

# USDA – NRCS Soil Survey

Thomas Reinsch  
National Leader  
World Soil Resources

Guy Smith (1982) credited Milton Whitney with statement:

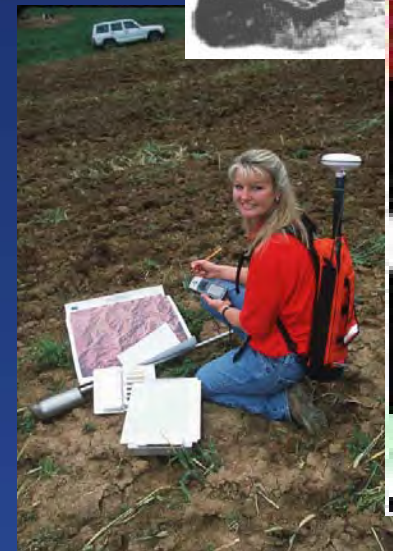
“We need a Soil Survey in order to be able to transfer experience, from research to the use of soils, from the fields or areas where we have experience to other Soils where it is applicable.”

# National Cooperative Soil Survey

Congress Has Directed The  
Secretary Of Agriculture To:

- Inventory Soils of USA  
Commonwealths  
& Territories
- Keep Soil Inventory  
Current
- Provide Interpretations
- Promote its use

1899 - 2011



# National Cooperative Soil Survey



National Park Service

National Park Service  
U.S. Department of the Interior



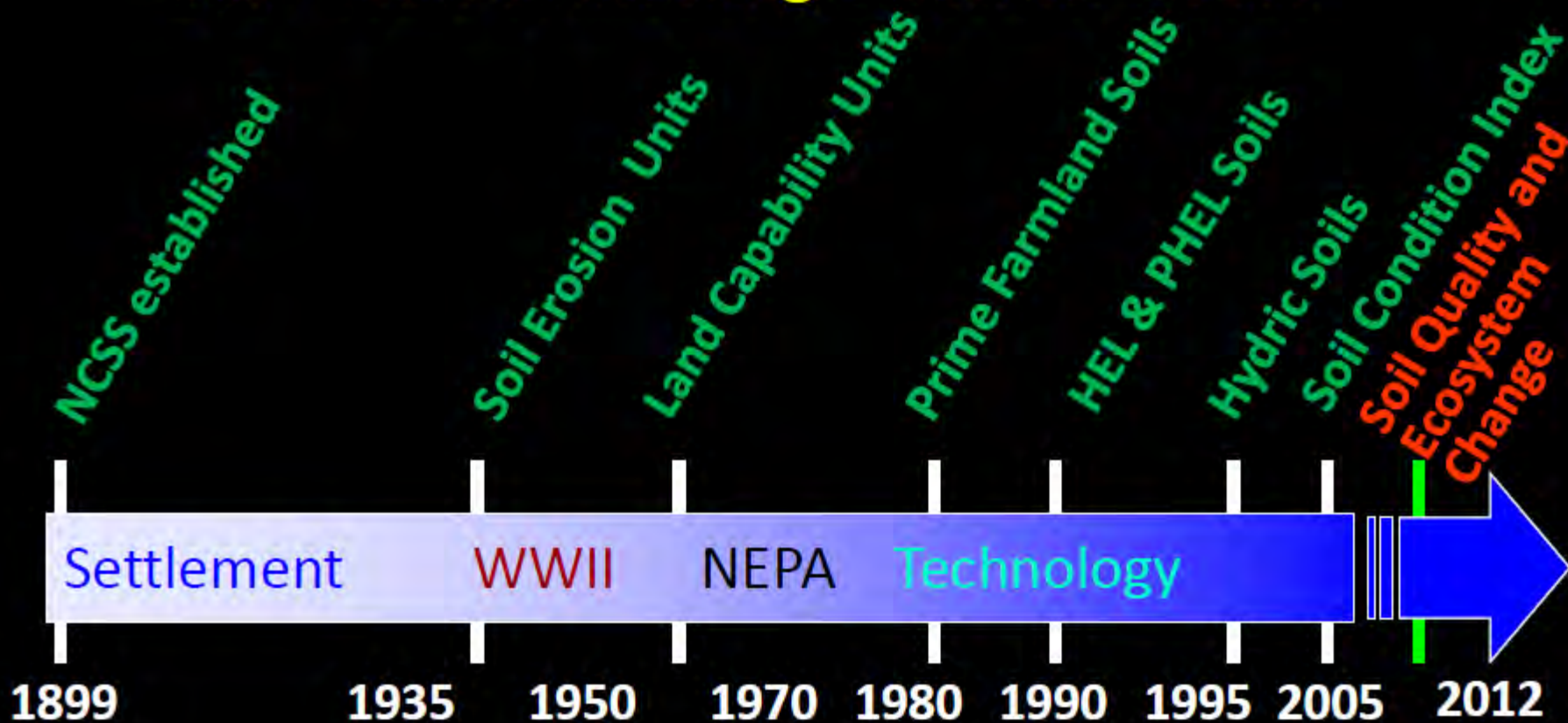
Cornell University

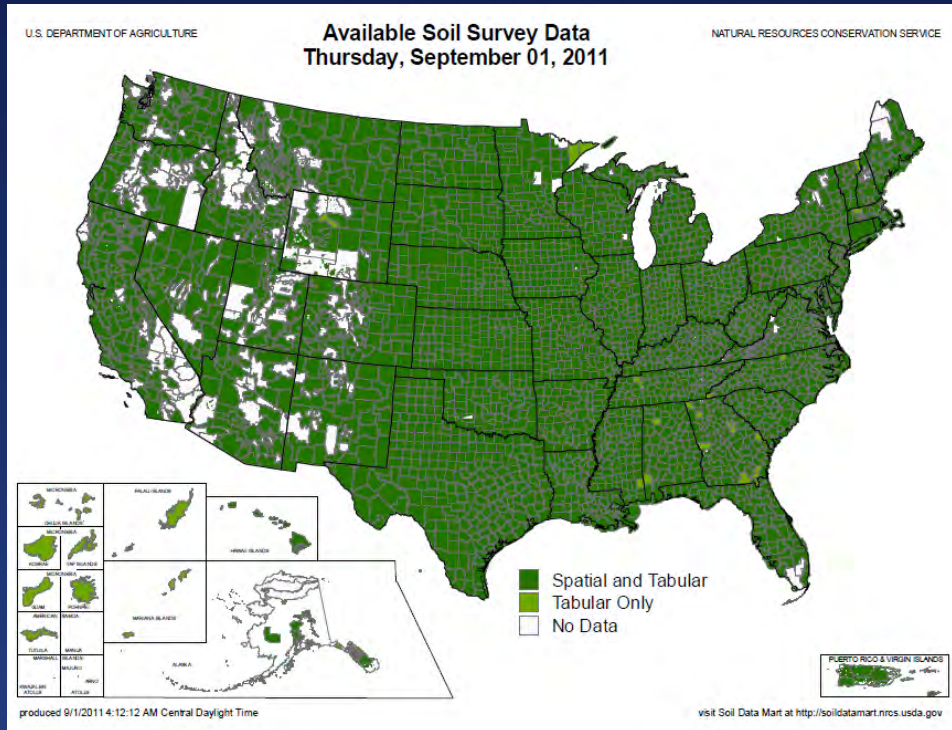
New York State Agricultural Experiment Station



OHIO  
DEPARTMENT  
of NATURAL  
RESOURCES

## 110+ Years of Meeting Customer Needs





- >90% of US has a soil survey
- About 70 million hectares remain, mostly federal lands in the west
- Significant efforts to update older projects.

