

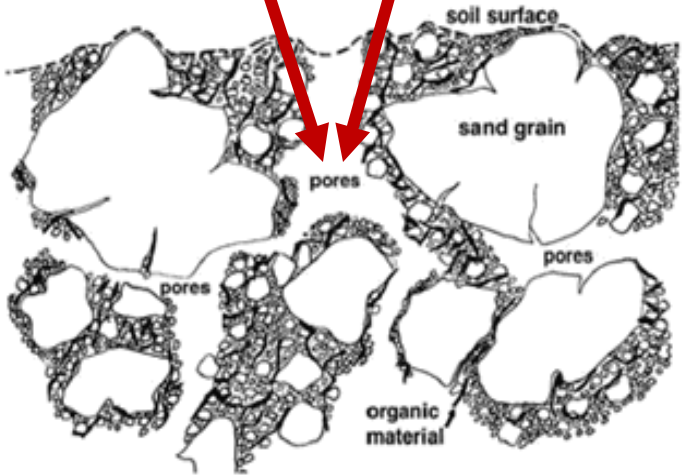
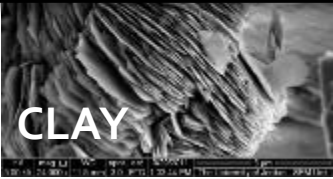
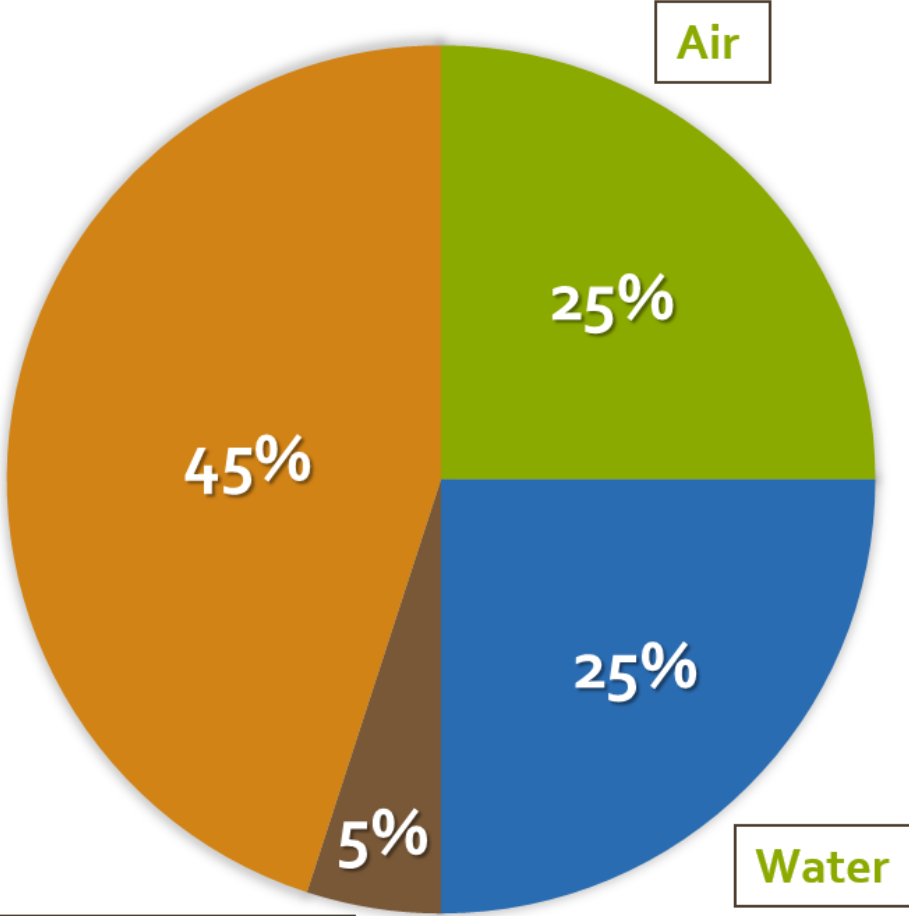


