Linking Ecological Sites, Dynamic Soil Properties, Conservation Planning, and Soil Health

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Soil Health Definition

• Capacity of the soil to function as a vital living ecosystem that sustains plants, animals, and humans
  – Nutrient cycling
  – Water (infiltration & availability)
  – Filtering and Buffering
  – Physical Stability and Support
  – Habitat for Biodiversity

Baseline or Reference Condition for Soil Health Assessments is not clear

Soil Survey
Ecological Sites
Dynamic Soil Properties
Regions
MLRAs – Major Land Resource Areas
LRU or CRA
Or other sub-MLRA

Soil Systems: Characteristic Landscapes within a sub-MLRA unit

(C. Hibner, A. Miller; SGI, 2008)
Proposed Hierarchy for sampling and extrapolating DSPs

• **MLRA or region**
  
  – MLRA or region

  • **LRU or other sub-MLRA**
    
    • Characteristic Catena (related to soil system)
      
      • Soil series
Proposed Hierarchy for sampling and extrapolating DSPs

- **MLRA or region**
  - LRU or other sub-MLRA
    - Characteristic Catena (related to soil system)
      - Landscape Elements or groups of soils that behave similarly
        - Soil series
Ecological Sites – groups of soil component phases

Soils of the Tesuque River Area

- Strath Terraces
  - 131 Sueleros
  - 131 Depolvo
  - 131 Xeromack
- Fan Remnant
  - 131 El Rancho
- High Stream Terraces
  - 121 Camelrock

Legend

- Eolian Material
- Tesuque Formation
- Water Table
- Alluvium
- Apache plume
- four-wing saltbush

Valley Floors

- 130 Jaralosa
  - flood plain steps
- 122 Cuyamunge
- 125 Bosquecito
- 125 Mirada

- side-oats grama
- galleta
- blue grama
- black grama
- Indian ricegrass
- oneseed juniper
- rush
- cotton wood
- willow
- sedge
- cattail

(C. Hibner, A. Miller; SGI, 2008)
Ecological Site:

An ecological site is a conceptual division of the landscape that is defined as a distinctive kind of land based on recurring soil, landform, geological, and climatic characteristics that differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation, and in its ability to respond similarly to management actions and natural disturbances.
What are the Triggers?

What are restoration techniques?
Land Management Optimization (LMO)

Soil Functions / Ecosystem Services

- Native / Naturalized Plant Communities
- Grain Rotation
- Forage Crops
- Root Crops
- Vegetable Rotation

Agricultural Production Groups

- Attainable for Forage Crops Production Group
- Ecological Potential
- Resource Concern Threshold
- Degradation / Resilience Threshold

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Rapid Carbon Assessment

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Degradation / Resilience Threshold

Resource Concern Threshold

Soil Functions / Ecosystem Services

Ecological Potential

Land Management Optimization for one Production Group

Attainable for Grain Rotations Production Group

Grain Rotations

Continuous no-till w/ cover crops

Organic system w/ cover crops

Diverse rotation, tillage

Monocrop, Deep tillage

Rotation, low-till, no cover crops

Disturbance within one Agricultural Production Group
Trends in Condition

Soil Function / Ecosystem Service

High

Ecological Potential

Attainable for Grain Production Group

Production Group A

Best Management System

Alternate Management System

Resource Concern Threshold

Degradation / Resilience Threshold

Poor Management System

Degrading / worst Management System

Time

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Dynamic Soil Properties (DSPs)

- Properties that change with land use and management
- Focused on changes that happen at the human time scale (decades to a century)
- Current Guidance
  

  - Assess soil change through comparison studies
    
    - One soil series or soil series component phase
    - Two or more land use/cover or management systems
Uses of DSP and ES work

• Set baseline
• Assess soil change
• Provide inputs for conservation planning
• Calibrate and validate soil modeling
Soil Function

Ecological Site

Soil Series

Taxa

R077CY036TX – Sandy Loam
Amarillo
Fine-loamy, mixed, superactive, thermic Aridic Paleustalfs

R080AY010OK – Claypan Prairie, South Kirkland
Fine, mixed, superactive, thermic Udertic Paleustolls
Rapid Carbon Assessment

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Soil Function

Ecological Site

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Amarillo
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--- Aggregate Stability (%) --- -------100

0  ----- Aggregate Stability (%) -- ------100

Water Stable Aggregates (1 – 2 mm); 0-2 cm

Rangeland  CRP  Management System  Conv. till Cotton

Rangeland  Conv. till  Management System  No Till

Ecological Site

Soil Series

Taxa
Use Soil Survey, Dynamic Soil Properties and Ecological Site Framework

To Assess soil condition
- Compare measured/observed values to those expected for similar or alternative management systems

To predict and scale soil change
- Aggregate observations and link to layers with relevant soil and management information
- Knowledge of alternative states/systems can be used to predict change under different conditions

To Improve Conservation
- Adjust conservation plans and practices to account for previous soil change
- Calibrate and validate models used in conservation planning
Questions?
Other ongoing work

• NE Dodge Co.
  – Catena based DSP project

• IN MLRA 111
  – Agricultural lands – ES and DSP project

• Sheridan Co., KS
  – Evaluation of no-till and cover crops

• Sutter Co., CA
  – Application of cover crops in Prune Orchard
111C Cropland ESD Pilot Project

• ESI Specialist – Tyler Staggs
• Regional ES QA – Stacey Clark
• Indiana State Office
  – State Con
  – State Agronomists
• Soil Survey Region 11 (acting)
  – Soil Survey Office – Findlay, OH
  – Support for Indianapolis SSO
Soil Organic Carbon Simulations with APEX
Chaney Soils of Eastern Texas

Soil Organic Carbon (tons/ha)

Years

Source: Mari-Vaugh Johnson
Proposed Hierarchy for sampling and extrapolating DSPs

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      » Landscape Elements or Ecological sites— with groups of soils that behave similarly
    
    • **Benchmark Soil** – soil that represents landscape element-ecological site-soil group, target for DSPs, monitoring etc.