

Camp Classen YMCA Trail Guide Warren Mountain Trail

Trail Cards



Trail Focus: Ecology
Length: Approx. 3 miles

14 Numbered Teaching Stations

Color Code: Orange
Revised Summer 2004

Ecology of the eastern deciduous forest and the high prairie grassland biomes.

- To develop a basic understanding of our natural surroundings and their interrelationship with man.
- To develop an awareness of the natural habitats of living organisms and the role of biotic and abiotic factors.
- To understand the ecotone of the Eastern Deciduous Forest and Great Plains biomes.
- To study the organization of the deciduous forest ecosystem.
- To become aware of the various niches and adaptations of the indigenous plants and animals.
- To analyze the effects of sunlight, soil types, and moisture on the growth of trees along the trail.
- To observe the formation of travertine and to investigate the rock formation processes.

Please refer to the complete Trail Guide for additional information.

Station Number	Title and focus	Page
1	Old Shower House: <i>The Eastern Deciduous Forest Biome</i> ecotone of the forest and prairie biomes	9-10
2	Step Up: <i>Forest Organization.</i> Horizontal and vertical organizations of a forest. Layers of a forest	11-12
3	Crooked Tree: <i>History of a Tree.</i> Trees' response to abiotic factors, growth to sunlight, the impact of weather Tree ring growth	13-14
4	Large Forest Opening: <i>When A Tree Falls.</i> Why trees fall, plant growth patterns.	15-16
5	First Lick Creek Crossing: <i>Arbuckle Mountain Springs.</i> Aquifers, springs, cool water and the land	17-18
6	Tree Stump: <i>Soil Formation and Types.</i> Alluvial deposits, substrate, soil layers, decomposition, soil types	24-25
7	Fish Pool: <i>Water Nourishes The Landscape.</i> Transitional forest, precipitation, irrigation, percolation, transpiration, etc.	26-27

Tree Identification information is found between trail cards for Stations #5 and # 6.

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Station Number	Title and focus	
8	Three Falls Scenic Area: <i>Travertine And Conglomerate.</i> The formation of sedimentary rocks, limestone, travertine, conglomerate	28-30
9	Top of Three Falls Cliff: <i>The High Prairie.</i> Xeric conditions, knob leaf oak Why is prairie here?	31
10	Knob Leaf Oak: <i>Prairie Area: The Juniper Invasion.</i> Remnant prairie, mono- & poly-culture, limiting factors, human efforts, biodiversity	32-34
11	Prairie: <i>Grassland Discovery.</i> Controlled burning and maintaining the prairie	35
12	Highway Department Survey Marker: <i>Cultural Influence</i> Scenic view, survey marker, natural resource usage	36-37
13	Switchback Point: <i>Ecotone</i> What is an ecotone? The confluence of biomes?	38-39
14	Trip Shed at 89er Village: <i>Trail Review</i> Reflective walk time and wrap-up	40

See Trail Guide for Appendix-Soil and Air Temperature Reading Chart and Questions

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TRAIL MATERIALS LIST

Soil thermometer

Air thermometer

Tree Ring samples (these can be ordered from Museum Products)

School Supplied Snack (for Top of Three Falls Cliff)

Spade for soil observation

School supplied Oatmeal for feeding fish

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NOTE ABOUT THE WARREN MOUNTAIN TRAIL

Due to the length of this trail, its unusual scenic qualities and ecological diversity, a minimum of 3 hours should be planned for its use.

During the course of this experience, the hikers will be required to cross Lick Creek three times which means shallow water wading or some pretty fancy rock-hopping. They will climb out of Lick Creek Canyon at the Three Falls scenic area by ascending a moderately steep 250-foot rock face to the Warren Mountain Trail. The trail on Warren Mountain crosses a mile of open prairie and juniper thicket before reentering the forested valley by a series of downward looping switchbacks that will eventually take the hikers back to Lick Creek and the trailhead.

You may want to have mid-trail refreshments (apples, oranges, granola bars, etc.). **The climb up the rock face must be undertaken cautiously.** Position adults along the climbing route about 20 to 30 feet apart. Keep the students away from the trees near the top. They may catch their clothing on the branches and be thrown off balance. An adult should climb the entire route to check if the path is clear before any students begin climbing. Station a teacher mid-way, overlooking Three Falls, and have the students wait until all group members have reached the mid-point of the climb. Then, as a group, proceed to the top of the ridge and sit down on the flat, rocky area near the Station 9 marker.

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Teaching and Hiking Suggestions

- Before beginning the trail, explain trail rules and what is expected of each student and counselor
- Backpacks should only contain necessary trail items
- Everyone should check for tied shoelaces
- Position counselors at the end of their cabin group
- Be observant of the surroundings and take advantage of “teachable moments”
- At teaching stations, gather students close so that they can hear, attend, and be involved
- Rotate cabin groups during the hike to give everyone a chance to be at the front

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Trail Rules

- Stay on trails and walk single file. This reduces erosion and helps maintain habitat for animals. Don’t shortcut the “switchbacks.”
- Don’t litter! Leave no record that you were here, except for footprints. Paper, water bottles, orange peels, piles of rocks, even broken limbs are sad signs of human impact.
- Be prepared. Dress for the weather. Bring water in hot weather. Don’t carry so much that you may tire yourself.
- Stay with your group. This keeps people safe, and allows everyone to share in the learning. Keep one person at the end to “bring up the rear.”
- Use study materials. There are other trail guides, field guides, and other materials available to tell you more.
- Be patient and quiet. Getting there is half the fun. Slow down: noise scares away wildlife, and you will miss the things you came to see. Take time to learn and appreciate beauty.

