

The Farmer Cares for the Land

Grade Level: 5-6

Approximate Length of Activity: One or two class periods

Objective

Students will identify cause and effect relationships in agricultural and environmental issues.

Michigan Content Standards: (Language Arts) R.WS.05.06; R.IT.05.02; R.CM.05.04; R.WS.06.03; R.WS.06.04; R.WS.06.06; R.IT.06.02; R.CM.06.01; R.CM.06.02; R.CM.06.04

Vocabulary

- **Chemical Fertilizers** – Inorganic materials, including nitrogen, phosphorus and potassium compounds, spread on or worked into soil to increase its fertility.
- **Contour** – Field operations, such as plowing or planting at right angles to the natural slope, used to reduce soil erosion, protect soil fertility and conserve water.
- **Dust Bowl** – Part of the Great Plains of the United States often subject to severe drought.
- **Ecosystem** – An ecological community together with its environment, functioning as a unit.
- **Environment** – The total of all external conditions which act upon an organism or a community of organisms to influence development or existence.
- **Erosion** – The wearing or carrying away of the surface from the earth, usually by wind or water.
- **Integrated Pest Management (IPM)** – An approach to pest management that incorporates all available techniques for managing pests and reducing economic damage while minimizing adverse side effects.
- **Legume** – A family that uses bacteria to convert nitrogen from the air to build up nitrogen in the soil. Legumes include peas, beans, peanuts, clover and alfalfa.
- **Nitrogen** – Naturally occurring gas in the air and soil.
- **Nutrients** – Element or compounds in the soil essential for plant growth.
- **Overgrazing** – Grazing lands so heavily that the soil will no longer produce plants.
- **Pesticides** – Substance used to control insect, plant or animal pests.
- **Resources** – The available means, including land, labor and capital, for producing food and fiber.
- **Rotate** – To plant or grow crops in a fixed order of succession.
- **Terraces** – Ridges of soil built across a slope to slow runoff of water in a field or pasture.
- **Topsoil** – Fertile upper layer of soil that is rich in organic matter.
- **Underground Water Supply** – Fresh water from underground aquifers that provides water to wells.
- **Vegetation** – The plants of an area or region: plant life.
- **Winter Wheat** – Wheat planted in the fall that survives the winter as a young seedling, and matures in the early summer of the following year.



Background

Farmers make their living off the land and care about the environment. Most people, farmers included, try to avoid practices that might harm or destroy their way of life. Despite this fact, many environmental problems are blamed on agriculture.

People began polluting long before they knew they were polluting. Early settlers in this country dumped their trash into rivers and streams without consideration for the harm it might do. Before gasoline powered tractors began releasing exhaust fumes into the rural countryside, workhorses were creating pollution problems of their own. The average farm horse produced 35 pounds of manure or solid waste and two gallons of liquid waste each day. Although horse manure can be an excellent fertilizer when spread across a large field, large amounts in small areas can create high concentrations of nitrogen and bacteria that can filter through the soil into the underground water supply.

Thousands of years ago, people began to farm because they found they could produce more food than by hunting and gathering. Over the years, people discovered some farming practices hurt the land. Cutting down trees, clearing away vegetation and letting animals overgraze left topsoil unprotected from wind and water erosion. Planting the same crop in the same field year after year used up all the soil nutrients. As a result, fields lost their ability to produce good crops.

Early farmers learned from mistakes and developed better farming methods. They learned to farm on a contour and build terraces and to rotate their crops. Farmers also learned to spread animal manure on fields to restore the organic matter and nutrients.

When Europeans settled the New World, they were amazed at what seemed like endless resources and acres of rich soil that had not been used for European-style crop farming. Many farmers abandoned the methods their ancestors had learned for protecting the land. When one field began to produce poor crops, farmers would simply abandon it and move farther into the wilderness.

As more people moved in, they began farming sloping lands that could easily wash away and sandy soils that could easily blow away. In the early 20th century, farmers began plowing up the native grasses of the Southern Plains to plant wheat. The land had not been farmed before so farmers had no way of knowing their hard work would be the first step toward creating what came 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 plowing up the plains would cause the soil to blow away. Once they saw what had happened, they did what farmers have been doing for thousands of years. They began thinking of different farming 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 the chemicals were getting into the water supply and making birds, fish, animals and people sick. Today farmers and agricultural researchers are working on ways to solve that problem and many more.

