

Prairie Plant Adaptations

Grade Level: 4-8

Lesson Overview

You look at your beautiful green lawn and there it is....a yellow dandelion! You grab a spade to remove it. As you strive to dig out every bit of its roots, you wonder, "How far down does this thing go?!" Dandelions are a perfect example of a plant adapted to survive the harshest conditions. In this lesson, students will examine adaptations that allow native Illinois prairie plants to survive drought, fire, wind, grazing, and extreme temperatures.

Student Objectives

1. Describe the characteristics of a prairie environment.
2. Understand simple plant physiology (roots, stems, leaves, flowers, and seeds).
3. Identify prairie plant adaptations using items metaphorically.

Materials

- ✓ Illinois Prairie Plant Adaptations Investigations Items or Pictures (pictures can be found at the end of the lesson)
- ✓ Prairie Plant Adaptations Investigations Key information sheet
- ✓ Root Systems of Prairie Plants” Poster by Conservation Research Institute (many versions are found on the internet)

Vocabulary

- **adaptation** – a physical structure or behavior that helps a plant or animal survive and reproduce in a given environment.
- **annual** – a plant completing its life cycle, from seed germination to production of new seed, within a year and then dying.
- **fibrous root** – a root system in which both primary and lateral roots are finely divided and have approximately equal diameter and length, as in most grasses. Opposite of tap root.
- **flower** – the reproductive structure of a flowering plant, consisting of the pollen-shedding anthers and/or the pollen-receiving stigmas, and usually (but not necessarily) showy petals or sepals which function to attract pollinating insects or birds.
- **forb** – a non-woody flowering plant other than a grass; herbaceous broadleaf plant.

- **grasses** – a common word that generally describes a monocotyledonous green plant in the Poaceae family. True grasses include most plants grown as cereal, for pasture, or for lawns.
- **growing point** – the tip of a stem or root where new growth occurs. The growing point for annuals is above ground level, whereas many prairie plants have their growing point below the ground to protect the plant from fire.
- **leaf** – plant part that catches sunlight and uses it to make food for the plant.
- **legume** – a plant, such as the soybean, that bears nitrogen-fixing bacteria on its roots, and thereby increases soil nitrogen content.
- **metaphor** – to apply a word or concept to an object which it does not literally denote in order to suggest a comparison between the two. “Books are windows to the world” is an example.
- **native** – one that was present in a defined area prior to European settlement. A defined area may be a site, state, region, or the U.S.A. or North America.
- **nitrogen-fixing plant** – types of plants, known as legumes, that use nitrogen directly from the soil with the help of bacteria that live in their roots.
- **perennial** – a plant that normally lives for three or more years.
- **pollination** – process by which pollen gets from one flower to another, often by means of wind, insects or animal action.
- **prairie** – the expansive, temperate North American grassland habitat dominated by more or less drought-tolerant grasses and mixed with various herbaceous broadleaf annuals and perennials. Comes from the French word for “meadow” and is often referred to as an “ocean of grass” in historical writings.
- **rhizome** – a thick underground horizontal stem that produces roots and has shoots that develop into new plants. Also called rootstock.
- **root** – plant part that holds the plant in place and soaks up water and minerals.
- **scarification** – the process through which wind, water, fire and animals break the seed coat; necessary for the germination of some plants.
- **seed** – plant part that becomes a new plant.
- **sod** – surface layer of ground containing a mat of grass and grass roots.
- **stem** – plant part that holds up the plant and moves water and food between leaves and roots.
- **tallgrass prairie** – prairie dominated by tall grasses such as Big Bluestem, Indian Grass, and Cord Grass.

- **tap root** – a primary root that grows vertically downward and gives off small lateral roots; occurs in dicots; opposite of fibrous root.
- **tuber** – a thick, creeping underground stem. An enlarged underground stem that serves as a food storage organ.

Background Information

Prairies are unique ecosystems dominated by grasses and other non-woody plants called forbs. These ecosystems are the result of the interactions between the precipitation and temperature of a region, the landforms, how quickly water drains from soil, fire, plants, and animals. Each plays a crucial role in the establishment of a prairie.

A prairie ecosystem includes all the living components-- plants and animals--and all the non-living components-- sun, water, fire, soil, and--nutrients.

Plants are usually the first thing that come to our minds when we think of prairie. Prairie plants are the basis for the prairie ecosystem for several reasons.

