Midwest Opportunities To Regenerate Soil Health

Barry Fisher
NRCS Soil Health Division
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unlock the SECRETS IN THE SOIL

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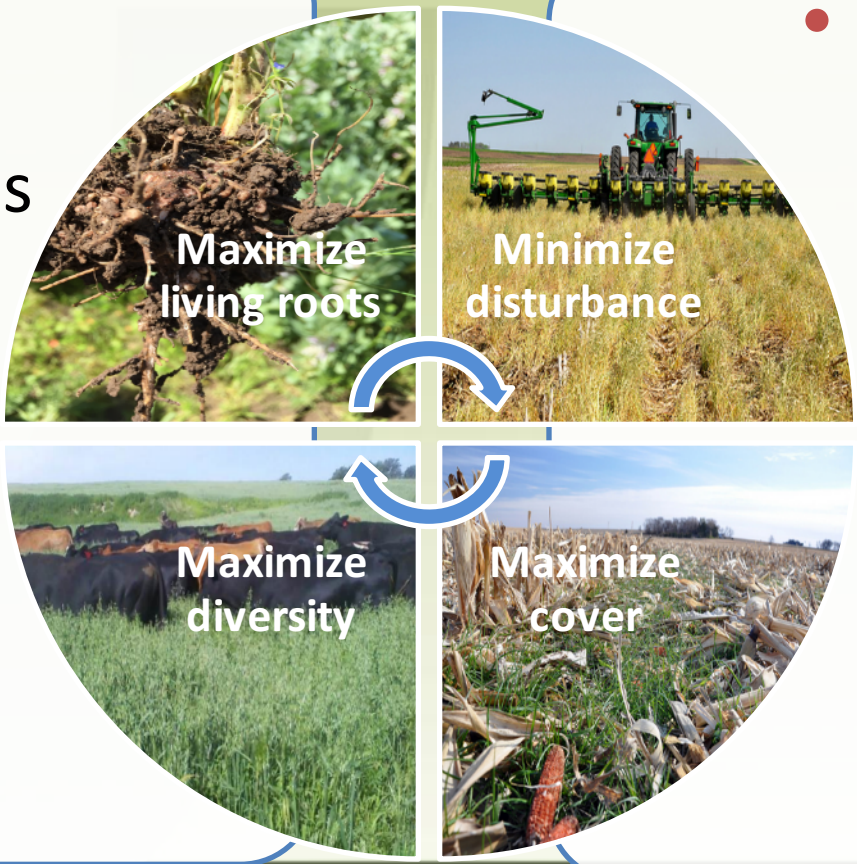
SOIL HEALTH:

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

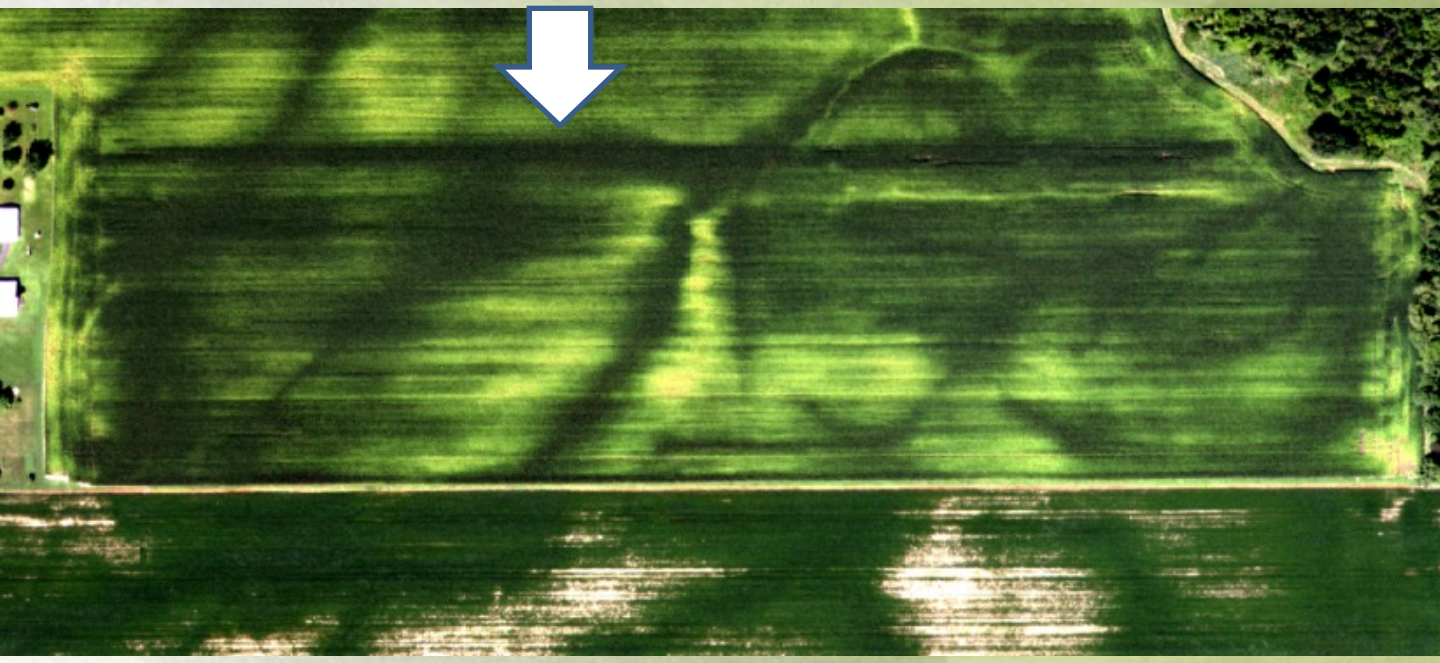
Soil Health Principles

Soil Health Principles To Support High Functioning Soils

- **Feed** diverse, continuous inputs (C sources, energy)



- **Protect** habitat (aggregates and organic matter)



The Fence Row Effect

Soil Health Principles at work

Principles at work

Making Soil Health A Priority!

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- **What does *Soil Health* mean?**
- **Key Indicators/Functions =**
  - Improv**ing** organic matter
  - Improv**ing** aggregate stability
  - Increas**ing** water infiltration
  - Increas**ing** available water
  - Improv**ing** nutrient cycling
  - Balanc**ing** and diversifying soil biology

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These are broadly accepted and listed in numerous peer reviewed papers and text books as indicators and functions that drive improved production, resilience to extreme growing conditions, and reduce costs that lead to net economic gains.

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production, resilience, and reduce costs

Improving organic matter

- stores and steadily releases crop nutrients, (production, resilience, costs)
- holds water and increases water availability, (production, resilience)
- improves infiltration of rainfall into the root zone, (production, resilience)
- improves air/gas exchange and (production, resilience,)
- increases yields. (production)

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production, resilience, and reduce costs

Improving aggregate stability

- Reduces crusting for better crop emergence (production)
- provides resistance to erosion and lost nutrients (production, resilience, costs)
- improves infiltration of rainfall and irrigation water (production, resilience)
- increases water availability for plants and soil organisms (production, resilience)
- More…

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production, resilience, and reduce costs

Increasing water infiltration

- improved irrigation efficiency (costs)
- Harvest more rainfall and irrigation water for crop growth (production)
- Reduces nutrient loss from runoff (production, costs)
- Reduces ponding and saturated soils for timely planting and field operations (resilience)
- Reduces denitrification (production, resilience)

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production, resilience, and reduce costs

Increasing water infiltration and available water

- improved irrigation efficiency (costs)
- More water available for crop growth and process (production)
- Reduces nutrient loss from runoff, ponding (production, costs)
- provides water for important biological processes and cycles (production, resilience, costs)
- serves as a temperature regulator for plants during extreme weather (resilience)

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production, resilience, and reduce costs

Improving nutrient cycling-biologically driven

- Delivers "time released" nutrients to crops (resilience)
- Biologically supplied nutrients enhance or complement applied nutrient management strategies (production, costs)
- improves nutrient availability to crops during extreme events (resilience,)
- reduces nutrient loss pathways by providing backup sequestration in non- crop seasons (costs)

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Soil Health Management System

