

THE HOMESTEAD ACT



Understanding the Prairie

Grades: 7-8

Background: The Homestead Act encouraged farmers to cultivate large areas of prairie in the West. Increased human activity, including farming, and the construction of railroads and towns, impacted prairie ecosystems throughout the West.

Objectives: Using the Nebraska prairie ecosystem as a case study, students will be able to:

- recognize plants and animals native to prairies
- explain the importance of plants to the prairie ecosystem
- establish an official herbarium at their local school
- construct, examine, and evaluate a food chain and food web interaction.

Sources: PBS Learning Media

The Lesson

<https://tpt.pbslearningmedia.org/resource/7557ecac-a4e6-49ae-bfbb-4884bb5a0713/platte-river-prairies/>

Overview: Learn about the chain of grasslands, wetlands, and woodlands that make up the Platte River Prairies. This lesson plan explores a complex ecosystem that supports a highly diverse community of plants and animals.

Lesson Summary: While some people think of Nebraska as a boring, flat place, the state's subtle landscape contains biologically rich and diverse ecosystems defined by rivers like the Platte. This set of learning activities help students understand the Biodiversity of the Grasslands of the Platte River Prairie. They will learn about the animals of the Nebraska prairie as well as vegetation, plant life and the important role they play to the prairie ecosystem. They will also understand how to help conserve this beautiful resource.

Time allotment: TWO 45-minute class periods or up to FOUR 45-minute class periods with the addition of the outdoor tour activity.

Learning objectives

- Students will be able to recognize plants and animals native to Nebraska prairies.
- Students will be able to explain the importance of plants to the prairie ecosystem.
- Students will be able to establish an official herbarium at their local school.
- Students will be able to construct, examine, and evaluate a food chain and food web interaction.

Prep for teachers

During instruction, adhere to a gradual release of responsibility. First, explain and model the strategy for students (ME) and then have the class complete the strategy together (WE). Next, put students into pairs to practice the strategy. (TWO), and finally, have the students work independently to complete the strategy (YOU).

Supplies

Online access to Platte Basin Timelapse website, pencil, paper, resource books of animals and plants of the Nebraska prairies. Platte Basin Timelapse: https://plattebasintimelapse.com/learn/platte-river-prairies_2

Vocabulary

<https://tpt.pbslearningmedia.org/resource/7557ecac-a4e6-49ae-bfbb-4884bb5a0713/platte-river-prairies/>

food web - the interlocking food chains within an ecological community.

food chain - a series of living beings in which each serves as food for the next. Bats eat insects, and so are above them in the food chain.

species - a group of living things that can mate with one another but not with those of other groups. A hound and a poodle belong to the same species.

energy transfer - The conversion of one form of energy into another, or the movement of energy from one place to another.

law of conservation of energy - the total energy of an isolated system remains constant—it is said to be conserved over time. Energy can neither be created nor destroyed; rather, it transforms from one form to another.

law of conservation of mass - mass in an isolated system is neither created nor destroyed by chemical reactions or physical transformations.

systems - a group of related things or parts that work together as a whole.

predator - an animal that hunts other animals for food. Cats are important predators on farms, where they kill destructive rodents.

prey - an animal being hunted, caught, and eaten by another animal. Rabbits are a favorite prey of coyotes.

herbivore - an animal that only feeds on plants.

carnivore - an animal that eats the flesh of other animals. Wolves are carnivores that are capable of hunting much larger animals than themselves.

scavenger - an animal that finds and eats dead animals or rotting plants; a person who finds things that others no longer want. Hyenas are scavengers.

detritivore - an animal that feeds on dead organic material, especially plant detritus.

decomposer - an organism, especially a soil bacterium, fungus, or invertebrate, that decomposes organic material.

trophic level - each of several levels in an ecosystem, comprising organisms that share the same function in the food chain and the same nutritional relationship to the primary sources of energy.

herbarium - a collection of dried plants that have been systematically arranged and labeled, often for scientific use.

tallgrass prairie - The tallgrass prairie is an ecosystem native to central North America.

