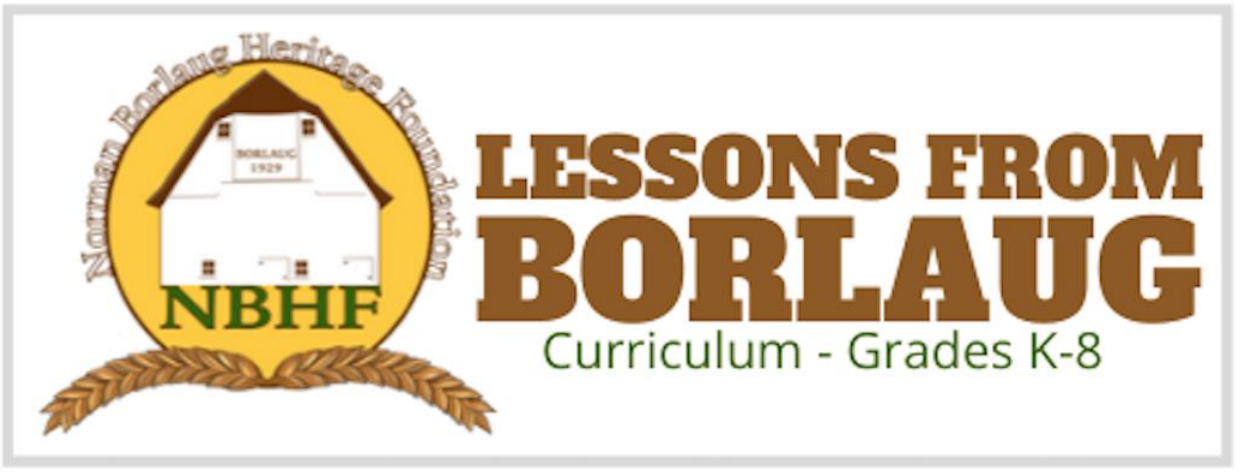
This master curriculum includes lessons for 5th Grade. Fifth graders will learn about farming crops from beginning to end. From caring for the soil, to harvesting, and sharing crops with others, students will gain insight to the saying, "Farm to Table".

Educators may find this curriculum useful to use prior to attending the Borlaug farms. The Norman Borlaug Heritage Foundation provides educational opportunities for schools to attend. Whether attending a tour or participating in Inspire Days, children will become aware of Norman Borlaug's work and his everlasting impact on the current day.

Want to learn more about Norman Borlaug or the Norman Borlaug Heritage Foundation? VISIT OR CALL!

Contact Chamber of Commerce for more information
101 2nd Ave. SW, Cresco, IA 52136
Email: Jason@howard-county.com
Call: 563-547-3434

Borlaug Farms Addresses
Birthplace farm: 20399 Timber Ave Cresco, IA 52136
Boyhood Farm: 19518 200th St. Cresco, IA 52136



5th Grade

Caring for the Land

Grade: 5th grade

Time: 1 hour

Purpose:

- Students will explain why people have different opinions regarding soil management and identify cause and effect relationships relating to agriculture and the environment.
- Students will describe how farmers, environmentalists, and environmental activists are alike and different.
- Students will identify various viewpoints that Dr. Borlaug had to work for and against during his time doing research in Mexico, Asia, and Africa.

Materials:

- *Caring for the Land* activity sheets
- White Board & Markers
- Computers/Internet

Resources:

- Caring for the Land Activity Sheets
- Caring for the Land Activity Sheets ANSWER KEY

Vocabulary:

- Chemical (inorganic) fertilizers: synthetic materials that are added to the soil to provide nutrients—including nitrogen, phosphorus, and potassium—necessary to sustain plant growth
- Contaminate: to make impure by contact or mixture with harmful bacteria, fungi, or dangerous chemicals
- Crop Rotation: to make impure by contact or mixture with harmful bacteria, fungi, or dangerous chemicals
- Decompose: to decay or break down into smaller pieces
- Environmental Activist: a person who words to protect the natural world from pollution and other treats
- Farmer: a person who works with land, plants, and animals to produce raw materials for food, clothing, shelter, and other products that are used in industry and manufacturing
- Legume: a family of plants which, with the aid of symbiotic bacteria, convert nitrogen from the air into a form that plants can use; legumes include many valuable food and forage species, including peas, beans, peanuts, clover, and alfalfa
- Organism: any living thing, plant or animal
- Pesticide: word used to describe a variety of substances used to control insects (insecticide), plants (herbicide), or animals (rodenticide for mice, etc.)

Spark Curiosity By…

1. Ask students to think about people they know who are farmers or environmentalists. Can farmers be environmentalists?
2. Continue discussion on the topic to create interest and gauge students prior to knowledge using the following questions:
    a. Why would farmers be motivated to protect natural resources like soil and water?
    b. What motivates environmentalists to protect natural resources?
    c. What methods do farmers use to protect soil and water quality?

