

Life in the Desert

ZOOGUIDES volume 6

TEACHERS NOTES



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INTRODUCTION

The ZooGuides™ series of software from REMedia provides a resource for K-12 teachers and librarians on life science topics. This Teacher's Guide offers suggestions, activities, and references for integrating the Life in the Desert ZooGuide into your curriculum. Other titles in the series include:

Butterflies of the World
Whales and Dolphins
Mammals of Africa
The Rainforest
World of Reptiles
Animals in Danger
Natural History of Yellowstone

Use this program:

- as an encyclopedic reference;
- to teach major biological concepts such as Evolution, Life Cycles, Classification, Biomes, and Ecology; and
- to understand and appreciate the intricate and fascinating ecology of the world's deserts.

What is in this Guide

The Life in the Desert Teacher's Guide offers suggestions for incorporating the accompanying CD-ROM into Life Science and Biology classes. These ideas are divided into two general levels, K-6 and 7-12. Feel free to adapt any of the activities to meet your specific curricular goals (eg, You may want to use a suggestion for a K-6 group that was written at a 7-12 level or vice versa).

In addition, this guide provides information on how to use the various sections of the program to complete activities, making the CD-ROM more useful than a mere reference tool. Read from a chapter, look at and listen to movies and use the chapters on the different groups of desert organisms to get a more complete picture of desert ecology.

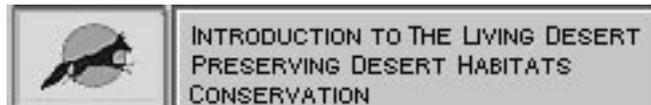
Finally, use this Teacher's Guide as a quick reference for the data provided in the ZooGuide. A list of helpful reference materials is provided so that your students can do more in-depth research once the program has sparked their imagination and interest.

USING THE LIFE IN THE DESERT ZOOGUIDE

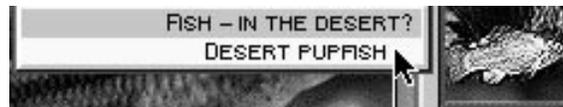
Navigating

The buttons on the left and right hand sides of your screen represent chapters of the Life in the Desert CD-ROM disk.

1. Place your mouse pointer over a chapter button to highlight the name of that chapter. When your mouse pointer is placed over the current chapter button, a list of subtopics will appear.



2. Click on the subtopic you are interested in and the CD-ROM will access that section of the current chapter. Many of the chapters' sections contain more than one page of text. Click on the left and right arrow buttons at the bottom of the text box to navigate through these pages.



3. To choose a different section in the current chapter repeat steps 1 and 2 above.
4. To choose a different chapter move your mouse pointer over the chapter you wish to visit, and click once on the chapter button.

Chapter topics have text and accompanied by a movie, animation, or still pictures and narration.

Playing Movies/Animations

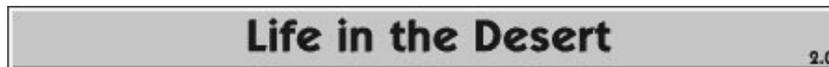
To run the movie, click inside the movie window once then press the play button located under the movie window. Use the other buttons to control the volume, to pause, or to jump forward or backward in the movie. To exit the movie simply click on the movie window again.



Viewing Photographs and Maps

In addition to movies and animation there are photographs and maps that can be viewed in one of two modes in this ZooGuide. When you click on a map or photograph it will enlarge to fill the screen. This allows closer study and more detail in the image and in the case of some maps, allows you to view pictures by clicking on a camera icon. To return to the smaller view of the picture or map, click on it again. You can print any map or picture when it is enlarged by clicking on the print button at the bottom left of the screen.

Getting Help



There is on screen help available in the ZooGuide. To access it, click on the title bar at the top of the screen. Click on the same area again to return to the program.

Other Buttons

There are four other buttons in the viewing window. They allow you to:



Print the text or graphic on a page. If a photo or painting is enlarged it will be printed. If the photo or painting on a page is not enlarged, the text for that page will be printed. If you are on a quiz page, clicking the print button will print a copy of the quiz for that chapter.



Access the index for Life in the Desert



Take a quiz for the current chapter



Exit the program.

Click once on one of these buttons to activate it.

INTEGRATING PARTS OF THE ZOOGUIDE

The Life in the Desert ZooGuide has three zones of student-program interaction. They can be used singly or integrated to create more in-depth explorations of the program. For example, if students are learning about desert iguanas and you want to see a map of where in the USA and Mexico the deserts are located you could go to the Map chapter and select the North America section. This provides more in-depth information than if you use only one part or the other of the ZooGuide. It also provides a context for launching into additional research using references listed at the end of this Teacher's Guide.

K-6 classes may want to use the parts of the program individually especially with younger students, increasing the integration with more interested or older students. The pictures, movies, and animation are probably the most useful parts of the program at this level. They provide interesting facts and attention grabbing footage.

7-12 classes can explore the chapters, text, graphics and individual species information separately or together depending on your focus. The activities included in this guide give other examples of how to integrate the parts of the ZooGuide to create projects and lessons that will motivate your students. It also provides suggestions for integrating Life in the Desert into your Life Science or Biology curriculum.

ACTIVITIES FOR K-6 TEACHERS

This section of the Teacher's Guide offers 15 activities and ideas for integrating the Life in the Desert ZooGuide into your life science curriculum. The activities range from having a debate to making maps of the world's deserts.

Each activity lists the topic covered, the sources of information it will use, materials you will need, a step-by-step description of the activity, and discussion questions to help you conclude and find out what your students have learned in the process. Modify, delete, or edit these activities to tailor them to your specific needs. Also look at the 7-12 activities for other ideas and ways to use the ZooGuide with your students.

K-6 Activity 1:

TOPIC: Picture Search

SOURCES: Desert Pictures folder on CD
Magazines with desert pictures

MATERIALS: Paper
Pen or pencil
index cards

ACTIVITY: In this activity students will explore and become familiar with the Life in the Desert ZooGuide by matching pictures of animals, plants and geographical features to images in the program.

To prepare for this activity, you will need to print pictures of plants, animals and scenes from the Desert Pictures folder on the CD. In addition, you may want to add pictures that you find in magazines for students to identify. Once you have gathered enough pictures (~ 10 per group) paste them on index cards and give a packet of them to each group with instructions to try to match them with pictures found in the ZooGuide.

