Erosion by Wind

- Types of soil movement
- Damage
- Erosiveness of surface wind
- Initiation of soil movement by wind
- Deposition
- Factor affecting soil erodibility by wind

Modes of Particle Transport during Wind Erosion

- Surface creep:
  - Transports large particles (0.5-2mm)
  - Particles role or are pushed along the surface
- Saltation:
  - Transports medium sized particles (0.1-0.5mm)
- Suspension:
  - Transports fine particles (<0.1mm) from pulverized soils
- These are interactive and occur simultaneously during erosion by wind

Surface Creep

- Represents 5-25 % of wind erosion
- Aggregates and/or particles move along the ground
- Aggregates can be slowly down sized as they creep along the ground
  - Can then begin saltating.

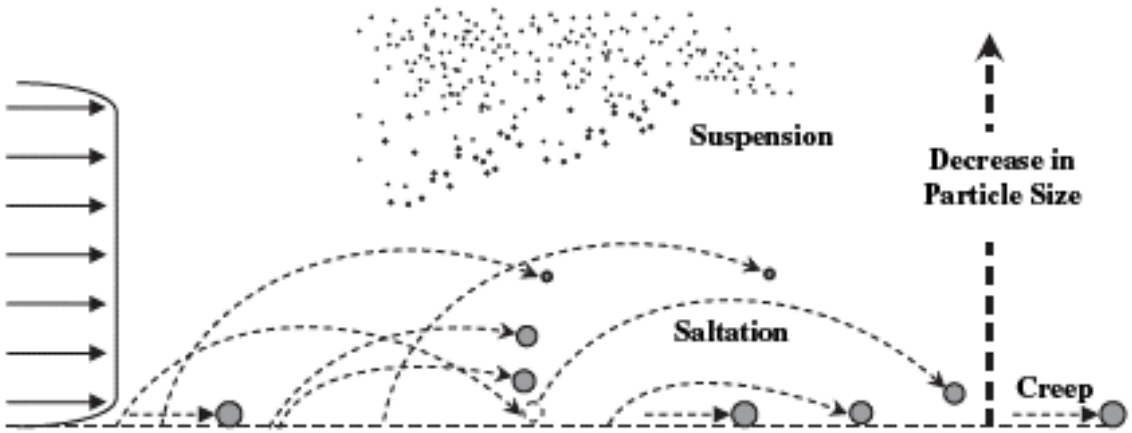


Fig. 3.4 Modes of soil particle transport by wind during erosion

Saltation

- This form of transport represents 50-70% of the total erosion by wind
- The jumping particles gain a lot of energy and can detach other particles
- Saltating particles are key to erosion
  - provide the detachment energy required to move larger and smaller particles into the air.

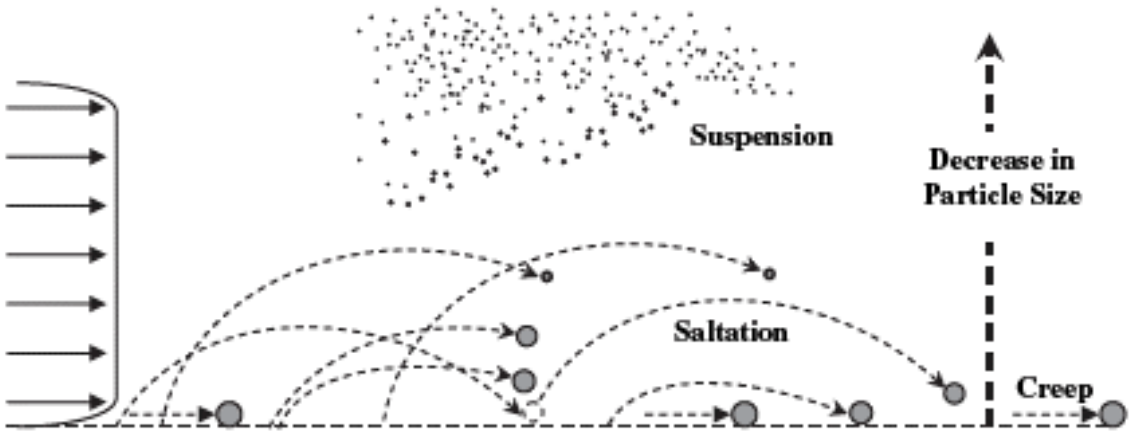


Fig. 3.4 Modes of soil particle transport by wind during erosion

Suspension

- Suspended particle can be carried long distances and can cause air quality problems
- However:
  - They only represents 3-40 % of wind erosion (This range will be used on an exam, the Book is **wrong**)

