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TOYOTA MOTOR MANUFACTURING, KENTUCKY, INC.

PRESENTS

THE LOUISVILLE ZOO BACKYARD ACTION HERO 2013 GUIDEBOOK 2014

THE DESERT

Welcome Future Heroes!

At Toyota Motor Manufacturing, Kentucky, Inc. (TMMK), we believe that protecting the environment is part of our mission to be a good neighbor across Kentucky. As we build cars in our plant in Georgetown, we are committed to protecting the environment, obeying the environmental laws, preventing pollution and continuously improving our processes. But the commitment doesn't stop there. It is everyone's responsibility to protect the environment.

Becoming a Backyard Action Hero is the first step in learning about how we coexist with the plants and animals that make up our environment. Once you have learned about some of the things in this book, you will be ready to take conservation action in your own backyard and beyond. Good luck!

Sincerely,

Your Friends at
Toyota Motor Manufacturing, Kentucky, Inc.

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What is a Backyard Action Hero?

A Backyard Action Hero – or BAH as they are called – is a kid or adult who is really into wildlife and habitats and is ready to take action to protect them. They think being "green" is cool, and they know that to really make a difference they not only need to learn, but they also need to act! BAHs care about animals and habitats in their own backyards as well as all around the world.

Since the Louisville Zoo is a great place to learn about all kinds of plants and animals, we'll share what's going on there and introduce some of the Zoo's real life conservation heroes!

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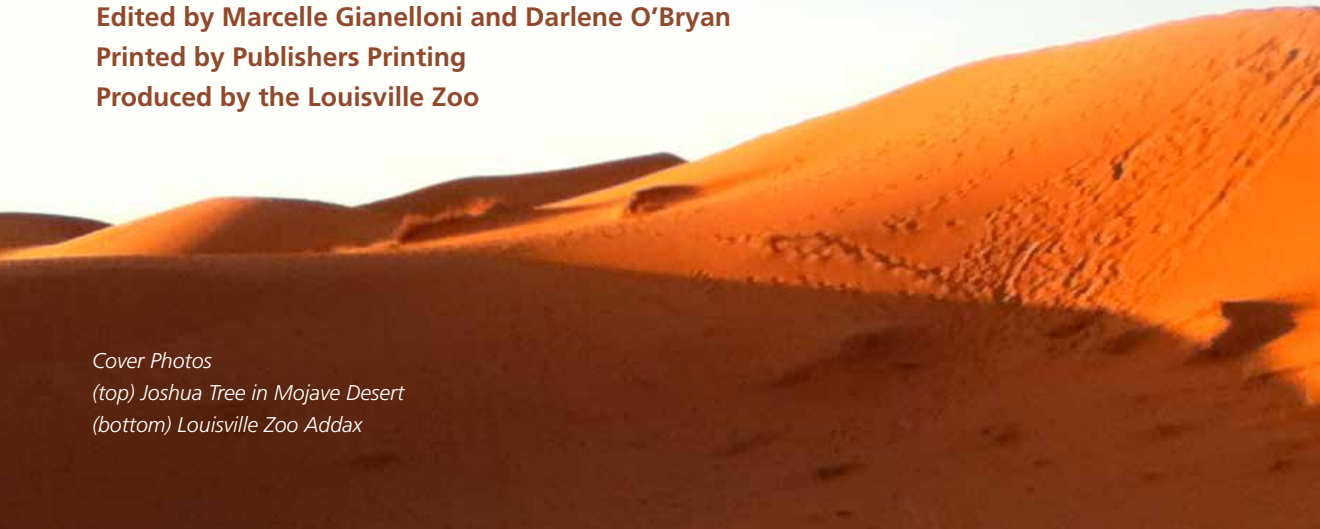
Printed by Publishers Printing
Produced by the Louisville Zoo



Cover Photos
(top) Joshua Tree in Mojave Desert
(bottom) Louisville Zoo Addax

An Introduction to Deserts

Sidewinder tracks in Death Valley, California

We are going to start this edition of Backyard Action Hero with a question. If you had to name what you think is the most remote and lifeless ecosystem on the planet, where would that be? If you said "the desert" you might be right on some accounts, but you may be wrong on many others. Considering that 40 percent of the Earth's population lives in marginal rainfall areas, it's hard for the Backyard Action Hero to ignore the role of deserts on our planet. This issue will take us on a journey across our planet's deserts.

