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US Black Soils: Update on Management and Condition Assessment

Skye Wills (presenter)

Stephen Roecker, Suzann Kienast Brown, Jason Nemecek, Paul Reich

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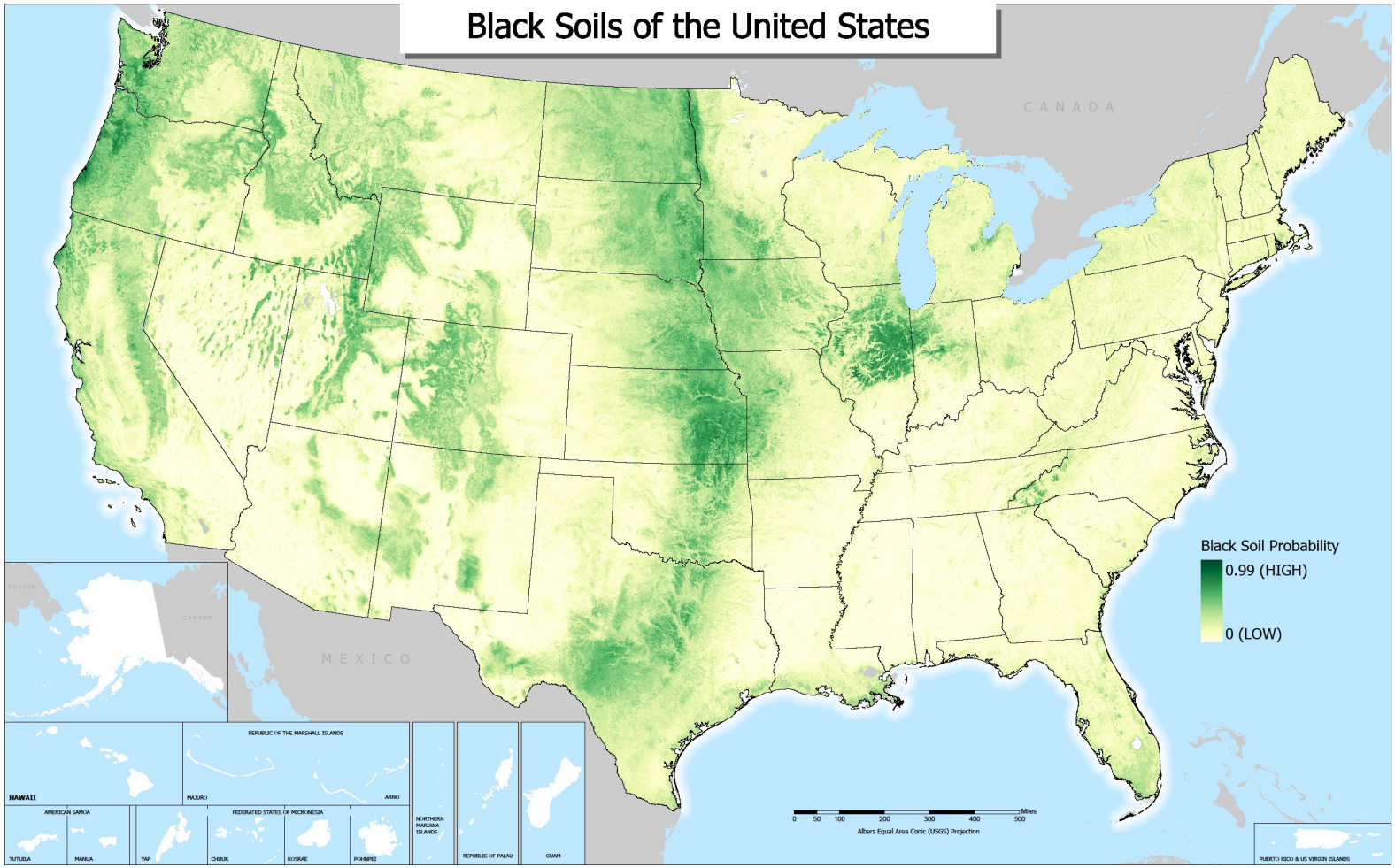
Black Soils of the United States



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July 2021

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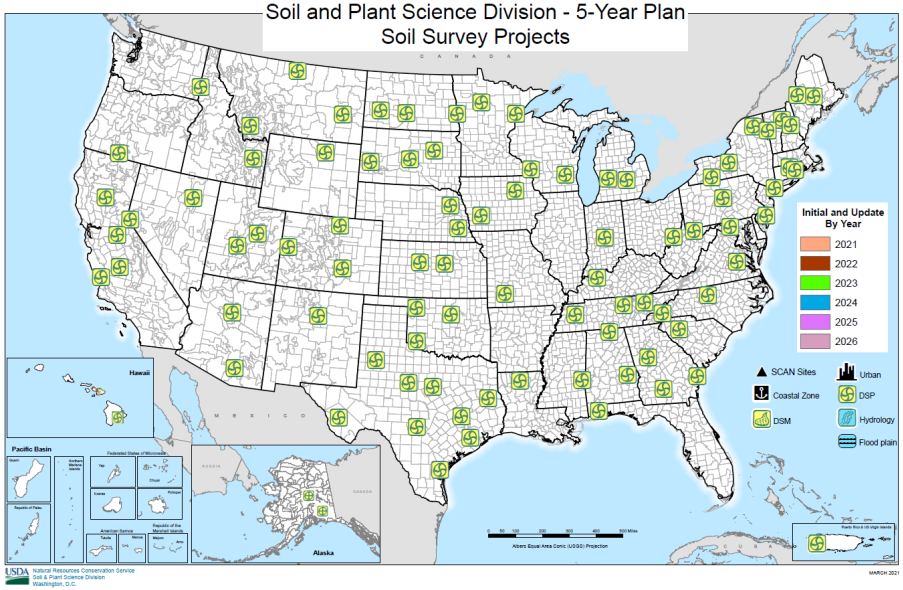
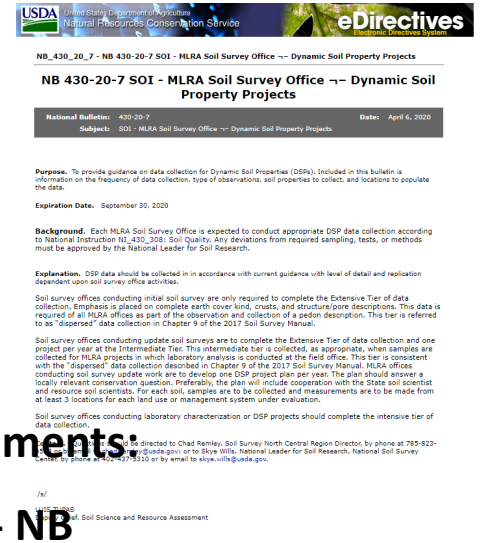
Dynamic Soil Properties (DSPs)

- DSPs are properties that change on a human time scale.
- Used by soil survey to measure and predict soil change with land use, management and disturbance

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NB_430_20_7 - NB 430-20-7 SOI - MLRA Soil Survey Office ¬– Dynamic Soil Property Projects

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National Bulletin: 430-20-7 Date: April 6, 2020
Subject: SOI - MLRA Soil Survey Office ¬– Dynamic Soil Property Projects

Purpose. To provide guidance on data collection for Dynamic Soil Properties (DSPs). Included in this bulletin is information on the frequency of data collection, type of observations, soil properties to collect, and locations to populate the data.

