

## Lesson C6–8

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# Understanding Soil Erosion and Management Practices

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**Unit C.** Plant and Soil Science

**Problem Area 6.** Basic Principles of Soil Science

**Lesson 8.** Understanding Soil Erosion and Management Practices

### **New Mexico Content Standard:**

**Pathway Strand:** Natural Resources and Environmental Systems

**Standard: I:** Recognize importance of resource and human interrelations to conduct management activities in natural habitats.

**Benchmark: I-A.** Identify resource management components to establish relationships in natural resource systems.

**Performance Standard: 3.** Identify impacts by humans on natural resources.

**Student Learning Objectives.** Instruction in this lesson should result in students achieving the following objectives:

1. Explain soil erosion.
2. Identify the causes of soil erosion and steps in the erosion process.
3. Explain the ways in which different types of wind erosion occur and the associated problems.
4. Distinguish between the different types of water erosion.
5. Identify urban management practices that reduce soil erosion.
6. Identify agriculture management practices that will minimize soil erosion.

**List of Resources.** The following resources may be useful in teaching this lesson:

Porter, Lynn, et al. *Environmental Science and Technology*. Danville, Illinois: Interstate Publishers, Inc., 2003. (Textbook and Activity Manual, Chapter 13)

**Other Resources.** The following resources will be useful to students and teachers:

Plaster, Edward J. *Soil Science & Management*. Albany, New York: Delmar Publishers, 1997. (Textbook and Lab Manual, Chapter 18 and 19)

Sager, Robert J., et al. *Modern Earth Science*. Austin, Texas: Holt, Rinehart, and Winston, Inc., 1998. (Textbook, Chapters 13 & 16)

VAS U4060, *Soil Erosion...The Silent Enemy of the Soil*. Urbana, Illinois: Vocational Agriculture Service.

## List of Equipment, Tools, Supplies, and Facilities

Writing surface  
Overhead projector  
Transparencies from attached masters  
Slidefilm projector

**Terms.** The following terms are presented in this lesson (shown in bold italics):

Accelerated erosion  
Conservation tillage  
Cover crops  
Diversion ditches  
Geologic erosion  
Glacier erosion  
Grassed strips  
Gully erosion  
Land slippage  
Mulching  
Natural erosion  
Rill erosion  
Runoff  
Saltation  
Sediment  
Sheet erosion  
Silt fences  
Soil erosion  
Strip cropping  
Surface creep

Suspension  
Terrace  
Water erosion  
Wind breaks  
Wind erosion

**Interest Approach.** Ask students to identify visible signs of erosion. They may have been fishing and noticed muddy water or driving and had difficulty seeing because of a dust storm. They should be able to identify many examples. Ask students where they think the soil is coming from. Ask if there are any problems associated with this movement of soil. Ask what could be done to reduce this soil erosion. When discussion is complete, cover lesson objectives with the students as you begin the lesson. As an alternative, you may show Vo-Ag Service slidefilm F723a, *Soil Erosion . . . The Silent Enemy* as an interest approach.

## Summary of Content and Teaching Strategies

**Objective I:** Explain soil erosion.

**Anticipated Problem:** What is soil erosion?

- I. **Soil erosion** is the process by which soil is moved. When soil is eroded, it may become pollution in the water or air. The land where it came from, loses fertility. Vegetation and other coverings help prevent soil erosion. There are two basic classes of erosion.
  - A. **Natural erosion** occurs naturally and has made beneficial changes in the earth such as rounding off mountains and filling in valleys. The redepositing of soil forms new, highly fertile areas, such as the Mississippi Delta. Natural erosion is sometimes referred to as **geologic erosion**. This means it has occurred on land not disturbed by humans.
  - B. **Accelerated erosion** removes topsoil at an excessive rate and usually results from human activity on the land. Such activity includes construction and plowing. Accelerated erosion causes large losses of soil fertility.

