USDA United States Department of Agriculture

Resource Concerns & Soil Health Indicators

Module 3

Mike Kucera
Agronomist

USDA United States Department of Agriculture

Objectives

- Define soil health indicators as they relate to soil function
- Locate and discuss the limitations to the soils data and interpretations that are currently available
- Identify how soil health indicators reveal the presence of resource concerns

Making Soil Health A Priority= Taking a Soil Health Journey

- What does *Soil Health* mean?
- Soil Health Indicator actions =
  - Improving organic matter
  - Improving aggregate stability
  - Increasing water infiltration
  - Increasing available water capacity
  - Improving nutrient cycling
  - Balancing and diversifying soil biology
  - Eliminating erosion
  - Reducing compaction

USDA United States Department of Agriculture

NRCS Resource Concerns

Resource Concern: An expected degradation of the soil, water, air, plant, or animal resource base to the extent that the sustainability or intended use of the resource is impaired.

Planning Criteria: Used to determine whether or not there is a resource concern associated with a specified land use….

- Compaction
- Organic matter depletion
- Soil organism habitat loss or degradation (new)
- Aggregate instability (new)

USDA United States Department of Agriculture

Compaction

Resource Concern	Description	Objective	Land
Compaction	Management-induced soil compaction at any level throughout the soil profile resulting in reduced: • rooting depth and structure • plant growth • soil biological activity • water infiltration and water holding capacity • aeration • habitat	• No platy structure or restrictive layers • No evidence of thickened roots or J-structure • Restricted layers exceeding 300 PSI at field capacity have been identified	• Crop • Forest • Assoc. Ag Land • Designated Protected Areas • Other Rural Land • Pasture

New Farm in 2018
Excessive Runoff

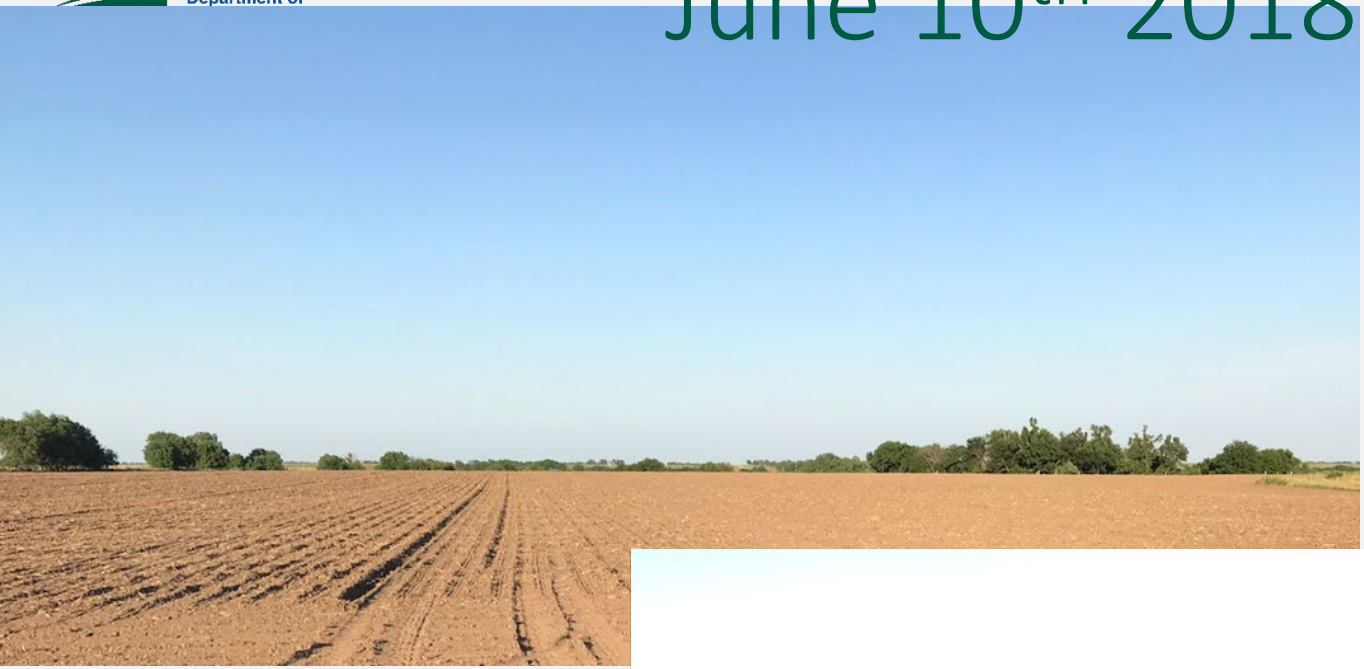
USDA United States Department of Agriculture

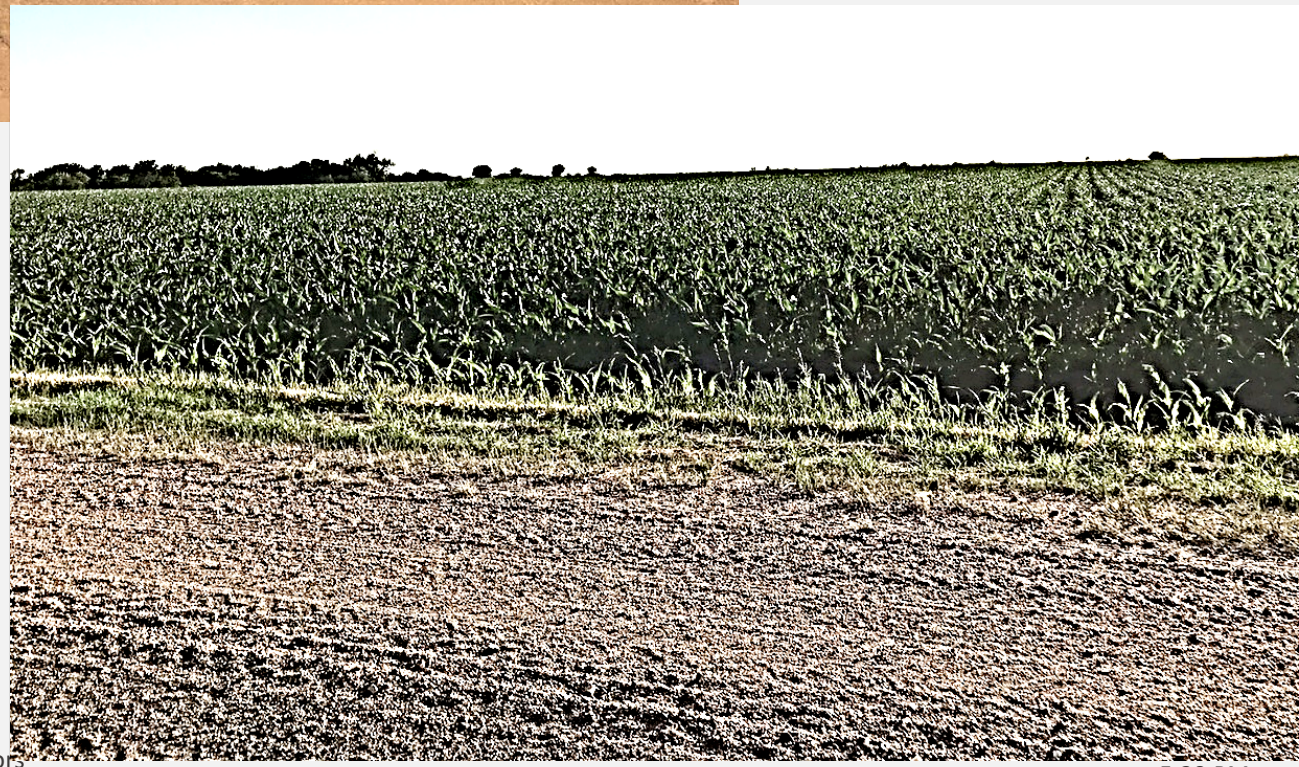
Organic Matter Depletion

Resource Concern	Description	Objective	Land
Organic matter Depletion	Management induced depletion of soil organic matter pools, e.g. labile carbon, total soil carbon or nitrogen resulting in limited soil function and processes that support: • plant growth • habitat and food for soil organisms • water and nutrient cycling	Total organic matter or carbon is being monitored and increasing according to approved total organic matter or carbon soil test	• Crop • Assoc. Ag Land

