



Soil Erosion

Lesson Plan: NRES B2-10



Anticipated Problems

1. What is soil erosion, and what are the two classes of erosion?
2. What are the causes of soil erosion, and what are the steps in the erosion process?
3. What are the ways in which different types of wind erosion occur, and what are the associated problems?
4. What are the different types of water erosion?



Terms

- accelerated erosion
- contour
- deposition
- detachment
- glacial erosion
- gully erosion
- land slippage
- natural (geologic)
- erosion
- rill erosion
- runoff
- saltation
- sediment
- sheet erosion

Terms

- soil erosion
- splash erosion
- surface creep
- suspension
- transport
- water erosion
- wind erosion





Soil Erosion

- ***Soil erosion*** is the process by which soil is moved.
 - When soil erodes, it may become air/water pollution
 - Land that is eroded loses fertility.
 - Vegetation, other coverings help prevent soil erosion.
 - Two basic classes: geologic and accelerated



Geologic Erosion

- ***Natural (geologic) erosion*** occurs in nature without human influence. This type of erosion has changed the landscape of the earth.
 - It has rounded off mountains and filled in valleys.
 - Deposits of eroded soil have formed new, highly fertile areas, such as the Mississippi Delta.

Accelerated Erosion

- ***Accelerated erosion*** removes topsoil at an excessive rate and usually results from human activity on the land.
 - Construction and plowing
 - Large losses of soil from farm lands
 - Loss of fertility





Causes of Erosion

- 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.
 - Four Basic types: wind, water, glacial, land slippage

Wind Erosion

- ***Wind erosion*** is the loss of soil due to the movement of wind over the land.
 - Usually occurs in dry climates (soil is loose)
 - Occurs on newly plowed fields, construction sites cleared by large equipment, and land where vegetation has been grazed too short.





Water Erosion

- ***Water erosion*** is the loss of soil due to water movement.
 - Major cause of soil loss in North America
 - Water erosion occurs when excess rainfall creates runoff that carries soil away.

Water Erosion



FIGURE 1. A rainfall will cause some soil to be washed away, especially if there is little or no vegetation to hold the soil in place.

Water Erosion



- ***Runoff*** occurs when rain falls faster than it can be absorbed into the soil.
 - Carries soil particles as it makes its way into streams and rivers.
 - Causes water pollution and sediment
- ***Sediment*** is the deposition of soil in the bottom of streams, riverbeds, ditches, etc.

● ● ● Glacial Erosion

- **Glacial erosion** occurs when the front edge of a glacier pushes soil, rocks, fallen trees, and other materials.
 - Soil erosion from glaciers is of minor importance except in areas where glaciers exist.
 - Prevalent during the Ice Age
 - Glacial erosion has greatly diminished as the planet has warmed.



Land Slippage

- ***Land slippage*** occurs on sloping land that is wet. Soil becomes saturated with water and slips down a hillside or mountain slope.
 - Also known as a mudslide or landslide
 - Banks along highways, streams, and ocean fronts are often subject to slides.





Process of Soil Erosion

- The process of soil erosion follows a simple, systematic progression each and every time. Three distinct steps:
 1. Loosening of soil particles: ***detachment***
 2. Moving of soil particles: ***transport***
 3. Placement of soil particles: ***deposition***



Detachment

- ***Detachment*** is the step in which the impact of raindrops shatters surface aggregates and loosens soil particles.
 - Some of the particles float into soil voids, sealing the soil surface so water cannot readily infiltrate the soil.
 - The scouring action of running water also detaches some soil particles.

● ● ● | Transport

- ***Transport*** is the step during which the detached soil grains move in flowing water and are carried down slopes.





Deposition

- ***Deposition*** is the step during which the soil is deposited as the water slows down.



Factors in Soil Erosion

- Four factors determine how susceptible a soil is to soil erosion.
 1. Structure and texture
 2. Slope
 3. Surface roughness
 4. Soil cover



Structure and Texture

- Soil structure influences infiltration of water.
 - Good soil structure allows water to enter the soil, thus reducing water runoff.
 - Soil texture has two effects on soil erosion.
 - Rate at which water can enter the soil
 - Ease of detachment of soil particles



Slope

- Two components determine slope: Length and grade
 - On a long slope, a greater surface area is collecting water, increasing flow volume.
 - Water runoff velocity will increase as slope grade increases.



Surface Roughness

- A rough soil surface slows the downhill flow of water.
 - Depends a great deal on the tillage practice used on the land.
 - Conventional tillage: the seedbed is left smooth with very few ridges.
 - Chisel plowing leaves the seedbed rough. Tillage across slopes, or on the ***contour***, also acts to slow water flow.

