The GREAT Great Basin Desert

Students will understand where the Great Basin Desert is located, it's climate and physical characteristics, and how the animals that live there are affected and adapted to this unique desert environment. Students will use this knowledge to create an animal specially adapted to the Great Basin Desert.

Grade Level: 5th Grade

Phenomena:
How do animals adapt to survive the environment they live in?

Objectives:

- Students will identify and describe characteristics specific to the Great Basin Desert.
- Students will identify animals native to the Great Basin Desert region and describe the adaptations which enable them to live in this harsh habitat.
- Students will create a unique animal adapted to the Great Basin Desert.

Materials:

- Map with North American Deserts labeled (pg. 8)
- Pictures of Great Basin Desert animals and explanations of their desert adaptations (pgs. 9 & 10)
- Drawing paper
- Pencils/markers/crayons
- Whiteboard/chalkboard
- Dry erase markers/chalk
- Bag containing: Sunglasses, snake skin, bunny ears headband, tube of icy/hot rub, sponge, small bag of salt, sleeping mask, bonsai plant or picture, camouflage fabric or item.
- Craft materials: play-dough, pipe cleaners, tissue paper, pop tabs, coffee filters, etc...

Time Considerations:

- Preparations: 15 minutes
- Activity 1: 15-20 minutes
- Activity 2: 5 minutes
- Activity 3: 5 minutes
- Activity 4: 5 minutes
- Activity 5: 15-20 minutes
- Activity 6: 10-15 minutes
- Conclusion: 5-10 minutes

Nevada Outdoor School . org

Next Generation Science Standards

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Science and Engineering Practices (SEP):
Developing and using models.
Engaging in argument from evidence.

Disciplinary Core Ideas:
5-LS2 Ecosystems: Interactions, Energy, and Dynamics

Cross Cutting Concepts:
Energy and Matter
Structure and Function

Excellence in Environmental Education Guidelines

Environmental Sciences Content Standard 15.0: Ecosystems— Students will demonstrate an understanding that ecosystems display patterns of organization, change, and stability as a result of the interactions and interdependencies among the life forms and the physical components of the Earth.
15.5.2 Investigate and describe how, for any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.
15.5.4 Investigate and describe how the local ecosystem has unique characteristics.

- **Strand 2.2-The Living Environment. A) Organisms, populations, and communities:** Learners understand that biotic communities are made up of plants and animals that are adapted to live in particular environments. **C) Systems and connections:** Learners understand major kinds of interactions among organisms or populations of organisms. **D) Flow of matter and energy:** Learners understand how energy and matter flows among the abiotic and biotic components of the environment. .

Strand 2.4 Environment and Society. B) Places: Learners begin to explore the meaning of places both close to home and around the world

Background

There are four main deserts in the United States: the Great Basin Desert, Sonoran, Mojave, and Chihuahuan deserts. The Great Basin Desert is the northern-most, coldest and largest of these deserts.

The Great Basin is a large, arid region of the western United States. Its boundaries depend on how it is defined. Its most common definition is the contiguous watershed, roughly between the Rocky Mountains and the Sierra Nevada, that has no natural outlet to the sea. The Great Basin is not a single basin, but rather a series of contiguous watersheds. It is bounded on the west by watersheds of the Sacramento—San Joaquin and Klamath rivers, on the north by the watershed of the Columbia Snake, and on the south and east by the watershed of the Colorado-Green.

The Great Basin Culture Area is home to several Shoshone and Great Basin tribes and extends further to the north and east than the hydrographic basin. The

200,000 square mile (520,000 square km) intermountain plateau covers most of Nevada and over half of Utah, as well as parts of California, Idaho, Oregon and Wyoming.

The Great Basin Desert is a cool or "cold desert" due to its more northern latitude, as well as higher elevations (at least 3,000 feet, but more commonly from 4,000 to 6,500 feet). Precipitation, generally 7-12 inches annually, is more evenly distributed throughout the year than in the other three North American deserts. Winter precipitation often falls as snow. Nevada ranks as the driest state, with an average annual precipitation of 9.5 inches.

The Great Basin Desert is located where it is and receives limited precipitation due to the rain shadow effect, created by the Sierra Nevada Mountains to the west and prevailing winds. The result is a dry, arid climate on the leeward side of the mountains.

