



Soil Health & Restoring Soil Function

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NRCS Soil Health Campaign

Soil Health Awareness

soil health THEATER

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Soil is a living and life-giving natural resource.

As world population and food production demands rise, keeping our soil healthy and productive is of paramount importance. So much so that we believe improving the health of our Nation's soil is one of the most important conservation endeavors of our time.

The resources on this soil health section of our site are designed to help visitors understand the basics and benefits of soil health—and to learn about Soil Health Management Systems from farmers who are using these systems.

Soil Health Across the Nation

Vote and help promote Soil Health

please vote today!

Explore the Science of Soil Health

The Science of Soil Health

Avoiding the... It may be on by a kinder, gentler farmer that gets very hard workman. With of NRCS' The the plan, can provide compaction relief for our cropland. It's so

Profiles in Soil Health

Under Cover Farmers of Stanley County, NE

My dream is to be a farmer and can be seen in NRCS' Soil Health Theater.

OKLAHOMA

PROFILES IN soil health

Jimmy Emmons
Dewey County, Oklahoma
2,000 acres
Crops: Wheat, alfalfa, canola, cow/calf operation
Covers: Multi-species

THE SCIENCE OF SOIL HEALTH

MONTANA

PROFILES IN soil health

Julie Taylor
Fairfield, MT
510 acres (cropland, pastureland & rangeland)
Crops: barley and hay
Covers: Austrian winter peas, berseem clover, soybeans, field peas, red clover & hairy vetch

Farming Changes Focus on Soil Health

Julie Taylor, who farms on the Fairfield Bench, has changed her farming practices to include no-till farming methods, planting cover crops, composting to augment soil fertility, and intensively grazing both hay land and rangeland.

- ✓ 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)



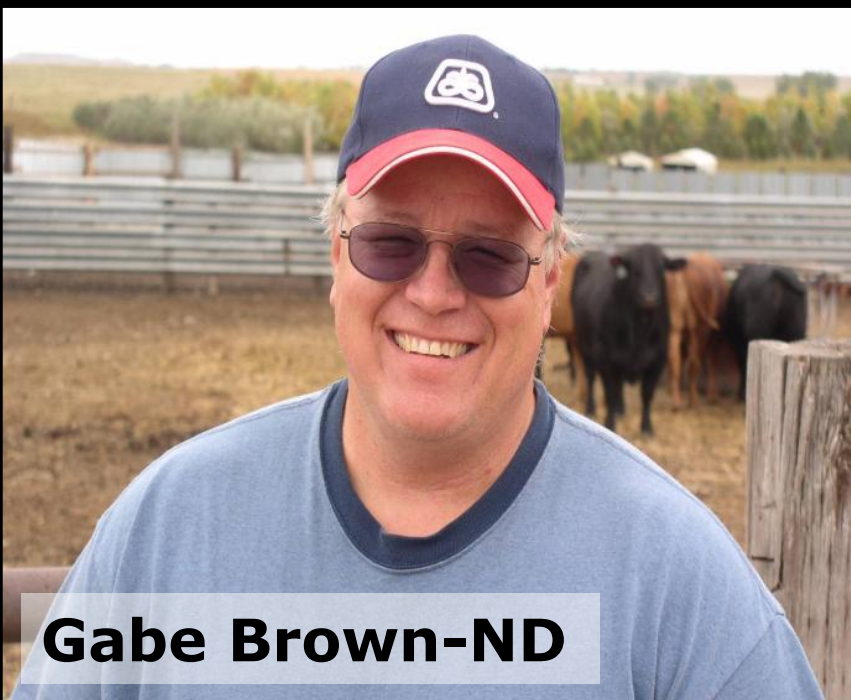
Soil is a Living Factory

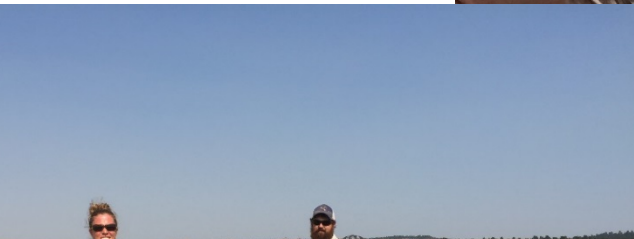
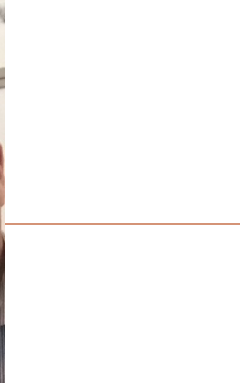
Macroscopic and microscopic organisms

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

Management activities improve or degrade soil health

- Tillage
- Fertilizer
- Pesticides
- Grazing
- Plant Diversity





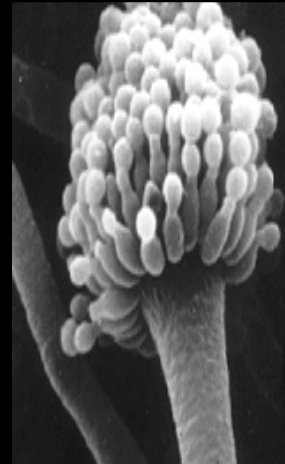
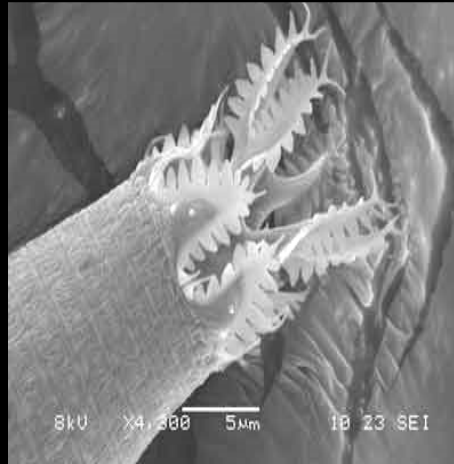
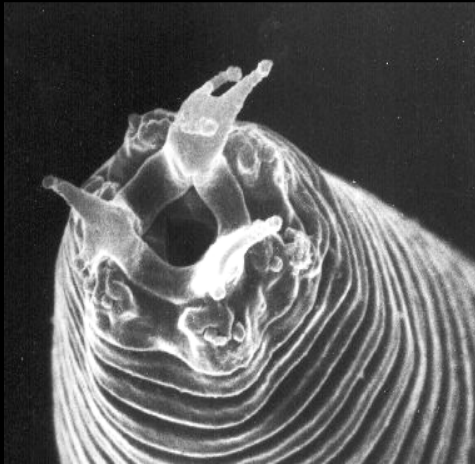