- Collection of conservation practices that focus on maintaining or enhancing soil health
- Address all four of the soil health principles
- Create a “synergistic” effect
- Cropping system specific
- Are practical and logical

Soil Health Management System

- **Achieving soil health through:**
  - **A Quality No-till System**
  - **Diverse and Strategic Cover Crops**
  - **Adapted Nutrient Management**
  - **Integrated Weed & Pest Management**
  - **Diverse Crop Rotations**
  - **Precision Farming Technology**
  - **Prescriptive Buffers and supportive practices**

Soil Health is not a destination...it's a Journey


Quality No-Till/Strip-till


Adapted Nutrient Management


New Technology
and
Integrated Weed &
Pest Management


Prescribed Cover Crops


Diverse Crop Rotation


Quality No-Till/Strip-till


Adapted Nutrient Management


New Technology
and
Integrated Weed &
Pest Management


Prescribed Cover Crops


Diverse Crop Rotation


Quality No-Till


Ecological Nutrient Management


Integrated Weed &
Pest Management
and
Precision Technology


Prescribed Cover Crops & Grazing


Diverse Crop Rotation


Quality No-Till/Strip-t


Adapted Nutrient Management


Prescribed Cover Crops


and
Integrated Weed &
Pest Management
Diverse Crop Rotation

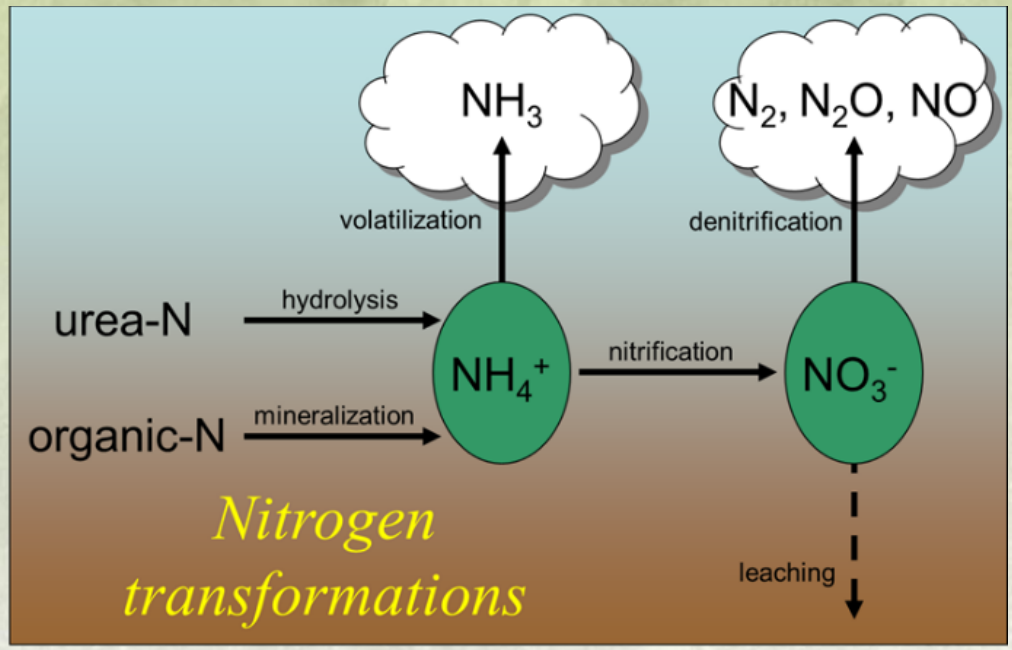
Developing Nutrients Management Strategies for Soil Health Cropping Systems

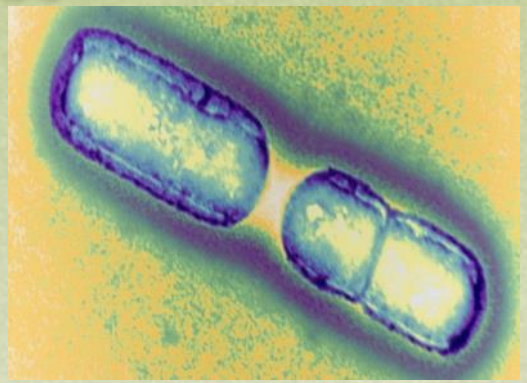
- 4-Rs

Must include SOM and Organic Nutrient Contribution

A simple approach to Understanding C:N Ratios and biological drivers for corn production and water quality