Course:

Biodiversity of Grasslands:
FOOD WEBS/CHAINS

**Step by Step
Instructions**

During instruction, adhere to a gradual release of responsibility. First, explain and model the strategy for students (ME) and then have the class complete the strategy together (WE). Next, put students into pairs to practice the strategy. (TWO), and finally, have the students work independently to complete the strategy (YOU).

Learning Objective:

1. Students will be able to recognize plants and animals native to Nebraska prairies.
2. Students will be able to explain the importance of plants to the prairie ecosystem.
3. Students will be able to establish an official herbarium at their local school.
4. Students will be able to construct, examine, and evaluate a food chain and food web interaction.

Engage (me):

Students begin by exploring 4 videos in the “Watch Prairie Animals” activity page on the Platte Basin Timelapse Project website:

<http://plattebasintimelapse.com/ed/chapter/wildlife/>

Next, instruct students to view 4 different videos that they find interesting, but NOT to write anything down. The point of this exercise is to simply engage students in locally found animals in the Nebraska prairie system. Once students have explored the activity for about 5-10 minutes, have them journal about what they watched. Ask the following questions:

1. Which animals did you view on the site?
2. What information—size, predator/prey relationships, where they live, etc.—can you tell me about the animals that you saw?
3. What time of day or night do you think you can find these animals in Nebraska?

These questions will help teach students how to pay attention to details, which will come in handy later when viewing more organisms and recording information about those organisms.

Grade Level:

Middle School

Subjects:

Science, Math, Ecology,
Environmental Studies

Time:

TWO 45-minute class periods or up to FOUR 45-minute class periods with the addition of the outdoor tour activity.

Materials:

Online access to Platte Basin Timelapse website, pencil, paper, resource books of animals and plants of the Nebraska prairies

Standards/Indicators:

see page 5

Explore (we/two):

Students now examine the plants of the prairie by going to the “Prairie Plants” page:

<http://plattebasintimelapse.com/ed/chapter/vegetation/>

Have students read the text—a more traditional way of gathering information—and view the two videos on the page. While watching the first video, have students answer the following questions:

1. Why are plants important?
2. What determines where plants grow?
3. How is the relationship between plants and insects important to the productivity of the prairie?
4. How many plant species are found in Nebraska? In the Platte Basin?
5. What is the value of an herbarium?

Once the first video is complete, have students watch the second video and record the steps needed to start your very own herbarium. There are 5 steps indicated in the video listed below. Review with students after all have viewed the video to make sure they know what is needed to begin collecting and preserving their own plants.

1. Collect Sample
2. Press Sample
3. Identification Confirmed
4. Mounting
5. Labeling

Students should brainstorm after the list is created about what equipment they have in the classroom that could be used to create a plant press. Students should come up with heavy books instead of belts to press plants, left over cardboard boxes, acid free photo mounting paper, large construction paper, glue, old newspapers, magnifying glass.

A separate activity can be done at this point to collect plants found around your school or local park (with permission of course) to begin your own classroom herbarium. Students can create an annual record of plants around their school by having their own herbarium in the classroom.

An **herbarium instruction sheet** (Handout 1: pdf) and separate **plant specimen label** (Handout 2: pdf) is available for you to use in the classroom. The instruction sheet is a handout to students while the plant label is for all students to use.

Explain (two/you)

Students will now explore and explain the connection between plants and animals in the prairie ecosystem in Nebraska. Students must visit the Food Chain/Food Web activity page:

<http://plattebasintimelapse.com/ed/chapter/activities-food-chain-food-web/>

and go through the process of identifying food chains and food webs. As students work through the food chain AND food web activity, have them answer the “**Platte Basin Timelapse Food Chain/Food Web Questions**” (Handout 3: pdf).

In order to answer the questions on the Food Chain/Web handout, students must have the background knowledge (or have access to it) of the following terms: **food web, food chain, species, energy transfer, law of conservation of energy, law of conservation of mass, systems, predator, prey, herbivore, carnivore, scavenger, detritivore, decomposer, trophic level**

Discuss the questions and answers in class to make sure the concepts are well understood, as there can be many misconceptions about food chains and food webs due to misunderstandings about the nature of energy and mass in a system.

