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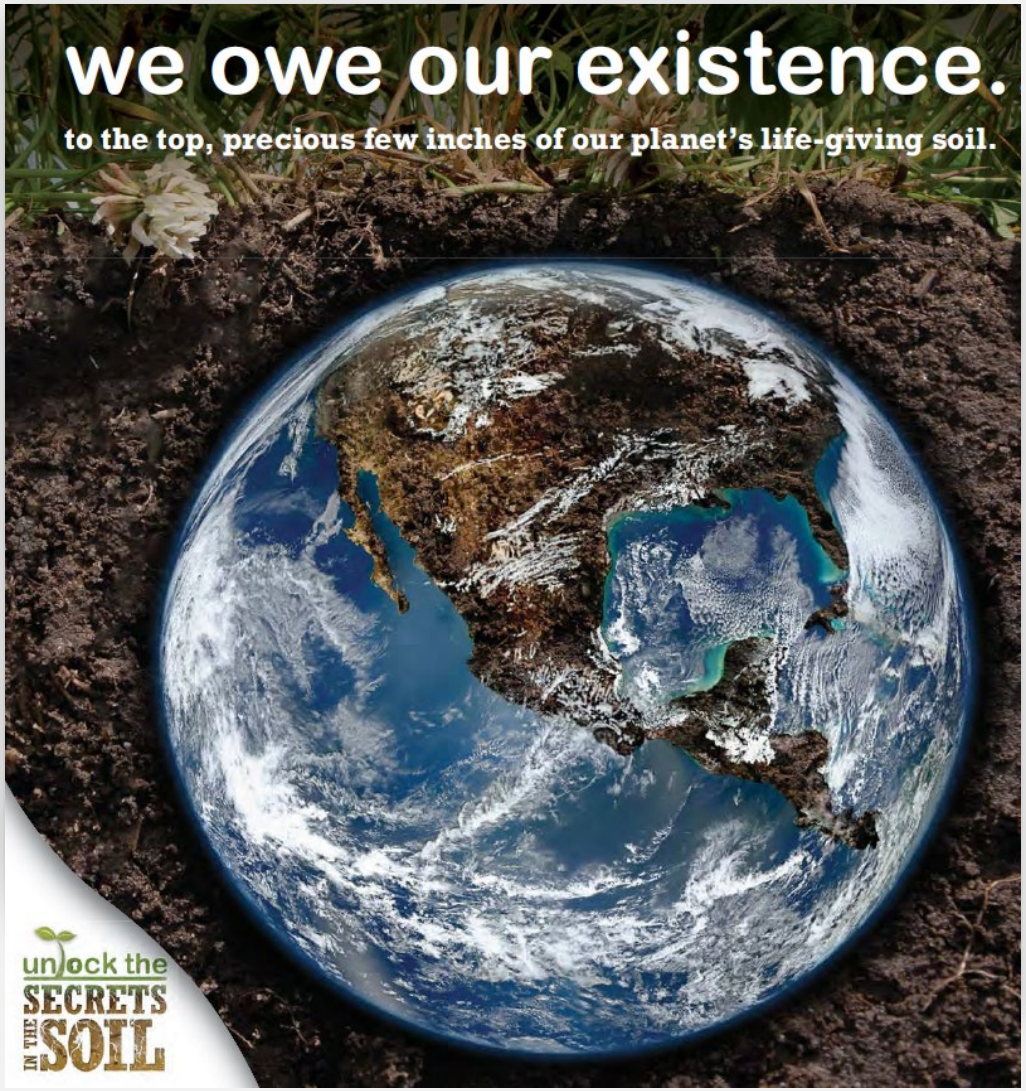

Introduction to Soil Health

Module 1

Kristin Brennan
MN NRCS
State Soil Health Specialist

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Polling Question

What does SOIL HEALTH mean to you?

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How does NRCS Define Soil Health?

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

What is Soil Quality?

SOIL QUALITY

- Soil quality is the capacity of soils within landscapes to sustain biological productivity, maintain environmental quality, and promote plant and animal health.
- *Protecting soil quality like protecting air quality and water quality should be fundamental goal of our Nation's Environmental Policy*

Poor Good

http://www.nrsl.umd.edu/research/NRSLResearchAreaInfo.cfm?ID=14

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SOIL HEALTH

Cornell researcher George Abawi describes soil health strategies at an Onion Council field day in Wayne County, N.Y.Photo by Carol R. MacNeil.

- Soil Health is the
  Soil Quality over t
  human use and
  management or t
  events.
- Descriptive terms
  Health
  - *Organic Matt*
  - *Crop appeara*
    green, health
  - *erosion – Soi*
    erode
  - *earthworms*
    numerous
  - *infiltration – fast, no ponding*
  - *Compaction - minimal*

> A soil may have poor inherent soil quality but still have good soil health.
>
> - Gregorich and Carter, 1997

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Polling Question

What are desirable functions of agricultural soils?

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- ✓ Anchor plant roots
- ✓ Produce food, feed, fiber, biofuels, and medicine
- ✓ Capture, filter, store water and make it available to plant roots
- ✓ Provide air to plant roots
- ✓ Cycle and furnish nutrients for plant growth
- ✓ Protect plants from pathogens and stress
- ✓ Detoxify pollutants
- ✓ Store and cycle Carbon
- ✓ Moderate release of gases
- ✓ Release water with low levels of nutrients
- ✓ Resist erosive forces
- ✓ Be resilient to drought, flood, and temperature extremes

