Adaptation: A Way of Life
Facilitation Guide

Vocabulary & Concepts

Adaptation a body part or behavior of an animal or plant that helps it live in its environment

Examples

- An eagle has sharp talons that help it grab its prey
- A mouse has very sensitive hearing to hear predators as they approach
- Cacti can retain water inside themselves to survive dry conditions

Succulence describes plants which have fleshy tissues that help conserve water

Examples

- Saguaro Cactus
- Prickly Pear
- Aloe Vera

Evaporative Cooling the process of lowering temperature by the transformation of liquid water into water vapor

Examples

- Panting
- Sweating
- Swamp Coolers

Nocturnal describes a plant or animal that is mostly active at night

Examples

- Owls
- Raccoons

"Prickly pear blooming.". Image courtesy David Gascioigne and National Park Service, license CC-BY-NC 2.0.

Adaptation: A Way of Life is a set of activities designed by the Arizona-Sonora Desert Museum in Tucson, Arizona that explores different adaptations that help plants and animals survive in the dry desert environment of the Sonoran desert. Many of these activities can be set up as a facilitated activity or as self-guided activity stations. The instructions in this facilitation guide are written to be used as signage for stations by trimming off the materials list and facilitation instructions on the left side of the page.

These activities are great on their own or as part of a larger program. Try integrating these activities into a structured story time or other program with these book and video resources:

Videos

Saguaro Wilderness: A Day in the Desert (National Park Service)
Icons of the American West: The Saguaro (National Park Service)

Books

Bedtime in the Southwest by Mona Hodgson
Southwest Sunrise by Nikki Grimes

Plant Adaptation: Succulence

Materials

- Square of wax paper
- Paper Towel
- Masking tape (optional)
- Sponge or eyedropper
- Water
- Native succulent plant, such as a prickly pear cactus, for participants to observe and compare with their models (optional)

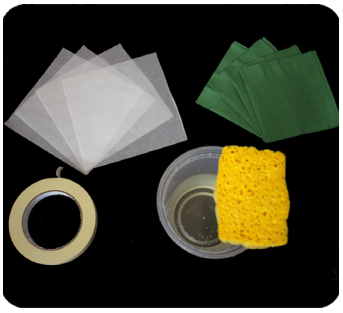
Facilitation Tips and Tricks

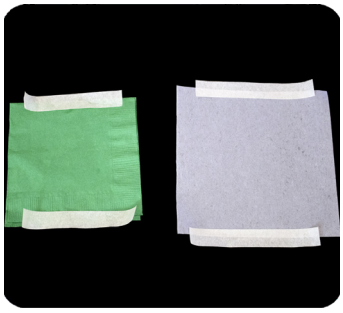
The materials for Adaptation 1, Demonstration 1, and the prickly pear model are nearly identical. Stock up on supplies for both and run them in different programs!

Ask participants: What do you observe? How are the wax paper and paper towel similar to the leaves of succulent plants? How are they similar to the fleshy inside of succulent leaves?

Instructions

Step 1. Gather materials for the activity (*top left*). If doing the activity outdoors or in a drafty area, you may wish to secure the paper towel/napkins and wax paper to your work surface with masking tape (*top right*). If you are setting up this activity as a station or facilitated activity, you can tape many of these to a table in advance.





Step 2. Using the sponge or eyedropper, sprinkle some water on both the paper towel/napkin (*bottom left*) and the wax paper (*bottom right*). The waxy coating of the wax paper is similar to the coating on the outside of succulent leaves, while the paper towel absorbs and retains water similar to the fleshy interior of succulent leaves.

Plant Adaptation: Succulence (*Part 2*)

Materials

- Small blackboard
- Square of wax paper
- Paper Towel
- Masking tape (optional)
- Sponge or eyedropper
- Water
- Timer

Facilitation Tips and Tricks

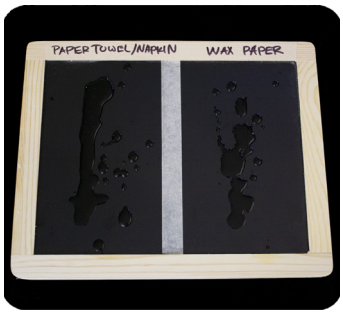
The effects of the evaporation are much more dramatic after longer periods of time, so this is a great activity to set up before a story time or other program to revisit afterwards. Consider completing the desert adaptations worksheet while you wait for the water to evaporate.