Elaborate (you)

At this point, students should be able to construct their own food chains and food webs. See Handout 4 labeled “**Platte Basin Timelapse Food Chain/Food Web Energy Flow Activity**” (Handout 4: pdf).

After creation of the food web, move on to the final question in the Evaluation portion.

Evaluate (you)

Option 1:

Have students complete the “**Prairie Reflection Essay**” (Handout 5: pdf) in order to help demonstrate their learning from the project. The time provided for the essay can be altered to fit within a given time you need, however the questions themselves are directed at synthesizing and evaluating what they have learned and should only be altered to fit the needs of individual students when appropriate.

Option 2 Advanced:

Have students create an outdoor tour of their surrounding school grounds or local park. The area has to be within walking distance of the school and you must have permission to place signs at the site. See Handout 6 **Platte Basin Timelapse Outdoor Tour**. This project is a performance-based assessment. This assessment goes into much greater detail than the exploration of the Prairie section of the Timelapse project, however it does promote the conservation and preservation efforts of the Timelapse project.

Vocabulary

food web, food chain, species, energy transfer, law of conservation of energy, law of conservation of mass, systems, predator, prey, herbivore, carnivore, scavenger, detritivore, decomposer, trophic level, herbarium, tallgrass prairie

Rubric - Platte River Prairies

	A	B	C	D	E
Picture (5)	Color picture included	Does not apply	Does not apply	Does not apply	Missing
Common Scientific Name (5)	Common & scientific names included, written correctly, and scientific name explained	Common & scientific names included, written correctly	Common & scientific names included, not written correctly	Common OR scientific names included	Missing
Identifying Characteristics (5)	6 or more identifying characteristics	5 identifying characteristics	4 identifying characteristics	2 - 3 identifying characteristics	Missing
Distribution: Habitat, Biome, etc (10)	Written description of habitat and small map showing distribution of organism	Not applicable	Written description of habitat but NO map	Not applicable	Missing
Limiting Factors to Population (10)	All biotic and abiotic factors that affect its population size	Not applicable	Biotic OR abiotic factors that affect population included	Not applicable	Missing
Ecological Role (20)	All ecological roles explained: predator/prey interactions; reproductive cycle; temperature tolerance; circadian rhythms; migration or year round; impact on humans (food, pest, aesthetic, etc)	Not applicable	Most ecological roles explained: predator/prey interactions; reproductive cycle; temperature tolerance; circadian rhythms; migration or year round; impact on humans (food, pest, aesthetic, etc) *Missing 2 of the required list above	Not applicable	Missing
Facts (5)	4 unique facts about the organism	3 unique facts about the organism	2 unique facts about the organism	1 unique fact about the organism	Missing
Environmental Awareness (10)	Explain the population size (non-concern, threatened, endangered, etc.); Provide environmental awareness & respect to your organism	Not applicable	Explain the population size (non-concern, threatened, endangered, etc.) OR Provide environmental awareness & respect to your organism	Not applicable	Missing

Standards/Indicators:

Next Generation Science Standards:

Performance Expectations:

- MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

Disciplinary Core Ideas:

- LS2.A Interdependent Relationships in Ecosystems
- LS2.B Cycles of Matter and Energy Transfer in Ecosystems

NE State Standards:

SC8.1.1.e, SC8.1.1.f, SC8.1.1.g, SC8.1.1.h, SC8.1.1.j SC8.1.2 (all) SC8.1.3.h & i SC8.3.3 (all)

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HANDOUT 1 - Herbarium Instruction Sheet (p.1)

Botany Specimen Preservation Instructions

Preserving specimens for future study is an important part of any science course. Plants must be harvested live and then “cured” to maintain optimum quality. A collection of preserved plants is called an herbarium. You will be responsible for creating the first TRUE, correctly identified, specimens in your school’s herbarium.

There are specific tools and equipment needed to make a successful plant library, but some items can be substituted with various found or constructed objects.

