Agriculture is a Cycle

Agriculture is a cycle. Farmers plant crops in spring, nurture them through the summer, and harvest them in the fall. In the winter the land rests to get ready for springtime, when the cycle begins again.

The cycles of agriculture are powered by our natural resources—soil, water, and energy from the sun. People are a resource, too.

PEOPLE MOVE IN CYCLES. We get up in the morning, eat, work, play and go to bed at night. Then we get up in the morning and start it all again. Farmers are the people who plant, nurture and harvest the crops and care for the animals that provide our food, clothing, shelter and most of what we need to survive.

WATER MOVES IN CYCLES. Water rains on the land (precipitation) so the plants can grow. It collects in oceans, rivers, lakes and streams (accumulation). It then rises into the sky and collects in clouds (evaporation). The clouds become heavy with water, and rain falls down to land again (precipitation).

PLANTS AND SOIL MOVE IN CYCLES. Plants grow in soil. They provide food for animals. Animals provide food for other animals. Plants and animals die and decompose, enriching the soil so plants can grow and feed the animals, and so the cycle goes on.

EARTH MOVES IN CYCLES. Earth rotates on its axis. It takes 365 days for the Earth to revolve around the Sun. As it revolves, moving nearer and farther from the sun, it gives us the cycle of seasons—spring, summer, fall and winter. With every 24-hour revolution, the Earth gives us the cycle of day and night.

AIR MOVES IN CYCLES. Animals and people breathe in oxygen and exhale carbon dioxide. Plants take in carbon dioxide, use it to make food, and give off oxygen. Animals and people breathe it in again.

THE SUN MOVES IN CYCLES. The sun provides energy for all of the Earth’s cycles. Without the sun, plants and animals would not survive.

Materials (for each bracelet)
12- to 14-inch thin brown leather cording
small pony beads—one each in the following colors
  clear (people)  blue (water)  green (plants)  brown (soil)
  orange or red (day)  black (night)  white (air)  yellow (sun)

1. Discuss the word “cycle.” Ask students what they think when they hear the word “cycle” (motorcycle, bicycle, tricycle). Write the word “cycle” on the chalkboard followed by the words “motorcycle,” “bicycle” and “tricycle.” What do all these words have in common?
2. Discuss metaphors. Ask students how the word “cycle” could be used as a metaphor.
3. Discuss each of the cycles listed on the flip side of this card. Tell students they will be making bracelets to help them remember the different cycles of life.
4. Have each student tie a knot about two inches from the end of the leather cord. Beginning with the clear “people” bead, have students string the colored beads in the order listed at right.
5. Ask students to list other cycles in their lives, e.g., “The school year is a cycle.” “A school day is a cycle.”

Extra Activity: Drop a mixed handful of beads (in all colors) onto an empty egg carton and have students graph how much of each bead fell in each hole. Compare this with the randomness with which elements like drought (not enough blue beads, or water) and flooding (too many blue beads, or water) impact our survival.

Skills: Art; Life Science; Language Arts (metaphors, word forms)
PEOPLE move in cycles. We get up in the morning, work, play and go to bed at night. Then we get up in the morning and start it all again. We start to school in the fall, stop in the summer, then start in the fall again. We eat breakfast, lunch and dinner, then wake up the next day and have to eat again.

Farmers plant crops in spring, nurture them during winter and harvest them in the fall. In the winter, the land rests to prepare for springtime, when the cycle starts again. Without this cycle of agriculture, people could not survive. There would be no food to eat, no sheets to sleep on, no shelter, no medicines, no balls or playing fields for playing games.

The cycles of agriculture are powered by abundant natural resources—soil, water, and energy from the sun. People are a resource, too. Because people have learned to use their resources wisely, America’s farmers and ranchers produce 16 percent of the world’s food on just 7 percent of the world’s land.

Land that can be used for growing food is called “arable land.” Every year we lose thousands of acres of arable land. Some of the land is lost because we need more houses for people to live in. Some gets paved over for parking lots and shopping malls. Some is poisoned by industrial waste and other pollutants. Some blows or washes away. Some gets worn out from overuse and mismanagement.