Expiration Date. September 30, 2020

Background. Each MLRA Soil Survey Office is expected to conduct appropriate DSP data collection according to National Instruction NI_430_308: Soil Quality. Any deviations from required sampling, tests, or methods must be approved by the National Leader for Soil Research.

Explanation. DSP data should be collected in in accordance with current guidance with level of detail and replication dependent upon soil survey office activities.

Soil survey offices conducting initial soil survey are only required to complete the Extensive Tier of data collection. Emphasis is placed on complete earth cover kind, crusts, and structure/pore descriptions. This data is required of all MLRA offices as part of the observation and collection of a pedon description. This tier is referred to as "dispersed" data collection in Chapter 9 of the 2017 Soil Survey Manual.

Soil survey offices conducting update soil surveys are to complete the Extensive Tier of data collection and one project per year at the Intermediate Tier. This intermediate tier is collected, as appropriate, when samples are collected for MLRA projects in which laboratory analysis is conducted at the field office. This tier is consistent with the "dispersed" data collection described in Chapter 9 of the 2017 Soil Survey Manual. MLRA offices conducting soil survey update work are to develop one DSP project plan per year. The plan should answer a locally relevant conservation question. Preferably, the plan will include cooperation with the State soil scientist and resource soil scientists. For each soil, samples are to be collected and measurements are to be made from at least 3 locations for each land use or management system under evaluation.

Soil survey offices conducting laboratory characterization or DSP projects should complete the intensive tier of data collection.

Questions should be directed to Chad Remley, Soil Survey North Central Region Director, by phone at 785-823-4565, by email at chad.remley@usda.gov; or to Skye Wills, National Leader for Soil Research, National Soil Survey Center, by phone at 402-437-5310 or by email to skye.wills@usda.gov.

/s/
Jason Kelley
Chief, Soil Science and Resource Assessment

Guidance Documents:

NB_430_20_7 - NB 430-20-7 SOI - MLRA Soil Survey Office ¬– Dynamic Soil Property Projects
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcseprd1343021

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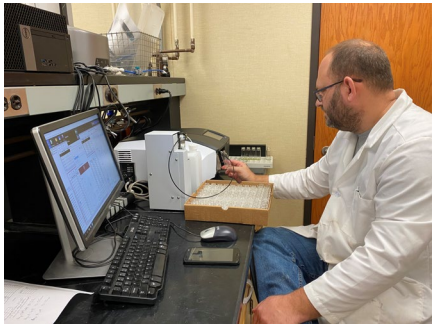
Soil Health Indicators in NRCS

Definition of soil health: https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/

Soil Health Technical Note Provides Standard Methods for Measuring Soil Health Indicators



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Soil Health
Technical Note No. 450-03

Recommended Soil Health Indicators and Associated Laboratory Procedures

https://directives.sc.egov.usda.gov/40576.wba

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Science of Soil Health Initiative: Will the things we see in the field translate into scientific measures that we can capture in soil survey databases and products?

Perennial Grass

Good structure (aggregation)

Conventional Winter Wheat

Massive (no structure or aggregation)

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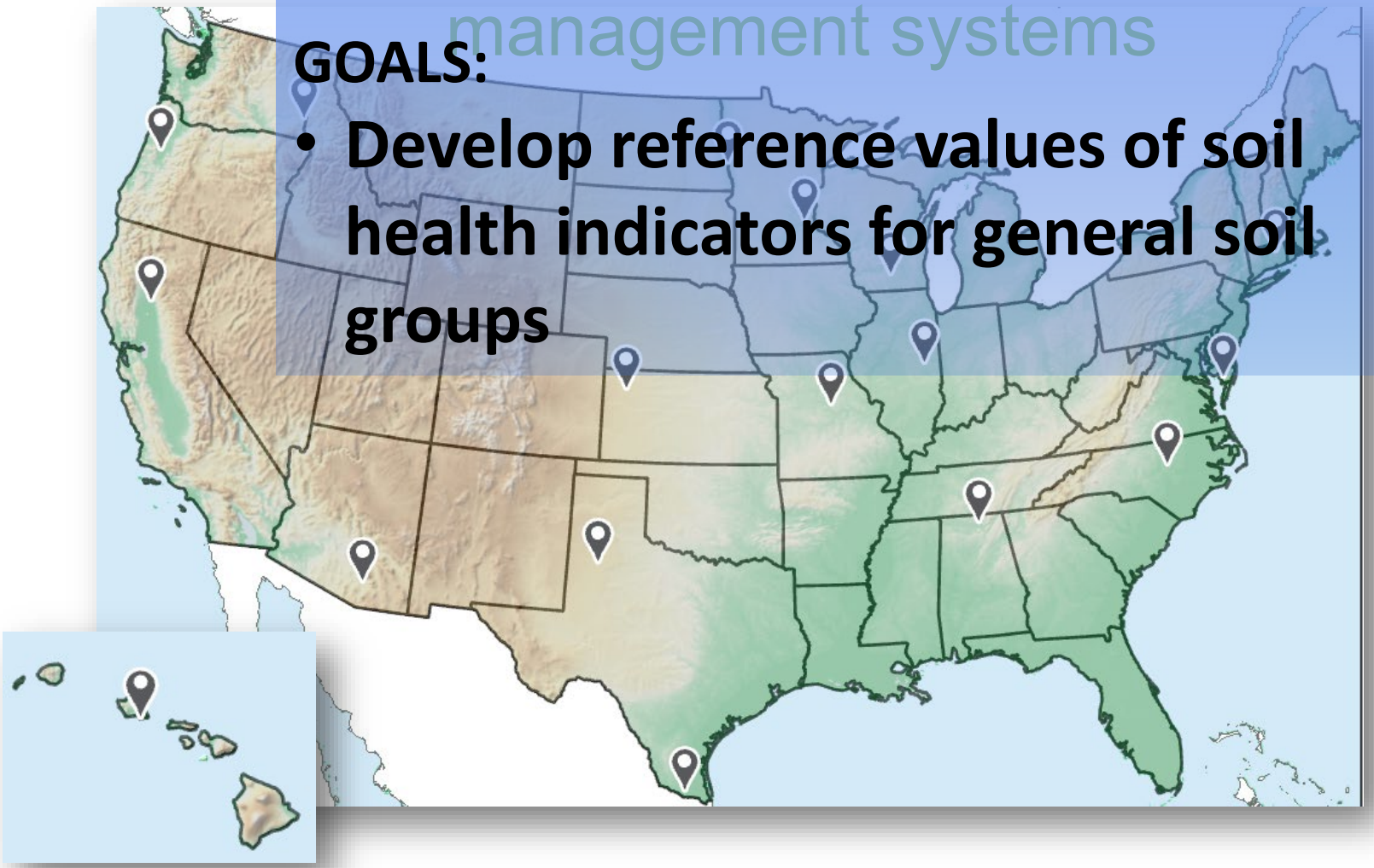
#DSP4SH – Dynamic Soil Properties for Soil Health