Ecology:

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

Interconnectedness

Soil Surface

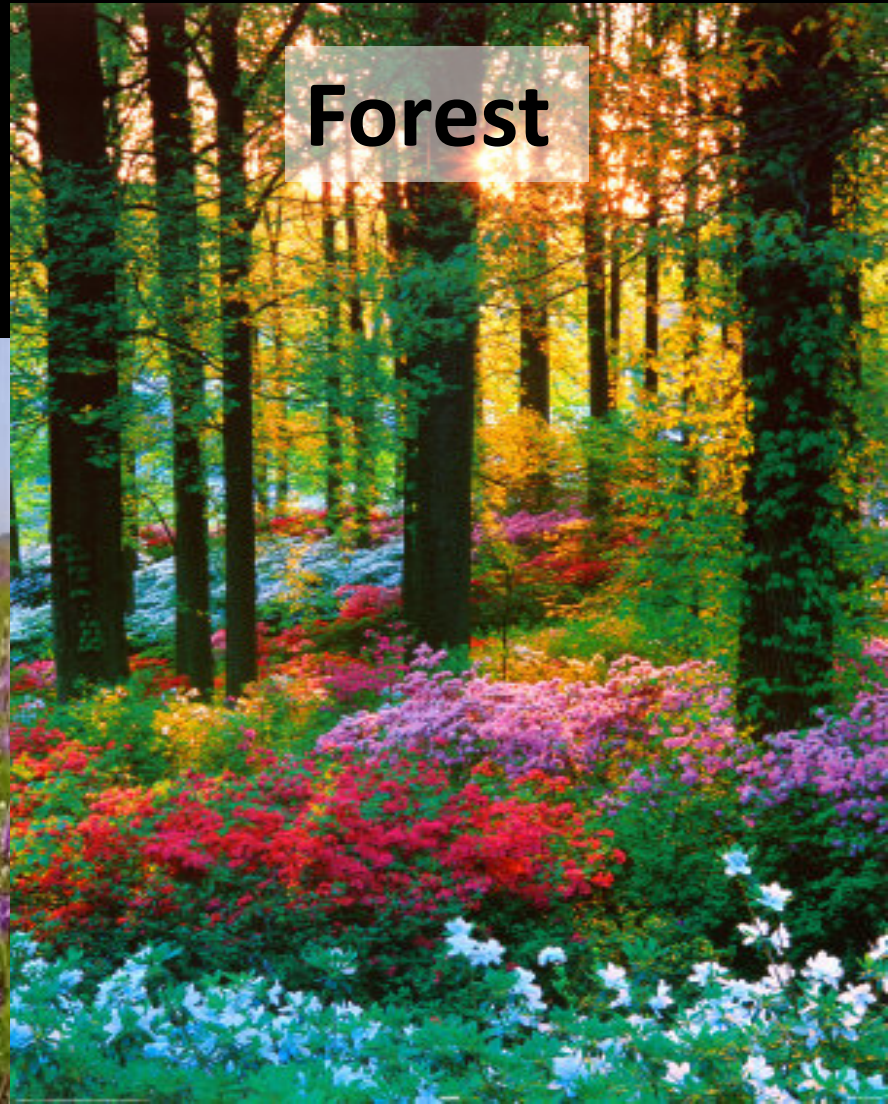


How do these Ecosystem Flourish Without Human Inputs?