Agricultural Background

The land is the livelihood of **farmers**. Most people, farmers included, try to avoid practices that harm their way of life. When raising crops and livestock, farmers actively manage soil, water, plants, and animals. Farming is one of the closest working relationships that people have with the environment, and sometimes farming practices lead to environmental problems. Often, it takes years for the environmental impacts of human activity to become evident, and it can be complicated to identify and change environmentally damaging actions. Farmers work both to produce food and to care for the land that is their livelihood. There are many different strategies for accomplishing these goals.

Considering the history of environmental issues can put modern-day controversies into context. People began polluting long ago. Early settlers in the United States dumped their trash into rivers and streams without considering the harm it might do. Before gasoline-powered tractors began releasing exhaust fumes, work horses created pollution problems of their own. The average farm horse produces 35 pounds of solid waste and 2 gallons of liquid waste each day. Although horse manure can be an excellent **fertilizer** when spread across a field, large amounts in small areas can create high concentrations of nitrogen and bacteria that can **contaminate** the water supply.

Thousands of years ago, people began to farm because they found they could produce more food in a more reliable manner by growing crops than by hunting and gathering. Over the years, people discovered that some farming practices harmed the land. Cutting down trees, clearing vegetation, and allowing animals to overgraze left the topsoil unprotected and vulnerable to erosion by wind and water. Planting the same crop on the same field year after year used up all the soil's nutrients, and the fields lost their ability to produce good crops. Early farmers learned from their mistakes and developed better farming methods. They learned to farm on the contour and build terraces—ridges of soil built across the slope to slow water runoff. They learned to rotate their crops (**crop rotation**), moving them from one field to another to let the soil rest. They learned how to spread animal manure on their fields to restore organic matter and nutrients.

When European settlers came to the New World, they were dazzled by what seemed like endless resources—acres and acres of rich soil. Many farmers abandoned the methods their ancestors used to protect the land. When one field began to produce poor crops, the farmer would simply abandon it and move farther into the wilderness.

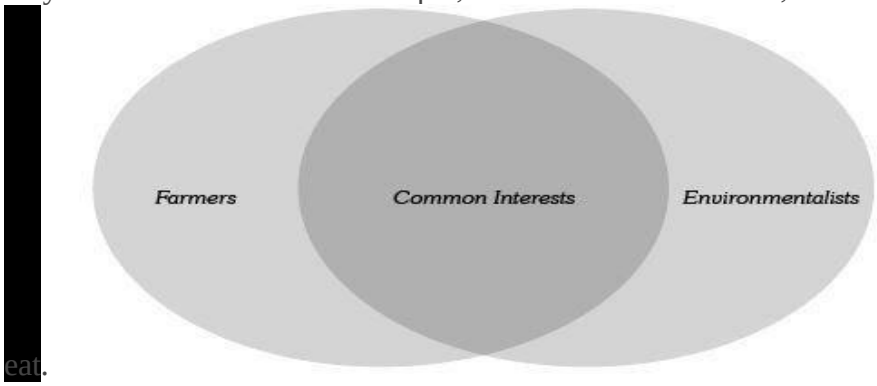
As more people moved in, more land was needed for farms. In the early twentieth century, farmers began plowing up the native grasses of the Southern Plains to plant wheat. They had no way of knowing that their hard work would be the first step leading to what would come to be known as the Dust Bowl. A severe drought dried up the exposed soil. With no grass roots to hold the sandy soil in place, it simply blew away with the strong summer winds.

Recognizing a problem is the first step toward solving it. Farmers didn't know that plowing up large, flat tracts of land would cause the soil to blow away in the event of a drought. Once they saw what had happened, they did what farmers have been doing for thousands of years. They began thinking of different methods they could use that would protect the soil.

One method involved using chemicals on weeds instead of turning the soil with a plow. For many years, this method seemed like an excellent way to keep the soil in place while producing the food people needed. Then, scientists discovered that some chemicals were getting into the water supply and making birds, fish, animals, and people sick. Other chemicals have begun to lose their effectiveness as weeds develop resistance to them. Today, farmers and agricultural researchers are working on ways to solve food production problems while taking into consideration the growing world population, the state of food prices and economics, and the condition of environmental resources such as soil and water.

Lesson

1. Begin the lesson by asking students to describe and define in their own terms the words: *farmer*, *environmentalist*, and *environmental activist*.
2. Ask students if they have heard any news reports about conflicts between farmers and environmental activists (endangered species preservation, invasive species management, public land use, wetland preservation, etc.).
3. Draw a Venn diagram on the whiteboard (see the example below), and ask students to list things about which farmers and environmental activists disagree and the things they have in common. For example, both care about the land, both need food to eat.



eat.

