Soil Health & Restoring Soil Function

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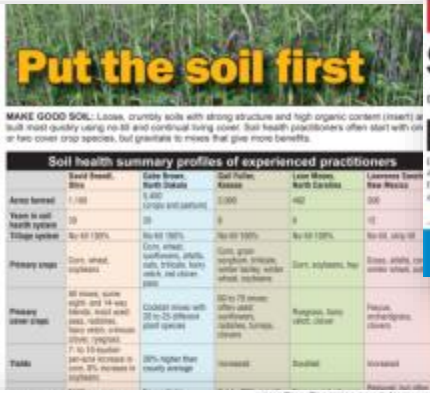
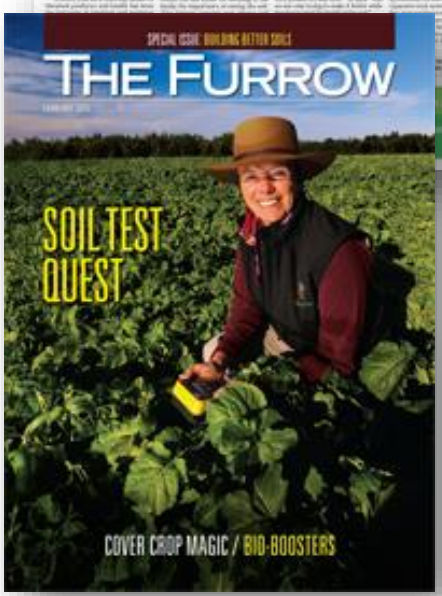
Growing ag Media Interest





NRCS Soil Health Campaign

- ✓ Raised awareness
- ✓ Expanded demand for system adapted information
- ✓ Raising many good questions

Why in 2016?

World population is estimated to be at 9.1 billion by 2050

To sustain this level of growth, food production will need to rise by 70 percent

Between 1982-2007, 14 million acres of prime farmland in the U.S. was lost to development

Energy demands

- Increase use of biofuels (40% of corn used for ethanol)
- Increase use of fertilizer (use of Anhydrous up 48%, Urea up 93%
- Phosphorous is a finite resource

Soil Health What is It?

The continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals, and humans

- Nutrient cycling
- Water (infiltration & availability)
- Filtering and Buffering
- Physical Stability and Support
- Habitat for Biodiversity (90% is mediated by soil microbes)

Soil is a Living Factory

Macroscopic and microscopic organisms

- Food
- Water
- Shelter
- Habitat
- Powered by sunlight

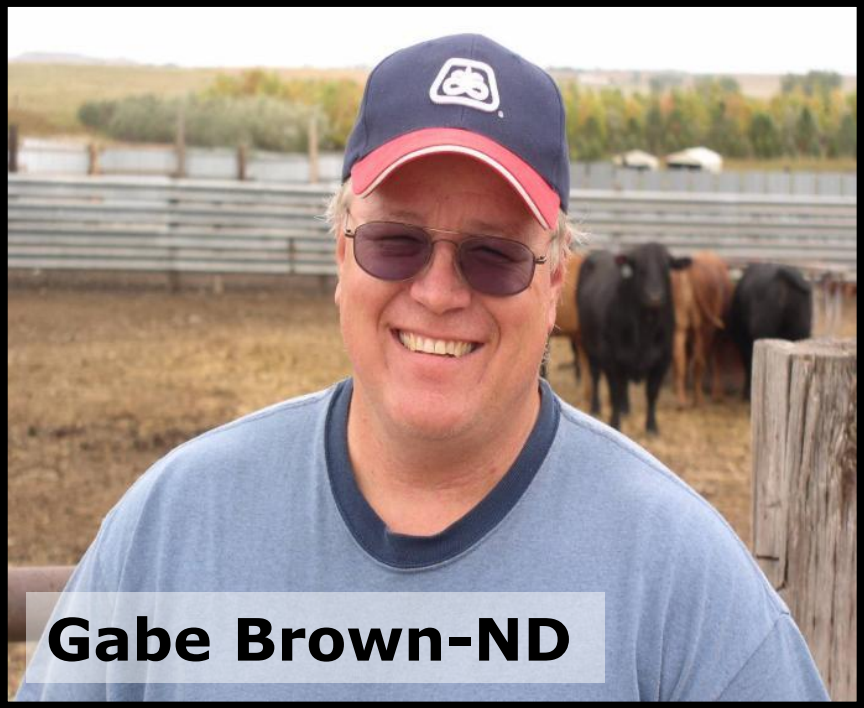
Management activities improve or degrade soil health

- Tillage
- Fertilizer
- Pesticides
- Grazing
- Plant Diversity


Ray Styer-NC


Dave
Brandt-OH


ROCKEY FARMS
SPECIALTY POTATOES
Est. 1938
Brandon
Rockey-CO


Gabe Brown-ND


Ray McCormick-IN







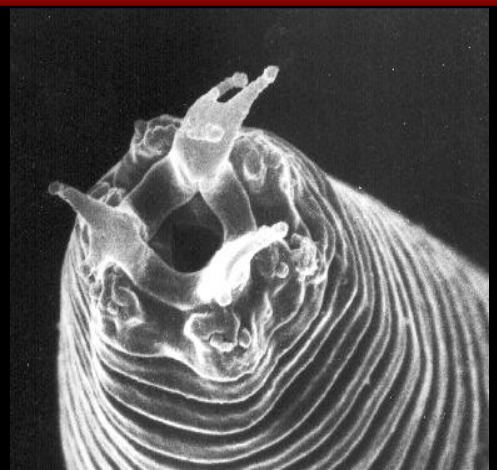


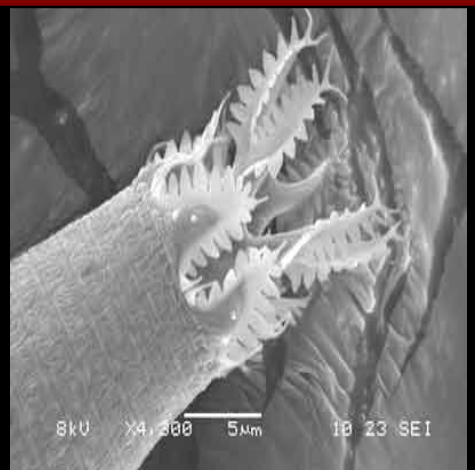

Ecology:

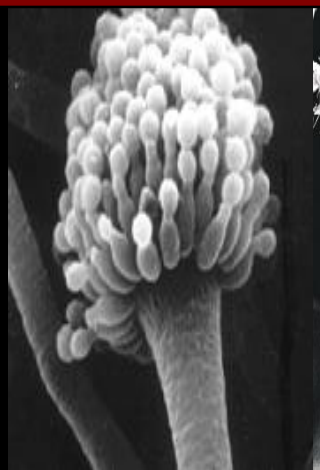
The study of relationships between people, animals, and plants, and their environment.