The US Soil Survey is a national asset valued at over \$7,000,000,000

<b>Orders of soil survey</b>	<b>Minimum size of delineation [ha]</b>
First order: very intensive - experimental plots, building sites	1 or less
Second order: intensive - general agriculture; urban planning	0.6 - 4
Third order: extensive - range land, community planning	1.6 - 16
Fourth order: extensive - for broad land use potential and general land management	16 - 252
Fifth order: very extensive	252 - 4000

# Soil Surveys Consist of:

- Spatial Data
  - ✓ Maps: 1:12,000 or 1:24,000
  - ✓ Ortho-photo base
- Tabular Data
  - ✓ Descriptions of map units
  - ✓ Soil Classification
  - ✓ Database of measured and estimated properties
- Interpretations for multiple uses



A screenshot of the Web Soil Survey website. The page features a navigation bar with links for Home, About Soils, Help, and Contact Us. A prominent green button labeled "START WSS" is visible. Below the button, there is a section titled "Welcome to Web Soil Survey (WSS)" with a small image of people working in a field. To the right, there is a "I Want To..." section with several links, including "Start Web Soil Survey (WSS)", "Know the requirements for running Web Soil Survey", "Know the Web Soil Survey hours of operation", and "Find what areas of the U.S. have soil data". At the bottom, there is an "Announcements/Events" section with a link to "Web Soil Survey 2.3 has been released!".

# Precepts Guiding Soil Survey

Richard Arnold

1. The study of soils is a scientific endeavor.
2. Pedologists want to be able to communicate their perceptions and understanding of soils to others.

# Precepts Guiding Soil Survey

Richard Arnold

3. Soil classification is a method of organizing and communicating our knowledge and perceptions and understanding of soils with others.  
(properties)

# Precepts Guiding Soil Survey

Richard Arnold

4. Soil maps provide a means of communicating what is known about the distribution of soil attributes in nature (soil geography).

# Precepts Guiding Soil Survey

Richard Arnold

5. Soil interpretations, as predictions of soil-related behavior for map units, are both a message and a means of communicating an integrated understanding about the influence of soil attributes on physical, chemical, and biological processes of interest to others.

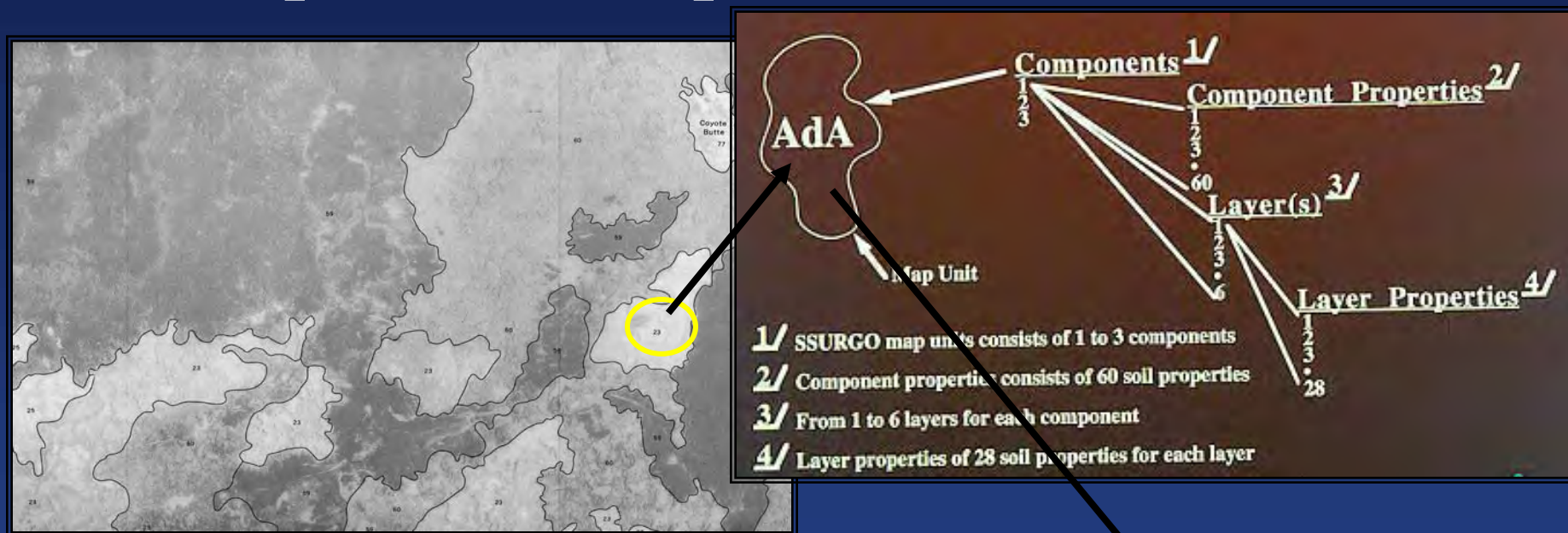
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A screenshot of the Web Soil Survey website. The header features a navigation menu with 'Home', 'About Soils', 'Help', and 'Contact Us'. Below the header, there is a large green 'START WSS' button. To the right, a 'I Want To...' section lists options like 'Start Web Soil Survey (WSS)', 'Know the requirements for running Web Soil Survey', 'Know the Web Soil Survey hours of operation', and 'Find what areas of the U.S. have soil data'. The main content area includes a 'Welcome to Web Soil Survey (WSS)' section with a small image of people working in a field and a paragraph of text describing the service. A footer section titled 'Announcements/Events' mentions 'Web Soil Survey 2.3 has been released! View description of new features.'