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Old Shower House The Eastern Deciduous Forest Biome

Ecologists explain that the deciduous, hardwood forest in the Arbuckle Mountains represents one of the western most extensions of the eastern forest in North America. A very similar forest is found in Pennsylvania. This is called the **Eastern Deciduous Forest Biome**. Barely a mile from here, the trail leaves the forest and enters a grassland ecosystem, which represents an eastern extension of the **Grasslands/Great Plains/Prairie Biome** of North America. This is one of the special features of the Oklahoma Arbuckle Mountains and Camp Classen in particular.

STUDENT ACTIVITIES

1. Have the students name and locate on an imaginary map of North America several other biomes including the Everglades, Southern Forest, Northern Forest, Arctic Tundra, Rocky Mountain, and one or more of the North American deserts.
2. List and discuss some of the animals that live in this forest including whitetail deer, turkey, wild hogs, armadillo, opossum, raccoon, coyote, fox, bobcat, rabbit, and tree squirrel.
3. Discuss the types of food and shelter provided by this forest for some of the animals that live here. (**Mast crop** of nuts and acorns and numerous hollow trees.)

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VOCABULARY WORDS

- **Biome:** A major ecological zone characterized by certain kinds of climatic conditions, dominant plants and wildlife.
- **Deciduous:** Parts fall off and are replaced. Examples include broadleaf trees, mammal teeth, and mammal hair.
- **Eastern Forest:** Forest of deciduous trees found chiefly in the eastern United States.
- **Great Plains:** Plains dominated by various species of grass, located chiefly in the central United States.

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Note: This is a small area to stop with a large group of students. This information could be discussed at Teaching Station 3 or 4.

Forest ecosystem has a horizontal and vertical organization that provides a variety of food and shelter for animals. The horizontal organization involves the spacing of plant species on the forest floor. The trees in this valley are straight and tall, some 90 to 100 feet in height. This is a lowland forest. The valley hillsides are forested with the same species of oaks and hickories, but the trees are smaller. That woodland is the transitional forest.

Locate the tops of the tallest trees that you can see. This is the canopy. Locate the next layer of trees with their crowns beneath the canopy. This is the understory. Notice the trees around you that are from 5 to 12 feet tall (2-4 meters). They occupy the shrub level. The flowers, grasses, and ferns make up the herbaceous level.

STUDENT ACTIVITIES

1. What are the factors that help determine tree size? Some trees grow very fast; this helps them get taller more quickly than their neighbors, thus getting to the sunlight first. If the living requirements (water, proper soil, sunlight, etc.) of the tree are easily met, the tree will grow bigger and more quickly. These same factors can limit the growth of trees.
2. Compare the environmental conditions of the lowland forest and transitional hillside. The species composition is about the same (same dominant trees, same plants in the understory, etc.), but the sizes of trees and plants are largely different, and those on the hillside are gnarled and twisted. Discuss why. Reasons may include the availability of water and soil depth on the hillside, or sunlight/shadows around the hills, and susceptibility to higher winds on the hillside (compared to the more sheltered valley.)

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3. Have the students name a forest in the tropics with trees over 200 feet tall and with 15 to 20 botanical layers. (That would be the tropical rain forest!)
4. Ask: "Would you expect to find more species of animal life in a forest with 20 botanical layers or 4 botanical layers?" The diversity of an ecosystem increases as the availability of life requirements does. Tropical rainforests have plenty of water, sun, nutrients, and are most geologically stable (few earthquakes or volcanoes).
5. Discuss the reasons for the lowland forest's productivity including: deep soils, high water table, numerous hollow trees and a variety of food producing trees, especially, the hickories, oaks, walnut and pecan.

VOCABULARY WORDS

- **Horizontal:** across; parallel to the earth's surface (Teacher may wave hands to help describe this.)
- **Vertical:** up and down. (Teacher may wave hands to help describe this.)
- **Lowland forest:** available water, deep soil and protection from high winds allow trees to grow tall and straight
- **Stratification:** layering
- **Transition:** (in this case) gradual change from forest to prairie with an increase in elevations and aridity of the landscape
- **Canopy:** uppermost layer of a forest, most exposed to sunlight, trees are best producers of seeds and leaves
- **Understory:** layer immediately below the canopy (approx. 10-20 meters high). Composed of trees which will later reach the canopy, as well as trees which are likely to stay at this height
- **Shrub level:** trees from approximately 2-4 meters. Young trees, and mature short trees. Dogwoods, redbuds, and plum trees are common examples of shrub tree level
- **Herbaceous level:** plants growing from waist-high to sock level (0-2 meters). Grasses, wildflowers, herbaceous plants
- **Diversity:** number of different kinds (biodiversity-kinds of living organisms; a function of height in a forest.)

