

# EXPLORE THE GREAT BASIN



**BRINGING THE NATURAL  
AND CULTURAL WONDERS  
OF THE REGION  
TO THE CLASSROOM**



*This resource activity guide was funded with grants from the National Park Service, the National Park Foundation, and the Great Basin Association. Parks as Classrooms is the educational program of the National Park Service in partnership with the National Park Foundation. Published 2001.*

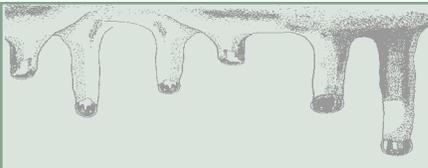
# TABLE OF CONTENTS

---

Forward	I
Using This Guide	II
Acknowledgments	II
Tell Us What You Think	III
Defining the Great Basin	V



## **UNIT 1 GREAT BASIN GEOLOGY GEOGRAPHY AND HYDROLOGY ACTIVITIES**



## **UNIT 2 CAVES BACKGROUND INFORMATION ON GEOLOGY, FLORA, AND FAUNA ACTIVITIES**



## **UNIT 3 BATS BACKGROUND INFORMATION ACTIVITIES**



## **UNIT 4 CLIMATE: PAST AND PRESENT BACKGROUND INFORMATION ACTIVITIES**

# TABLE OF CONTENTS

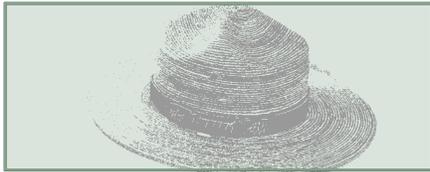
---



**UNIT 5**  
**DESERT DIVERSITY**  
**COMMUNITIES OF THE GREAT BASIN**  
**BACKGROUND INFORMATION**  
**ENDANGERED SPECIES**  
**ACTIVITIES**



**UNIT 6**  
**PEOPLE OF THE GREAT BASIN**  
**ARCHEOLOGY/ PREHISTORY**  
**AMERICAN INDIAN CULTURES**  
**WESTERN EXPANSION**  
**ACTIVITIES**



**UNIT 7**  
**GREAT BASIN NATIONAL PARK**  
**BACKGROUND INFORMATION ON THE PARK**  
**GENERAL INFORMATION FOR THE VISITOR**  
**ACTIVITIES**



**RESOURCES**  
**FURTHER READING**  
**GLOSSARY**

# FORWARD

---

Dear Teacher,

We hope you will find this Resource Activity Guide a significant help in teaching students about the Great Basin of the Western United States. We have designed it specifically for teachers of elementary grades four, five and six, but with an expectation that with a little effort, the presentation of information and activities can be adapted for other ages and levels. We plan to revise the Guide in the future and would very much appreciate hearing from you about your experiences using it and your recommendations for its improvement.

The Great Basin is a surprisingly diverse and fascinating place containing multitudes of unique ecosystems within it. The harsh climate of the Great Basin high desert has limited development of this vast, 200,000 square mile area, while the native peoples, plants, and animals, developed brilliant adaptations to survive and reproduce. The land forms and climate have changed dramatically over thousands of years. Huge lakes once separated the more than 200 mountain ranges; now water evaporates or sinks, but does not flow to the ocean.

The Great Basin offers exceptional opportunities for people to learn about the natural world and to reflect on the need for people to adapt to limits created by climate and natural resources in order to live sustainably on our small planet. The region contains pristine air, spacious views, dark night skies, and a remoteness that invites contemplation of the larger universe in which our world revolves and our short lives take place.

We hope this Resource Activity Guide helps you to excite your students about the Great Basin. Enjoy!



Becky Mills  
Superintendent, Great Basin National Park

## USING THIS GUIDE

The Great Basin is a unique place! The purpose of this guide is to help educators teach children about this spectacular area, whether or not they live in the Great Basin. The activities are designed for grades 4-6, but they can be adapted for younger and older students too. The guide is organized in units, with each unit providing background information and activities for both the classroom and the outdoors. If you are looking for more in-depth information on any of the subjects, use the resources section to identify books and reference materials that will be helpful to you.

The objectives of this guide are to:

- Provide educators with information on the physical, biological, and cultural resources and heritage of the Great Basin.
- Acquaint students with the Great Basin and its unique aspects through hands-on activities.
- Develop within the students an understanding of the value of the Great Basin and an appreciation for the total environment.
- Direct students toward actions they can take to protect the Great Basin and to be stewards of the environment.

We hope that the information and activities provided will help you and your students to develop a sense of this place we call the Great Basin. It is a place where the earth is moving, where numerous and diverse species make their homes, and where cultures have survived and thrived for thousands of years. Go forth and explore!

## ACKNOWLEDGMENTS

This resource activity guide is the collaborative effort of many people and organizations. We would like to acknowledge the contributions of all those listed below:

Nichole Andler  
Cristi Baldino  
Terry Baldino  
Carlsbad Caverns  
Jody Davila  
Everglades National Park  
Stan Ferris  
Great Basin Association  
Nancy Hadlock  
Bill Helmer  
Joshua Tree National Park  
Sharyl Kinnear-Ferris  
Ed Kuklinski  
Eve Kwiatowski

Hallie Larsen  
Roberta Moore  
Melanie Moreno  
Nevada Native American  
Education Association  
Anne Hopkins-Pfaff  
Kurt Pfaff  
Marcia Phillips  
Jason Ramsdell  
Jim Roche  
Brandi Roberts  
Jud Tuttle  
Ken Watson  
Alan Young

# TELL US WHAT YOU THINK!

After you have used *Explore the Great Basin Educator's Guide*, we would like to hear your comments . We request your help in making this a better program and one that fits your classroom needs. Please take a few minutes to answer the questions in this evaluation and return the evaluation to the address shown on the following page. Your comments and suggestions will ensure that *Explore the Great Basin* continues to be of value to you and your students. Thank you for taking the time to respond to this evaluation and happy exploring!

School Address:

---

Group Leader or Teacher:

---

Grade Level: \_\_\_\_\_

Did you use any of the activities in this guide? Yes \_\_\_\_\_ No \_\_\_\_\_  
(If yes, please complete the reverse side of this evaluation sheet.)

Did you arrange for a class visit to Great Basin National Park? Yes \_\_\_\_\_ No \_\_\_\_\_  
If not, would you like information about visiting the park with your class? Yes \_\_\_\_\_ No \_\_\_\_\_

## EXPLORE THE GREAT BASIN

Please circle your response(s) to the following:

Overall:	Good	Fair	Poor	Comments:
Usefulness	1	2	3	_____
Relevance to school curriculum .....	1	2	3	_____
Quality .....	1	2	3	_____
Interest Level .....	1	2	3	_____
Understandable .....	1	2	3	_____

What are your suggestions for improving this guide?