4. Share the background material and discuss problem/solution and cause/effect relationships.
5. Divide your class into three groups, and hand out copies of one of the *Caring for the Land* activity sheets to each group.
6. Ask students to read the situation described in the text carefully to identify the cause and effect, the problem and solution, and any alternatives and their effects. Ask each group to share what they discussed with the class.
7. Discuss the following questions:
   - Why do we need farmers? (food, clothes, shelter, other manufactured goods)
   - Who should decide how to use the land?
   - How should we decide how to use the land?

Extension Activities

After conducting these activities, review and summarize the following key concepts:

- The land is the livelihood of farmers, and most farmers try to avoid practices that harm their way of life.
- People have differing opinions about environmental issues.
- Farms provide food, shelter, clothing, and other manufactured goods.

Connection to Norman Borlaug

Dr. Borlaug grew up in a time when chemical fertilizers and the moldboard plow were used. They weren't even invented at the time. However, as he grew older these farming advances were more commonly used. Now, we have self-driving tractors, precision agriculture, and genetically modified seed.

As a scientist, Dr. Borlaug understood that soil quality played a key role in the successful growth of all crops. However, it took some convincing to those around him. He knew that chemical fertilizers, cultivating the land, and growing the right seed is crucial. Let's live like Norman and see how he felt debating for his modern-day practices.

For each of the three issues listed before, have a class debate. Students should be divided into 6 groups.

1. Against chemical fertilizers
2. For chemical fertilizers
3. Against cultivating the land
4. For cultivating the land
5. Against genetic enhancement of crop seed
6. For genetic enhancement of crop seed

Give the groups 5-10 minutes to do any further research to prove their side of the debate. When the time is up, the debates will begin.

Group 1 and Group 2 will face off. Group 1 will have the first statement. Group 2 will propose a rebuttal to group 1. They will continue to debate for 2 minutes or until they have proven all their points. When completed, have those in the audience take a vote on what group 'won' the debate. Go about groups 3vs4 and 5vs6 in the same manner.

Following the debates and voting, have an open discussion with the class. This conversation is directed toward their experience arguing for their point of view.

1. What part about debating for your side was easy?
2. What part about debating for your side was difficult?
3. Would you consider groups 1,3,5 environmentalists or farmers? Why?

Next, follow up with a class discussion that apply to today's issues.

1. How can you see this 'debate' unfolding in real life?
2. Who decides what is right and wrong?
3. Is there a common middle that can be met? How?

As technology in agriculture advances, these two groups of people (farmers and environmentalists) seem to fall on even further spectrums. Worldly problems such as global warming, world hunger, and soil surface loss come into play. Rather than posing the question, who is to blame, perhaps let's start posing question, how can we accomplish our different goals together.

Sources/Credits

- Lesson adapted from materials provided by Oklahoma Agriculture in the Classroom

National Agriculture Literacy Outcomes

Agriculture and the Environment

- Identify land and water conservation methods used in farming systems (wind barriers, conservation tillage, laser leveling, GPS planting, etc.) (T1.3-5.c)

Plants and Animals for Food, Fiber & Energy

- Understand the concept of land stewardship and identify ways farmers care for land, plants, and animals (T2.3-5.e)

Education Content Standards

Within HEALTH

Health Standard 8: Demonstrate the ability to advocate for personal, family, and c community health.

- 8.5.1

Within HISTORY

NCSS 10: Civic Ideals and Practices

- Objective 2

NCSS 3: People, Places, and Environments

- Objective 3

Within SCIENCE

3-LS4: Biological Evolution: Unity and Diversity

- 3-LS4-4

Common Core Connections

Reading: Anchor Standards

- CCSS.ELA-LITERACY.CCRA.R.1
- CCSS.ELA-LITERACY.CCRA.R.8

Language: Anchor Standards

- CCSS.ELA-LITERACY.CCRA.L.6

Students have now learned about various ways in which farmers care for the land. These various practices are important to soil and environmental health – especially those for plants, animals, and insects. With the right practices, farmers able to reap a great harvest. Let's learn more about harvesting wheat just like Norman Borlaug did.

Enjoying the Harvest

Grade: 5th grade

Time: 2 hours

Purpose:

- Students will identify the parts of a wheat plant and wheat kernel and investigate the process of milling wheat kernels into flour.
- Students will understand what staple foods are and some examples of such.
- Students will learn how Norman Borlaug impacted the creation of staple foods across the world by growing wheat successfully.

Materials:

- Loaf of white break or photo
- Loaf of whole wheat bread or photo
- Wheat kernels
- White flour
- Whole wheat flour

*Jewel bags are available for purchase from agclassroomstore.com.