Assess a common set of laboratory and field indicators across a range of soils and management systems

GOALS:

- **Develop reference values of soil health indicators for general soil groups**



#DSP4SH

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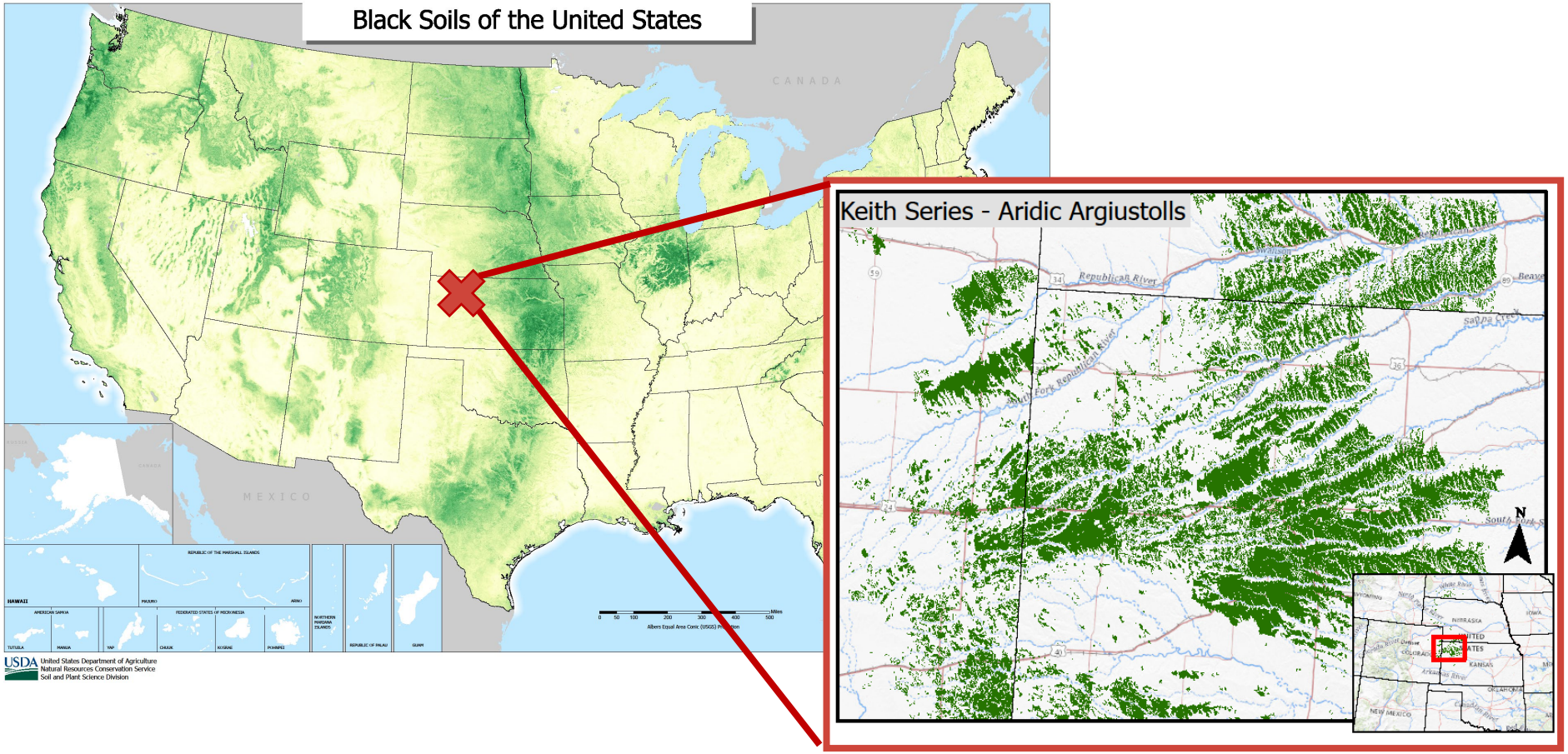

The Keith series consists of very deep, well drained, soils that formed in calcareous loess. Keith soils are on upland hillslopes, tableland plains, and valley terraces. Slopes range from 0 to 6 percent. Mean annual precipitation is about 46 centimeters (18 inches) and the mean annual air temperature is 11 degrees C (52 degrees F).

