Estivation, Xerophytes, and Ephemerals

What in the world?! Learn more about the interesting ways that animals and plants have adapted to living in arid Arizona

Grade Level:
3–12

Subject Areas:
Geography, Life Science, Environmental Science

Duration:
Preparation time: 50 minutes (for first time lesson is used; subsequent uses will be shorter)
Activity time: 1 hour

Setting:
Classroom

Skills:
Analyze, Apply, Discuss, Identify, Interpret, Organize

Vocabulary:
adaptation, arid, biodiversity, crepuscular, dissipate (heat), dormant, ephemeral, estivate, evaporation, hibernate, indigenous, invasive, native species, nocturnal, nonnative species, photosynthesis, phreatophyte, riparian, stomata, transpiration, xerophyte

Arizona Academic Standards:
Please see www.cals.arizona.edu/AZWATER/WET/standards/index.html for specific standards aligned with this activity.

Summary

Students play a matching game to identify Arizona animals and plants and their water conservation strategies by analyzing clues that describe various species' adaptations for the arid climate.

Objectives

Students will:

- define transpiration and evaporation and explain how these processes are related to plants' and animals' adaptations for water conservation and temperature management;
- interpret maps of temperature, precipitation, and elevation to make inferences about the types of ecosystems/habitats that exist in various parts of the state;
- identify native plants and animals that live in Arizona's deserts;
- describe adaptations of plants and animals that allow them to survive in the deserts of Arizona, including terms such as estivation, xerophyte, and ephemeral;
- compare human behaviors and technologies addressing water conservation to related plant and animal adaptations.

Materials

- *Copies of:* ***Arizona Reference Map*** (page 39), ***Average Annual Precipitation Map*** (page 43), ***Average Annual Maximum Temperature Map*** (page 44), ***Vegetation Coverage Map*** (page 45), *and* ***Physiographic Provinces Map*** (page 42) (1 set per student)
- *Set of* ***Arizona Adaptations Cards*** *Student Copy Pages* (1 per group of 24 students; can be mounted on cardboard or laminated for durability)
- *Set of* ***Arizona Species Cards*** *Student Copy*

Pages (1 per group of 24 students; can be mounted on cardboard or laminated for durability)
- Optional: *Reference materials with information about native plants and animals of Arizona*

Preparation

1. **Make copies of the *Arizona Adaptations Cards* and *Arizona Species Cards*.** There are ten sets of animal cards and four sets of plant cards (twenty-eight cards total). For twenty-eight students make one copy. With fewer students, remove some of the cards; with more students, have them play in teams.
2. **Make copies of the *Arizona Reference Map*** (page 39), ***Average Annual Precipitation Map*** (page 43), ***Average Annual Maximum Temperature Map*** (page 44), ***Physiographic Provinces Map*** (page 42), *and* ***Vegetation Coverage Map*** (page 45) (1 set per student or group of students).
3. **On the board, write the names of the plants and animals you will be using with your class (see the *Answer Key Teacher Copy Page*, page 99, for a complete list).**

Background

Many of the human behaviors and engineering feats that help us conserve water and stay cool we learned from desert plants and animals that have practiced water conservation for thousands of years. In fact, these adaptations to arid environments are embedded in their genetic code and have evolved and been passed down from generation to generation. In many parts of Arizona, plants and animals have adapted to hot, dry conditions.

Although water is one of the most common substances on Earth, it is not distributed equally across the planet. Water in the air and soil as well as temperature are the most important environmental factors in determining the amount and type of vegetation in an area. Temperatures in Arizona vary depending on elevation. In the high plateau and mountainous regions of the state, summer temperatures average about 82 degrees (Fahrenheit) in the day and 50 degrees at night. At lower elevations, high temperatures are common during the summer months and average over 100 degrees. Throughout the state, temperatures vary greatly between day and night. The daily minimum and maximum temperatures can vary by 30 or 40 degrees.

