Unit I: Other Farm Related Subjects

Lesson 1: Understanding the Importance of Managing Soil and Water

Student Learning Objectives:

Instruction in this lesson should result in students achieving the following objectives:

1. Explain the importance of managing soil.
2. Explain what soil erosion is and methods to prevent it.
3. Explain the importance of managing water.
4. Describe some methods of conserving water.
5. Explain the importance of managing waste.

Recommended Teaching Time: 1 hour

Recommended Resources: The following resources may be useful in teaching this lesson:

Porter, Lynn, et.al. Environmental Science and Technology, Second Edition. Danville, Illinois: Interstate Publishers, Inc., 2003. (Chapter 14)

Conserving Soil. League City, Texas: National Association of Conservation Districts, 1990. (Unit 2)

Loynachan, T., et.al. Sustaining our Soils and Society. Alexandria, Virginia: American Geological Institute, 1999.

Lee, Jasper, S., et al. AgriScience Discovery. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

List of Equipment, Tools, Supplies, and Facilities:

- Writing surface
- PowerPoint Projector
- PowerPoint Slides
- Transparency Masters
- Copies of student worksheets

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide 2):

- Crop residue
- Degradation
- Domestic wastewater
- Erosion
- Freshwater
- Grey water
- Hazardous waste
- Irrigation
- Minimum tillage
- No-till
- Sewage
- Solid waste
- Spent water
- Stewardship
- Streambank management
- Strip cropping
- Terrace
- Tilling
- Topsoil
- Wastewater
- Water conservation

Interest Approach:

Ask the students to describe the responsibilities of a store manager. Ask them what would happen if the manger did not do these tasks. Most likely the business would fail. The same is true with our environmental resources. We are the managers and we have certain responsibilities that we must do.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Explain the importance of managing soil.

Anticipated Problem: Why is managing soil important?

(PowerPoint Slide 3)

I. There are many philosophic and economic reasons for managing soil and minimizing its degradation. ***Degradation*** is lowering the quality of soil. The soil is no longer as productive or useful as it once was. The reasons for soil management can be categorized into several groups. Some of them are:

(PowerPoint Slide 4)

A. Humanitarian reasons—these reasons concern human welfare and social reform, in particular providing an adequate supply of nutritious food for the hungry. Providing enough for domestic use requires high soil productivity.

B. Economic Reasons—economic reasons concern expenses incurred on the farm to produce food and the costs of goods of the consumer.

(PowerPoint Slide 5)

C. Stewardship Reasons—***stewardship*** refers to our responsibility to manage natural resources to assure an adequate supply for future generations. Stewardship involves the practices of wise use, conservation, and preservation.

(PowerPoint Slide 6)

D. Environmental Reasons—soils should also be conserved for environmental reasons. It is a societal benefit to have a clean environment with adequate supplies of pure drinking water, clean air, productive soils, and recreational areas.

(PowerPoint Slide 7)

E. Aesthetic Reasons—this final category concerns maintaining the environment as a beautiful site to experience. Most people would like to avoid unsightly scars and bare, eroded soils on the landscape.

Use TM: 1-1 to review and reinforce this objective.

Objective 2: Explain what soil erosion is and methods to prevent it.
Anticipated Problem: What is soil erosion and what could be done to prevent it?

(PowerPoint Slide 8)

II. ***Erosion*** is the wearing away of soil by water, wind, and other sources. Soil erosion is the greatest threat to soil productivity and one of the largest sources of pollution in our water. ***Topsoil***, the most valuable layer of soil, is usually the first to disappear due to erosion.

(PowerPoint Slide 9)

A. Water erosion often begins with raindrops. To a soil particle, a raindrop is like a bomb falling from the sky. Raindrops can reach speeds of 30 kilometers per hour. When rain falls, millions of drops fall to the ground and splash soil particles as high as 1 meter into the air and splatter them as far as 1.5 meters away. As the water runs off the land, it often carries soil along with it into other water sources. The steeper the slope, the faster the water will run, which in turn digs up and carries away more soil.

(PowerPoint Slide 10)

B. Wind is also responsible for soil erosion. Soil particles that are unsheltered can be picked up and carried away. Any exposed soil surface is vulnerable, especially in dry conditions and dry climates. Wind can carry soil over a greater distance than water in a short amount of time. When it is dry and windy, huge clouds of soil can blow across the land and cause dust storms.

