

Chapter 1

Where in the World Is Oklahoma?

Chapter Preview

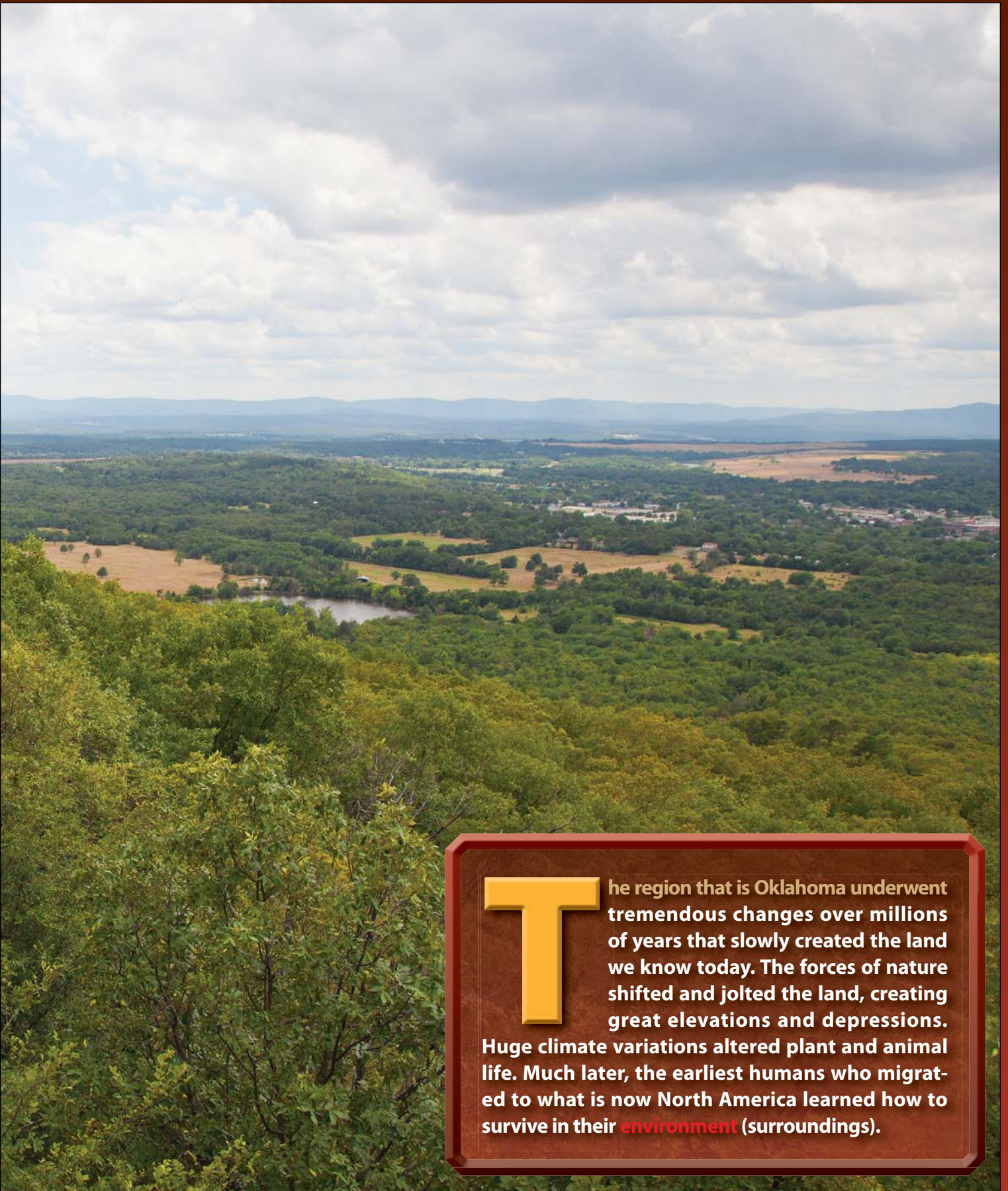
TERMS

environment, geography, latitude, longitude, erosion, basin, topography, mesa, butte, ecosystem, plateau, natural resources, irrigation, drought, fossil fuels, wildcatter, aquifer, tributary, weather, climate, elevation, tornado

PLACES

Panhandle, Black Mesa, Anadarko Basin, Arkoma Basin, High Plains, Gypsum Hills, Red Bed Plains, Wichita Mountains, Sandstone Hills, Arbuckle Mountains, Prairie Plains, Ozark Plateau, Ouachita Mountains, Red River Plains

The forests and ridges of the Ouachita Mountains region in eastern Oklahoma, seen from Heavener Runestone Park.



The region that is Oklahoma underwent tremendous changes over millions of years that slowly created the land we know today. The forces of nature shifted and jolted the land, creating great elevations and depressions. Huge climate variations altered plant and animal life. Much later, the earliest humans who migrated to what is now North America learned how to survive in their **environment** (surroundings).

Signs of the Times

VITAL STATISTICS

LAND AREA

69,903 square miles
(68,679 in land and 1,224 in water)

NUMBER OF BORDERING STATES

6

SURFACE WATER

60 major reservoirs and over one million surface-acres of water in 200 man-made lakes (more than any other state), approximately 11,611 miles of shoreline, and approximately 78,578 miles of creeks and rivers

UNDERGROUND WATER

23 major groundwater basins (a combined 320 million acre-feet of water)

PHYSIOGRAPHIC REGIONS

10

NUMBER OF COUNTIES

77

HIGHEST POINT

Black Mesa, 4,973 feet

LOWEST POINT

Little River floodplain at Oklahoma's eastern border, 287 feet

LOCATION

LATITUDE AND LONGITUDE

Between 94 degrees, 29 minutes, and 103 degrees west longitude; and between 33 degrees, 39 minutes, and 37 degrees north latitude

GEOGRAPHIC CENTER OF STATE

About 8 miles north of Oklahoma City

LOCATION WITHIN UNITED STATES

South-central—about 200 miles south of the geographic center of the continental U.S.

Section 1

What Is Geography?

As you read, look for

- the use of latitude and longitude to describe location,
- Oklahoma's boundaries,
- vocabulary terms **geography, latitude, and longitude.**

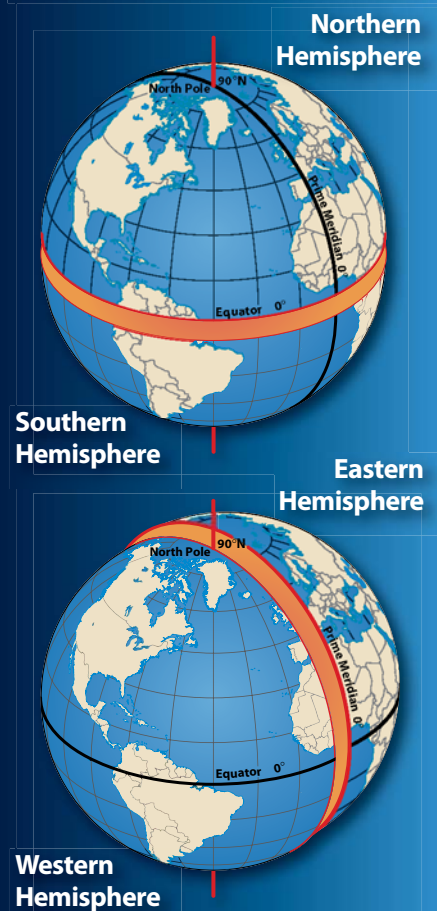
Geography is the study of Earth's physical features and how people interact with them. All life on Earth—plant, animal, and human—is affected by geography. On the other hand, geography is also affected by the interaction of living things on Earth. Geography helps us understand ourselves and where we live, as well as our relationship with the environment and with other people and places. It helps us understand why prehistoric people came here, why certain crops are grown, why towns are located where they are, and even why certain clothes are available. One aid that helps us learn about geography is the globe.

Location

Globes are models of Earth. Globes are divided into two halves called *hemispheres*. The globe, like the Earth, turns on an *axis*, an imaginary line. The north end of the axis is called the North Pole, while the south end is the South Pole. Halfway between the two poles is a line called the *equator* that divides Earth into two hemispheres, northern and southern. The United States is in the northern hemisphere.

Evenly spaced horizontal and vertical lines, or a grid, on the globe help us find absolute, or specific, locations anywhere in the world. The horizontal lines on either side of the equator are called *parallels*. They describe **latitude**, or the distance north (N) or south (S) of the equator measured in degrees ($^{\circ}$). The equator is at 0° latitude. The North Pole is located at 90° N latitude, and the South Pole is at 90° S latitude. Each degree can be further divided into smaller measurements called *minutes* ($'$). Sixty minutes equal one degree. Each minute can also be divided into 60 *seconds* ($"$).

Map 1 The Hemispheres



Map Skill: In which hemispheres does North America lie?

Something Extra!

A degree of latitude is generally equal to about 69 miles (111 kilometers).

Map 2 Oklahoma's Latitude and Longitude

Map Skill: What Oklahoma city is located at 36° 12' N latitude and 95° 54' W longitude?

The lines on the globe that run north and south between the poles are called *meridians*. The *prime meridian*, a north-south line that runs through England and Africa, is the starting point for measuring degrees of longitude. **Longitude** measures the distance east (E) or west (W) of the prime meridian.

Oklahoma is located between 94° 29' and 103° W longitude. In the early history of our country, the 98th meridian was believed to be a 20-inch rainfall line that predicted farming success or failure. Oklahoma also lies between 33° 39' and 37° N latitude. The 1820 Missouri Compromise set the 36° 30' N latitude line as the boundary below which slavery could exist. This boundary included the territory that became our state.

Oklahoma Geographic Statistics

Oklahoma covers an area of nearly 70,000 square miles or 45 million acres. Our widest east-west border is 464 miles, and the longest north-south border is 320 miles. Ranking eighteenth in size in the United States, Oklahoma is larger than any state east of the Mississippi River, and it is larger than many European countries. Oklahoma has 77 counties. Oklahoma City, the capital, is almost in the geographic center of the state.