---

---

---

Feel free to add comments below or attach more comments or suggestions on an additional sheet.

---

---

# EVALUATION OF ACTIVITIES

---

Title of classroom activity	Appropriate for your grade level?	Ease of use	Were the concepts conveyed?	Adequate background information?	Would you use this activity again?
1.					
2.					
3.					
4.					
5.					

Please return this evaluation form to:  
**EDUCATION COORDINATOR**  
100 Great Basin National Park  
Baker, Nevada 89311

# 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. Right in our backyard lies a vast natural laboratory. The Great Basin provides significant biological, geological, and cultural resources for you and your students to investigate and learn from. Here we can study anything from global climate change to salt flats to alpine wildflowers to mining history. The rich diversity of this region may be subtle, but from the sagebrush to the mountain tops there are a thousand secrets to discover.

## WHAT IS THE GREAT BASIN?

Defining the Great Basin begins with a choice: are you looking at the way the landscape formed (geologic), the way the water flows (hydrographic), 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

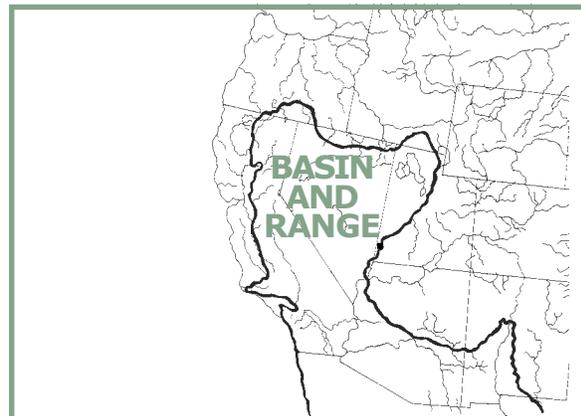
The hydrographic Great Basin is an approximately 200,000 square mile area that drains internally. Surface water leaves the Great Basin only by evaporation. Creeks, streams, or rivers find no outlet to either the Gulf of Mexico or the Pacific Ocean. All precipitation in the region evaporates, sinks underground or flows into lakes (mostly saline). The boundaries to the west and the east are the Sierra Nevada Mountains of eastern California and the Wasatch Mountains of Utah, respectively. The northern boundary is the Snake River Plain of Idaho and Oregon. The south rim is less distinct. John Fremont, upon naming the Great Basin, believed there was a mountain range to the south. This mountain range proved nonexistent. The Great Basin includes most of Nevada, half of Utah, and sections of Idaho, Wyoming, Oregon, and California. The term "Great Basin" may be slightly misleading because the region is actually made up of many small basins. The Great Salt Lake, Walker Lake, Pyramid Lake, and the Carson and Humboldt Sinks are a few of the "drains" in the Great Basin.



# THE GREAT BASIN

## THE GEOLOGIC GREAT BASIN: BASIN AND RANGE

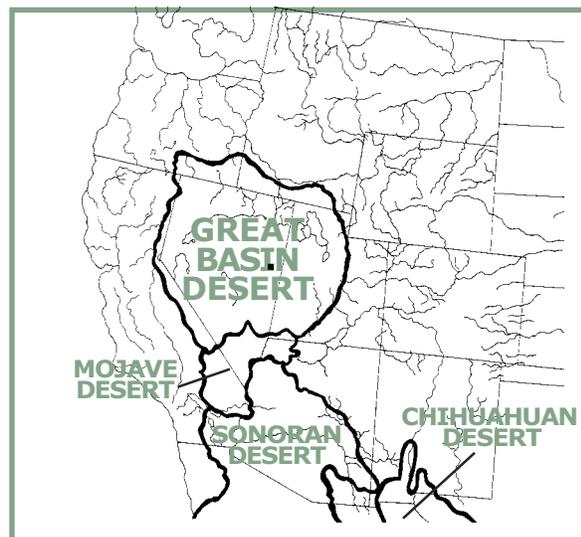
The Basin and Range region is recognized by its unusual topography. It is the product of the geological forces stretching the earth's crust, creating many, north-south trending, tilted mountain ranges. These mountain ranges are separated by flat valleys or basins. Across the region are "high, discrete, austere new ranges [that] come in waves, range after range after north-south range, consistently in rhythm with wide flat valleys; basin, range, basin, range; a mile of height between basin and range" (John McPhee, Basin and Range). These hundreds of ranges are what make Nevada the most mountainous state in the country. This geological region encompasses most of the hydrologic Great Basin, as well as parts of Arizona, New Mexico, Texas, and Mexico.



## THE BIOLOGIC GREAT BASIN:

The biological Great Basin is defined by plant and animal communities. The climate of the Great Basin Desert is affected by the rain shadow of the Sierra 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 in the lower drier valleys.

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. The various communities of the Great Basin are described in detail in the Desert Diversity unit.