The deserts of the world cover approximately 30 percent of the Earth's land surface. There are several ways to define a desert. One definition is that a desert is an area where the evaporation exceeds precipitation on a yearly basis. Backyard Action Heroes may recall our discussion of the water cycle in an earlier issue. (Past issues are available on our website at LOUISVILLEZOO.ORG/BAH.) Another definition states that any area that gets less than 10 inches of precipitation in a year is considered a desert. Deserts can be found on every continent. There are deserts in the tropics, in temperate areas and even in some of the coldest regions of our planet.

First, let's dispell some of the misconceptions people have about deserts. Many people have an image of the desert as always being hot, dry and consisting of blowing sand dunes. While this may describe some deserts, the vast majority are not like that at all. Many desert regions are far from being the barren wastelands that people imagine. Many desert regions are biologically diverse containing a variety of plants and animals that are well adapted to life in harsh desert conditions. The diversity of deserts goes far beyond just camels and cactus. While these are good examples of species adapted to life in the desert, and we will look at some of their special **adaptations**, many other interesting species make their living in the extreme conditions of the desert.

As with many of the ecosystems we have discussed in past Backyard Action Hero publications, it is always good to start with describing the **abiotic** (non-living) factors

Cactus Bloom

that influence what can live in an area like a desert. We've mentioned the lack of moisture – less than 10 inches of precipitation in a year. Temperature is also very important. Daytime temperatures in some deserts can reach 120+ degrees, yet at night it might approach freezing. Some deserts, like the Gobi Desert in Asia or the dry valleys of Antarctica are actually considered cold deserts, and may only warm up during the summertime. Creatures living in the deserts have to be able to deal with extremes in temperature, sometimes all within a single 24 hour period.

Lack of moisture, along with lack of nutrients and extremes in heat, mean that the soils of the desert are not real conducive to growing many types of plants.

The one type of plant that everyone thinks of when discussing the desert is the cactus. While cacti are not exclusive to the desert, they are well adapted to life there. Cacti can commonly be found in some of the deserts of the southwestern U.S. and northern Mexico.

Backyard Action Hero's might remember when we discussed the deciduous forest trees found here in Kentucky. We brought up that they have broad leaves that give off a lot of moisture.

Do you think broad leaves on plants living in the desert would be a good thing?

Broad leaves would not be a good idea if you were a plant living in the desert. The leaf structures of many desert plants are very different, and in some cases non-existent. In the typical cactus, the leaves are reduced to needle-like structures. Being needle-like in shape means less moisture is given off by the plant.

You may also have noticed that the stem is green. This is because the photosynthetic function of the plant has moved from the needle-like leaves into the stem. The stem may also have a folded or pleated shape to it. It can often be described as being accordion-like shape. This allows for the plant to expand and hold more water when the rains do come. The stem also has a waxy coating to it, which helps avoid water loss from within.

If you have ever tried to transplant a cactus at home, you probably were surprised by the thin shallow roots they tend to have. These thin, shallow roots allow the cactus to soak up water as quickly as possible. Most of the water evaporates off the hot surface of the ground very quickly and has little chance of soaking in very deep.

One other interesting adaptation that can be found in many desert plants is that they have the tendency to give off chemicals that keep other plants from growing near them. You might ask why? By keeping others from growing nearby, the plant has less competition for any water that becomes available. A plant that does this is said to be **allelopathic**.

All these adaptations are what help desert plants deal with the extreme conditions that they have to face on a daily basis.

Prickly Pear Cactus

ACTIVITY

INDOOR DESERT
Planting a Cactus

Caring for a cactus is easy. Follow these steps to bring a little of the desert inside.

What you will need:

- ☐ A small clay pot, unglazed with draining holes *(tip: pick the smallest size possible to fit your cactus plant)*
- ☐ Cactus plant *(tip: common ones for indoor planting include Pincushion, Chin Cactus and Prickly Pear)*
- ☐ Cactus potting mixture *(tip: can't find cactus potting soil? No problem. Just use 2 parts potting soil and 1 part sand or perlite)*
- ☐ Small pebbles, rocks or broken clay pot pieces for drainage

Steps

1. Cover the bottom of the pot with pebbles or other drainage material.
2. Fill the pot about one-third full with the potting mixture.
3. Carefully remove the cactus from its original container. *(Tip: The spines of the cactus will penetrate gardening gloves. Instead, fold newspapers into a circular band to create a barrier between your hands and the cactus plant.)*
4. Place the cactus in the middle of the pot and fill in around it with potting soil leaving about two inches from the potting soil to the top of the pot.