Nitrogen Mineralization and Immobilization





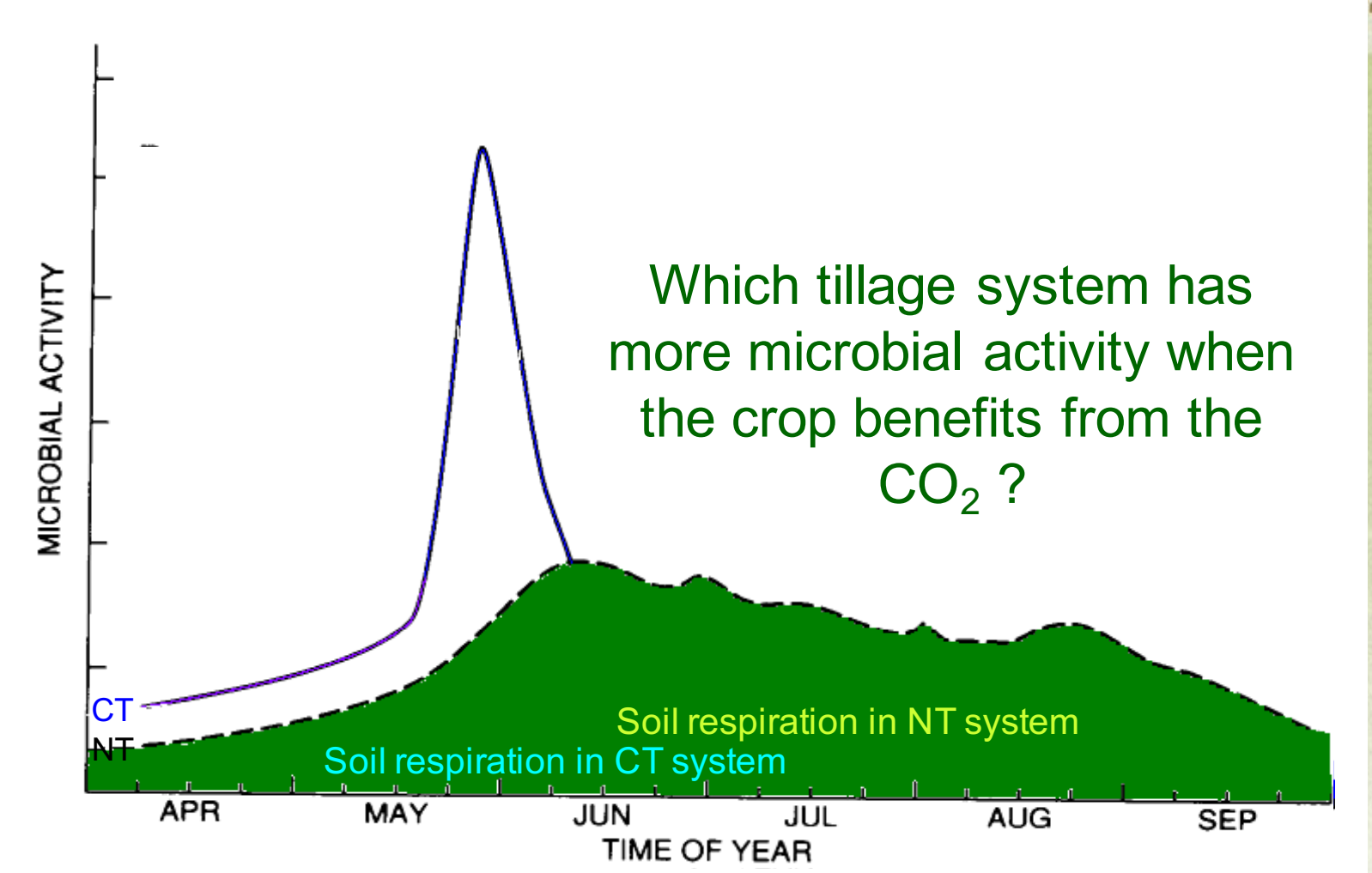
Biology

Only 30-55% of Inorganic Fertilizer is Directly Used by Plants

Fertilizer N applied (lb/ac)	Corn grain yield (Bu/ac)	Total N in corn plant (lb/ac)	Fertilizer-derived N in corn (lb/ac)	Soil-derived N in corn (lb/ac)	Fertilizer-derived N in corn as % of total N in corn
45	62	76	25	54	33
89	73	130	49	81	38
178	88	140	77	63	55

