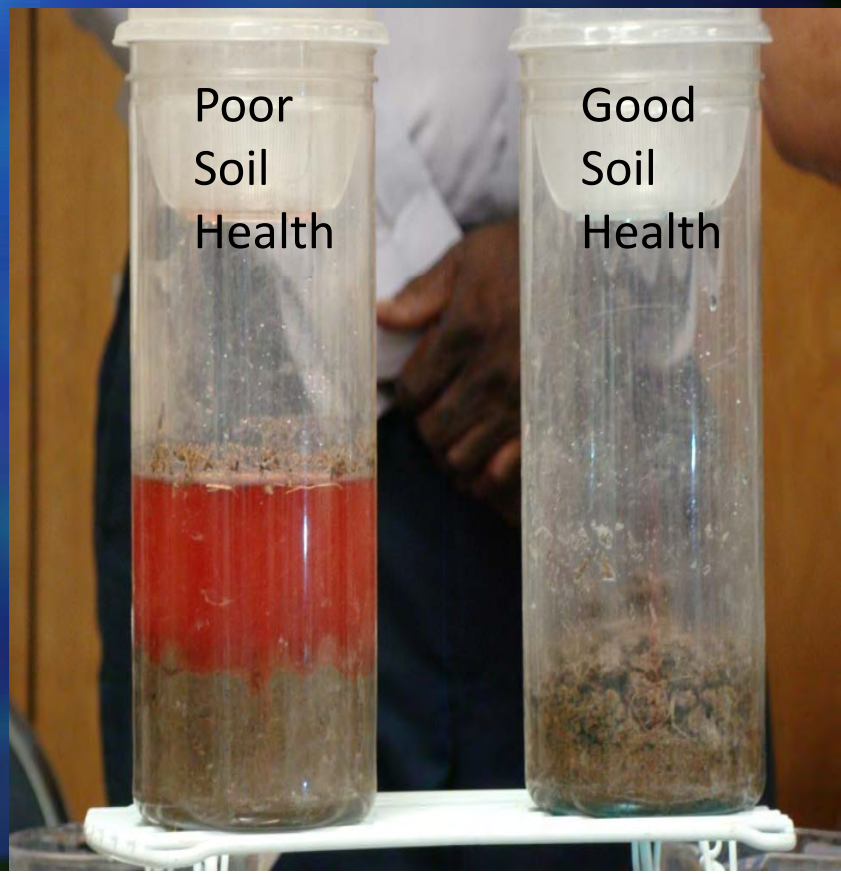
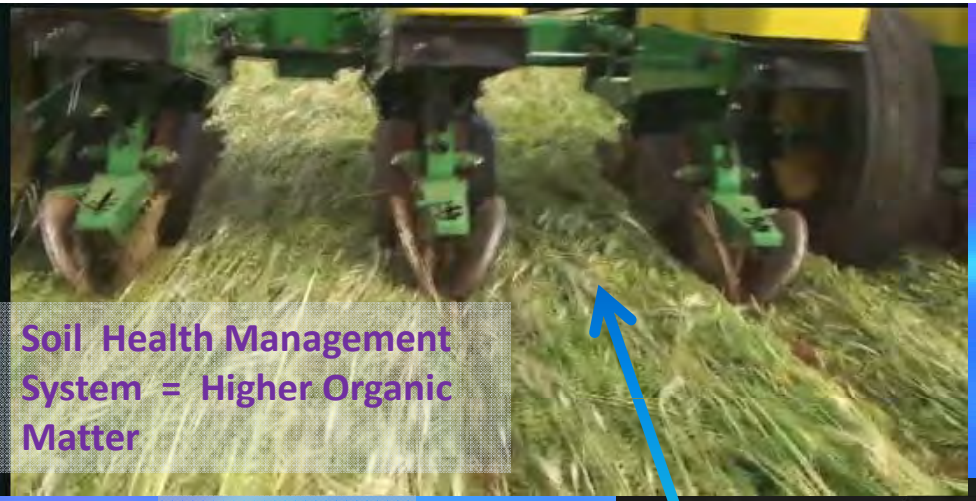
Soil Aggregate Stability

stable aggregates are a sign of good soil health.