Statewide, Arizona averages just thirteen inches of rain per year, with generally more precipitation at higher elevations, and less at lower elevations (e.g., twenty-one inches average annual precipitation in Payson vs. three inches in Yuma). There is very little surface water in Arizona—rivers and streams make up less than five percent of the state's surface area. **Riparian areas** occur along streams and rivers and around springs, ponds, lakes, and reservoirs. Examples include floodplains, stream banks, and lakeshores. More than 80 percent of the animal species in Arizona rely on riparian habitats for survival.

The place where a species lives is called its **habitat**. A habitat contains the food, water, and shelter that a plant or animal requires for survival. For simplicity, biologists, ecologists, and land managers often generalize habitats by associating them with types of vegetation or ecosystems. This makes it easier to understand where plants and animals live without having to know the exact needs of each species.

Because of variations in temperature, rainfall, altitude, and geography, Arizona has many different ecosystems that support different biotic communities, or groups of organisms. The plants, animals, fungi, microorganisms, etc. that live together and interact in a particular place make up a **community**. A community together with its physical environment (the soils, rock formations, water features, etc.) make up an **ecosystem**. Arizona's major ecosystems are: desert scrub, desert grasslands, chaparral, woodlands, pine forests, montane forests, subalpine forests, and riparian. These ecosystems are used to describe the habi-

tats of plants and animals in this activity (see pages 8–9 for descriptions of these ecosystems).

Arizona is among the top five U.S. states for **biodiversity**. This means that Arizona has many different living organisms that have adapted to live in its diverse habitats and ecosystems. There are more than four thousand different species of plants and animals that live in Arizona! Arizona's plants and animals have adopted various strategies to survive in environments that often have little water and high daytime temperatures. They find ways to avoid and dissipate heat, and to obtain and conserve water.

Plants and animals that have evolved with other organisms and have adapted to a specific place are called **native species**. Native species have evolved to live in the ecosystems of Arizona over thousands of years. **Nonnative species** are those that have been introduced or transported to a new environment that they did not evolve in. Some nonnatives do not have the mechanisms to survive in a new place. For example, a mangrove tree from the Everglades in Florida cannot survive the aridity in Arizona.

Other nonnatives have adaptations that help them to out-compete native species. An example is tamarisk, or salt cedar, a **phreatophyte** from the Middle East and the Mediterranean that was planted in the western United States to help control erosion along stream banks. A **phreatophyte** is a deep-rooted plant that obtains its water from the water table or layer of soil just above it. Tamarisk have long taproots, but they also have shallow roots that allow them to utilize water near the soil surface. Tamarisk's ability to survive periods of drought, as well as tolerate saline soils,

Desert agaves' leaves have thick, waxy skin to help reduce water loss.

Kerry Schwartz

Lissa Howe

Dense stands of tamarisk line the banks of the Colorado River.

Kerry Schwartz

The Gila woodpecker is adapted for life in the deserts of central and southern Arizona.

gives it a competitive advantage over native riparian plants in many desert riparian areas (especially those that don't experience natural flood events regularly). When tamarisk becomes dominant in an area, it can reduce habitat for certain species of wildlife (and other plants) that have evolved in relationship with other native species.

Animal Adaptations

One of the advantages that animals have over plants, when it comes to coping with environmental conditions, is that they are mobile. Some animals, like the big brown bat, live in the deserts in the wintertime and move to cooler areas in the summer to escape the extreme heat and dryness in the desert valleys. Other animals, such as the round-tailed ground squirrel, go into their burrows and **estivate** in the heat of the summer. **Estivation** is like **hibernation**, except it occurs in the hot dry summer instead of the cold wet winter. Desert toads, such as the Couch's spadefoot, also estivate, burrowing underground during the dry part of the year and awakening when the first summer thunderstorms come.

Another strategy that animals use to avoid the heat of the day is to sleep underground in their burrows or in the shade and then to come out and be active at dusk or dawn (**crepuscular** activity) or at night (**nocturnal** activity). Mule deer, Gila monsters, javelina, and many birds are crepuscular. Bats, foxes, skunks, rodents, and snakes are primarily nocturnal.

Some animals, such as brine shrimp and fairy shrimp, survive dry spells as eggs when the water evaporates. When the water returns, the eggs hatch and the shrimp grow and mature and lay new eggs before their habitat dries up again.