Activity 2: From Grind Stones to Roller Mills

- Tools for grinding grain (two stones, mortar and pestle, coffee grinder, spice grinder, pepper grinder, hand or electric wheat grinder, etc.
    - A Wheat Grinder Kit is available for purchase from agclassroomstore.com.
- Wheat seeds (Hard red wheat seeds can be purchased from the grocery store.)
- Bowls
- History of Flour Milling Timeline
- *Wheat Milling video*

Activity 3: Tortillas in a Bag

- *Bread, Bread, Bread* by Ann Morris
- *Tortillas in a Bag Recipe*
- 1-quart plastic resealable storage bag, 1 per group
- Wheat flour, 1 1/2 cups per group (Use the freshly ground wheat flour from *Activity 2.* Store bought flour can be added to ensure there is enough flour for each group.)
- Baking powder, 1 teaspoon per group
- Shortening, 2 tablespoons per group
- Hot water, 1/2 cup per group
- Salt, 1/4 teaspoon per group
- Griddle

- Spatula

Resources:

- Whole Wheat Bread Photo
- White Bread Photo
- Wheat Kernel Dissection Image
- Tortillas in a Bag Recipe
- Anatomy of a Wheat Plant Diagram

Vocabulary:

- Bran: the multi-layered, hard outer covering of a kernel of cereal grain
- Endosperm: nutritive matter formed within seed in seed plants
- Germ: the embryo of a seed in the seed of a cereal grain
- Grain: the edible seed or seed-like fruit of grasses that are cereals
- Mill: a machine used in treating (by grinding, crushing, stamping, cutting, or finishing) raw material
- Photosynthesis: the process through which a green plant turns water and carbon dioxide into food when the plant is exposed to light

Spark Curiosity By…

1. Show the students a loaf of white bread and a loaf of wheat bread, or use the attached photos. Draw a Venn diagram on the board. Label one circle "White Bread" and the other circle "Whole Wheat Bread."
2. Ask the students to explain what is the same and different about the two loaves of bread, and record the responses in the appropriate spots of the graphic organizer.
3. Show the students a bowl of wheat kernels, a bowl of white all-purpose flour, and a bowl of whole wheat flour. Point out that the white flour was used to make the white bread and the whole wheat flour was used to make the whole wheat bread, but both types of flour were made from wheat kernels. Explain to the students that they will be exploring the process of making flour, known as milling, to understand how different types of flour are made from wheat kernels.

Agricultural Background

Bread has been an important part of the human diet since early times. Loaves baked over 5,000 years ago have been found in ancient Egyptian tombs. Wheat has been discovered in pits where human settlements existed 8,000 years ago. In the Stone Age, solid cakes were made from crushed wheat. Bread provided ancient civilizations with a reliable food source.

The wheat plant has four basic parts—roots, stem, leaves, and head. The *roots* anchor the plant in the soil, absorbing water and nutrients and transporting them to the stem. The *stem* supports the head and helps transport nutrients and water throughout the plant. The *leaves* are responsible for **photosynthesis**. The *head* of the wheat plant contains the wheat seeds, also referred to as kernels or berries.

Wheat flour is made from the kernels of the wheat plant. The kernel is the seed from which the wheat plant grows. A wheat kernel contains three distinct parts—the **bran**, **germ**, and **endosperm**. The *bran* is the multi-layered, hard outer covering of the kernel. Bran consists of important antioxidants, B vitamins, and fiber. The *germ* is the embryo or sprouting section of the kernel. It is the part of the wheat kernel that will sprout and grow into a new wheat plant. During the milling process, the germ is often separated from the flour because its fat content limits the flour's shelf-life. The germ contains B vitamins, protein, minerals, and healthy fats. The *endosperm* is the germ's food supply. In its natural state, the endosperm provides essential energy to the young wheat plant, allowing the plant to send roots down into the soil to absorb water and nutrients and shoot sprouts up for sunlight.

In Neolithic times, saddle stones (cradle-shaped pieces of hard stone) and hand stones (cylindrical-shaped stones) were used to crush grain into coarse flour. In the Stone Age, hand-powered rotary querns consisted of a rotating circular stone on top and a stationary stone on the bottom to grind grain. In the 18th century, automated stone wheels, powered by wind or water, rose in popularity as a method of flour production. The invention of the roller **mill** in the middle of the 19th century increased the productivity of flour mills. Commercial flour mills today still use the roller mill, however they are utilizing the advances in modern technology to improve the efficiency, reliability, and safety of flour production.