In Oklahoma we have about 34 million acres in farm land.

**Online Lesson: Save Our Soil**

**Skills:** Earth Science, Graphs, Fractions, Social Studies

**Materials:** 1 large apple, sharp knife

Explain that the apple represents the world. Cut the apple as shown below to explain how the land is used:
WATER MOVES IN CYCLES. All of the Earth’s water can be found in one of the three states of matter—solid, liquid or gas. Water goes through all three states of matter in the water cycle. The water cycle is the continuous movement of the water from the Earth to atmosphere and back again. Next to air, water is the most abundant substance on the planet.

The heat from the sun causes water to rise into the sky. This is EVAPORATION. The water collects in the clouds, and the clouds become heavy with water. As the gaseous water moves upward, it runs into cooler air. In the cooler air the gaseous water condenses and becomes rain droplets or ice crystals. This is CONDENSATION.

The rain and snow that is formed this way falls to the ground. This is called PRECIPITATION.

As the water falls to the ground it collects in oceans, rivers, lakes and streams. This is called ACCUMULATION.

Most of the precipitation falls in the oceans and seas. Some of it evaporates and goes back into the air. The rest reaches the ground and soaks into the earth to become part of the groundwater supply which accumulates in lakes and streams.

Without water, we could not survive. Farmers could not grow the crops that feed and clothe us. Most of the water used by crops comes from precipitation, but sometimes farmers must use precious groundwater for watering crops so we will all have enough food to eat. This is called irrigation. Good farmers are very careful to make the most efficient use of water used on crops.

WATER CYCLE SONG (to the tune of “Oh, My Darlin’”)
EVAPORATION (Push both palms up, palms parallel to floor.), CONDENSATION, (Push with arms straight out to the side.), PRECIPITATION on my head. (Pretend to "rain" on head.) ACCUMULATION, (Make arms sweep back and forth in front.) WATER CYCLE,(Arms rotate in circle in front.) And we start all over again (Turn around in place in a circle.)

Water is a Cycle

Materials: hot plate, saucepan, two large aluminum cooking pans, plenty of ice cubes

1. Place a few ice cubes in the saucepan, and let students look at them and touch them while they are still solid.
2. Heat the ice cubes slowly, using the hot plate, so students can observe how matter changes from solid to liquid.
3. After the ice cubes melt, allow the water to boil, and explain that steam is water in its gaseous state.
4. Place more ice cubes in the aluminum pan, and hold it over the steaming saucepan. As the water droplets form on the bottom of the pan, ask students what form the droplets have taken.
5. Collect the condensing droplets by slanting the first aluminum pan and letting the droplets run into the second aluminum pan.
6. Have students draw pictures showing one form of water and something that needs water to live.

Give each student a paper drinking cup and a seal-locking bag. Instruct students to hold the bag by one corner so it is in a diamond shape. Tape the cup inside the bag to avoid slippage. Next, put two ounces of water in the cup. Seal the bag, and tape it to a sunny window. Have students record what they observe after 10 minutes, 30 minutes, two days and four days. (The water should evaporate from the cup, condense on the sides of the bag and collect in the bottom of the bag.)

Skills: Science P&I; Earth Science
Plants grow in soil. They provide food for animals. Animals provide food for other animals. Plants and animals die and decompose, contributing to new soil. New plants grow.

Decomposition is nature’s way of taking life and energy from dead plants and animals and changing it so new plants can use it. Bacteria and fungus eat the dead tissue from plants and excrete it in a form that helps live plants grow. These decomposers are so small you can’t see them except when they are all massed together. That’s the green, white or blue and furry stuff you’ve probably seen growing on food you keep in the refrigerator too long. Earthworms, land snails, slugs and even fly larva (maggots) are also important decomposers.

