Web Soil Survey

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Jim Fortner
Dennis Lytle

Ken Harward
Dennis Williamson
Background

- USDA – Natural Resources Conservation Service (NRCS) has the federal lead for the National Cooperative Soil Survey Program

- Objective is to map the soil resource of all lands in the U.S.

- To date, about 97% of privately owned land, and 92% of all land in U.S. has been mapped
Digitizing of soil survey maps began about 20 years ago, with a concentrated effort beginning about 10 years ago.

To date, about 2,425 soil survey areas have been digitized.

Goal is to complete the approximately 580 remaining mapped survey areas by end of 2007.
Data Delivery

- Until recently, the only national method of delivering this digital data was to provide a dataset of digital spatial and associated attribute data (SSURGO) for use in the customer’s local Geographic Information System.
  - Some states have developed local delivery systems.
Data Delivery

- In August 2005, NRCS released a new Web application – Web Soil Survey
Web Soil Survey

- A Web application that provides online viewing of soil survey maps, along with related data and information needed to make sound land use and management decisions.
Web Soil Survey

- Allows public access to digital soil survey data without the need for the user to
  - Have a resident GIS
  - Maintain data files locally
  - Keep data current
- User only needs a computer and Internet access
Web Soil Survey

- Provides an alternative to traditional hardcopy publication
- Provides a means for quicker delivery of soil maps and related information – both initial and updated
- Accesses the most current data available
Web Soil Survey

- Allows customer to select the information they want
  - Soil map units limited to their geographic area of interest (AOI)
  - Information relevant to their land use concerns; e.g., rangeland or cropland management
Target Audience

- Basically everyone
  - General public
  - Landowners and managers
  - Engineers, scientists, and other specialists
  - Federal, state, and local governmental agency employees
  - Consultants or technical service providers
WSS Products

- Standard Soil Survey Product
  - Standard introductory and explanatory text
  - Soil maps on orthophoto backdrop for the AOI from SSURGO data (where digitized)
  - Soil interpretive (thematic) maps for the AOI
  - Soil data and interpretation tables by AOI
  - All using up-to-date data

- Link to download SSURGO data
WSS Products

- Customized Soil Resource Reports (PDF)
  - Standard product plus
    - Content can be tailored to selected land use concern
    - Other resource data such as ecological site descriptions and photos
WSS Products

- Historic Soil Survey Reports (selected survey areas)
  - PDF replicas of traditional published reports
  - Text, tables, and maps by Soil Survey Area (SSA)
WSS Functionality

- Locate desired geographic area
  - Use zoom-in/out map tools
  - Select by county or soil survey area, street address, lat/long, PLSS
- Define the AOI to see data
  - Expanding rectangle or multi-sided polygon tool
  - AOI can cross survey area boundaries
- Get listing of data available for AOI
WSS Functionality

- View and/or print soil map and thematic maps
- Generate soil property and interpretive tables
- Access ecological site descriptions and other related resource information applicable to AOI
- View and/or print historical PDF manuscript w/selected map sheets
Timeline

- WSS 1.0 initial release – August 15, 2005
- WSS 1.1 – February 2006
- WSS 2.0 – July 2006
- Additional functionality on a bi-yearly release schedule
WSS Design

- A loosely coupled application
- Interface designed to guide the user through the application
- Leverage the Lighthouse navigation services, which include calls to the USDA TerraServer for imagery
WSS Design

- Use web service calls to -
  - OIP (USDA Office Information Profile) for address and phone number of local USDA service center office
  - Soil Data Mart for soil maps, data, and manuscripts
  - ESI S (Ecological Site Information System) for ecological site maps, data, photos, descriptions, and state/transition model diagrams
  - PLANTS database for links to plant profile information
WSS Design

- Use ArcIMS to display all maps in the browser
- Use ArcGIS Server to
  - Render soil maps for PDF output – print/save
  - Construct interpretive/thematic maps
- Use ArcSDE on top of MS SQL-Server to manage the spatial databases
Architecture

- Using virtual server arrangement - VMware
- 2 front-end web servers (load balanced)
- 2 web services servers (load balanced)
- 7 middle tier servers for ArcGIS 9.x (2), ArcGIS Server 9.x (3), and app specific (2)
- 2 back-end database servers – Soil Data Mart, various WSS geodatabases, and navigation layers (ArcSDE 8.3 & 9.x)
- .NET framework 1.1, ArcObjects, Javascript
Using Web Soil Survey
Start WSS
http://websoilsurvey.nrcs.usda.gov/app/

Welcome to the NRCS Web Soil Survey.