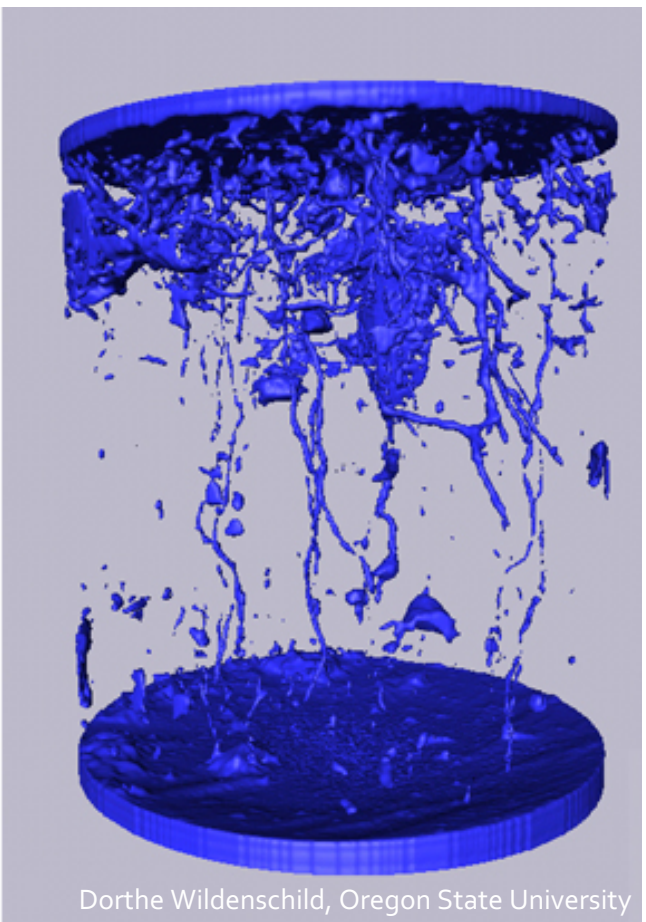
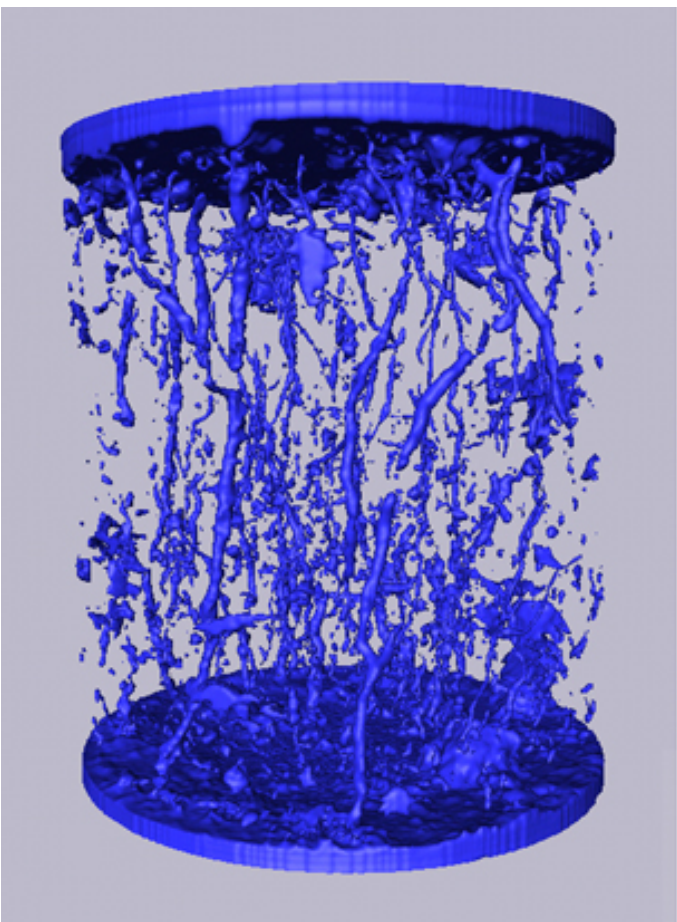
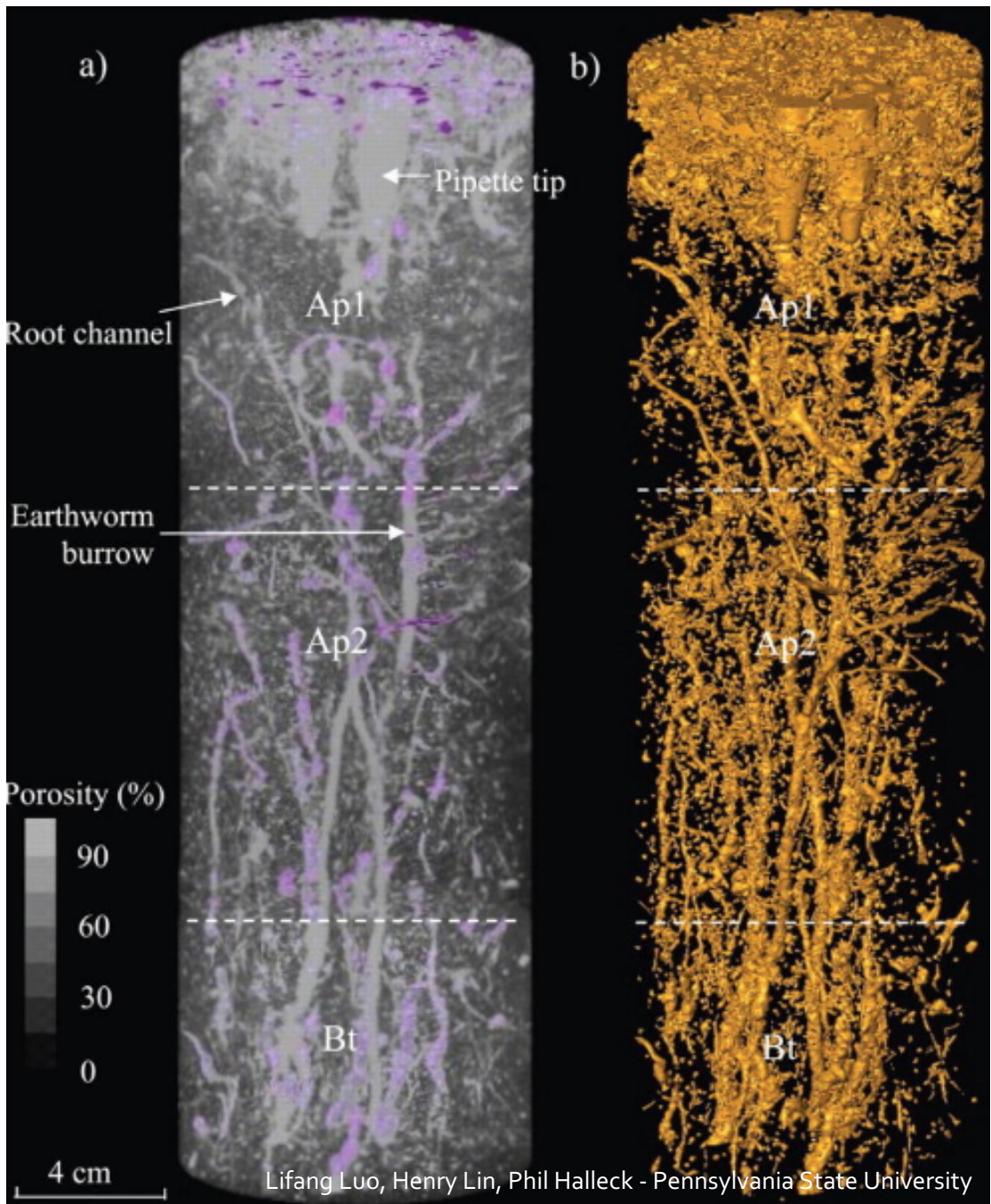
Unlocking the Secrets to Soil Health

Kristin Brennan
Assistant State Soil Scientist/Soil Health Specialist
Minnesota Natural Resources Conservation Service (NRCS)



WHAT IS SOIL?