*Have students read the "Erosion" section in Chapter 13 of the Environmental Science and Technology textbook. Using the notes above, explain soil erosion. Help students understand the two basic types of soil erosion. They should understand that some erosion is natural and has been occurring for thousands of years. Students should also understand that a number of human activities are responsible for causing excessive erosion.*

**Objective 2:** Identify the causes of soil erosion and steps in the erosion process.

**Anticipated Problem:** What are the causes of soil erosion and steps in the erosion process?

- II. Erosion is caused by many different weather factors, such as wind, water, and glacial movement. When land is cleared of protective covering, it is much more susceptible to erosion. The erosion process involves three distinct steps. The first step is the loosening of soil particles. The second step is the moving of soil particles. The third, is the deposition of soil particles. There are four basic types of erosion.
- A. **Wind erosion** is the loss of soil due to the movement of wind over the land. It usually occurs in dry climates where the soil is loose. Wind erosion occurs on:
1. newly plowed fields.
  2. construction sites cleared by large equipment.
  3. land where vegetation has been grazed too short.
- B. **Water erosion** is the loss of soil due to water movement. It is the major cause of soil loss in North America. Water erosion occurs when excess rainfall creates runoff that carries soil away. **Runoff** occurs when rain falls faster than it can be absorbed into the soil. Runoff water carries soil particles into streams and rivers. This causes water pollution and sediment. **Sediment** is the deposition of soil in the bottom of streams, riverbeds, ditches, etc.
- C. **Glacier erosion** occurs when the front edge of a glacier may push soil, rocks, fallen trees, and other materials. Soil erosion from glaciers is of minor importance except in areas where glaciers exist.
- D. **Land slippage** occurs on sloping land that is wet. Soil that is saturated with water, slips down the hillside or mountain slope. Land slippage is also known as mud slides or landslides. Banks along highways, streams, and oceanfronts are often subject to slides.

*Use a variety of techniques to help students master this objective. Students should understand the erosion process first. Explain that if any of the three steps in the process is missing, erosion will not occur. This will help students to understand in later objectives what can be done to minimize erosion. Use TM: C6–8A to discuss the different types of soil erosion.*

**Objective 3:** Explain the ways in which different types of wind erosion occur and the associated problems.

**Anticipated Problem:** What are the ways that different types of wind erosion occurs and what problems are caused?

- III. Wind erosion causes air pollution, produces highway safety hazards, and fills drainage ditches. It occurs when persistent or frequent high-velocity winds and a dry, residue-free soil surface exist. Soil is moved by saltation, suspension, and surface creep.

- A. **Saltation** occurs when the wind lifts medium-sized soil particles into the air. They are too heavy to remain in suspension, so they fall to the ground loosening other soil particles. This process repeats itself.
- B. **Suspension** occurs when very small soil particles become airborne and enter the main airstream. They are carried in the same general direction as the wind. Because the soil particles are small, they remain in suspension.
- C. **Surface creep** occurs as saltation takes place. The soil particles that are too heavy to be moved by saltation are moved along the surface by the impact of soil particles being displaced by saltation.

*Help students master this objective by explaining the different kinds of wind erosion. You may use TM: C6–8B to discuss wind erosion. Vo-Ag Service filmstrip F726-4, Wind Erosion Process will help in visualizing the process and effects of wind erosion.*

**Objective 4:** Distinguish between the different types of water erosion.

**Anticipated Problem:** What are the different types of water erosion?

IV. Three kinds of water erosion can occur. They are:

- A. **Sheet erosion** results when thin layers or sheets of soil are worn away. Sheet erosion can occur on nearly level land or on sloping land. If muddy water is moving off a field, sheet erosion is occurring. It may go unnoticed since no channels form. However, it may be just as problematic as erosion that is more apparent.
- B. **Rill erosion** usually occurs on sloping land where small channels are formed by running water. The signs of rill erosion can be masked by normal tillage practices.
- C. **Gully erosion** occurs when rills continue to wash away and become more severe. It is more likely on steeper slopes and cannot be smoothed by normal tillage practices.

*Discuss the three kinds of water erosion. Students should be able to recall seeing at least a couple of these kinds of erosion. Ask students what happens to the soil that is eroded away. Help them understand how this affects the productivity of the land that loses the soil. Vo-Ag Service filmstrip F726-2, Water Erosion Process, will help to enhance understanding of water erosion.*

**Objective 5:** Identify urban management practices that will reduce soil erosion.

**Anticipated Problem:** What are some management practices that can be implemented in urban areas to reduce soil erosion?