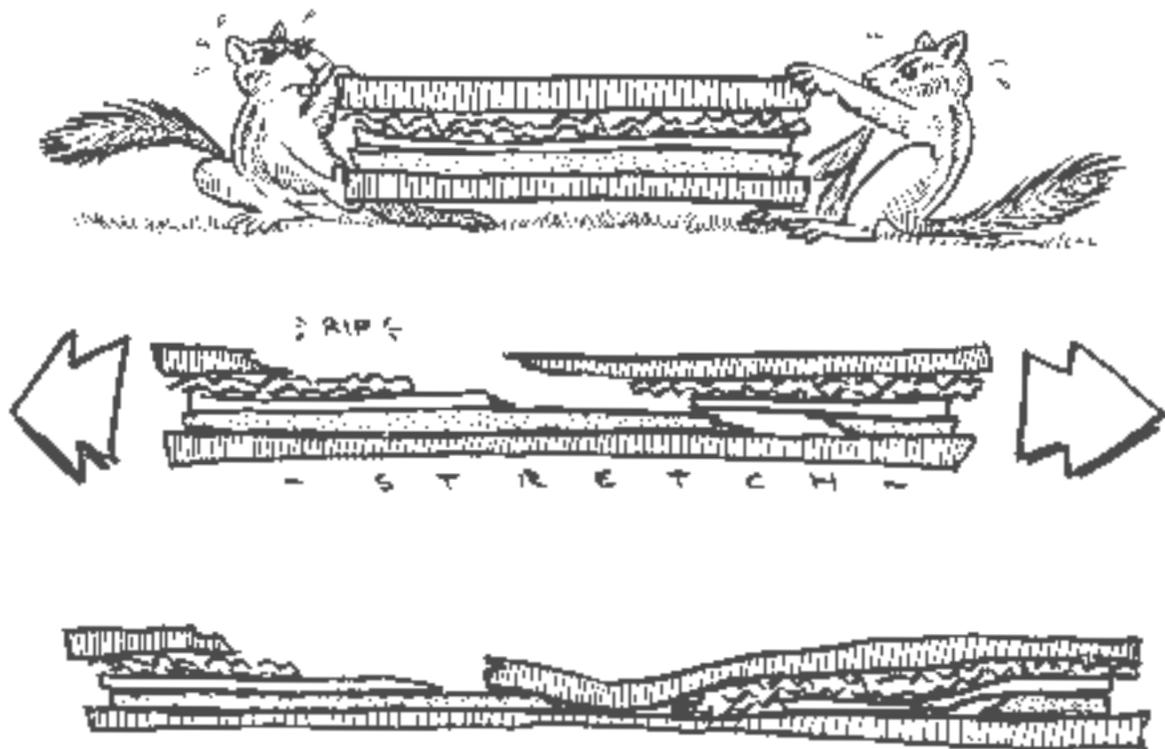
# GEOLOGY



## DYNAMIC GEOLOGY OF THE BASIN AND RANGE

Within the Basin and Range province, the earth's crust and upper mantle have been stretched up to twice their original width. The entire region has been subjected to extension, which thinned and cracked the crust as it was pulled apart, creating large faults. Along these roughly north-south trending faults, mountains were uplifted and valleys down-dropped, producing the distinctive alternating pattern of linear mountain ranges and valleys of the Basin and Range province.

Although there are other types of faults in the Basin and Range province, the extension and crustal stretching that shaped the present landscape produce mostly block faults. The upthrust side of these faults form mountains that rise abruptly and steeply, and the down-dropped side creates low valleys. The fault plane, along which the two sides of the fault move, extends deep into the crust, usually at an angle of 60 degrees. In places, the relief or vertical difference between the two sides is as much as 10,000 feet. When rocks are uplifted they are immediately subject to weathering and erosion. As mountains are weathered by water, ice, wind and other erosional agents, rock particles are stripped away and washed down the mountainside, often covering the fault plane. Sediment collects in the adjacent valleys, in some places burying the bedrock under thousands of feet of rock debris.



# GEOLOGY



## WHAT IS THE HYDROGRAPHIC GREAT BASIN?

The Basin and Range Geologic province's dynamic fault history has profoundly affected the region's water drainage system, or hydrology. Most precipitation in the Great Basin falls in the form of snow that melts in the spring. Rain that reaches the ground, or snow that melts, quickly evaporates in the dry desert environment. Some of the water that does not evaporate will sink into the ground and become ground water. The remaining water flows into streams and collects in short-lived lakes called playas on the valley floor and eventually evaporates or becomes groundwater. No streams, creeks, or rivers that originate within the Great Basin ever find an outlet to the ocean. The extent of internal drainage, the area in which surface water cannot reach the ocean, defines the geographic region known as the Great Basin.

The Great Basin's internal drainage results from blockage of water movement over high fault-created mountains and by lack of sufficient water flow to merge with larger drainages outside the Great Basin. This internally-drained area occupies approximately 200,000 square miles, including most of Nevada, a large part of Utah, and portions of Idaho, California, and Oregon. Most of the present-day Great Basin would drain to the sea - just as it did in the recent Ice Ages - if there were only more rain and snowfall.

## THERMAL SPRINGS IN THE GREAT BASIN

Approximately seven to twelve percent of the Great Basin's precipitation will become ground water. Even in the dry Great Basin, there are large amounts of water stored in the subsurface rock. The water seeps into the rocky underground "storage tanks" through porous soil or rocks and through fissures and faults. The thin, highly fractured crust produced by extensional stretching in the Basin and Range province enhances the circulation of fluids. A thin crust means that the earth's hot mantle is closer to the surface. In fact, the whole region has a higher heat flow than the surrounding areas. Cool fluids moving through the hot rock are heated and rise to the surface, forming thermal springs. The combination of geologic and hydrologic features of the region make the Great Basin an area with many thermal springs.

*Safety note: Never enter or jump into a thermal spring before testing the water - they can be hot enough to kill a person.*

## NOTES:

# GEOLOGY



## GEOLOGIC HISTORY OF THE GREAT BASIN

For most of the Paleozoic Era, a shallow sea covered the region that is now the Great Basin. Sand, mud, and the skeletons of marine organisms accumulated on the bottom of the sea. The particles were compacted and cemented to form the sedimentary rocks, sandstone, shale, and fossiliferous limestone.

The western Great Basin was squeezed by several phases of compressional deformation and mountain-building during later Paleozoic and Early Mesozoic time. During these compressional phases, the crust was pushed from west to east and large sections of the crust rode eastward up and over adjacent sections. Mountain ranges grew and then eroded away, their sedimentary debris accumulating in surrounding areas. Two phases of compressional mountain-building occurred during the Jurassic and Cretaceous. The first phase affected a zone from southern California to Wyoming, cutting through eastern Nevada. Paleozoic sedimentary rock layers were stacked double-thick, forcing the lower layers deep into the crust where they were heated and deformed. Magma injected between the rock layers cooled to form granitic rocks. The second phase of compression in the Cretaceous created the ancestral Rocky Mountains.

During the latter half of the Tertiary period of the Cenozoic era (about 40 to 20 million years ago), explosive volcanoes spread clouds of searing ash over thousands of square miles. About 20 million years ago, the Great Basin began to stretch east-west. The extensional forces created faults in the upper crust that led to the development of the modern Basin and Range landscape. The region continues to expand today.

During the Pleistocene epoch, glaciers formed in many of the higher mountains. This epoch has been marked by a series of glaciations, popularly known as "ice ages", alternating with warmer periods similar to today's climate. During the most recent glaciation, lakes flooded many valleys, plant communities shifted to warmer elevations and latitudes, and boreal mammals lived in the Great Basin.

\*MYA stands for MILLIONS OF YEARS AGO.