Once students start finding matches, have them write on the index card the name of the place, animal, or plant pictured. When they have found all or most of them, you can use the cards as flash cards for later review.

This activity is a good introduction to the ZooGuide for students because it requires them to use all the features of the CD to find the names of the pictures you have supplied to them. They should now be comfortable with using the various buttons to navigate and play movies.

Once they have finished labeling all the cards they can group them by type (e.g., put all the reptiles together, group all the animals that live in one type of desert, etc.)

DISCUSSION: Once students have completed this activity you can discuss the following as a group.

1. Which picture was the hardest to identify? Why?
2. Do you feel comfortable using the ZooGuide now? (If students answer no, give them another activity to do such as finding answers to questions, or give them a guided tour of the ZooGuide.)
3. As you were finding pictures, what interesting facts did you learn about deserts?

K-6 Activity 2:

TOPIC: What is a Desert?

SOURCES: Introduction — What are Deserts? chapter in Life in the Desert ZooGuide
References listed in this Guide

MATERIALS: Paper
Pen or pencil
Markers, colored pencils, or crayons

ACTIVITY: In this activity student will make a list of the features of a desert. They will then make drawings based on this list.

Begin this activity by asking students what they would find if they were in a desert. Make a list of their suggestions on the blackboard or overhead projector. They should include plants, animals, and physical features. If they know the names of some deserts, add these to the list as well.

Ask them if they know what defines a desert. They may come up with a variety of answers for this, but the only real definition of a desert is the amount of precipitation it receives during the year (less than 10 inches).

Look at the movie in the What are Deserts? section of the Introduction chapter of the ZooGuide to compare your list of desert characteristics with those contained in the program. Add any significant features that your list doesn't contain.

Students can now make a drawing of a desert based on their descriptions of the components of one. They can work in groups or individually. They could use pictures from the program to add to the picture or cut out pictures of plants and animals from magazines. They can also label the animals and plants that they include. Hang the pictures around the room or on a bulletin board.

DISCUSSION: Once students have created their deserts get together and discuss the activity with the following questions.

1. What kinds of plants live in a desert?
2. Why are deserts so dry?
3. What kinds of animals live in the desert?
4. Do people live in the desert?

K-6 Activity 3:

TOPIC: Weathering

SOURCES: Introduction — Desert Sculpture chapter in Life in the Desert ZooGuide
References listed at the end of this Guide

MATERIALS: Sand, clay dirt, water
Cardboard

ACTIVITY: In this activity students will recognize the agents of erosion and weathering that shape the desert landscape. Look at the Desert Sculpture section of the Introduction chapter in the ZooGuide and the 5 subsequent sections. Watch the movies and read the information. Make a list of the types of weathering that occur in the desert (wind, water, minerals, etc.).

Now that students are aware of the types of erosion that occur in the desert, you can conduct an experiment to show how they work to change the landscape. Use sand, water, and dirt in this experiment.

First make a muddy basin to represent the desert floor just after the winter rains. Mix a little water with some clay dirt and spread it on a piece of cardboard. Place the cardboard on the window sill for a few days in direct sunlight. What happens to the mud as it dries? Does it look like the pictures shown in the ZooGuide?

Next, take some sand and place it levelly in a box (to prevent it from flying around the room). Have students blow on the sand to simulate the wind. What happens to the sand? What happens if two or more students blow from different directions at the same time? Can they create some of the patterns seen in the sand dune pictures shown in the ZooGuide? How do they make them? (**A safety tip:** make sure students doing the blowing are wearing protective eye wear to prevent sand from getting in their eyes.) Ask students to come up with other ways to simulate desert weathering processes such as leaching salts and minerals.

DISCUSSION: Now that your students are familiar with weathering processes, discuss the following.

1. Name 3 kinds of weathering processes in the desert.
2. How does sand form in deserts? Does it form in the same way on beaches?
3. Is weathering limited to deserts? Where else do you think that erosion happens?

K-6 Activity 4:

TOPIC: Naming Desert Organisms

SOURCES: Ecology — Desert Ecosystems chapter in Life in the Desert ZooGuide
Species Index in Life in the Desert ZooGuide

MATERIALS: Paper
Pen, pencil

ACTIVITY: In this activity students will familiarize themselves with some of the organisms that live in the deserts of the world.

Begin by asking students to list animals and plants that live in the desert. Write their answers on the blackboard.

Next, open the Desert Ecology section of the Ecology chapter in the ZooGuide and ask students to identify the organisms shown in the movie. If they don't recognize a creature they can use the Species Index (buttons on the right side of the screen) to look up different animals and plants.

They can work in groups or individually to find the name of each organism. Once they have completed the list, they can compare to make sure everyone agrees on the names. If there are any discrepancies, check them again paying attention to the details of the animal or plant pictured.

The list of organisms shown in the Desert Ecology section are:
1) Palm trees, 2) Gila topminnows, 3) Prairie dogs, 4) Saguaro cacti, and 5) Prickly pear.

DISCUSSION: When your students have found all of the organisms in the movie, they can discuss the following.

1. What types of organisms are found in the desert (e.g., frogs, fish, mammals, reptiles, flowers, trees, cacti, insects, etc.)?
2. Which type of animal that lives in the desert surprised you most? Why?
3. Based on your list of animals and plants that live in the desert, is life in the desert diverse? Why not?

K-6 Activity 5:

TOPIC: Desert Features

SOURCES: Ecology — Arroyo, Sand Dunes, Playas, Seeking Shelter, and Oases chapter in Life in the Desert ZooGuide
References listed in this Guide

MATERIALS: Cardboard
Sand
Rocks
Clay
Paper maché

ACTIVITY: In this activity students will construct replicas of desert environments based on the features described in the ZooGuide. To make this activity more realistic, students could choose a specific desert on which to base their model.

Begin this activity by reviewing the features of a desert as represented in the Arroyo, Sand Dunes, Playas, Seeking Shelter, and Oases sections of the Ecology chapter of the ZooGuide. Students can make drawings of these physical shapes as they watch. They can then design, on paper, a layout for an imaginary desert which contains two or more of these structures. Alternatively, they can select a specific desert mentioned in the Maps chapter and make a replica of it.

Students can work in groups and use the materials listed above and any additional materials that they will need to make models of plants and animals to include.