Ask participants: What do you observe? Why would it be important for succulent leaves to have a waxy, water-resistant coating like the wax paper?

Are either of these adaptations enough for succulents to survive in dry deserts? How would these adaptations work together to retain water?

Instructions

Gather materials for the activity (*top left*). If using small blackboards for each participant, have them use masking tape to divide the blackboard and label it. You may also use masking tape to create sections of a large blackboard for each participant to create their own succulent model.

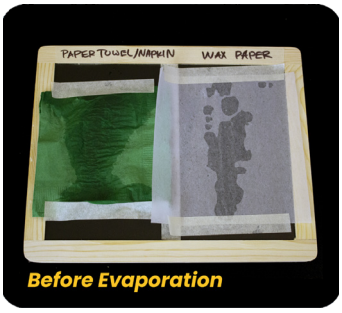


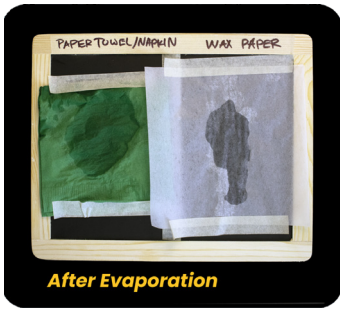
Step 1. Using your sponge or eyedropper, sprinkle water on each side of the blackboard (*top right*).

Step 2. Quickly cover the water with a napkin and piece of wax paper (*bottom left*).

Step 3. Set the timer to 3 minutes and leave the succulent model to sit until it goes off.

Step 4. Observe the results! Much of the water absorbed by the napkin will have evaporated, while most of the water under the wax paper will remain.





Prickly Pear Model

Instructions

Materials

- Large squares of wax paper (2 per model)
- Green paper towels or napkins (5-10 per model)
- Toothpicks (20-30 per model)
- Tape or glue

Facilitation Tips and Tricks

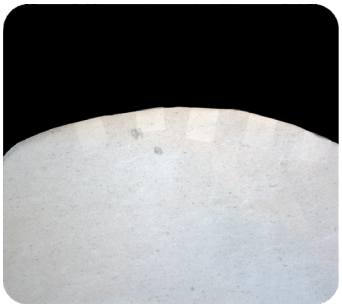
You may use tape or glue to secure the edges of your prickly pear model to each other, but glue will require drying between steps. Keep time limits for your program in mind when choosing materials!

Wax paper deli sheets are sold in large packs of individual sheets in sizes of 10x10 or 12x12 inches and are much more convenient for this activity than cutting sheets of wax paper form a roll.

If setting up this activity as a station, consider precutting the prickly pear leaf shapes out of wax paper or providing a cardstock stencil for patrons to trace identical leaves onto their wax paper.

Step 1. Secure the edges of your two sheets of wax paper together with tape or glue (*top left*). Then, cut the joined sheets of wax paper into the shape of a prickly pear leaf (*top right*).

Step 2. Secure the edges of your pieces of wax paper together with tape or glue (*middle left*). Be sure to leave a gap at the top of your prickly pear leaf for the paper towels/ napkins (*middle right*).



Step 3. To make the fleshy interior of your prickly pear, crumple your green paper towels or napkins to give them volume (*bottom left*). Then, stuff your crumpled napkins into your model through the gap you left in the previous step (*bottom right*)?

Prickly Pear Model (*Part 2*)

Instructions

Materials

- Large squares of wax paper (2 per model)
- Green paper towels or napkins (5-10 per model)
- Toothpicks (20-30 per model)
- Tape or glue

Facilitation Tips and Tricks

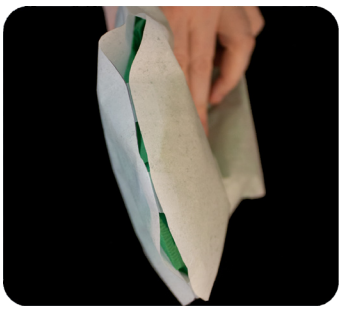
You may use tape or glue to secure the edges of your prickly pear model to each other, but glue will require drying between steps. Keep time limits for your program in mind when choosing materials!

Wax paper deli sheets are sold in large packs of individual sheets in sizes of 10x10 or 12x12 inches and are much more convenient for this activity than cutting sheets of wax paper form a roll.

