

unlock the
SECRETS
IN THE
SOIL

The New NRCS Soil Health Division Approach and Benefits

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USDA-NRCS
Washington, DC




United States Department of Agriculture
Natural Resources Conservation Service

United States Department of Agriculture is an equal opportunity provider and employer.



unlock the
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SOIL

1. **Why Soil Health?**
 - Challenges
 - Opportunities
 2. **Introducing the new Soil Health Division**
 - Structure
 - Who's who
 - Function
 3. **Approach and Benefits – Becoming a valued resource**
 - Leveraging Partnerships
 - SH Training
 - SH Assessment
 - SH Management Planning and Implementation
- 



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SECRETS
IN THE
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1. Why Soil Health?
 - Challenges
 - Opportunities



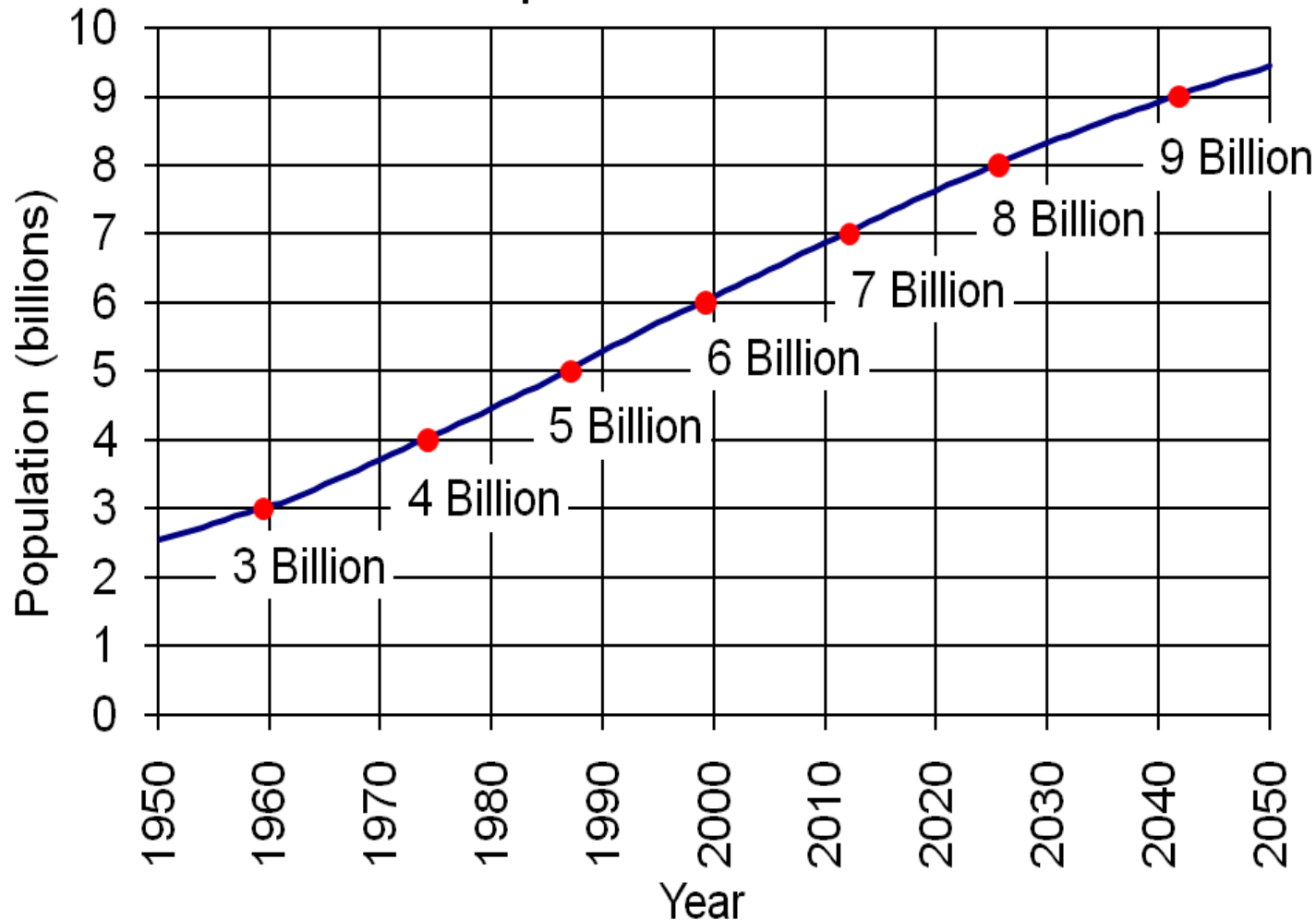


Our Challenges

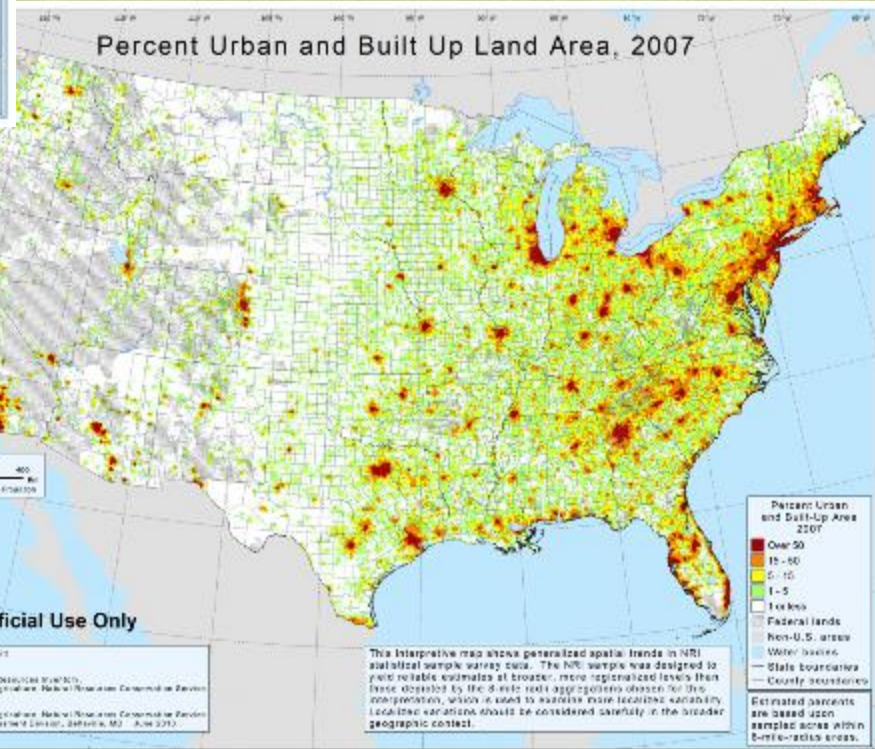
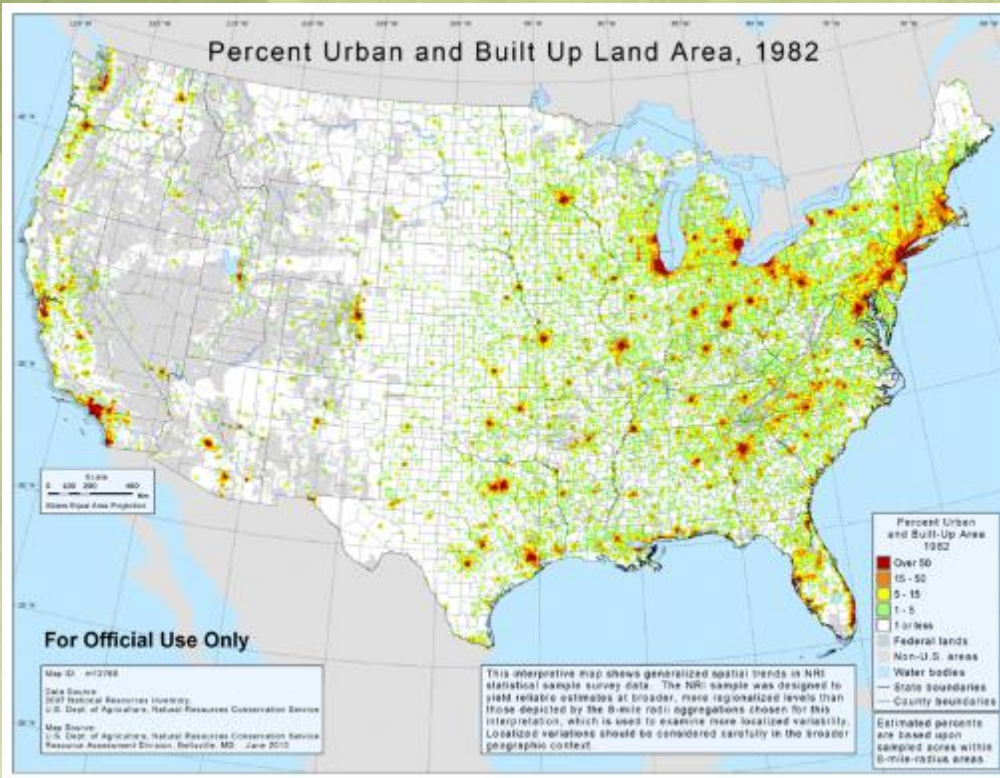
Feeding the population on a shrinking available land base