In nature dead plants and animals decompose and become humus for the soil. Humus acts as sponge to help the soil hold water. It also traps air in the soil. Plants need air and water in the soil to grow. When the farmer plants crops in the soil, the growing crops take out nutrients. The farmer can replace those nutrients by tilling dead plants back into the soil and letting the decomposers go to work. (Online lessons: “Look Out, Below;” “Mighty Earth Movers”)

ACTIVITY: After you have finished with your Jack-o-Lantern in the fall, cover the bottom of an aquarium with garden soil. Mix leaves, sticks and grass clippings with the soil. Place the pumpkin in the aquarium. Moisten the contents of the aquarium with a spray bottle, and cover it with plastic cling wrap. Tape it so little or no air will get in. Place a calendar near the aquarium. Mark the day the experiment began. Have students observe the aquarium and mark the calendar whenever anything significant occurs (the first day it “rains,” the day the pumpkin’s face caves in, etc.). Have students count how many days it takes the pumpkin to completely decompose. (Online lesson: “Case of the Missing Pumpkin”)

Skill: Life Science; Earth Science

Plants Move in Cycles

Fruits and vegetables have one characteristic in common—seeds. Without seeds there would be no new plants after the old plants died.

Many plants produce seeds in the fall. Plants with flowers have seeds. Seeds grow in vegetables and fruits. One plant may have many seeds. In fact, most plants produce many more seeds than will finally grow to new plants.

Seeds travel. Some seeds travel to far away places, and some stay close to the plant or tree where it grew. Some seeds, like dandelion and poppy seeds, are carried by the wind. Some, like lily pods, move through the water. Birds eat berries and carry the seeds far away. Some seeds stick to the fur of animals and are carried to new places. Some are scattered when the fruits carrying them pop open and shoot them out. People also move seeds. We collect seeds so we can plant them the following spring.

ACTIVITY: Provide each student with one sock. Have students turn the socks inside out and put them on over their shoes. Take the class outdoors to a grassy area, and have them drag their socked feet through the grass to collect seeds. A dry, weedy area would work best. Have students take off the socks and turn them so the seeds are inside before returning to the classroom. Have students carefully remove the seeds from the socks, sort them and make charts of every kind of seed they have collected. Discuss how each kind of seed is scattered to a new place. As an extension, have students leave some of the seeds on the socks. Moisten the socks and place them in plastic bags. After a few days, have students look to see if any of the seeds have sprouted.

Skill: Life Science
Earth rotates on its axis. It takes 365 days for the Earth to revolve around the Sun. As it revolves, moving nearer and farther from the sun, it gives us the cycle of seasons—spring, summer, fall and winter. With every 24-hour revolution, the Earth gives us the cycle of day and night.

Summer Solstice, around July 21, is the longest day of the year. Winter Solstice, around December 21, is the shortest. In the spring and fall are equinox, days when the hours of light and dark are the same. Spring Equinox is usually around March 21, and Autumn Equinox is around September 21.

All over the world people mark the seasons with festivals associated with agriculture. In spring we celebrate new life. On the farm the fields start to turn green, and there are baby animals everywhere. Farmers plant most of their crops in spring.

The summer sun makes everything grow and is the busiest time on the farm. Even the school year is based on a time when most everyone was involved in agriculture. Summer break was time off from school, so children could help on the farm. Fields had to be hoed to keep the weeds out. Crops had to be fertilized and protected from insects and other pests. Mid-summer celebrations provided rest from summer chores and relief from the heat.

Fall celebrations began as harvest festivals. After working from dawn to dusk for weeks at a time to get the crops in, it was time to celebrate the fruits of all that labor.

In winter work on the farm slows down. It is time for planning for the following growing season. Winter celebrations remind us that the dark, cold days will not last forever, and that the cycle will soon bring spring.

