



Soil Health & Restoring Soil Function

Marlon Winger
NRCS – Soil Health
Division

Regional Soil Health Specialist
Idaho, Montana, Wyoming



Growing ag Media Interest

www.FarmProgress.com April 2013

MISSOURI RURALIST

Grainers find new front sources **see Page 5** | Oilseedings make returns to state **see Page 15** | Get the good from your sprayer **see Page 28**

What lies beneath

By LYNNE BETTS

It's not health, but all agree, it's the high soil health. In every early soil health survey in the Midwest, the University of Missouri and Lawrence, Kansas, have been the first to show that the soil is the key to a healthy farm. It's not health, but all agree, it's the high soil health. In every early soil health survey in the Midwest, the University of Missouri and Lawrence, Kansas, have been the first to show that the soil is the key to a healthy farm.

Put the soil first

MAKE GOOD SOIL: Loosely, crumbly soil with strong structure and high organic content (insert) is built most easily using no-till and cover crop. Soil health practitioners often start with no-till or two cover crop species, but gradually to mixes that give more benefits.

Soil health summary profiles of experienced practitioners	Low Stress, North Dakota	Low Stress, North Dakota	Low Stress, North Dakota	Low Stress, North Dakota
Area farmed	1,100	1,400	1,500	1,600
Years in soil health system	10	10	10	10
Primary crops	Grain, wheat, soybeans	Grain, wheat, soybeans, corn, oats, barley, rye	Grain, wheat, soybeans, corn, oats, barley, rye	Grain, wheat, soybeans, corn, oats, barley, rye
Primary cover crops	Grain, wheat, soybeans	Grain, wheat, soybeans, corn, oats, barley, rye	Grain, wheat, soybeans, corn, oats, barley, rye	Grain, wheat, soybeans, corn, oats, barley, rye
Totals	1,100	1,400	1,500	1,600

70 www.FarmProgress.com February 2013 The Farmer

Conservation

Steps to build healthy soils

BY LYNNE BETTS

Do you feel like your soils are healthy? Or, put another way, are they performing up to their potential? Experts and farmers who've put soil health at the center of their radar screens over the past five to 10 years would guess your answer wouldn't automatically be a "yes."

Key Points

- Healthy soils are full of life and high in organic matter.
- Reducing tillage is the first step in building soil health.
- Another soil can mean that fewer crop inputs will be needed.

They say to be healthy your soils should be full of life, high in organic matter, well-structured and covered all the time. "Any farmer can tell you his or her farm is the best soil on the farm," says Jim Hoopes, an assistant professor and Ohio State University Extension educator. "The organic matter there, where the soil was built naturally, may be 5% to 6% or higher."

VALUE IN THE MIX: One of the keys to healthy soil is the mix of cover crops.

SPECIAL ISSUE: BUILDING BETTER SOILS

THE FURROW

SOIL TEST QUEST

COVER CROP MAGIC / BIO-BOOSTERS

www.FarmProgress.com JANUARY 2013

Crops

Mixes maximize cover crop benefits

BY LYNNE BETTS

COVER CROPS — actually, several cover crops — mean farmers who want to build healthy soils because cover crops are the key to a healthy farm. It's not health, but all agree, it's the high soil health. In every early soil health survey in the Midwest, the University of Missouri and Lawrence, Kansas, have been the first to show that the soil is the key to a healthy farm.

www.FarmProgress.com February 2013

NATURAL RESOURCE MANAGEMENT

Emulate nature to build organic matter

BY LYNNE BETTS

It's not health, but all agree, it's the high soil health. In every early soil health survey in the Midwest, the University of Missouri and Lawrence, Kansas, have been the first to show that the soil is the key to a healthy farm.

May 14, 2013

Home | Tools | Events | Blogs | Discussions

News Weather Markets Crops Livestock Business

Print Email Share Republish

Manage Soil Microorganisms for Healthier Soil

APRIL 27, 2013
By: Darrell Smith, Farm Journal Conservation and Machinery Editor

SOIL HEALTH

Manage soil microorganisms to pave the way to healthier soil and higher yields. You till (or don't till), manage drainage and apply lime or fertilizer to grow higher yielding crops. But that's the result, not the motivation. The reason you take those steps is to make your soil healthier by improving the habitat for microorganisms. You want those soil-dwelling creatures to be plentiful and active, decomposing residue and recycling its nutrients into forms your crops can use.

RELATED STORIES

- Soil Air and Water Unite

NRCS Soil Health Campaign

soil health THEATER

Watch Our Videos

dig a little LEARN A LOT

Learning Resources

GROW! with it

Learn From Growers

MEDIA get the DIRT on it

News Media Resources

GROWING & SHARING

Partner Resources

BIOLOGY & BEYOND

Soil Health Science

Unlock the Secrets in the Soil

Sign up for e-mail updates on Soil Health Awareness

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

BEHOLD OUR LIVING SOIL

please vote today!

Explore the Science of Soil Health

Profiles in Soil Health

Under Cover Farmers of Stanley County, NE

My, how our crops like to be under cover.

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

unlock the SECRETS the SOIL

unlock

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

unlock the SECRETS the SOIL

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)

