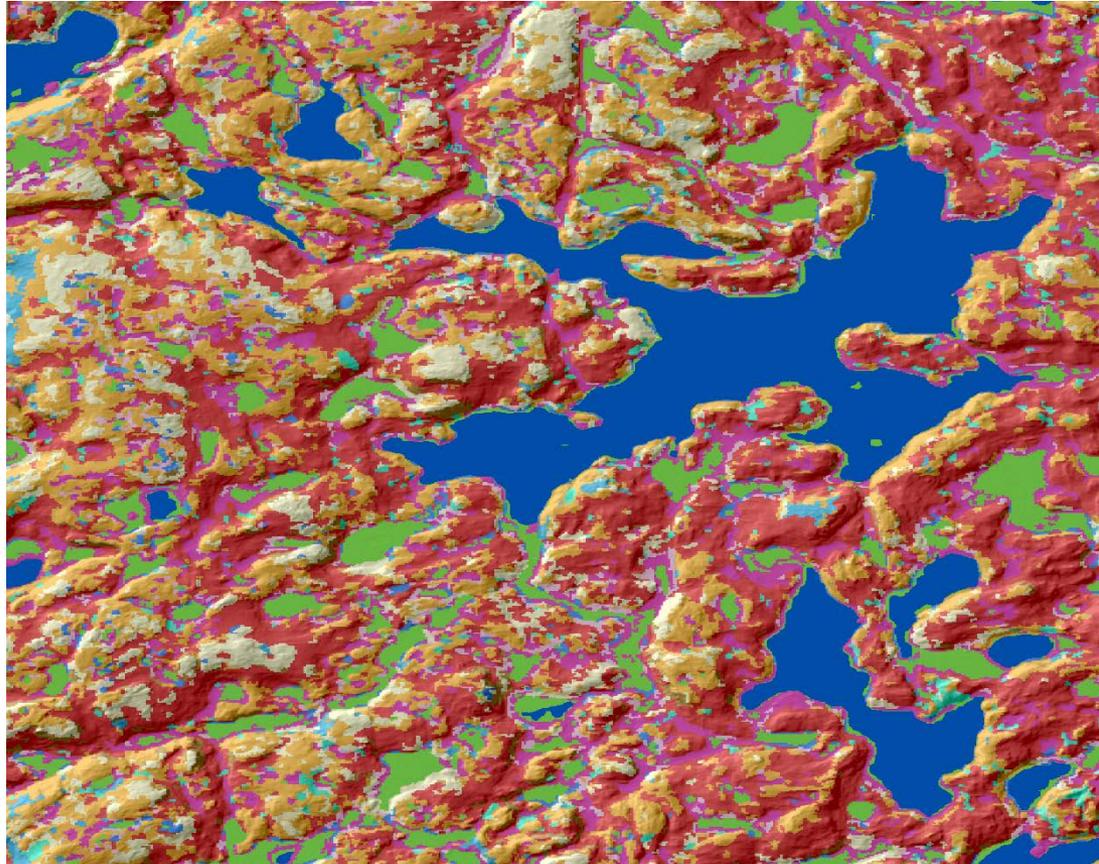
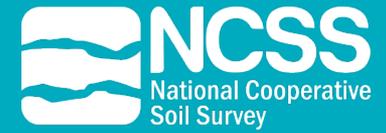




United States Department of Agriculture



Digital Soil Mapping Focus Team

May 17, 2018

Natural Resources Conservation Service

nrcs.usda.gov/

SSD Focus Teams



General charges

- Act as liaisons across Division and the National Cooperative Soil Survey (NCSS)
- Provide leadership, guidance, and coordination with their specified area of activity
- Serve as a repository of information in specified area of activity
- Provide a national perspective to regions and teams



DSM Focus Team



Team charges

- Coordinate DSM activities across the Division
- Identify training needs
- Identify needs to update standards and propose solutions
- Initiate annual field weeks to investigate soil-landscape relationships in selected project areas
- Assemble existing data
- Identify gaps
- Produce raster-based soil data and information



DSM Focus Team



Team leads

Tom D'Avello

(NRCS Soil Scientist/GIS Specialist – NSSC)