Caring for Your Cactus

1. Water the cactus once a week. During the winter, you might need to water it more often. To determine if your cactus needs water, put your finger about ½ inch into the soil and if it's dry – it needs water.
2. Water the cactus just until the water begins to drain out the bottom.
3. Sunlight, sunlight, sunlight – be sure to sit your cactus in an area that gets a lot of sunlight.

Animals in the desert also have to deal with the extreme temperature and lack of moisture. There are several strategies to deal with this. Camels have some interesting adaptations for life in the desert. Here to talk a little about the camels at the Zoo is keeper ADAM CAMPBELL.

When I say the word camel, what is the first thing that comes to mind? Most people would say "hump"! A camel's hump is one of many adaptations that enables them to survive in a desert habitat. The hump is filled with fat, "NOT WATER," that a camel can convert to water in times of drought. Healthy, well-fed camels like ours at the Zoo have firm humps that stand almost a foot above their back and can weigh almost 80 pounds! Camels also have feet that act like snowshoes and enable a camel to walk across loose sand without sinking into it. They also have long eyelashes and can close their nostrils during sandstorms to prevent sand from getting in their eyes and nose. In addition, they have specialized kidneys that prevent water loss, meaning they have lower concentration of water in their urine. Camels can also pull almost all the moisture out of the plants they eat so their droppings are very dry. Did you know that camel droppings are so dry they have been used to help start fires by people for centuries? Camels can go without water for 4-5 days during the hottest times of the year. When they do find water, they can drink 2.5 to 5 gallons of water in a minute. A really thirsty camel can drink up to 26 gallons of water in just 10 minutes. Camels in cold deserts are resourceful too and will eat small amounts of snow to stay hydrated.

There are two types of camels: Dromedary and Bactrian. Dromedary camels come from the hot deserts of Africa and the Middle East and have one hump. They have light colored

"Did you know that camel droppings are so dry they have been used to help start fires by people for centuries?"

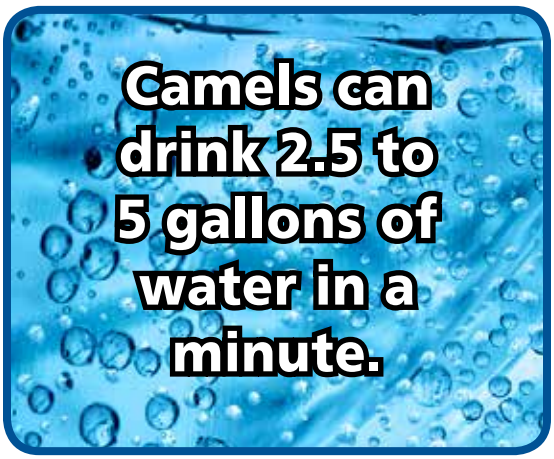
coats that don't absorb heat keeping them cool. They also have elbow and knee pads that keep their bodies off the hot sand when lying down. Two Dromedary camels live at our Zoo: Olivia and Amos.

The other species of camel is the Bactrian camel. Bactrians have two humps. They come from the Gobi Desert where it gets extremely cold. Bactrian camels will grow a long, shaggy, dark coat. The Zoo's other camel, Petey, is a hybrid camel that is half Dromedary and half Bactrian, meaning he has a body of a Dromedary and the size and coat of a Bactrian. If you come to the Zoo in the winter you will see that Petey grows a large shaggy coat to stay warm.

Louisville zookeepers like me help the camels deal with the heat in the summer and cold in the winter. In the summer, we brush the camels to help remove their winter coats so they don't overheat, and we also give them a mud wallow to lie down in to cool off. The camels also have several water bowls that fill up automatically so they always have fresh water. The male camels enjoy a nice cool bath with the water hose when it's really hot. In the winter, the camels can come inside their barn where we keep the temperature around 70 degrees. We also put wood shavings on the floor in their sleeping areas to provide extra insulation.

