PreK-12 Lesson Plans

Listening to the Prairie: Farming in Nature's Image

Come journey through the life, landscape, and natural world of the North American prairie. Listening to the Prairie: Farming in Nature's Image investigates the history of the North American prairie and exciting new approaches to agriculture in America. The exhibit includes stunning photographs of some of the most productive agricultural lands on earth. It features the stories and insights of four American farm families - the Larsons, Wilsons, Rissmans, and Mortensens, progressive farmers and ranchers who are reinventing their work in order to preserve their way of life.

Listening to the Prairie made a three-year tour of libraries across the United States from May 2001 through August 2004.

Agriculture in the Classroom, a national K-12 agricultural literacy program, is pleased to provide a series of lessons and activities to complement the Smithsonian Institution's traveling exhibition. These activities were created and compiled by New York Agriculture in the Classroom at Cornell University in Ithaca, NY. The contents are designed for PreK-12 teachers, educators, home-schoolers, and parents who spend time with their families at libraries and learning centers. With the exception of the on-site scavenger hunts, most of the enclosed materials can be utilized before or after your visit to the exhibition.

The purpose of these activities is to serve as educational supplements to the exhibition as well as a method with which to engage students and families about the daily issues of agriculture and the food and fiber industry. Although only 2.5% of our population live on farms, all of us eat and wear products derived from agriculture every day, including many products from the North American Prairie. Since most of the United States population do not live in the prairie, the "clues from nature" emphasized in the exhibition may be applied to nearly every region of the country.

Lessons:

Pre-K - 1
Introduction
Web of Life
Making Pretzels
Agriculture in Your Life
Here Come the Sunflowers
Worm Watching
Oats, Peas, Beans, and Barley Grow

2-5
Introduction
Prairie Scavenger Hunt
Weaving The Web
Losing Ground
Agriculture In Your Life
Food Connections
Oats, Peas, Beans, and Barley Grow

6-8
Introduction
Just Passing Through
Be A Food Detective
Beyond The Beef
Striking A Balance

9-12
Introduction
Prairie Scavenger Hunt
Be A Food Detective
Striking A Balance
Farming In Nature's Image

Listening to the Prairie: Farming in Nature's Image

Lessons for Grades PreK - 1

Developed, adapted and/or compiled by:

David G. Cox
Janet E. Hawkes

New York Agriculture in the Classroom
Cornell Educational Resources Program

For the United States Department of Agriculture -
Agriculture in the Classroom Program to accompany
the Smithsonian Institution's traveling exhibition.

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Listening to the Prairie: Farming in Nature's Image

"Agriculture is too important a topic to be taught only to the relatively small percentage of students considering careers in agriculture and pursuing vocational agriculture studies."

National Research Council

Overview

Across the United States, serious efforts are underway by educators and professionals to raise public awareness about agriculture and the many difficult challenges facing our nation's most vital and vulnerable industry. Research has shown that most Americans know very little about agriculture, its social and economic significance in the United States, and particularly, its links to human health and environmental quality. Likewise, most students have very little knowledge of the growing number of exciting career opportunities available within the agricultural industry.

Listening to the Prairie: Farming in Nature's Image, is an exhibition that will change how people think about agriculture in America. It's about growing food on the North American prairie and the forces of change that turned vast grasslands into one of the most productive agricultural lands on earth. These lands are our nation's most fertile, diverse, fragile, and endangered ecosystems, but they also serve as a model for environmentally sound agriculture. The traveling exhibition focuses on how changes in this ecosystem and other ecosystems across the country impact people and their communities. It reveals information on how a natural ecosystem works, and tells stories of farmers and ranchers who are farming in nature's image.

Ag in the Classroom

Smithsonian Institution

Sustainable Agriculture Research and Education

About These Activities

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Lessons and activities have been divided into four grade-level groups: PreK-1, 2-5, 6-8, and 9-12. All of the enclosed lessons, activities, and worksheets are B&W photocopy reproducible, and clearly formatted. Each lesson contains a brief overview, objectives, a list of materials needed, background information, activity instructions, and suggestions for extensions for those who wish to further explore the lesson topic or concept. A separate chart is included that summarizes all of the enclosed lessons and the appropriate National Standards (McRel) addressed.

In addition, Smithsonian Institution's National Museum of Natural History, the American Library Association (ALA), and participating libraries have assembled an impressive program of supplementary resources, activities, lectures, tours, and workshops for visitors of all ages to enrich their visit to this important exhibition. *Consult your library staff for the calendar of events and the wealth of educational resources gathered especially for this event*.

Enjoy your visit at this most important exhibition. The lessons to explore are universal and timeless, and will serve as valuable resources in agricultural awareness and education for years to come.

Ag in the Classroom

Smithsonian Institution

Sustainable Agriculture Research and Education

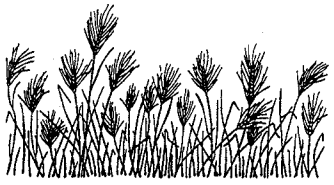
A Brief Prairie History[1]

The First Prairie Farmers – Crops have been grown on the prairie for more than 4,000 years. Native prairie farmers cultivated the soft, alluvial soils in the river bottomlands because they did not have forged metal tools to work the tough prairie sods in the uplands. They raised corn, beans, squash, pumpkins, sunflower, and tobacco in small garden plots for about twenty-five years, and then moved to new plots on a two to three hundred year rotation. Native farming communities also gathered edible wild plants and hunted rabbits, deer, and bison.

The Will of Iron – By the end of the 19th century, the North American prairie had become one of the greatest food-producing regions in the world. New machinery, new railroads, new government policies and the tenacity of new settlers made this transformation possible. The steel plow broke heavy prairie soils for planting crops. Affordable barbed wire fencing enclosed grazing and crop lands on the treeless landscape. Windmills provided a reliable water source for livestock and crops, and transcontinental railroads linked the new prairie producers with urban markets in the East and in Europe.

The Fruitful Plain – Today one American farmer feeds 143 people, more than five times that of a farmer in 1950. This phenomenal growth in production has resulted largely from technological forces of change – new machinery, new crop varieties and the development of chemical fertilizers and pest controls. Farms and ranches are also fewer, larger, and more specialized than they were fifty years ago.

New Alternatives – The willingness of the farmers and ranchers to change has been the cornerstone of successful American agriculture. What are common practices now, chemical pesticides and fertilizers, for example, were alternatives fifty years ago. Today's farmers and ranchers continue to adopt new approaches to keep their operations productive and profitable, while safeguarding the environment. If history is our guide, some of today's alternatives will be tomorrow's accepted practices.



[1] *Adapted from the final exhibition script of "Listening to the Prairie: Farming in Nature's Image."*

Smithsonian
Institution

Summary of Activities

Lessons for Grades PreK-1

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. The Web of Life – Game demonstrating interconnections between plants and animals
3. Making Pretzels – Cooking activity from grain to food
4. Agriculture in Your Life – Connecting agricultural sources to everyday products
5. Here Come the Sunflowers – Planting and growing activity
6. Worm Watching – Activity for observing worms in action
7. "Oats, Peas, Beans and Barley Grow" – Song about farming and prairie crops

Lessons for Grades 2-5

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. Weaving the Web – Game demonstrating interconnections between plants and animals
3. Losing Ground – Exploring water and wind soil erosion
4. Agriculture in Your Life – Connecting agricultural sources with everyday products
5. The Food Connection – Placing agriculture products on the Food Guide Pyramid
6. "Oats, Peas, Beans and Barley Grow" – Song about farming and prairie crops

Lessons for Grades 6-8

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. Just Passing Through – Investigating properties of soils
3. Be a Food Detective – Exploring sources of food from food labels
4. Beyond the Beef – Exploring all the products from beef cattle
5. Striking a Balance – Game demonstrating interconnections between plants and animals

Lessons for Grades 9-12

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. Exploring Soils – Investigating properties of soils
3. Be a Food Detective – Exploring sources of food from food labels
4. Striking a Balance – Game demonstrating interconnections between plants and animals
5. Farming in Nature's Image: The Larson Farm – Case study of sustainable agricultural practices

Integration with State Frameworks or Learning Standards*

Grades PreK -1

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x	x	x	x
The Web of Life			x			
Making Pretzels	x	x	x	x		x
Agriculture in Your Life	x	x	x			x
Here Come the Sunflowers			x			
Worm Watching	x		x			
"Oats, Peas, Beans, and Barley Grow"	x				x	

Grades 2-5

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x	x	x	x
Weaving the Web			x			
Losing Ground	x	x	x			
Agriculture in Your Life	x	x	x			
The Food Connection	x	x	x		x	x
"Oats, Peas, Beans, and Barley Grow"	x				x	

Grades 6-8

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x			x
Just Passing Through			x	x		
Be a Food Detective	x	x	x			x
Beyond the Beef	x	x	x			x
Striking a Balance			x	x		x

Grades 9-12

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x			x
Exploring Soils			x	x		
Be a Food Detective	x	x	x			x
Striking a Balance			x	x		x
Farming in Nature's Image	x	x	x			x

*Adapted from McRel (Mid-Continent Research for Education and Learning). For more information contact: http://www.mcrel.org/standards-benchmarks/

Agriculture in Your Life

Overview
Students will match everyday products with agricultural sources that can be found on the prairie. Lesson extensions provide an opportunity for students to visit a farm and/or meet with the farm family.

Suggested Grade Level
PreK - 1

Estimated Time
20 – 30 minutes

Objectives
Students will be able to:

1. identify the basic agricultural sources of everyday products, including food and fiber products outside the prairie.
2. Discuss the important day-to-day activities, chores and products from their adopted farm family.

Materials
Activity Sheet A

Background
Agriculture plays a major part in our lives: from what we wear, to what we use in our classes, and even to what we do after school. We may not always think of agricultural products as the physical source of the items or things we use everyday. However, most of these daily essentials can be traced back to an agricultural source.

Production agriculture, or farming, is what most students think of when they hear the word "agriculture." This is the actual production or growing of raw commodities. People who raise and harvest crops and livestock for consumption or purchase are typically categorized as farmers and ranchers. It doesn't stop there. Production agriculture also includes a variety of specialties, such as fish, timber, fur-bearing animals, trees, shrubs, flowers, herbs and much more.

Most of the products we use everyday come from agriculture. The sheets we sleep on and the pajamas we wear are made from cotton, just like Q-tips for your ears. The feathers in the pillows may come from chickens or ducks. The cereal and milk we eat for breakfast; the pencils, crayons, and paper that we use at

school; and the baseballs, bats and gloves we use after school all originate from raw agricultural products. We know that our food comes from agriculture, but you can see how we are surrounded by and reliant upon many agricultural products the whole day through.

Activity

1. Discuss background information, then hand out Activity Sheet A.
2. After students work through the activity, have a discussion about what other products come from agriculture.

Extensions

1. Have students color in images from Activity Sheet.

2. Adopt an Agriculturist – Many teachers find it educational to have someone involved in agriculture "adopt" their class. The students correspond regularly with the farmer or rancher and his/her family to practice writing skills and learn about the day-to-day operation of the farm or ranch. The family may send photographs or videotapes, grain or feed samples and other items from the farm or ranch. In turn, the students can write to the family to ask questions or react to what they have learned.

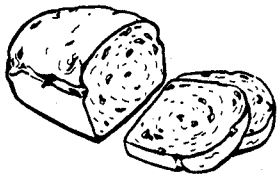
   (**NOTE:** Before students become involved, the teacher and the farm family need to set goals for the program. Establish a regular correspondence schedule to keep students interested. Try to get the farm family to visit the classroom, or schedule a student field trip to the farm.)

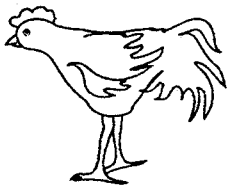
Adapted from Food for America, National FFA Organization, P.O. Box 68960, Indianapolis, IN 46268-0999

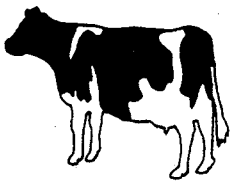
Name _____ Activity Sheet A

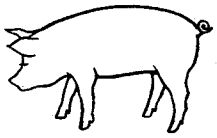
Agriculture in Your Life

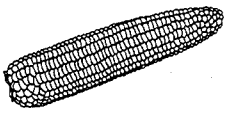
Draw a line from the picture of the food product to the picture of the plant or animal it comes from.

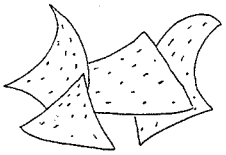


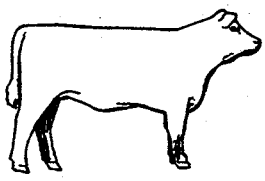


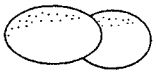












Here Come the Sunflowers!

Overview
Students will have an opportunity to learn about sunflowers and plant sunflower seeds, a native plant of the North American prairie.

Suggested Grade Level
PreK - 1

Estimated Time
40 minutes; plus daily watering and observation

Objectives
Students will be able to:

1. identify sunflowers, sunflower seeds, some foods made from sunflowers, and other uses of the plant.
2. demonstrate the basic steps in planting a seed.

Materials
1. Purchased sunflower seeds from local hardware store, garden store, or catalog; enough for 2 to 3 seeds for each student. Package labels should indicate whether or not seeds are pretreated with a fungicide or pesticide. **Use untreated seeds only!** Sunflower seeds used for bird food may be used, if fresh.
2. Plastic or paper cups as seed pots with drainage holes punched in bottoms plus waterproof tray on which to set them..
3. Small amount of real soil is preferable; otherwise purchased potting soil.
4. Windowsill to place seed pots, or a bright lamp.
5. Spray bottles with water.
6. Representative food products (oil, snacks, etc.) from grocery store. (optional)

Background
The sunflower (*Helianthus annuus*) is believed to have been domesticated from wild sunflowers around 1000 B.C. in the western United States. The wild sunflower plant is highly branched with small seed heads and small seeds in contrast to the large seed head of the domesticated sunflower. One reason the sunflower is grown so widely is its relatively short growing season, generally

requiring 90 to 100 days from planting to maturity in the north-central United States, and somewhat longer for longer-season varieties grown farther south.

Sunflower heads consist of 1,000 to 2,000 individual flowers joined together by a receptacle at the base. The large petals around the edge of the head are actually individual ray flowers, which do not develop seeds. Pollination and seed development begin at the periphery of the grain head and move toward the center. It usually takes about 30 days from the time the last flower is pollinated to seed maturity.

A well-known sunflower characteristic is that the flowering heads track the sun's movement, a phenomenon known as heliotropism. Most new varieties have heads that droop down to face the ground as the plants mature. This helps reduce damage from birds and from diseases that could occur if water collected in the sunflower heads.

Uses of Sunflowers

Food – Most United States production is devoted to the oilseed sunflower, while a smaller percentage is grown for whole-seed confectionary uses, such as candy, snack food, and baked goods. Vegetable oil is the main use for sunflowers in the United States and worldwide. Sunflower oil is considered premium oil due to its light color, mild flavor, low level of saturated fats, and ability to withstand high cooking temperatures.

Ornamental – Many people grow sunflowers in backyard gardens during the warm growing season, both for food and ornamental purposes. In recent years, the sunflower has become extremely popular with gardening enthusiasts, encouraging seed companies to produce a wide selection of sunflowers with ornamental qualities for cut-flower display, and attraction for birds and wildlife.

Birdseed – Another well-known use of sunflower seed in the United States is for birdseed, most typically mixed with millet and other grains. The black oilseed varieties are also sold separately, and usually are favored by birds over the striped confectionary seeds. The high oil content of sunflower seeds provides an excellent source of energy for birds.

Livestock – Sunflowers are sometimes used as livestock feed and, in recent years, the chopped stalks have been determined to be a reasonable silage crop.

Industrial – Although the sunflower has the potential for many industrial uses, in the United States, it is mostly used for food or feed purposes. Sunflower hulls have a limited market for specialty purposes such as poultry litter, fireplace logs, and other high fiber products. Sunflower oil has been researched as a potential diesel fuel substitute.

Activity

1. Give each student 2 to 3 sunflower seeds in a small container. Have them examine the seeds carefully. Ask what they will need to plant the seeds.
2. Pour a small amount of soil onto each student's desk or into his or her hands. Have students describe the soil. What is it made of? What color is it? How does it smell?
3. Pass out planting containers with drainage holes and have each student write his or her name on the containers. Have students fill the containers almost to the top with dampened soil. Provide spray bottles of water to moisten soil.
4. Have students poke a hole for each seed about one inch deep into the soil, place a seed in each hole and cover it lightly with soil.
5. Place the pots on a tray in a sunny window and water them when soil is dry to the touch. Check containers daily to avoid excessive drying if placed near a heating device or in the hot sun.
6. In 5 to10 days plants will emerge in each container. If more than one seed germinates, have students carefully cut out all but the healthiest plant.
7. Hand out Activity Sheet A. Have students color the pictures, cut them out, and paste them in the proper order to complete the cycle.
8. Hand out Activity Sheet B. Have students color the pictures, cut them out and use as sequencing cards.

Extensions

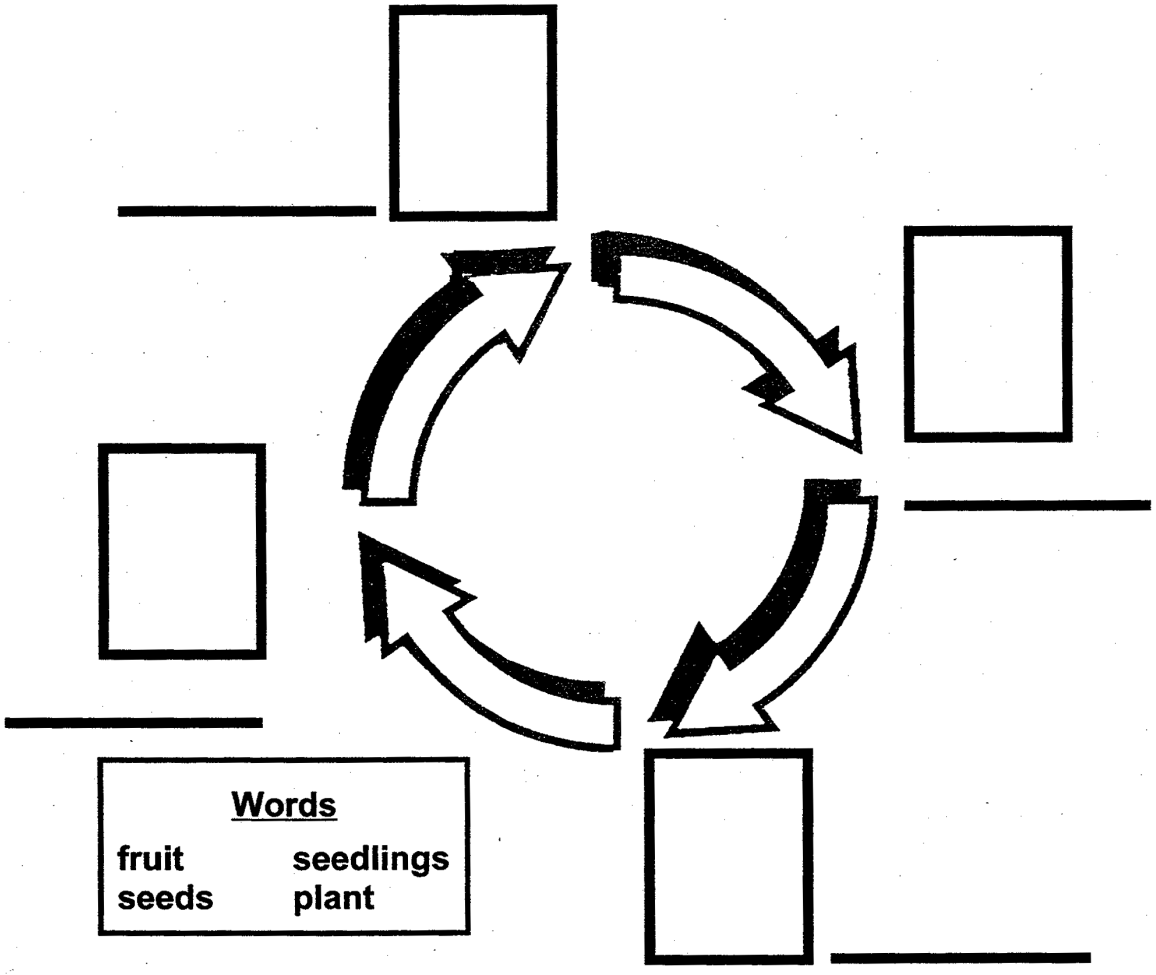
1. Shell and eat some sunflower seeds from the grocery store. Remember that seeds for planting may have been treated with pesticides. **Do not eat treated seeds!** Purchase only seeds that have **not** been pretreated.
2. Have students make calendars to keep a record of their plants' development. Take pictures of plants daily, especially during the seed germination period. Show pictures of sunflowers from seed catalogs, magazines, etc.
3. Have students look at home for sunflower products or other seed products they have eaten in the past few days. Examples may be sunflower oil, sunflower seed in packets for cooking or snacks, trail packs containing sunflower seed, cookies or cakes using sunflower seeds. (Teacher may bring in examples of products instead.)
4. Invite a local neighborhood gardener, gardening parent, greenhouse owner, county extension agent, or Master Gardener to visit the class and offer tips for growing healthy plants, including sunflowers.
5. If possible, take a field trip to a greenhouse, farm, or landscape nursery that grows and/or sells sunflowers.

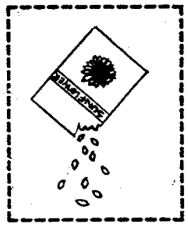
Adapted from Oklahoma Ag in the Classroom, Department of Agricultural Education, Communications and 4-H Youth Development, Oklahoma State University, Stillwater OK 74078

Name _____ Activity Sheet A

Here Come the Sunflowers!

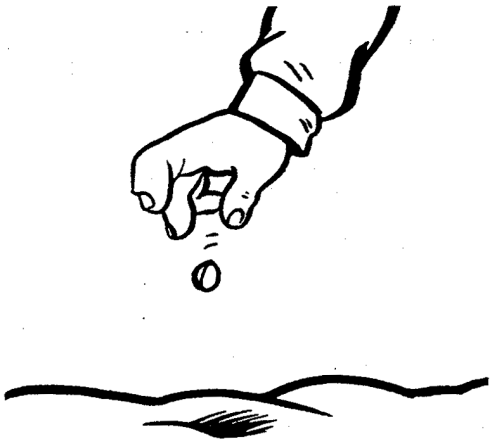
Cut out the pictures at the bottom of the page. Paste them in order in the boxes to complete the cycle. Then write the correct word in the space provided.

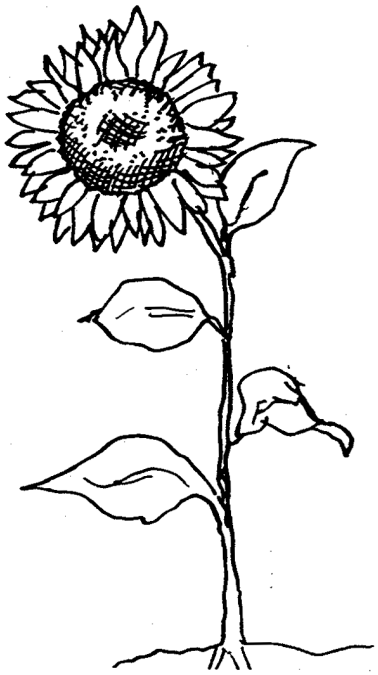




Name _____ Activity Sheet B

Here Come the Sunflowers!





Making Pretzels

Overview
People use plants for food. This lesson provides students with a first-hand experience about a familiar food (pretzels) that is made from wheat grains.

Suggested Grade Level
PreK - 1

Estimated Time
60 minutes

Objectives
Students will be able to:

1. describe an example of how people use plants for food.
2. demonstrate that plants provide food products by grinding wheat seeds into flour and using the flour to make pretzels.

Materials
1. Half pound of wheat seeds (often called wheat berries) from a health food store or bulk food department of the supermarket. (If unavailable, use the amount of whole wheat flour listed in the recipe and explain how wheat is ground into flour.)
2. Other ingredients listed in the recipe on page T-4.
3. Electric coffee grinder, hand cranked meat grinder, food processor (metal blade), or mortar and pestle, measuring cups, large mixing bowl, long handled wooded spoon, clean table to roll out dough, 2 baking sheets, and access to a baking oven.
4. Stalk of wheat from a florist or craft store (optional)
5. Activity Sheet A

Background
Although most young children can recognize a plant's roots, stems, leaves, flower buds, fruits, and seeds, they may not understand the function of all these parts. Likewise, few children can identify the plant sources of common foods, fibers, and building materials.

Children usually define plant parts according to their shape and position rather than their function. Emphasize that people eat many different parts of plants.

You can either accept the way children classify foods or explain the scientific classification. For example, many children will call potatoes "roots" because they grow underground, although potatoes are really underground stems that store food.

The following are examples of foods that are seeds: barley, buckwheat, corn, popcorn, oats, rice, wheat, peas, chick peas, lentils, dried beans, peanuts, soybeans, almonds, chestnuts, coconuts, hazelnuts, pecans, pine nuts, pistachios, cashews, walnuts, sesame, sunflower, anise, caraway, dill, nutmeg, peppercorns, cacao (cocoa, chocolate), carob, coffee, vanilla.

Activity

1. Read the following story:

We Eat Wheat

In the fall, a farmer planted wheat seeds. (Pass one wheat seed to each child.) All winter, the seeds lay in the ground. During the winter and spring, rain fell and soaked into the ground. When the weather got warmer, the seeds spouted and wheat plants began to grow. (Show picture 1. T-5) More rain fell, and the roots of the young wheat plants grew into the ground. Water went into the roots and up the wheat plants' stem into the green leaves. Air went into tiny openings in the leaves. The wheat plants did something that we can't do. With the water, the air, and the energy from sunlight, the plants made food that they used to help them grow taller and taller. (Show picture 2. T-5)

In the summer, the wheat plants used some of their food to make seeds like the ones in your hands. Then the wheat plant looked like this. (Show picture 3. T-5, or a wheat stalk with ripe grain.) Look carefully. How many seeds would you guess are on one plant? Measure half a teaspoon of wheat seeds to show about how many wheat seeds are in one head of wheat.

The farmer cut down the ripe wheat plants with a big machine called a combine. (Show picture 4. T-5) The wheat seeds were knocked off the plants and stored in big tower called a grain elevator. A train pulled a clean freight car in front of the grain elevator and the wheat seeds were sent down a chute into the freight car. The train took the wheat to the factory. At the factory, a machine ground the wheat seeds very finely into flour. The flour was put in bags and taken to grocery stores.

What might happen next? (We could buy the flour.)

What could we make with the flour? (Pancakes, pizza crust, bagels, cake, bread, pretzels.)

2. Tell the students that they will use flour and other ingredients to make pretzels. While the pretzels bake, the class can continue to make up the story about wheat. Place the wheat seeds in the grinder and give everyone a turn grinding them to make flour. Use the freshly ground flour and additional flour to make pretzels.

3. While the students are eating their pretzels, ask them to complete the story about the wheat plant. One variation might be as follows: Our teacher went to the grocery store and bought a bag of flour. The flour came from wheat seeds that a farmer grew. We mixed the flour that we ground ourselves with the flour from the store. We measured some flour and mixed it some other ingredients. We kneaded the dough and rolled it into ropes. Each of us made a pretzel from a piece of the dough. We baked the pretzels and ate them. They tasted good. We were eating the seeds of the wheat plant. The food the wheat plants made and stored in their seeds are food for us. When we ate the pretzels, the wheat became part of us!

4. The students could draw pictures and write stories to explain how they ground the wheat seeds and baked pretzels.

5. Students may use Activity Sheet A to tell stories about making pretzels and/or color and cut out to make sequencing cards.

Adapted from Project LEAP: Learning about Ecology, Animals, and Plants, College of Agriculture and Life Sciences, Cornell University, Ithaca, NY 14853

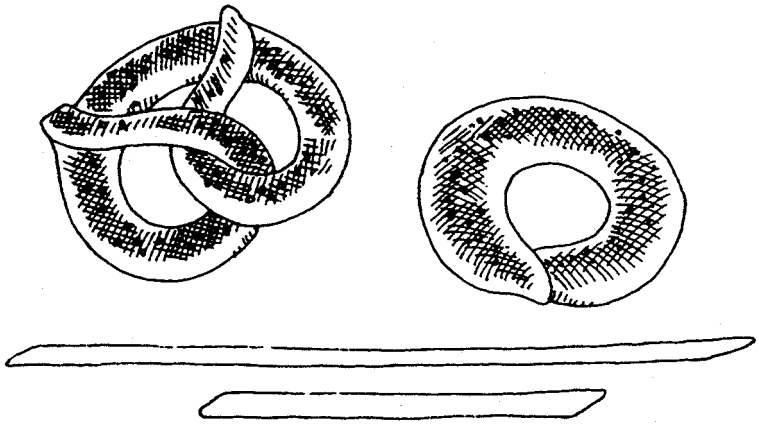
Soft Pretzels

4 cups all-purpose flour
4 cups whole-wheat flour
2 packages active dry yeast
2 teaspoons salt
2 2/3 cups very warm water (120˚ to 130˚)
6 tablespoons vegetable oil
2 tablespoons honey or sugar
2 tablespoons poppy or sesame seeds

Directions

1. Preheat oven to 425 degrees.
2. Lightly grease 2 baking sheets.
3. Stir together 2 cups all-purpose and 2 cups whole wheat flour, yeast, and salt.
4. Add water, vegetable oil, and honey, and beat 3 to 4 minutes with spoon.
5. Add 2 cups whole-wheat flour and enough additional all-purpose flour to make a soft yet manageable dough. Knead 8 to 10 minutes until smooth, adding more flour if necessary.
6. Divide dough into 24 equal portions and roll each into a 15-inch rope with slightly tapered ends. (See illustration below)
7. Roll lightly in seeds and shape into a pretzel and pinch ends to top to keep together.
8. Place on greased baking sheets and bake for 15 to 20 minutes.