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History of a Tree Crooked Tree

Materials needed: tree ring samples

“Every tree has a story to tell and the forest will talk if we will listen.” The forest and its animal residents produce many interesting and meaningful sounds, but trees also tell their stories by their shape. The trees in this forest try hard to grow straight and tall and some of these 200 year old oaks have succeeded. However, many of these trees are scarred, knobby, twisted, and gnarled with irregular limb growth patterns. Trees are constantly responding to and being acted upon by drastic physical and biological forces. Trees grow, die, fall, and decompose. Winds blow, fires burn, animals eat, rocks tumble, streams flood, man cuts, and droughts occur; yet, trees survive by adapting.

The following examples are found throughout the lowland and transitional forests. See how many you can find:

- a. Swollen tree trunks are the result of wind, fire, or insect damage to the inner bark.
- b. Hollow post oak trees with tops missing have suffered from heart rot, following wind damage.
- c. Oak trees with broad spiraling scars from top to bottom have been struck by lightning.
- d. Trees growing as twins or triplets from the same root system indicate that man probably harvested the parent tree.
- e. The outward angle of trunk growth and the crown shape of twins and triplets is stimulated by their competition for sun and space.
- f. Trees that are leaning or growing in circular arcs to the ground were held down with vines or pinned by fallen limbs.
- g. Trees with stubby trunks and limbs with abrupt right angle growth patterns have been crushed or shattered by falling timber.

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- h. Living trees with square or rectangular wallet-size holes in the living wood have been attacked by the pileated woodpecker hunting for beetle larvae.
- i. Trees with divided or crouched trunks near the top usually demonstrate wind or tree fall damage.
- j. Oak trees with knobby trunks have recovered from the limb breakage.
- k. Oak trees with perfectly round cup-size holes have suffered from wind topping (top is broken off from wind), heart rot (heartwood of tree is rotting out), the failure to heal of limb scars (scar where a limb has broken off) due to fox squirrel activity (the squirrels search for places to hide acorns or build nests).

STUDENT ACTIVITIES

1. The students will use tree ring samples to determine the age of the tree sample and identify wet and dry years in the tree's past. Can be done in groups of two or three students. (10 min.)
2. Discuss why most healthy canopy level trees tend to grow straight and tall. (They grew straight and quickly, hence their shape. The rest of the canopy protects them from some weather forces. Sunlight is readily available, so the trees stay healthy.)
3. Locate trees with squirrel and woodpecker holes.
4. Have each student locate and interpret the growth condition of a particular tree.
5. Have the students search for wind topped hollow trees and discuss their value to the wildlife community. (Squirrels need cavities for nut caches. Woodpeckers need nests and openings in the wood for food. Insects can get at the wood for their food. There may be other wildlife values!)

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Large Forest Opening When A Tree Falls

Materials needed: soil thermometer and air thermometer

A major feature of this forest is the large number of decomposing tree trunks on the forest floor and the corresponding openings in the canopy overhead. Trees die from various causes in every forest each year. The fallen and damaged red oak trees in this forest are directly related to the severe drought conditions in 1980. During the ten-week period without rain and with extremely high temperatures, the water table dropped so low that the Lick Creek springs stopped flowing and the trees shed their leaves prematurely. Insects damaged the stressed forest. Disease followed, and within two years the giant trees began to fall and are still falling periodically. Another minor drought occurred in the summer of 1995, and lasted 8 weeks.

STUDENT ACTIVITIES

1. Take a soil temperature reading. Students should make a prediction of the soil temperature. Insert a thermometer in the soil at the edge of the trail. (Make sure the thermometer is placed at the same depth in the soil at each location). Leave in the soil for 5 minutes. This is the perfect time to discuss the activities and discussions listed below. You might want to have a second thermometer to compare the air temperature to the soil temperature.
2. Discuss the possible reasons for the large number of new plants on the forest floor beneath the open canopy. (The open canopy leaves an abundance of available resources. New plants thrive in the sunlight and soil. Every kind of plant is competing for these resources, so there is a wide range of plants in the open space. Eventually, some will grow taller, or “out-compete” the others, and certain plant species will become dominant. Later still, the forest layers will form.)

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3. How will this new and varied plant growth affect the wildlife populations in this forest? (Plants literally determine the wildlife in an area. We should include insects and other small critters as wildlife. The plants themselves act as food, the flowers and seeds, too. Plants are habitat for many wildlife species as well.
4. Speculate concerning the effect of these dead trees on the forest floor. (Dead trees provide food and shelter for decomposers, and for consumers of decomposers. Subsequently, they yield an increase in the available nutrients in an area. Dead trees may fall in such a way that they change drainage patterns on the forest floor. Look for trees that act as natural dams in the area.)
5. How have these fallen trees affected the living trees around them? (Once fallen, they no longer compete for sunlight in the canopy, making room for other trees. As they decompose, they add nutrients to the soil. The thicker humus layer absorbs more water, making it available longer to the trees.) **Nitrogen cycle**
6. Why were the red oaks the most severely affected? (Something must have made them die or dry out more quickly than the others. Red oaks are the tallest trees in this forest, and so were first to be affected by winds. Their tops broke off before the other trees.)
7. Evaluate the present and long lasting effects of El Nino on this forest. (It is interesting to feel so isolated and peaceful in this forest, yet know we are so connected to something far off in the Pacific Ocean, where El Nino forms. Abundant rain and sunlight will make a healthy, balanced forest; drought and high wind will stress and kill plants and trees.)