ACTIVITIES
—Oklahoma has many festivals in the summer to celebrate and promote the crops that grow well in a particular area. Have students research ag-related festivals in your part of the state and locate other ag-related festivals statewide. (Oklahoma Department of Tourism website would be a good place to start: http://www.travelok.com) Have students map the festivals on a large map of Oklahoma and chart the mileage from your town to each of the festivals. (Social Studies Process, Geography)

—Have students research to find examples of ag-related celebrations around the world. Do people in other parts of the world celebrate these seasons at the same time we do? Is fall in the Northern Hemisphere the same as fall in the Southern Hemisphere? (Social Studies Process, Geography, Earth Science)

—Introduce students to the Farmer’s Almanac (www.farmer’s almanac.com). Have students keep track of the weather for several days and test the accuracy of that predicted in the Almanac. Have students devise their own research questions based on information available in the Farmer’s Almanac. Discuss the origins of folklore, and have students research folklore about the weather and planting. Have students interview some older farmers and gardeners to collect local folklore about planting and the weather. (Social Studies Process, Geography, Literature)

—Have students research the phases of the moon by looking in the encyclopedia, searching the library card catalog or using an online search engine. (Social Studies Process, Earth Science)

—Have students research what crops can be grown in locations near the equator that cannot be grown in locations far away from the equator. (How are conditions near the equator different from those farther away? Students may look in plant books and catalogues to find required growing conditions and match them with growing seasons near the equator and farther away.) Have students map the different time zones. (Geography, Life Science)

—Have students research the first and last frost in your area and calculate the length of the growing season. Then have students list plants that can and cannot be grown within this time period. (Geography, Life Science, Earth Science)
Earth Moves in Cycles: Autumn

—Have students try several different kinds of squash, using all five of their senses. (Science P & I)
—Provide several vegetables, and have students guess whether they will sink, float or bounce. (Science P & I)
—Dry fruits in a dehydrator, and discuss food preservation. Compare the size, volume and weight of fruits before and after drying. (Science P & I, Math: Measuring)
—Discuss why some foods grow underground and some above? Have students sort some common fruits and vegetables according to the part of the plant. (Life Science, Math: Sorting)
—Throughout the year the Moon rises, on average, about 50 minutes later each day. But near the autumnal equinox, the day-to-day difference in the local time of moonrise is only 30 minutes. The Moon will rise around sunset and not long after sunset for the next few evenings. This is a big help to Northern Hemisphere farmers during harvest because it provides extra light for harvesting crops. Have students research to find when the harvest moon is expected this year, and then observe and chart the harvest moon as a homework assignment. (Earth Science)
—Make pumpkin pie in a bag. (Online recipe in “Food and Fun.”) Estimate and count pumpkin seeds.
—Use crushed leaves and grass to make works of art showing texture, form, line and shape. (Art)
—Have students photograph a tree for several weeks as the colors change for a time-lapse diagram. (Art)
—Have students arrange their own still life works of art with fall items. Photograph the arrangements, and present them in a PowerPoint during a fall harvest meal. (Art)
—Have students dry and paint gourds to make musical instruments and gourd bird houses. (Art)
—Paint with wheat. Roll squash in paint to make designs. Boil vegetables and herbs to make dyes. (Art)

Earth Moves in Cycles: Winter

—Explore static electricity by rubbing silk, wool and cotton on balloons. Examine these materials under a microscope. Why does wool keep us warm? (Online lesson: “Fleece as White as Snow”) (Science P & I, Physical Science)
—The pecan harvest is in November. If possible, find someone with a pecan tree who is willing to let your students gather pecans. Pecans are like fingerprints and snowflakes. No two have the same pattern. (Online lesson: Pecan Fingerprints. Also see “A Tough Nut to Crack.”) (Social Studies)
—Experiment with pine cones. Have students examine dry pine cones, and then place them in water to see how they change. (Science P&I) Make bird feeders from pine cones. (Art)
—Have students research how farmers provide shelter for their animals in the wintertime? What other chores do farmers have in the winter months? Invite a farmer to class or get a Farm Pen Pal to find out (information available on the website.) (Social Studies: Careers; Life Science)
—How do we feed ourselves in the winter months, when fruits and vegetables cannot grow? Have students research food storage (Online lesson: Food for Keeps). Homework assignment: Take a trip to the grocery store, and look for country of origin labels showing the origins of fresh fruits and vegetables during the winter months. Find these locations on a map, and discuss opposite seasons in opposite hemispheres. (Geography)
—Make bread or tortillas in a bag and stone soup. (Available online as lessons and in “Food and Fun.”) (Science P&I)
—Recycle Christmas cards. Glue cards with winter scenes to large pieces of paper, and have students extend the scenes. (Art)
—Explore the agricultural benefits of snow. (Online lesson: “Snowball Fight”). Make snow ice cream. (Online recipe in “Food and Fun.”) (Earth Science, Life Science)
—Use dried flowers and other dried materials to make paper. (Online lesson: “Making Paper”) (Art)
—Use shredded paper to make papier mache. (Online lesson: “Chewed Paper and Sticky Stuff”) (Art)
Fun with Watermelon—Find the diameter, weight, radius, and circumference of a watermelon. (Measuring)