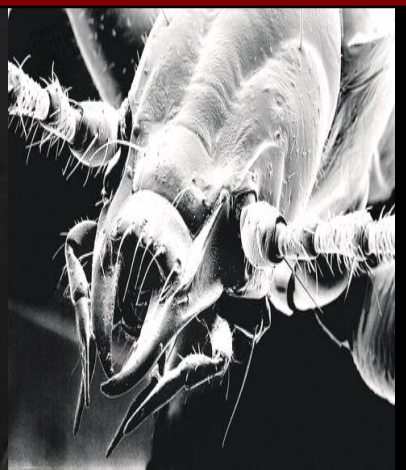
Interconnectedness

Soil Surface

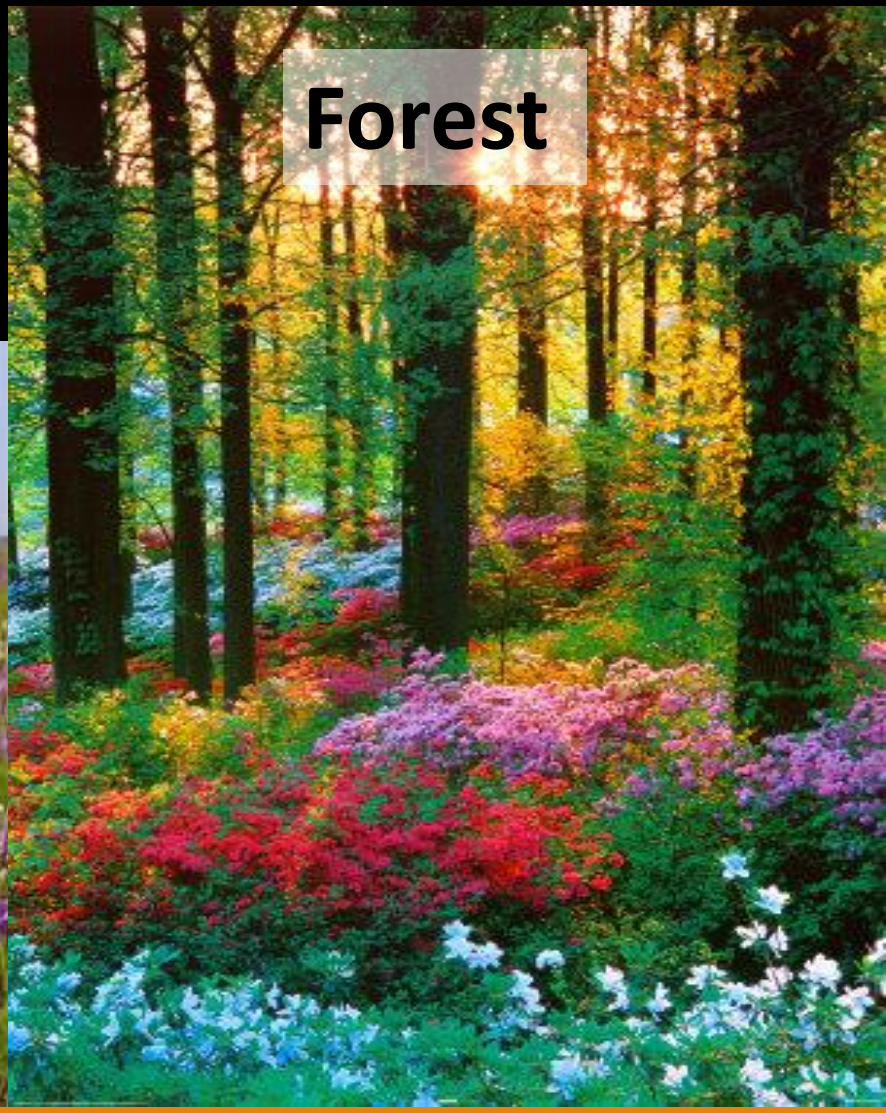




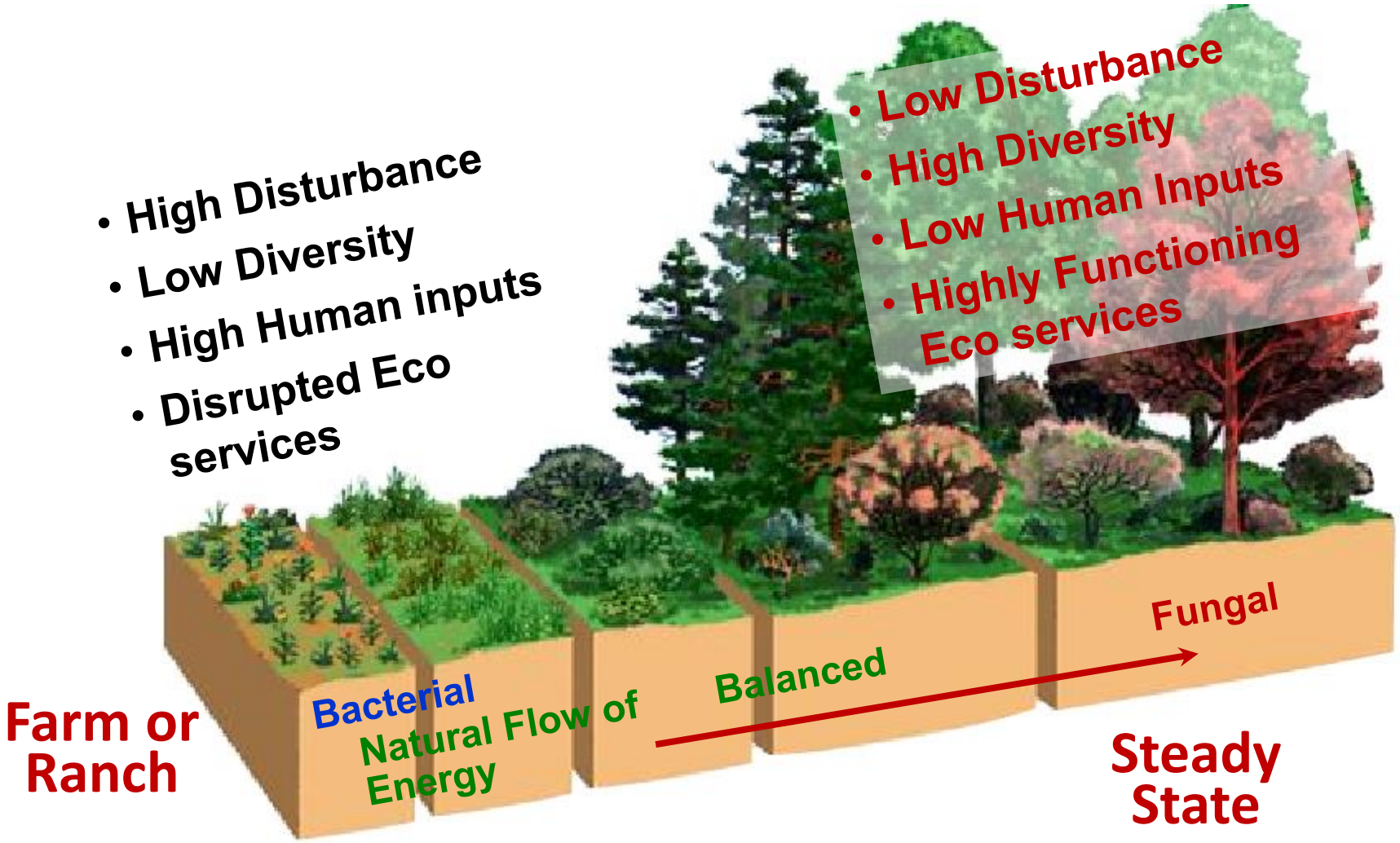




How do these Ecosystem Flourish Without Human Inputs?



