

Science on the Prairie field trip

This curriculum-based field trip intended for grades 5-7 explores the principles of science and their application in a prairie environment. Students will be introduced to the major elements of scientific inquiry as well as components of the tallgrass prairie ecosystem.

Introduction (5 minutes):

- Orientation to the park
- Orientation to the field trip
- Behavior expectations and safety considerations

Guided Hike (50 minutes):

- Grass identification and dichotomous keys
- Transects and plots – a simple scientific experiment
- Reflection on the ethics of practicing science in national parks

At the Ranch (50 minutes):

- Weather and fire
- Geology – limestone and fossils
- Soils
- Wildlife adaptations

Conclusion (5 minutes):

- Food webs

Total duration: 2 hours

Preparation: All activities are conducted outside and students should come prepared for all types of weather. Bring appropriate layers and dress in sturdy clothing and closed-toe shoes that you don't mind getting a little dirty.



Kansas Science Standards addressed:

Standard 1: Science as Inquiry

B1: The student will demonstrate abilities necessary to do the processes of scientific inquiry.

B3: The student will analyze how science advances through the interaction of new ideas, scientific investigations, skepticism, and examinations of evidence of varied explanations.

Standard 3: Life Science

B4: The student will identify and relate interactions of populations of organisms within an ecosystem.

B5: The student will observe the diversity of living things and relate their adaptations to their survival or extinction.

Standard 4: Earth and Space Science

B1: The student will understand that the structure of the Earth system is continuously changing due to Earth's physical and chemical processes.

Standard 6: Science in Personal and Environmental Perspectives

B2: The student will understand the impact of human activity on resources and the environment.

Instructor Materials Needed:

Guided Hike:

- Transects/plots established along the trail in open prairie and along forest edge
- Grass samples with seed heads (if early in the season)
- Plant field guide with dichotomous key
- Clipboards (if good weather)
- Reflection papers and pencils

At the Ranch:

- Photo of prescribed fire
- Data from weather station
- Photo of Permian age landmasses
(at the desk)
- Examples of fossils (as many as you have students)
- Map of historic prairie ranges
(at the desk)
- Magnifying glasses
(in Fox Creek backpack)
- Preserved lubber grasshopper
(extras in Travelling Trunk Spare Parts box on 3rd floor of the barn)
- Tracking poster
(S:/Big posters to print/tracking_gaiting.ai,
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- Gaiting cards
(in Fox Creek backpack)

Conclusion:

- Ball of string

Introduction: (5 minutes)

Objectives:

1. Students will receive orientation to the park
2. Students will receive orientation to the day's activities.
3. Students will understand that they are expected to behave safely and respectfully during the field trip.

Welcome students to Tallgrass Prairie National Preserve. Provide a brief introduction to the major themes of the preserve (i.e. scarcity of native tallgrass prairie, complex and biodiverse ecosystem, human history and historic features). Inform the students that in addition to being places where the public can come to relax, enjoy scenic beauty, and recreate, national parks are living laboratories. Scientists from all over the world contribute to and learn from the lessons taught in these remnant ecosystems. Ask for suggestions on the types of sciences that might be practiced in the tallgrass prairie (i.e. biology, ecology, geology, chemistry, archaeology, etc.) Introduce some that the students might not be familiar with (i.e. ornithology, herpetology, hydrology, etc.)

Today the students will be exploring what it takes to practice science in a national park setting. Science requires skills in observation, classification, and inference. It also requires knowledge of context and background.

Remind all students that today is a school day and the activities presented are part of their curriculum. Normal classroom behavior (i.e. listening when an instructor or fellow student is talking) is expected as well as adhering to safety precautions and park regulations. Always stay with your group and remain on the trail unless instructed otherwise. Remind students that everything in the park is protected and that removal of plants, flowers, rocks, artifacts, or defacing historic structures is prohibited.

Review potential hazards (ticks & chiggers, poison ivy, rocky trails).

Ask if there are any questions.

(If there are more than 20 students, split into 2 groups at this point to cycle between the guided hike and the activities on the grounds.)

Guided Hike: (50 minutes)

Objectives:

1. Students will practice observation skills.
2. Students will practice classification skills.
3. Students will learn at least 3 major species of grass.
4. Students will engage in scientific inquiry and explore the processes of the scientific method.
5. Students will have an opportunity for reflection.

Assign a parent/teacher to bring up the rear and remind the students of safety rules for the hike (stay on the trail, stay with the group, do not go in front of the leader, do not fall behind the parent/teacher.)

All scientific disciplines – from biology to physics – operate from the same basic principles; careful and accurate observation, removal of bias, reduction of variables. First start with a question, then make a hypothesis (a guess), and finally perform an experiment to test your hypothesis. Scientists have many questions about tallgrass prairies and since most tallgrass prairies have been altered (plowed, reseeded, etc.) this stretch of tallgrass prairie offers good opportunities for study. You will be studying a few of the aspects of tallgrass prairie today on your hike.