Once the models are complete, students can label the arroyos, playas, sand dunes, and oases that they have included in their desert.

DISCUSSION: As a group you and your students can discuss their models and answer the following questions.

1. Does your desert provide shelter from the sun for animals and plants? How?
2. If you included sand dunes, what kind did you use? Why? What kinds of wind produce these dunes?
3. How many of the deserts have oases? Where does the water for them come from?

K-6 Activity 6:

TOPIC: Research Paper

SOURCES: Ecology — Interrelations of Flora and Fauna chapter in Life in the Desert ZooGuide
Species Index in Life in the Desert ZooGuide
References listed in this Guide

MATERIALS: Paper
Pen or pencil
Pictures of desert flora and fauna

ACTIVITY: In this activity students will research the intricate relationships between plants and animals of the desert.

The desert is a harsh environment. In order for plants and animals to survive, they must rely on each other for food, water and shelter. This reliance creates multifaceted relationships between different organisms and an ecosystem that is easily disrupted.

Before students start writing the research paper, they should read and watch the information presented in the Interrelations of Flora and Fauna section in the Ecology chapter of the ZooGuide. They should choose one of the organisms mentioned in this section or one that they are interested in as the topic of their research. Suggested organisms include: Cactus wren, pronuba moth, woodpecker, dung beetle, and harvester ant.

Next, students should look up their organism in the Species Index (buttons on the right side of the screen) or the Index (the button with an I on it) to find out more about them. Once they have gathered all the information they can from the ZooGuide, they can use references such as those mentioned at the end of this Guide.

Their research should answer the following questions:

1. What other animals and plants does this organism rely on?
2. What organisms does it compete with for food, water, and shelter?
3. What would happen to this organism if a plant/animal that it needs was destroyed?

Students can present their findings in a paper accompanied by diagrams or drawings showing the interrelationship between organisms. They can also give oral presentations to the class.

DISCUSSION: Check what your students have learned about species interrelationships by discussing the following.

1. Why do plants and animals of the desert need each other so much?
2. What are the advantages to plants and animals of "helping" each other?
3. Where could you find out more about the complex relationships between plants and animals of the deserts?

K-6 Activity 7:

TOPIC: Mapping Deserts

SOURCES: Maps chapter in Life in the Desert ZooGuide
References listed in this Guide

MATERIALS: Enlargement of a world map
Markers, colored pencils, crayons
Ruler
Scissors
Glue
Magazines (with pictures of deserts)

ACTIVITY: In this activity students will map the deserts of the world and discover that they are located in similar latitudes.

Begin this activity by viewing the information presented in the A Global View section in the Maps chapter in the ZooGuide. It shows where the world's deserts are located.

Hand out black line drawings of world maps for each group or individual student. Label the Tropics of Cancer and Capricorn if they are not already labeled. Label the equator as well. Begin drawing the outline of each desert region on earth in pencil. When all of the deserts are outlined, look up each one and label it on the map.

Students can color code their maps and make a map legend that shows the code. (eg, Students could use yellow for deserts, green for forests, gray for mountains, and brown for plains, etc.) Then color each region following the codes.

Students can cut out or print pictures of desert organisms from the ZooGuide to include on their maps. They can also include organisms typically found in other land regions.

DISCUSSION: Once students have completed their maps they can display them and discuss the following.

1. What do you notice about the locations of the worlds deserts?
2. Why are most of them located on the Tropic of Cancer or Tropic of Capricorn? Are there any exceptions? What are they?
3. What type of land tends to be on either side of a desert? Why?

K-6 Activity 8:

TOPIC: Desert Drawing

SOURCES: Maps chapter in Life in the Desert ZooGuide
References listed in this Guide

MATERIALS: Paper
Markers, colored pencils, crayons
Scissors
Glue or tape

ACTIVITY: In this activity students will compare a drawing of a desert to a photograph of it.

Begin by asking students to choose one of the deserts mentioned in the Maps chapter of the ZooGuide. They can go to that desert and view the pictures or movie pertaining to it. They should then look up any of the plants or animals mentioned as living there and research them in the Index or Species Index.

Once they have seen all the pictures of that specific desert, they can make a drawing of it. They should include details like sand dunes and other physical features, plants and animals found there, and any people who inhabit this desert. (Some deserts are almost barren of life, but have interesting physical features.)

Next, students can do some research to find pictures of this desert. Make copies of one or more of them, cut them out, color them if necessary, and paste the picture on a piece of paper.

Students can place both the drawing and the real picture on the bulletin board, but not together. Then other students can try to guess which drawing goes with which photograph. Students can use string to connect the matching deserts. They can place labels on the strings that tell the name of the desert and where it is located.

DISCUSSION: After students have compared pictures they can discuss the following.

1. What features did you use to identify each desert?
2. Which desert was the most difficult to match? Why?
3. Which desert was the easiest to match? Why?
4. Did any of the deserts resemble each other? In what way?

K-6 Activity 9:

TOPIC: Desert Debate

SOURCE: Impact chapter in Life in the Desert ZooGuide

MATERIALS: Paper
Pen or pencil
Poster paper
Markers, colored pencils, crayons

ACTIVITY: In this activity students will list how humans use deserts, the pros and cons of our use, and debate an issue related to desert use.

Begin this activity by asking students to make a list of the ways they think humans use deserts. The list can include things such as raw materials, recreation, grazing, etc. Once students have run out of ideas they can look at the information provided in the Impact chapter in the ZooGuide.

Discuss as a whole class the pros and cons of this land use.

1. Are some things better than others?
2. What do your students think is the greatest threat to desert ecosystems today?
3. How can people use the deserts without destroying them?

Use the chart on the following page to organize this information and begin developing ideas for a debate. Divide your class into two groups (Pros and Cons), and choose one of the issues presented in the ZooGuide as the subject for your debate. Ask students in each group to develop arguments for or against this issue depending on their group's designation as the Pro or Con group. Use the data in the chart to help support points and contradict what the opposite team says.

You can act as moderator for the debate. You may want to present the debate to another class and have them vote on which side won the debate. Alternatively, you can judge which side made the stronger case, give students feedback on how to improve their arguments, and present the debate in its improved form to another group of students. A third possibility could be to assign no judgment, but simply allow your students to explore the strategy of a debate as a way to sharpen their skills as orators and thinkers.