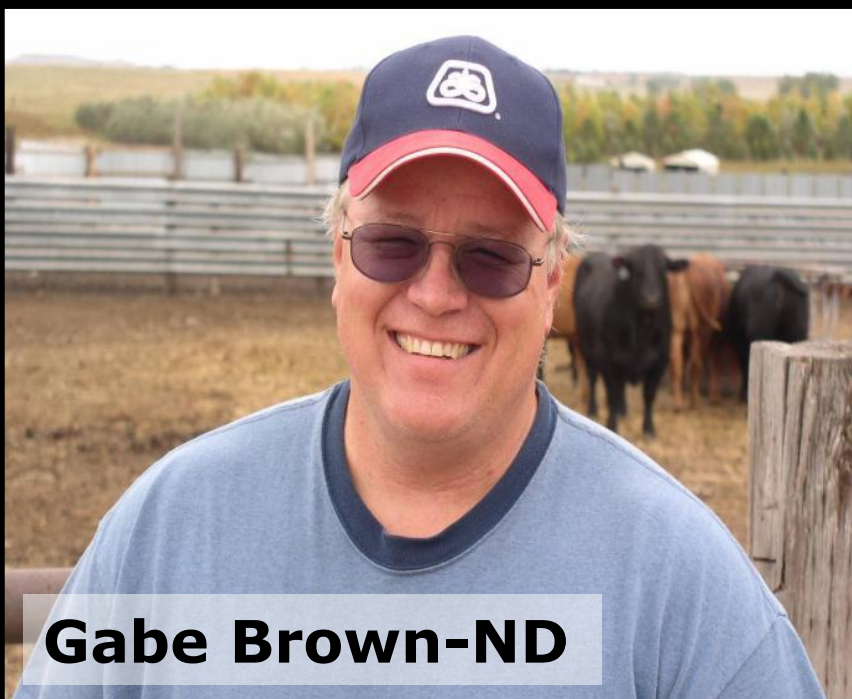
Soil is a Living Factory

Macroscopic and microscopic organisms

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

Management activities improve or degrade soil health

- Tillage
- Fertilizer
- Pesticides
- Grazing
- Plant Diversity



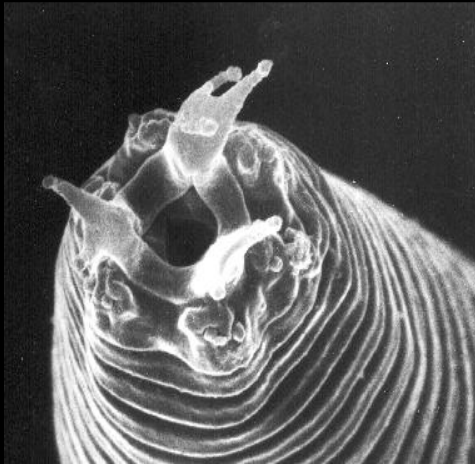


Ecology:

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

Interconnectedness

Soil Surface

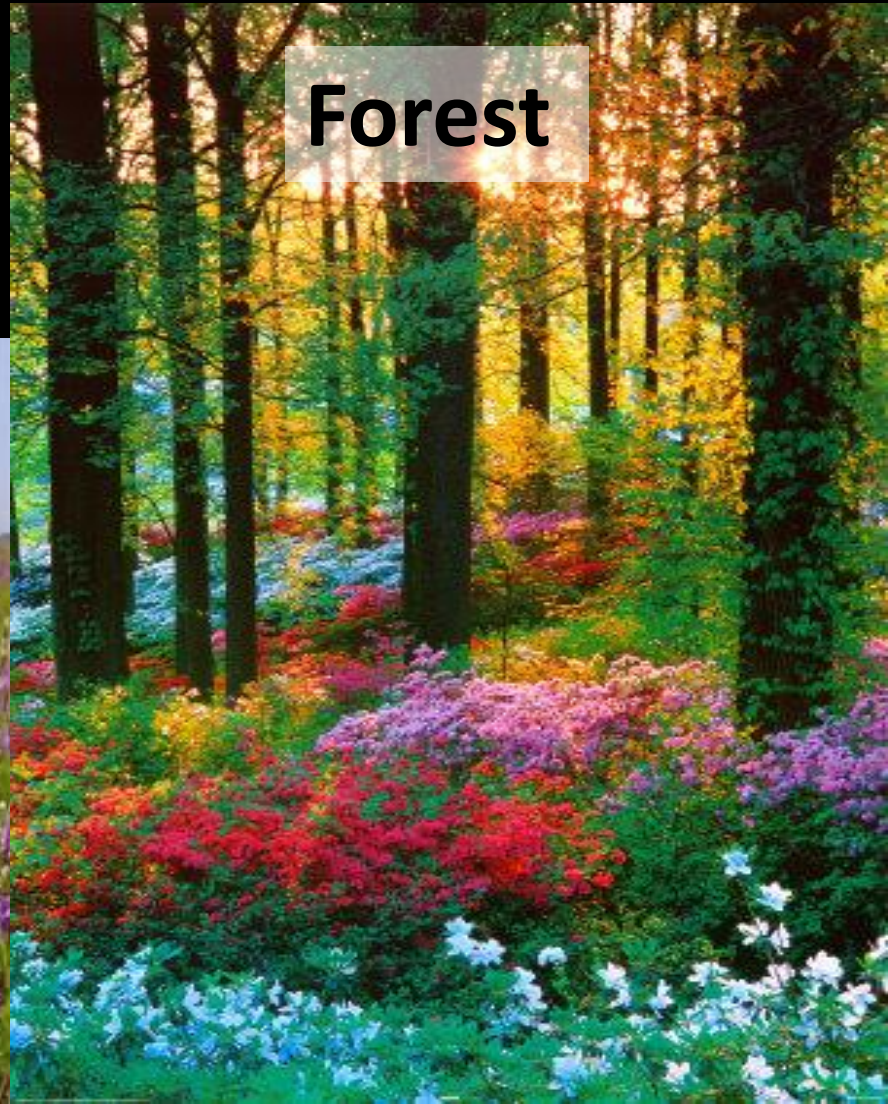


How do these Ecosystem Flourish Without Human Inputs?

