



Time:

(2) 1 hour classroom sessions

Level:

Grade 4

Goals:

This lesson will provide students an opportunity to identify adaptations of plants and animals in desert environments that allow them to survive.

Objectives:

1. After a lesson on desert plants and animals, students will be able to identify 3 adaptations of desert organisms.
2. After a lesson on the importance of Biological soil, students will be able to visually identify Biological soil and recognize that hikers should not step on that soil, with 100% accuracy.

Materials listed with each individual lesson plan.

Desert Adaptations

by Christina Cotter, Neicca Butts, and Mark Larese-Casanova

Correlations to Core Curriculum:

Fourth 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:

Desert Animal Adaptations

Amphibians and reptiles have many different adaptations that allow them to live in deserts, avoiding extremes in aridity, heat, or cold. The animals may be active only in certain seasons and at favorable times of the day. Many use the environment to actively regulate their body temperatures, preventing lethal extremes, and some are well adapted to the surfaces they live on—with modified appendages for burrowing or the capacity to run on, dive into, swim in or sidewind across loose sand.

During times of environmental stress, desert reptiles spend long periods of inactivity in burrows, often borrowed from those dug by rodents or other mammals. During hibernation in winter and estivation in summer, animals in burrows have greatly reduced metabolic rates. They live on water and nutrients stored in their bodies, while wastes accumulate to potentially-toxic levels.

https://www.desertmuseum.org/books/nhsd_adaptations_amph.php

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

Did you know?

What is small, almost invisible, and if you step on it, may not recover for 250 years? *Biological soil crust!*

http://www.azfcf.org/docs/DAC/Crust_Stewart.pdf

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

Biological soil Crust

Biological soil crusts are commonly found in semiarid and arid environments throughout the world. Areas in Utah where crusts are a prominent feature of the landscape include the Great Basin, and Colorado Plateau.

Biological soil crusts are predominantly composed of cyanobacteria (formerly called blue-green algae), green and brown algae, mosses, and lichens. Liverworts, fungi, and bacteria can also be important components.

Crusts play an important role in the environment. Because they are concentrated in the top 1 to 4 mm of soil, they primarily affect processes that occur at the land surface or soil-air interface. These include soil stability and erosion, atmospheric nitrogen-fixation, nutrient contributions to plants, soil-plant-water relations, infiltration, seedling germination, and plant growth.

Crusts are well adapted to severe growing conditions, but poorly adapted to compressional disturbances. Domestic livestock grazing, and more recently, recreational activities (hiking, biking, and off-road driving) and military activities place a heavy toll on the integrity of the crusts. Disruption of the crusts brings decreased organism diversity, soil nutrients, stability, and organic matter. Full recovery of crust from disturbance is a slow process, particularly for mosses and lichens. There are means to facilitate recovery. Allowing the cyanobacteria and green algae component to recover will give the appearance of a healthy crust. This visual recovery can be complete in as little as 1 to 5 years, given average climate conditions. However, recovering crust thickness can take up to 50 years, and mosses and lichens can take up to 250 years to recover.

<http://www.soilcrust.org/crust101.htm>

Materials:**Supplies –**

- Science Journals – 1 per student
- Pencils
- Poster Board (1 poster per small group)
- Markers, colored pencils, etc.
- Desert Pictures (attached at the end of the lesson plan)

Equipment--

- Desert Adaptations PowerPoint (available for free download on www.utahnatureexplorers.org)

Did you know?

Desert tortoises are able to burrow to escape heat. They can store water in their bladder, and are able to tolerate high levels of urea in their blood to keep from losing moisture through excess urinating. They can go for long periods of time without food or water.

<https://www.desertmuseum.org/kids/oz/long-fact-sheets/Desert%20Tortoise.php>

Materials:**Lessons and Activities:****Day 1 --**

Engage (15 minutes) – Show students the Desert Photos page (attached at the end of the lesson plan), which shows pictures of big sagebrush, a spadefoot toad, a western rattlesnake, and a prickly pear cactus. Pose the question: “What do these things have in common?” for student consideration. If needed, prompt them to think about where each of these plants or animals live. Provide a one-minute silent reflection for the question, a 1-minute partner share, and then discuss the question as a class. Highlight the fact that each of these plants or animals live in the desert. In order to live in such a harsh climate, they must adapt to survive. Discuss a few of the ways in which they are adapted. *(There is no need to go into great detail here, as this is just an introduction, and the following PowerPoint will more thoroughly discuss how desert plants and animals are adapted to survive in their ecosystem and climate.)*

Using the ‘Desert Adaptations PowerPoint,’ show students images of a variety of desert plants and animals. Discuss how each one is adapted to live in a harsh environment, with very little available water.

Explore (20 minutes) -- Students will work in groups of 4 to design an imaginary plant or animal that is well suited to a desert environment. Each group will display their creation using a poster. Half of the poster should be an illustration of the plant or animal, while the other half of the poster contains a bullet-point list (with at least 3 items) of qualities that make the creature well adapted to desert life. They should also give their plant or animal a name.