World Population: 1950-2050



Source: U.S. Census Bureau, International Data Base, June 2011 Update.



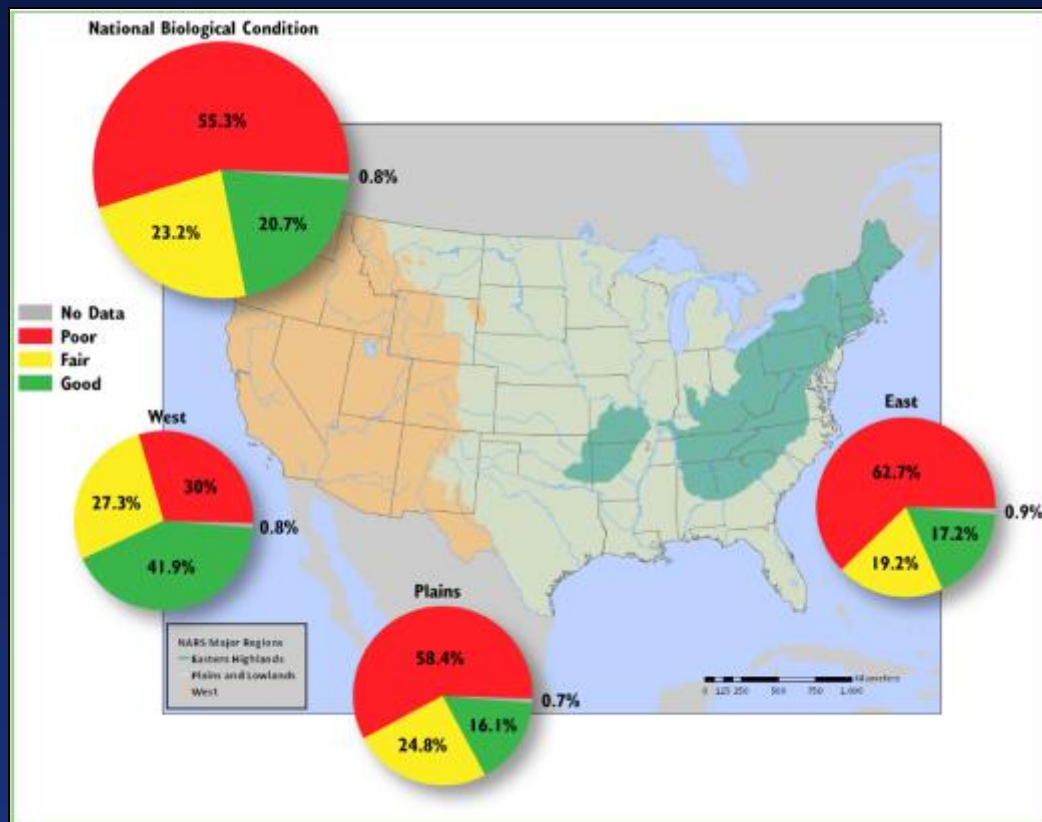
1982 – 2007:

- 41M acres lost to development
- 23M acres of that was active farm land



National Water Quality Challenges

- Biological conditions of nation's rivers and streams
 - Poor - 55.3%
 - Fair – 23.3%
 - Good – 20.7%
 - Unknown – 0.8%
- Greatest stressors:
 - Phosphorous
 - Nitrogen
 - Riparian cover and disturbance
 - Streambed sediment
 - Enterococci

