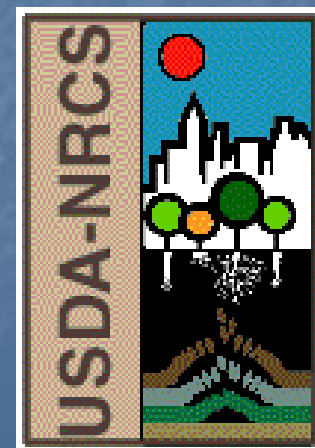


# Ecological Sites and their Relationship to Soil Mapping

Steve Campbell  
Soil Scientist  
USDA – Natural Resources Conservation Service  
West National Technology Support Center  
Portland, Oregon



# From the National Range and Pasture Handbook:

- Ecological sites have characteristic soils that have developed over time throughout the soil development process
- Soils with like properties that produce and support a characteristic native plant community are grouped into the same ecological site.

# From the National Soil Survey Handbook:

- Soil-ecological site correlation establishes the relationship between soil map unit components and ecological sites.
- Ecological sites are correlated on the basis of soils and the resulting differences in species composition, proportion of species, and total production of the historic climax plant community.

# Soil map unit on a mound – intermound landform



# Ecological Site Description Information Sources

- Web Soil Survey
- Ecological Site Information System (ESIS)

Click on the "Start WSS" button to get started.

websoilsurvey.nrcs.usda.gov



Home About Soils Help Contact Us

You are here: WSS Home

### Search

### Browse by Subject

- ▶ [Soils Home](#)
- ▶ [National Cooperative Soil Survey \(NCSS\)](#)
- ▶ [Archived Soil Surveys](#)
- ▶ [Status Maps](#)
- ▶ [Official Soil Series Descriptions \(OSD\)](#)
- ▶ [Soil Series Extent Mapping Tool](#)
- ▶ [Soil Data Mart](#)

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



## 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](#)
- [Know whether my web browser works with Web Soil Survey](#)
- [Know the Web Soil Survey hours of operation](#)
- [Find what areas of the U.S. have soil data](#)

### Announcements/Events

- [Web Soil Survey 2.0 has been released! View description of new](#)

The first step is to create your "Area of Interest (AOI)". Current selection criteria include Address; County; Soil Survey Area; Lat/Long; Section, Township and Range; Federal Land category, and Hydrologic Unit.

Area of Interest (AOI)

### Quick Navigation

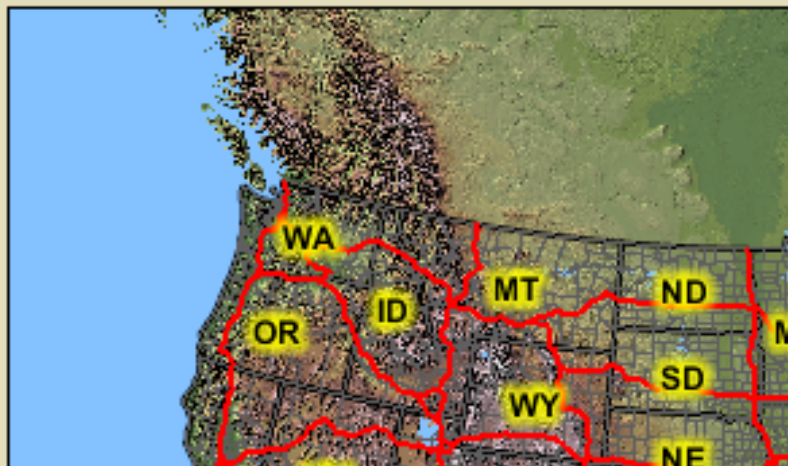
#### Navigate By...

- Address
- State and County
- Soil Survey Area
- Latitude and Longitude
- PLSS (Section, Township, Range)
- Bureau of Land Management
- Department of Defense
- Forest Service
- National Park Service
- Hydrologic Unit

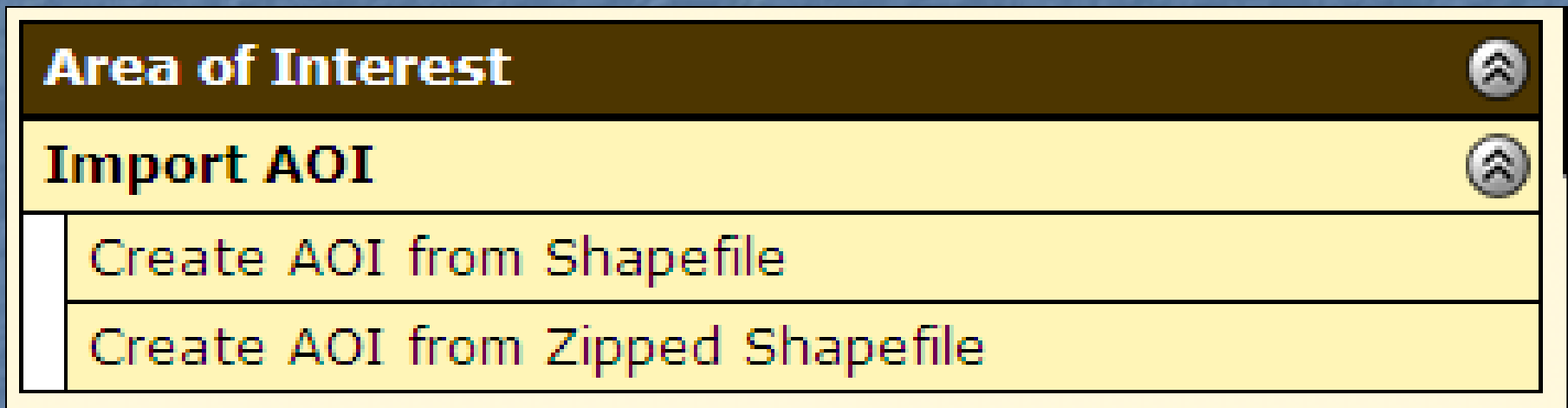
### Area of Interest Interactive Map



View Extent



A new option – you can import a shapefile or zipped shapefile to create an Area of Interest (AOI)





## PLSS (Section, Township, Range)

View



State Oregon

Principal Meridian Willamette

View Meridian Map

Section 3

Township 19

North

South

Range 35

East

West

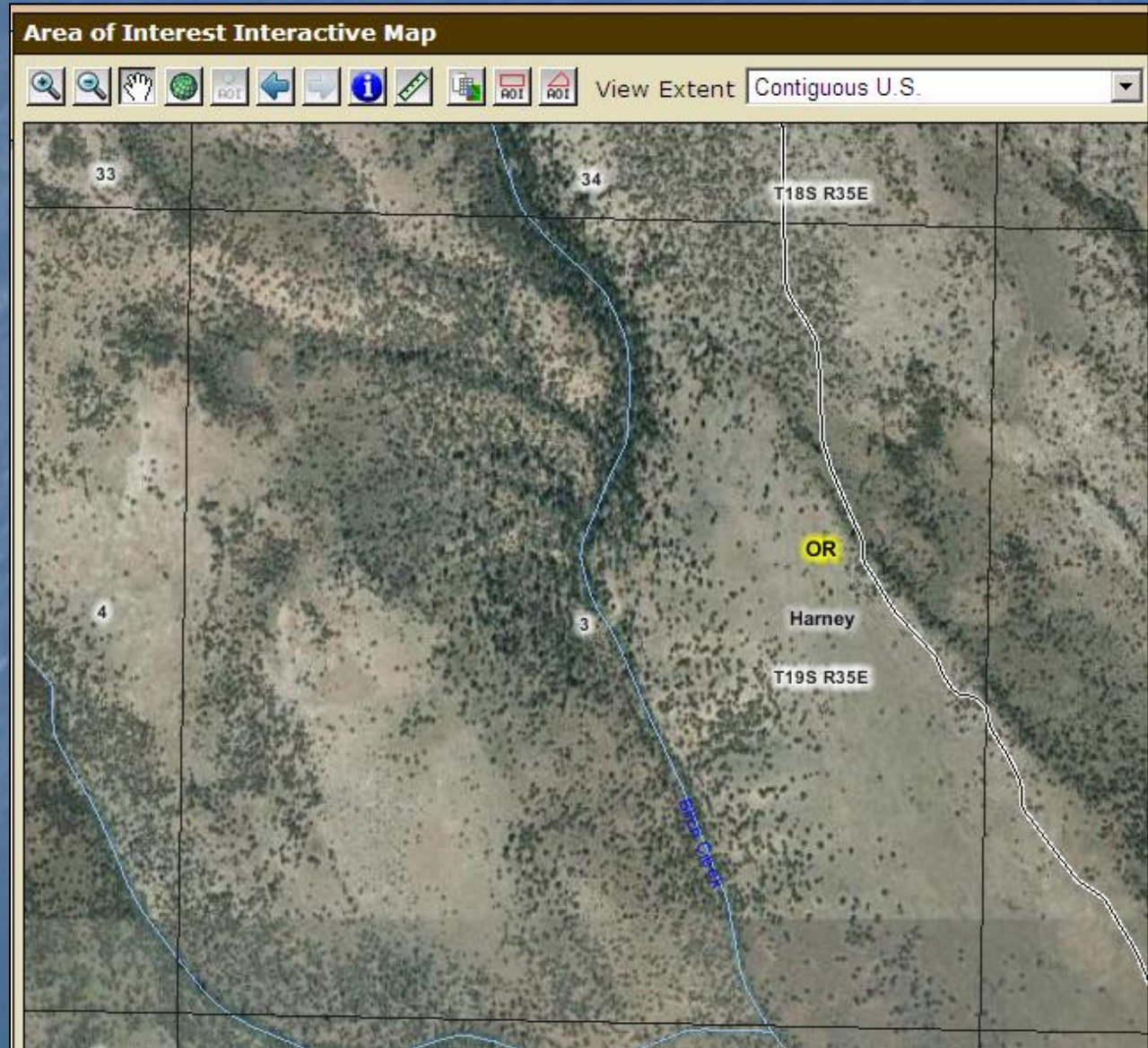
Show **PLSS**  
**Section** and  
**PLSS Township**  
**and Range**  
Layers in Map

View

In this example "PLSS" is the navigation choice. Select the State. Enter Section, Township, Range.