GREAT BASIN TIME CHART			
ERA	PERIOD	EPOCH	MYA
CENOZOIC	QUATERNARY <i>Q</i>	Recent	.01
		Pleistocene	
	TERTIARY <i>T</i>	Pliocene	2
		Miocene	5
		Oligocene	24
		Eocene	37
		Paleocene	58
MESOZOIC	CRETACEOUS <i>K</i>		66
	JURASSIC <i>J</i>		144
	TRIASSIC <i>T</i>		208
PALEOZOIC	PERMIAN <i>P</i>		245
	PENNSYLVANIAN <i>TP</i>		286
	MISSISSIPPIAN <i>M</i>		330
	DEVONIAN <i>D</i>		360
	SILURIAN <i>S</i>		408
	ORDOVICIAN <i>O</i>		438
	CAMBRIAN <i>C</i>		505
PRECAMBRIAN <i>PC</i>		570	

# GEOLOGY



## EFFECTS OF THE ICE AGES

The climate of the Great Basin has not always been as it is today. From approximately 1.6 million to 10,000 years ago (the Pleistocene epoch) the earth's climate underwent four periods of cooling and glaciation separated by three warmer interglacial periods, similar to today's climate. The Pleistocene climate changes had a dramatic effect on the Great Basin. One result of the cooler climate was increased precipitation. At lower elevations the precipitation fell as rain; in the higher mountain ranges the precipitation fell as snow - the beginnings of glaciation. (If snow piles up faster than it melts, over the centuries it will eventually become thick enough to begin to slowly move downhill under the pressure of its own weight and an alpine glacier is born.) The higher mountains in the Great Basin were capped by glaciers during cooler Pleistocene periods.

Ice is a strong erosional force and much of the topography we see today in the higher mountain ranges is due to carving of rock by glacial erosion. Bowl-shaped mountain faces called cirques and U-shaped valleys cut by glaciers can be easily seen in the Snake Range, the Ruby Mountains, and other mountain ranges of Nevada. Piled up along the sides of U-shaped valleys and at the bases of cirques are moraines, large piles of boulders carried and deposited by glaciers. Today only one small alpine glacier remains in the Great Basin; it is located in the South Snake Range within Great Basin National Park.

Another type of glacier, a rock glacier, is also found in the glacier cirque of Great Basin National Park as well as in other high mountain ranges around the world. Rock glaciers are made up of angular rock fragments with ice filling the spaces between the blocks. Rock glaciers resemble alpine glaciers in outline and down-slope movement. By freezing, thawing, and sagging, the ice works with gravity to provide the force that moves the rock glacier.

During Pleistocene glacial periods, plant distribution was different from today. The plant communities were down-slope or south of their present locations. Limber pine and bristlecones, found only at high elevations near the timberline today, could be found on the sides of mountains.

At the end of the Pleistocene, Earth's climate began to warm timberlines on the sides of the mountains. Hundreds of feet of snow and ice from the high country began to melt. Large amounts of rain and snowmelt collected in the valley bottoms as lakes. Large rivers and lakes were common throughout the Great Basin during the Pleistocene. However, most of the lakes and rivers have evaporated in the present desert environment. The Great Salt Lake is a remnant of the largest Pleistocene lake - Lake Bonneville.

The pinyon-juniper community is an excellent example of how the changing climate has affected the distribution of plant communities. The pinyon-juniper community is the most common in the forested areas of the Great Basin. This community has been moving northward since the climate warmed and most of the ice melted in the Great Basin. Part of the explanation for this northward change in distribution is found by looking at bird distribution. Birds that disperse seeds of these trees have also been heading north and increasing their range since the last glaciers receded at the end of the Pleistocene. Plant and animal populations are always closely linked. Climate change affecting one will inevitably affect the other as well, as they are part of the same community.

## NOTES:

# CREATING YOUR OWN ROCK LEGEND

**SUBJECTS:**

Creative writing, spelling

**LOCATION:**

Classroom

**DURATION:**

20-30 minutes

**OBJECTIVE:**

Students will use their imaginations to create a personal story based upon facts offered in class.

**KEY VOCABULARY:**

Legend, myth, story, minerals, geology

**MATERIALS:**

Pen, pencil, paper

**METHOD:**

- 1) Read the Goshute Legend to the class (possibly more than once).
- 2) Discuss what it could mean; do all stories have “meaning or a moral”? What is the difference between a story, a myth, or a legend?
- 3) Instruct the class to write their own story or myth about rocks and geology in their area. Use imagination! Encourage them to come up with wild stories based on the facts. If the students haven’t yet learned the “real” story about the Great Basin, then this will be their opportunity to create their own story!

**ADAPTATION:**

This exercise can be adapted for younger children in kindergarten through grade 3. Ask the students to create and write (or verbally contribute) sentences. String the sentences together and have the entire class create a story.



## “CREATION OF BASIN AND RANGE” (GOSHUTE LEGEND)

The Goshute have a legend describing how the basins and ranges of the Great Basin were formed:

“In the beginning, all the area in eastern Nevada was one large mountain. One day Hawk and Coyote met on this large mountain. They began to quarrel. The two animals became very angry. Soon Hawk soared high into the air. Hawk then dove down to the mountain and began ripping it apart with its claws. When Hawk finished, many ranges and basins had been created, including the Snake Range and Wheeler Peak.”

# DEEP TIME



## ACTIVITY 2

**SUBJECTS:**

Art, math, science

**LOCATION:**

Classroom

**DURATION:**

30-45 minutes

**OBJECTIVE:**

Demonstrate the relative distance of events in time.

**KEY VOCABULARY:**

Time, history, human history

**MATERIALS:**

Adding machine paper tape (at least 40 feet), crayons, Span of Time chart (see following page)

**METHOD:**

- 1) Find a space about 40 feet in length.
- 2) Assign one student to represent the beginning of the Earth and have them pull out the paper tape. Lay the tape on the floor.
- 3) Assign each student an event on the Span of Time chart and have him/her pace out the distance to his/her assigned event.
- 4) Starting out with the beginning of the Earth, have each student call out his/her event and how long ago it occurred.
- 5) Have each student draw a picture to represent his/her assigned event at the length of tape that represents that date in time. (Note that modern events have occurred in such a tiny part of recent history, compared with the rest of time, that it would be difficult to include all those events on the tape).

**EXTENSIONS:**

Try a larger format outdoors, using twine instead of paper tape. Using the same format, make a time line for human history.

For a math exercise, try converting the chart to metric or practice measuring in metric.

