

Deserts OF North America

Pre- & Post-visit Materials

Second Grade through High School
Activities

What is a Desert?
The Cahuilla People
Desert Plant Field Guide
Tasting the Desert
Desert Mural & Maps
Small Wonders
Fact Sheets

Developed & Designed by:



THE LIVING DESERT
Education Department

What is a desert?

- A. **Low rainfall and uneven distribution:** This means that rainy days are more likely to be rainy hours, or in the summer, brief rainy minutes with long periods of dryness. There may be downpours and flooding in one neighborhood, while, a few miles or blocks away the sun shines. An entire year's rainfall may fall in a single storm.
- B. **High evaporation rates:** When it does rain, the water doesn't hang around for long. If the vegetation doesn't suck it up where it's stored in roots, stems and leaves, the heat of the sun evaporates it. Sometimes within minutes, the ground appears as if no rain fell at all.
- C. **Extreme temperatures:** Temperatures can be cold enough for snow to form or hot enough to burn your feet on the ground. These temperature changes can happen literally overnight. During the day the thermometer can rise above 100° F; after the sun goes down, temperatures can chill down to 30° and even lower. Mammals that live in the desert have furry coats. During the day, this may be a problem, so they usually stay underground until nightfall. Their coats protect them against the cold night air.
- D. **Strong winds:** The changes in pressure from the heating and cooling temperatures as well as few wind-blocking landforms result in strong, dry winds whipping through the desert without much warning. Add sand to the mix and you can have a blinding sandstorm. At times, windblown sand has been so thick and strong that it sanded the paint right off cars driving through it!

What causes a desert?

Deserts occur where the sun strikes the earth most directly. If you look on a map or globe, you will see that most of the desert regions are between the latitudes of 15° and 40°. (Latitudes are lines running across the map or around the globe, not up and down – this is easy to remember if you think of latitude as being the rungs of a “ladder”, which sounds very similar. You would use these lines to climb up the map or globe.)

North of the equator is the *Tropic of Cancer* and to the south is the *Tropic of Capricorn*. The sun most directly strikes the earth between these tropics.

Air circulation also contributes to the creation of a desert. At the equator the air is hot and moist. Hot air can hold moisture, but hot air also rises. As the moisture-filled air at the equator heats up, it rises up away from the earth. As it rises it begins to cool, and cool air doesn't hold moisture well. Eventually it has to dump the moisture as rain near the equator. The air is now cooler and dryer than when it started and is about 10 miles above the earth's surface. It begins to move toward the poles. Air in the Tropic of Cancer heads to the North Pole. And air in the Tropic of Capricorn moves toward the South Pole. Cool air is heavier and denser than warm air. As the air moves to the poles it continues to cool. The heavier denser cool air sinks around 30° latitude. This increase in pressure from compression reheats the air and evaporates any remaining moisture before the air reaches the earth's surface. It is in this

