



SeaWorld/Busch Gardens Animal Adaptations

4-8 Classroom Activities

Desert Animal Adaptations

OBJECTIVE

The student will identify five adaptations of a desert animal that allow it to survive under extreme conditions. The student will conduct an investigation of three desert adaptations.

PREPARATION

Write the name of each desert animal (from the Desert Animal List) on an individual piece of paper. Create one paper for two students (half class size). Fold the papers and place in a large bowl for students to draw from.

ACTION

1. Explain that this activity about the adaptations of desert-dwelling animals has two components: a research component and an experimental component. To begin, divide the class into pairs. Ask each student pair to draw one slip of paper out of the "Desert Animal List" bowl.
2. For the *research* component, ask students to gather the following information about their desert animal: range, habitat, diet, gestation/incubation, population status, and five clearly defined adaptations that allow their animal to survive under the extreme conditions of a desert habitat. **Note:** Teachers may check students' answers using the Teacher's Guide on pages 5 to 11.
3. For the *experimental* component, distribute four sponges, a plastic bag, and a *Experimental Funsheet* to each student pair. Explain that these sponges will represent desert-dwelling animals. The students will simulate three adaptations and/or behaviors that some desert animals exhibit to help retain water and reduce overheating.
4. Explain the following three adaptations and/or behaviors of some desert dwelling animals and how the students will simulate each of these conditions. These conditions should be simulated for a 24-hour period.
 - A. Avoiding heat by being primarily active (searching for mates and feeding) at dusk and dawn and retreating to a shady place during the day. *The Shaded Sponge.*
 - B. Avoiding heat by digging a burrow under the surface of the soil or sand to escape the high surface temperatures. *The Burrow Sponge.*

- C. Retaining water by having waterproof skin that retains moisture. *The Waterproof Skin Sponge.*
 - D. As a control one of the sponges should be left out in a non-shaded area. *The Control Sponge.*
5. Instruct students to moisten all their sponges to the point of saturation. Next, students will weigh each sponge, record its weight, and designate it to one of the following conditions:
- A. *The Shaded Sponge:* Students will simulate this by placing one sponge in a shady area.
 - B. *The Burrow Sponge:* Students will simulate this by placing one sponge in a shallow burrow. The students will fill a disposable turkey pan with sand. Next, they should dig a shallow burrow in the sand, place the sponge inside and cover it with an inch of sand. The turkey pan should be placed in an area receiving direct sunlight. Note: Several student groups may share one disposable turkey pan and sand as long as there is enough room for all the burrows.
 - C. *The Waterproof Skin Sponge:* Students will simulate by placing one of their sponges in the plastic bag and then securely fasten it. Next, the students will leave the sponge in an area receiving direct sunlight.
 - D. *The Control Sponge:* Students will leave this sponge out in a non-shaded area. No experimental treatment should be given to this sponge.
6. Instruct students to monitor their sponges over the next 24 hours and record their data on the *Experimental Funsheet*. Students will weigh their sponges again the following day to observe how much moisture was lost under each of the conditions.
7. Students will present their research about a desert animal, adaptations, and their experiment to the class.
8. Lead a group discussion about the class experiment. Which condition (adaptation and/or behavior) retained the most water in the sponges and why? Which condition retained the least amount of water in the sponges and why? What other desert adaptations and/or behaviors were represented by the research portion of the project?

EXTENSION

Students may correlate each of the desert adaptations investigated during the study (finding a shady retreat, waterproof skin, and burrows) to a different desert animal that utilizes them.

DESERT ANIMAL LIST

1. Fennec fox
(*Vulpes zerda*)
2. leopard gecko
(*Eublepharis macularius*)
3. dromedary camel
(*Camelus dromedarius*)
4. Addax antelope
(*Addax nasomaculatus*)
5. meerkat
(*Suricata suricatta*)
6. gila monster
(*Heloderma suspectum*)
7. sidewinder
(*Crotalus cerastes*)
8. desert tortoise
(*Gopherus agassizii*)
9. Sonoran desert toad
(*Bufo alvarius*)
10. bilby
(*Macrotis lagotis*)
11. kangaroo rat
(*Dipodomys deserti*)
12. western diamondback rattlesnake
(*Crotalus atrox*)

MATERIALS

Per student pair:

- four sponges (same shape and size)
- disposable turkey pan
- one bag of sand
- one plastic sandwich bag (Note: The bag should close securely around the sponge with little excess).
- one *Experimental Funsheet*

Per class:

- one scale or triple-beam balance
- copy of Desert Animal List
- strips of paper
- bowl to hold strips of paper
- copy of *Desert Adaptation Teacher's Guide* on pages 5 to 11
- Internet or library access
- water

Experimental Funsheet

sponge size: _____ length _____ width _____ height

weight (g)
0 hour

weight (g)
24 hour

shaded sponge

burrow sponge

waterproof sponge

control sponge

COMMENTS:

1. Fennec Fox (*Vulpes zerda*)

RANGE: Northern Africa, throughout the Sahara Desert, East to the Sinai Peninsula and Arabia.

