



**Time:**

(1) 45 minute classroom session

**Level:**

Grades 3-5  
Standards selected for grade 4

**Goals:**

This lesson will provide students with an opportunity to become familiar with research skills using the concept of classification.

**Objectives:**

Students will be able to

1. Define the word 'adaptation'
2. Describe why adaptations are so important for desert animals in 2 or more sentences
3. Name an important adaptation of the Kangaroo Rat with 100% accuracy

*Materials listed below with the individual activity.*

# An Introduction to Desert Animal Adaptations: Kangaroo Rats

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## **Correlations to Core Curriculum:**

### 4<sup>th</sup> 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, Gilamonsters, 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

### Did you know?

The kangaroo rat is almost perfectly adapted to life in the desert. They can survive without ever drinking any water, getting needed moisture from their seed diet. They have excellent hearing and can even detect the silent sound of an owl approaching. Their large back legs enable them to jump up to 9 feet (2.75m) in one jump in order to escape predators.

<https://www.desertmuseum.org/kids/oz/long-fact-sheets/krat.php>

annual temperatures.

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>

### Animal Adaptations

Lack of water creates a survival problem for all desert organisms, animals and plants alike. But animals have an additional problem -- they are more susceptible to extremes of temperature than are plants. Animals receive heat directly by radiation from the sun, and indirectly, by conduction from the substrate (rocks and soil) and convection from the air.

Fortunately, most desert animals have evolved both behavioral and physiological mechanisms to solve the heat and water problems the desert environment creates. Among the thousands of desert animal species, there are almost as many remarkable behavioral and morphological adaptations developed for avoiding excess heat. Equally ingenious are the diverse mechanisms various animal species have developed to acquire, conserve, recycle, and actually manufacture water.

Some desert creatures utilize all of these physical and behavioral mechanisms to survive the extremes of heat and dryness. Certain desert mammals, such as kangaroo rats, live in underground dens which they seal off to block out midday heat and to recycle the moisture from their own breathing. These ingenious rodents (there are a number of species) also have specialized kidneys with extra microscopic tubules to extract most of the water from their urine and return it to the blood stream. And much of the moisture that would be exhaled in breathing is recaptured in the nasal cavities by specialized organs.

If that weren't enough, kangaroo rats, and some other desert rodents, actually manufacture their water metabolically from the digestion of *dry* seeds. These highly specialized desert mammals do not drink water even when it is given to them in captivity!

<http://www.desertusa.com/survive.html>

## Materials:

### Supplies --

- *The Magic School Bus Gets All Dried Up* by Joanna Cole (book)
- For each group (approximately 9 groups):
  - 4 bite sized pieces of different foods – turkey, apples, bread, cheese, and chips all work well
  - 4 zip-locking sandwich bags
  - Gooseneck lamp with 75 watt bulb
  - *Water, Water, Water* worksheet (one per student, attached at the end of lesson plan)
- Kangaroo Rat exploration slideshow

### Equipment --

- Internet access
- Projector and/or SmartBoard

## Lessons and Activities:

### Day 1--

**Engage (15 minutes)** – To introduce the topic of desert animal adaptations, read the book, *The Magic School Bus Gets All Dried Up*, by Joanna Cole.

Discuss what students thought was interesting from the book. Ask students, “What is an adaptation? Why are adaptations important?”

Introduce the Kangaroo Rat, a small animal well adapted to live in harsh desert conditions. You can show students the picture of the Kangaroo Rat (attached at the end of the lesson plan), if desired.

Discuss some of the most important adaptations that Kangaroo Rats have:

- Their kidneys are adapted to get rid of waste, while at the same time, losing as little water as possible
- Kangaroo rats do not sweat, which allows them to retain more water
- They have the ability to convert the seeds they eat into water when needed

**Explore (20 minutes)** – Ask students whether or not they think there is water in the food they eat. Why or why not? Make a list of food students believe has water on the whiteboard. Relate this to the ability of the Kangaroo Rat to obtain water from the food it eats.