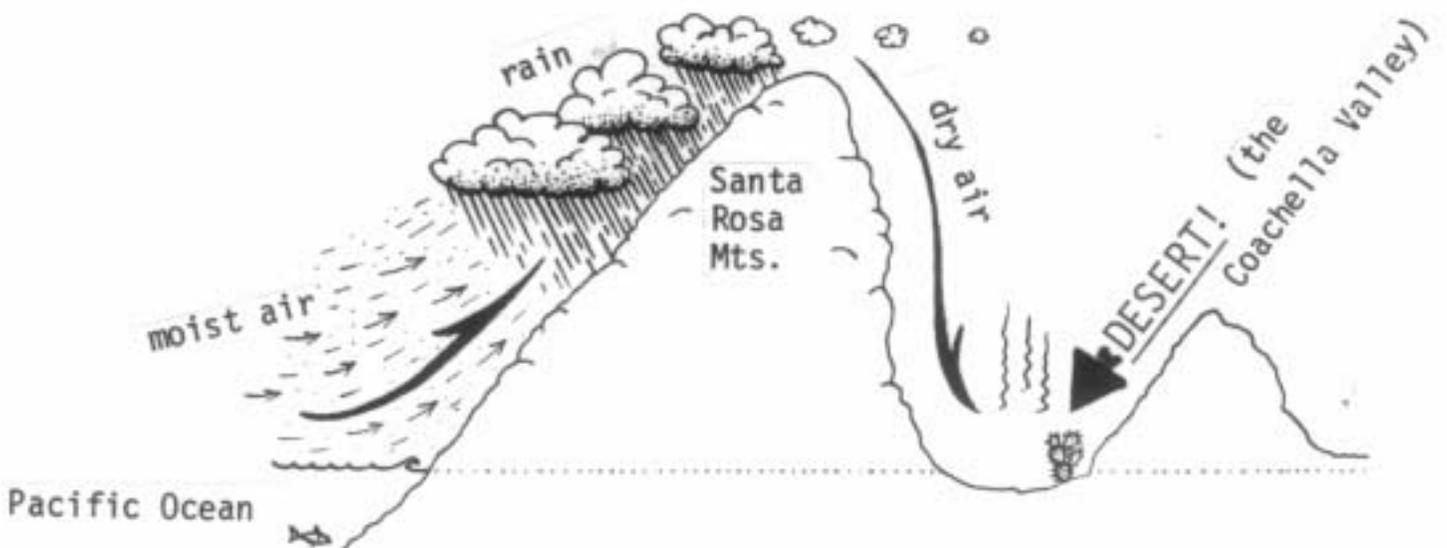
region, where there is a combination of high pressure and descending hot dry air, that we find deserts.

Deserts are sometimes caused by a combination of landforms, location on a continent and localized weather patterns.

Continental deserts are formed when an area of land is just too far inland to receive any water. The Gobi desert in Asia is an example of a continental desert.

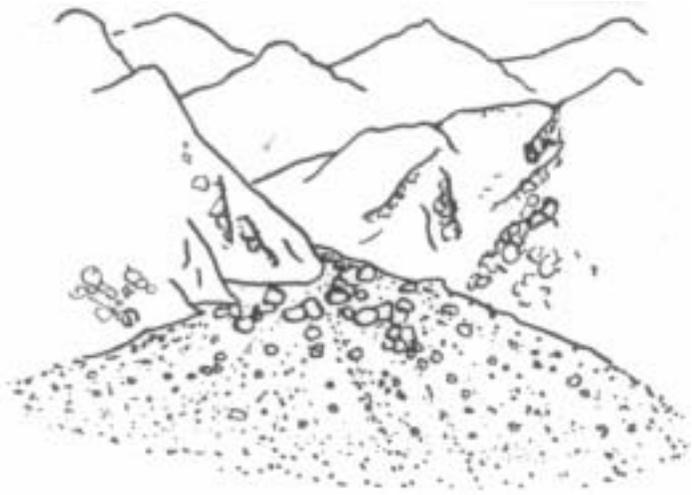
Fog deserts are areas that are almost completely rainless, but they are covered in fog. This happens when there is a combination of hot dry air above the land, moist warm air coming in from the sea and cooler currents flowing from the poles. The moist air from the seas and cooler currents from the poles cross. Because of high pressure in these areas, the moist air can't rise to form clouds and rain. Instead, it condenses into fog. Three examples of fog deserts are the Namib in southwest Africa, the Atacama in Peru and the Vizcaino Desert region of the Pacific Coast of Baja California.

Rain Shadow deserts are formed when moisture-carrying air is blocked by tall and wide landforms like mountain ranges. When moist air moves from the ocean inland, it may run into a mountain range. In order for the air to get through, it has to rise over the range. As it does it cools and condensation forms, releasing moisture in the form of rain or snow on the windward side (the side of the mountain the wind is blowing into). When the moisture is released, the drier air rises over the range. On the other side of the mountains, called the lee or inland side, the air descends. As it does, the air compresses and pushes the heat down into the valley. This hot, dry air not only has no moisture to give to the valley, but it evaporates most of the moisture that is already there. This leaves the valley hot and dry, creating a desert condition. Because the rain is dropped on the other side of the mountains, we say that these deserts are in the shadow of the rain. Our desert is a rain shadow desert. The San Jacinto Mountains (10,000ft.+) to the west block most of the rain, while some is blocked by the Santa Rosa Mountains to the south.