DISCUSSION: You can wrap-up this activity by discussing (or debating) the following.

1. Is all use of deserts bad? Why, why not?
2. Why did your class choose the issue they did? What is its significance to them?
3. What could happen if people continue to use deserts without regulations or protection for specific species?

IMPACT DEBATE CHART

Name:

Date:

Issue	Pros	Cons
1.		
2.		
3.		
4.		
5.		
6.		
7.		

K-6 Activity 10:

TOPIC: People of the Deserts

SOURCES: Impact — Who Lives in the Desert? chapter in Life in the Desert ZooGuide
References listed in this Guide

MATERIALS: Paper
Pen or pencil
Magazines with appropriate photographs

ACTIVITY: In this activity students will describe the typical life of native desert dwellers and compare their existence to life in a technologically advanced country like the USA.

Begin this activity by asking students if they can name some of the groups of people who live in deserts all over the world. They will probably know about the Navajos and Bedouins. Then introduce them to people like the Dogons of Mali and Aborigines of Australia with the Impact chapter in the ZooGuide.

To find out how these people have adapted to life in the deserts answer the following questions. Use the ZooGuide and other references to find the answers.

1. What kinds of clothes do desert dwellers wear?
2. What kinds of homes do desert people build?
3. What does nomad mean? Which desert dwellers are nomads?
4. Is life in the desert easy or difficult for people?
5. What do desert people eat?

Next, students can compare their daily lives with the lives of a group of desert people. How are they similar? How are they different? How do the differences reflect desert dwellers' adaptations to life in a harsh desert environment?

There are people in the Southwest USA who live in a desert environment, but they live the same way as your students do. They have fresh drinking water, shopping malls, swimming pools, plants and trees, and sometimes farms. What is the ecological cost of their occupancy of the desert?

DISCUSSION: Discuss the ideas presented in this activity as a whole group.

1. What did you learn about desert dwellers that you didn't know before?
2. Would you like to live in the desert without modern conveniences like air conditioning and fresh water?
3. How are Navajo traditions tied to the desert?

K-6 Activity 11:

TOPIC: Impact Letter

SOURCES: Impact chapter in Life in the Desert ZooGuide
Reference listing addresses of Washington DC representatives
Reference listing Bureau of Land Management address

MATERIALS: Paper
Pen

ACTIVITY: In this activity students will write a letter to their congressperson, state representative, or the local Bureau of Land Management office for information on the issues raised in the Impact chapter in the ZooGuide.

Begin by reading and viewing the information presented in the Impact chapter of the ZooGuide. What are the causes of damage and destruction to the desert ecosystems in the USA and the world? Make a list of the issues presented, discuss the pros and cons of each, and choose one or two as the basis for your letter.

Students can do some research to find out who their Congressperson or Senator is in the US government. If you live in a state with desert lands, you could write to your state government, again locating your representatives. A third possibility is to contact the Bureau of Land Management directly.

Once you and your class have decided who to write to students can begin composing a letter. It can contain some or all of the following, or you could make a list of the topics you want to address as a class.

1. Is this representative directly involved with the Bureau of Land Management?
2. Are there any bills before Congress pertaining to desert land use right now? What are they?
3. Request information on the Bureau of Land Management and its programs relative to the deserts.

DISCUSSION: Discuss the following when you have received an answer to your letter.

1. What are the current land use policies of the Bureau of Land Management for deserts?
2. What are their reasons for these decisions?
3. Do they match any of your pros and cons listed above? How?

K-6 Activity 12:

- TOPIC:** Exploring the Living Desert
- SOURCES:** The Living Desert chapter in the Life in the Desert ZooGuide
References listed in this Guide
- MATERIALS:** Paper
Pen or pencil
- ACTIVITY:** In this activity students will explore the Living Desert, a nature preserve in Southern California that provides a variety of experiences based on desert ecology.

Begin by passing out the handout on the next page which provides tasks and questions for students to answer as they view The Living Desert chapter in the ZooGuide.



Students can view the parts of the Living Desert by clicking on the maps shown in the chapter. If they click on the photo button, shown on the left, a picture of that area of the Living Desert will appear.

Students can also access the movies which feature the director of the Living Desert discussing the mission of the program.

The answers to the questions on the next page are:

- 1) zoo, endangered species conservation center, botanical garden, natural history museum, wilderness park, and nature preserve;
- 2) The kit fox is well adapted to life in the desert and is a good symbol of desert ecology.
- 3) Saguaro cactus;
- 4) 1970;
- 5) 1,200 acres;
- 6) Arabian oryx, Aruba Island rattlesnake, Grevy's zebra, thick-billed parrot;
- 7) It is filled with objects that help tell the story of the desert.
- 8) Mojave, Colorado, Sonoran, and Chihuahuan deserts;
- 9) click on the red down arrow, or go north.

DISCUSSION: Discuss the following after you have gone over the answers to the handout questions.

1. What part of the Living Desert did you like best? Why?
2. Why do you think that people worked so hard to set up the Living Desert?
3. Where can you go to learn more about programs like the endangered species one at the Living Desert?

The Living Desert

Name:

Date:

Use the Living Desert chapter in the ZooGuide to answer the following questions.

1. What are 4 of the jobs of the Living Desert?
2. Why is the kit fox a good symbol for the Living Desert?
3. What do you see if you click on the  button by Sonoran Garden on the map?
4. When was the Living Desert founded?
5. How large is the nature preserve?
6. What animals are involved in the Species Survival Plan at the Living Desert?
7. What is the Discovery Room's purpose?
8. What deserts are represented in the Botanical Gardens?
9. How do you get from Baja Canyon to the Cafe?

K-6 Activity 13:

TOPIC: Animal Research

SOURCES: Species Index in Life in the Desert ZooGuide
References listed in this Guide

MATERIALS: Paper
Pen or pencil
Markers, colored pencils, crayons

ACTIVITY: In this activity students will research an animal that lives in the desert to better understand the relationship between environment and the organisms that inhabit it.

Begin by making a list of the animals contained in the ZooGuide (use the Index button as a quick reference). Then either have students choose a name at random by pulling a name from a hat, or let them choose an animal that they are interested in. Try to make sure that all the major animal types are represented (e.g., mammals, birds, fish, amphibians, reptiles, insects, and spiders).