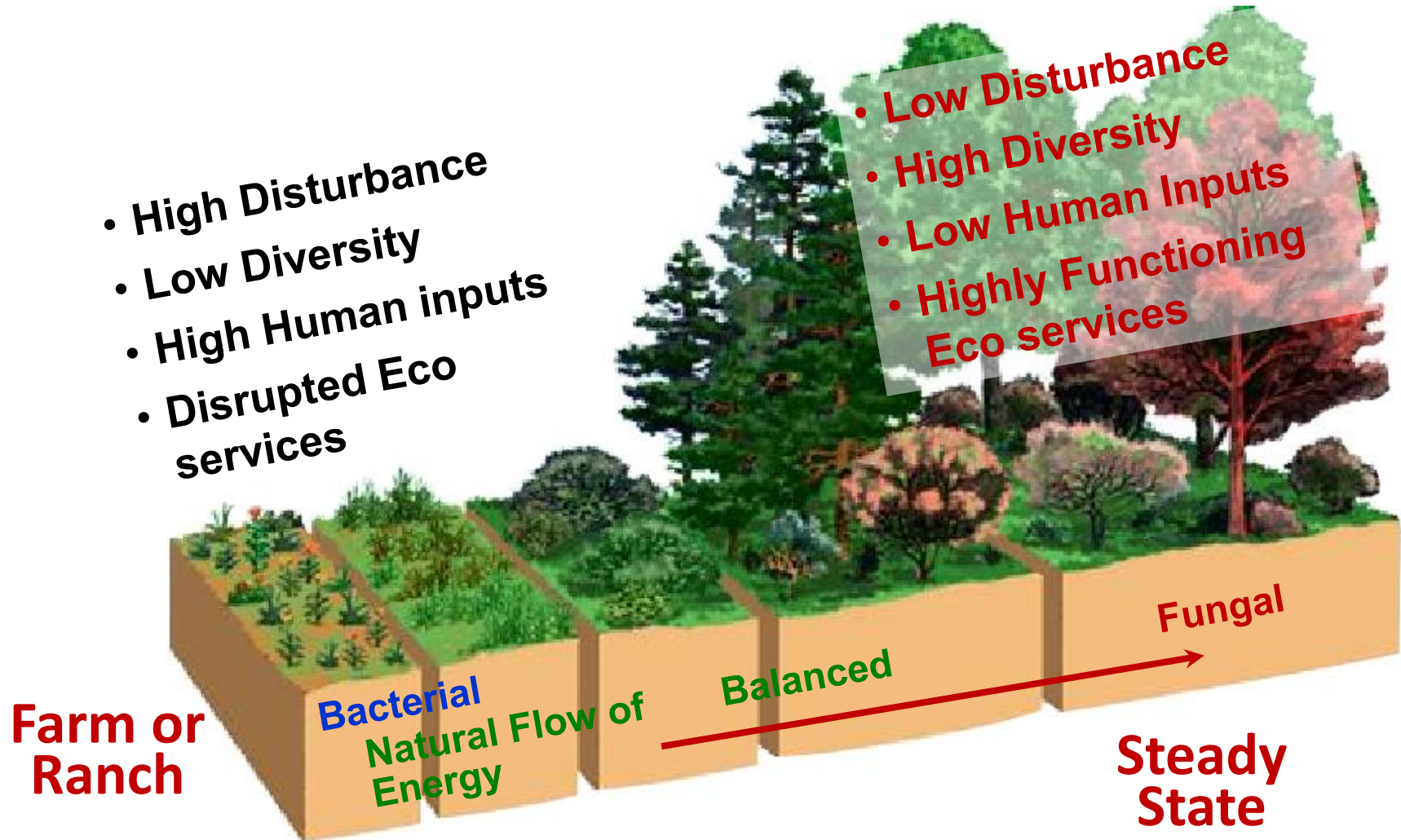
Prairie



Forest



Characteristics of a Stable Ecosystem





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

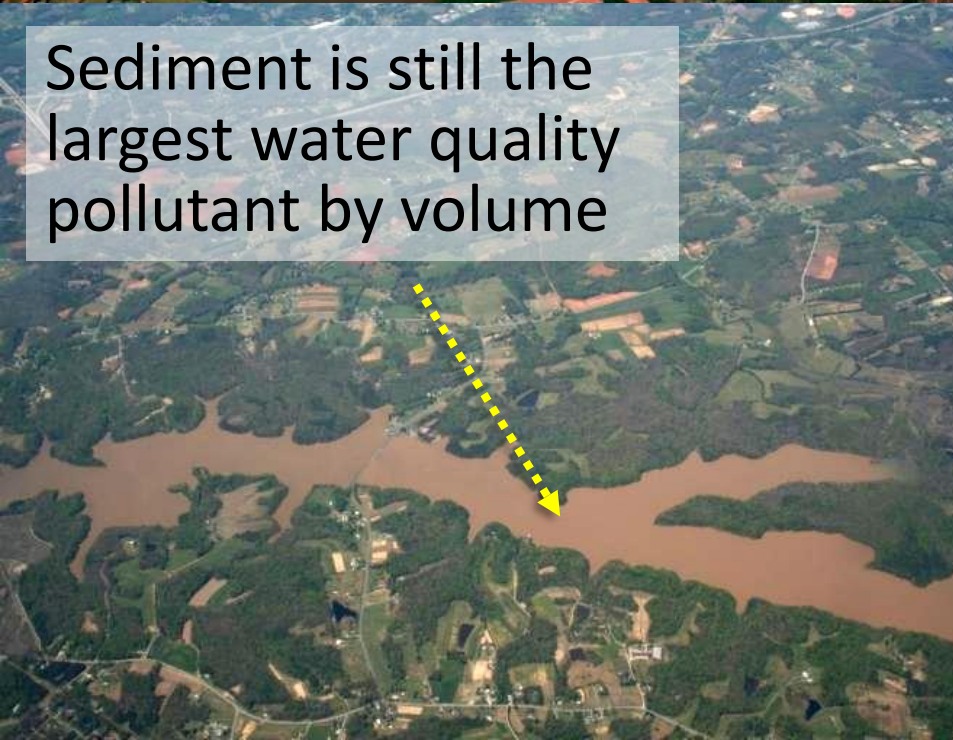
Erosion from bare fields into river



Oklahoma, October 2012, I-35



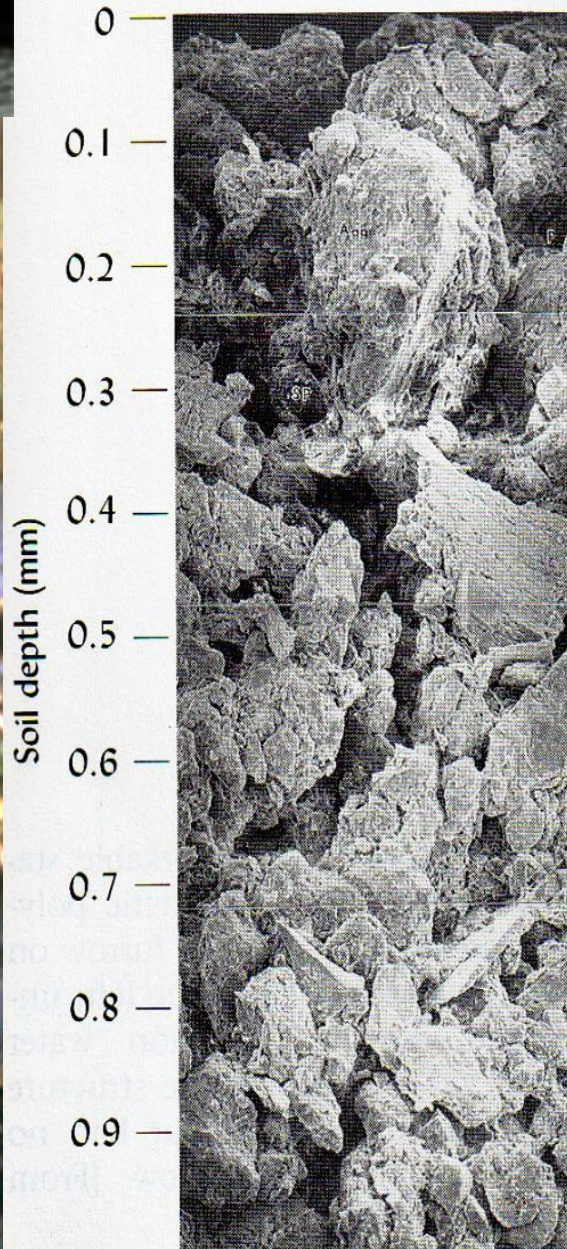
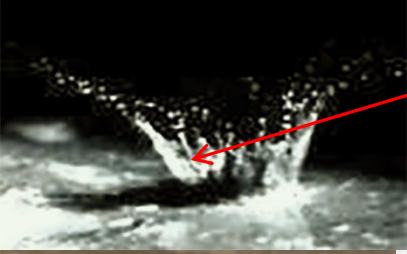
Sediment is still the largest water quality pollutant by volume