Plants absorb and convert energy from the sun into nutrients they use to grow, flower, and seed. These nutrients then get passed along the food chain of prairies to insects, rodents, birds, and other animals that eat the plants.

Plants help maintain the diversity of the prairie ecosystem, attracting animals who use the prairie for food and habitat.

Prairie plants have adapted to this specific environment with structures that help them survive. Some of these structures are leaves and stems, flowers, and root systems. By examining a prairie plant closely, you can find parts of the plant that make it able to live in its environmental conditions.

Many prairie plants, including grasses that cover prairies, have adapted over thousands of years to droughts, fire, and grazing animals.

Some of the many adaptations that prairie plants have made are:

- The growing point of many prairie plants is underground, where it can survive fire and regrow.
- Prairie grasses have narrow leaves that lose less water to evaporation than broad, flat leaves lose.
- Prairie plants have roots that extend downward for as much as 3.5 meters and form networks to absorb moisture during dry periods.
- Brightly colored flowers attract pollinators such as bees, wasps, and birds.

One of the most important adaptations of prairie plants is the root system, which is complex. Prairie plants and grasses have BIG ROOTS-- many times larger than the

parts of the plants that you see above ground. The deep root systems help prairie plants survive extreme heat, droughts, and fires.

Large root systems help prairie plants draw any available moisture from deep underground so they can withstand droughts. If they cannot find enough moisture for the plant to continue growing, the part of the plant above ground turns brown and dries off, but the root system and growing point remain alive underground. Prairie plant roots help to decrease soil erosion and help the plant find water.

Prairie plants have root systems that grow deep into the soil. Many also have a web of secondary roots. This network of roots helps hold the soil together when the wind blows strongly or when rains flood the ground.

Prairie plant roots are also crucial to their survival because many plants grow on dry to semi-dry sites. These deep roots find any available moisture that may be hidden deeper underground.

Because prairie plants have massive roots, they help contribute to the richness of the soil. Each year the plants create more roots to absorb moisture underground. Every year some of the roots die off, adding to the organic material in the soil. As this organic material decomposes, it returns important nutrients back to the soil. Over thousands of years, a large amount of organic material has decomposed, creating extremely fertile soil in Illinois. Illinois' most productive farmland used to be open prairie. The settlers found rich black soil under the thick grasses. This fertile soil was the foundation of farming that continues today.

(Retrieved from: <http://www.museum.state.il.us/muslink/prairie/htmls/eco.html>)

Procedure

1. Discuss and list ideas of what a prairie environment could include. Examples may include: hot summers, very little shade, periods of little rain, windy, cold winters, home for a diverse number of insects, birds, animals and plants, large areas of grasses and no trees, danger of fire burning large areas. The IDNR "Illinois Natural Divisions" Poster highlights where prairie was found in Illinois and lists some of the common plants and animals of the prairie.
2. Discuss the definition of adaptation and brainstorm about what adaptations would help plants survive in a prairie environment.
3. **Root Rope Activity:** Use a 24-foot length of rope or twine to demonstrate the actual size of a prairie plant. On the rope, mark one-foot increments with a permanent marker or with masking tape. Sixteen feet of the rope will be roots and 8 feet of the rope will be plant growth above the ground. Mark the dividing

line between above and below ground growth with a different color of marker or a piece of colored tape.

- Using the “Root Systems of Prairie Plants” poster by Conservation Research Institute, compare the length of roots to the height of the plant above ground level for various plant species. Ask students to differentiate between fibrous and taproot systems. One version can be found at: Put Down Roots Brochure from MN (Prairie Roots Poster and prairie facts) https://files.dnr.state.mn.us/assistance/nrplanning/community/roadsidesforwildlife/putdownroots_poster.pdf
 - Point out to students that two-thirds of a prairie plant is root.
 - Point out that prairie plants have their growing point below the ground to protect the plant from fire and grazing as prairie plants are perennials. Annual plants such as corn, soybeans and wheat have their growing point above the ground and cannot survive if grazed upon or destroyed by such things as high winds, hail or a hard frost.
 - Instruct students to make a line along the “root rope” to simulate the true size of various prairie plants pictured on the “Root Systems of Prairie Plants” poster.
4. **Metaphor Activity:** Explain to students that they will apply the concept of metaphors to learn about special adaptations that some plants may possess in order to survive in a prairie environment. Explain that everyday items can be used to represent how plants are adapted to survive in a prairie environment. This activity can be done either as a demonstration or as a hands-on activity. The cards provided at the end of the lesson can be used or the teacher may choose to gather actual items for the activity.
- To conduct the activity as a demonstration, hold up each card individually. Working together, have the students try to guess the type of adaptation the item represents and how this adaptation might help a plant survive in a prairie environment. It may be helpful to provide students with a hint such as, “this is an adaptation that is found in the roots.”
 - To conduct the activity as a hands-on activity, place cards in a pillowcase or paper bag. Instruct each student to reach into the bag and remove one item and provide their interpretation of how this item represents a plant adaptation, as well as how this adaptation might help a plant survive in a prairie environment. After presenting the demonstration or conducting the hands-on activity, the IDNR “Illinois Prairie Wildflowers” poster can be displayed to show some of the prairie plants mentioned in the activity.