(PowerPoint Slide 11)

C. Erosion can cause many problems.
   1. Erosion carries away the most fertile, productive soil.
   2. It breaks down the soil and reduces the organic matter.
   3. When water carries soil away into other water sources, the soil becomes a pollutant known as sediment. If you've ever seen a muddy lake or river, you've seen the effects of soil erosion.
   4. Fertilizers and pesticides can be carried along with the soil into water sources.

(PowerPoint Slide 12)

   5. As runoff increases, the soil is cut through, leaving rills (channels) that can become gullies.
   6. Crops and vegetation of any kind can be damaged, covered with soil, and uprooted because of erosion. This results in crop loss, reduced productivity, and reduced yields.
   7. Soil erosion can also damage structures by washing away roads and weakening building foundations.
   8. On steep slopes, erosion can cause landslides to occur.

(PowerPoint Slide 13)

D. Soil is a very precious natural resource that takes a considerable amount of time to form. We must do what we can to conserve soil. While soil erosion can never be stopped, it can be controlled.

(PowerPoint Slide 14)

1. One of the best ways to control soil erosion by water and wind is to protect the soil with healthy vegetation. Roadside ditches, waterways, and sloping areas are often planted with grass or other plants to help hold the soil in place. This vegetative area can also help hold back and filter out fertilizers and pesticides that could otherwise become water pollutants. Planting trees also provides a sheltered area for soil.

(PowerPoint Slide 15)

2. Construction sites often cover bare soil with straw until something more permanent is established to protect the soil. Straw bales are sometimes used in rows to form a small wall to slow water runoff. Once the construction is done, grass and other plants are usually put in place to control erosion.

(PowerPoint Slide 16)

3. In the past, farmers plowed their fields after harvest to mix the plant stems and leaves, known as ***crop residue***, with the soil. This is called ***tilling***. Today, many farmers leave the crop residue on the ground to help keep the soil in place. Farmers use a variety of tillage methods based on the conditions of the land. Since they make their living from the land, farmers understand the importance of protecting the soil.

(PowerPoint Slide 17)

   a. ***No-till*** farming involves leaving crop residue on a field at all times. The soil is not turned over or worked when the new crop is planted.
   b. ***Minimum tillage*** involves working the soil but leaving some crop residue in place as the new crop is planted.

(PowerPoint Slide 18)

4. Terracing is a management practice used on sloping land such as hillsides. A ***terrace*** is a ridge that follows the contour of the land to slow runoff. Terraces serve the same purpose as speed bumps in parking lots.
5. ***Strip cropping*** is an erosion control method in which different kinds of crops are planted in strips across a hillside. These strips that are contoured with the slope of the land help slow runoff.

(PowerPoint Slide 19)

6. ***Streambank management*** practices are used to help prevent soil from eroding along the banks of water. Rocks are often put strategically in place along rivers, streams, and lakes to control soil erosion. Planting willow trees can also help control erosion around water because the roots will hold the soil in place.

Use PowerPoint Slides 20, 21, 22, and 23 along with TM: 1-2 and TM: 1-3 to illustrate soil erosion and some soil conservation practices. Use WS: 1-1 and WS 1-2 to demonstrate the concepts of the objective to students. Share the following quote with the students: "We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect." -Aldo Leopold, 1949. Ask students to write their personal reflection of this quote. They should describe what the quote

means to them. Divide the students into small groups and have them share their reflections. Discuss the quote as a class. Hopefully, at some point students will realize that they play a role in caring for the land too.

Objective 3: Explain the importance of managing water.

Anticipated Problem: Why is managing water important?

(PowerPoint Slides 24 and 25)

III. Water has many uses. It plays an important role in many aspects of human life. Several areas in which water exerts an influence are:

A. Life Processes—water is essential for living organisms in carrying out the functions of life. Plants use water in major life processes such as photosynthesis and temperature regulation through transpiration. Animals use water in metabolism and in body fluids. Humans need water to stay alive. The human body is 65 percent water, with blood and plasma being 92 percent water, and muscle tissue being 80 percent water. The body maintains a certain water content; death results in more than 20 percent of the water is lost. If not enough water is supplied naturally, a crop producer may have to irrigate land. ***Irrigation*** is the addition of water by mechanical means.

(PowerPoint Slide 26)

B. Daily Living—water is used in daily living activities. The amount people use varies from one location to another. A family in the city uses 800 liters of water every week on average. The main uses include drinking, washing, and cooking. A family in the village uses 1300 liters of water every week on average. The main use is for farming.

(PowerPoint Slide 27)

C. Climate—water moderates the temperature of the earth. Because water has a high heat capacity, it can regulate and transfer heat. Cities near large bodies of water have climates moderated by the water. Extreme temperature changes are found in locations on land far away from water.