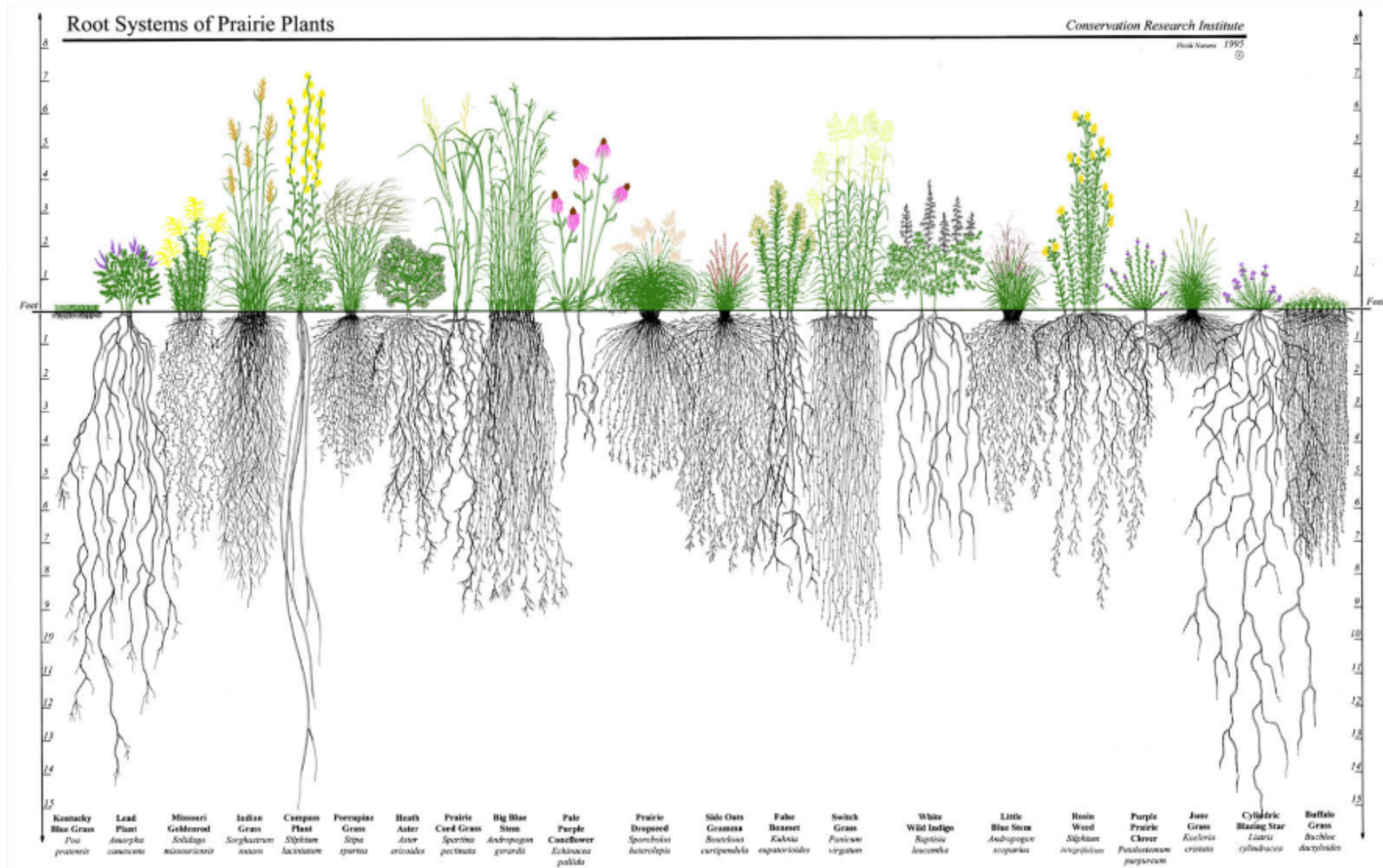




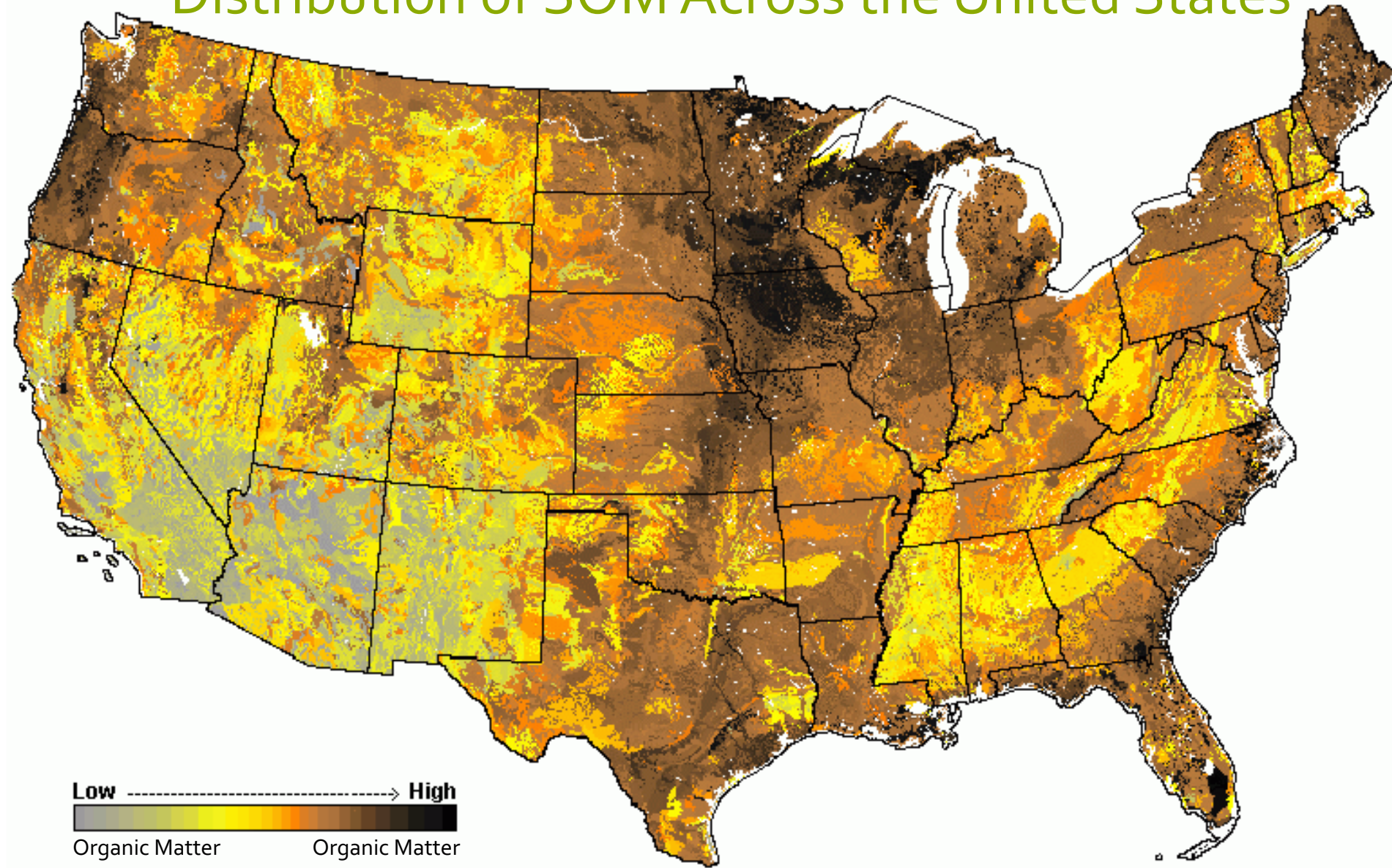
Dorthe Wildenschild, Oregon State University

- CT scan of soil cores. Pores spaces are much like our circulatory system, both in the way they look and function.
- Pores act as a super highway for nutrients, water, and oxygen.
- Transfer resources both horizontally and vertically.

Soil Carbon – Make an Investment



Distribution of SOM Across the United States



Hargrove and Luxmore (1988)



Soil Organic Matter -

Increases\Improves:

- Biological activity – growth and diversity of microbes
- Water infiltration, holding capacity, quality, and efficiency of use
- Soil tilth, structure, stability
- Natural fertility – nutrient cycling and storage
- Cation exchange capacity

Decreases\Reduces:

- Soil erosion
- Soil compaction
- Air pollution

- Dr. Kristine Nichols "Secrets of the Soil"

4 Principles of Soil Health


do not
DISTURB



Minimize soil disturbance.


mix it
UP



Maximize diversity (plants, animals, amendments, inoculants...).


discover
THE COVER



Keep the soil covered.

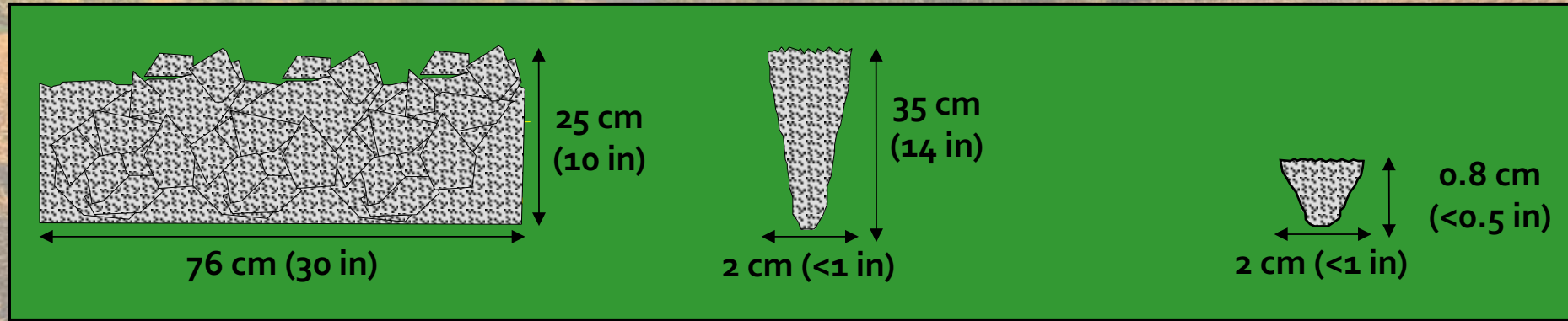

tap into
ROOTS



Maximize living roots.