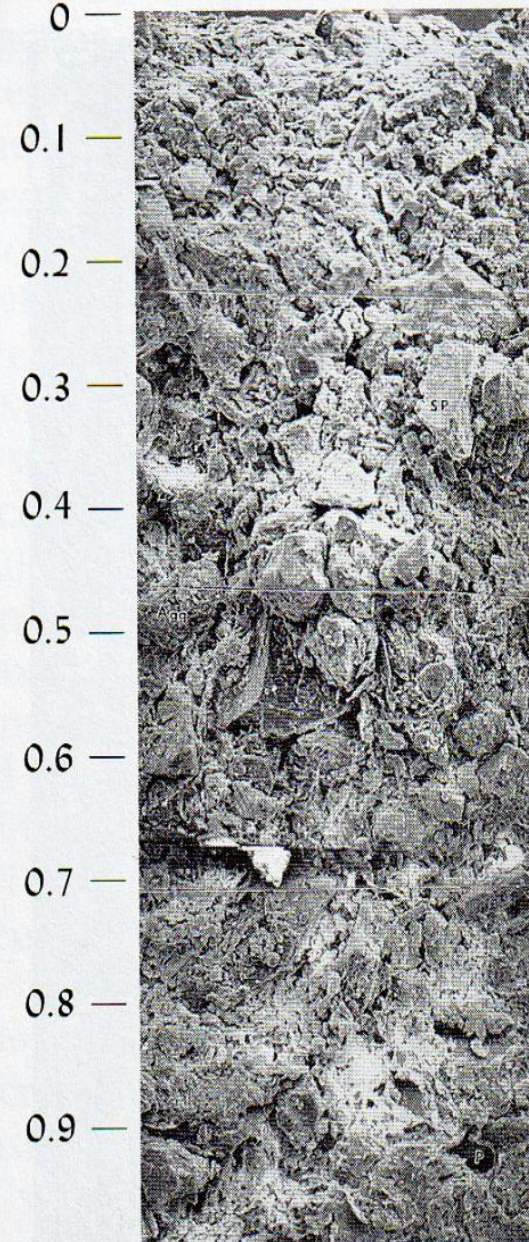
Lubbock, Texas Oct. 17, 2011



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



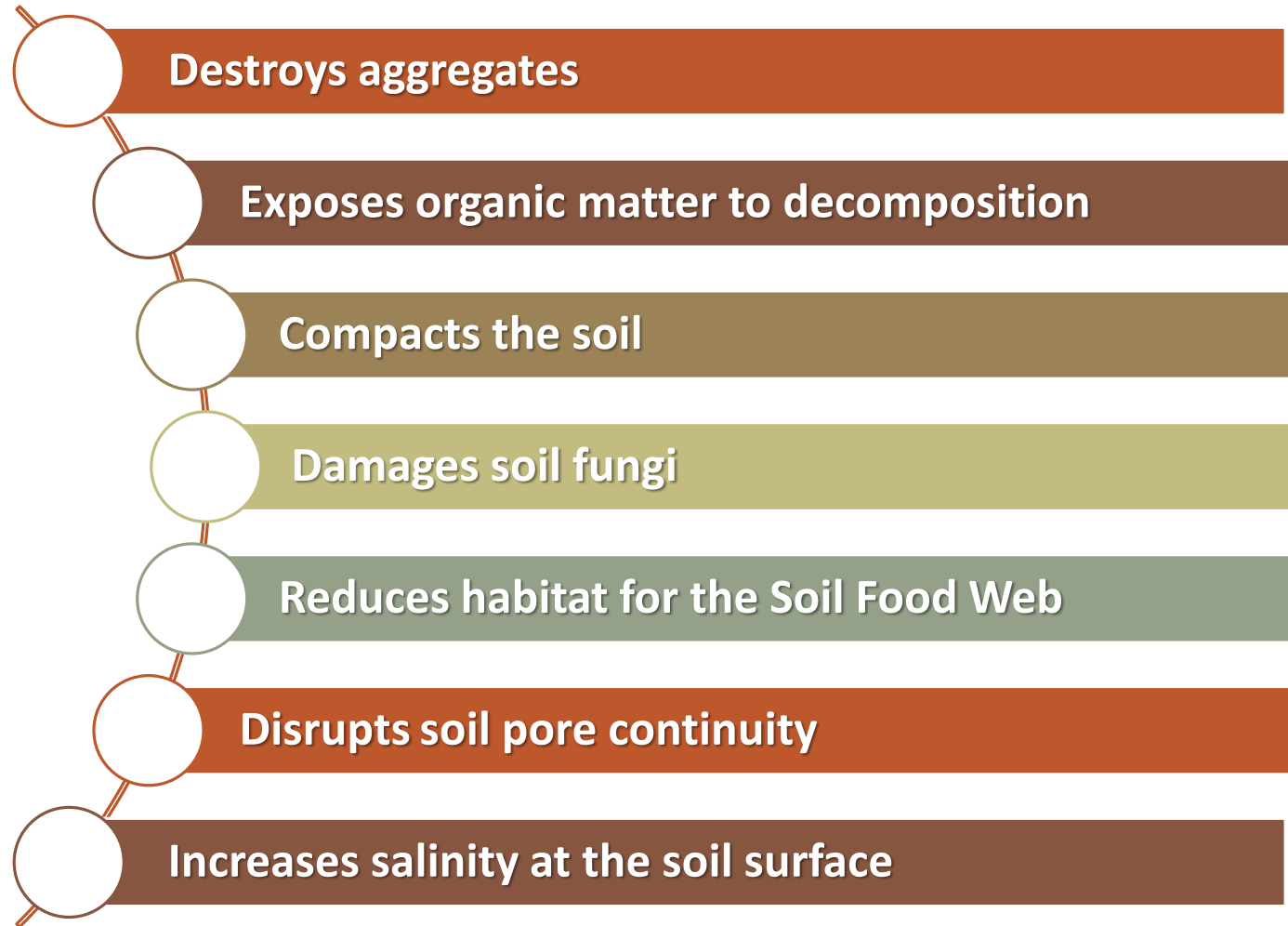
What is Tillage?



The physical manipulation of the soil for the purpose of:

