Desert Plant Adaptations

by Teresa Moore, Neicca Butts, and Mark Larese-Casanova

Time:
(1) hour classroom session

Level:
Grades 3-6
Standards selected for grade 4

Goals:
This lesson will provide students with hands-on experience to help them understand the necessity of adaptations for desert plants, and how these adaptations work.

Objectives:
Students will be able to

1. Define the word 'adaptation'

2. Describe why adaptations are so important for desert plants in 2 or more sentences

3. Give an example of a desert plant adaptation with 100% accuracy

Materials listed with individual activity below.

A Materials Kit has been created for this lesson plan, is available for order at utahnatureexplorers.org

Correlations to Core Curriculum:
4th Grade

- Standard 5: 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 environment in which they live.
        - Indicator b: Cite examples of physical features that allow particular plants and animals to live in specific environments (e.g., duck has webbed feet, cactus has waxy coating).

Background Information:

Utah's Deserts

In North America, there are four deserts -- the Great Basin, Mojave, Sonoran and Chihuahuan. All occur between the Sierra Nevada Mountains on the west and the Rocky Mountains on the east. Two of these deserts, the Great Basin and Mojave occur in Utah. Utah is also home to part of the Colorado Plateau, which is considered a semi-arid desert due to its slightly higher precipitation levels.

Whereas large portions of Utah are covered to the west of the Wasatch Mountains by the Great Basin and to the east by the Colorado Plateau, the Mojave is found only in the extreme southwest corner of the state. The Mojave Desert is a unique ecosystem where Joshua-trees, Gila monsters, dune primroses, and desert tortoises all thrive. The Mojave Desert is a HOT desert, unlike the Great Basin and Colorado Plateau. Air temperatures in Utah's Mojave sometimes reach 115 degrees Fahrenheit in the summer, and ground temperatures reach a scorching 140 degrees.

The Mojave is considered a hot desert because it receives nearly all of its precipitation as rainfall, whereas the Great Basin and Colorado Plateau are considered cold deserts because they receive most of their precipitation in the form of snow and have lower average annual temperatures.

Did you know?

The temperatures of hot deserts can reach up to 136º F. In Utah, a high temperature of 117º F has been recorded in the Southern part of the State. That is HOT!

https://sites.google.com/site/utahbiomesplantsanimals/desert

By definition, deserts receive generally less than 10" of precipitation each year, and they lose great quantities of moisture through evaporation. The Mojave is known as the driest of all the North American deserts. Rainfall throughout the Mojave Desert varies greatly. For example, St. George records an average of 7.95" of rain a year, whereas Death Valley has an annual rainfall average of only 1.7".
http://wildlife.utah.gov/education/newsletters/94spring-gw.pdf

Desert Plant Adaptations

Desert plants tend to look very different from plants native to other regions. They often look swollen, spiny, or have tiny leaves that are rarely bright green. Their strange appearance is a result of their remarkable adaptations to the challenges of the desert climate. Succulent plants store water in fleshy leaves, stems or roots. All cacti are succulents, as are such non-cactus desert dwellers like yucca and stonecrop. Drought tolerance (or drought dormancy) refers to a plant's ability to withstand desiccation without dying. Plants in this category have waxy leaves, and often shed leaves during dry periods and enter a deep dormancy. Most water loss is from transpiration through leaf surfaces, so dropping leaves conserves water in the stems. Annual plants escape unfavorable conditions by not existing. They mature in a single season, and then die after channeling all of their life energy into producing seeds instead of reserving some for continued survival.
http://www.desertmuseum.org/programs/succulents_adaptation.php

How to Make a "Prediction and Results" Class Graph

An example picture of a 'prediction and result' graph is below.

