



UNIT 7: ENVIRONMENT

Soil Conservation

Grade level: Upper elementary

NATIONAL STANDARDS

NS.K-4.4

Student Learning Objective

By the end of this lesson, students will be able to:

1. Identify the importance of conserving soil.
2. Explain how farmers practice conservation of natural resources.

Time: 50 minutes

Tools, Equipment, and Supplies:

Handouts of Activity Sheets 23:1, 23:2, and 23:3
Writing surface
Container/bucket of soil
An apple
A paring knife
Plastic trays (or shoe boxes) 5 inches deep
Plastic sheeting to line trays
Beakers and sprinkling cans (one for each tray)
Trowel
Stopwatch
Sod
Water

Key Term(s): Erosion

Background Information

Farmers use natural resources to produce food and fiber. Soil is needed to grow crops or grass for livestock to eat. Clean water and air are required for both plants and livestock.

Agriculture is a sustainable industry. This means farmers do things to maintain or prolong natural resources. These include management practices such as strip cropping, terracing, organic farming and crop rotation.

Because it takes 100 years for nature to replace one inch of topsoil lost to **erosion**, farmers must act as stewards of the land. By protecting the soil now, farmers can continue making a living off the land and enable future generations to reap an adequate harvest.



NOTES

Interest Approach

Place the apple and bucket of soil on the desk in front of the classroom.

Is anybody wondering what I am doing with this bucket and this apple?

Solicit some guesses. Comment positively on each response.

Let's see if we can figure out what is happening.

Scoop some soil out onto a table where students can see it.

What is this? Your mom might call this dirt, but its real name is soil. And without it, we couldn't live. Why is soil so important?

Solicit responses. Comment positively on each.

Great answers! It is very important to understand that soil supports plants in the ground, which we need for food. Soil also holds water so the roots of plants can absorb it. Additionally, soil holds minerals and organic material that promote plant growth.

See, soil is very important to us and to agriculture. So we must learn how to conserve the soil. Let's see how this apple can teach us the importance of conserving this valuable resource called soil.

OBJECTIVE 1: Identify the importance of conserving soil.

Very little of the earth's surface can actually be used for food production. Let's pretend that this apple represents the planet earth.

Use an apple to demonstrate:

Let's cut this apple into four different parts.

Using the paring knife cut the apple into four equal parts.

Three of the parts represent the area of the earth covered by water so we can set them aside. We are not talking about water; we are talking about soil. The fourth represents the earth's land mass. What percentage is $\frac{1}{4}$?

Allow a moment for them to calculate.

25 percent is correct. 25 percent of the earth is land.



NOTES

Now, let's cut the "land section" of the apple in half lengthwise, creating two eighths. One of these pieces represents land such as desert, swamp, Antarctic, Arctic and mountain areas that are not suitable for people to live in. What percentage of the earth is land not suitable for people?

Allow a moment for calculation. Assist students if they struggle.

12.5% is correct. Great job! Let's set this eighth aside.

Let's look at this other eighth. It represents the area where people can live. Let's slice it lengthwise into four equal parts. Three of these sections represent the areas of the earth that are too rocky, too wet or too hot for the production of food or are occupied by cities, factories and highways. People can live in these areas but cannot grow food. What percentage of the earth's surface is habitable but not suitable for food production?

Allow a moment for calculation. Assist students if they struggle.

9.375 percent is correct. Excellent!

What percentage of the earth's surface remains as land used for food production?

Allow a moment for calculation. Assist students if they struggle.

3.125 percent is correct. Good! Now let's carefully peel this last thirty-second. This peeling represents the amount of soil used for the production of food that feeds the entire world.

Why must soil be conserved? What would happen if it suddenly disappeared?

Solicit some responses. Comment positively for each response.

It takes nature 100 years to replace one inch of topsoil lost to **erosion** by soil or water. We must do everything we can to take care of the soil that keeps us living. We must encourage others to conserve our all-important soils.

OBJECTIVE 2: Explain how farmers practice conservation of natural resources.

Remember, it takes nature 100 years to replace one inch of topsoil lost to **erosion**. We need to do our part to conserve the soil, but we also need to realize that there is another group that works very hard to conserve the soil. Who could I be talking about?