When wheat arrives at the mill, it is weighed, tested, cleaned, and conditioned. To condition the wheat kernels, water is added to the **grain** in order to toughen the outer part of the wheat and soften the inner part. The wheat then rests for about twelve hours. Steel rollers break open the grain to release and separate the endosperm from the bran and the germ. The starchy endosperm is ground and sifted several times to make white, all-purpose flour. When making whole wheat flour, the bran and germ is put back into the white flour at the end of the milling process. The flour is then packed into bags to be transported to stores, bakeries, and food processing plants

Lesson

Activity 1: Wheat Kernel Dissection Model

1. Provide each student with the *Anatomy of a Wheat Plant Diagram*, a wheat stem, and a jewel bag. Use the diagram to discuss the main parts of a wheat plant and have the students locate the parts on the wheat stem.
2. Tell the students to thresh their wheat to separate the seeds from the plant. Refer to the Wheat Grinding Tutorial Video for instructions on how to thresh wheat by hand. The students should collect the wheat seeds in their jewel bags.

3. Explain to the students that each kernel of wheat has three main parts—the bran, germ, and endosperm. All-purpose flour, used to make white bread, is made from the endosperm of the wheat kernel. The endosperm is separated from the bran and the germ and ground into flour. Whole wheat flour contains the whole kernel—the bran, germ, and endosperm.
4. Pass out a piece of paper to each student. Instruct them to fold the paper into thirds and label the sections "Bran," "Germ," and "Endosperm." Using the information from the *Background Agricultural Connections* section of this lesson, discuss the three parts of the wheat kernel and have the students take notes about each part on their paper.
5. Show the students the video White Bread vs. Whole Wheat (Grain) and have them take additional notes about the three parts of the wheat kernel.

6. Provide each student with two copies of the *Wheat Kernel Dissection Image*, three pieces of lined paper, a brad, scissors, and a glue stick. Have them cut out both of the *Wheat Kernel Dissection Images*. Trace one of the images onto three pieces of lined paper, cut each lined kernel out, and number each page. Set one of the *Wheat kernel Dissection Images* aside and cut the bran, germ, and endosperm apart from the other.
7. Glue the bran image on page 1 of the lined kernels, the germ on page 2, and the endosperm on page 3.
8. Using their notes, have the students write a description of each part of the wheat kernel on the corresponding page.
9. Layer the wheat kernel model with the jewel bag of wheat seeds on top followed by the intact *Wheat Kernel Dissection Image*, page 1, 2, and 3. Punch a hole in the top of the packet and attach with a brad.

Activity 2: From Grind Stones to Roller Mills

1. Choose a minimum of three tools for grinding grain and place them on tables around the room with a bag of wheat kernels and a bowl to collect flour at each station.
2. Have students try their hands at milling flour with the different tools by allowing them to circulate through the stations. Save any flour that is successfully produced to be used in *Activity 3*.
3. After every student has had a turn at each station, invite the class to describe their experiences with each tool. Ask students which method they thought was most effective and if they can think of any better ways to grind wheat.
4. Explain that thousands of years ago, people used stones to crush grain into flour. Over time, more productive machines were invented. Use the History of Flour Milling Timeline to view and discuss the different technologies used throughout history to mill flour.
5. Show the students the video Wheat Milling to view a modern flour mill at work.

Activity 3: Tortillas in a Bag

1. Read the book *Bread, Bread, Bread* by Ann Morris and discuss the different types of bread from around the world that are featured in the book.
2. Tell the students that they are going to use the wheat flour they made in *Activity 2* to make tortillas, a type of bread from Mexico. Explain that the tortillas will be whole wheat tortillas because the flour they milled contains the bran, germ, and endosperm of the wheat kernel.
3. Gather the ingredients listed in the *Activity 3* section of the *Materials* list and have students wash their hands.
4. Divide students into small groups. Provide each group with a *Tortillas in a Bag Recipe*, the ingredients listed on the recipe, and a 1-quart plastic resealable storage bag.
5. Model each instruction on the recipe for the students before they begin.
6. Place the wheat flour, salt, and baking powder in a 1-quart resealable storage bag. Close the bag and shake just a few shakes to mix the ingredients.
7. Add the shortening and close the bag. From the outside of the bag, work the bag with your hands until the mixture looks crumbly and there are no pieces of the shortening visible.
8. Open the bag and add the hot water. Knead the bag until the dough is one large piece and the sides of the bag come clean.
9. Take the dough out of the bag and divide it into four equal pieces. Lay the dough on a tray and place the bag on top of the pieces. Allow the dough to rest for 15 minutes.

10. After the dough has rested, have the groups roll or pat it into 8-10 inch circles. If the dough is too sticky, add more flour.
11. Heat the griddle to medium or medium high. Place the dough onto the griddle and cook until dark brown spots appear. Turn and cook on the other side.

Concept Elaboration and Evaluation

After conducting these activities, review and summarize the following key concepts:

- The seeds or kernels of the wheat plant are located in the head of the wheat stalk.
- Each kernel of wheat has three main parts—the bran, germ, and endosperm.
- The flour used to make white bread is made from grinding the endosperm of the kernel.
- The flour used to make whole wheat bread is made from grinding the whole kernel—the bran, germ, and endosperm.