**NOTES:**

# DEEP TIME



## THE SPAN OF TIME

LENGTH OF TIME FROM PRESENT (INDOOR)	LENGTH OF TIME FROM PRESENT (OUTDOOR)	YEARS AGO	EVENT
38 FEET	254 YARDS	4.57 BILLION	EARTH BEGINS
29 FEET	194 YARDS	3.5 BILLION	LIFE ON EARTH BEGINS
25 FEET	167 YARDS	3 BILLION	FIRST FOSSILS FORM: ALGAE, FUNGI, BACTERIA ABUNDANT
4.5 FEET	31 YARDS	550 MILLION	JELLYFISH, SPONGES WORMS ABUNDANT
3.75 FEET	25 YARDS	450 MILLION	FIRST PRIMITIVE FISH
40 INCHES	22 YARDS	400 MILLION	EARLIEST LAND PLANTS (FERNS AND MOSSES)
35 INCHES	19 YARDS	350 MILLION	EARLIEST LAND ANIMALS (AMPHIBIANS)
31 INCHES	17 YARDS	310 MILLION	FIRST REPTILES
27 INCHES	15 YARDS	270 MILLION	REPTILES ABUNDANT (AS WELL AS DEVELOPED)
24.5 INCHES	14 YARDS	245 MILLION	AGE OF DINOSAURS BEGINS
18 INCHES	10 YARDS	180 MILLION	FLOWERING PLANTS DEVELOP
16 INCHES	9 YARDS	160 MILLION	BIRDS EVOLVE DINOSAURS ABOUND
7 INCHES	4 YARDS	70 MILLION	MODERN BIRDS DEVELOP
6 INCHES	11 FEET	65 MILLION	DINOSAURS EXTINCT AGE OF MAMMALS BEGINS
5 INCHES	8 FEET	50 MILLION	MAMMALS AND BIRDS ABUNDANT
4 INCHES	7 FEET	40 MILLION	FIRST ELEPHANTS
.5 INCHES	10 INCHES	5 MILLION	FIRST HUMANS
.15 INCHES	3 INCHES	1.5 MILLION	BEGINNING OF PLEISTOCENE AND ICE AGES
.001 INCH	.02 INCH	10,000	END OF MOST RECENT ICE AGE
.0002 INCH	.004 INCH	1,915	MT. VESUVIUS ERUPTS IN POMPEII
.0001 INCH	.0015 INCH	779	MAGNA CARTA SIGNED IN 1215
.00002 INCH	.0004 INCH	225	DECLARATION OF INDEPENCE SIGNED IN 1776

### SCALE

INDOOR: 0.1 INCH=1 MILLION YEARS

OUTDOOR: 2 INCHES=1 MILLION YEARS

# GREAT BASIN POETRY



**SUBJECTS:**

Creative writing, art, geology

**LOCATION:**

Classroom

**DURATION:**

30-45 minutes

**OBJECTIVE:**

Students will be able to visualize the Great Basin and its basin and range topography. They will create original art and poems reflecting their knowledge.

**BACKGROUND:** See paragraph on the Dynamic Geology of the Basin and Range (Page 1 of this chapter).

**KEY VOCABULARY:**

Basin and Range, Great Basin

**MATERIALS:**

Paper, pen or pencil, and drawing materials

**METHOD:**

- 1) Have the students each write a poem about the Great Basin or its basin and range topography.
- 2) Have the students each create a "picture poem" with their written poem (i.e. the students write the words of their poem in a drawing that depicts the Great Basin or basin and range topography to them.
- 3) Have the students illustrate their poems with other Great Basin and basin and range scenery such as plants, earth forms, and animals.

The Great Basin goes up and down basin and range basin and range basin and range basin  
basin and range basin  
basin and range basin  
basin and range basin

# GEOLOGY GUIDE

**SUBJECT:**

Geology

**DURATION:**

1-2 hours (not including prep time). You may choose to include the students in preparation as well, and you should set aside time over several days to do this. The formation of glaciers is a long process, so spreading the activity out over time may give students a better appreciation of this.

**KEY VOCABULARY:**

Moraine (terminal and lateral)

**MATERIALS:**

Half gallon milk carton, 12 foot long by 1 foot wide panel or board, sand, rocks, and gravel.

**OBJECTIVE:**

Students will be able to describe how a glacier carves an area and its characteristic appearance.

**METHOD:**

- 1) Remove one side panel from the half-gallon milk carton.
- 2) Fill 1/3 of the milk carton with rocks, sand and gravel mixed with water. Freeze it. When frozen...
- 3) Fill the second 1/3 of the milk carton with more rocks, sand and gravel mixed with water. Again, freeze it. When frozen...
- 4) Fill the final 1/3 of the carton with rocks, sand, and gravel mixed with water. Freeze the carton completely.
- 5) On a day when the temperature is above 55 degrees, lay out the 12-foot wood panel. Set the panel at a 20 degree angle.
- 6) Spread gravel approximately 1 inch thick on the top of the panel.
- 7) Remove the frozen block from the milk carton.
- 8) Lay the block of ice, rocks and gravel at the top of the panel.
- 9) After approximately an hour, observe the movement of the block and the resulting carving of the gravel surface on the wood panel.

**EXTENSION:**

Make more than one "glacier". Try the above exercise on a cool day and again on a hot day - is there any difference in how it moves? What about how quickly it melts? Discuss with the students how climate change maybe affecting present day glaciers.

Adapted from "Snappy Props" by Smitty Parrot

# GEOLOGY

---



# RESOURCES



The following is a list of resources that will provide more in-depth information on the subjects covered in this guide. Several of these books are out of print but may be available at a local public or university library. Books with an \* are children's books.

## **GEOLOGY:**

Fiero, Bill. 1986. *Geology of the Great Basin*. Reno: University of Nevada Press.

Harris, A. G., Tuttle, E. 1990. *Geology of National Parks*. Iowa: Kendall/Hunt Publishing. Fourth Edition. p. 521-533.

McPhee, John. 1981. *Basin and Range*. New York: Farrar, Straus, and Giroux.

Prinz, M., G. Harlow, and J. Peters. 1978. *Simon and Schuster's Guide to Rocks and Minerals*. New York: Simon and Schuster.

Snyder, C.T., G. Hardman, and F.F. Zdenek. 1964. *Pleistocene Lakes in the Great Basin* (map). USGS Miscellaneous Geologic Investigations Map I-416.

Stewart, J. H. 1980. *Geology of Nevada: a discussion to accompany the geologic map of Nevada*. Nevada Bureau of Mines and Geology Special Publication 4.

Stokes, W.L. 1986. *Geology of Utah*. Salt Lake City: Utah Museum of Natural History and Utah Geological and Mineral Survey.

Tarback, Edward., Lutgens, Frederick. 1990. *The Earth: An Introduction to Physical Geology*. Illinois: Merrill Publishing Company. Third Edition.

## **CAVES:**

\*Cole, Joanna. 1987. *The Magic School Bus Inside the Earth*. Scholastic Inc.

Forti, Paolo and Hill, Carol. 1986. *Cave Minerals of the World*. Albuquerque, NM: National Speleological Society.