Our state's shape is as unique as our cultural diversity. The three-county strip of land that extends west from the main rectangular body of the state is called the *Panhandle*. That Panhandle makes Oklahoma easily spotted on a United States map. States that border Oklahoma are Texas and New Mexico to the south and west, Colorado and Kansas to the north, and Missouri and Arkansas on the east.





Oklahoma is halfway between Los Angeles, California, on the West Coast and Washington, D.C., in the east. Oklahoma City is about 1,160 miles from each. The Gulf of Mexico is about 450 miles south, and Canada is 950 miles north of Oklahoma City.

Much of the state is part of a giant oval grassland that extends from Canada to Mexico. Known as the Great Plains, the area is between the higher elevations of the Rocky Mountain foothills and the lower elevations of the Coastal Plain. Oklahoma also is sometimes the meeting point for warm moisture from the Gulf of Mexico and cold air from the Arctic north.

The location of our state affects its environment, as do the people who call it home. The different environments have been divided into geographic regions. You will learn about those regions in the next section.

Map 3 Oklahoma in the United States

Map Skill: In what part of the United States is Oklahoma located?

It's Your Turn

1. How is geographic location measured?
2. Describe Oklahoma's location relative to other states.
3. What states border Oklahoma?

Section 2

Geographic Regions

Something Extra!

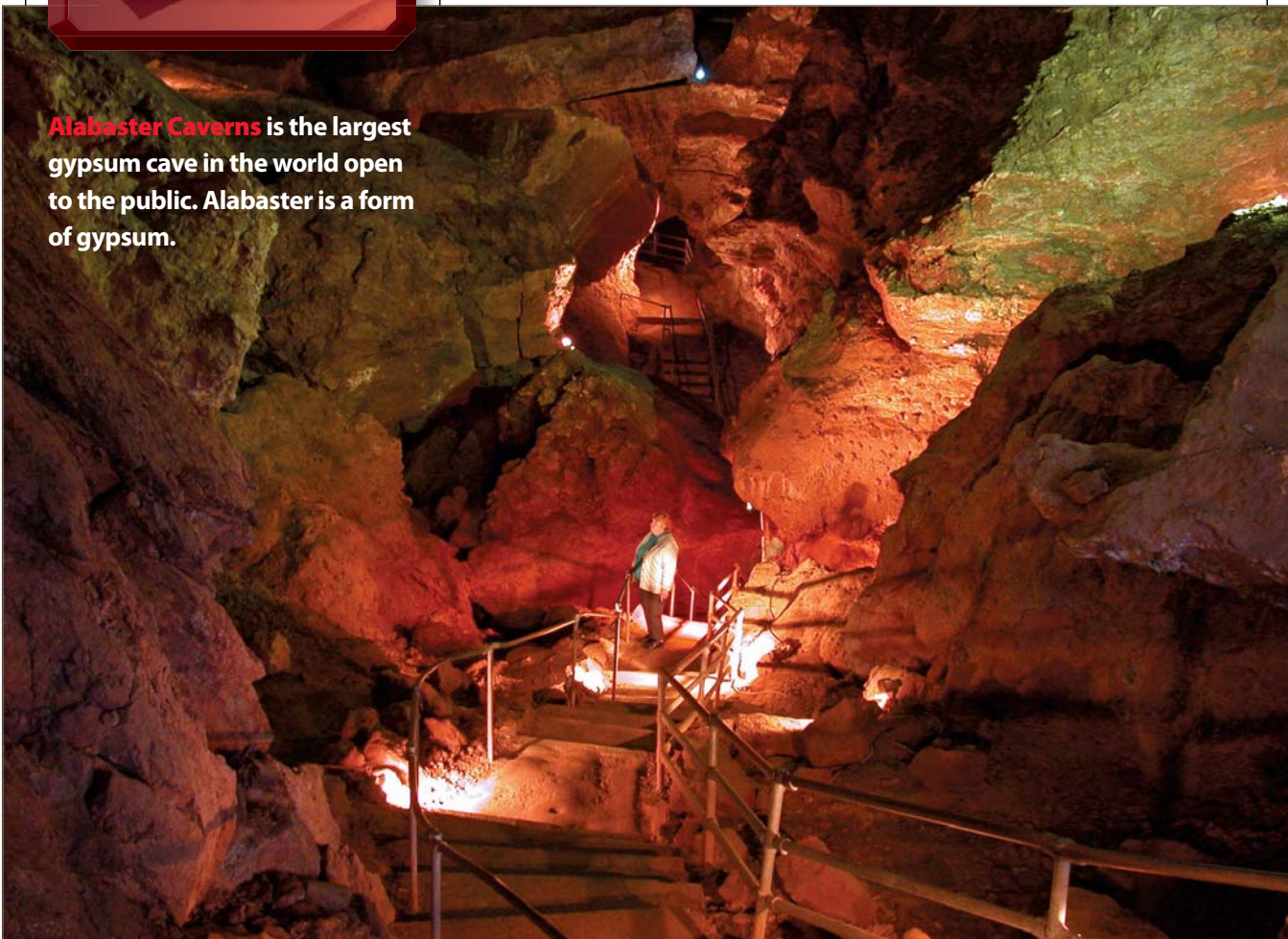
In 1953, Charles Grass, the owner of the land above Alabaster Caverns, sold the land to the state for \$34,000.

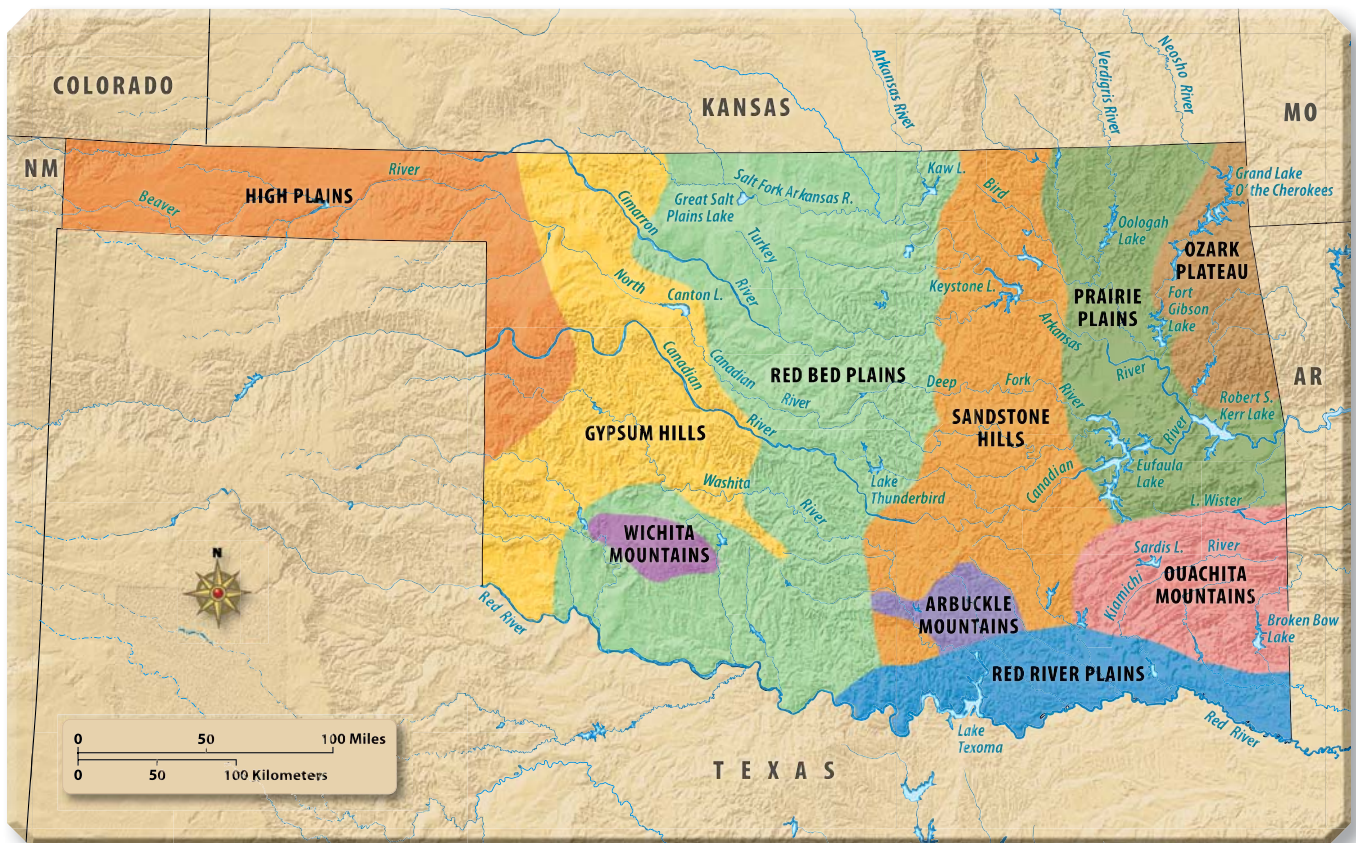
As you read, look for

- the ten geographic regions of Oklahoma,
- vocabulary terms **erosion, basin, topography, mesa, butte, ecosystem, and plateau.**

Millions of years ago, most of Oklahoma was covered by a thin layer of water teeming with prehistoric plant and animal life. As tectonic pressure (pressure in Earth's folds and faults) built up under Earth's surface, violent eruptions shoved and folded sections above the water

Alabaster Caverns is the largest gypsum cave in the world open to the public. Alabaster is a form of gypsum.





to create mountain ranges. Additional upheavals, changes in the climate, volcanic eruptions, and **erosion** (the wearing away of land) of the ancient mountains created different regions. Other areas were split open, forming large **basins** (deep sunken areas). The mountain regions of the state—Wichita, Arbuckle, and Ouachita—have greatly eroded over time, but they still provide a beautiful contrast to the plains and forests. The shallow seas in the Anadarko Basin and the Arkoma Basin eventually evaporated and slowly filled in with mountain silt and the remains of plant and animal life from nearby marshes. Those powerful, but slow, geologic processes left valuable minerals in our state. Dolomite, limestone, gypsum, and granite are mined and used in building materials and construction. Significant sources of energy—petroleum, natural gas, and coal—are found deep underground.