Rain shadows work systematically. Focusing on the Great Basin Desert, warm air over the Pacific Ocean begins the process by evaporating water. "Prevailing winds carry the moist air over land. As the air rises up the mountain, it expands and cools" (Heller, Orians, Purves, Sadava. In A Rainshadow). When the water molecules become too heavy, they are precipitated back to land. "This air, now dry, continues over the leeward side of the mountain. As the air descends the slope, it warms and picks up moisture from the environment. For this reason, the leeward side of the mountain remains dry" (Heller, Orians, Purves, Sadava. In A Rainshadow).

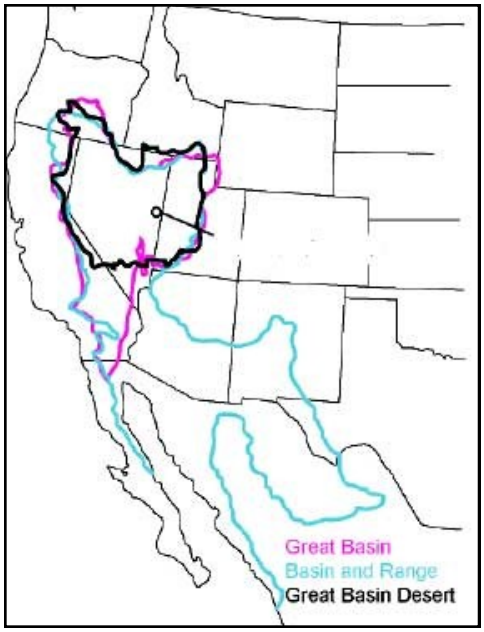
Desert animals, like desert plants, have adapted in very special ways to live in hot, dry environments. When finding water is a problem, many animals develop ways of living to help them use less water.

Almost all desert animals stay out of the sun during the hottest part of the day. They stay deep underground in burrows where it is much cooler.

Desert mammals, like mule deer and elk, are crepuscular during times of extreme temperatures, which means they are active for a few hours at dusk and dawn.

Migration is another behavioral adaptation some large mammals like elk and pronghorn rely on to survive harsh temperatures. In the summer, they move to the higher and cooler mountains. In the winter, they return to lower elevations.

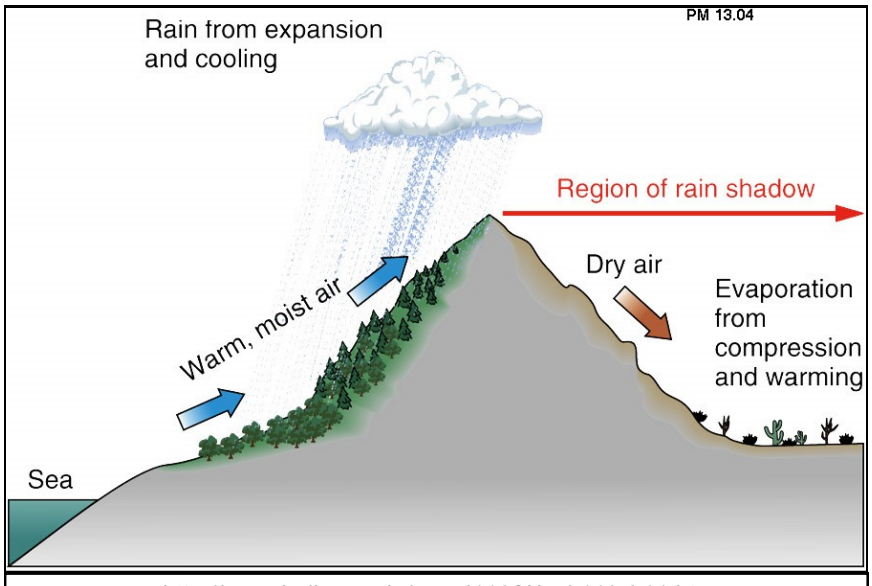
Some physiological adaptations, changes in body morphology, are long appendages that dissipate body heat into the environment. The enormous ears of jackrabbits and mule deer release body heat when the animal is resting in a cool location.



Conserving water is important for desert mammals. Some small mammals have no sweat glands, pass no urine or very concentrated urine, and acquire all or most of the moisture they need from the food they eat.

To survive extreme desert temperatures, marmots and other small mammals may enter a state of estivation, which is a dormant state that occurs during hot, dry periods or extreme cold. When an animal estivates, its breathing, heartbeat, and other body functions slow down. This reduction in activity decreases the need for water.