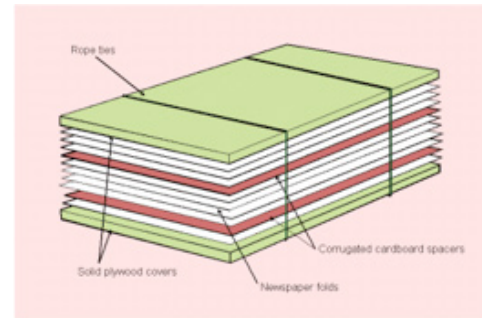
You will NEED:

1. A pair of pruning shears, stout scissors, or a box knife with a retractable blade (this is not allowed in school and will be regulated by the teacher when collecting specimens while at school);
2. Thorn-proof gloves or a pair of old leather gloves for handling prickly plants;
3. Small hand spade or small shovel (miniature one for kids) used to dig up small plants in order to collect plants and roots;
4. Plastic bags—either Zip-lock-style or trash bags (trash bags and gallon size storage bags are the best for field collection, as they help to keep plants from drying out while collecting);
5. LOTS of blotting paper, construction paper, or newspaper about 12 X 18 inches in size to place plants on for drying and may be changed (like a wet diaper) while the plants are drying);
6. Several pieces of corrugated cardboard about 12 X 18 inches in size. This must be the same size as the plywood in # 7;
7. Two pieces of plywood or similar strength material 12 X 18 inches for the top and bottom of a plant press to provide stability and even pressure when weight is applied;
8. Heavy books, such as an old phone book or a couple of text books from the classroom;
9. Hand lens (10x magnification minimum) or medium to large magnifying glass to identify small plant parts in the field and in the lab;
10. Poison Ivy medication (It is almost a certainty that one student will pick the plant to identify it, thus coming in contact with oleoresin urushiol, the clear sticky substance on the plant which causes a rash. Not everyone gets a reaction, and many become sensitive to the plant later in life or after repeated exposure to the chemical. Know what the plant looks like so that you can avoid it).

HANDOUT 1 - Herbarium Instruction Sheet (p.2)

How to Collect and Preserve Specimens for the Herbarium

1. Select only plants that are abundant and not known to be threatened or endangered and NOT on any local, state, or federal watch program.
2. When selecting an appropriate plant, make certain to collect the entire plant from the roots to the shoots (stems and leaves).
3. Use a trowel or small shovel to collect the plant and root system.
4. For larger plants, select only a small portion of the root and shoot systems (a stem section with leaves, fruits, and flowers) for preservation.
5. Collect all of the stages of reproduction, including flowers and fruits if present.
6. Store plant specimens in a plastic baggie while collecting. To keep plants sufficiently moist, you may want to include a few damp paper towels in the bag. Store plant specimens out of direct sunlight while in the field.
7. Once you have collected your plant specimens, take them back to the classroom to identify them and begin the drying process.
8. You will use a plant press (make one if needed) to preserve the plants. See illustration below.



9. Use books and cardboard from the classroom to create a plant press for drying your plant specimens.
10. Identify your specimen, create a label, and place both together on a sheet of newspaper. Make certain your identification is correct.
11. Once your plants have dried, attach each specimen with an accurate label to an herbarium sheet (acid-free white paper).
12. Now you are ready to catalogue your specimens.

Specimen Label for Plant Collection

Scientific Name (*Genus, species*): _____

Plant Family: _____

Common Name: _____

Origin (native/exotic): _____ County & State Collected: _____

Date Collected: _____ Elevation Collected (if applicable): _____

Collected By: _____

Township: _____ Range: _____ Section Number: _____

Relative Abundance: _____

Notes (folklore, native use, etc.): _____

Specimen Label for Plant Collection

Scientific Name (*Genus, species*): _____

Plant Family: _____

Common Name: _____

Origin (native/exotic): _____ County & State Collected: _____

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Collected By: _____

Township: _____ Range: _____ Section Number: _____

Relative Abundance: _____

Notes (folklore, native use, etc.): _____

HANDOUT 3 - Food Chain/Food Web Activity Questions (p.1)

Name: _____

1. What do food chains and food webs depict? Explain the relationship between food chains and food webs.
2. Why are there only a certain number of organisms in a food chain?
3. What does a beaver consume? What does an otter consume?
4. Identify one herbivore, one carnivore, one omnivore, and one detritivore.
5. The law of conservation of energy states that energy can neither be created nor destroyed and that the total energy of a closed system remains constant. Explain how this law applies to food chains and food webs. Be sure to emphasize how energy transfers from one organism to another and the role of the sun in an ecological system.

