OREGON SOILS DATA STANDARD

A COMPONENT OF THE OREGON GEOSCIENCE FRAMEWORK THEME
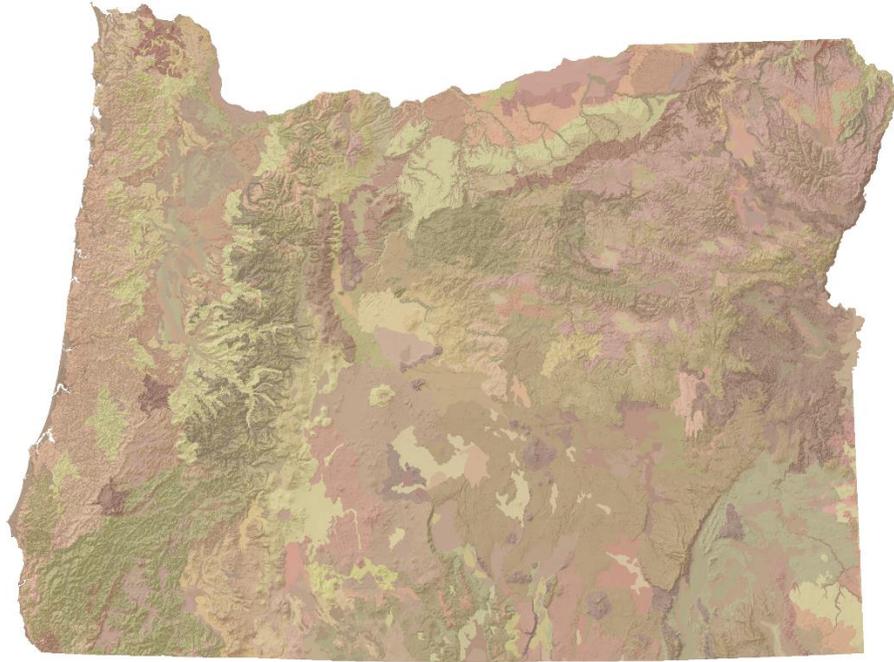
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Prepared by
Framework Soils Committee
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For questions or more information, contact:
Ian Reid, Chair
Oregon Soils Committee USDA-NRCS
1201 NE Lloyd Blvd.
Ste 900
Portland, OR 97232
Ian.reid@or.usda.gov

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Abbreviations and Acronyms Used in this Document

FGDC	Federal Geospatial Data Committee
NCSS	National Cooperative Soil Survey
NRCS	Natural Resources Conservation Service
OGDS	Oregon Geologic Data Standard
OSDS	Oregon Soils Data Standard
OSFL	Oregon Soils Framework Layer
SGDS	Soil Geographic Data Standard
SSURGO	Soil Survey Geographic Database
STATSGO	State Soil Geographic dataset
STATSGO2	U.S. General Soil Map
USDA	United States Department of Agriculture

1.0 INTRODUCTION

The Oregon Geographic Information Council (OGIC) is overseeing preparation of geospatial data standards for the state. The development of these standards will ease the sharing of data and assist cooperative data development efforts. OGIC assigned a Framework Implementation Team (FIT) to guide the development of standards for 15 statewide data themes. Separate (Oregon Framework) Work Groups are developing standards within each theme. Geoscience is one Oregon Framework theme with a Geologic workgroup guiding development of a Geologic Layer and a Soils workgroup coordinating a Soils Layer. This document concerns the Soils Layer.

This document is a standard for compiling soil map data statewide for Oregon. It is based on the National Cooperative Soil Survey (NCSS) standards and the Soil Geographic Data Standards of the Federal Geographic Data Committee (SGDS-FGDC). These standards provide the structure for organizing, storing, and using a range of soils map data. The NCSS and SGDS-FGDC data standards, as well as supporting methodologies, are designed for optimal use at 1:12,000 to 1:30,000 or smaller scales (FGDC, 1997) (Fig. 1). Most soil mapping in Oregon has been at a scale of 1:24,000, and certified data is distributed in the Soil Survey Geographic (SSURGO) Database standard.

As of this writing approximately 30% of the state either has not been mapped, or is being mapped by an ongoing NCSS progressive soil survey. For these areas of the state where certified SSURGO datasets do not currently exist, U.S. General Soil Map (STATSGO2, formerly known as the State Soil Geographic (STATSGO) dataset) data will be used. STATSGO2 is a broad-based inventory of soils best represented at a map scale of 1:250,000 in Oregon.