HABITAT: Desert and semi-desert

DIET: Mostly carnivorous; insects, snails, lizards, rodents, birds, eggs, and plant matter (fruits and berries).

GESTATION: 50 days. The fennec fox can have two litters per year if the first litter is lost and the food supply is plentiful. This is very unusual among the canids. Normally 2-5 young are born per litter.

STATUS: CITES Appendix 2

ADAPTATIONS:

1. Their large ears, which are usually 4 to 6 inches long, help dissipate excess body heat on hot days in the desert.
2. The fennec fox seems to be the only carnivore living in the Sahara Desert able to survive without free water. Their kidneys are adapted to restrict water loss, their extensive burrowing may cause the formation of dew, which can then be consumed, and they will receive moisture from the food that they eat.
3. Their burrowing and nocturnal lifestyle helps restrict water loss.
4. Their thick fur helps insulate them from the cold desert nights.
5. Their sandy coloration helps to reflect heat, and also provides excellent camouflage.
6. Fennec foxes also have thick fur on the soles of their feet, which insulate against the hot sand of the desert. This extra fur on the soles of their feet also affords them excellent traction in the loose sand.

2. Leopard Gecko (*Eublepharis macularius*)

RANGE: Southern Asia, India, Pakistan, Afghanistan, Iran, and Iraq

Habitat: Rock deserts and sparse grasslands.

DIET: Insects, including scorpions, but will also eat other lizards.

INCUBATION: 52 days, 2 eggs. Leopard geckos' sex is determined by incubation temperature. At 90°F, virtually all the babies are male; near 80°F, most of the babies will be female. An incubation temperature of 85°F will produce about an equal number of males and females.

STATUS: Not listed by USFWS or CITES

ADAPTATIONS:

1. Like many lizards, the leopard gecko has a tail, which breaks off readily when grabbed by a predator. This permits the gecko to get away if attacked. Unfortunately, it leaves a valuable food resource behind; the tail is used as a fat storage for lean periods in the desert.
2. They are strictly nocturnal, keeping out of the heat of the day, emerging at night from holes and crevices to hunt for food.
3. Many geckos lack eyelids, but the leopard gecko's are not only translucent, but they are movable, which allows them to blink and close their eyes while sleeping. Additionally, this helps protect their eyes against the blowing sand of the desert.
4. Leopard geckos conserve water by excreting nitrogenous wastes in the form of uric acid (solid crystal form) as opposed to urine.
5. Extra-thick skin helps to prevent drying out in the desert. Additionally, it protects from the wear and tear of moving through dry scrub or around sharp rocks.

3. Dromedary Camel (*Camelus dromedarius*)

Range: Middle East and northern Africa; Arabian Peninsula; introduced to Australia and Namibia.

Habitat: Arid dry regions.

Diet: Almost any vegetation that they can find.

Gestation: 12-13 months; one offspring.

Status: Not listed by USFWS or CITES

Adaptations:

1. The dromedary camel is capable of drinking 100 l (30 gal.) of water in just 10 min.
2. A camel can last three months without water, a special adaptation for desert living.
3. Camels store fat in the hump, not water. The fat can be metabolized for energy.
4. Unlike most mammals, a healthy camel's body temperature fluctuates throughout the day from 34°C to 41.7°C (93°F-107°F.) This allows the camel to conserve water by not sweating as the environmental temperature rises.
5. Camels exhibit specialized feeding behaviors. Feeding individuals select only a few leaves from each plant, and can eat parts of the plant that other species do not, such as the thorns of the acacia tree. Foraging herds of camels will spread over large areas so they do not eat all of the vegetation. These selective styles of feeding reduce stress on the plant life, and avoid competition between camels and other arid region herbivores.
6. Camels have nostrils that can open and close, protecting the respiratory tract from blowing sand.

4. Addax Antelope (*Addax nasomaculatus*)

RANGE: Northern Africa (Chad, Mali, Mauritania, and Niger)

HABITAT: Sand and stony desert, semi-desert, and barren steppes.

DIET: Desert succulents, grasses, and herbs, leaves of small bushes.

GESTATION: 257-264 days; one offspring per birth weighing 4.7 to 6.75 kg (10.5-15 lb).