Students can use the Species Index or the Index button to look up their animal. If they need more information to answer the following questions, they can use references found in the school or local library.

The following questions and topics are suggestions for the kinds of information students can research.

1. How is the animal adapted for life in the desert where there is limited water, temperature extremes, little food, etc.?
2. Describe your animal's food chain.
3. Do people use this animal? How?
4. Is it endangered? Why not?

Once they have found answers to these and other questions, students can write a research paper that combines the information into a coherent form. They can include a drawing or picture of their animal in its natural habitat. You could also go to the zoo and try to find their animals in naturalistic surroundings as a way to wrap up the activity.

DISCUSSION: Discuss the following once you have finished the activity.

1. Which animal that lives in the desert surprised you most?
2. Which of the animals that you studied most belongs in a desert? Why?
3. If you could create an animal that lives in the desert, what would it be like? (Students can base their answers on the information they gathered on their animals.)

K-6 Activity 14:

TOPIC: Evaporation Experiment

SOURCE: Introduction — Desert Temperatures in Life in the Desert ZooGuide

MATERIALS: 2 small cups per group
Water
Black markers (waterproof)
Refrigerator
Window sill with bright sunlight

ACTIVITY: In this activity students will perform an experiment to see how temperature effects water evaporation. This will give them an understanding of why, even after rain, deserts are so dry.

Begin the experiment by handing out two cups and a pitcher of water to each group of students. The cups should be clear plastic so that the water level is easy to see. Ask students to pour water into each cup. Try to get the levels even. With the black marker, mark the water level of each cup on the outside. Then place one cup in a cold refrigerator and the other one on a window sill that gets plenty of sunlight.

Check the cups every two days and mark the new water level. Write the date next to the line to keep track of which days you checked. Continue this process until at least half of the water is gone in either cup.

DISCUSSION: Finally, bring the cups together again and answer the following questions:

1. Which cup of water lost the most?
2. What happened to the water that was in the cups?
3. If the water was in a flat pan instead of a tall cup what do you think would have happened? Why?

K-6 Activity 15:

TOPIC: Plant Experiment

SOURCES: Species Index — Plants in Life in the Desert ZooGuide
References listed in this Guide

MATERIALS: Cactus
Leafy plant
Microscopes
Hand lenses
Paper
Pen or pencil
Dissection tray and knife for each group

ACTIVITY: In this activity students will conduct an experiment to compare leafy plants with succulents such as cacti. The differences in structure are related to the need for different functions because of the harsh conditions of deserts.

Begin the experiment by showing students a cactus and a common house plant (do not use a fern). Ask students to draw both and label common parts such as stems, leaves, and roots. What are leaves on a cactus? (the spines)

Next watch the information presented in the Species Index on plants of the desert. Students should take notes on the differences mentioned in the movie between cacti and other plants. They can try to locate some of these structures when they dissect the plants.

Now students should be ready to dissect the plants. Use caution with the dissecting knives. (You may want to have the plants already cut up for the class to avoid any accidents.) Make thin slices of stem, root, and leaf sections of both plants. Place them on a slide and look at them under the microscope. Students can draw the structures they see.

DISCUSSION: Ask students to compare the similarities and differences between roots, stems, and leaves of the two plants.

1. Do they see the reduced number of stomatas in the cacti?
2. What else is different?
3. How do these differences help cacti adapt to desert life?

ACTIVITIES FOR 7-12 TEACHERS

This section of the Teacher's Guide offers 15 activities and ideas for integrating the Life in the Desert ZooGuide into your Biology curriculum. The activities range from adaptations to dissecting cacti for comparison with leafy plants.

Each activity lists the topic covered, the sources of information used, a step-by-step description of the activity, and a conclusion section with questions to help you find out what your students have learned in the process. Modify, delete, or edit these activities to tailor them to your specific needs. You can also look at the K-6 activities for other ideas and ways to use the ZooGuide with your students.

7-12 Activity 1:

TOPIC: Introduction to Deserts

SOURCES: Introduction — What are deserts? chapter in Life in the Desert ZooGuide
Your Biology textbook
References listed at the end of this Guide

ACTIVITY: In this activity students will define a desert ecosystem, compare deserts with other biomes and contrast different types of deserts.

Use this activity in coordination with studies of Biomes or Ecosystems.

Begin this activity by discussing the following questions as a whole group, in small groups, or individually. Students can use the ZooGuide, their textbook, their knowledge of biomes, and other references to answer them.

1. What are the major biomes on earth?
2. What kind of life does each support?
3. What physical conditions define all deserts?
4. Where are deserts located on earth? Why?

Now that your students are familiar with biomes in general and deserts specifically, they can compare features, biodiversity, and adaptations that arise in different environments. They can write an essay which compares one or more biomes with deserts. The following topics can be included, added to, or changed.

1. Compare number of organisms per square meter.
2. Compare average rainfall.
3. Compare diversity of organisms per square meter.
4. Compare adaptations to that biome (eg., cactus wren vs. house wren, etc.).

Finally, students can compare and contrast the deserts of the world. Not all of them are hot. Choose a cold desert and a hot desert and compare the biodiversity present, the adaptations to each environment that organisms make, and the unique challenges of each kind of environment.

CONCLUSIONS: Discuss the following to conclude this activity.

1. Is life in the desert more diverse than you thought it was? What surprised you most?
2. What are some of the unique adaptations that organisms have developed in adapting to a desert environment?
3. Why do people think that deserts are barren?

7-12 Activity 2:

TOPIC: Physical Desert

SOURCES: Introduction — Types of Deserts in Life in the Desert ZooGuide
Introduction — High Pressure Zones, Continentality, Rain Shadow, and Cold Ocean Currents in Life in the Desert ZooGuide
Introduction — Desert Sculpture in Life in the Desert ZooGuide

ACTIVITY: In this activity students will explore the physical causes of desert formation, make a model of each, relate formation of deserts to their structure and the effects of the physical structure on animal adaptations.

Use this when studying Adaptation or Biomes.

To begin this activity students should read and watch the information presented in the Types of Deserts section in the Introduction chapter of the ZooGuide. The four sub-sections provide specific information about each of the four causes of desert formation.

Divide the class into 4 groups, each with a different physical cause assigned to it. Each group can make a model of that force (high pressure zones, continentality, rain shadow, or cold ocean currents) and study one desert formed in this way.