Click on the "View" button to zoom to this section.

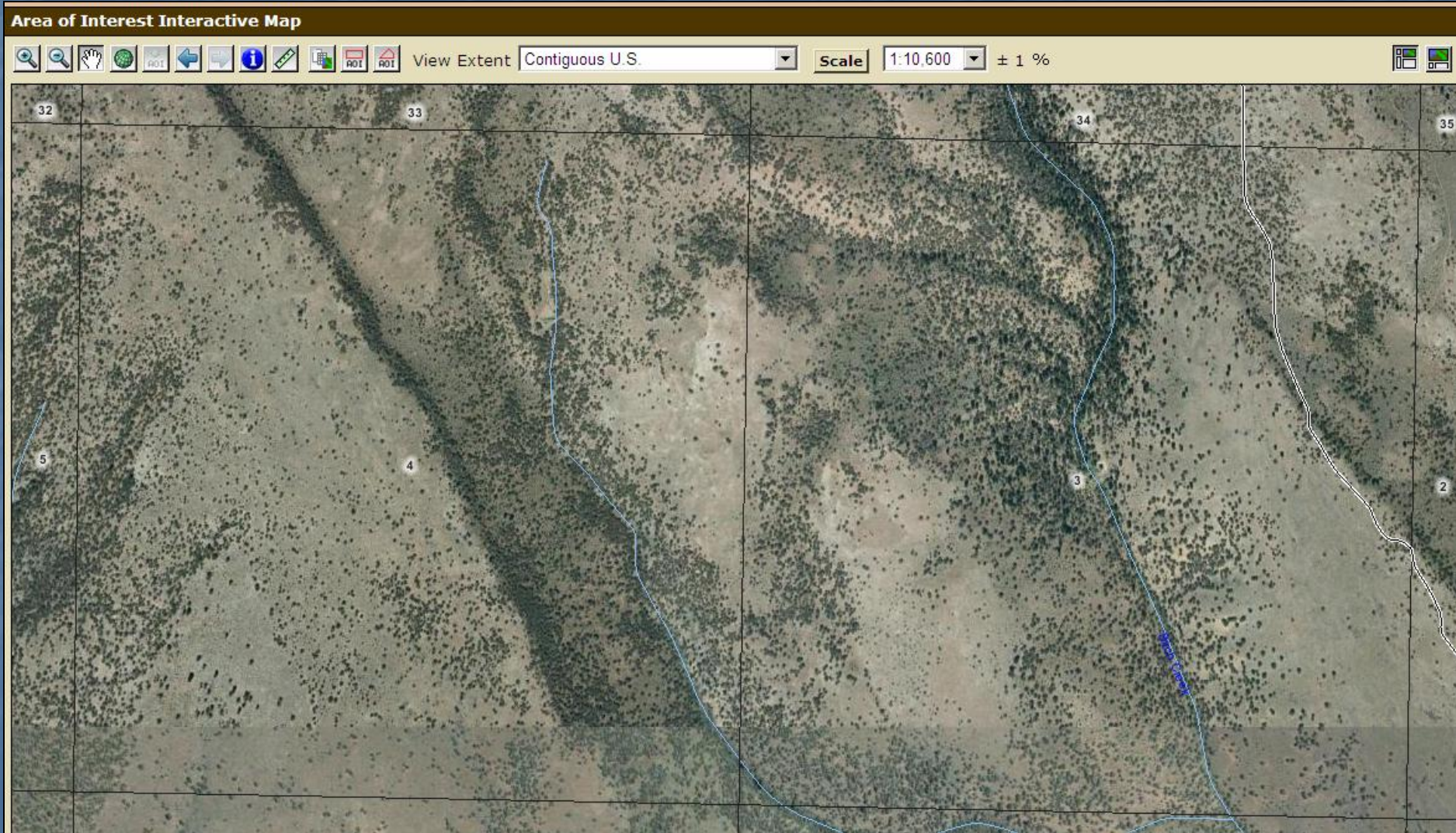
We're now zoomed in to Section 3, Township 19 S, Range 35 E. The State and County names are also displayed.

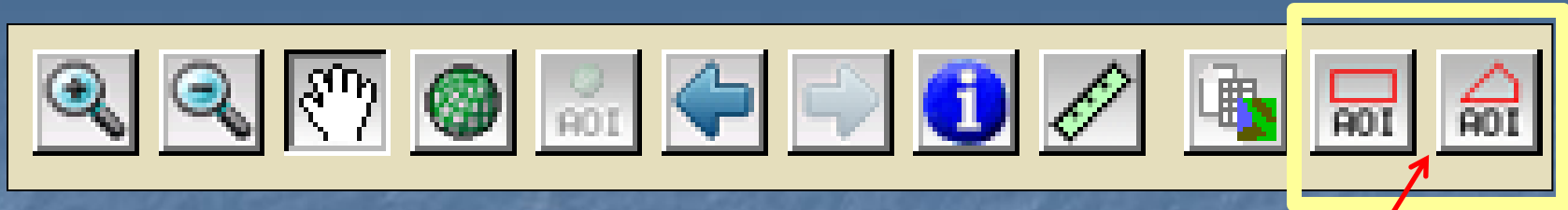


When you zoom in, the orthophoto, roads, and water features appear. Layers can be turned on and off by clicking on the "Legend" tab.

The screenshot displays a GIS application interface. On the left is a 'Map Legend' panel with a list of layers. A red arrow points to the 'Political Features' section, which includes 'States', 'Counties', 'Urban Areas', 'Cities', 'Postal Code', 'PLSS Township and Range', and 'PLSS Section'. Below this are 'Federal Land' categories like 'Bureau of Land Management', 'Bureau of Reclamation', 'Department of Defense', 'Fish and Wildlife Service', 'Forest Service', 'National Park Service', and 'Tennessee Valley Authority'. On the right is the 'Area of Interest Interactive Map' window. A red arrow points to the 'Legend' tab in the top-left corner of this window. The map shows an aerial view with overlaid features: a blue river labeled 'Three Rivers', a yellow crosshair, and various land parcels. Labels on the map include '33', '34', 'T18S R35E', '4', '3', 'OR', 'Harney Three Rivers', and 'T19S R35E'. The top toolbar of the map window includes icons for zooming, pan, and other navigation functions, along with a 'View Extent' dropdown set to 'Contiguous U.S.'