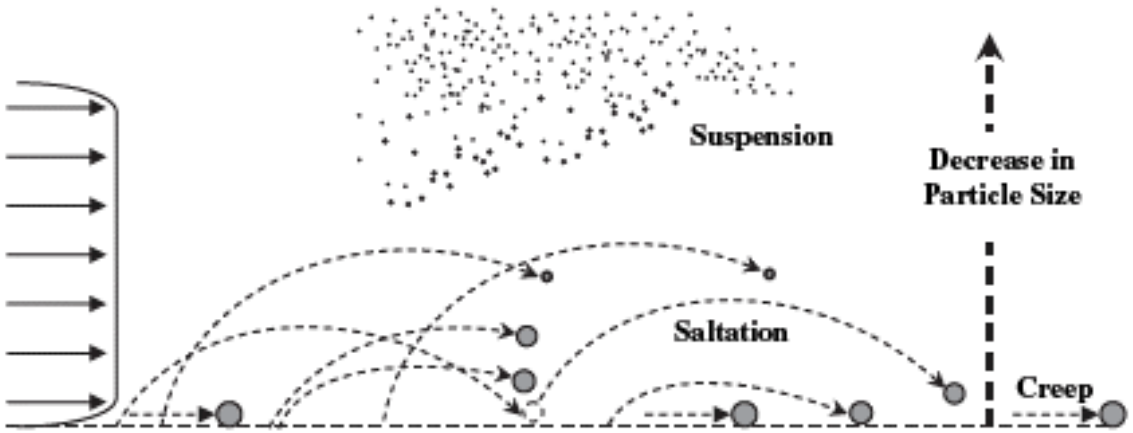


Fig. 3.4 Modes of soil particle transport by wind during erosion

Damage

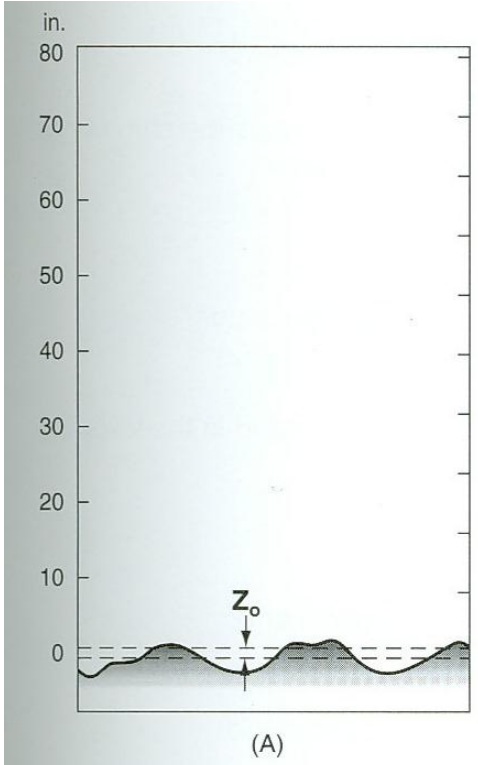
- Top soil loss:
  - Annual losses as high as 300 tons/acre (2 inches of soil) for highly erodible sandy soils
- Textural change:
  - Fine particles are carried great distances, saltating grains are move to fence rows
- Nutrient loss:
  - Clays and organic matter are carried great distances

Damage

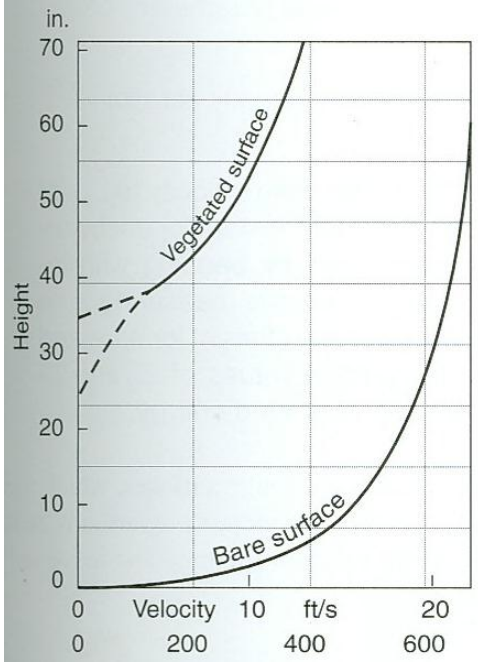
- Abrasion damage to crops
  - Will destroy emerging plants
- Deposition
  - Crops can be buried
  - Fences and ditches
- Air pollution
  - Dust clouds

Erosiveness of Surface Wind

- The higher the velocity the higher the energy and more erosive it will be.
- Velocities decrease with decreasing height above the surface
- Wind velocity must be 8 m/s (18 miles/hour) at 2m above the surface to initiate erosion
- Wind velocity over a bare soil is zero at a height (Zo) above the average height of the soil surface but below the tops of surface irregularities