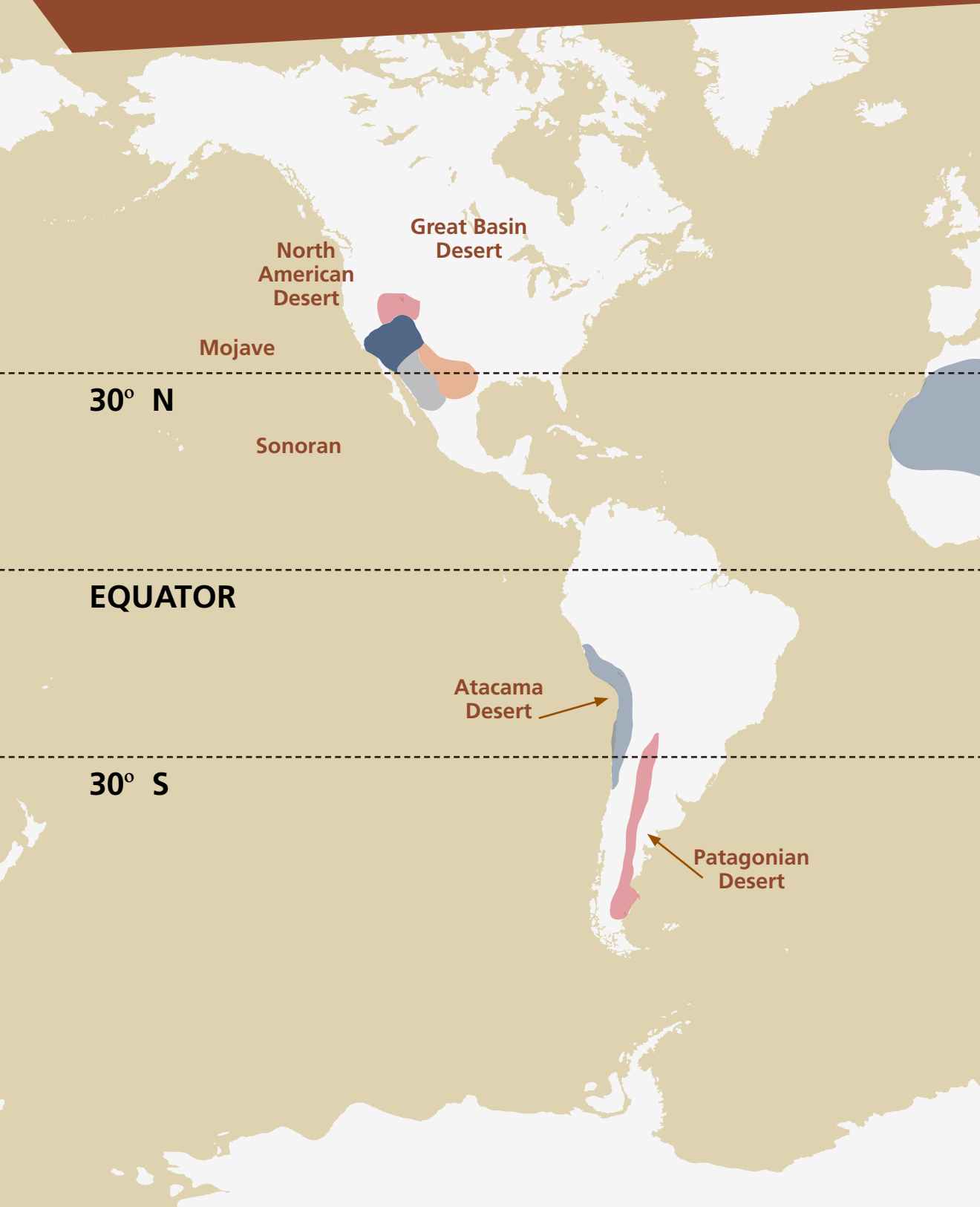
Camels are one of the best species for living in the harsh waterless desert environments. Whether it is the sweltering heat of the Sahara Desert, or the frozen Gobi Desert, camels can survive where most other large mammals cannot!

Thanks Adam, we will take a little more time observing the camels next time we are at the Zoo!



Noteable Deserts

Deserts tend to line up near the 30º latitude lines.