Suzann Kienast-Brown

(NRCS Soil Scientist/GIS Specialist – Region 4)

Jim Thompson

(Professor of Soils and Land Use, WVU)



DSM Focus Team



History

- DSM in SSD
 - Since 2002
 - Roughly 25 soil survey projects
 - » Update and initial
 - » Employed DSM methods to some extent
 - » Various methods
 - » Various products
 - North American Node of GlobalSoilMap
 - Roughly 15 soil scientists
 - » Plus NCSS cooperators



DSM Focus Team



Formation

- Raster Workshops initiated March 2015
- February 2016
 - DSM team initiated
- March 2016
 - 3 day brainstorming session
 - Soils information for entire US
 - Think big
 - No sideboards
 - Resulted in vision for Soils2026 and beyond
- January 2017
 - SSD Focus Teams formalized



DSM Focus Team



Unique challenge

- DSM and creation of raster soil products not operational in soil survey activities
 - Build a framework in SSD where one does not currently exist
 - » Standards
 - » Training
 - » Delivery
 - Proven methodology and technology

Unique opportunity



DSM Focus Team



Current activities

– Raster standards

- Focused on product, not process
- NSSH Part 648 to be published soon

– Training

- Learning the process and applying accepted DSM methods
- Curriculum identified from existing courses
- New *Introduction to DSM* course developed and delivered (April 2018)



DSM Focus Team

DSM training curriculum



Foundational Prerequisites Taken in the Following Order:

1. Spatial Analyst Workshop (NRCS-NEDC-000271)
2. Statistics for Soil Survey Part 1 (NRCS-NEDC-000400)
3. Intro to Digital Soil Mapping (NRCS-NEDC-000272)

Digital Soil Mapping with ArcSIE (NRCS-NEDC-000273)

- Prerequisites
 - All 3 foundational prerequisites

Statistics For Soil Survey Part 2 (NRCS-NEDC-000332)

- Prerequisites
 - Statistics for Soil Survey Part 1

Remote Sensing for Soil Survey Applications (NRCS-NEDC-000244)

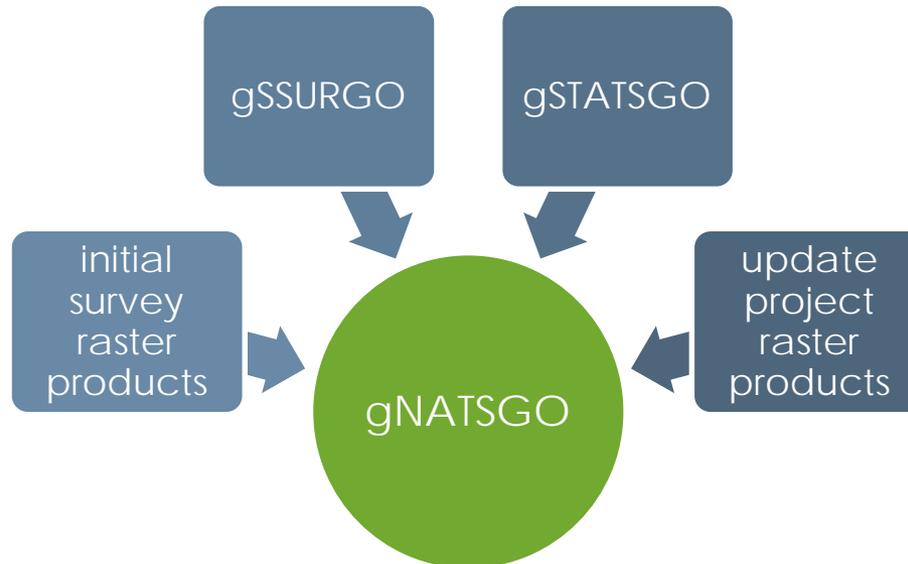
- Prerequisites
 - All 3 foundational prerequisites
 - Intro to Digital Remote Sensing (available on-line from Michigan State University)



DSM Focus Team

Current activities

- Raster product delivery
 - gNATSGO for raster class products
 - Database team producing gridded SSURGO/STATSGO
 - Eventually incorporate initial and update raster products
 - Best available class-based data



