



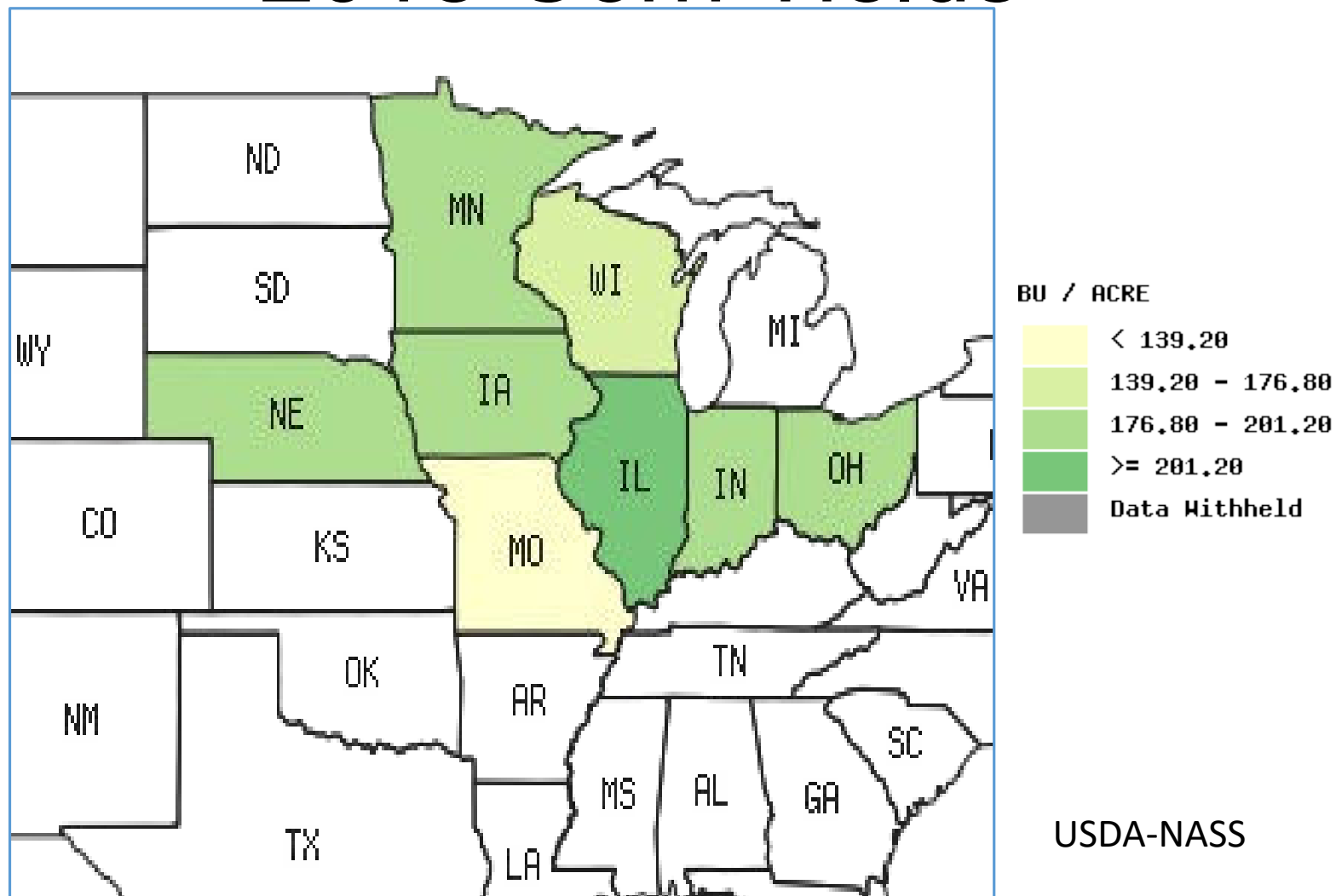
United States
Department
of Agriculture

Building Your Soil Health System on Sound Principals.