Activity 1: Observation and classification

Point out along the hike or (if early in the season) bring samples of tallgrass species – big bluestem, Indian grass, switchgrass, and little bluestem. Have students suggest observations of the grasses – height, color, shape, etc. Split into pairs. One half of the pair turns away or closes his/her eyes and the other half chooses an individual from the collection of samples or live specimens in the field. This student gets a minute or two to study the plant, observe as many characteristics as possible, and then must describe the individual to his/her partner. Use as much detail as possible. Remember, grasses are notoriously difficult to identify! Switch roles.

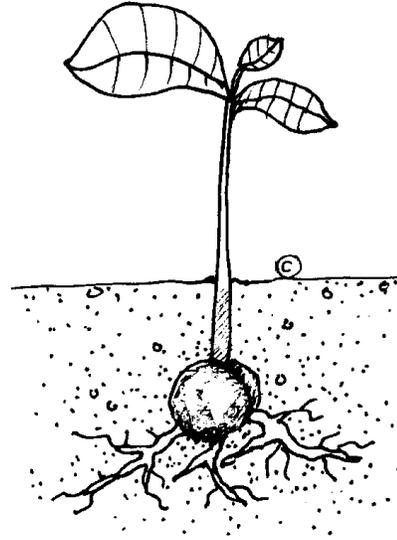
Discussion questions:

- Which characteristics and observations were the most helpful in describing your plant?
- Which were the most difficult to communicate?
- What sorts of tools would have been useful in this exercise? (i.e. hand lenses, drawings, maps, etc.)

Botanists (scientists who study plants) often use a tool called a *dichotomous key* to help them identify plants. **(Show an example from a field guide.)** By breaking things down into yes-or-no questions and by performing very precise observations, botanists can tell the difference between many blades of grass which at first glance appear identical.

Tell the students that there are over 450 different kinds of plants at Tallgrass Prairie, even though the prairie landscape may look fairly uniform. Some plants like to grow in open prairie, some like to stay near forest edges.

Pose the question: In which habitat do you expect to find the greater biodiversity of plants? Instruct the students to start forming a hypothesis because the next few steps will be a scientific investigation of that question.



Activity 2: Transect/plot in open prairie

When you come to the pre-established transect/plot in open prairie, stop the group. Explain that instead of trying to measure every square inch of ground, scientists often use transects (straight lines) or plots (usually squares or circles) to gain information that they can extrapolate to cover the whole area.

Divide the students into as many groups as you have transects or plots (maybe 4?). Their task is to count the *total* number of plants in the transect/plot and the number of *different species* of plants in the transect/plot. These two numbers will represent the abundance and biodiversity of plant life in open upland prairie.

Discussion questions:

- How might the placement of transects/plots affect the results?
- Would you expect to find more or fewer plants close to the trail or far away?
- This section of upland prairie has not been grazed in several years. How do you think its plant composition might be different from upland prairie that is grazed annually?

From this point, can anyone point out where they think there might be a body of water? (Indicate tree line at Fox Creek) Tallgrass prairies actually include many different kinds of microhabitats depending on the various water sources. Large creeks, small seasonal creeks, springs, and seeps all produce different kinds of habitat where different kinds of plants make their homes. Where there are different plants, there are also different insects, birds, reptiles, and mammals.

Activity 3: Transect/plot in forest edge

Repeat the experiment of calculating abundance and biodiversity in the forest edge area.

Discussion questions:

- According to our scientific investigation, which habitat has the greater biodiversity?
- What possible biases and variables are we contending with in this experiment?
- How could we correct these biases and variables in future investigations?
- What applications would these results have for scientists and managers? (i.e. habitat protection, land use, etc.)

Continue on to the schoolhouse. If the weather is favorable, instruct each student to find a comfortable place to sit on the ground at least 2 arm lengths away from their nearest neighbor and preferably with a view they enjoy. **(Distribute clipboards if outside)**. If it is cold, windy, or rainy, conduct the following activity inside the schoolhouse.

Activity 4: Reflection

Distribute a reflection paper to each student. Their task is to note three things they learned on the hike and during the experiment and to answer the following question:

“What do you think are some of the responsibilities that scientists carry when they conduct research in a national park? Consider impacts to the environment, biases, special rules in national parks.”

Load the students onto the bus to be shuttled back to the ranch headquarters.