Gunzi, Christianne. *Cave life*.

Hill, Carol. 1976. *Cave Minerals*. National Speleological Society.

Jackson, Donald Dale. 1982. *Underground Worlds (Planet Earth)*. Time Life Books.

McClurg, David R. 1986. *Adventures of Caving*. D&J Press.

Moore, George and Sullivan, G. Nicholas. 1978. *Speleology, the Study of Caves*. Cave Books.

\*Naden, C.J. 1979. *I Can Read About Caves*. Troll Associates.

Schmidt, Jeremy. 1987. *Lehman Caves*. Great Basin Natural History Association.

## **BATS**

Barbour, Roger and Davis, Wayne. 1969. *Bats of America*. University of Kentucky.

\*Cooper, Ann. 1994. *Wonder Series: Bats*. Robert Rinehart Publishing.

Fenton, M. Brock. 1983. *Just Bats*. University of Toronto.

# RESOURCES



## **BATS (CONTINUED)**

- Green, Carl R. and Sanford, William R. 1986. *The Little Brown Bat*. Crestwood House.
- Hill, Houn and Smith, James. 1984. *Bats: A Natural History*. University of Texas.
- Hopf, Alice L. 1986. *Bats*. Dodd, Mead.
- Jarrell, Randall. 1963. *The Bat Poet*. Macmillan.
- Johnson, Sylvia A. 1985. *Bats*. Lerner.
- Kaufman, John. 1972. *Bats in the Dark*. Cowell.
- Lauber, Patricia. 1968. *Bats, Wings in the Night*. Random House.
- Laycock, George. 1981. *Bats in the Night*. Four Wings.
- Leen, Nina. 1976. *The Bat*. Holt, Rinehart and Winston.
- Milton, Joyce. *Bats: Creatures of the Night*. Putnam.
- Schlein, Miriam. 1982. *Billions of Bats*. Lipp.
- Tuttle, Merlin D. 1988. *America's Neighborhood Bats: Understanding and Learning to Live in Harmony With Them*. University of Texas.
- Tuttle, Merlin D. *Bat House Builders Handbook* University of Texas.
- Wildlife Education Limited. 1989. *Zoobooks, Bats*. Frye and Smith.
- Ranger Rick's Nature Scope, Amazing Mammals*. 1986. National Wildlife Federation.
- Educators Activity Book About Bats*. 1991. Bat Conservation International.

## **CLIMATE PAST AND PRESENT:**

- Cobourn, John. 1982. *Protecting Our Water Resources*. Reno, NV: University of Nevada Cooperative Extension.
- Keen, Richard. 1987. *Skywatch*. Golden, CO: Fulcrum Press.
- \*Rauzon, Mark and C.O. Bix. 1994. *Water, Water, Everywhere*. San Francisco: Sierra Club Books for Children.
- Reisner, Marc. 1987. *Cadillac Desert*. New York: Penguin books.
- State of Nevada. 1992. *Nevada Water Facts*. Carson City, NV: State of Nevada, Department of Conservation and Natural Resources, Division of Water Planning.

# RESOURCES



## SAFETY:

Ganci, Dave. 1991. *The Basic Essentials of Desert Survival*. Merrillville, IN.: ICS Books, Inc..

Lehman, Charles. 1993. *Desert Survival Handbook*. Phoenix: Primer Publishers.

## ECOLOGY, NATURAL HISTORY, AND NATURE

Alcorn, J.R. 1988. *Birds of Nevada*. Fairview Publishing.

Arno, Stephen F. Timberline: *Mountain and Arctic Forest Frontiers*. 1984. Seattle, WA: The Mountaineers. 304 pp.

\*Carlson, Laurie. *Kids Camp! Activities for Backyard or Wilderness*. 1995. Chicago: Chicago Review Press.

Cronquist, A.; Holmgren, A.H.; Holmgren, N.H.; and J.L. Reveal. *Intermountain Flora: Vascular Plants of the Intermountain West, U.S.A.* 1986. Bronx, NY: The New York Botanical Garden. 270 pp.

Ehrlich, P.R.; Dobkin, D.S.; and D. Wheye. 1988. *The Birder's Handbook: A Field Guide to the Natural History of North American Birds*.

Elston, F. *Raven song: A Natural and Fabulous History of Ravens and Crows*. 1991.

Dunning, J. *Secrets of the Nest: The Family Life of North American Birds*. 1994.

Harper, K.T.; St. Clair, L.L.; Thorne, K.H.; and W.M. Hess. 1994. *Natural History of the Colorado Plateau and Great Basin*. Niwot, CO: University Press of Colorado.

\*Holley, Dennis. *Animal's Alive! An Ecological Guide to Animal Activities*. 1994. Roberts Rinehart Publishing.

Lanner, R.M. *The Pinyon Pine - A Natural and Cultural History*. 1981. Reno, NV: University of Nevada Press. 208 pp.

Lanner, R.M. *Trees of the Great Basin: A Natural History*. 1983. Reno, NV: University of Nevada Press. 215 pp.

\*Lingelbach, Jenepher. *Hands On Nature*. 1986. Vermont Institute of Natural Science.

\*Milord, Susan. *The Kids' Nature Book* 1996. Williamson Publishing Company.

Mozingo, Hugh. *Shrubs of the Great Basin*. University of Nevada.

Osmond, C.B.; Pitelka, L.F.; and G.M. Hidy, eds. *Plant Biology of the Basin and Range*. 1990. New York, NY: Springer-Verlag. 375pp.

Rogers, G.F. *Then and Now: A Photographic History of Vegetation Change in the Central Great Basin Desert*. 1982. Salt Lake City, UT: University of Utah Press. 152 pp.

Ryser, F.A. *Birds of the Great Basin*. 1985. Reno: University of Nevada Press..

\*Samson, Suzanne. *Tumblebugs and Hairy Bears: Exploring Insects with Children*. 1996. Robert Rinehart Publishing.

# RESOURCES



Schulman, E. 1958. *Bristlecone Pine, Oldest Living Thing*. National Geographic 63:355-372.

\*Shedd, Warren. *The Kids' Wildlife Book* 1994. Williamson Publishing Company.

Sigler, W.F. and J.W. Sigler. 1987. *Fishes of the Great Basin*. 1987.

Stokes, D. and L. Stokes. *Stokes Nature Guides: A Guide to Bird Behavior*.

Trimble, Stephen. *Sagebrush Ocean: A Natural History of the Great Basin*. University of Nevada.

\*Usborne 1994. *Illustrated Encyclopedia of the Natural World*. Education Development Company.