Characteristics of a Stable Ecosystem

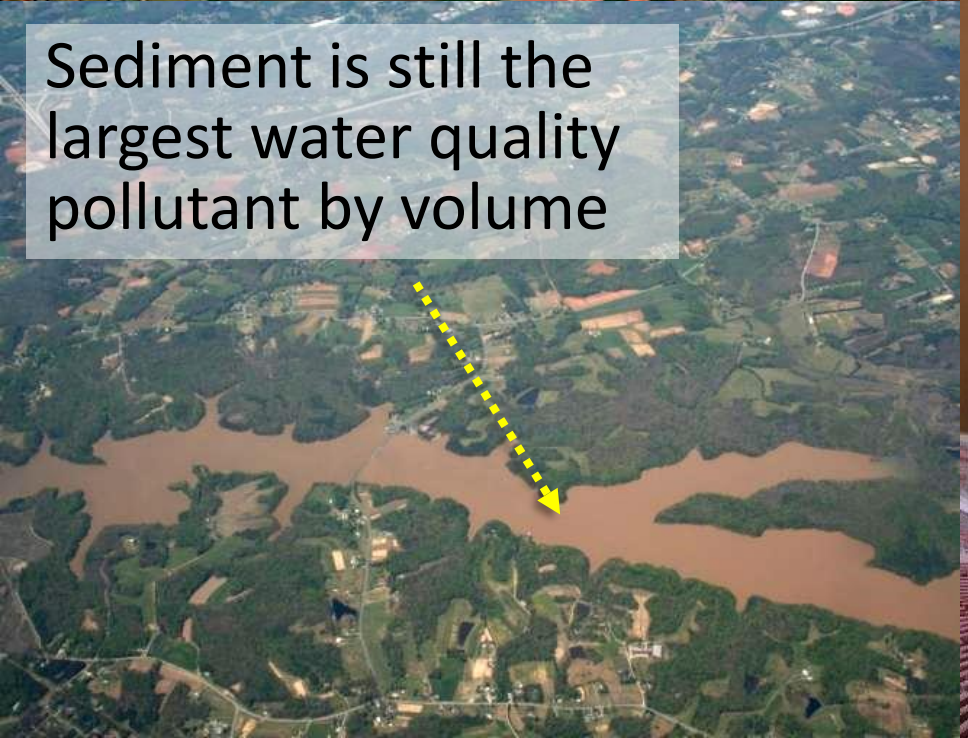



This soil is naked, hungry, thirsty and running a fever!
Ray Archuleta 2007

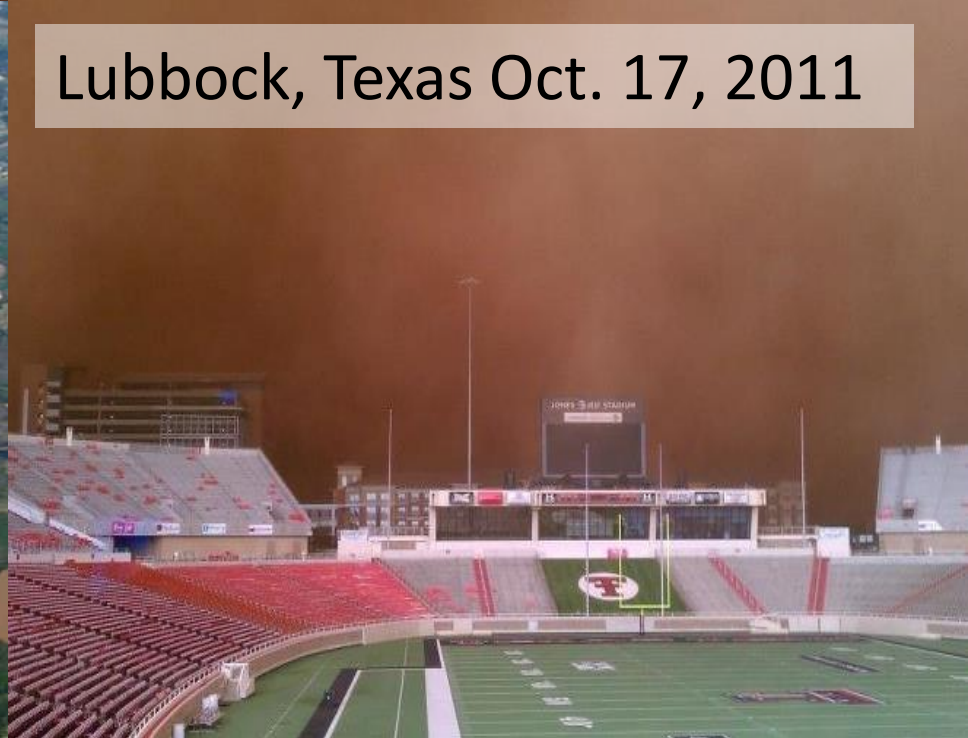
Erosion from bare fields into river

Oklahoma, October 2012, I-35

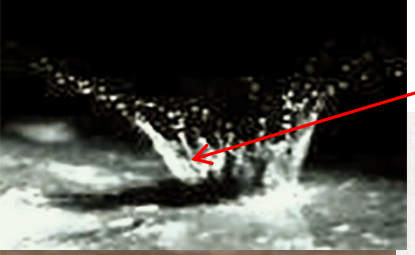