At the Ranch: (50 minutes)

Objectives:

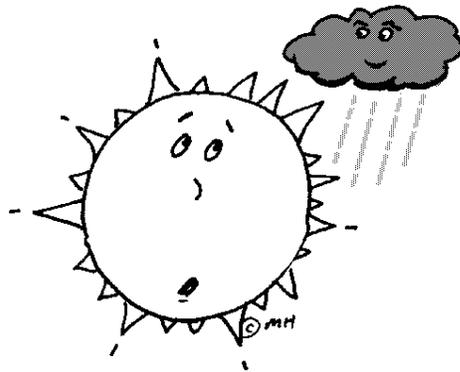
1. Students will learn about the role of weather and fire in the prairie ecosystem.
2. Students will receive an introduction to the processes of determining when a prescribed fire can/should take place.
3. Students will learn about the geologic story of the Flint Hills.
4. Students will receive an introduction to the wildlife of tallgrass prairie.
5. Students will gain an understanding of an ecosystem as a collection of living organisms (biotic factors) within an environment (abiotic factors).

Introduce the concept of an ecosystem. An ecosystem is a collection of living things that live together and have relationships with each other and the environment in which they survive. Some elements of an ecosystem are alive (biotic) like plants and animals and some are not alive (abiotic) like rocks and weather.

In order to understand a place and practice science in that place, you must have an understanding of the context, or ecosystem, in which you are studying.

Activity 1: Weather (at the weather station)

The sun is the power source for all life on Earth and weather patterns direct much of how prairie functions. The height and vigor of most plant species depends on how much rainfall they receive, animals alter their behavior and migration patterns depending on temperature variations, and natural forces like wildfires can have important impacts on prairie ecosystems.



Lead the students through a “tour” of the weather station near the top of the hill. Identify the various instruments, what they measure, and how the information is transmitted.

Discussion questions:

- How might the location of a weather station affect the readings it takes?
- How is your daily life affected by weather patterns?
- What sorts of weather extremes do you think organisms on the prairie would have to contend with? (i.e. drought, frost, flood, etc.)
- Do you or other members of your community keep track of the weather? For what purpose?

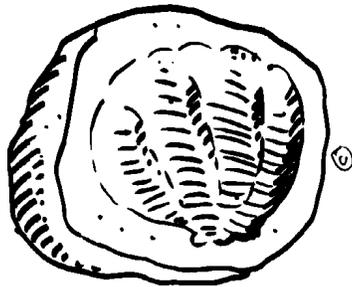
Scientists at Tallgrass Prairie set up this weather station partially to help them decide when it is appropriate to start a *prescribed fire*. (**Show a photo.**) A prescribed fire is an intentionally-started fire designed to mimic natural lightning-caused fires. Fires on the prairie help recycle nutrients back into the soil, open up space for new plants to grow, and create favorable habitat for many species of animals.

Discuss the “prescription” for fire (i.e. wind speed, wind direction, temperature, humidity, etc.). Does this weather station provide that information? Show **an example of the data** that the weather station transmits and discuss whether that would have been a good day for a prescribed fire.

Activity 2: Limestone and fossils (on the trail and at the overlook)

Below our feet is a complex biological world with millions of years of history. Long before there were grasses and trees and coyotes here, the Flint Hills were underwater in a vast shallow inland sea. (**Show picture of Permian age**) Relay the story of the formation of limestone and fossils. Go on a fossil hunt in a rocky outcrop on the trail or bring samples of different fossils. Introduce the students to some of the main types of fossils – **fusulinids, crinoids, bryozoans, and brachiopods**. Science is full of jawbreaker names like these because they have to describe so many specific things. If you have examples of all four, play the “This Is a *What?*” game. Objects like fossils with strange and difficult names can be familiarized with this fun exercise.

Everybody stands in a circle and the instructor introduces the different fossils in the game. Tell the students that it will start out very simple and become increasingly complex. Start by holding out a fossil toward the person to your left.



You: “This is a crinoid.”
Student: “A What?”
You: “A crinoid.”
Student: “A What?”
You: “A crinoid.”
Student: “Oh, a crinoid.”

The student then takes the crinoid and repeats the process with the person to his/her left. The lines are spoken in a steady rhythm. As the game progresses, add more fossils to the mix. Eventually, participants in the circle will be contending with two “conversations” simultaneously – both introducing and passing their object to the person to their left, and also

asking “A What?” and receiving an object from their right. For maximum challenge (and hilarity), have as many objects as you have students in the circle so that each person is constantly both giving and receiving a fossil simultaneously.

Activity 3: Soils (in the garden)

Discuss how rocks break down and combine with dead plants and microorganisms to create soils. The quality of prairie soils and the landscape in which they are found are what make prairies such attractive places for farming. (**Show a map of historic prairie ranges**) Discuss how the rockiness of the Flint Hills (remember the rock outcrops we just visited?) kept this part of the tallgrass prairie from being turned into cropland.