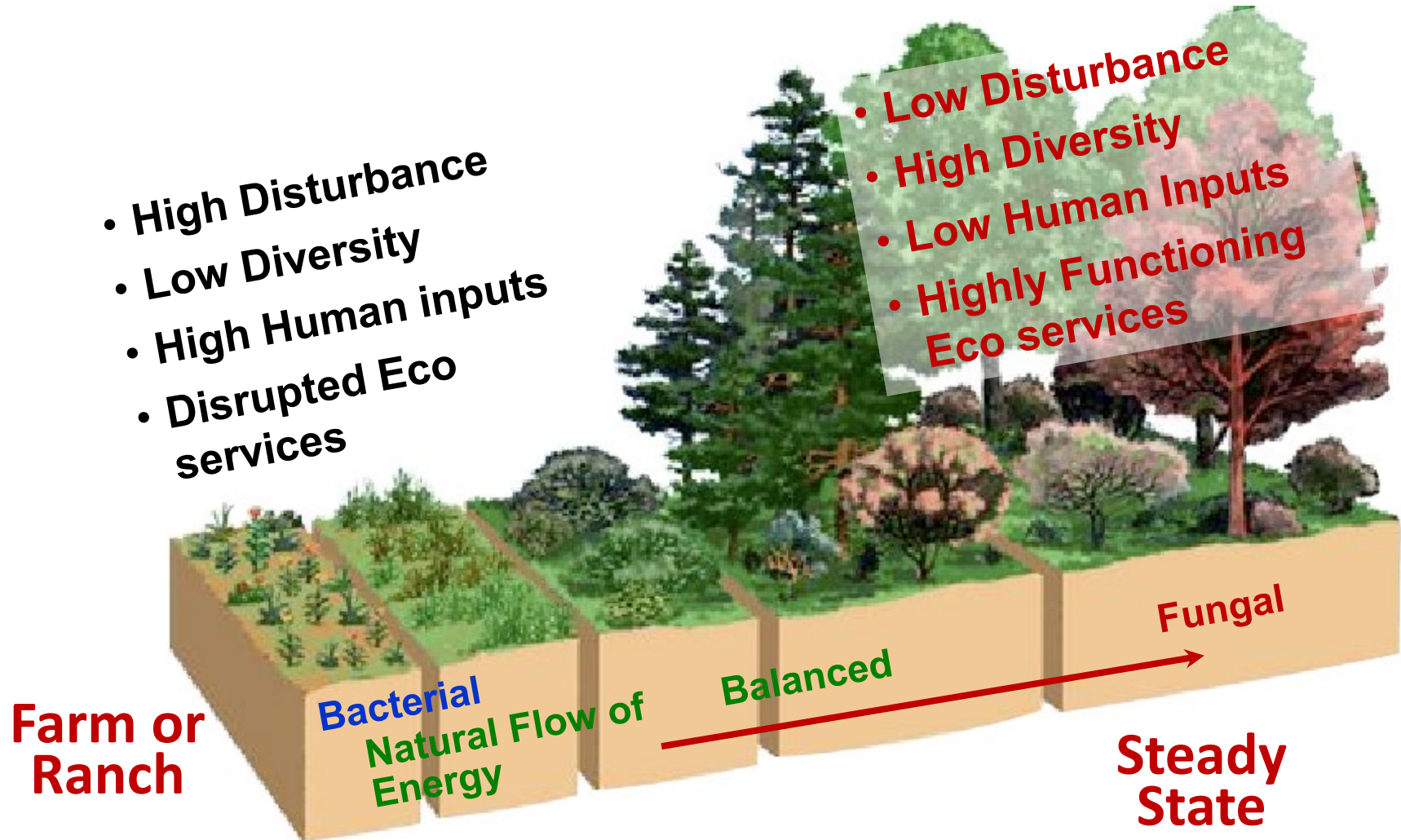
Prairie



Forest



Characteristics of a Stable Ecosystem





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

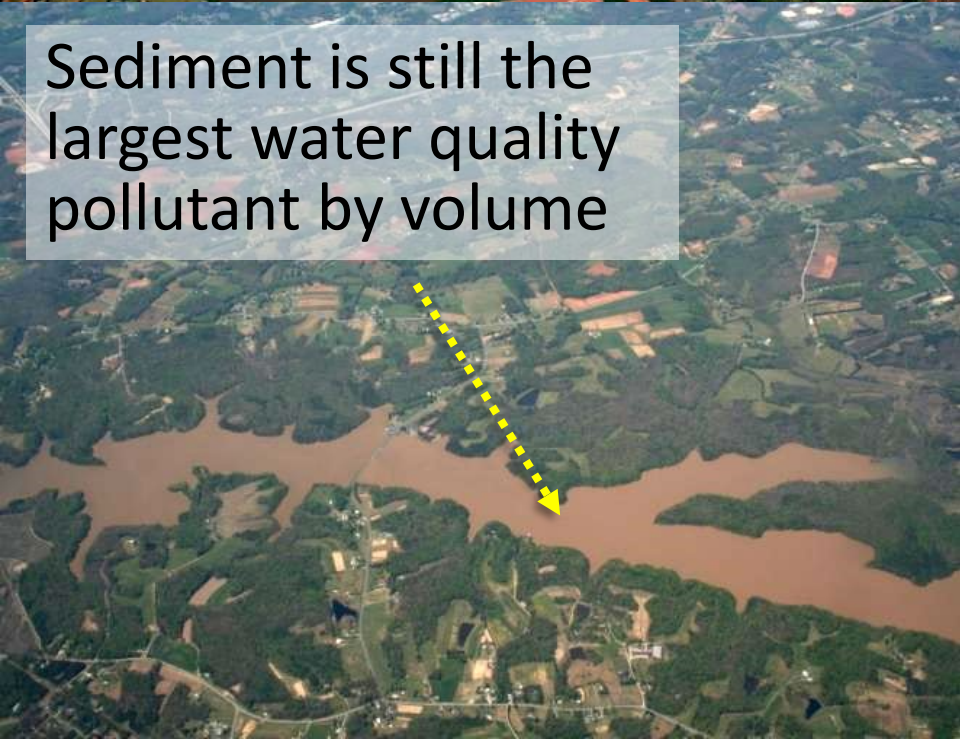
Erosion from bare fields into river



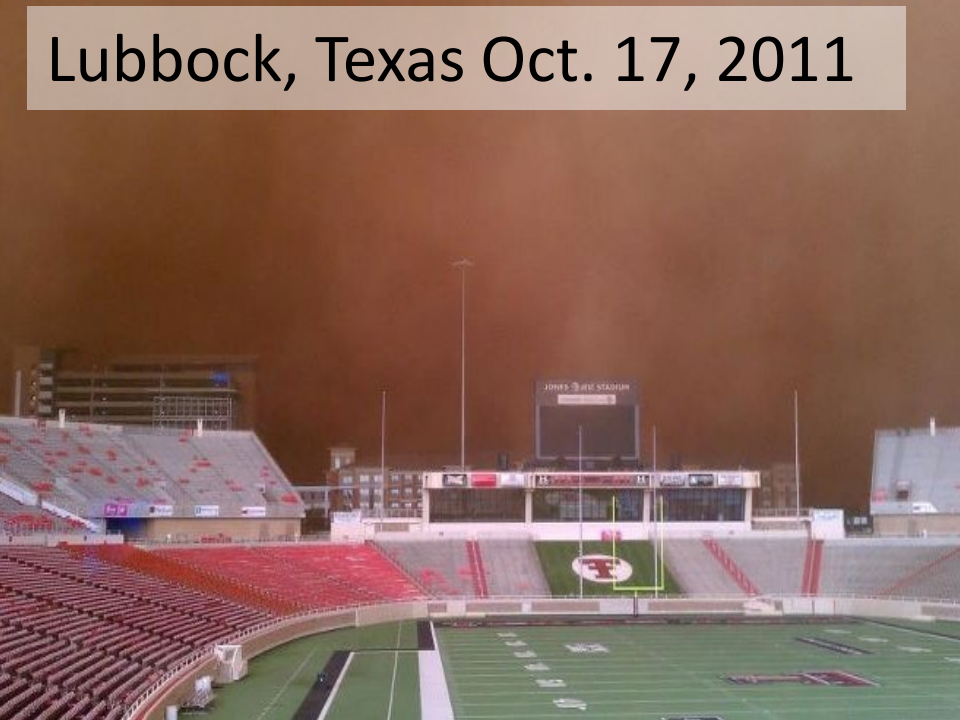