USDA United States Department of

June 10th 2018





USDA United States Department of Agriculture

New Soil Health Resource Concerns

Resource Concern	Description	Objective	Land Use
Soil organism habitat loss or degradation	• Quantity, quality, diversity or connectivity of food, cover, space, shelter and/or water is inadequate to meet requirements of soil organisms	• Improve habitat for soil organisms	• Crop • Pasture • Associated Ag Land • Designated Protected Area • Other Rural Land

USDA United States Department of Agriculture

New Soil Health Resource Concerns

Resource Concern	Description	Objective	Land Use
Aggregate Instability	Management induced degradation of water stable soil aggregates resulting in: • reduced water infiltration, water holding capacity, aeration • depressed resilience to extreme weather, • increased ponding, flooding, • increased soil erosion, • plant stress, • reduced habitat and soil biological activity: microbes, plants and animals	Improve aggregate stability	• Crop • Associated Ag Land

USDA United States Department of Agriculture

In-Field Assessment

- **Soil maps**
  - Info on inherent soil properties for proper interpretation
  - Vegetation productivity
  - Some soil health information
- **Interview producer**
  - Current concerns
  - Field/management history
- **Field visit**
  - Field soil health assessment

Home | About Soils | Help | Contact Us

You are here: Web Soil Survey Home

Search

Enter Keyword | Go

All NRCS Sites

Browse by Subject

- Soils Home
- National Cooperative Soil Survey (NCSS)
- Archived Soil Surveys
- Status Maps
- Official Soil Series Descriptions (OSD)
- Soil Series Extent Mapping Tool
- Geospatial Data Gateway
- eFOTG
- National Soil Characterization Data
- Soil Health
- Soil Geography

The simple yet powerful way to access and use soil data.

START WSS

I Want To...

- Start Web Soil Survey (WSS)
- Know Web Soil Survey Requirements
- Know Web Soil Survey operation hours
- Find what areas of the U.S. have soil data

Welcome to Web Soil Survey (WSS)

Web Soil Survey (WSS) provides soil data and information produced by the National Cooperative Soil

Conservation Ser
access to the larg
information syste
soil maps and da
than 95 percent
anticipates havin
future. The site i
online as the sing
survey informatio

Soil surveys can
local, and wider
investigation is n
soil quality asses
conservation and
more detailed inf
USDA Service Center at the following link:
USDA Service Center or your NRCS State Soil Scientist at the following link: NRCS State Soil Scientist.

Four Basic Steps

1 Define.

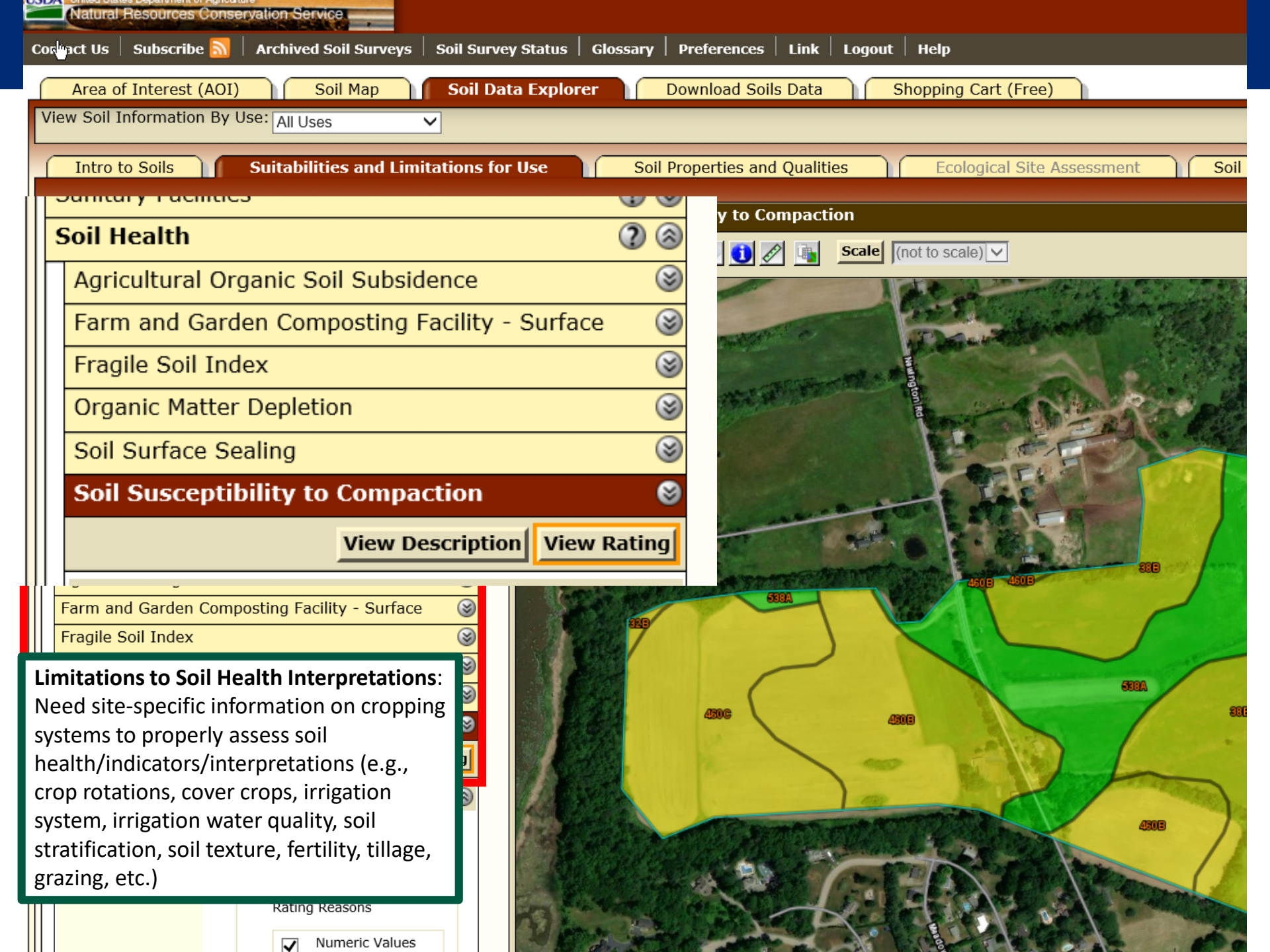
Use the Area of Interest tab to define your area of