DSM Focus Team



Current activities

- Raster product delivery
 - Future development of online delivery as part of WSS or other interface
 - SSD GIS architecture being evaluated
 - Soil class products and interpretations
 - Continuous soil property products and interpretations

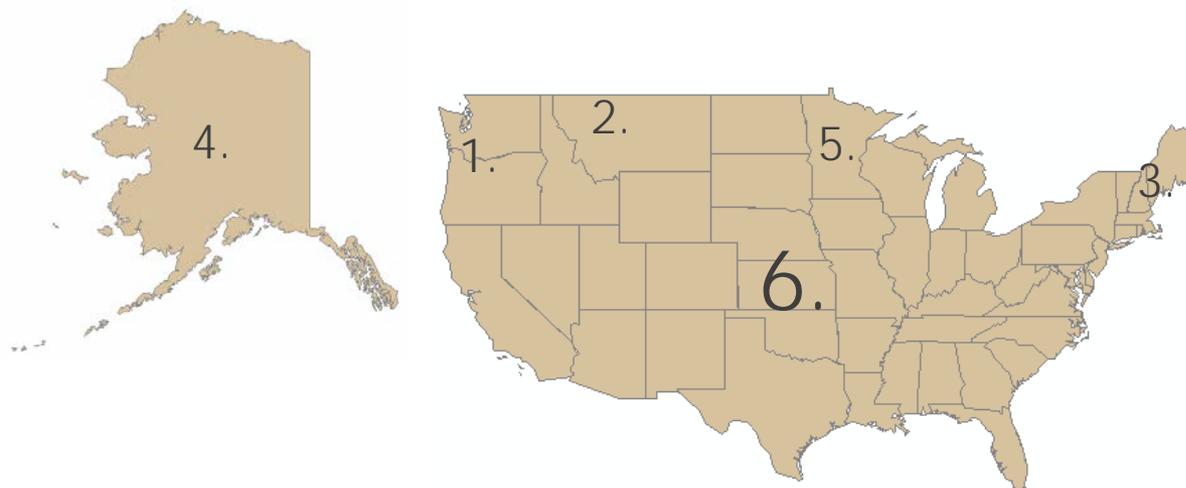


DSM Focus Team



Current activities

- Projects initiated
 - Cascades region, WA and OR (USFS, NMSU, USGS)
 - Bob Marshall Wilderness, MT (USFS, NMSU)
 - White Mountain NF, NH and ME (USFS)
 - Alaska (2 potential areas/partners identified; UMinn, ABR)
 - MLRA 90 and MLRA 102 update projects (NRCS SSR 10)
 - Nationwide continuous soil properties (USFS, USGS, Universities)



DSM Focus Team

Current activities

- Volunteers/members for sub-teams from NCSS
- Organize sub-teams; set regular meetings and activities
 1. Initial mapping projects
 2. MLRA update projects
 3. National coverage continuous soil properties



DSM Focus Team – Vision

Focus

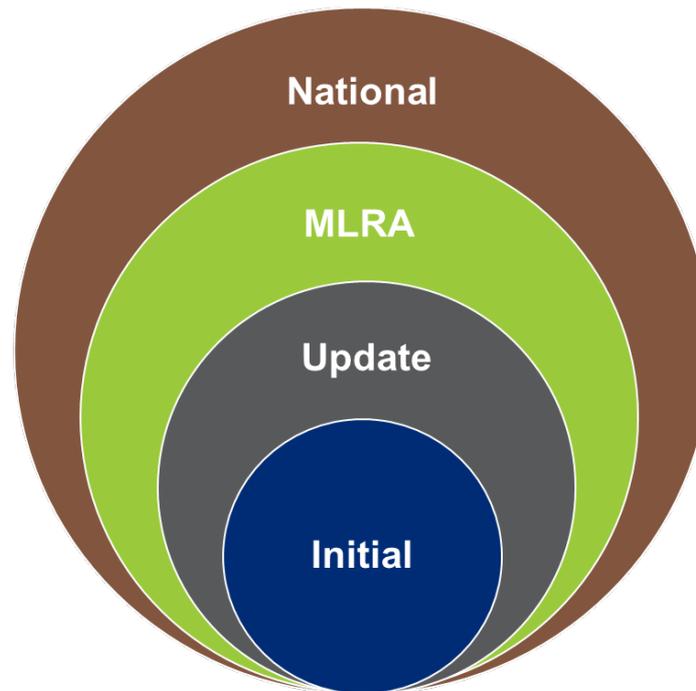
- Fundamental pedology
 - **Knowledge** of the soil resource as a natural body
 - Existing and newly acquired
 - **Field component**
- Latest technological resources
 - Applied adaptively throughout process and in **combination** with soil knowledge