STATUS: CITES Appendix I. Addax are one of the most endangered mammals in the world. Current estimates show there to be less than 500 individuals left in the wild.

ADAPTATIONS:

1. Addax possess broad, flat hooves with flat soles that help prevent them from sinking into the desert sand.
2. These desert antelopes' coat color changes from dark grayish-brown in winter (darker colors absorb more heat from the sun; thereby keeping them warmer) to white in the summer (lighter colors help reflect off heat from the sun; thereby keeping them cooler). This is an efficient method of maintaining body temperatures.
3. Addax will dig depressions in the sand in which to rest. These are often located in the shade of boulders for protection from the wind and sun.
4. Often considered the most-well adapted antelope to a desert environment, addax rarely need to drink since they are able to get most of the water they need from the plants they eat.
5. The addax antelope's light coloration helps camouflage with their desert environment.

5. Meerkat (*Suricata suricatta*)

RANGE: Southern Africa, Kalahari Desert.

HABITAT: Broad sandy plains covered with grasses and thorn scrub.

DIET: Worms, insects, small rodents, lizards, snakes, scorpions, bird eggs, fruits, ant larvae.

GESTATION: 6 to 12 weeks; 2-3 young.

STATUS: Common, protected in the Kalahari National Park

ADAPTATIONS:

1. A low metabolic rate allows them to survive with less food and water. Meerkats have long curved claws for digging and closed ears to keep out dirt when burrowing.
2. Meerkats have a specialized coat that keeps them warm when temperatures are cool and cool when temperatures are high.
3. Meerkats have outstanding vision; dark rings around their eyes help reduce glare from the sun.
4. A nictitating membrane on their eye acts like a windshield wiper to remove sand from their eyes when they blink.
5. Their underground burrows may have 20 different entrances and exits. These burrows serve for protection against predators and the sun.

6. Gila Monster Lizard (*Heloderma suspectum*)

Range: Southwestern United States and Northwestern Mexico

Habitat: Desert and arid regions

Diet: Eggs, young birds, mammals, and reptiles.

Incubation: The female lays 3-5 eggs and the incubation is about 10 months.

Status: CITES Appendix II

Adaptations:

1. Gila monsters spend as much as 98% of their life underground in burrows to avoid heat exposure.
2. Fat stored in the tail and abdomen is metabolized when food is scarce. Additionally, their metabolic rate is slow and they therefore go through their fat reservoirs slowly.
3. Thick skin prevents water loss to extreme desert temperatures.
4. Adult Gila monsters may consume up to 35% of their body weight when feeding. When eating such large amounts they may have to only consume three of these large meals a year.
5. The Gila monster's toxic venom is used against desert predators. Additionally, its pink or orange coloration (camouflage) also protects it against predators.

7. Sidewinder (*Crotalus cerastes*)

RANGE: Mojave and Sonoran deserts of southeastern California, western Arizona, southern Nevada, and southwestern Utah.

HABITAT: Arid deserts and flatlands.

DIET: Lizards, rats, mice, and sometimes birds. The venom of the sidewinder kills the prey.

GESTATION: 145-155 days. Give birth to live young. Females give birth to 15-18 young in late summer or early fall.

STATUS: Not currently listed by USFWS or CITES

Adaptations:

1. The sidewinder has upturned, horn-like scales over the eyes. This horn is capable of folding down over the eye for protection as it moves through burrows searching for food.
2. The sideways movement of the sidewinder (S-shaped locomotion) is particularly adapted for life in the desert. The side winding motion allows the snake to keep most of its body off the ground while moving. This reduces the body's contact with the hot desert sand and reduces heat absorption into the body.
3. The locomotion of the sidewinder also allows the snake to move rapidly over the loose shifting substrate.
4. Sidewinders are mostly nocturnal to help avoid the heat during the day.
5. The sandy color of the sidewinder protects themselves from predators and allows them to find/ trap prey easier in the desert.

8. Desert Tortoise (*Gopherus agassizii*)

RANGE: Mojave and Sonoran deserts of southeastern California, southern Nevada, south through Arizona into Mexico.

HABITAT: Desert and semi-arid areas

DIET: Herbivore. Grasses, herbs, and a wide variety of desert plants.

Incubation: A mature female might lay 4-8 white, hard-shelled eggs in a clutch and produce 2-3 clutches in a season. An incubation period is usually 90 to 120 days. The hatchlings' sex is temperature dependent. Cooler temperatures (79-87°F) produce all males and warmer temperatures (88-91°F) produce all females.