Materials

- "The Farmer Cares for the Land: Wetlands" worksheet
- "The Farmer Cares for the Land: Soil Erosion" worksheet
- "The Farmer Cares for the Land: Chemical Pesticides and Fertilizers" worksheet



Activity Outline

1. Ask students to describe what farmers do. Then ask them to define the word “environmentalist.” Ask if they have heard any news reports about conflicts between farmers and environmentalists (e.g. endangered species, grazing on public lands, wetlands). Draw a Venn diagram on the chalkboard, and ask students to list things about which farmers and environmentalists disagree as well as things they have in common. (Both care about the land. Both need food to eat.)
2. Share background material and discuss problem/solution and cause/effect relationships.
3. Divide your class into three groups, and hand out copies of one of the worksheets to each group. Have students read the situations on the student worksheets and identify the cause and effect and the problem and solution in each one. Students should also identify the alternatives and their effects.

Related Activities

1. Read the books *The Murkey Water Caper*, and *Your Point Is?* and *What Is A Watershed?* by Deborah Rodney Pex.
2. Instruct students to search current newspapers and magazines for issues having to do with conflicts between agriculture and environmentalism (wetlands, endangered species, etc.)
3. Lead a discussion on the conflicts between individual rights and the common good, (e.g., the individual rights of people who want to smoke in public places conflict with the need to protect the public from second-hand smoke). Lead the discussion toward the individual right of the farmer to use his or her land to make a living in conflict with the public need to protect the environment. Make sure students also recognize the common good that comes from having a safe, inexpensive and abundant food supply and that individual rights sometimes work toward the common good, (e.g., the public benefits if the farmer is able to earn a living by producing food).
4. The lesson “Soil...It’s More Than Just Dirt” located in the science section of this curriculum guide.
5. The lesson “Layer Away” located in the science section of this curriculum guide.



Resources

Student Books

- Andryszewski, T. (1993). *The Dust Bowl: Disaster in the Plains*. Millbrook.
- George, J.C. (1991). *Who Really Killed Cock Robin: An Ecological Mystery*. Harper Collins.
- Pollock, S. (1993). *Ecology*. Eyewitness Science, Dorling Kindersley.
- Scott, M. (1996). *Young Oxford Book of Ecology*. Oxford University Press.
- Stanley, J. (1992). *Children of the Dust Bowl: The True Story of the School at Weedpatch Camp*. Crown.
- Yount, L. (1995). *Pesticides*. Lucent.

Teacher Resources

- *My Father's Garden*, Bullfrog Films, PO Box 149, Oley, PA 19547. Phone 1-800-543-3764 (DVD contrasting the effects of conventional farming using chemicals with those of non-chemical organic farming through the stories of two farm families, one from North Dakota and one from Florida, \$32.50, available free for a 10-day review).
- "Things We Can Learn From a Cow and a Worm," National Cattlemen's Beef Association, Education Dept., 444 N. Michigan Ave., Chicago, IL 60611, (800) 368-3138 (22- by 34-inch educational poster with activities demonstrating the positive role ruminants, especially cattle, play in our environment. Earthworms are featured as an example of natural recycling, code #17-517, \$1.50.)
- Van Cleve, J. (1996). *Janice Van Cleve's Ecology for Every Kid*. Wiley.



The Farmer Cares for the Land

Wetlands

Wetlands are low areas saturated with water. Marshes and swamps are wetlands, as are the areas along creeks and rivers. They are called riparian areas.

Wetlands are an important part of the ecosystem of the earth. They act like sponges to store water during the wet times of the year and release it into the aquifers and underground streams where we get most of our drinking water. When there are no wetlands to soak up the waters, rains are more likely to turn into floods, destroying homes, businesses and farms. Plants that grow in wetlands hold the soil and help keep it from washing away.

Wetlands help purify water. They filter out harmful chemicals and wastes. Dirty water gets a good cleaning when it flows through a wetland.

Wetlands provide homes for birds and animals that need wet places to grow and reproduce. They are important rest stops for migrating birds. Many endangered plants and over 1/3 of the endangered animals live in or use wetlands.

At the time of the European settlement, there were about 215 million acres of wetlands in the lower 48 states. In the last 200 years, more than 54 percent of those wetlands have been lost. Most were converted to agricultural uses. For many years' people thought wetlands were obstacles to farming. They were also considered breeding grounds for mosquitoes. The government encouraged landowners to drain wetlands.

Now we know more about wetlands and how they help the environment, wildlife and humans. Federal laws have been passed to protect and preserve them. Some people don't like the wetland laws. People who have wetlands on their property think they should be able to use their property to earn money to support their families.

Problem (s) _____

Solution (s) _____

Cause (s) _____

Effect (s) _____

Does the solution create another problem? If so, what is it? _____



The Farmer Cares for the Land

Soil Erosion

Soil erosion happens when soil is washed or blown away. In most places, trees, grass and other plants hold soil in place. When vegetation is removed, winds and rains can carry soil away. Over the years, farmers have removed unwanted grass, weeds and other vegetation from the soil before planting their crops. Cattle and other farm animals can remove all the vegetation from an area if there are too many of them left in one place for too long. Once gone, soil takes several hundred years to regenerate.