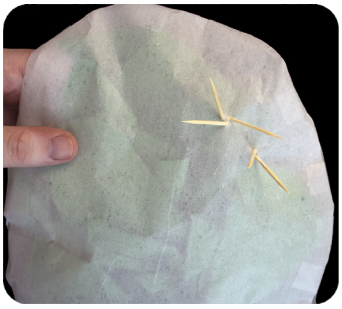
If setting up this activity as a station, consider precutting the prickly pear leaf shapes out of wax paper or providing a cardstock stencil for patrons to trace identical leaves onto their wax paper.

Depending on the thickness of your paper, you may need to pre-poke holes using a darning needle or similar object before adding the toothpicks (*top right*).

Step 4. Using tape or glue, finish securing the edges of your wax paper sheets together (*top left*). Next, begin poking toothpicks through the wax paper.



Step 5. Add toothpicks to your leaf model in clusters of two or three "needles" (*bottom left*). Continue adding clusters of toothpick needles until one or both sides of your prickly pear leaf are covered in needles.



You've made your own prickly pear leaf! How do these three adaptations (*needles, waxy leaf coating, and absorbent interior*) help a prickly pear survive in the desert environment?

Plant Adaptation: Shade and Leaf Angle

Materials

- A light source (sun or handheld light)

Facilitation Tips and Tricks

This activity models how the angle of the leaves of desert plants relative to the Sun controls how much light and heat energy is absorbed by those leaves.

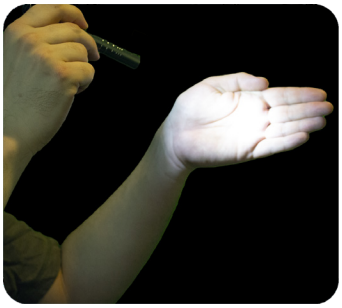
You may do this activity outside on a sunny day or use a flashlight or lamp as a light source. You could even use a reptile bulb in a lamp (available at most pet stores) to model the heat of the Sun!

Many desert plants angle their leaves parallel to the Sun's rays, so the thin edge of their leaves absorb the Sun's rays rather than the broad flat surface of their leaves. This helps keep desert plants from getting too hot.

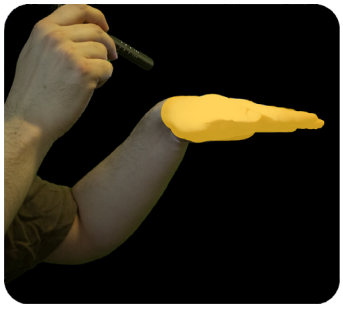
In addition to the angle of their leaves, some succulents create large spines on their leaves that create shade, cooling the plant during the heat of the day.

Instructions

Angle your hand so that the flat of your palm is directly facing a source of light (top left). Point out what part of their hand is receiving the most light (highlighted in yellow, top right).



Next, angle your hand so that your thumb or pinky is facing a source of light, with the flat of you hand facing the ground or ceiling (bottom left). Point out again what part of your hand is receiving the most light (highlighted in yellow, bottom right).



In the hot desert sun, which would leaf orientation would receive more light and heat quicker? Think about how heat affects water evaporation. Why do you think desert plants might need to regulate heat?

Animal Adaptation: Panting and Sweating

Materials

- A sponge, spray bottle, or eyedropper
- Water

Facilitation Tips and Tricks

This activity models evaporative cooling, the process by which sweating and/or panting cools down animals when they are hot.

Evaporative cooling is the cooling effect that happens on a surface when water evaporates or transforms from liquid water to water vapor. This process is called a phase change. Other phase changes water can go through include freezing (*the transformation of liquid water to ice*) or sublimation (*the transformation of ice to water vapor*).