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

Tillage



Moldboard Plow



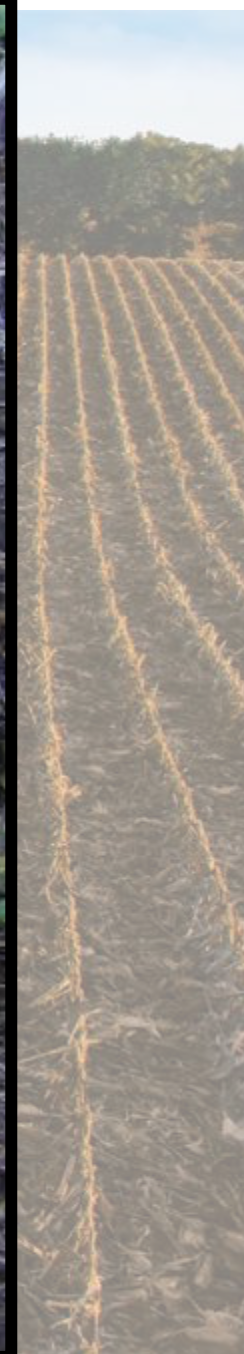
Subsoil Shank



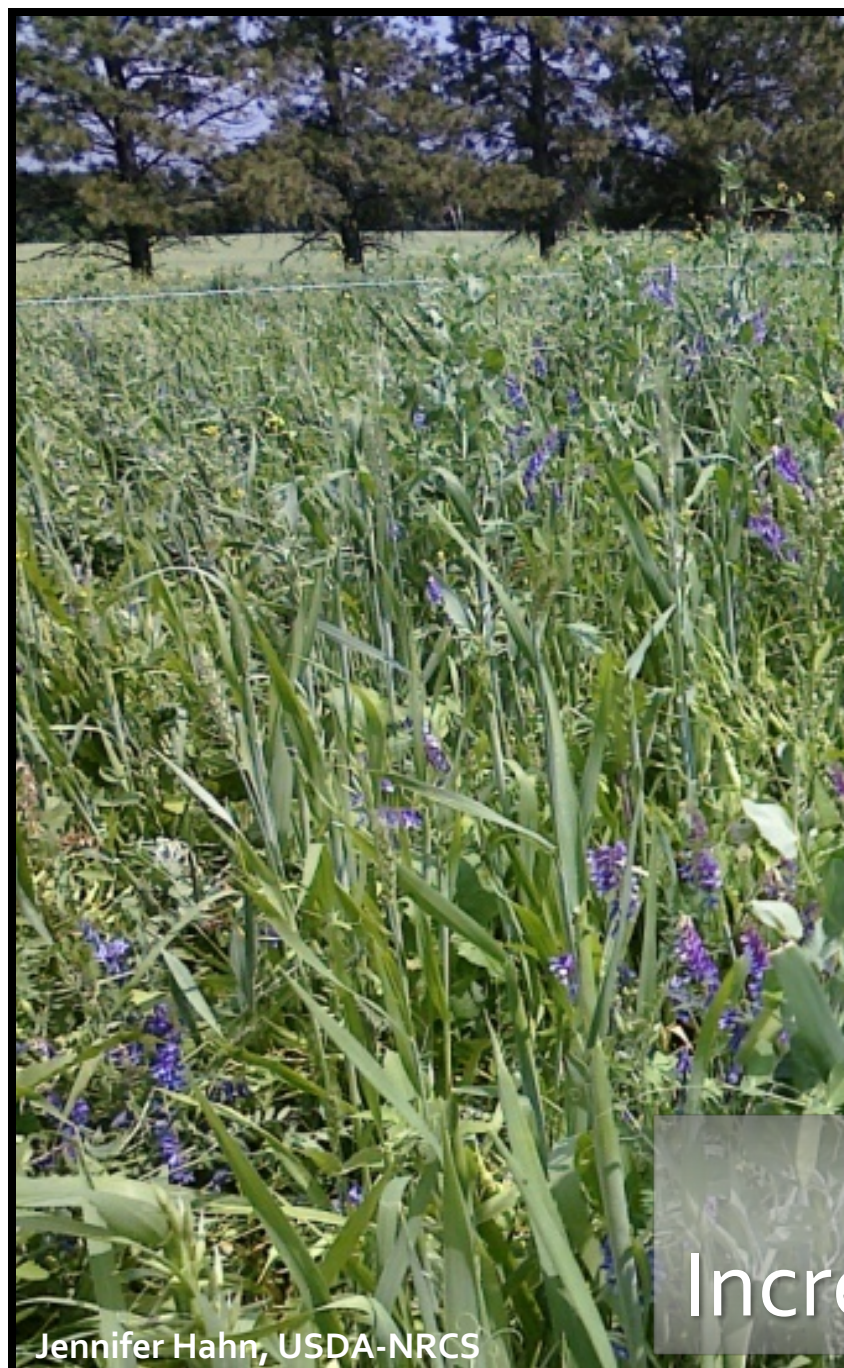
**No Knife
No Till Drill**



Dr. Kristine Nichols – “Bringing Soils to Life”