While considered part of the Great Plains, Oklahoma's **topography** (physical features of the land such as mountains or plateaus) varies greatly. Oklahoma is composed of ten regions with very distinct physical features. From west to east, those regions are High Plains, Gypsum Hills, Wichita Mountains, Red Bed Plains, Arbuckle Mountains, Sandstone Hills, Prairie Plains, Ozark Plateau, Ouachita Mountains, and Red River Plains. Many of the regions continue into our neighboring states.

Our land slopes down slightly from northwest to southeast. Black Mesa in the Panhandle, the highest point in Oklahoma, has an elevation of 4,973 feet above sea level, while the southeastern corner on the Little River floodplain is 287 feet above sea level.

Map 4 Oklahoma's Geographic Regions

Map Skill: In which geographic region do you live?

Something Extra!

Cimarron County is the only county in the United States to be surrounded by four different states—Kansas, New Mexico, Texas, and Colorado.

Black Mesa, the highest point in the state, lies within Black Mesa Nature Preserve in the Panhandle. This photograph, taken from the top of Black Mesa, shows the terrain of the High Plains region.

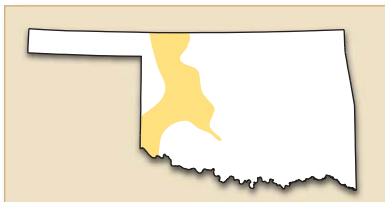


High Plains

The High Plains region includes the Panhandle and land along part of the western border of our state. The Black Mesa in Cimarron County was formed when a prehistoric volcano erupted in southeastern Colorado, spewing lava that hardened into basalt and formed the top of the mesa. (A **mesa** is a large flat-topped but steep-sided landform.) The Antelope Hills rise in gypsum peaks just south of the Canadian River in Ellis County. The Black Kettle National Grasslands are found a few miles south of the hills. Part of the Rita Blanca National Grassland is in the western part of the Panhandle. The region is favored by stargazers because it is sparsely populated. It is also a favorite of scientists searching for dinosaur bones, wagon train tracks, and evidence of early American Indian cultures.

An abundance of wildlife is found in the region including quail, dove, duck, wild turkey, pheasant, deer, elk, antelope, and prairie dog. Lake Optima and Beaver Dunes State Park offer recreational opportunities. Guymon is the largest city in the region. Other communities include Kenton, Boise City, Goodwell, Beaver, and Arnett. Cattle and hog feedlots, farming, ranching, and petroleum and natural gas production are major economic producers in the area.





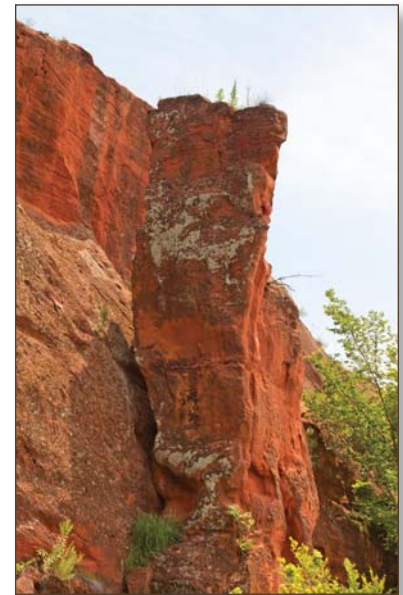
Gypsum Hills

The Gypsum Hills region in western Oklahoma covers a large area from the Kansas border to the far southwestern corner of the state. The gypsum deposits were left when

ancient seas evaporated. The area is named for the white gypsum buttes, which are joined by mesas and canyons, rivers and lakes. **Buttes** are isolated hills or mountains with steep sides; they are smaller than mesas. Gypsum hills are primarily found in three areas: the Glass Mountains in Major County; a group of white-topped knolls 40-50 miles southwest of the Glass Mountains; and in Harmon, Greer, and Beckham counties.

Springs and caves are also found in the region, including the Alabaster Caverns and the Selman Bat Cave. Alabaster Caverns near Freedom is the world's largest gypsum cave open to the public. Boiling Springs State Park north of Woodward, Red Rock Canyon State Park, and Canton and Foss lakes are in this region.

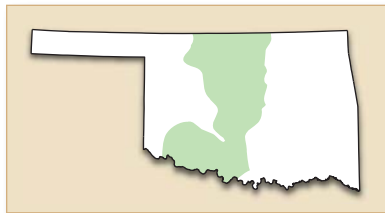
The rich soil of the region produces winter wheat, hay, alfalfa, soybeans, and cotton. Cattle are the primary livestock. Oil and natural gas have also been found in many areas. Woodward, Clinton, Elk City, Cordell, and Hollis are some of the communities in the region.



Top: The "Glass Mountains," so named because the gypsum reflected so much light. **Above:** Red Rock Canyon State Park is in the Gypsum Hills region.



Above: These red rock outcroppings show you how the Red Bed Plains region got its name. **Opposite page, below:** The colorful sand dunes of Little Sahara State Park, south of Waynoka, stand out against the surrounding landscape. The dunes were created over 11,000 years ago when the Cimarron River flowed over this area.



Red Bed Plains

The large, slightly rolling Red Bed Plains region also extends from Kansas to Texas. The distinctive red-orange shale and clay soil base was partly formed from ancient shallow seas. When the seas evaporated, salt deposits were left. The Great Salt Plains National Wildlife Refuge in Alfalfa County is the only place in the world you can dig for hourglass selenite crystals. Our unique state rock, the rose rock, is found near Noble. The rare rose rocks are formed when barium sulfate combines with quartz sand.

The Great Salt Plains area is a major resting area for thousands of migratory birds. Birds also flock to the Hackberry Flat Wildlife Management Area near Frederick. Once a Cheyenne campground, Roman Nose State Park is a scenic retreat set on a canyon bluff overlooking ancient mesas. Little Sahara State Park has over 1,600 acres of rideable sand dunes ranging in height from 25 to 75 feet. Much of the massive Cross Timbers area is in this region.





Top: The famous Round Barn in Arcadia is on Route 66, which cuts through the heart of the Red Bed Plains. **Above:** White pelicans flock to the shores of the Great Salt Plains Lake.

The fertile soil is ideal for growing wheat, hay, peanuts, and cotton and for grasslands for cattle and horses. Oil and natural gas wells dot many parts of the countryside. One of the largest population areas in the state is in this region—Oklahoma City and the surrounding communities of Edmond, Choctaw, Harrah, Midwest City, Del City, Moore, Norman, Mustang, and Yukon. Other towns in the region include Alva, Enid, Ponca City, Stillwater, Guthrie, Chickasha, El Reno, and Duncan.

Earthquakes occur in many parts of Oklahoma. Fault lines run north-south through central Oklahoma and east-west in the southern part of the state. Most Oklahoma earthquakes register between 1.8 and 3.3 on the Richter scale, so we don't usually feel them. However, on April 9, 1952, a magnitude 5.5 earthquake centered near El Reno caused moderate damage, including a crack in the State Capitol.

Voices from the Past

The Diary of Major Sibley

George Champlin Sibley was an Indian agent at Fort Osage, Missouri. In 1811, accompanied by eleven Osage Indians, he set out to explore and map the Salt Plains and the Cimarron River. Excerpts from his journal describe the area in this way:

I had leisure quietly to contemplate the wonderful scene before me, far surpassing anything that I had ever pictured to my mind from the descriptions I had obtained from Indians. It is a perfectly smooth and nearly level plain of red sand, so hard on the surface that our horses made no impression with their hoofs, except on the thin crust of salt with which it was entirely covered.

The salt crust that covered the whole of this plain when I saw it, was pretty uniformly of the thickness of a wafer, in some places nearly thrice that thickness. . . . Although I was not so fortunate as to find the Grand Saline in its most perfect condition, . . . yet I was highly gratified to find such incontestible evidence of the rapidity and vast extent of its operations. The whole plain (equal in its area to a circle thirty miles in circumference) was perfectly covered with a brilliant white crust of excellent salt. . . . In this state the Grand Saline bears a striking resemblance to



Major Sibley (left) described the Great Salt Plain (above) as a “beautiful white dazzling surface.”

a brilliant field of snow, with a crust on it after a rain.

This beautiful white dazzling surface (bordered by a fringe of verdant green) has the effect of looming, as the sailors call it, producing to the unpracticed eye, much delusion. . . . Whether an attempt will ever be made to draw this inexhaustible store of ready made salt into the channels of commerce, or not I will not now

inquire, but if it should ever be found desirable to do so, I do not entertain a doubt of its practicability.

(Source: “Extracts from the Diary of Major Sibley” *The Chronicles of Oklahoma* Vol. 5, No. 2 (June 1927): 213-217.)



Rock climbing and other outdoor activities are popular in the rugged landscape of the ancient Wichita Mountains, born half a billion years ago.

Something Extra!

When Lake Altus-Lugert was created, it flooded the town of Lugert. When the water level gets low, you can see the foundations of some of the town's buildings.



Wichita Mountains

The Wichita Mountains are among the oldest on Earth. Some 500 million years ago, layers of eroded silt were deposited, and the mountains began to form when ancient lava flows pushed up. Those once-lofty peaks have been eroded by climatic forces, but the huge granite boulders are popular for rock climbing. Visitors can drive the 2,464 feet to the top of Mount Scott. Quartz Mountain and Lake Altus-Lugert are on the far west end of the Wichita chain.