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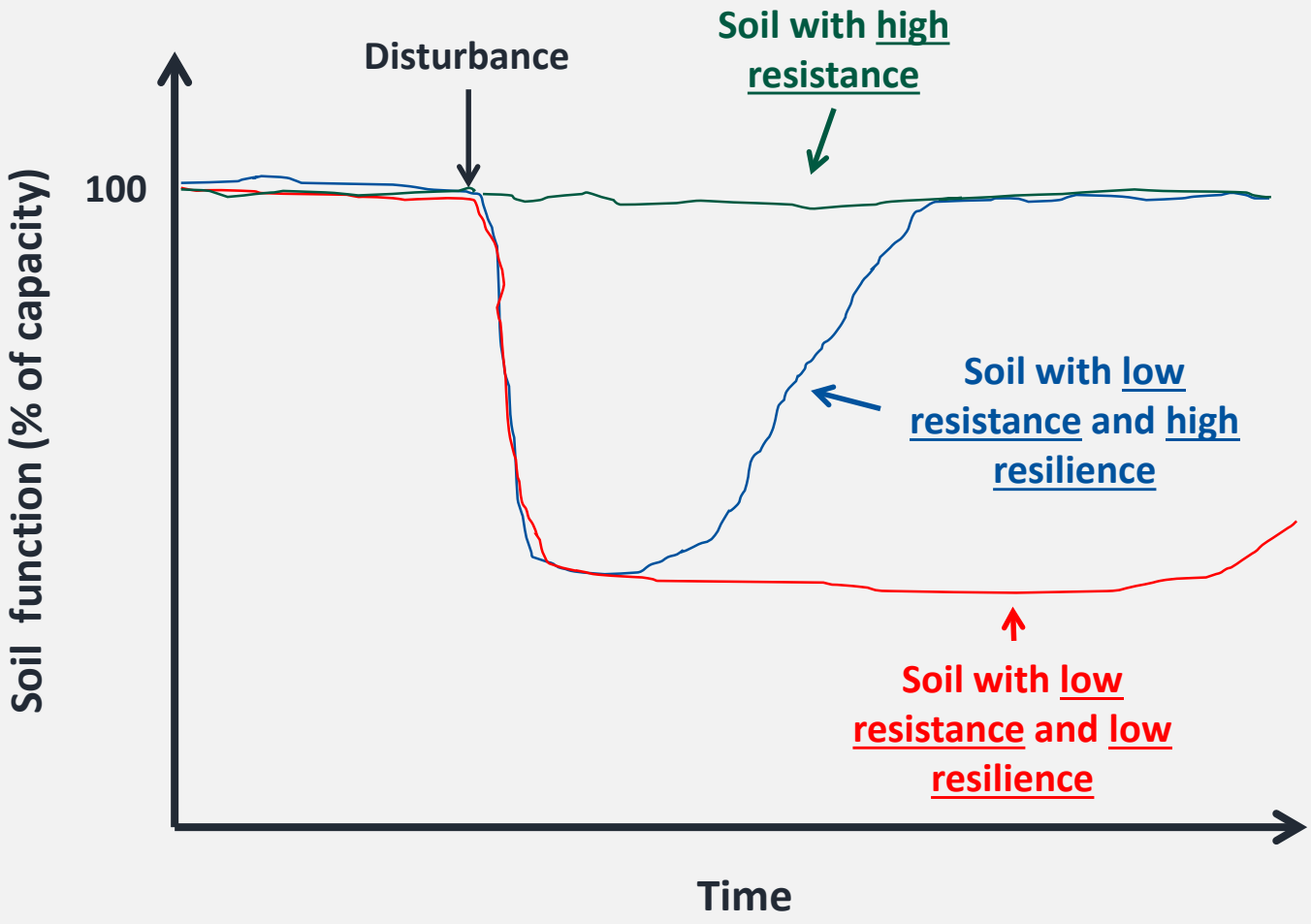
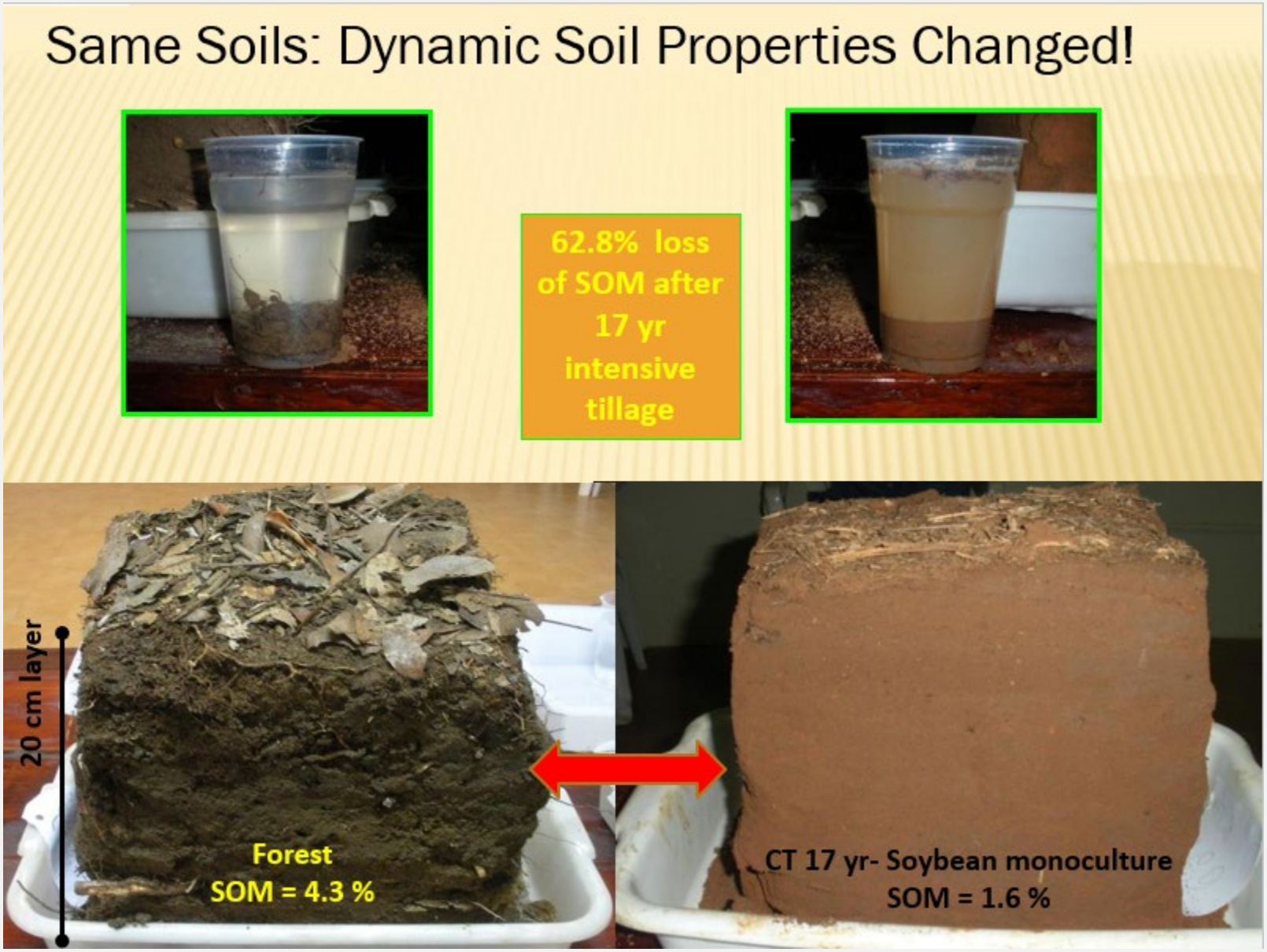
Soil Health and Function