HANDOUT 3 - Food Chain/Food Web Challenge (p.2)

Name: _____

1. What are the different trophic levels in a food chain? Why do organisms eat at different trophic levels?
2. Many consumers are omnivores, like humans, that feed at more than one trophic level. On which trophic level would you place an organism that can eat at multiple trophic levels?
3. It is a fact that not all energy available at each trophic level gets transferred to the next trophic level. Using your knowledge of the law of conservation of energy, explain how energy flows through the different trophic levels and why not all energy is transferred to the next trophic level, and how this energy is conserved in an ecosystem.
4. Decomposers are a group of consumers that are not always represented in food chains. Explain why these organisms are vitally important to the health of an ecosystem. **(HINT: Apply the law of conservation of energy and mass.)**

HANDOUT 3 - Food Chain/Food Web Challenge (p.3)

5. Because scientists know that not all energy is transferred from one trophic level to the next, they have developed an easy numerical way to represent the energy that is not transferred. It is called the 10% rule. Only 10% of the available energy at one level is transferred to the next level. For example, in a simple food chain with three organisms, the first organism may have 100 units of available energy; the next level or organism in the food chain would have only 10 units (10% of the previous number) of available energy; and the third organism would have 1 unit of available energy. With this information, practice your math skills by recording three food chains from the completed food web activity (Place your mouse cursor over an organism and the chain will be highlighted.) Follow the steps below:
- Record three separate food chains from the food web activity.
 - Label each food web, beginning trophic level (plants) with a different energy amount listed here: 100,000 units of energy, 10,000 units of energy, 1000 units of energy.
 - Using the 10% rule, calculate the amount of energy at each level in each of the three food chains that you have selected.
 - Did any of your food chains run out of energy?
 - Explain why true food chains are made up of only a few organisms.

HANDOUT 4 - Food Chain/Food Web Energy Flow Activity

Name: _____

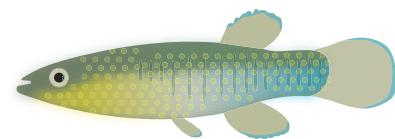
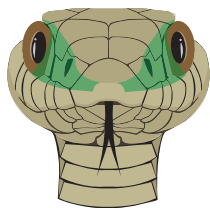
Date: _____

Materials Needed:

glue stick, plain 8 x 11 inch paper, scissors, pencil/pen, various pictures of organisms both plant and animal

Procedure:

1. Create a FOOD CHAIN by printing out the PBT images (next page pdf), which you will cut out, arrange, and paste on a clean sheet of paper. You can draw the pictures too. *Remember that food chains have no more than 5 organisms.
 - Label the transfer of energy on the food chain by drawing arrows in the direction of energy flow.
 - Label the 1st trophic level with 100,000 units of energy and calculate the energy remaining at all other trophic levels.
 - Include all of the following labels on your food chain: heterotrophs, autotrophs, decomposers, all ordered consumers such as 1st, 2nd, 3rd, and 4th.
2. Create a FOOD WEB using the PBT images (pdf), which you will cut out, arrange, and paste on a clean sheet of paper. You can draw the pictures too.
 - Label the transfer of energy on the food web by drawing all appropriate arrows to indicate the direction of energy flow.
 - Note the trophic level(s) on which each consumer feeds in order to illustrate connections in your food web.
 - Label all of the herbivores, carnivores, omnivores, scavengers, detritivores, decomposers, and producers (autotrophs).



HANDOUT 5 - Prairie Reflection Essay

Name: _____

Date: _____

You will have a full 30 minutes to write your answers to the following four questions. Tomorrow you will have 30 minutes to re-read, re-organize, and revise your ideas into a coherent essay. Please answer all four questions to the best of your ability. Make sure to give examples whenever possible.