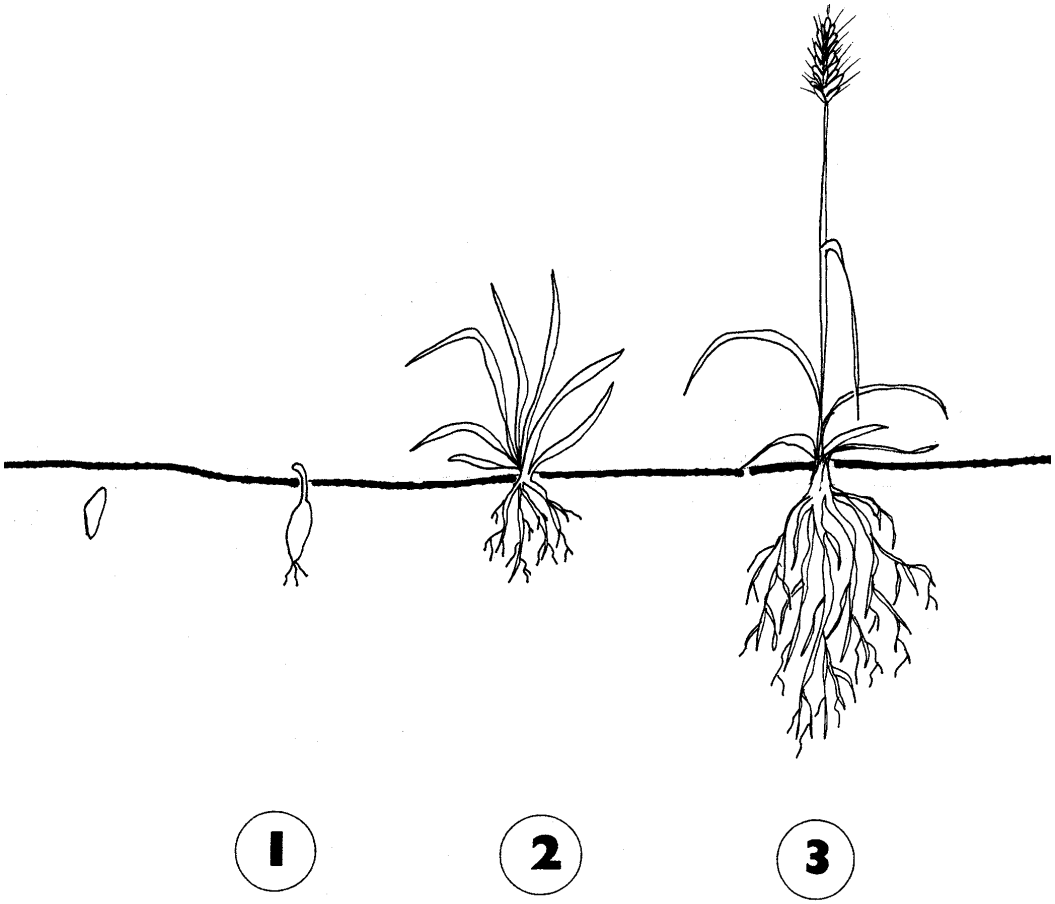
Yield: 24 pretzels



From Patricia F. Thonney and Carol A. Bisogni, "Now You're Cooking." Ithaca: Division of Nutritional Sciences, Cornell University, 1988. Reprinted with permission.

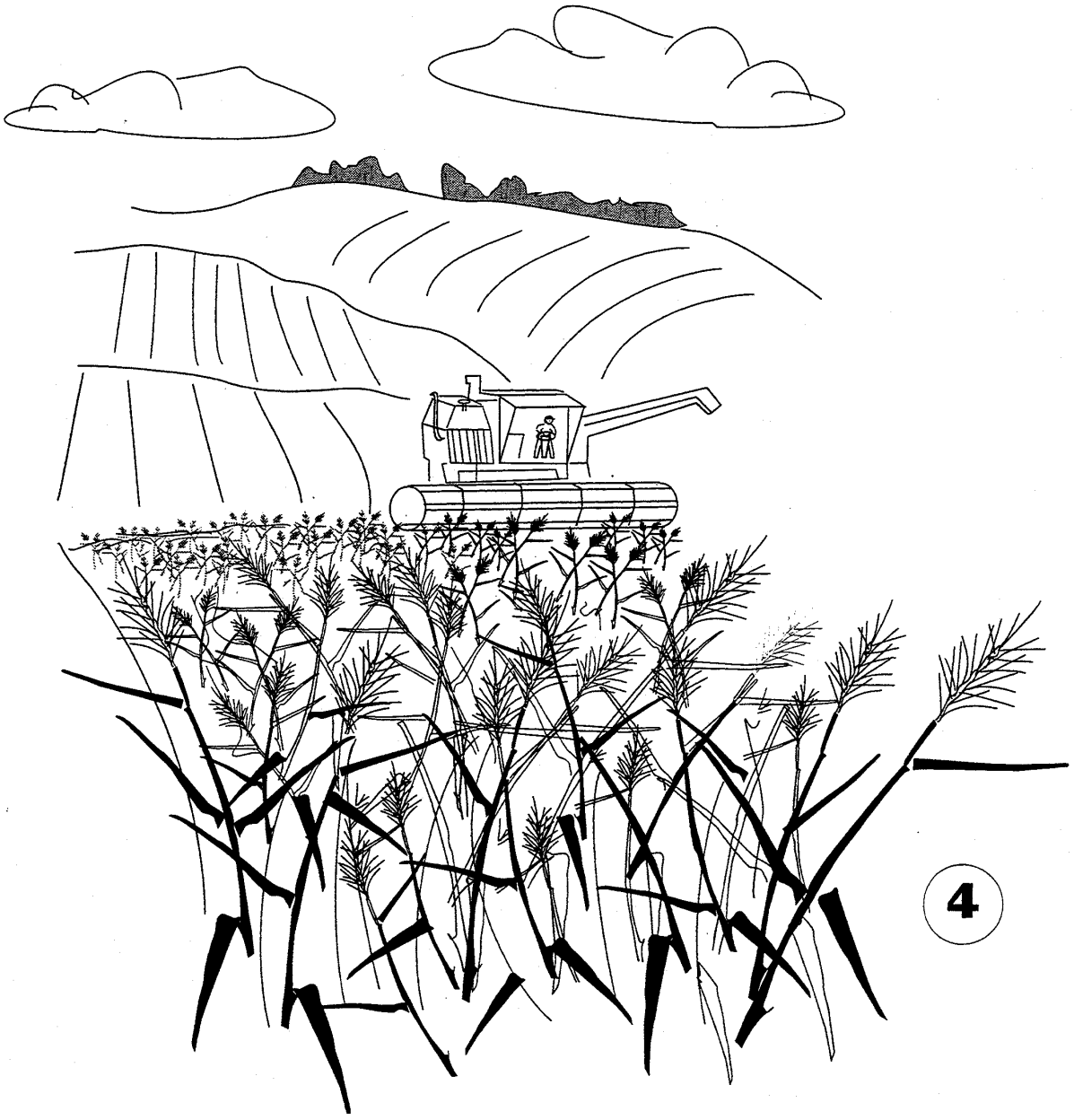
Making Pretzels

Stages in the Growth of Wheat

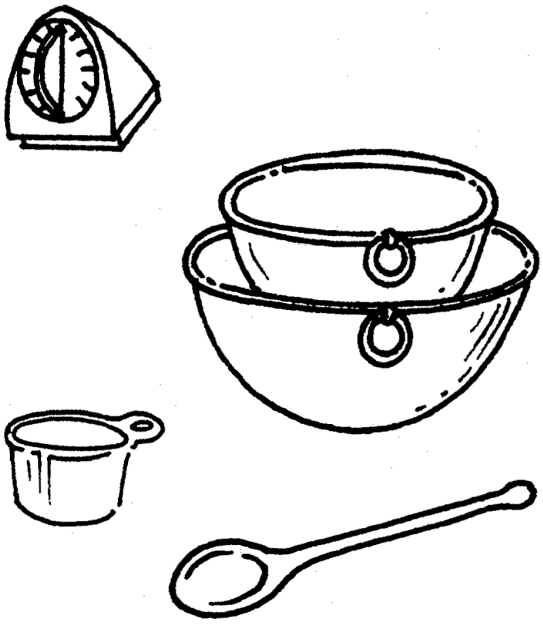


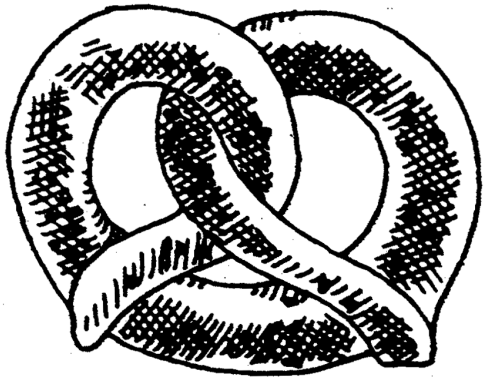
Making Pretzels

Stages in the Growth of Wheat

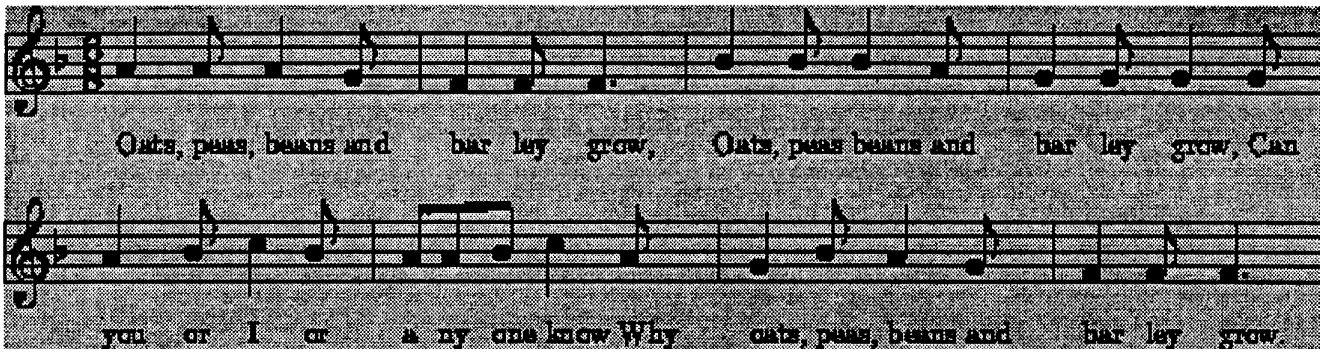



Flour





Oats, Peas, Beans and Barley Grow



(do the motions while singing)

Oats, peas, beans and barley grow,
Oats, peas, beans and barley grow,
Can you or I or anyone know
How oats, peas, beans and barley grow?

First the farmer sows his seed,
Stands erect and takes his ease,
Stamps his foot and claps his hands,
And turns around to view his lands.

(Repeat First Verse)

Next the farmer waters the seed,
Stands erect and takes his ease,
Stamps his food and claps his hands,
And turns around to view his lands.

(Repeat First Verse)

Next the farmer hoes the weeds,
Stands erect and takes his ease,
Stamps his foot and claps his hands
And turns around to view his land.

(Repeat First Verse)

Last the farmer harvests his seed,
Stands erect and takes his ease,
Stamps his foot and claps his hands
And turns around to view his land.

(Repeat First Verse)

Prairie Scavenger Hunt

Overview
While visiting the "Listening to the Prairie" exhibition, students will search the exhibit panels to locate common animals, flowers, and insects. This activity will encourage students to slow down, carefully observe, and "listen to" the contents of the exhibit.

Suggested Grade Level
PreK - 1

Estimated Time
20 – 30 minutes

Objectives
Students will be able to:

1. identify common animals, flowers, and insects found on the prairie.
2. work in teams, follow directions, and practice observation skills.

Materials
Activity Sheets A & B

Background
Listening to the Prairie; Farming in Nature's Image is about agriculture in the North American prairie and the forces of change that turned vast grasslands into one of the most productive agricultural lands on earth. It reveals the relationship between prairie ecology and new ways to grow food.

The Fruitful Prairie – More than 25 percent of America's productive cropland, pastureland, and rangeland are located in the North American prairie.

The Prairie Ecosystem – In its natural state, the prairie is a complex, fragile, and dynamic ecosystem that has sustained a diversity of plant and animal life for thousands of years.

From Native Grasses to Cultivated Grains – Deep fertile soils and a favorable growing climate influenced 19th and 20th century farmers to cultivate the prairie

by replacing native grasses with profitable grains and legumes such as wheat, corn, barley, rice, and soybeans.

Forces of Change – Natural forces, such as wind and fire, and human forces, including agriculture and technology, have altered much of the prairie ecosystem.

Sustainable Agricultural Practices – By listening to and observing nature, some farmers and ranchers have adopted practices that keep their operations productive and profitable, while protecting a diverse prairie ecosystem for future generations.

If history is our guide, some of today's alternatives will be tomorrow's accepted practices. Discover these principles and more. Explore how they affect you and your community.

Activity

1. Divide class into teams or small groups of two or three.
2. Distribute Activity Sheets A & B to each group.
3. Have each group search for the items and remember where they found them.
4. Walk together as a class or group through the exhibit and have the students point out the items they have found. Discuss the plants, animals, insects, etc. with the students, and what role these items play in the prairie ecosystem.

Items: ladybug, monarch butterfly, sun, sunflower, windmill, horse, deer, cow, pig, chicken, hawk, bison, tractor, grasshopper, field mouse, snake, corn, wheat, fox, coyote, fire, prairie dogs, grass, human – 24 total.

NOTE: There is at least one of every item in the exhibit, but the exact number of each item is not given. The number of items the students find will satisfy the activity.

Extensions

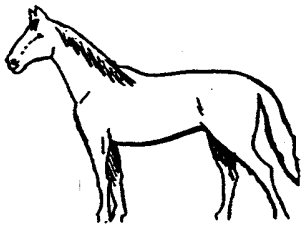
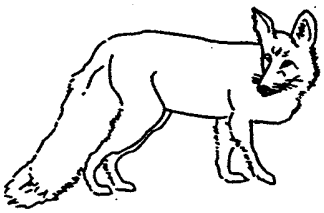
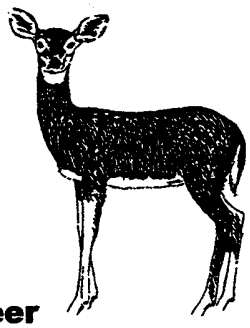
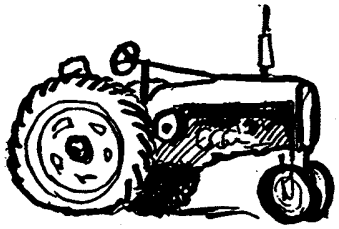
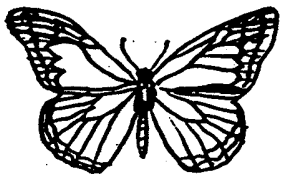
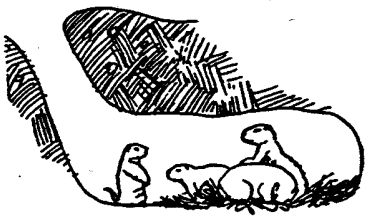
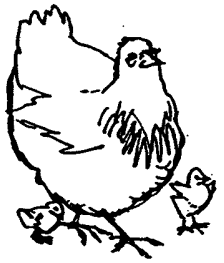
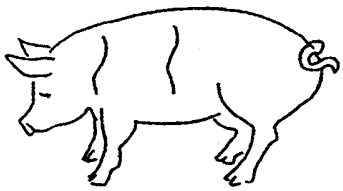
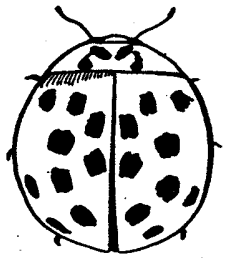
1. Have students color the illustrations either before or after visiting the exhibit.

2. Have each group of students select one or two items they have found in the exhibition, find out more information about each and share with the class.

Name _____ Activity Sheet A

Prairie Scavenger Hunt

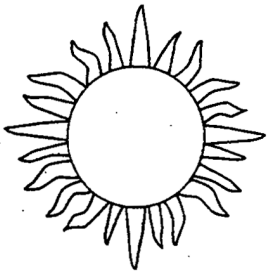
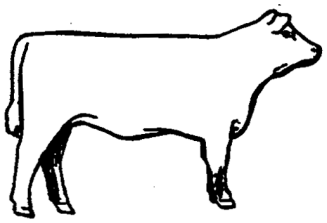
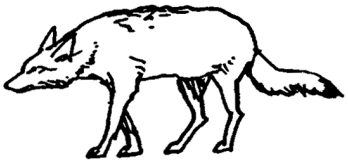
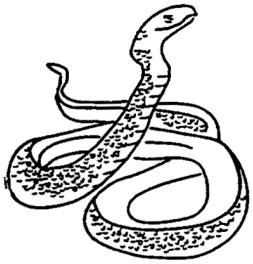
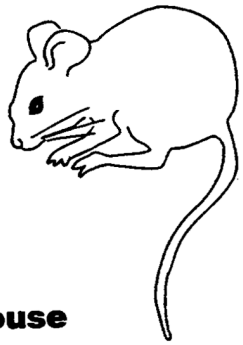
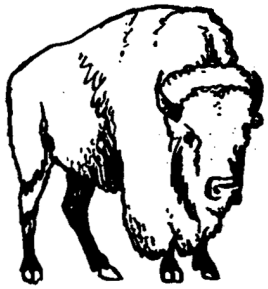
Find as many of the items on this sheet as you can in the exhibit. Write down the number you found in each box. Try to remember where you found them!

 **Horse**	 **Fox**	 **Deer**
 **Tractor**	 **Human**	 **Hawk**
 **Monarch butterfly**	 **Prairie dogs**	 **Fire**
 **Chicken**	 **Pig**	 **Ladybug**

Name _____ Activity Sheet B

Prairie Scavenger Hunt

Find as many of the items on this sheet as you can in the exhibit. Write down the number you found in each box. Try to remember where you found them!

 **Sun**	 **Corn**	 **Beef cattle**
 **Wheat**	 **Coyote**	 **Sunflower**
 **Snake**	 **Windmill**	 **Mouse**
 **Grass**	 **Bison**	 **Grasshopper**

Worm Watching

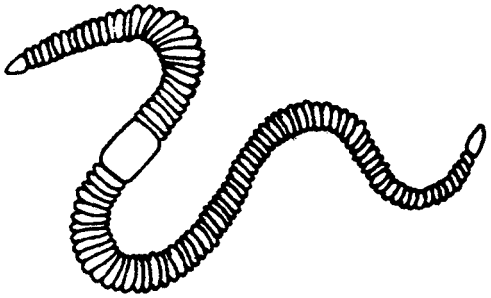
Overview
Over a period of a week to ten days, students will have the opportunity to observe the unique role earthworms play in building soils.

Suggested Grade Level
PreK – 1

Estimated Time
45 minutes plus observation and discussion time after 7-10 days.

Objectives
Students will learn how earthworms help build good soil.

Materials
1. One-gallon glass jar with holes in the lid
2. Loose soil (preferably top soil)
3. Handful of earthworms (at least six)
4. Lettuce
5. Grass clippings
6. Decaying leaves
7. Black or dark paper
8. Tape



Background
Earthworms are very important to agriculture. They improve the topsoil and make it healthier for plant growth. The tunnels earthworms make in the soil help air and water and insects move the soil. Earthworms actually eat the soil and dead organisms in the soil. They digest the parts of the soil their bodies need and excrete what they don't need. The parts they excrete, called castings, are much richer in minerals after they have been through the worm's digestive system. The average earthworm produces its own weight in castings every 24 hours. According to the *USDA Yearbook of Agriculture*, the earthworms in one acre of land can bring to the surface as much as 20 tons of soil in one year (one acre is just about the size of a football field and one ton is 2,000 pounds).

Earthworms are found everywhere on earth, except at the north and south poles. European settlers brought earthworms to North America in the 17th and 18th centuries. If earthworms existed in North America prior to this, they probably became extinct during the last ice age that ended about 10,000 years ago.

Earthworms can be so tiny you can't see them without a microscope, or they can be several feet long. There are many different types of earthworms. They are called by many names including orchard worms, rain worms, angleworms, red wigglers, night crawlers, and field worms.

The earthworm has no head, no eyes, no teeth and no antennae. Its body is made up of many ring-like segments. There is a swollen band, lighter in color than the rest of the body, at the front of the earthworm's body.

You can usually find earthworms near the surface of the soil after it rains. They will die if they dry out and do not like strong light. Earthworms are very sensitive to chemicals. Some people raise earthworms to sell as fish bait or to help enrich poor soil.

Activity

1. Fill the gallon glass jar loosely with damp topsoil, leaving at least two inches at the top.
2. Share background material, and allow students to examine the worms and draw or describe what they see.
3. Place the worms in the jar, and cover them with lettuce and grass clippings or decaying leaves. Wrap the jar with the dark paper, and tape it in place.
4. Leave jar in a cool, dark place for at least a week. Have students take turns dampening the soil if needed and adding more food as the lettuce and other materials disappear. Do not disturb the jar for at least a week.
5. Have students draw pictures of the earthworms and predict what will happen in the jar.
6. After 10 days, unwrap the jar and have the students observe what the worms have been doing. Have them draw pictures of the tunnels the worms dug.
7. Take the jar outside on a warm day, and carefully dump the contents onto a flower garden or some other spot where the worms can work their way back into the earth. Have students gently probe the soil and look for signs of the food they had placed in the jar over the past 10 days.

Extensions

1. Set up another jar, and feed the worms different kinds of organic materials (shredded paper, bread crumbs, thin apple slices, grated orange peel). Earthworm breeders use a mixture of cornmeal and coffee grounds. Have students keep record of how fast each item disappears and make simple bar graphs to demonstrate their data.

2. Have students brainstorm about how the earthworm got each of its names. (See background). Have each student choose a name and write a story about it.

3. If your class has started a compost pile, wait until it has had time to start decomposing, and then have an earthworm hunt. Students may use sticks, large spoons or garden trowels to dig gently through the compost. Have them look especially for wormlets (tiny thread-like baby worms about one-sixteenth of an inch long – best viewed through a hand lens).

Adapted from Oklahoma Ag in the Classroom, Department of Agricultural Education, Communications and 4-H Youth Development, Oklahoma State University, Stillwater OK 74078

The Web of Life

Overview
Students construct a food web to learn how all living things in an ecosystem are interconnected and energy for life comes from the sun.

Suggested Grade Level
PreK - 1

Estimated Time
30 - 40 minutes

Objectives
Students will be able to:

1. show how plants and animals get energy, by telling other students which plants and animals are eaten by other animals.
2. explain that energy for life comes from the sun.
3. explain how all living things depend directly or indirectly on green plants for food.
4. use pictures and arrows to create a food web that includes the sun, green plants, and animals from the prairie.

Materials
1. Ball of yarn
2. Pictures of prairie plants, animals, and humans
3. Tape to attach pictures to clothing
4. Space for the class to form a large circle

Background
Living Things Need Energy From Food

Energy can be defined as the capacity for change. Living things need energy for everything they do. For example, a butterfly needs energy to change position when it flies, and a daffodil needs energy to change size as it grows and blooms.

All living things get energy from food. Green plants use energy from the sun to make their food. Plants use the food they make for energy to grow. Animals get energy by eating plants or other animals.

The Sun is the Source

The energy in living things originates from the sun. Green plants are the only living organisms that can use the energy from the sun to make food.

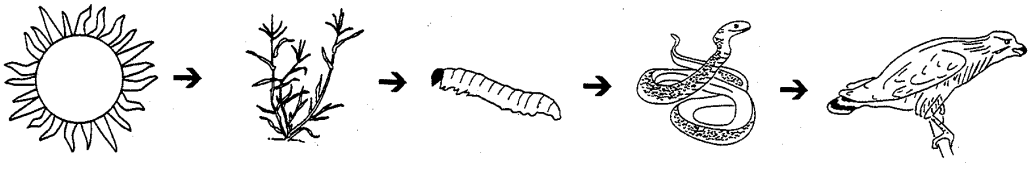
Although many children know that the sun keeps plants healthy, they may not know that plants rely on the sun's energy to make food, or that this food can be used by the plant itself or by animals that eat the plant. For example, a maple tree uses the sun's energy to make sugar, a food, in its leaves. The tree uses sugar for energy to grow and stay alive. If people eat maple syrup, they get energy from the sugar that was in the tree. But people cannot hold out their hands to the sun and make food in the same way that a maple tree can make food in its leaves.

Children may think that the sun is important because it keeps animals warm. The sun does provide warmth to the animals, but, more importantly, the sun provides the energy that green plants use to produce food. Animals get this energy when they eat plants. To help students understand that animals depend on the sun for food energy, have them think about how long a deer could live if it only basked in the sun and did not eat green plants. The relationship between the sun's energy and the energy required by living things will become clearer as the children learn about food chains and webs.

Children may cling to the idea that plants draw in usable food from the soil through their roots. It is true that plants absorb water and essential minerals from the soil and that they need water to make food. Food contains energy, however, and the water and minerals in the soil do not contain energy. So plants use the energy from the sunlight plus the water and minerals from the soil along with carbon dioxide from the air to produce food that contains energy.

Food Chains

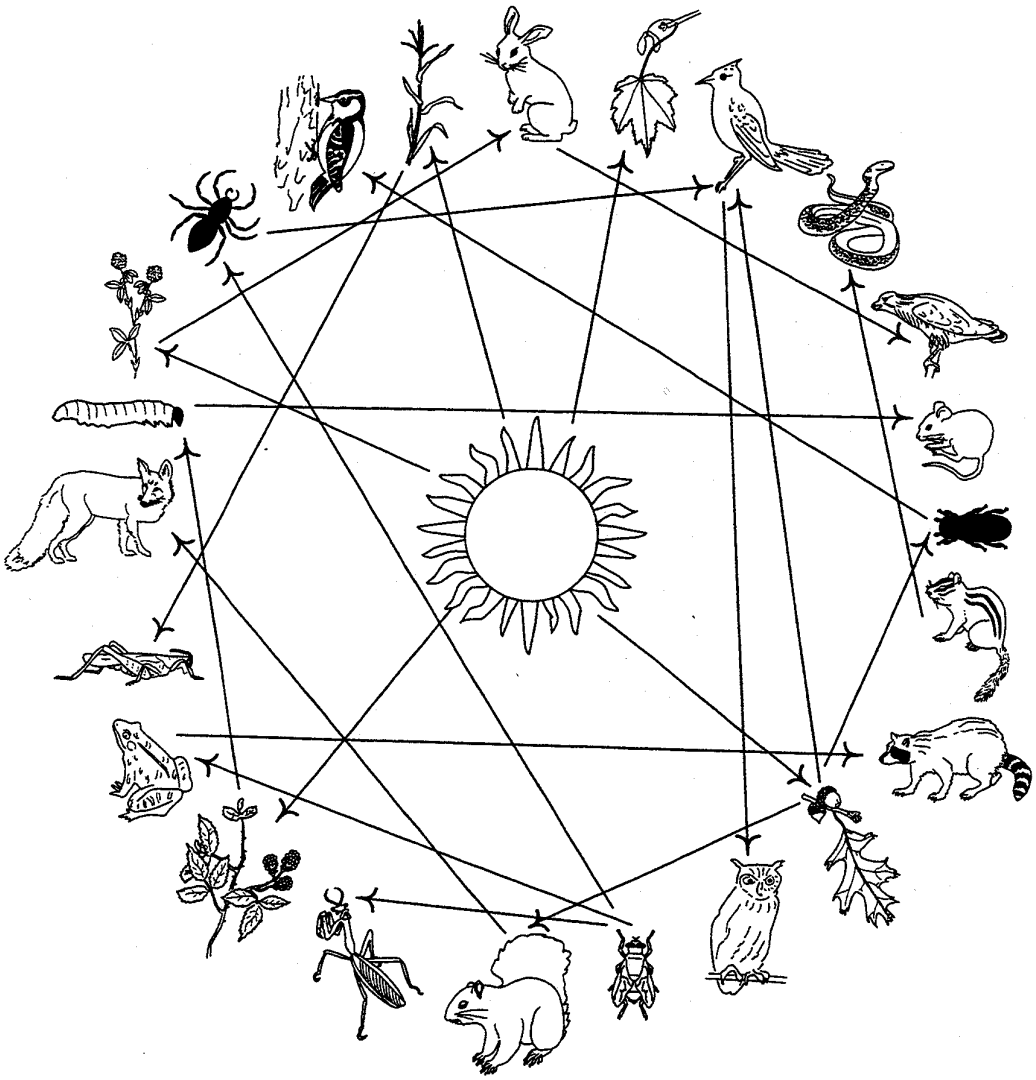
A food chain's energy is transferred in sequence; for example, energy from sunlight, to green plants, to animals that eat plants, and to animals that eat other animals. Green plants use the sun's energy directly to make food. When animals eat green plants and other animals eat those animals, the energy moves from one living thing to another along the food chain. Animals that eat plants are called herbivores, animals that eat both plants and animals are called omnivores, and animals that eat *only* other animals are called carnivores: Ultimately, all members of a food chain depend on the energy from the sun that green plants transform into food energy.



Arrows indicate the transfer of energy from one organism to another. The sun provides energy for the grass, the grass for the caterpillars that eat the grass, and so on.

Food Webs

Food webs are more complex than food chains. They consist of several food chains that are interconnected. The following example is a series of food chains, which together make a food web.



Activity

1. Copy, cut and pass one picture of prairie plants and animals to each student. Help students tape their pictures to their chests. The teacher should represent the sun. Be sure that there are enough plant species represented.

2. Tell the students that they will see how plants and animals are all interconnected in the prairie and other ecosystems. Have them sit in a circle and introduce themselves as the plant or animal they represent. They should look around and then tell the group:

   Who in the circle could I give my energy to? (Who might eat me?)

   Who in the circle could give me energy? (Whom could I eat?)

   This is an opportunity to talk about relationships between plants and animals and how they get their energy. Explain that humans, bears, raccoons, etc., are omnivores that eat both plants and animals.

3. Explain that the ball of yarn represents sunbeams, or energy from the sun. Hold the end of the yarn tightly and toss the ball to someone who can use that energy (a green plant). When a student representing the green plant catches the ball of yarn, he or she should hold the yarn and throw the ball to someone else who could use the energy (an animal that might eat them). For example, the sun might throw the yarn to the grass, the grass to the grasshopper, and the grasshopper to the quail. Each time have the students hold tightly to the loop of yarn. Next have students throw the ball of yarn to someone that either they give energy to **or** they get energy from. The quail could throw the yarn to the fox (someone who takes energy from them; eats them) or to the caterpillar (someone they get energy from; something they eat). NOTE: Most of the action will take place between the plants, the sun and the herbivores (animals that eat plants) It takes many energy transfers to get to the carnivores (animals that eat other animals).

   After the ball of yarn has been passed to everyone at least once, and the plants and the sun many times, explain that you have created a food web (it looks like a spider's web). This is a graphic way to show how plants and animals are interrelated in a community.

Ask:

Who is holding the most yarn? (The sun.)

Why? (Because the sun gives energy to all the plants to make food)

Who else is holding many loops of yarn? (Green plants.)

What would happen if all the green plants died? (There would be no food. Nothing else in the food web could survive.)

What would happen if one kind of plant, such as all the clover, died? (The student representing clover could drop the yarn and the food web would sag and be less complex.)

If all the clover was gone, who else may have trouble getting enough food? Who gets their energy from the clover? (Look at the sagging parts of the web to see who was holding pieces that are connected to the clover)

Why should we be concerned about each kind of plant or animal? (Because other plants and animals in the food web may depend on them. We are all connected.)

Emphasize that each group is important and applaud each in turn.

Will the carnivores (animals that eat other animals) please show their teeth?

Will the omnivores (animals that eat both plants and animals) please wave their arms?

Will the herbivores (animals that only eat plants) please stamp your feet?

Will the only living things that can make food using the sun's energy – green plants – please take a bow?

Collect the "Who Eats Who" sheets for another activity.

Extensions

1. Students can learn more about the plant or animal they represent and tell a story about the plant or animal to the class.

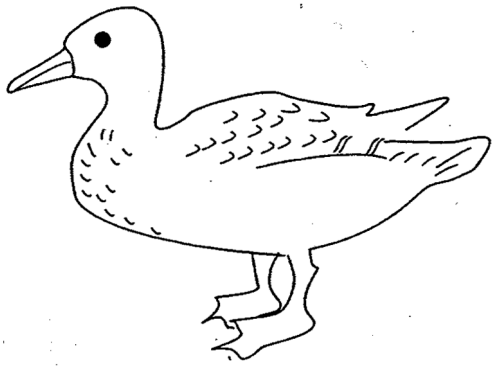
2. Have students color the plant or animal they represent prior to creating the food web.