 unlock the
SECRETS
IN THE
SOIL



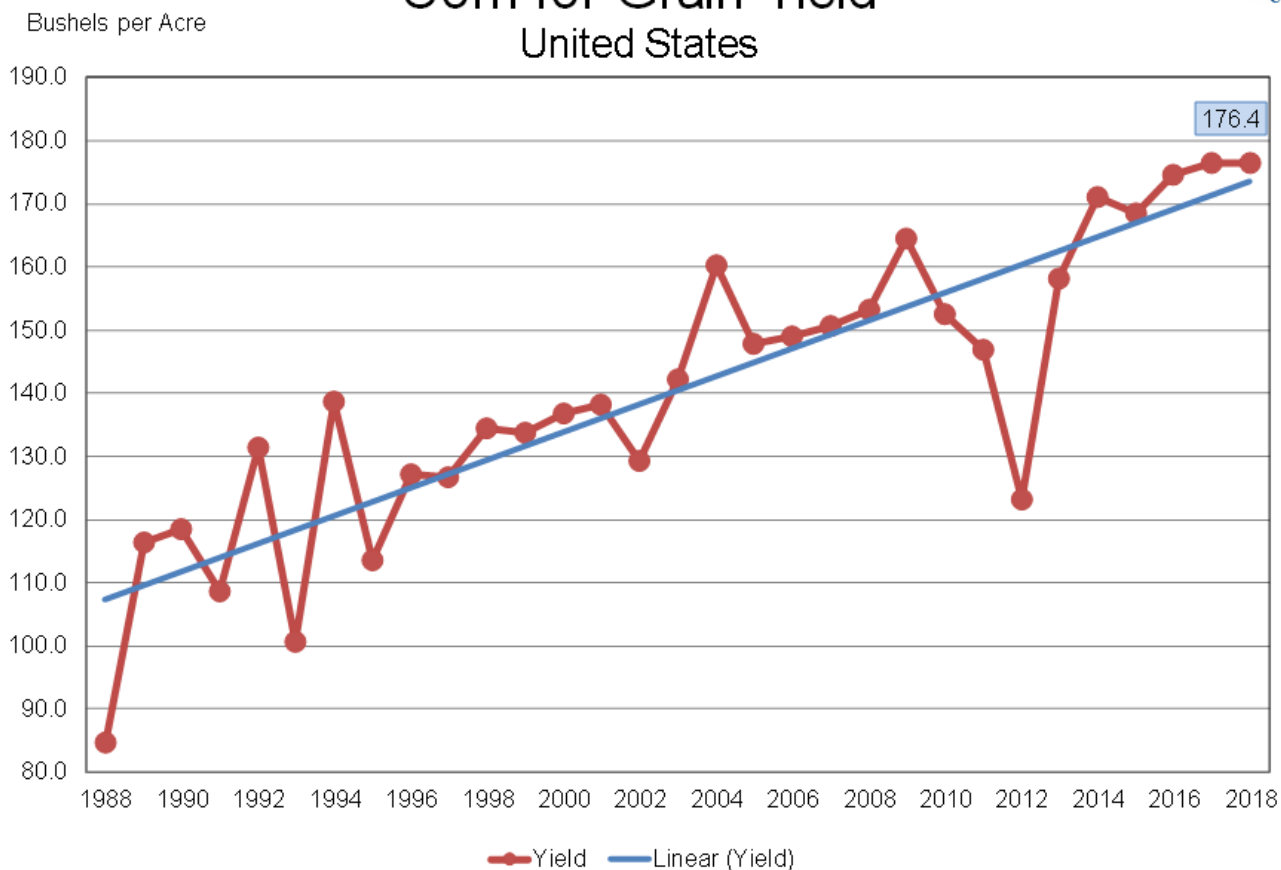
2018 Corn Yields



2018 Corn Yields