5. Discussion Questions:

- a. What plants are most commonly found on land that was once prairie?
Corn, soybeans, wheat, oats and pastureland
- b. Do these plants have the same adaptations as native prairie plants?
Corn, soybeans, wheat and oats are all annuals. The plants must grow quickly to make best use of the growing season. Most prairie plants are perennials. In some cases, prairie plants would take several years before they would flower as time was spent developing the plant root system to ensure survival on the prairie.
- c. Do you think prairie plants have a place in today's world?
Prairie plants are being used more often in landscaping as they require less water and are more disease resistant. Much research is being done on using native prairie grasses for grazing and forages as these grasses can survive more diverse and harsher environments.

Extension Activities

Dandelions provide an excellent example of a plant having roots that grow several feet in the ground in order to survive. Ask students if they have ever noticed that a dandelion will grow again if it is only cut off at the surface of the ground. Carefully dig up the entire plant and root system of a dandelion. Have the students measure the length of the roots and compare to the height of the plant.

Additional Resources

- Illinois Department of Natural Resources has many posters, student activity booklets, and a Prairie Resources Trunk that complement prairie lessons. An educator can download many of these items and IDNR will ship to school addresses. A few you may wish to review include:
 - Prairie Primer: Activity Book/Poster (32 page document (A) and 2 page poster (B))
<https://www2.illinois.gov/dnr/publications/documents/00000647.pdf>
 - <https://www2.illinois.gov/dnr/publications/Documents/00000647.A.pdf>
 - <https://www2.illinois.gov/dnr/publications/Documents/00000647.B.pdf>
 - Illinois Prairies Coloring Poster
<https://www2.illinois.gov/dnr/publications/documents/00000659.pdf>
 - Illinois Prairie Resources Trunk List of Contents (May be borrowed)
<https://www2.illinois.gov/dnr/education/Documents/PrairieTextList.pdf>

- Prairie Resources from IDNR
<https://www2.illinois.gov/dnr/education/Pages/EduPrairies.aspx>

- The Tallgrass Prairie in Illinois (Illinois Natural History Survey site)
<https://www.inhs.illinois.edu/animals-plants/prairie/tallgrass/what/>
- Prairie Wildflowers of Illinois (An excellent source to learn about individual plants)
https://www.illinoiswildflowers.info/prairie/plant_index.htm
- Tallgrass Prairie Center of University of Northern Iowa – Curriculum Images...
Pictures of prairie plant roots of various species.
https://www.tallgrassprairiecenter.org/curriculum_images
- The World Beneath Your Feet: A closer Look at Soil & Roots by Mark Miller:
<https://secure.iowadot.gov/lrtf/docs/WorldBeneath.pdf>
- Put Down Roots Brochure from MN (Prairie Roots Poster and prairie facts)
https://files.dnr.state.mn.us/assistance/nrplanning/community/roadsidesforwildlife/putdownroots_poster.pdf

Standards

Illinois Science Standard

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.

Illinois English Language Arts Standard

ELA.4.RST.1. Cite specific textual evidence to support analysis of science and technical text.

The **M**ultidisciplinary **A**gricultural **I**ntegrated **C**urriculum (mAGic) was created in 2004 under the leadership of the Illinois State Board of Education (ISBE) and the Facilitating Coordination in Agricultural Education Project (FCAE). Funding was made available through the FCAE grant budget from the agricultural education line item of the ISBE budget. This revision, as printed, was developed in January 2021.