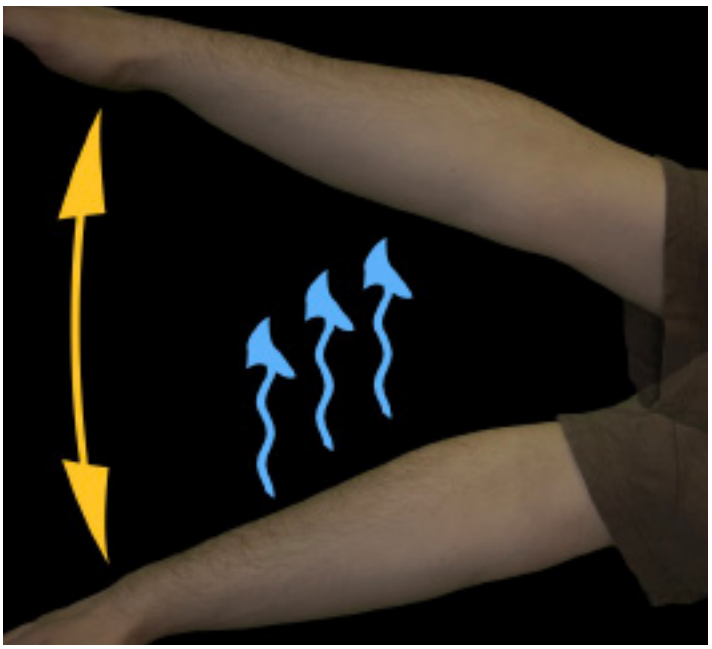
Ask participants: How do desert animals stay cool? Do many desert animals sweat? If not, why? (*Answer: it is hard to find water to drink in the desert to replace the water lost from sweating).* Desert animals, such as coyotes and mountain lions, pant to cool down instead.

Panting and sweating aren't the only ways animals use evaporative cooling to beat the heat. Humans have created devices to cool their environment through evaporative cooling for thousands of years. Ancient Egyptians and Persians constructed towers called wind catchers that used evaporative cooling to cool whole buildings without electricity. Many people who live in deserts today use devices called swamp coolers to cool their homes and offices!

Instructions

Extend your arms out on either side of your body. Using the sponge, spray bottle, or eyedropper, sprinkle some water on one of your arms (*top*).

After one of your arms has been wetted, flap your arms up and down. As you move the wet arm up and down, you should feel a cooling effect on the area of your arm that is wet (*bottom*). This feeling is evaporative cooling occurring as the water on your arm turns into water vapor!



Art extension: Create your own desert plant or animal

Materials

Various craft supplies, such as:

- Chenille sticks
- Googly eyes
- Markers
- Pencils
- Glue
- Tape
- Colored tissue paper
- Puff balls
- Craft sticks
- Drawing paper
- Toothpicks

Facilitation Tips and Tricks

Encourage patrons to use what they learned to create their own desert plant or animal with adaptations to help it survive in the desert. What adaptations will help protect it from predators, to get food, or to conserve water?

If doing this as a facilitated program, invite patrons to share their creations. Can others guess what the adaptations are? Ask them: How do your plant or animal's adaptations help it survive?

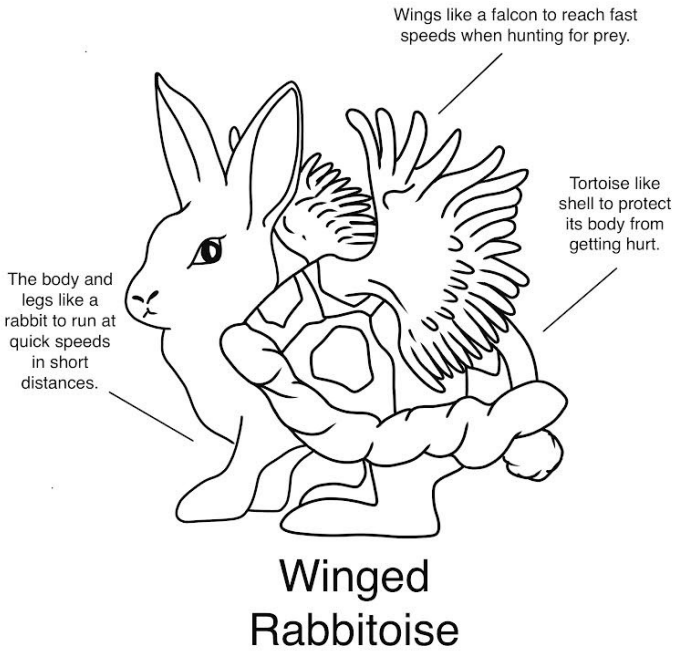
Instructions

Step 1. Identify three adaptations that your desert plant or animal has to help it survive in a desert environment.

Step 2. Use the art supplies to create your animal.

Step 3. Give your animal a name!

Example



Winged Rabbitoise

How does your plant or animal's adaptations help it survive?