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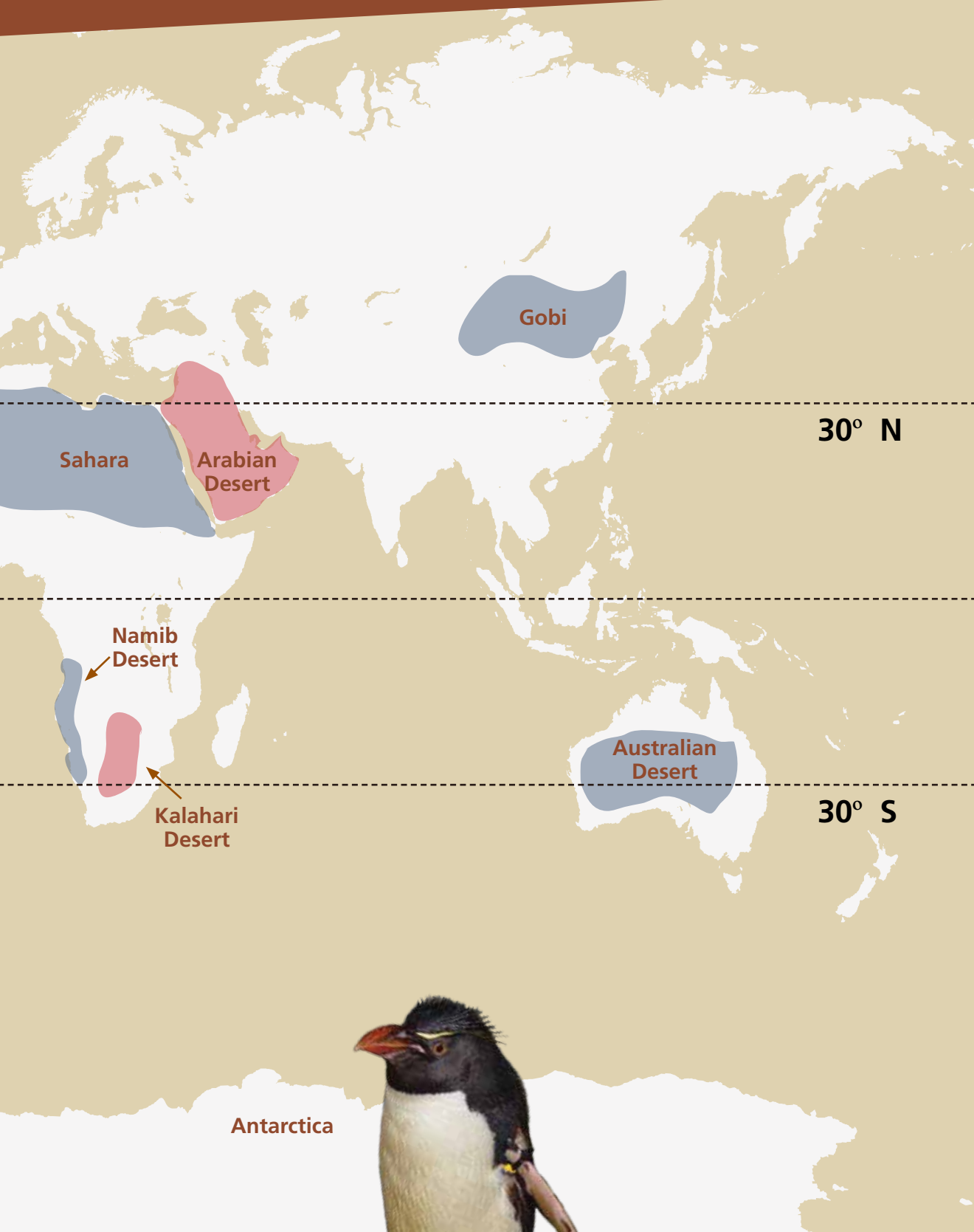

Gobi
Sahara
Arabian Desert
30° N
Namib Desert
Australian Desert
Kalahari Desert
30° S
Antarctica

Did you know that there are areas on earth that are referred to as "cold" deserts? These areas are deserts not because of hot temperatures, but because of the lack of precipitation. There are actually places in the Arctic and Antarctic that get as little as five inches or less of precipitation in a year. Even the Tundra, which we discussed in an earlier Backyard Action Hero publication, gets less than eight inches of precipitation annually. We tend to think of snow in these areas, but when scientist measure precipitation, they are only concerned with the amount of melted precipitation. Did you know that on average, 10 inches of snow melts down to only one inch of water? So places in the Arctic can get 50 inches of snow in a year, but that only melts down into five inches of water. This is drier than many of the desert areas of the southwestern United States and northern Mexico. In fact, there are places in the interior of Antarctica where it is estimated that there has been no precipitation for several million years. This might explain the lack of animal and plant life in many of these areas.