These mAGic lessons are designed to bring agriculture to life in your classroom. They address the Illinois Learning Standards in math, science, English language arts and social studies.

Illinois mAGic project update writers/reviewers: Rhodora Collins – Dekalb County; Suzi Myers – Kane County; Connie Niemann – Montgomery County; Debbie Ruff – Livingston County; Jennifer Waters – Sangamon County; Dawn Weinberg – Hancock County; and Carrie Winkelmann – Menard County.

Items for Prairie Plant Adaptations Investigations Information Sheet

Item	Adaptation It Represents	Example Prairie Plant
Roots	NOTE: The poster, <i>Root Systems of Prairie Plants</i> provides visual examples of these root adaptations.	
Anchor Picture Card	Roots are the anchor for a prairie plant. Two-thirds of a prairie plant is below the ground. Roots may travel several feet down to search for moisture, with a few plants having roots as long as 15 feet deep.	Lead Plant has roots that go 14 feet deep with the above ground growth of only 2 feet.
Bundle of Yarn	Roots are fibrous to hold soil in place. (Most grasses)	Big Bluestem
Pea Pod Picture Card	Nitrogen-fixing roots are an adaptation of plants called legumes. These roots take nitrogen directly from the soil with the help of soil-born bacteria. Legumes belong to the pea and bean family.	White Wild Indigo
Sponge	Roots combine with the soil to form a tough mass called sod. Sod absorbs rainwater like a sponge and stops erosion. (Most grasses)	Indian Grass Big Bluestem Switch Grass
Stems		
Cork	One of the only trees able to survive a prairie fire was the Bur Oak. The bark of this tree is very thick and corky to protect the tree from the intense heat.	Burr Oak
Drinking Straw	Grasses have flexible hollow stems to bend easily in the wind.	Indian Grass
Leaves		
Compass Picture Card	Leaves orientate in a north-south position in order to maximize sunlight.	Compass Plant
Sandpaper	Leaves are covered with very short, stiff hairs that make the leaves feel very rough. This helps prevent water loss and prevents the plant from being eaten.	Prairie Dock
Spruce branch	Narrow or finely divided plant leaves prevent overheating and slow down evaporation.	Rough Blazing Star
Fake fur square	Leaves have a soft, downy covering to prevent water loss. Hairy plant leaves reflect sunlight, which helps prevent overheating.	Black Eyed Susan
Toothpicks	Leaves have sharp spines and hairs to discourage grazing plant eaters and small juice-sucking insects.	Rattlesnake Master
Wax paper	Leaves have a waxy coating to prevent water loss.	Rattlesnake Master
Cup	Leaves encircle the stem to form a cup that holds water. Referred to as "clasping".	Cup Plant
	Chart continued on next page	

Flowers		
Package of Scented Markers	Flowers have bright colored blooms to attract insect pollinators. Some flowers are also highly scented to attract insects for pollination.	Wild Bergamot
Seeds		
Velcro	Some seeds have special hooks or barbs that stick to the fur of animals or clothing of people.	Illinois Tick Trefoil
Parachute Picture Card	Many seeds can fly through the air as they have developed wings or silky hairs that allow them to be carried by the wind.	Prairie Milkweeds
Other		
Sun	Prairie plants survive in an environment that is hot, with very little shade.	Most prairie plants
Matches	Fire is an integral part of native prairie. Fire helps to break down dried plant material into organic matter. Some seeds require fire to germinate (scarification). Fire was used by Native Americans for hunting. Native Americans often called fire "the red buffalo."	Most prairie plants
Corn Kernel	Many of the prairie plants were grasses. Today, Illinois prairies are planted in a different type of grass, called corn. Illinois is a part of the Cornbelt and is one of the top two producers of corn.	Corn
Soybean Seed	The soybean seed belongs to the legume family. It is an important crop on today's Illinois farms. Native prairie contained forbs that were legumes.	Soybeans

 <p style="text-align: right;">Roots</p>	 <p style="text-align: right;">Roots</p>
 <p style="text-align: right;">Roots</p>	 <p style="text-align: right;">Roots</p>



Stems



Stems



Leaves



Leaves



Leaves



Leaves



Leaves



restyle Leaves



Leaves



Flowers



Seeds



Seeds



Prairie



Prairie



Prairie



Prairie