

UC Santa Barbara

Educational Materials

Title

Coal Oil Point Reserve Dune Plant Adaptations Lesson

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Coal Oil Point Reserve: Dune Plant Adaptations

Next Generation Science Standards

2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats. [Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.] [Assessment Boundary: Assessment does not include specific animal and plant names in specific habitats.]

3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. [Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]

3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. [Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]

Lesson Plan: Sand Dunes

Cognitive Learning Objectives:

Students will gain an introduction to plant adaptations and the general characteristics of a coastal dune community.

Affective learning objectives:

Students will feel connected to the local environment and understand the importance of this unique ecosystem.

Materials: KIN journals, Plant Identification Cards

Preparation: Prior to student's arrival, identify and locate the list of appropriate native and non-native plants to be studied in the dune community. Some of these include Sea Rocket (*Cakile maritima*), Beach Saltbush (*Atriplex leucophylla*), Red Sand Verbena (*Abronia maritima*), Beach Primrose (*Camissoniopsis cheiranthifolia*), Beach Bur (*Ambrosia chamissonis*), Bush Lupine (*Lupinus arboreus*), Coyote Brush (*Baccharis pilularis*), and Buckwheat (*Eriogonum parvifolium*).

Choose an area where the students can freely walk around and observe the plant community without trampling over it.

Engage: At the beach, ask students what environmental conditions they see that shape the beach and dunes? *Wind, waves, tides, currents, erosion, deposition, anthropocentric causes, plant and animal communities.* What environmental conditions are present that may make it difficult for plants to

grow? *Sandy soil, little fresh water, salt, intense sunlight, wind, human impacts. Make sure that you mention dunes are a fragile ecosystem and are rare in this part of California. Ask students to be cautious about where they walk and what they step on.*

Explore: Looking around, what adaptations might a plant have that allows it to live in these conditions? Familiarize students with the concept of evolved adaptations in organisms, mainly plants for this lesson. Ask students if they notice anything about the plants around them. Are there more plants close to the water or further away, near the dunes?

Explain: What are some major natural forces that shape the dunes (waves, tides, wind, erosion and deposition, etc.) as well as the impacts made by humans and other animals in the surrounding communities. When wind blown sand is caught by dune plants and settles into mounds, embryo sand dunes are formed. Gradually the winds continue to add sand and blow the dunes inland, where they grow in size, and continue to collect sand. Waves, wind, plants, weather, and trampling by people all have an impact on dune shape. Ask students to put out their palm and feel the warmth of the sunlight on their skin. Then, turn their hand vertically. It should feel less warm. Tell students that vertical leaves are an adaptation that some dune plants have to deal with sunlight, For example, point out that Red Sand Verbena has vertical leaves. The plants are important for the dunes because they hold them together and protect against erosion.

Elaborate: Lead students on a short walk through the dune community pointing out specific examples of plant adaptations in the dune community. See how many of the following adaptations you can find:

- Tall and skinny
- Seeds that float
- Gray leaves
- Short roots
- Big shiny leaves
- Hairy leaves

- Long roots
- Grow low to the ground
- Small leaves
- Sticky

Some questions to ask: Why are the leaves of Beach Saltbush (*Atriplex leucophylla*) grayish and hairy? *To provide protection from intense sunlight and blowing sand.* Where does Salt Grass (*Distichlis spicata*) get its name? Does it taste salty? *Yes, it tastes salty.* How is this an adaptation? Why do many of the dune plants, such as Beach Saltbush, Beach Primrose (*Camissonia cheiranthifolia*), or Beach Bur (*Ambrosia chamissonis*), grow so low to the ground? *Prostrate growth forms are due to wind and wind-blown sand.* Sea Rocket (*Cakile maritima*) has fruits that look like little rockets. Do you think they might float? Why might this be an adaptation? Look for other plants, such as Beach Bur to demonstrate other mechanisms of seed dispersal. Do the Beach Bur seeds stick to your socks? Why? Many new islands are being created by volcanoes and other natural forces all of the time. If nobody is around to plant trees on a desert island in the middle of the ocean, where do the plants (palm trees, etc.) come from?

Let students ponder these questions and explore before giving them the answers right away.

Evaluate: Divide students into pairs and have each pair find a few examples of adaptations that help plants survive, and see if they can identify them using the key on page 42 of the KIN journal or at the end of this lesson plan.



Sea Rocket
(*Cakile maritima*)



Beach Saltbush
(*Atriplex leucophylla*)



Red Sand Verbena
(*Abronia maritima*)



Beach Primrose
(*Camissoniopsis cheiranthifolia*)



Beach Bur
(*Ambrosia chamissonis*)



Bush Lupine
(*Lupinus arboreus*)



Coyote Brush
(*Baccharis pilularis*)



Buckwheat
(*Eriogonum parvifolium*)