By Clarence Chavez

Where Are your Soils?

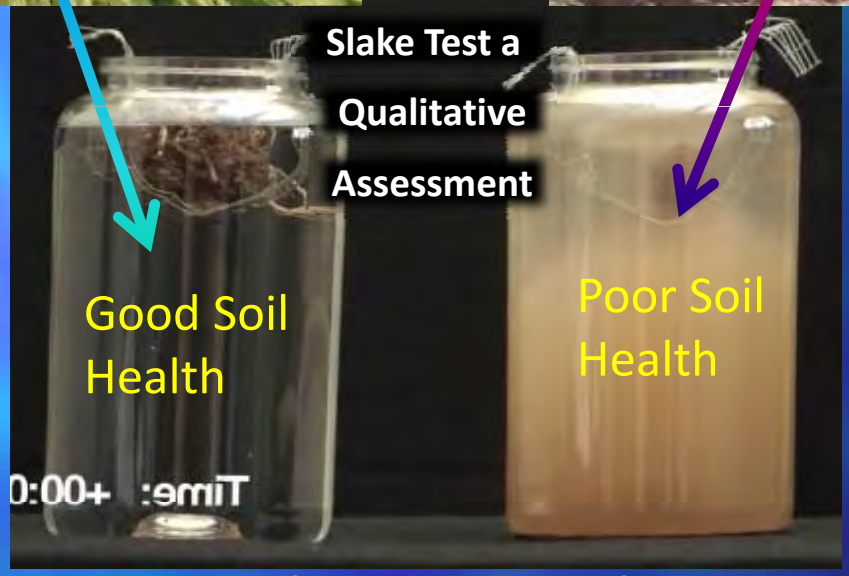




Soil Health

Soil Biota

Soil Health Management System
Cover Crops Crop Rotations
Conservation Tillage Nutrient Mgt.
Irrigation water Management
Integrated Pest Management
Laser Leveling Proper Irrigation System



Where is your Soil ?

Conventional Farming:
No-Cover Crops Low Soil Organic Matter
Soil Compaction Intensive Tillage
Mono Culture Crop Low Crop Residues
Reduced Soil Food Web Winter Fallow
Biological - Physical – Chemical out of Sync.

Soil Aggregate Stability: A measure of the proportion of the aggregates in the soil which do not easily slake, crumble or disintegrate.

USDA NRCS

NRCS is an equal opportunity provider and employer.

Agronomy Tech Note 76 (http://www.nm.nrcs.usda.gov/technical/handbooks/iwm/nmiwm.html)