These are just a few of the adaptations animals of the desert have in order to survive the extreme temperatures and harsh conditions.



http://www.indiana.edu/~geol116/Week11/wk11.htm

- Collect needed supplies for Activities.
- Print off pages 8-16 for class visuals.

Activity 1: North American Desert Discussion

Preparation

Start the lesson by asking students what type of ecosystem we live in, northern Nevada (desert).

Then, ask if anyone knows the name of the desert. (Great Basin Desert).

Doing the Activity

Bring in a map and put it up on the board. Ask the class if anyone can point out the Great Basin Desert. Using the map, have a student point to the Great Basin Desert.

Next, ask the class if they know any other deserts found in North America. Call up volunteers to hold pictures up of the Mojave, Sonoran, and the Chihuahuan Deserts. Share with the students how unique the Great Basin Desert is in comparison to the others. Then, pose this question to the class: Does anyone know how this desert formed? Why is it here?
Let the students share their ideas and then tell them that they are going to find out!

Activity 2:

Seaman, Richard..
In Reptiles of California's Coachella Valley.

Rain Shadow Effect!

Ask for one or two volunteers to hold a push up position for a fair amount of time. Then move the class to an open area of the room.

Before the student gets into the push up position, ask the class what is to the west of us (The Sierra Nevada). Continue asking questions about what is to the west of our location until the classes reaches the Pacific Ocean. Key locations to identify in this discussion are: the Sierra Nevada, California valley, and Pacific Ocean.

At this point, have your volunteer hold a push up position, as you demonstrate and explain the rain shadow effect.

The instructor can either have a damp sponge or Kleenex to squeeze over the volunteer to simulate precipitation.

Begin at the ocean (off the shoes). Explain the air over the ocean is warm and by way of evaporation is able to hold a large amount of moisture. Prevailing winds then move this air over the land into the California valley. The air becomes over saturated and heavy with moisture, that rain or snow, during the winter months, is precipitated in the valley and mountains. At this point squeeze the sponge or Kleenex to simulate precipitation.

The air continues over the mountains to the leeward side of the mountains. Ask the class to reflect on the amount of precipitation they personally see living Great Basin Desert.
Not much, why? A majority of the moisture was already released.

The air is now warm and dry. As the wind moves the air over the desert, what little moisture in the environment is evaporated and carried away. Demonstrate this by releasing or expanding the sponge or Kleenex.

Ask the students to return to their desks and draw the rain shadow in their journals or on a blank sheet of paper.

Activity 3: Desert Challenges & Adaptation Discussion

The desert environment, presents many challenges. As a class, brainstorm challenges plants and/ or animals face in the desert and record their ideas on the board. Students should also write examples in their journals.

Typically thoughts include lack of water, extreme temperatures, little shade, little or no shelter, and lack of food.

Ask students what it is called when plants and animals change how they live or how they are, to better survive in their habitats.

Typically, students will give you examples of how plants and animals adapt. Avoid saying the word adapt and instead, try to let the students come up with the word adaptation on their own.

With a few leading questions, students should be able to think of the word adaptation.

To concrete this concept more, share pictures of Great Basin Desert animals and plants whose adaptations are obvious.

Have students identify the adaptations in the pictures and brainstorm other organisms who have adapted.

Read the background information in this lesson plan and other resources to explain other adaptations found in the Great Basin Desert.

Activity 4: Grab Bag Activity

To elaborate on the challenges and adaptations found in the Great Basin Desert, engage students in this activity.

Begin by dividing the class in half and create groups of 2-3 students within each half. Groups in the first

half the class, will draw an object from the Grab Bag that represents a challenge of the desert. The other half will choose an object that represents an adaptation found in the Great Basin Desert.

Grab bag objects are metaphors which may be confusing to students. To clarify demonstrate the activity. by using the sunglasses as an example.

The goal of this activity is for students to determine what challenge or adaptation their object represents. When students have decided, have each group write their answer on the board .
Allow 5-6 minutes for the groups to discuss their object and then invite the groups to stand and present their findings.

If some groups struggle with this activity, they may receive hints from the instructor or they may open it up for class discussion.

Once all groups have recorded their answers, have each group justify their reasoning to the class.

Finally have the whole class think critically as to what adaptation is necessary to meet the challenges of living in the desert environment.