3. Have students draw their own picture of a plant or animal from the prairie.

Adapted from Project LEAP: Learning about Ecology, Animals, and Plants, College of Agriculture and Life Sciences, Cornell University, Ithaca, NY 14853.

The Web of Life

Human



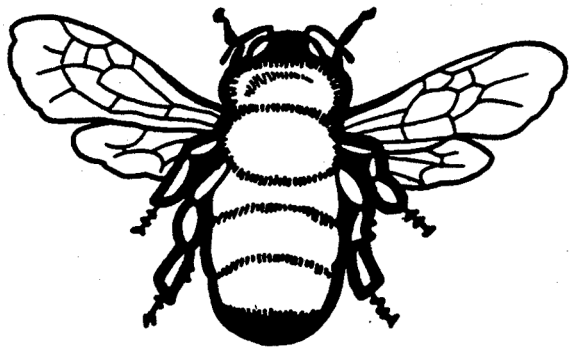
Duck

Prairie Grass

Deer

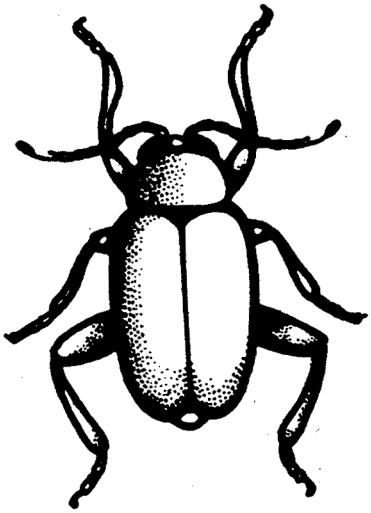
The Web of Life

Owl



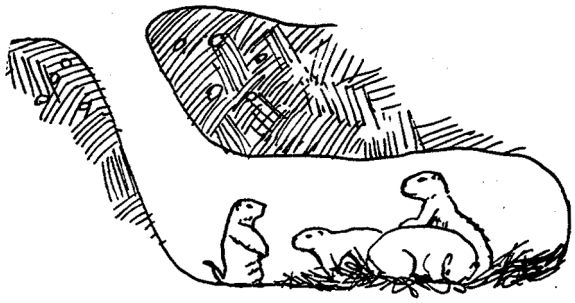
Bee

Mole

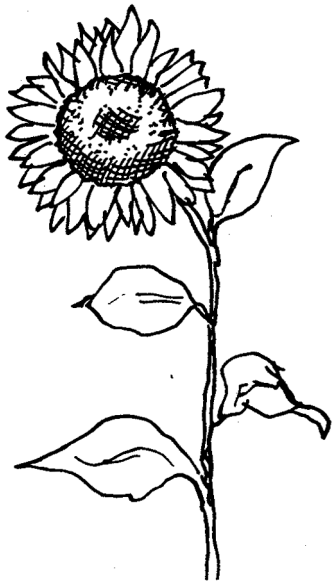


Beetle

The Web of Life



Prairie Dogs

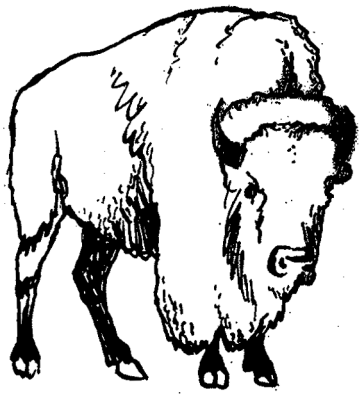


Sunflower

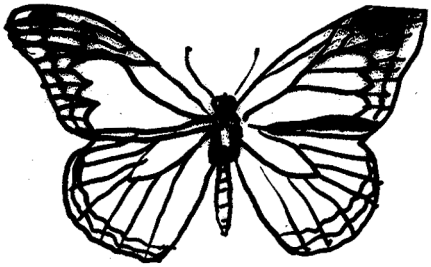
Meadow lark

Quail

The Web of Life

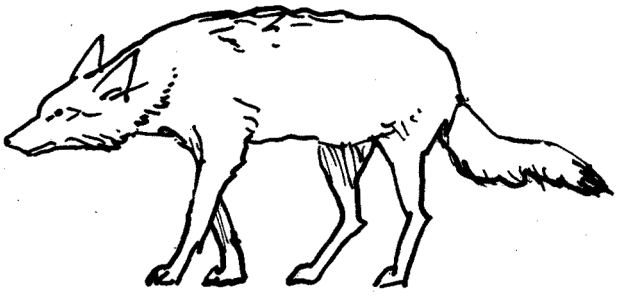


Bison



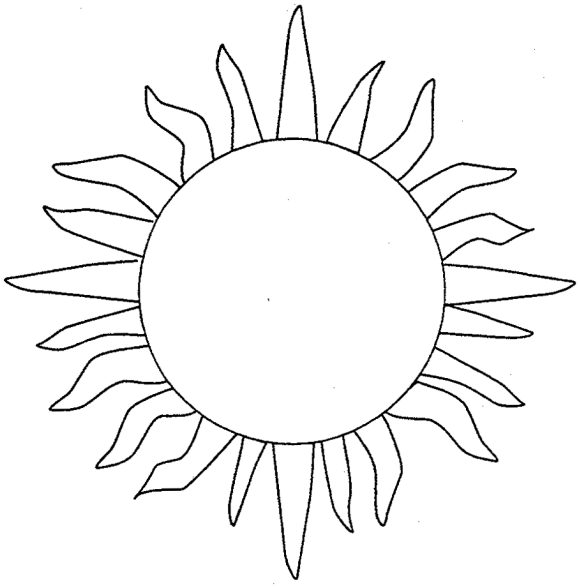
Butterfly

Aster



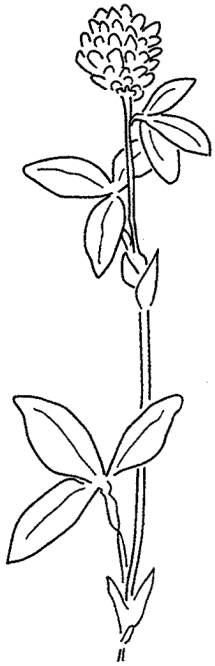
Coyote

The Web of Life

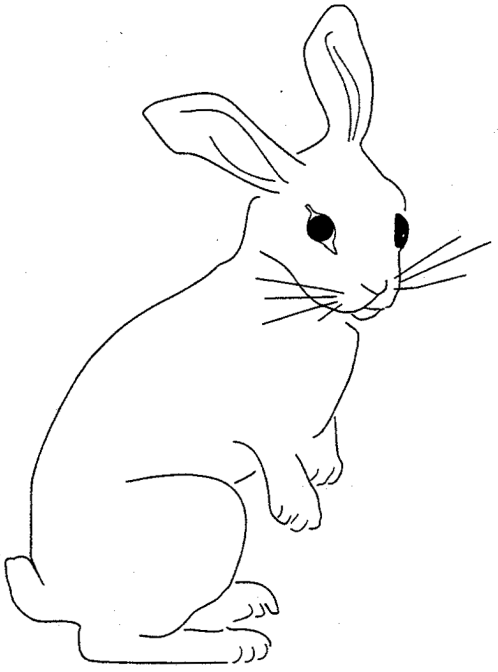


Sun

Orchard grass

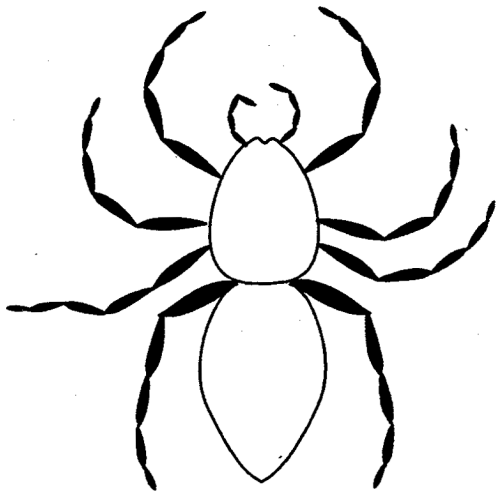


Clover

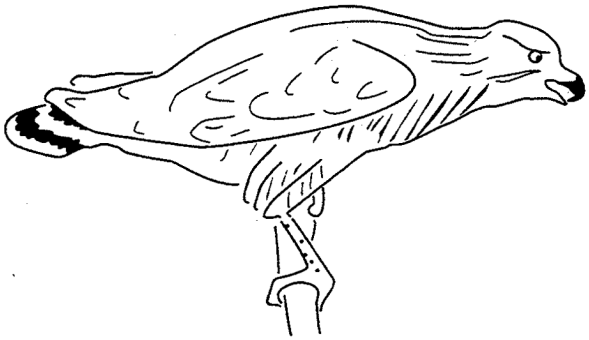


Rabbit

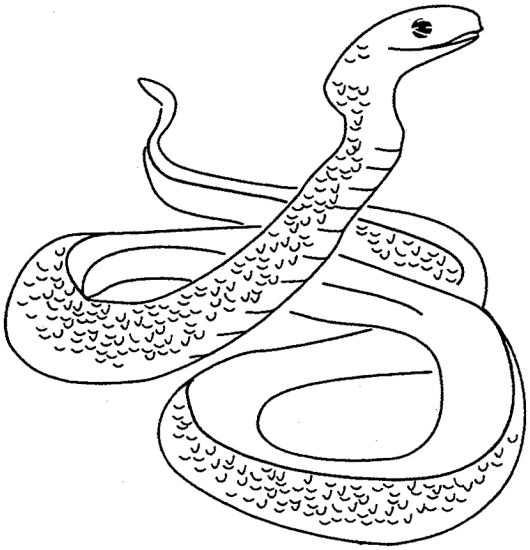
The Web of Life



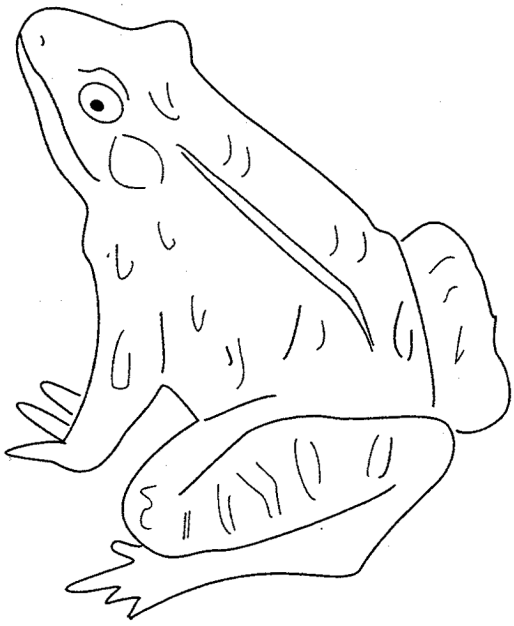
Spider



Hawk

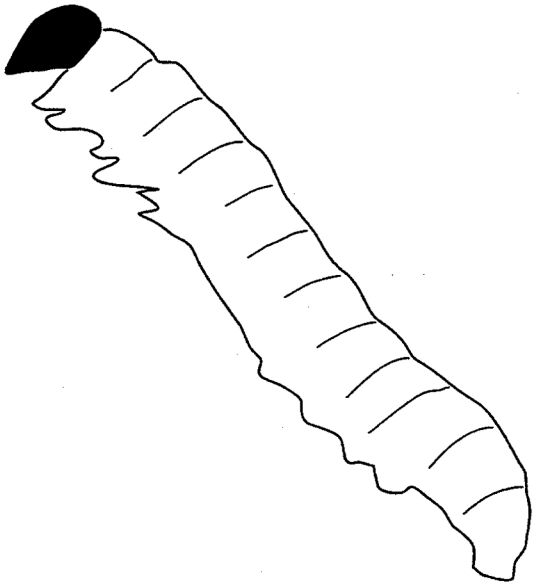


Snake

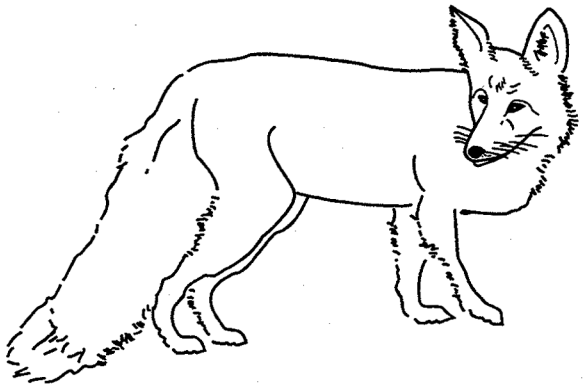


Frog

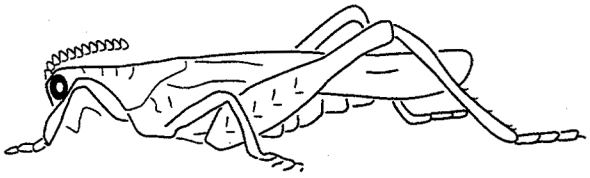
The Web of Life



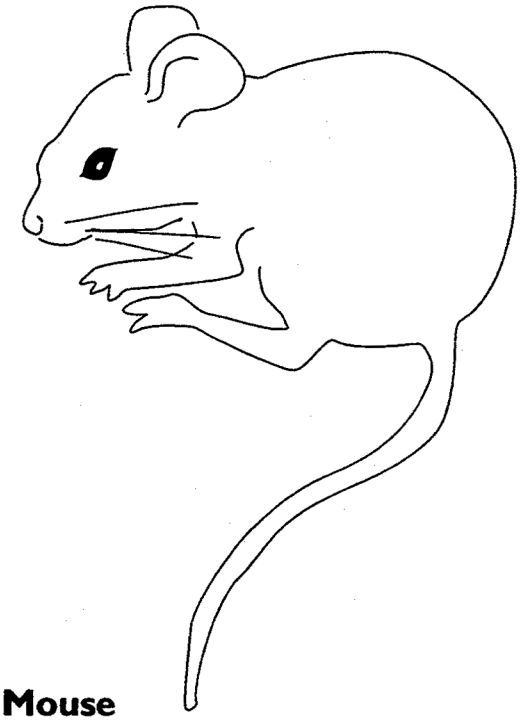
Caterpillar



Fox

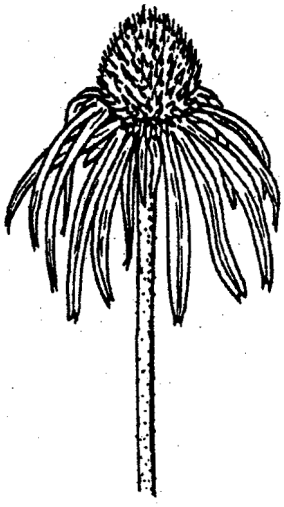


Grasshopper

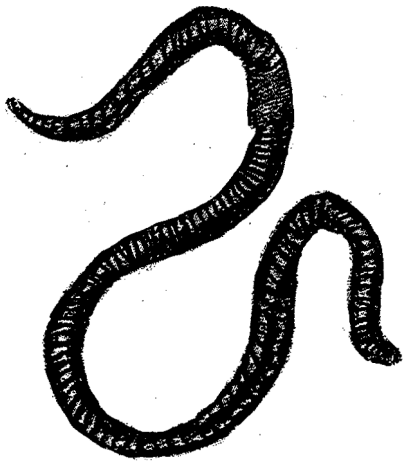


Mouse

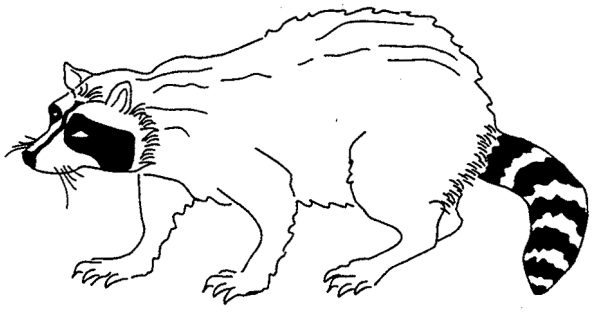
The Web of Life



Coneflower



Worm



Raccoon

Black-eyed Susan

Listening to the Prairie: Farming in Nature's Image

Lessons for Grades 2 - 5

Developed, adapted and/or compiled by:

David G. Cox
Janet E. Hawkes

New York Agriculture in the Classroom
Cornell Educational Resources Program

For the United States Department of Agriculture -
Agriculture in the Classroom Program to accompany
the Smithsonian Institution's traveling exhibition.

Listening to the Prairie: Farming in Nature's Image

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Listening to the Prairie: Farming in Nature's Image

"Agriculture is too important a topic to be taught only to the relatively small percentage of students considering careers in agriculture and pursuing vocational agriculture studies."

National Research Council

Overview

Across the United States, serious efforts are underway by educators and professionals to raise public awareness about agriculture and the many difficult challenges facing our nation's most vital and vulnerable industry. Research has shown that most Americans know very little about agriculture, its social and economic significance in the United States, and particularly, its links to human health and environmental quality. Likewise, most students have very little knowledge of the growing number of exciting career opportunities available within the agricultural industry.

Listening to the Prairie: Farming in Nature's Image, is an exhibition that will change how people think about agriculture in America. It's about growing food on the North American prairie and the forces of change that turned vast grasslands into one of the most productive agricultural lands on earth. These lands are our nation's most fertile, diverse, fragile, and endangered ecosystems, but they also serve as a model for environmentally sound agriculture. The traveling exhibition focuses on how changes in this ecosystem and other ecosystems across the country impact people and their communities. It reveals information on how a natural ecosystem works, and tells stories of farmers and ranchers who are farming in nature's image.

Ag in the Classroom

Smithsonian Institution

Sustainable Agriculture Research and Education

About These Activities

Agriculture in the Classroom, a national K-12 agriculture awareness program, is pleased to provide a series of lessons and activities to complement the Smithsonian Institution's traveling exhibition. These activities were created and compiled by New York Agriculture in the Classroom, a division of the Cornell Educational Resources Program at Cornell University in Ithaca, NY. The contents are designed for PreK-12 teachers, educators, home-schoolers, and parents who spend time with their families at libraries and learning centers. With the exception of the on-site scavenger hunts, most of the enclosed materials can be utilized before or after your visit to the exhibition.

The purpose of these activities is to serve as educational supplements to the exhibition as well as a method with which to engage students and families about the daily issues of agriculture and the food and fiber industry. Although only 2.5% of our population live on farms, all of us eat and wear products derived from agriculture every day, including many products from the North American Prairie. Since most of the United States population do not live in the prairie, the "clues from nature" emphasized in the exhibition may be applied to nearly every region of the country.

Lessons and activities have been divided into four grade-level groups: PreK-1, 2-5, 6-8, and 9-12. All of the enclosed lessons, activities, and worksheets are B&W photocopy reproducible, and clearly formatted. Each lesson contains a brief overview, objectives, a list of materials needed, background information, activity instructions, and suggestions for extensions for those who wish to further explore the lesson topic or concept. A separate chart is included that summarizes all of the enclosed lessons and the appropriate National Standards (McRel) addressed.

In addition, Smithsonian Institution's National Museum of Natural History, the American Library Association (ALA), and participating libraries have assembled an impressive program of supplementary resources, activities, lectures, tours, and workshops for visitors of all ages to enrich their visit to this important exhibition. *Consult your library staff for the calendar of events and the wealth of educational resources gathered especially for this event*.

Enjoy your visit at this most important exhibition. The lessons to explore are universal and timeless, and will serve as valuable resources in agricultural awareness and education for years to come.

Ag in the Classroom

Smithsonian Institution

Sustainable Agriculture Research and Education

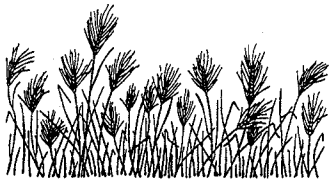
A Brief Prairie History[1]

The First Prairie Farmers – Crops have been grown on the prairie for more than 4,000 years. Native prairie farmers cultivated the soft, alluvial soils in the river bottomlands because they did not have forged metal tools to work the tough prairie sods in the uplands. They raised corn, beans, squash, pumpkins, sunflower, and tobacco in small garden plots for about twenty-five years, and then moved to new plots on a two to three hundred year rotation. Native farming communities also gathered edible wild plants and hunted rabbits, deer, and bison.

The Will of Iron – By the end of the 19th century, the North American prairie had become one of the greatest food-producing regions in the world. New machinery, new railroads, new government policies and the tenacity of new settlers made this transformation possible. The steel plow broke heavy prairie soils for planting crops. Affordable barbed wire fencing enclosed grazing and crop lands on the treeless landscape. Windmills provided a reliable water source for livestock and crops, and transcontinental railroads linked the new prairie producers with urban markets in the East and in Europe.

The Fruitful Plain – Today one American farmer feeds 143 people, more than five times that of a farmer in 1950. This phenomenal growth in production has resulted largely from technological forces of change – new machinery, new crop varieties and the development of chemical fertilizers and pest controls. Farms and ranches are also fewer, larger, and more specialized than they were fifty years ago.

New Alternatives – The willingness of the farmers and ranchers to change has been the cornerstone of successful American agriculture. What are common practices now, chemical pesticides and fertilizers, for example, were alternatives fifty years ago. Today's farmers and ranchers continue to adopt new approaches to keep their operations productive and profitable, while safeguarding the environment. If history is our guide, some of today's alternatives will be tomorrow's accepted practices.



[1] *Adapted from the final exhibition script of "Listening to the Prairie: Farming in Nature's Image."*

Smithsonian
Institution

Summary of Activities

Lessons for Grades PreK-1

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. The Web of Life – Game demonstrating interconnections between plants and animals
3. Making Pretzels – Cooking activity from grain to food
4. Agriculture in Your Life – Connecting agricultural sources to everyday products
5. Here Come the Sunflowers – Planting and growing activity
6. Worm Watching – Activity for observing worms in action
7. "Oats, Peas, Beans and Barley Grow" – Song about farming and prairie crops

Lessons for Grades 2-5

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. Weaving the Web – Game demonstrating interconnections between plants and animals
3. Losing Ground – Exploring water and wind soil erosion
4. Agriculture in Your Life – Connecting agricultural sources with everyday products
5. The Food Connection – Placing agriculture products on the Food Guide Pyramid
6. "Oats, Peas, Beans and Barley Grow" – Song about farming and prairie crops

Lessons for Grades 6-8

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. Just Passing Through – Investigating properties of soils
3. Be a Food Detective – Exploring sources of food from food labels
4. Beyond the Beef – Exploring all the products from beef cattle
5. Striking a Balance – Game demonstrating interconnections between plants and animals

Lessons for Grades 9-12

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. Exploring Soils – Investigating properties of soils
3. Be a Food Detective – Exploring sources of food from food labels
4. Striking a Balance – Game demonstrating interconnections between plants and animals
5. Farming in Nature's Image: The Larson Farm – Case study of sustainable agricultural practices

Integration with State Frameworks or Learning Standards*

Grades PreK -1

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x	x	x	x
The Web of Life			x			
Making Pretzels	x	x	x	x		x
Agriculture in Your Life	x	x	x			x
Here Come the Sunflowers			x			
Worm Watching	x		x			
"Oats, Peas, Beans, and Barley Grow"	x				x	

Grades 2-5

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x	x	x	x
Weaving the Web			x			
Losing Ground	x	x	x			
Agriculture in Your Life	x	x	x			
The Food Connection	x	x	x		x	x
"Oats, Peas, Beans, and Barley Grow"	x				x	

Grades 6-8

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x			x
Just Passing Through			x	x		
Be a Food Detective	x	x	x			x
Beyond the Beef	x	x	x			x
Striking a Balance			x	x		x

Grades 9-12

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x			x
Exploring Soils			x	x		
Be a Food Detective	x	x	x			x
Striking a Balance			x	x		x
Farming in Nature's Image	x	x	x			x

*Adapted from McRel (Mid-Continent Research for Education and Learning). For more information contact: http://www.mcrel.org/standards-benchmarks/

Agriculture in Your Life

Overview
Students will practice word manipulation while categorizing sources of basic agricultural products. Lesson extensions provide additional opportunities for students to make real connections to agriculture.

Suggested Grade Level
2 - 5

Estimated Time
20 - 30 minutes

Objectives
Students will be able to:

1. identify the original agricultural sources of basic everyday products produced around the United States.
2. identify food and fiber products outside traditional farming circles.

Materials
1. Activity Sheets A, B, & C
2. Colored pencils or crayons

Background
Agriculture plays a major part in our lives: from what we wear, to what we use in our classes, and even to what we do after school. We may not always think of agricultural products as the physical source of the items or things we use everyday. However, most daily essentials can be traced back to an agricultural source.

Production agriculture, or farming, is what most students think of when they hear the word "agriculture." This is the actual production or growing of raw commodities. People who raise and harvest crops and livestock for consumption or purchase are typically categorized as farmers and ranchers. It doesn't stop there. Production agriculture also includes a variety of specialties, such as fish, timber, fur-bearing animals, trees, shrubs, flowers, herbs and much more.

Most of the products we use everyday come from agriculture. The sheets we sleep on and the pajamas we wear are made from cotton, just like Q-tips for your ears. The feathers in pillows may come from chickens or ducks. The cereal and

milk we eat for breakfast; the pencils, crayons, and paper that we use at school; and the baseballs, bats and gloves we use after school all originate from raw agricultural products. We know that our food comes from agriculture, but we are surrounded by and reliant upon many agricultural products the whole day through.

Vocabulary/Glossary

agriculture – farming; the science, art and business of cultivating the soil, producing crops and raising livestock useful to people.
cotton – the soft, white seed hairs, which fill the seed pod of the cotton plant.
crops – agricultural products, growing, harvested, or collected; for example, wheat, cotton, fruit, honey.
dairy cows – cows raised mainly for the production of milk for dairy products.
farmer – a person who earns a living by farming, especially one who manages or operates a farm.
forestry – the science of systematic forest management for the production of timber, conservation, recreation, and wildlife.
flowers – plants cultivated for their blossoms; flowering plants.
horticulture – the art or science of growing flowers, fruit, vegetables, trees or shrubs.
livestock – domestic animals kept for use on a farm or raised for sale and profit.
rancher – a person living and working on a large farm raising livestock in large numbers.
timber – trees or forests collectively; wood suitable for building whether cut or still in the form of trees.
wheat – any of several cereal grasses having dense erect spikes containing grains which thresh free of chaff.

Activity

1. Discuss background information, then hand out Activity Sheet A. Students should match the product with its agricultural source.

   Answer Key: Activity Sheet A
   timber – paper, pencils, potpourri, houses
   dairy cow – cheese, ice cream, yogurt
   cotton – blue jeans, paper, shirts
   flower – perfume, potpourri
   wheat – spaghetti, tortillas, cereal

2. Discuss with students other products that come from agriculture.
3. Hand out Activity Sheet B. Discuss the vocabulary words and the **bold-faced** heading words listed to ensure that students understand them.
4. Review alphabetizing. Have students write the vocabulary words in alphabetic order on the lines under each heading. After students complete the exercise, they can complete the Word Find puzzle.

Answer Key: Activity Sheet B

crops – corn, cotton, rice, soybean, wheat
livestock – beef cattle, dairy cattle, poultry, sheep, swine
horticulture – apples, flowers, trees, turf grass, vegetables
dairy – butter, cheese, ice cream, sour cream, yogurt

5. Have students work on Activity Sheet C. **NOTE:** Each commodity should have a different color dot and each commodity should be marked on the United States map with its designated color.

Extensions

1. Adopt an Agriculturist – Many teachers find it useful to have someone involved in production agriculture "adopt" their class. The students correspond regularly with the farmer or rancher and his/her family to practice writing skills and learn about the day-to-day operation of the farm or ranch. The family may send photographs or videotapes, grain or feed samples and other items from the farm or ranch. In turn, the students can write to the family to ask questions or react to what they have learned.

   (**NOTE:** Before students become involved, the teacher and the farm family need to set goals for the program. Establish a regular correspondence schedule to keep students interested. Try to get the farm family to visit the classroom, or schedule a student field trip to the farm.)

2. Have students look beyond Activity C and place answers on a larger wall map of the United States. Ask students to discuss agricultural products they know are grown in certain parts of the country. For example, Florida and California: citrus fruits; Gulf of Mexico: seafood. Why are these products produced in these locations? Have groups draw these products or cut out pictures from magazines to place on the classroom map. State rankings of various common commodities are available from the USDA website <www.usda.gov>

3. Have the class construct an "occupation line" showing how many people and different occupations are involved in delivering a raw product to the consumer (transportation, manufacturing, packaging, sales, stores, etc.) Use several products including some that the consumer uses fresh (fruit, beef or chicken) and some that are changed from the raw material (clothing, furniture).

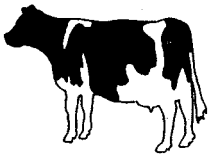
Adapted from Food for America, National FFA Organization, P.O. Box 68960, Indianapolis, IN 46268-0999.

Name _____ Activity Sheet A

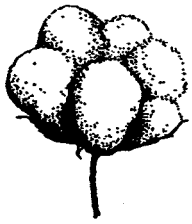
Agriculture in Your Life

Match the product on the right with the pictures of the product's agricultural source.

Timber



Dairy Cow



Cotton

Flower

Wheat

cheese

blue jeans

paper

spaghetti

perfume

ice cream

pencils

tortillas

shirts

potpourri

houses

yogurt

cereal

Name _____ Activity Sheet B

Agriculture in Your Life

Place the vocabulary words in alphabetic order under the appropriate topic.

Crops	Livestock	Horticulture	Dairy
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Vocabulary Words

beef cattle	corn	soybeans	apples
cotton	vegetables	ice cream	butter
sour cream	cheese	poultry	swine
sheep	dairy cattle	flowers	rice
turf grass	wheat	yogurt	trees

Find and circle the words in the puzzle.

butter	sheep
cheese	swine
corn	trees
cotton	vegetables
rice	wheat

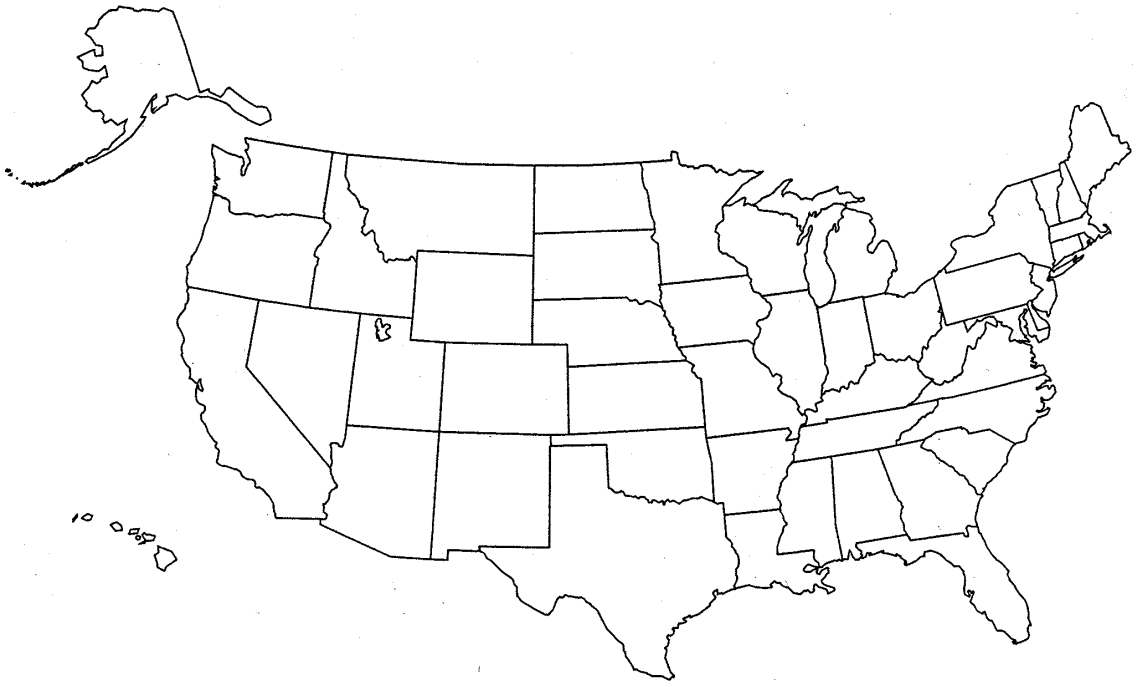
WORD FIND

c o r n a c t b o e g
o q t s n s a u m s s
t r e e s h m t r e w
t o a w h e a t w e i
o c r t l e o e f h n
n s f b m p j r i c e
v e g e t a b l e s o

Name _____ Activity Sheet C

Where in the United States does your food come from?
Where does your lunch come from?