Adapted from Brady & Weil, 2008

Management impacts function



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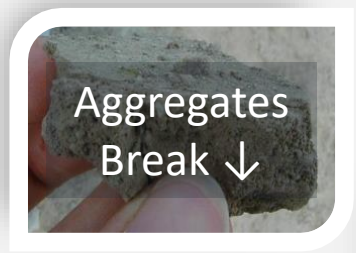
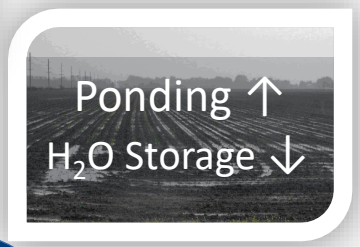
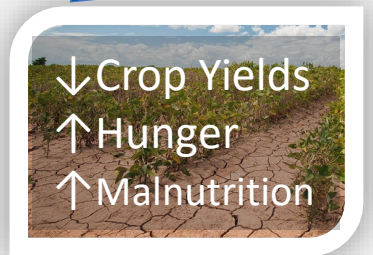
Downward Spiral of Soil Degradation







Adapted from Building Soils for Better Crops, 3rd ed.

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Characteristics of Loss of Soil Function

Photo credits: Case International; all others USDA


USDA-NRCS


Springfield, Illinois – May 17, 2017
Photo: Justin L. Fowler/The State Journal-Register


USDA-NRCS


Manchester, Iowa – May 15, 2017
Photo: Kevin McCusker

Texas SNIRT in our MN Snow!

Updraft®

MPR News Weather and its underlying science

The Tex-Mex blizzard: Snirty snow, hundreds of power lines down

Paul Huttner April 11, 2019, 1:56 PM 0 Comments

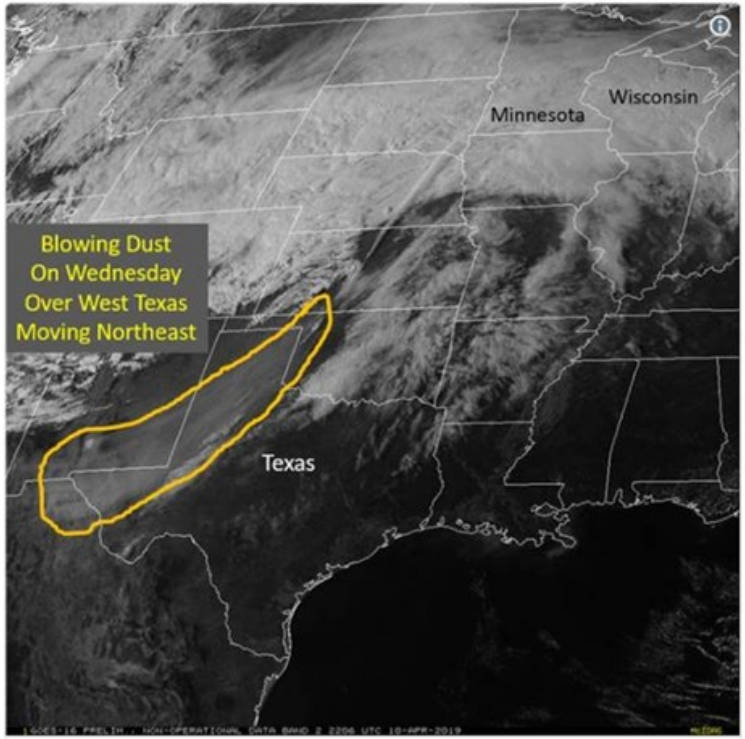
Just when I thought I'd seen everything Minnesota weather can deliver.

Our latest Minnesota April blizzard is producing Texas-sized impacts. We saw the usual heavy snow, sleet, wind, thunder and lightning. But many Minnesotans also woke to a layer of brownish-yellow dust covering our usually pristine white snow.

Todd Shea
@luvipas

Everyone's talking about the dirty snow from dust in the air. Have to admit, there is a brown layer of something in there...

The dust injection blew into Minnesota from west Texas and northern Mexico. National Oceanic and Atmospheric Administration satellites tracked the dust plume, some of which traveled as far as 1,000 miles.



NWS Twin Cities
@NWSTwinCities

Have you noticed a tan or orange tint to the snow this morning? If so, the color is likely due to dust that was blown by high winds all the way from west Texas. Here's a satellite image from yesterday showing the blowing dust in west Texas heading NE.