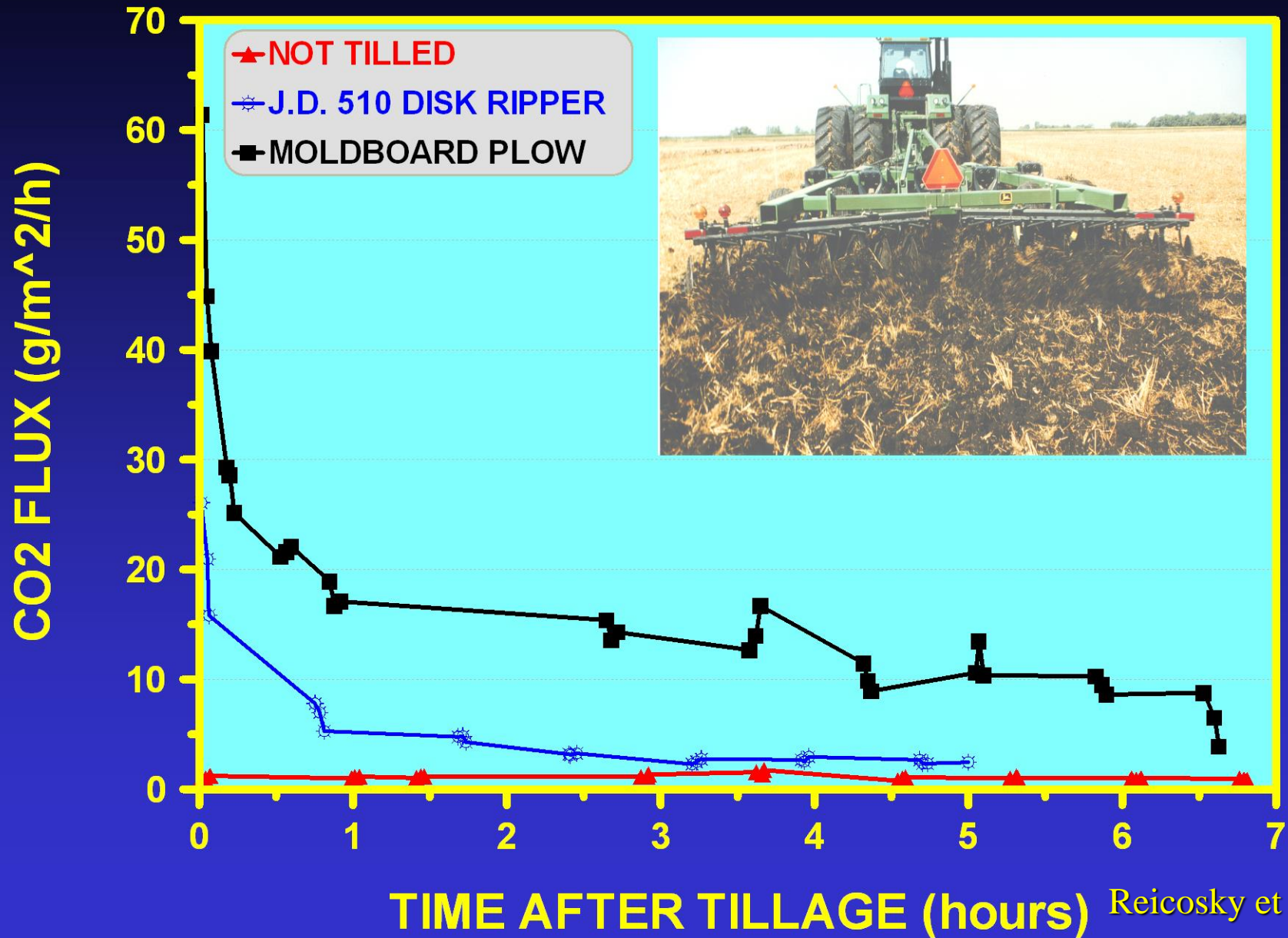
- Management of previous crop residue
- Control of competing vegetation (weeds)
- Incorporation of amendments (fertilizer/manure)
- Preparation of a soil for planting equipment
- Recreation for folks who don't fish or golf.