Then each group can present its model and information about the specific desert to the class. The presentation should include:

1. a summary of the desert formation type,
2. a description of how this force shapes the desert terrain, and
3. a list of the types of organisms that live in this kind of desert.

CONCLUSIONS: Once students have given their presentations the whole class can get together and discuss the following.

1. Are all deserts the same? Why not?
2. Using a specific example, how does desert formation effect its structure?
3. How does the physical structure of a desert effect the types of flora and fauna that inhabit it?

7-12 Activity 3:

TOPIC: Adaptations to the Desert

SOURCES: Ecology — Desert Ecosystems chapter in Life in the Desert ZooGuide
Species Index in Life in the Desert ZooGuide
Your Biology textbook
References listed in this Guide

ACTIVITY: In this activity students will relate organism adaptations to the limitations of the desert environment and state the limiting resources of the desert.

Use this activity in conjunction with studies of Ecology or Adaptation.

Begin by asking students what the limitations of the desert environment are. They should list such things as water, heat, lack of shade, food scarcity, etc. Compare their list with what is mentioned in the Desert Ecosystems section of the Ecology chapter.

Once they have completed their list, ask them to choose one plant and one animal from the Species Index in the ZooGuide to research. How are animals and plants adapted to the physical conditions listed above?

How do physical structures in the desert help organisms to cope with the limitations listed above? Students can use the Arroyo, Sand Dunes, Playas, Seeking Shelter, and Oases sections of the Ecology chapter to help answer this question.

When students have completed their research on the animal and plant of their choice, they can present their findings to the class in the form of a report. You may want to make sure students don't all choose the same organisms by having them pick names at random from a container with names from the ZooGuide Index in it.

CONCLUSIONS: After students have given their presentations they can answer the following questions as a group.

1. Why do cacti have large fleshy stems?
2. Why do many desert mammals have large ears?
3. Why do many reptiles live in deserts?
4. How are cactus needles doubly adapted to desert environments?

7-12 Activity 4:

TOPIC: Flora and Fauna Interactions

SOURCES: Ecology — Interrelations of Flora and Fauna in Life in the Desert ZooGuide
Species Index in Life in the Desert ZooGuide
Your Biology textbook
References listed in this Guide

ACTIVITY: In this activity students will study one of the interactions discussed in the ZooGuide and present their findings in a news report format.

Use this activity when studying Adaptation, Ecology, or Food Webs.

Flora and fauna need each other to survive. In the desert this is even more true. Animals use plants for food, water, protection and homes. Some animals get their food and water from insects and other animals because fresh water is so scarce.

Begin this activity by reading and watching the information presented in the Interrelations of Flora and Fauna section in the Ecology chapter in the ZooGuide. Students should choose a group of interrelated species mentioned in the ZooGuide or do some research and find a group of at least five connected species.

They can then write a news summary to be presented in a 6 o'clock news format:

1. explaining the species interdependence,
2. the impact that removing any one of them would have on the organisms left and
3. including illustrations that show how they are connected.

Students can set up a news room and present their findings as if they were the top stories of the day.

CONCLUSIONS: Conclude this activity by discussing the following questions.

1. Why is a reliance on other animals and plants so important to survival in the desert?
2. Why are bushes and trees spread so far apart in deserts?
3. How are structures like a woodpecker's nest important to other desert organisms?
4. Which animal/plant interaction was the most unique? Why?

7-12 Activity 5:

TOPIC: Research Paper

SOURCES: Maps chapter in Life in the Desert ZooGuide
Impact — Destroying the Deserts chapter in Life in the Desert ZooGuide
Your Biology textbook
References listed in this Guide

ACTIVITY: In this activity students will research a desert mentioned in the ZooGuide and discuss adaptations, food webs, interdependence, physical forces that shape deserts and human impact on deserts.

Use this activity when studying Adaptations, Food Webs or Ecosystems.

Begin this activity by assigning a desert listed in the Maps chapter of the ZooGuide to each student or group of students. They can read about it in the Maps chapter and look up any organisms mentioned as living there in the Species Index. They can use other references and their Biology textbook to continue their research.

The following issues should be addressed in the research papers:

1. What adaptations have organisms in this environment made?
2. Describe a typical food web for this desert.
3. Describe an interdependent relationship among the organisms that live in this desert (other than a food web).
4. What physical forces shaped this desert? How do they relate to the adaptations of organisms living there?
5. How have humans impacted this desert? What are the effects on the ecosystems you discussed in questions 2 and 3?

Students can include maps, pictures and drawings of organisms' habitats, etc. to illustrate points made in the text of their reports. They can then present their findings to the class.

CONCLUSIONS: Discuss the following as a whole class.

1. Why are deserts and their ecosystems important to the world's ecology?
2. Why is diversity of life within deserts so important?
3. What is the result of human impact on the deserts of the world? Is this true everywhere? Give examples to support your answer.

7-12 Activity 6:

TOPIC: Comparing Deserts

SOURCES: Maps chapter in Life in the Desert ZooGuide
Species Index in Life in the Desert ZooGuide
Your Biology textbook
References listed in this Guide

ACTIVITY: In this activity students will compare two different kinds of desert to better understand the similarities and differences among them.

Use this activity when studying Biomes, Adaptations or Ecology.

Students can choose two of the deserts listed in the Maps chapter of the ZooGuide. They should differ structurally in one or more ways (eg., how they are formed, where they are geographically located, etc.)

In their research, students can compare and contrast the following:

1. physical features — size, temperatures, presence of desert structures such as arroyos and sand dunes, etc.,
2. amount of life present as measured by diversity and organisms per square meter,
3. use by humans (homes, recreation, resources, etc.) and their impact, and
4. amount of water present (fresh, mineral, rainwater, etc.).

Students can use the chart on the next page to make the comparison easier and then create a presentation based on the information they have gathered.

CONCLUSIONS: To conclude this activity discuss the following questions.

1. What surprised you most about your comparison of the two deserts you chose?
2. Why are some deserts able to sustain more life than others?

Comparing Deserts

Name:

Date:

DESERT A:	DESERT B:

7-12 Activity 7:

TOPIC: Saving the Deserts — An Environmental Campaign

SOURCES: Impact chapter in Life in the Desert ZooGuide
Your Biology textbook
References listed in this Guide

ACTIVITY: In this activity students will create an environmental campaign to foster awareness of the plight of deserts of the world.