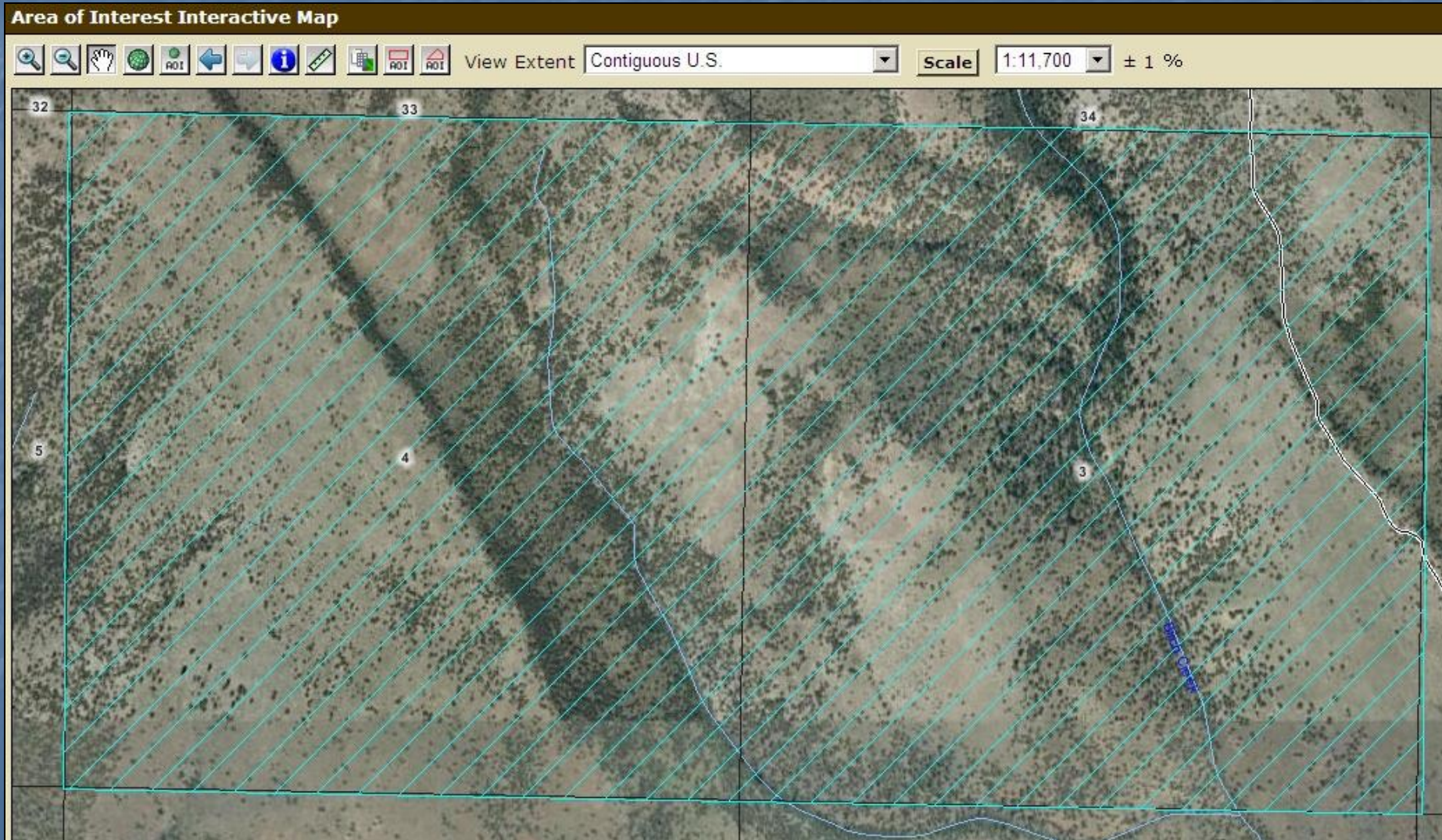
In this example, we want to include both Section 3 and 4 in our Area of Interest. We'll use the Zoom Out tool to make both sections visible.





The "AOI" buttons are used to create your Area of Interest. The left button creates a rectangle. The right button creates a polygon of any shape. The user creates the shape by left clicking at each vertex. Left double click at the last vertex to create the Area of Interest.

After you draw your "Area of Interest", it will appear as a blue hatched area.



**Area of Interest (AOI)** **Soil Map** ←

**Search** [v]

**Area of Interest Properties** [u]

**Clear AOI**

**AOI Information** [?] [u]

Name	<input type="text" value="Birch Creek Restoration Project"/>
Map Unit Symbols	<input checked="" type="radio"/> Use Soil Survey Area Map Unit Symbols <input type="radio"/> Use National Map Unit Symbols
Area (acres)	1,278.2

**Soil Data Available from Web Soil Survey** [?] [u]

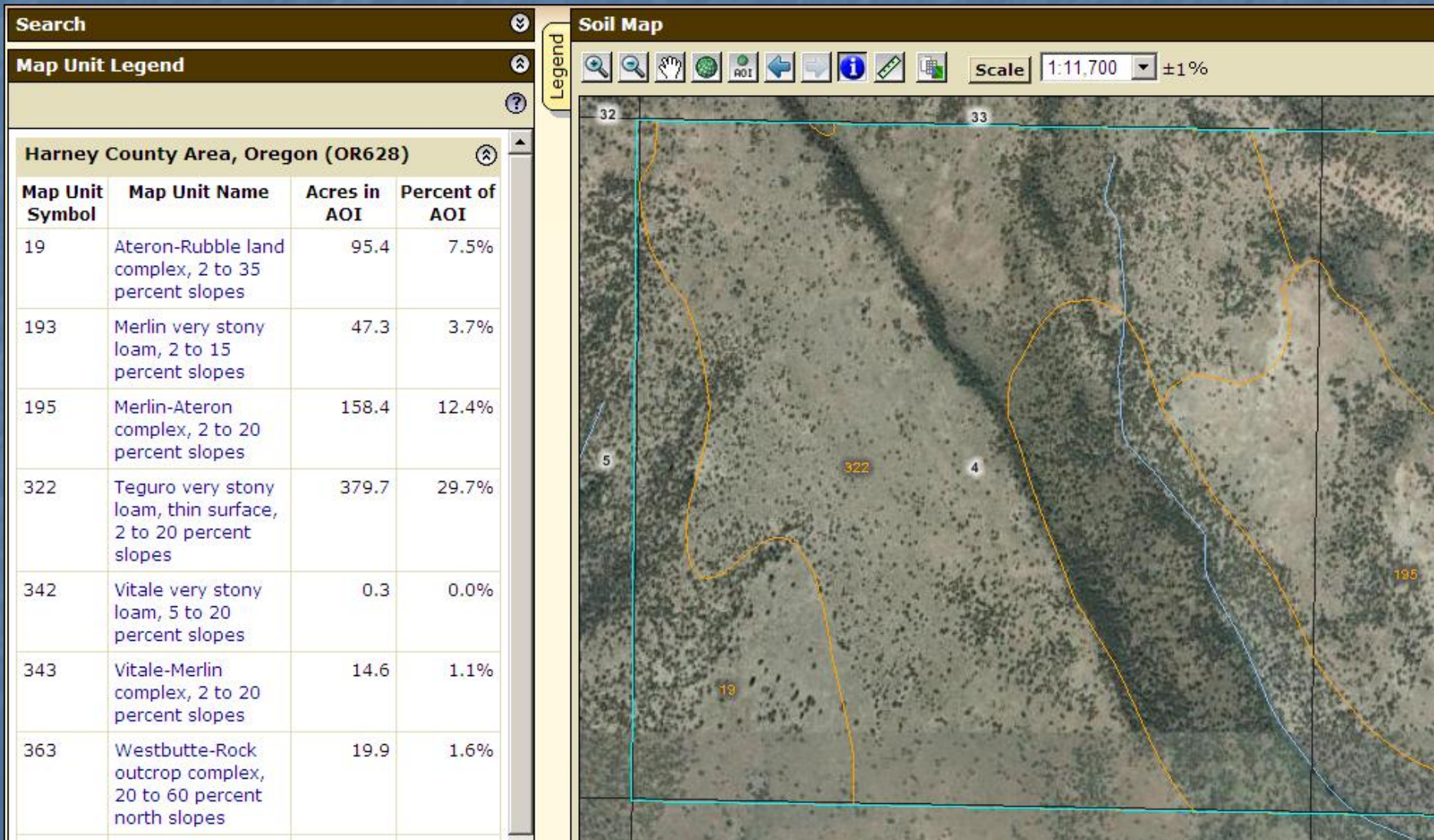
**Harney County Area, Oregon (OR628)**

Soil Maps	Version 4, Jul 15, 2010
Soil Data	Version 7, Feb 12, 2010

After the "AOI" is created, the size of the area and the type of data that is available is displayed.