What Tillage does to the Soil



JOHN DEERE 510 DISK RIPPER CO2 FLUX DATA

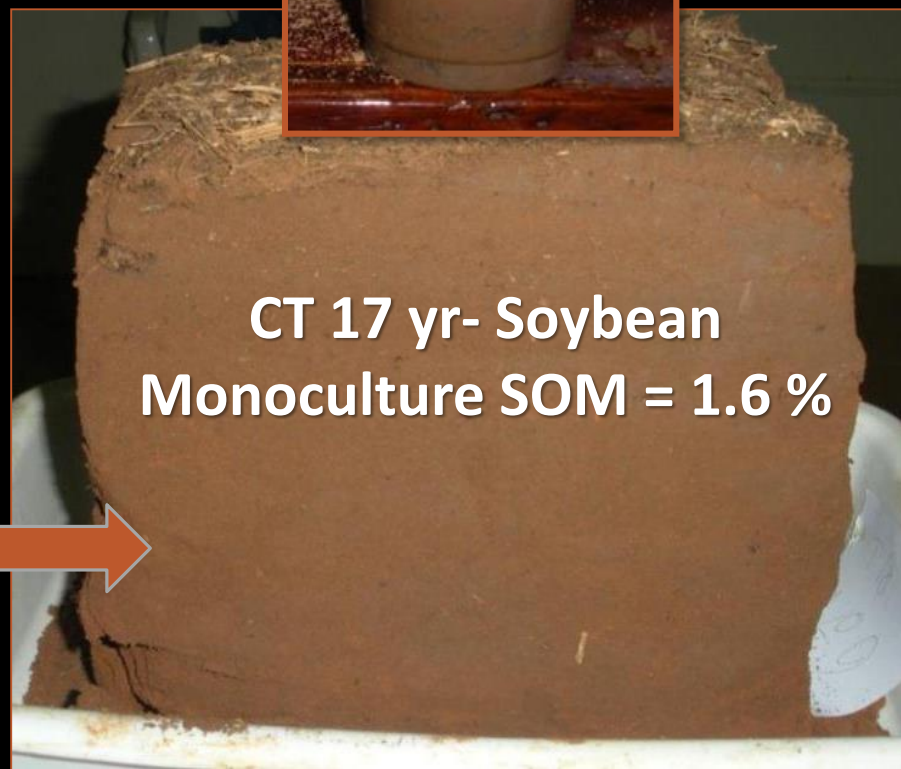
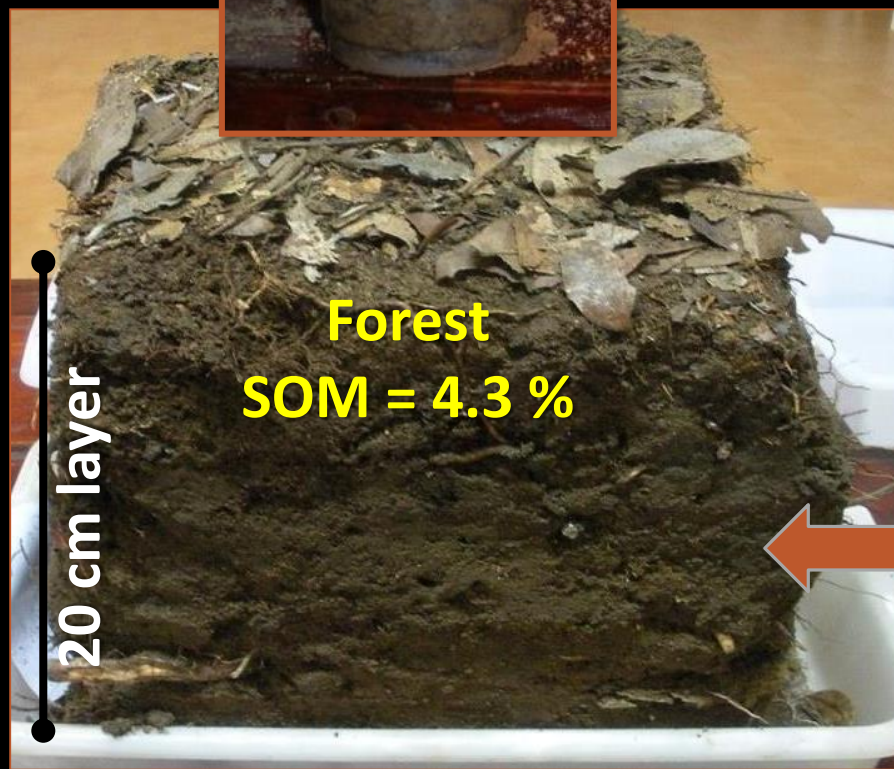
SWAN LAKE TILLAGE DEMONSTRATION AUGUST 24, 1994