Sediment is still the largest water quality pollutant by volume

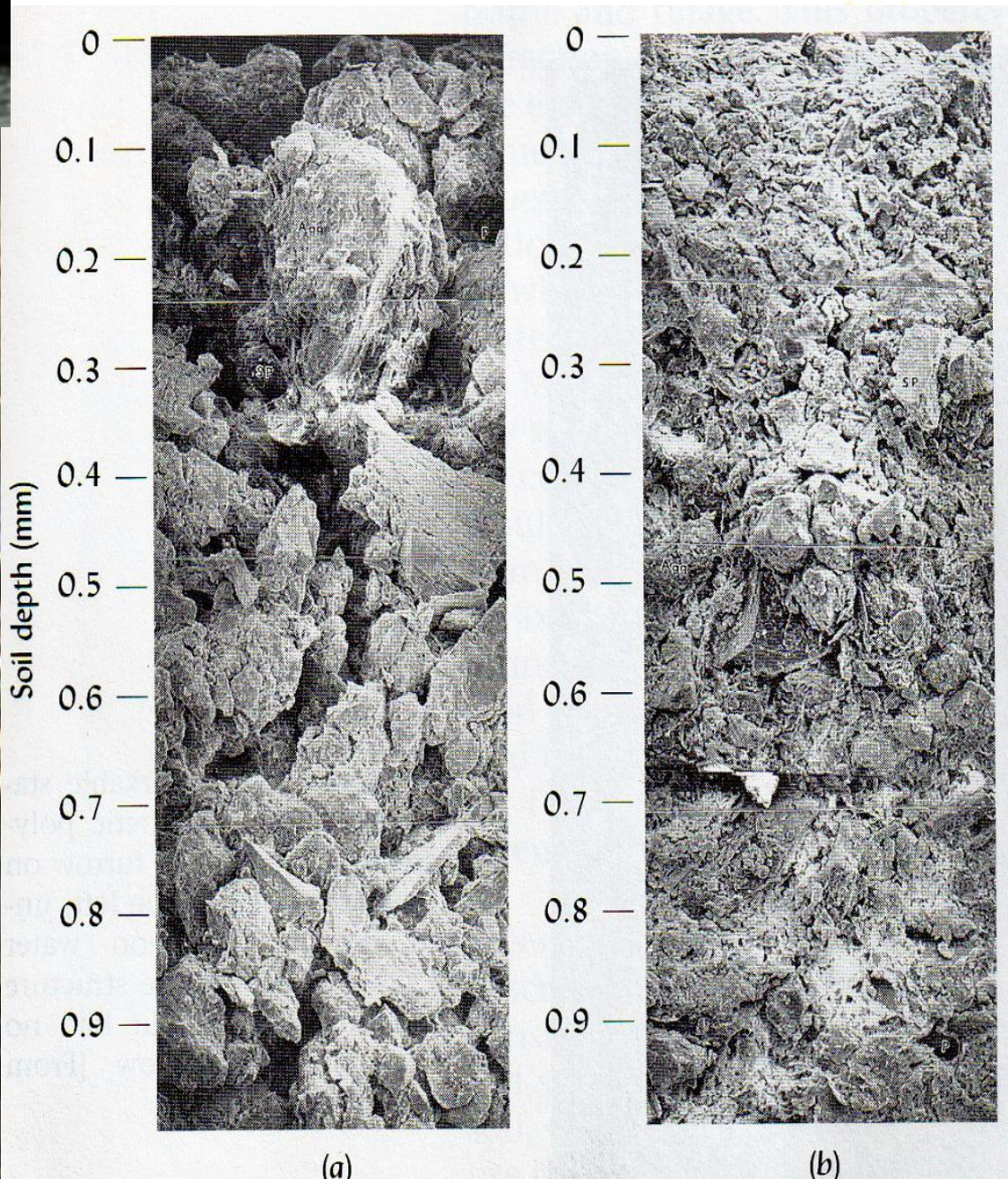


Lubbock, Texas Oct. 17, 2011



The Battle is Won or Lost Here






Agricultural soils do not have a water erosion/runoff problem, they have a water infiltration problem.

Understands Soil Function !

Does Not Understand Soil Function!