The 59,000-acre Wichita Mountains Wildlife Refuge was set aside from the Comanche-Kiowa-Apache Reservation in 1901. The area around the base of the mountains is a rare remnant of the past, a mixed grass prairie. Buffalo were reintroduced to the refuge in 1907. The refuge is also home to longhorn cattle, elk, deer, wild turkey, and numerous smaller animals and birds.

The unique town of Medicine Park sits in the foothills. Most of the homes and shops in this planned resort town are made of granite cobblestones. Nearby Meers started out as a mining camp, when stories of gold brought prospectors to the mountains. A *seismograph* (an instrument that records Earth's movements) at Meers monitors the Meers fault for earthquake activity.

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Fort Sill was established in 1869 to stop Indian raids. It changed from cavalry to field artillery in the early 1900s. The city of Lawton is home to some 97,000 people.



Sandstone Hills

The Sandstone Hills region is just east of the Red Bed Plains region. The Cross Timbers extends into this region. Sandstone and shale are the main rocks in the area.

The shale eroded, leaving sandstone hills that rise up to 400 feet.

The Tallgrass Prairie Preserve north of Pawhuska in the Flint Hills offers a look at one of North America's former major ecosystems. (An **ecosystem** is an interacting system of living organisms—plants, trees, animals, fish, and so on—and their nonliving environment.) Buffalo graze on tall bluestem, Indian grass, and switchgrass, just as they did hundreds of years ago. Keystone is one of several lakes in the area. Oilman Frank Phillips established a wildlife preserve and museum, Woolaroc, in the Osage Hills. Many poultry and egg farms are located in the eastern part of the state, but ranching, oil, and natural gas are the main industries. The discovery of oil and gas brought wealth to the area. In the 1920s, the Osage Indians were among the wealthiest people in the country when oil was found in Osage County. About the same time, the discovery of the Greater Seminole Oil Field with its twenty-six pools ignited the growth of many small towns in the area. Coal mining spurred growth in the McAlester area.

The western side of the Tulsa metropolitan area is part of this region, including Sand Springs and Sapulpa. The southern part of the region includes the communities of Shawnee, Ada, Holdenville, Wewoka, Coalgate, and Atoka.



Top: The Sandstone Hills region stretches south to the vicinity of McAlester, an area rich in coal.

Above: Buffalo still graze in the Tallgrass Prairie National Preserve, which protects the remains of what was once 400,000 square miles of tall-grass prairie in North America.



Above: Interstate 35 cuts through the Arbuckle Mountains region. Many places along the road offer views of the rock structure.
Below: Turner Falls is the highest waterfall in the state.



Arbuckle Mountains

The Arbuckle Mountains region is nestled in south-central Oklahoma. The highest point of 1,415 feet is in the West Timbered Hills, southwest of Davis. Like the Wichita

Mountains, the Arbuckle chain runs east-west, rather than north-south as do most of our country's mountain ranges. The Arbuckles are part of a very old mountain system, and granite exposed in Murray County is 1.4 billion years old.

Most of these mountains are composed of folded and faulted limestone, dolomite, sandstone, and shale. Road cuts for I-35 provide views of the impressive rock structure. This region has the most diverse mineral resources in the state: limestone, dolomite, glass sand, granite, sand and gravel, shale, iron ore, lead, zinc, tar sands, and oil and gas.

In 1870, a somewhat random point was chosen just south of Fort Arbuckle for the Initial Point Marker. The Initial Point is the starting point for the numbering system for dividing most of the state into townships and sections. That numbering system is used in legal land descriptions.

The major cities are Ardmore and Sulphur. The Chickasaw National Recreation Area and the oldest park in Oklahoma, Turner Falls Park, are also in this region. Turner Falls has two natural swimming pools and a 77-foot waterfall.





Prairie Plains

Although it is called the Prairie Plains, this region has many hard sandstone hills and ridges. Today, the area is an agricultural show-place. In the region's rich soil, farmers grow everything from strawberries to tomatoes.

Water is the major feature of this region. Eufaula, our state's largest lake, and Lake Oologah are here. Another water feature has been added to the area—the Oklahoma Aquarium in Jenks. The region is home to the Port of Catoosa, an international shipping port and one of the largest, most inland river ports in the United States.

The McClellan-Kerr Arkansas River Navigation System made this possible. The system, which covers 445 river miles, created navigable channels up the Arkansas River to Muskogee, where it then followed the less-elevated Verdigris River to Catoosa. The system has five locks and dams in Oklahoma and thirteen in Arkansas. It takes a barge about ten days to reach New Orleans.

The state's second-largest city, Tulsa, is in the region as are Owasso, Broken Arrow, Bartlesville, and Muskogee. The region also includes major areas of coal, much of which is surface mined.

The Prairie Plains region has abundant water and produces coal, oil, and many agricultural products. It is the home of our second-largest city, Tulsa.



Ozark Plateau

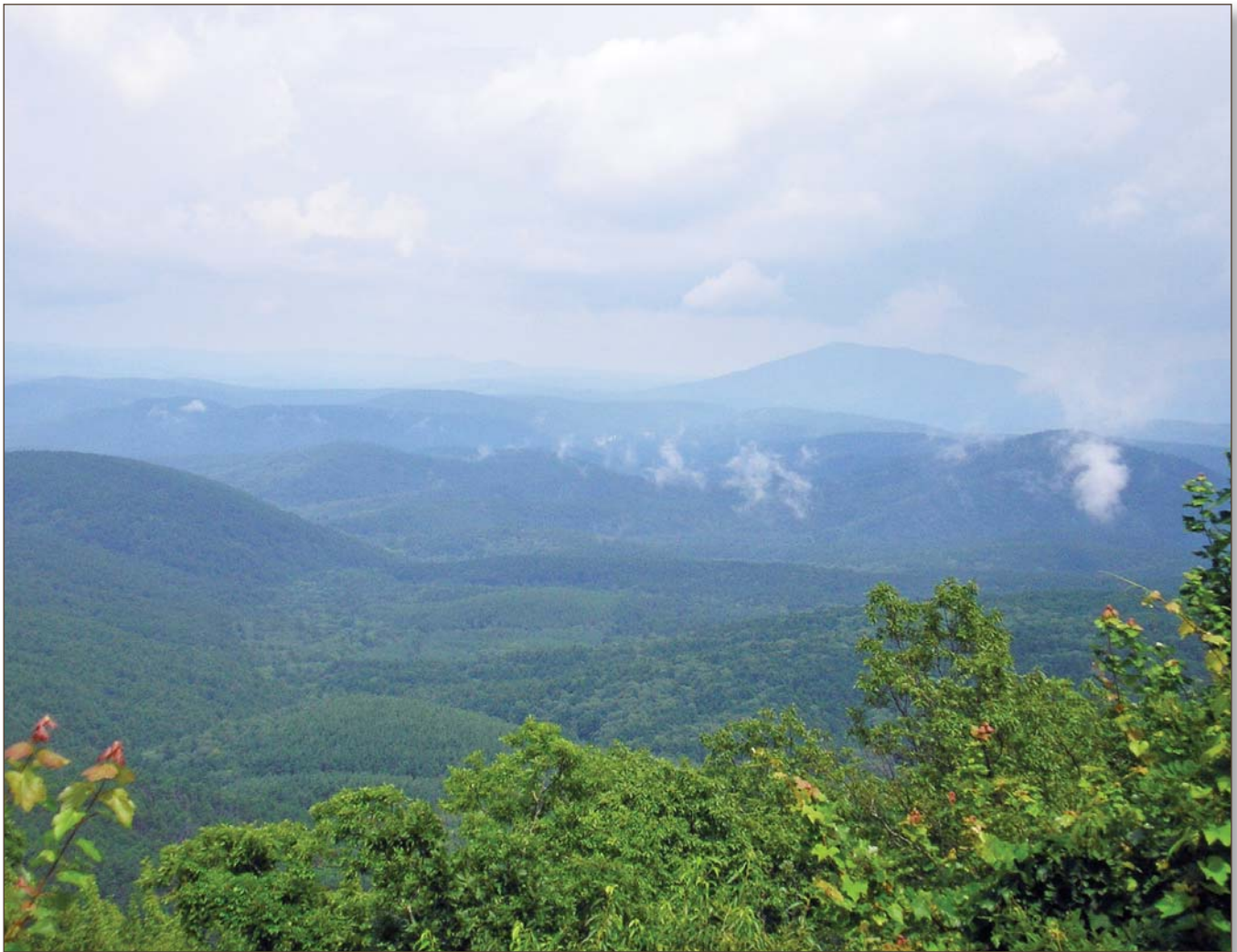
The Ozark Plateau region in northeastern Oklahoma is part of the Ozark Mountain chain of Missouri and Arkansas. A **plateau** is an elevated, relatively level area. Much of the region is heavily wooded with such trees

The Ozark Plateau, (below) which extends into Arkansas, Kansas, and Missouri, is generally wooded and hilly. Rivers like the Illinois (above) have cut deep valleys in the plateau and provide many opportunities for outdoor recreation.

as oak, hickory, and elm. Many fruits, berries, and vegetables are grown in the area. Lead and zinc were also mined here at one time.

The two main rivers in the region are the Illinois and the Grand. The Pensacola Dam was built south of Vinita on the Grand, creating the very popular Grand Lake O' the Cherokees. The Illinois River is popular for float trips. Taking advantage of the tremendous scenery, a number of state parks are located in the region. Miami, Grove, and Tahlequah are the major cities in the Ozark Plateau region.





Ouachita Mountains

The Ouachita Mountain region of towering pine and hardwood trees in southeastern Oklahoma extends into Arkansas. It includes some of the roughest land in the state. The Ouachita-Ozark mountains may once have been part of a mighty mountain range that stretched from the Appalachian Highlands to southwest Texas. Rich Mountain, the highest peak in the region, is 2,666 feet high. The east-west ridges in the region have such names as Winding Stair, Jack Fork, Buffalo, Blue Bouncer, and Kiamichi. The timber-covered, rough terrain and caves provided safety for Indian people and, later, hideouts for outlaws.