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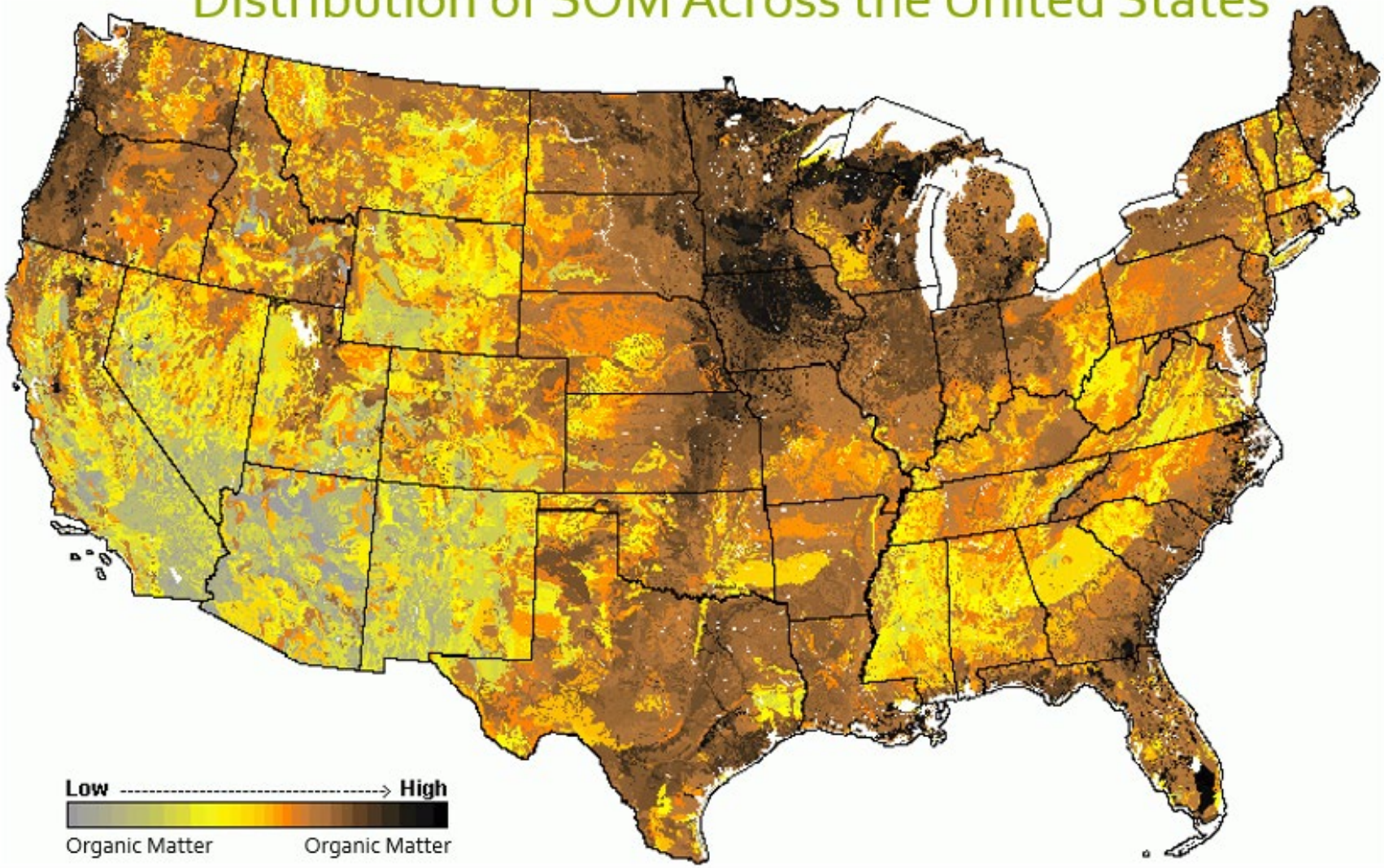
Distribution of SOM Across the United States



Hargrove and Luxmore (1988)