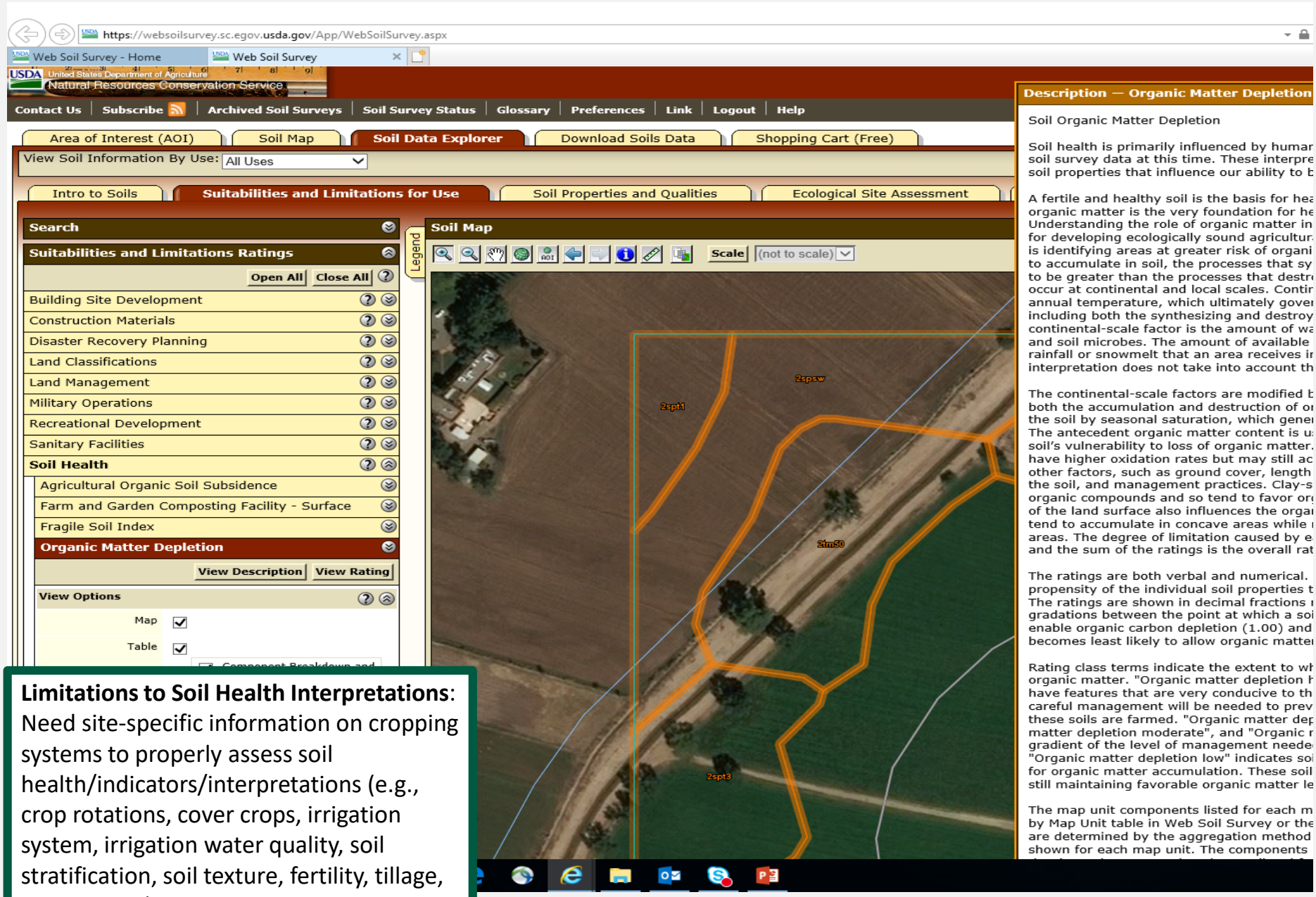
- View new features and fixes.
- Web Soil Survey Release History