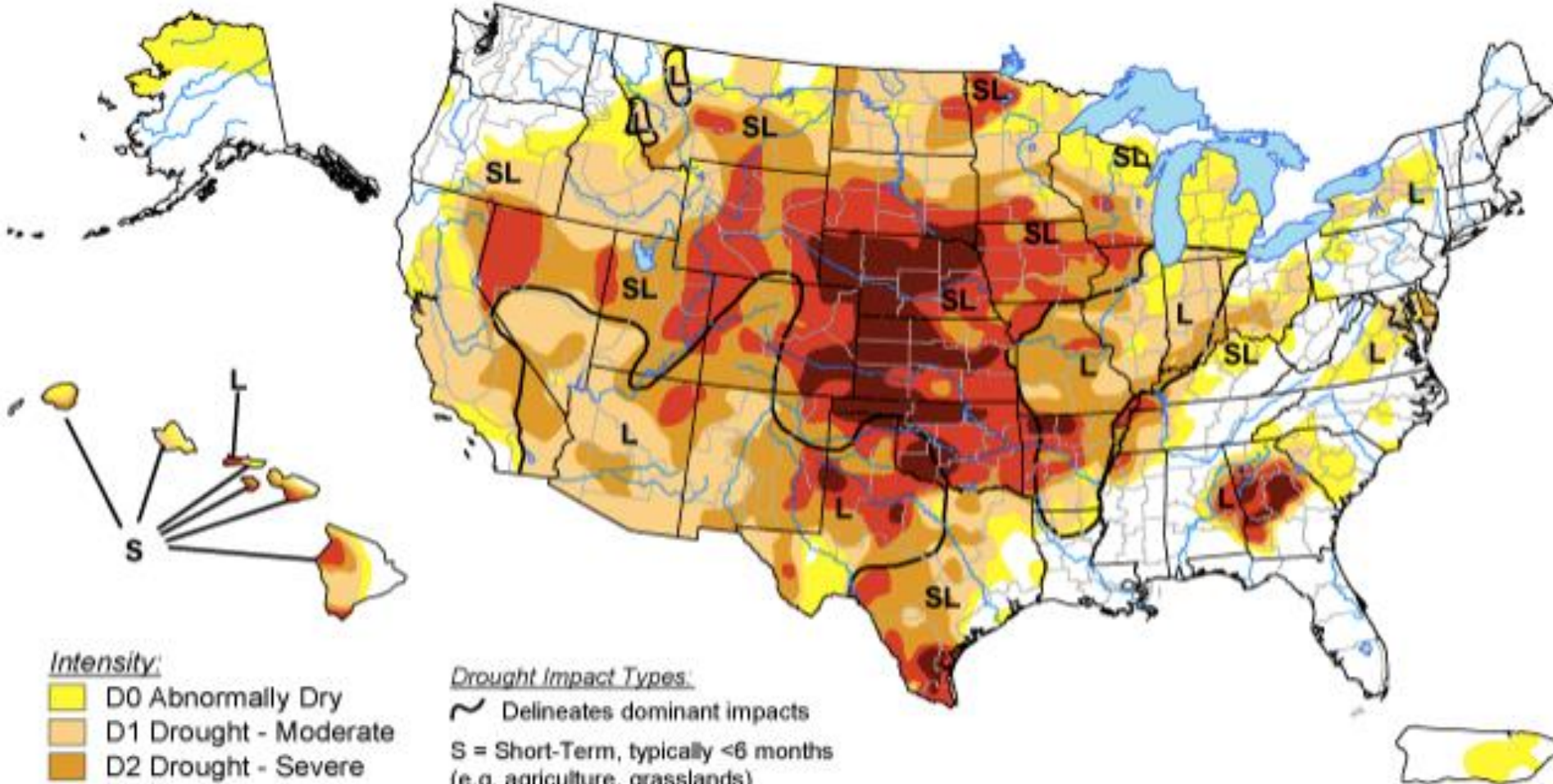


Biological condition of the nation's rivers and streams, based on the Macroinvertebrate Multimetric Index. From National Rivers and Streams Assessment (2008–2009) (EPA, 2013.)






U.S. Drought Monitor

September 25, 2012


Valid 7 a.m. EDT



Intensity:

-  D0 Abnormally Dry
-  D1 Drought - Moderate
-  D2 Drought - Severe
-  D3 Drought - Extreme
-  D4 Drought - Exceptional

Drought Impact Types:

-  Delineates dominant impacts
- S = Short-Term, typically <6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically >6 months (e.g. hydrology, ecology)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://droughtmonitor.unl.edu/>



Released Thursday, September 27, 2012

Author: Anthony Artusa, NOAA/NWS/NCEP/CPC



Water Challenges –
will we have
enough?

Challenges stemming from poor soil health...?



Downward Spiral of Soil Degradation in annual systems



1. Intensive tillage, insufficient added residues, low diversity, no surface cover

2. Soil organic matter decreases, erosion, subsoil compacted

4. Surface becomes compacted, crust forms

6. More soil organic matter, nutrients, and top soil lost

8. Crop yields decline

9. Hunger and malnutrition, especially if little access to inputs

3. Aggregates break down

**5. Infiltration decreases
Erosion by wind and water increases**

7. MORE ponding & persistent wetness, but LESS soil water storage; less rooting; lower nutrient access by plants; less diversity of soil organisms, more disease

Soil Health: the continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals, and humans



Opportunity

Dorn Cox, 2012



Challenge

Bianca Moebius-Cline, 2012



Our Win-Win Opportunities

Feed ourselves, improve profits,
AND improve the environment!

(with some innovation, investment, and
patience we CAN get there)

After Hurricane Irene

Cornell Willsboro Research Farm, NY



2011: Resilience to extreme weather

NT NT
NT NT
NT NT
NT NT



NT corn remained standing



PT corn lodged in high winds

Improved Infiltration - Brookings County, SD



No-Till

**Conventional
Till**

No Cover



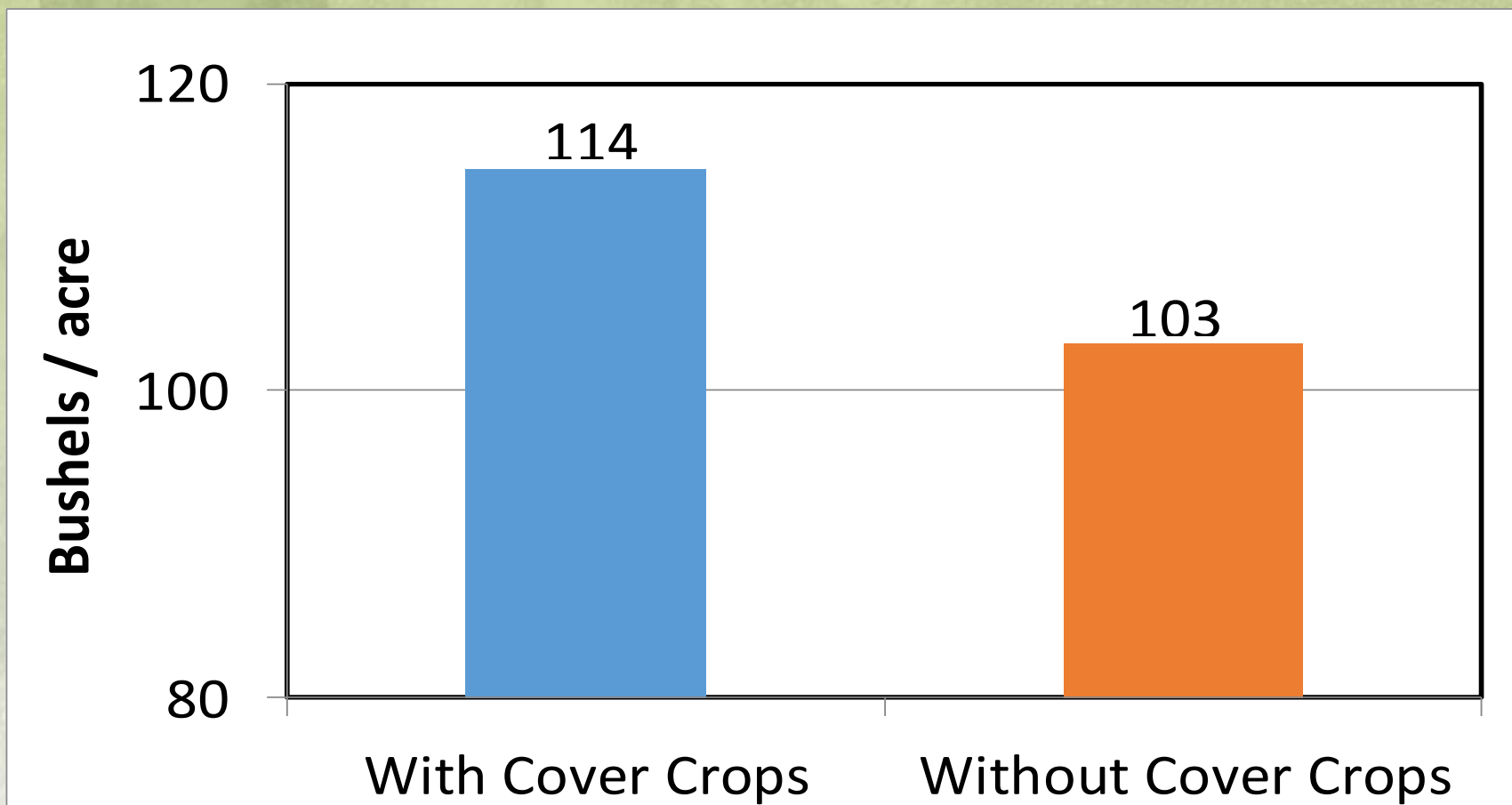
With Cover Crop



USDA-SARE, CTIC Survey 2013



2012 Corn Yield, Drought States



Soil Health Campaign



Soil Health Awareness

Unlock the Secrets in the Soil

Sign up for email updates on Soil Health Awareness

Soil is a living and life-giving natural resource. As world population and food production increase, the importance of our nation's soil is one of the most important resources on the earth. Healthy soils underpin the basic and benefits of our nation's food and fiber systems from farm to fork.

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!
Media Made Resources

GROWING & SHARING
Farmer Resources

BILOGY & BEYOND
Soil Health Science

BEHOLD THE SOIL
The poll, can provide compensation relief for our farmers.