Solicit responses. Comment positively on each response.



NOTES

Great! We are focusing on farmers. They are the “Earth Keepers” that take the best care of the soil. Farmers protect the soil today so it can grow food now and in the future. They use many different conservation methods to prevent the soil eroding.

Erosion is when soil is carried away by wind or water.

Use a Choral Response e-Moment® to memorize erosion.

Great job! Now let’s identify some of the things farmers do to take care of the soil.

Hand out the Activity Sheet 23:1, “Soil Conservation Practices.”

The first method farmers use to conserve soil is referred to as **contour planting**. In contour planting, crops are planted around the curve of a hill rather than up and down the hill. This helps keep the soil from washing down the hill.

Another method is called **terracing**. In terracing, wide ridges are made around a hill to prevent water from rushing down the hill too fast. This method is very similar to contour planting; however, terraces are permanent structures that shape the land.

You see grassed waterways where farmers plant grass in low areas and do not plow low areas in a field where water usually runs down the hill.

Leaving trees or grass on steep hillsides rather than clearing them for cropland creates **forest and grass areas**.

The last method is called **windbreak**. This method involves planting rows of trees to slow down the wind and prevent soil loss from blowing wind.

Use a Crayon e-Moment and have students create a colorful representation of each method. Be sure to discuss each drawing.

Now let’s look at the graph on our activity sheet. What has happened to cropland erosion because of these practices by farmers? Exactly! It has declined.

The next activity will require some preparation before class. Have all of the materials prepared before class begins in order that the students may engage in the activity. Follow the procedure below in order to prepare all containers or have students create their own containers if enough time is available.



NOTES

Let's perform a little experiment to see which soil conservation methods work best to prevent soil erosion.

Place the students in groups of five and handout the activity sheet 23:2, Preventing Soil Erosion.

Follow my instructions very closely and be sure to record all of your findings.

1. Gather the necessary supplies:

- Container/bucket of soil
- Plastic trays (or shoe boxes) 5 inches deep
- Plastic sheeting to line trays
- Glass beakers (one for each tray)
- Water sprinkling containers (one for each tray)
- Trowel
- Stopwatch
- Sod
- Water

2. Construct the water erosion trays:

- The trays should be approximately five inches deep.
- At the center of one end of each tray cut a "V" that will funnel water and sediment into a beaker.
- The "V" should be approximately two inches wide and two inches deep.

3. Place soil in the water erosion trays:

- If using shoe boxes, line the boxes with plastic sheeting and leave excess sheeting at the end with the "V" in order to funnel water and sediment through the "V" and to protect the box.
- If using a plastic tray place sheeting at the end with the "V" in order to funnel water and sediment through the "V" and into the beaker.
- Regardless of container, moisten the soil you plan to use so that it packs effectively.
- Fill the container to the bottom of the "V" with packed soil. It is important to pack the soil for the water to remain near the surface of the soil.

4. Vary the surface condition of each soil container. Several variations can be created.

- One could have a bare, packed surface representing no cover or erosion prevention techniques.



NOTES

- b. Place the sod on the top of the soil of another container and press it in firmly to represent a cover crop or use strips of sod to represent strip cropping.
- c. In another container, create rows of packed soil running across the width of the container and perpendicular to the flow of water. This condition represents terracing or contour farming.
- d. Scrape and loosen the surface of the soil to represent tilled soil on a slope with no erosion prevention techniques.

5. Prepare the containers for water and sediment collection:

- a. Raise one end of each container to the same height.
 - i. Multiple trials at varying angles may be used.
- b. Place a beaker below the "V" of each tray so it catches the water and sediment runoff.

6. Create runoff in each container:

- a. Place an equal amount of water in each sprinkle can.
- b. Pour equal amounts of water into each tilted tray creating runoff.
 - i. The amount of water may vary according to tray size, soil type, etc. Experiment with the amount of water in your trays in order to create adequate runoff that is consistent across trays. Regardless, the volume and rate of application of water should be consistent from tray to tray.
- c. Collect the runoff and sediment in each tray's beaker.

7. Compare the volume of runoff and sediment collected in each beaker.

Discuss the results and draw conclusions related to effective erosion control.