Animals have developed ways to dissipate the desert heat. Many desert animals are light-colored which helps them to stay cooler by not absorbing as much of the sun's heat. Light-colored scales, feathers, and fur also serve as camouflage and protect against predators.

Using **evaporation** is an effective way to cool down in the desert. Perspiration is one method; the skin gives off water either as a vapor by simple evaporation from the skin or as sweat. When humans get too hot, we sweat and the moisture evaporates off of our bodies to help us cool down. Coyotes can pant to stay cool. The air moving in and out of a coyote's lungs evaporates moisture on its tongue and in its mouth, which helps to lower its body temperature. Owls and nighthawks stay cool by opening their mouths and moving their throats in an action similar to panting. Some desert animals, such as the jackrabbit, have long appendages that help to cool them. A jackrabbit's ears can be five to eight inches long! The blood vessels in their ears are close to the surface, which helps dissipate heat.

Because water is so scarce, desert animals have developed ways to obtain and retain water. Most desert animals get their water from the food they eat. Insects, birds, and animals all obtain essential water from the flowers, fruits, seeds, stems, leaves, and roots of plants. Kangaroo rats use water more efficiently than most other mammals. They are able to metabolize all the moisture they need from the dry seeds they eat. Kangaroo rats also have special organs in their noses that help to capture moisture from their breath so it isn't lost when they exhale, and specialized kidneys that concentrate their urine to retain water within their systems. Some scavengers and predators, such as turkey vultures and owls, also can get all the moisture they need from their food.

Plant Adaptations

Arizona plants have also adapted in interesting ways to the desert heat and aridity. Some plants have shallow roots to soak up lots of rainwater quickly, while others have long taproots to draw water from deep in the ground (and some have both!). Many desert plants begin to grow in the shade of larger plants, or "nurse" plants, because they can't survive the full sun when they are young. Saguaro cacti often germinate in the shade of nurse plants.

Xerophytes are plants that have adapted to arid environments by developing physical structures that help them to survive extreme heat and water deprivation. Sagebrush, saltbush, creosote bush, palo verde, agave, and cacti are all examples of xerophytes. Cacti are some of the most drought-tolerant plants on Earth. Their shallow root systems can soak up lots of water quickly when it rains, and they can store enough water in their stems to meet their needs for over a year. Cacti reduce the amount of water lost to the environment through **transpiration** by having spines instead of leaves and thick waxy skin (transpiration occurs when water vapor in a plant is lost to the atmosphere through pores in its leaves, called stomata). They also utilize a specialized metabolic system (Crassulacean Acid Metabolism or CAM) that allows them to keep their stomata closed during the day, opening them at night for the exchange of carbon dioxide and oxygen that allows the plant to complete its cycles of photosynthesis and respiration.

Other xerophytes have adapted by reducing or eliminating their leaves to reduce the amount of water lost through the leaves. They often have green bark like the palo verde tree to enhance photosynthesis. Sagebrush leaves have silvery hairs that reflect sunlight and keep the leaf surfaces cooler.

Phreatophytes, such as mesquite, grow extremely long roots to tap into water deep beneath the surface. Mesquite trees have the deepest roots of any native desert plant and can reach down eighty feet. Both mesquite trees and creosote bushes have deep taproots that allow them to draw up deeper ground water and shallow radial roots that absorb rainwater from near the surface.

Desert **perennials** survive by becoming dormant when it is hot and dry and then rejuvenating when it rains. Ocotillo will appear to be dead until it rains, and then they spring to life, growing new leaves within a couple of weeks. When the weather becomes hot and dry again, the ocotillo loses its leaves and goes dormant again until the next rainfall. It can repeat this cycle as many as five times a year. The desert lily is a bulb that can store food and moisture underground for years before it comes out of dormancy.

Ephemeral plants germinate when it rains and can complete their entire life cycle in a few weeks or months. There are hundreds of species of ephemerals that have adapted to life in the desert. Examples include lupine, desert sand verbena, and Mojave aster. They grow, flower, and produce seeds in just a few weeks. The seeds can remain viable in the soil for years, waiting for just the right wet spring conditions to germinate.