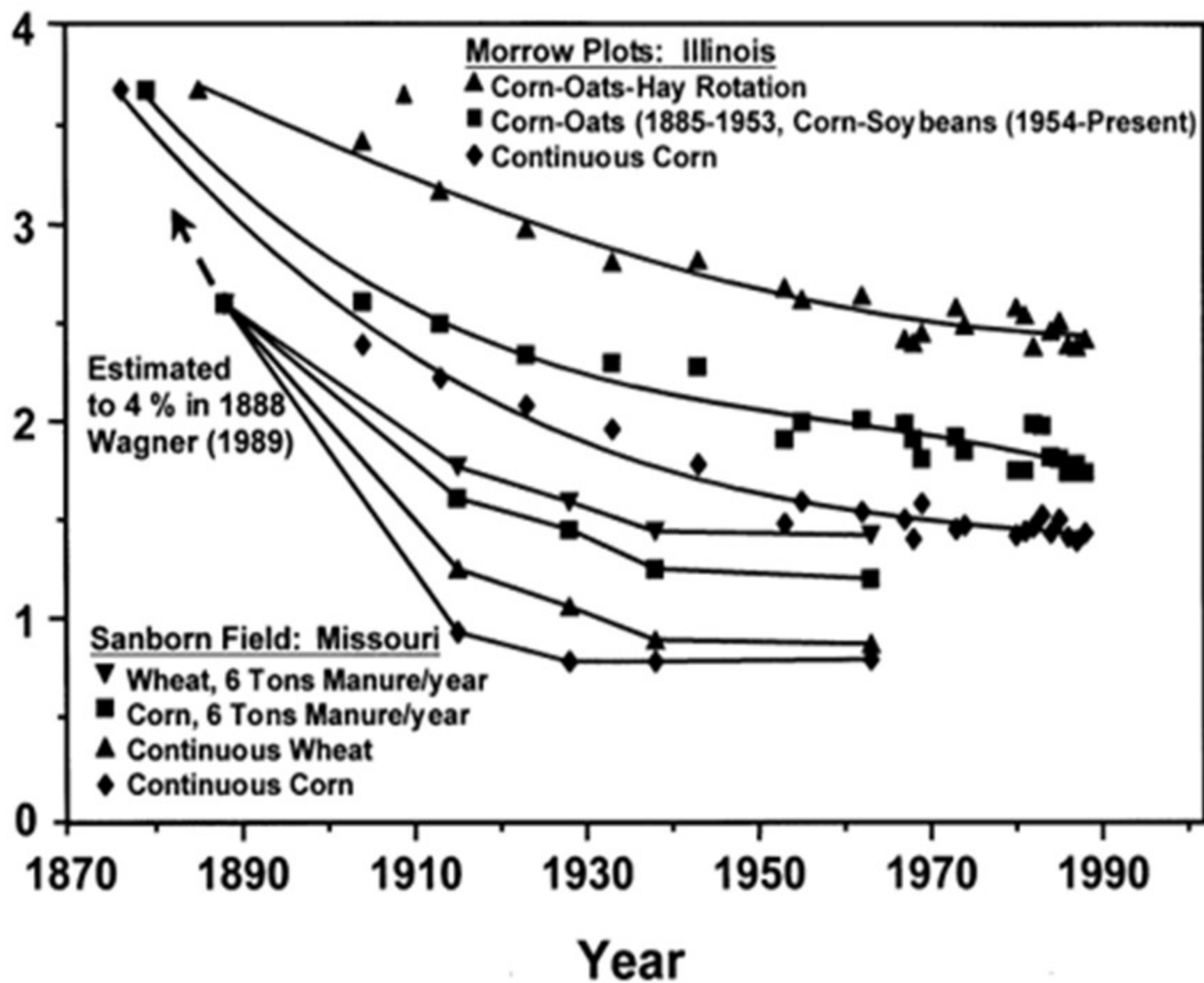


Corn for Grain Yield United States



USDA-NASS
2-8-19

Soil Organic Carbon (%)