The forest is spectacular any time of the year, but the scenic Talimena Drive is especially known for its fall foliage. Grazing lands, small farms, and lumbering are important to the economy. Several very popular state parks are in the region including Beavers Bend, Robbers Cave, Spiro Mounds, Talimena, Clayton Lake, and Lake Wister. Wilburton, Antlers, and Broken Bow are communities in the area.

Top: This spectacular view is from the Talimena Drive, which runs along the top of the Ouachita Mountains.

Something Extra!

The Talimena Drive was named for Talihina, Oklahoma, and Mena, Arkansas, the towns at each end of the drive.



The Red River Plains lie along the Red River, one of the major tributaries of the Mississippi River. The river forms the southern border of Oklahoma with Texas. In this photograph taken from the west, Oklahoma is on the left and Texas is on the right.



Red River Plains

This southeastern region lies along the low elevation of the Red River where rich, sandy soils and a long growing season were ideal for growing melons, squash, corn, and pumpkins by early Indians. Dams along the Red River have provided better flood control, making more of the area available for farming. The eastern part of the region includes cypress swamps and forests. Lakes in the area are Texoma, Murray, and Hugo. Towns include Madill, Durant, Hugo, and Idabel.

Early travel along the Red River into Louisiana was difficult because of a 150-mile jam of logs and debris known as the "Great Raft." Attempts began in 1833 to clear the centuries-old logjam, a

job that took almost forty years to complete. Once cleared, steamboat travel was possible to Forts Towson, Washita, and Arbuckle. The area later became a center for Choctaw and Chickasaw cotton plantations.

One early-day steamboat that didn't arrive at its destination of Fort Towson was uncovered in the 1990s after a flood caused the Red River to change its course. Experts believe the boat was delivering military provisions when it sank. An exhibit of the wreck can be seen at the Oklahoma History Center in Oklahoma City.

It's Your Turn

1. Name the ten geographic regions of the state.
2. How was Black Mesa formed?
3. Which region has the "roughest" topography?

Oklahoma's Natural Resources

As you read, look for

- Oklahoma's natural resources,
- how Oklahoma's natural resources contribute to the economy, and
- vocabulary terms **natural resources**, **irrigation**, **drought**, **fossil fuels**, **wildcatter**, **aquifer**, and **tributary**.

Something Extra!

Our state soil was named after the small community of Port in Washita County.

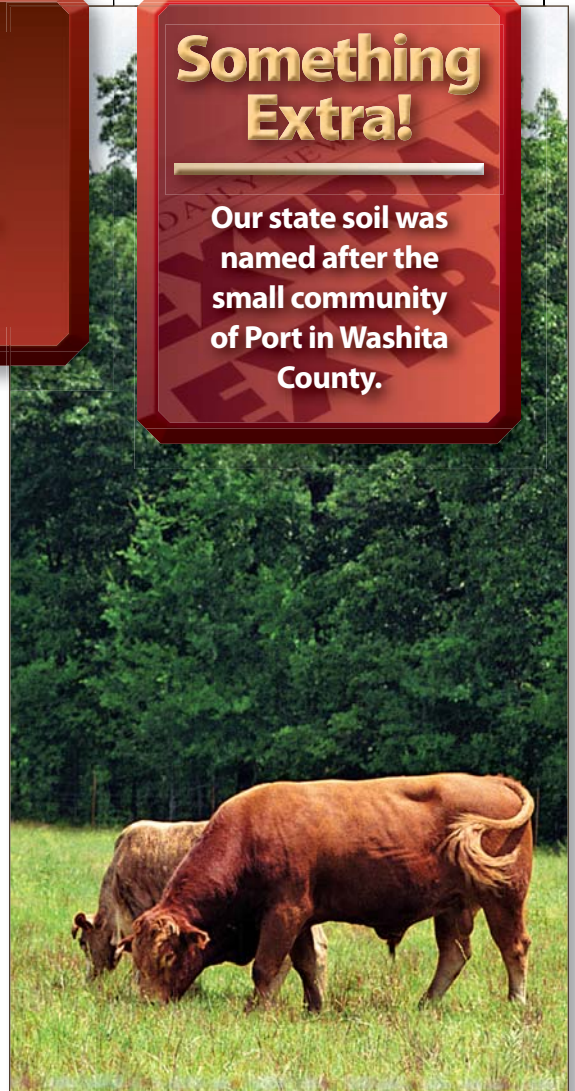
Natural resources are those things found in nature that are useful to humans. Oklahoma has a wide variety of natural resources in addition to a resourceful and imaginative population. Fertile soils, mixed vegetation, forests, minerals, and water all contribute to the productive economy of the state.

Soils

Soil is one of our most important natural resources. Humans have always relied on soil to survive. Our food and some of our clothing and shelter come from plants that grow in the soil. Soil is composed of organic matter, loose rock material, water, and air. The fertility and appearance of the land in various parts of the state are partly caused by 2,500 different soils. The soil group that extends over most of Oklahoma is called *mollisols*.

Port silt loam soil was named as one of Oklahoma's state symbols in 1987. This dark brown to dark reddish brown soil is good for growing alfalfa, grains, cotton, and other sown crops, as well as for range, pasture, and woodland.

Generally, soil is sand, silt, or clay. Different crops do better in different soils. Peanuts, for instance, grow well in sandy soils, but require irrigation because the soil drains easily. **Irrigation**, supplying water to land by artificial means, is expensive, but it sustains a crop during dry spells. Our red clay soil usually requires fertilizer before it is suitable for a crop.



The soil of some regions of the state is particularly good for grazing.



Top: Machinery helps farmers increase crop yield but is very expensive. **Above:** Hardwood forests can be found in the eastern part of the state. **Opposite page, below:** The blossoms of the redbud, Oklahoma's state tree, are an early sign of spring.

During the 1920s, farmers were able to grow more crops because of new technology. But extreme **droughts** (long periods without rainfall) in the 1930s and farming methods of the era caused the topsoil from the fields to blow away. This resulted in what is known as the "Dust Bowl." The Dust Bowl severely affected the Panhandle of Oklahoma, along with parts of Texas, Kansas, Colorado, and New Mexico. Other states were damaged by the dust storms. In response, the federal government created the Soil Conservation Service in 1935 to conserve natural resources on agricultural lands. McIntosh County was the first to take advantage of the service.

Vegetation

Oklahoma's location places it between two vegetation zones: the humid eastern woodlands and the drier western grasslands. The Ouachita Mountains and the Ozark Plateau in the east contain a variety of hard and soft woods valuable for their beauty, recreation opportunities, and commercial use. The central part of the state is a mix of grasslands and woodlands of oak, mulberry, pecan, willow, sycamore, sumac, and dense undergrowth known as the Savanna and Woodlands area.

In 1832, the well-known author Washington Irving referred to the Cross Timbers of central Oklahoma as "forests of cast iron." The area

was a dense thicket, 5-30 miles wide in places, of post oak and blackjack oak trees, plus underbrush of grapevines and scrub oak bushes. This proved to be a detriment to exploration and early settlement.

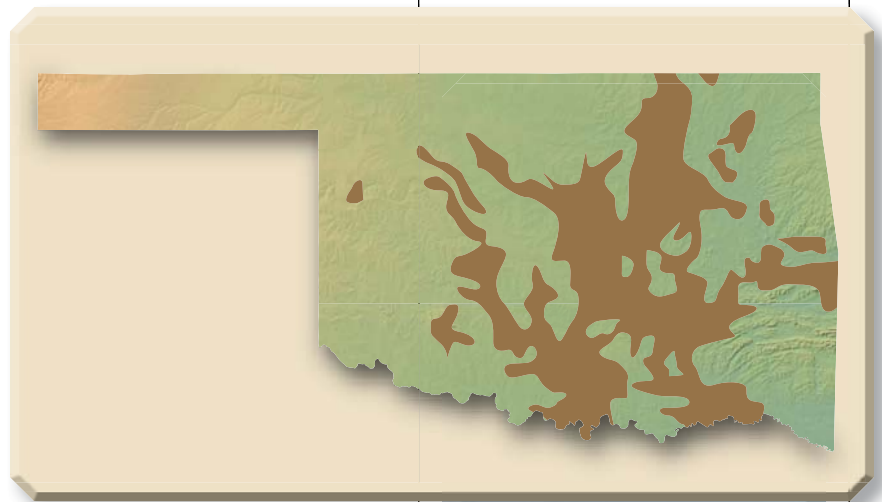
Grasslands of bluestem, buffalo, and grama grass are found in the western part of the state. In some places, early settlers in Oklahoma rode through grasses that were as tall as the wagon bed. Paths had to be cleared so the children could walk to school. Climate changes and, to a lesser degree, humans constantly cause a tug-of-war between grasslands and woodlands.

In spite of the impression of Oklahoma as a state of flat prairies and wheat fields, 20 percent of the land, or about 10 million acres, is forested. Located at the crossroads of the United States, Oklahoma has a variety of forests. There are approximately 140 tree species native to the state. Majestic cypress and pine give way to oak and hickory in the east. Blackjack and post oak are primarily found in the central Cross Timbers. Mesquite is in the southwest, and pinion pine and juniper trees are in the northwest corner of the Panhandle. There are 6 million acres of commercial forest. The most valuable timber commercially comes from the oak and pine forests of southeastern Oklahoma. These trees are milled into fiberboard, plywood, and paper.

Because the bottomland hardwoods were in great demand for construction in the early days of settlement, those forests were the first to be cut. The land was then often cleared for agriculture. By 1956, the U.S. Forest Service estimated that only 15 percent of these original hardwoods remained. These forests are slowly returning thanks to planting new trees, better management, and wildfire containment.