## AMERICAN INDIANS

Balls, E.K. Early uses of California plants. Berkeley, CA: University of California Press; 1962.

Brady, Leah; Dale, Debra; Dunn, Yvonne; Emm, Maxine; and Bernice Servilican. 1992. *Celebrating Nevada Indians Curriculum Guide*. Native American Education Association, 11165 Silver Lane, Silver Springs, NV.

\*Carlson, Laurie. *More Than Moccasins: A Kid's Activity Guide to Traditional North American Indian Life*. 1994. Chicago: Review Press.

\*Caduto, M.J. and J. Bruchac. *Keepers of the Animals*. 1991. Golden, CO: Fulcrum Press.

\*Caduto, Michael J. and Joseph Bruchac. 1989. *Keepers of the Earth: Native American Stories and Environmental Activities for Children*. Golden, CO: Fulcrum, Inc.

\*Caduto, M.J. and J. Bruchac. 1994. *Keepers of Life*. Golden, CO: Fulcrum Press.

\*Caduto, M.J. and J. Bruchac. 1991. *Native American Stories*. Golden, CO: Fulcrum Publishing.

Dangberg, G.M. 1968. *Washo Tales*. Carson City, NV: Nevada State Museum.

D'Azevedo, W.L., ed. 1986. *Great Basin: Volume 11 of the Handbook of North American Indians*. Washington, D.C.: Smithsonian Institution.

Haglund, E. A. The Washoe, Paiute, and Shoshone Indians of Nevada. 1961. Carson City, NV: State of Nevada Department of Education.

Hurst, Winston B., and Joe Pachak. 1989. *Spirit Windows: Native American Rock Art of Southeastern Utah*. Edge of the Cedars Museum. Blanding, UT.

Madsen, D.B. *Exploring the Fremont*. 1989. Salt Lake City, UT: Utah Museum of Natural History.

Martineau, LaVan. 1992. *The Southern Paiutes: Legends, Lore, Language, and Lineage*. Las Vegas, NV: KC Publications.

Reed, F. *Uses of Native Plants by Nevada Indians*. 1971. Carson City, NV: State of Nevada Department of Education.

# RESOURCES

---



## **GREAT BASIN NATIONAL PARK**

Lambert, Darwin. 1991. *Great Basin Drama: Niwot, CO, Roberts and Great Basin Natural History Association.*

Nicklas, Michael. *Great Basin, the Story Behind the Scenery.* Las Vegas, NV, KC Publications

Unrau, Harlan D. 1990. *A History of Great Basin National Park.* National Park Service.

Schmidt, Jeremy. 1987. *Lehman Caves* Great Basin Natural History Association

## **GREAT BASIN ASSOCIATION:**

The Great Basin Association is a not-for-profit organization whose mission is to support the interpretive, educational, cultural, and research activities of Great Basin National Park and the Great Basin physiographic region. The Association produces and sells interpretive and educational materials and presents programs relating to the Great Basin. The Association provides funds for the park's newspaper and Junior Ranger program. Funds are generated through membership revenues, donations, and bookstore sales.

Please consider becoming a member of the Great Basin Association. Members receive a 15% discount on all purchases from the bookstore, located in the park's Visitor Center. Most national park cooperating associations will honor your Great Basin Association membership card for a similar bookstore discount.

**Great Basin Association**  
**Baker, Nevada 89311**  
**(775) 234-7270**

# GLOSSARY

---

**ADAPTATION:**

A behavior, physical feature, or other characteristic that helps a living creature survive and make the most of its habitat.

**ALLUVIAL FAN:**

A fan shaped deposit formed where streams issue from the mountains onto the lowland.

**ALPINE:**

The biogeographic zone including the elevated slopes above treeline.

**ATLATL:**

A throwing device, from the Aztec word meaning "spear thrower".

**BAROMETER:**

An instrument for measuring atmospheric pressure.

**BASIN AND RANGE:**

Topography characterized by isolated, nearly parallel (north-south) mountain ranges with intervening valleys or basins. Basin and range includes Nevada, the southern parts of Oregon and Idaho, parts of Utah, California, Arizona, New Mexico and northern Mexico.

**BIOLOGICAL COMMUNITY:**

All of the living things, both plants and animals, living in a particular environment, together fulfilling their individual needs.

**BLOCK FAULTING:**

A type of normal or gravity faulting in which the Earth's crust is separated into blocks of different orientations and elevations.

**CARNIVORE:**

An animal that eats meat. Gopher snakes, mountain lions, and golden eagles are examples of carnivores that live in the Great Basin.

**CLIMATE:**

The historical record of average daily and seasonal weather events.

**CLOUD:**

A visible body of fine droplets of water. A cloud may exist up to several miles above the earth's surface.

**CONDENSATION:**

The process by which water changes from a vapor state to a liquid or solid state. Water vapor stored in clouds condenses to form rain.

**CROSS-DATING:**

A method of comparing tree rings of different trees to determine the life-span and time of life of the trees.

**DENDROCHRONOLOGY:**

Determining the age of a tree by counting its rings; the study of variations in past climates by comparing tree rings.

**DESERT:**

An arid, barren land, generally receiving less than 9 inches of precipitation per year. Cold deserts (such as the Great Basin) receive most of their precipitation as snow.

# GLOSSARY

---

**ENVIRONMENT:**

The combination of external or extrinsic physical (or social) conditions affecting and influencing the growth and development of organisms.

**EROSION:**

The wearing away of any part of the Earth's surface by natural agents such as water, wind and gravity.

**ECOSYSTEM:**

The interaction of the biological community (all living things) and the physical environment (water, air, minerals, and soil).

**ENDANGERED SPECIES:**

A species of plant or animal in danger of extinction throughout a significant portion of its range.

**ENDEMIC:**

Belonging exclusively or confined to one place.

**ETHNOBOTANY:**

The uses of plants by a race or people.

**EVAPORATION:**

The process by which water changes to vapor.

**EXOTIC SPECIES:**

Not native, something that did not exist in the area before human beings brought it from another place.

**EXTINCT SPECIES:**

A species which has vanished from existence.

**FAULT:**

A fracture or fracture zone in the Earth's crust along which there has been movement of the sides relative to each other.

**GLACIER:**

A large block of ice moving slowly down a slope or valley. A glacier can also spread outward on a land surface or if melting exceeds snowfall, the glacier retreats up a valley or land surface.

**GREAT BASIN:**

The geographical and hydrological region comprised of most of Nevada, southern Oregon and Idaho, western Utah, and a little of eastern California. This region is characterized by internal drainage; the surface water sources evaporate or percolate before they can flow to the ocean.