- V. In urban areas, the main concern is keeping the soil covered and controlling water runoff. This applies to construction sites, roads, parking lots, and recreational areas. Practices that help conserve soil in urban areas include:
  - A. **Mulching** is placing a layer of straw, burlap, or other material on the top of soil to protect it from wind and water. Mulch helps hold water and reduce the impact of water flow.

- B. **Silt fences** are placed at the bottoms of slopes to hold the soil yet allow the water to flow. This keeps sediment out of streams and lakes and prevents the loss of soil. Silt fences may be made out of bales of hay, plastic strips, or other materials.
- C. **Cover crops**—Vegetation can be planted on excavated soil to hold it in place. Winter grass can be planted in the fall on new lawn areas to prevent erosion until the following spring when a permanent sod can be established.
- D. Building on the contour—Streets, buildings, and other structures can be located on the contour of the land to slow water flow.
- E. Stabilizing banks—Creeks and roadsides often have banks that will quickly erode. Rip-rap, fabrics, straw, vegetation, and concrete are some materials used to stabilize banks.
- F. Planting trees and shrubs—Trees and shrubs can be planted in areas where erosion is possible. The roots hold the soil. The limbs and leaves on the tree slow the impact of rain and fallen leaves cover the ground.
- G. Storm water management—Curbs, ditches, and other structures may be installed to properly manage excess precipitation.

*Use a variety of teaching techniques to help students master this objective. Divide the class into seven groups. Have students refer to pages the “Soil Conservation in Urban Areas Section” in Chapter 13 of the Environmental Science and Technology textbook. Assign each group one of the practices used to conserve soil in urban areas. Each should read their section and determine practical ways that particular practices could be used. After sufficient time, bring students back into one large group. Have each group discuss the management practice that they have been assigned. They should use a writing surface so that the rest of the class can take notes. Help students understand where and how the various management practices could be used and how they would minimize soil erosion in urban areas.*

**Objective 6:** Identify management practices in agriculture that will minimize soil erosion.

**Anticipated Problem:** What management practices in agriculture will help minimize soil erosion?

- VI. Agriculture utilizes the soil for growing crops. This creates loose soil that can be easily eroded. Several management practices can be implemented to reduce soil erosion.
  - A. Plant on the contour—This involves planting around slopes rather than up and down them. This helps slow the flow of water and allows it to be absorbed rather than runoff.
  - B. Rotate crops—Planting different crops on land from one year to the next helps reduce soil erosion. It leaves residue on the surface to help hold the soil in place.
  - C. Terraces—A **terrace** is a ridge or row of earth mounds placed across a slope. Terraces allow a gradual drop for the flow of water. This helps prevent rapid water flow and aids in holding soil in place.
  - D. **Grassed strips**—Small strips covered with grass may be left near plowed areas. This slows the flow of water and helps keep gullies from forming.

- E. **Diversion ditches**—Small ditches may be built across slopes to slow water movement and divert it in to a safe outlet. They are similar to grassed waterways, but may be lined with riprap or other material.
- F. **Strip cropping** is planting alternating strips of crops on sloping land. The strips slow the flow of water and hold the topsoil in place.
- G. Vegetative covers—Fields may be planted in winter cover crops after fall harvest. The cover crop adds fertility and protects the soil from erosion.
- H. **Conservation tillage** involves planting crops with little or no plowing. Crop residue from the previous year is left on the surface to protect the land.
- I. **Wind breaks**—Rows of trees may be planted to slow blowing wind and help prevent wind erosion.

*A variety of teaching techniques may be used to help students master this objective. Use TM: C6–8C to discuss agricultural management practices that will minimize soil erosion. Use specific examples of local practices whenever possible. You may also show Vo-Ag Service slidefilms, 726-3—Controlling Water Erosion with Conservation Planning and 726-5—Controlling Wind Erosion to enhance students understanding of this objective.*

**Review/Summary.** Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Questions at end of chapters in the textbook may also be used in the review/summary.

