Wind Erosion

Process and mechanics

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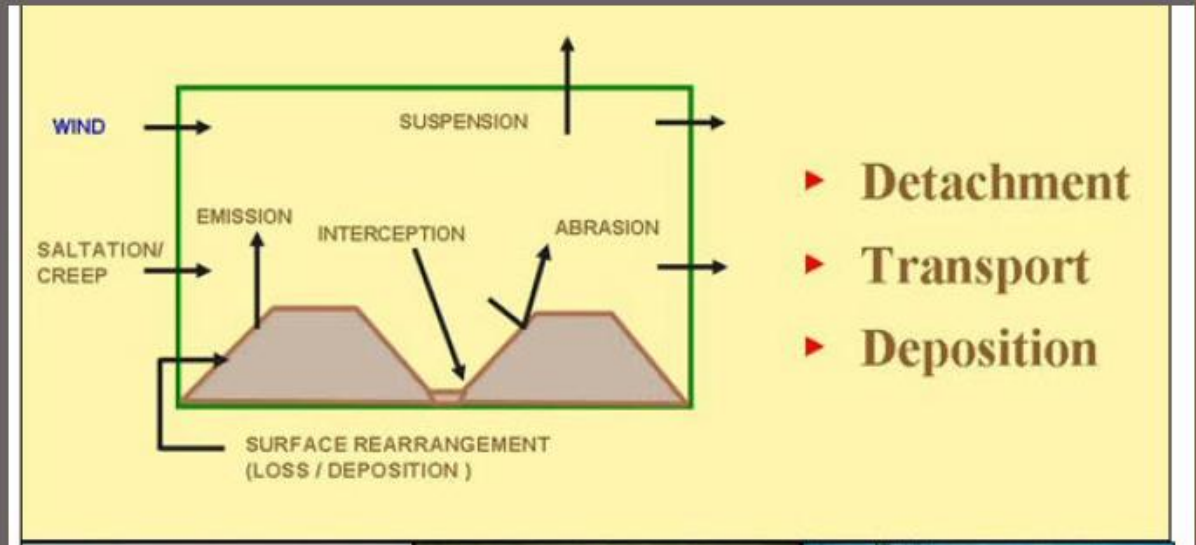

https://infosys.ars.usda.gov/WindErosion/index.html

Short video

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NRCS WEPS Pages

About Wind Erosion Research

Soil Erosion

Movement of soil particles and soil aggregates from or to the surface of a soil profile.

Wind Erosion: Particles: < 2mm

This includes particle sizes: Sand
Silt
Clay

Soil survey provides the best, consistent, available, classification and mapping of soil profile information in the world. Many soil properties that affect erosion estimates are "dynamic".

Eroding material available at soil surface once detached by wind energy move as

1. creep,
2. saltation and
3. suspension

Terms: Avalanche Effect, soil surface armoring, sheltered region

Wind Erosion: occurs on landscapes when:

"**SOURCE**" of erodible soil material is present at the soil surface
AND
"**TRANSPORT**" of erodible soil material occurs by Erosive Wind Energy

Soil Erosion by wind moves as:

Soil Creep Saltation Suspension

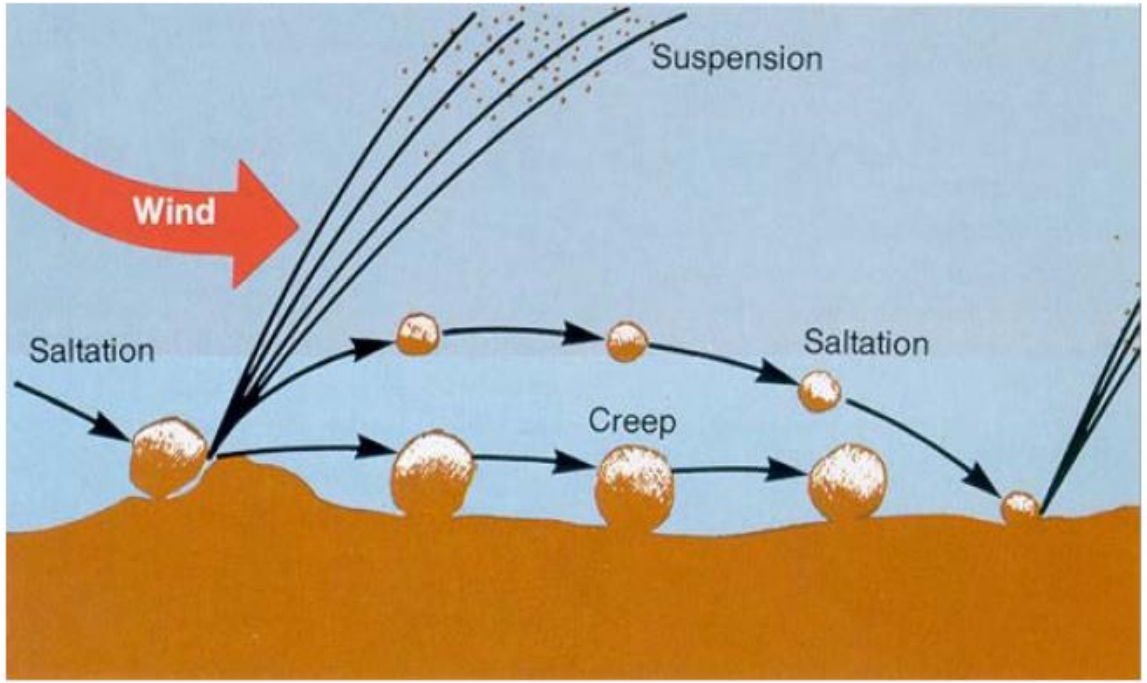
Soil particles move within and from a delineated area of interest AOI