There are several ways that animals can deal with life in the desert. For those that can't take the heat of the day, it is a good idea to move around at night. This is known as being nocturnal. Mammals tend to be nocturnal since they can maintain a warmer body temperature. For those that can't deal with the cold of the night, being diurnal, or moving around during the day is an option. Many reptiles tend to be diurnal. For those creatures that can't tolerate either extreme heat or cold, activity may take place at dawn and/or dusk. These

(Background) The Sun beats down in Sahara Desert, Morroco

(Top) Zebra-tailed Lizard in Death Valley, California

(Bottom) Ravens in Death Valley

animals are said to be **crepuscular** in nature. In Kentucky, deer tend to be crepuscular. Desert soils are not very rich in nutrients and are generally made up of a thin layer of sand and gravel. Some creatures depend on this thin layer to create burrows which can be used to avoid the heat of the sun or the cold of the night. The Desert Tortoise in the southwestern United States actually acts as a **keystone species**, by creating burrows that many other species utilize throughout the day. A few examples of creatures that will use these burrows are snakes, amphibians, tarantulas, burrowing owls and small mammals.

One of the biggest problems for desert regions is disturbance by all-terrain vehicles. These types of uses of the desert by humans lead to the breaking up of the soil and thus erosional problems when winds and rains do come.

While deserts may seem like very harsh environments, they are also very fragile.

While deserts may seem like very harsh environments, they are also very fragile. The slightest disturbance of the thin desert soil can create many problems for the creatures living there. Some desert animals are facing endangerment and potential extinction, not only from habitat destruction, but issues with poaching.

Along with deserts not being very resilient when dealing with disturbances, the nature of their soils makes them poor places for agriculture.

ACTIVITY

Dealing with Desert Heat

Materials needed:

- ☐ 2 pieces of cardboard (Approximately 8 ½" X 11")
- ☐ Pencil, scissors
- ☐ 2 thermometers

Procedure

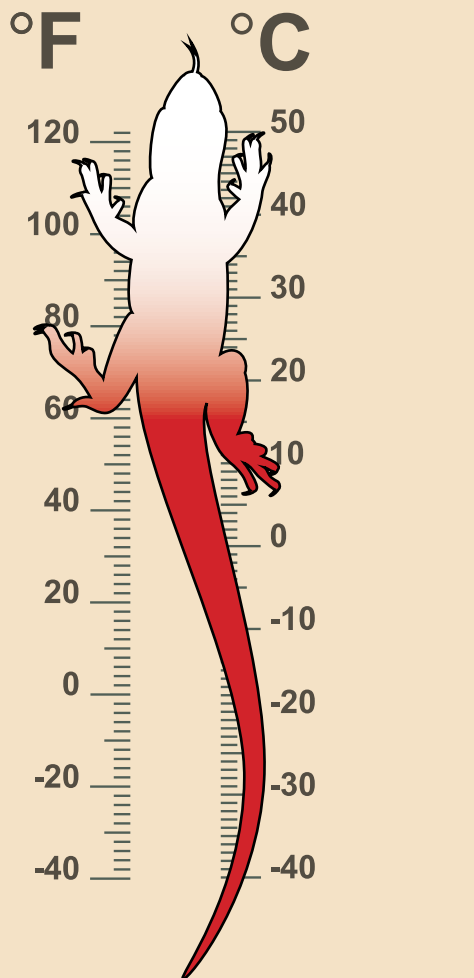
Draw a lizard on each of the pieces of cardboard. Make each as large as you can on the space available. Cut them out. Tape the thermometer on the lizards (one on each). Place one lizard outside in a sunny location. Place the other in a shady location. After about ½ hour check the temperature readings and record.

The purpose of this experiment is to get an idea what it would be like for a creature living in the desert, having to deal with a lot of direct sunlight. It also might help to consider the following:

How might a desert animal warm itself up if it needed to, or how might it be able to cool down?

How would reptiles and mammals differ in their needs related to heat in the desert?

Where might creatures in the desert go to seek sunlight or to seek the shade?



Here to talk about the endangered Addax Antelope that can be found at the Louisville Zoo, is long time zookeeper SILVIA ZIRKELBACH.

Addax antelope are a rare species well-suited for life in their home range of the Sahara Desert. In the wild they eat grasses and rarely drink water. Scientists believe they have a special lining in the stomach that stores water. The hooves of addax have two toes on each foot, like a cow, and their hooves are wide and flat to help them walk in sand. Light hair coat helps reflect sunlight to keep cooler.