Profiles in Soil Health

Unlock the Science of Soil Health

Under Cover Crops in Blount County, NC

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



MONTANA

PROFILES IN soil health

Julie Taylor

Changes 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.

inter peas, berseem clover, red clover & hairy vetch



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

unlock

THE SCIENCE OF SOIL HEALTH



Return on our Nation's Soil Health Investment

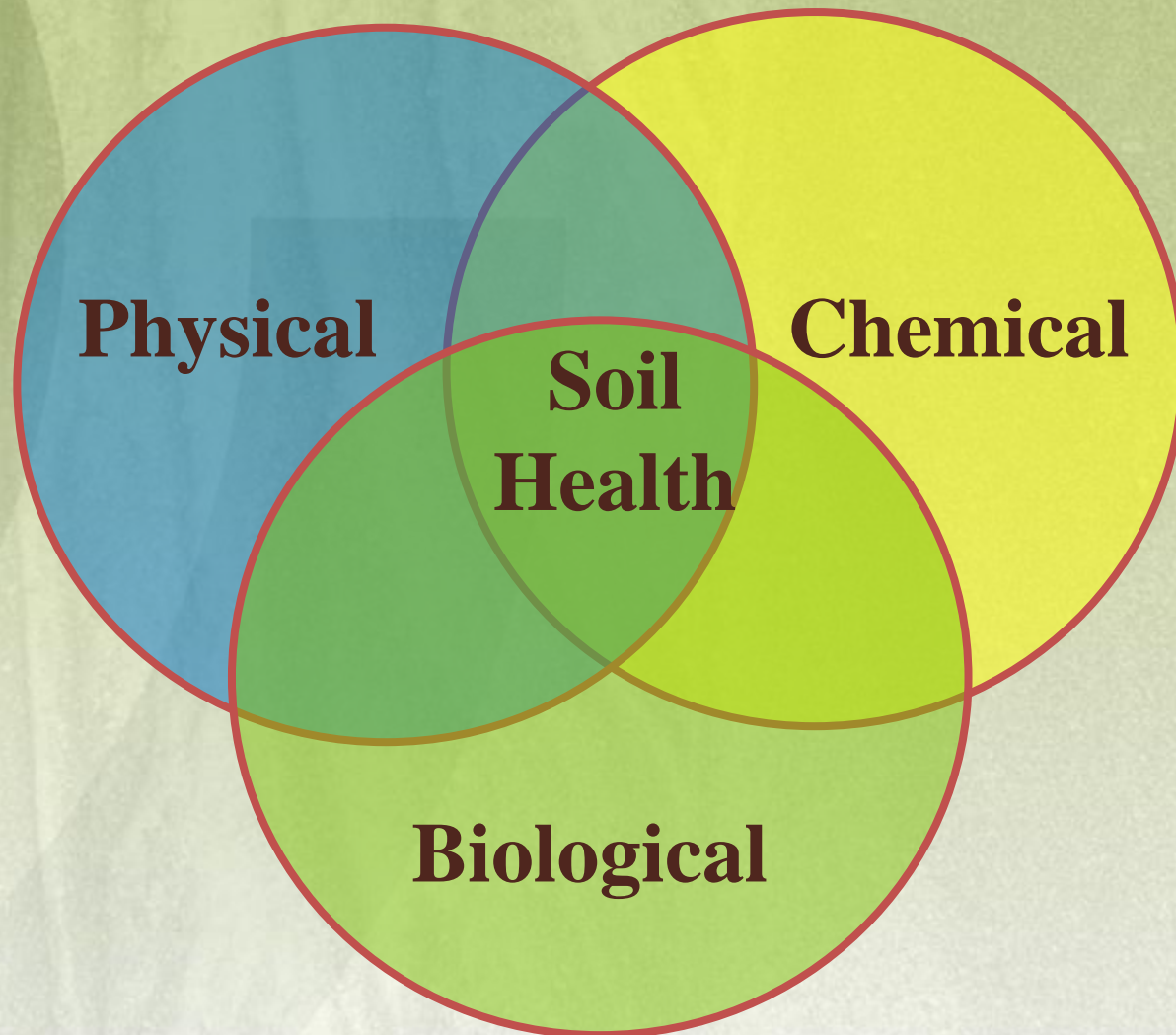
BENEFITS

- Nutrient cycling
- Pest suppression
- Carbon sequestration and energy savings
- Water infiltration
- Less runoff, erosion, flooding
- Water storage and availability
- Resilience
- Biodiversity, groundwater, clean water and air ...
- Long-term economic viability
- Sustained reliable productivity – to feed 9 billion

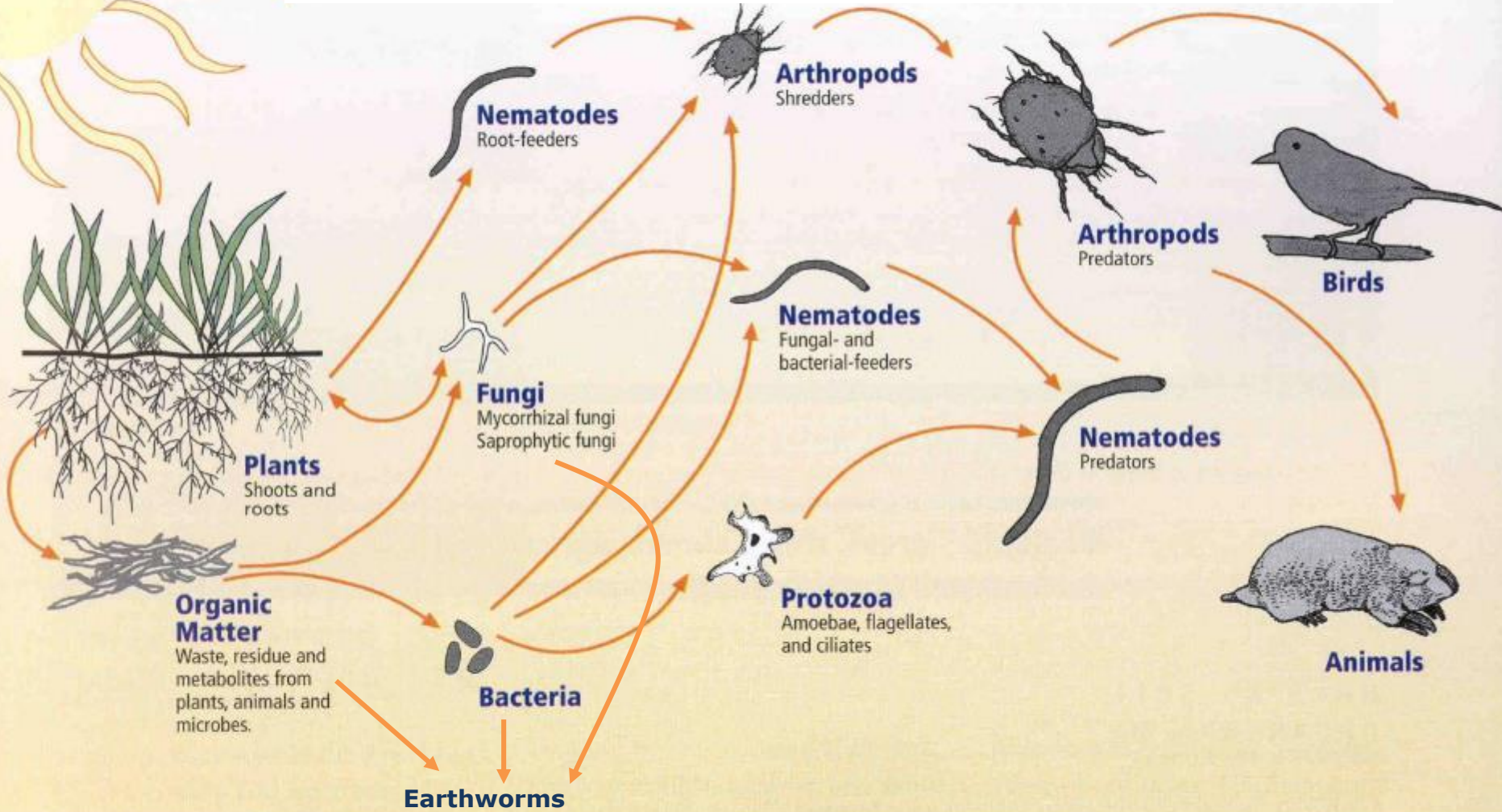
Photos: NRCS and Dorn Cox, 2012



Processes in Healthy Soil are working optimally



Feed your underground livestock (the soil food web)