Jay Fuhrer, USDA-NRCS



Jennifer Hahn, USDA-NRCS



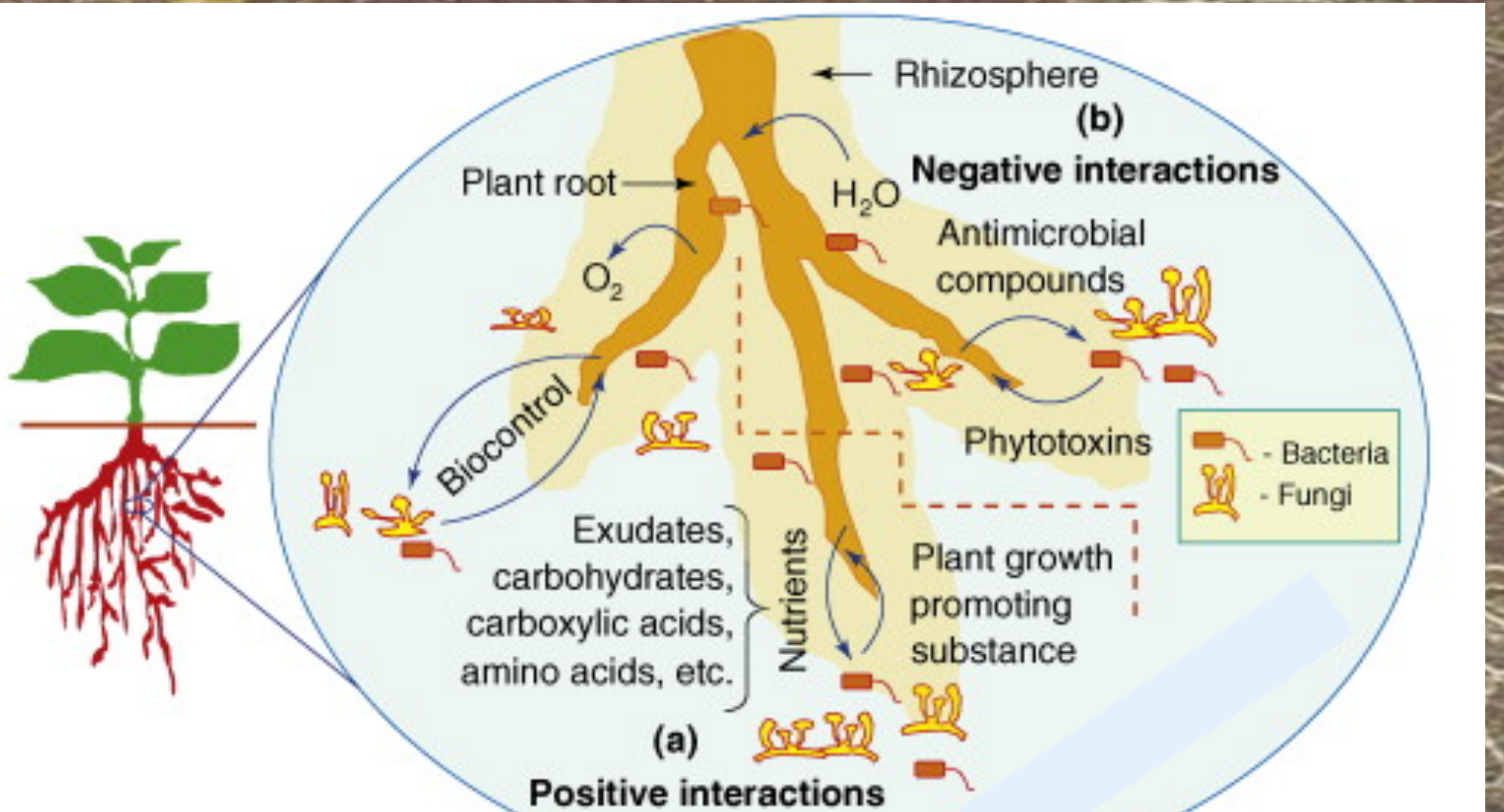
Jennifer Hahn, USDA-NRCS



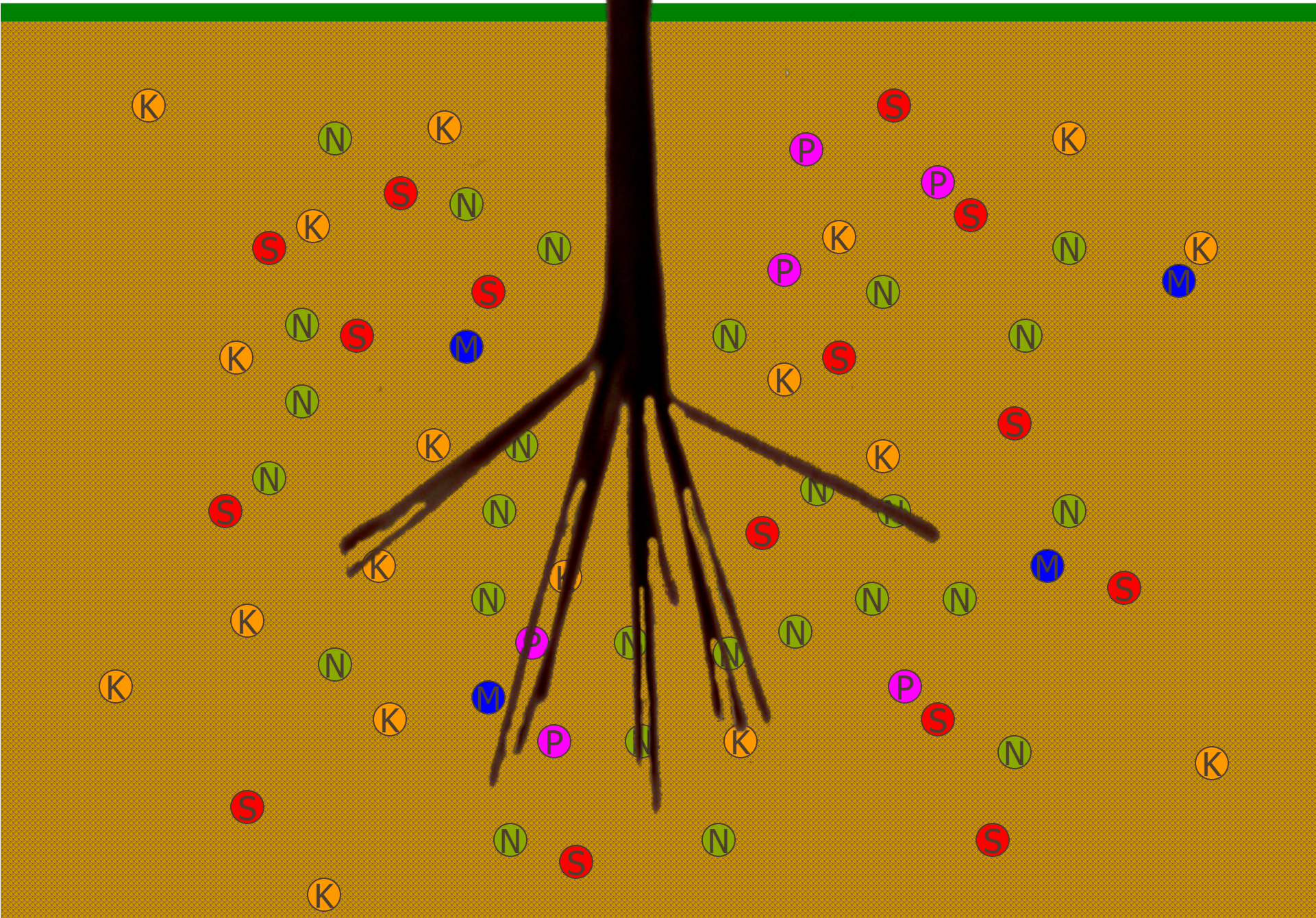
USDA-NRCS

Cover Crops Increasing Diversity