Use this activity when studying Ecology or Endangered Species.

Begin this activity by brainstorming a list of causes of desert destruction. Once you have completed the list read the information presented in the Impact chapter in the ZooGuide. Add any causes of impact that were not already listed.

Next, break students into campaign groups that will brainstorm ideas for a campaign to save the deserts of the world. Each team should choose one or more of the causes listed by the students to address in their campaign. They should also address some or all of the following:

1. How can humans minimize our impact?
2. Choose a symbol of the problems facing deserts today (eg., an animal or plant that is near extinction, an oil well, an off road vehicle, etc.) and use it in your campaign on buttons, t-shirts, etc.
3. Research the cause of destruction your group chose and do the following
 - a. come up with viable solutions to the problem,
 - b. begin a campaign to recognize, organize, and stop the problem, and
 - c. write slogans, make posters, give talks to other classes, write to state or federal lawmakers about the problem, write to organizations who are trying to correct the problem and ask for information or offer support, etc.

CONCLUSIONS: The above campaigns can continue for a quarter with intermittent projects that continue students' efforts. As a conclusion, students can write an essay about what they have learned and the impact they think their campaign has had on the school community.

7-12 Activity 8:

TOPIC: People of the Deserts

SOURCES: Impact — Who Lives in the Deserts? chapter in Life in the Desert ZooGuide
Your Social Studies textbook

ACTIVITY: In this activity students will explore human desert habitats from the deserts of North America to those of Australia and Africa.

Use this activity when studying Habitat, Adaptations, or Ecology.

There are seven sub-sections in the Impact — Who Lives in the Deserts? section of the ZooGuide. Students can look through all of them and then choose one group that fascinates them most. They should do some research on this group of desert dwellers that answers the following questions.

1. Who are they?
2. How long have they inhabited the desert?
3. How have they adapted their social structure, homes, food, water needs, etc. to succeed in the desert?
4. What other organisms do they rely on to survive?
5. Have their bodies adapted to desert conditions? How?
6. How is their culture tied to the desert? Give at least 3 examples.

Once each group or individual student has addressed these questions and compiled the answers in a report or essay, they can present their finding to the class. They can then compare different desert dwelling groups and search for similar strategies for survival among the various groups.

CONCLUSIONS: Compare the groups studied by answering the following questions.

1. Why are some desert dwellers sedentary while others are nomadic?
2. What are three similarities between all of the groups of desert people studied?
3. What are three common strategies that all desert people have developed to survive in their harsh environment?

7-12 Activity 9:

TOPIC: Endangered Species of the Deserts

SOURCES: Impact — Endangered Desert Life chapter in Life in the Desert ZooGuide
Species Index in Life in the Desert ZooGuide
References listed in this Guide

ACTIVITY: In this activity students will develop plans for saving endangered desert species from extinction. In addition, they will study what the Species Survival Plan is doing to save endangered species in captivity.

Use this activity with studies of Ecology, Predator-Prey relationships, or Endangered Species.

Begin this activity by reading and viewing the information contained in the Endangered Desert Life section of the Impact chapter. There are many animal and plant species listed as being endangered. Reasons for endangerment are also mentioned. Use the chart on the next page to list these species, reasons for endangered status, and what is being done to save them.

Do some research to find out about the Species Survival Plan mentioned in the ZooGuide. Answer the following questions:

1. What is its goal?
2. What species is it currently trying to save?
3. How are captive-bred animals successfully released into the wild?
4. What other programs are doing similar work?

Students are now ready to develop their own plans for saving an endangered desert species. They can modify the tactics used by the Species Survival Plan, that of another organization that they have researched, or they can develop their own plan based on the general principles used in this field.

Their plan should include a time table, step-by-step instructions and intermediate goals in the process. They should address such issues as where breeding stock will come from, how they will ensure diversity of DNA, and how the species will be released to get maximum benefit.

CONCLUSIONS: Once students have developed their plans, you can judge their validity, vote on the best approach, and submit a proposal to a local zoo for their comments and suggestions.

Desert Endangered Species

Name:

Date:

SPECIES	WHY ENDANGERED	EFFORTS TO SAVE

7-12 Activity 10:

TOPIC: Exploring the Living Desert

SOURCES: The Living Desert chapter in Life in the Desert ZooGuide
References listed in this Guide

ACTIVITY: In this activity students will explore the Living Desert, a nature preserve in Southern California that provides a variety of experiences based on desert ecology.

Use this activity when studying Ecology, Endangered Species, or Botany.

Begin by passing out the handout on the next page which provides tasks and questions for students to answer as they view The Living Desert chapter in the ZooGuide.

Students can view the parts of the Living Desert by clicking on the maps shown in the chapter. The maps enlarge and allow students to move around using the arrow keys shown on the left. If they click on the camera button, a picture of that area of the Living Desert will appear.

Students can also access the movies which feature the director of the Living Desert discussing the mission of the program.

The answers to the questions on the next page are:

- 1) Zoo, endangered species conservation center, botanical garden, natural history museum, wilderness park, and nature preserve;
- 2) The kit fox is well adapted to life in the desert and is a good symbol of desert ecology.
- 3) Saguaro cactus;
- 4) 1970, because people living there wanted to preserve the desert ecosystem;
- 5) 1,200 acres;
- 6) Arabian oryx, Arula Island rattlesnake, Grevy's zebra, thick-billed parrot; they have reintroduced the Arabian oryx to Oman successfully;
- 7) It is filled with objects that help tell the story of the desert.;
- 8) Mojave, Colorado, Sonoran, and Chihuahuan deserts.

CONCLUSIONS: Discuss the following after you have gone over the answers to the handout questions.

1. What is the most unique part of the Living Desert? Why?
2. Why do you think that people worked so hard to set up the Living Desert?
3. Why has the Living Desert expanded its mission to include the endangered species program?

The Living Desert

Name:

Date:

Use the Living Desert chapter in the ZooGuide to answer the following questions.

1. What are 4 of the goals of the Living Desert?
2. Why is the kit fox a good symbol for the Living Desert?
3. What do you see if you click on the  button by Sonoran Garden on the map?
4. When was the Living Desert founded? Why was it founded?
5. How large is the nature preserve?
6. What animals are involved in the Species Survival Plan at the Living Desert?
How successful has it been?
7. What is the Discovery Room's purpose?
8. What deserts are represented in the Botanical Gardens?