Once you start writing, you may use dictionaries and other writing aides, but **YOU MAY NOT DISCUSS YOUR WRITING WITH ANYONE.**

1. Describe how the Platte Basin Timelapse project that you created made a difference in your understanding of ecology and specifically prairie food chains and food webs.
2. What long-term benefits could the Platte River Prairies project provide to you?
3. How did you apply what you had already learned in school to the project?
4. What skills have you gained from the project that may help you to become a more responsible citizen when using Nebraska's water resources?

HANDOUT 6 - Outdoor Classroom Tour (p.1)

Name: _____ Date: _____

Purpose:

Provide an electronic self-guided tour of a natural area for the surrounding community, weekenders, and school groups.

Objective:

Create a self-guided tour of a natural area such as prairie, woodland, wetland, and pond. Product should include images, text, and a video link with QR codes posted outside in a designated area. You may work individually OR in pairs (2 students only).

Assignment:

1. Begin by researching either terrestrial or aquatic organisms found in the natural area OR specific area such as a wetland, woodland, pond, prairie, rotting log, etc. You should have experience with this if you have already gone outside to document the many different organisms in your habitat.
2. Locate one specific organism on which to focus your research, such as a specific type of shrub, a prairie wildflower, an invasive species of plant, poisonous plant, edible plant, tree, a wolf spider burrow, burrowing wasps, monarch butterflies, bird, or, bird's nest, amphibian, reptile, etc. Focusing on one specific habitat (such as a riparian area) will help guide your tour project and cut down on the amount of work you will need to do. Example title and topic: "Striped Chorus Frog: A Closer Look at a Wetland," OR "Redwing Blackbirds: The Noisy Stewards of the Cattails," OR "Pond Mud: The Secret Is in the Smell." You may also wish to illustrate the relationship between two organisms, such as milkweed and monarch butterflies. But in most cases, you will highlight ONE specific organism from your chosen habitat.
3. Investigate a resource within the local community to assist with your research. Examples of resources include: university professors, city arborist, the local city parks and recreation department, local zoo, weed control technicians, game and parks officials, natural resource districts, USGS wetland restoration team, professional online websites, university extension pages, etc. You may want to contact resources during class time using your own cell phone, school phone, or email.
4. Gather all information and plan what part (habitat or organism) of the tour you will provide. If you plan to use a video you will be using your own camera or a computer's built-in camera. You will be travelling outside in order for you to photograph locations and various organisms at designated times.

continued on next page...

HANDOUT 6 - Outdoor Classroom Tour (p.2)

5. Your QR codes should include the following information:
 - Photo of organisms of interest or habitat of interest.
 - Common AND scientific name of organisms. If a habitat is your focus, then you must include common organisms found there, as well as names that help to describe the habitat, such as wetland, bog, or marsh. Be specific with the terminology.
 - Identifying characteristics of the organisms or habitat in order to help people identify it when outside. Try to avoid using taxonomic terms unless they are explained or labeled. Use common language when appropriate but be accurate.
 - Distribution and population of the organisms or habitat. This needs to be a written description with a small map showing shaded areas where the organism or habitat can be found.
 - Identify the biotic and abiotic factors that limit a population or populations.
 - Ecological role of the organism(s) must be explained. Include the following: predator-prey interactions, temperature tolerance, circadian rhythms, hibernation, migration, or year round resident, impact on humans such as a food source, pest, etc.
 - Important or interesting fact(s) that you want the public to know about your organisms or habitat.
 - Environmental Awareness: provide visitors with information that makes them more environmentally aware of the habitat and your organism(s). Explain human impacts, solutions to impacts, and ways to lessen impacts to your habitat or organism. (Local resources should be included when available.) For example: "Wetlands are easily damaged by foot traffic, so take the shortest route into the area and follow the exact route out, or follow a trail when available."
6. The QR codes will be placed outside for the public to use. Do your best work, as it will be on public display.

CREDITS - Platte River Prairies

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The audio, illustrations, photos, and videos are credited beneath the media asset.

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