TAXONOMIC CLASS: Fine-silty, mixed, superactive, mesic Aridic Argiustolls

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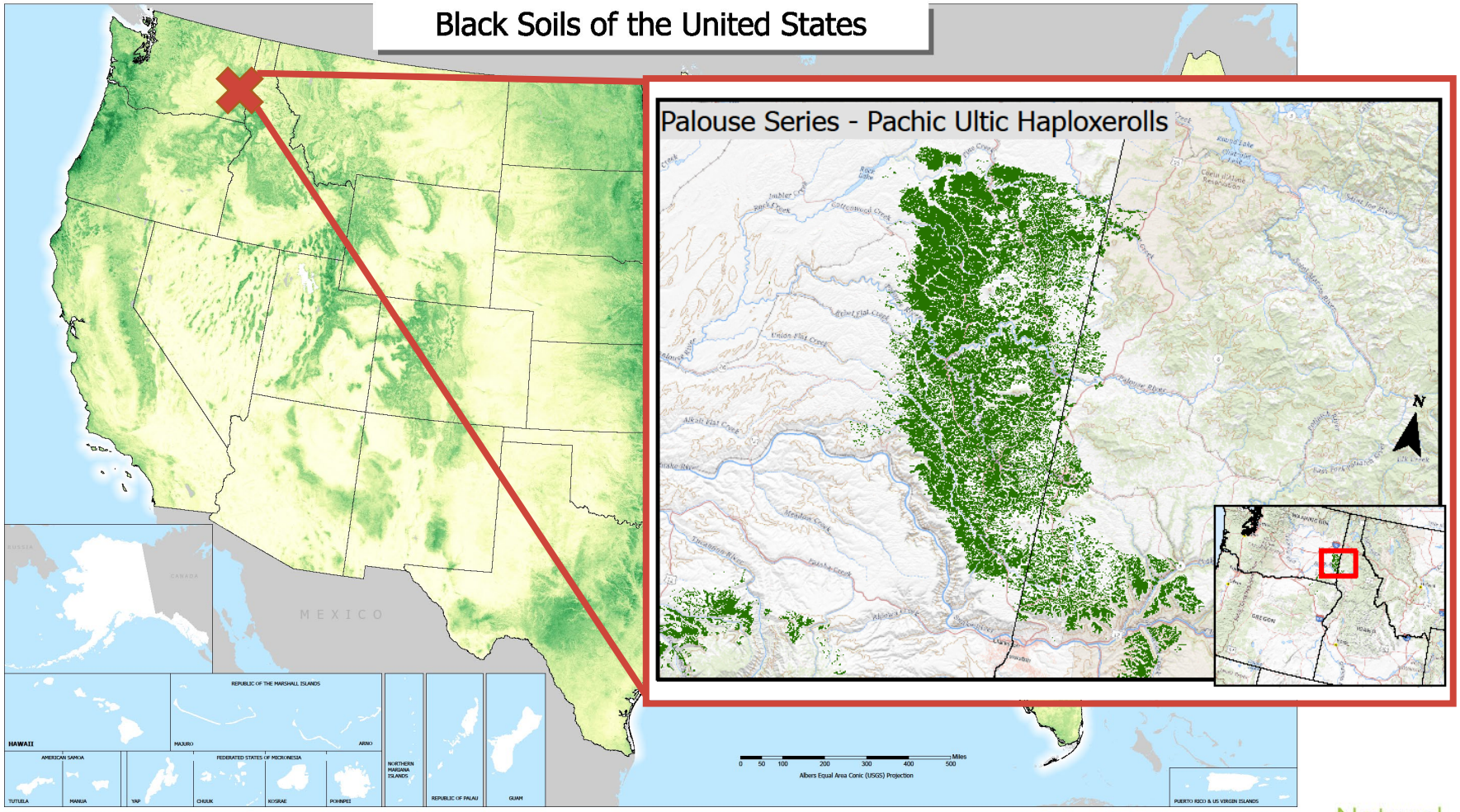

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The Palouse series consists of deep, well drained soils formed in loess on hills. Slopes are 0 to 60 percent. The average annual precipitation is about 53 cm (21 inches), and the mean annual air temperature is about 9 degrees C (48 degrees F.).

TAXONOMIC CLASS: Fine-silty, mixed, superactive, mesic Pachic Ultic Haploxerolls

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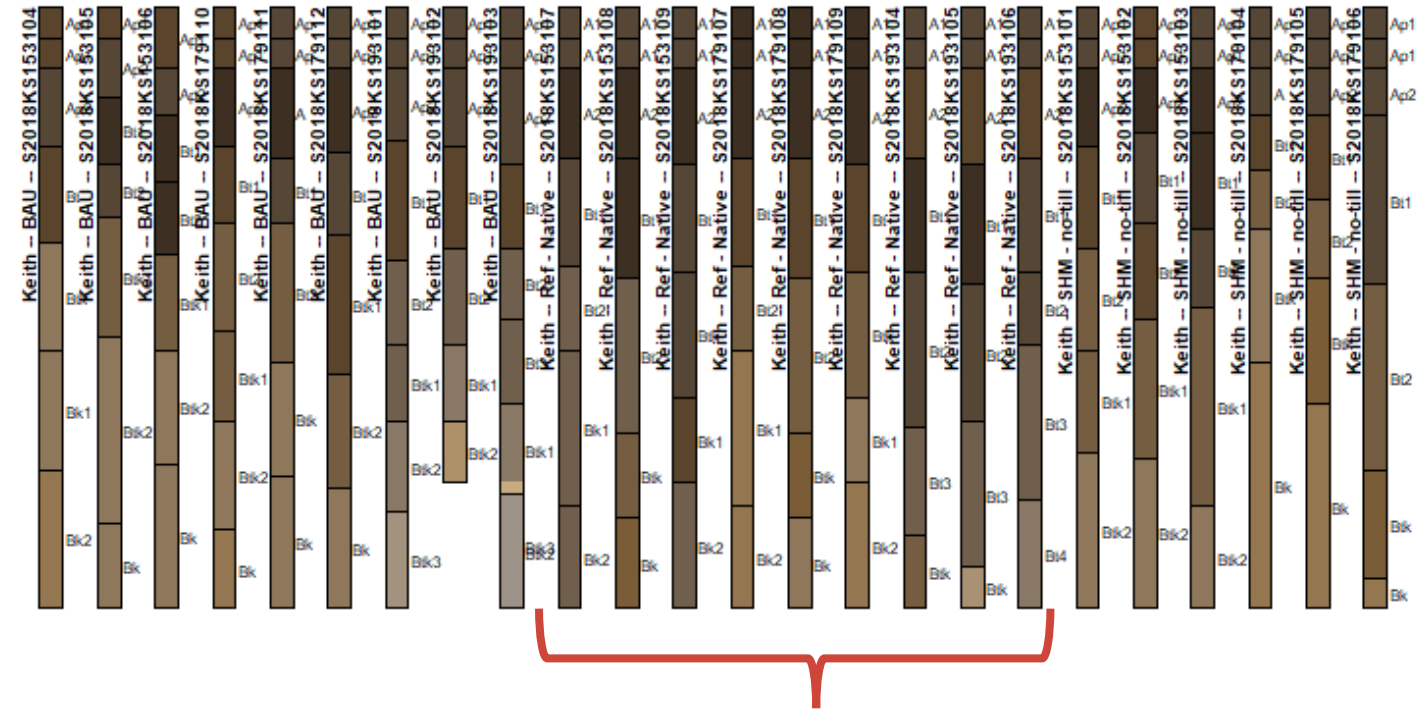
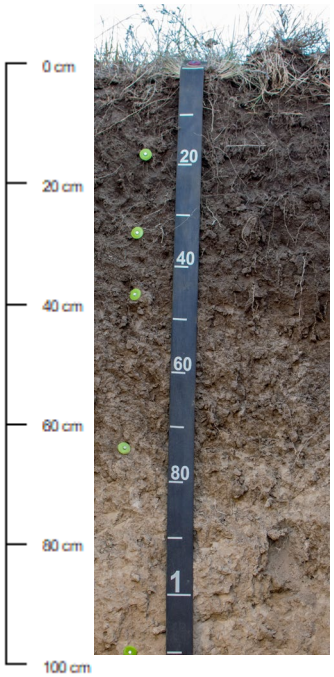
Keith Soils in DSP4SH project