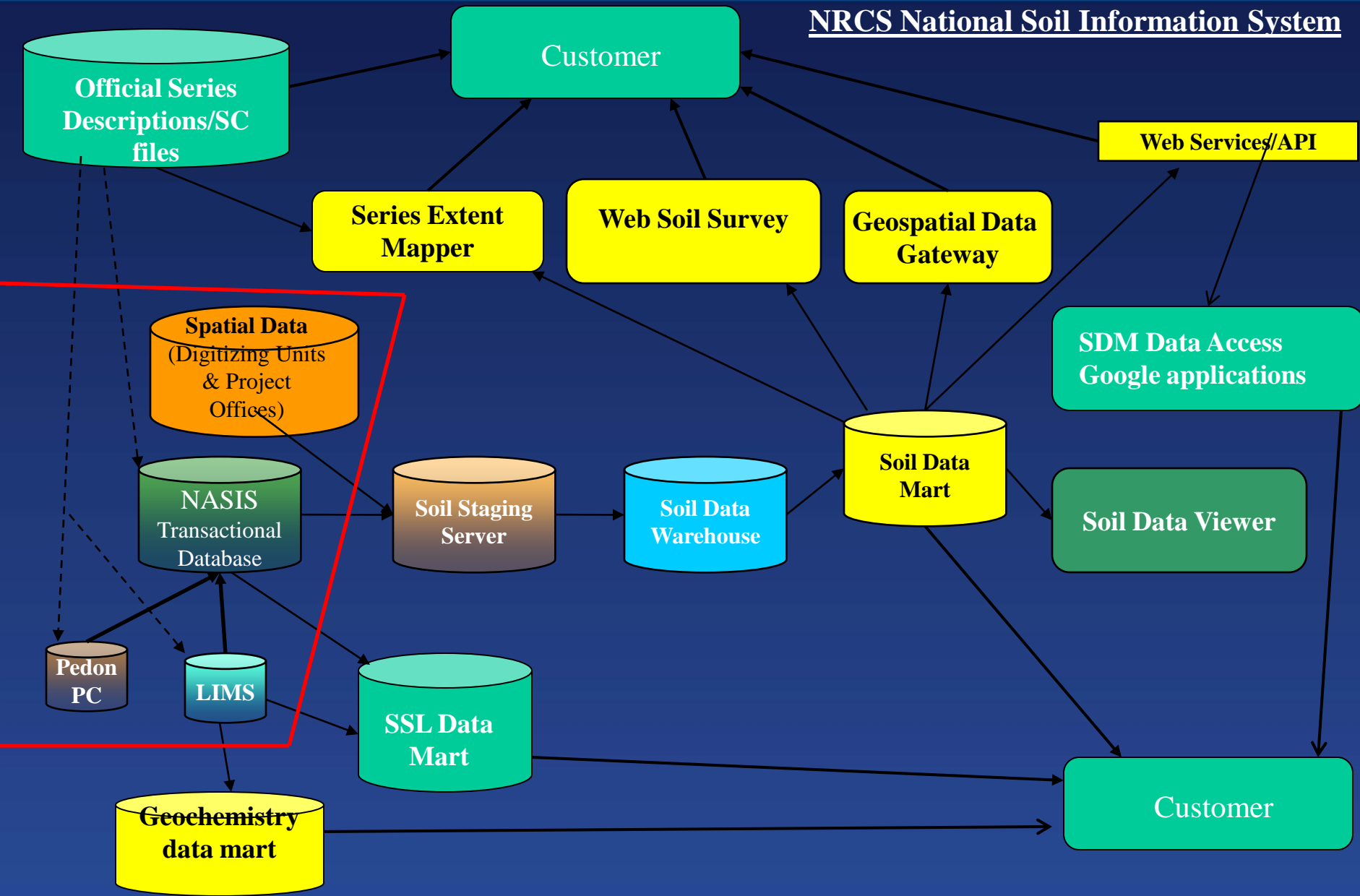
# Soil Map Unit Concepts



A	B	C	D	E	F
AREA	PERIMETER	CO651_27_	CO651_27_1	MUSYN	MUKEY
2257938.29232	8322.45531	2.00000	1.00000	33	506447
2521801.32352	14994.80703	3.00000	2.00000	25	506438
219.03567	85.03323	4.00000	3.00000	42	506425
2135130.93202	9661.65014	5.00000	4.00000	43	506422
1128477.26921	9084.35479	6.00000	5.00000	42	506425

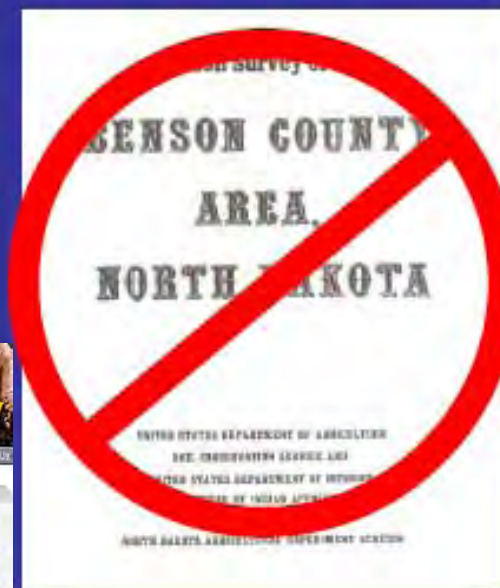


NRCS National Soil Information System



# So How Do I Go to get Soil Survey Information?

## Soil Data Mart




## Purpose of Soil Data Viewer

- **SSURGO database is complex (nearly 60 attribute tables)**
- **Interface shields users from the complexity of the database**
- **Provides users access to standard soil interpretations and soil properties**
- **Computes a single rating using soil series and horizon level data for a mapunit**
- **Relieves the user from the burden of:**
  - Querying the database
  - Processing the data
  - Linking to the spatial map
  - Symbolizing the results

# Soil Data Viewer

The screenshot displays the Soil Data Viewer application with several windows open. The main window shows a map of the Rocky Mountain National Park area, overlaid with a color-coded soil hazard assessment. A secondary window displays a 'Soils Report' document, which includes a table of soil data. The report title is 'Soils Report' and the section is 'Potential Fire Damage Hazard - Dominant Condition'. The report text describes the potential hazard of damage to soil characteristics from fire, based on a moderate fireline intensity. The survey location is Rocky Mountain National Park, Colorado, and the survey status is 'Initial'. The report also includes a table with four rows of soil data, detailing soil names, ratings, and dominant components.

**Soils Report**

**Potential Fire Damage Hazard - Dominant Condition**

The potential hazard of damage to soil nutrient, physical, and biotic characteristics from fire. Ratings assess: The impact of fires (prescribed or wildfire) of moderate fireline intensity (116-520 btu's/sec/ft) that provide the necessary heat to remove the duff layer and consume soil organic matter in the surface layer.