Explain (15-20 minutes) -- Groups will present their posters to the class, and posters will be displayed throughout the classroom or in the hall. *(If you are short on time, you may choose to have each group present their creation to another group rather than the entire class.)*

Elaborate (5 minutes) – If time is still available after groups have finished presenting, discuss as a class and write on the board some of the most important adaptations of desert animals.

Day 2 –

Engage (15 minutes) – Ask the students the question “What is small,

Supplies –

- Picture of Biological soil soil crusts (attached at the end of the lesson plan)
- Cardstock or construction paper (1 piece per student)
- Markers, crayons, scissors, etc.

Equipment--

- Internet access
- Ability to stream and project video (preferable, not required)
- Whiteboard/markers

almost invisible, and if you step on it, may not recover for 250 years? *Biological soil crust!*" Show the picture (attached at the end of the lesson plan) of Biological soil crust, and inform students that Biological soil crust has many names, such as 'cryptobiotic soil crust', 'cryptogamic soil,' and 'microbiotic soil'. Explain that these names are interchangeable, and all refer to the same type of soil crust.

Show this short YouTube clip about biological soil crust.
<https://www.youtube.com/watch?v=hDvMkhLhjrI> (Length 3:10)

This clip has been put together by Canyonlands National Park Services. It gives a short description as to what biological soil crusts are, why they are so important, and describes what happens when somebody steps on them.

(If video presentation technology is not available, discuss and explain what biological soil crusts are, using pictures if available. Help the students understand why we say 'Don't Bust the Crust!')

As a class, make a T-chart listing the "do's" and "don'ts" of desert hiking, especially where biological soil crusts are present.

Explore (25 minutes) -- Individually, students will create a tri-fold brochure advertising the slogan "Don't Bust the Crust". The cover should be illustrated with the slogan, while the inner folds should contain at least 4 tips for people who will go hiking in the desert.

For more information on the 'Don't Bust the Crust' slogan, and the implications behind it, visit the websites in the 'resource' section below.

Explain (10 minutes) -- Allow students to share and explain their brochure to another peer that is not in their class. This will provide students with an opportunity to individually (or in partners) explain what they have learned about biological soil crusts in their own words.

Elaborate (5-10 minutes) -- If time is still available, students can share their brochures with each other in partners or small groups. Display the brochures in a hallway or other public location before allowing students to take them home.

Assessment:

Students should be assessed on their participation in the creation of their animal and the presentation of their poster. Presentations

Did you know?

Biological soil crusts are also known as cryptogamic, microbiotic, Biological soil, and microphytic crusts.

<http://www.soilcrust.org/crust101.htm>

should be at least 1-2 minutes long, and every group member should participate in both the creation and presentation of the poster. The poster should include a picture of their animal, along with an invented name. It should also include at least 3 reasons why their animal would be well adapted to survive in a desert habitat.

A rubric for this assessment can be found at the end of the lesson plan.

Extensions:

- Students can write an entry in their science journal using the following starter: "If I could be a desert animal, I would be a _____. I would be able to survive in the desert because _____." (They can use a real desert animal, or one of the class invented animals for this journal entry.)
- To help students remember specific adaptations of desert animals, students may use index cards to create a memory/matching game. Pairs of cards will include one card with the name and picture of a plant/animal, and a second card with a description of the way that plant/animal is adapted to life in the desert. After creating the game, the game should be played in partners. This could be a great way to review before a unit test.

Resources:

Books

- *Utah Master Naturalist Deserts Textbook*
http://extension.usu.edu/utahmasternaturalist/files/uploads/UMNP_Deserts_Text.pdf
- *Desert Animal Adaptations* by Julie Murphy
- *Would You Survive?* by John Townsend
- *Explore the Desert* by Kay Jackson

Websites

- Don't Bust the Crust --
<http://www.azfcf.org/docs/DAC/Crust.Stewart.pdf>
- Biological Soil Crusts -- <http://www.soilcrust.org/index.htm>
- Biological soil Soil --
<http://www.moabbikepatrol.com/soils.htm>
- Arizona-Sonora Desert Museum --
https://www.desertmuseum.org/books/nhsd_adaptations_amph.php
- The Living Desert --
http://www.livingdesert.org/desert_animals.html

Desert Animal Creation Rubric

The poster has a picture of the animal or plant creation, as well as a name for the plant or animal. <i>(10 points)</i>	The poster has a picture of the animal or plant creation, <i>or</i> a name for the plant or animal. <i>(5 points)</i>	There is no picture of the plant or animal, and the plant and animal is not named. <i>(0 points)</i>
There are at least 3 valid bullet points explaining why the plant or animal is well suited to desert life. <i>(10 points)</i>	There is at least 1 valid bullet point explaining why the plant or animal is well suited to desert life. <i>(5 points)</i>	There are no valid bullet points explaining why the plant or animal is well suited to desert life <i>(0 points)</i>
Each group member participated in the creation of the poster and the presentation of the plant or animal <i>(10 points)</i>	Each group member participated in the creation of the poster <i>or</i> the presentation of the plant or animal <i>(10 points)</i>	Not all group members participated in the poster creation or presentation <i>(0 points)</i>

Student Name:

Score: /30



Big Sagebrush



Spadefoot Toad



Western Rattlesnake



Prickly Pear Cactus



Biological Soil Crust

Photo taken by Neal Herbert from National Park Service