(PowerPoint Slide 28)

D. Manufacturing—the making of steel, refining oil, producing paper, processing food, and many other activities in manufacturing require large amounts of water. More efficient manufacturing processes can reduce the amount of water required. Some paper mills use nearly 150 kiloliters of water to make 900 kilograms of paper.

(PowerPoint Slide 29)

E. Transportation—rivers, oceans, canals, and other bodies of water are used to transport raw products and manufactured materials. Rivers and canals often use barges guided by tug boats. In transportation, water is not used or changed into another form.

(PowerPoint Slide 30)

F. Recreations—swimming pools and water parks often require the use of scarce freshwater from wells or other sources. ***Freshwater*** is water that has little or no salt, with the salt content being less than 3.0 parts per thousand. Where possible, water is reconditioned and used in recreational facilities.

Use TM: 1-4 to assist in the review and further discussion of this topic.

Objective 4: Describe some methods of conserving water.

Anticipated Problem: How can we conserve water?

(PowerPoint Slide 31)

IV. While we use a lot of water for many different things, we need to remember that water is a limited natural resource. No "new" water is made. The water we have is recycled by means of the water cycle. We have access to only a small amount of fresh water. Many areas have enough water to supply their needs. However, water shortages may occur due to factors such as drought, flood, pollution, population growth, industrial needs, and others. When this happens, or better yet before it happens, conservation of water is needed.

(PowerPoint Slide 32)

A. **Water conservation** is using water-saving methods to reduce the amount of water needed and increase the water supply for optimum long-term economic and social benefits. Conservation of water can ensure that supplies of fresh water will be available for everyone, today and tomorrow. Every drop counts. Every individual can make a difference.

(PowerPoint Slide 33)

B. Conserving water makes sense, but it often involves changing habits which have evolved over time. Habits can be very hard to break.
   1. Begin by simply turning off water whenever it is not being used.
   2. Fill the bathtub with less water.
   3. A capped bottle filled with rocks (or something to weigh it down) will take up space in the toilet tank and reduce the amount of water available to flush.
   4. The volume of water needed to water plants or the lawn can be reduced by watering the early morning or late evening and by watering less often and more carefully.

(PowerPoint Slide 34)

   5. Fix leaky faucets.
   6. Keep a bottle of cold drinking water in the refrigerator instead of running water until it becomes cool.
   7. When washing dishes by hand, use a sink full of rinse water rather than letting the water run.
   8. Use a hose with no leaks and an on/off nozzle or use buckets when washing automobiles and buildings.

Use TM: 1-5 to discuss some habits students can change to help conserve water. Use WS: 1-3 to help students identify the ways they use water. Use WS: 1-4 to help students inform others about the importance of water conservation and encourage them to conserve water. This activity can be done individually, in small groups, or as an entire class.

Objective 5: Explain the importance of managing waste.
Anticipated Problem: Why is managing waste important?

(PowerPoint Slide 35)

V. All processes that occur produce some kind of waste. It is important that means for managing the waste in an efficient and sanitary way are developed and conducted. There are several different kinds of wastes that are generated through a variety of activities. It is important to be able to identify them in order to know the proper management technique to follow. Some of the types of waste are:

(PowerPoint Slide 36)

A. Wastewater—***wastewater*** is used water that contains dissolved or suspended matter. It is produced by homes, factories, farms, and other places where water is used. Wastewater can damage the environment. Streams and lakes can be destroyed by wastewater. Factories and farms treat water before it is released to assure that it causes little or no damage. Water released into a stream or lake should not appreciably change the natural conditions in the stream or lake. There are different kinds of wastewater. They are:

(PowerPoint Slide 37)

1. Spent water—***spent water*** is water that has been used and can no longer serve the purpose for which it was used because of contamination.
2. Domestic wastewater—***domestic wastewater*** is the wastewater produced by humans in their daily lives.
3. Grey water—***grey water*** is the water produced by bathing, cooking, and washing dishes and clothes.
4. Sewage—***sewage*** is the wastewater produced by residential and commercial sources.

(PowerPoint Slide 38)

B. Solid waste—***solid waste*** is garbage, refuse, sludge, and other discarded material. Solid wastes are non-liquid materials that do not dissolve in water or other solvents.

C. Hazardous waste—***hazardous waste*** is waste that is potentially dangerous to human health or the environment. The materials may be solid, liquid, or vapor wastes.

Use TM: 1-6 to review and reinforce this objective.

Review/Summary: Focus the review and summary of the lesson around the student learning objectives **(PowerPoint Slide 39)**. Call on students to explain the content associated with each objective.