At the Louisville Zoo, we feed the addax pelleted grain and orchard grass. We offer water, but they seldom drink. The yard has become grassy over the years, so we add sand areas which they often lay in. They also have a barn for shelter because the Louisville climate can get cold and rainy or snowy.

The addax exhibit has one male and two females. Both sexes have horns and the shape and length of the horns can often be used to identify individuals. We hope that later this year they will have babies. We would be helping to increase the population managed in zoos. Some zoos are involved in returning animals born in managed populations to their wild habitat.

Thanks Silvia, that was some great information!

The natural desert regions of the planet can be home to a diverse population of species. Desert areas are actually increasing all over the world. Unfortunately, these are not always natural deserts that are being formed. Images of wind-blown sand and lack of vegetation that many associate with deserts are a result of thousands of years of land misuse, bad agricultural practices and more recently, global warming. Areas such as these are increasing through a process known as **desertification**. Backyard Action Heroes can help by learning more about desert ecosystems, by educating others about deserts and the intricate relationships between the plants and animals that live in these areas, by protecting them and by being more respectful towards this ecosystem.

Desert Food Web Graphic

The arrows represent the movement of matter and energy from one population to the next. *(Example, the hawk eats the rabbit to obtain its matter and energy so the arrow is moving toward the hawk.)*

ACTIVITY

Desert Survival

This is a fun activity to do with a group of friends and or family members.

Suppose you found yourself broken down in the middle of the desert. Your jeep isn't going anywhere and you know that you will have to hike out to survive. There are a number of items in your vehicle, but there is no way you can carry everything with you and you have no idea how long it might take you to reach safety. This could take days.

Assume each person is actually on their own in the desert – alone – you are not there in a group. You have to pick 10 items from the list below to take with you to help you survive in the desert. You can only pick 10. After picking your items carefully, sit down and have a group discussion as to why each person picked what they did and why they may have not chosen certain items. This can make for an interesting conversation. Some items will obviously be more useful than others. There are no real "right" or "wrong" answers, but people's reasoning may be very different and interesting. *(Some things to think about: What might be the benefit of one item over the other, or what might be the pitfalls of one item over the other? Example: Sandals vs. Boots?)*

HAVE FUN!

CHOOSE 10 FROM THE CHART

Clothing	Gear	Food
Long-sleeve white cotton shirt	Matches	Ramen Noodles
Sleeveless black shirt	Charcoal	Potato Chips
Long light-colored pants	Flashlight	Granola bars
Dark-colored shorts	Compass	Chocolate Bar
Hiking Boots	Cotton Sheet	Water bottle (full)
Sandals	Plastic Sheet	
Winter hat	Umbrella	
Wide Brimmed Sun hat	Sleeping Bag	
Bandanna	Pocket Knife	
Winter Gloves	Rope	
Heavy Jacket	Sunscreen	
Sunglasses	Insect repellant	
	Toothpaste	
	Soap	

Vocabulary

ADAPTATION

A feature or behavior that helps an organism survive in its particular ecosystem

ABIOTIC

Non-living factors in an ecosystem that influence life there (Example: temperature, precipitation or wind)

ALLELOPATHIC

The giving off of chemicals by a plant to prevent other plants from growing near them or to repel insect predators

CREPUSCULAR

Active at dawn and/or dusk

DESERTIFICATION

The converting of areas of grasslands, forests etc., over time, into "desert-like" areas through human activity