1. Clear the whiteboard. On the bottom of the whiteboard, place a small piece of paper representing each of the possible predictions. On the other side of the whiteboard, you will do the same process for the possible results.
2. Give each student 2 post it notes. Ask them to separate the post-it notes, and then to write their name on both pieces of paper.
3. Pose the question to the student. In the example picture below, the question was "What type of apple do you think you will enjoy the most? Red, Yellow, or Green?" In this lesson plan, your question would be "Which material will retain water the best? Paper towel, aluminum foil, cardboard, or fabric?"
4. Dismiss students in table groups (or a few students at a time) to come put one of their post-it notes above the paper on the whiteboard representing their prediction. Remind students that they can only choose one.
5. Do the experiment.

Did you know?

Cactus is the singular word for the plant, cacti or cactuses are the plural forms.

http://www.sciencekids.co.nz/sciencefacts/plants/cactus.html

Italicized items in this list are included in the 'Desert Plant Adaptations' Material Kit, available for order at utahnatureexplorers.org

Materials:

Supplies --

- *9 paper towels*
- *9 wax paper squares*
- *9 fabric squares*
- *9 aluminum foil squares*
- *40 pieces of tape*
- 36 ice cubes
- 36 copies of 'Desert Plant Adaptations' (attached at the end of the lesson plan)
- *Cactus picture*

6. Have students follow the same process, but this time, they should put their post-it note above the paper representing the actual result of the experiment.
7. Compare and contrast the predictions and results.

Predictions and Results – "Which apple tastes the best?"

Lessons and Activities:

Day 1 --

Engage (15 minutes) – To introduce the topic of plant adaptations, show students the short video clip "Plant Adaptations," from a Scholastic StudyJam.

http://studyjams.scholastic.com/studyjams/jams/science/plants/plant-adaptations.htm

Discuss what students thought was interesting from the video clip. Ask students, "What is an adaptation? Why are adaptations important?"

Introduce the topic of desert plants, and discuss that, in order to live in such harsh environments, desert plant have to adapt.

Show students a picture of a cactus (attached at the end of the lesson plan). Discuss that since there is so little water in the desert, one of the most important adaptations a cactus can have is the

(attached at the end of the lesson plan)
- *72 post-it notes*
- Writing utensils

Equipment --
- Internet access
- Projector or SmartBoard
- Whiteboard

ability to retain (or store) water. Ask students to predict how the cacti store their water. Record these predictions on the whiteboard or in their individual science journals.

Explore (30 minutes) – Divide students into small groups (approximately 4 people per group).

Remind students that one of the most important adaptations cacti have is that they can hold water in for long periods of time. This is critical in a desert environment, where rain is both scarce and sporadic.

Tell students that they are going to experiment with a variety of 'skin' types to see which will retain water the best. This experiment will model different skin types that cacti could potentially have. It is up to the students to determine which skin type would best suit the cactus plant and explain why.

Pass out the 'Plant Adaptations' worksheet, one per student.

Explain each of the 'skin types' they will be using – paper towels, wax paper, fabric, and aluminum foil. Ask each of the students to predict (in a complete sentence) which skin type they think will retain water the best is, and why on their worksheets. (In order to help students make accurate predictions, it may be helpful for you to hold up a sample piece of each material and describe its characteristics as a class.)

After the predictions have been made, have each group collect the following materials:
- 1 Paper towel
- 1 Wax paper square
- 1 Fabric square
- 1 aluminum foil square
- 4-5 pieces of tape
- 4 ice cubes
- 1 Baking sheet (if leaving the ice cubes inside the classroom)

Working as a group, the students should wrap 1 ice cube in each of the materials, and then tape the wrapping to hold it in place. *(This will probably work best if each student is assigned to wrap one of the materials.)* Make sure that students are entirely covering their ice cube with the material they are using, and that they are using the tape to secure the material well. This will prevent leakage that's not meant to happen, which could skew your results.

To simulate the hot desert environment, have your students take

their 'experiment' outside to sit in the hot sun. This method is the quickest and most effective method that we have found in doing this experiment. It has also shown to work best when the ice cubes are simply laid on the sidewalk/asphalt, each separated by at least a few inches. This will prevent water leaking from one ice cube to get onto another material and skew the experiment.