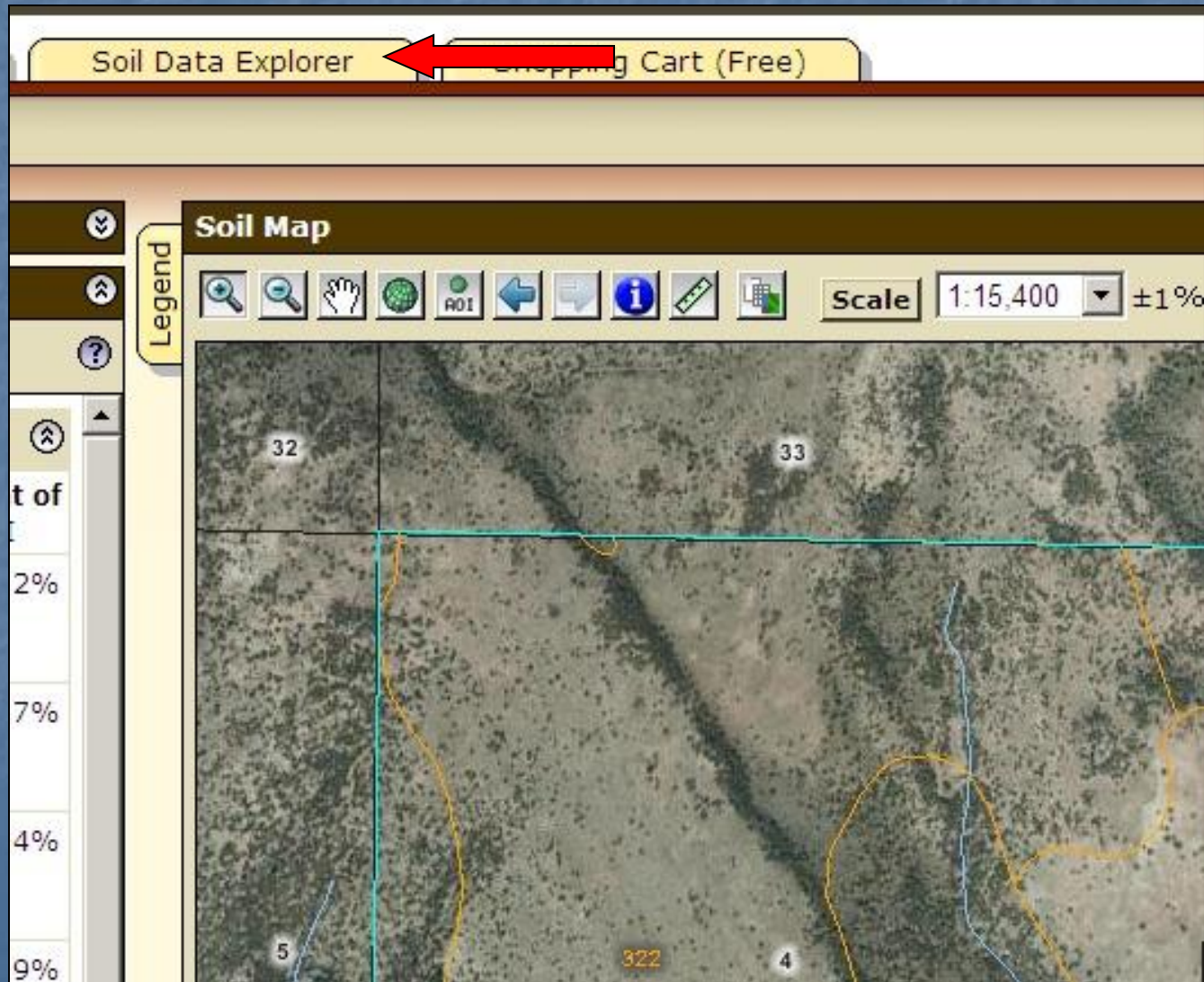
The next step is to click on the "Soil Map" tab.

# Soil Map with Legend of Map Units, Acres, and Percent of Area

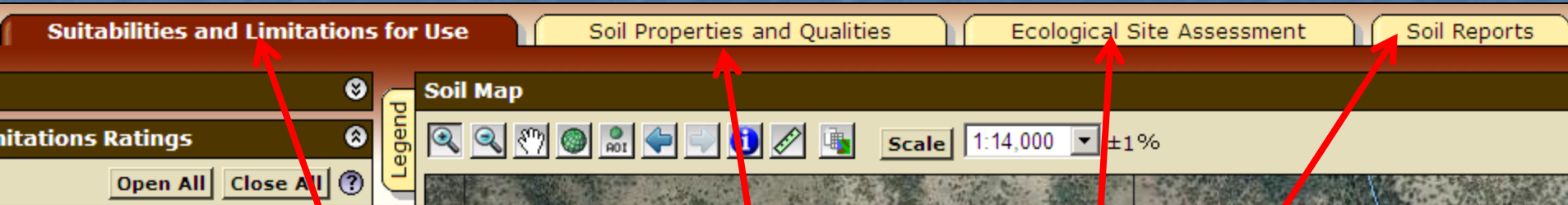




Click on the "Soil Data Explorer" tab to create maps and reports of soil properties, interpretations, and ecological site information.



The Soil Data Explorer tab provides multiple options for displaying soils and ecological site information.



The **"Suitabilities and Limitations for Use"** tab is used to create maps and reports of a soil interpretation such as "Rangeland Seeding Basin Ecoregion".

The **"Soil Properties and Qualities"** tab is used to create reports for a soil property such as "Clay in the surface horizon".

The **"Ecological Site Assessment"** tab is used to view and print reports that contain multiple soil properties and interpretations.

The **"Soil Reports"** tab is used to view and print reports that contain multiple soil properties and interpretations.

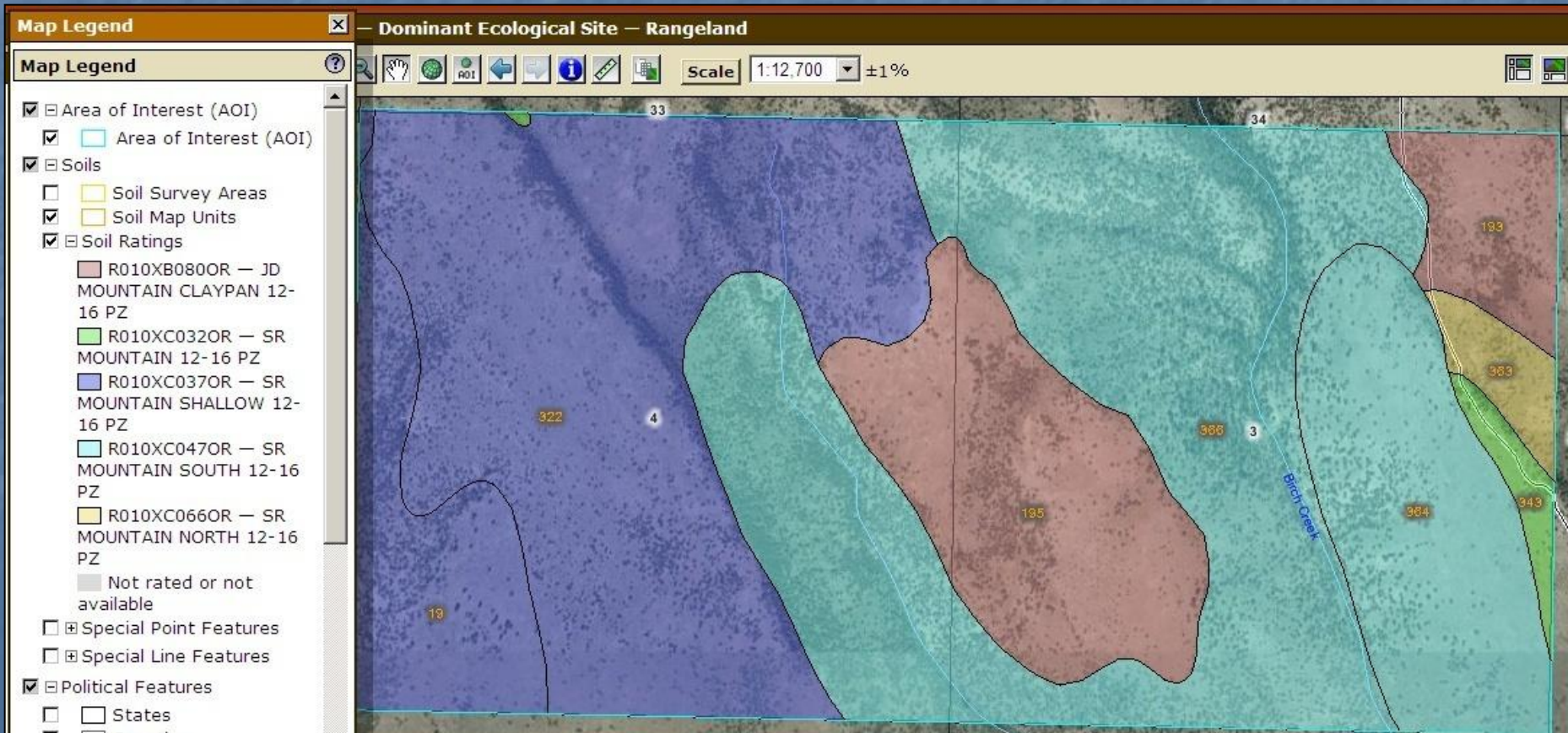
The **Ecological Site Assessment** tab can be used to generate maps of the dominant ecological sites and reports of ecological site descriptions.

Soil Properties and Qualities



**Ecological Site Assessment**

Soil Reports



# The **Ecological Site Assessment** tab report of Ecological Sites in the Area of Interest (AOI).

**Table — Ecological Sites by Map Unit Component — Rangeland**

**Harney County Area, Oregon**

Map unit symbol	Component name (percent)	Ecological site	Acres in AOI	Percent of AOI
19	Ateron (50%)	R010XC037OR — SR MOUNTAIN SHALLOW 12-16 PZ	93.6	7.3%
	Rubble land (35%)			
193	Merlin (85%)	R010XB080OR — JD MOUNTAIN CLAYPAN 12-16 PZ	47.0	3.7%
195	Merlin (60%)	R010XB080OR — JD MOUNTAIN CLAYPAN 12-16 PZ	158.4	12.4%
	Ateron (25%)	R010XC080OR — SR MAHOGANY MOUNTAIN LOAM 14-18 PZ		
322	Teguro, thin surface (85%)	R010XC037OR — SR MOUNTAIN SHALLOW 12-16 PZ	381.9	29.9%
342	Vitale (85%)	R010XC032OR — SR MOUNTAIN 12-16 PZ	0.4	0.0%
343	Vitale (50%)	R010XC032OR — SR MOUNTAIN 12-16 PZ	13.9	1.1%
	Merlin (35%)	R010XB080OR — JD MOUNTAIN CLAYPAN 12-16 PZ		

**Ecological Sites**

Open All Close All ?