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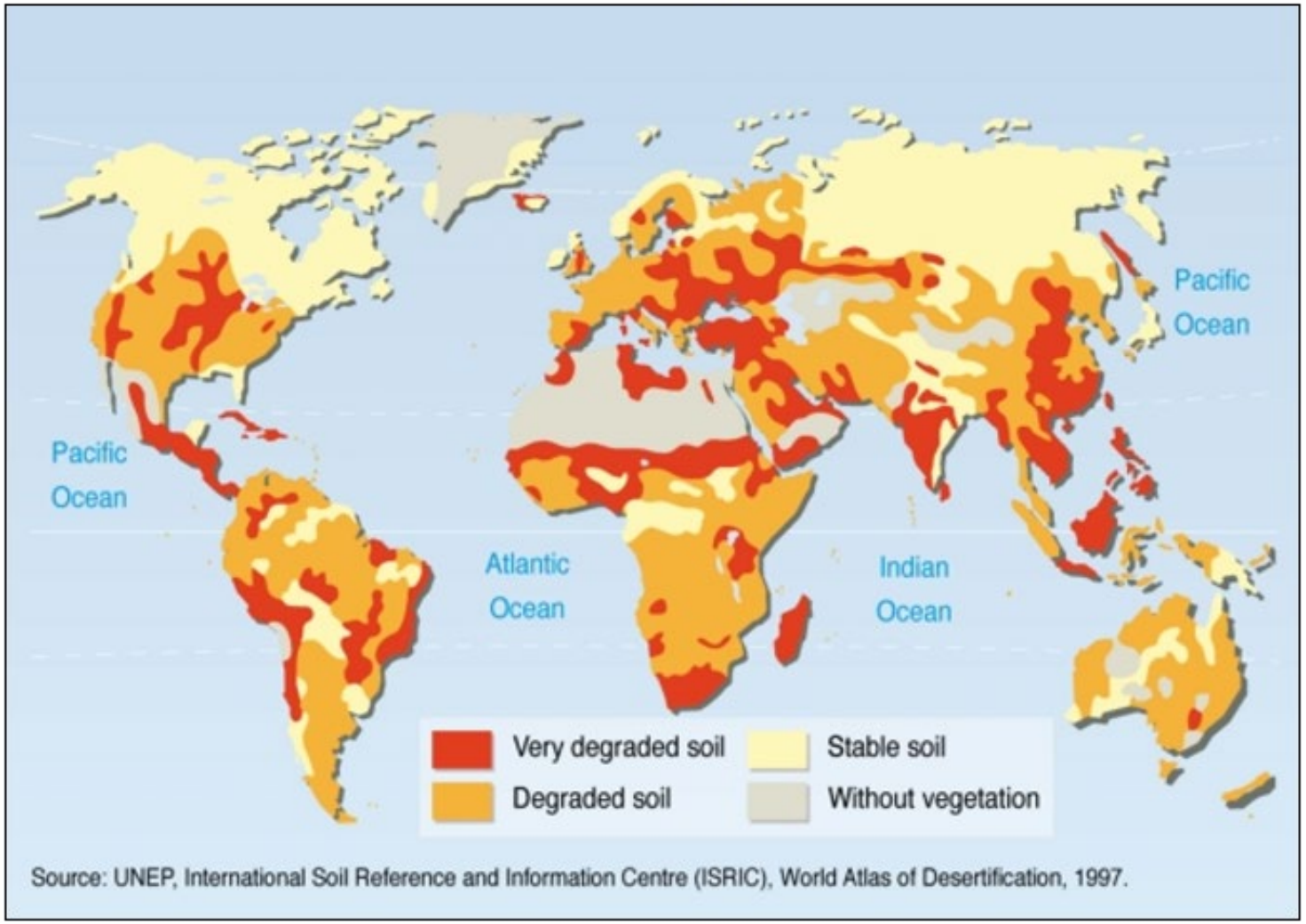
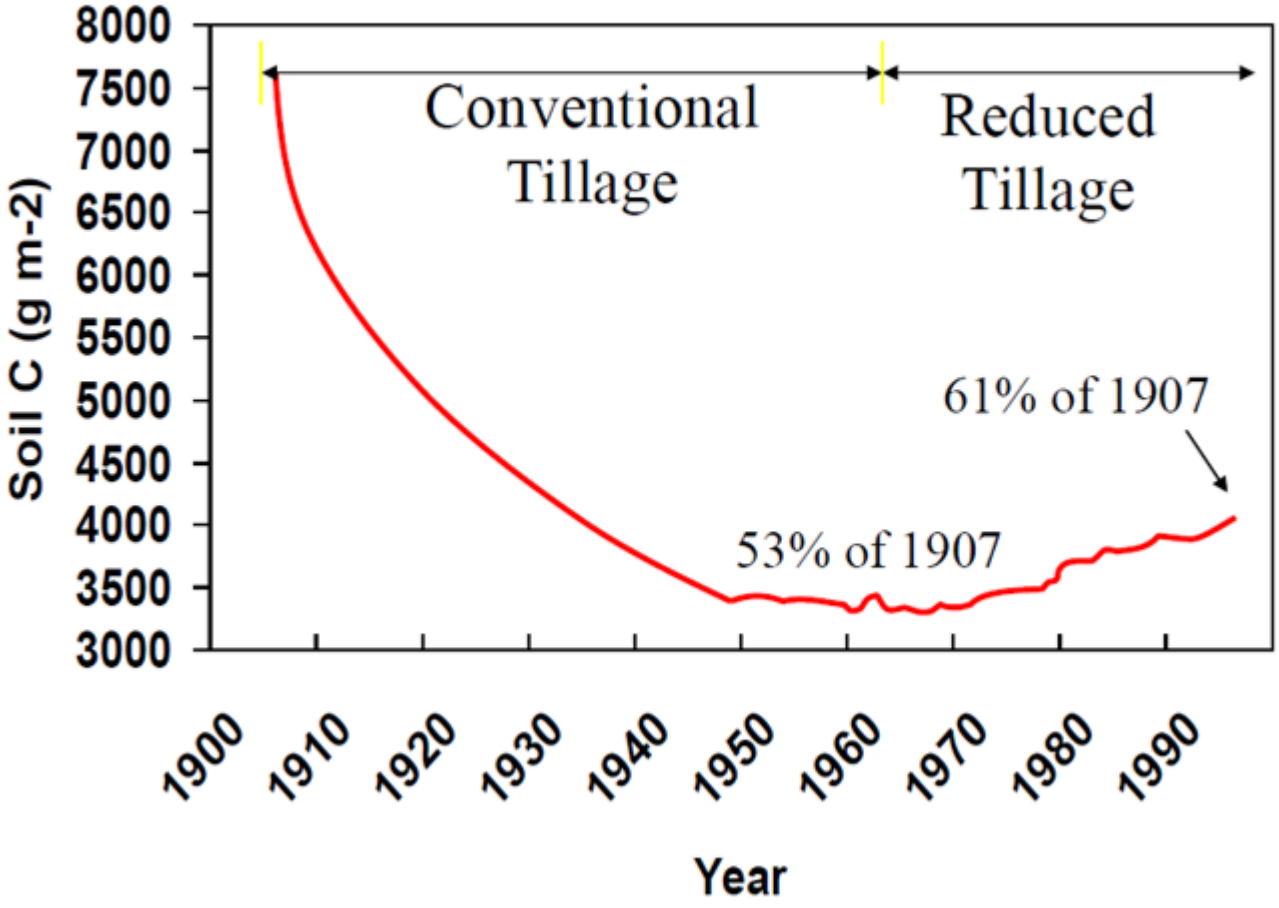
Global Soil Degradation



Source: UNEP, International Soil Reference and Information Centre (ISRIC), World Atlas of Desertification, 1997.