Calculated from Reddy and Reddy, 1993 and modified from Weil & Brady, The Nature and Properties of Soils, 15th ed.

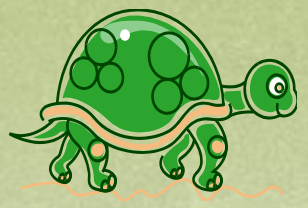
Effect of tillage on microbial activity



Havlin et al. (1999)

Strategically…
CC should match desired C:N Ratio

Material	C:N Ratio	
Rye Straw	82:1	Good for Soybean
Wheat Straw	80:1	
Oat Straw	70:1	
Corn Stover	57:1	
Rye Cover Crop (Anthesis)	37:1	
Rye Cover Crop (Vegetative)	26:1	
Mature Legumes	25:1	
Balanced Microbial Diet	**24:1**	
Daikon Radish	19:1	Good for Corn
Crimson Clover	17:1	
Ryegrass (Vegetative)	15:1	
Young Alfalfa	13:1	
Hairy Vetch Cover Crop	11:1	
Soil Microbes (Average)	8:1	



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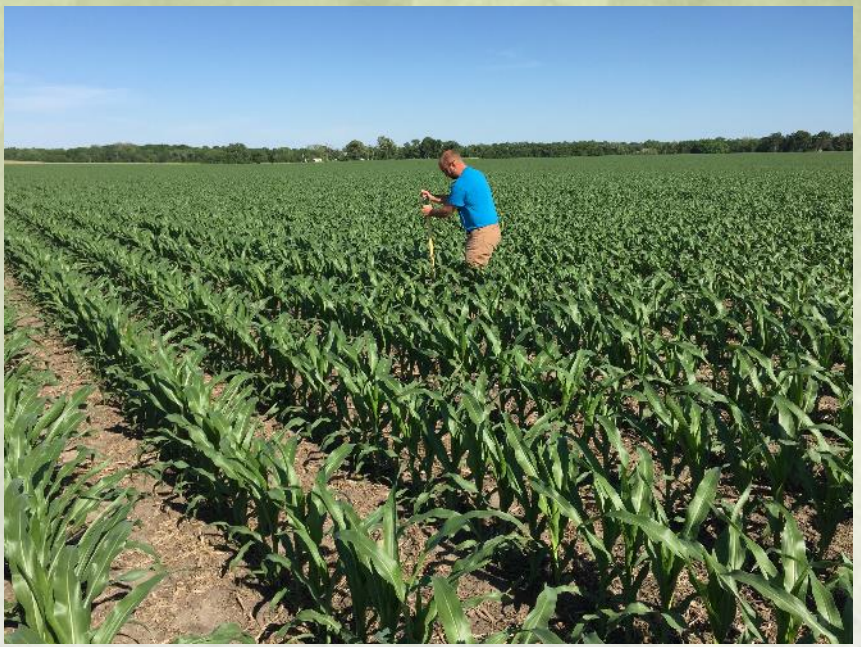
Strategically…
Planning the System Using the Step by Step Approach

Enjoy The Rewards of Soil Health!