Clarence Chavez 2012

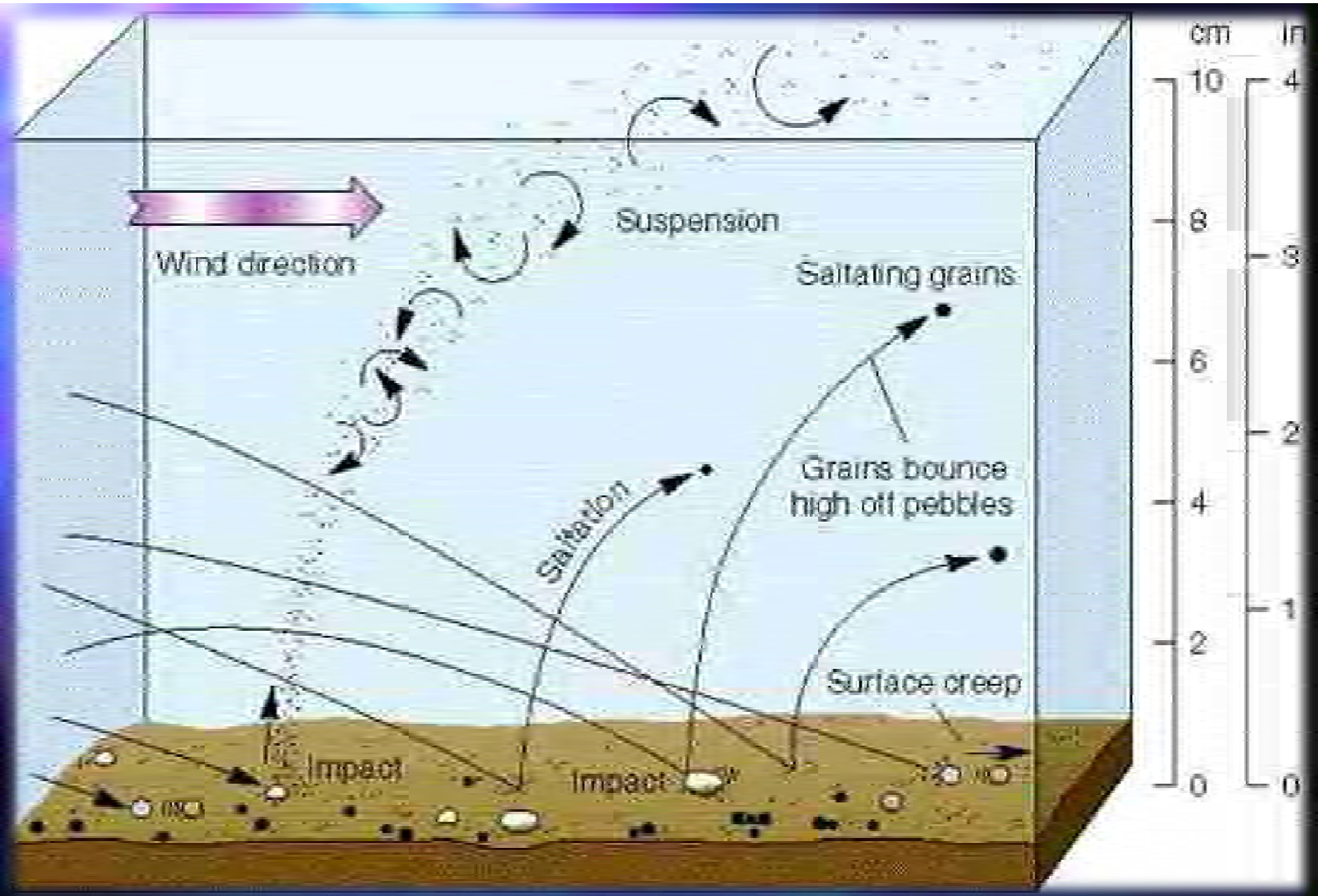
Why is aggregate stability important?

The recovery or degradation of soils affects.

- Infiltration
- Root growth
- Resistance to water and wind erosion.
- Indicator of organic matter content
- Biological activity
- Nutrient cycling in soil
- Crop production and yields
- Soil erosion (wind & water)