**HABITAT:**

The place where a plant or animal lives; an organism's home. This place provides food, water, shelter and space.

**HERBIVORE:**

An animal that eats only plant materials. Mule deer, kangaroo rats, and pinyon jays are examples of herbivores that live in the Great Basin.

**HUMIDITY:**

The amount of water vapor in the atmosphere.

**IGNEOUS ROCK:**

Rock formed by the crystallization of molten magma.

# GLOSSARY

---

**INVERSION:**

Contrary to the normal situation, temperatures increase with elevation.

**MAGMA:**

Naturally occurring molten rock containing water and gases, found below the Earth's surface.

**METAMORPHIC ROCK:**

Rock changed by great temperature, pressure, stress, and/or chemical changes, usually at depth in the crust from preexisting rocks (either igneous or sedimentary).

**METEOROLOGY:**

The study of the atmosphere and its interactions and processes.

**MESIC:**

Requiring a moderate amount of moisture.

**NATIVE SPECIES:**

A plant or animal that evolved or was transported to an area through natural means.

**OMNIVORE:**

An animal that eats a wide range of foods, both plants and animals. Humans are examples of omnivores that live in the Great Basin.

**MANO:**

A stone used for grinding food by hand.

**METATE:**

A stone with an indented upper surface for grinding food.

**PETROGLYPH:**

A picture or design that is carved, picked, or etched into a rock surface.

**PLAYA:**

The flat floored bottom of an undrained desert basin that becomes, at times, a shallow lake.

**PICTOGRAPH:**

A picture or design painted on a rock surface.

**POLLUTION:**

Environmental contamination with man-made waste.

**PRECIPITATION:**

Water received on earth directly from the clouds as rain, hail, sleet or snow.

**PREDATOR:**

Any animal which hunts live animals for its food.

**PREY:**

An animal taken by a predator as food.

**RIPARIAN:**

Relating to, or living on the bank of a natural watercourse, such as a stream.

**ROCK GLACIER:**

A mass of year round ice covered by rocks that exhibits past or present movement or flow.

# GLOSSARY

---

**SEDIMENTARY ROCK:**

Rocks deposited in layers through the action of water or wind.

**TECTONIC PLATE:**

One of the geological structures making up the Earth's crust, related to the deformation of the crust by faulting and folding.

**THREATENED SPECIES:**

A species present in its range but in danger because of a decline in its numbers and/or population.

**TREELINE (OR TIMBERLINE):**

The upper or lower elevational limit of arboreal growth.

**WEATHER:**

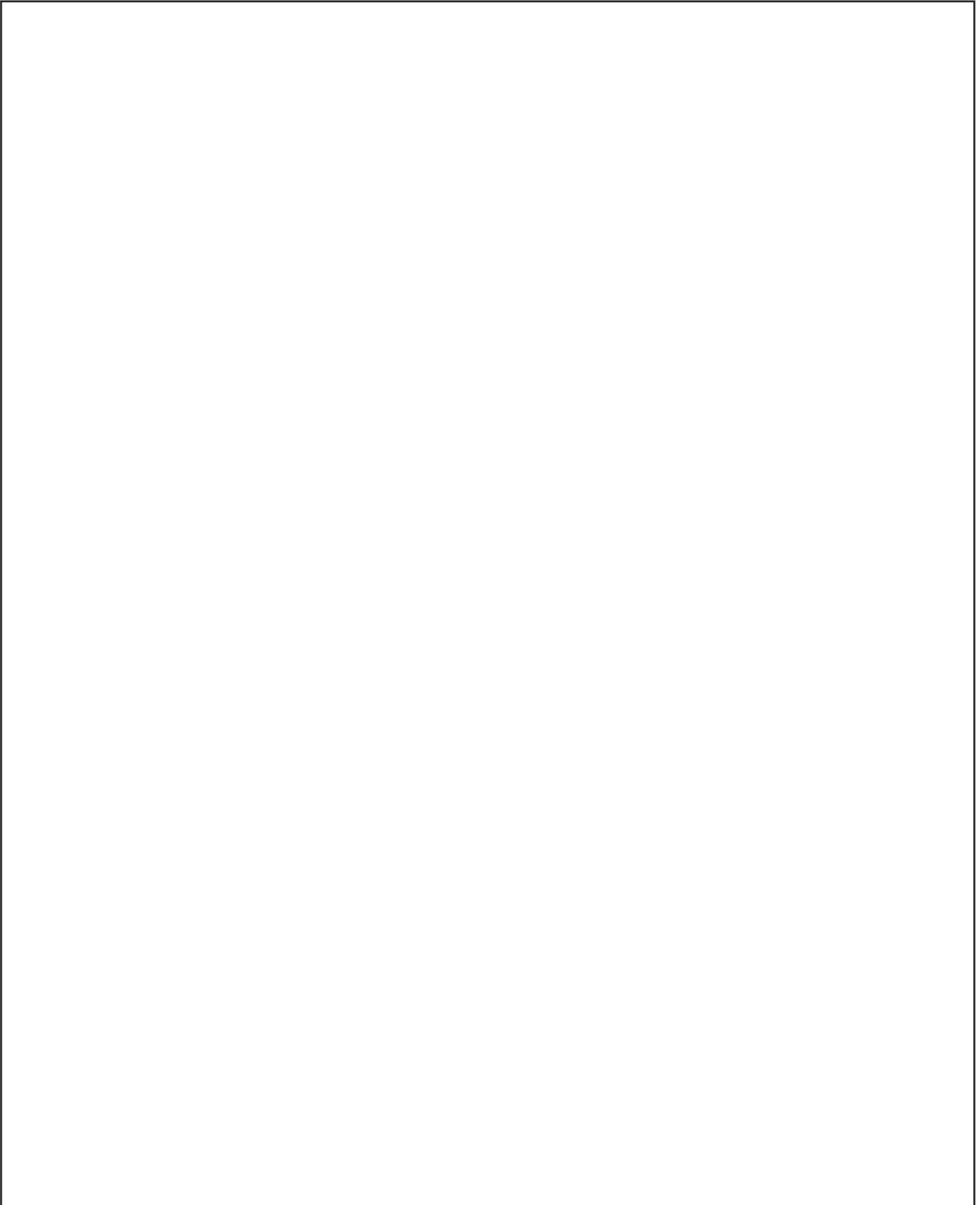
The state or condition of the atmosphere at any particular time or place.

**WIND DIRECTION:**

The direction from which the wind is moving.

# NOTES

---

A large, empty rectangular box with a thin black border, intended for taking notes. It occupies the majority of the page below the title.