Oklahoma, October 2012, I-35



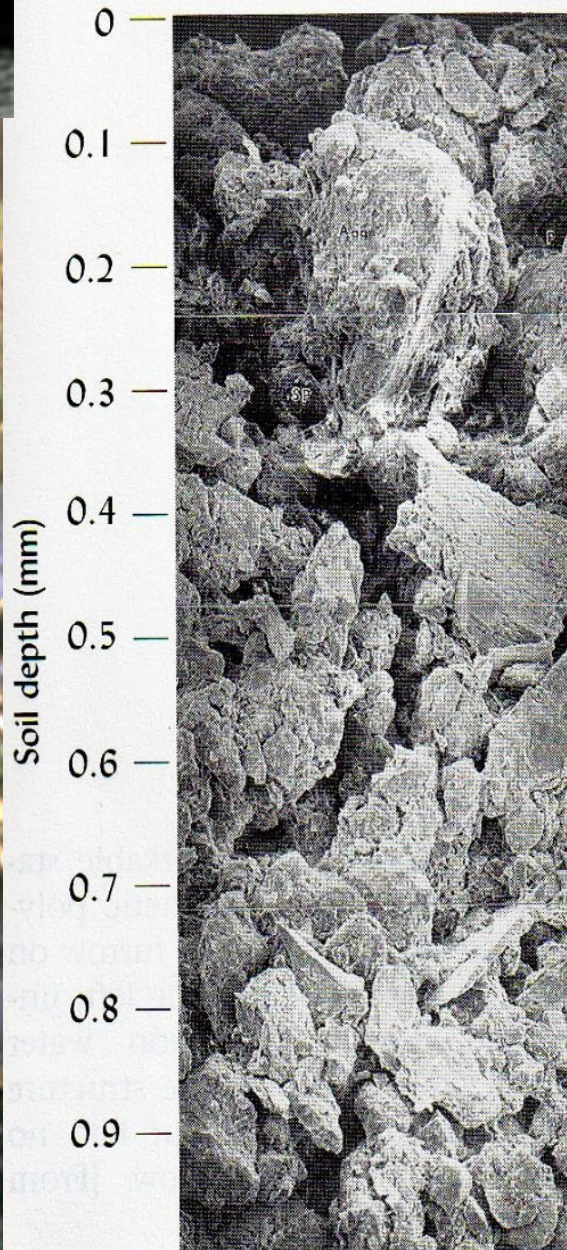
Sediment is still the largest water quality pollutant by volume



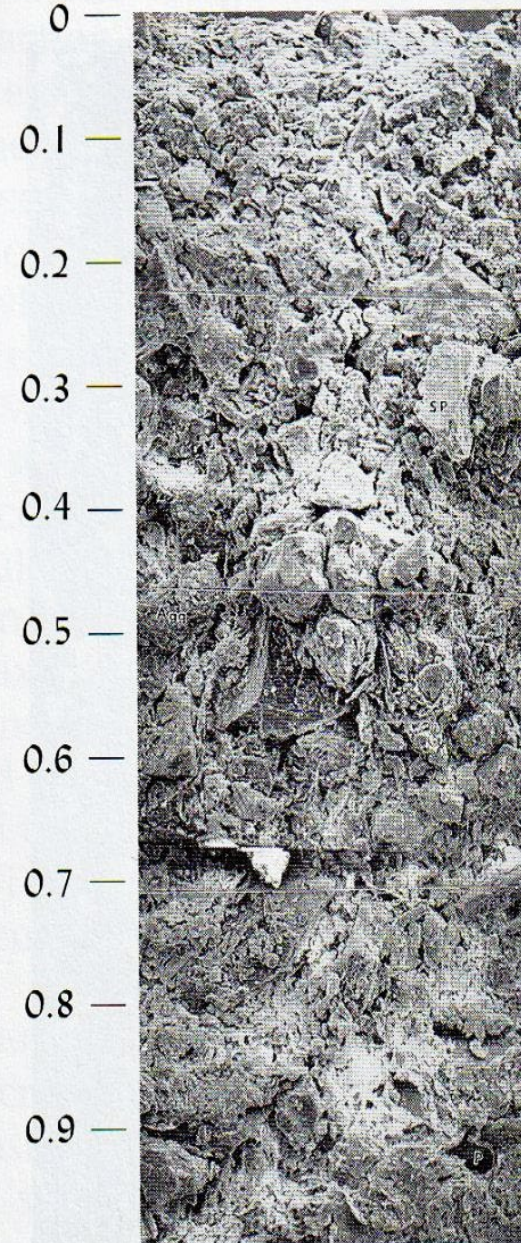
Lubbock, Texas Oct. 17, 2011



The Battle is Won or Lost Here



(a)