Desert Landforms

The extreme weather of the desert creates extreme habitats. Wind and water are two major influences. The desert is sometimes described as a land without water. But if everything needs water to live and there are a lot of things that live in the desert- where is the water? When you walk in the desert, look around; you will see signs of water everywhere in the landforms and life forms that live there.



Alluvial fans are created when flood waters rush out of a canyon or mountain range onto a flat, open plain. All the water and debris that was contained by the sides of the canyon gets dumped out and spreads to form what looks like a fan. When the water absorbs into the ground or evaporates into the air, it leaves behind all the rocks and debris it carried down the canyon or mountain. When you look at an alluvial fan you will see the larger, heavier debris sitting right near the canyon exit or the narrow end of the fan, and the lighter material farther out on the edge, or wide end of the fan. The power and strength of the water is reduced as it spreads out. It drops the heavier items first, so they remain near the exit of the canyon. The water carries the lighter items as long as possible but

eventually drops them near the outer edges.

Bajadas are formed when several alluvial fans join together. Canyons can have several exits, and water can escape from any of them. After several floods, the alluvial fans can overlap. More than one alluvial fan joined together is called a bajada. Bajada means slope in Spanish and is pronounced ba-HAH-da.

Washes are formed when the water coming out of a canyon or mountainside continues across the desert flats. This forms a temporary river. Eventually the water is absorbed into the ground or evaporates into the air, forming a dry riverbed. There are many life forms that exist in washes and live their lives based on this infrequent, but powerful, flow of water.



What happens to the water in washes and in rivers like **Whitewater**? In our desert, water that flows out of Whitewater and other desert washes get partially absorbed underground, where it passes through an **aquifer**. An aquifer is a large formation of rock under the desert. Water passes through it and gets filtered and cleaned. Thousands of years may pass before the water completes its journey. If there is seismic activity, like an earthquake that causes the rocks under the desert to shift, some of this water can be forced up to the surface to form **fresh water springs**. If you look out in our desert you can identify springs by locating palm trees on mountain slopes. Palms like to have their feet in water, so they will only grow where water is close to or on the surface. When water is evaporated off the surface, salt can be leached out and may sit on the surface, creating **large salt flats**.



In some cases it is wind, not water, that is most influential in creating landforms. Wind is responsible for the shifting of sand that creates **sand dunes**.

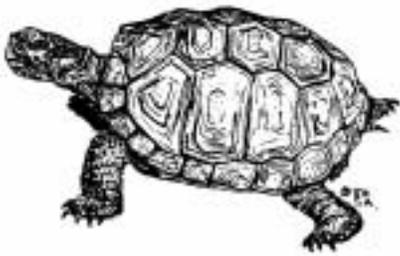
Who Lives in the desert?

Animals that live in the desert have adapted or changed over time to adjust to this environment. Through both behavioral and physical adaptations, these creatures have managed to survive and thrive in this ecosystem.



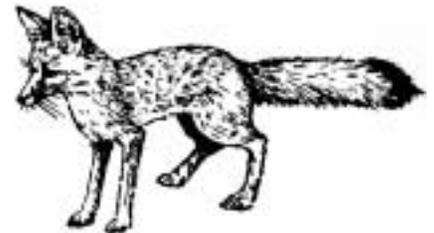
Nocturnal/ Diurnal: Many desert animals sleep during the heat of the day and are active at night, when it cools down. This behavior is called **nocturnal**. **Diurnal** creatures are active during the day and sleep at night. To avoid the heat, these animals may retreat to shady spots or go underground during the hottest times of the days.

Hibernation/ Estivation: In late summer, most plants and water sources become scarce as the sun heats up the desert to over 100°F. To cope with the heat, some animals go into a deep sleep called **estivation**. Those who have difficulty coping with extreme cold temperatures practice **hibernation** in the winter.



Animals that live in the desert may have specialized internal organs, like oversized bladders, to store liquids for long periods of time. The desert tortoise has a large bladder, which acts like a water storage tank. Animals, like the kangaroo rat, are so specialized and have so many adaptations that they may never need to drink water. They get all their moisture from seeds.

Desert animals are often sandy colored to blend in with the desert soils. They tend to be thinner and have longer extremities, which makes it easier to eliminate excess body heat. The short, stockier bodies of northern mammals help retain body heat in cold winter weather. Comparing arctic and kit foxes, you can see the difference between the small, lanky kit fox of the desert and the stout, compact arctic fox.