Most states produce their own milk, eggs, fruits, vegetables, and grains. Some states produce so much of a particular crop or animal that they have become famous for their particular products. Color each small circle on the legend with a different color and then color a small circle on the map to match the products of the most productive states in the United States. **Mark each agricultural product with a different color.** Many states will have more than one colored circle. Why are these products produced in these locations?



Legend

- O Beef: Texas, Nebraska, Kansas, Colorado, Iowa, Oklahoma, and California.
- O Chickens: Arkansas, Georgia, Alabama, North Carolina, Mississippi, and Texas.
- O Corn: Illinois, Iowa, Nebraska, Indiana, Minnesota, and Ohio.
- O Dairy Products: Wisconsin, California, New York, Pennsylvania, Minnesota, and New England.
- O Eggs: California, Georgia, Arkansas, Indiana, Pennsylvania, and Texas.
- O Fruit & Vegetables: California, Florida, Arizona, Washington, New York, Georgia.
- O Pork: Iowa, Illinois, Minnesota, Nebraska, Indiana, North Carolina, and Missouri.
- O Soybeans, major oil crop used in salad dressings and mayonnaise: Illinois, Iowa, Nebraska, Indiana, Minnesota, and Ohio.
- O Potatoes: Idaho, Washington, California, North Dakota, Maine, and Wisconsin.
- O Tomatoes: Florida, California, Virginia, Ohio, Georgia, and Michigan.
- O Wheat: North Carolina, Kansas, Montana, Oklahoma, Washington, and Minnesota

The Food Connection

Overview
Students will make the connection between agricultural products, the food they eat, and the location of various foods on the Food Guide Pyramid.

Suggested Grade Level
2 - 5

Estimated Time
45 minutes

Objectives
The students will be able to:

1. understand the Food Groups of the Food Guide Pyramid
2. determine the place of various foods on the Food Guide Pyramid
3. name foods from each of the Food Groups

Materials
1. Teacher Reference Sheet
2. Activity Sheet A – Food Guide Pyramid
3. Activity Sheet B – Desktop Pyramid
4. Scissors
5. Glue or glue sticks

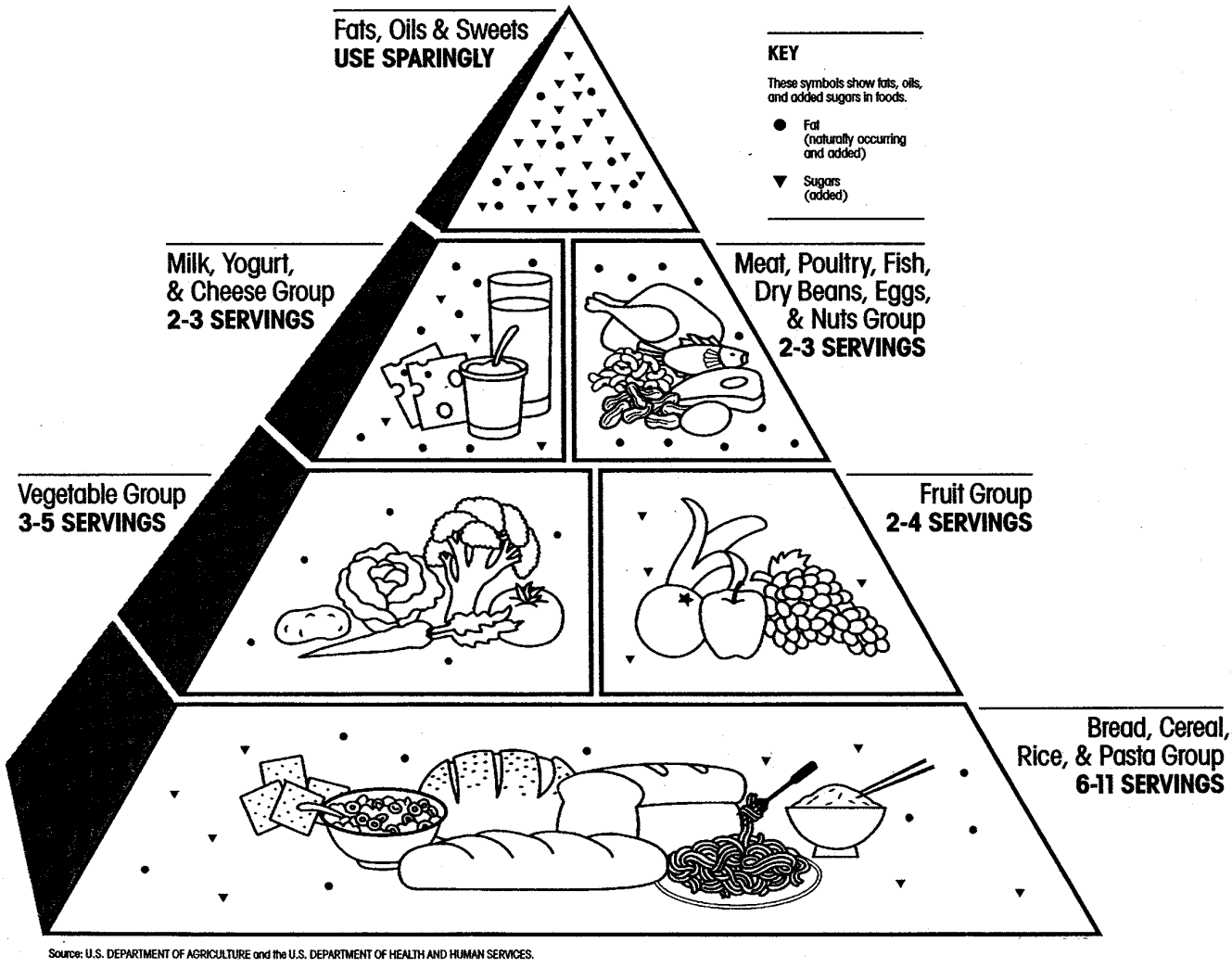
Background
The Food Guide Pyramid emphasizes food from five food groups in the three lower tiers on the Pyramid, including:

1. Bread, cereal, rice, and pasta
2. Vegetables
3. Fruits
4. Milk, yogurt, and cheese
5. Meat, poultry, fish, dry bean, eggs, and nuts

Each of the food groups provides some, but not all, of the nutrients your body needs each day. No food group is more important than another, and food in one group cannot replace those in another group. You need foods from each of the

five food groups. The top tier of the pyramid, Fats, Oils and Sweets, are to be used sparingly in a healthy diet.

The Food Guide Pyramid is an outline for what you should eat each day and recommends the number of servings from each group. A healthy diet includes foods from **all** groups.



Source: U.S. DEPARTMENT OF AGRICULTURE and the U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES.

Activity

1. Give students the Food Guide Pyramid handout and have them read the information.
2. Brainstorm with your class different foods from each of the food groups on the pyramid.
3. Have students make the Desktop Pyramid and place foods in each group.

Extensions

1. Create a large classroom collage of the Food Guide Pyramid. Encourage students to cut out food pictures from newspaper ads, empty food containers and labels; or draw pictures to represent the plethora of foods in each group. Use masking tape to define the borders of the food groups on a wall or bulletin board.

2. Challenge students to create their own Food Guide Pyramid using a drawing program on the computer. Allow them to record their personal favorite foods in the appropriate chambers, or capture their daily consumption of foods for further analysis during this unit of study.

3. Have a tasting party of a variety of foods that may be new to your students, including as many foods from each group as possible. This would also be an opportunity to discuss combination foods that contain ingredients from more than one food group.

4. Build your own Food Guide Pyramid using empty cereal boxes brought from home. Cover each box with plain paper; then divide students into work groups. Have them glue or draw food items on one broad side of each box. When each group has completed their Food Group box, have the class assemble their pyramid against the wall.

Adapted with permission from the National Cattleman's Beef Association.

Food Guide Pyramid

OTHERS

apple butter
bacon
candy
cream
cream cheese
gelatin
gum
gummy snacks
honey
margarine
salad dressing
sherbet
soft drinks
sugar
sweet desserts
whipped cream and toppings

MILK GROUP

cheese
cheese spreads
custard
ice cream
milk
prepared instant breakfast
rice pudding
tapioca
yogurt

MEAT GROUP

bean dip
beef
beef jerky
black beans
chicken
clams
coconut
duck
eggs
fish
garbanzo beans
hamburger
hot dogs
lamb
liver
lobster
nuts
peanut butter
pinto beans
pork
roast beef
sausage
seeds
shrimp
steak
tripe
turkey
veal

VEGETABLE GROUP

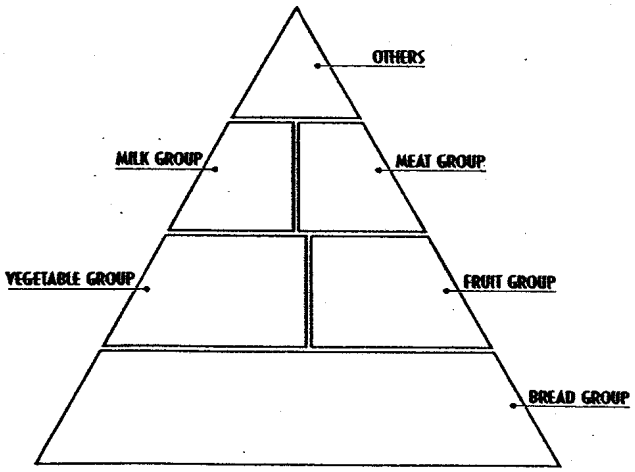
agave
alfalfa sprouts
artichoke
asparagus
bamboo shoots
beets
broccoli
Brussels sprouts
cabbage
carrots
cassava
cauliflower
celery
chicory
chilis
coleslaw
collards
corn
cucumber
dandelion greens
eggplant
elote
endive
escarole
French fries
green beans
green peas
green pepper
hominy
jicama
kale
kelp
kohlrabi
lettuce
lima beans
lotus root
lupine
mashed potatoes
mushrooms
mustard greens
okra
onion
parsnips
pickles
poi
potato chips
potatoes
prickly pear cactus
pumpkin
purslane
radish
romaine
rutabaga
sauerkraut
seaweed
spinach
squash
succotash
sweet potato
taro
tomato
turnip greens
turnips
vegetable juice
vegetable soup
water chestnuts
watercress
wax beans
yam
zucchini

FRUIT GROUP

apple
avocado
banana
banana chips
cherimoya
cherries
cider
dates
figs
fruit juices
fruit roll-ups
grapefruit
grapes
guava
lemon
mandarin oranges
mango
maraschino cherries
melon
olives
orange
papaya
peach
pear
pineapple
platano
raisins
watermelon
zapote

BREAD GROUP

bagel
biscotti
bolillo
bread
cake
cake or sugar cones for ice cream
cereal
cheese balls
cheese crackers
cheese curls
cookies
corn chips
corn tortilla
couscous
crackers
croissant
croutons
donut
flour tortilla
graham crackers
macaroni
masa
matzo
oatmeal
pastry
pie crust
pita bread
popcorn
popover
pretzels
rice
rice cakes
soda crackers
sopa
spaghetti
taco shell
Yorkshire pudding

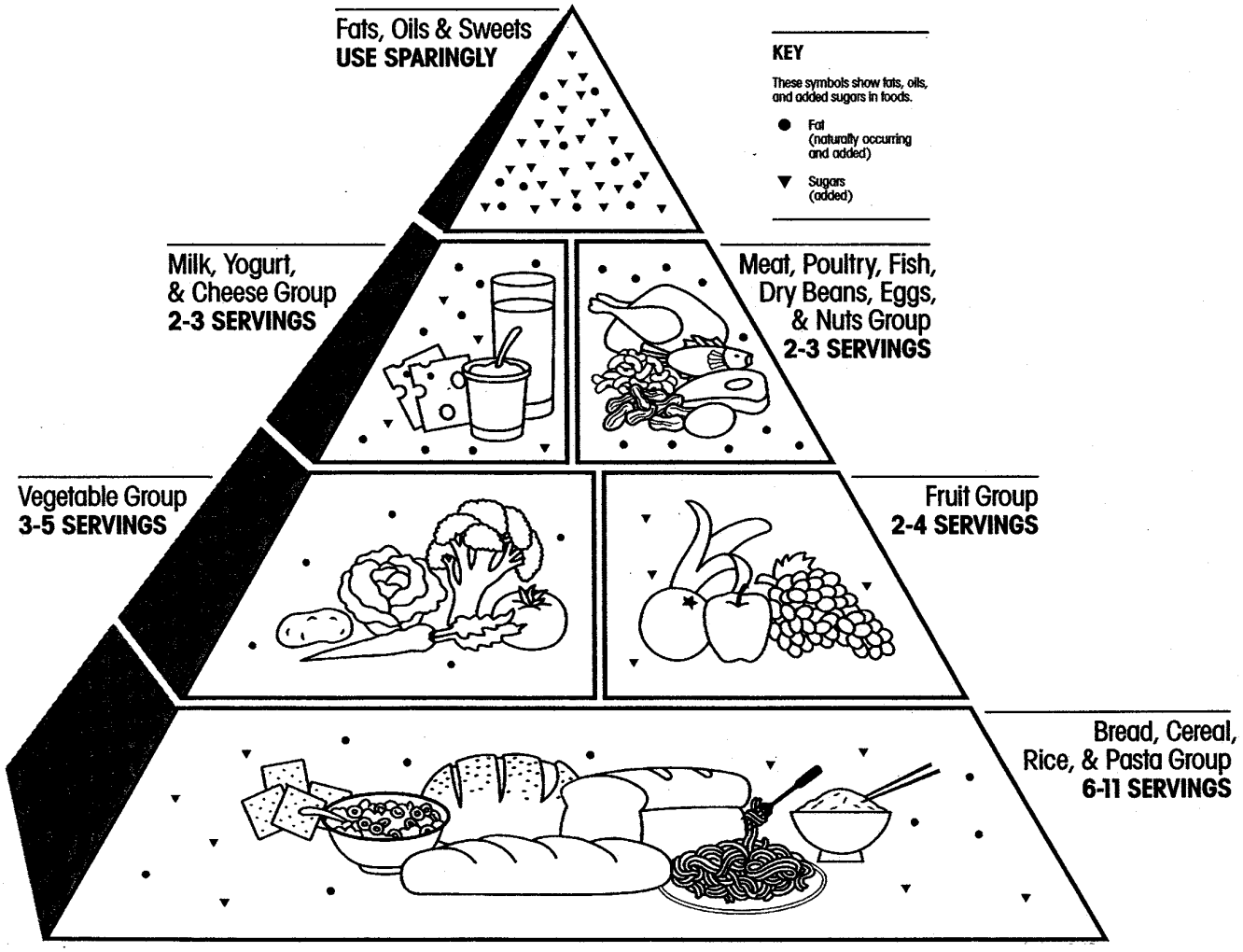


Name _____ Activity Sheet A

Food Guide Pyramid

Part of having a healthy body is eating the right foods. The Food Guide Pyramid was developed by the United States Department of Agriculture (USDA) to help you understand which foods and how much of each food to eat.

By looking at the Food Guide Pyramid, you can see the types of foods you should eat each day. The bigger the section of the pyramid, the more food you should eat of that kind. The base or lowest level of the Food Guide Pyramid is the biggest, so you should eat the most servings of these foods (breads, cereal, rice and pasta group). The top of the Food Guide Pyramid is the smallest, so you should eat the least of these foods. Therefore, you build your healthy body from the bottom of the pyramid up!

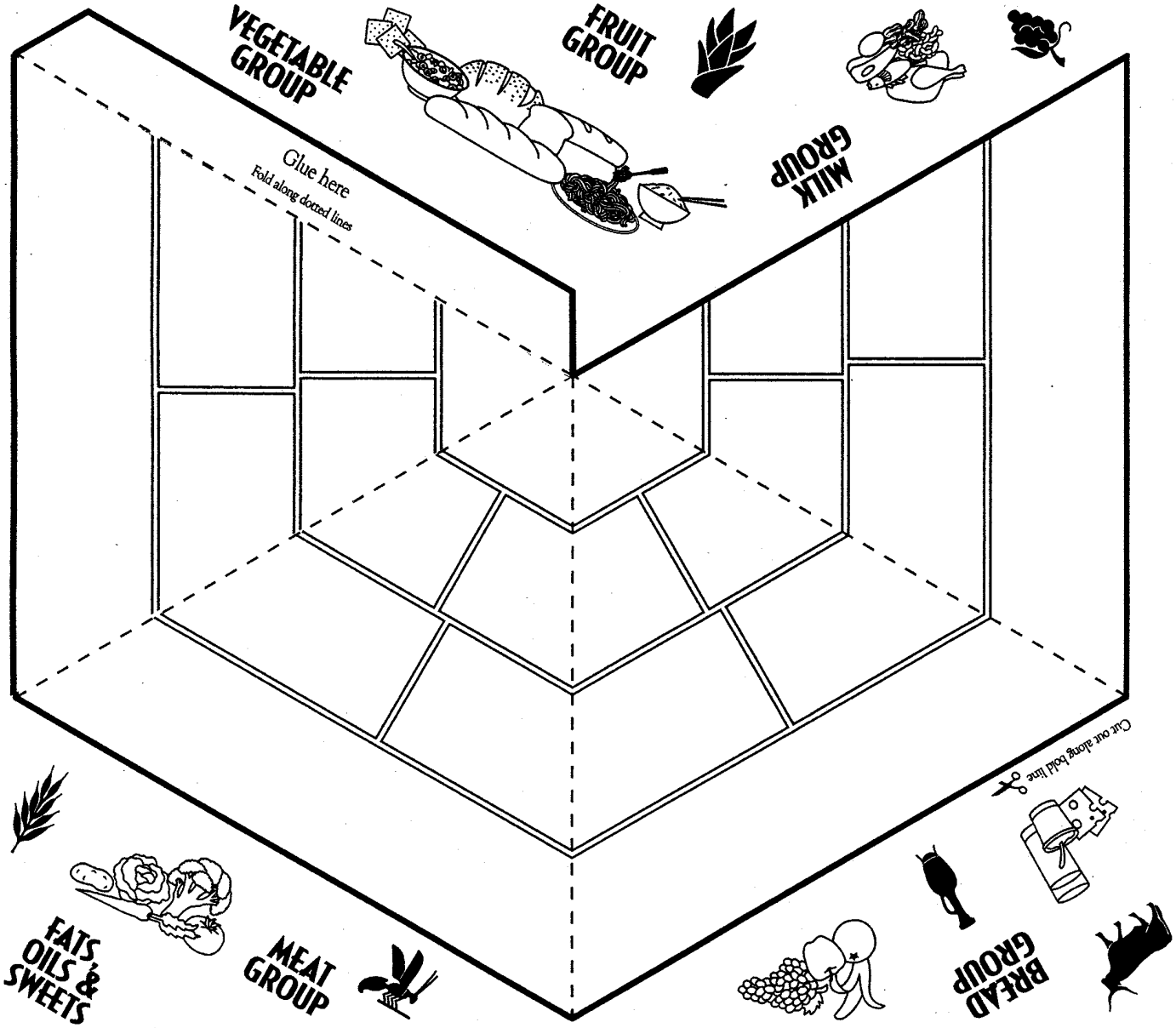


Source: U.S. DEPARTMENT OF AGRICULTURE and the U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES.

Name _____ Activity Sheet B

Desktop Pyramid

Directions: Cut out the figure of the pyramid. Fold and glue the tabs to create your very own Food Guide Pyramid. Glue the food group names on the correct section of the pyramid on one side of the pyramid. On another side, cut out and glue on the foods from the prairie. On the third side draw or write the names of some of your favorite foods from each group.



Losing Ground

Overview
This lesson presents the story of the Dust Bowl and two activities, which simply demonstrate how the effects of farming practices in the early 20th Century contributed to severe soil erosion of a large portion of the North American grasslands.

Suggested Grade Level
2 - 5

Estimated Time
45 minutes

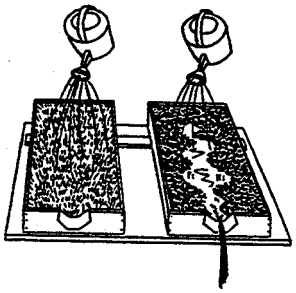
Objectives
Students will be able to:

1. demonstrate that crop cover or mulch greatly reduces soil erosion by water and/or wind.
2. identify agricultural practices that are beneficial to soil conservation.

Materials: Activities A & B
1. A copy of "The Dust Bowl" story for each student
2. Two plastic flower flats or any two boxes that measure approximately 16" long, 12" wide, and 2" deep
3. A piece of sod to fit into one flat; loose, dry soil to fill the second flat
4. 2 large watering cans with sprinkler heads with equivalent volume and pouring speeds.
5. 2 large wide-mouth jars
6. Mulch: grass clippings, straw, wood chips, or sawdust
7. Watch or stopwatch
8. Water
9. Cardboard box or carton
10. Enough loose, **dry** soil to make a small pile
11. White paper and pencils
12. Electric fan or hairdryer

Background
Although every inch of soil cannot be covered continuously with crops, grass, or mulch, there is no doubt of their value in conserving soil and water. These two

activities will illustrate how crop cover or mulch reduces soil erosion from excess water and wind, and paves the way for discussion of various conservation measures. But first, have the students read "The Dust Bowl" story.



Activity A – Soil and Water

1. Cut a "V" notch at one end of each flat or box.

2. Cut a piece of sod from a lawn or field and trim vegetation to two inches for easier workability. A piece of sod with weeds will even suffice for this activity. However, the denser the plant cover, the more effective will be the activity.

3. Fill the second flat with soil to within one-half inch from the top of the flat. NOTE: For better results, the soil in each sample should be of similar dampness but not wet.

4. Set the flats with the "V" notches at the edge of a table or curb and tilt the unnotched end of each flat to create a sloped surface.

5. Set the jars below the "V" notches at the end of each flat. There must be room enough under the flats for the jars to stand upright.

6. Have the students pour at least one gallon of water from a height of 12" onto each flat simultaneously, if possible, with the watering cans. Pour steadily and at the same rate for each flat.

7. Time how quickly the water runs off each flat. Record the results.

8. Note which jar has the muddier water and which jar has the most water. Record the results.

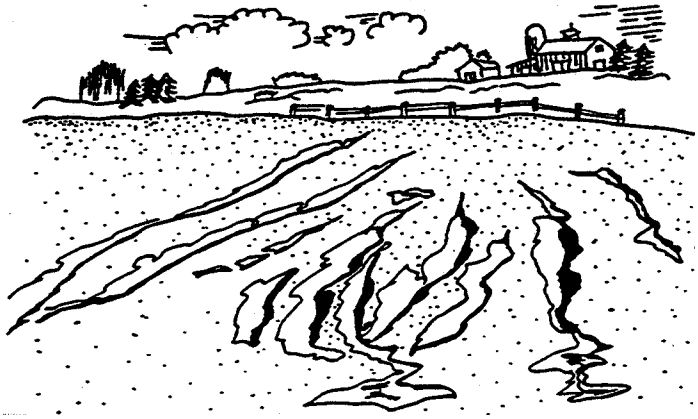
9. Have students describe the appearance of the plain soil flat after the "heavy rain." Record the results.

10. Repeat the experiment, this time putting mulch over the bare soil. Notice what happens and record the results.

DISCUSSION

The water that ran off the soil surface carried soil with it. The water that ran off the sod should have been much cleaner. It also should take longer to run off and continue for a longer period of time.

This activity shows the importance of a ground cover or crop cover in protecting soils from erosion by water. If large fields are left uncovered, the topsoil (the most fertile layer) can wash away. Only the less fertile subsoil remains. Also, heavy rains can cut huge gullies in the fields making it impossible to plow. The results can be disastrous in regions where there are heavy rains.



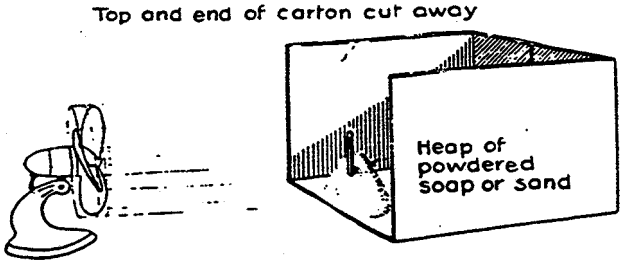
Extensions

1. Keeping the mulch in place, have students tilt the unnotched end of the flats to a higher (steeper) angle and repeat step number 6 above. Observe the differences in the speed of the water runoff. Have them describe where they might see a similar scene in real life and how this might effect the environment.

2. Repeat the activity at steeper and steeper angles; eventually tilting the flat high enough to cause the mulch run off with the water. What can the students conclude?

Activity B – Soil and Wind

1. Cut away one side of the large carton, place the white paper on the bottom of the carton, and pour a pile of very dry soil or soap flakes onto the paper.
2. Turn the fan or hairdryer towards the pile and notice how the particles move.
3. Put various obstacles (pencils or rulers) in the soil. Notice what happens.



DISCUSSION

When you checked the white paper, did you notice that it was covered with a fine layer of tiny soil particles? Even though you may not see them at first, wind can lift tiny soil particles into the air if soil is left uncovered. As the wind increases, so does the number and size of soil particles lifted into the air. As you learned by reading in *The Dust Bowl,* wind erosion can lead to disastrous dust storms and the loss of valuable topsoil.

When pencils were put into the soil, you should have noticed that the soil blew less and tended to pile in the path of heavy winds. In areas where there are heavy winds, it is very important to protect the soil with tree fences, crop covers, crop residue, strip cropping, or by other special plowing methods.

Extensions – wind and soil

1. Have students use higher and lower speeds of the fan or hairdryer on the pile of soil in the box. What can they conclude from their observations?

2. Add moisture to the pile of soil. Repeat the step above. What differences did they observe if any?

3. Have students divide into small groups of 2-3 and find out more about the Soil Conservation Service and what it does today to teach our citizens about soil and water conservation practices.

Cornell Educational Resources Program (CERP), Department of Education, Cornell University, Ithaca, NY 14853.

Name _____ Activity Sheet

Losing Ground: The Dust Bowl

During the 1930's, the United States went through an economic crisis known as the Great Depression. Many banks closed and jobs, money, and food were scarce. At the same time, the Great Plains area of the southwestern United States was devastated by a severe and prolonged drought. Rainfall was well below normal for about seven years. In addition to the drought, high winds blew across the dry plowed fields every day. The loose soil was blown into the air and created dust storms larger than anyone had ever seen. Day after day, week after week, and for years, one storm after another blew the soil off the fields.

Reportedly, one storm in 1934 started in the Great Plains and pushed eastward at 60 to 100 miles per hour. Airplane service was grounded and people had to drive their cars with their lights on at midday. Some people who were caught in the storm were lost for days in the darkness. The storm reached the eastern seaboard, shutting out the sun in New York, Baltimore, and Washington, DC. Dust even sifted into the White House and settled on President Roosevelt's desk. A day later, ships at sea reported that dust was covering their decks. There were many people who thought the world was coming to an end.

The southwestern region of the Great Plains where most of the dust storms occurred became known as the Dust Bowl. The whole area, covering parts of the states of Texas, Oklahoma, Kansas, Colorado, and New Mexico, looked like a misplaced beach. Crops turned brown, withered and died from the lack of rain and the blowing dust. People and animals alike suffered from breathing the dust into their lungs, and many died as a result. Since no crops could grow, people and animals alike suffered from the lack of food. Milk cows went dry and hogs were so thin that they couldn't be sold at any price. Many farmers were on some kind of government "relief" or welfare. In all, over 50 million acres of land were affected. It was indeed a time of bleakness and despair.

The Problem

People can do very little to influence the wind and the rain. But their treatment of the land can make the effects of wind and the lack of rain far worse than need be. There were three main factors that contributed to the Dust Bowl: poor farming practices, the drought, and the Great Depression.

The Great Plains were originally grasslands with sandy soil. The plains are a vast expanse of flat land and are very dry, receiving variable amounts of rainfall from one year to the next. During a good year with plenty of rain, crops such as cotton, wheat, and corn could be grown successfully in large fields. The problem was that farmers were gambling on a "good year" every year at the expense of their land. Their farming practices simply did not include safeguarding their farmland against one or more bad years.

The short buffalo grass that grew naturally on the Great Plains held the soil in a tightly woven network of roots. When the farmers plowed under the sod, called sod busting, they planted crops that could bring in more income. Unfortunately, these cash crops didn't hold the soil well, especially when they were in the early stages of growth. Thus, the valuable topsoil was left largely unprotected from the harsh weather conditions of the plains. Compounding the problem of careless land-use was the lure of new technology in farming. During the late 1800's and early 1900's, the sod-busters had only mules, horses, and oxen to pull their plows. The areas they were able to cultivate were relatively small. However, as tractors and machinery improved, more and larger fields could be worked with less time and labor.

Since the prices for these cash crops were very good at the beginning of the 1930's, farmers planted as much land as they could. Out-of-town, "suitcase" farmers moved out the plains, bought up large quantities of land, and hired workers and tractors to plant every acre of land available. It seemed to be a perfect "easy profit" way to farm. But the fact was that most farmers didn't realize at the time that plowing up the Great Plains would cause the soil to blow away.

The good times ended quickly. A series of droughts and intense summer heat waves in 1931, '34, '36, and '37 pointed out what everyone had failed to notice. There was simply too much uncovered land with nothing to hold down the soil. Severe soil erosion was inevitable. The results were devastating. Farmers had borrowed money to plant large amounts of crops, but when the crops failed, they had nothing to sell. Unable to repay their loans, many lost their homes and farms to the banks. There was a huge population shift off the farms, especially in the five Dust Bowl states. People left to go "down the road," often on foot, in search of any kind of job that could help feed their families. Many of these people became known as "Okies" since so many came from Oklahoma. But people came from many other states as well. Some people traveled as far as the lush valleys of California to take jobs as migrant farm workers.

The Solution

The problem of the damaged and unproductive land still needed to be solved. Fortunately, the United States government took notice of this serious national problem, and President Roosevelt's "New Deal" set up many programs to help farmers reclaim the land.

One policy was to persuade farmers through incentive payments to improve their farming practices and land use. Instead of only producing soil-depleting crops like corn, the farmers were encouraged to alternate cash crops with crops that would hold the soil and improve it. The idea was to promote long-term conservation practices instead of short-term cash crop production.