Procedure

Warm Up

1. **Ask students this question: "How do you know when you wake up in the morning that you are in Arizona and not in Florida?" to initiate a discussion of climate and the environment and how it varies from place to place.** How does living in Arizona's climate (vs. someplace like Oregon) influence their behaviors and lifestyle (e.g., the clothing they wear, the types of plants growing in their yard)? What about the plants and animals that are adapted for their area of Arizona—could a Gila monster survive in Alaska? Could a walrus survive in the Sonoran Desert? Why don't we see saguaro cacti anywhere other than the Sonoran Desert? Many desert organisms have adapted in ways that allow them to survive and thrive in hot, arid environments.
2. **Ask students to brainstorm desert plants and animals with special adaptations for their environments.** Remind them that plants, as well as animals, have evolved mechanisms and structures for conserving

water and for staying cool (a very important element of conserving water in the desert). Make sure you cover the adaptations and species on the ***Adaptations*** and ***Species*** cards.

The Activity

1. **Define the terms *transpiration* and *evaporation*.** Ask students how having the following characteristics would enable plants to conserve water and stay cool: few or no leaves; waxy coating on leaves; shallow radial roots; deep tap roots; water storage capacity. Ask students to explain the advantages and disadvantages of evaporation and transpiration in plants and animals that are trying to conserve water and stay cool.
2. **Distribute copies of the maps listed in the *Materials* section and have students identify where they live on the *Arizona Reference Map* (page 39).** What plants and animals live in their area? What adaptations have they made to survive? Now have students identify other areas on the Arizona map and compare water availability, temperature, and rainfall in these areas, using the appropriate maps. Discuss the ways that the climate of a place influences the types of ecosystems and habitats that are found there. What kinds of plants and animals live in these different habitats and how have they adapted?
3. **Tell students they are going to play a matching game in which they must match a species to its adaptations, using clues about how it has learned to survive in the arid climates of Arizona.**
4. **Distribute *Arizona Adaptations Cards* and *Arizona Species Cards* to the class, taking care to ensure that every card has a match.** If there are more cards than there are students in the class, you can do two rounds of the activity to make sure all the cards get used. If there are more students than cards, have students pair up.
5. **Explain that some cards list characteristics, mechanisms, or behaviors that a specific plant or animal has adopted for survival in Arizona, and that other cards have pictures of specific plants and animals in Arizona.** Based on the clues, students have to find their match. If they have an ***Adaptations*** card, they have to find the ***Species*** picture card that it describes. If they have a ***Species*** card, they have to find the person that has the ***Adaptations*** card that matches it. Encourage all students to move around the room and talk to each other until they find their match.
6. **When students have found their match, they must pair up and sit down together.**
   - Grades 3 through 6: Have students choose their favorite adaptation of their particular plant or animal. When everyone is sitting down with their partner, go around to each pair and have them show their plant or animal card and quickly tell their favorite adaptation. Then mix up the cards and play the game again. The game should go faster in subsequent rounds.
   - Grades 7 through 12: Tell students not to show their cards to anyone after they have found their match. After playing the game, have each pair of students come to the front of the room individually and begin reading the ***Adaptation Card*** clues for their plant or animal one at a time, without revealing the answer. The rest of the class should try to give the species' name correctly after as few clues as possible ("Knowledge Bowl" style).

Wrap Up

1. **Discuss how adaptations enable species to live in their environment.** Ask students to summarize water- and heat-related adaptations included in the game by

categorizing types of adaptations (for example, avoiding heat, storing water, dissipating heat, etc.) and listing specific adaptations within those categories. Write the categories and adaptations on the board. Can they think of other examples of species that have adopted some of these same mechanisms for survival? Which of these adaptations have humans adopted for survival (e.g., wearing light clothing, sitting in the shade, digging deep wells to the water table, taking afternoon siestas, etc.).

2. **Remind students that native plants and animals have evolved over thousands of years to live in a particular place.** The adaptations they have made over time allow them to thrive in the dry, sometimes hot environment of Arizona.
3. **Discuss the following question: "What water conservation efforts undertaken by humans originated from observing and studying plants and animals?"** Have students brainstorm ideas and make a list of related behaviors/adaptations/technologies on the board. Refer to the activity, "Desert Seasons" (page 108), in which human survival strategies for desert living are explored.