(b)





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





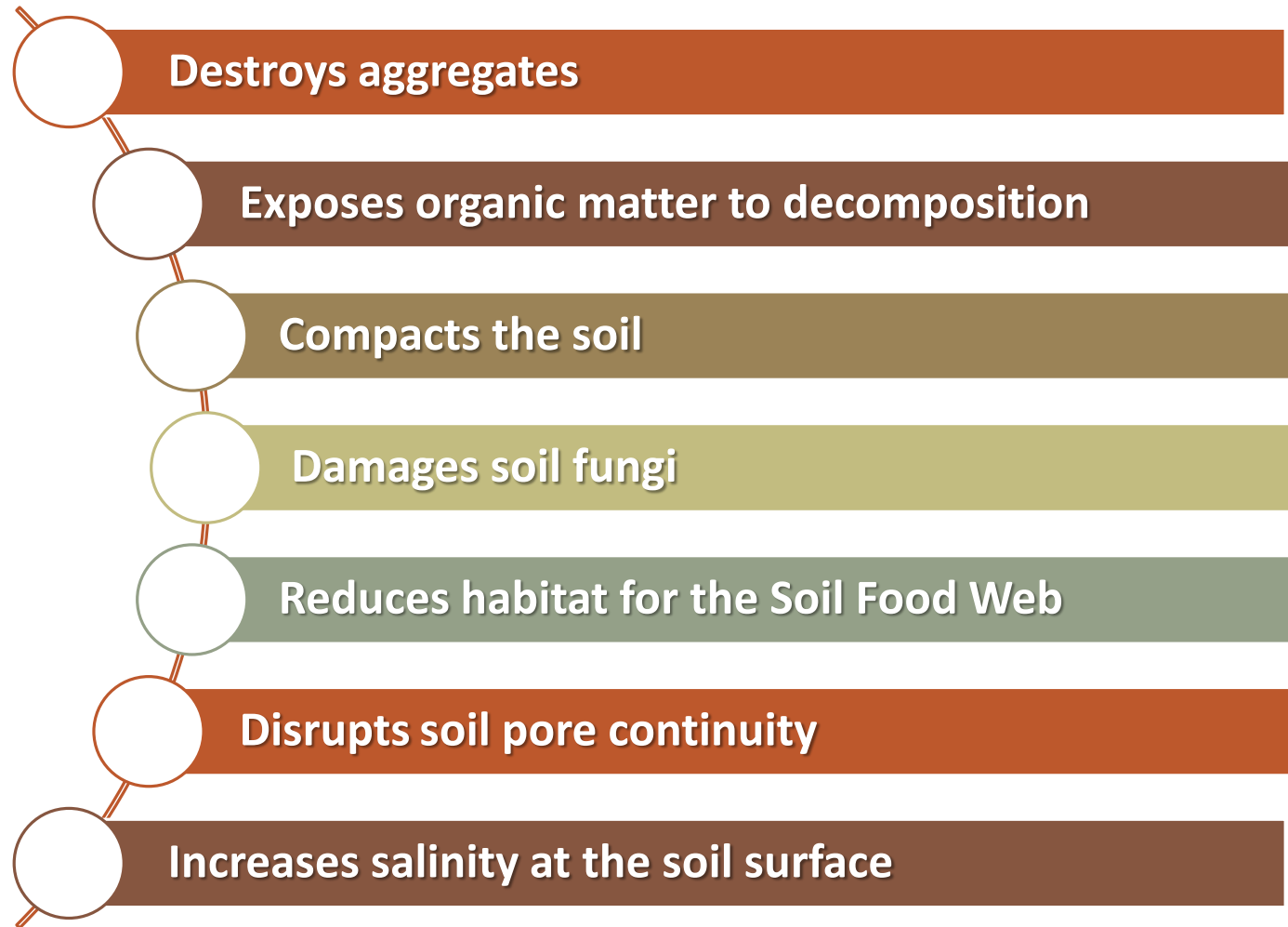
What is Tillage?



The physical manipulation of the soil for the purpose of:

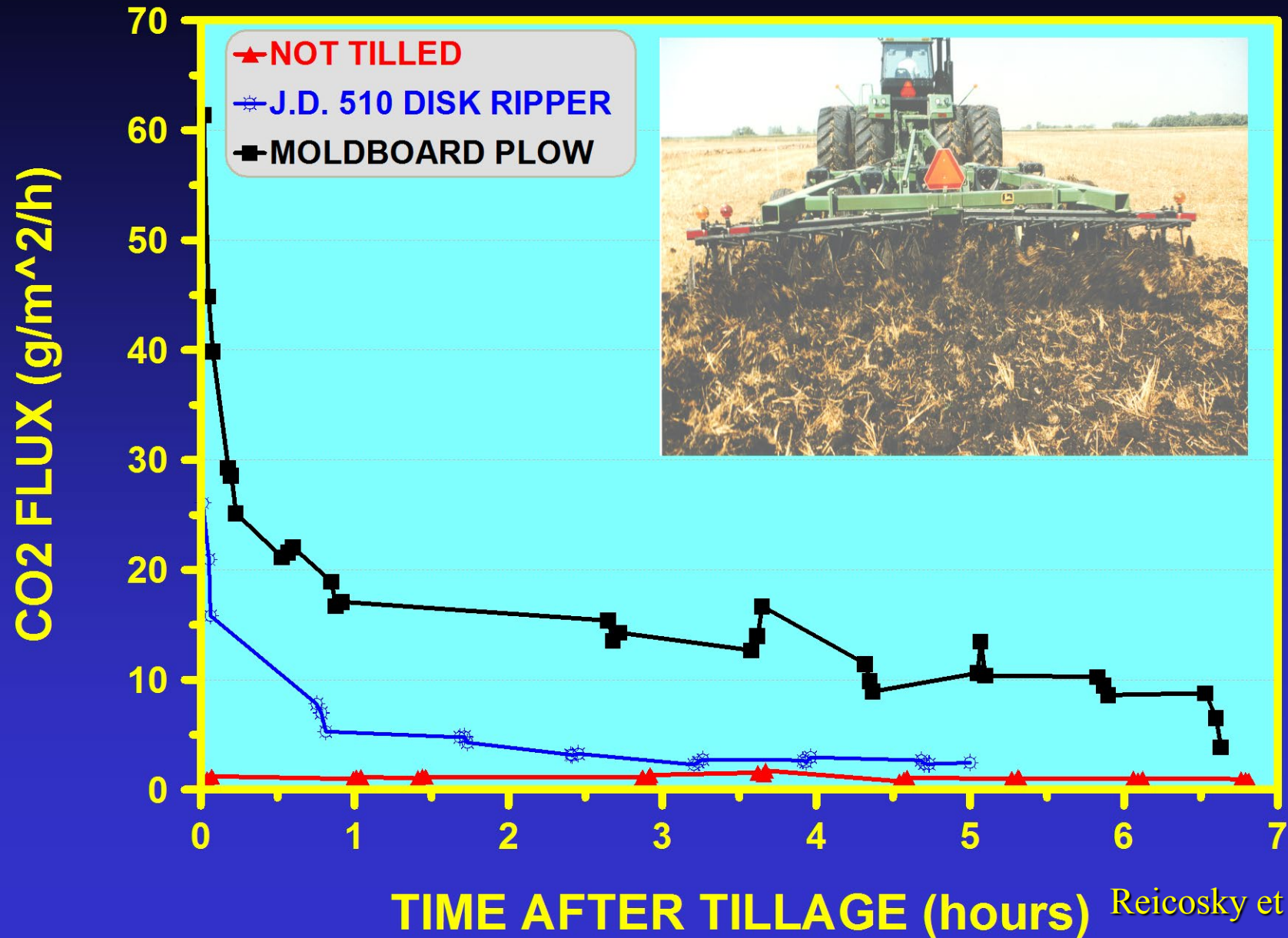
- Management of previous crop residue
- Control of competing vegetation (weeds)
- Incorporation of amendments (fertilizer/manure)
- Preparation of a soil for planting equipment
- Recreation for folks who don't fish or golf.