DSM Focus Team – Vision

Foundation

- Same tools and approaches are scalable and cross-informative



DSM Focus Team – Vision



Support

- Sub-teams for local focus
 - Points of contact, discussion, coordination
 1. Initial mapping
 2. MLRA updates
- Sub-team for national focus
 - Development of methods and products
 3. National coverage continuous soil properties



DSM Focus Team – Vision

Deliverables

- Continuous raster soil properties
- Key soil property layers at depth intervals
 - 0-5cm
 - 5-15cm
 - 15-30cm
 - 30-60cm
 - 60-100cm
 - 100-200cm
- Prediction uncertainty
 - 90% prediction interval

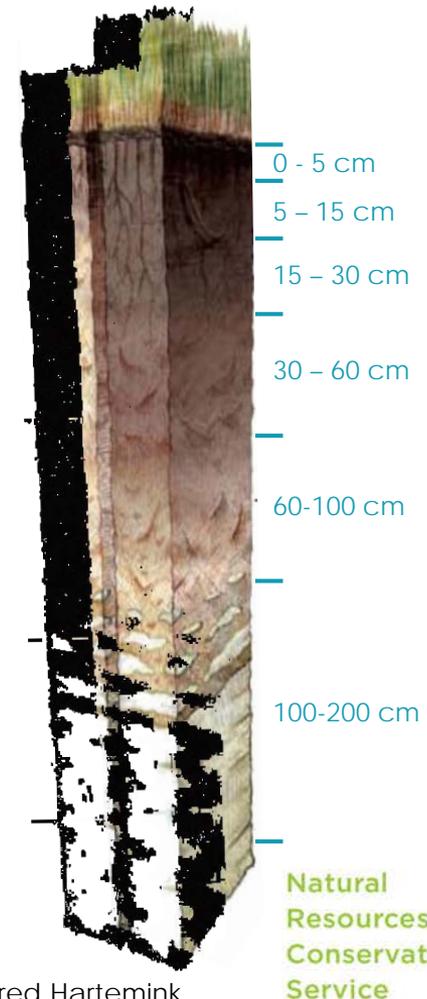


Image: Alfred Hartemink

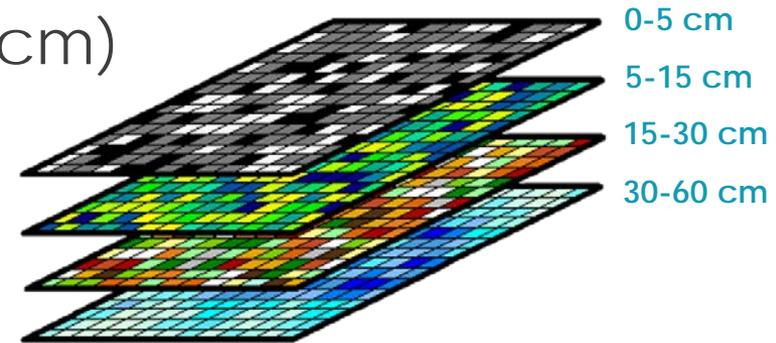


DSM Focus Team – Vision

Target soil properties

- Total profile depth (cm)
- Plant-exploitable soil depth (cm)
- Organic carbon (g/kg)
- pH (x10)
- Sand, silt, clay (g/kg)
- Rock fragments ($\text{m}^3 \text{m}^{-3}$)
- ECEC (cmolc/kg)
- Bulk density of fine earth (<2 mm) fraction (Mg/m^3)
- Bulk density of whole soil (Mg/m^3)
- Available water holding capacity (mm)