● ● ● Soil Cover

- Bare soil is fully exposed to the erosive forces of raindrop impact and the scouring of running water.
 - Reduces the energy available to cause erosion to the soil.
 - A mulch, a cover, or crop residue absorbs the energy of the falling raindrop. (reduces soil detachment)

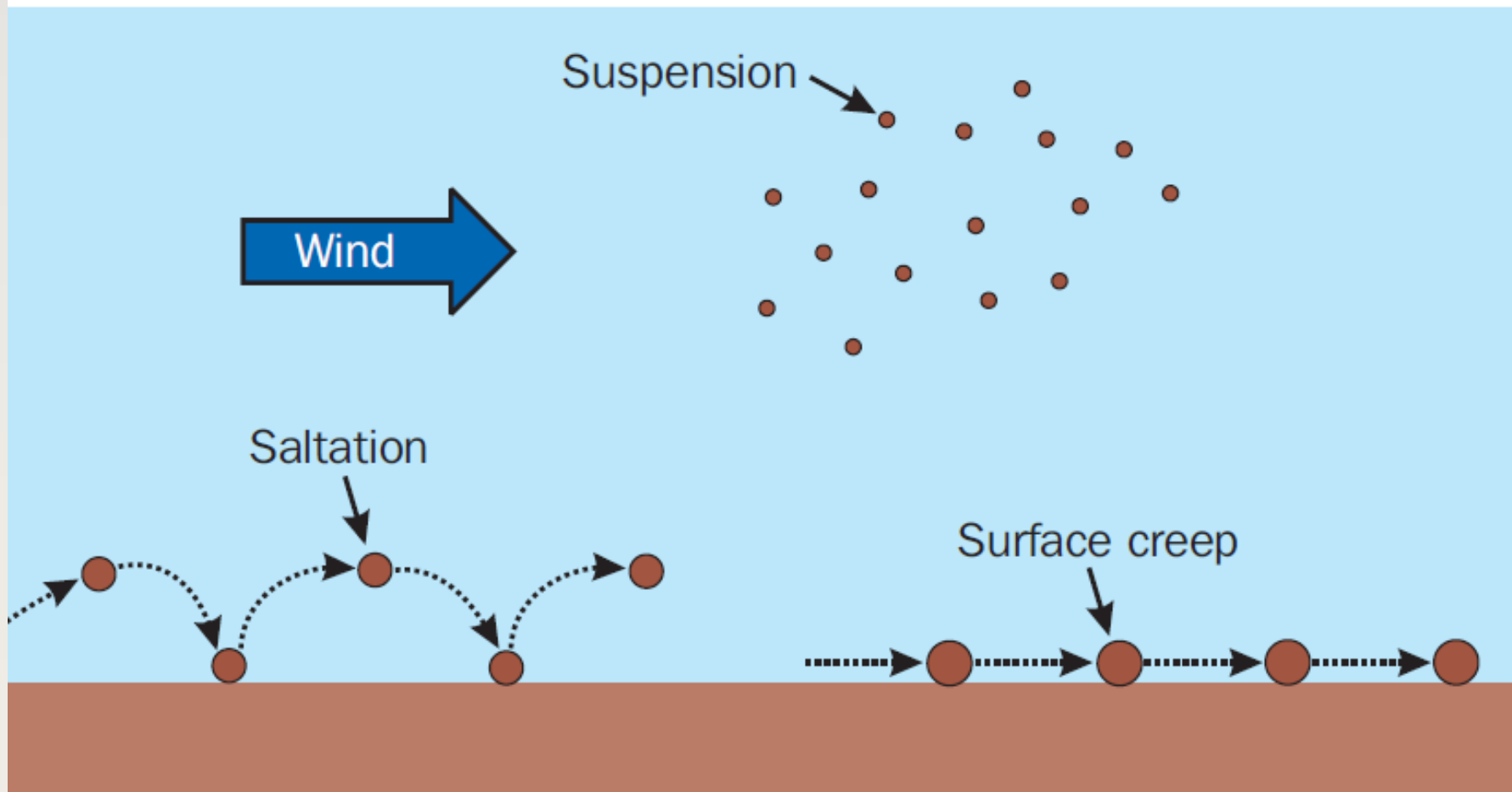




Wind Erosion

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

SUSPENSION, SALTATION, AND SURFACE CREEP



● ● ● Suspension

- ***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.



● ● ● Saltation

- ***Saltation*** occurs when the wind lifts medium-sized soil particles into the air.
 - Too heavy to remain in suspension, so they fall to the ground, loosening other soil particles.
 - This process repeats itself.





Surface Creep

- *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.



Water Erosion

- Four kinds of water erosion can occur.
 - Splash erosion
 - Sheet erosion
 - Rill erosion
 - Gully erosion



Splash Erosion

- ***Splash erosion*** is the direct movement of soil by splashing.
 - A soil grain can be thrown as far as 5 feet by a raindrop splash.
 - Splashed particles fill the voids between other aggregates and seal the soil surface.

Splash Erosion



(Courtesy, Natural Resources Conservation Service, USDA)



Sheet Erosion

- ***Sheet erosion*** results when thin layers, or sheets, of soil are worn away.
 - Can occur on nearly level land or on sloping land.
 - When muddy water is moving off a field
 - May go unnoticed since no channels form
 - May be just as problematic as erosion that is more apparent.

Sheet Erosion



(Courtesy, Natural Resources Conservation Service, USDA)



Rill Erosion

- ***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.

Rill Erosion



(Courtesy, Natural Resources Conservation Service, USDA)



Gully Erosion

- ***Gully erosion*** occurs when rills continue to wash away and become more severe.
 - More likely on steeper slopes and cannot be smoothed by normal tillage practices
 - So large the equipment cannot cross them
 - Usually begin to form near the bottoms of slopes or on steep slopes

Gully Erosion



(Courtesy, Natural Resources Conservation Service, USDA)



Review

- Compare and contrast the two classes of soil erosion.
- Name the three steps of soil erosion.
- Describe the three types of wind erosion.
- Describe the four types of water erosion.