

Investigation Five - Desert Dynamics I

Standard V Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.
Objective 2 Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environments in which they live.
Intended Learning Outcomes 1. Use science process and thinking skills

Standard
V
Objective
2

Background Information

Plants and animals will use many methods to survive in the environment available to them. Desert plants must adapt to their dry environment in a variety of creative and useful ways that allow them to survive.

One way is through changes in stomata. Stomata are the holes in plants leaves where water transpires. Many desert plants have very small stomata or fewer than normal. Cacti have stomata that are deep in the plants' tissues, which reduces water loss.

The leaves and stems of many desert plants have a thick, waxy covering. This waxy substance also helps reduce moisture loss. Small leaves mean less evaporative surface per leaf. It also means that it won't get as hot as a large leaf would in the sun.

Some plants, such as Mormon tea and cacti, carry out most of their photosynthesis in their green stems. Some grow leaves during the rainy season and then shed them when it becomes dry again. Blackbrush only has photosynthesis during these rainy periods, and other plants can totally shut down photosynthesis to reduce water loss. Junipers have the ability to cut off water to a major branch during a drought, resulting in a dead branch but a live tree.

Other desert adaptations can be shallow widespread roots that will absorb a maximum of rainfall, or spines and hairs that shade the plants and break up drying winds across the leaf surface. Desert annuals avoid drought and heat by surviving as seeds stored in the soil, sometimes for many years.

Some desert plants take advantage of cooler temperatures at night to become "active." Plants like evening primrose and yucca bloom at night. The paintbrush plant has a unique adaptation. They are partial parasites. Their roots tap into nearby plant roots, usually sagebrush or grasses, and gather food and moisture from their host.

This investigation actually contains many different activities that you can choose to do. Some of the activities can take a few days to see the results. Plan ahead for the desired results.

Pre-Assessment/Invitation to Learn

Brainstorm ways that desert plants are different from or similar to wetland plants. Use a copy of the Venn diagram to summarize the student responses.

Instructional Procedure

Materials

- Pictures of Utah plants and animals that live in the desert (Pictures can be found on the USOE website under "Resources")
- Venn diagram
- Live examples: cactus, jade plants, aloe vera plant, (desert plants)
- Live examples: ferns or any green leaf indoor plant
- Sponges, water, Vaseline, cookie sheet, fuzzy cloth, white cloth, socks, pipe cleaners
- Sandwich bags and ties, clear tube
- Hand lenses

1. Take the live examples of desert plants and let the students examine and make predictions on how these plants can survive in the desert. Let the students write their predictions in their science journal.
2. Divide the students into small groups. Give each group an Aloe Vera plant leaf so the students can see the inside of the leaf and have the students write down their observations.
3. Ask one group up at a time to observe the roots of the Aloe Vera plants.
Ask: What kind of root does this plant have? (shallow root)
How does this root help the plant survive in the pot? (Allows the plant to absorb water quickly.)
How does this plant relate to a desert plant, such as a cactus? (Both plants have thick leaves and shallow roots. The plant stores water into its leaves and uses it when there is no water available. Both roots absorb water quickly.)
4. Bring the class back together after all the groups have seen the root. Bring in a leafy plant example and a desert plant (cactus). Ask the students the difference between the two plants. Discuss the differences between the two plants. Place a sandwich bag over some of the leaves on the green leafy plant and the cactus leaf. Tie down the bag over some of the leaves on the green leafy plant and the cactus leaf. Tie down the bag with a wire tie. Place both plants into the sun. Let the students make daily observations and write down what they see and prediction in their science journals. In a few days, the leafy plant will lose water through its leaves. The evidence will be water droplets on the bag. The cactus will store the water in the leaves and use the water as needed. Few water droplets should appear on the bag.
5. Discuss the difference between the green leafy plant and a light green desert plant (rabbitbrush).
Ask: Why does one plant have lighter color leaves than the other one? (The lighter leaves will reflect light.)
How will this help the plants survive in the desert? (Since the light is reflected then the leaves won't dry out so quickly, less transpiration.)
6. Take two sponges and soak them in water until they can no longer hold any more. Explain that these sponges represents leaves and water contained in them. Then take one of the sponges and spread Vaseline over the surface, covering the sponge completely. The Vaseline represents the waxy covering that most desert plants have on their leaves. Place both sponges on a cookie sheet and leave them alone for two to three days or until the observations.