Sign up for e-mail updates via GovDelivery

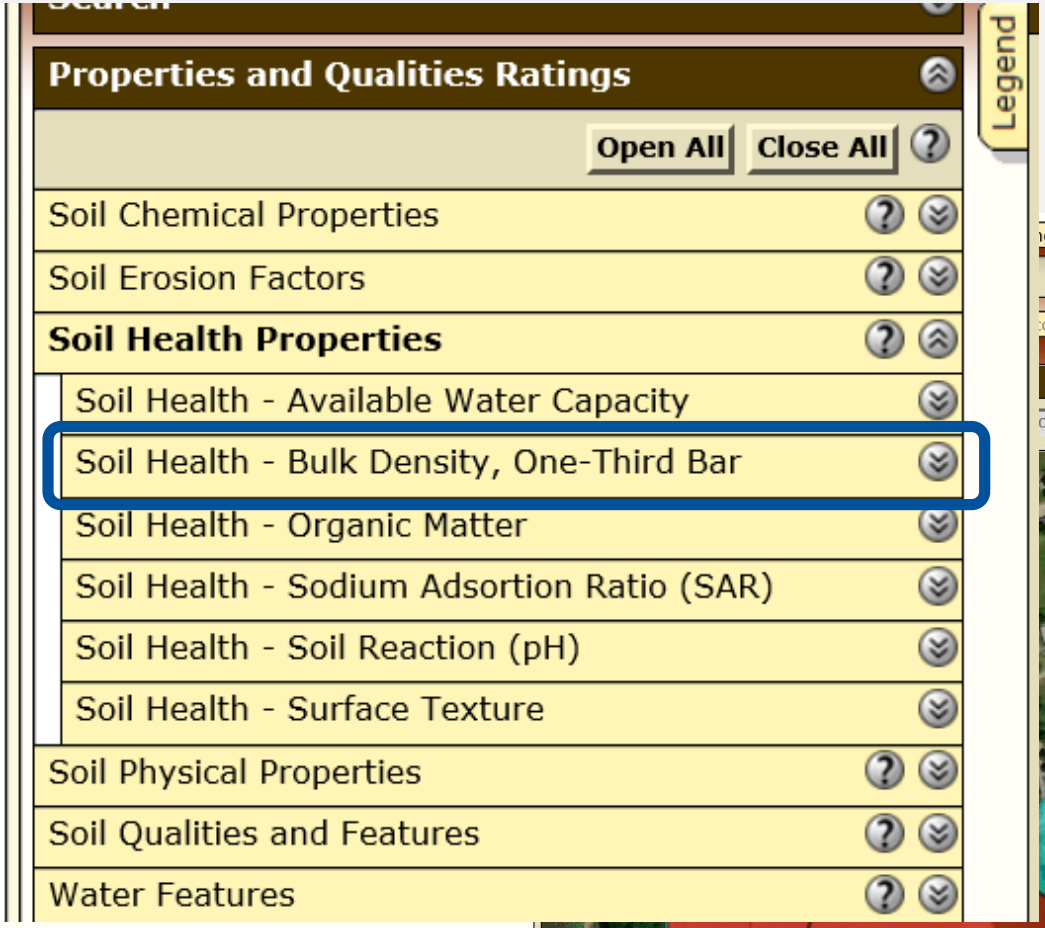
CART

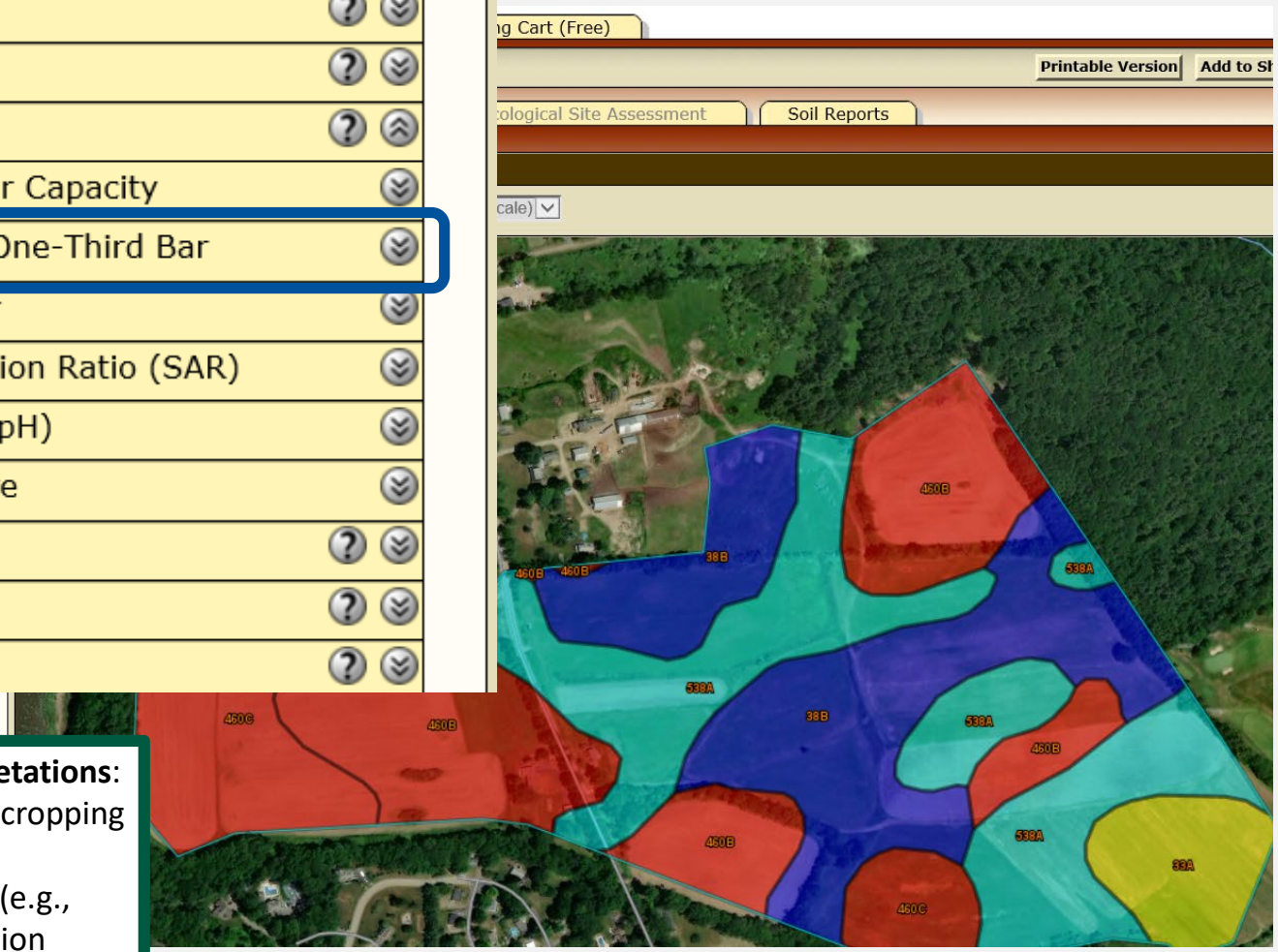
Conservation Assessment & Ranking Tool


Natural Resources Conservation Service
Contact Us | Subscribe | Archived Soil Surveys | Soil Survey Status | Glossary | Preferences | Link | Logout | Help
Area of Interest (AOI) | Soil Map | Soil Data Explorer | Download Soils Data | Shopping Cart (Free)
View Soil Information By Use: All Uses
Intro to Soils | Suitabilities and Limitations for Use | Soil Properties and Qualities | Ecological Site Assessment | Soil
Soil Health
Agricultural Organic Soil Subsidence
Farm and Garden Composting Facility - Surface
Fragile Soil Index
Organic Matter Depletion
Soil Surface Sealing
Soil Susceptibility to Compaction
View Description
View Rating
y to Compaction
Scale
(not to scale)
Farm and Garden Composting Facility - Surface
Fragile Soil Index
Limitations to Soil Health Interpretations: Need site-specific information on cropping systems to properly assess soil health/indicators/interpretations (e.g., crop rotations, cover crops, irrigation system, irrigation water quality, soil stratification, soil texture, fertility, tillage, grazing, etc.)
Rating Reasons
Numeric Values
538A
32B
460C
460B
38B



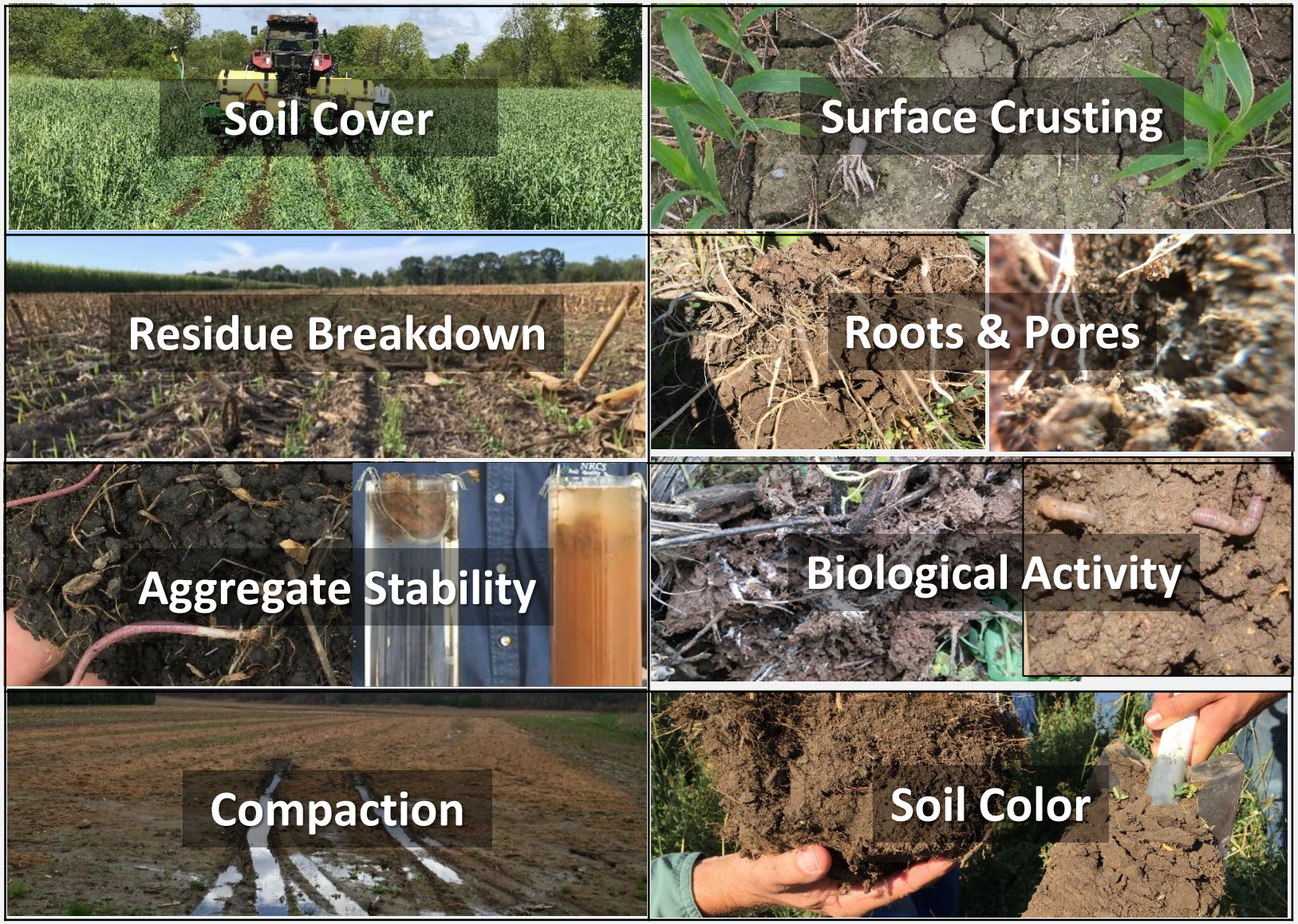
Limitations to Soil Health Interpretations: Need site-specific information on cropping systems to properly assess soil health/indicators/interpretations (e.g., crop rotations, cover crops, irrigation system, irrigation water quality, soil stratification, soil texture, fertility, tillage, grazing, etc.)





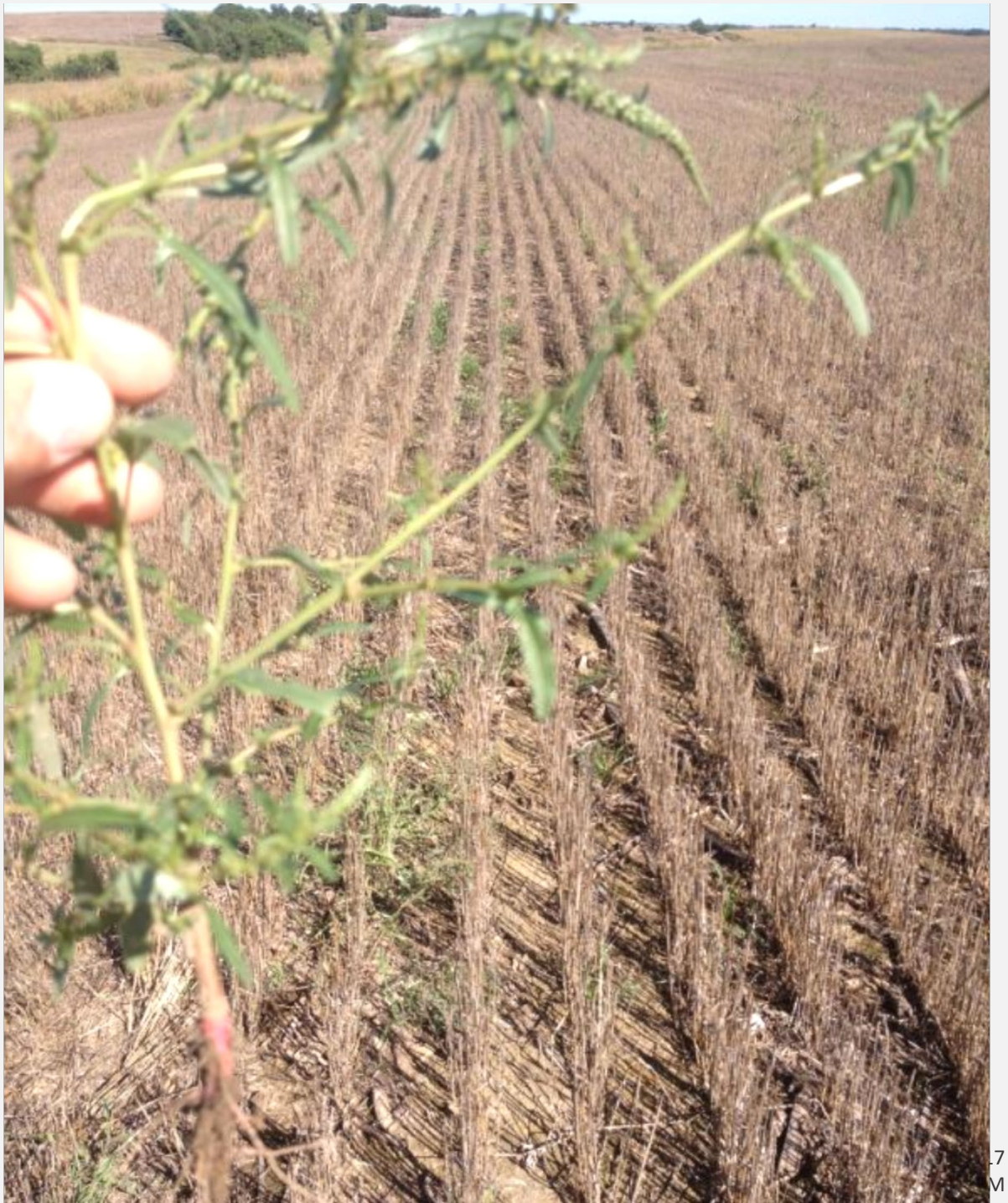
Limitations to Soil Health Interpretations: Need site-specific information on cropping systems to properly assess soil health/indicators/interpretations (e.g., crop rotations, cover crops, irrigation system, irrigation water quality, soil stratification, soil texture, fertility, tillage, grazing, etc.)