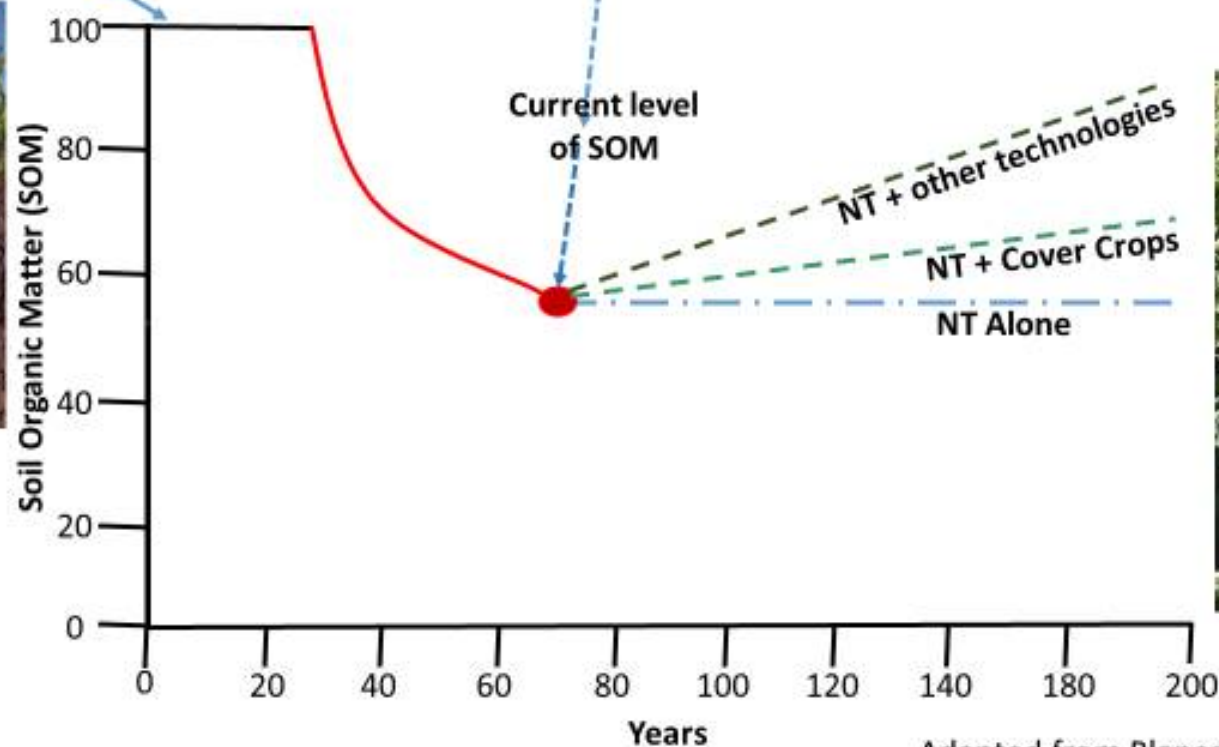


Have We Lost Soil
Function?



Can We Regenerate Functions

Tallgrass Prairies are the most productive ecosystems in USA



Adapted from Blanco-Canqui, H. et al. 2015



SOIL HEALTH:

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

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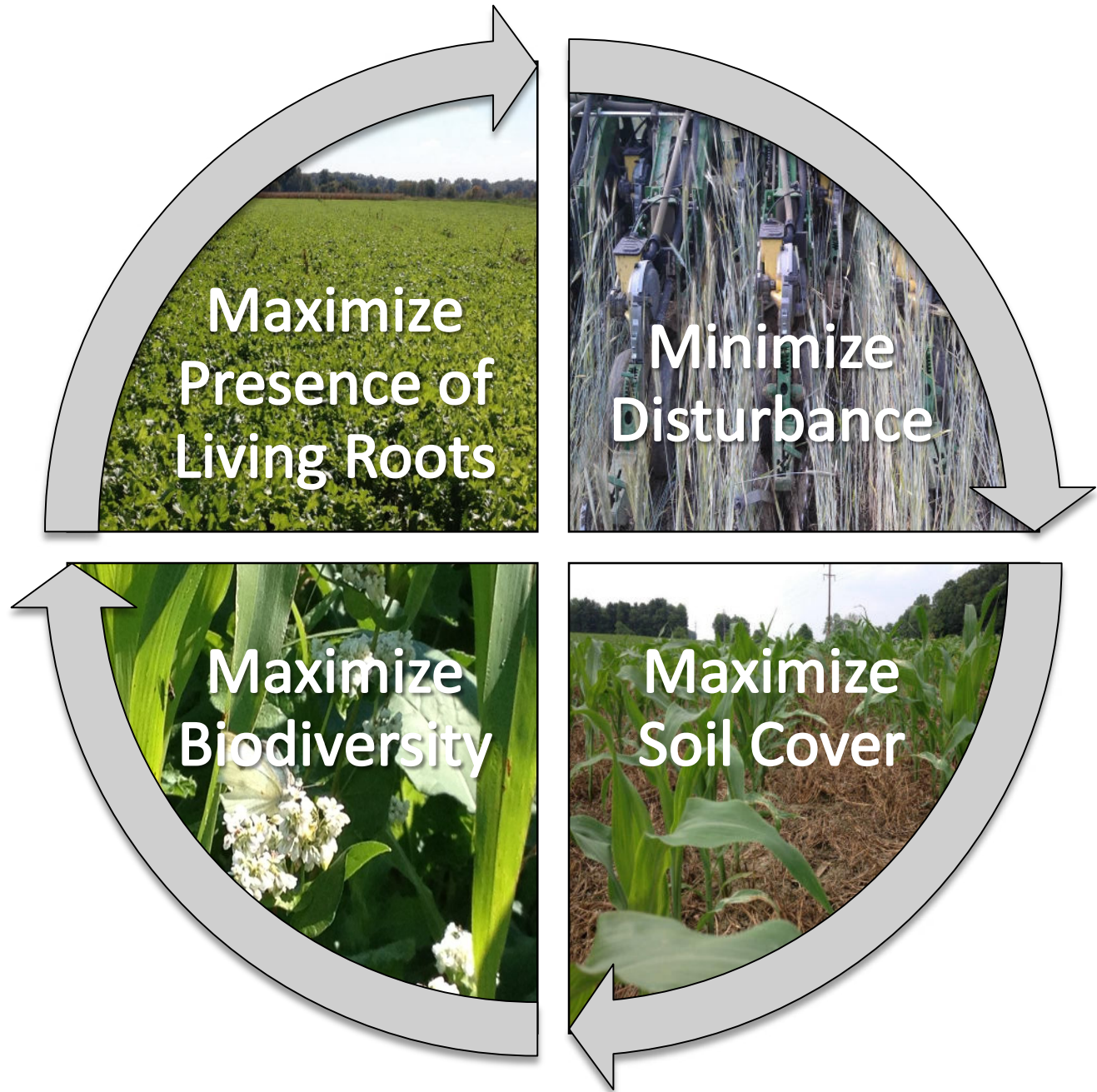
- Nutrient cycling
- Water (infiltration & availability)
- Filtering and Buffering
- Physical Stability and Support
- Habitat for Biodiversity (90% is mediated by soil microbes)

A changing vision of soil...