Over the last seventy years, a forest of red cedar trees has been emerging in western Oklahoma. Because of fewer wildfires, the cedars have spread quickly over many pasture lands, resulting in less grass for livestock. The cedars have spread over some 3-4 million acres. New sawmills have opened to take advantage of the wood, producing landscaping mulch, litter box chips, lumber, and insect repellent.

Oklahoma forests and trees provide much more than lumber. They are a habitat for hundreds of animals, birds, and insects. The redbud (our state tree) and the dogwood are the first flowering signs of spring. The woodlands provide a natural filtering system for good quality drinking water and for the air we breathe. Wooded areas offer people recreation places and provide shade and windbreaks.



Map 5 Ancient Cross Timbers

Map Skill: Across which geographic regions did the ancient Cross Timbers stretch?





Something Extra!

Some of the richest oil lease deals were made under the Million Dollar Elm Tree in Pawhuska by members of the Osage tribe.

Mineral Resources

Fossil fuels—fuels formed in the ground from the remains of dead plants and animals—have been a large part of our state’s storied past, as well as its present and future. Fossil fuels include oil, natural gas, and coal.

Oil and Natural Gas

The petroleum industry has been through numerous boom-and-bust cycles since before statehood. Indians first spotted oil seeping from the ground or as slicks on streams. Petroleum was first produced in the territory in 1882, but the first major oil discovery was not made until 1897 at the Nellie Johnstone No. 1 well near Bartlesville. Word traveled quickly and **wildcatters** (oil industry risk takers) soon streamed into the territory. In 1901, the Red Fork field near Tulsa was the first that was financially significant, followed by several others in the area including the Glenn Pool in 1905. Tulsa soon came to be known as “the Oil Capital of the World.” By statehood, Oklahoma was producing 40 million barrels of oil a year. Fields in Carter County and near Okmulgee began producing in 1907. They were soon followed by fields in Hewitt, Garber, and Healdton. By 1920, production was up to more than a billion barrels a year.

In 1928, the oil boom moved to Oklahoma City, and in 1930 oil and natural gas came gushing out of a well that came to be called “Wild Mary Sudik.” Every county in the state has seen some form of petroleum production. Oklahoma ranks in the top six states in the nation in oil production, producing 204,000 barrels a day in 2011. Natural gas, the cleanest-burning fossil fuel, gained importance the last half of the twentieth century. Oklahoma ranks in the top four in the nation in natural gas production.

Coal

Early Indians dug the first coal by hand and sold it by the basket. Commercial coal mining began in Oklahoma in 1873. Oklahoma’s coal deposits are all in the eastern part of the state, including the Arkoma Basin. Today, most of the mining is done in surface operations near Hartshorne and McAlester. Nearly 1.4 million tons of coal were mined in 2010. The Pioneer Coal Miner Memorial in McAlester pays tribute to the thousands who worked the mines and those who lost their lives.

Nonfuel Minerals

No metals have been mined in Oklahoma in recent years, although at one time zinc, lead, manganese, and iron ore were mined here. Tripoli, a mineral deposit used for grinding and polishing, is mined in Ottawa County. Sand and gravel are found throughout the state and used for building construction and roadways. Oklahoma granite, sometimes called “grey gold,” is found mainly in the Arbuckle and Wichita mountains. Most of our State Capitol was built of granite quarried near Tishomingo and black granite from Cold Springs. Limestone is mined in more than thirty counties. When crushed, it is used in making cement and as a fertilizer. Clay found in the state is used for making bricks to build homes and buildings and for making pottery. Glass is produced from silica sands from south-central Oklahoma. Oklahoma is third in the country in helium production, a byproduct of natural gas wells.

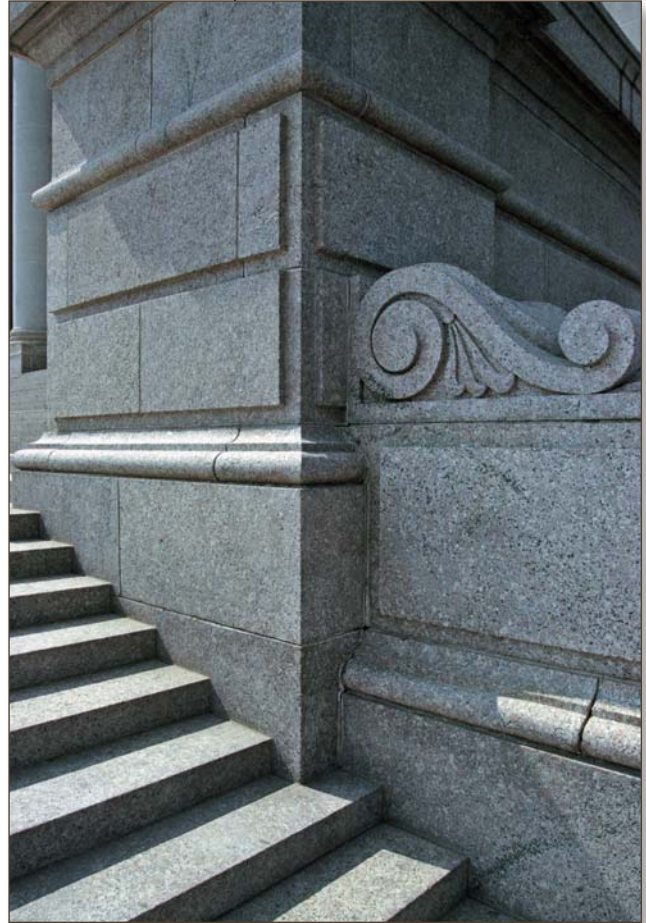
The first gypsum mill in Oklahoma Territory, the Ruby Stucco Mill, was located in Blaine County. The county is still considered to have the purest gypsum deposits in the nation; there is a major plant at Southard. Gypsum is also mined at several other locations in Oklahoma, which is the top producer of the mineral in the country. Gypsum is used to make drywall and plaster for construction, cement, chalk, dental molds, surgical casts, paint filler, toothpaste, soil additives, tofu, and plaster of Paris.

Oklahoma is the only state that produces iodine. Iodine is produced from oilfield brine (water containing salt) in northwestern Oklahoma. It is used in pharmaceuticals, disinfectants, animal feed, photography, and cloud seeding.

Salt

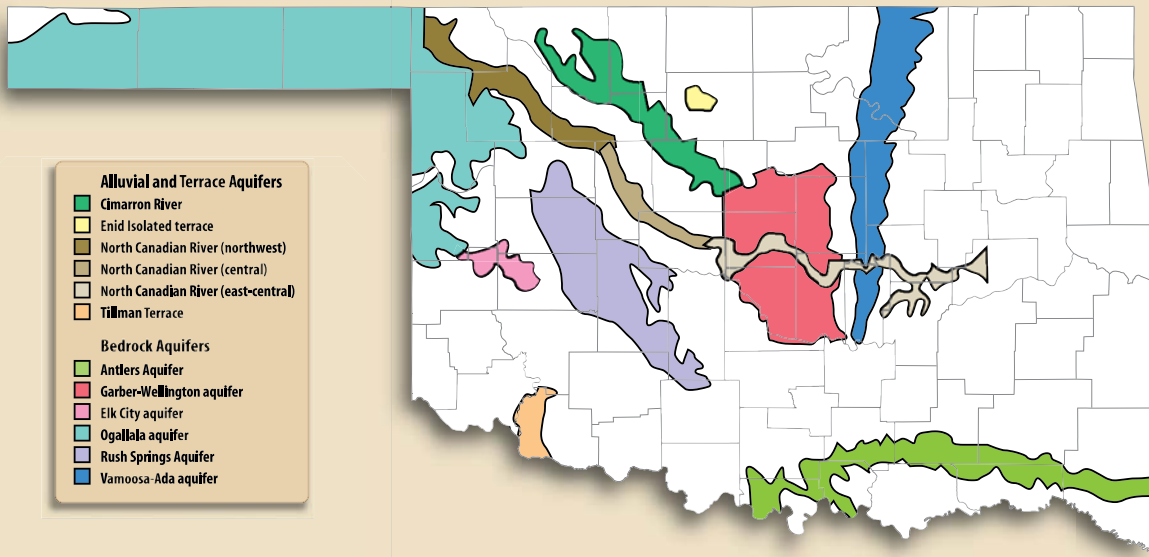
The state’s salt resources have been used for centuries. Several counties in northwestern Oklahoma contain salt plains, and the eastern part of the state has numerous salt springs. Early day salt works separated the salt from the spring water by boiling it to evaporate the water. Salt on the plains simply needed to be loaded in a container.

As early as 1815, salt was a commodity in the territory, involving many people and businesses over the years. During the Civil War, salt became scarce, and the supplies in the territory became very valuable. Production remained strong through the first half of the twentieth century.



Above: The State Capitol stands on a base of Oklahoma granite.

Opposite page: Despite its ups and downs, the oil industry is still an important part of Oklahoma’s economy.



- Alluvial and Terrace Aquifers**
- Cimarron River
 - Enid Isolated terrace
 - North Canadian River (northwest)
 - North Canadian River (central)
 - North Canadian River (east-central)
 - Tillman Terrace
- Bedrock Aquifers**
- Antlers Aquifer
 - Garber-Wellington aquifer
 - Elk City aquifer
 - Ogallala aquifer
 - Rush Springs Aquifer
 - Vamoosa-Ada aquifer

Map 6 Oklahoma's Aquifers

Map Skill: Which aquifer underlies the northeastern section of the state?

Groundwater

One of the most valuable resources to human life—groundwater—lies beneath the surface of Oklahoma. Underground basins of porous gravel, rock, and sand hold water that seeps down from rainfall, lakes, and ponds. These basins are called **aquifers**. Nearly half of the fresh water used in Oklahoma comes from aquifers.

The Ogallala aquifer runs from Texas into the edge of South Dakota and portions of five other states. It stretches across the Panhandle and part of northwestern Oklahoma and is perhaps the most important aquifer in the state. Millions of gallons of this water are used to irrigate fields. But groundwater from the aquifer is being used for irrigation and development faster than it can be replenished by rainfall, causing a major ecological problem for the future.