All Ecological Sites

R010XB0800R — JD MOUNTAIN CLAYPAN 12-16 PZ

**R010XC0320R — SR MOUNTAIN 12-16 PZ**

**This Ecological Site**

View Ecological Site Info

**View Options**

All Plant Community Photos	<input checked="" type="checkbox"/>	←
State Transition Diagram	<input checked="" type="checkbox"/>	←
Ecological Dynamics Description	<input checked="" type="checkbox"/>	←

View Ecological Site Info

Reference Plant Community

R010XC0370R — SR MOUNTAIN SHALLOW 12-16 PZ

R010XC0470R — SR MOUNTAIN SOUTH 12-16 PZ

R010XC0590R — SR MAHOGANY ROCKLAND 12+ PZ

R010XC0660R — SR MOUNTAIN NORTH 12-16 PZ

R010XC0800R — SR MAHOGANY MOUNTAIN LOAM 14-18 PZ

After selecting an ecological site, the following ***View Options*** are available:

- Plant Community Photos
- State Transition Diagram
- Ecological Dynamics Description

# Reference Plant Community Photo:

## R010XC0320R – SR MOUNTAIN 12 – 16 PZ

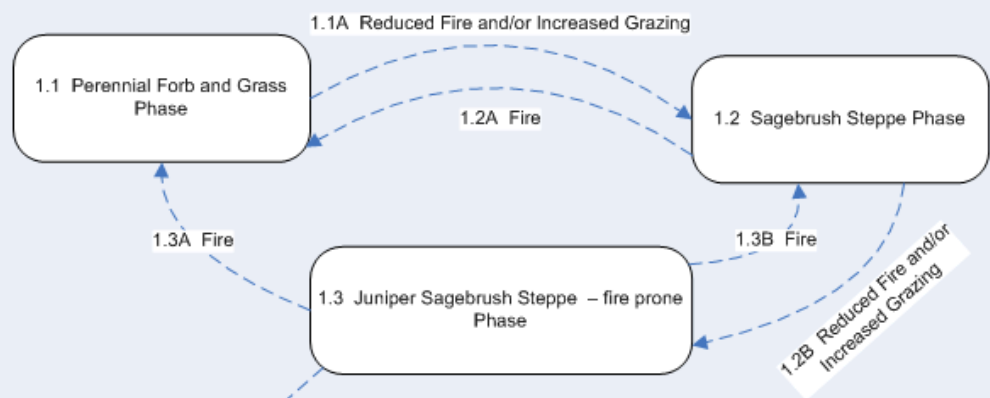
All Plant Community Photos – R010XC0320R – SR MOUNTAIN 12-16 PZ Ecological Site

Reference Plant Community



State Transition Diagram for R010XC032OR — SR MOUNTAIN 12-16 PZ Ecological Site

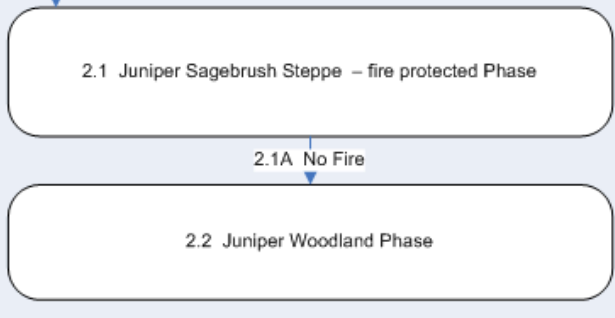
State 1 – Reference State, bunchgrass dominated



T1A Continued Fire Suppression

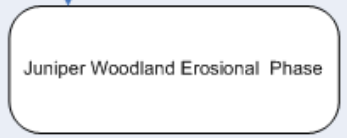
R2A Mechanical Juniper Removal

State 2 – Juniper dominated



T2A Soil Erosion

State 3



State Transition  
Diagram:  
Ecological Site  
R010XC032OR -  
SR MOUNTAIN  
12 – 16 PZ

# Ecological Dynamics Description

## R010XC032OR - SR MOUNTAIN 12 – 16 PZ

### Ecological Dynamics Description — R010XC032OR — SR MOUNTAIN 12-16 PZ Ecological Site

The potential native plant community is strongly dominated by Idaho fescue and mountain big sagebrush. Sandberg bluegrass is the dominant shallow rooted perennial grass. Bluebunch wheatgrass, prairie junegrass and a variety of forbs are present. Wild crab apple and antelope bitterbrush occur sporadically. Vegetative composition of the community is approximately 75 percent grasses, 10 percent forbs and 15 percent shrubs. Approximate ground cover is 70 to 80 percent (basal and crown).

#### Range in Characteristics:


Idaho fescue increases on silty clay loam surfaces. Bluebunch wheatgrass increases on slight south and west exposures. Needlegrasses increases on coarser surfaces and over shallower depths. Shrubs increase over gravelly and fractured substratums. Basin big sagebrush increases at lower elevations and as the precipitation zone approaches 12 inches. Production, antelope bitterbrush, serviceberry, snowberry and pine increase at the upper end of the precipitation zone.


#### Response to Disturbance - States:

If the condition of the site deteriorates as a result of overgrazing, Idaho fescue decreases. Mountain big sagebrush rapidly increases. Sandberg bluegrass increases and juniper invades. With continued overgrazing, juniper and big sagebrush dominate the overstory. Sandberg bluegrass dominates the understory. Annual invasion is limited unless ground disturbance occurs. With further deterioration and lack of fire juniper dominates the site, shrubs decrease and bare ground increases. With fire and heavy use or ground disturbance, annuals and Sandberg or bulbous bluegrass increase. Bare ground increases and excessive erosion contributes to downstream sedimentation.


States: ARTRV-T/POSE-Bare Ground; JUOC/ARTRV-T/POSE-Bare Ground; POSE-POBU -Annuals-Bare Ground




**Ecological Sites** 





All Ecological Sites

R010XB080OR — JD MOUNTAIN CLAYPAN 12-16 PZ 

**R010XC032OR — SR MOUNTAIN 12-16 PZ** 

This Ecological Site

**Reference Plant Community** 

**View Options** 

Plant Community Photos

Plant Community Description

Plant Community Tables

- Annual Production
- Plant Species Composition
- Plant Growth Curve

1. Select the "Reference Plant Community" option
2. Select the "View Options"
3. Click the "View Plant Community Info" button to generate a report.

**Tables — Reference Plant Community**

Annual Production (Lbs/Acre)			
Plant Type	Low	Representative Value	High
Grass/Grasslike	900	1,200	1,500
Forb	120	160	200
Shrub/Vine	180	240	300
<b>Totals</b>	<b>1,200</b>	<b>1,600</b>	<b>2,000</b>

**Plant Species Composition (Lbs/Acre)**

Grass/Grasslike				
Group	Plant Common Name	Plant Scientific Name	Annual Production Pounds Per Acre	
			Low	High
<b>1: Dominant deep rooted bunchgrass</b>			<b>960</b>	<b>1280</b>
	Idaho fescue	<i>Festuca idahoensis</i>	960	1280
<b>2: Sub-dominant deep rooted bunchgrass</b>			<b>32</b>	<b>320</b>
	bluebunch wheatgrass	<i>Pseudoroegneria spicata</i> ssp. <i>spicata</i>	32	320
<b>3: Sub-dominant shallow rooted perennial grass</b>			<b>32</b>	<b>80</b>
	Sandberg bluegrass	<i>Poa secunda</i>	32	80
<b>4: Other perennial grasses</b>			<b>64</b>	<b>384</b>
	western needlegrass	<i>Achnatherum occidentale</i>	0	32
	Thurber's needlegrass	<i>Achnatherum thurberianum</i>	32	128
	mountain brome	<i>Bromus marginatus</i>	0	32
	threadleaf sedge	<i>Carex filifolia</i>	0	32
	squirreltail	<i>Elymus elymoides</i>	0	32
	prairie Junegrass	<i>Koeleria macrantha</i>	16	48
	basin wildrye	<i>Leymus cinereus</i>	16	48
	oniongrass	<i>Melica bulbosa</i>	0	32