Concept soil property



**standard depths, properties, and uncertainty requirements based on GlobalSoilMap.net standard 2.4*



DSM Focus Team – Vision



Future deliverables

- Interpretations for management and use
 - The data stack becomes the database
 - Add slope, climate, etc. layers needed for calculating interpretations
- Class data – taxonomic or technical

Iterative process

- Improved annually
 - Additional properties
 - Lower uncertainty

Continuous investigation and improvement



DSM Focus Team – Vision

Proof of concept

- *GlobalSoilMap*
 - STATSGO
- *SoilGrids* (1km, 250m, 100m)
 - Point data
- *Intermediate Scale SSURGO/STATSGO2 Raster Soil Property and Interpretations Map (ISSR)* (800m)
 - SSURGO/STATSGO blend
 - In review

Improved methods and knowledge base



DSM Focus Team – Vision



Search with SoilGrids.org

Layer options

Layers

- Filter layers
- Site characteristics (4)
 - Depth to bedrock (R horizon) up to 200 cm
 - On Off
 - Predicted probability of occurrence (0–100%) of R horizon
 - Absolute depth to bedrock (in cm)
 - Soil organic carbon stock in tonnes per ha
- Physical soil properties (5)
- Chemical soil properties (4)
- Soil classification (TAXNWRB) (2)
- Soil classification (TAXOUSA) (2)

Shade layer On Off

Opacity

Soil profiles On Off

Base map

Legend On Off

Important notice

SoilGrids is designed as a globally consistent, data-driven system that predicts soil properties and classes using global covariates and globally fitted models. If you are looking for soil information on national and/or local levels we advise you, before using SoilGrids, to compare SoilGrids predictions with soil maps derived from national and local soil geographical databases. National soil maps are usually based on more detailed input soil information and therefore are often more accurate than SoilGrids (within the local coverage area). For an overview of national and regional soil databases, please refer to the [Soil Geographic Databases compendium](#).

Unit: cm
200
57
0

SOILGRIDS 3D

DSM Focus Team – Vision



SoilGrids — global grids | Index of /data/recent/ | https://www.soilgrids.org/#/1/?zoom=8&layer=OCSTHA_M_sd2_250m

Search with SoilGrids.org

Unit: tonnes / ha
850
140
0

SOILGRIDS 3D

Layer options

Layers

Filter layers

Site characteristics 4

- Depth to bedrock (R horizon) up to 200 cm
- Predicted probability of occurrence (0–100%) of R horizon
- Absolute depth to bedrock (in cm)

