YMCA CAMP CLASSEN
Trail Guide
Warren Mountain Trail

Trail Cards

Trail Focus: Ecology
Length: Approx. 3 miles

13 Numbered Teaching Stations
Color Code: Orange

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.

Standards on this Trail

5.ESS2.2 Describe and graph amounts of saltwater and freshwater in various reservoirs to provide evidence about the distribution of water on Earth.

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

5.PS2.1 Support an argument, with evidence, that Earth's gravitational force pulls objects downward toward the center of the earth.

5.LS2.2 Use models to explain factors that upset the stability to local ecosystems.

5.ESS3.1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environments.

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

Station Number	Title and focus
8	**Three Falls Scenic Area:** *Travertine and Conglomerate.* The formation of sedimentary rocks, limestone, travertine, conglomerate
9	**Top of Three Falls Cliff:** *The High Prairie.* Xeric conditions, knob leaf oak Why is prairie here?
10	**Knob Leaf Oak:** Prairie Area: *The Juniper Invasion.* Remnant prairie, mono- & polyculture, limiting factors, human efforts, biodiversity
11	**Prairie:** *Grassland Discovery.* Controlled burning and maintaining the prairie
12	**Highway Department Survey Marker**: *Cultural Influence* Scenic view, survey marker, natural resource usage
13	**Switchback Point**: *Ecotone* What is an ecotone? The confluence of biomes?

TRAIL MATERIALS LIST

School Supplied Snack (for Top of Three Falls Cliff)

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 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.

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

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.

1

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 similar forest is found in Pennsylvania. This area 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.

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.

Forest Organization

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.

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.)

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 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 timbe.
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. Have each student interpret what might have led to the tree with the #3 on it to grow in the way that it did.

4

Large Forest Opening
When A Tree Falls

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 eachyear. 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.

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.

5

First Lick Creek Crossing
Arbuckle Mountain Springs

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 featured 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. Oceans have about 97% of the world's water, the rest is freshwater but most of that water is found in glaciers and icecaps and inaccessible for use.

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 Stump

Soil Formation and Types

As the mountains **weathered and eroded**, the valley shaped by Lick Creek, 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.

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

Fish Pool
Water Nourishes the Landscape

Sitting on these vertical limestone exposures, gazing into this deep spring pool, surrounded 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: Some schools stop here for pictures on the rocks and for the kids to feed the fish in the pool.

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.

Three Falls Scenic Area
Travertine and Conglomerate

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. 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.

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.**

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 (cocoliths, radiolaria, etc.) Most products that advertise their calcium content (antacids, etc.) contain calcium carbonate.

9
Top of Three Falls Cliff
The High Prairie

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!

10
Knob Leaf Oak
Juniper Invasion

The Juniper Invasion

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 this area 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.

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.

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

11
Prairie

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. 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.

12
Highway Department Survey Marker
Cultural Influence

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 it 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.

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.

NOTE: Be careful on the switchbacks the leaves and shade can make the area slippery even if the rest of the trail is dry.

VOCABULARY WORDS

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