Soil Disturbances that Impact Soil Health

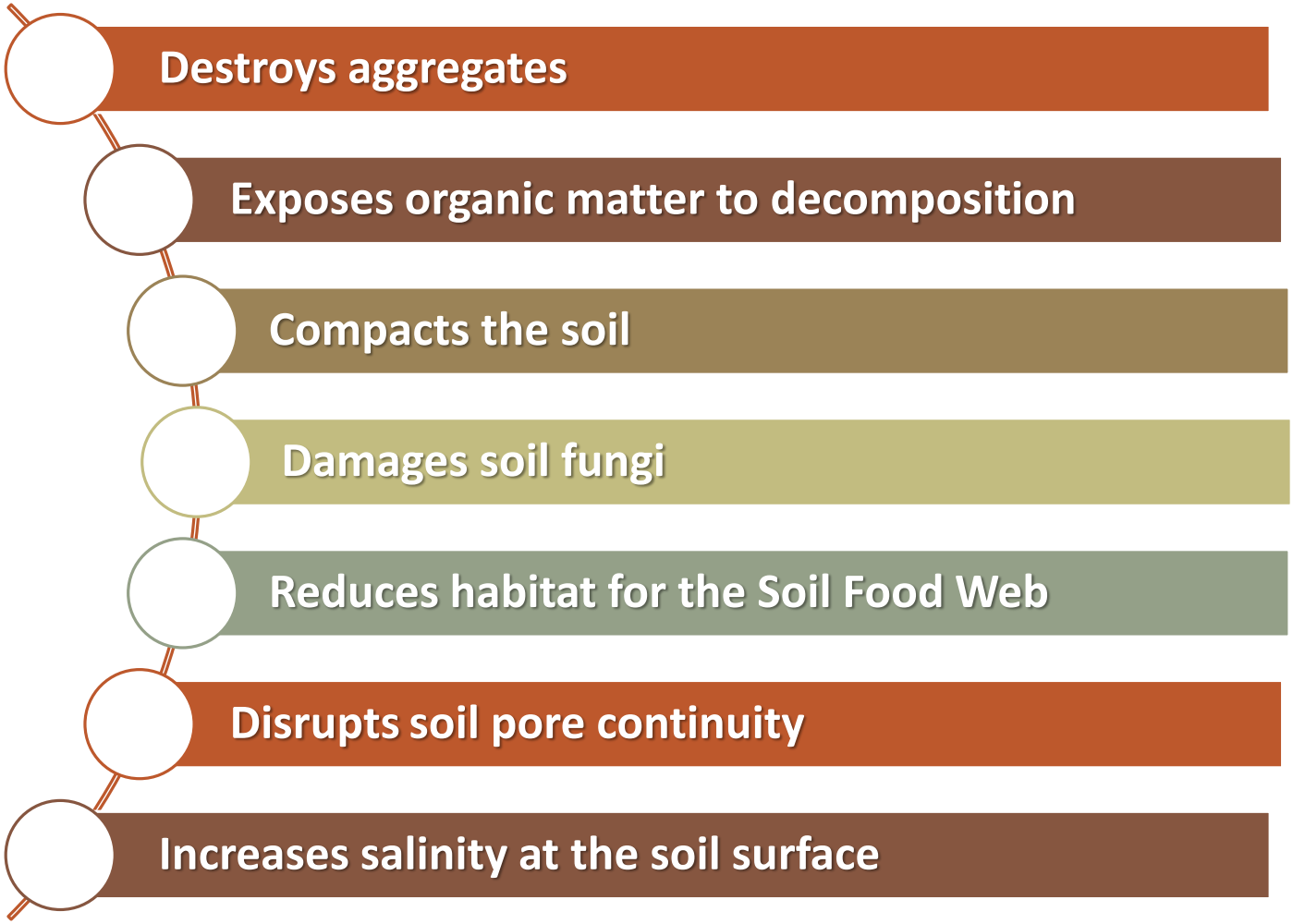
Physical	• Tillage • Compaction
Biological	• Lack of Plant Diversity • Over grazing
Chemical	• Misuse of fertilizer, pesticides, manures and soil amendments

What is Tillage?

The physical manipulation of the soil for the purpose of:

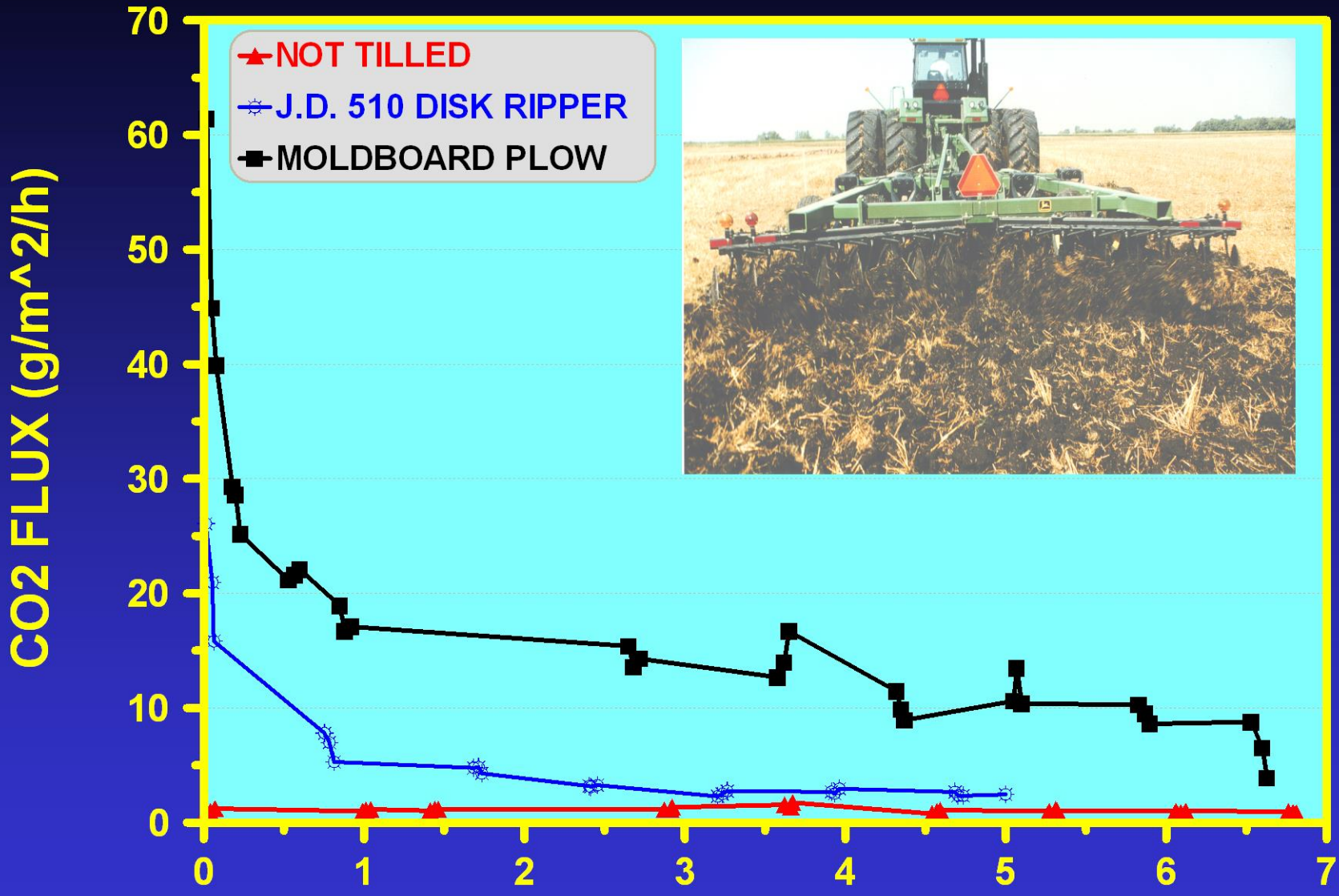
- Management of previous crop residue
- Control of competing vegetation (weeds)
- Incorporation of amendments (fertilizer/manure)
- Preparation of a soil for planting equipment
- Recreation for folks who don't fish or golf.