First trophic level:
Photosynthesizers

Second trophic level:
Decomposers Mutualists
Pathogens Parasites
Root-feeders

Third trophic level:
Shredders
Predators
Grazers


Fourth trophic level:
Higher level predators

Fifth and higher trophic levels:
Higher level predators


Adapting Soil Health Management Principles to soils, regions, and cropping systems requires broad collaboration!





do not
DISTURB

 Minimize soil disturbance.


m) x it
UP

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


d) scover
THE COVER

 Keep the soil covered.

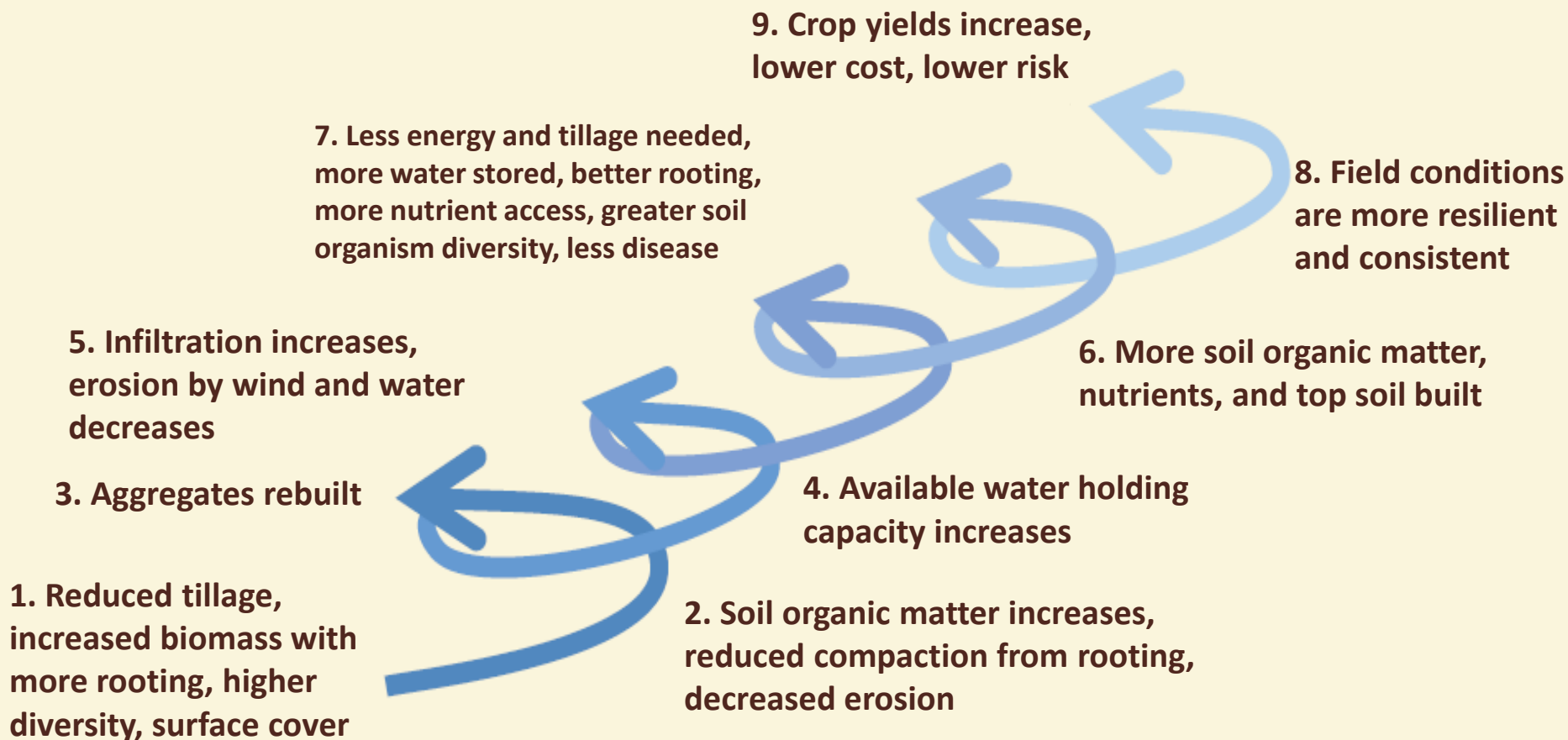

tap into
ROOTS

 Maximize living roots.

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



WIN-WIN Regenerative Soil Health Management Systems for Healthy Soils





Geographically specific management challenges

For example - Climate: too wet, too cold, too dry, too hot, all of the above...

- **KS:** Is there enough water for a cover crop?
- **VT:** Is there enough growing season for cover crop establishment?
- **FL:** Will enough residue remain to suppress weeds?
- **NY:** Will residue keep the soil too wet or cold in the spring?
- **CA:** how to economically justify a cover crop, when a high value vegetable crop could grow instead?
- **WY:** What management effort is economically worth while when climate variability controls soil functioning?

How do we get there?



- Producers and service providers must understand basic processes
- Assess current soil health status
- Develop appropriate plan
- Implement and adjust!
- Need economic info for broader adoption



Photos: NRCS and Dorn Cox, 2012





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 - Function



Staffed to represent varied production systems, leverage efforts, address critical issues

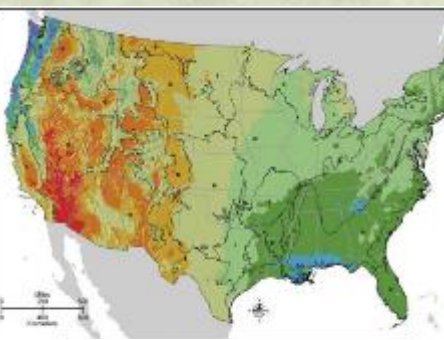
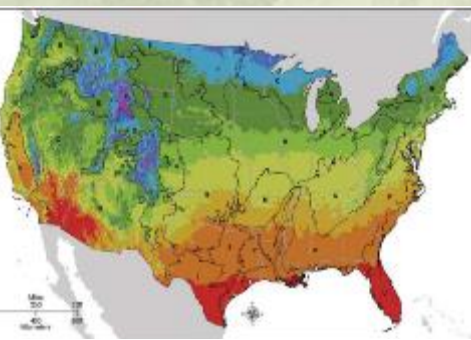
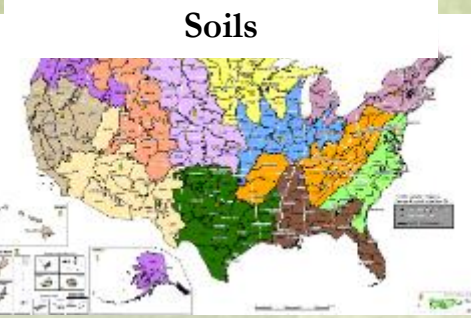