Wind Erosion: "Source"

Eroding material once detached move as

1. creep
2. saltation and
3. suspension

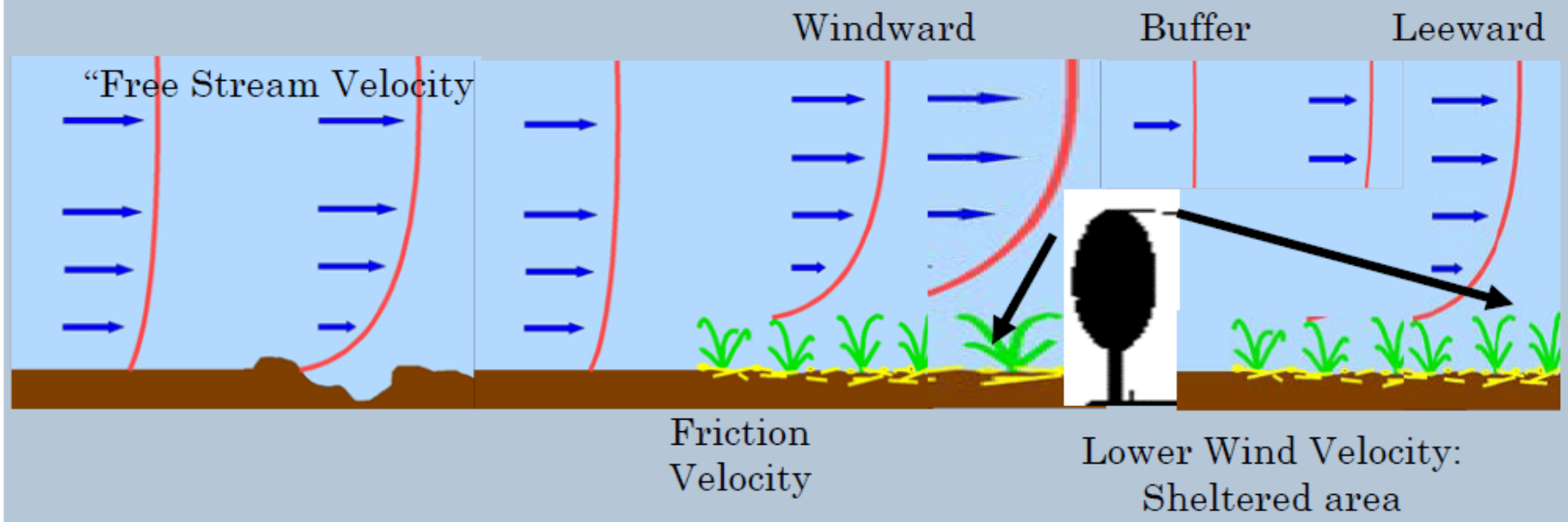
particles: 0.5 – 2 mm coarse sand, aggregates
0.10 - 0.5 mm fine to mod sand
< 0.10 mm , silt clay vfs



Saltating particles are primary disturbance leading to suspension

Wind Erosion: “Transport”

Soil surface condition, vegetation and residue removes energy from the wind and slows it. Average forward velocity near soil surface (**Friction Velocity**) is lower than the “**Free Stream velocity** high above the soil surface. Velocity gradient is the **"wind velocity profile”. Threshold velocity** is Free Stream velocity required for friction velocity needed to initiate soil movement (approx. 13 mph depending on source material)



Erosivity: (wind energy)
Physics: energy needed to move particles of different size and density

Threshold velocity,
general 8 m/s (18 mph) freestream
approx. 13 mph friction velocity at soil surface (bare surface)
Air density affects energy for a given wind speed.

