



Soil Degradation

Lesson Plan NRES B2-9



Objectives

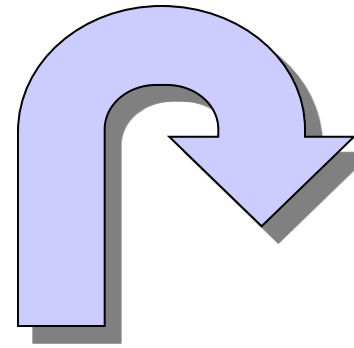
1. What is soil degradation?
2. How can construction result in soil degradation?
3. What are the sources of contamination, and how do they result in soil degradation?
4. What is soil erosion, and how does it result in soil degradation?
5. What are other sources of soil degradation?
6. What are some management strategies that limit soil degradation?

Terms

- alkalization
- compaction
- construction
- contamination
- deforestation
- desertification
- salinization
- soil degradation
- soil erosion



Soil Degradation



- ***Soil degradation*** is a lowering of the quality of soil or a loss of soil productivity.
 - Occurs because people do not understand soil or the consequences of their actions
 - Minimizing soil degradation is important in maintaining a good environment
 - Results from construction, contamination, and erosion

Construction & Soil Degradation

- ***Construction*** is the altering of land by building roads, houses, offices, factories, and other structures.
 - Causes soil degradation in several ways.



Construction & Soil Degradation

- Replaces productive land with structures that prevent the production of plants or animals
- Removal of native grasses and trees
- Large equipment may move topsoil around and cover it with subsoil.
- Soil can be compacted when wet by heavy equipment.
- Digging deep into the earth brings up subsoil and parent material. When these are spread on the surface, fertility is lowered.



Sources of Contamination & Soil Degradation

- ***Contamination*** is the seeping of chemicals, oil, and other substances into the land.



FIGURE 1. Pesticide containers must be properly disposed of to avoid soil contamination.

Sources of Contamination & Soil Degradation

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





Sources of Contamination & Soil Degradation

- Land formerly used as dumps, mines, and factory sites may be rehabilitated.
 - Removing contaminated soil
 - Covering with noncontaminated soil
 - Expensive

Sources of Contamination & Soil Degradation

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



Soil Erosion

- ***Soil erosion*** is the process by which soil is moved.
 - The primary factor in soil degradation.
 - When soil is moved, it may become pollution in water or air
 - Results from natural causes, human activities

Soil Erosion



- Some erosion is natural.
 - The shape of the earth's landscape leads to erosion.
 - Mountains are rounded off, and material fills valleys and may form new, highly fertile areas.
 - Example: Mississippi Delta

Soil Erosion



FIGURE 2. Rivers carrying sediment downstream is an example of natural erosion.



Soil Erosion

- Human activities are the major cause of erosion. Some agricultural practices that increase the risk of erosion are:
 - Overgrazing by animals
 - Planting of monoculture crops
 - Row cropping
 - Tilling and plowing
 - Crop removal from the fields
 - Land-use conversion

Other Sources of Degradation

- Improper irrigation practices that result in salinization, alkalization, and waterlogging.
 - ***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.



Other Sources of Degradation

- The growing of crops without replacing plant nutrients and soil organic matter.
 - The soil involved is “mined” of nutrients.
 - As fertility drops, soil organic matter is lost and soil structure deteriorates.



Other Sources of Degradation

- Use of chemical fertilizers over time.
 - This is one cause of a decrease in soil organic matter and a decrease in soil biological activity.



Other Sources of Degradation

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



Other Sources of Degradation

- ***Deforestation***, or the removal of trees from forested lands. The removal of protective plant cover due to deforestation, overgrazing, and other practices leads to a condition called ***desertification***.
 - Most common in low-rainfall areas
 - Humus content and fertility drop
 - Surface soil is exposed to the elements and becomes subject to erosion



Other Sources of Degradation

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

Other Sources of Degradation

- The paving of land for roads and parking lots.
 - This creates impermeable surfaces that increase streaming and ground loss.