BAU - Business as Usual

SHM-Soil Health Mgmt





Ref - Native Reference

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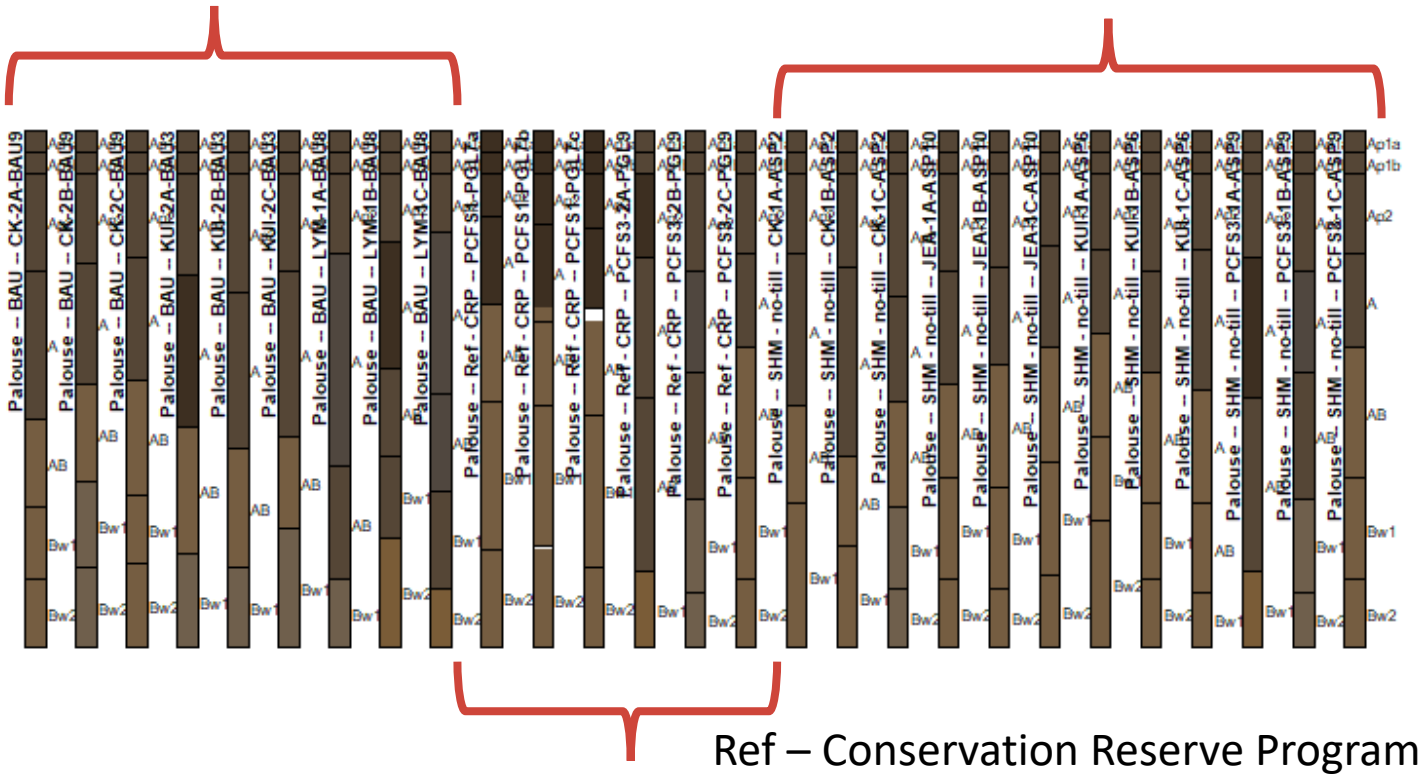
Palouse Soils in DSP4SH project