In 1935, the U.S. Soil Conservation Service was established. The federal government realized that soil erosion had spread beyond the five-state region of the Dust Bowl to South Dakota, Wyoming and Nebraska, and steps were taken to repair the damage and to prevent it as well. Natural grasslands were reserved for controlled cattle grazing instead

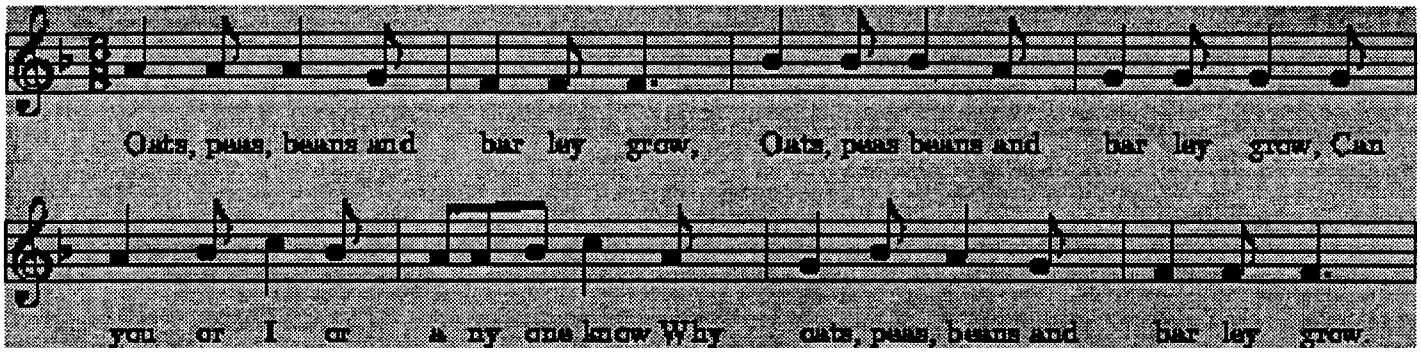
of farming. Other lands that were unsuitable for farming were purchased for parklands. Every farmer was encouraged to diversify and rotate crops from field to field each year. Instead of burning crop stubble in the fall, farmers left it to decompose in the field to add organic matter to the soil. Planting was done in zigzag contours against the prevailing winds. If the soil was too dry at planting time, an emergency crop that could withstand drought was planted. When wheat was planted, it was alternated with strips of native grasses so that there would be something to prevent soil erosion if the wheat failed. These measures worked well for preventing both wind and water erosion, and they are still used today.

Soil Conservation Today

The Soil Conservation Service continues to be dedicated to the protection of farmland as well as conservation of water resources. Most of the land in the United States is now within a Soil Conservation District that is governed locally. Each District has done soil surveys that include maps made by soil scientists to describe the location and types of soils within the area. With this information, each District can identify lands that are more prone to erosion than others. They can then recommend the types of agriculture or urban land uses that are best suited for each soil type.

Soil conservation is moving into the high tech age with remote sensing, aerial photography, and soil mapping with digital computer imaging. With an increasing population and decreasing green space, innovative soil and water conservation practices are more important today than ever before.

Oats, Peas, Beans and Barley Grow



(do the motions while singing)

Oats, peas, beans and barley grow,
Oats, peas, beans and barley grow,
Can you or I or anyone know
How oats, peas, beans and barley grow?

First the farmer sows his seed,
Stands erect and takes his ease,
Stamps his foot and claps his hands,
And turns around to view his lands.

(Repeat First Verse)

Next the farmer waters the seed,
Stands erect and takes his ease,
Stamps his food and claps his hands,
And turns around to view his lands.

(Repeat First Verse)

Next the farmer hoes the weeds,
Stands erect and takes his ease,
Stamps his foot and claps his hands
And turns around to view his land.

(Repeat First Verse)

Last the farmer harvests his seed,
Stands erect and takes his ease,
Stamps his foot and claps his hands
And turns around to view his land.

(Repeat First Verse)

Prairie Scavenger Hunt

Overview
While visiting the *Listening to the Prairie* exhibition, students will search for a variety of items located throughout the exhibition. This activity will encourage students to slow down, carefully observe, interact with, and "listen to" the contents of the exhibit.

Suggested Grade Level
2 - 5

Estimated Time
20 - 30 minutes

Objectives
Students will be able to:

1. identify common plants and animals found on the prairie.
2. work in teams, and practice written, illustration and observation skills.

Materials
Activity Sheet A

Background
Listening to the Prairie; Farming in Nature's Image is about agriculture in the North American prairie and the forces of change that turned vast grasslands into one of the most productive agricultural lands on earth. It reveals the relationship between prairie ecology and new ways to grow food.

The Fruitful Prairie – More than 25 percent of America's productive cropland, pastureland, and rangeland are located in the North American prairie.

The Prairie Ecosystem – In its natural state, the prairie is a complex, fragile, and dynamic ecosystem that has sustained a diversity of plant and animal life for thousands of years.

From Native Grasses to Cultivated Grains – Deep fertile soils and a favorable growing climatic influenced 19th and 20th century farmers to cultivate the prairie

by replacing native grasses with profitable grains and legumes such as wheat, corn, barley, rice, and soybean.

Forces of Change – Natural forces, such as wind and fire, and human forces, including agriculture and technology, have altered much of the prairie ecosystem.

Sustainable Agricultural Practices – By listening to and observing nature, some farmers and ranchers have adopted practices that keep their operations productive and profitable, while protecting a diverse prairie ecosystem for future generations.

If history is our guide, some of today's alternatives will be tomorrow's accepted practices. Explore how they affect you and your community.

Activity

1. Divide class into teams or small groups of two or three.
2. Distribute a Scavenger Hunt Activity Sheet to each group.
3. Have each group search for the items and record answers and observations.
4. Walk back through the exhibit together as a class and have students share their observations with their classmates.

Extensions

1. Have each group of students select one or two items they found interesting while visiting the exhibition. Find out more information about each and prepare a report to share with their classmates.

2. Five "Cues from Nature" (found on the exhibition panel entitled *An Ear to the Ground* and summarized below) can be applied in nearly every eco-region around the country. For a more advanced activity, have students choose one (or more) of these five principles and explore how it might apply to their home or school. Have them share their ideas with their classmates.

   "Cues from Nature"
   a. Keep it covered… farmers keep fields planted year-round to enrich soil and prevent erosion.
   b. Make it diverse… farmers raise a variety of crops and animals to hedge against pest outbreaks, severe weather, and market changes.
   c. Keep it dynamic… farmers frequently rotate crops and grazing animals to keep the land fertile.
   d. Keep it recycling… farmers re-use plant/animal wastes to fertilize crops.
   e. Work with natives… farmers and ranchers plant pastures with native plant species to nourish livestock and wildlife.

Name_____ Activity Sheet A

Prairie Scavenger Hunt

Directions: Find the answers to all the questions by looking and listening to the exhibit. Record your answers and observations below.

A. How many ladybugs can you find in the exhibit? Where are they? What do ladybugs do in the prairie?

B. Look in the shopping cart at the beginning of the exhibit and pick one product by touching the screen. What plant or animal is this product made from? Find an example of this plant or animal in the exhibit.

C. Sketch an animal that lives underground in the prairie.

D. Find three (3) animals (mammals or insects) that eat only plants.

List them here:

1.
2.
3.

Are they called carnivores, herbivores, or omnivores? (circle one)

Name_____ Activity Sheet A

E. Find three (3) animals that eat other animals.

List them here:

1.
2.
3.

Are they called carnivores, herbivore, or omnivores?
(circle all that apply)

F. In the exhibition find the dollar and answer the following questions:

a. What percent (%) of your food dollar goes to the farmer?

b. Name five (5) other places where your food dollar goes.

G. Find two (2) types of grasses and write something about each grass.

Grass #1

Grass #2

H. Find two (2) types of grains and write something about each grain.

Grain #1

Grain #2

I. Why is the farmer burning the grasses on the prairie?

What would happen if the farmers did not burn the grasses?

J. Stop…look…and <u>listen</u> to the story about the prairie ecosystem and explain how the sandpipers get their water.

Weaving the Web

Overview
Students construct food webs to learn how food chains are interconnected.

Suggested Grade Level
2 – 5

Estimated Time
30 – 40 minutes

Objectives
Students will be able to:

1. construct a food chain and explain how energy flows through the chain.
2. explain how all living things depend directly or indirectly on green plants for food.
3. use pictures and arrows to create a food web that includes the sun, green plants, herbivores, omnivores, and carnivores.

Materials
1. Ball of yarn
2. Activity Sheets 1- 8 (pictures of prairie plants and animals)
3. Tape to attach pictures to clothing
4. Space for the class to form a large circle

Background
Living Things Need Energy From Food

Energy can be defined as the capacity for change. Living things need energy for everything they do. For example, a butterfly needs energy to change position when it flies, and a daffodil needs energy to change size as it grows and blooms.

All living things get energy from food. Green plants use energy from the sun to make their food. Plants use the food they make for energy to grow. Animals get energy by eating plants or other animals.

The Sun is the Source

The energy in living things originates from the sun. Green plants are the only living organisms that can use the energy from the sun make food.

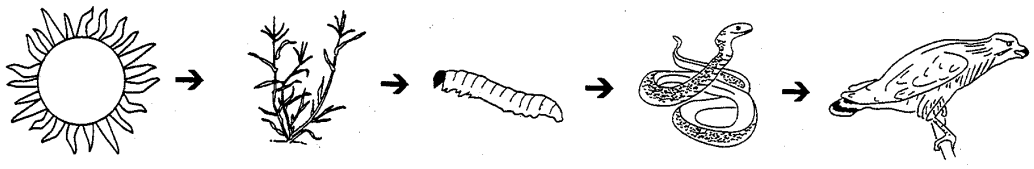
Although many children know that the sun keeps plants healthy, they may not know that plants rely on the sun's energy to make food, or that this food can be used by the plant itself or by animals that eat the plant. For example, a sugar maple tree uses the sun's energy to make sugar, a food, in its leaves. The tree uses the sugar for energy to grow and stay alive. If people eat maple syrup, they get energy from the sugar in the tree. But people cannot hold out their hands to the sun and make food in the same way that a maple tree can make food in its leaves.

Children may think that the sun is important because it keeps animals warm. The sun does provide warmth to the animals, but, more importantly, the sun provides the energy that green plants use to produce food. Animals get this energy when they eat the plants. To help students understand that animals depend on the sun for food energy, have them think about how long a deer could live if it only basked in the sun and did not eat green plants. The relationship between the sun's energy and the energy required by living things will become clearer as the children learn about food chains and webs.

Children may cling to the idea that plants draw in usable food from the soil through their roots. It is true that plants absorb water and essential minerals from the soil and that they need water to make food. Food contains energy, however, and the water and minerals in the soil do not contain energy. So plants use the energy from the sunlight plus water and minerals along with carbon dioxide from the air to produce food that contains energy.

Food Chains

A food chains' energy is transferred in sequence. For example, energy comes from the sun, to green plants, to animals that eat plants, and to animals that eat other animals. Green plants use the sun's energy directly to make food. When animals eat green plants and other animals eat those animals, the energy moves from one living thing to another along the food chain. Animals that eat plants are called herbivores, animals that eat both plants and animals are called omnivores, and animals that eat *only* other animals are called carnivores. Ultimately, all members of a food chain depend on the energy from the sun that green plants transform into food energy.



The above diagram illustrates a food chain that might be found in the prairie. Arrows indicate the transfer of energy from one organism to another. The sun provides energy for the grass, the grass for the caterpillars that eat the grass, and so on.

Students may want to use arrows to show animals moving toward their food. It may be necessary to help students recognize their thinking, as in the following example: "Does your arrow show that the frog hops toward the fly to get food? Now, can you draw the arrow to show which way the food energy is going? Does eating the fly give energy to the frog?" As they draw food chains in this unit, the students will better understand how the sun's energy passes through food chains.

Food Webs

Food webs are more complex than food chains. They consist of many food chains that are interconnected. The following example is a series of food chains, which together make a food web.

sun ➔ grass ➔ grasshopper ➔ blue jay ➔ owl

sun ➔ grass ➔ rabbit ➔ hawk

sun ➔ clover ➔ caterpillar ➔ snake ➔ hawk

Vocabulary/Glossary

carnivore – an animal that eats only animals
community – all the plants and animals that live in one place, and that interact and depend on one another.
energy – the capacity for change: all living things need energy from food to live and grow.
food chain – transfer of energy in sequence, for example, from green plants, to animals that eat plants, to animals that eat other animals.
food web – a network of food chains that are interconnected within a particular community.
herbivore – an animal that eats only plants.
interact – to influence one another
omnivore – an animal that eats both plants and animals

Activity

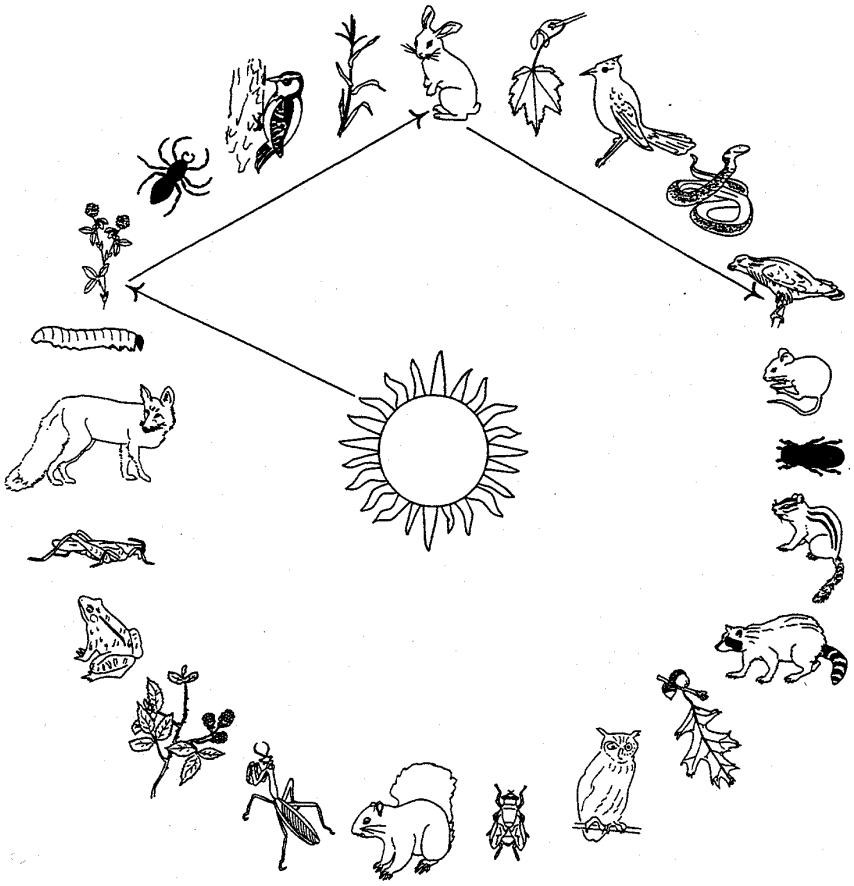
1. Copy Activity Sheets 1 – 8 and cut apart. Have students tape one picture each to their chests.
2. Tell the students that they will make a food web. Have them stand in a circle and introduce themselves as the plant or animal they represent. The student with the sun picture should stand in the center. They should look around and ask themselves:

Who in the circle could I give my energy to? (Who might eat me?)

Who in the circle could give me energy? (Whom could I eat?)

3. Explain that the ball of yarn represents sunbeams, or energy from the sun. Ask the student representing the sun to hold the end of the yarn tightly and toss the ball to someone who can use that energy (a green plant). When a student representing the green plant catches the ball of yarn, he or she should hold a piece of the yarn and throw the ball to someone else who could use the energy. For example, the sun might throw the yarn to the grass, the grass to the grasshopper, and the grasshopper to the meadowlark. After the yarn reaches a carnivore, break it off to represent one food chain. (Explain that humans, bears, raccoons, etc. are omnivores and can end a food chain, or they could be eaten by a carnivore.)

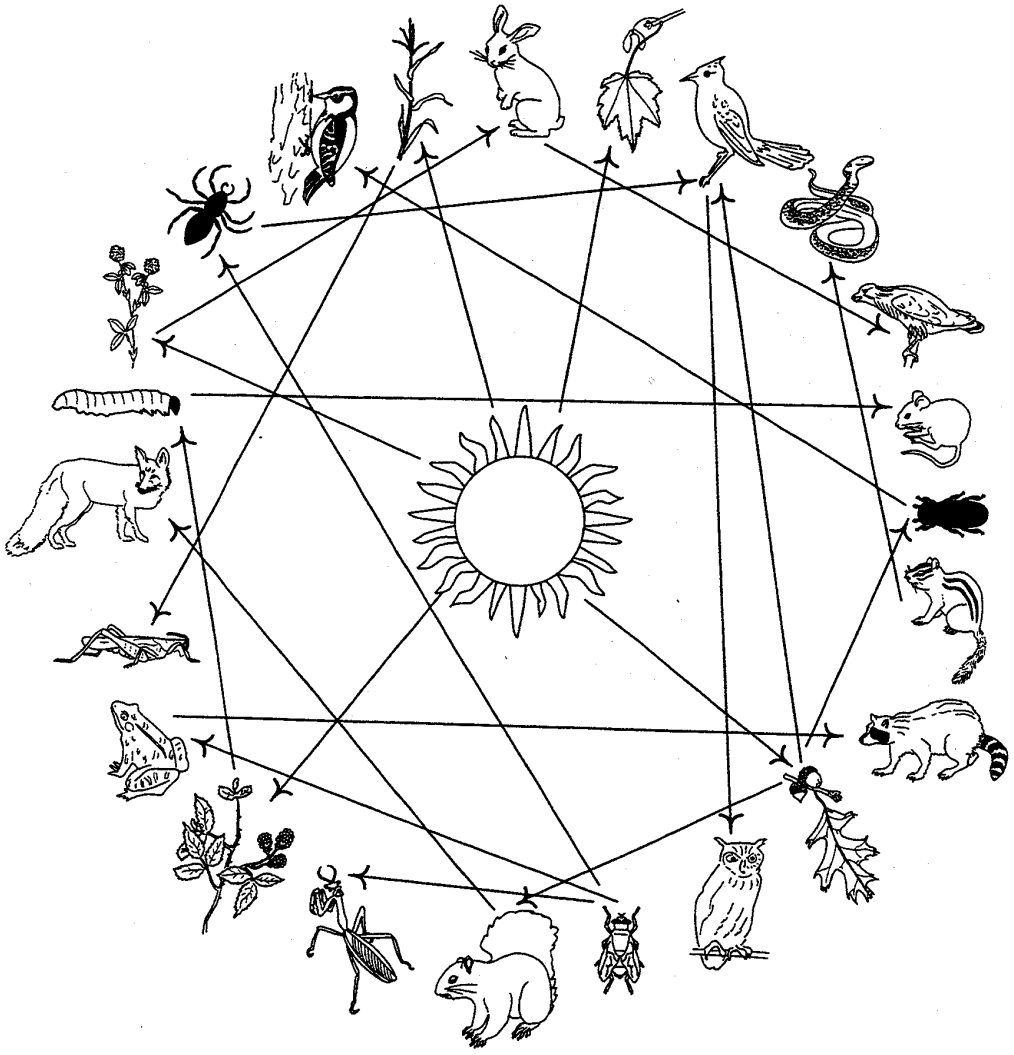
After the first food chain is completed, a view from above might look like this.



Ask: How can all these other plants and animals get the energy they need? (Through different food chains)

4. Return the yarn to the sun to start another chain. This time the sun might throw its energy to the grass, the grass to the field mouse, and the field mouse to a great horned owl. Again, break the yarn, throw it back to the sun, and have the sun start another chain. Continue making chains until every student holds at least one strand of yarn.

Now a view from above might look like this.



Ask:

Have we made food chains? (Yes, lots of them!)

What do all of our food chains together look like? (A food web.)

What is the difference between a food chain and food web? (A food web is made up of several food chains. A web is more complicated than a chain because it has connections among the chains.)

Who is holding the most pieces of yarn? (The sun.)

Why? (Because each food chain starts with the sun.)

Who else is part of many food chains? (Green plants)

What would happen if all the green plants died? (Nothing else in the food web could survive.)

Ask:

How could we show what could happen if one kind of plant, such as all the clover died? (The student representing clover could pull out his or her pieces of yarn and sit down.)

If all the clover is gone, who may have trouble getting enough food? (Identify all the animals that were in food chains that included clover. Whoever had yarn pulled out of their hands might have trouble getting enough food without the clover.)

What happened to our food web? (It is much thinner, less complex, and less strong.)

Why should we be concerned about each kind of plant or animal? (Because other plants and animals in the food web may depend on it.)

Emphasize that each group is important and applaud each in turn.

Will the carnivores please show their teeth?

Will the omnivores please shake a leg?

Will the herbivores please wink an eye?

Will the only living things that can make food using the sun's energy – green plants – please take a bow?

Collect the "Who Eats Who" sheets to save for another activity.

Extensions

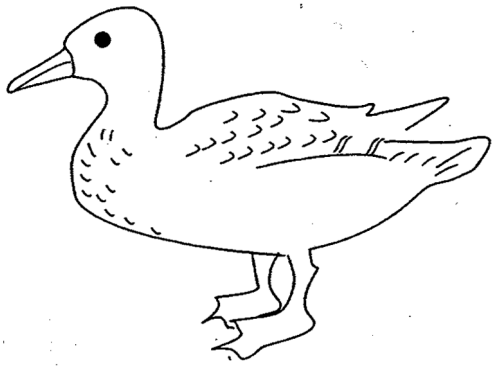
1. Have students identify food chains from other ecosystems (forest, wetland, marine, etc.) and make pictures of the plants and animals from that ecosystem, using arrows to indicate the flow of energy.

2. Students can learn about the plant or animal they represented in the food web activity and write a report, tell a story, or make an illustration about the plant or animal to share with the class.

Adapted from Project LEAP: Learning about Ecology, Animals, and Plants, College of Agriculture and Life Sciences, Cornell University, Ithaca, NY 14853.