3 Basic Steps is what makes WSS a simple yet powerful way to quickly access and analyze soil data.

1 Define.

2 View.

3 Explore.

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.
Pathway through WSS

- Locate and define AOI
- View soil map
- Browse/explore associated soil and related resource information
- Print/download the selected map or report
Area of Interest

Features

- Navigate to an AOI using basic map navigation themes
  - Transportation
  - Orthophoto
  - Hydrography
  - Political features

- Zoom-In/Out map tools available
Area of Interest
Features, cont.

- Locate or navigate to an AOI using selection criteria:
  - Soil Survey Area
  - County
  - Street address and/or Zip Code

- Define an AOI by drawing a polygon on a map – expanding rectangle or digitize multi-sided polygon
Area of Interest

Features, cont.

- Display datasets available for AOI
  - Soil map
  - Soil reports – from Soil Data Mart
  - PDF manuscript
  - PDF maps
View Other Geographic Areas
Locate AOI

Select Criteria:
- Address
- County
- Soil Survey Area

Zoom

Draw

Web Soil Survey
by Street Address
by County
by Soil Survey Area
Use Zoom-In Tools

Web Soil Survey

Preferences | Help

Area of Interest | Soil Map | Soil Data Explorer

Area of Interest Selection Criteria

Select Criteria
Address
County
State | Nebraska
County | Lancaster

Soil Survey Area

Area of Interest Interactive Map

View Extent: Continental U.S.
Set AOI – draw rectangle
Selected AOI

Area of Interest Properties

AOI Information
- Name: Hidden Valley Acres
- Area (acres): 292.8

Data available from Web Soil Survey for specified AOI:
- Lancaster County, Nebraska (NE109)
  - Soil Map: yes
  - Suitabilities and Limitations for Use: yes
  - Soil Properties and Qualities: yes
  - Soil Reports: yes
  - Soil Survey Publication: Manuscript: no, Maps: no

All Soil Survey Areas:
- Ecological Site Data: yes

Save AOI Name

Area of Interest Selection Criteria

Select Criteria
- Address
- County
- Soil Survey Area
  - State: Nebraska
  - County (optional)
Pathway through WSS

- Locate and define AOI
- **View soil map**
- Browse/explore associated soil and related resource information
### View Soil Map

#### Area of Interest Properties

**AOI Information**
- **Name**: Hidden Valley Acres
- **Area (acres)**: 292.8

**Data available from Web Soil Survey for specified AOI**
- **Lancaster County, Nebraska (NE109)**
  - **Soil Map**: yes
  - **Suitabilities and Limitations for Use**: yes
  - **Soil Properties and Qualities**: yes
  - **Soil Reports**: yes
  - **Soil Survey Publication**: Manuscript: no, Maps: no

#### Area of Interest Selection Criteria

**Select Criteria**
- **Address**
- **County**
- **Soil Survey Area**
  - **State**: Nebraska
  - **County (optional)**:  

[Image of the Web Soil Survey interface with the highlighted area of interest]
### Lancaster County, Nebraska

<table>
<thead>
<tr>
<th>Map Unit Symbol</th>
<th>Map Unit Name</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>BpF</td>
<td>Burchard-Nodaway complex, 2 to 30 percent slopes</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>BrD</td>
<td>Burchard clay loam, 6 to 11 percent slopes</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>Cp</td>
<td>Colmor-Nodaway silty clay loam, 0 to 2 percent slopes</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>JuC</td>
<td>Judson silt loam, 2 to 6 percent slopes</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>N9</td>
<td>Nodaway silt loam, 0 to 2 percent slopes</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>Nz</td>
<td>Nodaway silt loam, channelled</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>PaC2</td>
<td>Pawnee clay loam, 2 to 7 percent slopes, eroded</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>PaD2</td>
<td>Pawnee clay loam, 7 to 11 percent slopes, eroded</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>PaC3</td>
<td>Pawnee clay, 2 to 7 percent slopes, severely eroded</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>ShC</td>
<td>Akzarben silty clay loam, 2 to 5 percent slopes</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>ShD</td>
<td>Akzarben silty clay loam, 5 to 9 percent slopes</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>W</td>
<td>Water</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>WIC2</td>
<td>Wymore silty clay loam, 3 to 7 percent slopes, eroded</td>
<td>19</td>
<td>7</td>
</tr>
</tbody>
</table>
Pathway through WSS

- Locate and define AOI
- View soil map
- **Browse/explore associated soil and related resource information**
Explore Soil Information
Soil Data Explorer Features