- The concept of “fixed” soil properties has been shattered by **soil health farmers.**
- They have **CHANGED** the health and function of their soil.

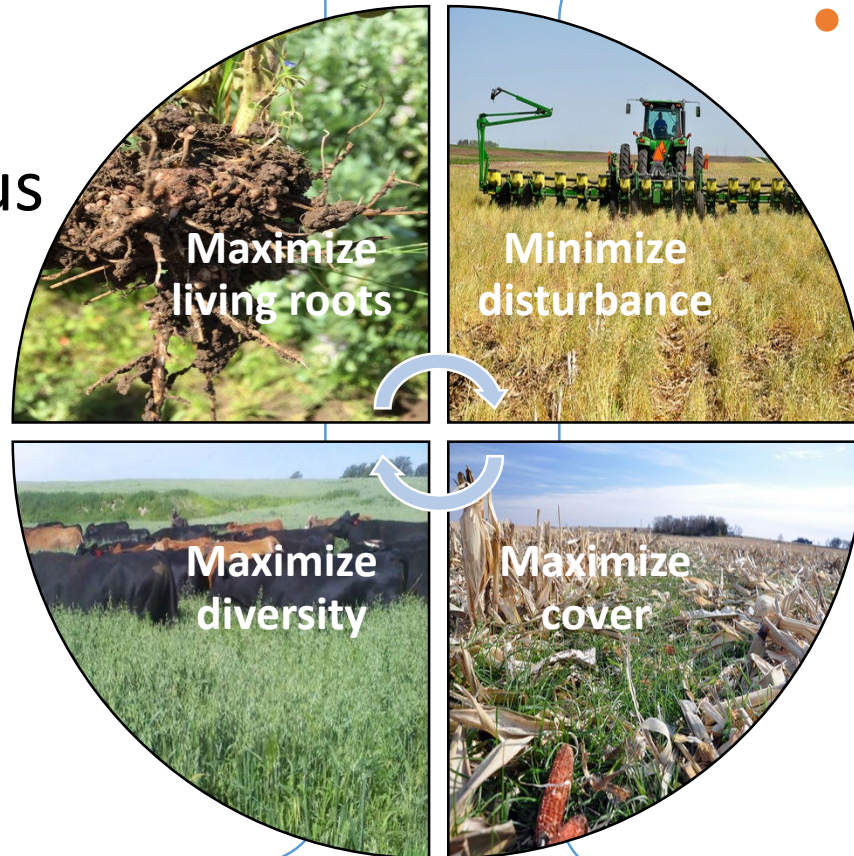


Soil Health Principles



Soil Health Principles To Support High Functioning Soils

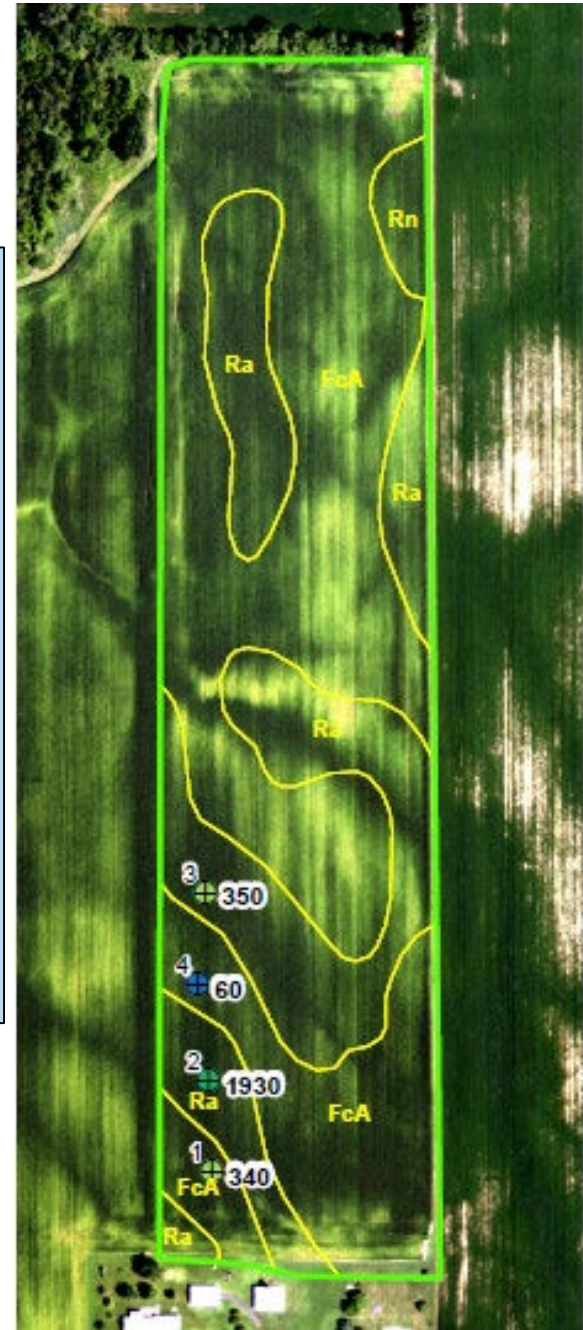
- **Feed**
diverse,
continuous
inputs (C
sources,
energy)