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

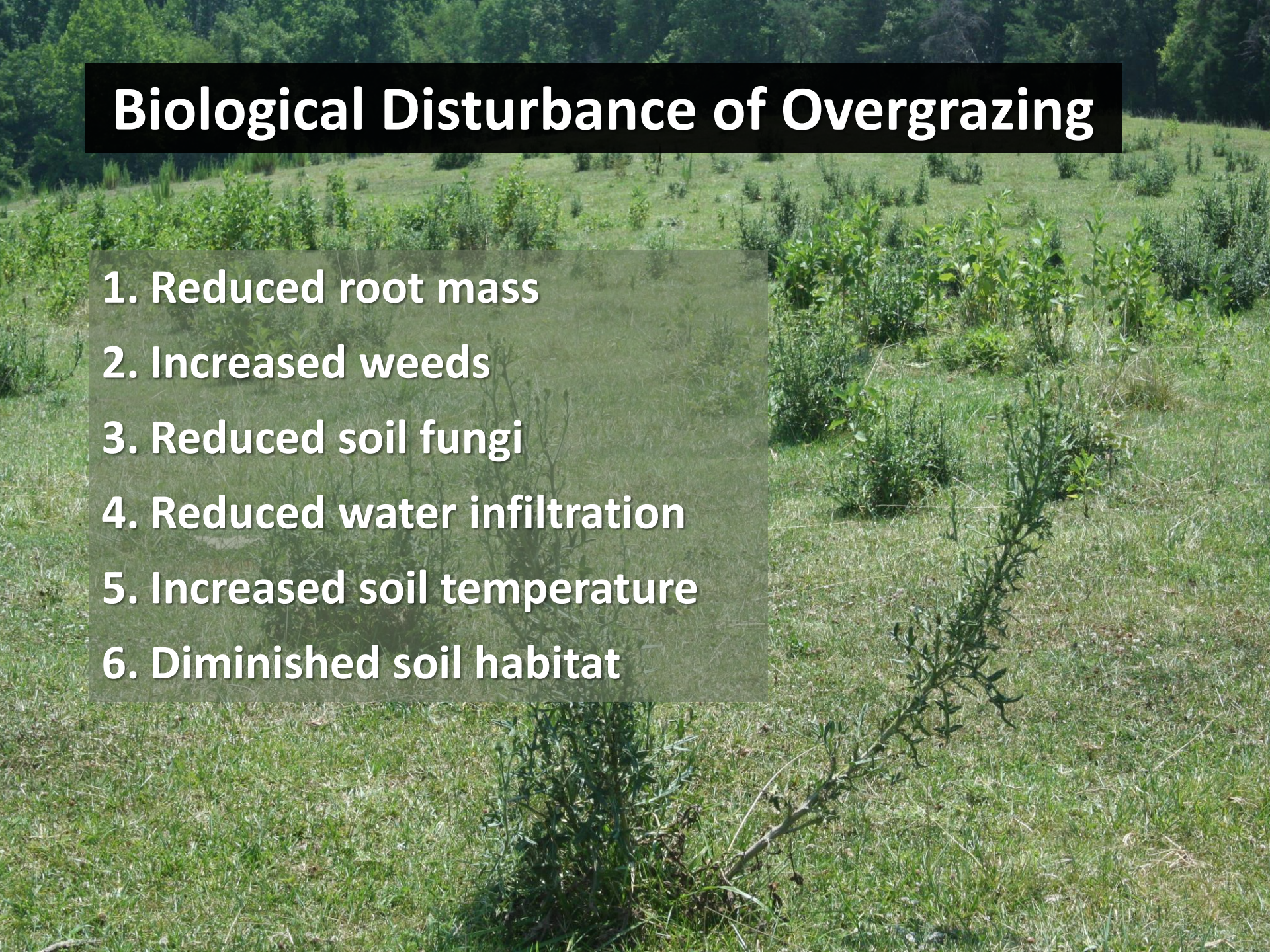


- **Overgrazing**

- 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



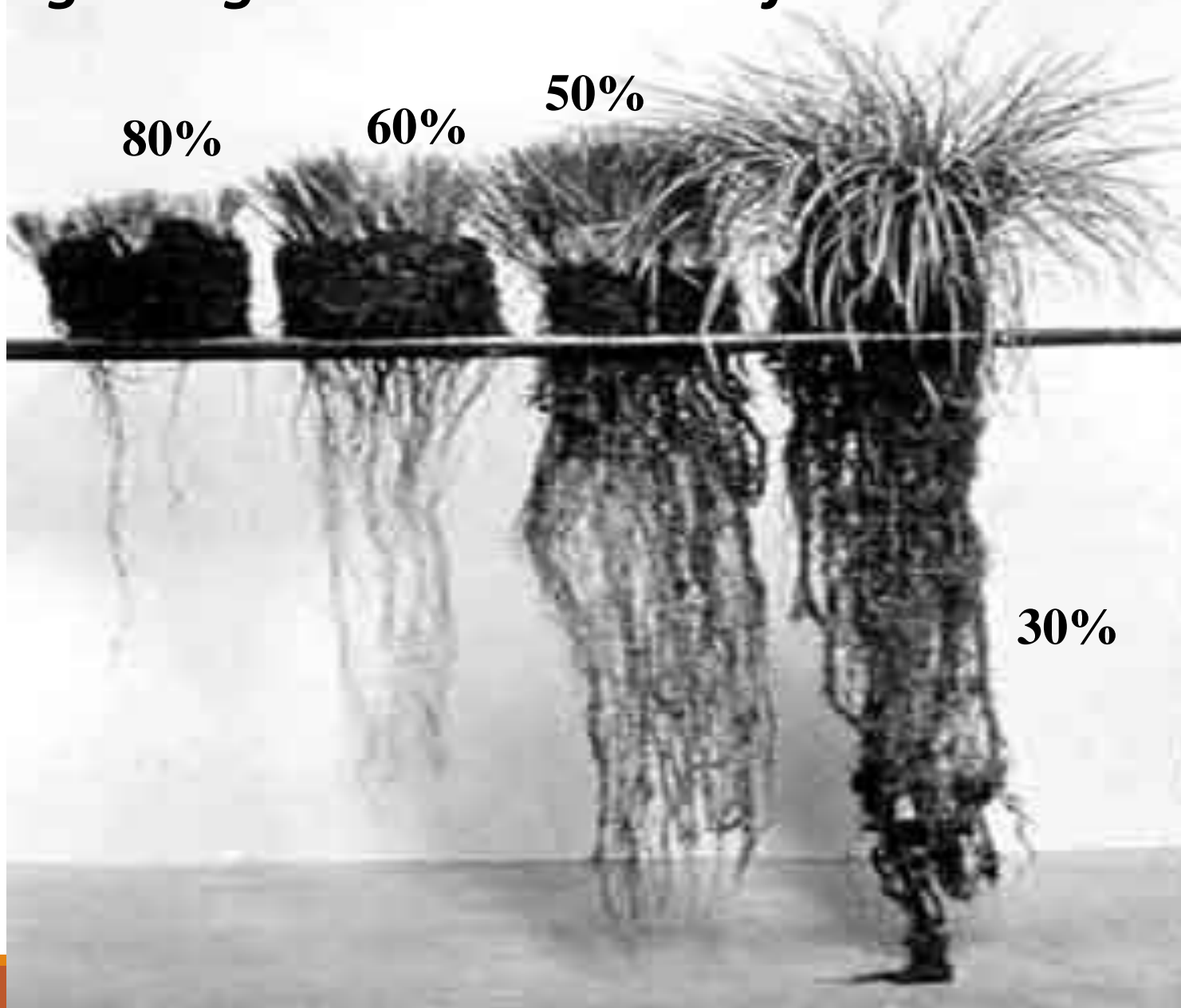


Alternative water sources & controlled access to stream but no control of grazing time on watershed