In-Field Soil Health Assessment To Identify Resource Concern Presence



USDA United States Department of Agriculture

Stubble and Weed Management adaptation (herbicide resistance)



USDA

USDA United States Department of Agriculture

In-Field Assessment

Indicator: Adequate Soil Cover		
Importance	• Protection/resistance to erosion • Temperature/water moderation • Protection of aggregates/ soil organic matter	
Description	Soil cover is the percent of the soil surface that is covered by plant residue, organic mulch and/or live plants. The C:N ratio and amount of residue will impact how long it will last before breakdown.	Lack of cover exposes the soil to erosion and detachment of soil particles from rain and reduces the food source for soil microbes.
Resource Concerns Addressed	• Aggregate instability • Soil organism habitat loss or degradation • Soil organic matter depletion	• Surface compaction

USDA United States Department of Agriculture

In-Field Assessment

Indicator: Adequate Soil Cover		
In-field measurement	1. Farmer interview of management system (recorded for current erosion model). Document tillage system, crop rotation, high biomass crops. 2. Use photo-comparison method or state approved estimation methods, OR 3. Use line transect as described in https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_022074.pdf	
Rating Criteria	Year-round surface cover from plants, plant residue or mulch	
	Acceptable	**Unacceptable**
	Cover >70% after planting	Cover < 70% after planting

In-Field Assessment: Residue Cover

Al-Kaisi, M. and Kwaw-Mensah, D. Iowa Soil Health Field Guide. Crop 3089A; https://store.extension.iastate.edu/product/Iowa-Soil-Health-Field-Guide

- Estimate the percent of soil surface covered with dead plant material within the immediate area of your test location. The chart above shows what 25-90% residue cover looks like. Your crops will be different, but the percent cover will look the same.

USDA United States Department of Agriculture

In-Field Assessment

Indicator: Residue Breakdown	
Importance	• Food source for soil organisms • Builds soil organic matter • Too rapid → not enough cover • Too slow → management problems
Description	• Biological shredding, fragmenting, cycling or incorporating of previous crop residue. • The rate at which residue decomposes is an indicator of relative biological activity. • Assessed by gauging the age of previous residue and evidence of shredding, fragmenting and/or incorporating into soil without tillage
Resource Concerns Addressed	• Soil organism habitat loss or degradation • Soil organic matter depletion

In-Field Assessment

Indicator: Residue Breakdown		
In-field measurement	Residue breakdown is assessed by looking at the existing residue cover for signs of breakdown, shredding and incorporation by soil organisms after planting. Considerations when conducting the assessment: 1. If tillage present, then not applicable 2. How many seasons/layers of crop residue are present 3. Residue composition and type (C:N) residue crops were grown 4. Residue color and condition of most recent crop residue 5. Farmer interview of management system	
Rating Criteria	**Acceptable**	**Unacceptable**
	Residue pieces are small, mixed in surface or minimal crop residue remaining from >1 cropping seasons	Residue in large pieces left after planting, can be handled without crumbling and/or lots of residue from 2 or more cropping seasons

USDA United States Department of Agriculture

In-Field Assessment

Indicator: Surface Crusting	
Importance	• Reduces emergence • Increases risk of ponding and runoff; decreases infiltration • Limits soil air and/or water exchange • Reduced water storage
Description	Crusts form after rain or irrigation on soils with weak aggregate stability.
Resource Concerns Addressed	• Aggregate instability • Soil organic matter depletion • Compaction • Soil organism habitat loss or degradation

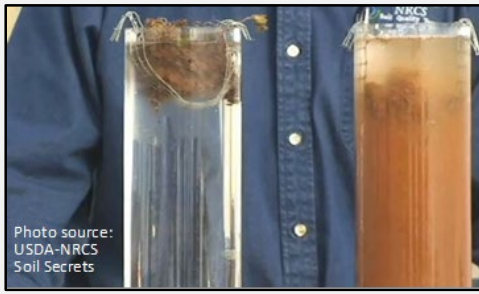
In-Field Assessment

Indicator: Surface Crusting		
In-field measurement	Typically evaluated by visual observation after rainfall/irrigation and drying (document with photos) • Note whether crusts are throughout the field or only in patches. • Evidence of ponding • Poor crop emergence uneven stand	
Rating Criteria	**Acceptable**	**Unacceptable**
	Evidence of surface crust on less than 20% of field	Evidence of surface crust on more than 20% of field

In-Field Assessment

Indicator: Aggregate Stability	
Importance	• Improves soil air and water exchange (pore space) and water storage • Resists erosive forces of wind & water • Decreases risk of ponding and runoff; increases infiltration • Increases microbial habitat, activity, and nutrient cycling
Description	• Wet aggregate stability suggests good soil porosity and how well a soil can resist raindrop impact and erosion.
Resource Concerns Addressed	• Aggregate instability • Soil organism habitat loss or degradation • Soil organic matter depletion • Compaction

In-Field Assessment



Indicator: Aggregate Stability		
In-field measurement*	Choose one of the following three methods: • Slake test (ideally under dry conditions; if moist soils don't slake then do a second test) • Strainer test • Jornada Slake test (stability kit) **See protocols provided	
Rating Criteria	**Acceptable**	**Unacceptable**
	Aggregate remains intact • >90% for slake test with little cloudy water • "stands up" for strainer test and water leaving container is translucent • Jornada criteria	Aggregate disintegrates • less than 50% remaining (slake) • Soil "slumps" into a puddle, runoff is not translucent • Jornada criteria

In-Field Assessment

Indicator: Compaction	
Importance	• Decreased rooting depth, plant growth • Decreased biological biomass & activity • Poor infiltration, drainage, aeration, & water storage
Description	Management induced (6” below normal or past field operations) reduction of large pores and degraded structure (i.e., platy) that results in decreased rooting depth, plant growth and soil biological habitat and activity.
Resource Concerns Addressed	• Compaction • Soil organic matter depletion • Soil organism habitat loss or degradation • Aggregate instability

In-Field Assessment

Indicator: Compaction		
In-field measurement	Measurements should be conducted with soil moisture near field capacity using a spade, penetrometer, wire flag, or knife. • Evaluate multiple representative locations in the field, avoiding consistent wheel tracks. • Record depths of restrictive layer(s) • If using a penetrometer record depths and readings (PSI) of identified layers • Evaluate root development and distribution • Look for platy structure • Surface water ponding	
Rating Criteria	Rating is based on multiple areas of the field that shows evidence of a restricted layers in the soil profile	
	Acceptable	**Unacceptable**
	Granular structure, appropriate PSI reading, vertical channels or roots.	Evidence of platy structure, unacceptable PSI, root restriction, surface ponding, horizontal or abnormal root architecture.