Assessment

Have students:

- define transpiration and evaporation and explain how these processes are related to plants' and animals' adaptations for water conservation and temperature management (***The Activity***, Step 1);
- interpret maps of temperature, precipitation, and elevation to make inferences about the types of ecosystems/habitats that exist in various parts of the state (***The Activity***, Step 2);
- identify a species from a set of clues describing behaviors and/or physiology that conserve water and help the species stay cool (***The Activity***, Steps 3–6);
- explain how adaptations enable plants and animals to live in diverse habitats (including defining terms such as *estivation*, *xerophyte*, and *ephemeral*) (***Wrap Up***, Step 1);
- identify human behaviors and technologies addressing water conservation that are related to plant and animal adaptations (***Wrap Up***, Step 3).

Extensions

Using the information about ecosystems found on pages 8–9**,** have students try to identify the habitats/ecosystems in which the various plant and animal species may be found.

Using their knowledge of Arizona adaptations, have students create, draw, and label a new (imaginary) species of plant or animal that is adapted to live in the same ecosystem that the students live in. (This can also be used as an assessment tool.)

Have students visit the library or search the Internet to learn about other organisms' adaptations for water conservation and make new game cards. The game can then be played with these new cards, and groups can share sets to expand their knowledge of Arizona plants and animals.

Have students identify other behaviors that plants and animals have adopted to conserve water and stay cool. Then have them research and discover the human analog to these behaviors.

Have students research invasive, nonnative species in Arizona. What adaptations from other parts of the world have these species made that make it possible for them to survive as well as or better than native species? (See: 1) www.usgs.nau.edu/SWEPIC/SWVMA/InvasiveNon-NativePlantsThatThreatenWildlandsInArizona.pdf and 2) http://alic.arid.arizona.edu/invasive/html/index.shtml.)

Have students design and construct a mini-habitat for their school that illustrates desert-adapted plants and animals from their local ecosystems.

Case Studies
***City of Seven Wonders* (page 275)**
***Tucson: Living as a Desert Community* (page 302)**
***Home Grown Tomatoes* (page 289)**

Recommended Reading		
Grades K–5	**Grades 6–8**	**Grades 9–12**
Cactus Café: A Story of the Sonoran Desert (Kathleen W. Zoehfeld)	*One Small Square—Cactus Desert* (Donald M. Silver)	*Cultures of Habitat* (Gary Nabhan)
Storm in the Desert (Carolyn Lesser, Ted Rand)	*Deserts and Dry Lands: A Changing World* (Steve and Jane Parker)	*The Secret Knowledge of Water* (Craig Childs)
Roadrunner's Dance (Rudolfo Anaya)		*Arizona: The Beauty of It All* (Sam Negri)
Way Out in the Desert (T. J. Marsh, Jennifer Ward)		

K–2 Options

Tell students they are going to play a matching game to learn some plants and animals that live in Arizona. Make two copies of each ***Species*** card and do not copy the ***Adaptations*** cards. Have students place the cards face down, taking turns to turn over two cards at a time to find matches. If a student gets a match, he or she takes another turn. Before taking the next turn, write the name of the animal or plant on the board and have students repeat the name aloud. Playing this game will familiarize students with plants and animals native to Arizona.

Resources

Bowers, Janice Emily. 1993. *Shrubs and Trees of the Southwest Deserts*. Tucson, AZ: Southwest Parks and Monuments Association.