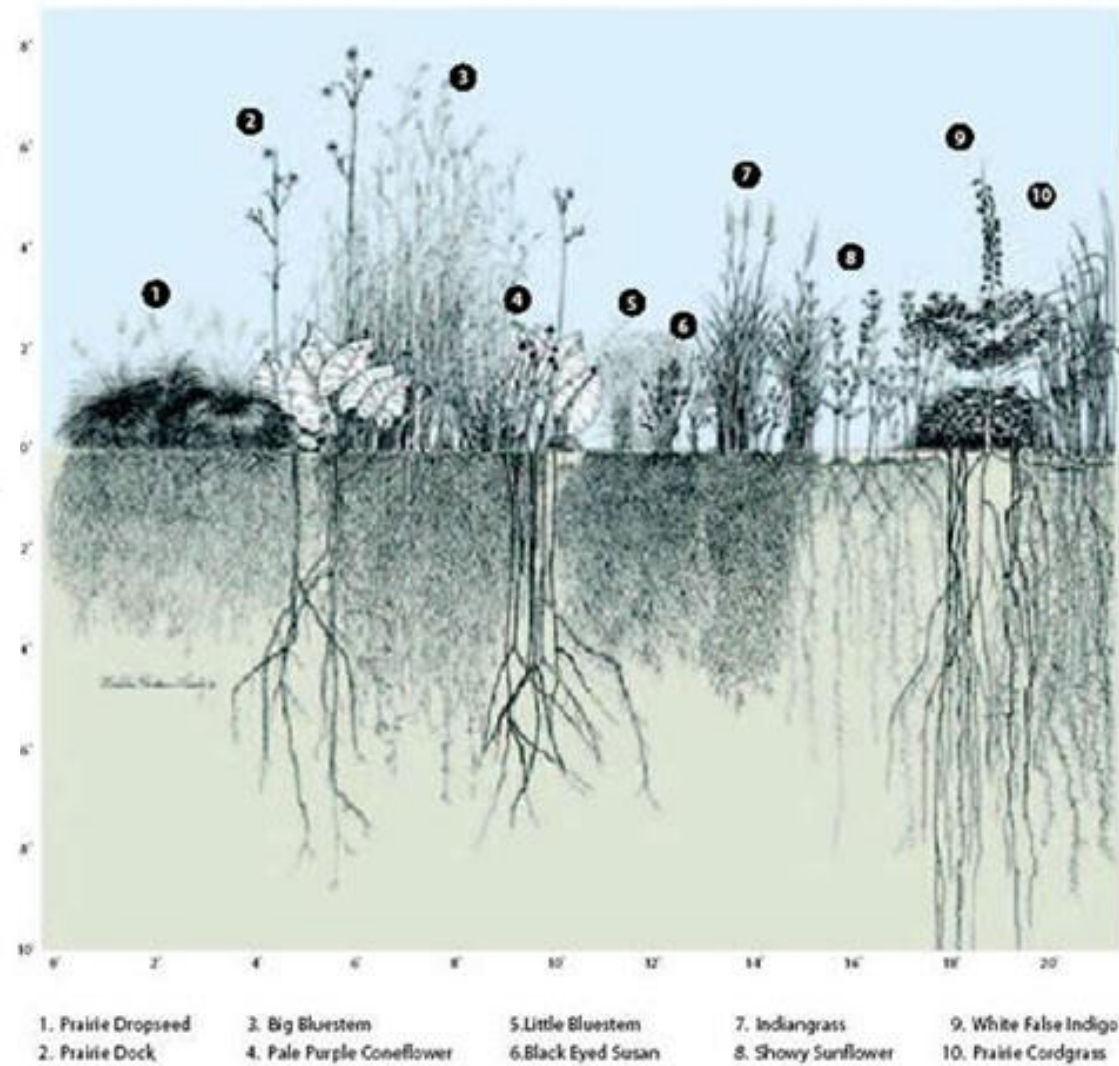
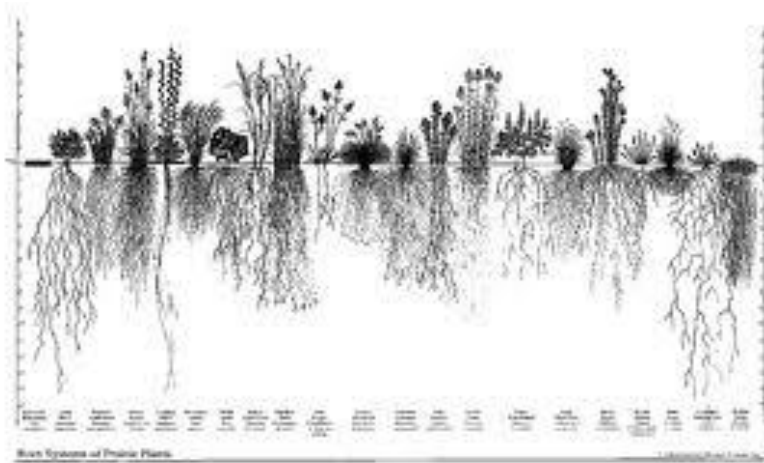
Soil Health in pasture systems



Overgrazing: another source of disturbance



Diversity of roots in nature



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



Impact of Fertilizer on Soil Health

The background of the slide is a photograph of a rural landscape. In the foreground, there is a field of bright yellow flowers, likely rapeseed. In the middle ground, a green tractor is visible, partially obscured by the flowers. The background shows a line of trees under a pale, overcast sky.

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