BAU - Business as Usual

SHM-Soil Health Mgmt



Ref – Conservation Reserve Program
Perennial Reference

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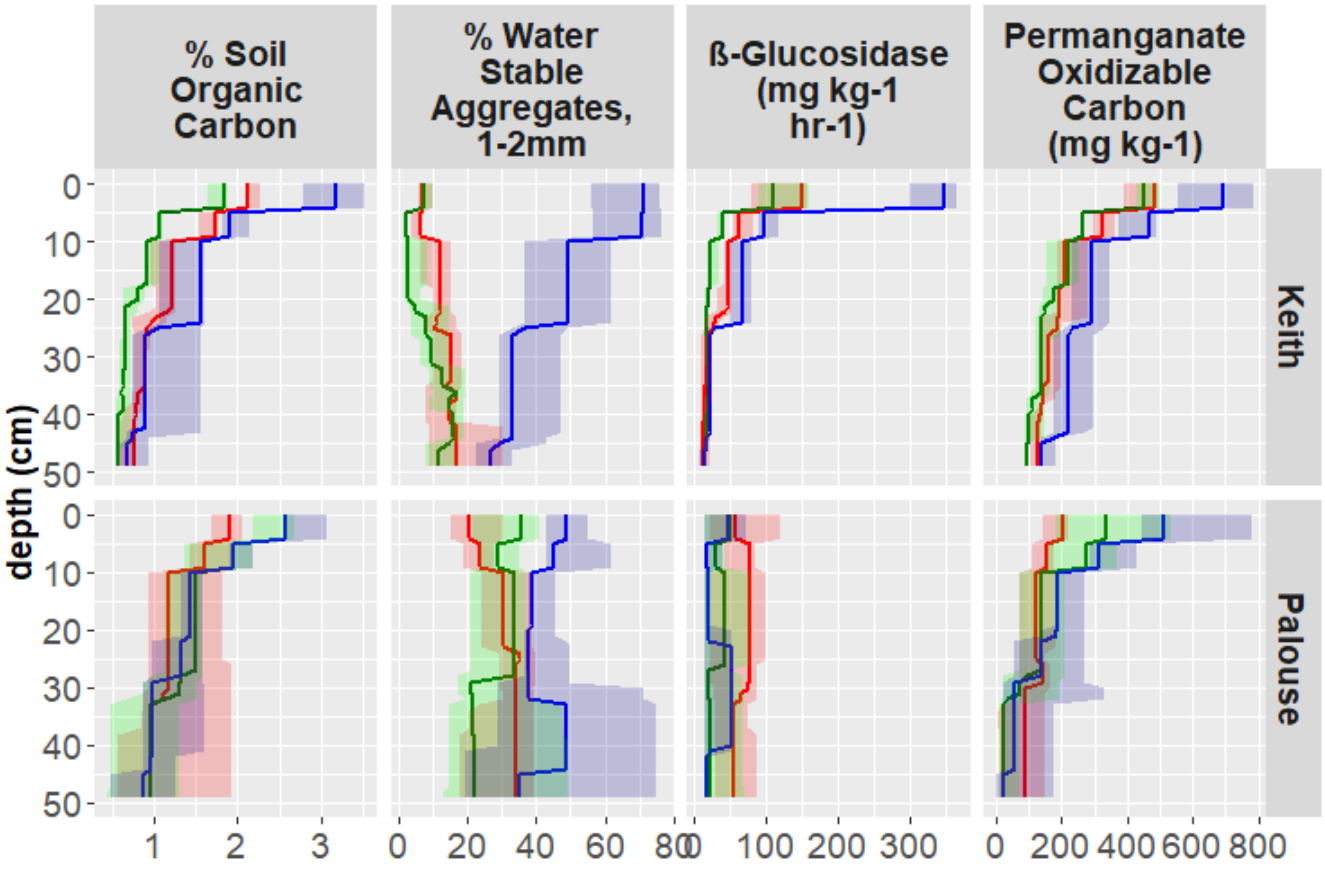

Management Group

- Business as Usual
- Soil Health Management
- Reference

Business As Usual -- conventional row-crop agriculture
Soil Health Management system -- row-crops with no-till and some cover crops
Reference Conditions (ecological potential)-- native or naturalized vegetation