This document outlines a content standard – the Oregon Soils Data Standard (OSDS) - emphasizing soil features, concepts, and relationships pertaining to information presented on soil maps. The standard addresses the graphic data elements held in a geographic information system (GIS) and the non-graphic descriptive information linked to the graphic elements, which could be organized in a relational database such as SSURGO.

This document also seeks to provide guidance on site-specific investigations of soils in Oregon to address needs for soils geospatial data at scales greater than 1:12,000 (e.g. 1:5,000). These high-intensity investigations are outside the scope of a typical NCSS SSURGO soil survey and no mechanism for cataloging or aggregating non-NCSS soils investigations is provided in this standard.

1.1 MISSION AND GOALS OF STANDARD

The mission of this standard is to provide a consistent and maintainable structure for soil map data being compiled statewide for Oregon. The name of this statewide compilation dataset is the Oregon Soils Framework Layer (OSFL). Its overall aim is to assist both producers and users of soil map data in Oregon. The following goals influenced development of this standard:

- To assemble the best available soils information statewide for Oregon.

- To provide for periodic updates as new NCSS soils mapping is completed and provide a process and data structure to incorporate this new mapping into the OSFL.

- Create a widely usable dataset and data structure, while acknowledging that soils terminology is extremely technical.

- To provide guidance and structure for spatial data collected and distributed at scales too detailed for national concerns.

1.2 RELATIONSHIP TO EXISTING STANDARDS

The OSDS is directly related to the existing Soil Geographic Data Standards (SGDS) of the FGDC. The overall objective of the SGDS is to standardize the names, definitions, ranges of values, and other characteristics of soil survey map attribute data developed by the National Cooperative Soil Survey (NCSS) (FGDC, 1997). The NCSS is the body composed of the various federal, state, and local units of government who work cooperatively to develop the soil survey of all lands in the United States. The SGDS is a set of data standards for the inventory, mapping, and reporting on the soil resources of the United States. It includes a description of the proposed data elements to be used when reporting and transferring data used to describe soil map units and their components. These map units are associated with soil maps developed by the National Cooperative Soil Survey.

The OSDS data schema is identical to that of the SSURGO implementation of the SGDS standard. Because the OSFL also incorporates STATSG2 data in areas where SSURGO data is not available the spatial data is multi-resolution. The spatial data is dominantly 1:24,000, and unmapped areas show mapping units at a scale of 1:250,000. The OSFL tabular data will have some missing data elements where those elements are not collected, or interpretations cannot be made at the smaller STATSGO2 mapping scale.

The SGDC does not detail data elements used to describe soils at a specific point/site on the landscape, the field methods used to collect the data, or the various classification systems used to classify soils. The OSDS provides guidelines to deal with point/site data.

Documents containing the field methods and various classification systems are listed as references at the end of this standard. The Oregon Geologic Data Model (http://www.oregon.gov/DAS/FISPD/GEO/Standards/Standards.shtml) served as an important reference in designing the OSDS, as did the previous draft soil standard prepared by Dr. J. Noller, Department Head and Professor, Landscape Pedology, Department of Crop and Soil Science, Oregon State University.

1.3 DESCRIPTION OF THE STANDARD

This standard lays out the essential content and data structure necessary to describe, produce, and use the OSFL. These essential elements are a distillation of the important features normally included as the content of soil maps and deemed necessary for the statewide layer.

The standard addresses three organizational components:

1. Geospatial elements (or geometry)
2. Description of soils and soil map units
3. Metadata for documentation

This standard has been written recognizing that: soils maps are complex and interpretive; the classifications of soils and soil-landscape concepts interpretations have and will continue to evolve over time. Acknowledging these, the standard strives to be highly adaptive and refrains from re-interpreting the data and interpretations the author developed in the original soils map.

An important part of the OSFL is the initial use of STATSGO2 data in order to produce a statewide soils layer because so much of the state remains unmapped or uncorrelated by NCSS standards. Over time, as soils mapping is completed in these areas SSURGO data will replace STATSGO and OSFL will approach full statewide soils coverage at a scale of 1:24,000.