What Tillage does to the Soil



JOHN DEERE 510 DISK RIPPER CO2 FLUX DATA

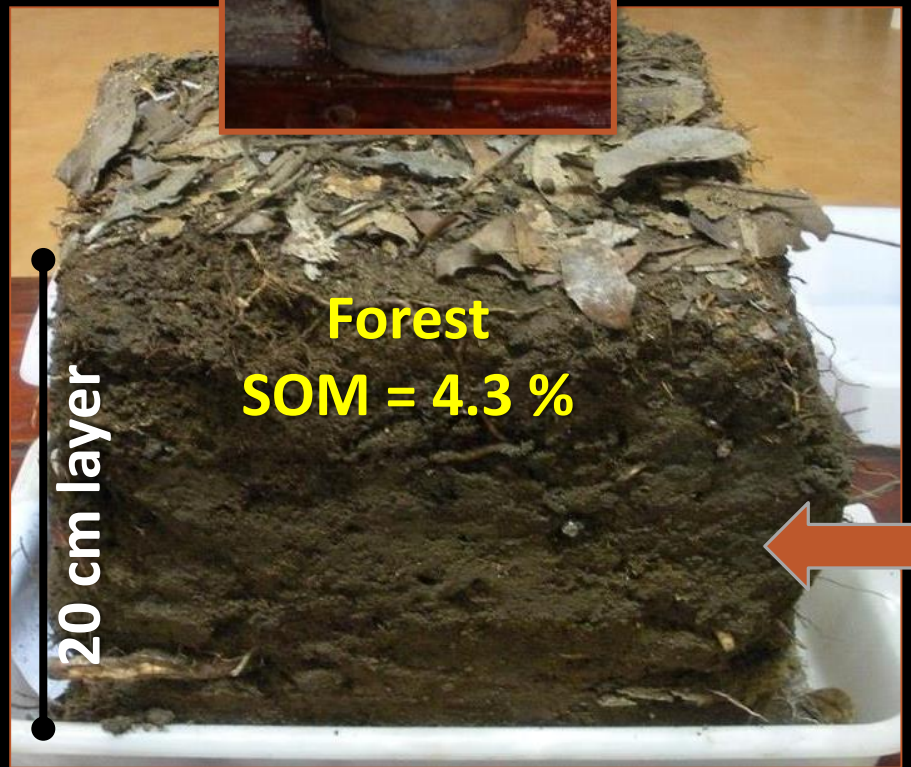
SWAN LAKE TILLAGE DEMONSTRATION AUGUST 24,1994