How does the wind blow

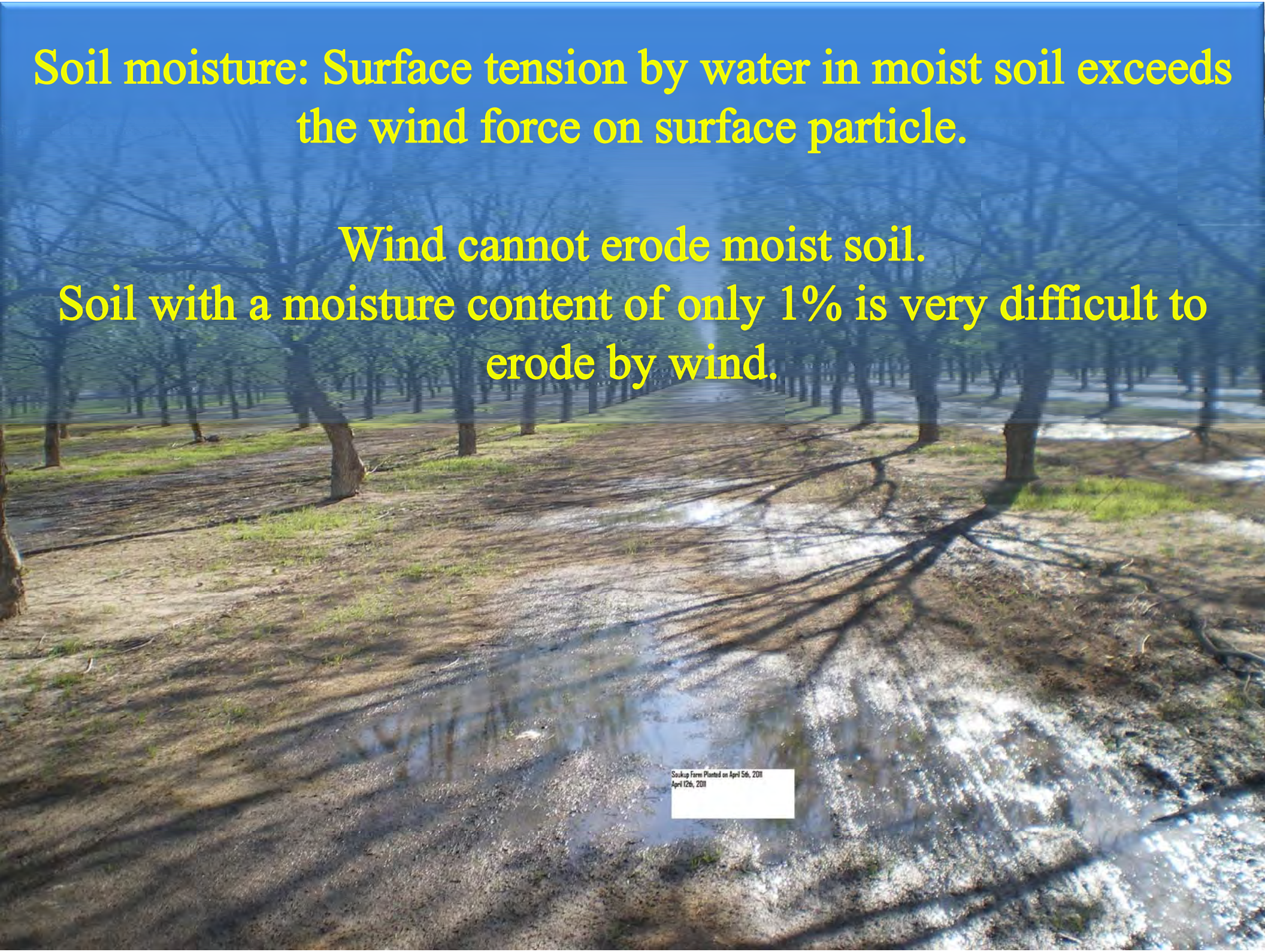
Aggregate Stability has every thing to do with Erosion


Wind direction
Suspension
Saltating grains
Grains bounce
high off pebbles
Saltation
Surface creep
Impact
Impact
cm
in
10
8
6
4
2
0
4
3
2
1
0