STATUS: Threatened

ADAPTATIONS:

1. The desert tortoise may be active during the day (diurnal) or the morning and evening (crepuscular), depending on the temperature.
2. This tortoise burrows under the sand to protect itself from extreme desert temperatures.
3. Adults can survive for about a year without water. They are able to obtain water from their diet.
4. Tortoises can withdraw their head, legs, and tail into the shell providing themselves protection against predators.
5. To utilize the infrequent rainfalls, tortoises dig shallow pits to catch the water. The tortoises may be found waiting by these areas when rain is in the forecast.

9. Bilby (*Macrotis lagotis*)

RANGE: Australia

HABITAT: Deserts, dry forests, dry grasslands, and dry shrubby areas

DIET: Omnivore (plants and animals) eating insects, lizards, mice, worms, snails, fruit, seeds, and some plants.

GESTATION: Marsupial. The breeding season is from March to May. The gestation period is 21 days and the female has a litter of 1 to 3 pups. The young then go to the backward opening pouch of the mother (with eight teats) for about 80 days.

STATUS: Endangered

ADAPTATIONS:

1. The bilby is able to obtain water from the food it eats.
2. The bilby mainly forages and hunts for food at dawn and dusk (crepuscular) when the temperatures are cooler.
3. Strong, clawed feet dig burrows to help escape the heat of the day and predators. Some of the burrows can be up to 5 ft long. Additionally, they dig to search for food.
4. The bilby's long ears help dissipate heat.
5. The bilby's long whiskers help orient themselves in the dark burrows and at nighttime.

10. Kangaroo Rat (*Dipodomys deserti*)

RANGE: Western and South Western North America

HABITAT: Deserts and other dry regions

DIET: Mostly seeds and grasses

STATUS: Not listed on USFWS or by CITES

GESTATION: 32-day gestation period. Some species (there are 22 species of kangaroo rats) have 2 to 3 litters a year with 1 to 7 offspring (2 is the most common).

ADAPTATIONS:

1. Kangaroo rats dig burrows to protect themselves from predators and heat.
2. Kangaroo Rats are nocturnal (avoiding the heat during the day.)
3. They have large hind feet that keep them from sinking into the sand.
4. Kangaroo rats obtain may obtain their water from the food they eat.
5. Kangaroo rats have fur-lined pouches on the sides of their face that they use to carry food to their burrow. This behavior allows them to gather more food quickly reducing the time outside the safety of their burrows.
6. Large ears help dissipate heat.

11. Desert Toad (*Bufo alvarius*)

RANGE: Northern parts of Mexico, Southern parts of Arizona and New Mexico, and Southeast California.

HABITAT: Deserts and semi-arid habitats.

DIET: Carnivorous and is known to eat snails, beetles, spiders, grasshoppers, lizards, mice, and other smaller toad species.

INCUBATION: 8,000 eggs are laid in water and hatch in 2-12 days. Larvae metamorphose after 6 to 10 weeks.

STATUS: Not listed on USFWS or by CITES

ADAPTATIONS:

1. The desert toad lives underground 10 months out of the year. It seals itself in a burrow with gelatinous secretions and remains inactive until a heavy rain occurs.
2. During the 2 months of the year that they are above the ground, they have to have protection against predators. This toad can secrete a poison that irritates the mucous membranes of predators.
3. Desert toads are nocturnal to avoid the heat of the day.
4. Desert toads have a small, hard, crescent-shaped growth on their hind feet to help them dig burrows. This also gives them the nickname of the spade foot toad.
5. The toad survives on fat from its body during hibernation.

12. Western Diamondback Rattlesnake (*Crotalus atrox*)

RANGE: Arkansas, most of Texas and Oklahoma, the southern parts of New Mexico and Arizona, the southern tip of California, and the northern parts of Mexico's Chihuahua and Sonora.

HABITAT: Desert flats to rocky hillsides.

DIET: Carnivore: small mammals such as rabbits, rats, mice, and birds.

GESTATION: Gestation period of about 167 days, 10 to 20 young are born. The young do not stay with the mother for more than a few hours.

STATUS: Not listed by USFWS or CITES

ADAPTATIONS:

1. All reptiles possess a thick, scaly skin composed of keratin. This reptilian skin greatly reduces the loss of water.
2. Reptiles have slower metabolic rate than a similarly sized mammal. This means reptiles breathe less often, conserving water that would otherwise be lost.
3. Reptiles are ectothermic or cold-blooded. Since they do not have to maintain a constant body temperature, they don't eat as often as a mammal of comparable size. Therefore, they can survive on smaller amounts of food.
4. Western diamondback rattlesnakes may retreat to cooler areas during the day such as rock crevices or burrows.
5. The western diamondback rattlesnake's facial pits are highly sensitive to infrared radiation (heat) and serves as a direction finder in locating warm-blooded prey or predators.