Divide students into small groups (approximately 4 people per group).

Explain that, in their small groups, students will be testing whether or not some of the food they eat has water in it or not. Give each group the necessary supplies (the bits of food, sandwich bags, lamp, and worksheets).

Explain the procedure to students. They will first predict which food will have the most water and which will have the least on their worksheet. After they have made their predictions (in complete sentences), they should place each of the food chunks into a separate Ziploc bag, close the bag, and place each bag about 15-20 inches underneath the lamp. (*As an alternative to the lamp, you can place the bags outside in direct sunlight on a hot day.*)

Once they have finished this process, students should come to the

### Did you know?

Desert kangaroo rats are the smallest of all kangaroo rats, and are also the most adapted to live in arid habitats.

rug to learn more about the unique adaptations of kangaroo rats.

While letting the bags sit under the light, present the attached slideshow and discuss the adaptations of Kangaroo Rats for about 15 minutes.

When the presentation is finished, students should go back to their group area and see which bag has collected the most condensation. Explain to students that the water has evaporated from the food and will be sitting on the walls of the bags.

Students should answer the 'follow-up' questions on their worksheet.

**Explain (10 minutes)** – Discuss: Were predictions correct? Which food held the most water? The least amount of water? How does this activity relate to the abilities and adaptations of Kangaroo Rats? What is the same? What is different?

How would students use this information (knowing which foods have the most water) if they were planning a trip to the desert?

As a class, plan a lunch to take for an imaginary desert field trip.

Close with a brief discussion on why Kangaroo Rats have an adaptation which allows them to get most of their water from the food that they eat.

### Assessment:

This lesson is intended to be an introduction to a larger unit on desert animal 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, the meal they create for their imaginary field trip to the desert, and as they talk about what adaptations are and why they are important. You may also choose to collect student worksheets at the end of the lesson.

### Extensions:

- Watch the episode of *Magic School Bus: All Dried Up!* online at <https://www.youtube.com/watch?v=8gVoyEjyLAs>. The clip time is 25:53.
- Have students make predictions about other foods that hold water. Experiment with different foods, conditions, and lab setup.

### Did you know?

Desert kangaroo rats can store food in their cheeks for weeks at a time!

- Language Arts – Have students write a short story of ‘A Day in the Life of a Kangaroo Rat.’ Have students write about what the kangaroo rat does, encounters with predators, and how they survive the harsh desert conditions. In the story, students should use the following words: *adaptations, desert, water needs.*

### Resources:

#### Books

- *Kangaroo Rat (Scholastic Readingline)* by Eileen Robinson
- *Creatures of the Desert World* by National Geographic Society
- *The Magic School Bus Gets All Dried Up* by Joanna Cole

#### Websites

- Original lesson plan: The Magic School Bus Gets All Dried Up -- <http://www.scholastic.com/teachers/lesson-plan/magic-school-bus-dries>
- *Utah Master Naturalist Deserts Textbook* [http://extension.usu.edu/utahmasternaturalist/files/uploads/UMNP\\_Deserts\\_Text.pdf](http://extension.usu.edu/utahmasternaturalist/files/uploads/UMNP_Deserts_Text.pdf)
- Utah: Land of Natural Diversity (Information on Utah Deserts) -- [http://wildlife.utah.gov/education/magazine/diversity\\_i.pdf](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>
- Desert Animal Survival -- <http://www.desertusa.com/survive.html>
- Animal Fact Sheet: Kangaroo Rat -- <https://www.desertmuseum.org/kids/oz/long-fact-sheets/krat.php>

Name \_\_\_\_\_  
Date \_\_\_\_\_

# Water in our Foods

1. Which food type do you think holds the most water in it?

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2. Which food type do you think holds the least amount of water in it?

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3. What do you think will happen to the food after it is put in the bag and left under the light for 20 minutes?

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## After doing your experiment...

4. Which food actually held the most water? How can you tell?

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5. Which food actually held the least amount of water? How can you tell?

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Draw scientific sketches of each of the experiments below.