—Provide one watermelon for each group. Have each group examine its watermelon carefully and write down or draw observations. Then place all the watermelons together and have each group locate its own watermelon. (Science P&I)

—Have students sort some different varieties of watermelon by size, feel, color, texture, taste etc. (Sorting)

—Have students estimate the number of seeds in a watermelon, then save and count them. (Number Sense)

—Have a watermelon relay. Teams of students stand in a row and pass the watermelon from one to the other. (Movement, Teamwork)


—Graph which variety of watermelon students like best. (Data Analysis)

—Weigh watermelons and students. Estimate: Do students weigh more or less than watermelons? How many watermelons would it take to weigh as much as an average student (or vice versa)? (Measuring)

Online watermelon lessons: Working Watermelon; Melon Meiosis

Other summer activities

—Start fall gardens with cool weather plants like spinach, beets, and greens. (Life Science)

—Discuss temperature. Why is it hot in the summer and cold in the winter? Chart temperatures for a week, and compare with other parts of the country. (Earth Science)

—Have students figure out how many days are in summer? What are the summer months? (Earth Science)
Carbon dioxide gas is a colorless, odorless gas that is part of our atmosphere. It is formed by respiration (breathing), combustion (burning), chemical reaction and decomposition (rotting). Carbon dioxide is present in all organic matter.

Animals breathe in oxygen and exhale carbon dioxide. Plants take in carbon dioxide through photosynthesis, use it to make food, and give off oxygen. Animals breathe it in again. This is known as the carbon cycle.

Sometime in the past 600 million years, scientists believe some of the plants and animals fell into wet, swampy places where there was little oxygen in the soil. Since the normal decay process is not possible without oxygen, these plants and animals released very small amounts of carbon as carbon dioxide and methane gas. Over time these masses of matter became oil, coal and natural gas which still contained most of the carbon from the original plants and animals. About 200 years ago, people discovered they could burn these materials to produce tremendous amounts of energy.

When people people first started burning fossil fuels, they didn’t realize they would be causing an imbalance in the carbon cycle. Once scientists discovered what was happening, they began to look for ways to solve the problem.

Agriculture provides a very important solution by keeping land covered with crops and trees. Scientists found that planting millions of trees helped take up extra carbon dioxide through photosynthesis. Another solution was getting farmers to keep their land covered in plants. This practice also keeps soil from washing away.

In Oklahoma we have about 34 million acres planted in crops and about 10 million acres in forest.

### Bubbles in the Cabbage Juice

**Materials:** red cabbage; zip-closing bag; hot water; container for cabbage juice; five clear, short, fat cups; funnel; yeast; sugar; two 16-ounce soda bottles, five balloons, one bottle of club soda, baking soda, vinegar.

1. Tear up several leaves of red cabbage and put them in a zip-closing bag. Pour hot water over the cabbage, and zipt the bag shut. Let the cabbage steep in the water until the water is blue and cold. Pour the liquid into a cup. Discard the bag and cabbage. Explain that cabbage juice is an indicator (a substance which indicates the presence, absence or concentration of a substance) because it contains a natural chemical that changes colors, based on whether a substance is an acid or a base, and that carbon dioxide makes carbonic acid when dissolved in water.