Phillips, Steven J., and Patricia Wentworth Comus. 2000. *A Natural History of the Sonoran Desert*. Tucson: Arizona-Sonora Desert Museum Press.

e-Links

Arizona Riparian Council
Educational information and fact sheets about riparian areas.
http://azriparian.asu.edu/fact.htm

Arizona-Sonora Desert Museum
Educational resources about the Sonoran Desert.
www.desertmuseum.org

Arizona Water Science Center
Information about all aspects of water in Arizona.
http://az.water.usgs.gov

Desert USA
Links to Web pages for Arizona botanical gardens and arboreta.
www.desertusa.com/mag99/apr/stories/arbs.html

Western Regional Climate Center
Current and historical climate data.
www.wrcc.dri.edu/CLIMATEDATA.htm

Estivation, Xerophytes, and Ephemerals
Answer Key

Arizona Species Matches

1. black-tailed jackrabbit
2. Couch's spadefoot
3. Gila monster
4. big brown bat
5. javelina
6. fairy shrimp
7. burrowing owl
8. human
9. California condor
10. kangaroo rat
11. saguaro cactus
12. desert agave
13. mesquite
14. creosote bush

Arizona Adaptations Cards

I rarely have to drink because I get most of the moisture I need from the plants that I eat.

I am hard for predators to catch because I can jump up to 20 feet in one bounce and can run more than 25 miles per hour.

I am tan with a black tail. My underbelly is white.

During the hot parts of the day, I sleep in the shade.

I have long ears that help to keep me cool. They can be 5 to 8 inches long.

I live in all the grasslands and deserts of Arizona.

(1)

During the very driest part of the year, I estivate (become dormant, as in hibernation).

I stay buried in the soil for months and then come out when summer thunderstorms begin.

I breed in temporary rain pools that fill during summer storms.

I have a short wedge-shaped bone on the bottom of each hind foot, which I use to bury myself in the ground.

I live throughout southern Arizona. I can sometimes be found near the desert edge of farm fields.

(2)

I am crepuscular (I am active at dusk and at dawn). I spend most of my time asleep in my burrow during the hottest part of the day.

I am a large, slow-moving, plump reptile with a short fat tail.

I have a pattern of black and orange on my body.

I am a protected species. It is against Arizona state law to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect me.

I live in ecosystems ranging from low Sonoran Desert to woodlands.

(3)

I am nocturnal (I am active during the night). During the day I sleep in old mines or caves where it is cool.

Every night, I eat half my weight in insects.

I fly, but I don't have feathered wings.

I find my way by making sounds that are higher than humans can hear (called echolocation).

During the summers, I like to be in the pine-covered mountains. In the winter, I live at lower elevations in the Sonoran Desert.

(4)

Arizona Adaptations Cards

I am crepuscular. That means that I am active at dusk and at dawn. I spend most of my time asleep in the shade during the hottest part of the day.

Prickly pear cactus is my favorite food. It has lots of water in it and the spines don't hurt my mouth.

I have poor eyesight and good hearing. You may smell my musky scent before you see me.

My name comes from the Spanish word for sword because of my sharp teeth.

I live in the Sonoran Desert and Central Arizona Highlands, where I prefer mesquite habitats with an abundance of prickly pear cacti.

(5)

I survive as an egg when the water evaporates during dry spells.

When the water returns, 6 to 10 months later, my egg hatches and I mature before the pool dries up again.

I can complete my life cycle in as few as 16 days.

I am only ½ to 1-½ inches long and I swim upside down.

I live in pools of water throughout all the ecosystems in Arizona.

My eggs can be carried from pool to pool by traveling animals, or picked up in the wind and blown to other pools.

(6)

I stay cool by opening my mouth and moving my throat in an action similar to panting.

I am an unusual bird because I live in the ground. I make my home in burrows that were dug by mammals.

I am crepuscular (active at dawn and dusk), but sometimes I hunt at night and you can see me hunting in the day when it's not too hot.

I have brown and white feathers and big yellow eyes.

I eat insects, scorpions, small mammals, birds, amphibians, and reptiles.

I live in dry, open areas with no trees and short grass, often in abandoned agricultural fields.

(7)

When I get too hot, I sweat and the moisture evaporates off my body to keep me cool.

I build shelters to provide shade for times when it is hot.

I walk on two legs.

I usually have more hair on my head than other places on my body, which helps keep me cool when the sun is directly overhead.

I use tools to transport and store water so I always have a supply.

I live all over in Arizona.

(8)

Arizona Adaptations Cards

When it is really hot, I like to soar up high where the air is cooler. I can soar at altitudes up to 15,000 feet!

