moving again. Planting beach grass also helps protect and stabilize existing sand dunes.

Human activities such as pedestrian traffic and off road vehicles need to be managed to preserve the dunes. Trails have been constructed so you can visit the dunes and their environment without disturbing the ecosystem. You will also find designated areas for sunbathing and picnic areas so you can enjoy the outdoors without damaging the sensitive parts of the environment.

Plants found at the dunes

Sand dune soils provide poor mineral nutrients. What nutrients the sand does have are found on the surface of microscopic soil particles called micelles. Sand is a relatively coarse texture soil with little decomposing organic matter and few mineral-holding micelles. Therefore, the main source of mineral nutrients comes from the spray from waves during heavy storms and rainfall. Plants depend on the small film of water around the soil. In the summer temperatures of the sand can reach as high as 115 degrees or higher. This dries out the surface layers. Plants have a root system that penetrates below the hot dry surface. The main source of water is the rainfall that filters through to the roots.

The constant shifting of the sand makes it hard for plants to survive. Beach grass has adapted to survive in shifting sands by having stems that will grow horizontally. As the sand builds up around the plant, the stem grows longer where the leaves stay above ground. As the plant continues to grow the extensive root system anchors the dune.

Dunes are like bogs, swamps, and fields. If they left alone and untouched they will eventually grow into a forest. It is estimated to take about a thousand years to have the dune become a climax forest. This can only happen if the dune is anchored down by beach grass and cannot move.

Beach grass is the primary dune building plant. Other types of plants able to survive on the dunes are sea rocket, seaside spurge, wormwood, and beach pea. Most trees die if their trunks are buried by sand. The cottonwoods can survive by sprouting new roots higher on the trunk. You can also find climbing plants like the poison ivy, wild grape, and green briar in dune areas.

This lesson is based on a lesson found on a web site:

<http://www.col-ed.org/cur/sci/sci177.txt> , written by Barb Hawkins, Wabaunsee East USD 330, Harveyville, KS



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Materials: For each group

1. 2-speed hair dryer
2. 2 flat pans
3. Small grass clumps
4. Angular stones
5. 3 liters of clean sand
6. A dustpan and broom for clean up.

Teach:

1. Explain to the students that this experiment is to determine what factors affect the kinds of sand dunes the wind creates.
2. You can break up the class in groups of two to three students or you can do the experiment as a whole class.
3. The experiment should be done on a table, the floor or outside.
4. Label each pan A and B. Place 1.5 liters of sand in each pan.
5. In pan B arrange the stones and grass in different areas throughout the sand.
6. Turn the dryer on low speed. Hold it at a 45-degree angle; 10cm from one end of the pan A. Hold it for one minute. Record all observations.
7. Repeat the step 6 for pan B.
8. Change the dryer speed to high. Repeat step 6 for both pan A and pan B.
9. Make a sketch of the appearance of the sand in each pan.
10. Level the sand in each pan and repeat step 6 for 3 minutes instead of one minute.
11. Record findings and sketch the appearance of the sand in each pan.
12. Have the students share and discuss their findings.

Guided Practice:

The teacher will assist students in making the directions clear and following each group as they conduct the experiment.

Closure:

Ask the students what is the importance of sand dunes to our area. Why should we protect the sand dunes?

Extended Activities:

1. Have the students take a large piece of paper and fold it into sections so they can draw the different steps of development of a sand dune.
2. Have the students research the different plants found in a sand dune.
3. Take the students to a local sand dune and see if they can identify any of the plants they learned about.

Web sites:

1. http://www.epa.gov/glnpo/image/viz_nat1.html



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This site gives you images of sand dunes and wetlands from the Great Lakes.

2. <http://www.geo.msu.edu/geo333/dunes.html>
This site offers information on sand dunes.
3. <http://www.seagrant.sunysb.edu/Pages/LontDunesonWeb.htm>
This site is on Lake Ontario's dunes and wetlands. The site has connections to other sites.
4. <http://www.cce.cornell.edu/seagrant/dune/dune.html>
When you are on the site click onto educational activities for activities to use with the students.
5. <http://www.col-ed.org/cur/sci/sci177.txt> This is the site the lesson was based on.

Children's Books:

1. "Life in a Sand Dune" Malcolm Perry, Raintree/Steck-Vaughn, Sept. 2003, ISBN 1410903508, (ages 4-8)
1. "Sand on the Move: The Story of Dunes" Roy A. Gallant, Franklin Watts, Incorporated, March 1998, ISBN 0531158896 (ages 9-12)
2. "Sand Dunes", Jan Gumprecht Bannan, Carolrhoda Book, May 1989, ASIN 0876143214, (ages 9-12)
3. "Summer Sands", Sherry Garland, Gulliver Books, April 1995, ASIN 0152824928, (ages 4-8)