Which type of soil conservation practice seemed to be most effective? Why?

SUMMARY/REVIEW

REFLECTIVE REVIEW QUESTIONS:

- Compare the different methods farmers use to reduce soil erosion. How are they similar?
- Soil is definitely a limited resource farmers work with. What are other important natural resources they must manage?

Hand out the Activity Sheet 23.4, "Soil Facts." Review the importance of soil conservation.

We have learned quite a bit about soil conservation today. I encourage



NOTES

students to take the Soil Facts Activity Sheet home and share it with your parents.

APPLICATION

APPLICATION 1: Help students learn more about photosynthesis with this experiment. You'll need:

- A potted plant (bean plants work well for this experiment)
- Two paper squares, about 1 inch on each side
- A paper clip
- A sunny window

Tell students that green plants need water, minerals and chlorophyll to make food. The word chlorophyll means "light-green leaf." The process is called photosynthesis.

Near the top of the plant, place two paper squares on the top and bottom of the same leaf. Use the paper clip to fasten the squares in place. Place the plant in a sunny window. After a few days, remove the paper clip. The area you have covered with the paper is lighter. Because that area of the leaf got no light, the plant could not produce chlorophyll there. This experiment shows that without sunlight and chlorophyll, plants cannot make food.

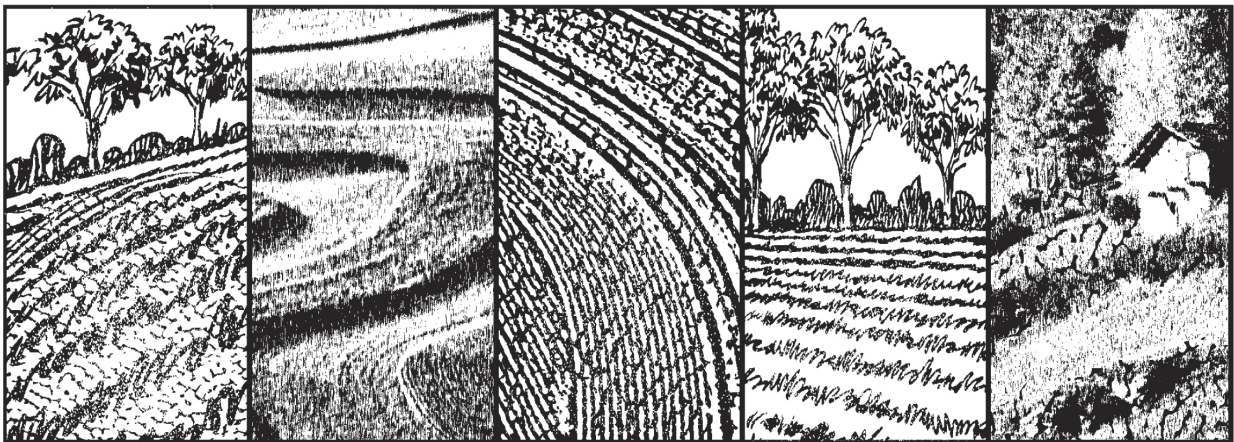


ACTIVITY SHEET 23:1

Soil Conservation Practices

Farmers use several different methods to conserve soil. Match the number of practice below to the correct box on the picture.

1. **Contour planting**—Planting crops around the curve of a hill rather than up and down the hill.
2. **Terraces**—Making wide ridges that go around a hill to prevent water from rushing down the hill too fast.
3. **Grassed Waterways**—Planting grass and not plowing low areas in a field where water usually runs down a hill.
4. **Forest and Grass Areas**—Keeping steep hillsides in trees or grass rather than clearing for cropland.
5. **Windbreak**—Rows of trees planted to slow down the wind and prevent soil loss from blowing wind.