I get most of the moisture I need from the food that I eat.

When I get hot, I defecate on my legs, using the evaporation of the moisture to cool myself down.

I am the largest bird in North America, and my wingspan can reach 9 ½ feet.

I have a bald, red face so that I can stay clean when I eat carrion (dead animals).

I am extremely rare, but if you are lucky you may see me soaring over the Grand Canyon.

(9)

I never drink water, even if I am offered it in captivity.

I get all the moisture I need from the seeds that I eat.

I have a special organ in my nose that captures water that would otherwise be exhaled.

I am a small animal with a long tail, and I hop like a kangaroo.

During the hot part of the day I seal off my burrow and sleep under the ground.

I live in all of Arizona's deserts.

(10)

As a seed, I sprout and grow in the shade of larger plants, or "nurse" plants.

My "skin" is covered with a thick, waxy coating that limits water loss.

My outer surface is folded into pleats that can expand when I take up lots of water.

I am the largest cactus in Arizona; one of the tallest of my species was 78 feet tall!

I am found only in the Sonoran Desert.

(11)

I reduce the amount of water lost to the environment by having thick, waxy skin.

I grow very slowly, which allows me to survive on little water. It takes me about 20 years to produce one large flower stalk.

I store water in my leaves.

My white flowers are often pollinated by bats.

I am usually found in habitats that are dry, but cooler than the hottest desert valleys.

(12)

Arizona Adaptations Cards

I am a phreatophyte, which means that I have very long roots to tap into water deep beneath the ground.

I have the deepest roots of any desert plant. My roots can reach down as far as 80 feet!

Native people traditionally used my nutritious pods for food, my wood for fuel, and my tough roots for fibers.

I have tiny leaves to reduce the amount of water lost through transpiration.

I am a tree that usually grows in desert washes or along streams and rivers.

(13)

I have deep taproots as well as shallow roots so that I can draw up ground water and also absorb rainwater from near the soil surface.

I have tiny leaves with stomata, or pores, that I close during the day to keep in moisture.

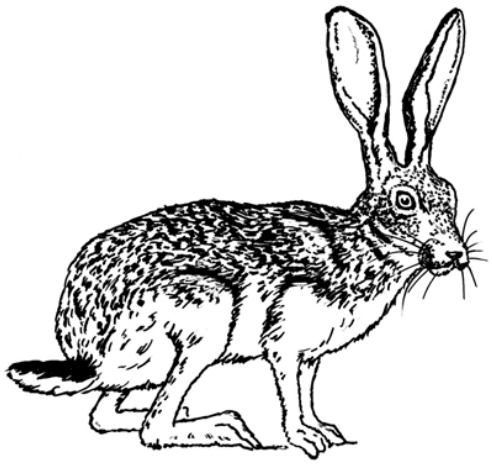
I can survive for up to two years without rain.

A certain individual of my species is believed to be the oldest living plant in the world—over 11,000 years old!

I can grow in the hottest desert regions.

(14)

Arizona Species Cards



black-tailed jackrabbit

Couch's spadefoot

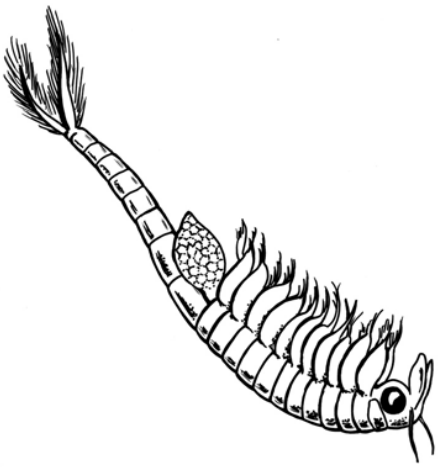
Gila monster

big brown bat

Artist: Rachel Ivanyi, © Project WET

Arizona Species Cards

javelina



fairy shrimp

burrowing owl

human

Artist: Rachel Ivanyi, © Project WET

Arizona Species Cards

California condor

kangaroo rat

saguaro cactus

desert agave

Artist: Rachel Ivanyi, © Project WET

Arizona Species Cards

mesquite

creosote bush

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