Grab Bag: Challenges

- **Icy/hot** represents that temperatures in the Great Basin Desert are both extremely hot and cold.
- **Sponge** represents that the plants soak up water and the land is dry, as well as the many terminal lakes and rivers in the Great Basin. Deserts are very dry, receiving less than 10 inches annually, usually in only a few episodes of rainfall a year.
- **Salt** represents salt flats common in the Great Basin Desert from the many terminal lakes and rivers that collect salt from the land and don't reach the ocean.

Grab Bag Objects: Adaptations

- **Sunglasses** represent little protection from the sun.
- **Snake skin** represents that deserts are home to many cold-blooded animals.
- **Bunny ears** represent the many animals that have big ears with a lot of surface area which they use to dispense heat in extreme temperatures.
- **Sleeping mask** represents the many nocturnal animals that live in the desert.
- **Camouflage** represents the common desert animal adaptation to look like it's surroundings so it is hidden from predators.

Activity 5:
Desert Challenge Summary

After the students have finished their presentations, summarize how it is not easy for living things to survive in the desert. From the range in temperature to small amounts of water and shade. Animals, plants, and people face many challenges throughout the year.

Ask students if they can think of any other challenges to add to the list on the board.

Activity 6: New Species!

Explain to the students that they are now experts at detecting adaptations.

They now have the opportunity to show their expertise by constructing a new species that has at least two adaptations using the supplies that you give them.

To clarify, show students an animal that you made (prior to class) and explain its adaptations to the desert.

Ask students to record their new species information in their journal, using the following questions:

a. Where in the desert does the creature live?
b. What does the creature eat and when?
c. What are the adaptations of this creature?

Remind students that as they are creating their creature they should be thinking about how their animal is adapted in the Great Basin Desert.

Great Basin Desert

Conclusion

After an appointed amount of time, ask the students to pair share their creature.

If there is enough time, choose a few volunteers to share their creature and its adaptations with the class.

Adaptations Review:
Review with the class the main points of the lesson:

a. What challenges do animals face living in the desert ecosystem?
b. How have the animals adapted to these challenges?
c. How is the Great Basin Desert different from other deserts?
d. Would these animals need to be adapted differently if they were living in a different desert?

Assessment

Informally evaluate students' knowledge of the Great Basin Desert by their participation in class discussion; ability to answer questions reviewing animals native to the Great Basin Desert; and what adaptations they personally have to survive the desert environment.

Formally evaluate students by observing the animal they create and adaptations they choose for the Great Basin Desert.

Ask students what three common characteristics of a desert are and how animals might adapt to these conditions.

Extensions

Physical vs. Behavioral Adaptations:
Explain to the class there are many different types of adaptations, which all fall into two main categories: physical and behavioral.
Ask students to explain what they think each kind of adaptation means. *Physical adaptations are found on the animals; a change in an animal's characteristic; Behavioral adaptations are how plants and animals act or what they do.*
Write the students' ideas on the board and do the next activity.
To demonstrate one type of adaptation, ask each student to untie their shoe. If a students does not have shoelaces on their shoes, have the student untie the other shoe of their neighbor.
Explain that the class is going to be timed to see how long it takes for everyone to tie one shoe. Be sure to time this first round.
When students finished tying the shoe, they signal by raising their hand in the air. Stop the time when everyone has raised their hands.

Round two. Explain that everyone is do this again, except no one can use their thumbs.
Demonstrate this once for the students before they are timed.
Time the class again, but stop the time at 2 minutes. Ask the class what they believe their thumbs are to the human species. *An adaptation*
Ask the class what type of adaptation thumbs are - *Physical.*
In what ways are the thumbs important for humans?

Library Research
Use library books to help students research a U.S. desert of their choice. Have them then write a paragraph about why it is an interesting and unique place.

Ask the students to compare and contrast their desert to the Great Basin Desert.

Class Showcase
Students' work can be complied to make a class Great Basin Desert Animal Book showcasing their animal creations.

Desert Comparison
Show students the attached pictures of each North American Desert (pgs. 13-16. Have students work in groups to compare the deserts. Use library books to enhance this research. Have students write a paragraph comparing and contrasting two North American deserts.

Great Basin Desert Plants
Explain that desert plants have two main adaptations: the ability to collect and store water and features that reduce water loss. Use attached pictures and explanations of desert plant adaptations (pgs. 11 & 12) to discuss how these adaptations allow plants to live in this desert.

Have students name some plants in the Great Basin Desert: purple monkey flower, scorpion weed, sagebrush, shadescale, great basin fishhook cactus, etc. Then take students on an exploratory hike to allow them to observe for themselves some common desert plants adaptations.