What about our Desert?

There are four North American desert regions. The region farthest north is the **Great Basin** region. It is much colder than our desert and is covered in snow for part of the year. The region farthest east and farthest south is the **Chihuahuan** desert region, which includes Big Bend National Park. This desert has the highest amount of species diversity of any of the desert regions and is the youngest, only forming within the last 10,000 years.

Just above our desert is the **Mohave** Desert, which includes Joshua Tree National Park and Death Valley. The Mohave is mostly (*with the exception of Death Valley*) a high desert and is cooler and moister than our desert. Our desert is the **Colorado** Desert, a subdivision of the much larger **Sonoran** desert. The Sonoran reaches from southern California into Arizona and northern and western Mexico. (*See map*)

Our portion of the Sonoran desert is very hot and dry. It includes the Salton Sink, which is 227 feet below sea level and is bordered on the west by *Mt. San Jacinto*, which is over 10,00 feet high. We typically get less than 4 inches of rain a year. In the winter we get longer soaking rains; in the summer, brief afternoon thunderstorms are more likely.



The Cahuilla People



The People

The word *Cahuilla* probably means master or ruling one. This refers to mental, moral and spiritual strength or strength of character rather than physical strength. The Cahuilla people are not a past culture; they are an important part of today's desert community. Their lifestyles have changed due to European influences, but early Cahuilla life and language are well documented.

Traditionally, members of the clan have worked for the good of the whole. Since they believe that all things have a place interwoven in nature, they do not view themselves as the top of a pyramidal food chain. They are one link in an endless circle of life. Rather than control nature, Cahuilla feel an obligation to respect all life around them, to value what they have and use materials efficiently.

Knowing their Environment

Living in an unpredictable environment, the Cahuilla had to develop an intimate relationship with the natural world. They had to know every seasonal and transitional cycle of the plants and animals. The cycles changed from year to year as weather patterns changed. It was not a matter of following a monthly list of activities; they needed to be able to recognize subtle changes in plant and animal life and respond to these changes. Plant development that sometimes occurred in March might occur in April or May; and in some years, not at all. Learning how to recognize these patterns meant the difference between having enough food for the year and going hungry.

Most of the Cahuillas' daily life focused on food gathering, hunting, preparing or storing. Each individual had a responsibility that contributed to the survival of the whole community. Boys and elderly men were usually responsible for the hunting of small game like quail, rabbits, squirrels and lizards; insects like grubs, cicadas and bees, and the collection of honey. Boys learned from the elders how to stalk and hunt successfully, and eventually they would join the men in hunting large game. Women and girls were responsible for the collection of most plant materials. Exceptions were the collection of acorns, pinyon and agave, in which the men participated. Plant preparation and use required skill and knowledge that took years to develop.

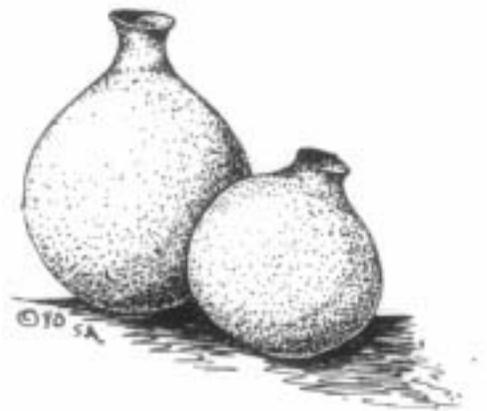
Collecting and storing food from different plant communities were especially important. Food supplies varied at different elevations during different times of the year. After a heavy rain season in the spring, food at lower elevations might be plentiful, but by summer, several weeks of high heat might deplete these supplies. Storing the plentiful food of spring and moving collection efforts to higher elevations, where food supplies were still available, allowed the Cahuilla to get through each season.