One sponge should be dried. The dry sponge represents plants that need water every days like plants in the forest. The one with a covering over the leaves prevents water from leaving the plant. Thus, desert plants can store water and use it later when no water is available. Students can write all observations in their science journal.

7. Discuss how some desert plants use a different method to protect themselves. Make a sock with pipe cleaners sticking out of it. This represents leaves with spines (prickly pear cactus). Spines can protect the plant from animals and provide shade which creates less evaporation.
Ask - How do the spines help this plant? (protects from animals - less evaporation)
Show the students the fuzzy cloth or sagebrush leaves.
Ask - How does this plant protect itself from the sun? (The hairs on the leaves provide less evaporation from happening.)
8. Journal entry: Copy the page of the riddle cards. Let the students work in pairs or small groups to solve the riddles. See if the students can match desert plants with the adaptation. They may cut riddle cards and glue them into their journals.

Curriculum Extensions

Library Media-

- Compare plants and animals of Utah's desert to plants and animals found in Asia's large desert. (Standards I, II)

Language Arts-

- Let the students write a story about a small animal living in Utah's desert and how it survives during the summer and winter months. Let the students publish their story in the form of a book. Example: pop-up book.
(Standard VIII, Objective 6)
- Using information about plants, create an origami folded book that summarizes written information using quality sentence structure and illustrations.
(Standard VIII, Objective 6)

Assessment Suggestion

Desert origami books are a good product to assess student understanding of this concept. Share student products with a buddy class.

Resources

Websites:

- Access Project Wild's past issues of *Nature's Call* at www.wildlife.utah.gov/project_wild
- www.usoe.k12.ut.us/curriculum/science/4thgrade

Books:

- *Red Rock Adventures*, a teacher's guide to Canyon Country Outdoor Education, available for check out with USEE, Utah Society for Environmental Education.

Homework and Family Connections

Go on a scavenger hunt in the family's backyard or an area nearby. Observe different kinds of plants and make observations about adaptations and physical characteristics they possess.

Riddle Cards

<p>My roots spread out underneath the ground. When it rains they soak up any water to be found. The shallow roots wait for rains to fall. Soaking it up I trap it all.</p>	<p>The prickly spines don't feel very nice, If you think you want dinner, you'd better think twice! A mouthful of me is a painful surprise. Don't bother to taste me, you'd better be wise!</p>
<p>Although it's been weeks since there was rain, I stored up water so I won't complain. My thick stem stores the H₂O So I can survive the sun's hot glow.</p>	<p>My leaves are colored lightly or gray. They reflect the sun and keep it away. My leaves are quite small, as a rule, In hot temperatures they keep me cool.</p>
<p>My leaves and stems have a waxy touch. Water trapped inside me helps so much. When rain does fall I fill up fast, So when it stops, my water will last.</p>	<p>My prickly spines are really leaves, That stop the wind and help relieve My losing moisture to the wind. I'm grateful for a spiny skin.</p>
<p>My deep taproot drills down very deep. To underground water, where it may seep. Sometimes my root is 40 feet down. That's a long way to go underground.</p>	<p style="text-align: center;">(vacant)</p>

Answers to Riddles

<p>(SPINES PROTECT FROM ANIMALS) (Any cactus with spines)</p>	<p>(SHALLOW ROOTS) (creosote bush, pinon pine)</p>
<p>(LIGHT COLORS ABSORB LESS HEAT) (globemallow, rabbitbrush)</p>	<p>(WATER STORED IN THICK STEM) (joshua tree, beavertail cactus)</p>
<p>(HAIRS, SPINES LESSEN EVAPORATION) (prickly pear cactus, sage brush)</p>	<p>(WAX TRAPS MOISTURE) (juniper, cliffrose)</p>
<p>(Vacant)</p>	<p>(ROOTS FIND AVAILABLE WATER) (mesquite, yucca)</p>

DESERT AND WETLAND PLANTS