Vocabulary

Adaptation: An alteration in structure or function to help the plant or animal survive in it's environment.

Arid: Without moisture, extremely dry.

Behaviors: To do or say things in a particular way.

Characteristics: A typical quality or feature.

Desert: A region so arid because of little rainfall that it supports only sparse vegetation. An arid region that receives little rainfall and supports only sparse vegetation.

Ecosystem: A community of plants and animals, interacting with their environment.

Habitat: The area or environment where an organism or ecological community normally lives or occurs.

Limiting Factor: An environmental variable that limits or slows the growth or activities of an organism.

Plateau: A level land surface considerably raised above joining land on at least one side.

Population: All the organisms that constitute a specific group or occur in a specified habitat.

Watershed: A drainage area, often drained by a stream or river.

Sources

- Antelope image: www.biggamejournal.com/species/antelope/.
- Antelope info: http://www.gpnc.org/pronghor.htm.
- Great Basin Desert. Wikipedia. Last updated 21 June 2008. http://en.wikipedia.org/wiki/Great_Basin_Desert.
- Map of American Deserts, Info on Animal and Plant adaptations and Mule Deer Image: http://www.scsc.k12.ar.us/1999Outwest/members/LachowskyR/lesson_plan.htm.
- Info on Animal and Plant adaptations: http://www.ndow.org/wild/animals/facts/index.shtm#amphibians AND www.wikipedia.org. Great Basin Rattlesnake info: http://www.nps.gov/brca/naturescience/gbrattlesnake.htm
- www.stoller-eser.com/**adaptations**.htm — accessed 28 June 2010.

Heller, Craig H.; Orians, Gordon H.; Purves, William K.; and Sadava, David. In *A Rainshadow*. (chap. Ch. 56/Ecology and Biogeography - Life: The Science of Biology Seventh Edition) Retrieved Jan. 4, 2011, from http://bcs.whfreeman.com/thelifewire/content/chp56/5602001.html

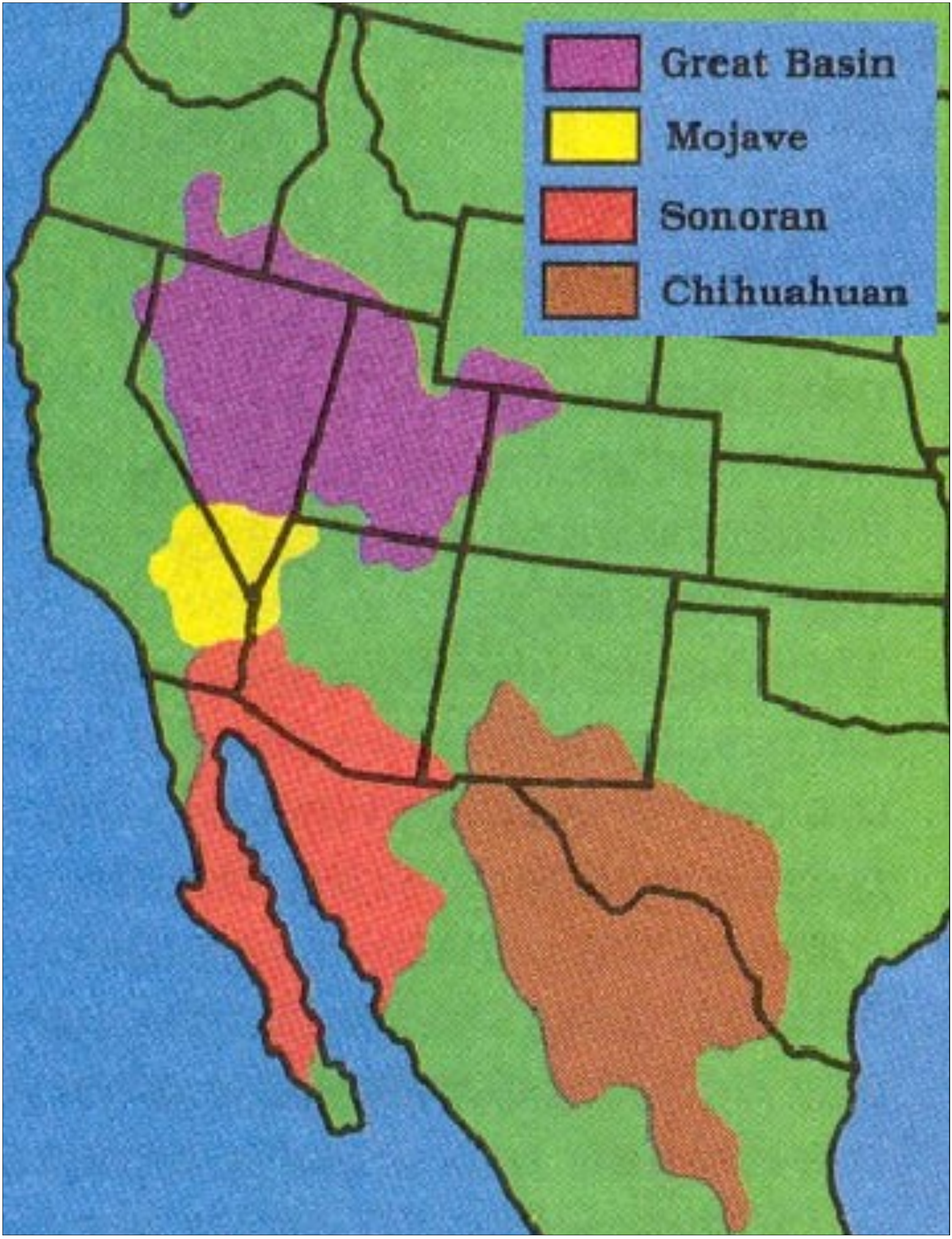
Notis, John.. (2007, Nov. 1). In *Great Basin Rattlesnake*. (chap. Public Gallery) Retrieved Feb. 10, 2011, from http://picasaweb.google.com/notisj/Critters#5154022181455983618.