Connection to Norman Borlaug

As students are munching on their fresh tortillas, read aloud these paragraphs to add context to the lesson.

Staple foods are eaten routinely and a dominant portion of the standard diet for intake of multiple nutrients. Wheat is considered a staple crop that produces staple foods for nearly all countries across the world. We have learned about one staple food used from wheat.

1. Ask students to brainstorm aloud other staple foods. Examples may include: meat, milk, potatoes, cheese, eggs.

Many years ago, and still today, people across the world are experiencing starvation. They do not have access to staple foods. In the mid 1900's, Norman Borlaug recognized that issue in Mexico, India, Pakistan, and Africa. To feed the world, he produced a variety of wheat that is strong enough to stand during the elements of weather, and produces many seed heads. He then sold the wheat seed to the starving countries so they can grow their own source of food. Allowing them the power to grow wheat, allowed them the power to create a staple food - bread.

Sources/Credits

- http://www.wheatworld.org/wheat-101/wheat-facts/

National Agriculture Literacy Outcomes

Plants and Animals for Food, Fiber & Energy

- Discuss similarities and differences in food, clothing and shelter, and fuel sources among world cultures (T2.3-5.a)

Education Content Standards

Within SCIENCE

4-LS1: From molecules to Organisms: Structures and Processes

- Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Common Core Connections

Reading: Anchor Standards

- CCSS.ELA-LITERACY.CCRA.R.1
- CCSS.ELA-LITERACY.CCRA.R.2

Writing: Anchor Standards

- CCSS.ELA-LITERACY.CCRA.W.4

Mathematics: Practices Standards

- CCSS.MATH.PRACTICE.MP5
- CCSS.MATH.PRACTICE.MP6

Students have learned about the wheat plant and its diverse parts. Wheat has been an important crop for the development of civilizations with thanks to Norman Borlaug and his life-changing research. His famous crop was able to produce a surplus, meaning people made more than what they knew what to do with! Let's take a look at what farmers do with their surplus crops.

Land, Air, Sea

Grade: 5th grade
Time: 2 hours

Purpose:

- Students will discover how agricultural commodities are transported from producers to consumers.

Materials:

Interest Approach - Engagement

- *Pickles to Pittsburgh* by Judi Barret

Activity 1: Modes of Transportation

- 8 ½" x 11" pieces of blank paper, 2 per student
- *Small Transportation Pictures*, 1 set (half sheet) per student

Activity 2: Moving Commodities

- *Supply Chain Cards*, 1 commodity set per group (cut cards apart)
- Follow Milk's Journey From Farm to Store video
- The Turbana Banana Journey video
- A Christmas Tree's Journey video
- Fish Transportation from Senegal with Air France KLM Cargo video
- CGB Grain video
- Supply Chain Cards Answer Keys, 1 commodity page per group

Activity 3: Shipping Scenarios

- *Commodity Cards*
- Hat, bag, or box
- *Large Transportation Pictures*

Resources:

- Small Transportation Pictures
- Commodity Cards
- Supply Chain Cards Answer Keys
- Supply Chain Cards
- Large Transportation Picture

Vocabulary:

- Agribusiness: the business of agricultural production; the range of businesses related to producing, processing, and distributing agricultural products
- Cargo: good carried on a ship, plane, or vehicle
- Consumer: a person who purchases the goods and services offered by a producer
- Consumption: using something, how much of something has been used
- Distribution: the action or process of supplying goods to stores and other businesses to sell to consumers
- Export: to send goods or materials to another country

- Import: to receive goods or materials from another country
- Insulate: to separate from conducting bodies by means of nonconductors to prevent transfer of electricity, heat, or sound
- Perishable: likely to spoil or decay
- Processing: in agriculture, the alteration or modification, for the purpose of storage, transport, or sale, of an agricultural product
- Producer: a person who provides service or creates, grows, or manufacturer good that people buy
- Production: an article or substance produced by labor
- Reefer: refrigerated shipping container for transporting perishable, having it own stand alone cooling system
- Shelf-stable: not likely to spoil or decay
- Supply chain: the sequence of processes involved in the production and distribution of a commodity
- Transportation: the movement of people or goods from one place to another

Spark Curiosity By…

1. Read the book Pickles to Pittsburgh by Judi Barrett
2. As a class, discuss the difference between fiction and non-fiction books. Ask the students, "What type of book is Pickles to Pittsburgh?" (fiction)
3. Ask the students to identify the different modes of transportation the Falling Food Company used to ship the found around the world.
4. Discuss the idea that, even though this book is fictional, some of these same modes of transportation are used in real life to get agricultural products from producers to consumers.