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



The Fence Row Effect



Principles at work

An aerial photograph of a vast agricultural landscape. The foreground and middle ground are dominated by large, rectangular fields of corn, planted in distinct, parallel rows. A narrow, winding stream or ditch cuts through the fields, creating a natural boundary. In the background, a road or a different type of terrain is visible, showing a mix of brown and green hues. The overall scene illustrates the application of agricultural principles in a real-world setting.

J. Maloney Brownsburg, IN

Neighbor



Quality No-Till



Ecological Nutrient Management



Integrated Pest Management



Prescribed Cover Crops & Grazing



Diverse Crop Rotation

Principles for Success ... We Must have a Game Plan

Game Plan Principles for:

- Nutrient Management
- Cover Crop Termination
- Pest Management
- Weather- read the defense!



Principle Nutrients Management Strategies for Soil Health Cropping Systems

Game-Plan Principles for:

- **Nutrient Management**



- **Adaptive Management**

Principles for Success ... We Must Adapt the Game Plan

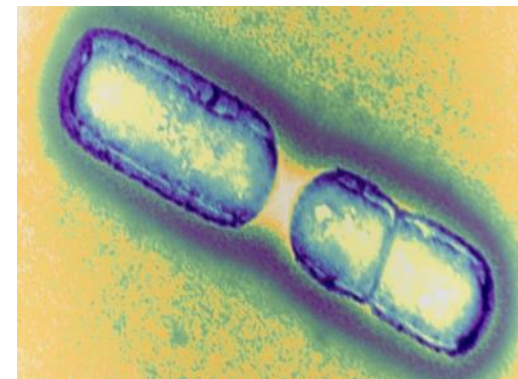
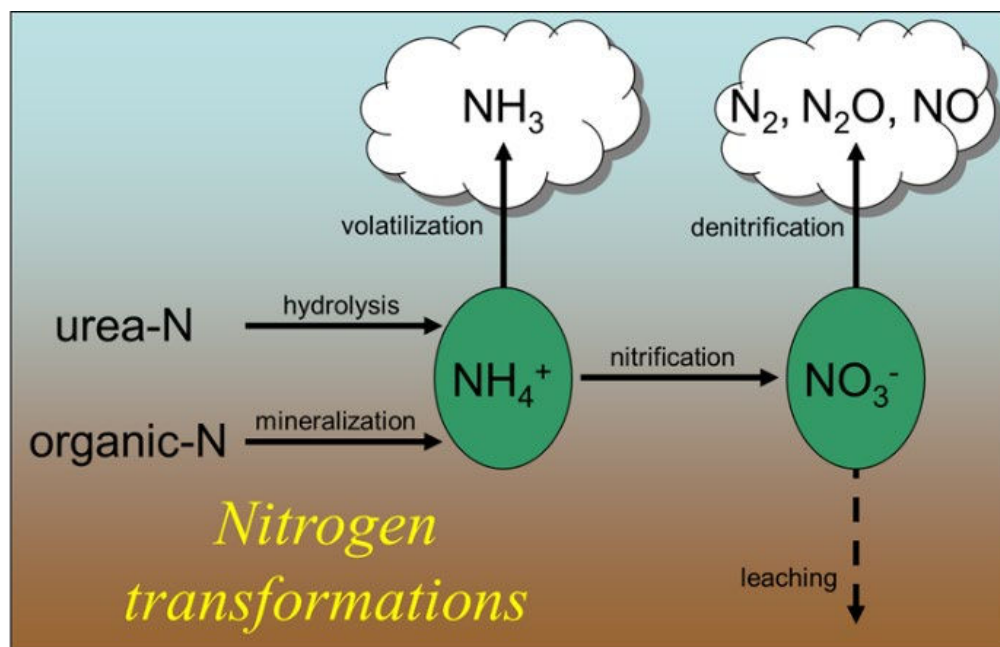