Dunning, Jeremy. In *Deserts, Glaciers and Shorelines*. (chap. Week 11: G-116 Our Planet and its Future) Retrieved Jan. 6, 2011, from http://www.indiana.edu/~geol116/Week11/wk11.htm

Rosiere, R. E. (2009). In *Great Basin Desert*. (chap. ShurblandsRange Types of North America) Retrieved Jan. 10, 2011, from http://www.tarleton.edu/Departments/range/Shrublands/Great%20Basin%20Desert/greatbasindesert.html

Seaman, Richard.. In *Reptiles of California's Coachella Valley*. Retrieved Mar. 1, 2009, from http://www.richard-seaman.com/Reptiles/Usa/California/CoachellaValley/index.html

Willson, Gary.. (2000, Mar 2). In *Big Bend National Park*. (chap. Ocotillo and Chisos Mtns) Retrieved Feb. 23, 2009, from http://willsononline.com/bigbend2000


Great Basin
Mojave
Sonoran
Chihuahuan

Great Basin Desert Animal Adaptations

Pronghorn Antelopes have widely-spaced eyes so they are able to see up to three miles away. Their strong herd instinct allows them to work together to fend off predators. They are the fastest runners in North America, and have been clocked at 60mph, and can sustain speeds of 30mph for many miles. Lastly, the herd runs in perfect unison in a very tight, oval-shaped formation, much like a flock of birds.

Great Basin Rattlesnakes are cold-blooded animals that are not exhausted by extreme changes in temperature. Also this allows them to be able to only eat a few times a year. The "Loreal Pit" between their eyes and their nostrils that detects temperature changes as little as a one degree change from 20-30 feet away, possibly indicating prey nearby. They are also able to sense vibrations through the ground created by the movement of other animals, again helping them to detect their prey.

Mule Deer have large ears that dissipate heat from their body and helps to keep them cool during the extremely hot temperatures of the summer. They can detect water with their keen sense of smell and then use their large feet to claw it out to as much as two feet deep.

The **Horned Lizard** has skin which is almost perfectly camouflaged with it's habitat—increasing it's ability to fend off predators. They burrow into the sand to escape extremely hot temperatures, and use their large, flat bodies to collect solar warmth when it is cool. Additionally, predators are inhibited by the lizard's wide, thorny body. As a last ditch defense mechanism, they will squirt blood out of their eyes, which is not only startling, but also irritating to the mucus membranes of some predators.

The **Common Poorwill** is the only bird known to go into torpor for extended periods (weeks to months). Torpor is a (usually short-term) state of decreased physiological activity in an animal, usually characterized by a reduced body temperature and a slowed rate of metabolism. The birds spend much of their winter inactive, concealed in piles of rocks. The Common Poorwill frequently takes prey off of the ground or by leaping into the air from the ground. They can survive on stony desert slopes with very little vegetation.