In-Field Assessment

Indicator: Roots and Biopores (Continuity)	
Importance	• Release exudates to stimulate microbes and form aggregates and soil organic matter • Biopores are channel that remain from season to season and are often areas of organic carbon concentration, plant nutrients, and biological activity • Increases aeration, infiltration, drainage, and water storage and availability
Description	• Roots influence the soil immediately adjacent to them through exudates, growing and leaving soil organic matter as they die
Resource Concerns Addressed	• Aggregate instability • Soil organic matter depletion • Soil organism habitat loss or degradation

In-Field Assessment

Indicator: Roots and Pores		
In-field measurement	• Observe evidence of dark, root channels or biopores left by previous plants or earthworms	
Rating criteria	**Acceptable**	**Unacceptable**
	Presence of dark, root channels or biopores left by previous plants or earthworms	Roots are stressed and do not follow previous root channels, no pores evident from earthworms

USDA United States Department of Agriculture

In-Field Assessment

Indicator: Biological Activity		
Importance	• Diverse population supports numerous ecosystem functions • Involved in aggregation and SOM formation • Nutrient cycling, disease suppression, detoxification	
Description	• The presence and relative abundance of earthworms and meso- and macro-invertebrates such as mites, springtails, millipedes, roundworms, beetles or termites can provide evidence of a healthy soil ecosystem. • Fungal hyphae may also be noticed.	
Resource Concerns Addressed	**Primary Concern:** • Soil organism habitat loss or degradation	**Secondary:** • Aggregate Instability • Soil organic matter depletion

In-Field Assessment

Indicator: Biological Activity

In-field measurement	1. Brush back residue (if present) look for evidence of activity of macro arthropods, e.g. millipedes, ants, beetles, etc. 2. Look for evidence of earthworm activity, e.g. casts, mildens, large pores. 3. Break the soil apart and carefully look for earthworms or signs of earthworms channels or macro-organisms 4. If manure piles present flip over and look for insects 5. Look for signs of fungal hyphae that appear as white to light tan threads or masses (note hyphae could be from AMF or saprophytic fungi	
Rating Criteria	Rating based on observations of the presence of fungal hyphae, macro-invertebrates, earthworms, etc.	
	Acceptable	**Unacceptable**
	Clearly evident; numerous organisms observed	No biological activity visible, lacking earthworms, no saprophytic fungi, low to no evidence of macrofauna

In-Field Assessment

Indicator: Soil Color (Optional)	
Importance	• Darker colors related to higher SOM • Can reflect moisture and/or redox conditions • Can indicate certain mineralogy
Description	• Color can be used as an indicator of loss or accumulation of organic matter. • Typically, loss of SOM results in relatively lighter color, while accumulation results in darkening of the soil.
Resource Concerns Addressed	**Primary Concern:** • Soil organic matter depletion • Aggregate Instability • Soil organism habitat loss or degradation **Secondary:** • None listed

In-Field Assessment

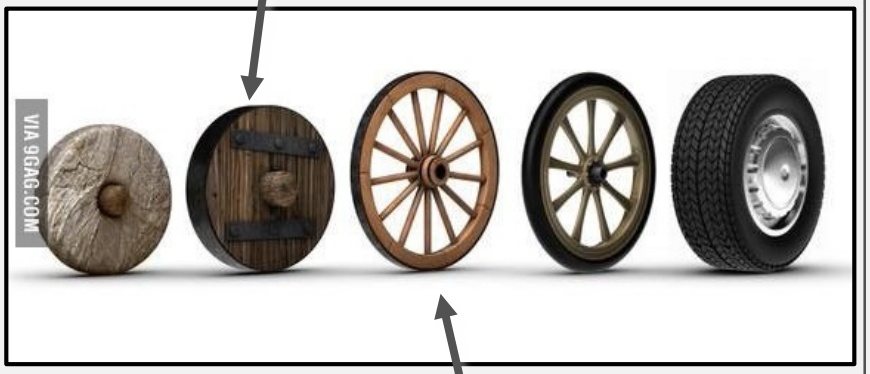
Indicator: Soil Color (Optional)		
In-field measurement	1. Use a shovel to dig a hole below the layer affected by management typically 6” to 12” to observe the soil profile 2. Observe color differences in the soil profile looking for layers of accumulations or accumulation along pores or root channels deeper in the soil profile	
Rating Criteria	Ratings based on indications of color differences or presence of SOM accumulation with the lowest rating having the greatest negative affect.	
	Acceptable	**Unacceptable**
	An obvious darker surface layer with root/pores extending down into the soil profile	No stratified layer, soil mixing observed and/or surface is lighter in color than the horizon below

*Note soil moisture makes soil appear darker and should be noted if comparing different fields

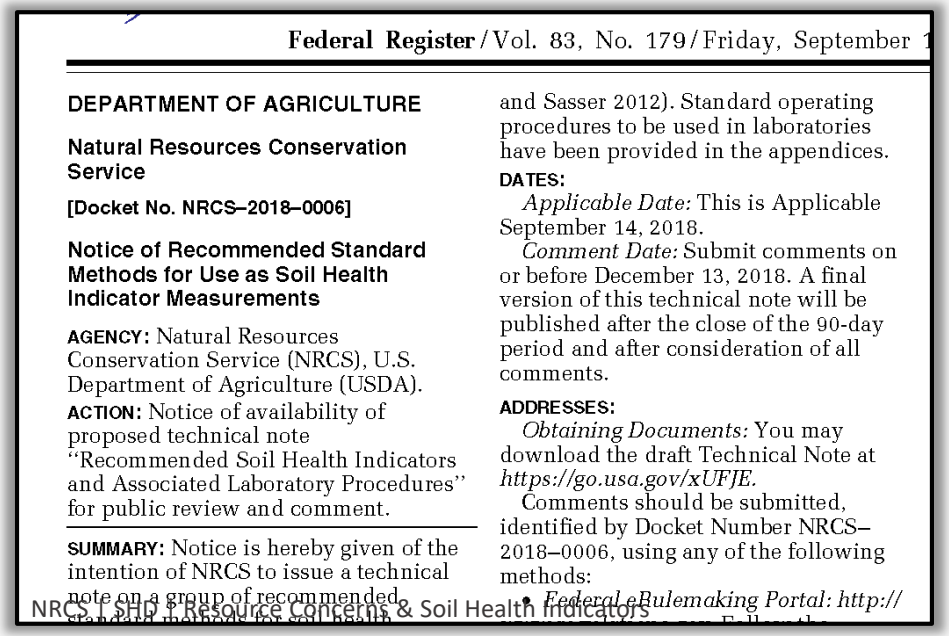
Lab Indicators for Soil Health

- USDA consensus on laboratory methods
- Easy & inexpensive
- Sensitive but robust
- Same methods
- Regionally calibrated

Standard Nutrient Test
Macro, Micro, SOM, CEC



Upgraded: Biological, C&N, Physical



Federal Register / Vol. 83, No. 179 / Friday, September 1

DEPARTMENT OF AGRICULTURE

Natural Resources Conservation Service

[Docket No. NRCS–2018–0006]

Notice of Recommended Standard Methods for Use as Soil Health Indicator Measurements

AGENCY: Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture (USDA).

ACTION: Notice of availability of proposed technical note "Recommended Soil Health Indicators and Associated Laboratory Procedures" for public review and comment.

SUMMARY: Notice is hereby given of the intention of NRCS to issue a technical note on a group of recommended standard methods for soil health

and Sasser 2012). Standard operating procedures to be used in laboratories have been provided in the appendices.

DATES:

Applicable Date: This is Applicable September 14, 2018.

Comment Date: Submit comments on or before December 13, 2018. A final version of this technical note will be published after the close of the 90-day period and after consideration of all comments.

