

Unit E: Basic Principles of Soil Science

Lesson 6: Understanding Soil Degradation

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

1. Describe soil degradation.
2. Explain how construction can result in soil degradation.
3. Identify sources of contamination and explain how they result in soil degradation.
4. Explain soil erosion and how it results in soil degradation.
5. Identify other sources of soil degradation.

Recommended Teaching Time: 2 hours

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

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

List of Equipment, Tools, Supplies, and Facilities:

Writing surface
PowerPoint Projector
PowerPoint Slides
Transparency Masters

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

- Accelerated erosion
- Alkalization
- Compaction
- Construction
- Contamination
- Desertification
- Natural erosion
- Salinization
- Soil degradation
- Soil 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 what is meant by soil degradation. They may not be familiar with degradation. It may need some explanation or time to find its meaning. Once determined, allow students to offer suggestions for the meaning of soil degradation. Guide their discussion to include all types of soil degradation, including nonagricultural sources. Help students see the ramifications of soil

degradation from a human population standpoint. When discussion is complete, use the lesson objectives to lead into the specific lesson.

Summary of Content and Teaching Strategies

Objective 1: Describe soil degradation.

(PowerPoint Slide 3)

I. **Soil degradation** is a lowering of the quality of soil or the loss of soil productivity. Soil degradation occurs because people do not understand soil and the consequences of certain of its uses.

(PowerPoint Slide 4)

Minimizing soil degradation is important in maintaining a good environment.

Soil degradation results from:

- A. Construction
- B. Contamination
- C. Erosion

****Use the definition above to discuss soil degradation. Ask students to identify activities that occur locally and may result in soil degradation. The discussion should include the three types listed above. Discuss the importance of minimizing soil degradation to the future of humans.**

Objective 2: Explain how construction can result in soil degradation.

(PowerPoint Slide 5)

II. Construction can result in soil degradation.

A. **Construction** is altering land by building:

- 1. Roads
- 2. Houses
- 3. Offices
- 4. Factories
- 5. Other structures

(PowerPoint Slide 6)

B. Construction degrades the soil by replacing productive land with structures that prevent the production of plants or animals.

(PowerPoint Slide 7)

C. Construction degrades the soil when native grasses and trees are removed. This leaves the soil unprotected from erosion.

(PowerPoint Slide 8)

- D. Large equipment may move topsoil around and cover it with subsoil.
- E. Soil can be compacted when wet by heavy equipment.
- F. Digging deep into the earth brings up subsoil and parent material. When it is spread on the surface, fertility is lowered.

****Use TM: E6-1 to discuss ways that construction contributes to soil degradation.**

Objective 3: Identify sources of contamination and explain how they result in soil degradation.

(PowerPoint Slide 9)

III. **Contamination** results when chemicals, oil, and other substances leak into the land.

(PowerPoint Slide 10)

- A. Some contaminants soak into the soil and destroy its ability to support plant growth.
- B. Other materials may pass through the soil and enter the ground water. This can contaminate water supplies.

(PowerPoint Slide 11)

- C. Land formerly used as dumps, mines, and factory sites may be rehabilitated. This involves removing contaminated soil and covering what remains with non-contaminated soil. This process is expensive.

(PowerPoint Slide 12)

- D. Soil may be contaminated by agricultural practices, such as:
 - 1. Use of too much fertilizer.
 - 2. Use of excess chemicals.
 - 3. Use of irrigation water containing salt.

****Ask students what is meant by contamination. Ask them to identify ways they believe soil may become contaminated. Emphasize that contaminated soil can sometimes be rehabilitated, but that it is very expensive. Also, discuss that soil contamination may occur from both agricultural and non-agricultural sources. Discuss how contamination can reduce the productivity of the soil.**

Objective 4: Explain soil erosion and how it results in soil degradation.

(PowerPoint Slide 13)

IV. **Soil erosion** is the process by which soil is moved. When it is moved it may become pollution in water or air. Soil erosion results from:

(PowerPoint Slide 14)

- A. Natural causes. **Natural erosion** shapes the earth's landscape by rounding off mountains and filling in valleys which may form new, highly fertile areas.

(PowerPoint Slide 15)

- B. Human actions. Human activity, such as construction and plowing may cause **accelerated erosion**, which removes topsoil at an excessive rate. In many places, soil is being lost faster than it is being formed. This will result in loss of soil fertility and productivity.