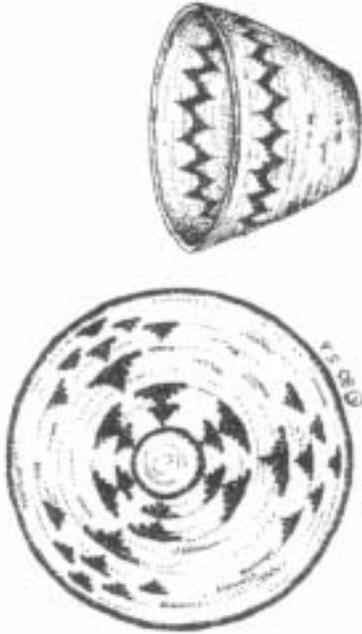
Sharing for Survival

Some plants and animals live only in specialized habitats within the larger desert. Different tribes had their own food gathering areas and became skilled at collecting, harvesting and hunting specific game. Trading between the people helped ensure a balance of materials for all and reduce the need for defensive control of areas. Because of their skill in using natural materials and their willingness to share, the Cahuilla managed to live in relative peace.

Tools for Survival

Tools were generally made by the people who used them. In most cases, women made baskets, ollas (clay carriers) and tools for gathering, preparing foods and making clothing. Men made tools for hunting, homebuilding and ceremonies. Sometimes these lines crossed, as men were involved in gathering and weaving when projects required great strength.





Women's Tools: **Ollas** (*made from coiling clay found in nearby areas*) were often used for holding liquids and left plain or simply decorated. **Baskets** (*made from tight coiling or twining methods using reeds and grasses*) were designed in four main styles: flat, for a tray; shallow for holding seeds; deep with a support strap or net, for holding larger loads; and globular, for storing tools or trinkets. **Grinding stones or mortars** (*made from bedrock or smaller stones with a bowl shape*) were used for processing pods into meal. The process used a **pestle** (*made from the same material as the grinding stone*) or a rounded rock used in a pounding motion. A **metate** (*made from a thin, flat slab of rock*) was used with a **mano** (*rounded rock with a flat bottom*) to continue to process the meal into a finer flour texture. The mano was rubbed back and forth across the metate, grinding down the meal.

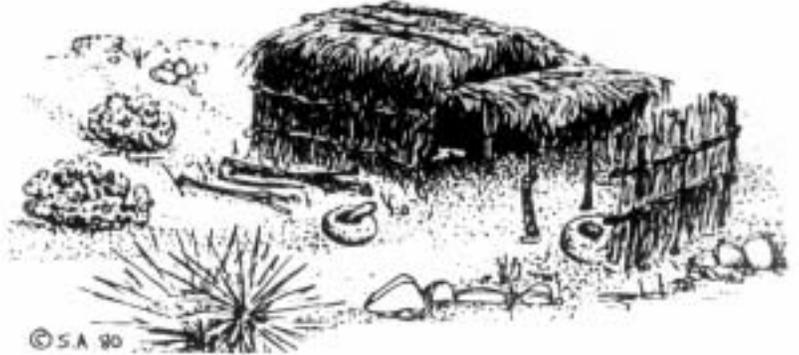
Men's Tools: the **granary** (*made from tough stems and arrowweed woven into a 3- to 6- foot wide basket with a bird's nest design*) was one weaving tool used by men because of the strength required to use the materials.

Bows (*made from mesquite or desert willow and agave fibers*), were usually 3.5 to 4 feet long and used with **arrows** (*made from a straight stalk of arrowweed*). **Carrying bags** (*made from animal skins*) were used to

carry extra arrows. The **throwing stick** (*carved from a red shank, ribbonwood or other hardwood*) was used for hitting small game. A **club** (*made from cottonwood*), also called a **potato masher**, could be used to strike an opponent when necessary. Men made building structures (homes and sweat houses), the tools to construct them and ceremonial tools- little is known about exactly what ceremonial tools were used.

Ritual and Play

Though much time was spent collecting materials and foods for survival, ritual and play were important elements of the Cahuilla life. Ritual was part of all activities and instilled a respect for the environment and all living things. Play was most common during the winter months when there was little collection activity.



String games resembling cat's cradle were not only popular but were used as part of divination and other ritualistic activities. Extremely complex patterns were designed, and it was believed that they had to remember these to gain entrance into the spirit world.

Bathing and bodily cleanliness were very important to the Cahuilla and a time for fun and ritual. When a boy in the village spotted a new moon, he would call the other boys to the pool for a swim and good luck. Another ritual involved the women of the tribe racing to the pool just before dawn when the moon was at a certain point in the sky, while the reflection of the moon remained on the water.