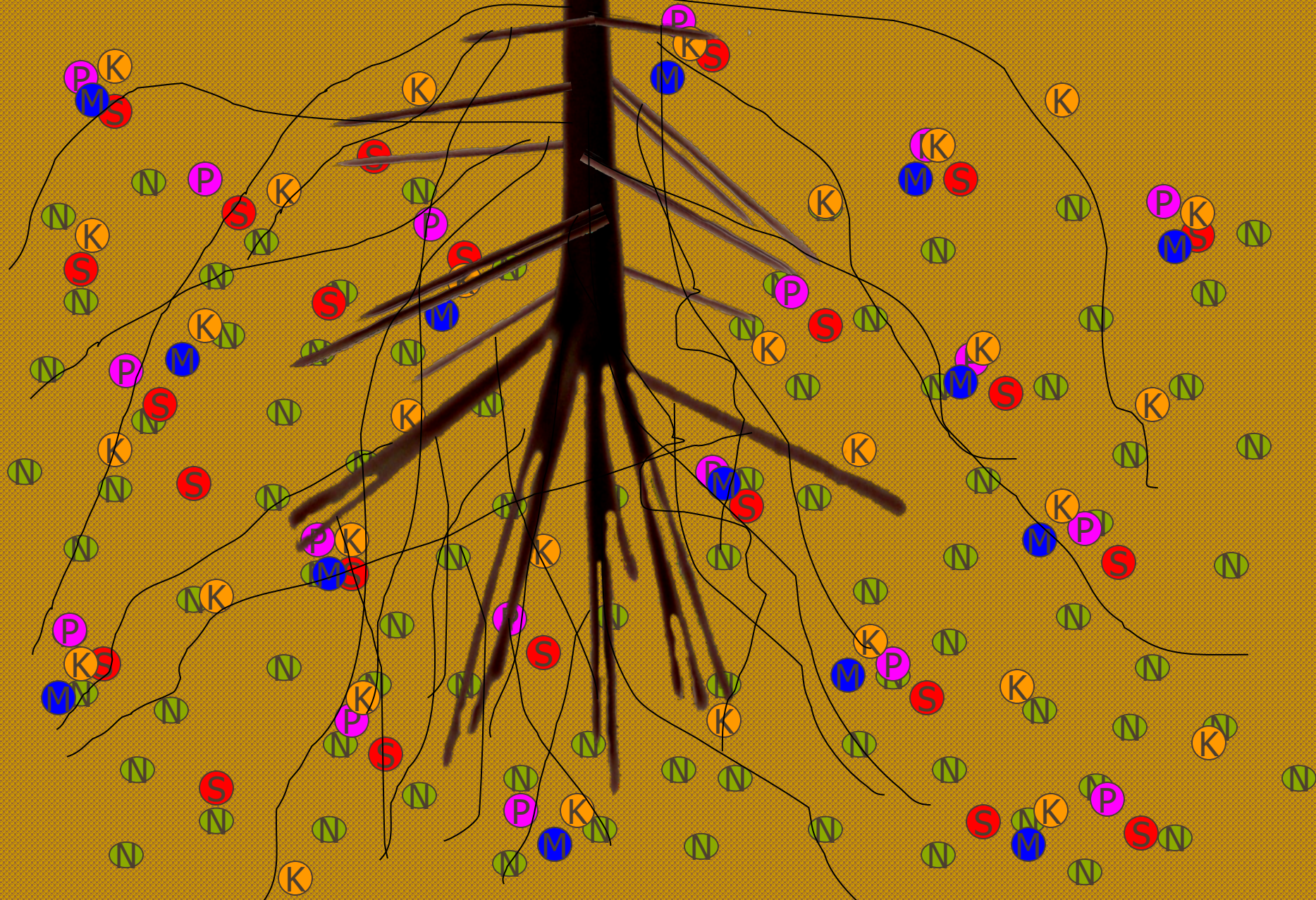
The Rhizosphere



Trends in Biotechnology 2010 28, 142-149 DOI: (10.1016/j.tibtech.2009.12.002)



What can the plant access alone?



Collaboration between root fungus and roots

Soil is ALIVE!!