Application: Application can involve one or more of the following student activities using attached worksheets:

WS: 1-1 Raindrops: How do they affect the soil?
WS: 1-2 Soil erosion from the wind: blown away
WS: 1-3 Water awareness test: How do you measure up?
WS: 1-4 Water conservation: How can you help?

Evaluation: Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activity. A sample written test is included.

Answers to Sample Test:

Matching

1. B
2. C
3. A
4. F
5. D
6. E

Fill-in-the-blank

1. Stewardship
2. Topsoil
3. Tilling
4. No-till
5. Streambank management
6. Irrigation

Short Answer

1. Spent water, domestic wastewater, grey water, sewage
2. See Objective 4.

Sample Test

Understanding the Importance of Managing Soil and Water

Name: _____

Matching: *Match each word with the correct definition.*

a. Crop residue	d. Minimum tillage
b. Degradation	e. Strip cropping
c. Erosion	f. Terrace

_____ 1. Lowering the quality of soil.

_____ 2. The wearing away of soil by water, wind, and other sources.

_____ 3. Plant stems and leaves.

_____ 4. A ridge that follows the contour of the land to slow runoff.

_____ 5. Involves working the soil but leaving some crop residue in place as the new crop is planted.

_____ 6. An erosion control method in which different kinds of crops are planted in strips across a hillside.

Fill-in-the-blank*: Complete the following statements*.

1. _____ refers to our responsibility to manage natural resources to assure an adequate supply for future generations.
2. _____, the most valuable layer of soil, is usually the first to disappear due to erosion.
3. In the past, farmers plowed their fields after harvest to mix the plant stems and leaves with the soil. This is call _____.
4. _____ farming involves leaving crop residue on a field at all times.
5. _____ practices are used to help prevent soil from eroding along the banks of water.
6. _____ is the addition of water by mechanical means.

***Short Answer**: Answer the following questions*.

1. What are four types of wastewater?

2. What are five water conservation methods?

TM: 1-1

REASONS FOR SOIL MANAGEMENT

- Humanitarian reasons
- Economic reasons
- Stewardship reasons
- Environmental reasons
- Aesthetic reasons

TM: 1-2

SOIL EROSION

Rills

Gullies

Landslide

Outwash

Wind Erosion

Wind Erosion

TM: 1-3

SOIL CONSERVATION PRACTICES

Healthy vegetation along a road to control erosion.

A newly installed terrace to slow water runoff.

No-till soybeans growing through corn crop residue.

Covering newly prepared lawn with straw to control erosion.

Strip cropping.

Rocks placed along a streambank to control soil erosion.

TM: 1-4

USES OF WATER

- Life processes
- Daily living
- Climate
- Manufacturing
- Transportation
- Recreation

TM: 1-5

WAYS TO CONSERVE WATER

- Begin by simply turning off water whenever it is not being used.
- Fill the bathtub with less water.
- A capped bottle filled with rocks (or something to weigh it down) will take up space in the toilet tank and reduce the amount of water available to flush.
- The volume of water needed to water plants or the lawn can be reduced by watering the early morning or late evening and by watering less often and more carefully.
- Fix leaky faucets.
- Keep a bottle of cold drinking water in the refrigerator instead of running water until it becomes cool.
- When washing dishes by hand, use a sink full of rinse water rather than letting the water run.
- Use a hose with no leaks and an on/off nozzle or use buckets when washing automobiles and buildings.

TM: 1-6

TYPES OF WASTE

- Wastewater
  - Spent water
  - Domestic wastewater
  - Grey water
  - Sewage
- Solid waste
- Hazardous waste

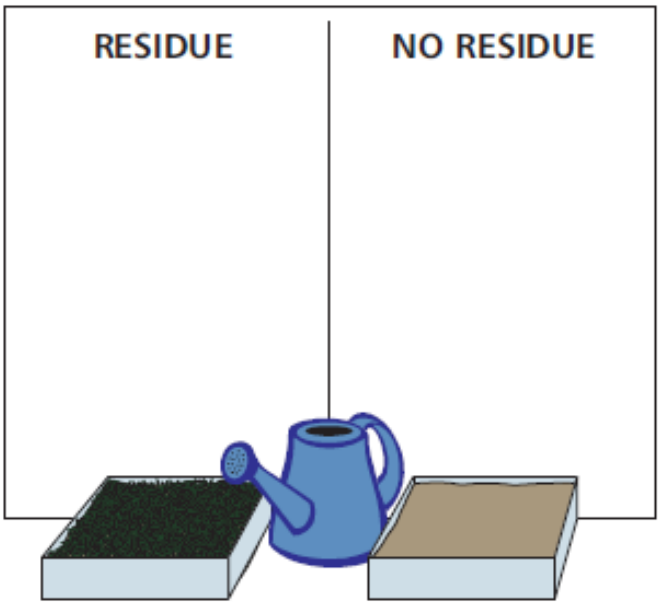
WS: 1-1

RAINDROPS:

HOW DO THEY AFFECT THE SOIL?