Lessons

There are many lessons we learn from the Cahuilla people that can be used in the classroom and in our daily life:

- Wise use of resources and the reduction of waste materials

- Teamwork to ensure not only the comfort of a community but its survival

- Importance of personal responsibility to the entire natural community, which includes all living things

- Benefits of acute environmental awareness and a close relationship with the environment

- Importance of sharing and preserving resources for today and the future

Desert Plant Field Guide

(all grade levels/ limit number of plants for younger students)

Introduction

In this activity students will take a close look at desert plants, learn to identify them in the field and document the changes in plant life through different seasons. They will collect and organize information from fact sheets (provided), classroom resources and/or the recommended books on the enclosed resource list. These guides are limited only by the creativity of the students. They can be combined with pressed plants, photographs, drawn illustration or cutout from magazines. These guides can be kept in the classroom and added to as a yearlong project. Left as a class resource or donated to the school library, they can be used as a resource for individual students or other classes.

Objectives

- 1) Introduce students to plants that grow in local desert areas.
- 2) Increase appreciation for native plants by exploring their uses.
- 3) Help students to recognize and identify these plants in their native landscape.
- 4) Refine observation skills by looking at, identifying and drawing specific plant specimens.
- 5) Organize information into useful formats.

Materials

Drawing paper

Slightly heavier paper for a cover sheet to create a field guide cover (*Suggestion: Use cardboard for the back cover. It can double as a writing surface in the field.*)

Pens and pencils

Scissors

Glue

Coloring material: Markers, paints, crayons or colored pencils

Plant list and information sheets (*included*)

Cahuilla Information packet (*included*)

Field guides or books from resource list

Pictures or examples of plants on plant list

Binding materials: string, binder rings, staples or round-headed paper fasteners

Flower-pressing materials (*optional*)



Plant List – (*information sheets included*)

Creosote
Agave
Mesquite
Acacia

Directions – (*small group or class activity*)

1. Have students design their own field guide for desert plants. (GET CREATIVE: Decorate the cover; add a pencil connected with string and binder clip to hold loose papers when outside.) Decide how to organize information. Suggested topics include Seasonal Descriptions, Cultural Uses, Habitat and Interesting Facts.
2. Research plants on the plant list using information sheets (*included*). In addition, have students use field guides, encyclopedias, on-line resources and/or books listed on the enclosed resource sheet. This will show students different ways to present information and help when organizing their own field guides.

3. Document what the plants look like for easy field identification. Include illustrations. If you have live examples, try pressing the flowers and stems to preserve them and secure them in your field guide.
4. Document seasonal life cycles – when they flower, seed, drop leaves, etc.
5. Research their uses. Include native peoples of the desert, immigrants to the desert and modern uses, if any. What kind of tools would be used to process and store the food? You may want to include personal accounts from family members that have used these plants. When would they be harvested and how would they be stored for use year round? (Use enclosed information on Cahuilla and other resource books.)
6. Have students select other plants with which they are familiar and add them to their field guides.

At the Living Desert

Take your field guide to the Living Desert. Try to find the plants in our gardens, exhibits or growing wild on our grounds.

Some of our gardens represent not only geographic desert regions but also different elevation levels like the Sonoran foothills and upper elevations of the Colorado Desert.

Notice what stage of development the plant is in. Would it be a good time to collect?

Visit the Ethno-botanical Garden to see the tools used by the Cahuilla people to prepare plant materials. Do you recognize any tools that you researched?

Bring a camera and photograph the plants you see on grounds to add to your field guide.