Forb				
Group	Plant Common Name	Plant Scientific Name	Annual Production Pounds Per Acre	
			Low	High
<b>7: Dominant perennial forbs</b>			<b>32</b>	<b>48</b>
	arrowleaf balsamroot	Balsamorhiza sagittata	32	48
<b>8: Sub-dominant perennia forbs</b>			<b>112</b>	<b>224</b>
	common yarrow	Achillea millefolium	16	32
	milkvetch	Astragalus	16	32
	fleabane	Erigeron	16	32
	buckwheat	Eriogonum	16	32
	desertparsley	Lomatium	16	32
	lupine	Lupinus	16	32
	phlox	Phlox	16	32
<b>9: All other perennial forbs</b>			<b>30</b>	<b>200</b>
	agoseris	Agoseris	2	10
	onion	Allium	2	10
	pussytoes	Antennaria	2	10
	brodiaea	Brodiaea	2	10
	mariposa lily	Calochortus	2	10
	Indian paintbrush	Castilleja	2	10
	bastard toadflax	Comandra	2	16
	bushy bird's beak	Cordylanthus ramosus	2	10
	tapertip hawksbeard	Crepis acuminata	2	16
	waterleaf	Hydrophyllum	0	16

Shrub/Vine				
Group	Plant Common Name	Plant Scientific Name	Annual Production Pounds Per Acre	
			Low	High
<b>11: Dominant evergreen shrub</b>			<b>48</b>	<b>128</b>
	mountain big sagebrush	<i>Artemisia tridentata</i> ssp. <i>vaseyana</i>	48	128
<b>12: Subdominant evergreen shrub</b>			<b>16</b>	<b>48</b>
	basin big sagebrush	<i>Artemisia tridentata</i> ssp. <i>tridentata</i>	16	48
<b>15: Other shrubs</b>			<b>32</b>	<b>320</b>
	Saskatoon serviceberry	<i>Amelanchier alnifolia</i>	0	32
	threetip sagebrush	<i>Artemisia tripartita</i>	0	32
	big sagebrush	<i>Artemisia tridentata</i> ssp. <i>xericensis</i>	0	32
	yellow rabbitbrush	<i>Chrysothamnus viscidiflorus</i>	0	32
	squaw apple	<i>Peraphyllum ramosissimum</i>	0	32
	antelope bitterbrush	<i>Purshia tridentata</i>	0	32
	wax currant	<i>Ribes cereum</i>	0	32
	Woods' rose	<i>Rosa woodsii</i>	0	32
	common snowberry	<i>Symphoricarpos albus</i>	0	32
	horsebrush	<i>Tetradymia</i>	0	32
Tree				
Group	Plant Common Name	Plant Scientific Name	Annual Production Pounds Per Acre	
			Low	High
<b>16: Evergreen sub-dominant trees</b>			<b>0</b>	<b>64</b>
	western juniper	<i>Juniperus occidentalis</i>	0	32
	ponderosa pine	<i>Pinus ponderosa</i>	0	32

# Plant Growth Curve Table

## Plant Growth Curve



### Growth Curve Name

B10 SR Mtn, Cool & No 12-16pz

### Growth Curve Description


SR Mtn, Cool & No 12-16pz RPC Growth Curve

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0%	0%	0%	10%	30%	30%	15%	5%	5%	5%	0%	0%

# Ecological Site Information System (ESIS)

<http://esis.sc.egov.usda.gov/>

United States Department of Agriculture




Natural Resources Conservation Service

Ecological Site Information System

PLANTS | **ESIS** | ESD | FSGD | ESI Rangeland | ESI Forestland

### Quick Access


- ▶ About ESIS
- ▶ ESD Home
- ▶ FSGD- Forage Suitability Groups
- ▶ ESI - Forest
- ▶ ESI - Range



## Ecological Site Information System (ESIS)

ESIS is the NRCS repository for ecological site descriptions and for information associated with the collection of forestland and rangeland plot data. ESIS is organized into two applications and associated databases; the Ecological Site Description (ESD) application and the Ecological Site Inventory (ESI) application. This section, plus the access tab on the right, provides quick access to technical resources and technical guidance for developing and understanding ecological sites.

[...More Info](#)



## Ecological Site Description (ESD)

The ESD application is used to enter, edit and store ecological site information. Only approved ecological sites for forestland and rangeland are available to the public. Open this section to access approved and non-approved ESD's. Entry/Edit privileges are required to access non-approved sites. Click on MLRA/state of interest, and available ESDs within that MLRA/LRU for the state will be displayed.

[...More Info](#)

### Technical Resources

- [USDA - ARS Range Database](#)
- [Web Soil Survey](#)
- [Ag Handbook 296](#)
- [Climate Data](#)
- [Soil Change Guide](#)

### Technical Guidance

- [National Range & Pasture Handbook](#)
- [National Biology Manual](#)
- [National Biology Handbook](#)
- [National Forestry Manual](#)
- [National Soil Survey Handbook \(NSSH\)](#)

### Reports

- > [Approved ESD Reports](#)
- > [Approved Reference Sheets](#)

### Data Access

- > [Data Edit/Entry, Download, Reports](#)
- > [GSAT Downloads](#)

Click on the ***Approved ESD Reports*** link to access ecological site descriptions.

## Ecological Site Description (ESD) System for Rangeland and Forestland

The Ecological Site Description (ESD) application provides the capability to enter, edit, and view reports of rangeland and forest land ecological site descriptions. Anyone may view reports of approved Ecological Site Descriptions. Data entry, edit, download, and viewing draft reports is for authorized users only.

## ESIS User Guide

# Queries for Ecological Site Descriptions (ESD's) can be submitted by Major Land Resource Area (MLRA), State, or both

[MLRA Information](#)

[MLRA Explorer](#)

MLRA

None Selected



State

None Selected



None Selected



Submit

002X

003X

004B

005X

006X



In this example we'll query for ESD's in MLRA 8 from Oregon.

MLRA Information

MLRA Explorer

MLRA

008X

State

Oregon

Submit

Click the ***Submit*** button after the query criteria are selected.

A list of ESD's in MLRA 8 from Oregon are produced.

Click on an ESD link to view the ecological site description.

## Ecological Site Description Selection

*Select a site to view Report*

ID	Type	MLRA	Site Name	Biotic Name
<a href="#">R008XY110OR</a>	R	008X	LOAMY 10-12 PZ	
<a href="#">R008XY120OR</a>	R	008X	LOAMY 12-14 PZ	
<a href="#">R008XY130OR</a>	R	008X	SANDY LOAM 10-12 PZ	
<a href="#">R008XY140OR</a>	R	008X	SHALLOW LOAM 10-14 PZ	
<a href="#">R008XY150OR</a>	R	008X	VERY SHALLOW LOAM 10-14 PZ	
<a href="#">R008XY200OR</a>	R	008X	SOUTH 10-14 PZ	/Artemisia tridentata ssp. tridentata-Ericameria nauseosa/Pseudoroegneria spicata ssp. spicata-Poa secunda



### Data Access

- > [Return to Reports Selection Screen](#)

### Report Selections

- General
- > [Physiographic Features](#)
- > [Climate Features](#)
- > [Water Features](#)
- > [Soil Features](#)
- > [Plant Communities](#)
- > [Site Interpretations](#)
- > [Supporting Information](#)
- > [Rangeland Health Reference Sheet](#)
- > [Complete Report](#)
- > [HTML Printable Format](#)

# UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE

## ECOLOGICAL SITE DESCRIPTION (New Format Report)

### ECOLOGICAL SITE CHARACTERISTICS

Site Type: Rangeland

Site Name: SOUTH 10-14 PZ

*Artemisia tridentata ssp. tridentata - Ericameria nauseosa /  
Pseudoroegneria spicata ssp. spicata - Poa secunda*  
( / basin big sagebrush - rubber rabbitbrush / bluebunch wheatgrass -  
Sandberg bluegrass)

Site ID: R008XY200OR

Major Land Resource Area: 008-Columbia Plateau



Soil survey data in combination with other spatial data can be used as tools to help develop and correlate ecological sites.