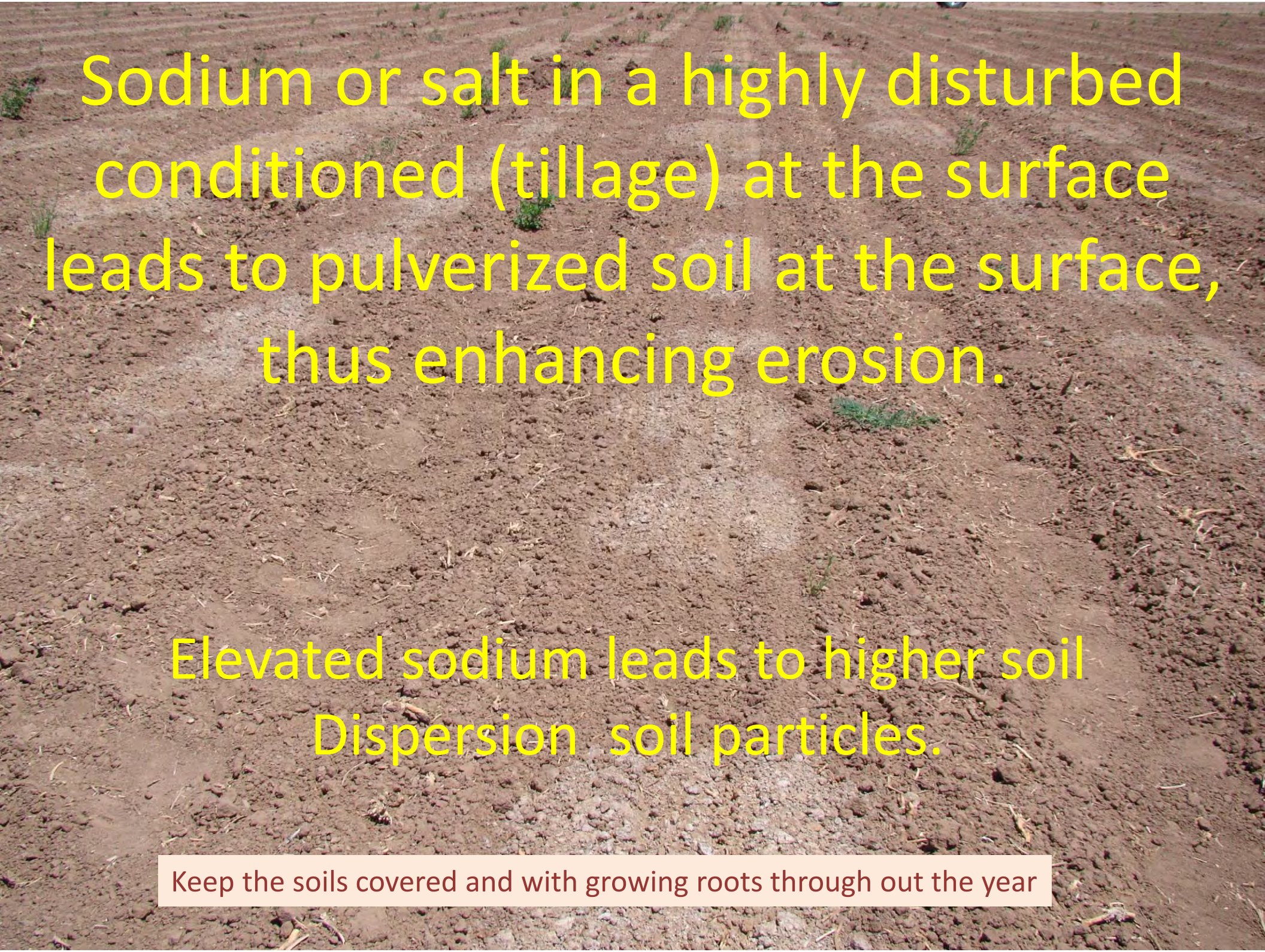
Small changes in vegetation lead to large changes in erosion by the wind or water.

Soil moisture: Surface tension by water in moist soil exceeds the wind force on surface particle.