VOCABULARY WORDS

- **El Nino:** Spanish for “The Little Boy”. This wind originates in the warm climate west of South America, and affects weather in Central America or the southwest part of North America.

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First Lick Creek Crossing Arbuckle Mountain Springs

Optional Materials: thermometers

When Lick Creek stops flowing (due to low rainfall), you can tell where the spring-fed pools are. The stream flows from Three Falls to Lake Guy James, then on past the Fossil Pit to Classen Falls and Lake Classen. These spring waters are being held in a porous limestone or sandstone formation called an **aquifer**. Through the centuries, as Lick Creek has continued to erode deeper into the valley floor, this aquifer has been “nicked”, so to speak, causing the release of its stored water into the creek bed. As we gaze into these cool, crystal clear pools with their populations of watercress, minnows, crickets, frogs, and crawfish, the question most often asked is, “Is the water good enough to drink?” It is impossible to predict the presence or absence of potentially harmful pathogens without laboratory studies, so this question can’t be answered. It isn’t harmful to the delicate plants and animals that live here, and due to the remoteness of this location; there is no possibility of household, industrial, community, barnyard or hazardous waste pollution. One of the truly marvelous features of Camp Classen is the presence of spring waters that have not been contaminated by man’s activities. These little spring pools represent isolated aquatic ecosystems in their purest state.

STUDENT ACTIVITIES

1. Discuss the ways Lick Creek is shaping this valley. Look around for examples of erosion. Water erosion makes a “V” shaped valley. You can also find evidence of erosion where water has been stopped up by a natural dam (e.g.- a brush pile). Lick Creek must be an old stream because it is the main “artery” for the whole valley. It must have worked for literally thousands of years to make this whole valley!

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2. How does the presence of Lick Creek and its spring pools affect the ecology of this forest? Any time of year, the deep green color is evident. The clear water from the aquifer is an excellent habitat for green algae, watercress, and nearby moss. The forest area near the spring stays irrigated, even through a drought.
3. Measure, compare, and discuss the air and water temperatures at this site. You can do this with simply a finger, or use a thermometer. Spring water is normally around 50 degrees Fahrenheit.
4. Discuss ways that this spring can be protected from man’s future activities. Consider policies Camp Classen should make, government regulations, or simply our own culture and behavior.
5. Point out the sycamore trees growing along the creek since they only grow near a water source because of their great need for water. Therefore, they are referred to as “survival trees”.

VOCABULARY WORDS

- **Aquifer:** water bearing subsurface rock, must be both permeable and porous.
- **Spring:** a place where water comes from the ground, from an opening in an aquifer.
- **Erosion:** moving rocks, sediments, and materials by the actions of wind, water, and ice.

TREE IDENTIFICATION

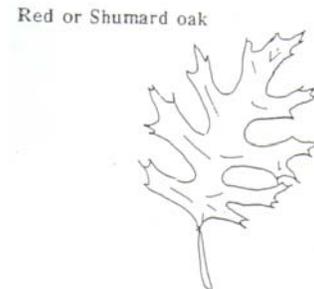
It's possible to live a long productive life without learning to identify trees. Some people even hike to Three Falls on occasion without learning anything about tree identification or forest ecology. However, when teachers and students walk this trail, their objective is to learn as much as possible about the forest as a wildlife community. Before we can really learn to appreciate our neighbors at home, it's helpful to know who they are and what they do. The same rule applies to the forest community. The recognition of trees in their natural setting is one way to develop an appreciation for the purpose they serve. The leaf design, bark color and texture are useful criteria in identifying trees.

The post oak is a canopy level tree with a bark structure consisting of rectangular, cork-like, brownish plates that are separated by long, dark fissures. The leaves are hand size with several rounded lobes with spineless margins.



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The red oak is a canopy level tree with bark structure consisting of grayish flat plates that are hard and irregularly shaped. The plates are separated by shallow dark fissures and often blotched with light colored crustose lichen colonies. The leaves are hand size with seven or more spine-tipped lobes.



The chinkapin oak is a canopy level tree with light colored, soft, flaky bark. The leaf is hand size and elliptically shaped with a wavy tooth margin.



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The blackjack oak is an under story-to-canopy level tree with hard black bark of angular ridge like plates separated by deep fissures and furrows. The leaf is hand size with three large spine-tipped lobes.



The burr oak is a canopy level tree with bark texture consisting of large, deeply fissured, rectangular brownish plates. The leaf is six to ten inches long with ten or so rounded lobes.

The ash is a canopy level tree with a bark texture consisting of small, white, corky squarish plates separated by dark fissures. The leaf is compound. The leaflets are shiny and smooth margined, placed six to eight on the stem.

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The hickory is an understory-to-canopy level tree with a bark texture consisting of hard irregularly shaped plates separated by elliptical fissures, often blotched with crustose lichen colonies. The leaf is compounded with five to nine elliptically shaped leaflets on each stem. The leaflet margins are serrated.