The Carbon Problem

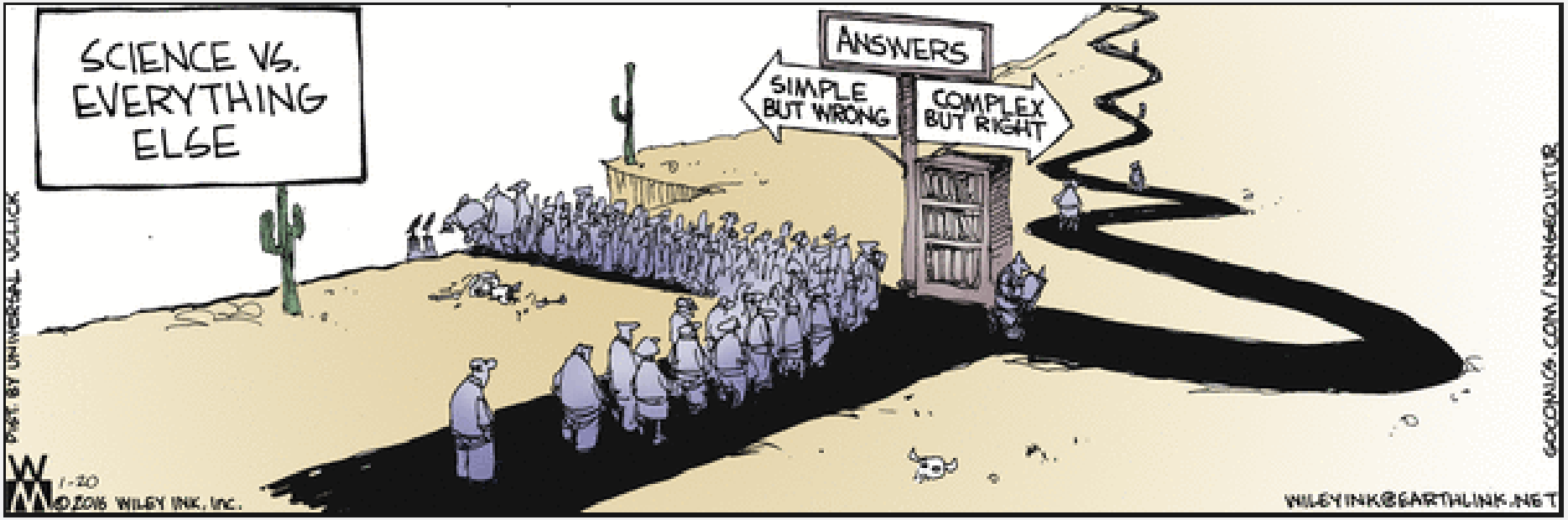


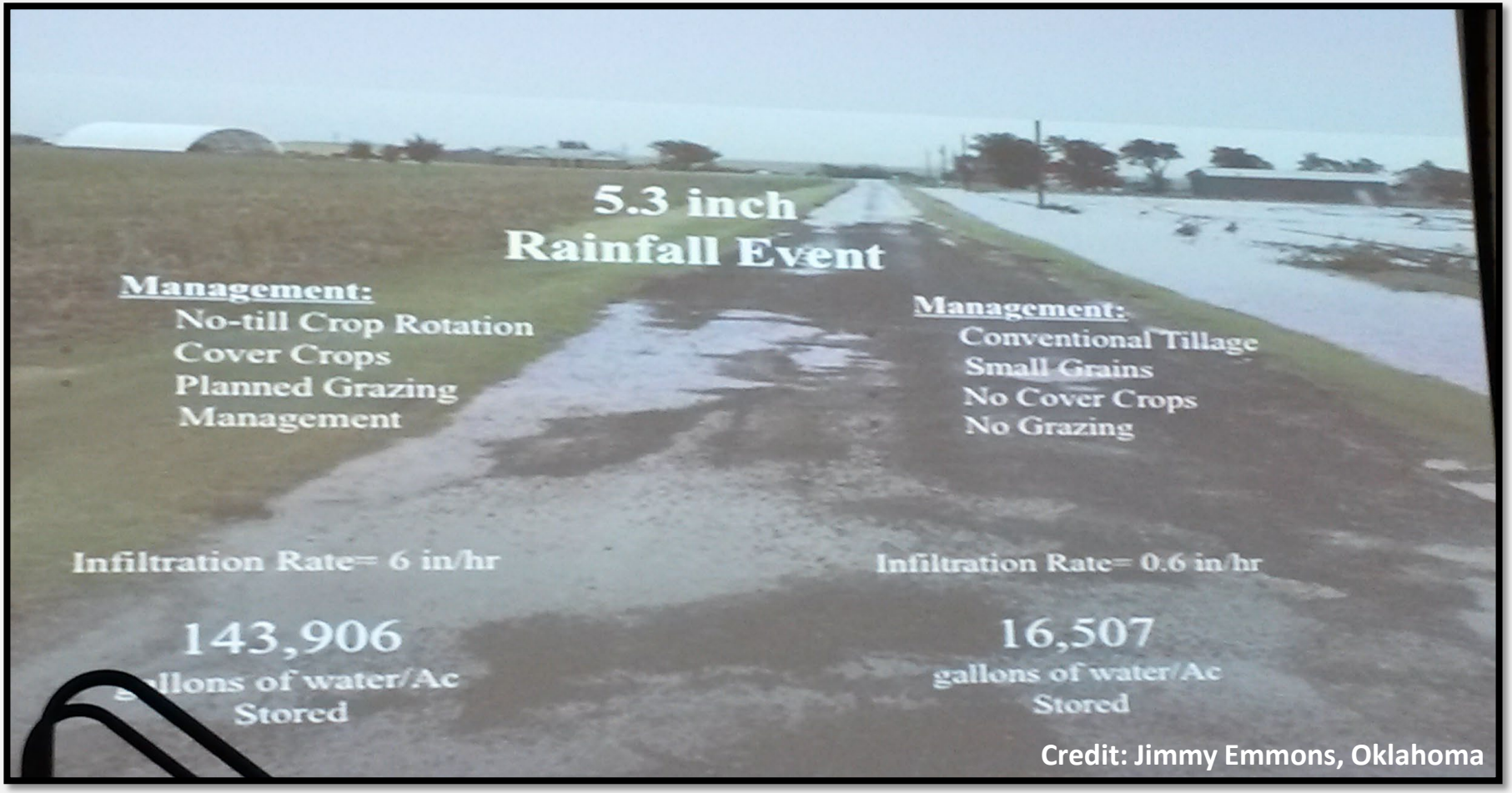
From Lal et al., 1998

5 Principles of Soil Health

Beware that soil health changes slowly over time.
Don't expect immediate results…

- Minimize soil disturbance.
- Maximize diversity (plants, animals, amendments, inoculants…).
- Keep the soil covered.
- Maximize living roots.
- Add livestock when possible.


