

Unit E: Basic Principles of Soil Science

Lesson 7: Understanding Soil Erosion and Management Practices

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.

Recommended Teaching Time: 3 hours

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

- A PowerPoint has also been developed for use with this lesson plan

List of Equipment, Tools, Supplies, and Facilities:

Writing surface
PowerPoint Projector
PowerPoint Slides

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide 2 and 3):

- 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: Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

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

Summary of Content and Teaching Strategies

Objective 1: Explain soil erosion.

(PowerPoint Slide 4)

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.

(PowerPoint Slide 5)

There are two basic classes of erosion.

(PowerPoint Slide 6)

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.

(PowerPoint Slide 7)

Natural erosion is sometimes referred to as **geologic erosion**. This means it has occurred on land not disturbed by humans.

(PowerPoint Slide 8)

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.

****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.

(PowerPoint Slide 9)

II. Erosion is caused by many different weather factors, such as wind, water, and glacial movement.

(PowerPoint Slide 10)

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.

(PowerPoint Slide 11)

There are four basic types of erosion.

(PowerPoint Slide 12)

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.

(PowerPoint Slide 13)

B. **Water erosion** is the loss of soil due to water movement. Water erosion occurs when excess rainfall creates runoff that carries soil away.

(PowerPoint Slide 14)

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.

(PowerPoint Slide 15)

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.

(PowerPoint Slide 16)

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 rivers are often subject to slides.

****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 PowerPoint Slide 17 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.

(PowerPoint Slide 18)

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.

(PowerPoint Slide 19)

- 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.

(PowerPoint Slide 20)

- 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.

(PowerPoint Slide 21)

- 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 PowerPoint Slide 22 to discuss wind erosion.**

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

(PowerPoint Slide 23)

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

(PowerPoint Slide 24)

- 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.

(PowerPoint Slide 25)

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.

(PowerPoint Slide 26)

- 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.

(PowerPoint Slide 27)

- 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 might 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.**

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

(PowerPoint Slide 28)

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:

(PowerPoint Slides 29 and 30)

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.

(PowerPoint Slides 31 and 32)

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.

(PowerPoint Slides 33 and 34)

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.

(PowerPoint Slides 35 and 36)

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. Riprap, fabrics, straw, vegetation, and concrete are some materials used to stabilize banks.

(PowerPoint Slides 37 and 38)

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.

(PowerPoint Slides 39 and 40)

G. Storm water management—Curbs, ditches, and other structures may be installed to properly manage excess precipitation.

****Ask students where they have seen these practices put in use.**

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

(PowerPoint Slide 41)

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.

(PowerPoint Slides 42 and 43)

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.

(PowerPoint Slide 44)

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.

(PowerPoint Slides 45 and 46)

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.

(PowerPoint Slides 47 and 48)

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.

(PowerPoint Slides 49 and 50)

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.

(PowerPoint Slides 51 and 52)

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.

(PowerPoint Slide 53)

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.

(PowerPoint Slides 54 and 55)

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.

(PowerPoint Slides 56 and 57)

I. **Wind breaks**—Rows of trees may be planted to slow blowing wind and help prevent wind erosion.

****Use PowerPoint Slide 58 to discuss agricultural management practices that will minimize soil erosion. Use specific examples of local practices whenever possible.**

****If there are cameras available, have the students bring 2 pictures of soil erosion that they see in the environment. They will then identify the cause and what can be done to help protect the remaining soil. They will need to attach these pictures to the written report. The assignment needs to be a minimum of 1 page. If there aren't cameras available, have the students explain what they have seen in the paper they write.**

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 on PowerPoint Slide 59 can also be used.

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

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

Test

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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.

Part Three: Short Answer

Instructions. Use the space provided to answer the following questions.

1. The erosion process involves three distinct steps. They are:

a.

b.

c.

2. Explain how gully erosion is different from rill erosion.

3. Identify three different management practices that can be used in urban areas to help minimize soil erosion.

a.

b.

c.

4. Identify three different management practices that can be used in agriculture to help minimize soil erosion.

a.

b.

c.