Reicosky et al., 1995

Management Changes Soil Properties & Capacity of Soil to Function

62.8% loss of SOM after 17 yr intensive tillage



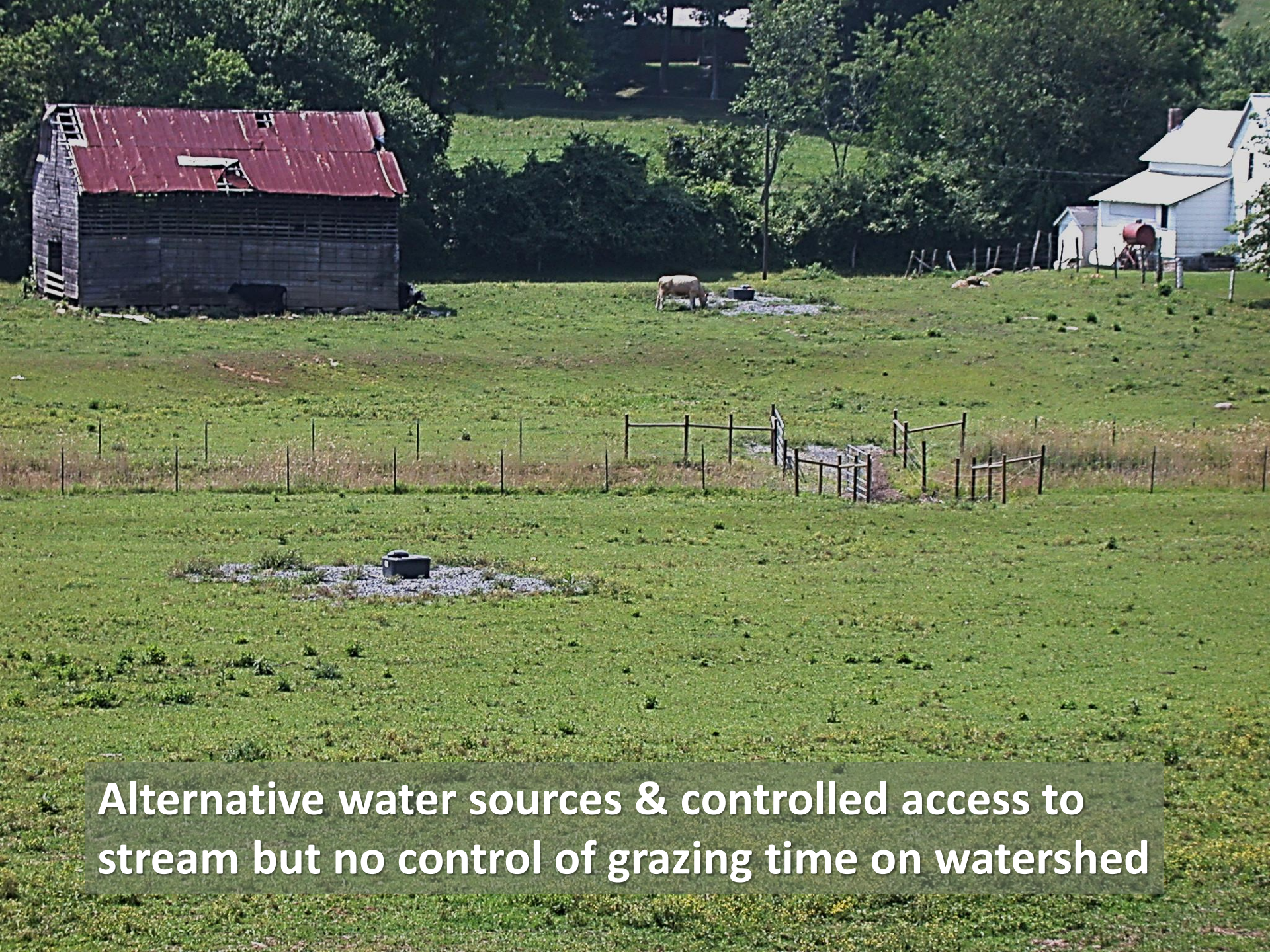
Biological Disturbance

- **No diversity in the crop rotation**
  - Growing single species or few crops in rotation
  - Lack of diversity limits diversity of plant root exudates
  - Hampers the development of a diverse soil biota

- **Overgrazing**
  - Plants are exposed to intensive grazing for extended periods of time, without sufficient recovery periods
  - Many pasture have single species grasses

Biological Disturbance of Overgrazing

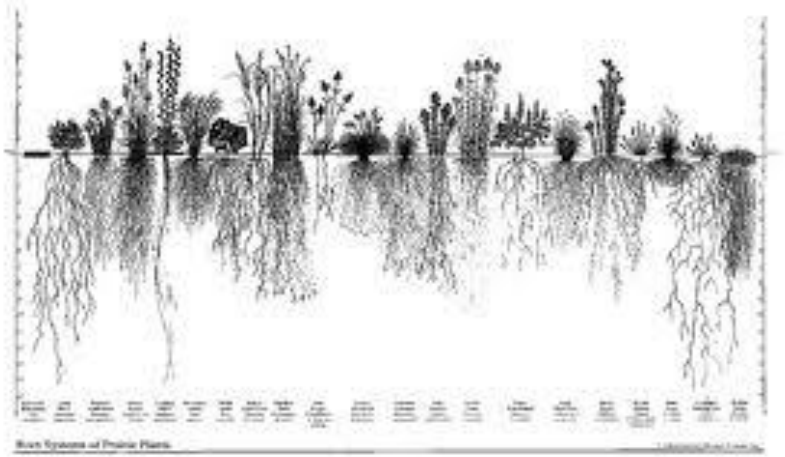
1. Reduced root mass
2. Increased weeds
3. Reduced soil fungi
4. Reduced water infiltration
5. Increased soil temperature
6. Diminished soil habitat

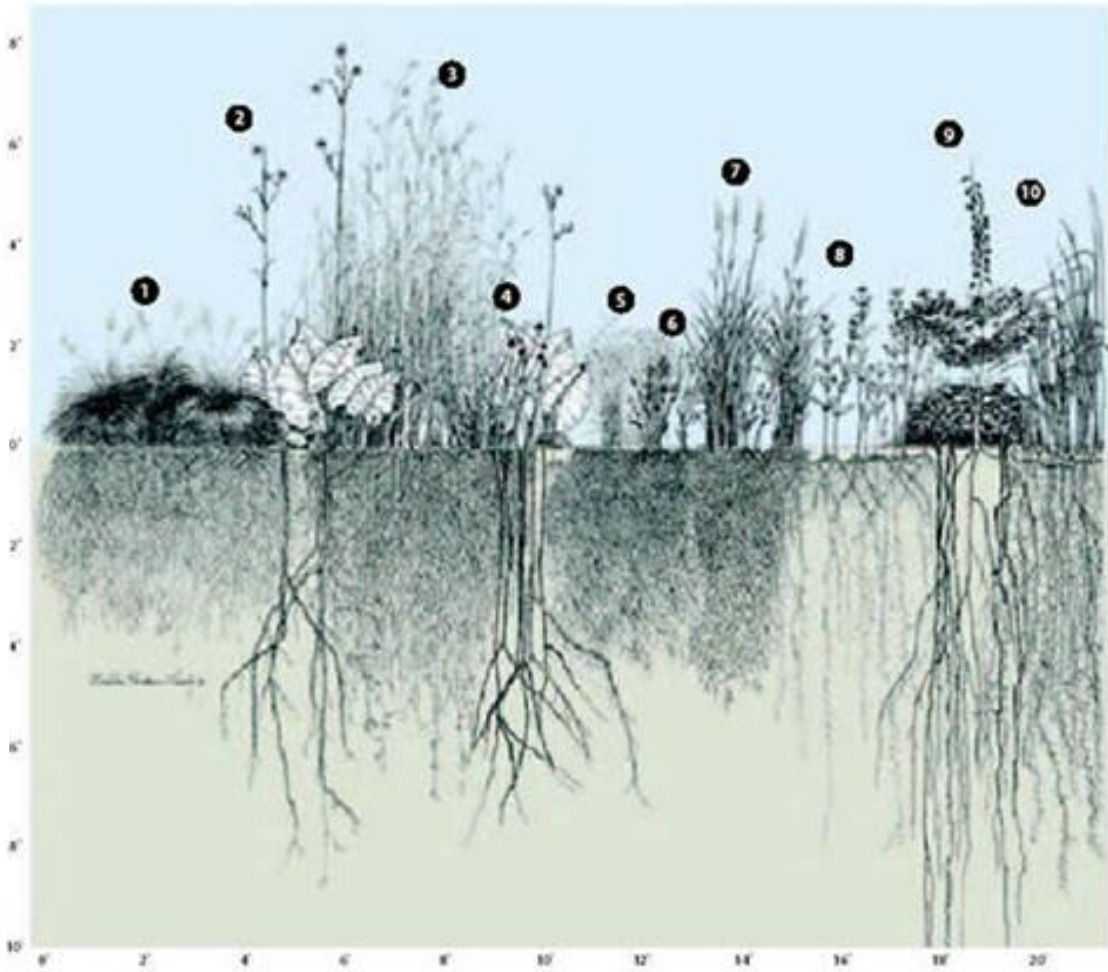

Alternative water sources & controlled access to stream but no control of grazing time on watershed