SCIENCE VS. EVERYTHING ELSE
ANSWERS
SIMPLE BUT WRONG
COMPLEX BUT RIGHT
WILEYINK@EARTHLINK.NET



Credit: Jimmy Emmons, Oklahoma

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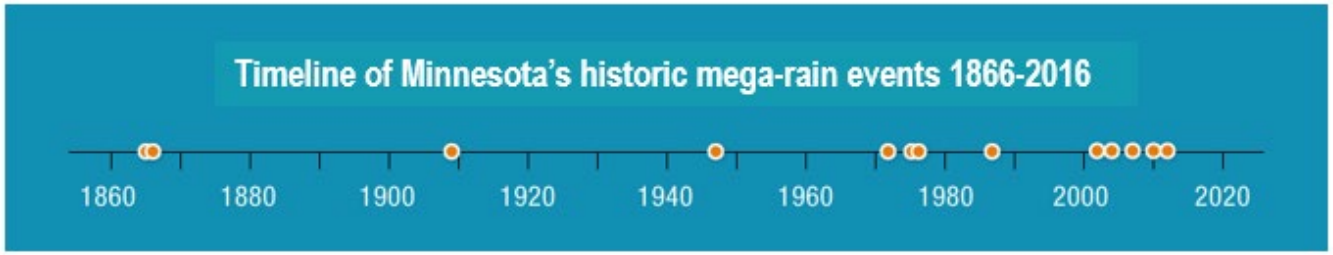
Three weeks later. . .

Credit: Jimmy Emmons, Oklahoma



Source: Minnesota Department of Natural Resources, State Climatology

Credit: Derek Axten, Axten Farms, Saskatchewan

Soil Health: It's not "just for farmers," anymore.

Grocery stores are the front lines.

Top 10 US Food & Beverage Producers (2017, FoodProcessing.com):

1. PepsiCo, Inc.*
2. Tyson Foods, Inc.*
3. Nestle
4. Kraft Heinz Co.
5. Coca Cola, Inc.
6. Anheuser-Busch InBev*
7. JBS USA (beef, pork and lamb processor, cattle feedlot operator)*
8. Smithfield Foods, Inc. (hog producer, pork processor, packaged meat manufacturer)*
9. Molson Coors Co.*
10. General Mills*

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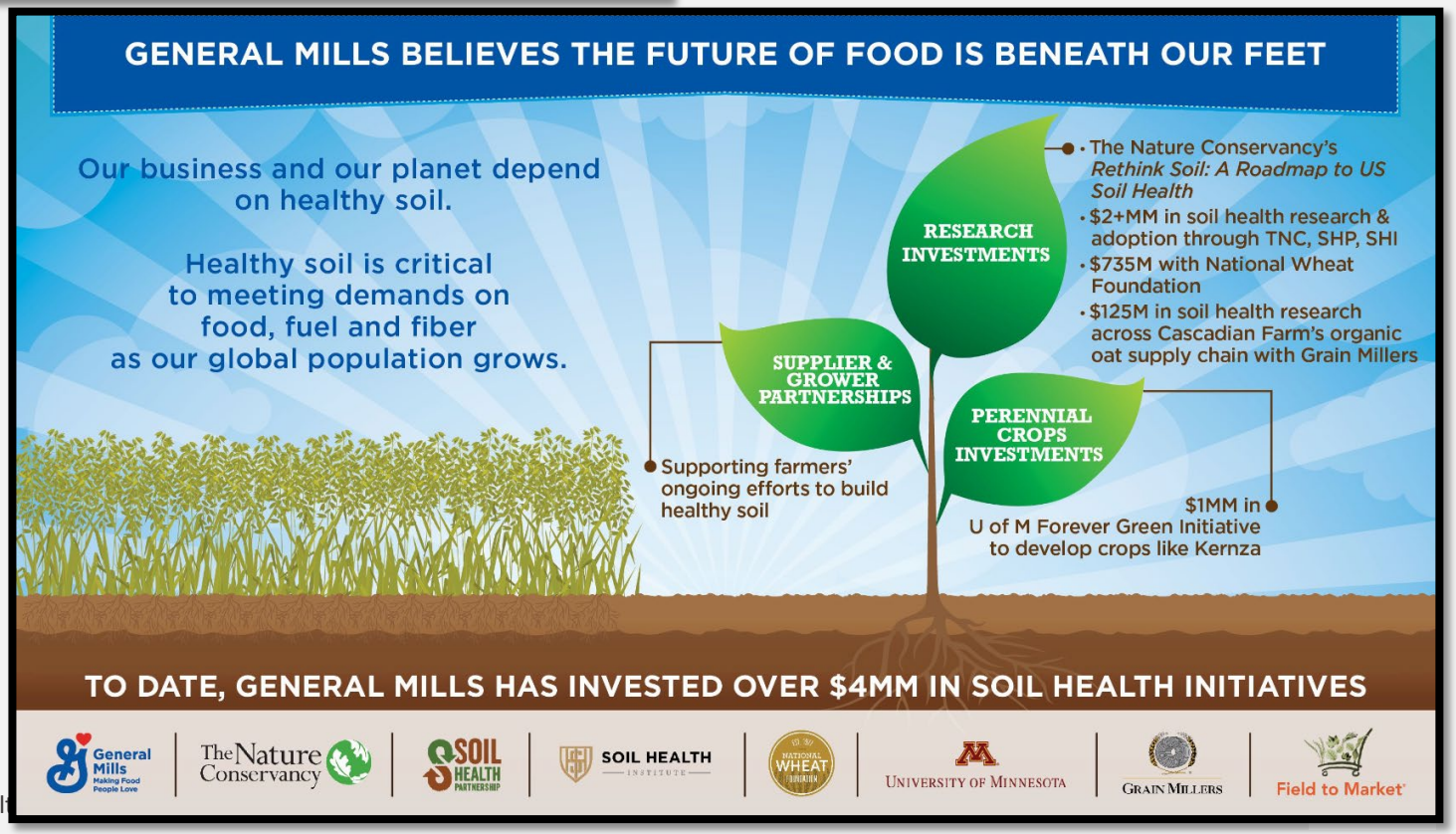
BUSINESS