Weaving the Web

Human



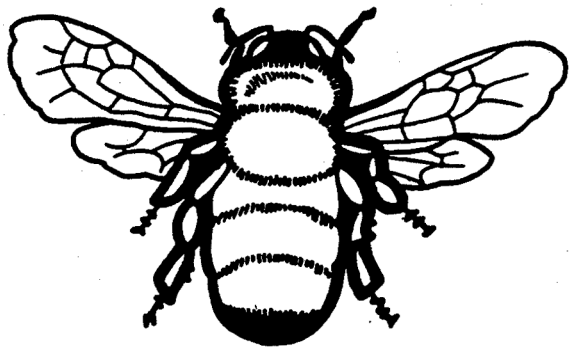
Duck

Prairie Grass

Deer

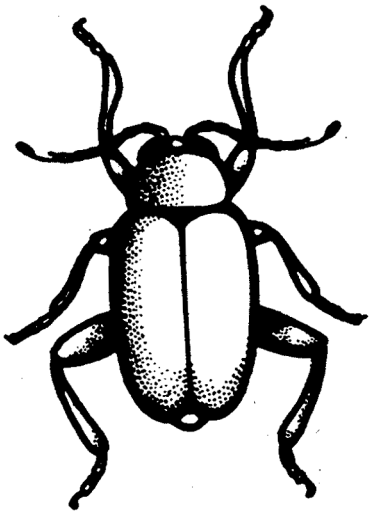
Weaving the Web

Owl



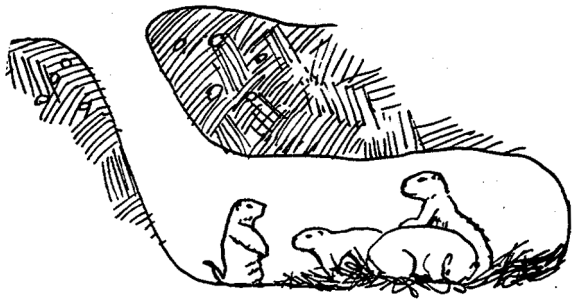
Bee

Mole

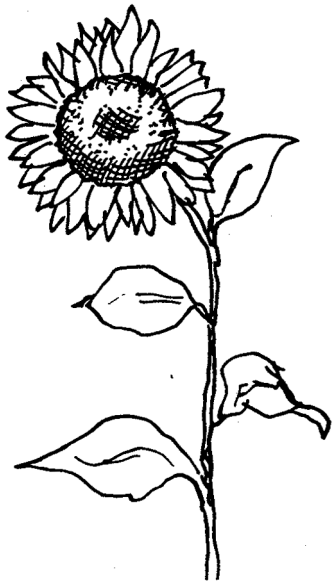


Beetle

Weaving the Web



Prairie Dogs

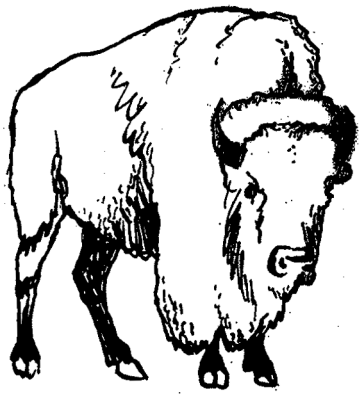


Sunflower

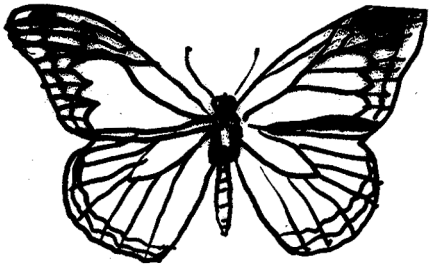
Meadow lark

Quail

Weaving the Web

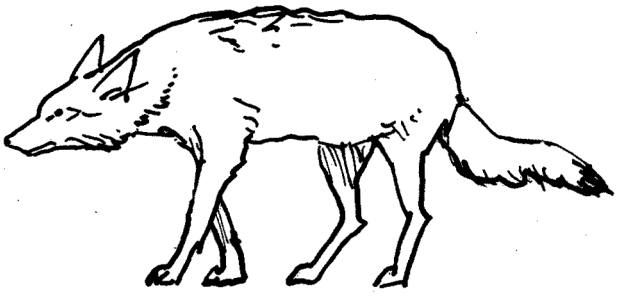


Bison



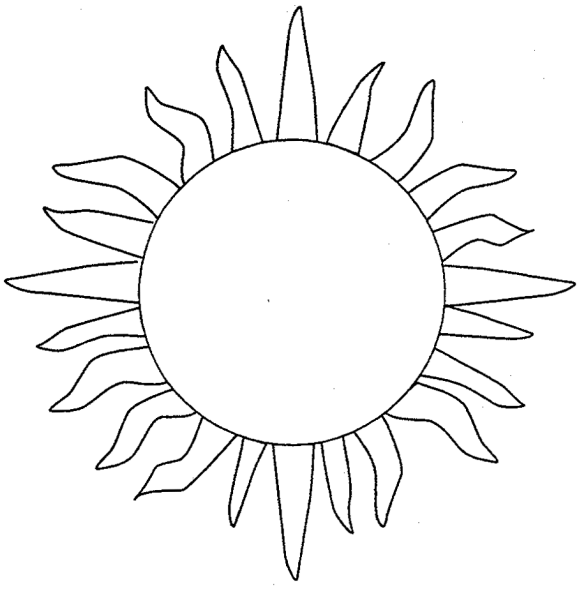
Butterfly

Aster



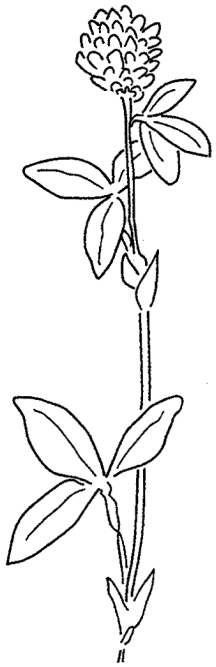
Coyote

Weaving the Web

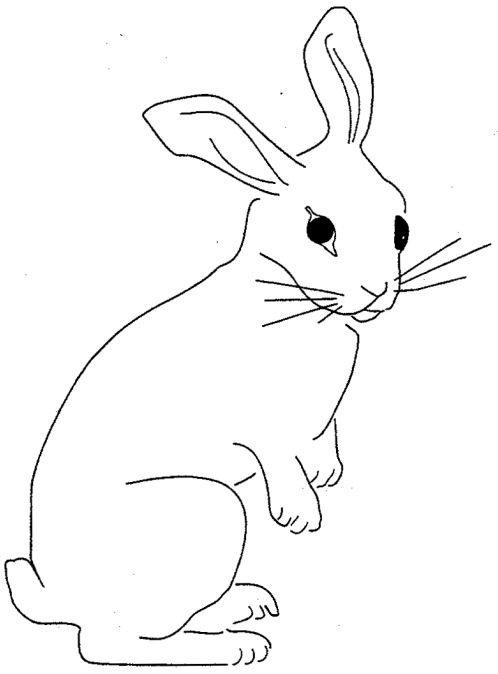


Sun

Orchard grass

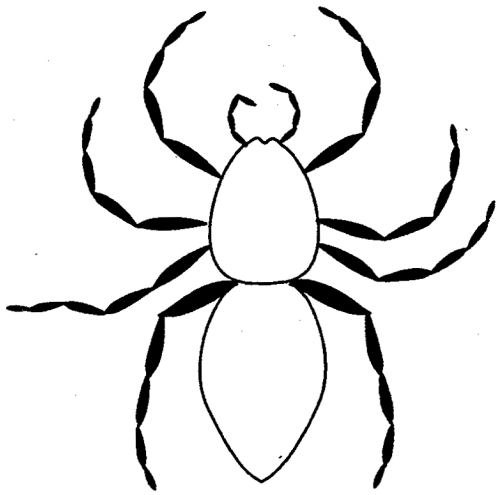


Clover

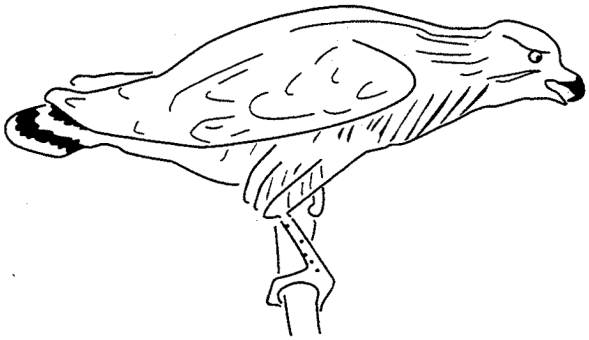


Rabbit

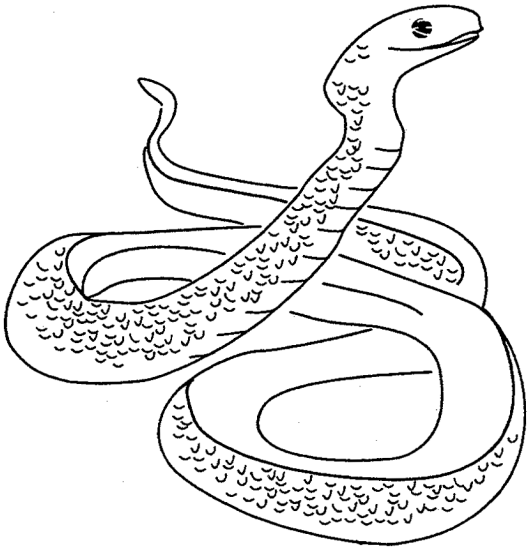
Weaving the Web



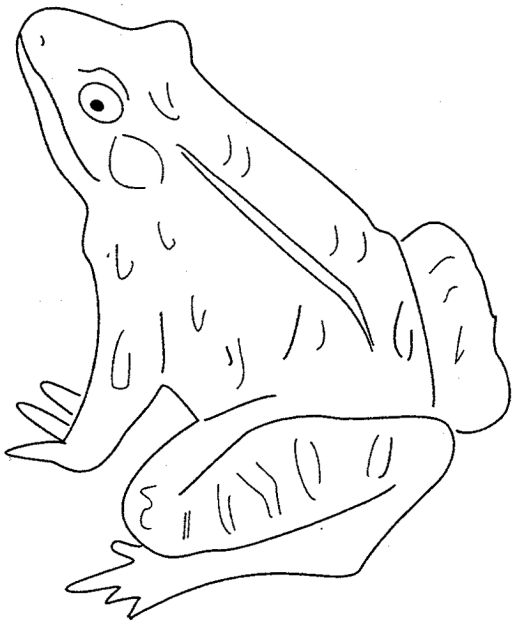
Spider



Hawk

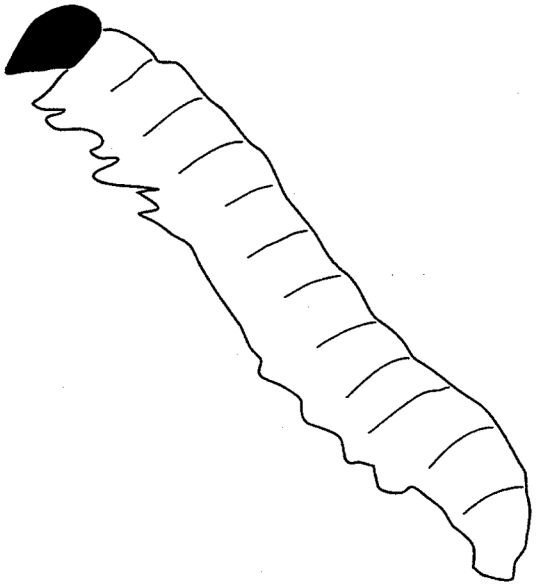


Snake

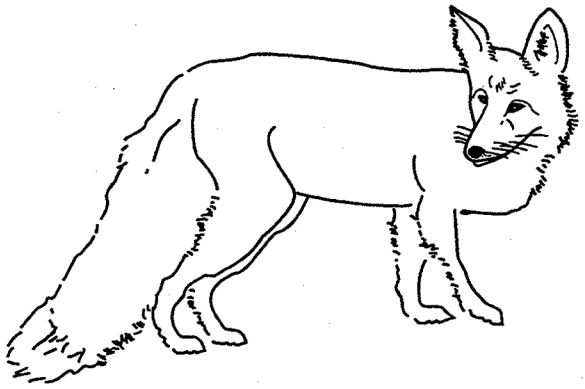


Frog

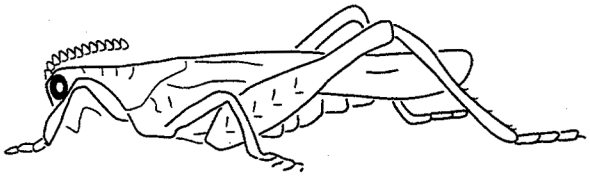
Weaving the Web



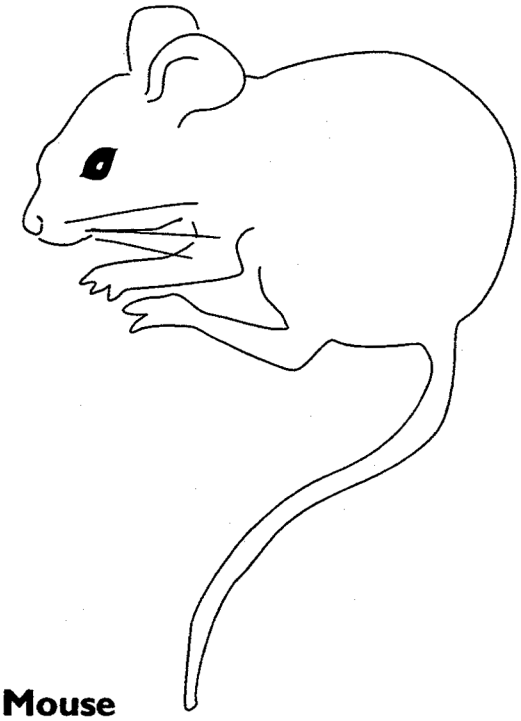
Caterpillar



Fox

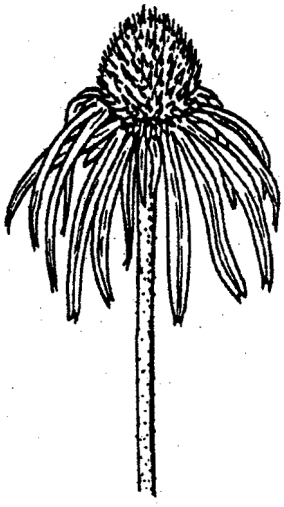


Grasshopper

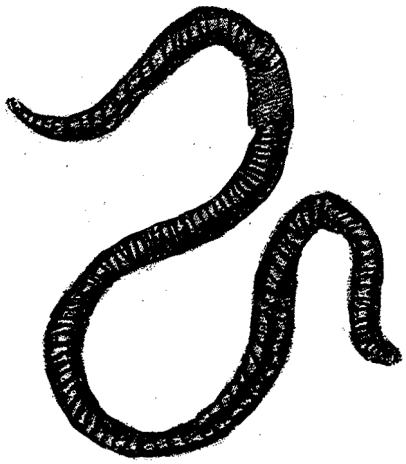


Mouse

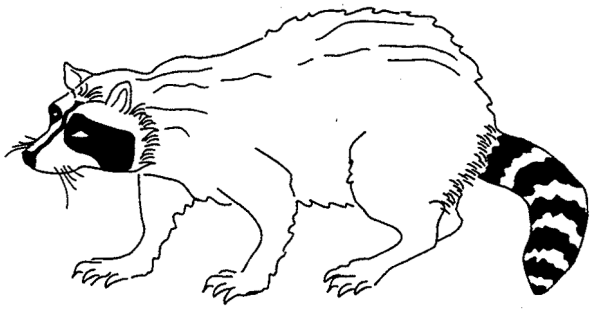
Weaving the Web



Coneflower



Worm



Raccoon

Black-eyed Susan

Listening to the Prairie: Farming in Nature's Image

Lessons for Grades 6 - 8

Developed, adapted and/or compiled by:

David G. Cox
Janet E. Hawkes

New York Agriculture in the Classroom
Cornell Educational Resources Program

For the United States Department of Agriculture - Agriculture in the Classroom Program to accompany the Smithsonian Institution's traveling exhibition.

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Listening to the Prairie: Farming in Nature's Image

"Agriculture is too important a topic to be taught only to the relatively small percentage of students considering careers in agriculture and pursuing vocational agriculture studies."

National Research Council

Overview

Across the United States, serious efforts are underway by educators and professionals to raise public awareness about agriculture and the many difficult challenges facing our nation's most vital and vulnerable industry. Research has shown that most Americans know very little about agriculture, its social and economic significance in the United States, and particularly, its links to human health and environmental quality. Likewise, most students have very little knowledge of the growing number of exciting career opportunities available within the agricultural industry.

Listening to the Prairie: Farming in Nature's Image, is an exhibition that will change how people think about agriculture in America. It's about growing food on the North American prairie and the forces of change that turned vast grasslands into one of the most productive agricultural lands on earth. These lands are our nation's most fertile, diverse, fragile, and endangered ecosystems, but they also serve as a model for environmentally sound agriculture. The traveling exhibition focuses on how changes in this ecosystem and other ecosystems across the country impact people and their communities. It reveals information on how a natural ecosystem works, and tells stories of farmers and ranchers who are farming in nature's image.

Ag in the Classroom

Smithsonian Institution

Sustainable Agriculture Research and Education

About These Activities

Agriculture in the Classroom, a national K-12 agriculture awareness program, is pleased to provide a series of lessons and activities to complement the Smithsonian Institution's traveling exhibition. These activities were created and compiled by New York Agriculture in the Classroom, a division of the Cornell Educational Resources Program at Cornell University in Ithaca, NY. The contents are designed for PreK-12 teachers, educators, home-schoolers, and parents who spend time with their families at libraries and learning centers. With the exception of the on-site scavenger hunts, most of the enclosed materials can be utilized before or after your visit to the exhibition.

The purpose of these activities is to serve as educational supplements to the exhibition as well as a method with which to engage students and families about the daily issues of agriculture and the food and fiber industry. Although only 2.5% of our population live on farms, all of us eat and wear products derived from agriculture every day, including many products from the North American Prairie. Since most of the United States population do not live in the prairie, the "clues from nature" emphasized in the exhibition may be applied to nearly every region of the country.

Lessons and activities have been divided into four grade-level groups: PreK-1, 2-5, 6-8, and 9-12. All of the enclosed lessons, activities, and worksheets are B&W photocopy reproducible, and clearly formatted. Each lesson contains a brief overview, objectives, a list of materials needed, background information, activity instructions, and suggestions for extensions for those who wish to further explore the lesson topic or concept. A separate chart is included that summarizes all of the enclosed lessons and the appropriate National Standards (McRel) addressed.

In addition, Smithsonian Institution's National Museum of Natural History, the American Library Association (ALA), and participating libraries have assembled an impressive program of supplementary resources, activities, lectures, tours, and workshops for visitors of all ages to enrich their visit to this important exhibition. *Consult your library staff for the calendar of events and the wealth of educational resources gathered especially for this event*.

Enjoy your visit at this most important exhibition. The lessons to explore are universal and timeless, and will serve as valuable resources in agricultural awareness and education for years to come.

Ag in the Classroom

Smithsonian Institution

Sustainable Agriculture Research and Education

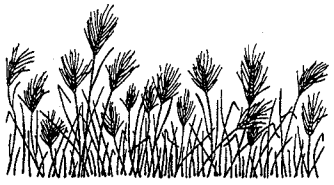
A Brief Prairie History[1]

The First Prairie Farmers – Crops have been grown on the prairie for more than 4,000 years. Native prairie farmers cultivated the soft, alluvial soils in the river bottomlands because they did not have forged metal tools to work the tough prairie sods in the uplands. They raised corn, beans, squash, pumpkins, sunflower, and tobacco in small garden plots for about twenty-five years, and then moved to new plots on a two to three hundred year rotation. Native farming communities also gathered edible wild plants and hunted rabbits, deer, and bison.

The Will of Iron – By the end of the 19th century, the North American prairie had become one of the greatest food-producing regions in the world. New machinery, new railroads, new government policies and the tenacity of new settlers made this transformation possible. The steel plow broke heavy prairie soils for planting crops. Affordable barbed wire fencing enclosed grazing and crop lands on the treeless landscape. Windmills provided a reliable water source for livestock and crops, and transcontinental railroads linked the new prairie producers with urban markets in the East and in Europe.

The Fruitful Plain – Today one American farmer feeds 143 people, more than five times that of a farmer in 1950. This phenomenal growth in production has resulted largely from technological forces of change – new machinery, new crop varieties and the development of chemical fertilizers and pest controls. Farms and ranches are also fewer, larger, and more specialized than they were fifty years ago.

New Alternatives – The willingness of the farmers and ranchers to change has been the cornerstone of successful American agriculture. What are common practices now, chemical pesticides and fertilizers, for example, were alternatives fifty years ago. Today's farmers and ranchers continue to adopt new approaches to keep their operations productive and profitable, while safeguarding the environment. If history is our guide, some of today's alternatives will be tomorrow's accepted practices.



[1] *Adapted from the final exhibition script of "Listening to the Prairie: Farming in Nature's Image."*

Smithsonian
Institution

Summary of Activities

Lessons for Grades PreK-1

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. The Web of Life – Game demonstrating interconnections between plants and animals
3. Making Pretzels – Cooking activity from grain to food
4. Agriculture in Your Life – Connecting agricultural sources to everyday products
5. Here Come the Sunflowers – Planting and growing activity
6. Worm Watching – Activity for observing worms in action
7. "Oats, Peas, Beans and Barley Grow" – Song about farming and prairie crops

Lessons for Grades 2-5

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. Weaving the Web – Game demonstrating interconnections between plants and animals
3. Losing Ground – Exploring water and wind soil erosion
4. Agriculture in Your Life – Connecting agricultural sources with everyday products
5. The Food Connection – Placing agriculture products on the Food Guide Pyramid
6. "Oats, Peas, Beans and Barley Grow" – Song about farming and prairie crops

Lessons for Grades 6-8

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. Just Passing Through – Investigating properties of soils
3. Be a Food Detective – Exploring sources of food from food labels
4. Beyond the Beef – Exploring all the products from beef cattle
5. Striking a Balance – Game demonstrating interconnections between plants and animals

Lessons for Grades 9-12

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. Exploring Soils – Investigating properties of soils
3. Be a Food Detective – Exploring sources of food from food labels
4. Striking a Balance – Game demonstrating interconnections between plants and animals
5. Farming in Nature's Image: The Larson Farm – Case study of sustainable agricultural practices

Integration with State Frameworks or Learning Standards*

Grades PreK -1

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x	x	x	x
The Web of Life			x			
Making Pretzels	x	x	x	x		x
Agriculture in Your Life	x	x	x			x
Here Come the Sunflowers			x			
Worm Watching	x		x			
"Oats, Peas, Beans, and Barley Grow"	x				x	

Grades 2-5

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x	x	x	x
Weaving the Web			x			
Losing Ground	x	x	x			
Agriculture in Your Life	x	x	x			
The Food Connection	x	x	x		x	x
"Oats, Peas, Beans, and Barley Grow"	x				x	

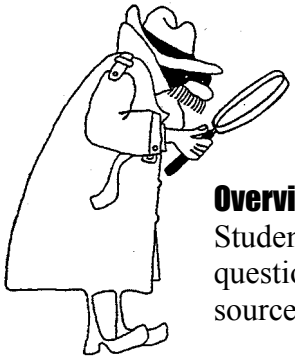
Grades 6-8

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x			x
Just Passing Through			x	x		
Be a Food Detective	x	x	x			x
Beyond the Beef	x	x	x			x
Striking a Balance			x	x		x

Grades 9-12

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x			x
Exploring Soils			x	x		
Be a Food Detective	x	x	x			x
Striking a Balance			x	x		x
Farming in Nature's Image	x	x	x			x

*Adapted from McRel (Mid-Continent Research for Education and Learning). For more information contact: http://www.mcrel.org/standards-benchmarks/



Be a Food Detective

Overview
Students will explore the exciting area of food and nutrition and answer specific questions about prepared food products, including what a food is made from, the source of its ingredients, and how the ingredients were grown.

Suggested Grade Level
6 - 8

Estimated Time
45 minutes and/or options for homework assignments

Objectives
Students will be able to:

1. identify specific ingredients of prepared food products and explain where and how these products are grown.
2. demonstrate an understanding of foods they eat.

Materials
1. Provide a collection of food labels and/or have students bring some to class.
2. Activity Sheet A

Background
The food that is available in a supermarket comes from all over the world. Historically, food was produced and distributed locally. Now, food products in supermarkets could have been grown thousands of miles from where they are purchased and consumed.

Often when looking at a packaged food product, it is hard to determine where the ingredients came from. You have to be a food detective to determine the source of your food. There are several clues that may help you in your search.

Start with the food label. The label provides information on the ingredients of the food and should provide the name and location of the product manufacturer or distributor. If the food was produced in another country, for example Italy, the label may say "Product of Italy." This holds true for most countries. If the ingredients came from other countries and the food product was manufactured in the United States, the label may not tell the source of each ingredient. Fruits and

vegetables are generally seasonal. Although some produce items are available all year, they may be more expensive and of lower quality when out-of-season. By changing the source of the fruit or vegetable, the season for the item at the supermarket can be extended. For example, Chile provides fresh grapes during the off-season in the United States. Chile is in the Southern Hemisphere and has seasons opposite ours: when it is winter here, it is summer there. Controlled environments are also used to extend the season of some fruits and vegetables. Apples, for example, can be stored in a low oxygen, high carbon dioxide environment and remain crisp and edible for the whole year. Also, some vegetables such as tomatoes, lettuce, and cucumbers are grown in greenhouses during the winter.

Examples of Fruits and Vegetables available in each Season in the United States			
Winter	Spring	Summer	Fall
Avocadoes	Artichokes	Beans	Apples
Brussels sprouts	Asparagus	Apricots	Grapes
Cabbage	Broccoli	Beets	Melons
Cauliflower	Lettuce	Blueberries	Pears
Grapefruit	Mushrooms	Lemons	Pumpkins
Potatoes	Papayas	Limes	Squash
Parsnips	Peas	Corn	
Oranges	Pineapples	Cherries	
	Radishes	Peaches	
	Strawberries	Peppers	
	Sweet Potatoes	Plums	
		Summer squash	
		Tomatoes	
		Zucchini squash	

In the produce department where food generally does not have labels, ask the produce manager about the source of particular items. With prepared foods, it is often hard to determine the sources of all the ingredients. For example, chocolate is in many products and it is produced from the seedpods of cacao trees grown in many tropical environments.

It is interesting to see how food is produced and what is involved in getting food from the point of production to the table.

Activity

1. Break up class into small groups of 2 - 3.
2. Distribute labels and Activity Sheet A to each group.
3. Review the background information and proceed with the first exercise on the activity sheet as a group discussion.
4. Have students investigate this activity further or move on to the additional extension activities on page S-2.
5. Have students share their findings with their classmates.

Have students take a prepared food product and find out what the food is made from, the source of the ingredients, and how those ingredients were grown. Look on the label for clues that may help them discover where in the world the food came from. Fill in the Food Detective Ingredient Chart with the clues they find. Use sources from the library or the Internet to help find information about how and where food is grown.

For example: According to the label, Joe's Spaghetti Meat Sauce is made from tomatoes, beef, onions, peppers, garlic, herbs and spices. The tomatoes were grown on tomato plants. Tomato plants are grown in fields and need warm weather to make fruit and for the fruit ripen. The label shows that this sauce was manufactured in California. It is likely that the tomatoes for the sauce were grown in California.

FOOD DETECTIVE INGREDIENT CHART

NAME OF FOOD: *Joe's Spaghetti Meat Sauce*

INGREDIENTS (list each ingredient below)	**INGREDIENT SOURCE** (What the ingredient comes from and how it is grown or produced)	**INGREDIENT PLACE** (Where the ingredient might have been grown or produced)
Tomato	*Tomato plants grown in fields in warm weather*	*California (from the label)*
Beef	*Beef comes from cattle. Cattle eat grass and grain.*	*Unsure of source*
Garlic	*Garlic is grown as bulbs*	*California (from the label)*

Extensions

1. Have students take one of the ingredients on the Food Detective Ingredient Chart, do some research and write a short story about the ingredient. Their story should include how the ingredient is grown, where it is typically grown, how it is handled and transported, other food products that contain the

ingredient, other uses for the ingredient and any interesting facts about the ingredient. (Example: corn is used as a food for people and animals. It is also used in powder, to make biodegradable plastics, as a lubricant, a sweetener, a thickener, a fuel, and cooking oil among other uses.)

2. Have students pick one ingredient on their Food Detective Ingredient Chart and make a collage, using words and pictures, of foods containing that ingredient. Again, they may need to do some snooping around to get more information.

3. Have students find a food that is produced in another country or in another part of the United States from where they live. Find out more about the place where the food comes from. When they have found all the clues, share the information with their classmates and families.

Adapted from "Look Inside Your Supermarket: ShopRite Supermarket Tours," prepared by Janet E. Hawkes Consulting.

Name _____ Activity Sheet A

Be A Food Detective

Directions:
Take a prepared food product and find out what the food is made from, the source of the ingredients, and how those ingredients were grown. Look on the label for clues that may help discover where in the world the food came from. Fill in the Food Detective Ingredient Chart with the your clues. Use sources from the library or the Internet to help find more information about how and where food is grown.

FOOD DETECTIVE INGREDIENT CHART		
NAME OF FOOD: _____		
INGREDIENTS (list each ingredient below)	**INGREDIENT SOURCE** (What the ingredient comes from and how it is grown or produced)	**INGREDIENT PLACE** (Where the ingredient might have been grown or produced)

Name _____ Activity Sheet A

Now that you have found clues to the mystery of where some food comes from, try some of the activities below and research them a bit further.

1. Take one of the ingredients on the Food Detective Ingredient Chart and find out more about it. Do some research and write a short story about the ingredient. Your story should include how the ingredient is grown, where it is typically grown, how it is handled and transported, other food products that contain the ingredient, other uses for the ingredient and any interesting facts about the ingredient. (Example: corn is used as a food for people and animals. It is also used in powder, to make biodegradable plastic, as a lubricant, a sweetener, a thickener, a fuel, and cooking oil among other uses.)

2. Pick one ingredient on your Food Detective Ingredient Chart and make a collage, using words and pictures, of foods containing that ingredient. Again, you may need to do some snooping around to get more information.

3. Find a food that is produced in another country or in another part of the United States from where you live. Find out more about the place where the food comes from. When you have found all the clues, share the information with your classmates and family. Now you are a real food detective.

Beyond the Beef

Overview
This lesson focuses on the many products that are derived from beef cattle beyond just meat and meat products. Students will see that animal agriculture is an important part of their everyday lives.

Suggested Grade Level
6 - 8

Estimated Time
One-half a class period plus time at home or in the community.

Objectives
Students will be able to:

1. identify products they use every day that contain beef by-products
2. understand the importance of animal agriculture in their everyday lives

Materials
1. Background Information Sheets
2. Activity Sheet

Background
A steer is a lot more than steak and roast beef. Cattle by-products are a part of many manufactured items that we use every day and their use enables us to use 99% of every animal.

You may normally think of beef as a hamburger, steak or a roast, which are served at meal times. But there are other edible parts besides the protein-packed muscle. The variety meats, such as livers and hearts, are just two of the many alternatives that are used in gourmet dishes. There are also edible by-products that are not quite so obvious. Do you know that gelatins in products such as ice cream and yogurt are made from the hooves, horns, hide and bones of the cow? Cattle provide a portion of the ingredients in manufactured products such as chewing gum. People depend on cattle for ingredients in many food products.

"What do beef cattle have to do with me? I don't have any in my backyard!" This might be your first reaction to the statement above. However, items manufactured from beef by-products are part of our daily environment. The soap

you washed with this morning; the baseball equipment in the closet; or even the paint on the walls of your home – all of these contain a beef by-product.

Tires have stearic acid from beef cattle, which makes the rubber hold its shape under continuous surface friction. Even the asphalt on our roadways has a binding agent from beef fat. Beef by-products are used in all sorts of mechanical items. Chemical manufacturers use numerous fatty acids from inedible beef fats and proteins for all sorts of lubricants and fluids.

Activity

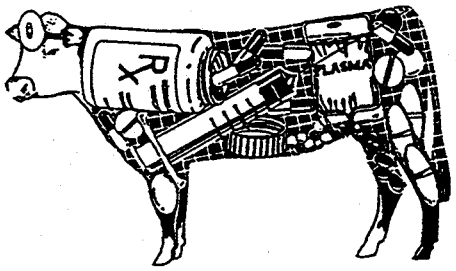
1. Brainstorm with students what products they think come from beef cattle.
2. Have students read over the Background Information on some of the products made from beef cattle.
3. Ask how many of the items are part of their everyday lives?
4. Using the Activity Sheet, have students complete an investigation of products they have at home that come from beef cattle.

Extensions

1. Have students list (in a journal) the number of products they encounter throughout a whole day that come from beef cattle. Discuss in class the next day.

2. Find the nearest beef cattle producer in your state. Go on a visit to the farm/ranch or invite the producer to speak to the class about raising beef.

Adapted from The American National Cattlewomen, Inc.



Name _____ Activity Sheet

Beyond the Beef - Background Information

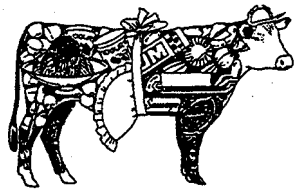
Beef in Your Meal

You may normally think of beef as a hamburger, steak or delicious roast for a satisfying meal. But there are other edible parts besides the protein-packed muscle. The variety meats, such as liver and heart, are just two of the many tasty alternatives that are used in gourmet dishes.

There are also edible by-products that are not quite so obvious. Do you know that gelatins in products such as ice cream and yogurt are made from the hooves, horns, hide and bones of the cow?

Cattle provide a portion of the ingredients in manufactured products such as chewing gum. People depend on cattle for ingredients to make food products such as these:

- sausage
- candies
- chewing gum
- clarification agents for
  - juice, wine and beer
- consume
- cookies
- gelatin in salads/desserts
- head cheese
- ice cream
- marshmallows
- mayonnaise
- oleo shortening
- pate
- sausage casings
- yogurt
- variety meats
  - liver, heart
  - tongue, kidneys

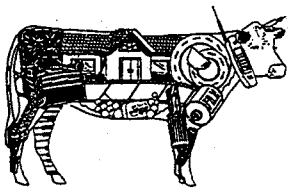


Beef at Work, Play and in the Home

"What do cows have to do with me. I don't have one in my backyard!" This might be your first reaction to the statement above. However, items manufactured from beef by-products are part of our daily environment.

The soap you washed with this morning; the baseball equipment in the closet; or even the paint of the walls of your home – all of these contain a beef by-product. The following contain one or more beef by-products:

- bone china
- bonemeal biscuits
- boots and shoes
- candles
- cosmetics
- crayons
- deodorants
- detergents
- doggie chews
- fabric softeners
- floor wax
- glue
- insecticides
- leather sporting goods
- luggage
- paint
- pet foods
- photographic film
- plastics
- shampoo/cream rinses
- shaving cream
- soaps
- textiles
- toothpaste
- upholstery
- violin strings



Name _____ Activity Sheet

Beyond the Beef - Background Information

Beef in the Pharmacy

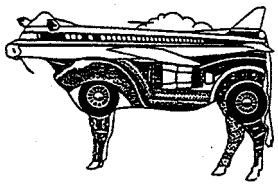
The medical world also relies on this resource for the pharmaceutical wonders it produces and uses. This is because cattle have great similarities in organic chemical structure to humans. Our bodies will easily accept a medication or treatment made with these animal components. Some products are synthesized. However, many are still made more economically from cattle.

Insulin – treatment of diabetes
Heparin – prolongs the time needed for blood to clot
Corticotrophin – used in the treatment of allergies, rheumatoid arthritis, rheumatic fever, and respiratory diseases
Thyrotropin – stimulates the thyroid gland
Parathyroid hormone – used to treat parathyroid deficiencies
Thrombin – promotes coagulation during surgery
Glucagon – treats hypoglycemia (low blood sugar)
Sodium levothyroxine – thyroid replacement therapy
Fibrinolysin – treatment of blood clots within the cardiovascular system
Pancreatin – treatment of infants with celiac disease (gluten intolerance) and related pancreatic deficiencies
Thyroid – treats myxedema (metabolitic disease caused by deficient action of the thyroid gland) in adults and cretinism (deformity and mental retardation in children
Parathyroid hormone – used to treat parathyroid deficiencies

Beef on the Road

Tires have stearic acid that makes the rubber hold its shape under continuous surface friction. Even the asphalt on our roadways has a binding agent from fat. Some other unusual but necessary products are:

asphalt
rubber tires
textiles for upholstery
car polishes and waxes
hydraulic brake fluid



Beef in Industry

Beef by-products are used in all sorts of mechanical items. Chemical manufacturers use numerous fatty acids from inedible beef fats and proteins for all sorts of lubricants and fluids.

animal feed
cement blocks
explosives
fertilizers
high gloss for magazines
industrial cleaners
lubricants
molds for plastics
printing ink
whitener for paper

Name _____ Activity Sheet

Beyond the Beef - Activity Sheet

"What do beef cattle have to do with me? I don't have any in my backyard!" Virtually the entire beef animal (99%) is used for something, but only 41% of it is used as meat. The rest of the steer is used to provide products we use daily.

Using the Beyond the Beef Background Information Sheet, see how many things you can find in your home that come from a beef animal. List products below.

Beef in Your Meal

Beef in Industry / On-the-Road

Beef at Work, Play, and Home

Beef in the Pharmacy

Just Passing Through

Overview
Students will investigate soils and observe how water moves through soil, how soil properties affect flow rate and water holding capacity. Students time the flow of water through different soils and measure the amount of water held in these soils. They will also observe the filtering ability of soils by noting the clarity of the water before and after it passes through the soil.

Suggested Grade Level
6 - 8

Estimated Time
45 minutes

Objectives
Students will be able to:

1. develop an understanding of how water flows through soils and how the water changes as it goes through.
2. utilize the scientific method; i.e., ask questions, develop and test hypotheses, observe and analyze results, and draw conclusions.
3. work together in small groups and share findings with classmates.

Materials
(per group of 3-4 students)

1. "Just Passing Through" Activity Sheet A
2. Clear 2L (soda) bottle
3. Three 500mL beakers or similar size clear containers marked off in cm to pour and catch water
4. Soil samples: bring to class 1L samples of different types of soil from around the school grounds or from students' homes. Possibilities include topsoil, potting soil, sand, soils that are compacted, soils with grass growing on top, soils with clearly different textures.
5. Fine window screen or other fine mesh that does not absorb or react with water (1mm or less mesh size).
6. Quantity of clean sand
7. Water
8. Clock or timer

9. Red and black marking pens
10. pH Test Kit (Extension option)

NOTE: Smaller containers may be used, if desired, as long as the soil container sits firmly on the water-catching container. Reduce the amounts of soil and water, but have all students begin with the same amounts.

Background

What happens to water when it passes through soil depends on many things such as the size of soil particles (texture and particle size distribution), how the particles are arranged (structure), how tightly they are packed (bulk density), and the chemical attraction between the soil particles and the water. Some types of soil let water flow in quickly, and then hold the water inside the soil like a sponge. This might give plants a better chance of using some of that water. Other types of soil may let the water go completely through in just seconds. Still other soils may keep water from getting in at all. None of these soil types is better than the other; they are simply different.

Activity

1. Hand out "Just Passing Through" Activity Sheet A
2. Remove label and lid and cut off bottom (above curve) of the 2L bottle.
3. Turn the bottle over so it looks like a funnel and place a circle of screen inside the bottle so that it covers the cap opening.
4. Pour 3-4 cm of sand onto the screen. The sand will keep the screen from becoming clogged.
5. Place the bottle, mesh side down, on a beaker or clear container.
6. Pour 1L of soil into the bottle over the sand.
7. Conduct the Class Demonstration and Inquiry.
8. Have students do the Group Investigation.

Class Demonstration and Inquiry

1. Choose a soil for the classroom demonstration (a sandy loam works best) and put some of the soil out on white paper on a table for students to observe. Have students look closely at the soil and notice the color, presence of plant material or other organic matter, the feel, the shape of the particles and record their observations of the soil on the board.

2. Next, place a 1L soil sample in the cut off 2L bottle inverted over the beaker. Pour 300mL of water into a 500mL beaker or other clear container and mark the level in black. Have students notice the clarity of the water. Ask students what will happen when we pour the water into the soil. Ask follow-up questions that get students to explain why they think the soil and water will behave as they predict. Possible questions may include: Will the water run through the bottom of the bottle? Will it <u>all</u> run out? If not <u>all</u>, how much?

