

Black Mesa

Where the Rocky Mountains Meet the Short-Grass Prairie

Objective

Students will read and answer questions about Black Mesa. Students will create a time line of the history of Black Mesa. Students will research to compare the Black Mesa area with other parts of Oklahoma.

Background

See Reading Pages. (Sources: Bement, Leland C. and Casey R. Carmichael, *From Top to Bottom: Pedestrian Survey of the Black Mesa Region Cimarron County, Oklahoma*, University of Oklahoma, Oklahoma Archaeological Survey, Archeological Resource Survey Report No. 48, 2003. <http://www.ou.edu/cas/archsur/pdf/files/BlackMesaFinalReport.pdf> and Gumerman, George, *A View From Black Mesa: The Changing Face of Archaeology*, University of Arizona Press, 1992.)

Procedures

1. Read and discuss the information and vocabulary found on the Reading Pages included with this lesson.
 - Divide students into four groups.
 - Assign each group to answer one of the groups of comprehension questions included with this lesson.
 - Discuss the questions as a class.
2. Students will develop time lines based on the information presented in the background.
3. Black Mesa is the highest point in Oklahoma. Students will use online or library resources to answer these questions:
 - What is the lowest point? Name the county where the lowest point is located. Find the county on the Oklahoma map included with this lesson.
 - What is the average elevation?
4. Students will use online or library resources to identify the states in the Gulf of Mexico watershed.
5. Research the Homestead Act of 1862. What are “squatter’s rights?”
6. Students will design experiments showing how mesas form from lava flows (hard material forming a capstone on top of softer materials so that the material surrounding it erodes away while the material under the capstone stays in place.)
7. Students will design experiments to show why the soil in the Black Mesa area is dry even after heavy rains compared with soil with more vegetation.
8. Oklahoma has at least 10 ecological regions. Students will use online or library resources to identify the 10 regions. Students will identify the ecological region for your part of the state.
9. Most of the soils in the Black Mesa area are classified as Entisols. Research online to find a description of Entisols. These types of soils are suitable for what type of agriculture?

Oklahoma Academic Standards

GRADE 3

Earth Systems: 2-2
Geography: 1CE,2AB; Oklahoma
History: 1,3,59,11

GRADE 4

Earth Systems: 1-1; 2-1,2
Geography: 1AB,3,5. Native
Americans: 1

GRADE 5

Earth Systems—2-1

GRADE 6

Earth Systems: 2-4
Geography: 1.1,2,4; 2.1B; 3.1B,2,3;
4.5; 5.1B

GRADE 8

Earth Systems:1-4; 2-1,3; 3-1

Oklahoma's WPA Fossil Bones Project

In 1931, road workers were clearing a path through Kenton, near Black Mesa, when they unearthed a five-foot long rib bone. J. Willis Stovall, a geologist from the University of Oklahoma, was called in to investigate. The rib belonged to an Apatosaurus, and Stovall suspected there might be more in the Black Mesa area.

In 1935 Stovall acquired federal funding from the Depression-era Works Progress Administration (WPA) to dig for more dinosaurs. From 1935 to 1942 the untrained WPA crew worked in the area and unearthed around 30,000 fossil specimens.

By 1942, the project was abandoned, and the bones were dumped into crates and boxes. For the next 50 years, the collection was moved around from place to place on the OU campus. At one time they were even stored in a concrete cave under Owen Field.

In the 1980s, with a series of grants from the National Science Foundation, the fossils were finally cataloged and properly stored.

Today, the fossils are the centerpiece for the Sam Noble Oklahoma Museum of Natural History in Norman.

Source: Wall, Holly, Secrets of the Dust Bowl Digs, *This Land Press*, April 23, 2013, <http://thislandpress.com/04/23/2013/secrets-of-the-dust-bowl-digs/>

Extra Reading

- Allaby, Michael, *Droughts (Weather Science)*, Facts on File, 2011.
- Chambers, Catherine, *Drought (Wild Weather)*, Heinemann, 2007.
- Cooper, Michael, *Dust to Eat: Drought and Depression in the 1930s*, Clarion, 2005.
- Desonie, Dana, *Geosphere: The Land and Its Uses (Our Fragile Planet)*, Chelsea House, 2008.
- Egan, Timothy, *The Worst Hard Time*, Mariner, 2006.
- Gardner, Robert, *Super Science Projects About Earth's Soil and Water (Rockin' Earth Science Experiments)*, Enslow, 2007.
- Gifford, Clive, *Flooding and Drought (Looking at Landscapes)*, Evans Brothers, 2005.
- Hesse, Karen, *Out of the Dust*, Scholastic Paperback, 1999.
- Lamadrid, Enrique R., Arrellano, Juan Estevan and Amy Cordova, *Juan the Bear and the Water of Life: La Acequia de Juan del Oso*, University of New Mexico, 2008.
- Potter, Tracey, *Treasures in the Dust*, HarperCollins, 1999.
- Stille, Darlene R., and Hossain and Farhana, *Soil: Digging Into Earth's Vital Resource (Exploring Science: Earth Science Series)*, Compass Point, 2005.
- Wallace, Marianne, *America's Prairies and Grasslands: Guides to Plants and Animals*, Fulcrum, 2001.
- Woods, Michael, and Mary B. Woods, *Ancient Agriculture: From Foraging to Farming*, Runestone, 2000.