- Filter the soil information by land use category
- Learn the terminology and concepts of soils and specific land uses
- View interpretive soil data and soil properties in the form of thematic maps, tables, and text description
- Access ecological site information
- Print maps and reports
Intro to Soils

Homebuyers

The foundation supports the walls, the walls support the roof, and the soil holds them all. But how can you tell if the soil will be a good "home" for your house? You need to answer some important questions:

- Is the soil stable, or does it have properties that can cause the foundation or walls to crack?
- Is the soil in an area subject to flooding?
- Will storm runoff drain safely away from the house and lot? Or will it turn your yard, or basement, into a pond?
- Does the soil have a seasonal high water table that can cause a basement to flood or a septic system to fail?
- Is the soil deep enough for a basement to be dug economically? For garden and landscape plants to take root and thrive?
- Is the soil so steep that erosion may be severe?

A soil survey can help you answer these and many other questions about the soil.
Suitabilities and Limitations

Instructions:
1. Pick a rule.
2. Set options.
3. Push "View Ratings" button.
Display Interpretive Map
### Summary Report

#### Tables - Dwellings With Basements

##### Summary by Map Unit - Lancaster County, Nebraska

<table>
<thead>
<tr>
<th>Soil Survey Area</th>
<th>Map Unit Name</th>
<th>Rating</th>
<th>Total Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>BpF</td>
<td>Burchard-Nodaway complex, 2 to 30 percent slopes</td>
<td>Very limited</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>BrC</td>
<td>Burchard clay loam, 5 to 11 percent slopes</td>
<td>Somewhat limited</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>Cp</td>
<td>Coln-Nodaway silty clay loams, 0 to 2 percent slopes</td>
<td>Very limited</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>JuC</td>
<td>Judson silt loam, 2 to 6 percent slopes</td>
<td>Somewhat limited</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>No</td>
<td>Nodaway silt loam, 0 to 2 percent slopes</td>
<td>Very limited</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>Ns</td>
<td>Nodaway silt loam, channelled</td>
<td>Very limited</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>PaC2</td>
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<td>7</td>
</tr>
<tr>
<td>Pbc3</td>
<td>Pawnee clay, 2 to 7 percent slopes, severely eroded</td>
<td>Very limited</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>ShC</td>
<td>Aksarben silty clay loam, 2 to 5 percent slopes</td>
<td>Very limited</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>ShD</td>
<td>Aksarben silty clay loam, 5 to 9 percent slopes</td>
<td>Very limited</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>W</td>
<td>Water</td>
<td>Not rated</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>Wc2</td>
<td>Wymore silty clay loam, 3 to 7 percent slopes, eroded</td>
<td>Very limited</td>
<td>19</td>
<td>7</td>
</tr>
</tbody>
</table>

##### Summary by Rating Value

<table>
<thead>
<tr>
<th>Rating</th>
<th>Total Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very limited</td>
<td>190</td>
<td>0.42282287245672</td>
</tr>
<tr>
<td>Somewhat limited</td>
<td>38</td>
<td>0.085545749734</td>
</tr>
<tr>
<td>Null or Not Rated</td>
<td>19</td>
<td>0.0442282287245672</td>
</tr>
</tbody>
</table>
Description

Dwellings are single-family houses of three stories or less. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet.

The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.
Soil Properties and Qualities

Instructions:
1. Pick a rule.
2. Set options.
3. Push "View Ratings" button.
Select Soil Property or Quality

Properties and Qualities Ratings

- Soil Chemical Properties
- Soil Erosion Factors
- K Factor - Rock Free
- K Factor - Whole Soil

Instructions:
1. Pick a rule.
2. Set options.
3. Push "View Ratings" button.

View Options
- Map
- Table
- Description Of Rating
- Rating Options

Advanced Options

FDA | Accessibility Statement | Privacy Policy | Non-Discrimination Statement | Information Quality | FirstGov | White House
Display Results – T factor
### Summary by Map Unit - Lancaster County, Nebraska

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<td>7</td>
</tr>
<tr>
<td>Cp</td>
<td>Colo-Nodaway silty clay loams, 0 to 2 percent slopes</td>
<td>5</td>
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<td>7</td>
</tr>
<tr>
<td>JuC</td>
<td>Judson silt loam, 2 to 6 percent slopes</td>
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<td>PaC2</td>
<td>Pawnee clay loam, 2 to 7 percent slopes, eroded</td>
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</tr>
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<td>PbC3</td>
<td>Pawnee clay, 2 to 7 percent slopes, severely eroded</td>
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<td>19</td>
<td>7</td>
</tr>
<tr>
<td>W</td>
<td>Water</td>
<td>Null</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>WtC2</td>
<td>Wymore silty clay loam, 3 to 7 percent slopes, eroded</td>
<td>5</td>
<td>19</td>
<td>7</td>
</tr>
</tbody>
</table>