DIURNAL

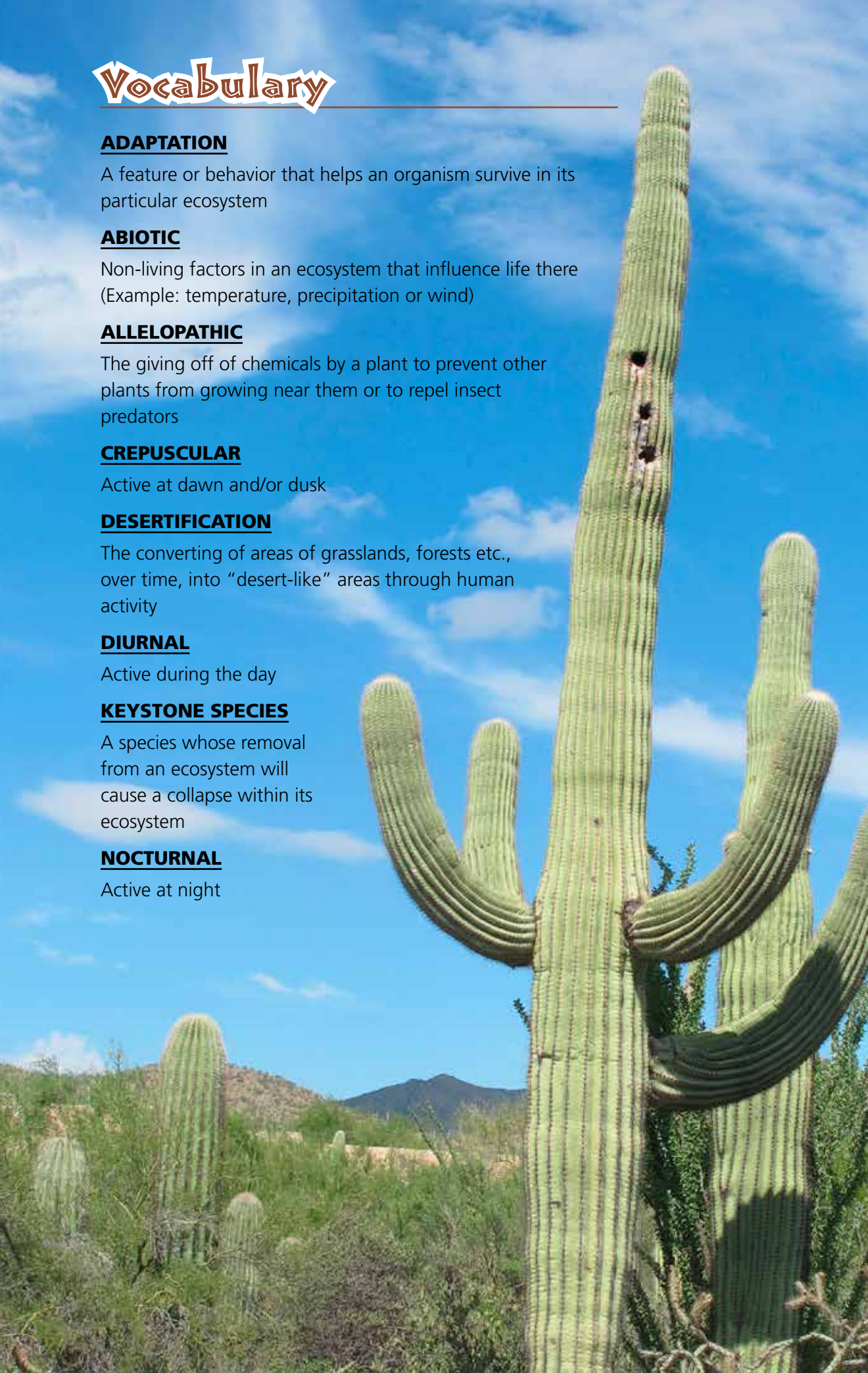
Active during the day

KEYSTONE SPECIES

A species whose removal from an ecosystem will cause a collapse within its ecosystem

NOCTURNAL

Active at night



Get Your Parents & Teachers Involved, Too!

The Louisville Zoo can be your partner in providing you, your family members and teachers with the knowledge and inspiration to be the future caretakers of nature and wildlife. Visit louisvillezoo.org/education for information about field trips, classes, camps, overnight programs, professional development and so much more.

Kentucky may seem like a long way from the desert, but your efforts do make a difference. There are lots of ways a BAH and his or her family can get involved in protecting our deserts and planet. Here are some more things YOU can do:

- Reduce, Reuse and Recycle
- Organize a cleanup day and pick up litter around your school or in a local park.
- Find ways to conserve and reduce your carbon footprint around your house. Turn off the water while you brush your teeth. Replace burned out light bulbs with compact fluorescents. Turn your thermostat up or down a couple of degrees (up in the summer, down in the winter.)
- Try to buy products made of recycled materials or that come from sustainable sources. Also choose to buy products with the least amount of packaging. That means there's less to throw away.
- Learn as much as you can about animals and their habitats and how to help protect and preserve them. The Louisville Zoo is a good place to start.

The Louisville Zoo, a non-profit organization and state zoo of Kentucky, is accredited by the American Alliance of Museums and by the Association of Zoos and Aquariums.