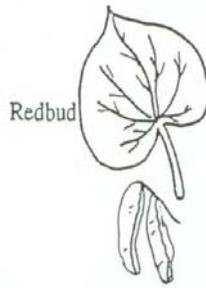
The winged elm is a shrub-to-understory level tree with a grayish smooth surfaced bark with irregular cork-like flanges on the outer limbs. The leaf is small with a pointed tip, serrated margin and paper-like texture. The woodland plum is a shrub level tree with shiny gray, curly scaled bark. The outer limbs have spines and the leaf is shiny and smooth with serrated margins.

The juniper is a shrub-to-understory level tree with reddish brown stringy textured bark. The leaves are evergreen, scale-like, spine-tipped, and aromatic.

The Texas buckeye is a shrub-level tree with flaky gray bark. The leaves are broadly elliptical with toothed margins, arranged palm-like, six leaflets to the stem.

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The redbud is a shrub-level tree with smooth, dark gray bark. The leaf is heart shaped, with a shiny surface and smooth margin.



TREE IDENTIFICATION VOCABULARY WORDS

1. Encourage each student to “adopt” a tree species and be prepared to identify and discuss its characteristics when called upon along the trail.
2. Encourage the students to use their hands to investigate tree bark textures.
3. Identify the fallen leaves in one square yard of forest litter.
4. Stop for tree identification quizzes at appropriate sites on the trail.

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6

Tree Stump

Materials needed: soil thermometer

Soil Formation and Types

As the mountains **weathered and eroded**, the valley being shaped by Lick Creek was filled with alluvial deposits of sand, gravel, and cobbles mixed with a yellowish soil-like substance. Lick Creek has cut through these deposits to bedrock, exposing a profile of outwash materials from ten to twelve feet deep. This exposed deposit becomes darker nearer the surface and contains very few stones. The light colored material within a foot of the surface is deposits washed from higher elevations and is the substrate upon which the lowland forest became established. By removing a small amount of powdery, decomposed leaves (the duff layer) the humus layer is exposed. This humus is dark, fluffy, and aromatic- the more recent recycling efforts of countless decomposing organisms including earthworms and nematodes. The trees are being fed by a blend of **inorganic(abiotic)** substances called parent material from the eroded rock in the alluvial deposits, and **organic(biotic)** substances from the decay of plants and animals on the forest floor. This is the **detritus** food chain.

STUDENT ACTIVITIES

1. Take the second soil temperature reading near the edge of the stream.
2. Discuss how deep soils benefit the lowland forest. This includes the capacity to hold water as well as to provide a firm anchor for massive root systems. Oaks and hickories require deep soils for their massive root systems. A great deal of water passes through an oak tree in a single day; up through the roots, through the xylem, and transpiring through the leaves. Leaves can dry out more quickly than pine or cedar needles, and thus the trees must grow in a relatively moist habitat.

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3. Discuss how landscapes below have benefited from the bank-cutting activities of Lick Creek. Ask where the eroded material (“alluvium”) went after Lick Creek removed it from upstream? Of course, it has been deposited in the valley downstream (**deposition**). The various dead organisms, which used to live in the water, enrich the alluvium, making rich soil deposits.
4. Have the students examine the litter, duff, and humus layers for decomposing organisms. Have the students hold and smell a handful of humus and discuss their reaction. This means, “get down and feel and smell!” **Remember, they can’t do this in a classroom, and it will leave an impression more lasting than the things we say. Be positive about the smell....**
5. Have students determine the age of tree by counting rings on the stump.

VOCABULARY WORDS

- **Alluvial:** resulting from stream erosion and deposition; “washout”
- **Substrate:** that which is below
- **Duff layer:** leaves and other organic matter fallen to the forest floor, beginning to decompose
- **Humus layer:** a brown or black organic substance consisting of partially or wholly decayed organic matter that provides nutrients for plants and increases the ability of soil to retain water
- **Parent material:** the bedrock source for mineral-rich particles of soil.
- **Weathering:** breaking rocks into smaller and smaller pieces or sediment.
- **Cobbles:** usually describes rounded shaped rocks embedded in soil
- **Deposition:** occurs when sediments and larger rocks are dropped (deposited) by wind, water, ice erosion

7

Fish Pool

Water Nourishes The Landscape

Sitting on these vertical limestone exposures, gazing into this deep spring pool, surrounded on all sides by an undisturbed forest, listening to the flow of water as well as other sounds in nature, it easy to think about the natural forces that have shaped this landscape. At this location, Lick Creek forms the boundary between lowland (nearly completely deciduous) and transitional forest (mixed deciduous, and cedars and grasses)The valley narrows into a canyon upstream. Notice the depth of the spring pool beneath the small waterfall. The same process of “scraping out”, or gouging that is happening as at the bottom of a playground slide- physical weathering and erosion. The water is naturally slightly **acidic**, and the limestone is **alkaline, chemical** erosion also occurs when the two mix here The shapes of the boulders and the trees leaning over the eroded banks are partly rounded, but still showing their layered, angular shape.

The little stream is usually quiet, but after heavy rains it roars- gouging pools, cutting banks, tumbling rocks, pushing trees, and carrying debris; shaping the landscape by force. The force of the water flushes sediments and rocks out of the pool, keeping it deep and free from large amounts of aquatic plants.