What Tillage does to the Soil



JOHN DEERE 510 DISK RIPPER CO2 FLUX DATA

SWAN LAKE TILLAGE DEMONSTRATION AUGUST 24, 1994

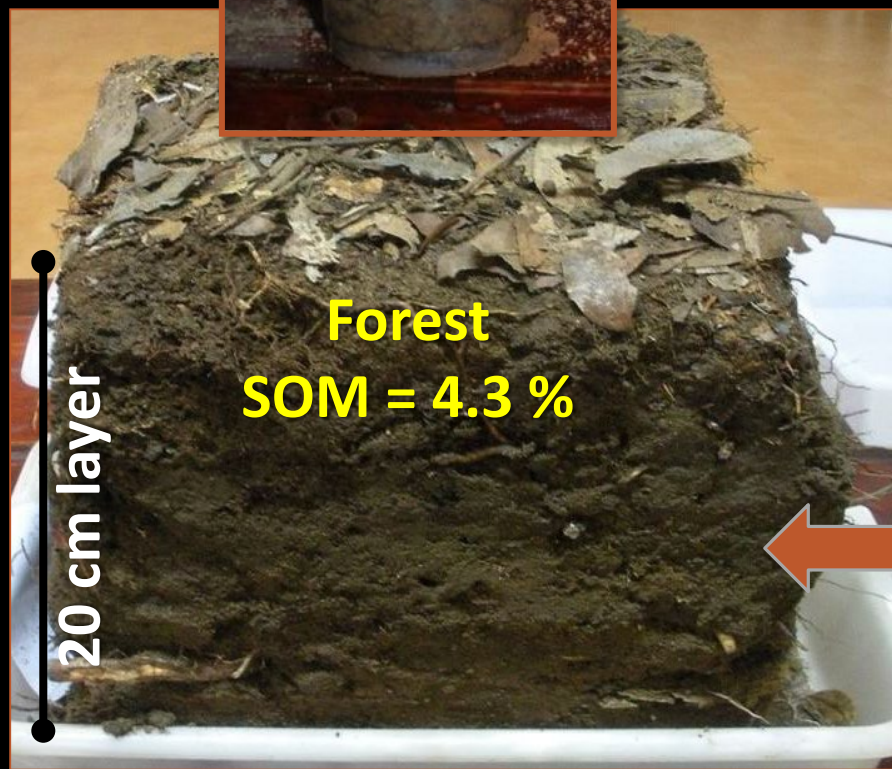


Reicosky et al., 1995

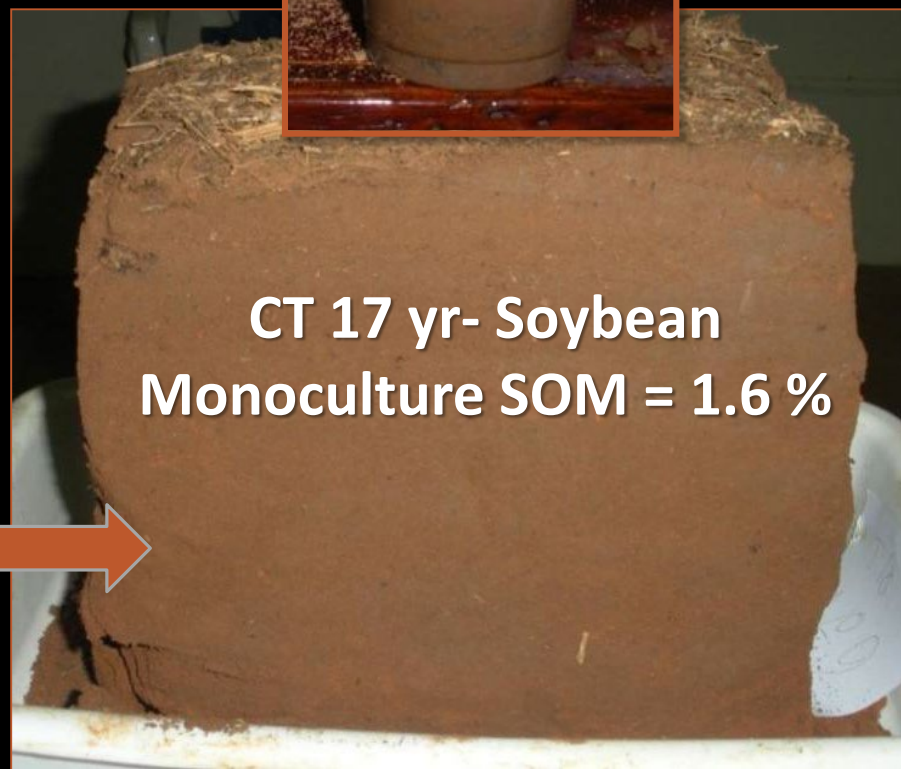
Management Changes Soil Properties & Capacity of Soil to Function



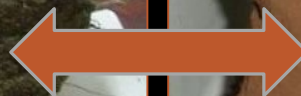
62.8% loss of
SOM after 17 yr
intensive tillage



Forest
SOM = 4.3 %



CT 17 yr- Soybean
Monoculture SOM = 1.6 %



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



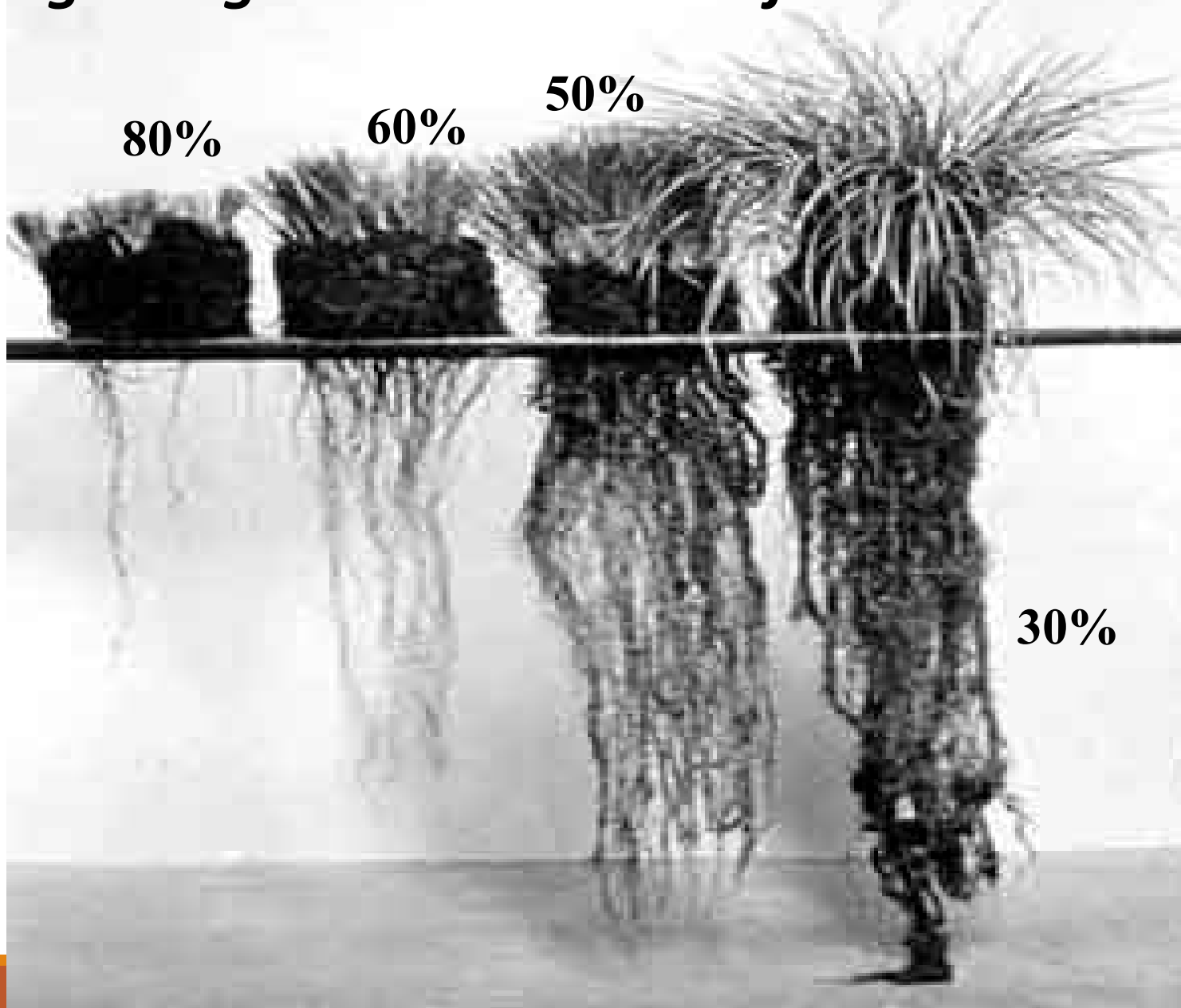
Alternative water sources & controlled access to stream but no control of grazing time on watershed