Instruct each student to pick up a handful of soil (scientists aren’t afraid to get dirty!). Pass out **hand lenses**. What do you see in your handful of soil? Can you identify any of the grains as sand, clay, organic matter, or maybe even live organisms?

Share these fun facts (from <http://www.blm.gov/nstc/soil/Kids/facts.html>).

“A single shovelful of soil can contain more species of organisms than live above ground in the entire Amazon rain forest.”

“One cup of soil may hold as many bacteria as there are people on Earth. That’s over 6 billion!”

“Mature trees can have as many as 5 million active root tips.”

“A teaspoon of forest soil may hold more than 10 miles of fungi.”

“Almost all freshwater travels over soil or through soil before entering our rivers, lakes, and aquifers (underground water lakes).”

Discussion questions:

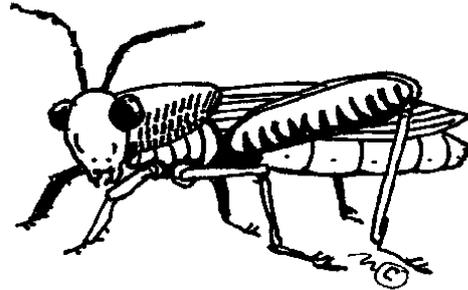
- How do you think the soil exposed in the garden might be different from the soil in the uplands?
- Considering the importance of soil in our everyday lives (growing food, water, building materials, clothing materials, etc.), who can you think of who might not be considered a traditional “scientist” but who studies soil?

Activity 4: Wildlife (on the front lawn)

The prairie is home to many different forms of wildlife. Most prairie animals are small and secretive and the vast majority are insects. **(Pass around the preserved lubber grasshopper)**

Discussion questions:

- What are some examples of how insects contribute to healthy ecosystem functioning in *positive* ways? (i.e. pollinators, food sources for other animals)
- What are some examples of how some insects can be harmful? (i.e. biting insects, disease carriers, crop destruction).



All animals, whether insects or birds or mammals or reptiles, adapt in physical and behavioral ways to survive and thrive in the prairie ecosystem. Direct the students attention across the highway to the brome field, Fox Creek, and the upland prairie hills in the background. How many different habitats can they see? Could there be additional habitats that they cannot see from far away? (i.e. holes, shrubs, etc.) Some animals adapt to the prairie by becoming highly specific and specializing in one particular kind of niche. Some live only in trees, some live underground, some live in rock piles, etc.

Instruct the students that on the count of three they are to *walk briskly*, not run, to a place they believe could be a niche habitat for an animal. Only one student may occupy a niche. Establish boundaries!

Did anybody not find a niche?

Discuss the relative advantages and disadvantages to specializing like this. Discuss how the coyote is an example of a generalist who has adapted to many different kinds of environments. The coyote also has the advantage of camouflage which helps it hunt in stealth through the grasses.

Play a few rounds of the game Camouflage. One student is “it” and closes his/her eyes for a period of about 20 seconds. The other students hide but must be in a position where they can either *see* the person who is “it” or one limb must be exposed. Again, establish boundaries!

Discussion questions:

- Which were the most effective hiding places?

- Did bright colors help expose hiding students? Did behavior like stealth and silence help disguise hiding students?

Finally, discuss how scientists rely on more than just visual sightings of animals to help them understand what is present. (**Show tracking poster**) Most animals are very stealthy and will not allow themselves to be exposed. Practicing careful observation of tracks and signs help scientists discover not only what animals are present, but where they go, what they eat, and how they behave.

Go over the different gaiting strides of animals – diagonal walking, bounding, hopping, and galloping. Lay the **gaiting cards** on the ground and let students practice.

Conclusion (5 minutes)

Objectives:

1. Students will appreciate the interconnectedness of ecosystems.
2. Students will understand that nothing lives in isolation – including humans.

Bring the whole group back together into a circle at the end of the field trip. Discuss how all the activities they participated in today and all of the elements of the prairie they learned about are connected. Create a “food web” by tossing the



ball of string around the circle. When you toss the ball to someone, hold onto your end of string and say the name of something – a plant, an animal, a force of nature – that influences something else. You may go from the sun to

big bluestem to a prairie chicken to a coyote to a grasshopper. When everybody has a hold of the string, give it a gentle tug and see who in the circle felt it. Nothing lives in isolation – even humans.

Ask if anyone would like to share something they enjoyed, learned, or would like to learn more about from the field trip. Invite the students to contact the park if they are interested in learning more about what kind of science is done here as well as what other career options the National Park Service has to offer. Remind the students that national parks are special places set aside for them, their families, and the world and that they are always welcome to visit, learn, relax, and recreate.

Thank the students for their attention and participation

Thank and have the students thank their teacher, parent chaperones, and bus driver for bringing them out on this field trip.