The **water (hydrological) cycle:** After water arrives in the Arbuckle Mountains as precipitation, some re-enters the atmosphere by evaporation. Some is used by plants and released by transpiration. Some is used by animals and released through urination and perspiration. Some water seeps underground and enters the aquifer- called percolation. Point out where these activities happen. This hillside is called a **watershed**, the creek is a **tributary**, and the **run-off** is the water that fills this channel after a heavy rain.

NOTE: There is a **beehive** in a tree just after this stop. You or the students might notice it on the right side of the trail. The bees are not dangerous (**unless you really disturb them**). Stop and watch them at their work!

STUDENT ACTIVITIES

1. Look for evidence that Lick Creek has flowed out of its bank. You might see brush piles, or wash marks on trees or rocks.
2. Discuss the hydrologic cycle and the origin and destination of the precipitation that falls in the Arbuckle Mountains. (Clouds, which usually come from the west and south, bring water from the Pacific Ocean and Gulf of Mexico on towards the Atlantic Ocean and some of it falls into the substrate.)
3. Name the tributaries between Lick Creek and the Gulf of Mexico. (Lick Creek flows to the Washita River, past works by the Army Corps of Engineers, then to the Mississippi, then to the Gulf of Mexico in **Louisiana**).
4. You can reinforce geology concepts and vocabulary at this time, including weathering, erosion, deposition, plate tectonics and limestone formation.

VOCABULARY WORDS

- **Precipitation:** a liquid or solid falling through a liquid or gas medium
- **Evaporation:** a warmer gas rising through another gas medium
- **Transpiration:** heated gas rising from plant tissue; evaporation from leaves
- **Percolation:** liquid passing through a solid, porous, and permeable medium
- **Watershed:** the region draining into a river, river system, or other body of water, or the ridge that separates a watershed
- **Tributary:** a stream that flows into a larger stream or other body of water.

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8

Three Falls Scenic Area Travertine and Conglomerate

Materials: oatmeal for fish feeding

NOTE: No swimming or climbing on rocks is allowed. (Climbing up the **designated pathway** is acceptable.) This area can be dangerous, and **adult supervision is required**. **The climb up the rock face must be undertaken cautiously.** *Position adults along the climbing route about 20 to 30 feet apart. Keep the students away from the trees near the top. They may catch their clothing on the branches and be thrown off balance. An adult should climb the entire route to check if the path is clear before any students begin climbing. Station a teacher midway, overlooking Three Falls, and have the students wait until all group members have reached the mid-point of the climb. Then, as a group, proceed to the top of the ridge and **sit** down on the flat rocky area near the station 9 marker. You may want to have mid-trail refreshments.

Lick Creek originates as an **artesian spring** in the ranchland west of Camp Classen. As the stream enters the camp property, it curves and cascades downward 60 feet over three stair-stepped waterfalls. The two upper falls are hidden from view by **conglomerate** boulders and cliffs. Lick Creek flows over a large **travertine** overhang into the pool below. Lick Creek has deposited this travertine formation and continues to do so, representing a unique contemporary rock-forming process that continues as long as the water flows. **Travertine:** Large quantities of dissolved limestone (calcium carbonate) are carried by the waters of Lick Creek from the aquifer and deposited on mosses and algae along the watercourse. As the calcium carbonate thickens, the vegetation dies and is replaced with other plant colonies that are covered with calcium carbonate then die. The mineral deposit grows outward, covering fallen leaves and sticks which results in a foamy or boxy appearance. The accumulation is **travertine**. The process takes a few years. The Lick Creek travertine, when dry, is light, porous, and fragile. It breaks easily when weathered, turning into a windblown or water-born calcium dust.

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Conglomerate: Look for smaller rocks and cobbles within the rock. Conglomerate rock is like a large corporation: rock with smaller rocks in it, or a corporation with smaller companies in it. Conglomerate is hardened alluvial gravel and sand, the result of weathering, erosion, deposition and compaction. This particular conglomerate is called Collings Ranch Conglomerate, named for the ranch which was **here from 1920-1960s**. **Conglomerate** is much younger than the limestone that is common here. **The limestone** is evidence of a shallow ocean, and is dated at 480 million years (“Ordovician Period”), while the **conglomerate** is about 270 million years. At this time (270 million years), the limestone beds were being **folded and uplifted**. As the rocks uplifted, rain and streams weathered and eroded the rocks, left alluvial deposits, lithified (turned to stone) as **conglomerate**.

STUDENT ACTIVITIES

1. Look for rocks within the rocks, to know what a conglomerate rock is.
2. Search for travertine fragments in the rocks below Three Falls; compare their weight with limestone cobbles of equal size and explain.
3. Discuss the relationship between the light colored alluvial mixture in the lower valley and the calcium carbonate crust on the rocks at Three Falls. The alluvial mixture in the valley is composed of limestone bits, silt, detritus, and sand; it’s heavy. The calcium carbonate crust is more pure eroded particles from the limestone and is much less dense. The top of the waterfall is eroding, and so it is receding (going back). The waterfall has been receding for literally thousands of years. For fun, and it is difficult to be accurate, predict where the waterfall might have been when Columbus landed in the western hemisphere (further ahead, **downstream**), or where it will be **500 years in the future (further back, upstream)**.
4. Discuss a simple food chain linking the calcium in our bones to the calcium carbonate in Lick Creek. [Travertine—soil—grass—cow—milk—bones].