General Mills announces regenerative land-use goal: 1 million acres by 2030

General Mills promises to expand regenerative-farming principles

By Kristen Leigh Painter (http://www.startribune.com/kristen-leigh-painter/276895091/) Star Tribune

MARCH 4, 2019 — 8:08PM



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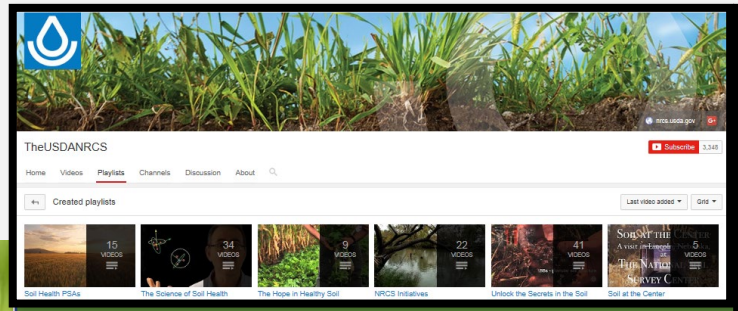
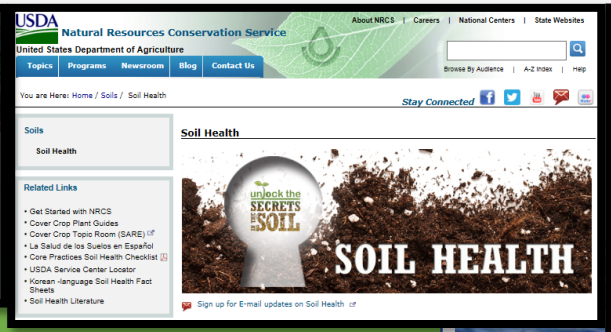
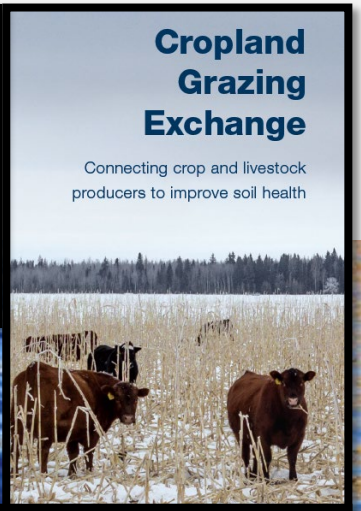
Build Your Soil Health Knowledge!

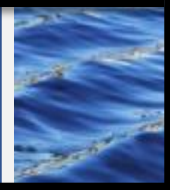


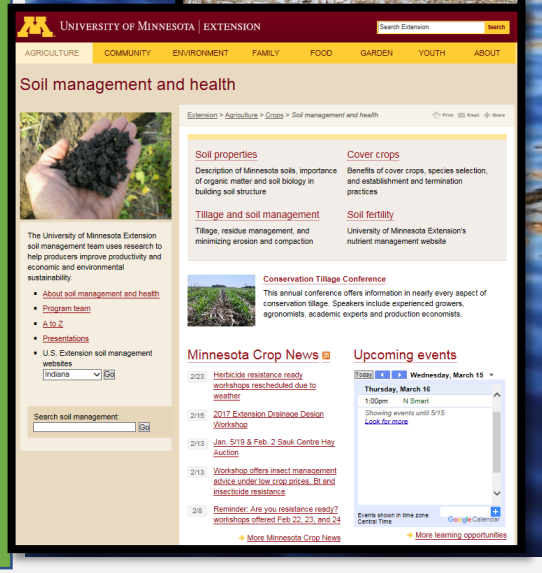




Soil Health Resources

- NRCS – Unlock the Secrets of the Soil
  - https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health/
- 'TheUSDANRCS' channel on YouTube
  - Science of Soil Health, Hope in Healthy Soil, Unlock the Secrets in the Soil
  - https://www.youtube.com/user/TheUSDANRCS
- University of Minnesota – Soil Health Website
  - http://www.extension.umn.edu/agriculture/soils/
- Upper Midwest Tillage Guide
  - https://extension.umn.edu/soil-and-water/soil-management-and-health#upper-midwest-tillage-guide-1233360
- Midwest Cover Crop Council
  - https://extension.umn.edu/soil-and-water/soil-management-and-health#upper-midwest-tillage-guide-1233360
- SARE (Sustainable Agriculture Research and Education)
  - https://www.sare.org/





Minnesota NRCS

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CAUTION!

- Never make tools (No-Till, grazing, cover crops, etc.) a goal
- If your goal is improving soil quality/health; understanding how the soil functions is critical!
- Tools do not build houses, skilled workers do. Without a goal of building a house, tools and workers are wasted.
- You must become the skilled worker with a clear goal in mind; only then do the tools become of lasting value.

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Polling Question

The key to understanding soil health is:

a. *Understanding the importance of cover crop mixes*
b. *Understanding how soil functions*
c. *Understanding reduced tillage systems*
d. *Knowing what microorganisms inhabit the soil*
e. *Relating soil health to runoff and infiltration*