Soil Health in pasture systems

Overgrazing: another source of disturbance

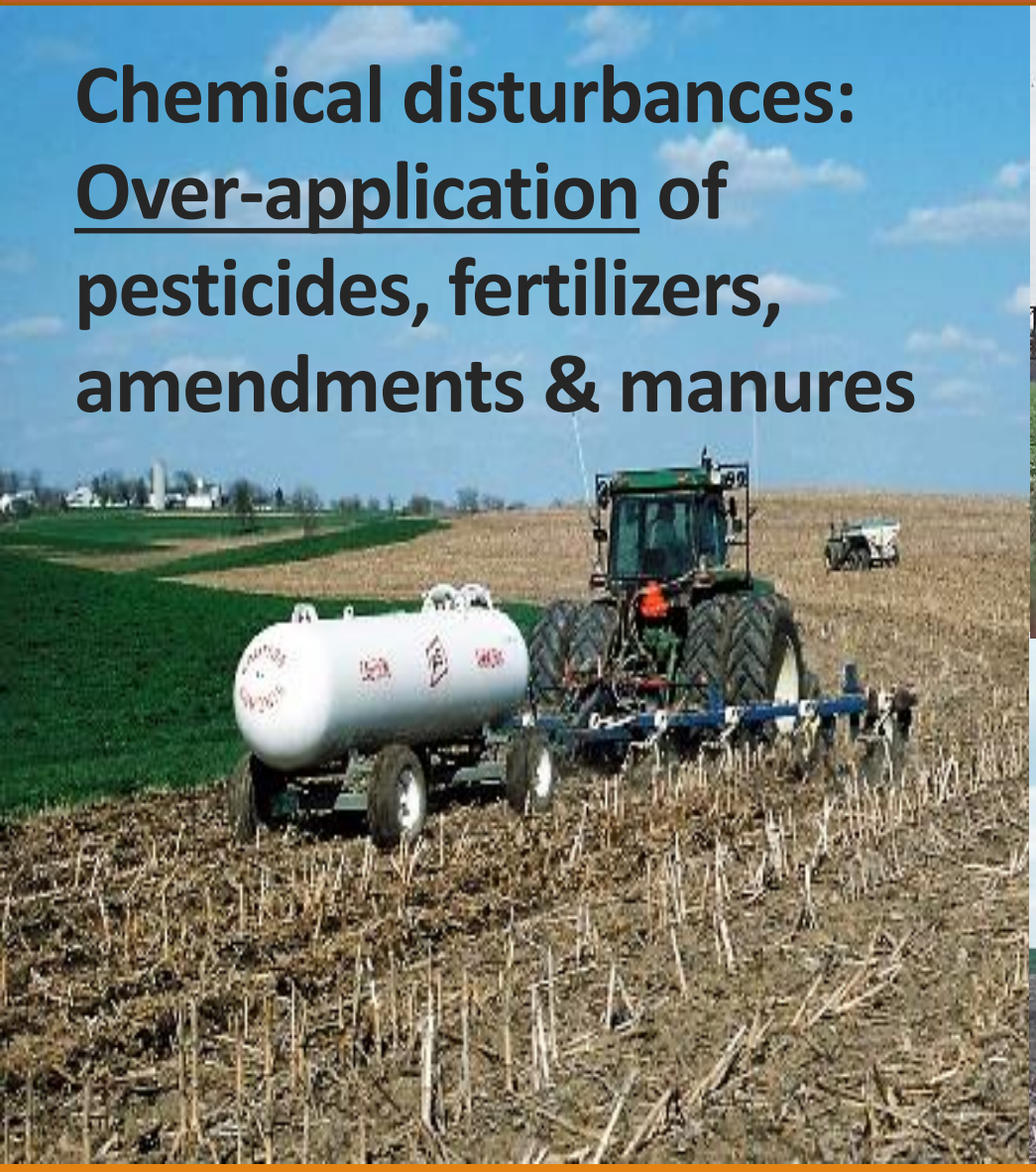
Diversity of roots in nature





1. Prairie Dropseed
2. Prairie Dock
3. Big Bluestem
4. Pale Purple Coneflower
5. Little Bluestem
6. Black Eyed Susan
7. Indiangrass
8. Showy Sunflower
9. White False Indigo
10. Prairie Cordgrass

Chemical disturbances: Over-application of pesticides, fertilizers, amendments & manures



Impact of Fertilizer on Soil Health

- Short-circuits the rhizosphere & P cycle
- Depresses activity of natural N fixers
- Stimulates bacterial decomposition of SOM
- Excess N at risk for leaching or denitrification
- Increased soil salinity (Synthetic fertilizers are salts)

Paradigm Shifts

Paradigm shift #1 Stop treating the symptoms of dysfunctional soil; solve the problem of dysfunctional soil.

Paradigm shift #2 Restoring soil function can be accomplished without going broke.

- Apply basic principles of ecology to create quality habitat.

Paradigm shift #3 Conservation practices do not restore soil health, understanding soil function restores soil health.

Managing for Soil Health

Keep the soil armored with plants and plant residues

Minimize disturbance of the soil

Maximize diversity of plants

Keep living roots in the soil as much as possible

Incorporate livestock into the cropping system

Create the most favorable habitat possible for the soil food web

Soil Health Is Understanding How the Soil is Designed to Function and Managing it Accordingly