VOCABULARY WORD

- **Calcium Carbonate:** Chemically, CaCO_3 , also called lime, the predominant chemical precipitant in oceans. Most seashells (clams, oysters, snails, brachiopods, corals, etc.) are made of this mineral. Chalk is made of microscopic calcium carbonate shells (coccoliths, radiolaria, etc.) Most products that advertise their calcium content (antacids, etc.) contain calcium carbonate.

STUDENT ACTIVITIES

1. This space is ideal for a rest and a school provided snack.
2. Sit back and enjoy the view.
3. Photo opportunity!

The Juniper Invasion

The very moment that you huff and puff over the last conglomerate boulder on the canyon wall above Three Falls and start north across Warren Mountain, you enter an entirely different ecological system. This is a land of **xeric** vegetation consisting of prickly pear cactus, barrel cactus, yucca, prairie flowers, and grasses.

Sixty years ago the Arbuckle Mountain highlands were capped with expansive prairie habitats representing a major eastern extension of the Great Plains Biome. Cattle ranching is still being done on the prairie West and South of camp.

One of the most unique features of the plant zone above Three Falls is the occurrence of an unusual little tree-the Knob Leaf Oak. The entire world population of this species is in Murray County, Oklahoma and is restricted to a very narrow growth zone on the hillside between the transitional forest and the prairie.

The **factors** that have restricted tree growth and encouraged the prairie on Warren Mountain in the past include:

Shallow soils-abiotic

Steep grades-abiotic

Severe wind and sun exposure-abiotic

Repeated grazing and browsing by bison and cattle-biotic

Frequent burning-abiotic

The **grassland** of Warren Mountain is being impacted severely by the rapid growth of juniper trees and shrubs. The absence of grazing and fires seems to be the major reason for these changes.

STUDENT ACTIVITIES (part 1)

1. Using the words xeric (dry conditions) and mesic (moderate conditions), contrast the factors determining plant cover in the forest and the prairie.
2. Speculate why these two ecosystems are so different if the same amount of rain falls on each. The most likely answer is the bedrock. Hard rock erodes slowly, thus making less soil. Soft rock yields more soil, and allows tree roots to grow down into cracks. Cedars grow well in the xeric conditions and shallow soil, oaks and hickories grow well in mesic conditions and deeper soil.
3. Speculate concerning the future of the knob leaf oak, considering its limited distribution and association with the juniper. This oak is a tough little tree, but its small range must be small for a reason. We must, of course, not do anything to cause their demise.
4. Teacher-Collect a knob leaf oak leaf for comparison with the oaks in transitional and lowland forest.

The trail leads north on Warren Mountain through juniper thickets and little patches of remnant prairie. These populations of original grasses and flowers are being maintained artificially by the removal of small juniper trees. The plant cover on Warren Mountain is rapidly changing from a polyculture (many different plants) of mixed grasses and flowers to a monoculture (one kind of plant) of juniper trees as the one dominant species. The question most often asked is: "What has happened to cause juniper invasion?"

A comparison of monocultures and polycultures shows that a decrease in animal populations will follow a major loss of plant species, and the Arbuckle Mountain region's ability to sustain wildlife, including deer and turkey, may be severely limited in the future.

Humans now manage the prairies at Camp Classen: burning about every two years, cutting the trees with chainsaws, and trimming young trees with branch loppers.

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STUDENT ACTIVITIES (part 2)

1. Discuss why a plant polyculture supports more wildlife than a plant monoculture. A diversity of plants yields a diversity of resources for diverse wildlife.

The juniper tree produces a blue-purple fruit that ripens in January and is a favorite food for robins, cedar waxwings, and a few small rodents. Students should take sniff of it, it's not harmful, but beware the bitter taste! Berries from an English relative of this tree are used in the making of the alcoholic beverage, gin. The wood from junipers, or cedars, is used for many things. Cedar shavings make excellent bedding for small animals.

2. Ask students if any of them buy cedar shavings for a pet they might have at home. Cedar is commonly made into pencils. Some student may be writing in his or her journal right now with a stick of cedar! The wood is naturally resistant to insects, and has a pleasant smell, so generations of people have used this wood **as a liner for clothes chests or closets.**

3. Try smelling some cedar wood. A good way to do this is to find a recently dead branch, and peel away some of the bark. Get your nose real close!

Beware the juniper legend about 'toxic juniper plant oil'!

Actually, junipers grow so densely that they shade out plants around them as well as using a relatively high amount of soil water.

VOCABULARY WORDS

- **Xeric:** dry, desert-like conditions of soil
- **Polyculture:** many types of life, plant or animal for examples
- **Monoculture:** one type of plant or animal

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Materials needed: soil thermometer

Grassland Discovery

STUDENT ACTIVITIES

1. Have students notice the native state of the prairie without the presence of the junipers. Controlled burning has helped to restore the prairie.
2. Take a third soil temperature reading and compare to previous readings.
3. Notice the four orange posts. These outline an acre of land (43,560 square feet). Camp Classen sets on 2400 acres of land. 640 acres is one square mile. Ask students to estimate the size of Camp Classen in square miles.