Name _____

Scientific Study Format

Title of Experiment or Study:

I. Stating the Problem:

What do you want to learn or find out?

II. Forming the Hypothesis:

What is known about the subject or problem, and what is a prediction for what will happen?

III. Experimenting: (Set up procedures)

This should include: materials used; dates of the experimental study; variables, both dependent and independent (constant and experimental); how and what was done to set up the experiment; fair testing procedures; evaluation of potential safety hazards and practice of appropriate safety procedures.

IV. Observations:

Includes the records, graphs, data collected during the study.

V. Interpreting the Data:

Does the data support/defend the hypothesis?

VI. Drawing Conclusions:

Justify the data collected with concluding statements about what has been learned. Discuss any problems or concerns. Use other studies to support the conclusion. Give alternative ideas for testing the hypothesis.

Black Mesa

Oklahoma is one of the most geographically diverse states in the US. We have at least 10 distinct ecological regions—more per square mile than in any other state.

Oklahoma is between the Great Plains and the Ozark Plateau in the Gulf of Mexico watershed. Our state slopes from high plains on the western boundary to low wetlands in the southeast. Our lowest point is 289 feet above sea level, on the Little River near Idabel on the far southeastern boundary.

In the northwest corner of the Panhandle is our highest peak, Black Mesa. Located in Cimarron County, Black Mesa is a basalt lava flow 4,973 feet above sea level.

What we know as Black Mesa was once a wide valley. About 2.4 million years ago, a volcano erupted 65 miles away, in present-day Colorado, and spewed lava over the area that became Black Mesa. Over the years the topography has slowly reversed from valley to mesa, with the hard erosion-resistant basalt from the lava flow protecting the sediments beneath from eroding away. The surrounding area, composed of softer sandstone and shale, was eroded by the Cimarron River and its tributaries, leaving the basalt cap high atop the mesa.

At Black Mesa the Rocky Mountains meet the short grass prairie. Unlike the tall grass prairies found in the eastern part of the state, the vegetation in this area was dominated by short-grass prairie, dotted with juniper trees and Cholla cactus.

The sparse vegetation grows on brown, loamy soils, classified as entisols. Entisols are soils that show little or no evidence of horizon development. They typically occur in areas where erosion rates are faster than the rate of soil development, such as dunes, steep slopes and flood plains.

Rainfall at Black Mesa is erratic. Summer storms may start around mid-July and continue into September. Thunderheads build to tremendous heights, then burst, flooding local areas. Dry stream beds become raging rivers, gullies form and the earth's surface becomes a quagmire. Moisture usually does not penetrate the soil very deeply, and rapid runoff is normal. Soon after the rains stop, the soil is dry again.

BLACK MESA PEOPLE IN ANCIENT TIMES

Artifacts found near Kenton lead scientists to believe there were seminomadic people living in this area thousands of years ago. They survived by hunting and gathering wild plants. They may also have supplemented wild foods with small crops of corn and squash. Eventually they may have grown more dependent on agriculture and established relatively permanent villages. Prehistoric farmers returned to the same habitation sites and campsites year after year. They were flood-plain farmers. They positioned their fields so they would catch some portion of the seasonal rains as they streamed off the mesas.

BLACK MESA IN RECORDED HISTORY

The first written record we have of the Black Mesa area is from the Spanish explorer Francisco Vásquez de Coronado who travelled through there in 1541,

Vocabulary

agriculture— the science or occupation of cultivating the soil, producing crops, and raising livestock

archaeologist— a specialist in the science that deals with past human life as shown by fossil relics and the monuments and tools left by ancient peoples

artifact— a usually simple object (as a tool or ornament) showing human work and representing a culture or a stage in the development of a culture

basalt— a dark gray to black usually fine-grained igneous rock

diverse— differing from one another

climate— the average weather conditions of a particular place or region over a period of years

ecological— having to do with the relationships between living things and their environment

erosion— the action or process of wearing away by or as if by the action of water, wind or glacial ice

erratic— marked by lack of consistency or regularity

geologist— a specialist in the science that deals with the history of the earth and its life especially as recorded in rocks

gully— a trench worn in the earth by running water after rains

habitation— a dwelling place

seminomadic— a group of people who move from place to place, usually following game or wild plants and

sometimes returning seasonally to a place to grow crops

soil horizon— a distinct layer of soil or its underlying material in a vertical section of land mesa

partido—a system whereby a wealthy sheep-owning patron leased some of his flock to one or more landless shepherders for three to five years in return for 20 percent payments in lambs or wool each year. At the end of the contract, the shepherd gave the patron a number of sheep equal to those originally leased. In this way, the partidario acquired a small flock of his own.

paleontologist— a specialist in the science dealing with the life of past geological periods as known especially from fossil remains

quagmire— soft spongy wet ground that shakes or gives way under the foot

supplement— something that supplies what is needed or makes an addition

thunderhead— a large cumulus cloud often appearing before a thunderstorm

topography— the shape and height and depth of the features of a place

valley— an area of lowland between ranges of hills or mountains

volcano— a vent in the earth's crust from which melted or hot rock and steam come out

following the Canadian River. He reported encounters with tribes of people identified as Terya and Querecho. These tribes may have been ancestors of the Kiowa and Comanche, who occupied the area in the first half of the 19th Century.