Soil organic carbon stock in tonnes per ha 6

Available depths

- 5–15 cm
- 0–5 cm
- 5–15 cm**
- 15–30 cm
- 30–60 cm
- 60–100 cm
- 100–200 cm

Soil classification (TAXNWRB) 2

Soil classification (TAXOUSA) 2

Shade layer On Off

Opacity 0.7

Soil profiles On Off

Base map OpenTopoMap

Legend On Off

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DSM Focus Team – Vision



Search with SoilGrids.org

Layer options

Layers

Filter layers

Site characteristics 4

Physical soil properties 5

Bulk density (fine earth) in kg / cubic-meter

Clay content (0-2 micro meter) mass fraction in %

Available depths 7

30 cm

Coarse fragments volumetric in %

Silt content (2-50 micro meter) mass fraction in %

Sand content (50-2000 micro meter) mass fraction in %

Chemical soil properties 4

Soil classification (TAXNWRB) 2

Soil classification (TAXOUSA) 2

Shade layer On Off

Opacity 0.7

Soil profiles On Off

Base map OpenTopoMap

Legend On Off

Important notice

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DSM Focus Team – Vision

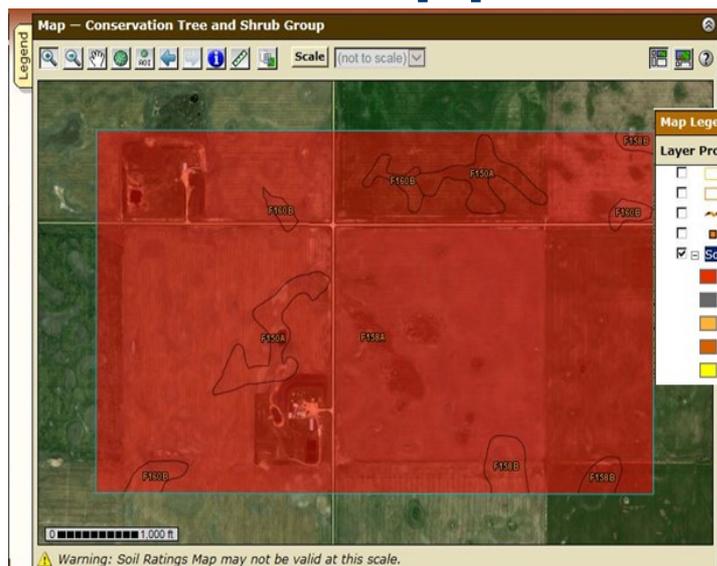


Benefit

- *A complete, consistent, correct, comprehensive, and current inventory of the soil resources of the United States*
- Flexible and relevant
- Addresses
 - Growing environmental challenges
 - Expanding user needs
 - Multiple scales
- Delivery in a timely manner



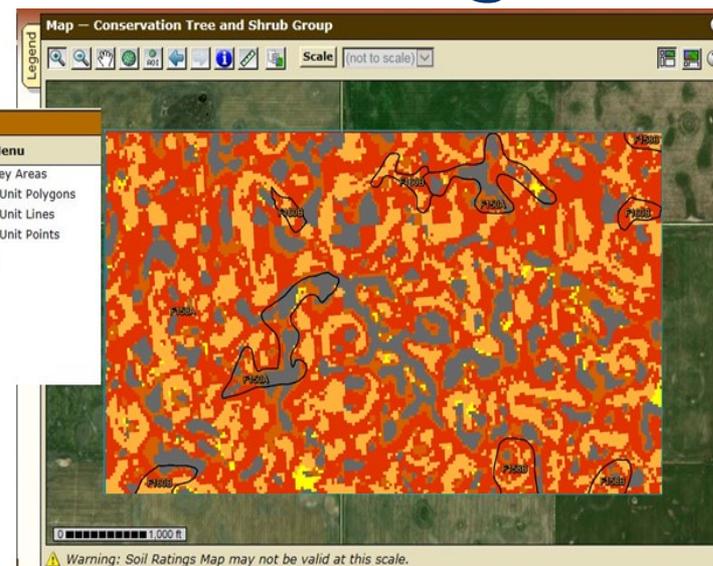
provide the Best Available Data About Soil Science to support decision making



Tables — Conservation Tree and Shrub Group — Summary By Map Unit

Summary by Map Unit - Renville County, North Dakota (ND075)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
F150A	Hamlet-Tonka-Wyard complex, 0 to 3 percent slopes	1	24.9	3.8%
F158A	Hamlet-Souris-Tonka complex, 0 to 3 percent slopes	1	600.1	92.2%
F158B	Hamlet-Souris-Tonka complex, 0 to 5 percent slopes	1	12.9	2.0%
F160B	Hamlet-Souris-Balaton loams, 1 to 5 percent slopes	1	12.6	1.9%
Totals for Area of Interest			650.5	100.0%



Tables — Conservation Tree and Shrub Group — Summary By Map Unit

Summary by Map Unit - Northern Black Glaciated Plains, Souris Till Plain (SS55A_1)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
F1004B	Souris loam, 1 to 4 percent slopes	1kk	133.6	20.5%
F1003A	Hamlet loam, 1 to 3 percent slopes	1	276.2	42.5%
F1007A	Wyard loam, 1 to 3 percent slopes	2	77.5	11.9%
F1001B	Balaton loam, 1 to 4 percent slopes	1kk	30.0	4.6%
F1002A	Hamerly loam, 0 to 2 percent slopes	2kk	8.3	1.3%
F1005A	Svea loam, 1 to 4 percent slopes	1	11.8	1.8%
F1006A	Tonka silt loam, 0 to 2 percent slopes	10	113.2	17.4%
Totals for Area of Interest			650.5	100.0%

Natural
Resources
Conservation
Service