Management Strategies to Limit Soil Degradation

- Soil quality management involves six parts.
 - Different types of soil and land use call for different practices to enhance soil quality.



Management Strategies to Limit Soil Degradation

- The levels of organic matter in the soil should be enhanced.
 - Adding new organic matter every year is regarded as one of the most important ways to improve and maintain soil quality.



Management Strategies to Limit Soil Degradation

- Excessive tillage should be avoided.
 - Tillage leads to the loss of organic matter.
 - Minimizing tillage reduces organic-matter losses and protects the soil surface with plant residue.



Management Strategies to Limit Soil Degradation

- Tillage has value in agricultural production.
 - Used to loosen surface soil, prepare seedbeds, and control weeds and pests.
 - Also can damage soil structure, speed the decomposition and loss of organic matter, increase the threat of erosion, destroy the habitat of helpful organisms, and cause compaction.



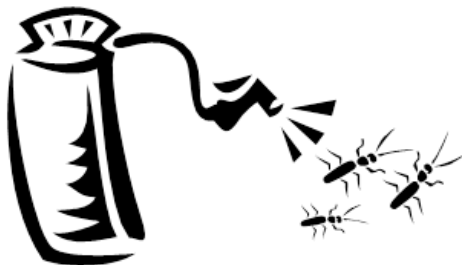
Management Strategies to Limit Soil Degradation

- Efficient management of pests and nutrients is important. Pesticides and chemical fertilizers have valuable benefits. However:
 - They can harm non-target organisms
 - They can pollute water and air if they are mismanaged



Management Strategies to Limit Soil Degradation

- Pest and nutrient management begins with testing and monitoring soil and pests.
 - Chemicals should be applied only when necessary, at the right time, and in the right amounts
 - Also, nonchemical approaches to pest and nutrient management, such as crop rotations, cover crops, and manure management, should be used.





Management Strategies to Limit Soil Degradation

- Soil compaction should be prevented.
 - It reduces the air, water, and space available to roots and soil organisms.
 - The causes are repeated traffic, heavy traffic, or travel on wet soil.
 - Compaction of deep soil by heavy equipment is difficult if not impossible to remedy, so prevention is essential.

Management Strategies to Limit Soil Degradation

- Groundcover provides a number of benefits.
 - Bare soil is prone to wind and water erosion and to drying and crusting.
 - Groundcover protects soil from erosive forces, provides habitats for larger soil organisms, such as insects and earthworms, and can improve water availability.



Management Strategies to Limit Soil Degradation

- Ground can be covered by leaving crop residue on the surface after harvest or by planting cover crops.
 - Cover crops provide organic matter, continuous cover, and food for soil organisms.



FIGURE 3. Leaving crop residue intact helps to slow down soil erosion.
(Courtesy, Natural Resources Conservation Service, USDA)



Management Strategies to Limit Soil Degradation

- Groundcover must be managed to prevent problems.
 - Can delay soil warming in spring, harbor diseases
 - Results in excessive buildup of phosphorus at the surface



Management Strategies to Limit Soil Degradation

- Diversity of cropping systems is beneficial.
 - A variety of cultural practices can reduce weed and disease pressures.
 - Different types of plants contribute different types of residue to the soil.
 - An assortment of soil organisms can help control pest populations.

Management Strategies to Limit Soil Degradation

- Diversity can be increased by using buffer strips, small fields, or contour strip cropping.





Management Strategies to Limit Soil Degradation

- Diversity over time can be increased by using long crop rotations.
 - A variety in the type of vegetation increases the diversity of insects, microorganisms, and wildlife.



Review

1. What are some causes of soil degradation?
2. Name three sources of soil contamination.
3. Give an example of natural soil erosion.
4. Explain how chemical fertilizers result in soil degradation.
5. Name a management strategy that would help to prevent soil degradation.