Addressing the Nation's most critical issues through Soil Health

Climate Change Adaptation and Mitigation

Plant Materials Centers

Critical Conservation Areas

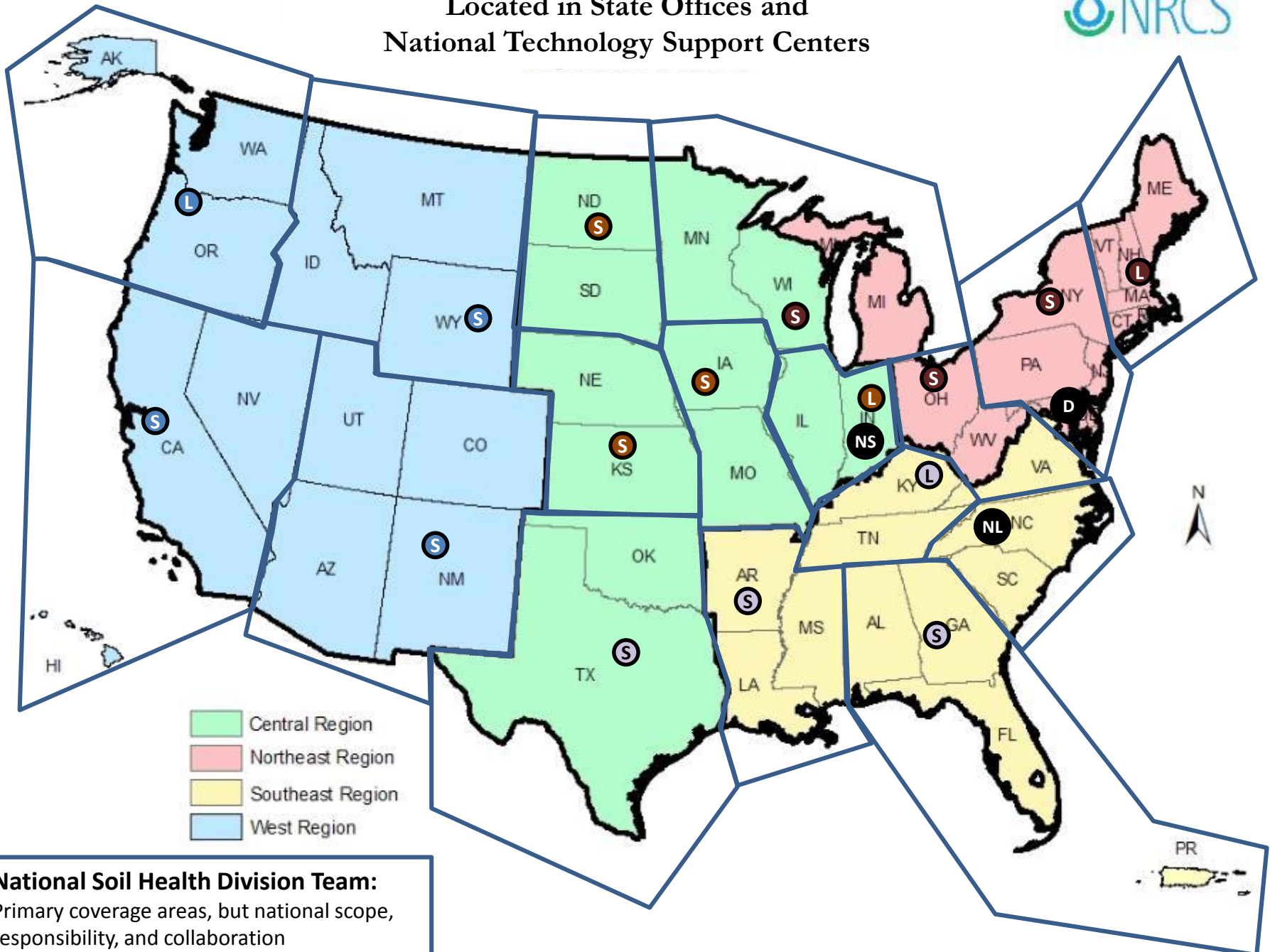


Climate

ARS & Land Grant Research Partners

NRCS Soil Health Division Staff

Located in State Offices and
National Technology Support Centers





Staffing up the USDA-NRCS Soil Health Division

Division Director
Dr. Bianca Moebius-Clune

National Communications & Partnership Liaison
To be hired in FY16

National Soil Health Team Leader
Mr. David Lamm

National Soil Health Specialist
Dr. Diane Stott

Regional Team Leaders (4)
Mr. Barry Fisher – Central
Dr. Brandon Smith – Northeast
Dr. Dennis Chessman – Southeast
Dr. Jennifer Moore-Kucera – West

Regional Soil Health Specialists (12)
West: Rudy Garcia – NM; Marlon Winger – WY;
Central: Candy Thomas – KS; Doug Peterson – IA;
Southeast: William Durham – TX; Nathan Lowder – GA;
Ray Archuleta – AR;
Northeast: Justin Morris – WI; Dr. Paul Salon – NY;
3 others to be hired