Other aquifers such as the Rush Springs, the Garber-Wellington, the Antlers, and the Vamoosa-Ada are among the twenty-three major groundwater basins that also supply water to 40 percent of Oklahoma cities and farms.

Waterways

Visitors to Oklahoma are often surprised by the number of rivers and lakes we have. More than five hundred rivers and streams (or 78,578 miles), thirty-four major reservoirs, and hundreds of lakes and ponds supply approximately 60 percent of the water we consume. Much of this is for agricultural irrigation, but surface water is also used for municipal water supplies, mining, and recreation. As interest in water from Oklahoma grows, discussion of water rights and who owns them also increases.



Most of the lakes in Oklahoma have been man made since the 1930s by damming rivers to provide water for city, industrial, and agricultural growth and for flood control. The U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, and the Grand River Dam Authority have largely been responsible for building the lakes. Oklahoma has more man-made lakes than any other state in the nation. It has about 11,611 miles of shoreline, slightly less than the estimated combined coastline of the Atlantic, Gulf, Pacific, and Arctic coasts (12,383 miles). Our two largest lakes are Eufaula and Texoma. Eufaula has 105,000 surface acres, while Texoma covers 88,000 acres in surface area. Most of Oklahoma's thirty-five state parks are built around lakes.

Rivers and streams in Oklahoma vary greatly in their appearance and flow. River depth and flow are created from precipitation and groundwater. Western streams tend to be wide and sandy with high gypsum and salt concentrations. Streams in the east receive more rainfall and generally are deeper with rocky banks and a more rapid flow. The Continental Divide that runs along the top of the Rocky Mountains divides the flow of water between the Pacific and Atlantic oceans. Because of the slope of the Oklahoma terrain and its location east of the Rockies, rivers in Oklahoma usually flow from northwest to southeast.

Two major rivers, the Arkansas and the Red, have large drainage systems in Oklahoma. The Arkansas River, with 328 miles in Oklahoma, begins in the Rocky Mountains and gathers **tributaries** (streams and rivers that flow into larger rivers) during its four-state journey to the Mississippi River. Eventually the Arkansas River carries two-thirds of

Map 7 Oklahoma's Rivers and Lakes

Map Skill: What river(s)
feed into Lake Texoma?



Above: The Poteau River is the only river in the state that flows northward. **Right:** The Blue River flows generally southeasterly and eventually joins the Red River.

Something Extra!

Oklahoma's longest river is the Beaver/ North Canadian River at 766 miles.





the state's runoff water. Rivers in Oklahoma that feed into the Arkansas are the Salt Fork, Cimarron, Verdigris, Grand, Illinois, and Canadian. The area known as "Three Forks," where the Verdigris, Grand, and Arkansas join near present-day Muskogee, was an early settlement area.

The second major drainage system is the Red River, which also forms the southern boundary of the state. At 592 miles, the Red is the second-longest river in the state. Beginning in the New Mexico high plains, it travels across the Texas Panhandle. In Oklahoma, it receives water from the North Fork, Washita, Boggy, Blue, and Kiamichi rivers. At various times, the Red River has been an area of conflict between the United States and Spain, France, Mexico, Texas, the Confederate States during the Civil War, and, in more modern times, between Oklahoma and Texas.

The Cimarron River is a tributary of the Arkansas River. It joins the Arkansas just west of Tulsa.

It's Your Turn

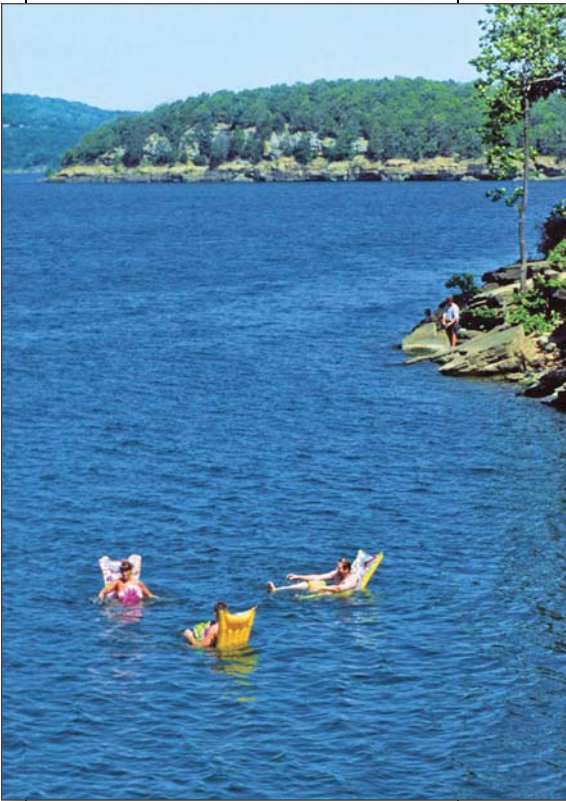
- 1. Why is soil so important?**
- 2. What are the three fossil fuels?**
- 3. Name Oklahoma's two major river drainage systems.**

Section 4

Oklahoma's Climate

As you read, look for

- the difference between climate and weather,
- vocabulary terms **weather, climate, elevation, and tornado.**



Lake Tenkiller's clear waters are a good place to cool off during Oklahoma's hot summer days.

As the famous Oklahoman Will Rogers said, "If you don't like the weather, just wait a minute, it'll change." People often confuse weather and climate. **Weather** measures the current conditions of the atmosphere: temperature, precipitation, and wind. **Climate** is the average weather of an area over a long period of time, such as 25-30 years. The daily television news gives a weather report, not a climate report.

Because of our state's location, weather conditions can change from warm and sunny to cold and cloudy in a matter of hours, or it can be quite different only a few miles away. On November 11, 1911, Oklahoma City reached a record high 83°F (Fahrenheit) early in the day. By afternoon, a strong cold front brought in Arctic air, dropping the temperature to a record low of 17°F by midnight. Often, the prevailing westerly winds collide with cold Arctic air from the north and hot, humid air from the Gulf of Mexico over or near Oklahoma creating explosive storms. Climatologists (those who study climates) classify our weather as humid subtropical. Even though it can vary greatly, our climate is usually temperate, neither too hot nor too cold.

Temperatures

The average annual temperature in Oklahoma is about 60°F. Winters are usually short and mild, with below-freezing temperatures approximately 60 days in the south and 95 days in the north. January tends to be the coldest month, averaging 36°F.

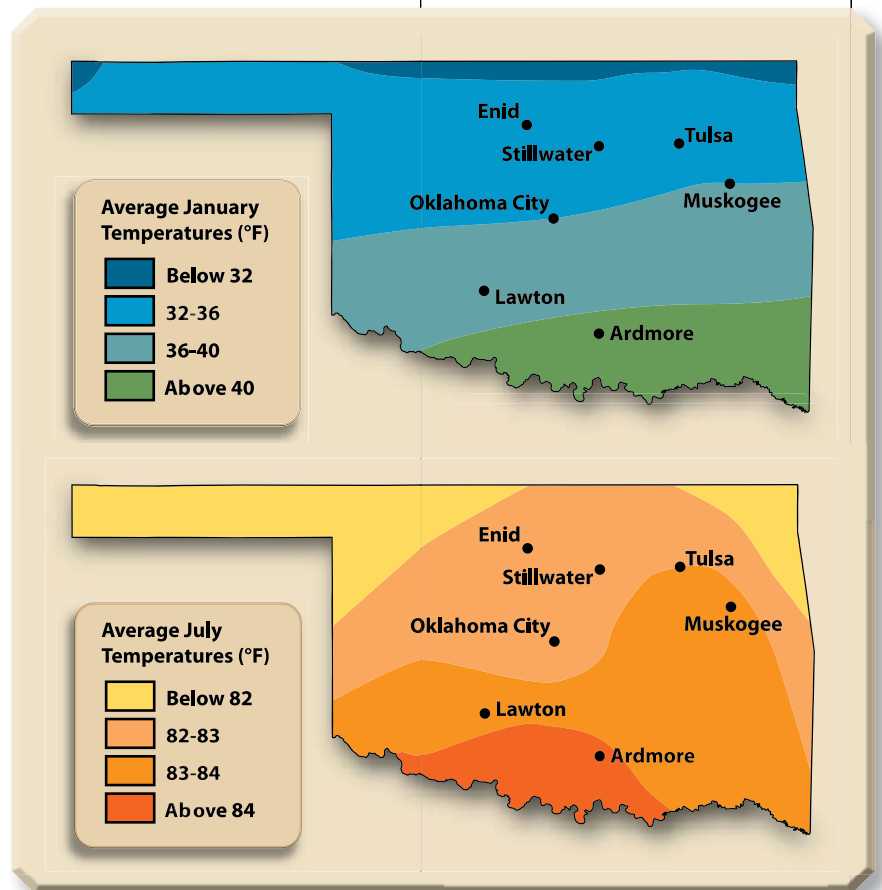
Summers are long and usually get hot. It is not uncommon for July and August temperatures to be more than 90°F. Periods called "Indian summer" can extend those high temperatures into fall. The temperatures

mean that Oklahoma has a long growing season for agriculture, ranging from 168 days in the north to 225 days along the Red River.

Precipitation

Oklahoma also has a great variation in rainfall, which is influenced by its latitude and **elevation** (the height of a place above sea level). The southeastern section averages approximately 51 inches of rain per year, although Kiamichi Mountain Tower in the Ouachitas recorded over 84 inches in 1957. The Panhandle receives about 15 inches of rain yearly, but Hooker in Texas County only had 6.2 inches of precipitation in 2011, a year of record drought for the state. Snowfall averages only about 2 inches in the southeast and up to some 30 inches in the Panhandle.