Agricultural Background

How does food get to the grocery store? The term **supply chain** is used to describe the sequence of processes involved in the **production**, **processing**, and **distribution** of a **commodity**. The chain begins with the equipment farmers (the **producers**) need to produce food, such as seeds, fertilizer, and machines. Farmers plant, maintain, and harvest crops or raise animals. The food is cleaned, processed, and packaged before being shipped to grocery stores and into the hands of **consumers**. Each step in the chain is part of **agribusiness**, a term used to describe the range of businesses related to producing, processing, and distributing agricultural products.

Transportation is a critical part of the supply chain. Some regions cannot produce certain foods due to population density, seasons, and climate and soil conditions. In the United States, food is shipped an average of 1,500 miles before being sold.[2] The five main modes of transporting agricultural products are trucks, trains, airplanes, cargo ships, and barges. Trucks provide fast delivery and controlled temperatures for **perishable** food. There are many different types of trucks used to move agricultural products. Tanker trucks carry

liquids, including milk, in enclosed cylinders. Milk tankers have special stainless steel bodies which are heavily **insulated** to keep the milk cold during **transportation**. Milk tanker drivers are trained milk graders. Tanker drivers evaluate milk for food safety based on temperature, sight, and smell.[1] Container trailers move shipping and storage containers. The containers can be transferred onto a cargo ship, barge, or train. A flatbed trailer has a level surface with no sides or top. They are used for quick loading and unloading and for loads of abnormal size.[1] Dry vans are non-refrigerated trailers used for carrying **shelf-stable** foods. **Reefers** are refrigerated trailers used for carrying perishable items. In reefers, the temperature is carefully monitored while food products are being moved.[1] Logging trailers are used to carry logs, and livestock trailers move farm animals. Weigh stations are monitored by highway patrol officers who may check the weight of the truck and driver logbooks which contain driving hours, routes, and load contents.

Refrigerated rail cars, also known as reefers, have been in development since the 1860s and are still used today. Stocked with ice blocks to keep produce chilled, the first reefers relied on icing stations located at regular intervals along the track. Starting in the 1930s, reefers were made using large pieces of plywood (due to the lack of steel during World War II) and cooled by circulating fans. Modern day reefers have a variety of new technological features. GPS, data logging systems, and remote diagnostic testing allow customers and train companies to monitor their **cargo** with real-time data.[1]

Airplanes are the fastest of all types of transportation. Air transport is used for high value and perishable products that need to travel long distances. Careful packaging, handling, and refrigeration allows these commodities to be shipped to destinations all over the world.[1]

Cargo ships include container ships, bulk carriers, and refrigerated reefer ships. Cargo ships can hold as many as 18,000 shipping containers. Ships are used to transport large quantities of items across oceans and seas.

Barges are flat-bottomed vessels that are self-propelled, pushed, or towed. Barges are mostly used to carry freight on smaller in-land waterways. Barge transportation is important to U.S. agriculture because it provides low-cost transportation from major production areas to coastal areas for export to foreign markets.[3]

GPS, mobile scanners, and smartphones are used to track agricultural products from the producer to the consumer. This real-time data increases delivery efficiencies and food safety.

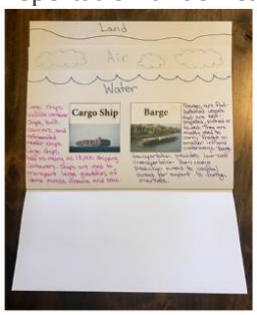
Lesson

Activity 1: Modes of Transportation

1. Use the information in the *Background Agricultural Connections* to discuss the five major modes of transportation used to ship agricultural products—truck, train, airplane, cargo ship, and barge.
2. Create a "Look Book" to identify the benefits and limitations of each mode of transportation. Stack two sheets of 8 1/2" x 11" paper, and place the back sheet one inch

higher than the front sheet. Bring the bottom of both sheets upward and align the edges so that all four layers are one inch apart. Crease the papers.

3. Add a title to the Look Book by writing "Transporting Agricultural Products" on the top of the bottom layer. Label the other layers "Land," "Air," and "Water."
4. Have the students glue the *Small Transportation Pictures* under the correct labels and write the benefits of each mode of transportation underneath the pictures.
5. 



Activity 2: Moving Commodities

1. Organize students into five groups. Assign each group a different commodity (milk, bananas, Christmas trees, fish, and soybeans), and provide the groups with *Supply Chain Cards* for their commodity.
2. Ask the groups to arrange their cards in the order they think each task is performed throughout the process of getting the product from the farmer to the consumer.
3. Have the groups watch the video below that corresponds with their assigned commodity and use the information from the video to make any necessary adjustments to their card sequence.
    a. Milk: Follow Milk's Journey From Farm to Store
    b. Bananas: The Turbana Banana Journey
    c. Christmas Trees: A Christmas Tree's Journey
    d. Fish: Fish Transportation from Senegal with Air France KLM Cargo
    e. Soybeans: CGB Grain
4. Provide each group with their commodity's *Supply Chain Cards Answer Key*, and instruct them to check their card sequence by comparing it to the answer key.
5. Provide time for each group to share the journey their agricultural product took to get from the producer to the consumer with the class.