Great Basin Desert Fauna *

Great Basin Desert Plant Adaptations

Dwarf Purple Monkeyflower adapts to the lack of water by completing its entire life-cycle within three weeks. In early summer, when water is available for a short time, the monkeyflower sprouts, grows, flowers, produces a seed, dies, and becomes dormant again.

The **Prickly Pear Cactus** collects moisture in the spongy tissue of its enlarged stems, called pads. The cactus can then draw on this stored supply of water when the weather turns dry.

Big Sagebrush grows two sets of leaves that help it retain water. Large leaves in the spring allow the plant to take in water and grow rapidly. These leaves are dropped in the summer, and a smaller, year-round set exposes less surface area to evaporation. Additionally, sagebrush has three different root systems. The first is a shallow mat of roots that helps to absorb rainfall as quickly as possible. A second, deeper set of roots extracts water that soaks into the soil as the winter snowpack melts. Finally a taproot extends downward six feet or more to order to reach the long-lasting ground water.

The leaves and stem of the **Rubber Rabbitbrush** are covered by wooly hair that protects the plant from the wind and reflects back the sun. Additionally, its small leaves expose a minimum area to the drying wind and sun.

Scorpionweed has deeply veined, matted leaves that channel water to the roots and reduce evaporation by shading the ground beneath the plant. Light-colored cilia, or hair-like structures, cover the plant and inhibit air movement across the leaves, reflect sunlight, and trap a thin layer of moisture-laden air around the leaves. Each of these factors greatly reduces the impact of the hot, dry climate.

Great Basin Desert Flora *


Big Sagebrush
(Artemisia tridentate)


Bristlecone Pine
(Pinus Balfourianae)


Rubber Rabbitbrush
(Ericameria)

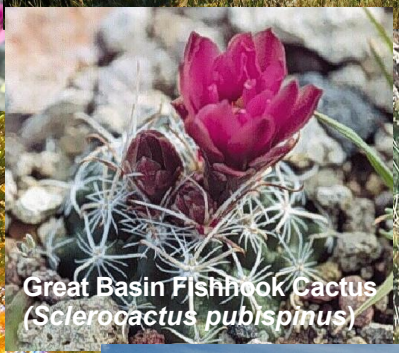

Antelope bitterbrush
(Purshia tridentate)

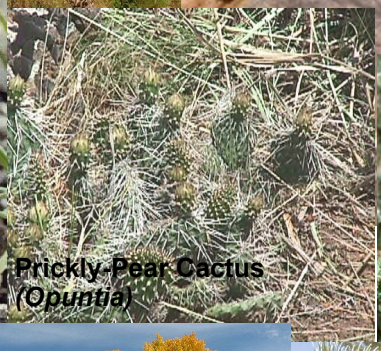

Scorpion Weed
(Phacelia)


Utah Juniper
(Juniperus osteosperma)

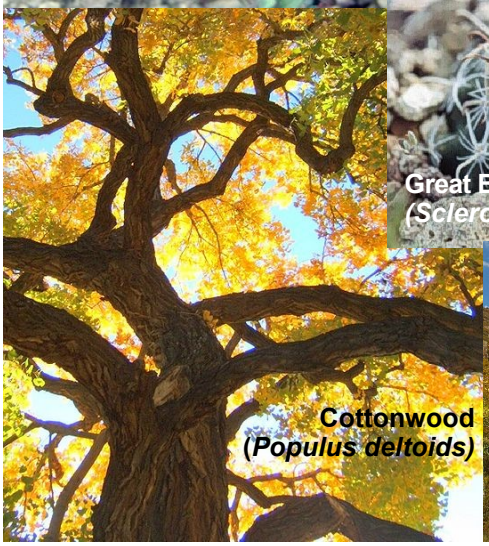

Mountain-mahogany
(Cercocarpus)

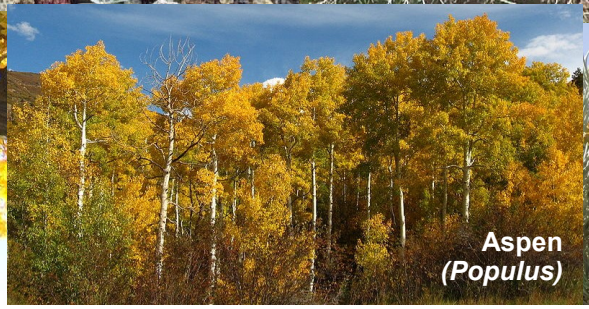

Dwarf Purple Monkeyflower
(Mimulus nanus)