Hail storms, torrential rain, and lightning can all cause damage. When the temperature quickly drops below freezing, rain droplets turn into hail (balls of ice) of varying sizes that fall to earth with sometimes destructive power. Hail can damage property and destroy crops in a matter of minutes. Water control projects have greatly helped flood-prone areas, but enough heavy rain can still take a toll on property and life. Severe weather often results in dangerous lightning. There are some 40 million lightning strikes each year across the country, and about 1 million of those strikes are in Oklahoma.



Map 8 Average Temperatures

Map Skill: What is the average July temperature where you live?

Map 9 Oklahoma's Annual Precipitation

Map Skill: What is the average annual precipitation where you live?

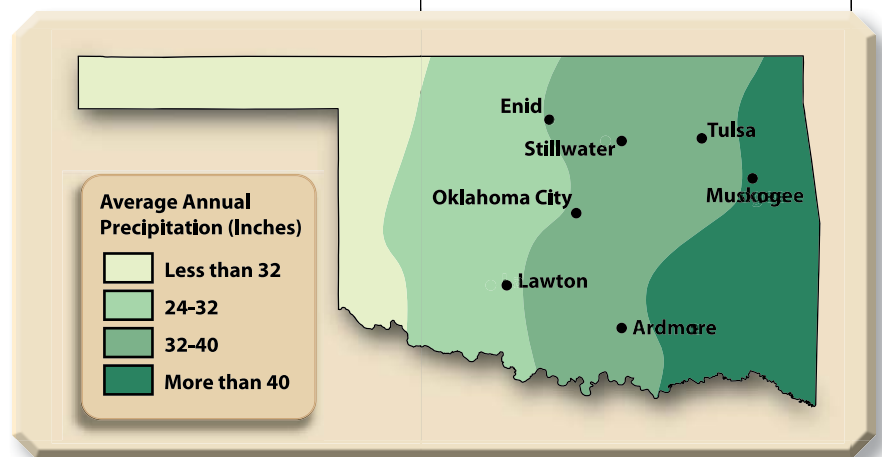


Figure 1
Enhanced Fujita Scale for Tornadoes

Category	Wind Speeds	Potential Damage
EF0	65–85 mph	Minor damage
EF1	86–110 mph	Moderate damage
EF2	111–135 mph	Considerable damage
EF3	136–165 mph	Severe damage
EF4	166–200 mph	Devastating damage
EF5	Over 200 mph	Incredible damage

Something Extra!

The word *tornado* comes from the Spanish word *tronada*, which means “thunderstorm.”

Tornadoes

Tornadoes have occurred throughout the United States, but Oklahoma and nearby states tend to have more. This area is sometimes referred to as “Tornado Alley.” **Tornadoes** can form when clashing air masses create funnels of winds that rotate counterclockwise. Usually these storms are less than a quarter-mile wide, but some can grow to as much as two miles wide. Since 1950, Oklahoma has averaged 54 tornadoes a year. The most active tornado year was 1999 with 145;

the lowest number of tornadoes, 17, was recorded in 1988.

Oklahoma has become a leading state in the weather study and forecasting industry. The National Severe Storms Laboratory in Norman uses sophisticated radar systems to monitor the weather and provide advance warnings. A number of weather-related industries have also located in our state.

Climate and the Economy

Winds—sometimes damaging, but sometimes much appreciated—that sweep through Oklahoma are responsible for another new industry in our state. Wind has long been used to power windmills to pump water from the ground and to generate electricity in some rural homes. As we look for more renewable energies to replace the need for fossil fuels, companies are responding with wind farms in the state. These “farms” consist of giant wind turbines that generate electricity when the wind blows. Transmission lines move the electricity to the consumer.

Oklahoma’s geography is as diverse as the people who live here. The variations in our climate, daily weather, soils, vegetation, topography, and resources are impressive. The following chapters will help you see how humans adopted and adapted to Oklahoma as their home, using its natural resources, and leaving their imprint on the land.

It’s Your Turn

1. What type of climate does Oklahoma have?
2. What is Oklahoma’s average annual temperature?

Environmental Challenges

Tornadoes



Oklahoma's climate consists of a mixture of three climatic regions: humid, subhumid, and semi-arid. Most often these produce agreeable weather. But sometimes, especially in the spring months of April, May, and June, the cool, dry air from the north collides with the warm, moist air from the south, producing destructive storms known as tornadoes. Oklahoma ranks fourth in the nation in the number of tornado sightings. Tornadoes generally move across the state from southwest to northeast following thunderstorms. When the funnel-shaped clouds touch the ground, the strength of the winds can reach speeds of 300 miles an hour, and the tornadoes can travel across the ground as fast as 70 miles an hour.

Sweeping up everything in their paths, tornadoes can cause tremendous destruction and death. A 1947

Tornadoes are among the most destructive forces of nature. Every year they do about \$400 million in damages. Oklahoma is in "Tornado Alley," the plains states where tornadoes are most frequent.

tornado that struck Woodward caused \$10 million damage and killed 116 people. The worst tornadic episode on record occurred on May 3, 1999, when over 70 tornadoes crossed Oklahoma! The largest of these, an F5 tornado, struck Grady and Cleveland counties with a wind force of between 250 and 300 miles an hour. Damages were estimated at \$1.2 billion, and 44 people lost their lives. Early warnings from the National Weather Center in Norman and local radio and television stations no doubt kept the death toll from being much higher.

Chapter Review

Chapter Summary

- Geography is the study of Earth's physical features and how people interact with them.
- Oklahoma's absolute location on the globe is between 94° 29' and 103° W longitude and between 33° 39' and 37° N latitude.
- Oklahoma's area is nearly 70,000 square miles, which places it eighteenth in size in the United States.
- Oklahoma is divided into 77 counties. The capital, Oklahoma City, is almost the geographic center of the state.
- The states that border Oklahoma are Texas, New Mexico, Colorado, Kansas, Missouri, and Arkansas.
- There are ten geographic regions in Oklahoma ranging from the High Plains of the Panhandle to the Red River Plains along the southern border.
- The highest point in Oklahoma is Black Mesa; the lowest point is the southeastern corner of the Little River floodplain.
- Oklahoma has a wide variety of natural resources.
- Our climate is usually temperate with an average annual temperature of 60°F.
- Oklahoma experiences such weather phenomena as hailstorms, torrential rainstorms, lightning, ice storms, and tornadoes.

Vocabulary

Define, identify, or explain the importance of each of the following as it relates to Oklahoma.

1. aquifer
2. basin
3. butte
4. climate
5. drought

6. ecosystems
7. elevation
8. environment
9. erosion
10. fossil fuel
11. geography
12. irrigation
13. latitude
14. longitude
15. mesa
16. natural resources
17. plateau
18. topography
19. tornado
20. tributary
21. weather
22. wildcatter

Understanding the Facts

1. Name three natural resources of Oklahoma.
2. What were the Cross Timbers?
3. What is the significance of the "Initial Point"?
4. How did the state's rivers and streams affect settlement and development?
5. What is significant about Oklahoma's lakes?
6. Why is the weather so changeable in Oklahoma? What influences that change?

Developing Critical Thinking

1. What do you think geography is, and why do you think the study of geography is important in understanding history?
2. Describe the geographic region where your school is located and how the region influences the types of crops and industry that exist there.
3. Describe how agriculture in the state is affected by the state's climate.

4. Why were the Cross Timbers a detriment to exploration and settlement in Oklahoma?

Applying Your Skills

1. Using a globe, locate Tunisia on the continent of Africa and Oklahoma on the continent of North America. Compare the sizes of these two areas. The lines running across the globe are *latitude* lines. Determine Tunisia's latitude and compare it to the latitude of Oklahoma.
2. On an outline map of Oklahoma, use a color pencil or pen to trace the state's two major rivers. Which tributaries connect with these two rivers?
3. Using a map of the United States, determine how far the southeast corner of Oklahoma is from New Orleans, Louisiana.
4. On a map of Oklahoma, locate the following cities: Oklahoma City, Tulsa, Muskogee, Lawton, Ardmore, Guymon, McAlester. Locate the county that touches four states.

5. Research the National Severe Storms Laboratory in Norman. How does it help other parts of the country in addition to Oklahoma?
6. Watch the weather news on local television for a period of five days.

Exploring Technology

1. There are many sayings and much folklore about the weather. Use the search words *weather folklore* to find three or four beliefs that you think are most interesting. Then determine through observations, interviews, or web searches if any are true.
2. Using your favorite search engine on the Internet, look up tornadoes. Which states have the most tornadoes, and where does Oklahoma rank among them? When did the most severe tornado in our state occur? Describe its path of destruction. How has the advancement in the reporting and tracking of tornadoes resulted in saved lives?

Building Skills

Finding the Main Idea

When you read about a topic, don't try to remember every detail. Identifying the main idea of a paragraph will help you organize information and remember more of what you read.

The main idea of a whole paragraph is often stated in the first sentence of the paragraph. The other sentences in the paragraph provide supporting details. The main idea of the following paragraph is stated in the first sentence. The other sentences in the paragraph provide the supporting details.

Geography is the study of Earth's physical features and how people interact with them. All life on Earth—plant, animal, and human—is affected by geography. On the other hand, geography is also affected by the interaction of living things on Earth. Geography helps us understand ourselves and where we live, as well as our relationship with the environment and with other people and places. It helps us understand why prehistoric people came here, why certain crops are grown,

why towns are located where they are, and even why certain clothes are available. One aid that helps us learn about geography is the globe.

What are some of the details provided by the other sentences? You are correct if you said everything on Earth is affected by geography; geography affects the interaction of all living things; and geography helps us understand ourselves, where we live, and how we live.

Do you think it is necessary to remember all the details in the paragraph? If not, which ones do you think are most important? It is not necessary to remember all details, but try to pick out the major fact from a paragraph.

Read the last paragraph under the head "Soils" on page 23 and answer the following questions.

1. What is the main idea of the paragraph?
2. Which sentence in the paragraph states the main idea?
3. Which sentences provide supporting details?