

The Education Program at the New Jersey Sea Grant Consortium

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DUNES AND DUNE GRASS

OVERVIEW

Students study the essential parts of the Cape American Beach Grass *Ammophila breviligulata* and discover the basic necessities for plant survival.

OBJECTIVES

Following completion of this lesson, students will be able to:

- Name the parts of a beach grass plant.
- Understand how the parts of a beach grass plant work together to help the plant.
- Describe how a sand dune gets started.
- Know what a plant needs to survive in the harsh environment of the beach.
- Gain an understanding of the function of a barrier beach.
- Appreciate the natural habitat created by sand dunes.

GRADE

1-8th grade

NJCCC STANDARDS

5.1 Science Practices: A, B, C, D; 5.3 Life Science: A, B, C, D, E, 5.4: A, C; 6.3 Social Studies: 8.1 Critical Thinking, Presentational Skills, Educational Technology B, C, E, F; 9.1 21st Century Life Skills: A, B, C, E, F; Mathematics: 1, 5

MATERIALS

- Notebook for journal writing
- Beach Grass Plants (one plant for each team of two students)
- Potting soil
- Watering can
- Window sill (or grow light)
- Plant sprayer
- Magnifying lens (one for each team)
- Ruler (one for each team)
- 4 Popsicle sticks glued in a square shape to make a frame (one for each team)
- Old newspapers
- Paper plates or white paper
- Container to plant plants in

PROCEDURE

Students observe an actual beach grass plant and explore the parts that make up the plant: roots, stems, leaves and flowers. If you are teaching this lesson to older students allow them to research the function of each part. If teaching younger students, you may want to explain the function in simple terms. Have students make a diagram or drawing of the plant and label the parts.

To begin, gather the students together and tell them that they are going to look at the four parts of a plant. Using two plants as a demonstration (one with roots into the soil and the other just a cutting pushed into the soil) ask for a volunteer to come up and push on the plants and observe what happens. Ask why one plant falls over and not the other. Tell them that one of the four parts of a plant they will be looking at today is called a **root**. The root holds the plant in place and brings water and food (minerals) from the soil to the plant.

Distribute materials. Cover the workspace with old newspapers to keep it clean. Have students working in teams of two uncover the roots of a beach grass plant gently, so that the plant and roots do not break. Use water from a spray bottle to gently wash away any remaining soil from the roots. When the plant is cleaned, lay it on a paper plate or white paper and examine the roots with the magnifying glasses. Use a ruler to measure the length of the roots. Record the measurement in their journal. Use the popsicle stick square to lay on top of a section of roots and count how many roots or root hairs you see in one square space. Note: you may choose to do this part outside because of the mess.

Ask the students to draw a diagram of the plant they are observing and include the roots, stem, leaves and flower. Label the parts on their drawing. Ask if students can identify other parts of the plant like the stem, leaves or flower. If they can, label their drawings accordingly.

Explain the function of the parts if they are not doing their own research on this topic. **Stems** carry water and food from the roots to the leaves. They also hold the leaves up to get the energy from the sun. **Leaves** are the food factory for the plant. They take the water and minerals from the soil and combine it with the sunlight energy and carbon dioxide from the air to make food for the plant. Explain how animals/humans breathe out carbon dioxide to give to the plants while the plants give off oxygen for us to breathe in. Explain what the **flowers** of beach grass look like and that the purpose is to make fruit and seed. Beach grass commonly makes new plants from a **rhizome**.

After the students have completed their drawings and labeled the parts, encourage them to color their pictures.

To complete the activity, gather the partners/teams together and have them share with the entire class their drawings and discoveries. Ask the teams to replant the beach grass using the materials provided, then care for and watch their plant grow over the next few weeks.

Questions for students to answer in their journals about the beach plant:

- What does this plant look like if you were to describe it to someone who cannot see it? Describe the plant in detail as you make observations.
- How many leaves do you see?
- Use a ruler to measure your plant when you first get it and then each week as you are observing it. How tall is it at the beginning of the study? How much taller does it get?
- How long are the roots at the beginning and end of the study?
- How often do you have to water it? If it turns brown, what does that mean?
- Compare the parts of a common house plant with the beach grass.

BACKGROUND

Dunes act as flexible barriers to ocean storm surges and waves. They help prevent erosion of beach areas behind the dunes. They also provide habitat for many animals, including migratory birds. Sand dunes, once established, provide habitat for insects, birds and small mammals like mice and fox.