7-12 Activity 11:

TOPIC: Classification of Desert Organisms

SOURCES: Species Index in Life in the Desert ZooGuide
Your Biology textbook
References listed in this Guide

ACTIVITY: In this activity students will list all the major phyla that inhabit the deserts of the world.

Use this activity when studying Classification.

Begin by asking students to make a list of all the major phyla found on earth. How many of these have representatives living in deserts?

Use the Species Index to find representatives of each phylum that inhabits the deserts. Then answer the following questions:

1. Are all the phyla represented?
2. Are all the phyla represented in every desert?
3. Which desert has the most representatives (which is the most diverse)?
4. How do the phyla requiring a water environment (amphibians, fish, algae, etc.) survive?

CONCLUSIONS: Discuss the answers to the above questions as a group, once students have researched on their own. Then wrap-up this activity with the following questions.

1. Why do so many diverse organisms live in the deserts?
2. How do you explain the existence of amphibians and fish in the desert?
3. Are there any major classes of animals not found in the desert? What are they and why don't they have habitats in the deserts?

7-12 Activity 12:

TOPIC: Desert Life Cycles

SOURCES: Species Index in Life in the Desert ZooGuide
Your Biology textbook
References listed in this Guide

ACTIVITY: In this activity students will explore how life cycles are effected by environment, by comparing life cycles of similar organisms in and out of the desert.

Use this activity in conjunction with studies of Ecology, Evolution, and Life Cycles.

Begin by asking students how they think the desert environment might effect reproduction and parts of desert animals' life cycles. They should answer that the availability of water is crucial for reproduction of many desert dwellers and that the timing of flowers with the emergence of insects is crucial too. There are, of course, other examples that your students may brainstorm as well.

Students can now answer the fundamental question: **How is life cycle effected by environment?** by comparing animals that live in the desert versus their close cousins that live elsewhere. For example, they can look up dung beetles, butterflies and other invertebrates in the Insects and Animals Without Backbones sections of the Species Index. To research non-desert cousins of these species students can use references or their Biology textbook.

CONCLUSIONS: Once students have made their comparisons and have some ideas about the adaptations that desert organisms have made to their environment, they can answer the following questions.

1. What are the strategies that desert animals use to regulate their life cycles to the availability of water or food?
2. How do these strategies differ from those used by non-desert dwelling cousin species that do not have to worry about water?
3. Which organism that you studied has the most unique adaptation to its life cycle? What is the adaptation?

7-12 Activity 13:

TOPIC: Plant Experiment

SOURCES: Species Index — Plants in Life in the Desert ZooGuide
References listed in this Guide

MATERIALS: Cactus
Leafy plant
Microscopes
Hand lenses
Paper
Pen or pencil
Dissection tray and knife for each group

ACTIVITY: In this activity students will conduct an experiment to compare leafy plants with succulents such as cacti. The differences in structure are related to the different environments that they inhabit.

Begin the experiment by showing students a cactus and a common house plant (do not use a fern). Ask students to draw both and label common parts such as stems, leaves, and roots. What are leaves on a cactus? (the spines)

Next read and watch the information presented in the Species Index on plants of the desert. Students should take notes on the differences mentioned in the movie between cacti and other plants. They can try to locate some of these structures when they dissect the plants.

Now students should be ready to dissect the plants. Use caution with the dissecting knives. Make thin slices of stem, root, and leaf sections of both plants. Place them on a slide and look at them under the microscope. Students can draw the structures they see.

CONCLUSIONS: Ask students to compare the similarities and differences between roots, stems, and leaves of the two plants.

1. Do you see the reduced number of stomatas in the cacti?
2. What else is different?
3. How do these differences help cacti adapt to desert life?

7-12 Activity 14:

TOPIC: Review of Life in the Desert ZooGuide

SOURCES: Life in the Desert ZooGuide
References listed in this Guide
Your Biology textbook

ACTIVITY: In this activity students, working alone or in small groups, will develop a new chapter to add to the ZooGuide. This will require them to review all of the sections of the ZooGuide, assess where there is room for additional information, and research to get facts for the additional section.

Students can do multimedia additions to the ZooGuide, including videotape footage, interviews with professionals in the field, pictures of organisms discussed, etc. This is an open-ended project that you and your students can tailor to fit your school's access to equipment, deserts, and desert experts.

The additional data and images that are collected to make new sections or chapters for the ZooGuide can be kept with the ZooGuide for future projects or classes to use as a reference. Students' work should be polished looking and well written.

CONCLUSIONS: Conclude this activity by asking students in each group to present their new section for the ZooGuide. They can invent questions for other students to answer using their data, or they can invent a game to use the data with. Again, brainstorm ideas and be creative.

7-12 Activity 15:

TOPIC: Evolution of a Desert

SOURCES: Life in the Desert ZooGuide
Your Biology textbook
References listed in this Guide

ACTIVITY: In this activity students will discover the origins of deserts by conducting research into the geology, paleontology, and geography of the earth at earlier times in its history.

Use this activity when studying Evolution and early life on earth.

Begin this activity by reviewing the information contained in the Life in the Desert ZooGuide. It offers some clues as to the origins of the deserts (look up the Australian deserts) and good background on their current conditions.

Use reference materials to study the history of the earth's land masses. Then answer the following questions.

1. What has happened to the land over time?
2. When did the current deserts first develop?
3. What did the American Southwest look like millions of years ago? How have scientists determined this?
4. What present day desert structures hint at their watery past?
5. What current climatic conditions caused the modern deserts to form?
6. Are there lush, green places today that were once deserts? Where are they?

CONCLUSIONS: Once students have completed their research and discovered answers to the above questions, the whole class can get together and share their findings and discuss the following.

1. Why is it important to understand the origins of deserts?
2. How did you use other science disciplines to answer the above questions?
3. Modern deserts form natural barriers to keep species apart. Explain how they help the process of evolution.

References:

The references listed in this section are divided into two parts: K-6 activity references, and 7-12 activity references. The references listed were found in a local public library and represent a small portion of the books that are available on this topic. If you cannot find a specific reference listed here, try to find a book with similar content in your school or local library.

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