****Define erosion for students using the above definition. Students should understand the difference between natural erosion and that caused by human activity. Students should realize that there is nothing that can be done about natural erosion. Also, some natural erosion can actually be beneficial. Explain how accelerated erosion reduces soil productivity.**

Objective 5: Identify other sources of soil degradation.

(PowerPoint Slide 16)

V. In addition to construction, contamination, and erosion, soil may suffer degradations from the following sources:

(PowerPoint Slide 17)

- A. Improper irrigation practices that result in salinization, alkalization and water logging. **Salinization** is an accumulation of soluble salts. **Alkalization** is an accumulation of exchangeable sodium. Both of these, as well as waterlogging, are harmful to plant growth.

(PowerPoint Slide 18)

- B. Growing crops without replacing plant nutrients and soil organic matter. These soils are “mined” of nutrients. As fertility drops, soil organic matter is lost and soil structure deteriorates.

(PowerPoint Slide 19)

- C. Pollution of soils with chemicals, industrial waste, human waste and improperly handled livestock waste. A large accumulation of heavy metals, salts or an acute accumulation of chemicals can render soil unproductive.

(PowerPoint Slide 20)

- D. Overgrazing, deforestation and other practices that remove productive plant cover cause a condition called **desertification**. This problem is most common in low rainfall areas. Humus content and fertility drops. Surface soil is exposed and becomes subject to erosion.

(PowerPoint Slide 21)

- E. **Compaction** is the packing of soil particles tightly together after years of tillage with heavy machinery. It can break down soil structure. Plant growth is reduced, organic matter drops, permeability is lost, and runoff increases.

**** Students should identify sources of soil degradation that occur locally. Divide students into groups and have each group take one source of soil degradation. Have them develop solutions that might minimize the amount of soil degradation. When finished, students should share their findings with the remainder of the class.**

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 22 can also be used.

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=d, 2=a, 3=c, 4=e, 5=b, 6=f

Part Two: Completion

1. accelerated erosion
2. environment
3. lowers
4. alkalization
5. contamination

Part Three: Short Answer

1. Remove contaminated soil and cover the remaining soil with non-contaminated soil.
2. Soil fertility declines, organic matter is lost, and soil structure deteriorates.
3. a. Construction—altering land by building roads, houses, etc.; removal of native grasses and trees; compacting soil.
b. Contamination—results when chemicals, oil, etc. leaks onto the land; kills plants, contaminates ground water.
c. Erosion—movement of soil by water and air.

Test

Unit E Lesson 6: Understanding Soil Degradation

Part One: Matching

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

- | | | |
|--------------------|---------------------|--------------------|
| a. compaction | c. soil degradation | e. contamination |
| b. natural erosion | d. salinization | f. desertification |

- _____ 1. An accumulation of soluble salts.
- _____ 2. Results after years of tillage with heavy machinery and often breaks down soil structure.
- _____ 3. The lowering of soil quality and productivity.
- _____ 4. The term used to describe the seeping of chemicals, oil, and other substances into land.
- _____ 5. Has caused the rounding off of mountains and filling in valleys without human activities interfering.
- _____ 6. A condition resulting from the removal of productive plant cover.

Part Two: Completion

Instructions. Complete the following statements.

- 1. Human activities, such as construction and plowing, may cause _____, which removes topsoil at an excessive rate.
- 2. Minimizing soil degradation is important in maintaining a good _____.
- 3. Digging deep into the earth brings up subsoil and parent material, which, when spread on the surface, _____ the soil's fertility.
- 4. _____ is an accumulation of exchangeable sodium in the soil, which is harmful to plant growth.
- 5. The use of too much fertilizer or excess chemicals are examples of _____, a type of soil degradation.

Part Three: Short Answer

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

1. How can land that was formerly used as dumps, mines, or factory sites be rehabilitated?

2. What is the effect on soil of growing crops without replacing plant nutrients and organic matter that has been removed?

3. Name and give examples of three human activities that have degraded our soils.

a.

b.

c.

WAYS CONSTRUCTION CONTRIBUTES TO SOIL DEGRADATION

- 1. Native grasses and trees are removed leaving soil unprotected from erosion.**
- 2. Topsoil is covered with subsoil.**
- 3. Soil is compacted and mashed into deep ruts when it is wet.**
- 4. Digging deep into the earth brings up parent material and subsoil that is spread on the surface, lowering the fertility.**