**Soil Survey: Rocky Mountain National Park, Colorado, Parts of Boulder, Grand, and Larimer Counties**

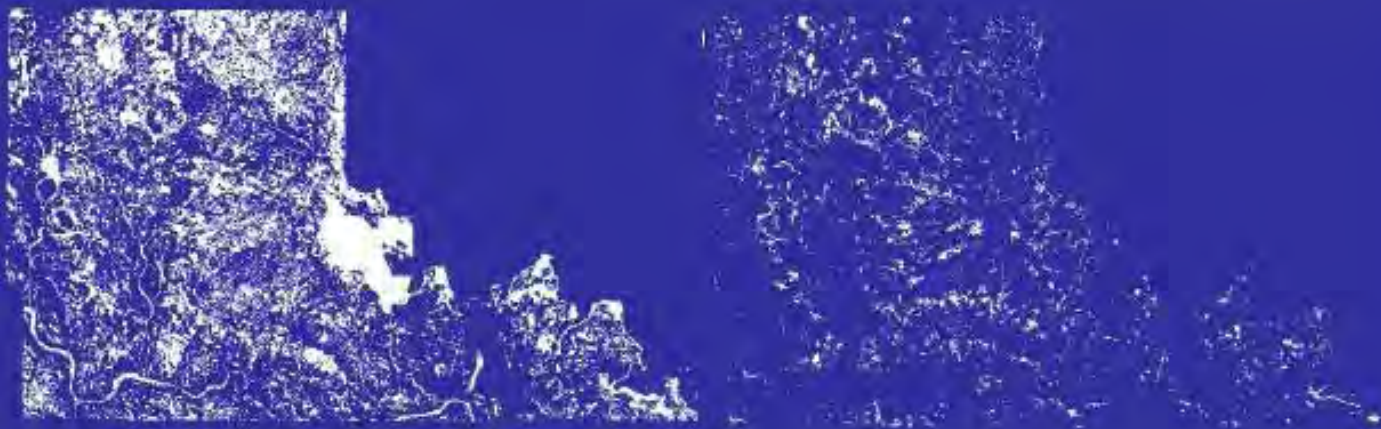
**Survey Status: Initial**

**Correlation Date: 12/01/1999**

**Distribution Date: 11/26/2001**

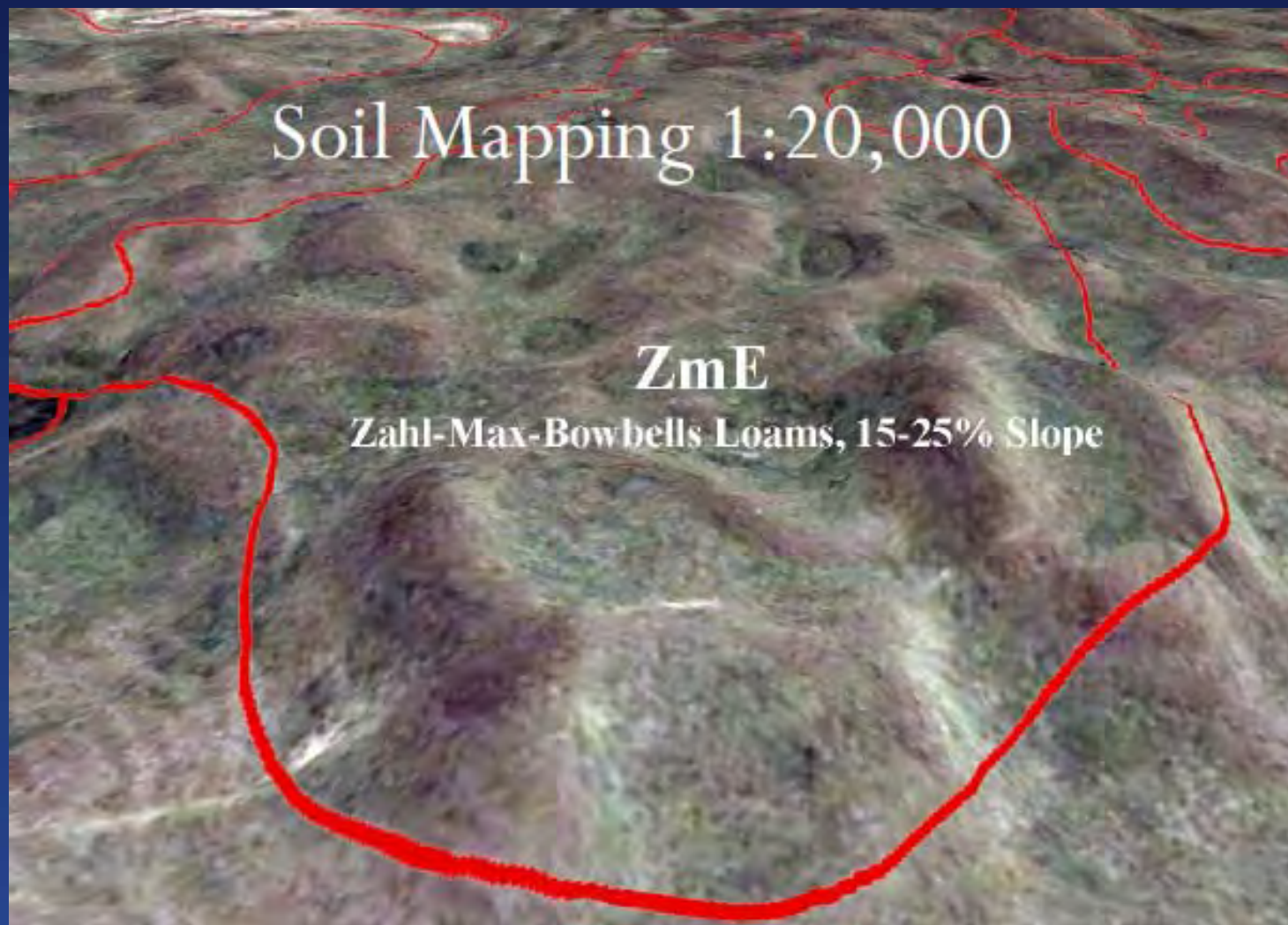
Map Symbol	Soil Name	Rating	Dominant Component(s) and Reason(s)
1	ARCHROCK-FALLRIVER ASSOCIATION, 15 TO 50 PERCENT SLOPES	Low	Component - ARCHROCK (50%) • Texture/coarse fragments
2	ARCHROCK-ONAHU-ROCK OUTCROP COMPLEX, 10 TO 75 PERCENT SLOPES	Low	
3	BULLWARK-CATAMOUNT COMPLEX, 20 TO 50 PERCENT SLOPES	High	Component - BULLWARK (50%) • Texture/slope/coarse fragments • Texture/slope/coarse fragments Component - CATAMOUNT (40%) • Texture/slope/surface depth • Texture/slope/surface depth
4	CATAMOUNT GRAVELLY COARSE SANDY LOAM 5 TO 20	High	Component - CATAMOUNT (90%) • Texture/surface depth/coarse fragments • Texture/surface depth/coarse fragments