• 4-Rs



Must include SOM and
Organic Nutrient Contribution

Understanding Nitrogen Mineralization and Immobilization



Biology

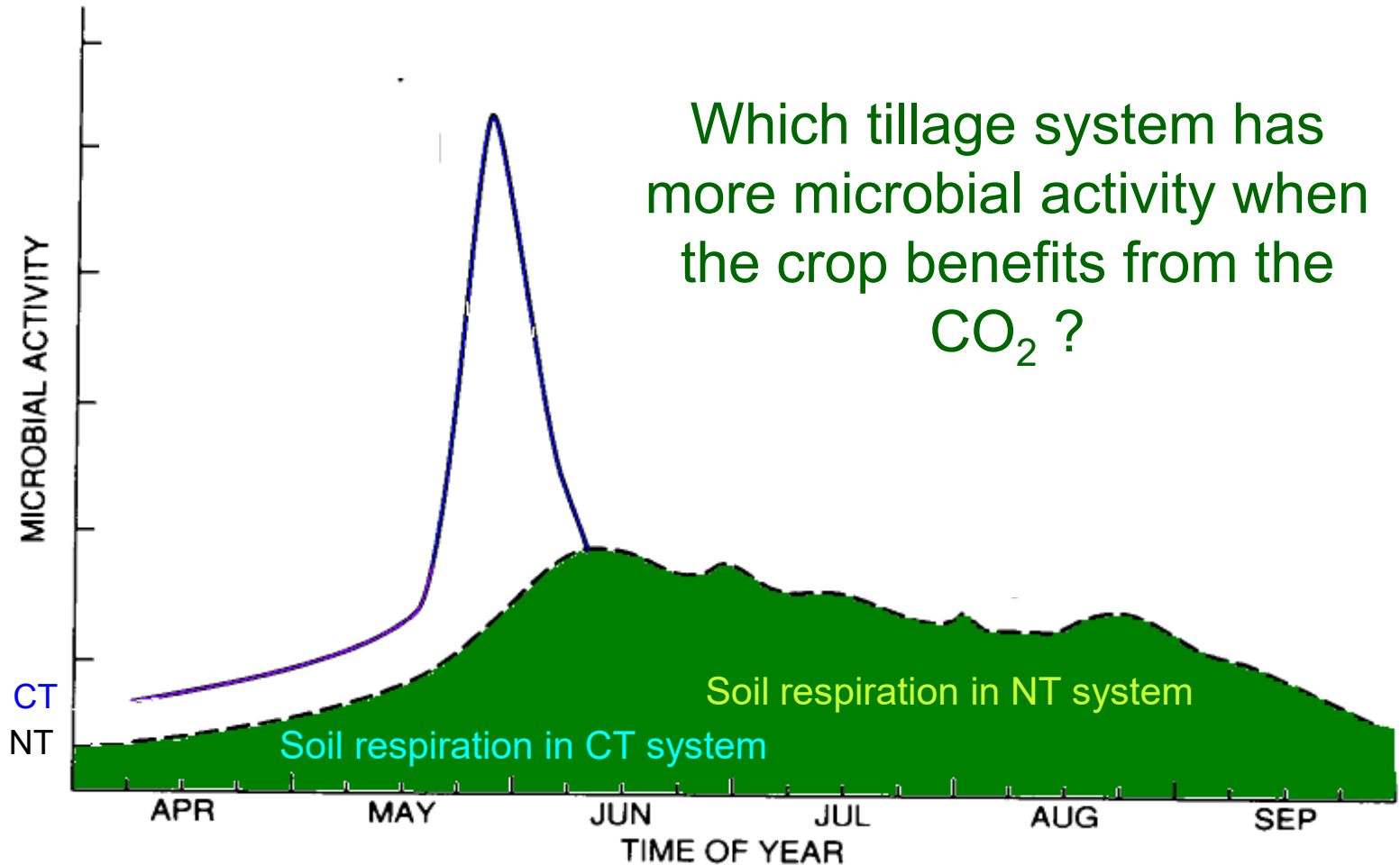


Only 30-55% of Inorganic Fertilizer is Directly Used by Plants

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)

No-Till planters



Precision nutrient
placement and rate

Starter Nitrogen
+ S



Strategically...

CC should complement the following crop

What about Corn?



Strategically...