Barry



David



Bianca



Diane



Brandon



Doug



Marlon



Nathan



Rudy



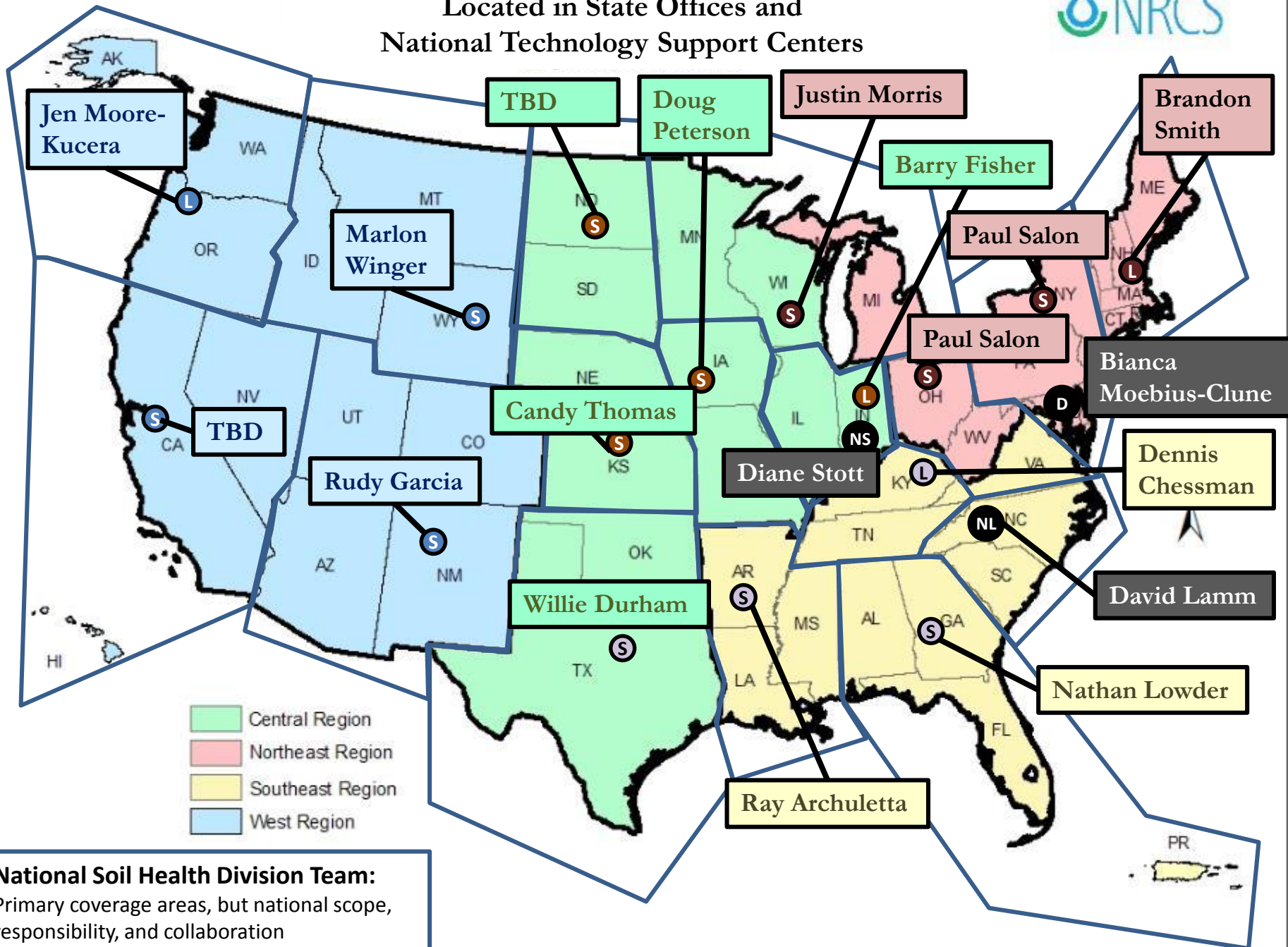
Paul



Jen

NRCS Soil Health Division Staff

Located in State Offices and
National Technology Support Centers





Diverse Skill Sets and Backgrounds

- Soil health management planning and implementation
- Soil health assessment
- Farming/ranching, equipment
- Diverse production systems (agronomic, horticultural, grazing in pasture & range, forests)
- Plant materials and cover crops
- Soil Biology, Agronomy, Soil Survey, Weed Sci, Range Sci, Ecology, Ag Engineering ...
- Leadership, management, coordination
- NRCS, research, extension, teaching, industry, outreach, partnerships, consulting, on-farm implementation
- Partnerships with researchers, extension staff, industry, governmental and non profit organizations

Goals of the new NRCS Soil Health Division



- **Leverage Partners**

Within NRCS and externally (NACD, SARE, TNC, EDF, SHP, Soil Renaissance, ARS, NIFA, Universities, Industry, Nonprofits ...)

- **Ensure Scientific Basis**
- **Evaluate Economics**
- **Quantify Benefits**



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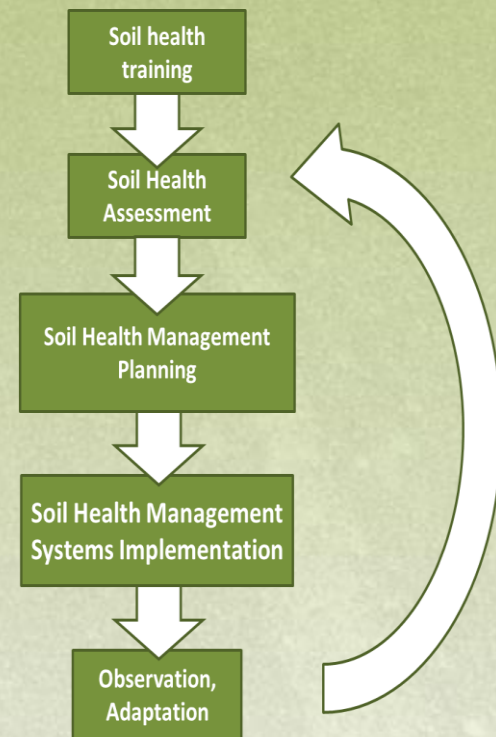
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What will our team DO?

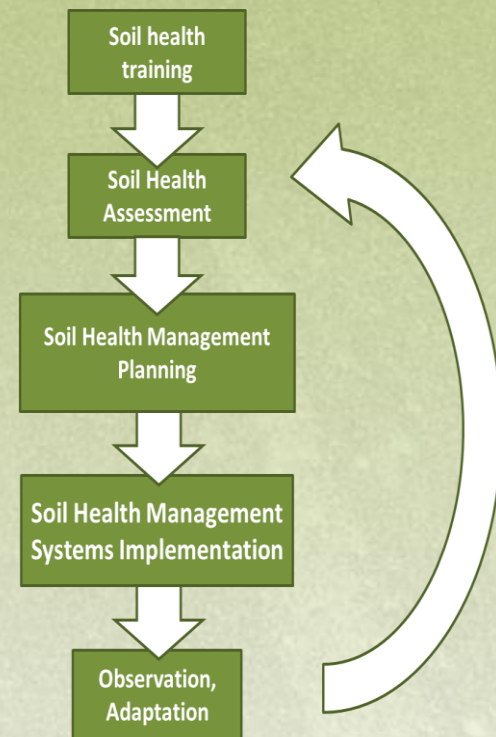
- Build & leverage partnerships
 - Within our own agency
 - Other government agencies
 - Universities, ARS, other research partners and societies to address critical applied research questions
 - Industry and non-profits to broaden adoption





What will our team DO?

- Build & leverage partnerships
- Compile, develop, & provide advanced training & materials, assess gaps
- Provide direct consultative assistance
- Facilitate development and acquire new technologies & approaches for the agency
- Develop & revise NRCS standards to facilitate successful soil health management systems implementation on farms and ranches
- Inform leadership of needs, issues, opportunities, and successes to strategically build impact



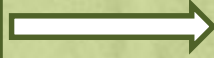
HOW will our National Team work with NRCS State Soil Health Teams and Stakeholders?



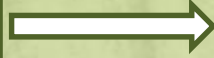
Becoming a valuable resource:

- Assess and inventory needs and opportunities at regional level – strategize to build agency capacity with limited resources
- Build bridges to/between successful efforts, and lessons learned, in the region or nation
- Coordinate soil health efforts so that grass roots ideas are leveraged broadly, and to avoid duplication of efforts
- Enable communication of a consistent, science-based NRCS soil health message, adapted for regional differences
- Develop, provide, contribute to trainings
- Lead, contribute to solutions for technical problems
- Keep efforts and materials based on latest science

**Contribute,
amplify,
demonstrate**



**Research,
evaluate, improve,
provide service**



**Soil health
training**

**Soil Health
Assessment**

**Soil Health Management
Planning**

**Soil Health Management
Systems Implementation**

**Observation,
Adaptation**

**Opportunities for
Collaboration with the
new Soil Health
Division**





NRCS Soil Health Assessment Initiative

- Will gather national soil health sample dataset
 - Initially ~1000 samples planned, contributions to larger national dataset welcome
 - Multiple commercially available soil health assessments on each sample (Cornell, Haney, PLFA, beta-glucosidase)
 - Long-term experiments
 - Commercial farm sites
 - Soil management history
 - Inputs
 - Yields
- Collaborations to expand dataset? (contact Diane Stott, National Soil Health Specialist, diane.stott@in.usda.gov)
- Convening scientists to standardize methods, leveraging partnerships to facilitate broader availability and develop appropriate recommendations

<http://www.conservationwebinars.net/webinars/cornell-soil-health-assessment-a-diagnostic-approach-for-evaluating-and-managing-soil-health/>



Example NH pilot project

Assessment → Planning → Implementation

Described in <http://www.conservationwebinars.net/webinars/cornell-soil-health-assessment-a-diagnostic-approach-for-evaluating-and-managing-soil-health/>