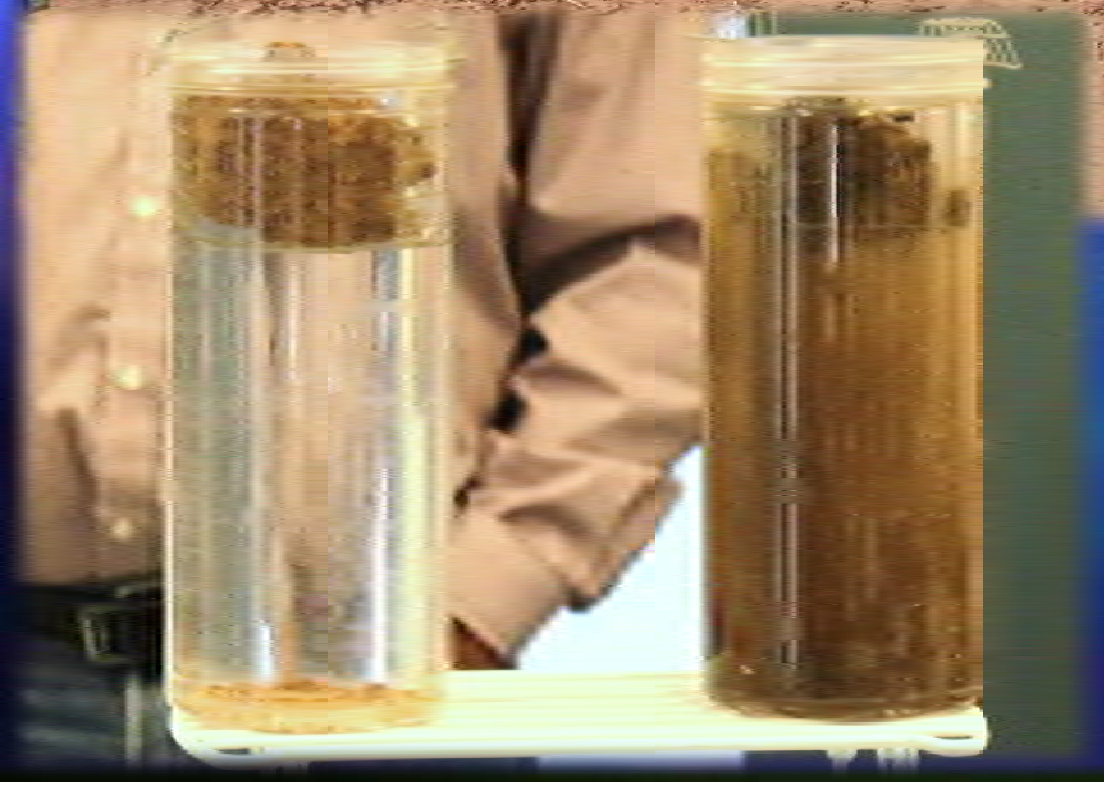
Wind cannot erode moist soil.
Soil with a moisture content of only 1% is very difficult to erode by wind.



Surface Characteristics: Structure of the surface, Organic material, Crop Residue at the surface reduces erosion.


Sodium or salt in a highly disturbed conditioned (tillage) at the surface leads to pulverized soil at the surface, thus enhancing erosion.
Elevated sodium leads to higher soil Dispersion soil particles.
Keep the soils covered and with growing roots through out the year

Tillage disrupts ecosystem processes (this leads to soil erosion)



Why is Aggregate Stability Important ?

Changes in aggregate stability may serve as early indicators of recovery or degradation of soils.

Aggregate stability is critical for infiltration, root growth, and resistance to water and wind erosion.

Aggregate stability is an indicator of organic matter content, biological activity, and nutrient cycling in soil.

Degrees of Aggregate Stability/ Soil Slaking

Aggregate Stability Test

Objective of test: to measure amount of sand in the sample.

1. **Sieve and Weigh the Soil Sample.**

2. **Slowly Wet the soil sample in 0.25 mm Sieve, over a wet terry cloth from bottom up.**

3. Wet Sieve the Soil with distilled water.

Note: make sure the aggregates remain immersed in water on the upstroke.