- Bacteria
- Fungi
- Nematodes
- Protozoa
- Micro and Macroarthropods



Building Soil Armor



Conventional



Undisturbed



Jay Fuhrer, NRCS



Jay Fuhrer, NRCS



Cover Crop Cocktail

Conventional



Reduced

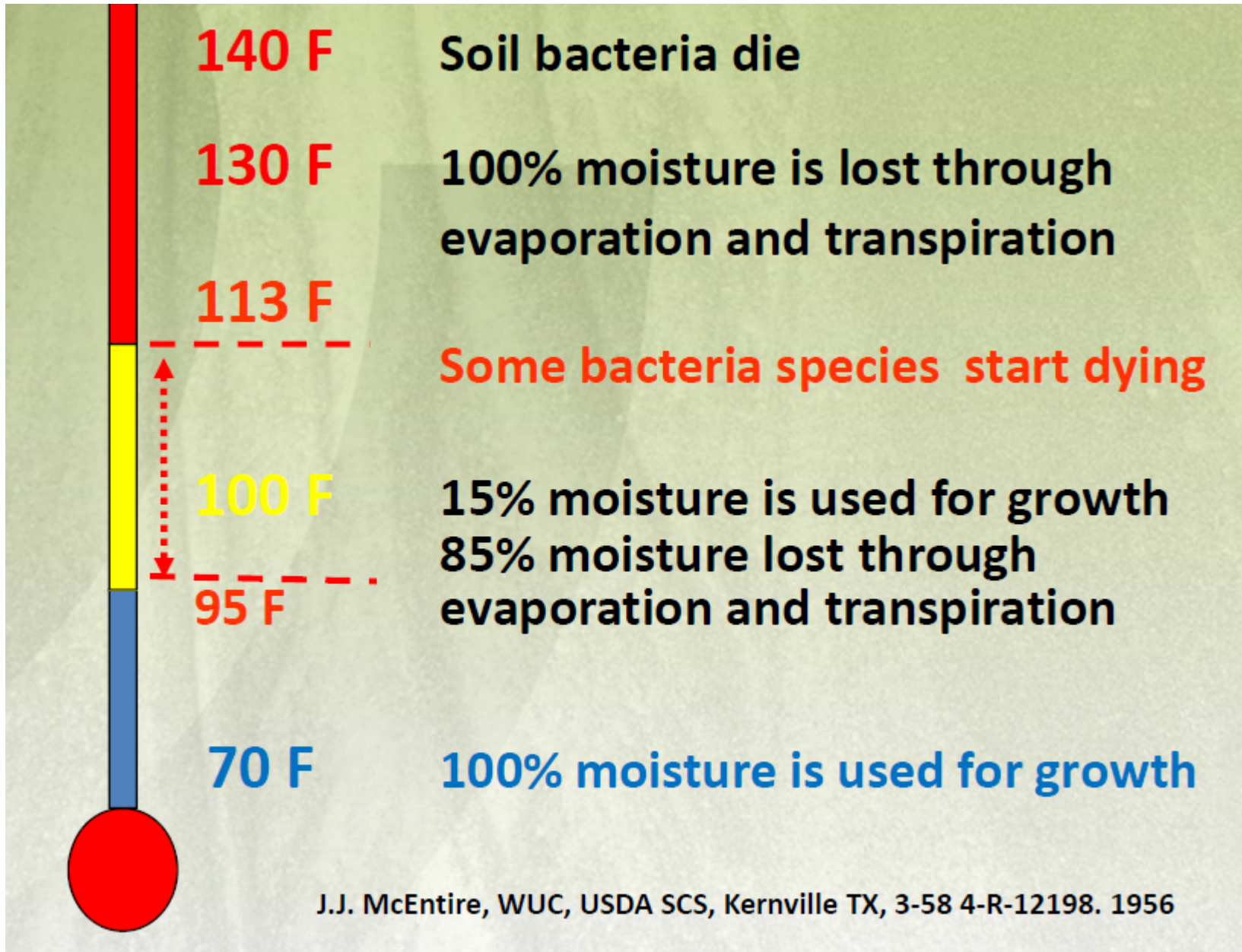


No-Till



Nolan and Goddard

Soil Health = Resiliency



Brown Ranch after 13 inches of rainfall in 24 hr period



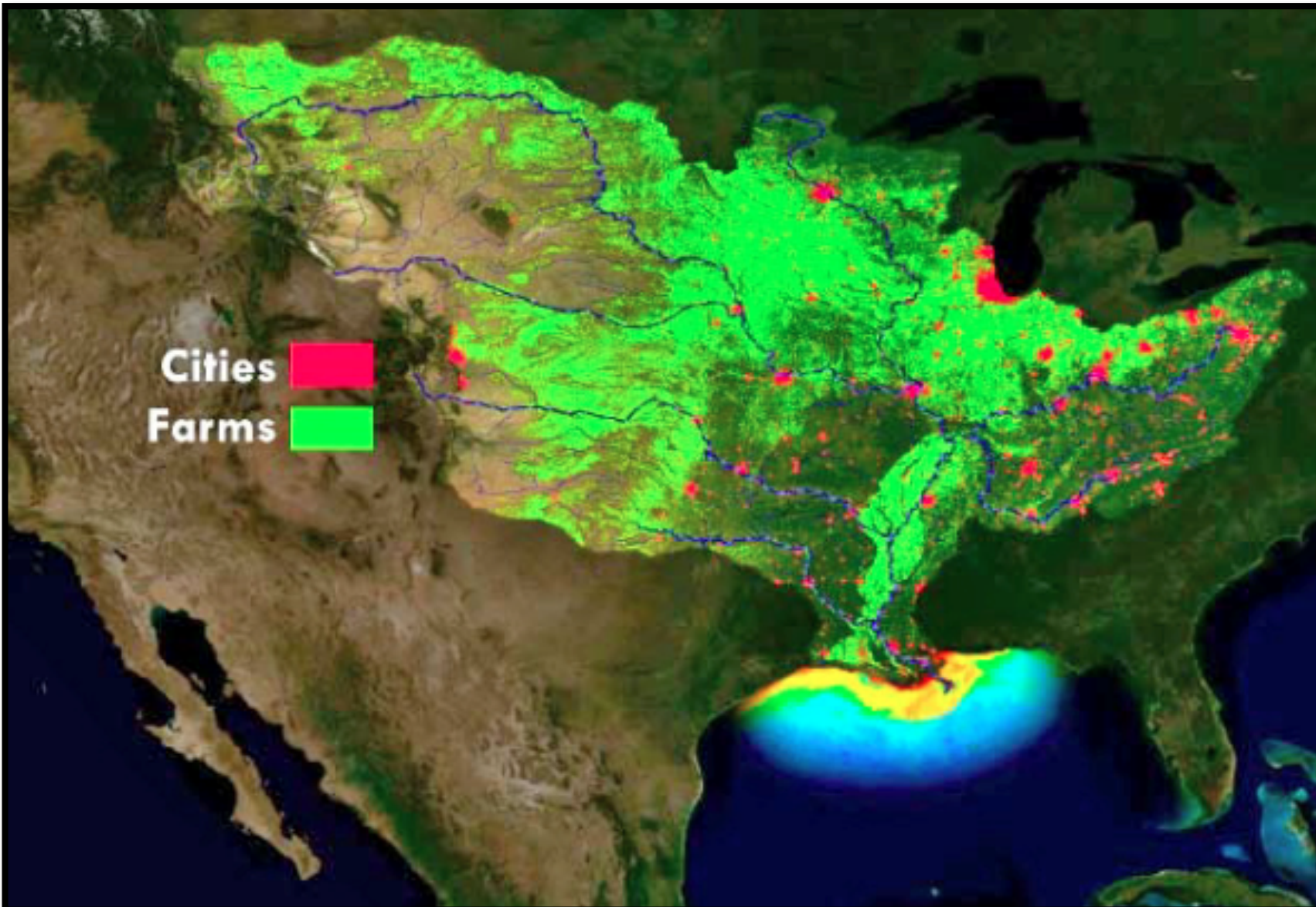
Jay Fuhrer, USDA-NRCS



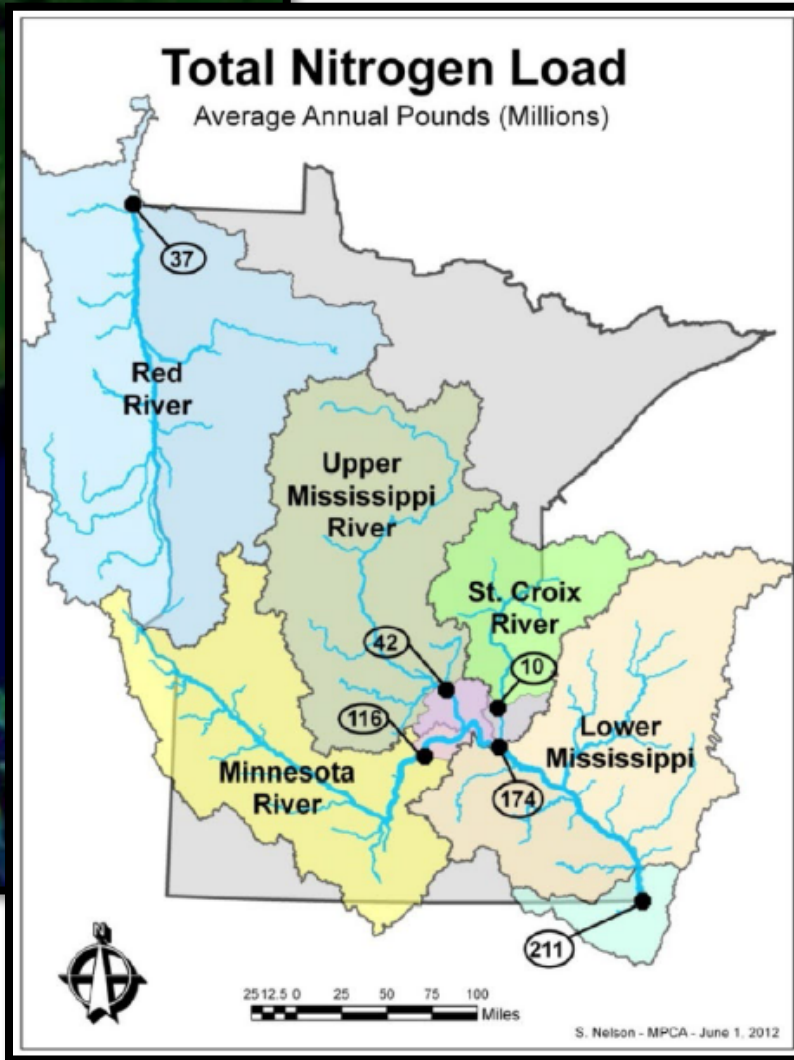
USDA-NRCS



USDA-NRCS



This image illustrates the agricultural runoff that eventually funnels into the Gulf of Mexico. The dead zone appears there in red and yellow.
Credit: Nature