**Application.** Application can involve the following student activities using recommended lab activities:

Unit 18, Soil Conservation, in *Soil Science & Management Lab Manual*.

Unit 19, Urban Soils, in *Soil Science & Management Lab Manual*.

**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 activities. A sample written test is attached.

## Answers to Sample Test:

### Part One: Matching

1=g, 2=a, 3=f, 4=c, 5=h, 6=e, 7=b, 8=d

### Part Two: Completion

1. terrace
2. conservation tillage

3. accelerated
4. slippage
5. sheet

**Part Three: Short Answer**

1.
  - a. loosening of soil particles
  - b. moving of soil particles
  - c. depositing of soil particles
2. Gully erosion involves much larger channels than rill erosion. The channels from gully erosion cannot be removed with normal tillage operations. Those from rill erosion can be removed with normal tillage operation.
3. Student can list any three of the following:
  - a. mulching
  - b. silt fences
  - c. cover crops
  - d. building in the contour
  - e. stabilizing banks
  - f. planting trees and shrubs
  - g. storm water management
4. Students can list any three of the following:
  - a. planting on the contour
  - b. rotate crops
  - c. terraces
  - d. grassed strips
  - e. diversion ditches
  - f. strip cropping
  - g. vegetative covers
  - h. conservation tillage
  - i. wind breaks

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# Test

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## Lesson C6–8: Understanding Soil Erosion and Management Practices

### Part One: Matching

*Instructions.* Match the term with the correct response. Write the letter of the term by the definition.

- |                     |                   |                |
|---------------------|-------------------|----------------|
| a. geologic erosion | d. rill erosion   | g. saltation   |
| b. runoff           | e. strip cropping | h. cover crops |
| c. suspension       | f. sediment       |                |

- \_\_\_\_\_ 1. Medium-sized soil particles that bounce along the surface of the soil.
- \_\_\_\_\_ 2. Natural erosion that occurs on land never disturbed by humans.
- \_\_\_\_\_ 3. Soil deposited on the bottom of streams and rivers.
- \_\_\_\_\_ 4. Small soil particles are lifted into the air stream where they remain for miles.
- \_\_\_\_\_ 5. Vegetation planted on excavated soil to hold it in place.
- \_\_\_\_\_ 6. Planting two or more crops in an alternating fashion on sloping land.
- \_\_\_\_\_ 7. This occurs when it rains faster than the water can be absorbed by the soil.
- \_\_\_\_\_ 8. Small channels formed in the soil by running water. They can be removed by normal tillage methods.

### Part Two: Completion

*Instructions.* Complete the following statements.

1. A \_\_\_\_\_ is a ridge or row of earth mounds placed across a slope to allow a gradual drop for the flow of water in order to reduce erosion.
2. \_\_\_\_\_ involves planting crops with little or no plowing and leaving crop residue on the surface to protect the soil.
3. \_\_\_\_\_ erosion removes topsoil at an excessive rate and usually results from human activity on the land.
4. Land \_\_\_\_\_ occurs on slopes that are saturated with water. Sometimes referred to as mudslides.
5. \_\_\_\_\_ erosion results when thin layers of soil are removed from the surface and often goes unnoticed.



# **TYPES OF SOIL EROSION**

- 1. Wind erosion**
- 2. Water erosion**
- 3. Glacier erosion**
- 4. Land slippage**

# TYPES OF WIND EROSION

- 1. Saltation — soil particles bounce along the soil surface**
- 2. Suspension — soil particles remain suspended in air for long distances**
- 3. Surface creep — due to impact saltation, heavy soil particles move along the surface**

# **AGRICULTURAL MANAGEMENT PRACTICES USED TO MINIMIZE SOIL EROSION**

- 1. Plant on the contour**
- 2. Rotate crops**
- 3. Terraces**
- 4. Grassed strips**
- 5. Diversion ditches**
- 6. Strip cropping**
- 7. Vegetative covers**
- 8. Conservation tillage**
- 9. Wind breaks**