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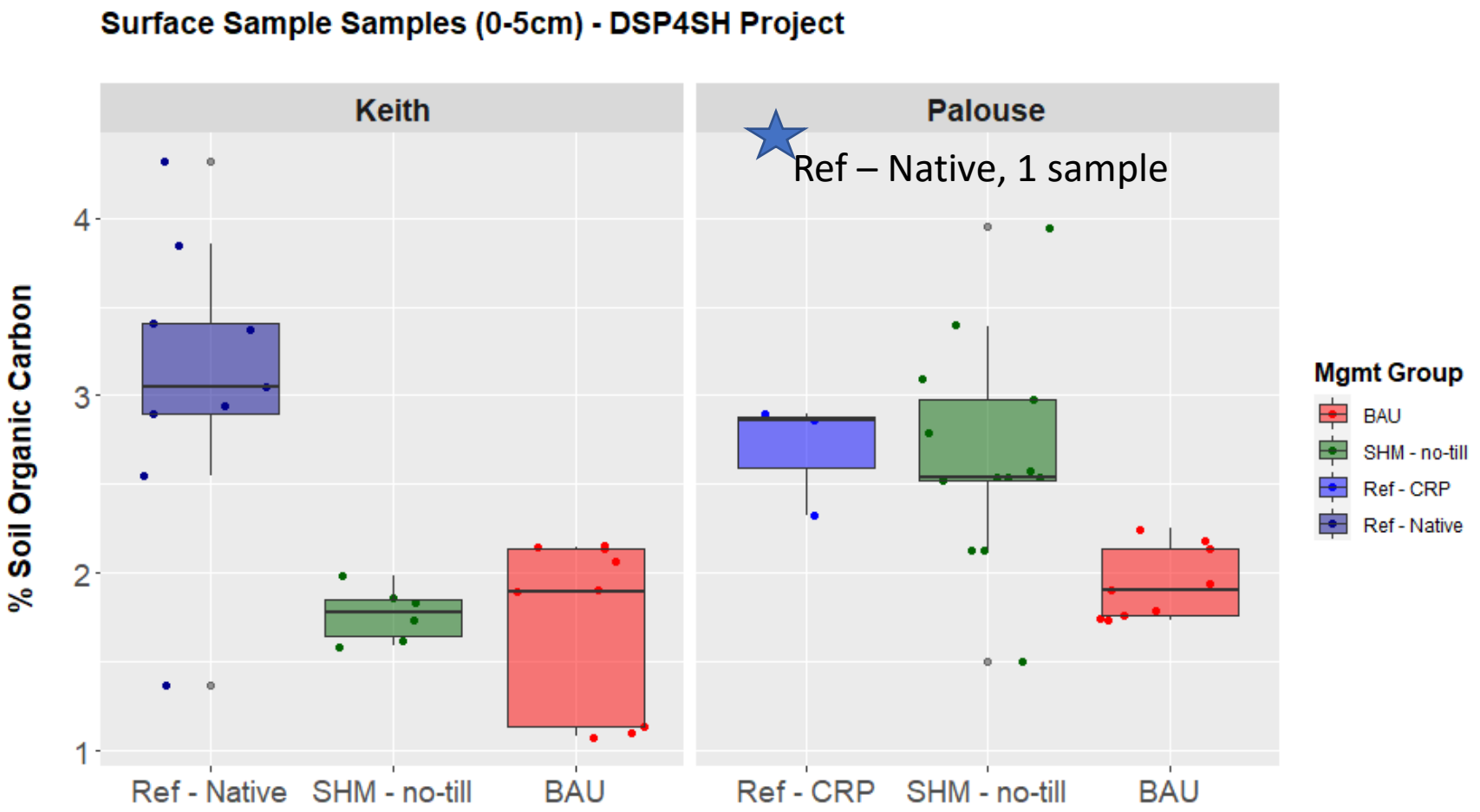
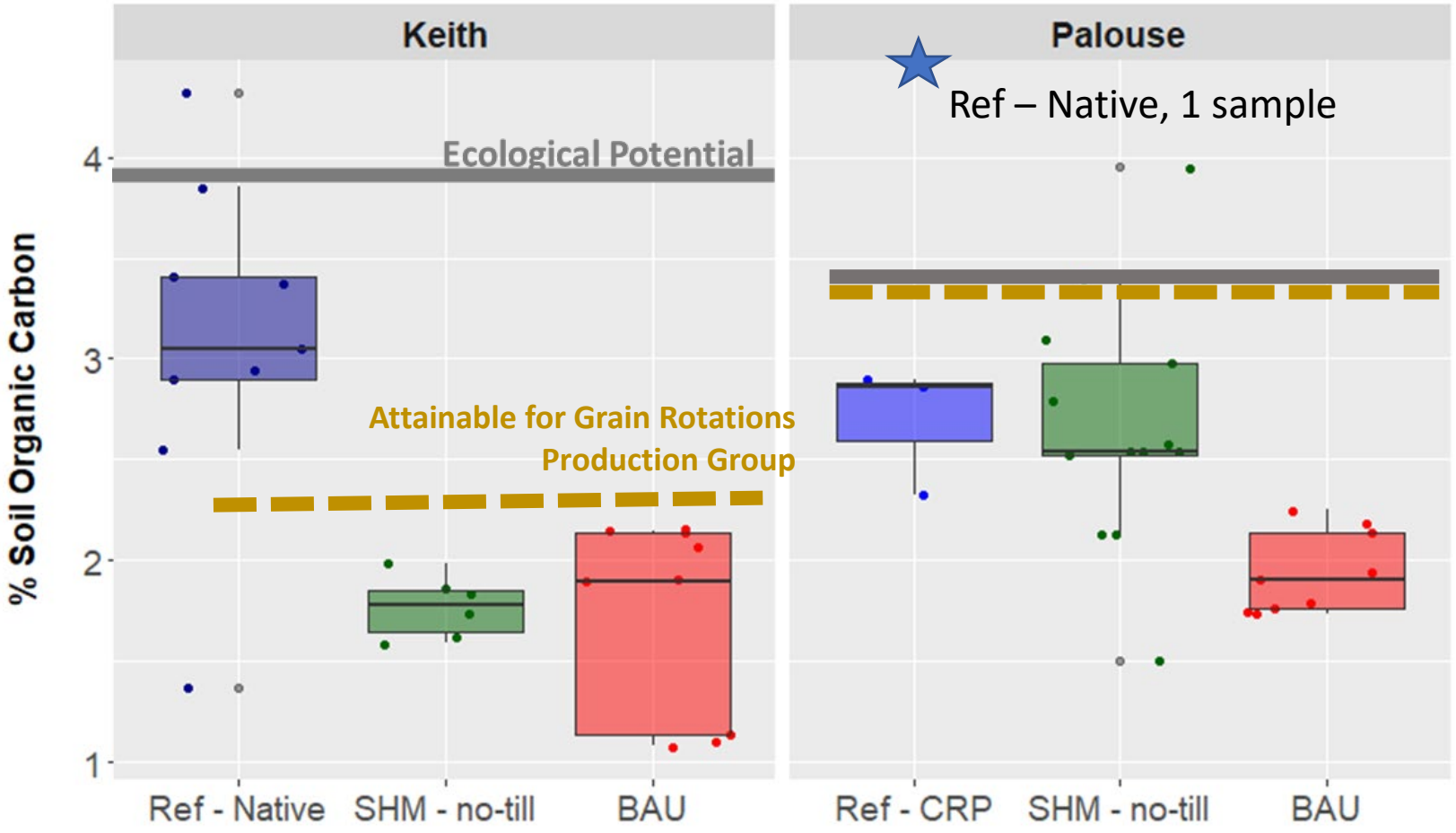
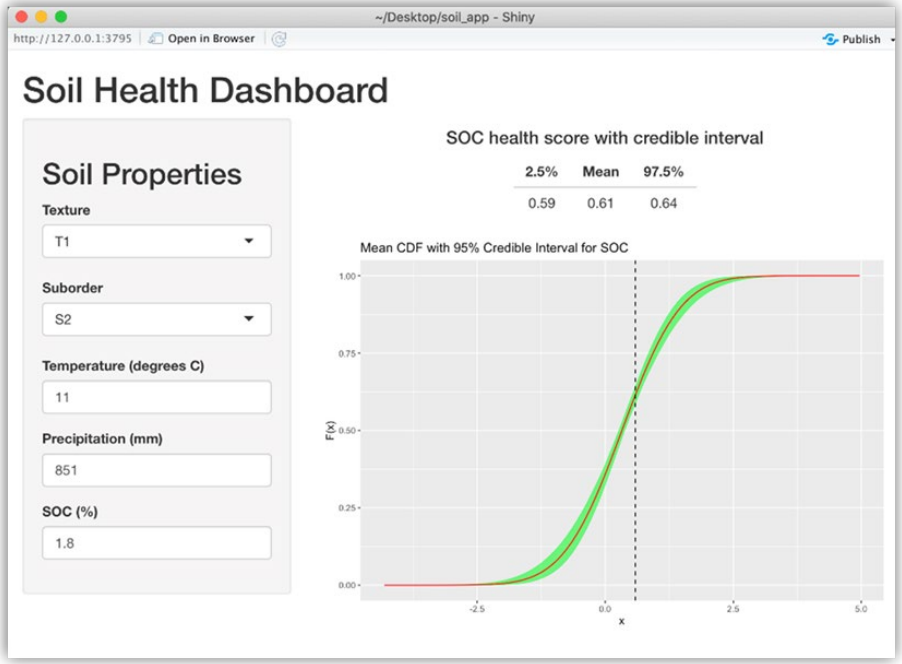

Surface Sample Samples (0-5cm) - DSP4SH Project
Keith
Palouse
Ref – Native, 1 sample
% Soil Organic Carbon
4
3
2
1
Ref - Native
SHM - no-till
BAU
Ref - CRP
SHM - no-till
BAU
Mgmt Group
BAU
SHM - no-till
Ref - CRP
Ref - Native


Keith
Palouse
Ref – Native, 1 sample
Ecological Potential
Attainable for Grain Rotations Production Group
% Soil Organic Carbon
4
3
2
1
Ref - Native
SHM - no-till
BAU
Ref - CRP
SHM - no-till
BAU

SHAPE curves and scores for examples

The SHAPE tool is a flexible, robust, and user-friendly soil health interpretation framework grounded in the principles of soil science to:

- Evaluate distribution of soil properties with a peer group of soils
  - Texture
  - Suborder (taxonomy)
  - Temperature
  - Precipitation
- Assess individual samples with this probability
- Summarize assessment of conservation systems across US