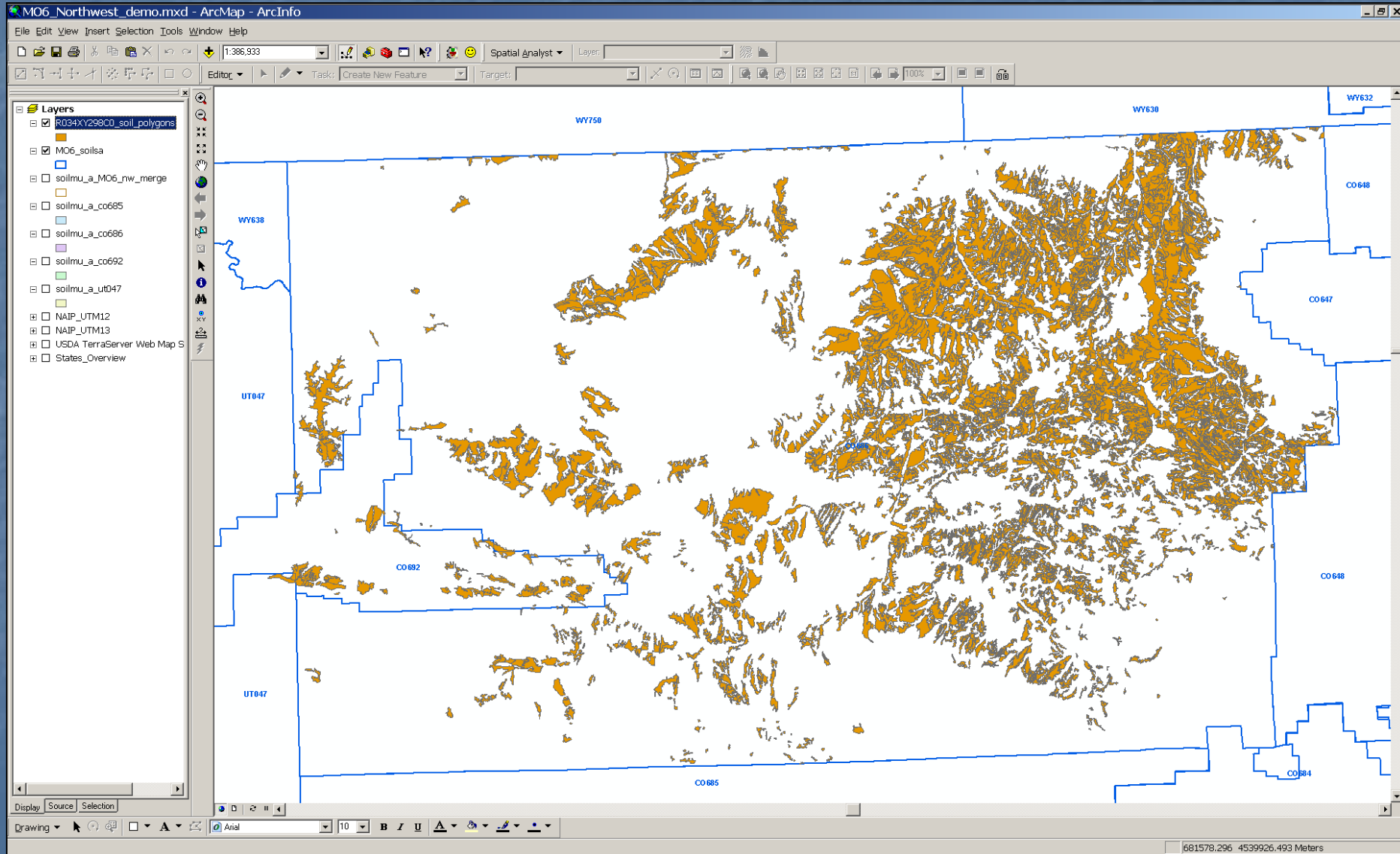
soildatamart.nrcs.usda.gov



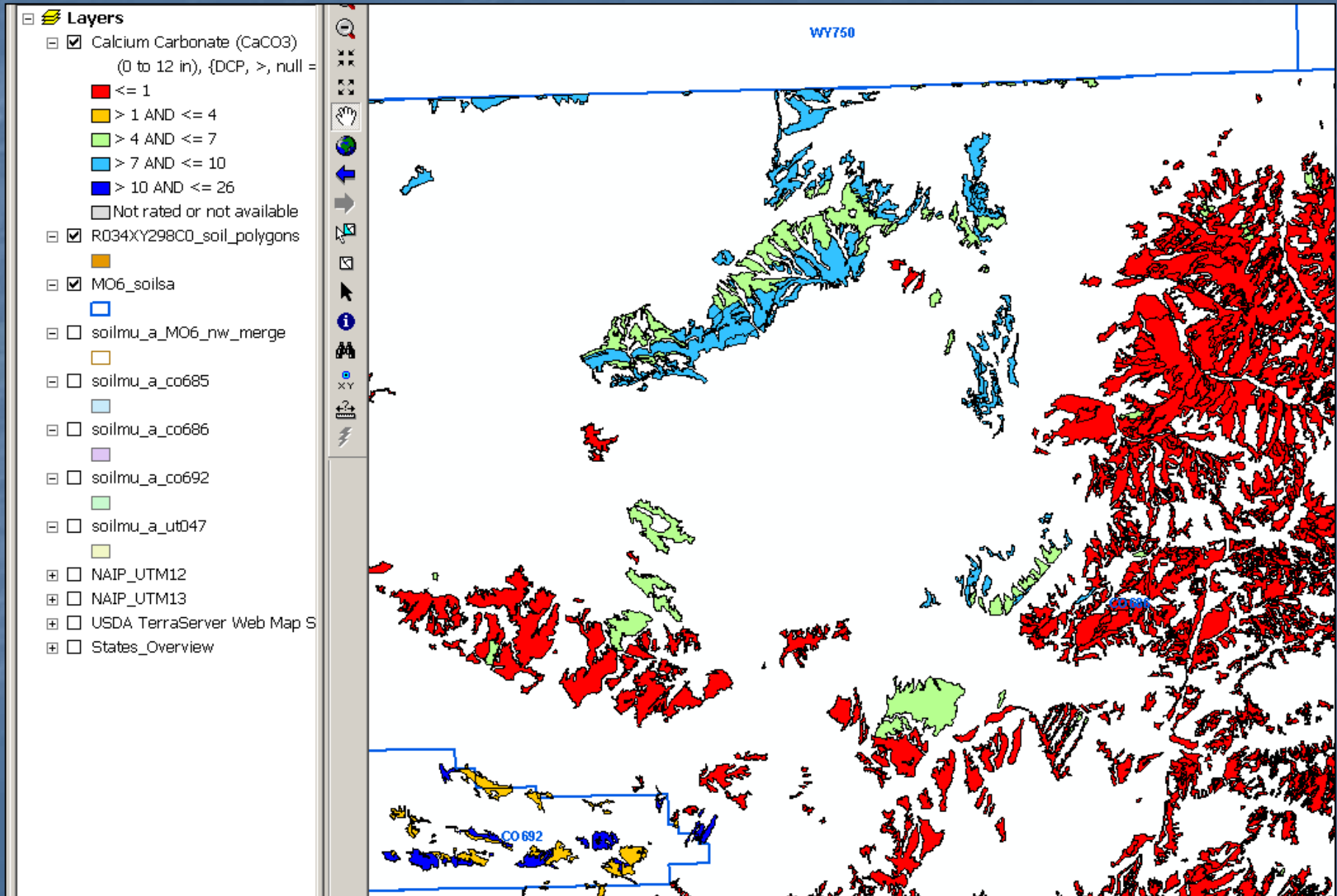
datagateway.nrcs.usda.gov



# Map showing the extent of an ecological site created from soil survey tabular and spatial data.



# Map showing the soil calcium carbonate content in the upper 12 inches using the **Soil Data Viewer** ArcMap tool (<http://soils.usda.gov/sdv/>)