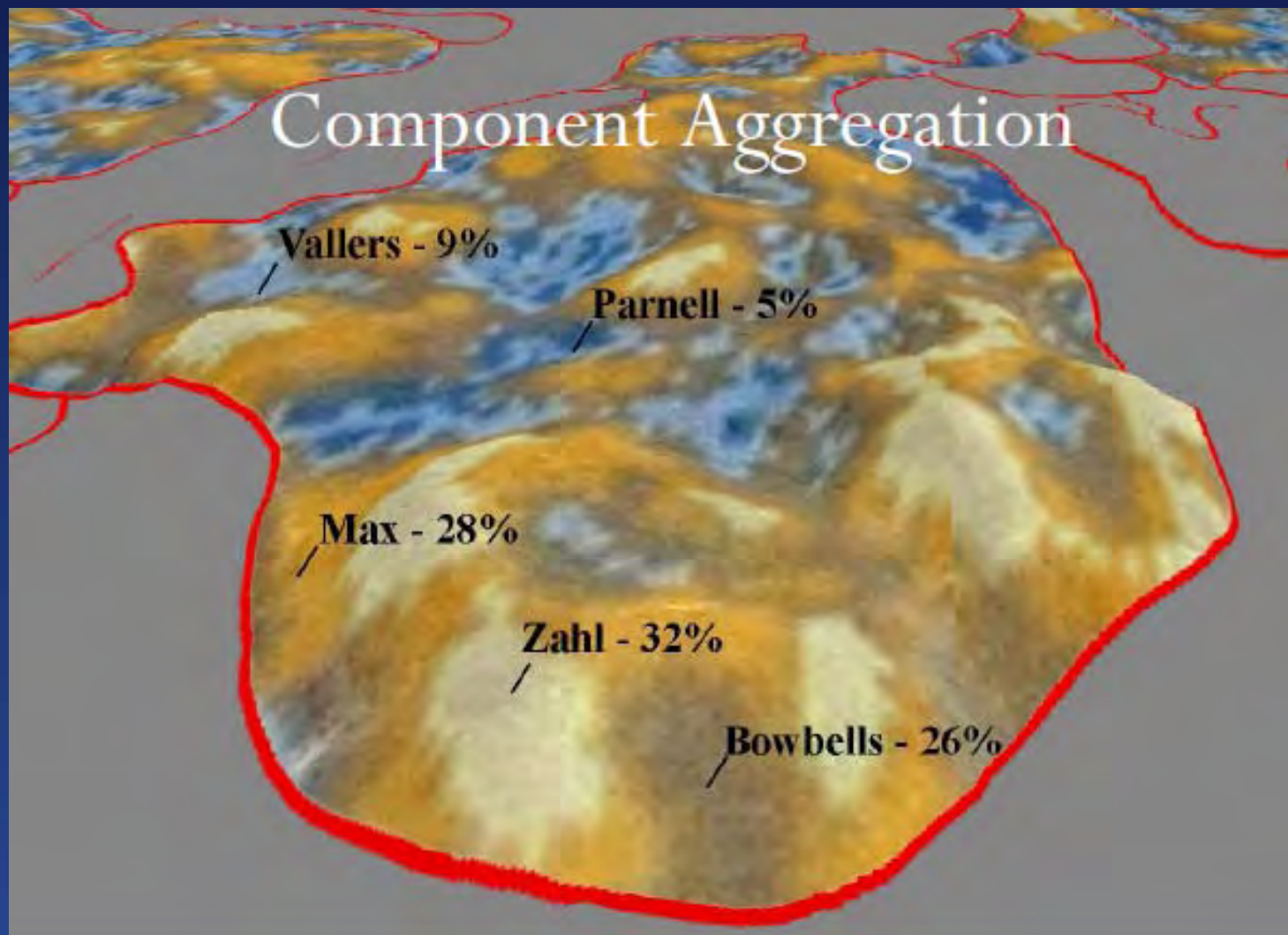
# Interpreting Soil Interpretations



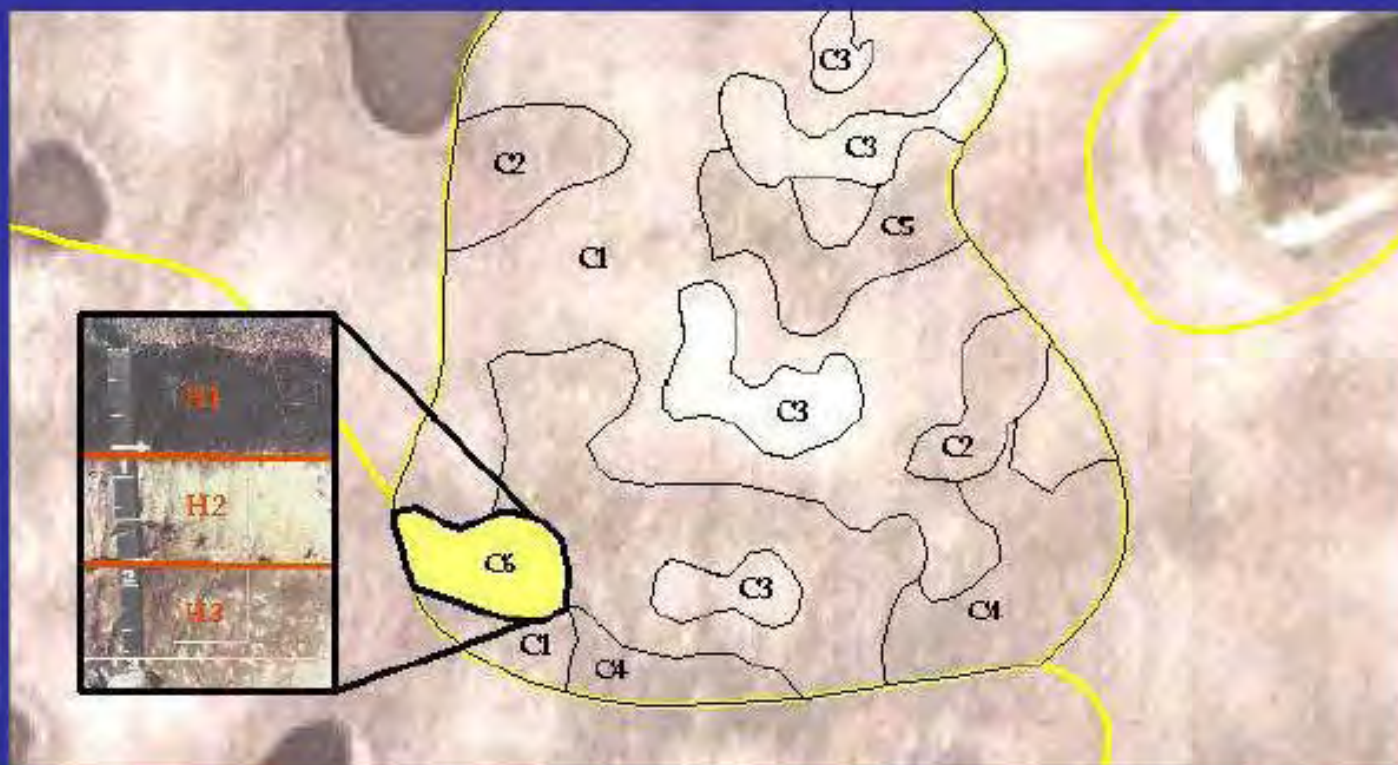
*Linking Mapping Concepts to Ratings*







# Horizon Aggregation



## Component Aggregation

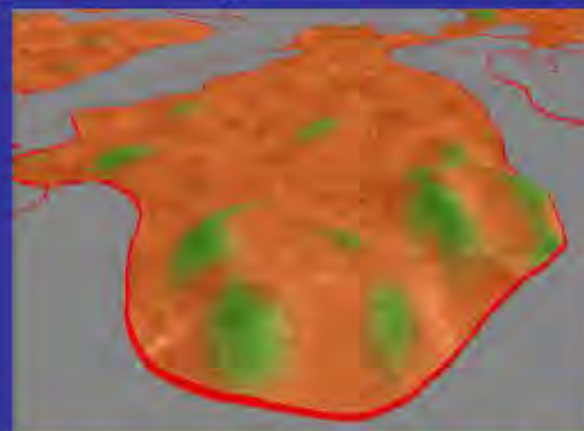
Selected Soil Property - Soil Erosion Factors: Kf

Component	Composition	Kf
Zahl	32	.30
Max	28	.28
Bowbells	26	.24
Hamerly	9	.24
Parnell	5	.28

Aggregation Method

Dominant Component

.30



Component	Composition	Kf
Zahl	32	.30
Max	28	.28
Bowbells	26	.24
Vallers	9	.24
Parnell	5	.28

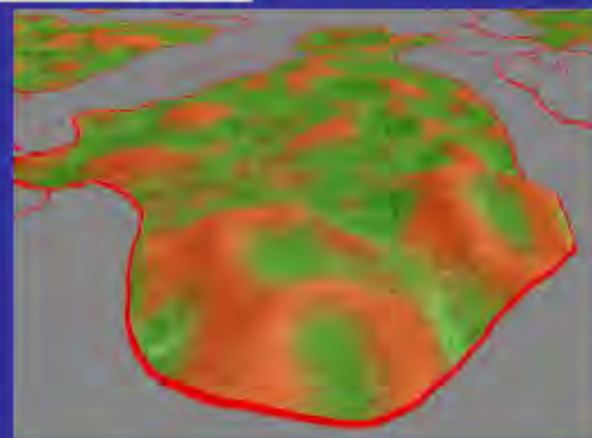
“Dominant Soil”



Aggregation Method

Dominant Condition

.24



Component	Composition	Kf
Zahl	32	.30
Max	28	.28
Bowbells	26	.24
Vallers	9	.24
Parnell	5	.28

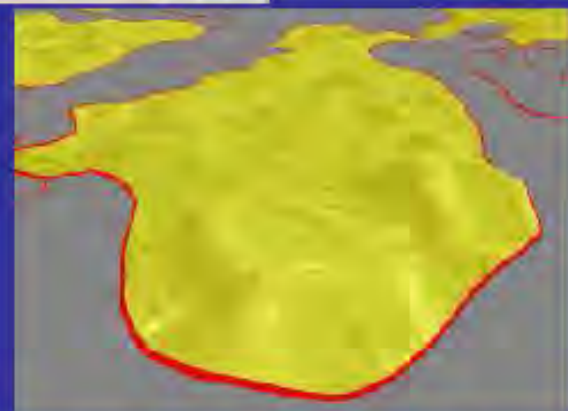
“Dominant Property”



Aggregation Method

Weighted Average

**.27**



Component	Composition	Kf		
Zahl	32	X	.30	0.8
Max	28	X	.28	1.3
Bowbells	26	X	.24	1.2
Vallers	9	X	.24	0.6
Parnell	5	X	.28	+ 0.4

“Average Property Value”