Freestream velocity: 30 m height (more work needed on turbulence)

Friction velocity: 0-3 ft above soil surface, surface conditions, more work on topography

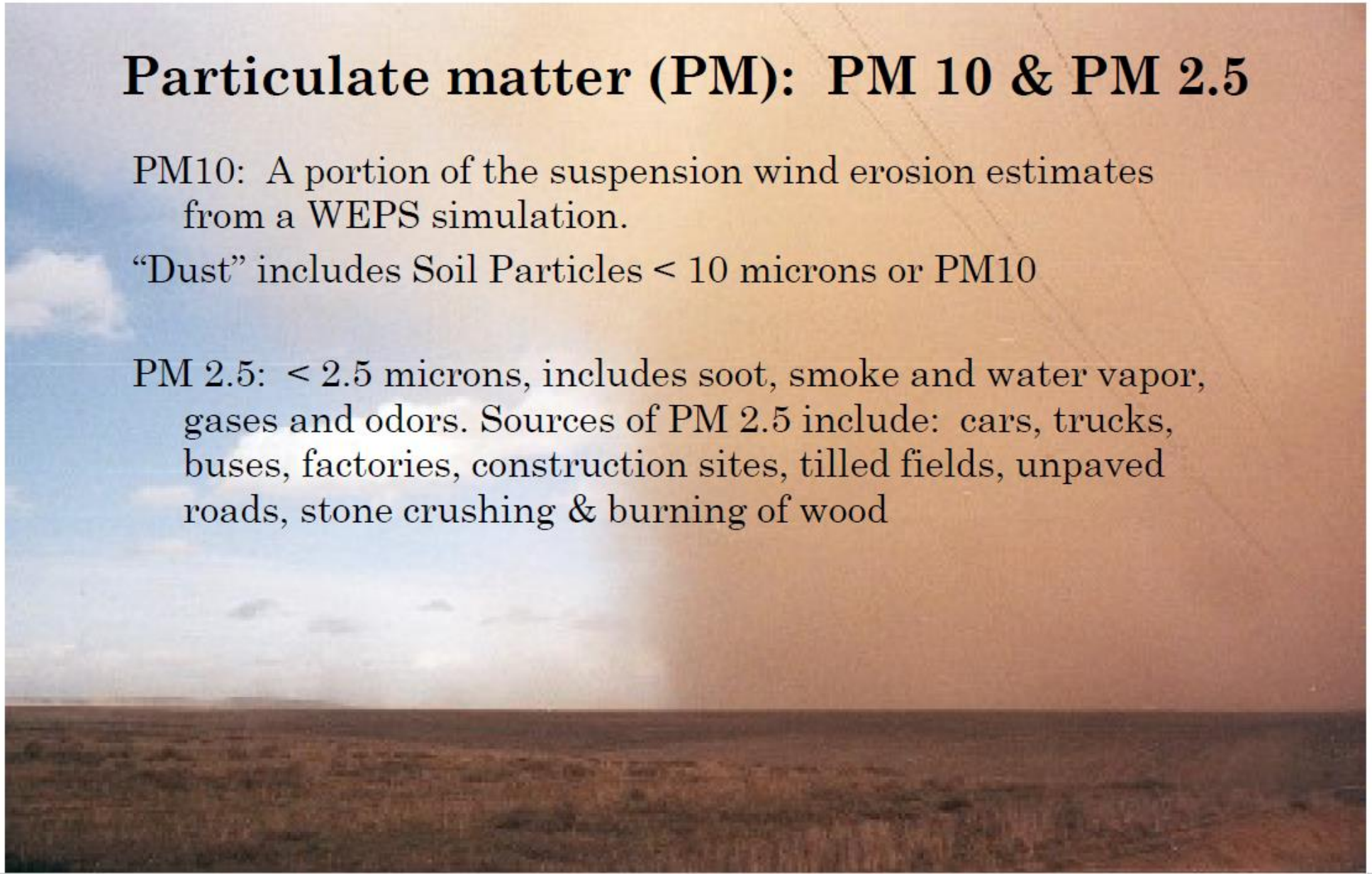
Climate patterns: Pattern is consistent, intensity varies annually within a range for location

Energy has limited ability to carry SC, unlimited SSP

Avalanche effect: Saltation – disturbance

Armored surface or crust: limited source until disturbed

Air Quality Issues



Particulate matter (PM): PM 10 & PM 2.5

PM10: A portion of the suspension wind erosion estimates from a WEPS simulation.

"Dust" includes Soil Particles < 10 microns or PM10

PM 2.5: < 2.5 microns, includes soot, smoke and water vapor, gases and odors. Sources of PM 2.5 include: cars, trucks, buses, factories, construction sites, tilled fields, unpaved roads, stone crushing & burning of wood

Complexity of the factors and variables that affect wind erosion assessment can be modelled affectivly with advances in computer automation. Understanding of the basic science and mechanics of wind erosion has been very constant.

Soil organic matter levels in the surface horizon impacts soil aggregate stability, water infiltration of water and air and water holding, cation exchange soil bulk density (root growth). Loss of what little SOM available due to erosion is a long term problem and SOM is the first to go with wind erosion with clay and silt particles as dust.

Often assessed on an annual or regional basis. Average annual estimates, Using the best data available to represent climate and surface condition variables, current wind erosion science allows analysis on daily and even hourly time steps. This is important development since the processes that affect erosion at a site are constantly changing.

These variables and resulting erosion risk or estimated rates vary with time: time and site specific: Assessing and managing wind erosion should be done at the delineated land parcel unit level. Area wide or regional silver bullet programs are important but need to be applied according to land parcel and management site specific needs and management objectives.

Your best source for reference and history regarding the mechanics of wind erosion before and after WEPS was developed and used by NRCS for planning.

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