# Tabular reports of soil properties from soil survey databases

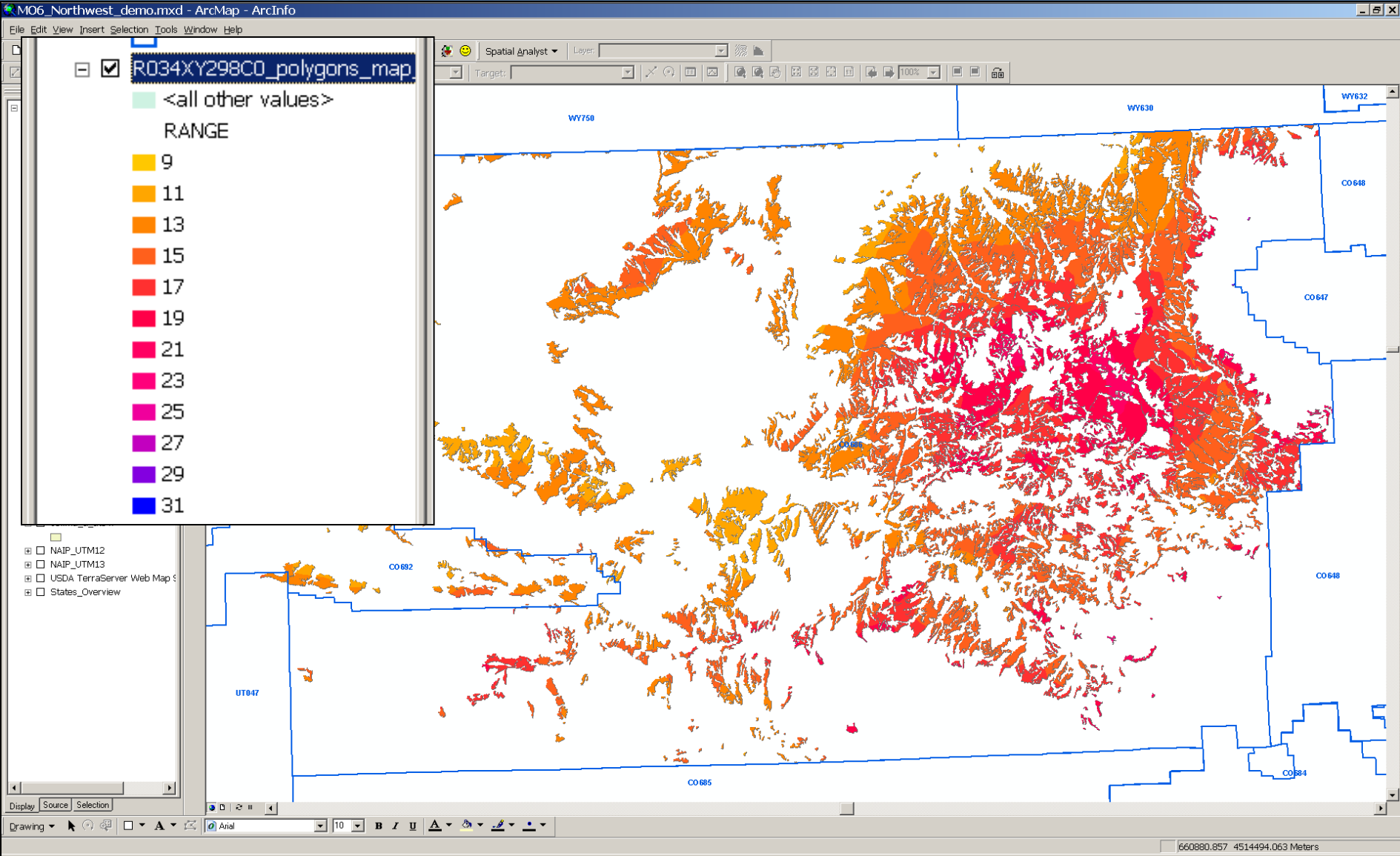
## Chemical Soil Properties

Moffat County Area, Colorado

[Absence of an entry indicates that data were not estimated. This report shows only the major soils in each map unit]

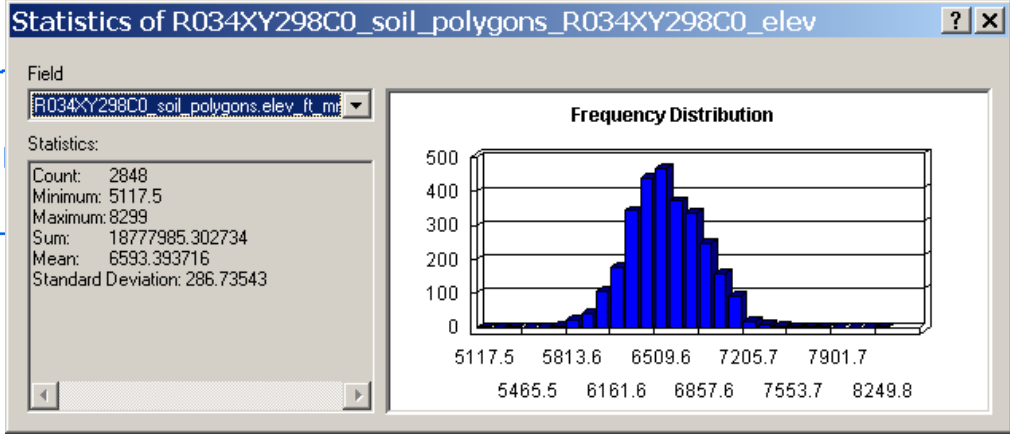
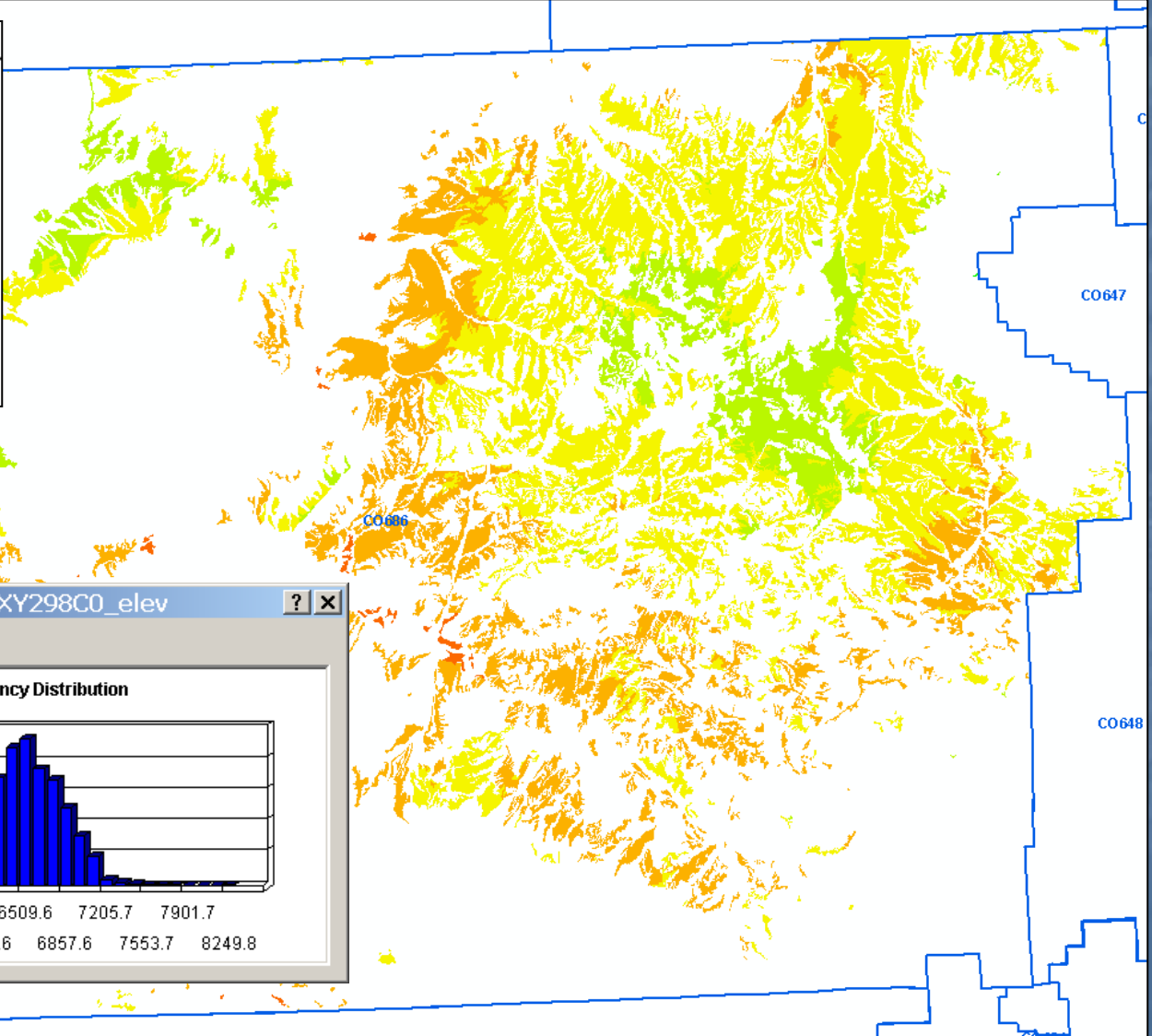
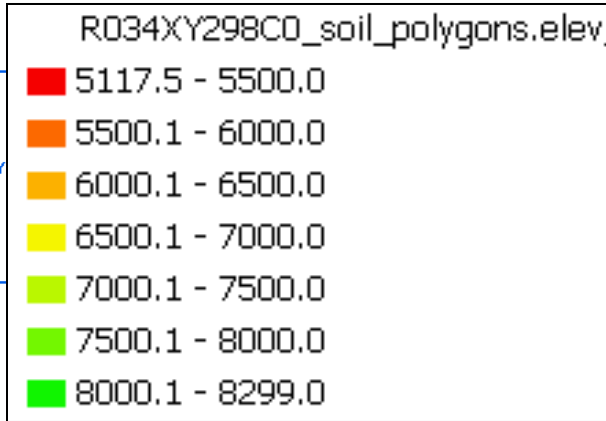
Map symbol and soil name	Depth	Cation- exchange capacity	Effective cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorption ratio
	<i>In</i>	<i>meq/100 g</i>	<i>meq/100 g</i>	<i>pH</i>	<i>Pct</i>	<i>Pct</i>	<i>mmhos/cm</i>	
4:								
Almy	0-6	10-20	---	7.4 - 8.4	0	0	0.0	0
	6-30	10-20	---	7.4 - 8.4	0-3	0	0.0	0
	30-60	10-15	---	7.9 - 9.0	5-15	0	0.0-2.0	0-2
14:								
Berlake	0-10	5.0-10	---	7.4 - 7.8	0	0	0.0	0-1
	10-25	10-20	---	6.6 - 7.8	0	0	0.0	0-1
	25-33	5.0-10	---	6.6 - 7.8	0	0	0.0	0-1
	33-60	5.0-10	---	6.6 - 7.8	0	0	0.0	0-1
Maysprings	0-6	5.0-10	---	6.6 - 7.8	0	0	0.0	0
	6-22	10-20	---	6.6 - 7.8	0	0	0.0	0
	22-29	5.0-10	---	6.6 - 7.8	0	0	0.0	0
	29-60	2.0-10	---	7.4 - 8.4	0-2	0	0.0	0

# Mean annual precipitation from PRISM spatial data





# Elevations from 30-meter Digital Elevation Model (DEM)



# Questions ???



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