Aggregation Method

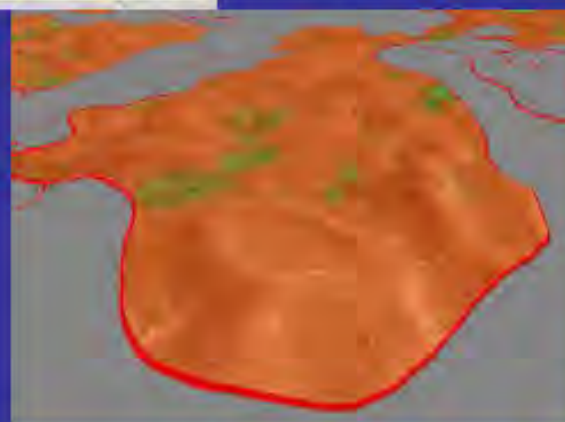
All Components

Tie-break Rule

Lower

Higher

.30



Component	Composition	Kf
Zahl	32	.30
Max	28	.28
Bowbells	26	.24
Vallers	9	.24
Parnell	5	.28

“Extreme Value”



# Product Delivery - WSS



Web Soil Survey

Home About Soils Help Contact Us

You are here: Web Soil Survey Home

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

[Start the Web Soil Survey Application](#)

**START WSS**

**Welcome to Web Soil Survey (WSS)**



Web Soil Survey (WSS) provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. NRCS has soil maps and data available online for more than 95 percent of the nation's counties and anticipates having 100 percent in the near future. The site is updated and maintained online as the single authoritative source of soil survey information.

**I Want To...**

- Start Web Soil Survey (WSS)
- Know the requirements for running Web Soil Survey — will Web Soil Survey work in my web browser?
- Know the Web Soil Survey hours of operation
- Find what areas of the U.S. have soil data

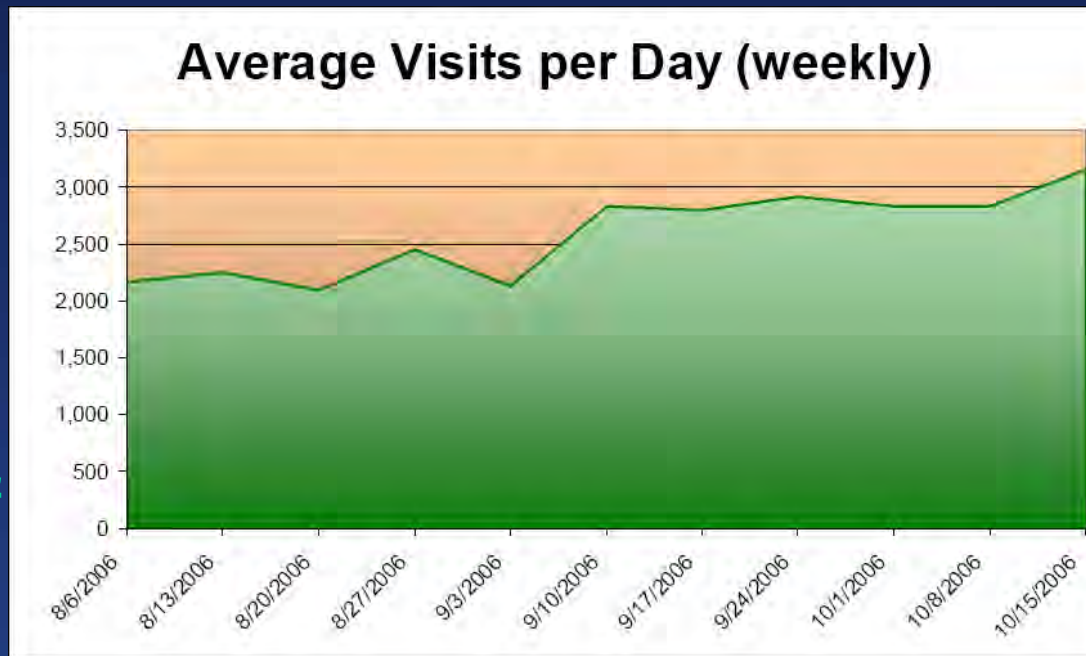
**Announcements/Events**

- Web Soil Survey 2.3 has been released! View description of new features.

## Web Soil Survey

# WSS – First Year

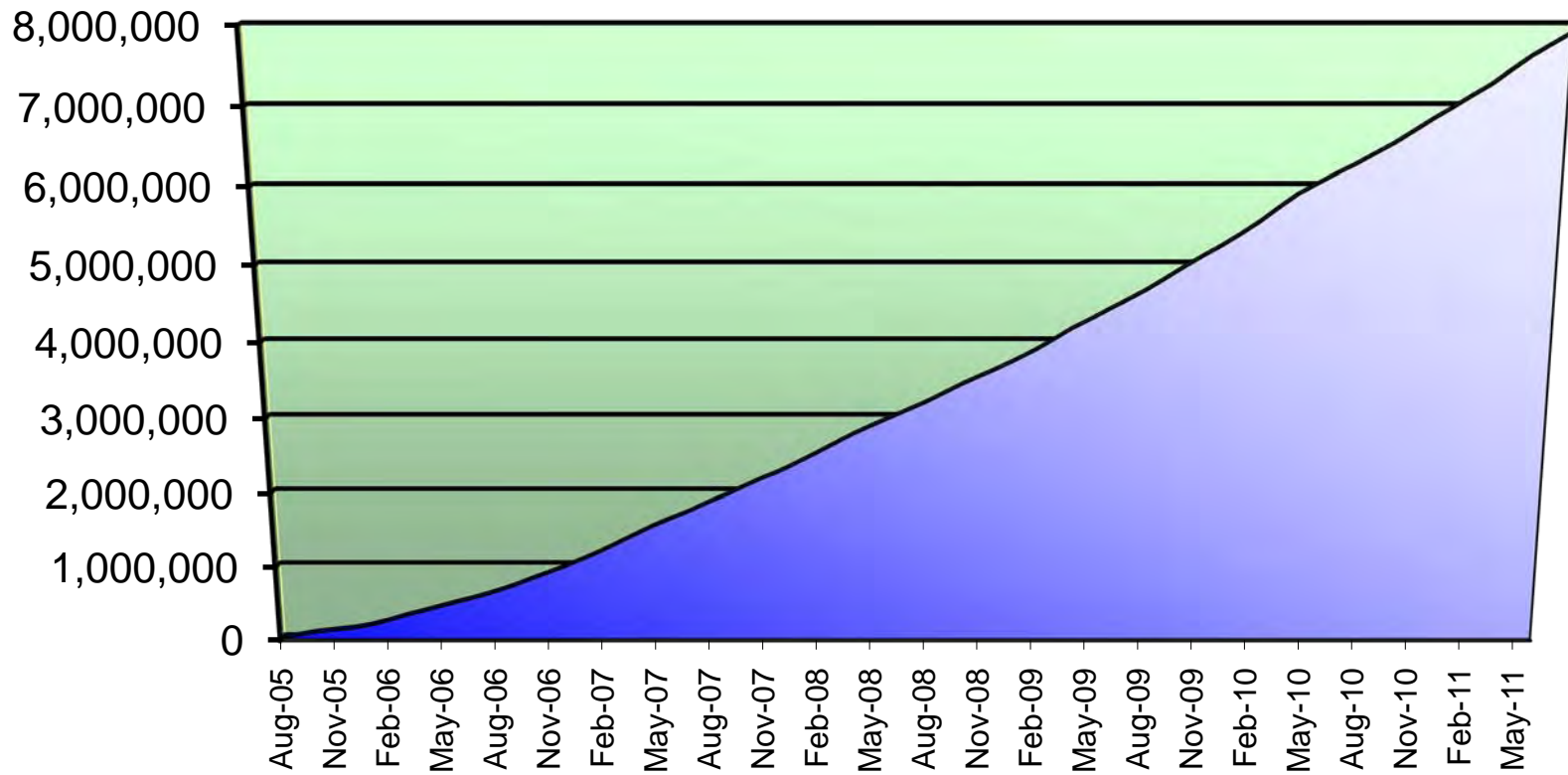
Web Soil Survey was released in August 2005 ... currently receiving about **1,500 visits per day**. At this rate the **number of visitors in the first year will exceed the number of soil survey copies printed in the last 8 years**