ADDRESSES:

Obtaining Documents: You may download the draft Technical Note at *https://go.usa.gov/xUFJE.*

Comments should be submitted, identified by Docket Number NRCS–2018–0006, using any of the following methods:

- *Federal eRulemaking Portal: http://*

USDA United States Department of Agriculture

Woods End Laboratories

Powered by: SOLVITA

SOIL FERTILITY & HEALTH REPORT

Client: William Brinton, Woods End Farm, 290 Belgrade Rd. P.O. Box 297, Mt Vernon, ME 04352, United States

Sample Identity: 9529.3
Acct Number: 100
Sample: Soil: Italy: Lower Vineyard Casa I
Sample Date: 8/19/2015
Intended Crop: Grapes @ 5 t/a

Solvita Soil Health Factors		RANKING:
Solvita - CO2 Burst	90	Medium
Solvita - SLAN, amino-N	48	Low
Aggregate Stability	35	Medium
Organic Matter	3.2	Medium

Nutrients Value per hectare available
N + P2O5 + K2O hectare =

Nutrients Available kg/ha

N	P2O5	K2O
115	229	210

NUTRIENT FERTILITY

Analysis	Units	Le
Nitrate-N 0-6"	ppm	
Additonal Nitrate-N	ppm	
Ammonium-N 0-6"	ppm	
Profile Avail-N	ppm	
Biological N-Min	kg/ha	
N-Estimated For Crops		
Phosphate as P	ppm	
Potassium as K	ppm	
Calcium	ppm	
Magnesium	ppm	
Sodium	ppm	
pH	Units	
EC	dS M	
Nutrient Index	Rating	
Most Limiting Factor		

Other factors

Water Soluble Carbon	ppm	
Water Soluble-N	ppm	
Soluble C:N Ratio	Unit	
Aluminum, Extractable	ppm	
P-Saturation	ratio	
Iron, Extractable	ppm	

0 — 100

67

OVERALL FERTILITY SCORE

0 — 50

17

SOIL HEALTH SCORE

Notes and Recommendations

USDA Cover Crop Recommendations

Types of Cover Crop Blends Suggested:

20% Legume 80% Grass/Non-legume

Nutrient Limitations/Recommendations

Nutrient Required (estimated	
56	17

Notes on the Report: Soil Health S
Overall Ferti

SOIL HEA

Cornell Soil Health Assessment

Joe Vegland
123 Main St.
Anytown, NY, 12345

Agricultural Service Provider:
Smith, George
Jim's Consulting
George@jimsconsulting.com

Sample ID: A_123
Field/Treatment: Field
Tillage: No Till
Crops Crown: MIX, MIX, MIX
Date Sampled: 5/31/2014
Given Soil Type: Anytown
Given Soil Texture: Silt Loam
Coordinates: 42.44790 °N; 76.47570 °W

Measured Soil Textural Class: Silt Loam — Sand: 5% Silt: 70% Clay: 25%

Test Report

	Indicator	Value	Rating	Constraint
Physical	Available Water Capacity	0.13	28	Water Retention and Availability
	Surface Hardness	148	62	
	Subsurface Hardness	425	8	Subsurface Pan/Deep Compaction, Deep Rooting, Water and Nutrient Access
	Aggregate Stability	22.5	26	Aeration, Infiltration, Rooting, Crusting, Sealing, Erosion, Runoff
Biological	Organic Matter	3.2	42	
	ACE Soil Protein Index	6.5	35	
	Root Pathogen Pressure	5.5	44	
	Respiration	1.17	15	Soil Microbial Abundance and Activity
	Active Carbon	391	12	Energy Source for Soil Biota
Chemical	pH	6.0	71	
	Phosphorus	9.3	100	
	Potassium	264.7	100	
	Minor Elements (Mg: 419 Fe: 1.1 Mn: 12.9 Zn: 1.9)		100	
	Overall Quality Score	49	Low	

Soil Health Assessment Center
University of Missouri

Soil Health Assessment

Basic Soil Health Package $36

- ntially Mineralizable Nitrogen
- e Carbon
- Aggregate Stability
- alt and water)

- Reduce nitrogen expenditures —take credit for nitrogen released by soil during growing season.
- Estimate activity of soil organic matter and soil microorganisms
- Evaluate soil structure and water relationships
- Optimize pH and crop suitability; maximize nutrient availability.

panded Soil Health Package $80

- ntially Mineralizable Nitrogen
- l Nitrogen
- re Carbon
- l Organic Carbon
- er Stable Aggregates
- alt and water)
- tive Cation Exchange Capacity
- angeable Cations
- t Available Phosphorus

- Gain all the benefits of the Basic Package
- Add total Nitrogen and Carbon to the analyses to put perspective on PMN and active carbon
- Measure ECEC, capacity of soil to hold cations (calcium, magnesium, potassium, sodium, hydrogen and aluminum) at the current soil pH. Most CEC measurements are made with pH adjusted to 7. ECEC estimates more closely current soil conditions allowing future improvements to be measured.
- Measure effective base saturation, the proportion of ECEC held by the basic cations of calcium, magnesium, potassium and sodium. Hydrogen and aluminum are acidic cations.
- Measure phosphorus available for plant uptake

Package Enhancements

- pholipid Fatty Acids (PLFA) $50
- Density $ 5
- ralizable Acidity $11
- cle Size $36

- Add any of these analyses to either of the above packages
- Analyze Phospholipid Fatty Acid content of your soil to estimate the biomass and groups of microbes present in the soil.

Midwest Laboratories

We are currently developing and analyzing other tests to add to our Soil Health program so please call the lab or check our website for further developments and pricing.

PLFA **$59.50**

Soil biological testing at Ward Laboratories is conducted by analyzing phospholipid fatty acids, or PLFA. PLFA gives a representation of living soil microbial biomass and allows us to identify the presence or absence of various functional groups of interest through known PLFA biomarkers. PLFA is a snapshot of soil community structure and abundance at the time of sampling. As environmental conditions such as temperature and moisture change so does the microbial community. This ability of the soil microbial community to change provides producers with a tool to compare agricultural management techniques with respect to overall better microbial community health.

Haney Test **$49.50**

The Haney Test is a dual extraction procedure that allows the producer to assess overall soil health. The test is used to track changes in soil health based on management decisions. This test examines total organic carbon and total organic nitrogen to determine a C:N ratio used to make general cover crop recommendations. This test also includes the **Solvita CO_2 Burst Test** to look at microbial activity and potentially mineralizable nitrogen. The weak acid (H3A) extraction represents some available plant nutrients.

Solvita CO_2 Burst Test **$25.00**

The Solvita CO_2 Burst Test is a new tool which easily and accurately measures soil biological CO_2 respiration. (Solvita.com, 2012)

SOIL HEALTH COMPLETE: **$65.00**

is comprised of three components:

1. An in-depth soil analysis that will address the chemical aspects of the soil by S3C Analysis.
2. The Solvita 1-day CO2C test.
3. The Haney test with a Soil Health Calculation.

SOIL HEALTH BASIC: **$55.00**

is comprised of three components:

1. An basic soil analysis that will address the chemical aspects of the soil by S1AN Analysis.
2. The Solvita 1-day CO2C test.
3. The Haney test with a Soil Health Calcuation.