What will the water look like? Clear? Murky? Very dirty? How long will it take for the water to flow through? Record all the student hypotheses on the board. Mark the pouring container with a red line where the students predict how much water will flow through the soil.

3. Pour the water onto the soil and begin timing. Ask students to describe what happens as you pour the water. Is the water staying on top? Where is it going? Do you see air bubbles? Why or why not? Does the water coming out of the soil look the same as the water going in? Record the class observations on the board. Also record the time it took for the water to go through the soil.

4. Ask students to compare their hypotheses with what they observed. Once the water has stopped dripping from the bottom of the bottle, remove the soda bottle and hold up the beaker of water that passed through the soil. Ask students to compare their hypotheses about the water to their observations. Pour the water back into the pouring container and compare the amount with the starting amount (black line). How much water is missing? How can we measure the missing amount? Compare the amount of water with the amount students predicted would come through the soil (red line). Is there more or less water then the class predicted? What happened to the missing water? Is the water more or less clear than the water that was poured through the soil? Compare samples.

5. Have students predict what will happen if they poured more water into the soil. Record their hypotheses and try it. Compare the observations with their predictions and ask clarifying questions. Next, have students try the same investigation with other soil samples. **NOTE:** Wash funnel and screen and add more clean sand before using a new soil sample.

Group Investigations

1. Give each student the "Just Passing Through" Activity Sheet A, which is a place to record hypotheses, observations, and conclusions. Have the students, in groups of 3-4, repeat the above investigation with the other soil samples.

2. Have students share their results and conclusions with the whole class. Discuss why there were differences between soil samples. Have students draw conclusions about water holding capacity based on the properties of soils.

3. Compare the results of the group investigations. Discuss the differences in soils. Ask questions about soil properties and uses of soils. Which soil property would you look for if you wanted to plant a garden? …build a

driveway or a playground? What happens if the soil is full of water and a heavy rain falls on it? How can you change the way the soil holds water? What happens to the soil when organic matter is added, when plants are growing on top of it, when it is compacted, or when it is plowed?

Extensions

1. Have students try this activity with soil components such as pure sand or clay and compare the differences. They could also do the activity with other materials such as commercial potting soil, perlite, compost, and vermiculite and make conclusions about the properties of these soil enhancements.

2. Students can experiment with filtering by using very murky water and passing it through clean sand.

3. Using distilled water, have students measure the pH of the water. Predict whether the pH will be different after the water passes through the soil. Pour the water through, and then test the pH again. Have students draw conclusions about the affect of soil on water pH.

Adapted from the GLOBE Program, Global Learning and Observing to Benefit the Environment.

Name _____ Activity Sheet A

Just Passing Through

1. Describe your soil sample (color, texture, feel, shape of particles, size of particles, plant material, etc.)

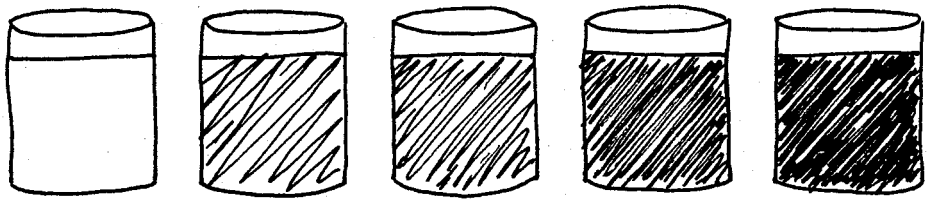
Hypotheses:

2. What do you think will happen when you pour water through the soil sample?

3. How long do you think it will take for the water to flow through the soil?

4. How much water do you think will pass through the soil sample?

5. What will the water look like? (Circle your prediction.)



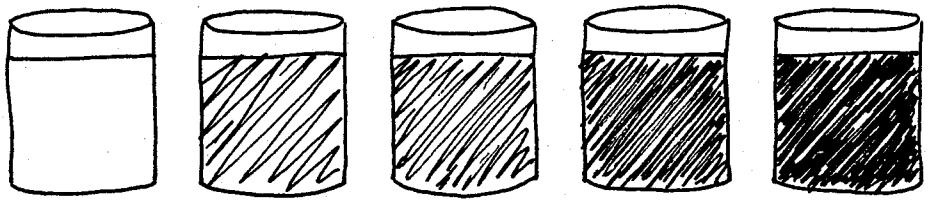
Observations:

6. What happened when you poured the water onto the soil?

7. How long did it take for the water to flow through the soil?

8. How much water flowed through the soil?

9. What did it look like? (Circle your observation.)



10. Did your observations match your hypotheses? In what ways?

11. What do you think would happen if you poured more water onto the wet soil?

12. What can you conclude about this soil sample and its capacity to hold water?

13. What might this soil be good for? Explain your answer.

Prairie Scavenger Hunt

Overview
While visiting the *Listening to the Prairie* exhibition, students will search for a variety of items located throughout the exhibition. This activity will encourage students to slow down, carefully observe, interact with, and "listen to" the contents of the exhibit.

Suggested Grade Level
6 - 8

Estimated Time
20 – 30 minutes

Objectives
Students will be able to:

1. identify common plants and animals found on the prairie.
2. ask questions, develop hypotheses, and draw conclusions.
3. work in teams, and practice written, illustration and observation skills.

Materials
Activity Sheet A

Background
Listening to the Prairie; Farming in Nature's Image is about agriculture in the North American prairie and the forces of change that turned vast grasslands into one of the most productive agricultural lands on earth. It reveals the relationship between prairie ecology and new ways to grow food.

The Fruitful Prairie – More than 25 percent of America's productive cropland, pastureland, and range land are located in the North American prairie.

The Prairie Ecosystem – In its natural state, the prairie is a complex, fragile, and dynamic ecosystem that has sustained a diversity of plant and animal life for thousands of years.

From Native Grasses to Cultivated Grains – Deep fertile soils and a favorable growing climatic influenced 19th and 20th century farmers to cultivate the prairie

by replacing native grasses with profitable grains and legumes such as wheat, corn, barley, rice, and soybeans.

Forces of Change – Natural forces, such as wind and fire, and human forces, including agriculture and technology, have altered much of the prairie ecosystem.

Sustainable Agricultural Practices – By listening to and observing nature, some farmers and ranchers have adopted practices that keep their operations productive and profitable, while protecting a diverse prairie ecosystem for future generations.

If history is our guide, some of today's alternatives will be tomorrow's accepted practices. Explore how they affect you and your community.

Activity

1. Divide class into teams or small groups of two or three.
2. Distribute Activity Sheet A to each group.
3. Have each group search for the items and record answers and observations.
4. Walk back through the exhibit together as a class and have students share their observations with their classmates.

Extensions

1. Have each group of students select one or two items they found interesting while visiting the exhibition. Find out more information about each and prepare a report to share with their classmates.

2. Five "Cues from Nature" (found on the exhibition panel entitled *An Ear to the Ground* and summarized below) can be applied in nearly every eco-region around the country. For a more advanced activity, have students choose one (or more) of these five principles and explore how it might apply to their home or school. Have them share their ideas with their classmates.

   "Cues from Nature"
   a. Keep it covered… farmers keep fields planted year-round to enrich soil and prevent erosion.
   b. Make it diverse… farmers raise a variety of crops and animals to hedge against pest outbreaks, severe weather, and market changes.
   c. Keep it dynamic… farmers frequently rotate crops and grazing animals to keep the land fertile.
   d. Keep it recycling… farmers re-use plant/animal wastes to fertilize crops.
   e. Work with natives… farmers and ranchers plant pastures with native plant species to nourish livestock and wildlife.

Name _____ Activity Sheet A

Prairie Scavenger Hunt

Directions: Find the answers to all the questions by looking and listening to the exhibit. Record your answers and observations below.

A. Find five (5) sunflowers throughout the exhibit? Note where you find them. Name three (3) products made from sunflowers.

B. Look in the shopping cart at the beginning of the exhibit and select two (2) products by touching the screen. Find the sources (what they are made from) of these products elsewhere in the exhibit, but **not** from that panel. Note what each product is and where it is found in the prairie.

C. Sketch an animal that lives underground in the prairie.

D. Find the five "Cues from Nature," that some farmers and ranchers use when growing plants and animals.
   1.
   2.
   3.
   4.
   5.

E. Recycling is a way of returning energy to the ecosystem. Find an example in the exhibit where a farmer or rancher uses recycling and describe what they are doing?

Name _____ Activity Sheet A

F. In the exhibition find the dollar and answer the following questions:

1. What percent (%) of your food dollar goes to the farmer?

2. Name five (5) other places where your food dollar goes.

G. Find two (2) types of grasses and write something about each grass.

Grass #1

Grass #2

H. Find two (2) types of grains and write something about each grain.

Grain #1

Grain #2

I. Why is the farmer burning the grasses on the prairie?

What would happen if the farmers did not burn the grasses?

J. What can farmers do to keep crops from being destroyed by grasshoppers? (Hint! Listen to the narrator talk about prairie ecosystem.)

Striking a Balance

Overview
The sun's energy is captured by individual plants and transferred to animals through food chains. Students will participate in an activity that demonstrates the principles and dynamics of food chains.

Suggested Grade Level
6 - 8 (10 students minimum)

Estimated Time
45 minutes

Objectives
The students will be able to:

1. learn to predict a likely food chain for a given habitat.
2. understand that energy is lost through breathing, heating and moving.
3. understand that energy is transferred when it passes from one organism to another.

Background
Feeding relationships are often difficult to observe. In this activity, students gain some understanding of these relationships by assuming the roles of animals, playing tag, and simulating feeding relationships. Popcorn is spread over a lawn, park, or playground area. The kernels of popcorn represent plants, which are the food sources for the plant eaters. Some students play grasshoppers (plant eaters or herbivores), some students play frogs (grasshopper eaters or carnivores), and some students play hawks (frog eaters or carnivores).

The object of the game is for each animal to eat without being eaten before the "day" (five minutes) is over. In nature, the populations of plants and animals are usually large enough to insure continuation of the species if some are lost. In this game, populations (popcorn "plants", grasshoppers, frogs, and hawks) are so small that the survival of <u>one</u> of each kind will be considered an indication of a "balanced" ongoing community. You can repeat the game many times in one activity session, but encourage the students to change the rules of behavior and the numbers of each kind of animal until a "balance" is achieved in your plant – grasshopper - frog - hawk food chain.

Materials

For the whole group:

1. 2 –3 gallons of popped popcorn
2. 1 marking pen
3. 1 kitchen timer, watch, or stopwatch
4. plastic sandwich bags, one for each student plus a few extra, as follows:

• sixty percent (60%) of the class will be grasshoppers and given "stomachs," plastic sandwich bags marked with a line 1.5" from the bottom of the bag.
• twenty-five (25%) of the class will be frogs, and given "stomachs," plastic sandwich bags marked with a line 2.5" from the bottom of the bag.
• fifteen percent (15%) of the class will be hawks, and given "stomachs," plastic sandwich bags marked with a line 2.5" from the bottom of the bag (same as frogs).

5. sashes in three different colors, plus a few extra of each color:
   color 1 = 60% of sashes for grasshoppers
   color 2 = 25% of sashes for frogs
   color 3 = 15% of sashes for hawks

6. site selection: a lawn, park, or playground approx. 50' x 50' or larger.

Activity

Striking a Balance Game – The objective is to survive as an animal in a make-believe food chain by getting enough to eat while avoiding being eaten.

1. Introduce food chains by asking students if they know what mice eat and what eat mice. (Mice eat seeds and snakes eat mice.) Diagram the relationship they describe and introduce it as a food chain. . Arrows point in the direction that energy transfers within the food chain (sun → seeds → mice → snakes). Ask the students if they can think of other food chains, including a food chain that contains humans (i.e., sun → grass → beef → humans).

2. Tell students that you will be distributing plants (popcorn) that grasshoppers eat. ***(Save some for later!)*** Ask students what plant popcorn comes from!

3. Consider a random drawing to determine students' roles. Be sure to change sashes and stomachs if students' roles change.

4. Hand out a grasshopper stomach and sash **(color 1)** to 60% of the group.

5. Hand out a frog stomach and sash **(color 2)** to 25% of the group.

6. Hand out a hawk stomach and sash **(color 3)** to 15% of the group.

7. When the game begins, the grasshoppers pick up (eat) popcorn and place it in their stomach bags. Frogs try to tag (eat) the grasshoppers. When a frog eats a grasshopper, the grasshopper's stomach contents are transferred to the stomach of the frog. (While the transfer is taking place, both the grasshopper and the frog are safe from other frogs and hawks.) Hawks try to tag (eat) the frogs. When a hawk eats a frog, the frog's whole stomach contents are transferred to the stomach of the hawk. (While the transfer is taking place, the frog is safe from other hawks.) Hawks do not eat grasshoppers in this game. **NOTE:** Animals that are eaten rejoin the game (to simulate reproduction) and continue to gather food. Once a grasshopper or a frog has filled its stomach to the marked line, it has survived. A hawk must have the equivalent of one frog to survive. Only then can they go to a designated safe area (tree, post, etc.) as "survivors."

8. Set the timer for 5 minutes and start the game. At the end of the first game, analyze what happened. How many animals survived? If at least one of each kind of animal survives, you have an ongoing food chain. Return the popcorn to the activity area after each game.

9. *Instant Replay* – Ask for suggestions on rule changes that might result in more of a balance after the five-minute game. Usually <u>one</u> rule is changed for each replay. When you have settled on your new rules, play again. Suggest some of the following changes if the students do not offer any. A) Change the number of grasshoppers and/or frogs and/or hawks. B) Time releases: let grasshoppers forage unmolested; one minute later release frogs, and later the hawks. C) Spread out more popcorn.

10. After each game, analyze the results. How many grasshoppers, frogs, and hawks survived? Encourage students to compare game results after each rule change, and to comment on how the game "balance" compares with balance in the real world. In nature's balance, there are more plants than plant eaters, and more plant eaters than animal eaters. What would happen if there were 50% less popcorn plants? What would happen to the animals that depend on those plants? If there were no frogs, what would happen to the plant population? …the grasshopper population? …the hawk population? Do hawks need plants to survive? Have students describe some food chains in which they are a part? Are there any plants or animals that are <u>not</u> part of any food chain?

Adapted from the Outdoor Biology Instructional Strategies (OBIS), Lawrence Hall of Science, University of California, Berkeley, CA 94720.

Listening to the Prairie: Farming in Nature's Image

Lessons for Grades 9 - 12

Developed, adapted and/or compiled by:

David G. Cox
Janet E. Hawkes

New York Agriculture in the Classroom
Cornell Educational Resources Program

For the United States Department of Agriculture - Agriculture in the Classroom Program to accompany the Smithsonian Institution's traveling exhibition.

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Listening to the Prairie: Farming in Nature's Image

"Agriculture is too important a topic to be taught only to the relatively small percentage of students considering careers in agriculture and pursuing vocational agriculture studies."

National Research Council

Overview

Across the United States, serious efforts are underway by educators and professionals to raise public awareness about agriculture and the many difficult challenges facing our nation's most vital and vulnerable industry. Research has shown that most Americans know very little about agriculture, its social and economic significance in the United States, and particularly, its links to human health and environmental quality. Likewise, most students have very little knowledge of the growing number of exciting career opportunities available within the agricultural industry.

Listening to the Prairie: Farming in Nature's Image, is an exhibition that will change how people think about agriculture in America. It's about growing food on the North American prairie and the forces of change that turned vast grasslands into one of the most productive agricultural lands on earth. These lands are our nation's most fertile, diverse, fragile, and endangered ecosystems, but they also serve as a model for environmentally sound agriculture. The traveling exhibition focuses on how changes in this ecosystem and other ecosystems across the country impact people and their communities. It reveals information on how a natural ecosystem works, and tells stories of farmers and ranchers who are farming in nature's image.

Ag in the Classroom

Smithsonian Institution

Sustainable Agriculture Research and Education

About These Activities

Agriculture in the Classroom, a national K-12 agriculture awareness program, is pleased to provide a series of lessons and activities to complement the Smithsonian Institution's traveling exhibition. These activities were created and compiled by New York Agriculture in the Classroom, a division of the Cornell Educational Resources Program at Cornell University in Ithaca, NY. The contents are designed for PreK-12 teachers, educators, home-schoolers, and parents who spend time with their families at libraries and learning centers. With the exception of the on-site scavenger hunts, most of the enclosed materials can be utilized before or after your visit to the exhibition.

The purpose of these activities is to serve as educational supplements to the exhibition as well as a method with which to engage students and families about the daily issues of agriculture and the food and fiber industry. Although only 2.5% of our population live on farms, all of us eat and wear products derived from agriculture every day, including many products from the North American Prairie. Since most of the United States population do not live in the prairie, the "clues from nature" emphasized in the exhibition may be applied to nearly every region of the country.

Lessons and activities have been divided into four grade-level groups: PreK-1, 2-5, 6-8, and 9-12. All of the enclosed lessons, activities, and worksheets are B&W photocopy reproducible, and clearly formatted. Each lesson contains a brief overview, objectives, a list of materials needed, background information, activity instructions, and suggestions for extensions for those who wish to further explore the lesson topic or concept. A separate chart is included that summarizes all of the enclosed lessons and the appropriate National Standards (McRel) addressed.

In addition, Smithsonian Institution's National Museum of Natural History, the American Library Association (ALA), and participating libraries have assembled an impressive program of supplementary resources, activities, lectures, tours, and workshops for visitors of all ages to enrich their visit to this important exhibition. *Consult your library staff for the calendar of events and the wealth of educational resources gathered especially for this event*.

Enjoy your visit at this most important exhibition. The lessons to explore are universal and timeless, and will serve as valuable resources in agricultural awareness and education for years to come.

Ag in the Classroom

Smithsonian Institution

Sustainable Agriculture Research and Education

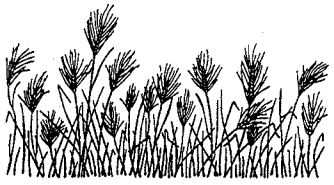
A Brief Prairie History[1]

The First Prairie Farmers – Crops have been grown on the prairie for more than 4,000 years. Native prairie farmers cultivated the soft, alluvial soils in the river bottomlands because they did not have forged metal tools to work the tough prairie sods in the uplands. They raised corn, beans, squash, pumpkins, sunflower, and tobacco in small garden plots for about twenty-five years, and then moved to new plots on a two to three hundred year rotation. Native farming communities also gathered edible wild plants and hunted rabbits, deer, and bison.

The Will of Iron – By the end of the 19th century, the North American prairie had become one of the greatest food-producing regions in the world. New machinery, new railroads, new government policies and the tenacity of new settlers made this transformation possible. The steel plow broke heavy prairie soils for planting crops. Affordable barbed wire fencing enclosed grazing and crop lands on the treeless landscape. Windmills provided a reliable water source for livestock and crops, and transcontinental railroads linked the new prairie producers with urban markets in the East and in Europe.

The Fruitful Plain – Today one American farmer feeds 143 people, more than five times that of a farmer in 1950. This phenomenal growth in production has resulted largely from technological forces of change – new machinery, new crop varieties and the development of chemical fertilizers and pest controls. Farms and ranches are also fewer, larger, and more specialized than they were fifty years ago.

New Alternatives – The willingness of the farmers and ranchers to change has been the cornerstone of successful American agriculture. What are common practices now, chemical pesticides and fertilizers, for example, were alternatives fifty years ago. Today's farmers and ranchers continue to adopt new approaches to keep their operations productive and profitable, while safeguarding the environment. If history is our guide, some of today's alternatives will be tomorrow's accepted practices.



[1] *Adapted from the final exhibition script of "Listening to the Prairie: Farming in Nature's Image."*

Smithsonian
Institution

Summary of Activities

Lessons for Grades PreK-1

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. The Web of Life – Game demonstrating interconnections between plants and animals
3. Making Pretzels – Cooking activity from grain to food
4. Agriculture in Your Life – Connecting agricultural sources to everyday products
5. Here Come the Sunflowers – Planting and growing activity
6. Worm Watching – Activity for observing worms in action
7. "Oats, Peas, Beans and Barley Grow" – Song about farming and prairie crops

Lessons for Grades 2-5

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. Weaving the Web – Game demonstrating interconnections between plants and animals
3. Losing Ground – Exploring water and wind soil erosion
4. Agriculture in Your Life – Connecting agricultural sources with everyday products
5. The Food Connection – Placing agriculture products on the Food Guide Pyramid
6. "Oats, Peas, Beans and Barley Grow" – Song about farming and prairie crops

Lessons for Grades 6-8

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. Just Passing Through – Investigating properties of soils
3. Be a Food Detective – Exploring sources of food from food labels
4. Beyond the Beef – Exploring all the products from beef cattle
5. Striking a Balance – Game demonstrating interconnections between plants and animals

Lessons for Grades 9-12

1. Prairie Scavenger Hunt – Introduction to "Listening to the Prairie"
2. Exploring Soils – Investigating properties of soils
3. Be a Food Detective – Exploring sources of food from food labels
4. Striking a Balance – Game demonstrating interconnections between plants and animals
5. Farming in Nature's Image: The Larson Farm – Case study of sustainable agricultural practices

Integration with State Frameworks or Learning Standards*

Grades PreK -1

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x	x	x	x
The Web of Life			x			
Making Pretzels	x	x	x	x		x
Agriculture in Your Life	x	x	x			x
Here Come the Sunflowers			x			
Worm Watching	x		x			
"Oats, Peas, Beans, and Barley Grow"	x				x	

Grades 2-5

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x	x	x	x
Weaving the Web			x			
Losing Ground	x	x	x			
Agriculture in Your Life	x	x	x			
The Food Connection	x	x	x		x	x
"Oats, Peas, Beans, and Barley Grow"	x				x	

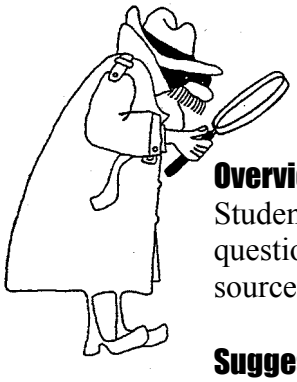
Grades 6-8

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x			x
Just Passing Through			x	x		
Be a Food Detective	x	x	x			x
Beyond the Beef	x	x	x			x
Striking a Balance			x	x		x

Grades 9-12

Activity	ELA	SS	SCI	Math	Arts	LS
Prairie Scavenger Hunt	x	x	x			x
Exploring Soils			x	x		
Be a Food Detective	x	x	x			x
Striking a Balance			x	x		x
Farming in Nature's Image	x	x	x			x

*Adapted from McRel (Mid-Continent Research for Education and Learning). For more information contact: http://www.mcrel.org/standards-benchmarks/



Be a Food Detective

Overview
Students will explore the exciting area of food and nutrition and answer specific questions about prepared food products, such as, what a food is made from, the source of its ingredients, and how the ingredients were grown.

Suggested Grade Level
9 - 12

Estimated Time
45 minutes and/or options for homework assignments

Objectives
Students will be able to:

1. identify specific ingredients of prepared food products, and explain where and how these products are grown.
2. demonstrate an understanding of foods they eat.

Materials
1. Provide a collection of food labels and/or have students bring some to class.
2. Activity Sheet A

Background
The food that is available in a supermarket comes from all over the world. Historically, food was produced and distributed locally. Now, food products in supermarkets could have been grown thousands of miles from where they are purchased and consumed.

Often when looking at a packaged food product, it is hard to determine where the ingredients came from. You have to be a food detective to determine the source of your food. There are several clues that may help you in your search.

Start with the food label. The label provides information on the ingredients of the food and should provide the name and location of the product manufacturer or distributor. If the food was produced in another country, for example Italy, the label may say "Product of Italy." This holds true for most countries. If the ingredients came from other countries and the food product was manufactured in the United States, the label may not tell the source of each ingredient. Fruits and

vegetables are generally seasonal. Although some produce items are available all year, they may be more expensive and of lower quality when out-of-season. By changing the source of the fruit or vegetable, the season for the item at the supermarket can be extended. For example, Chile provides fresh grapes during the off-season in the United States. Chile is in the Southern Hemisphere and has seasons opposite ours: when it is winter here, it is summer there. Controlled environments are also used to extend the season of some fruits and vegetables. Apples, for example, can be stored in low oxygen, high carbon dioxide environment and remain crisp and edible for the whole year. Also, some vegetables such as tomatoes, lettuce, and cucumbers are grown in greenhouses during the winter.

Examples of Fruits and Vegetables available in each Season in the United States			
Winter	Spring	Summer	Fall
Avocadoes	Artichokes	Beans	Apples
Brussels sprouts	Asparagus	Apricots	Grapes
Cabbage	Broccoli	Beets	Melons
Cauliflower	Lettuce	Blueberries	Pears
Grapefruit	Mushrooms	Lemons	Pumpkins
Potatoes	Papayas	Limes	Squash
Parsnips	Peas	Corn	
Oranges	Pineapples	Cherries	
	Radishes	Peaches	
	Strawberries	Peppers	
	Sweet Potatoes	Plums	
		Summer squash	
		Tomatoes	
		Zucchini squash	

In the produce department where food generally does not have labels, you can ask the produce manager about the source of particular items. With prepared foods, it is often hard to determine the sources of all the ingredients. For example, chocolate is in many products and it is produced from the seedpods of cacao trees grown in many tropical environments.

It is interesting to see how food is produced and what is involved in getting food from the point of production to the table.

Activity

1. Break up class into small groups of 2 - 3.
2. Distribute labels and Activity Sheet A to each group.
3. Review the background information and proceed with first exercise on the activity sheet as a group discussion.
4. Have students investigate this activity further or move on to the additional extension activities on page S-2.
5. Have students share their findings with their classmates.

Have students take a prepared food product and find out what the food is made from, the source of the ingredients, and how those ingredients were grown. Look on the label for clues that may help them discover where in the world the food came from. Fill in the Food Detective Ingredient Chart with the clues they find. They can use sources from the library or the Internet to help find information about how and where food is grown.

For example: According to the label, Joe's Spaghetti Meat Sauce is made from tomatoes, beef, onions, peppers, garlic, herbs and spices. The tomatoes were grown on tomato plants. Tomato plants are grown in fields and need warm weather to make fruit and for the fruit ripen. The label shows that this sauce was manufactured in California. It is likely that the tomatoes for the sauce were grown in California.

FOOD DETECTIVE INGREDIENT CHART		
NAME OF FOOD: *Joe's Spaghetti Meat Sauce*		
INGREDIENTS (list each ingredient below)	**INGREDIENT SOURCE** (<u>What</u> the ingredient comes from and <u>how</u> it is grown or produced)	**INGREDIENT PLACE** (<u>Where</u> the ingredient might have been grown or produced)
Tomato	*Tomato plants grown in fields in warm weather*	*California (from the label)*
Beef	*Beef comes from cattle. Cattle eat grass and grain.*	*Unsure of source*
Garlic	*Garlic is grown as bulbs*	*California (from the label)*

Extensions

1. Have students take one of the ingredients on the Food Detective Ingredient Chart, do some research and write a short story about the ingredient. Their story should include how the ingredient is grown, where it is typically grown, how it is handled and transported, other food products that contain the

ingredient, other uses for the ingredient and any interesting facts about the ingredient. (Example: corn is used as a food for people and animals. It is also used in powder, to make biodegradable plastics, as a lubricant, a sweetener, a thickener, a fuel, and cooking oil among other uses.)

2. Have students pick one ingredient on their Food Detective Ingredient Chart and make a collage, using words and pictures, of foods containing that ingredient. Again, they may need to do some snooping around to get more information.

3. Have students find a food that is produced in another country or in another part of the United States from where they live. Find out more about the place where the food comes from. When they have found all the clues, share the information with their classmates and families.

Adapted from "Look Inside Your Supermarket: ShopRite Supermarket Tours," prepared by Janet E. Hawkes Consulting

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Name _____ Activity Sheet A

Be A Food Detective

Directions:
Take a prepared food product and find out what the food is made from, the source of the ingredients, and how the ingredients were grown. Look on the label for clues that may help you discover where in the world the food came from. Fill in the Food Detective Ingredient Chart with the your clues. Use sources from the library or the Internet to help find more information about how and where food is grown.

FOOD DETECTIVE INGREDIENT CHART		
NAME OF FOOD: _____		
INGREDIENTS (list each ingredient below)	**INGREDIENT SOURCE** (What the ingredient comes from and how it is grown or produced)	**INGREDIENT PLACE** (Where the ingredient might have been grown or produced)

Name _____ Activity Sheet A

Now that you have found clues to the mystery of where some food comes from, try some of the activities below and research them a bit further.

1. Take one of the ingredients on the Food Detective Ingredient Chart and find out more about it. Do some research and write a short story about the ingredient. Your story should include how the ingredient is grown, where it is typically grown, how it is handled and transported, other food products that contain the ingredient, other uses for the ingredient and any interesting facts about the ingredient. (Example: corn is used as a food for people and animals. It is also used in powder, to make biodegradable plastic, as a lubricant, a sweetener, a thickener, a fuel, and cooking oil among other uses.)

2. Pick one ingredient on your Food Detective Ingredient Chart and make a collage, using words and pictures, of foods containing that ingredient. Again, you may need to do some snooping around to get more information.

3. Find a food that is produced in another country or in another part of the United States from where you live. Find out more about the place where the food comes from. When you have found all the clues, share the information with your classmates and family. Now you are a real food detective.

Exploring Soils

Overview
Students will investigate soils and learn about soil texture, soil water-holding capacity, and other properties of soils.

Suggested Grade Level
9 - 12

Estimated Time
90 minutes

Objectives
Students will be able to:

1. develop an understanding of how water flows through soils and how the water changes as it goes through.
2. utilize the scientific method; ie, ask questions, develop and test hypotheses, observe and analyze results, and draw conclusions.
3. work together in small groups and share findings with classmates.
4. analyze a soil to determine its texture.

Activity A – Soil Texture

Materials
(per group of 3-4 students)

1. "Soil Texture" Activity Sheet A
2. Soil samples: bring to class 1L samples of different types of soil from around the school grounds or from students' homes. Possibilities include topsoil, potting soil, sand, soils that are compacted, soils with grass growing on top, soils with clearly different textures.
3. 1 quart-jar (mason) with lid
4. Water
5. Marking pen
6. White poster board

Background

Soils are precious natural resources that affect every part of the ecosystem. Soils hold water and nutrients for plants and ultimately animals. All the food we eat and the natural materials we use, such as paper, wood and clothing, depend on soils. It is important to understand soil and its role in the ecosystem and in agriculture.

The physical properties of soils affect the type and amount of vegetation that can grow in a given location. For example, the amount of water a soil can hold (water holding capacity) is a factor affecting the plants that can survive. Certain plants grow in sandy well-drained desert soils while others grow in heavy clay soil wetlands. Soil temperature, soil pH, soil structure, organic matter content, soil moisture and soil fertility are all variables that affect the organisms that can live in the soil, and which, in turn, impact the entire ecosystem.

Soil texture is the way a soil feels, and refers to the amount of sand, silt and clay particles that are present in a soil. Sand, silt and clay particles are all different sizes. The largest soil particle is sand (2.00-0.05mm in diameter), which feels gritty to the touch. The next smaller particle size is silt (0.05-0.02mm in diameter), which feels smooth or "floury" to the touch. The smallest particle size is clay (<0.02mm), which feels sticky and is hard to squeeze in your hand. Most soils have a mixture of sand, silt, and clay. (See Soil Texture Activity Sheet.)