Aggregate Stability Test

4. Dry the Aggregates on low air flow.

5. Weigh the Aggregates after drying.

Aggregate Stability Test

7. Disperse Aggregates in Calgon Solution. Allow the Aggregates in the sieve to soak for 5 min, moving the sieve up and down periodically.

8. Only Sand particles should remain in the Sieve.

9. Dry and Weigh the Sand. Remove all excess water with terry cloth first. Use drying apparatus.

Aggregate Stability Test

Calculations:

Water Stable Aggregates (% of soil > 0.25 mm) =
[(Weight of Dry Aggregates – Sand) / (Weight of dry soil – Sand)] x 100

Example:

Weight of aggregates = .50g
Weight of Dry Aggregates = .48g
Weight of dry sand = .092g

[(0.5 – 0.092) / (0.50 – 0.92)] x 100 = ?
[(0.368) / (0.408)] x 100 = ?
[0.90196] x 100 = 90.60%
Stable Aggregates

Root Exudates, and Glomalin (by mycorrhizal fungi)

Which are derived from Soil Biota and the breakdown organic matter.

(Carbon is the energy in the soil)

Aggregate Stability Test

1. ***Greater amounts of stable aggregates suggest better soil quality.***

2. ***When the proportion of large to small aggregates increases, soil quality generally increases.***

Soil Biota are the Soil Builders

It is the breakdown of large, air-dry soil aggregates (>2-5 mm) into smaller sized micro-aggregates (<0.25 mm) when they are suddenly immersed in water.

Why is Slaking Test Important?

1. Indicates the stability of soil aggregates,

2. Resistance to erosion (Wind & Water),

3. Suggests how well soil can maintain its structure to provide water and air for plants and soil biota when it is rapidly wetted.

Slake Test

1. Collect surface aggregates.
2. Fill plastic box with water.
3. Dip soil aggregates in water using sieve baskets

Slake Test

Observe Aggregates:

Observe Aggregates:

<u>Rating</u>

0 Soil too unstable to sample (falls through sieve).

1 50 % of structural integrity lost within 5 seconds of insertion in water.

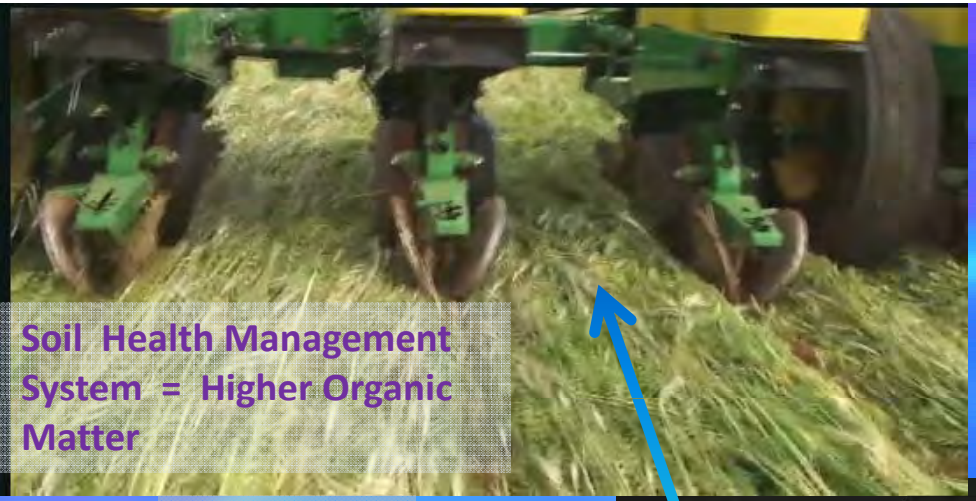
2 50 % of structural integrity lost 5 - 30 seconds after insertion.