The Kiowa and Comanche were nomadic tribes that came onto the Plains after the Spanish introduced horses. They survived by hunting bison in the Oklahoma and Texas panhandles and fiercely defended their territory from the Anglo and Spanish traders who came through en route to Santa Fe on the Cimarron Trail. By the 1870s buffalo hide hunters had depleted the bison herds, and the US military had hunted down the Kiowa and Comanche and driven them to reservations.

Partido shepherds from NM may have begun to graze sheep in the area early in the 1800s. By the mid 1860s the Baca and Trujillo families of Santa Fe had established large sheep ranching operations near Kenton. They kept peace with the Kiowa and Comanche by allowing them to “steal” small numbers of sheep from their herds.

TERRITORIAL DAYS

After the Civil War, cattlemen moved in. Soldiers returning from war needed a way to earn a living, and the demand for beef was growing. Gradually the cattlemen organized themselves into ranches and established their own rules for arranging the land and settling disputes. Around 1870 they paid the Bacas \$1 per head to drive their 50,000 sheep back into New Mexico. The Trujillos received the same offer but chose to remain.

In the territorial days, before Oklahoma statehood, there was confusion among the cattlemen over the legal status of the Panhandle. Some attempts were made to arrange rent with the Cherokees, despite the fact that the Cherokee Outlet ended at the 100th meridian. However, in 1886, Interior Secretary LQC. Lamar, declared the area to be public domain.

The Panhandle could not be officially settled with the Homestead Act of 1862 because the land was not yet surveyed. Settlers by the thousands flooded in to assert “squatter’s rights.” They surveyed their own land and by September 1886 had organized a self-governing and self-policing jurisdiction, which they named the Cimarron Territory. Finally Secretary Lamar made it legal by declaring the area open to settlement by squatter. The Panhandle was considered a grazing district, so settlers were not required to do the usual planting and plowing required for homesteading. Instead, they were required to show proof of grazing to receive a deed. The peak filing period for claims was 1903, with an average 25 claims per day.

HARD TIMES

The people who staked their claims in this part of the state were shaped by the harsh climate. More than any other part of the state, the Oklahoma Panhandle was the heart of the Dust Bowl of the 1930s. Although the conditions were brutal, many of those who had held homesteads stuck it out.

Some of them found work digging for dinosaur bones. Since 1935 the area has provided geologists and paleontologists rare opportunities to examine Jurassic and Triassic rocks and the dinosaur bones in them. (See “Oklahoma’s WPA Fossil Bones Project,” included with this lesson.) More than 18 tons of camptosaurus, stegosaurus, apatosaurus, diplodocus, and edmontosaurus bones have been quarried at Black Mesa. A string of allosaurus footprints can be seen clearly along Carrizo Creek just north of the mesa itself. During the Jurassic Period, the ecology was much different than it is today. It was lush and verdant, with running rivers and tropical forests—the exact opposite climate that it has now.

Black Mesa

COMPREHENSION QUESTIONS

Group One Questions

1. Explain how the topography of Black Mesa changed from valley to mesa?
2. What was the location of the volcano from which the lava that formed Black Mesa flowed?
3. Which Oklahoma river is the location for the lowest elevation in Oklahoma? Which Oklahoma river and its tributaries is responsible for eroding the area around Black Mesa? What river was Coronado following when he explored the Black Mesa area in 1541? Use an online search engine or library resource to find both of these rivers. Draw the rivers on the map of Oklahoma included with this lesson.

Group Two Questions

1. Explain this statement: "At Black Mesa the Rocky Mountains meet the short grass prairie."
2. What kind of vegetation grows naturally in the Black Mesa area?
3. Explain why the soil is dry in the Black Mesa area soon after a heavy rainstorm?

Group Three Questions

1. The ancient people who lived near Black Mesa were semi nomadic hunters and gatherers who became more settled when they started growing crops. Explain why people become more settled when they start growing crops.
2. What is a flood plains farmer?
3. Coronado may have encountered the ancestors of which Oklahoma tribes that we know today?
4. What did the Spanish bring that allowed these tribes to come onto the Plains? How did they survive? Why did they finally leave the area? How did the Partido shepherds keep peace with these tribes?

Group Four Questions

1. Cattlemen moved into the area after what war? What was the reason for the increase in cattle production at this time?
2. Cattlemen tried to pay rent to the Cherokees to graze cattle on the land near Black Mesa. Why was that not necessary?
3. What was the reason the Panhandle could not be officially settled after the Homestead Act of 1862? What did the settlers do instead? Why were settlers not required to grow crops when settlement became official?
4. What unusual line of work were some residents of the area able to find during the Depression of the 1930s?