On the Southern Plains, the soil is sandy; annual rainfall is low; there are large, open areas; and high winds are common. The first settlers allowed livestock to roam and graze the plains until there was little vegetation left to hold the soil in place. Early in the 20th century, farmers plowed up the natural grass cover on the plains and planted winter wheat. Between 1934 and 1937, the area had less rainfall than usual. With large areas of plowed land having no grass root system to anchor it, much of the soil blew away. The dust storms and sandstorms buried roads and houses. Clouds of dust reached as far east as Washington, D.C.

In response to the disaster, the federal government created the Soil Erosion Service and the Civilian Conservation Corps to find ways to recover the land. Workers replanted grass, planted trees and showed farmers scientific agricultural methods to help them protect the soil.

One method was to put large numbers of animals out to graze on one piece of land for a short time period and then move them to a new pasture. This allowed the animals to get the nutrition they needed while cutting down on overgrazing and erosion.

Another method was no-till farming. A farmer using this method plants crops directly in the plant stems, stalks, and leaves from the last harvest. For this method to work, the farmer must use herbicide to kill unwanted grass and weeds. This method stops erosion, but some people worry that the herbicides may pollute the underground drinking supply.

Problem (s) _____

Solution (s) _____

Cause (s) _____

Effect (s) _____

Does the solution create another problem? If so, what is it? _____



The Farmer Cares for the Land

Chemical Pesticides and Fertilizers

In the natural plant cycle, plants take nutrients from the soil and return them when plants die and decompose. When people take plant matter from the soil, they are also removing nutrients. Over time, if the nutrients aren't replaced, the soil can no longer provide enough nutrients for plants to grow. Farmers may replace these nutrients by adding animal manure, growing a legume crop, resting fields or rotating crops from year to year. These techniques allow fields to restore nutrients through natural processes.

In the 1920s, farmers began using tractors instead of horses and mules. They began using inorganic nitrogen fertilizers to replace the organic nitrogen the fields had been getting from animal manure. Nitrogen is one of the major nutrients plants need to grow. In the 1940s, farmers learned to use chemicals to kill insects and weeds. Those chemicals helped the world's farmers to produce greater quantities of food and fiber.

Chemicals have caused some problems too. Chemical pesticides can kill other organisms besides the ones for which they are intended. Some of the organisms they kill are useful ones that help crops grow naturally. Chemical fertilizers also cause reactions in the soil, which, over time, can make the soil less desirable for plant growth. Chemicals used in agriculture can also contaminate the water we drink. Sometimes they move through the soil and enter the underground water supply, and sometimes they are carried by rainwater into streams, rivers and lakes.

Farmers are concerned about these problems. They are trying new methods that will help them grow enough food for all people to eat without damaging their land and water supplies. These methods help farmers use fewer chemicals on their fields. One method is Integrated Pest Management, or IPM. With this method, farmers first find out how many and what kinds of pests they have. Chemical pesticides are not used unless there are enough pests to cause economic crop damage. Environmentally-friendly pesticides and beneficial insects are also a part of the IPM plan.

Another method makes use of a computer installed in the farmer's tractor. The farmer takes soil samples from the fields and has them chemically tested at a laboratory. The computer is connected to a satellite positioning system that uses the soil test results to tell the fertilizer spreader where to place the fertilizer and how much to use.

Problem (s) _____

Solution (s) _____

Cause (s) _____

Effect (s) _____

Does the solution create another problem? If so, what is it? _____



The Farmer Cares for the Land

A. Wetlands

Problem	Loss of wetlands
Solution	Passing laws to protect wetlands
Cause	Draining or filling in wetlands
Effect (s)	Flooding, loss of habitat for wildlife, loss of natural water purification

Does the solution create another problem? If so, what is it?
People are unable to use their property as they wish.

B. Soil Erosion

Problem	Soil erosion
Solution	Rotational grazing, no-till farming
Cause	Overgrazing, clearing vegetation from soil
Effect (s)	Soil washes or blows away

Does the solution create another problem? If so, what is it?
Use of herbicides may cause water pollution.

C. Chemical Fertilizer and Pesticides

Problem	Overuse of chemicals
Solution	Integrated Pest Management, computers to monitor fertilizer use
Cause	Using chemical fertilizers and pesticides
Effect (s)	Increases production, pollutes water

Does the solution create another problem? If so, what is it?
None identified in the text.