CC should match desired C:N Ratio

Material

C:N Ratio

Rye Straw

82:1

Wheat Straw

80:1

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

Crimson Clover

17:1

Ryegrass (Vegetative)

15:1

Hairy Vetch Cover Crop

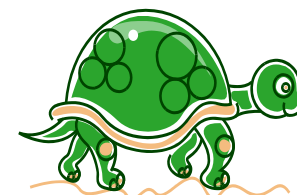
11:1

Soil Microbes (Average)

8:1

Good for
Soybean

N
Immobilization



Good
for
Corn

N
Mineralization



Strategically...

CC should complement the following crop

...Which is better?

Corn into:

High Carbon (Cereals
Rye/Wheat)

...or

Low Carbon C:N

Cover Crop (Vegetative),
Winter Kill or Legume
(Clover/Peas)



Strategically...

CC should complement the following crop

Corn into a mix:

Low C:N (High Protein)

Can Provide:

- Optimum Nutrient Release
- Extra water during rapid demand



Strategically...

What about Soybeans?

Choices

Do Soybeans
need N ?

... Sure, but
they
capture
their own!



Strategically...

Soybeans do well into a high carbon Cover Crop.

...Why?

Weed Control, Late Season Water and Nutrient Cycling



Principles for Success ... We Must have a Game Plan

Game-Time Decisions for:

- Nutrient Management
- **Cover Crop Termination**
- Pest Management
- **Weather**



Planning the System Using the If >than / Then Approach

Terminate the Cereal Rye at 12"... Or...



Planning the System Using the If > than / Then Approach

...Or...> than 16"- Then

- Plant green
 1. Spray 1-2 days BEFORE planting or
 2. Spray AFTER planting (same day or within 1-2 days)
 3. Advantages and risks with each option
(see Table 1 in Purdue AY-353-W)





Principles for Success ... We Must have a Game Plan

Game-Time Decisions for:

- Nutrient Management
- Cover Crop Termination
- Pest Management
- Weather- read the defense!



Pest Management Game Plan-

- Integrated (and Adaptive) Pest Management Systems
 - Utilizes holistic management
 - Limit pest opportunities
 - Integrates predator/ prey relationships
 - Employs beneficial biology and cultural practices
 - Are seldom based on preventative chemistry
 - Utilize technology and chemical treatments when necessary



THE XERCES SOCIETY GUIDE

Farming with Native BENEFICIAL INSECTS

PREDATORY INSECTS

Firefly Beetles, Fireflies, Lightning Bugs

ORDER: Coleoptera

FAMILY: Lampyridae



ADULT FIREFLIES have soft, leathery wing covers. They superficially resemble soldier beetles, but most can be distinguished by the light-producing segments near the end of the abdomen. Female fireflies have shorter wings and fewer luminous segments than males, and many species are wingless. The predatory larvae have strong, sicklelike jaws, and are referred to by some as "glowworms" because they are also luminescent.

COMMON PREY: Snails, slugs, caterpillars, and other soft-bodied insects in soil and moist or

ADDITIONAL HABITAT: Larvae reside in damp areas where prey is found, and under bark. Fireflies pupate in soil, under rocks, or in leaf litter.

CONSERVATION STRATEGIES: Tall grass in field edges or nearby habitat can shelter adults and should be protected or supplemented. Reduce tillage to protect egg-laying sites as well as larval habitat and overwintering sites. Flowers with an open structure and exposed nectaries, such as those in the sunflower family, may attract pollen- and nectar-seeking adults.

Provide habitat for beneficial insects with hedgerows and buffer strips



...Let it bee



Principles for Success ... We Must have a Game Plan

Game-Time Decisions for:

- Nutrient Management
- Cover Crop Termination
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Sometimes it just rains...



A close-up, slightly high-angle shot of a dense field of tall, vibrant green grass. The blades are long and slender, with some showing signs of being cut or broken. Interspersed among the grass are several clover leaves, which are smaller and have a distinct three-lobed shape. The lighting is bright, suggesting a sunny day, and the overall color palette is dominated by various shades of green.

**How can we
rebound from such a
bad situation?**





Do you have a Plan for variable situation?

Feb. 25



Early Establishment is Usually Better! ...Plan for it.



How can we gain
resilience to
harsh weather?



When in
doubt...
Plant!

Soil Health Principles





I feel
great!

Thanks
for the
nice soil!

Crop Talk!

- Listen to what the crop is telling you...



The Golden Principle- Lack of cover is seldom a good thing!



Things don't always go
the way you plan....



Plan anyway



United States Department of Agriculture

Plans Following Sound Principles Lead to Good Soil Health Decisions

USDA is an equal opportunity provider, employer, and lender."