If it is not an option to take the ice cubes outside, you can simply wait for the ice cubes to melt inside your classroom; however, this will likely take significantly longer, so make sure to plan extra time for the ice cubes to melt.

While waiting a few minutes (approximately 10-15) for the ice cubes to melt, have the students make a class 'prediction vs. results' chart on the whiteboard. *(For instructions on how to do this, see the background information section of the lesson plan.)*

If you finish your class graph quickly, have students copy this prediction graph into their science journal, using proper graphing techniques. Remind them to leave space for a results graph in their journal as well.

After the class predictions have been made, have students return to their ice cube experiment. Have them observe each of the ice cubes, and how well each of the coverings has retained their water. Have the students answer the questions on their 'Plant Adaptations' worksheet, and draw scientific sketches in the appropriate boxes.

Explain (15 minutes) – Have students use their second post-it note, and create the class 'conclusions' chart. Compare the predictions and results. Were they similar? Different? If they copied the prediction graph in their science journals, have them copy down the results graph as well in their individual science journals.

Discuss with students why the wax paper retained the water the best. Talk about the waxy coating on cacti that allow them to hold in water. Relate the science experiment to the adaptations of desert cacti.

Assessment:
This lesson is intended to be an introduction to a larger unit on desert adaptations; therefore, no formal assessment has been created. There are many opportunities for informal assessment naturally provided throughout the lesson – comparing the students' predictions versus results, their understanding of the importance of wax coating as they discuss during the 'explain' section, and as they

Did you know?

The skin has two parts: the epidermis and the hypodermis. A waxy layer of cells known as the cuticle covers the skin's epidermis. The wax in the cuticle helps the stem to hold in its water vapor reducing water loss.

http://www.cactusmuseum.com/survival.asp

talk about what adaptations are and why they are important.

Extensions:

- Explore the adaptations of other desert plants. Do all of them have the same adaptations? Different adaptations? Create a Venn Diagram (or another comparison chart) comparing and contrasting the adaptations of desert plants.
- Art/Language Arts: Have students create their own cacti. Provide construction paper, coloring utensils, various adaptation materials (such as wax paper for the skin coating, or toothpicks for the spines). Have the students write a brief description of why the specific adaptations they chose for their cactus are important to the cactus' survival in the desert.

Resources:

Books

- *Utah Master Naturalist Deserts Textbook* http://extension.usu.edu/utahmasternaturalist/files/uploads/UMNP_Deserts_Text.pdf
- *One Hundred One Questions About Desert Life* by Alice Jablonsky
- *Explore the Desert* by Kay Jackson
- *A Walk in the Desert* by Rebecca L. Johnson
- *The Magic School Bus: All Dried Up: A Book About Deserts* by Joanna Cole, written by Nancy Stevens

Websites

- Original lesson plan – http://education.illinois.edu/YLP/Units/Curriculum_Units/95-96/Desert_Ocean_Tmoore/plant_adaptations.html
- Scholastic Study Jam – http://studyjams.scholastic.com/studyjams/jams/science/plants/plant-adaptations.htm
- Utah: Land of Natural Diversity (Information on Utah Deserts) – http://wildlife.utah.gov/education/magazine/diversity_i.pdf
- Desert USA: Desert Life (Answers to Questions About Desert Life) -- http://www.desertusa.com/life.html

Name_____
Date_____

Desert Plant Adaptations

1. Which material do you think will best represent the skin of a cactus by holding water inside? (Paper towel, wax paper, fabric, or aluminum foil)

   _____
   _____
   _____
   _____

2. After doing the experiment, which material actually held the water in best? _____
   _____
   _____

3. Why do you think this material held in the water the best? _____
   _____
   _____
   _____

4. How does this material represent the skin of a cactus plant? _____
   _____
   _____
   _____

Draw scientific sketches of each of the experiments below.

Ice cube in paper towel	Ice cube in wax paper	Ice cube in fabric	Ice cube in tinfoil

Prickly Pear Cactus