Tasting the Desert

(all grade levels)

Introduction

The desert provided everything to the Cahuilla, including food. Since the early Cahuilla days, immigrants and visitors have come to the desert and learned to use its resources for a number of things. Often we aren't aware of the importance of a resource until it is gone. In this activity, students will sample foods derived directly from desert plants. On the resource list, there are desert recipe books to sample for further reading and *eating!*

Objectives

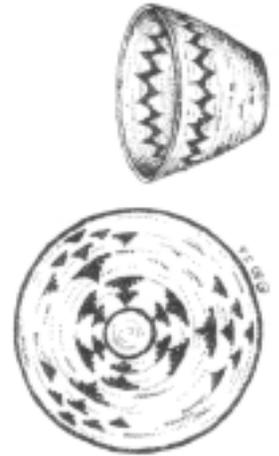
- 1) Practice volume measurements
- 2) Determine the best way of sharing ingredients between different groups
- 3) Determine the amount of a recipe needed to feed the entire group

Materials

Enclosed recipe list
Enclosed kitchen supply list
Cahuilla Information Packet

Directions – *(small group- each does different recipe; food shared at the end)*

1. Discuss with your students from where food comes. Prior to arriving at our table, and even before it arrives at the grocery store, where does it originate? Discuss the process used to create foods we eat. From what are the foods made? Are they made from animals or plants? If they are made from plants, from what parts of the plant do they come? Are they leaves, seeds, fruits or flowers that make the food we eat?
2. Set up all the food in a central location. Label this "THE SOURCE".
3. Pass out the recipe lists to each group.
4. Each group takes a turn at "THE SOURCE", collecting their ingredients and selecting the measuring and kitchen supplies they will need.
5. Each group has to problem solve how many people each recipe will feed and decide if they need to increase the ingredients.
6. Have students work in small groups with one adult supervisor assigned to each group.
7. Students do all the preparation with adult help where needed.
8. Students clean all the dishes and cooking surfaces when completed.
9. Have a tasting party! During this time discuss why it was important to share ingredients and how easy it was to increase measurements. Relate these issues to the Cahuilla people and their responsibilities to their community. Did each student have a task in preparing the food? What would happen if one of those students didn't do their job? How well did the group cooperate?



Desert Mural

(lower elementary)

Introduction

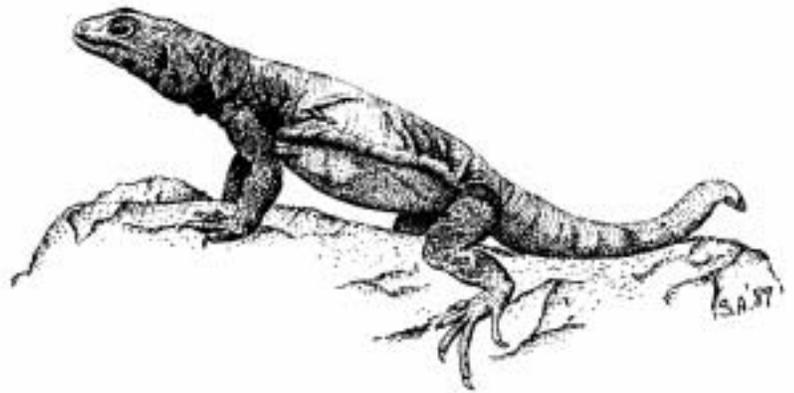
After studying individual inhabitants of an ecosystem, students will understand their relationships and where they fit in their environment by creating a colorful visual aid. As students create this mural and add animals and plants, talk about why the inhabitants live where they do. What do they have in their environment that they need to survive? You can add homes, like underground burrows or caves for tortoise, burrowing owls, bats, snakes, scorpions and a number of reptiles and mammals. Two sample murals with some simple landforms are enclosed. One is labeled. You can use these as guides or create your own desertscape.

Objectives

- 1) Understand the relationships between the different types of desert life by creating a visual aid that groups life forms by habitat.
- 2) Learn to organize information.
- 3) Determine where creatures need to live in order to survive.

Materials

Butcher paper or poster board
Magazine pictures of native plants and animals *(Optional if students will not be drawing the plants and animals themselves)*
Glue
Scissors
Colored paper
Natural materials *(optional)*
Drawing and coloring materials:
pencils, crayons, paints and/or markers
What is Desert? Information sheet
(included)