ACTIVITY SHEET 23:2

Preventing Soil Erosion

Activity directions:

1. Gather the necessary supplies:
 - a. Container/bucket of soil
 - b. Plastic trays (or shoe boxes) 5 inches deep
 - c. Plastic sheeting to line trays
 - d. Glass beakers (one for each tray)
 - e. Water sprinkling containers (one for each tray)
 - f. Trowel
 - g. Stopwatch
 - h. Sod
 - i. Water
2. Construct the water erosion trays:
 - a. The trays should be approximately five inches deep.
 - b. At the center of one end of each tray cut a "V" that will funnel water and sediment into a beaker.
 - c. The "V" should be approximately two inches wide and two inches deep.
3. Place soil in the water erosion trays:
 - a. If using shoe boxes, line the boxes with plastic sheeting and leave excess sheeting at the end with the "V" in order to funnel water and sediment through the "V" and to protect the box.
 - b. If using a plastic tray place sheeting at the end with the "V" in order to funnel water and sediment through the "V" and into the beaker.
 - c. Regardless of container, moisten the soil you plan to use so that it packs effectively.
 - d. Fill the container to the bottom of the "V" with packed soil. It is important to pack the soil for the water to remain near the surface of the soil.
4. Vary the surface condition of each soil container. Several variations can be created.
 - a. One could have a bare, packed surface representing no cover or erosion-prevention techniques.
 - b. Place the sod on the top of the soil of another container and press it in firmly to represent a cover crop or use strips of sod to represent strip cropping.
 - c. In another container, create rows of packed soil running across the width of the container and perpendicular to the flow of water. This condition represents terracing or contour farming.
 - d. Scrape and loosen the surface of the soil to represent tilled soil on a slope with no erosion prevention techniques.

NOTES



NOTES

5. Prepare the containers for water and sediment collection:
 - a. Raise one end of each container to the same height.
 - i. Multiple trials at varying angles may be used.
 - b. Place a beaker below the "V" of each tray so it catches the water and sediment runoff.
6. Create runoff in each container:
 - a. Place an equal amount of water in each sprinkle can.
 - b. Pour equal amounts of water into each tilted tray creating runoff.
 - i. The amount of water may vary according to tray size, soil type, etc. Experiment with the amount of water in your trays in order to create adequate runoff that is consistent across trays. Regardless, the volume and rate of application of water should be consistent from tray to tray.
 - c. Collect the runoff and sediment in each tray's beaker.
7. Compare the volume of runoff and sediment collected in each beaker.

Discuss the results and draw conclusions related to effective erosion control.



ACTIVITY SHEET 23:3

Preventing Soil Erosion

Fill out the chart below for each tray. Let the runoff settle and measure the volume of sediment in each beaker.

	Soil type	Amount of time water flows from the sprout	Amount of runoff	Volume of sediment
Tray 1				
Tray 2				
Tray 3				
Tray 4				
Tray 5				
Tray 6				

Q. When's the best time to plant a tree?

A. Twenty years ago.

Q. When's the next best time to plant a tree?

A. Today





ACTIVITY SHEET 23:4

Soil Facts

The United States is losing about 6.4 billion tons of soil each year because of erosion. That would fill 320 million dump trucks, which if parked end-to-end would extend to the moon and three quarters of the way back. Eroding soil is washed into lakes and rivers and blown into the air, where it pollutes our environment. If we all knew a little more about soil, we could each do our part to preserve this precious resource. Here are some facts and conservation tips about soil.

- Soil makes up the outermost layer of our planet.
- Topsoil is the most productive soil layer. It has varying amounts of organic matter (living and dead organisms), minerals and nutrients.
- Five tons of topsoil spread over an acre is as thick as a dime.
- Soil scientists have identified over 70,000 kinds of soil in the United States.
- An average soil sample is 45 percent minerals, 25 percent water, 25 percent air, and 5 percent organic matter.
- Different-sized mineral particles, such as sand, silt and clay, give soil texture.
- Lichens help to break apart rocks from soil.
- Fungi and bacteria help break down organic matter in the soil.
- Plant roots break up rocks, which become part of new soil.
- Roots loosen the soil and allow oxygen to penetrate. This is beneficial to the animals living in the soil.
- Earthworms digest organic matter, recycle nutrients and make surface soil richer.
- One earthworm can digest 36 tons of soil in one year.
- Mice take seeds and other plant materials into their underground burrows. This material eventually decays and becomes part of the soil.
- Mice, moles and shrews dig burrows that help aerate soil.

Source: National Wildlife Federation