Activity 3: Shipping Scenarios

1. Place the *Large Transportation Pictures* in a line on the floor, bulletin board, or white board.

2. Students can work individually, as partners, or in groups. Place the C*ommodity Cards* into a hat, bag, or box. Have students take turns choosing one card. Each card includes a commodity and where that product was grown or raised.
3. Provide the students with access to computers or tablets to locate where the product was grown or raised on a map.
4. Comparing the location of where their product was grown or raised to where they live, have the students determine the main mode of transportation they think would be best for shipping the commodity on their card to their local grocery store. Have them place their commodity card underneath the correct transportation picture. Note that there may be more than one correct option.
5. Ask the students to explain their choices to the class.

Concept Elaboration and Evaluation

After conducting these activities, review and summarize the following key concepts:

- The supply chain is the sequence of processes involved in the production, processing, and distribution of a commodity.
- Transportation is a critical part of the supply chain.
- The five main modes of transporting agricultural products are trucks, trains, airplanes, cargo ships, and barges.

Connection to Norman Borlaug

In the late 1960's and early 70's, Norman had the difficult task of supporting the supply chain of his wheat from America to Pakistan and India. Both countries at the time were starving and needed the wheat seed to start a crop, harvest the grain, and bake bread.

Read this aloud to the class:

Dr. Borlaug, *February, 12 1970*

We are in need of your help. My country is experiencing horror. Children are dying, parents cannot feed their families, robberies go unnoticed, and our soil is unfertile. Please come see this for yourself if you don't believe me. But most importantly, send us 40,000 bushels of wheat. We need new wheat varieties that will feed our starving nation. In order to meet the next harvest, we need to seed in 65 days at the latest. I am begging you for your guidance. My country cannot experience hunger like this anymore.

Sincerely,
Mr. President of India

1. Ask students what the main problem is. Students should be able to identify the issue, who it concerns, and what one is asking of the other.
2. Discuss as a class what important information they know and what they need to find out.
    a. What is Known
        i. Wheat is going to India
        ii. India needs wheat in 65 days
        iii. The date of request is February, 12th of 1970.
    b. Need to Find Out
        - Where is the wheat coming from?
        - How long of a trip is it?
        - How fast can the boat travel?
3. Direct students to the site http://ports.com/sea-route/. Depending on computer to student ratio, create groups or allow students to work alone.
4. Provide students with the beginning information. Students should then type in the information and click calculate when done.

. Start Port: Port of San Francisco, United States
    - Destination Port: Port of Mumbai, India
5. Students should be able to answer all questions listed in the "Need to Find Out" column. If not, adjust the speed of the boat to meet the expectations.

When students have all information needed, they are to write a letter back to the Indian leader explaining the plan.

1. As a class, construct a paragraph long letter. This letter should include…
    - an opening
    - Where the wheat seed is coming from
    - The speed of the boat its traveling in
    - How many miles the boat will be traveling
    - How long it will take to arrive
    - The date it should arrive
    - A closing statement

This situation is based on a true story. Norman was asked on behalf of the Indian government to send his Mexican native seed to India to end the country's starvation. Therefore, not only did Norman understand soil health and plant breeding, but understood the supply chain across the world! When he was approached he did not have handy internet devices to help him calculate the seed's trip. Despite the challenge, he delivered the seed on time and played a large role in India's rise to power.

Sources/Credits

- p://learnaboutag.org/resources/wgo/16.pdf
- http://www.foodsystemprimer.org/food-distribution/
- https://www.ams.usda.gov/services/transportation-analysis/barge

National Agriculture Literacy Outcomes

Culture, Society, Economy, and Geography

- Explain the value of agriculture and how it is important in daily life. (T5.3-5.d)
- Provide examples of agriculture products available, but not produced in their local area and state T5.3-5.e)

Food, Health, and Lifestyle

- Diagram the path of production for a processed product, from farm to table (T3.3-5.b)

Education Content Standards

Within HISTORY

NCSS 7: Production, distribution, and Consumption

- Objective 8

NCSS 9: Global Connections

- Objective 1

Common Core Connections

Reading: Anchor Standards

- CCSS.ELA-LITERACY.CCRA.R.1

Speaking and Listening: Anchor Standards

- CCSS.ELA-LITERACY.CCRA.SL.1
- CCSS.ELA-LITERACY.CCRA.SL.4

Writing: Anchor Standards

- CCSS.ELA-LITERACY.CCRA.W.2
- CCSS.ELA-LITERACY.CCRA.W.4