Directions – *(class activity)*

1. Discuss with students the different types of habitats that exist in the desert: washes or arroyos, dunes, mountains, oases and foothills. Discuss what these habitats offer the plants and animals that live in them? *(Use enclosed What is Desert? Information sheet.)*
2. On a large sheet of butcher paper draw a landscape of our desert. Be sure to include progression from desert floor to the high desert elevations. *(See example enclosed.)*
3. Have students add the plants and animals in their proper habitat and elevation level. You may want to use natural materials and glue them onto the mural. *(See enclosed plant and animal list.)*
4. You can make a game out of this activity by having students draw and cut out all their animals and plants in advance. As the teacher or student reads clues about the needs of each animal or plant, the class can decide where the life form goes on the mural. For example: A palm tree needs to have roots in fresh water – where would it need to live? In a fresh water spring! As students guess, they get to take their picture up and glue it onto the mural.
5. When it is completed, you can use your mural as a starting point to write a desert story or play. It can be about a specific animal or plant or community or habitat.

At the Living Desert

The Living Desert exhibits include many of the habitats you have on your mural. There is a palm oasis with fresh water spring, a canyon and a wash. Ask a docent to help you identify these areas on your tour. Talk about the types of plants and animals you see. Were any of them included on your mural?

Small Wonders

(All grade levels)



Introduction

When students come to zoos, they often look for the big animals on exhibit, the magnificent lions or the cheetahs. They want to see the big mammals and birds and much of their focus is on the exotic – the things they don't see in their everyday world. In many cases they are not as aware of their everyday environment as they are of those far away. This activity teaches them to look for the wonder in their everyday world. By looking at a small plot of land on the school grounds or in a field near by, students will be aware of the variety of activities that go on. You can choose to look at one site or divide the class and assign each group or individual a different site.

Objectives

- 1) Refine active observation skills to notice the small details of the environment.
- 2) Increase appreciation of life forms at all levels of the chain.
- 3) Explore points of view- those of small creatures living in a large world.

Materials

Plot of land that contains plants and insect life

Magnifying glasses (*optional*)

Bug collection/observation boxes (*optional*)



Directions

1. Before beginning this project, teachers should visit the plot of land that they will be visiting with students. Look closely at the plants and ground and pick out a couple signs of life to help direct your students. If plants are flowering, look on the petals, inside the hypanthium (*exterior, cup-like extension that covers where petals connect inside the flower*) for signs of life. Use a magnifying glass if necessary. Look for anything from homes, to plant damage, to frass (*insect droppings*). This will help direct students in the beginning, but don't point out everything. Leave something for them to find.
2. Have students sit in their plot of land and observe quietly for a few minutes. Don't worry about writing things down; leave papers and pencils inside the classroom. At first, don't look up close, just sit and watch for movement. You may have to wait for a couple of minutes, since you probably disturbed activity when you sat down. Give the creatures time to get comfortable and continue their activities. Then observe what they are doing.
3. After a few minutes, slowly move closer. Look deep inside the flowers. You may have to watch for a couple of minutes, but often you will see tiny mites or other insects. Look for homes such as anthills, spider webs and carpenter bee holes. Encourage students to observe for as long as possible. Watch the activities that are going on. If they capture a bug in their observation box, remind them to return it to the location from which it came.
4. Return to the classroom. Ask the students to describe what they saw from memory. Don't worry about identifying them by name; just describe what they looked like, their size, color and what they were doing. Let each group have a chance to describe something.
5. Talk about what it must be like to be that small. What would it be like to live your whole life on a flower? What would it be like to be a spider that has to spin a web, stretch it out across an open space and wait for food to come to you? Expand the discussion to talk about the number of life forms that were found in just that small plot. If there is that much activity in that little space, imagine what type of activity is going on throughout the desert.
6. As a follow-up, students can pick something they saw and write a short story. Students can tell their story in the first person as one of the creatures that lives in a flower (*a spider, ant or even one of the plants that is growing in the garden*). They can write a story about that community and the challenges endured to live in such a big world. They can even write about what it might be like for that bug to look at by a big creature (*the student*), which seemingly appears out of nowhere, observes or distracts the bug and then disappears again.

At the Living Desert

Visit the McManus Building where we have smaller life forms like local cockroaches, scorpions and pupfish. These animals take advantage of their small size to hide from predators or to live in bodies of water as small as a puddle.

Visit some water sources on grounds like the Sonoran Pond and the Oasis Pond and look for signs of small life. Water bugs are different from land bugs; see if you spot any and compare them with the insects you viewed in your plot. What are these water bugs doing?