### Description - T Factor

The T factor is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.
Change Land Use

Folder list changes according to land use

Tabs change
Ecological Site Name Map
# Ecological Site Assessment

## Table - Summary by Ecological Sites in Area of Interest

<table>
<thead>
<tr>
<th>Soil Survey Area Map Unit Symbol</th>
<th>Component</th>
<th>Ecological Site</th>
<th>Total Acres in AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>BpF</td>
<td>Burchard (55%)</td>
<td>R106XY068NE - Silty, NE &amp; Loamy Upland, KS - under development</td>
<td>19</td>
</tr>
<tr>
<td>Nodaway (45%)</td>
<td>R106XY068NE - Silty Overflow - Veg. zone 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BrD</td>
<td>Burchard (100%)</td>
<td>R106XY075NE - Silty, NE &amp; Loamy Upland, KS - under development</td>
<td>19</td>
</tr>
<tr>
<td>Nodaway (45%)</td>
<td>R106XY068NE - Silty Overflow - Veg. zone 4</td>
<td></td>
<td></td>
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<tr>
<td>JuC</td>
<td>Judson (100%)</td>
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<td>Nodaway (100%)</td>
<td>R106XY068NE - Silty Overflow - Veg. zone 4</td>
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<tr>
<td>Ns</td>
<td>Nodaway (100%)</td>
<td>R106XY068NE - Silty Overflow - Veg. zone 4</td>
<td>19</td>
</tr>
<tr>
<td>PaC2</td>
<td>Pawnee (100%)</td>
<td>R106XY074NE - Clayey - Veg. zone 4</td>
<td>19</td>
</tr>
<tr>
<td>PaD2</td>
<td>Pawnee (100%)</td>
<td>R106XY074NE - Clayey - Veg. zone 4</td>
<td>19</td>
</tr>
<tr>
<td>PnC2</td>
<td>Pawnee (100%)</td>
<td>R106XY074NE - Clayey - Veg. zone 4</td>
<td>19</td>
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<td>ShC</td>
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<td>R106XY075NE - Silty, NE &amp; Loamy Upland, KS - under development</td>
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<td>ShD</td>
<td>Aksarben (100%)</td>
<td>R106XY075NE - Silty, NE &amp; Loamy Upland, KS - under development</td>
<td>19</td>
</tr>
<tr>
<td>Wtc2</td>
<td>Wykona (100%)</td>
<td>R106XY074NE - Clayey - Veg. zone 4</td>
<td>19</td>
</tr>
</tbody>
</table>

## Description - Silty, NE & Loamy Upland, KS - u (R106XY075NE) Ecological Site

The natural potential vegetation on this site is a tall grass prairie. Big bluestem, little bluestem, indiangrass, and gamagrass produce about 85 percent of the total vegetation by weight. The vegetation on this site was dev of periodic fires and grazing. The grazing was predominantly by large transient herds of bison and lesser numb.

When fire is eliminated, much of this site may become dominated by woody species. Buckbrush, osage orange, locust, are some of the first species to increase on this site. If the site is allowed to continue with little or no fires will in time dominate the site.
Soil Property and Interp Reports

- Soil Reports
  - Dwellings and Small Commercial Buildings

- Options
  - Include Minor Soils
  - Include Description

- Dwellings and Small Commercial Buildings Table
  - Land Use: Buried
    - Map symbol and soil name: Buried
    - Rating class and limiting features: Very limited
  - Land Use: Filled
    - Map symbol and soil name: Filled
    - Rating class and limiting features: Very limited

- Additional Land Use Categories
  - Construction Materials
  - Cropland Productivity
  - Forestland Management
  - Forestland Productivity
  - Rangeland Productivity
  - Recreational Development
  - Urban Disposal
  - Water Management
Usage of WSS

- The latest statistics show we average about 1,550 unique visitors per day.
- Average time of each visit is about 20 minutes.
- Since August 15, we have had about 217,000 visitors.
  - This is about equal to the total number of soil survey books we have published in last 6 years combined.
Lessons Learned

- We need to allow a couple of months to test and debug before going live with a new application using new COTS tools (ArcGIS Server).

- We always get jammed at the end with a fixed release date and no contingency plan for mitigating risks of using "wet paint" software, whether it is ours or COTS.

- Our deployment to Kansas City is once again in a completely new environment, VMware. We really need a couple of months to fine tune, debug, test, etc., before going live.
Questions?