Nunes, et al. 2021. The soil health assessment protocol and evaluation applied to soil organic C. *Soil Science Society of America Journal*. https://acsess.onlinelibrary.wiley.com/doi/full/10.1002/saj2.20244

Kansas – Keith Soil Series

- ★ **Reference – Score 0.92**
- ● **Soil Health Management System – Score 0.23**
- ▲ **Business as Usual – Score 0.23**

Washington State – Palouse

- **Reference – Score 0.98**
- **Soil Health Management System – Score 0.92**
- **Business as Usual – Score 0.24**

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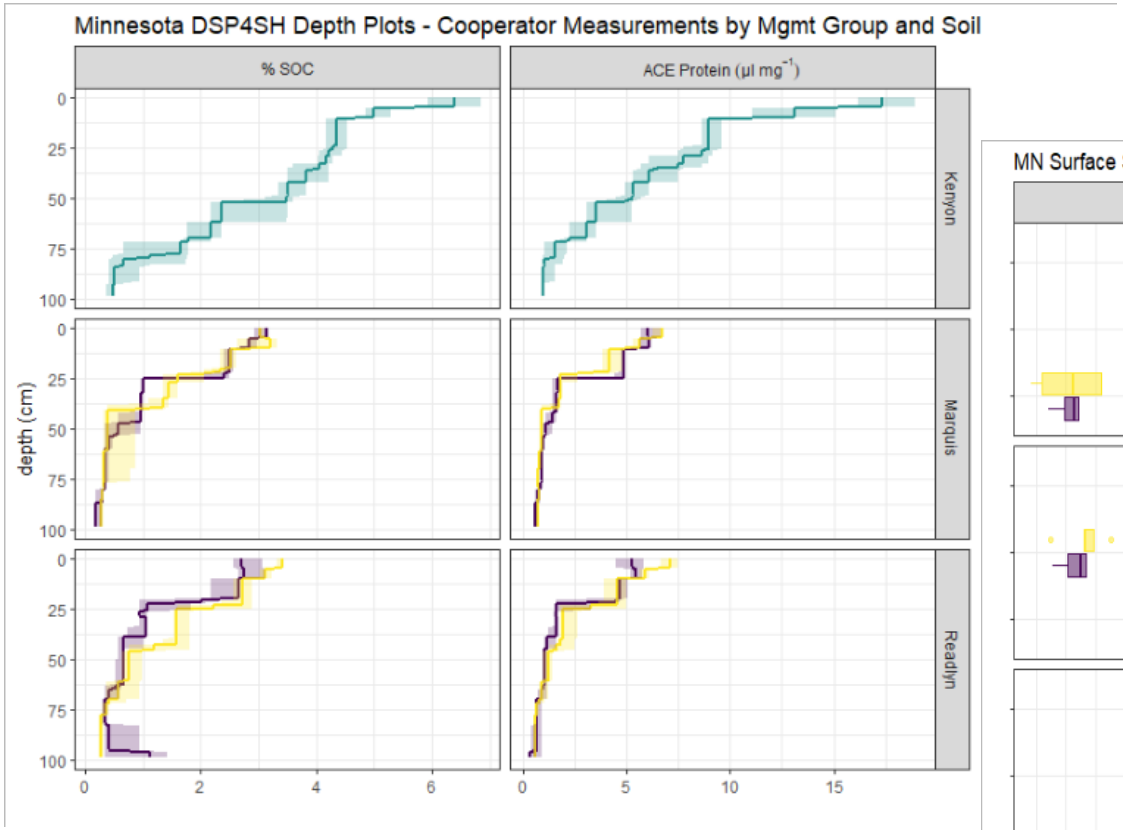
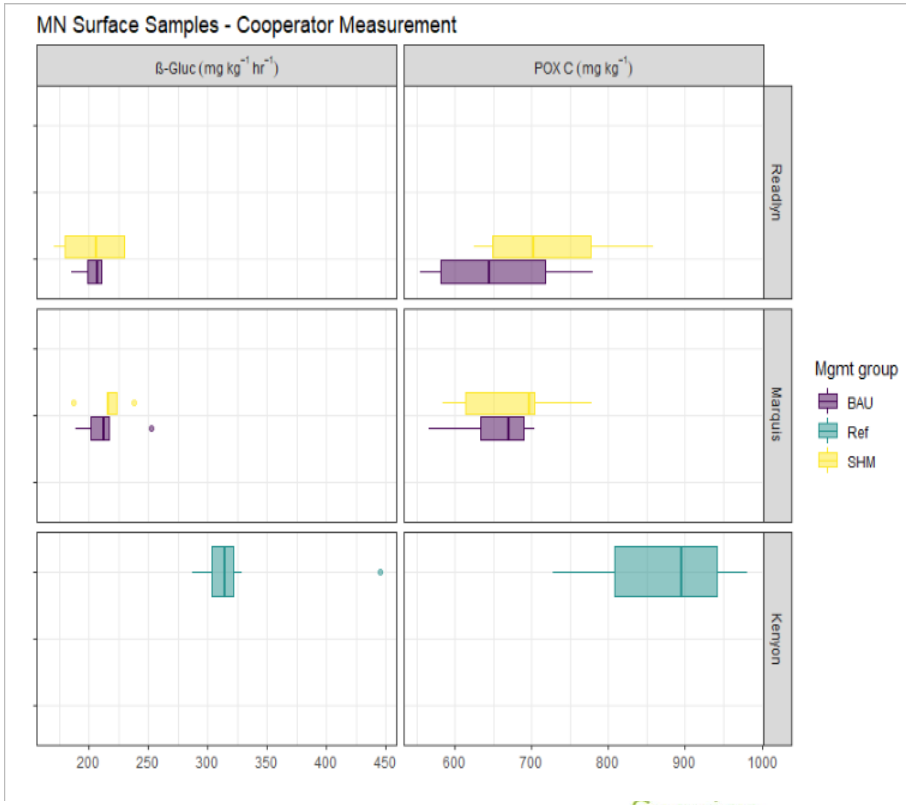
Initial Results from Minnesota
Highlight a problem – comparable sites





Summary

- **Black soils are extensive in the US**
- **Black soils can be used to group soils and evaluate soil assessments**
  - Ecological potential – capability
  - SHAPE curves
- **These concepts can be linked to soil security and food security**
- **On-going work to evaluate black soils in the north central US will provide more information on the central concept of black soils and allow us to test these concepts**

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Questions: skye.wills@usda.gov

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