2. Label the cups as follows: control, yeast/sugar, baking soda/vinegar, club soda, breath. Divide the cabbage juice equally among the cups. Use the funnel to put an envelope of yeast, 1 teaspoon of sugar and 1/2 cup warm water into one of the soda bottles. Put a balloon over the mouth of the bottle, and gently shake the contents. Let the bottle and balloon sit until the balloon is inflated. Twist the balloon closed, and bubble the gas from the balloon into the cup labeled yeast/sugar.

3. Blow up four balloons, and let the air out. Open the club soda, and quickly put one of the balloons on the bottle mouth. Let the balloon stay on the bottle until it inflates. Twist the balloon closed, and take it off the bottle. Let the gas in the balloon bubble down into the cup labeled club soda.

4. Put one tablespoon of baking soda in a 16-ounce bottle. Put 2 tablespoons of vinegar into a balloon, using the funnel. Attach the balloon to the mouth of the bottle, and allow the vinegar to flow into the bottle to mix with the baking soda. When the balloon inflates, follow the same procedure as before.

5. Blow up the last balloon, and bubble the “gas” into the breath cup.

6. Line up all four cups, and compare with the control cup. Have students record and graph their observations.

**Skills:** Science P&I; Earth Science
The sun provides energy for all of the Earth’s cycle. Without the sun, plants and animals would not survive. All sources of fuel are a result of the sun’s power.

Only one two-billionth of the heat from the sun enters the Earth’s atmosphere. The rest is lost in space. Of the energy (heat) that enters the atmosphere, about 30 percent is reflected back to space because of the clouds. About 30 percent of the energy is absorbed by the atmosphere and warms the air. Then about 40 percent of the energy in the atmosphere reaches the earth’s surface to warm the ground and the seas. Heat from the ground and the seas will then warm the atmosphere.

Plants must have sun to grow. Plants convert the energy from the sun into energy we can use. The plants we can grow in Oklahoma depend on the length of our growing seasons - the number of days from the time of the last frost in the spring to the first frost in the fall. Some plants, like garden peas and lettuce, can survive light frost and cooler temperature but don’t do well in the extreme heat of Oklahoma summers. Others, like okra and eggplant, love the heat. Certain plants also need more hours of sunlight than others. The world is divided into growing zones, dependent upon the number of days between the first and last frost. Oklahoma is in zones 6 and 7.

To view the USDA Plant Hardiness Map, go to this website: http://www.usna.usda.gov/Hardzone/ushzmap.html

ACTIVITIES
—Plant beans in cups. After they have sprouted, place some near a window and others in progressively darker places. Have students record their observations. (Skill: Science P & I; Life Science)
—Experiment with phototropism: Move the bean plants to different spots around the room over several days or weeks so students can observe them moving toward the light. (Skill: Earth Science)
—Make a solar oven by lining an empty oatmeal box with aluminum foil. Cut holes in opposite sides of the box. Place a hot dog in the box, and run a clothes hanger through the holes, piercing the hot dog inside. Cover and tape the box. Put it outdoors on a sunny day to cook. Depending on how sunny the day, your hot dog should be ready in 30 minutes to an hour. (Skill: Science P & I; Earth Science)
—Plant wheat or grass in an aquarium. After it has germinated, cover the aquarium with a box to see the importance of sunlight. (Skill: Science P & I; Life Science)
—Monitor several spots in the school yard to find out how many hours of sunlight they get in a day. On a sunny day, check the locations once an hour, and place a marker for every hour the sun is shining in that spot. Use plant books or seed catalogs to research which plants can grow in which spot, based on the hours of sunlight. (Skill: Science P & I; Life Science)
—Go outside on a sunny day and play Shadow Tag. One player is designated “shadow chaser.” To make a tag, he or she steps on any other runner’s shadow. When a tag is made, the shadow chaser joins the runners, while the tagged player takes over as the new shadow chaser. At any time the shadow chaser may call out: “Shadows cros over!” at which time all runners spring to the opposite corner of the play area from where they are standing. (Skill: Movement)