determine if compac-
wth, water infiltration,

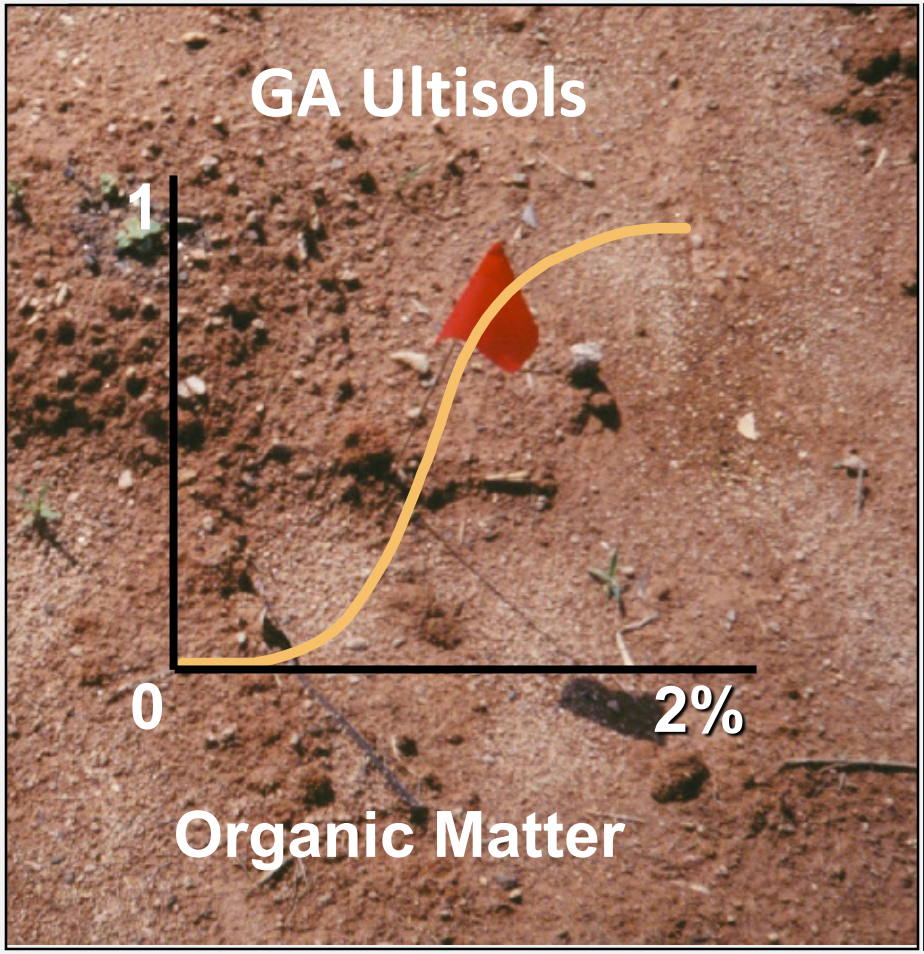
1-800-887-7645
www.wardlab.com
3
WARD

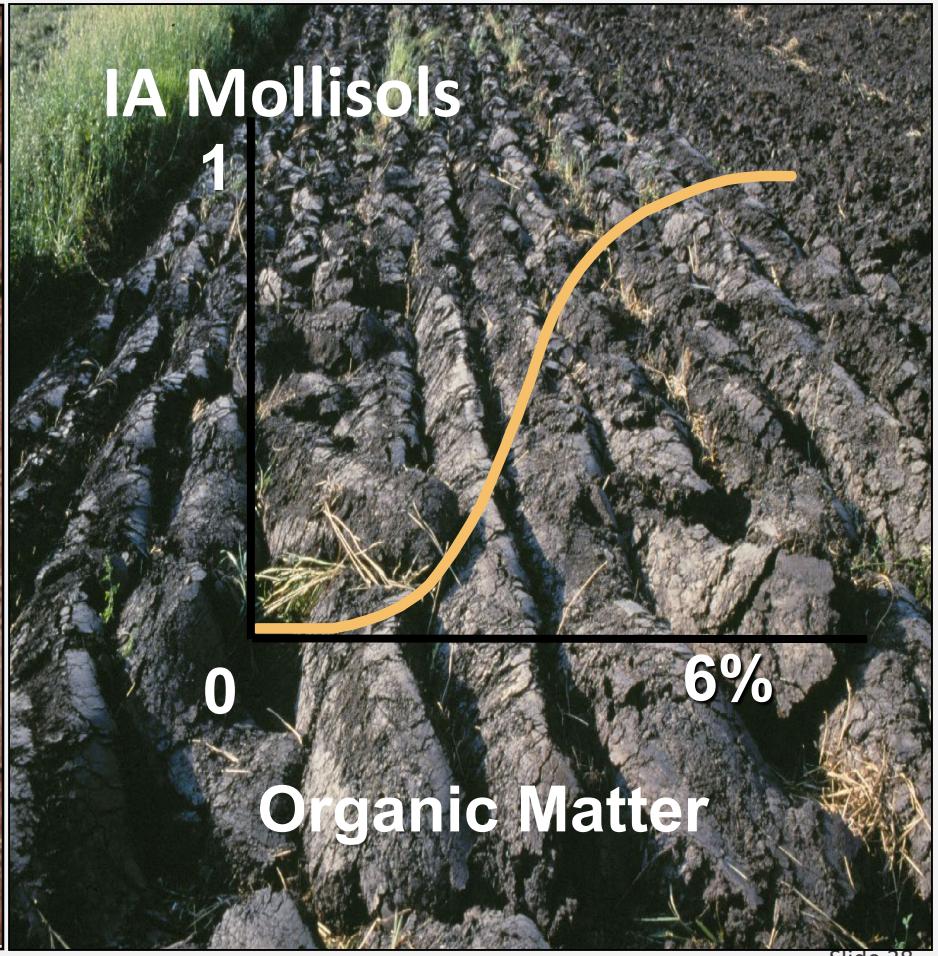
Lab Indicators For Soil Health

Soil Structural Stability & Water Partitioning	• **Aggregate stability** • Available water capacity
Soil Organic Matter Cycling	• **Soil organic C** • Soil organic matter
Carbon Food Source	• **Permanganate oxidizable C (Active C)** • Water extractable organic C
Microbial Activity	• **Short-term C mineralization (respiration)** • **Enzyme activities**
Bioavailable N	• **Acid Citrate Extractable protein** • N mineralization; Water extractable organic N
Microbial Community Composition/ Function	• **Fatty acid profiling (PLFA** or **EL-FAME**) • Molecular characterization

Calibration & Interpretation

- Indicator interpretation via soil based scoring functions
- Soil, climate and cropping system





USDA United States Department of Agriculture

An Example: Assessment of Aggregate Stability

Measured Value – 10% stable

Score – 20 on a scale of 0-100

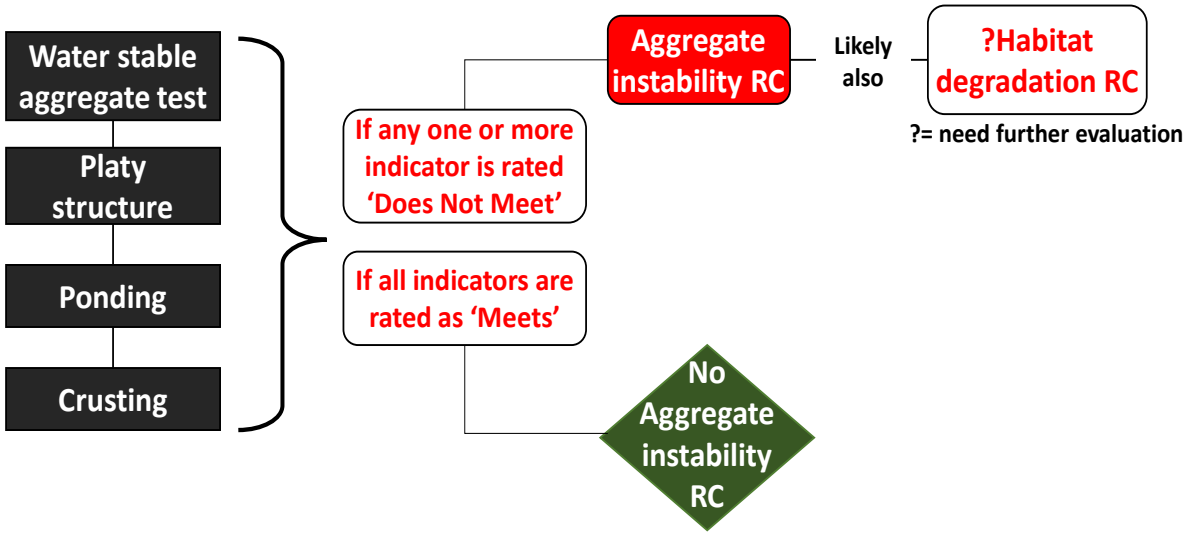
Interpretation – aggregate stability is too low for the soil type/climate and identified as a resource concern

Management Suggestion – Building more stable aggregates through appropriate cover crops, improved crop rotation, integration of livestock and/or manure into the system, mulches, surface residue, etc

Management Decision – based on production system and producer preferences

Aggregate Instability Resource Indicator Decision Tree

Circle the indicators that were rated unacceptable during the evaluation and follow decision tree below to determine if the given resource concern (RC) is present.



Adaptive Management On the Kucera Farm
Mike Kucera Agronomist