Soil Health in pasture systems

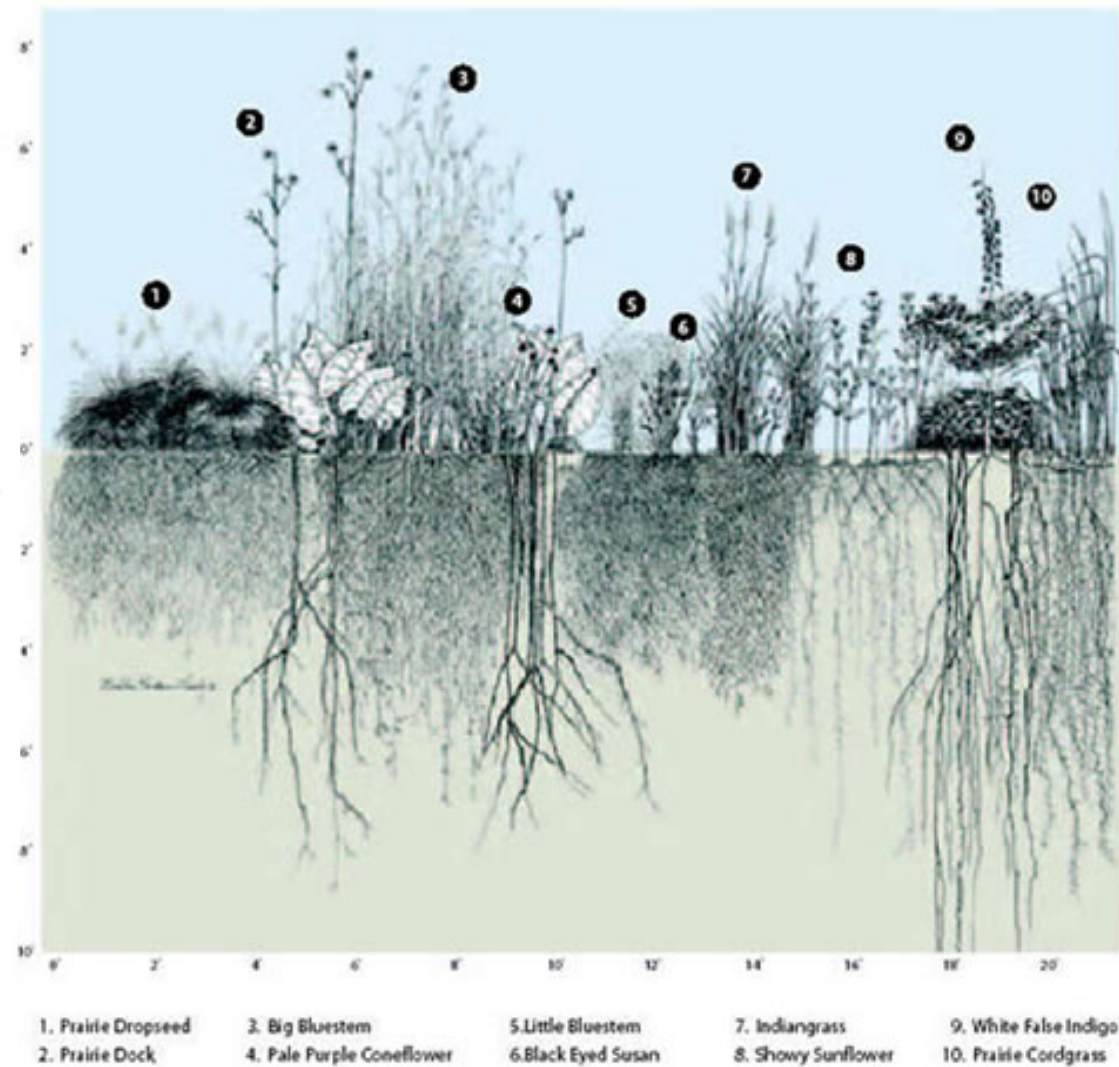
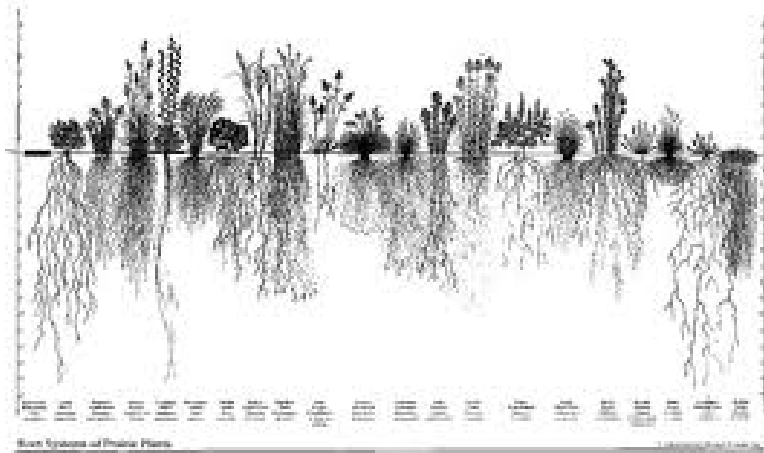




Overgrazing: another source of disturbance



Diversity of roots in nature



**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