The beginning of a sand dune can start with a rock or pile of seaweed or even a piece of driftwood. Beach dunes have also been started by using fencing or used holiday pine trees to trap sand and to headstart the dune process. Beach sand accumulates behind the item as the wind blows the sand inland. As the small mound gets bigger, plants like sea rocket or beach grass can colonize it. Once there is a plant or two, the pile of sand gets bigger. The roots of the plant hold the sand in place, accumulating even more sand and as a result, establishing a dune.

Beach grass is one of the most important plants on a sand dune. It spreads quickly by its specialized roots, called **rhizomes** that can grow down and sideways through the sand. These rhizomes, along with the roots of the plant, form a network that helps hold the entire dune in place. Sand dunes are homes to many other plants including sea rocket, seaside goldenrod, beach pea, beach plum, prickly pear cactus, mullein, wild rose and poison ivy. These plants are adapted to living in the dunes' harsh beach environment. Storms and strong winds can change the shape of sand dunes and push them inland. Besides major storms, one of the major causes of sand dune change is trampling by people. Walking or playing on sand dunes damages the beach grass that holds dunes together. It takes only a few footsteps to kill a beach grass plant. When the plant dies it cannot hold the sand in place. As a result, winds blow away the sand breaking down the dune.

Area of Biological Interest The Jersey Shore is home to great diversity of marine and plant life. You may be familiar with some of the marine creatures such as Atlantic Silversides, Mummichogs, Horseshoe crabs, flounder, hermit crabs, clams and mussels. There are a number of terrestrial plants that grow in this harsh environment as well: beach grass, sea rocket, seaside goldenrod, beach pea, beach plum, prickly pear cactus, mullein, wild rose and poison ivy. These plants trap sand creating a natural beach by forming dunes. Most of these plants are hardy varieties with deep spreading roots. Beach grass in particular has the ability to withstand salt spray, repeated burials, overwash, exposure to extreme heat and sunlight and limited fresh water. Beach grass is considered a pioneer plant because it is the first plant to stabilize the sand above the water mark. As the grasses grow, sand grains are continuously blown across the beach and trapped by the stems. Beach grass grows rapidly during the warm weather months. Repeated burials of sand stimulate further growth, trapping even more sand that pile up on the dunes building them, thus enhancing the area.

Once the primary dune gets established it acts like a barrier to protect the area behind it. Other types of plants can then establish themselves in this protected area. Together with beach grass these plants reduce erosion from the ocean waves during times of intense storms. As the plants die naturally, their decomposing materials provide a nutrient base for new plant growth. A variety of thickets and shrubs and eventually trees can grow in this nutrient rich soil behind the dunes. The predominant species of shrubs and trees found in this coastal area are beach plum, bay berry, poison ivy, winged sumac, wild black cherry, holly and eastern red cedar.

Social and Economic Value of Beaches The travel and tourism industry is important to the economy in New Jersey and other coastal areas. Few realize that travel and tourism is already America's largest industry and employer and beaches are its leading tourist destination. (Economic Value of Beaches, 2008) Beaches make a large contribution to America's economy and especially in New Jersey.

Beach erosion is the number one concern that tourists have about beaches. For example, in 1989, 74 percent of those polled in New Jersey said that the Jersey Shore was going downhill. In 1998, only 27 percent thought the Jersey Shore was in decline with 86 percent saying that the shore was New Jersey's best feature. (Houston 2013). The difference between the two time periods was the construction of the beach

nourishment project from Sandy Hook to Barnegat Inlet. This is considered the largest beach nourishment project in the world (U.S. Army Corps of Engineers, 2001). We should look at our beaches as a national treasure.

New Jersey beaches not only provide recreation for beachgoers and fishermen and support a large tourism industry, but play a more critical role when New Jersey's coastal communities are faced with coastal storms. New Jersey's unique geography places the state in the potential path of hurricanes, tropical storms and northeasters. Healthy beaches provide protection and mitigation from these natural disasters by acting as buffers between the surf and homes, businesses and infrastructure found along the coast.

The NJDEP Department of Coastal Engineering along with the U.S. Army Corps of Engineers provides beach nourishment and re-nourishment projects for the purpose of restoring beaches along our coastline.