3 50 % of structural integrity lost 30 - 300 seconds after insertion or < 10 % of soil remains on the sieve after 5 dipping cycles.

4 10 - 25% of soil remaining on sieve after 5 dipping cycles.

5 25 - 75% of soil remaining on sieve after 5 dipping cycles.

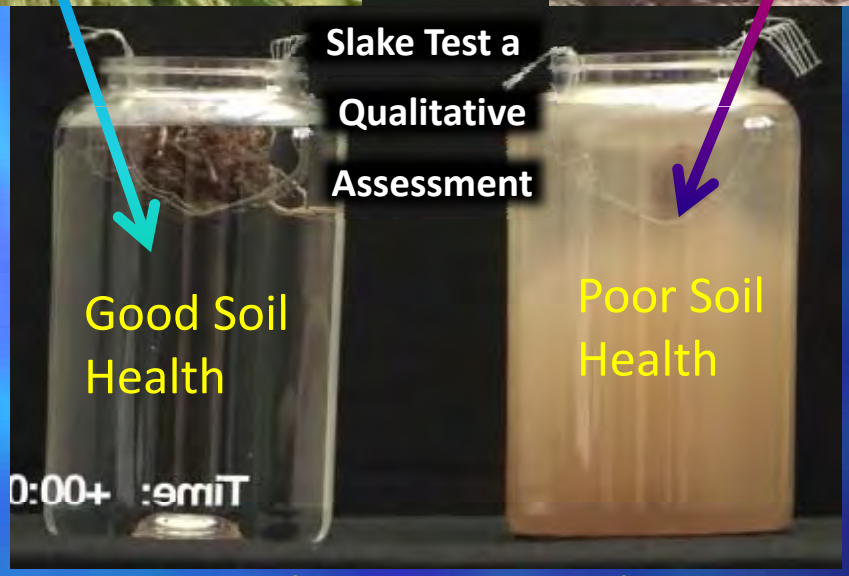
6 75 - 100% of soil remaining on sieve after 5 dipping cycles.



Soil Health

Soil Biota

Soil Health Management System
Cover Crops Crop Rotations
Conservation Tillage Nutrient Mgt.
Irrigation water Management
Integrated Pest Management
Laser Leveling Proper Irrigation System



Where is your Soil ?

Conventional Farming:
No-Cover Crops Low Soil Organic Matter
Soil Compaction Intensive Tillage
Mono Culture Crop Low Crop Residues
Reduced Soil Food Web Winter Fallow
Biological - Physical – Chemical out of Sync.

Soil Aggregate Stability: A measure of the proportion of the aggregates in the soil which do not easily slake, crumble or disintegrate.

USDA NRCS

NRCS is an equal opportunity provider and employer.

Agronomy Tech Note 76 (http://www.nm.nrcs.usda.gov/technical/handbooks/iwm/nmiwm.html)

Clarence Chavez 2012

Conservation practices that lead to slaking include:

- Conventional tillage methods that disturb soil and accelerate organic matter decomposition,
- Removing crop residues (Burning, Harvesting)
- Using pesticides harmful to soil organisms that cycle organic matter and promote aggregation.
- Improper Irrigation Water Mgt.
- Management of activities that disturb soil and leave it bare can result in a rapid decline in soil organic matter, biological activity, and aggregate stability.

Conservation practices that minimize slaking include:

- **Conservation Crop Rotation**
- **Cover Crops**
- **Prescribed Grazing**
- **No-Till or Minimum-Till (reduce operations)**
- **Mulching**
- Salinity and Sodic Soil Management

For more information Please Contact Your Local Office of the:

Natural Resources Conservation Service

or

Soil and Water Conservation District

Non-Discrimination Statement

- "The U.S. Department of Agriculture (USDA) prohibits discrimination in all of its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex (including gender identity and expression), marital status, familial status, parental status, religion, sexual orientation, political beliefs, genetic information, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).“

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service