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Highway Department Survey Marker Cultural Influence

Note: Be sure to stay on established trails. Do not cut through the grasses.

The trail on Warren Mountain offers an east facing view of Camp Classen and the Arbuckle Mountains' landscape. You see the City of Davis, rock quarries, road cuts, standpipes (for municipal water), bridges (road and railroad), transmission towers, and highways. Sometimes oil drilling equipment is visible. In the valley is an access road, water tank, and utility poles and Camp Classen's old water storage tank is seen on the opposite hillside. This evidence of man's involvement in Arbuckle Mountain ecology are called **cultural influences**. The foot trail leading to this point, the oil exploration pad to the west, the Oklahoma Highway Department benchmark at our feet and Lake Guy James, a 1968 impoundment of Lick Creek, provide other evidence of man's presence. The highway department benchmark was probably set in this stone when surveying was done in the 1950s to choose a route for Interstate 35. The marker can be noted on a map. This is the second highest point in Murray County-elevation of 1,050 feet. The highest point is the mountain with the signal towers. Interstates are now the main conduits for commerce in our country. The strongest recent economic growth areas are often near these interstates. Listen for the distant sound of vehicles on I-35. In the 1800s, our "commercial highways" were rivers and other waterways.

Man's influence is not always harmful, and in can be essential. The key to maintaining a healthy productive environment is learning how to use the earth's resources; oil, gas, water, soil, rock, timber, and natural areas, with as little negative impact as possible.

By encouraging Camp Classen **visitors to stay on the trails, use the switchbacks, leave no litter, refrain from turning rocks and disturbing vegetation**, man's use of this natural area can continue without serious damage to the environment.

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STUDENT ACTIVITIES

1. How many of the man-made features visible from Warren Mountain have negative impact on the environment? Are their positive impacts of these man-made features? For example, the human traffic paths-interstates- are difficult for wildlife to cross. The highway has made separate populations of such animals as deer and coyotes on either side.
2. Discuss the meaning of negative impact.
3. Discuss the things that hikers and campers can do to protect the environment. What can we in this group do to help this mountain? In 1996, over 10,000 people hiked this trail.
4. Have the students name as many natural resources as they can think of.

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13 Switchback Point The Ecotone

Standing on the edge of one major terrestrial ecosystem and looking down into another is an unusual experience when it is understood that one represents the Great Plains Biome and that the other represents the Eastern Forest Biome of North America. This is the zone of merger, the **ecotone**, between two of the world's healthiest and productive ecological systems.

Individually, over most of their vast expanses, these biomes enjoy long growing seasons, deep soils, adequate moisture and a great diversity of plant and animal life. They are climatically comfortable, geologically stable, ecologically productive, and free from rampant disease and famine. The only place more productive than either biome is the contact zone called the **ecotone**. These biomes are what they are because of their plant cover. Their efficiency as ecosystems decreases in proportion to, and as a result of, grass and tree removal. For example, the leaf cools the tree, the tree cools the forest, and the forest cools Oklahoma. Prairie marshes cleanse water and prairie grasses stabilize soils and climates.

Animals that live on the ecotone between two habitats, or two biomes, receive the **benefit** of the best conditions from each system. Some animals may take cover in one section, and forage for food in the other. An ecotone is the best place to look for wildlife. The cooling and stabilizing effects of biologically productive plant associations also improve the quality of man's environment.

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STUDENT ACTIVITIES

1. Have the students evaluate the living conditions typical of several North American biomes. Desert? Okeefenokee Swamp? Boreal Forest (Northern pine forest, north US, southern Canada)? Florida Everglades?
2. Why has the Great Plains been called the breadbasket of the world? Deep soils are the finest habitat for wheat and other grains in the world. The United States is richly blessed with its ability to produce far more grain than any other country in the world.
3. Discuss the ways that ecosystems affect climate. Plants absorb heat energy, thus cooling their surroundings. The dense plant biomass in a tropical rainforest does a great deal of cooling of the planet. The heat energy is absorbed at the same time as light energy, in photosynthesis. What plant on earth absorbs the most heat energy, and releases the most oxygen as it metabolizes? The answer is algae.

VOCABULARY WORDS

Ecotone-overlapping zone of two biomes, for example grassland and deciduous forest. Rich in biodiversity.
Biodiversity-wide variety of plants and animals

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14 Trip Shed at 89er Village Trail Review

STUDENT ACTIVITIES

1. Take time as you hike back to enjoy the special wonder of the walk you have just taken.
2. Perhaps this reading is appropriate to share with students:

From *A Sense of Wonder*, by Rachel Carson:

“If I had influence with the good fairy who is supposed to preside over the christening of all children, I should ask that her gift to each child in the world be a sense of wonder so indestructible that it would last throughout life, as an unfailing antidote against boredom and disenchantments of later years, the sterile preoccupation with things that are artificial, the alienation from the sources of our strength.”

Ask students to stop, and count in silence for 30 seconds:

How many different natural sounds can they hear?

How many different un-natural sounds can they hear?

How many different smells are in the air?

3. Review some of the topics your group has been studying.

It may have been a struggle to get up Warren Mountain, but it is hoped that you think, “It was worth it!” Has this trail experience helped you build a stronger Body? Mind? Spirit?

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