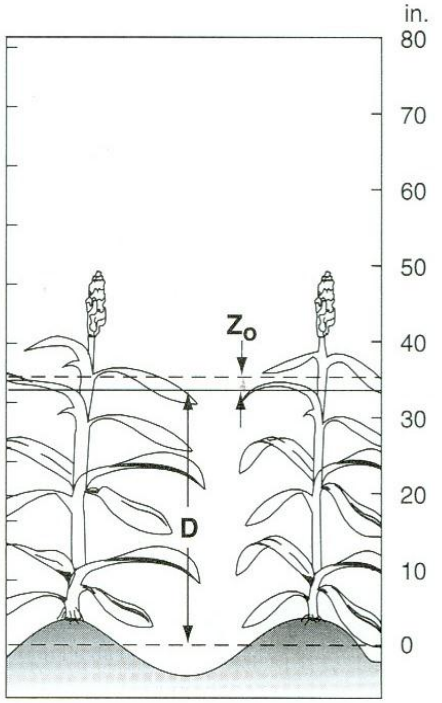


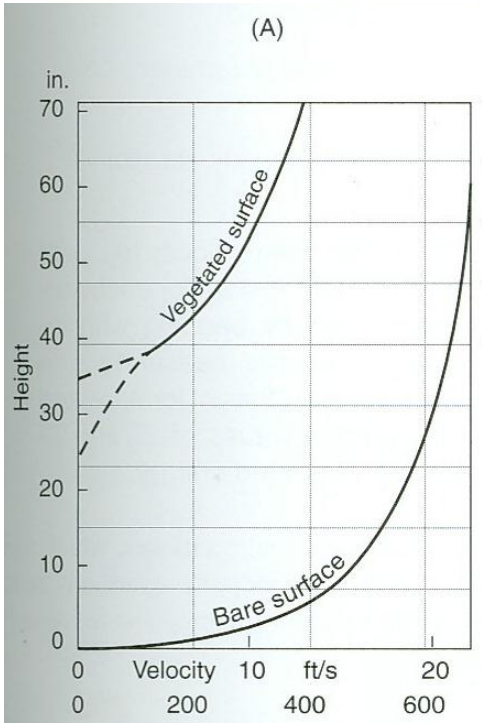
(A)



Erosiveness of Surface Wind

- Vegetation causes the height of Zo to be increased
- D is the zero plane displacement.
  - Within this zone air still moves slowly and erratically, but is not erosive
- The height of Zo is fixed by surface roughness and does not change as a function of wind speed.





Initiation of Erosion

- Medium sized particles start to creep and/or saltate
- Saltation begins with a particle leaping into the air.
- Low pressure above particle and high pressure below causes particle to leap into air

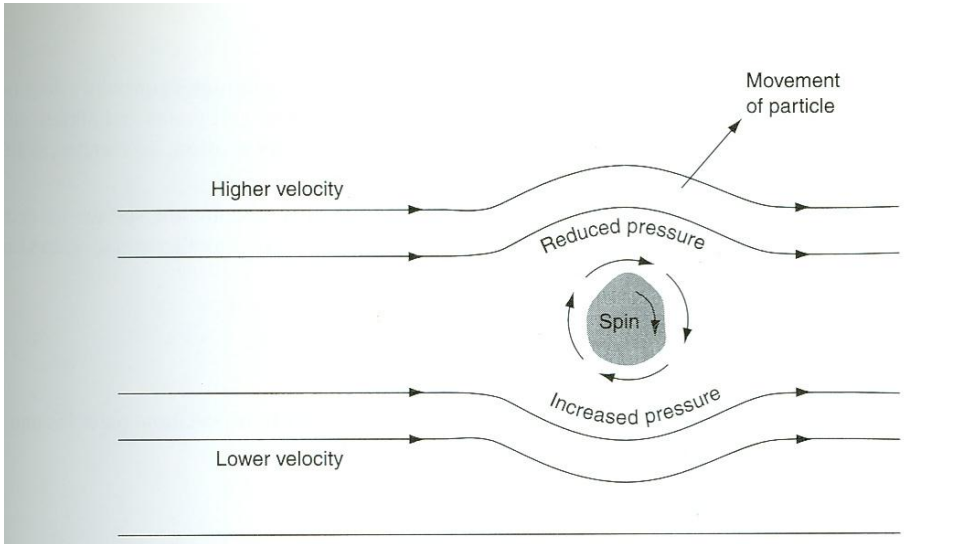


Figure 5–7 A spinning sand grain in a moving airstream is lifted by increased air pressure below and reduced pressure above.

Avalanching

- The increasing rate of erosion as wind blows farther across a field is called Avalanching.
- Results from:
  - Eroded material is more erodible
  - Increased number of saltating particles bombarding surface
  - Surface is smoothed and wind flows faster on surface