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

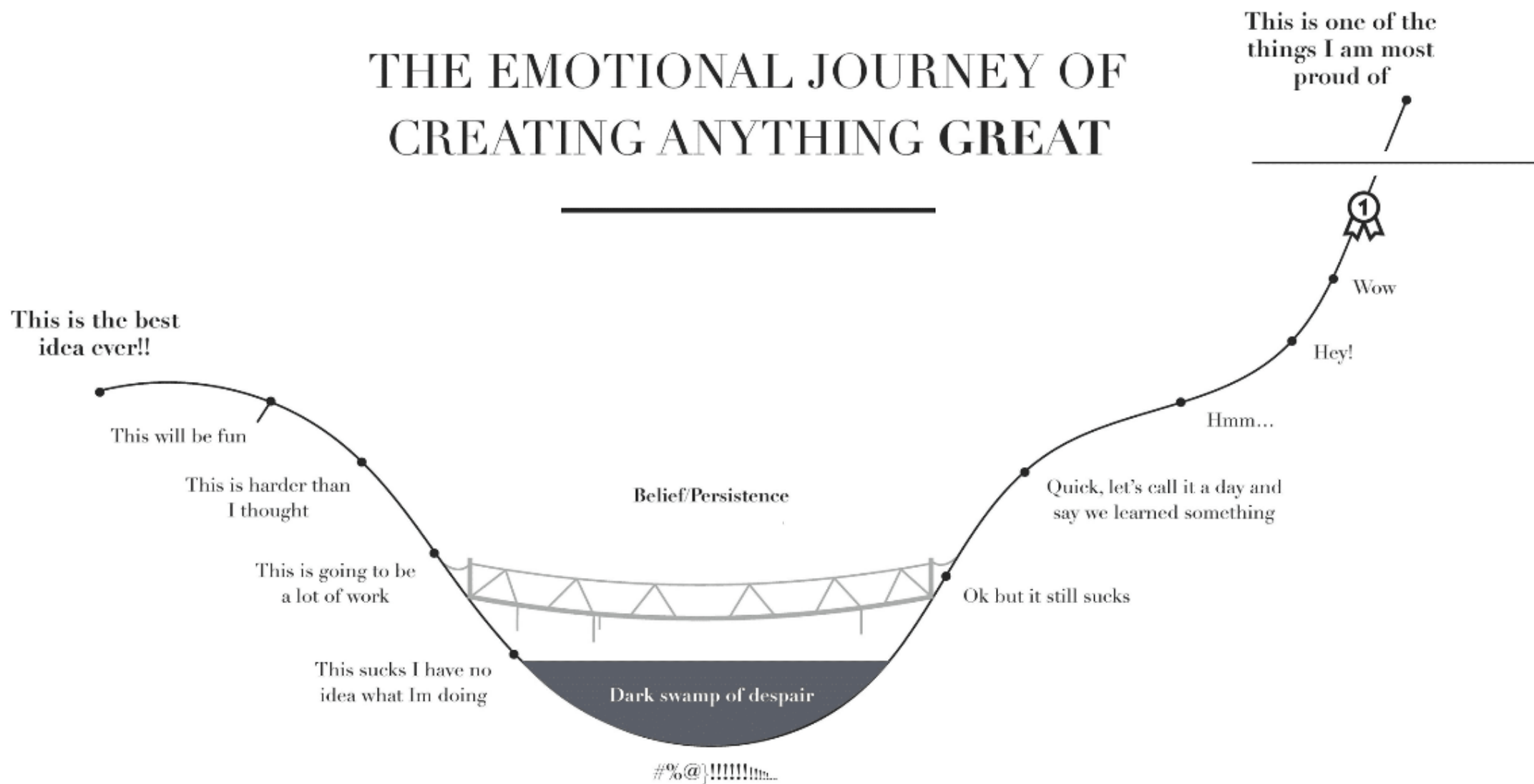
Managing for Stewardship

- What are your goals and the goals of your renter?
- What changes can be made to the current management system?
- Expectations vs reality.
- Find common ground, balance is key.
- What resources/assistance is available?
- What is the legacy you want to leave?

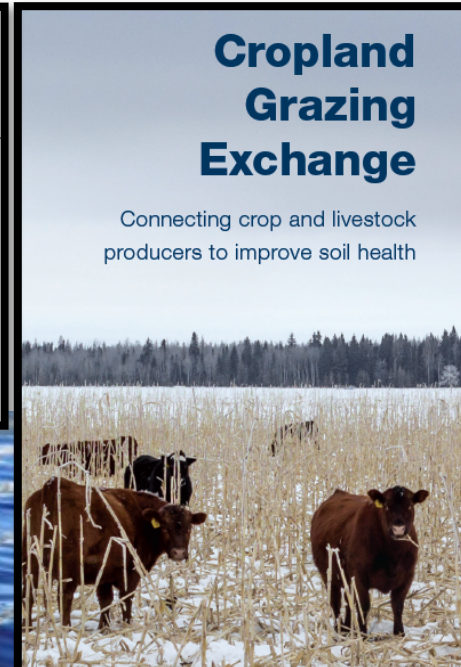
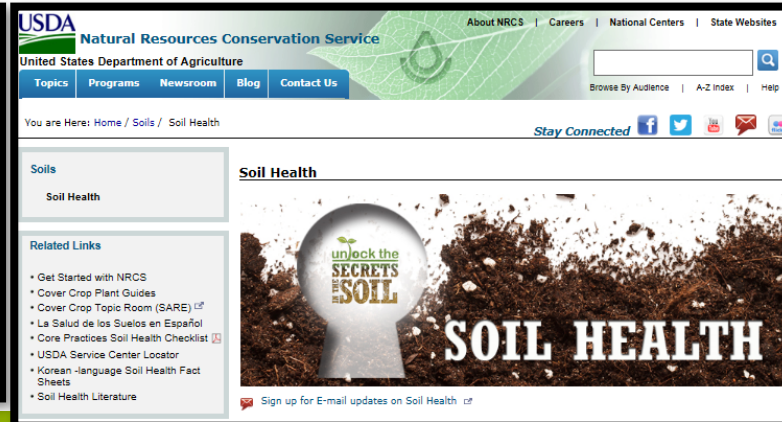
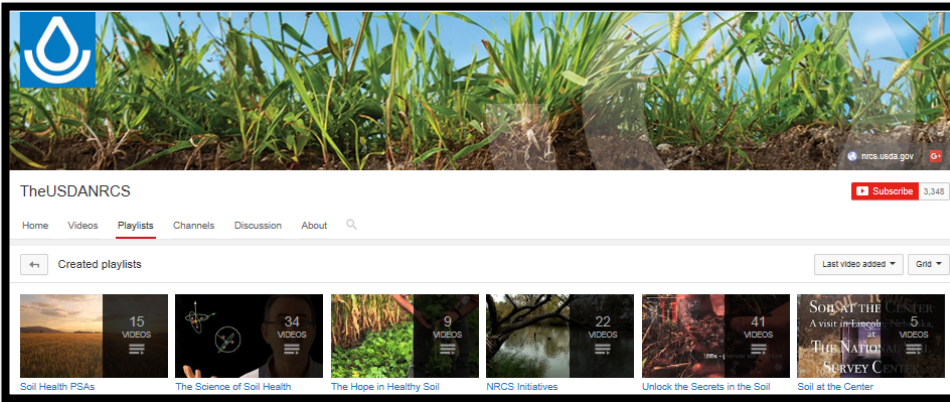


Photo: North Star Bank of Iowa

THE EMOTIONAL JOURNEY OF CREATING ANYTHING GREAT

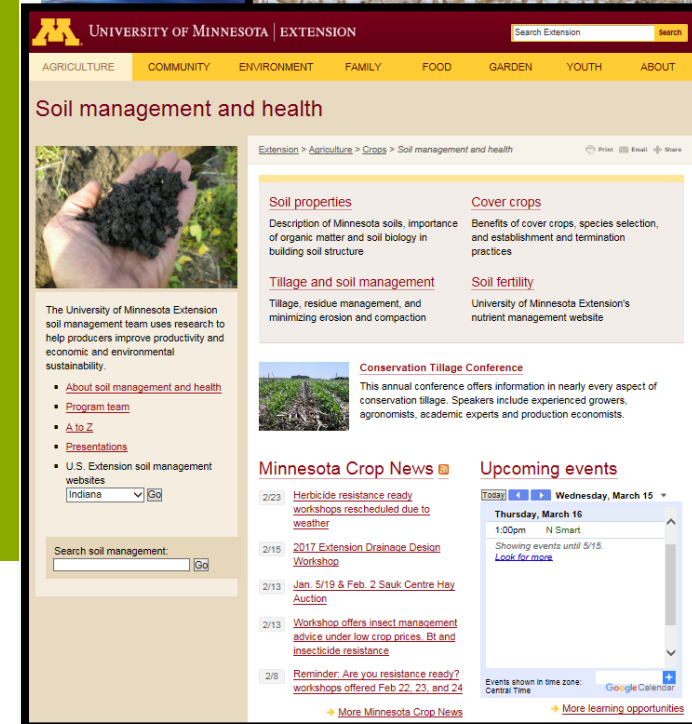


THE EMOTIONAL JOURNEY IS INEVITABLE AND PERHAPS NECESSARY



Soil Health Resources

- Cropland Grazing Exchange (NRCS, MDA, SFA)
 - www.mda.state.mn.us/cge
- University of Minnesota – Soil Health Website
 - <http://www.extension.umn.edu/agriculture/soils/>
- 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>



“Worms Working in the Field” (wheatteam)

- <https://www.youtube.com/watch?v=5a7ntcLoN-s>





When one tugs
at a single thing
in nature,
he finds it
attached
to the rest of
the world.

- John Muir



Acknowledgements

Jay Fuhrer, Soil Health Specialist, USDA-NRCS, Bismarck, ND
"Building Blocks of Soil Health"

Dr. Kristine Nichols, Chief Scientist at the Rodale Institute
"Bringing Soils to Life: The Bugs in the System"
"Secrets of the Soil"

THANK YOU!