Managing for a Living Ecosystem Requires Dynamic Management

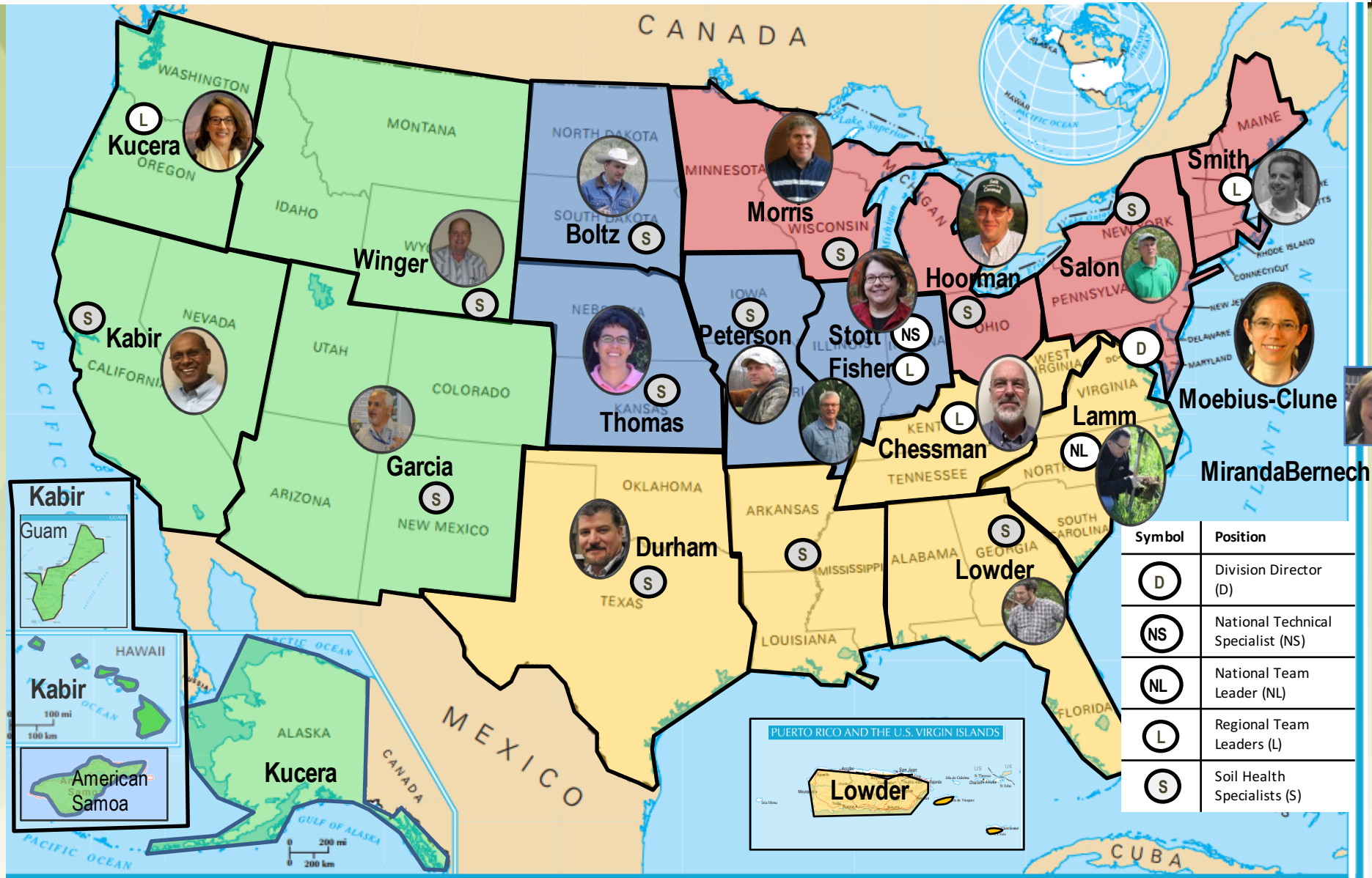
MORE INFORMATION ABOUT SOIL HEALTH –

Google = "NRCS Soil Health"

Soil Health Campaign

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

National USDA-NRCS Soil Health Division



Symbol	Position
D	Division Director (D)
NS	National Technical Specialist (NS)
NL	National Team Leader (NL)
L	Regional Team Leaders (L)
S	Soil Health Specialists (S)

U.S. Department of the Interior
U.S. Geological Survey

The National Atlas of the United States of America®

Contacts: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/contact/conservation/st/#soil

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Barry Fisher, Soil Health Division
USDA-NRCS, Central Leader
Barry.fisher@wdc.usda.gov

nrcs.usda.gov/