Activity

1. Each group of 3-4 students should have a soil sample.
2. Have students do the "Soil Texture" activity to determine the texture of their soil.
3. Compare results among all of the different groups, and discuss how soil texture affects the uses of soil.

Activity B – Just Passing Through

Materials

(per group of 3-4 students)

1. "Just Passing Through" Activity Sheet B
2. Clear 2L (soda) bottle
3. Three 500mL beakers or similar size clear containers marked off in cm to pour and catch water
4. Soil samples: bring to class 1L samples of different types of soil from around the school grounds or from students' homes. Possibilities include topsoil, potting soil, sand, soils that are compacted, soils with grass growing on top, soils with clearly different textures

5. Fine window screen or other fine mesh that does not absorb or react with water (1mm or less mesh size)
6. Quantity of clean sand
7. Water
8. Clock or timer
9. Red and black marking pens
10. pH Test Kit (Extension option)

NOTE: Smaller containers may be used, if desired, as long as the soil container sits firmly on the water-catching container. Reduce the amounts of soil and water, but have all students begin with the same amounts.

Background

What happens to water when it passes through soil depends on many things such as the size of soil particles (texture and particle size distribution), how the particles are arranged (structure), how tightly they are packed (bulk density), and the chemical attraction between the soil particles and the water. Some types of soil let water flow in quickly, and then hold the water inside the soil like a sponge. This might give plants a better chance of using some of that water. Other types of soil may let the water go completely through in just seconds. Still other soils may keep water from getting in at all. None of these soil types is better than the other; they are simply different.

Activity

1. Hand out "Just Passing Through" Activity Sheet B
2. Remove label and lid and cut off bottom (above curve) of the 2L bottle.
3. Turn the bottle over so it looks like a funnel and place a circle of screen inside the bottle so that it covers the cap opening.
4. Pour 3-4 cm of sand onto the screen. The sand will keep the screen from becoming clogged.
5. Place the bottle, mesh side down, on a beaker or clear container.
6. Pour 1L of soil into the bottle over the sand.
7. Conduct the Class Demonstration and Inquiry.
8. Have students do the Group Investigation.

Class Demonstration and Inquiry

1. Choose a soil for the classroom demonstration (a sandy loam works best) and put some of the soil out on white paper on a table for students to observe. Have students look closely at the soil and notice the color, presence of plant material or other organic matter, the feel, the shape of the particles and record their observations of the soil on the board.

2. Next, place a 1L soil sample in the cut off 2L bottle inverted over the beaker. Pour 300mL of water into a 500mL beaker or other clear container and mark the level in black. Have students notice the clarity of the water. Ask students

what will happen when we pour the water into the soil. Ask follow-up questions that get students to explain why they think the soil and water will behave as they predict. Possible questions may include: Will the water run through the bottom of the bottle? Will it all run out? If not all, how much? What will the water look like? Clear? Murky? Very dirty? How long will it take for the water to flow through? Record all the student hypotheses on the board. Mark the pouring container with a red line where the students predict how much water will flow through the soil.

3. Pour the water onto the soil and begin timing. Ask students to describe what happens as you pour the water. Is the water staying on top? Where is it going? Do you see air bubbles? Why or why not? Does the water coming out of the soil look the same as the water going in? Record the class observations on the board. Also record the time it took for the water to go through the soil.

4. Ask students to compare their hypotheses with what they observed. Once the water has stopped dripping from the bottom of the bottle, remove the soda bottle and hold up the beaker of water that passed through the soil. Ask students to compare their hypotheses about the water to their observations. Pour the water back into the pouring container and compare the amount with the starting amount (black line). How much water is missing? How can we measure the missing amount? Compare the amount of water with the amount students predicted would come through the soil (red line). Is there more or less water then the class predicted? What happened to the missing water? Is the water more or less clear than the water that was poured through the soil? Compare samples.

5. Have students predict what will happen if they poured more water into the soil. Record their hypotheses and try it. Compare the observations with their predictions and ask clarifying questions. Next, have students try the same investigation with other soil samples**. NOTE**: Wash funnel and screen and add more clean sand before using a new soil sample.

Group Investigations

1. Give each student the "Just Passing Through" Activity Sheet, which is a place to record hypotheses, observations, and conclusions. Have the students, in groups of 3-4, repeat the above investigation with the other soil samples.

2. Have students share their results and conclusions with the whole class. Discuss why there were differences between soil samples. Have students draw conclusions about water holding capacity based on the properties of soils.

3. Compare the results of the group investigations. Discuss the differences in soils. Ask questions about soil properties and uses of soils. Which soil property would you look for if you wanted to plant a garden? …build a driveway or a playground? What would happen if the soil is full of water and a heavy rain falls on it? How can you change the way your soil holds water? What happens to the soil when organic matter is added, when plants are growing on top of it, when it is compacted, or when it is plowed?

Extensions

1. Have students try this activity with soil components such as pure sand or clay and compare the differences. They could also do the activity with other materials such as commercial potting soil, perlite, compost, and vermiculite and make conclusions about the properties of these soil enhancements.

2. Students can experiment with filtering by using very murky water and passing it through clean sand.

3. Using distilled water, have students measure the pH of the water. Predict whether the pH will be different after the water passes through the soil. Pour the water through, and then test the pH again. Have students draw conclusions about the affect of soil on water pH.

Adapted from the GLOBE Program, Global Learning and Observing to Benefit the Environment.

Name _____ Activity Sheet A

Soil Texture

Soil Texture by Feel

Human hands are sensitive to differences in soil particles, so one way of determining the texture of a soil is by "feel." The largest soil particle is sand (2.00-0.05mm in diameter), which feels gritty to the touch. The next smaller particle size is silt (0.05-0.02mm in diameter), which feels smooth or "floury" to the touch. The smallest particle size is clay (<0.02mm), which feels sticky and is hard to squeeze in your hand. Most soils have a mixture of sand, silt, and clay.

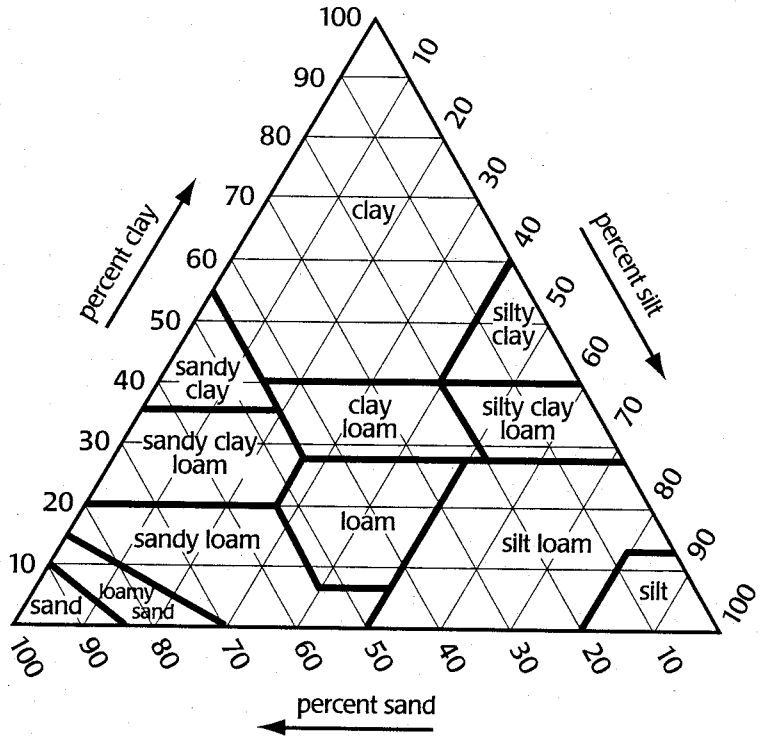
One way to determine the texture of a soil is by moistening a soil sample and trying to form the ribbon with the sample. By feeling the soil sample and answering questions about its behavior, you can get a rough idea of the soil texture.

Follow the procedure below to determine the texture of a soil:

1. Take a soil sample the size of a small chicken egg (2 Tbs.) and add enough water to moisten it. The soil should form a ball when squeezed. If it crumbles, add some more water, and it gets too wet, just add some more dry soil. If the soil sample will not form into a ball, regardless of the moisture, you have **Sand**.
2. Place the ball of soil between your thumb and forefinger and gently push the soil forward with your thumb, squeezing it upward into a ribbon. Try to keep the ribbon uniform in thickness and width.
3. Does soil form into a ribbon? If yes, go on to #4. If no, you have **Loamy Sand**.
4. If soil forms a weak ribbon, less than 1" before breaking, you have **Loam**.
    a. Does soil feel gritty? If yes, you have **Sandy Loam**
    b. Does soil feel equally gritty and smooth? If yes, you have **Loam**
    c. Does soil feel smooth? If yes, you have **Silt Loam**.
5. If soil forms a medium ribbon, 1-2" before breaking, you have **Clay Loam**.
    a. Does soil feel gritty? If yes, you have **Sandy Clay Loam**.
    b. Does soil feel equally gritty and smooth? If yes, you have **Clay Loam**.
    c. Does soil feel smooth? If yes, you have **Silty Clay Loam**.
6. If soil forms a strong ribbon, 2" or longer before breaking, you have **Clay**.
    a. Does soil feel gritty? If yes, you have **Sandy Clay**.
    b. Does soil feel equally gritty and smooth? If yes, you have **Clay**.
    c. Does soil feel smooth? If yes, you have **Silty Clay**.

Name _____ Activity Sheet A

Scientists use a Soil Texture Triangle to determine the relative amounts of sand, silt and clay and then classify the soil into a texture type. Based on your ribbon test, decide where your soil fits on the Soil Texture Triangle below.



Soil Texture by Sedimentation

Another way to determine soil texture is by dividing the soil into its component parts using water to separate the particles.

Directions:

1. Fill a large (quart size) jar two-thirds full with water. Add soil until the water level is nearly to the top of the jar.
2. Cover and shake vigorously. Set the jar on a level surface and allow time for the particles to settle. The smallest particles may take overnight or even several days to settle.
3. Hold a piece of white poster board against the jar and mark the different layers on the board. Label these layers, from coarsest to finest (bottom to top), as sand, silt, and clay. Mark the top of the water level as well.
4. By measuring each layer of soil and the overall height of the water, you can calculate the percentage of each component and compare your results to the Soil Texture Triangle to determine the overall soil texture.

Name _____ Activity Sheet B

Just Passing Through

1. Describe your soil sample (color, texture, feel, shape of particles, size of particles, plant material, etc.)

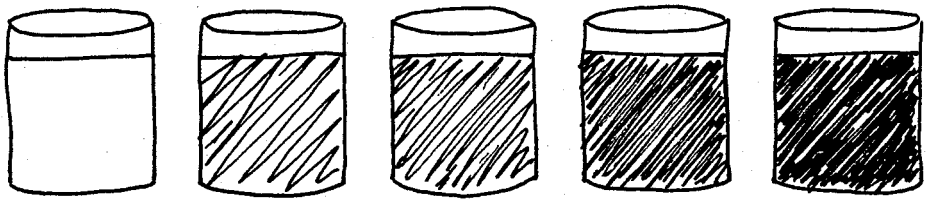
Hypotheses:

2. What do you think will happen when you pour water through the soil sample?

3. How long do you think it will take for the water to flow through the soil?

4. How much water do you think will pass through the soil sample?

5. What will the water look like? (Circle your prediction.)



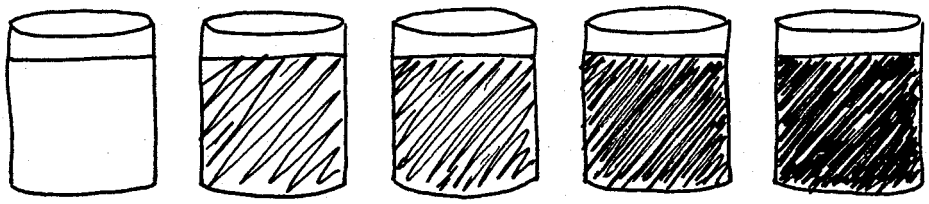
Observations:

6. What happened when you poured the water onto the soil?

7. How long did it take for the water to flow through the soil?

8. How much water flowed through the soil?

9. What did it look like? (Circle your observation.)



10. Did your observations match your hypotheses? In what ways?

11. What do you think would happen if you poured more water onto the wet soil?

12. 12.What can you conclude about this soil sample and its capacity to hold water?

13. What might this soil be good for? Explain your answer.

Farming in Nature's Image

Overview
Using a case study of a Nebraska farmer using practices that work with nature, students will explore many ways to "farm in nature's image." Discussion focuses on profitable agricultural practices that also are beneficial to the natural environment.

Suggested Grade Level
9 - 12

Estimated Time
45 minutes and/or option for homework assignment

Objectives
Students will be able to:

1. identify the farming practices that work with nature.
2. analyze a case study and exercise critical thinking skills.

Background
See "Case Study – Farming in Nature's Image: The Larson Farm."

Materials
1. "Case Study – Farming in Nature's Image: the Larson Farm"
2. Activity Sheet: Case Study Questions

Activity
1. Distribute the case study and the case study questions to students.
2. Have students read the case study individually or as a class.
3. Clarify any information in the case study.
4. Have students answer the case study questions.
5. Discuss students' answers as a class.

Extensions
1. Visit the "Listening to the Prairie" exhibition; see images of the Larson farm.
2. Find out information about organic agriculture certification in their state.
3. Have students interview local farmers about agricultural practices that the farmers feel work well with the regional ecology.

Case Study
Farming in Nature's Image: The Larson Farm

Tom Larson's father, Glen, began raising corn and alfalfa as feed for beef cattle and hogs on a Nebraska farm after World War II. His farm, described by his son as "very traditional," followed a monoculture system, which involved growing a single crop in each field. Glen Larson plowed, disked and harrowed to get straight crop rows with no weeds. Just preparing the field required up to four tractor passes, with another two to three for cultivation. The laborious work kept Glen busy from sunup to sundown for much of the season.

By the mid-1980's, Tom Larson took stock of the operation, its size and the amount of labor needed, and was dissatisfied. The 156-acre farm was reliant on just a few agricultural commodities (cattle, hogs, corn and alfalfa), and was too small in the prevailing "get big or get out" environment to make money. Meanwhile, he spent hours and hours on a tractor to produce feed for livestock.

Tom decided to make some adjustments and strive for maximum economic returns rather than maximum crop yields. He became certified organic, a method of farming that does not use synthetic chemicals, began a 90 – 100 cattle stocker operation in a unique grazing system, and he raised poultry outdoors on pasture. He diversified and grew many crops; organic grains, including popcorn, soybeans for tofu, barley for birdseed, and forage turnips. His profitability goals went hand-in-hand with soil improvement. "There are crops that deplete the soil and there are crops that build up the soil and we try to have a mix of those," he said. "We grow whatever mix it takes to be profitable in a very long-range outlook."

The old farm system of growing and harvesting grain as cattle feed helped raise fat cattle, but the cost didn't justify the return. These days, the cows are gaining weight just as fast from eating forage turnips and the stubble after grain harvest. Tom now receives premium prices for selling the feeder cattle because they are in such good condition for the finishing lot. Forage turnips, seemingly an unusual feed for cattle, provide as much nutrition as high-quality alfalfa.

To diversify in a way that would help the soil as well as be profitable, Tom introduced a small grain, a coarse grain and a legume that he plants in narrow strips for weed control. Those products are produced organically for human consumption, not for animal feed. "Being on limited acres, we looked at crops that would net more dollars per acre, which is a long-standing value with me," he said. "I'm not really interested in production per acre. It's the net dollars per acre that I can generate."

Once Tom decided to diversify, his path was set. Over the next decade and a half, he would try new ventures, focusing both on their outcome in the marketplace and their place in his rotation in the fields. His new motto is spread the economic risk through diversification. A major change came when Larson began raising pasture and forage

crops for grazing animals rather than harvesting grain and feeding it to confined livestock. Tom "double-dips" wherever possible, selling organic grains in the marketplace but also sending his cattle into the crop fields to graze grain stubble in conditions carefully controlled to maintain a steady diet. "We're turning sunlight into dollars through grass and alfalfa," Tom said.

Tom constantly reassesses his rotation, choosing crops that "we're able to sell without a lot of hassle or effort." He grows organic soybeans for the tofu market as well as organic popcorn. He used to raise oats, but low market prices prompted him to try Ethiopian barley, which he sells to a birdseed processor at about twice the price of oats. He had seen that type of barley grown in the neighboring Dakotas, and found it also grew well farther south.

The farm is configured in narrow, 12.5 foot-wide strips arranged in a pinwheel pattern across the landscape. As such, Larson's grains and forages grow side by side in a rotation orchestrated for environmental benefits as well as profits. He plants small grains in the spring, then harvests them in July in time to plant forage turnips for his livestock operation.

Cattle graze within 32 paddocks. When his stocker operation, which centered on raising 100 heifers from early spring into late fall before selling, lost money in the mid 1990s, Tom began renting his pasture to a neighbor for several months a year. Key to the heifers' diet is the forage turnips he plants in mid-summer but never harvests with a machine. "The turnips walk off the farm on the hoof," he said. "The cows get a nice salad every day between grain stubble and turnip greens." Tom sells his crops through a variety of organic marketing channels. He uses local processors and the National Organic Directory from the California Alliance with Family Farmers as main sources of buyers for his crops.

A survey of farm and ranch budgets for 95 area families showed that the average net return on irrigated corn came to $22 an acre. That might have been a livable income for most of his neighbors, with an average farm size of 800 acres, but to Tom, at one-third the size, those returns spelled economic disaster and foreclosure. Realizing he needed to earn three to five times more value per acre, Tom decided to raise food crops. "Having a small operation, $22 an acre does not cut it," he said. "We just can't survive on that. Being certified organic has given us access to different markets than we traditionally had, and it's much more profitable."

According to a state extension educator, Tom brings in between $150 and $200 per acre, while his neighbors earn just $20 to $50 per acre. With their larger land base, he figures their standards of living are about equal, although he works fewer hours. Experimenting with new crops often brings good rewards. Switching to Ethiopian barley was a better investment than oats, which brought just $2.40 per bushel. By comparison, he receives about $8.40 per bushel for organic barley, although he gets lower yields. In real numbers, the barley is about twice as profitable.

Tom continues to nurture a hobby that helps keep the operation in the black: retrofitting farm equipment for his unique needs. Much of the equipment on today's market is built for larger farms, so he continually reconfigures old equipment. He has modified planters, cultivators and harvest equipment. Rather than buying a new tractor outright, he lowers the out-of-pocket expense by trading in an old one he's fixed up.

Tom's crop strips and rotations in his organic system allow him to eliminate purchased chemicals without a noticeable increase in insect and disease problems. After a heavy rain, Larson sees little water pooling or running off his farm, which he attributes to improved soil structure with better water infiltration. "If we have a significant rain event, I can go across the road and look at the neighbor's field and see quite a lot of standing water," he said. "I think we have a soil structure now with good infiltration capacity, and we're building our organic matter slowly."

To control weeds, Tom tries to plant with minimal soil disturbance and seeds at twice the recommended rate. The dense cover of small grains early in the season helps crowd out weeds. He also retains crop residue on the soil surface not only to deter weeds, but also to help water infiltration and slow soil erosion. The system also seems to attract more wildlife, particularly songbirds, as well as deer, raccoons and opossums. "We have all sorts of these creatures running around, and I think they're an indicator of the health of the ecosystem," he said.

Tom has time for his family. When he raised a corn crop, he spent intense, busy weeks throughout the year doing field preparation, planting, cultivating and harvesting. By raising four crops, he has spread his work across the calendar, planting about one-third of his acreage at one time. "I do the same amount, or maybe a little bit more, but it is spread more evenly through the year," he said. He found a neighbor with whom he exchanges farm chores so they can both travel. "If you walk in a graveyard and look at the headstones, you see names, but I don't think you see any of them that say: 'He worked every day of his life and that was it.' To me, the events that make up quality of life are the little trips you take and the good times you have together."

"Farmers should not be afraid to try new things," Tom said, "but they should do so on a small scale." Networking with other farmers is key to success, especially because beginning farmers can learn from the mistakes of others – although they should expect to make plenty of their own. "If you don't make mistakes, you're not trying hard enough," he said. "In the realm of mistakes, I just don't like to make big, ugly, expensive ones. We take the tactic of trying very small-scale experiments on a little part of the acreage and keeping track of the results."

Tom plans to continue tweaking his farming system year-by-year, seeking not only better profits, but also new challenges. "I would be very frustrated if I was in a job where I did the same thing, day in and day out," he said. "Some say they've been in farming for 35 years. Does that mean they have 35 years' experience, or do they have one year of experience 35 times? I like the challenge of having a little variation from year to year."

To Tom, good stewardship means measuring his impact on natural resources against the desires of future residents of the land. "If, 200 years down the road, an anthropologist would look at this particular farm and find no evidence of whoever was here, then I've been a good steward with a vision beyond my life span," he said. "Some of the Native American religions center around doing nothing that will adversely affect the next seven generations. I think that's a realistic goal to strive for."

Adapted from U.S.D.A.- S.A.R.E. program case studies.

Name _____ Activity Sheet: Case Study Questions

Case Study – Farming in Nature's Image: The Larson Farm

Read "Farming in Nature's Image: The Larson Farm." Answer the following questions.

1. Why did Tom Larson change the way he was farming?

2. Name and explain three practices that add profitability on the Larson farm.

3. What are some practices on the Larson farm that benefit the environment?

4. How did Tom Larson change the labor needs on his family farm?

5. What are two benefits of reducing the use of heavy equipment on the Larson fields?

6. If you were Tom Larson, what other things would you do on the farm to increase profitability and farm in nature's image?

Prairie Scavenger Hunt

Overview
While visiting the *Listening to the Prairie* exhibition, students will search for a variety of items located throughout the exhibition. This activity will encourage students to slow down, carefully observe, interact with, and "listen to" the contents of the exhibit.

Suggested Grade Level
9 - 12

Estimated Time
30 - 40 minutes

Objectives
Students will be able to:

1. identify common plants and animals found on the prairie.
2. ask questions, develop hypotheses, and draw conclusions.
3. work in teams, and practice written, illustration and observation skills.

Materials
Activity Sheet A

Background
Listening to the Prairie; Farming in Nature's Image is about agriculture in the North American prairie and the forces of change that turned vast grasslands into one of the most productive agricultural lands on earth. It reveals the relationship between prairie ecology and new ways to grow food.

The Fruitful Prairie – More than 25 percent of America's productive cropland, pastureland, and range land are located in the North American prairie.

The Prairie Ecosystem – In its natural state, the prairie is a complex, fragile, and dynamic ecosystem that has sustained a diversity of plant and animal life for thousands of years.

From Native Grasses to Cultivated Grains – Deep fertile soils and a favorable growing climatic influenced 19th and 20th century farmers to cultivate the prairie

by replacing native grasses with profitable grains and legumes such as wheat, corn, barley, rice, and soybeans.

Forces of Change – Natural forces, such as wind and fire, and human forces, including agriculture and technology, have altered much of the prairie ecosystem.

Sustainable Agricultural Practices – By listening to and observing nature, some farmers and ranchers have adopted practices that keep their operations productive and profitable, while protecting a diverse prairie ecosystem for future generations. If history is our guide, some of today's alternatives will be tomorrow's accepted practices. Explore how they affect your community.

Activity

1. Divide class into teams or small groups of two or three.
2. Distribute Activity Sheet A to each group.
3. Have each group search for the items and record answers and observations.
4. Walk back through the exhibit together as a class and have students share their observations with their classmates.

Extensions

1. Five "Cues from Nature" (found on the exhibition panel entitled *An Ear to the Ground* and summarized below) can be applied in nearly every eco-region around the country. Have students choose one (or more) of these five principles and explore how it might apply to their home, school, or region. Have them share their ideas with their classmates.

   "Cues from Nature"

   a. Keep it covered… farmers keep fields planted year-round to enrich soil and prevent erosion.
   b. Make it diverse… farmers raise a variety of crops and animals to hedge against pest outbreaks, severe weather, and market changes.
   c. Keep it dynamic… farmers frequently rotate crops and grazing animals to keep the land fertile.
   d. Keep it recycling… farmers re-use plant/animal wastes to fertilize crops.
   e. Work with natives… farmers and ranchers plant pastures with native plant species to nourish livestock and wildlife.

2. Significant forces of change to the North American prairie are explicitly presented throughout the exhibition. Have each group of students further research other explicit and/or implicit forces of change. Use participating library, school resource center, or Internet to prepare a presentation for class or for another group (seniors/adults) visiting the exhibition at a later date.

Name_____ Activity Sheet A

Prairie Scavenger Hunt

Directions: Find the answers to all of the questions by looking and listening to the exhibit. Record your answers and observations below.

A. Find three (3) grains throughout the exhibit. Note where you find them. Name two (2) products made from each grain.

Grain #1

Grain #2

Grain #3

B. Look in the shopping cart at the beginning of the exhibit and select three (3) products by touching the screen. Find the source of these products elsewhere in the exhibit, but **not** from that panel. Note what the products are and where they are found in the prairie.

1.

2.

3.

C. Sketch an example of a significant change that has occurred on the prairie within the last 100 years.

D. Find the "Cues from Nature," that some farmers and ranchers use when growing plants and animals.

1.
2.
3.
4.
5.

E. Recycling is a way of returning energy to the ecosystem. Find an example in the exhibit where a farmer or rancher uses recycling and describe what they are doing?

F. Vegetative cover keeps soils from eroding. Find an example in the exhibit and briefly explain why keeping soil covered helps to prevent soil erosion.

G. In the exhibition, find the dollar and answer the following questions:

1. What percent (%) of your food dollar goes to the farmer?
2. Where else does your food dollar go?
3. How can you, as a consumer, spend your food dollar so that a larger percentage goes to the farmer?

H. Find two (2) types of grasses and write something about each grass.

Grass #1

Grass #2

I. Find two (2) types of grains and write something about each grain.

Grain #1

Grain #2

J. Listen to the narrator tell the story of the prairie. What is considered the most important force that shapes the prairie ecosystem? Why is it so essential?

Striking a Balance

Overview
The sun's energy is captured by individual plants and transferred to animals through food chains. Students will participate in an activity that demonstrates the principles and dynamics of food chains.

Suggested Grade Level
9 - 12 (10 students minimum)

Estimated Time
45 minutes

Objectives
The students will be able to:

1. learn to predict a likely food chain for a given habitat.
2. understand that energy is lost through breathing, heating and moving.
3. understand that energy is transferred when it passes from one organism to another.

Background
Feeding relationships are often difficult to observe. In this activity, students gain some understanding of these relationships by assuming the roles of animals, playing tag, and simulating feeding relationships. Popcorn is spread over a lawn, park, or playground area. The kernels of popcorn represent plants, which are the food sources for the plant eaters. Some students play grasshoppers (plant eaters or herbivores), some students play frogs (grasshopper eaters or carnivores), and some students play hawks (frog eaters or carnivores).

The object of the game is for each animal to eat without being eaten before the "day" (five minutes) is over. In nature, the populations of plants and animals are usually large enough to insure continuation of the species if some are lost. In this game, populations (popcorn "plants", grasshoppers, frogs, and hawks) are so small that the survival of one of each kind will be considered an indication of a "balanced" ongoing community. You can repeat the game many times in one activity session, but encourage the students to change the rules of behavior and the numbers of each kind of animal until a "balance" is achieved in your plant - grasshopper - frog - hawk food chain.

Materials

For the whole group:

1. 2 –3 gallons of popped popcorn
2. 1 marking pen
3. 1 kitchen timer, watch, or stopwatch
4. plastic sandwich bags, one for each student plus a few extra, as follows:

- sixty percent (60%) of the class will be grasshoppers and given "stomachs," plastic sandwich bags marked with a line 1.5" from the bottom of the bag.
- twenty-five (25%) of the class will be frogs, and given "stomachs," plastic sandwich bags marked with a line 2.5" from the bottom of the bag.
- fifteen percent (15%) of the class will be hawks, and given "stomachs," plastic sandwich bags marked with a line 2.5" from the bottom of the bag (same as frogs).

5. sashes in three different colors, plus a few extra of each color:
   color 1 = 60% of sashes for grasshoppers
   color 2 = 25% of sashes for frogs
   color 3 = 15% of sashes for hawks

6. site selection: a lawn, park, or playground approx. 50' x 50' or larger.

Activity

Striking a Balance Game – The objective is to survive as an animal in a make-believe food chain by getting enough to eat while avoiding being eaten.

1. Introduce food chains by asking students if they know what mice eat and what eat mice. (Mice eat seeds and snakes eat mice.) Diagram the relationship they describe and introduce it as a food chain. Arrows point in the direction that energy transfers within the food chain (sun → seeds → mice → snakes). Ask the students if they can think of other food chains, including a food chain that contains humans (i.e., sun → grass → beef → humans).

2. Tell students that you will be distributing plants (popcorn) that grasshoppers eat. ***(Save some for later!)*** Ask students what plant popcorn comes from!

3. Consider a random drawing to determine students' roles. Be sure to change sashes and stomachs if students' roles change.

4. Hand out a grasshopper stomach and sash **(color 1)** to 60% of the group.

5. Hand out a frog stomach and sash **(color 2)** to 25% of the group.

6. Hand out a hawk stomach and sash **(color 3)** to 15% of the group.

7. When the game begins, the grasshoppers pick up (eat) popcorn and place it into their stomach bags. Frogs try to tag (eat) the grasshoppers. When a frog eats a grasshopper, the grasshopper's stomach contents are transferred to the stomach of the frog. (While the transfer is taking place, both the grasshopper and the frog are safe from other frogs and hawks.) Hawks try to tag (eat) the frogs. When a hawk eats a frog, the frog's entire stomach contents are transferred to the stomach of the hawk. (While the transfer is taking place, the frog is safe from other hawks.) Hawks do not eat grasshoppers in this game. **NOTE:** Animals that are eaten rejoin the game (to simulate reproduction) and continue to gather food. Once a grasshopper or a frog has filled its stomach to the marked line, it has survived. A hawk must have the equivalent of one frog to survive. Only then can they go to the safe area (tree, post, etc.) as "survivors."

8. Set the timer for 5 minutes and start the game. At the end of the first game, analyze what happened. How many animals survived? If at least one of each kind of animal survives, you have an ongoing food chain. Return the popcorn to the activity area after each game.

9. *Instant Replay* – Ask for suggestions on rule changes that might result in more of a balance after the five-minute game. Usually <u>one</u> rule is changed for each replay. When you have settled on your new rules, play again. Suggest some of the following changes if the students do not offer any. A) Change the number of grasshoppers and/or frogs and/or hawks. B) Time releases: let grasshoppers forage unmolested; one minute later release frogs, and later the hawks. C) Spread out more popcorn.

10. After each game, analyze the results. How many grasshoppers, frogs, and hawks survived? Encourage students to compare game results after each rule change, and to comment on how the game "balance" compares with balance in the real world. In nature's balance, there are more plants than plant eaters, and more plant eaters than animal eaters. What would happen if there were 50% less popcorn plants? What would happen to the animals that depend on those plants? If there were no frogs, what would happen to the plant population? …the grasshopper population? …the hawk population? Do hawks need plants to survive? Have students describe some food chains in which they are a part? Are there any plants or animals that are <u>not</u> part of any food chain?

Adapted from the Outdoor Biology Instructional Strategies (OBIS), Lawrence Hall of Science, University of California, Berkeley, CA 94720.