Great Basin Fishhook Cactus
(Sclerocactus pubispinus)


Prickly-Pear Cactus
(Opuntia)


Shadscale
(Atriplex confertifolia)


Cottonwood
(Populus deltoids)


Aspen
(Populus)


Single-leaf Pinyon
(Pinus monophylla)

Great Basin Desert

Mojave Desert

Sonoran Desert

Chihuahuan Desert

Willson, Gary.. (2000, Mar 2). In Big Bend National Park.

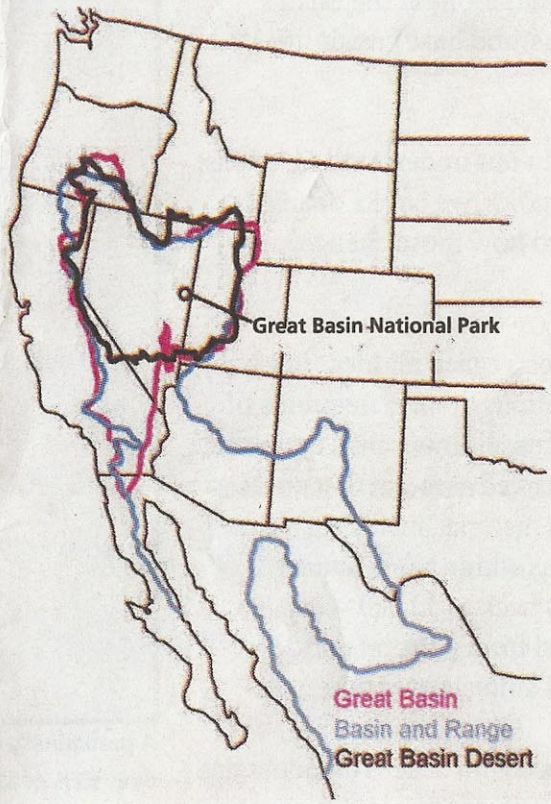
What Is The Great Basin?

At first glance, the Great Basin appears to be a desolate landscape not worthy of exploration, but nothing could be further from the truth. The rich diversity of this region may be subtle, but from the sagebrush to the mountain tops there are a thousand secrets to discover.

Defining the Great Basin begins with a choice: are you looking at the way the water flows (hydrographic), the way the landscape formed (geologic), or the resident plants and animals (biologic)? Each of these definitions will give you a slightly different geographic boundary of the Great Basin, but the hydrographic definition is the most commonly used.

The Hydrographic Great Basin is a 200,000 square mile area that drains internally. All precipitation in the region evaporates, sinks underground or flows into lakes (mostly saline). Creeks, streams, or rivers find no outlet to either the Gulf of Mexico or the Pacific Ocean. The region is bounded by the Wasatch Mountains to the east, the Sierra Nevada to the west, and the Snake River plain to the north. The south rim is less distinct. The Great Basin includes most of Nevada, half of Utah, and sections of Idaho, Wyoming, Oregon, and California. The term "Great Basin" is slightly misleading; the region is actually made up of many small basins. The Great Salt Lake, Pyramid Lake, and the Humboldt Sink are a few of the "drains" in the Great Basin.

The **Basin and Range** region is the product of geological forces stretching the earth's crust, creating many north-south trending mountain ranges. These ranges are separated by flat valleys or basins and form an undulating pattern: basin, range, basin, range, basin, range. These hundreds of ranges make Nevada the most



The **Great Basin Desert** is defined by plant and animal communities. The climate is affected by the rain shadow of the Sierra Nevada and Cascade Mountains. It is a temperate desert with hot, dry summers and snowy winters. The valleys are dominated by sagebrush and shadscale. The biologic communities on the mountain ranges differ with elevation, and the individual ranges act as islands isolated by seas of desert vegetation. Because the Great Basin exhibits such drastic elevation changes from its valleys to its peaks, the region supports an impressive diversity of species, from those adapted to the desert to those adapted to forest and alpine environments.

From: National Park Service, U.S. Department of the Interior, Great Basin National Park. *The Bristlecone: The Official Newspaper of Great Basin National Park.* Summer 2009-2010. p. 16.