Materials:

- ✓ One piece of poster board
- ✓ Two square pans
- ✓ Soil
- ✓ Sprinkling container
- ✓ Water
- ✓ Residue (straw, dry grass clippings, wood chips, or leaves)
- ✓ Permanent marker
- ✓ Newspaper or plastic to cover table



Procedure:

1. Near the top of the long edge of the poster board, label one half “RESIDUE” and the other half “NO RESIDUE.”
2. Cover your table with newspaper or plastic.
3. Stand the poster board up on the table. Use the wall to support the poster board.
4. Fill the two square pans with soil.
5. Place one pan directly in front of each half of the poster board.
6. Cover the pan in front of the “RESIDUE” half of the poster board with a large amount of residue (straw, dry grass clippings, wood chips, or leaves).
7. Sprinkle the same amount of water on each of the pans to simulate rain.
8. Remove the poster board and observe how much soil splashed on each half. Which half of the poster board had more soil splashed on it? What does this tell you about the importance of covering the soil to protect it from erosion?

WS: 1-2

SOIL EROSION FROM THE WIND: BLOWN AWAY

Materials:

- ✓ Paper confetti (very small pieces of paper)
- ✓ Shallow pan
- ✓ Green flat marbles (medium to large size, enough to cover the pan)
- ✓ Blow dryer (set on no heat) or a small fan with two speed settings

Procedure:

1. Place several layers of paper confetti in the shallow pan. The confetti represents the soil.
2. Set the blow dryer/small fan on the low setting. Holding the blow dryer/small fan several inches from the pan, turn it on for about 10 seconds. This represents the wind. What happens to the "soil"? Record your observations in the Data Table.
3. Replace the soil in the pan.
4. Set the blow dryer/small fan to the high setting. Holding the blow dryer/small fan the same distance from the pan, turn it on for about 10 seconds. What happens to the soil with this stronger wind? Record your observations in the Data Table.
5. Replace the soil in the pan and cover it with a protective layer (flat green marbles).
6. Repeat the wind experiments (low and high settings). What happens to the soil now? Record your observations in the Data Table.
7. What does this experiment tell you about the effect of wind on our soil? Why would it be a good idea to use healthy vegetation, straw, crop residue, rocks, or other cover material on the soil?

Data Table		
	Low Wind	High Wind
Bare soil		
Covered soil		

WS: 1-3

WATER AWARENESS TEST: HOW DO YOU MEASURE UP?

Introduction:

Every day we do or don't do things which affect the amount of water we use and the condition we leave it in as it is disposed. Here is an opportunity for you to consider what your impact is to both the problem and the solution. Take a few moments to check the box you feel is most appropriate.

Do You…

	Never	Sometimes	Often
1. Leave the faucet running as you brush your teeth	_____	_____	_____
2. Leave the faucet running while you wash your hands	_____	_____	_____
3. Take long showers	_____	_____	_____
4. Fill the bathtub as full as possible	_____	_____	_____
5. Let the tap water run until it gets cold	_____	_____	_____
6. Wash your bike (or other recreational item) every weekend	_____	_____	_____
7. Leave the hose running while soaping down your bike	_____	_____	_____
8. Sweep lawn and garden trimmings into the curb or down storm drains	_____	_____	_____
9. Let buckets or glasses overflow	_____	_____	_____
10. Place buckets or containers under leaky faucets	_____	_____	_____

	Yes	No
11. Know where your water comes from	_____	_____
12. Know where your water goes	_____	_____
13. Volunteer to help clean up your community	_____	_____
14. Encourage others to fix leaks	_____	_____
15. Let your friends and family members know about ways they can help	_____	_____

WS: 1-4

WATER CONSERVATION: HOW CAN YOU HELP?

Directions:

Review your answers on the Water Awareness Test. Were you aware of all the ways you waste water? Are there any habits that you could change to help reduce the amount of water that you use? Design a pamphlet, poster, or bulletin board display that informs others of the importance of conserving water and the things they may not be aware of. Be sure to include information of the limited amount of water that is available on Earth and the many simple ways that we can all conserve water. Share your design with family members and other students and encourage them to help save precious water!