Interpreting Soil Health Assessments in NH NH-590 Quick Reference

Test Results	Suggested Management Practices		NH NRCS Practice (code)
	Short Term	Long Term	
Physical Concerns			
Low Aggregate stability	<ul style="list-style-type: none"> Incorporate fresh organic materials Use shallow-rooted cover/rotation crops Add manure, green manure, mulch 	<ul style="list-style-type: none"> Reduce tillage Use a surface mulch Rotate with sod crops 	(328) Conservation Crop Rotation; (340) <u>COVER CROP</u> ; (329) Residue Mgmt No-Till/Strip-Till; (484) Mulching; (512) Forage & Biomass Planting; (528) Prescribed Grazing
Low Available Water Capacity	<ul style="list-style-type: none"> Add stable organic materials, mulch Add compost or biochar Incorporate high biomass cover crop 	<ul style="list-style-type: none"> Reduce tillage Rotate with sod crops Incorporate high biomass cover crop 	(328) Conservation Crop Rotation; (329) Residue Mgmt No-Till/Strip-Till; (317) Compost Facility; (340) <u>COVER CROP</u> ; (512) Forage & Biomass Planting; (528) Presc. Grazing
High Surface Hardness	<ul style="list-style-type: none"> Perform some mechanical soil loosening (strip till, aerators, broadfork, spader) Use shallow-rooted cover crops Use a living mulch or interseed cover crop 	<ul style="list-style-type: none"> Shallow-rooted cover/rotation crops Avoid traffic on wet soils, monitor Avoid excessive traffic/tillage/loads Use controlled traffic patterns/lanes 	(328) Conservation Crop Rotation; (345) Residue Mgmt, Mulch Till; (340) <u>COVER CROP</u> ; (484) Mulching; (528) Prescribed Grazing (512) Forage & Biomass Planting
High Subsurface Hardness	<ul style="list-style-type: none"> Use targeted deep tillage (subsoiler, yeomans plow, chisel plow, spader.) Plant deep rooted cover crops/radish 	<ul style="list-style-type: none"> Avoid plows/disks that create pans Avoid heavy loads Reduce traffic when subsoil is wet 	(324) Deep Tillage; (329) Residue Mgmt, No-Till/Strip-Till; (345) Residue Mgmt, Mulch Till (340) <u>COVER CROP</u> ; (606) Subsurface Drain
Biological Concerns			
Low Organic Matter	<ul style="list-style-type: none"> Add stable organic materials, mulch Add compost and biochar Incorporate high biomass cover crop 	<ul style="list-style-type: none"> Reduce tillage/mechanical cultivation Rotate with sod crop Incorporate high biomass cover crop 	(328) Conservation Crop Rotation; (340) <u>COVER CROP</u> ; (329) Residue Mgmt No-Till/Strip-Till; (317) Compost Facility; (528) Prescribed Grazing (512) Forage & Biomass Planting;
Low Active Carbon	<ul style="list-style-type: none"> Add fresh organic materials Use shallow-rooted cover/rotation crops Add manure, green manure, mulch 	<ul style="list-style-type: none"> Reduce tillage/mechanical cultivation Rotate with sod crop Cover crop whenever possible 	(328) Conservation Crop Rotation; (329) Residue Mgmt, No-Till; (340) <u>COVER CROP</u> ; (345) Residue Mgmt, Mulch Till; (528) Presc. Grazing (512) Forage & Biomass Planting



Photos: Bianca Moebius-Clune and Dorn Cox, 2012

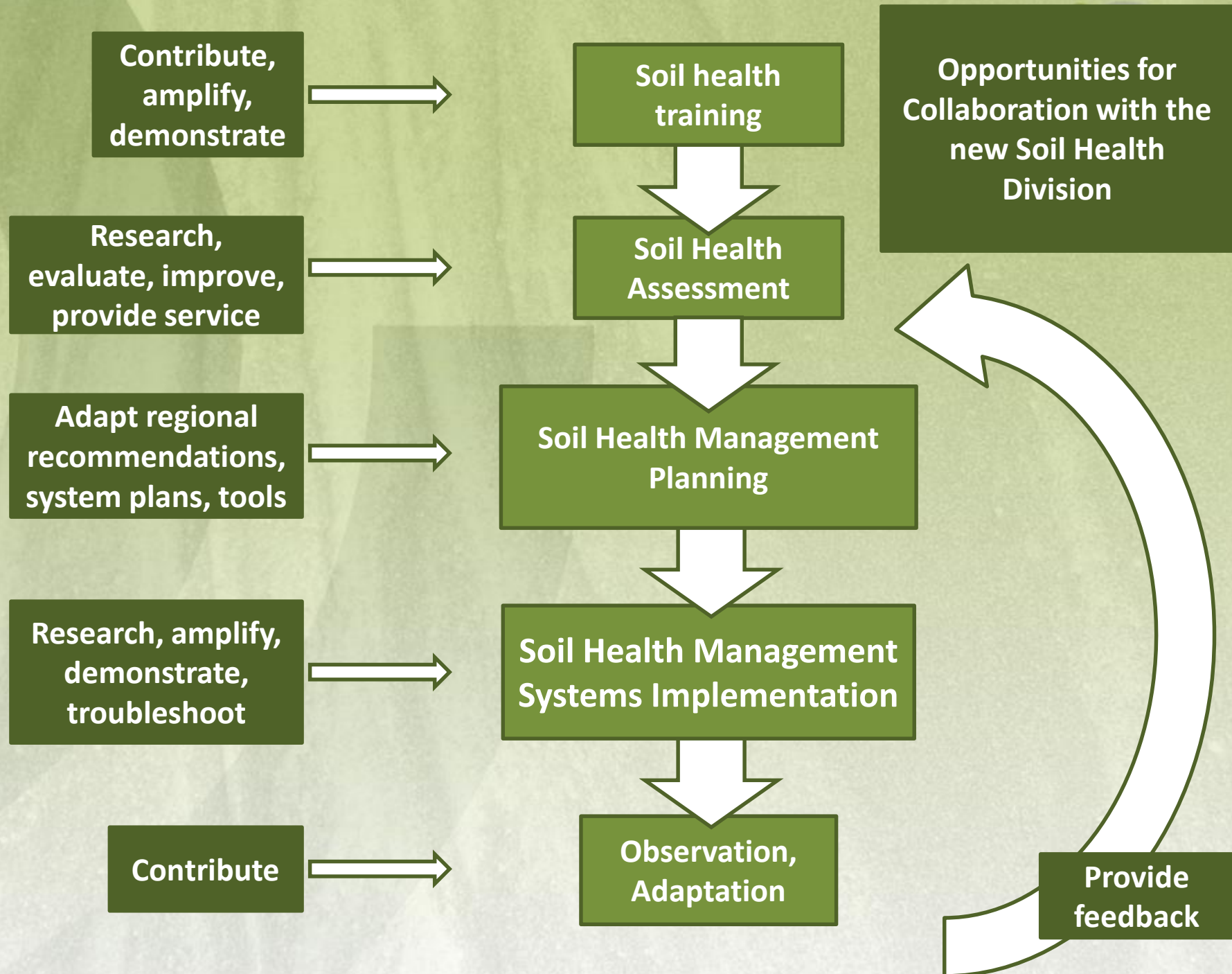
One Farm: Soil Health Management Planning and Implementation led to Improved Productivity and Clear Pond



Photos: Bianca Moebius-Clune and Dorn Cox, 2012

Photos: Dorn Cox

Moebius-Clune, et al., 2014. Implementation of a Soil Health Management Plan resolves pond eutrophication at Tuckaway Farm, NH. What's Cropping Up? <https://blogs.cornell.edu/whatscroppingup/category/soil-health/>



Return on our Nation's Soil Health Investment

Changing the Face of Agriculture and How We Feed our Nation



BENEFITS

- Nutrient cycling
- Pest suppression
- Carbon sequestration and energy savings
- Water infiltration
- Less runoff, erosion, flooding
- Water storage and availability
- Resilience
- Biodiversity, groundwater, clean water and air ...
- Long-term economic viability
- Sustained reliable productivity – to feed 9 billion

Photos: NRCS and Dorn Cox, 2012



Thank you!

How can we collaborate best?



- Leverage Partners
- Ensure Scientific Basis
- Evaluate Economics
- Quantify Benefits



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USDA-NRCS, Washington, DC**
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