As nourished beaches undergo erosion, they must be maintained through beach re-nourishment. This process consists of restoring the beach to what is considered "initial conditions" and usually has less time and cost involved with the project when compared to the initial nourishment. The time between projects are called the re-nourishment cycle and is dependent on the severity of erosion as well as storms. Funding beach nourishment comes from several sources: federal, state and local and depends on the location of the project.

VOCABULARY

Root - part of the plant that anchors the plant, grows downward and absorbs nutrients and moisture.

Stem - the main trunk of the plant.

Leaves - usually green lateral structure attached to the stem and functioning as an organ of photosynthesis.

Flowers - the blossom of a plant.

Rhizome – an underground horizontal stem that send out roots and shoots. Also called rootstalk, rootstock.

EXTENSION

Plant Investigation- Using Cape American Beach Grass as the plant, students keep a journal on care and observations of their plant over time.

Growing Plants in the Classroom- Things you will need: plants, soil, pots to grow the plants in. Using Cape American Beach Grass as one of the plants, grow other varieties of grass to compare growth and care. You may also use other varieties of plants if you are comparing growth and care. Take the students on a field trip to see the plants growing naturally. Explore how plants have different needs than people. Ask students what plants need to stay alive. Discuss the parts of a plant: roots, stems, leaves and flowers.

Growth Cycle

After your plants have outgrown their pots, have an active lesson on dividing the plants and repotting them increasing the number of plants from the original plant. As another activity you may also choose to have students design their own container, possibly making use of recycled materials. Take a field trip after obtaining permission from a local beach, plant your beach grass plants to start the dune building process.

REFERENCES

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United States Department of Agriculture. "*Ammophila breviligulata*",
<http://plants.usda.gov/java/profile?symbol=AMBR>
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Houston, James The Economic Value of Beaches – a 2013 update
http://www.marloweco.com/images/Beaches_Produce_570_Billion_in_Federal_Tax_Revenues.pdf
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For more information on dune restoration and dune plants:
http://gcuonline.georgian.edu/wootton_l/restoration.htm

BEACH GRASS WORKSHEET

Can you label the picture with the plant parts? Use the word list and label each part in the right place. Use the space below to write down what each part does.

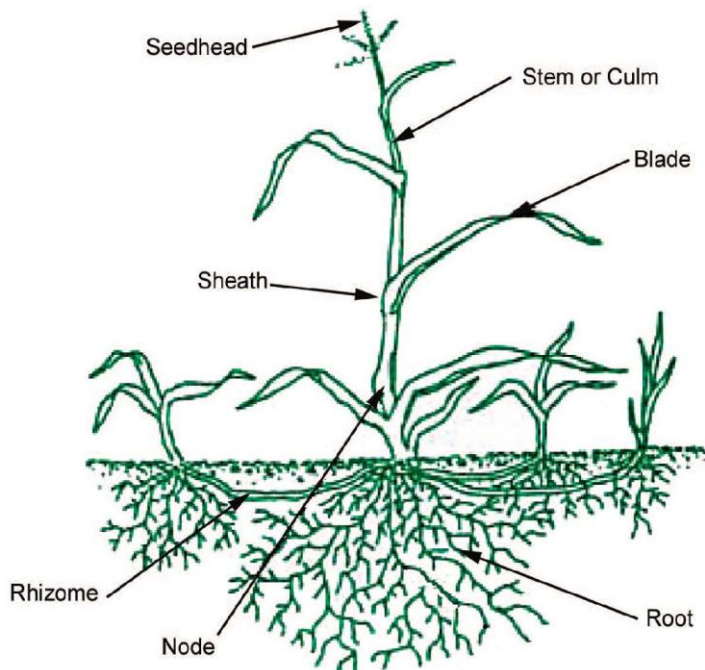
rhizome	sheath	stem	node
leaf blade	crown	root	culm



BEACH GRASS WORKSHEET

Answer Sheet

rhizome	sheath	stem	node
leaf blade	crown	root	culm



Culm is another word for stem.

Stem is the main upright section of the plant supports the leaves and carries water and food from place to place within the plant.

Rhizome is the horizontal root also called creeping root stalk.

Sheath is the covering on the stem.

Node is the point of origin of the leaves, buds or branches.

Leaf Blade is the long narrow leaf with sharp edges.

Crown part of the plant above ground.

Root the part of the plant below the soil that takes in nutrients.