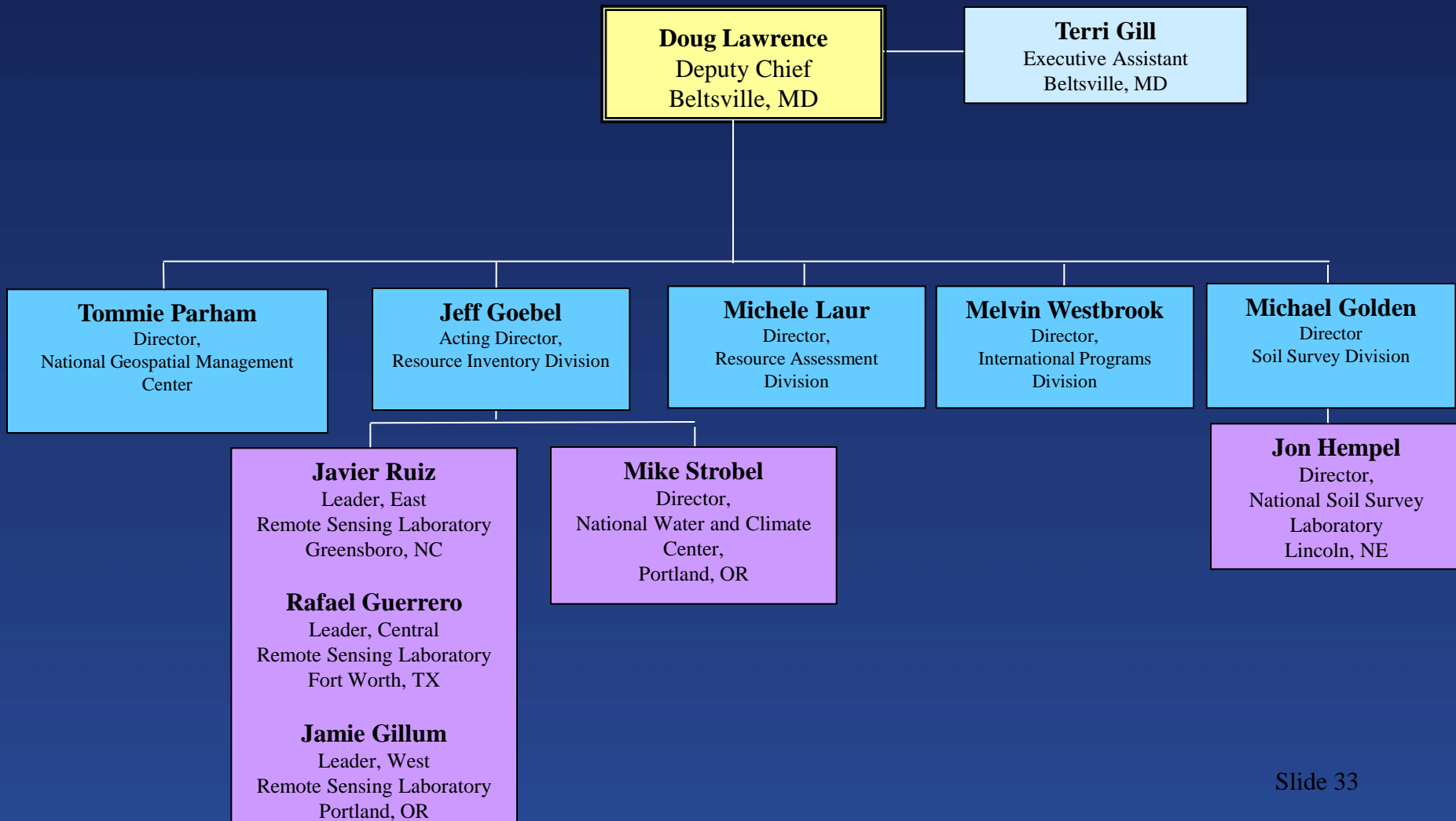
# WSS – Lifetime stats

- Came on line August 2005
- Broke 1M visits Jan 2007 (+ 16 months)
- Broke 3M visits by June 2008 (+ 19 months)
- Broke 6M visits by May 2010 (+ 23 months)
- Average 4,641 visits per day in June 2011
- Total hardcopy publications since inception:  
est. 3300 surveys \* ~1K ea. = 3.3M books since  
~1957

## Web Soil Survey Cumulative Visits



# Soil Survey and Resource Assessment Deputy Area

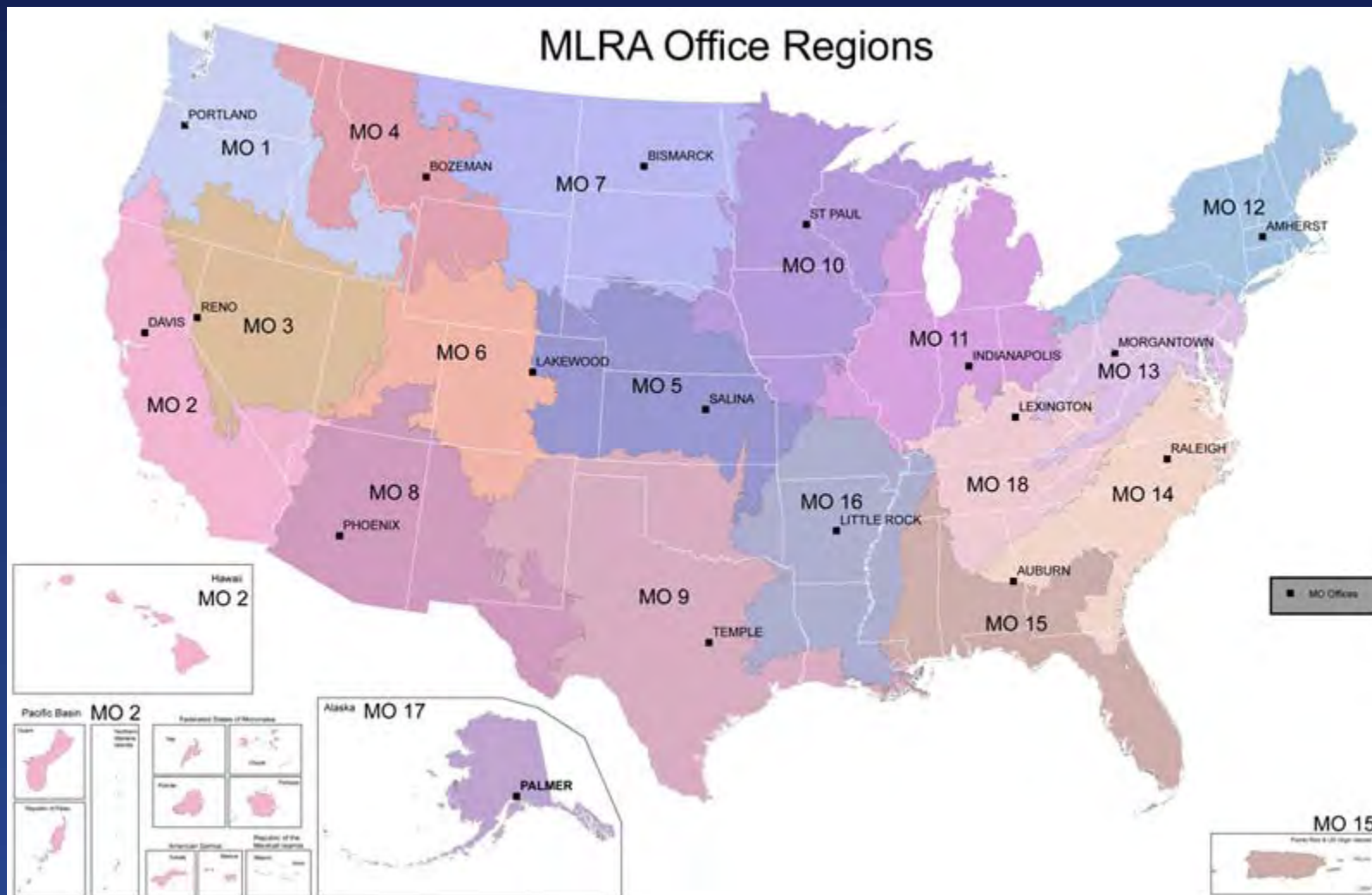


- o **Soil Survey Division National Leadership**
  - Paul Benedict – National Soil Program Manager
  - Jon Hempel – Director National Soil Survey Center
  - Chris Smith – National Leader Technical Soil Services
  - Maxine Levin – National Liaison NCSS
  - Carolyn Olson – National Leader Climate Change
  - Thomas Reinsch – National Leader World Soil Resources
  - Larry West – National Leader Soil Research and Laboratory
  - Michael Robotham – National Leader Soil Interpretations
  - Cameron Loerch – National Leader Soil Standards
  - Susan Andrews – National Leader Soil Ecology
  - Dave Hoover – National Leader Soil Business Systems

# Roles and Responsibilities

## Director, Soil Survey Division

- overall policy formulation;
- program development and implementation;
- National Cooperative Soil Survey (NCSS);
- oversight of national soil survey activities;
- coordination of staff functions





# Roles and Responsibilities

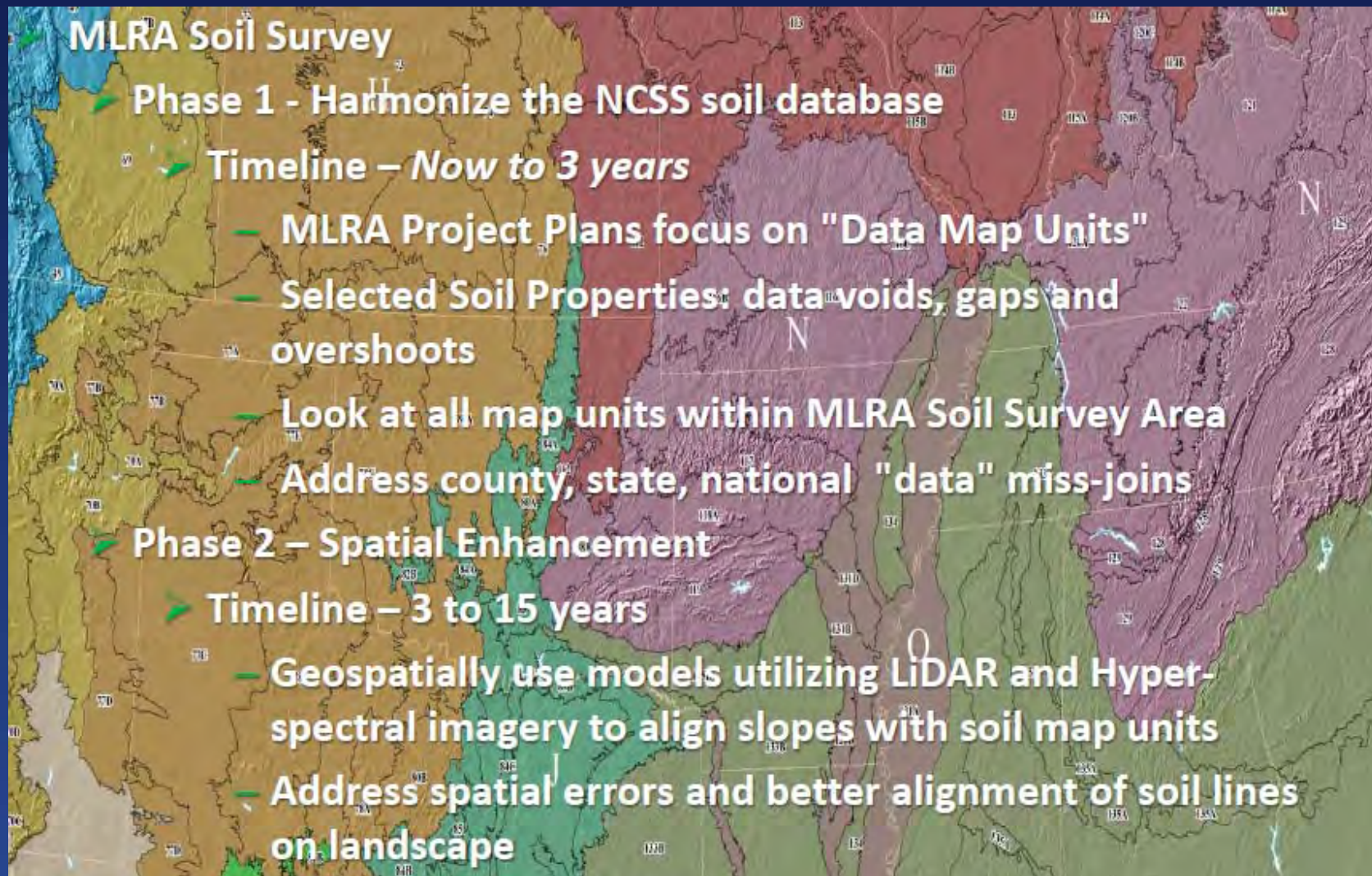
## MO Leaders

- leadership
  - production
  - quality assurance
- planning and management
  - maintenance of status and progress data;
  - technical supervision of Project offices in the MLRA

# Roles and Responsibilities

## State Soil Scientists

- technical soil services to other staffs
- supervision of Resource Soil Scientists
- supervision of Soil Survey Project Leaders
- development of cooperative relationships to enhance funding and use of soil surveys



### MLRA Soil Survey

- ▶ **Phase 1 - Harmonize the NCSS soil database**
  - ▶ **Timeline – Now to 3 years**
    - MLRA Project Plans focus on "Data Map Units"
    - Selected Soil Properties: data voids, gaps and overshoots
    - ▶ Look at all map units within MLRA Soil Survey Area
    - Address county, state, national "data" miss-joins
  - ▶ **Phase 2 – Spatial Enhancement**
    - ▶ **Timeline – 3 to 15 years**
      - Geospatially use models utilizing LiDAR and Hyper-spectral imagery to align slopes with soil map units
      - Address spatial errors and better alignment of soil lines on landscape

- **Future Direction and Opportunities**
  - **Global Soil Partnership for Food Security, Climate Change Adaptation and Mitigation (FAO)**
    - Elevates importance of Soils with Air and Water for Sustainability
    - International Scale – Soil Carbon
    - International Scale - Harmonization of Soil Data
    - International Scale – Standards (Universal Soil Classification System, Lab Methods, Horizonation)

- The need for Universal Soil Standards
  - IUSS Soil Classification & ICOMATH (urban soil Classification)- Chair Jon Galbraith
  - IUSS Working Group: Universal Soil Classification System & Standards Chair Jon Hempel
    - Members from each continent including: Africa, Russia, China, Brazil, Hungary, Australia, Germany, Korea, Italy, Netherlands, and United States
    - NCSS members: Curtis Monger, Jon Galbraith, Jon Hempel and Micheal Golden
    - <http://iuss.org/>
- International Union of Soil Sciences