1.4 APPLICABILITY AND INTENDED USE OF THE STANDARD

The intent of this standard is to foster the orderly development, sharing, and maintenance of the OSFL. This standard proposes using the consistent format, structure, and documentation of the SGDS-FGDC for the OSDS. It is a minimum standard intended to be usable by all levels of government, as well as academia and the private sector. As work on national soils data standards evolves this standard will evolve and strive to be compatible with such efforts.

1.5 STANDARD DEVELOPMENT PROCEDURES

The Oregon Geoscience Framework Group – Soils Committee, was formed in 2007 but an OSDS standard had not been approved by OGIC by early 2014. The current soils committee has met approximately quarterly since April 2014. The current committee reviewed the FGDC Soil Geographic Data Standards (SGDS) data model and heard a presentation of the standard and a proposal by the USDA Natural Resources Conservation Service (NRCS) to implement the SSURGO data model, filling in unmapped areas with STATSGO2 data. NRCS drafted a SSURGO/STATSGO2 soils layer which covers the entire state of Oregon. Elements of the draft model, map and sample soils interpretive maps have been available for wider review/comment on the Oregon Geospatial Enterprise Office (GEO) ftp site: ftp.gis.oregon.gov.

This site is hosted by the Oregon Department of Administrative Services.

Once approved the OSFL data will be made available through the GEO Spatial Data Library:
http://www.oregon.gov/DAS/CIO/GEO/Pages/sdlibrary.aspx

1.6 MAINTENANCE OF THE STANDARD

The Soils Committee acknowledges that this standard will need periodic maintenance during preparation of the OSFL. Updates to this standard will be presented, when appropriate, to the Soils Committee for comment, revision, and final endorsement. The NRCS Oregon State Office will be the initial data steward for the OSFL and can remain so as long as the OSDS standard is SGDS-FGDC compliant as implemented in SSURGO and STATSGO2. If the OSFL and OSDS evolve away from that then stewardship will have to shift to another entity, for example Oregon State University.

2.0 BODY OF THE STANDARD

2.1 SCOPE AND CONTENT OF THE STANDARD

The scope of this standard encompasses the public domain vector and associated tabular soils data compiled for the OSFL. Initially the data set will reflect current NCSS methodologies and SGDS-FGDC structure, and will include SSURGO and STATSGO2 data. Map scales will be a combination of 1:24,000 and 1:250,000. This standard adopts national standards that are applicable up to 1:12,000 scale.   Over time the national standard may evolve by the modification or addition of geospatial and attribute elements.   By adhering to that standard database structural changes can readily be applied to the OSFL.

When appropriate, such modifications and additions will be submitted to the Soils Committee for acceptance and the revised data content publicized to all interested users of the standard.

This standard does not include a standardized science language for describing, classifying and interpreting soils, including their description and classification. The standard soils language is encoded at the national level by NCSS.

This standard provides guidance for the collection of site-specific soils information at map scales of up to 1:100. This range of scales makes documentation of the original reference map scale and soils investigation essential and the guidance addresses these concerns.

No recommendation is made on how to archive, aggregate or incorporate site-specific data into the OFSL.

2.2 NEED FOR THE STANDARD

Soils maps are very diverse in the type(s) of information that they contain and the soils- related issues that they address. They are produced by State or Federal agencies, private industry consultants, and academic researchers according to well-described, standard professional guidelines for content and form (see appendix). The features displayed on soils maps are interpretive and specific to each soils survey.

2.3 PARTICIPATION IN STANDARDS DEVELOPMENT

The Soils Committee is comprised of federal, state, and academic representatives. Participation in the Committee is open to all entities that are concerned with the production, use and exchange of statewide digital geologic information. Past and present member affiliations include:

- Oregon Department of Administrative Services

- Oregon Department of Agriculture

- Oregon Department of Environmental Quality

- Oregon Department of Geology & Mineral Industries

- Oregon Department of Revenue Oregon Department of Transportation

- Oregon Watershed Enhancement Board

- U.S. Bureau of Land Management

- U.S. Forest Service

- U.S. Geological Survey

- U.S. Government

- U.S. Natural Resources Conservation Service

- Oregon State University, Department of Crop and Soil Science, Soil Science Unit

This standard was tested and implemented in a pilot OSFL project in 2014. The project integrates SSURGO and STATSGO2 mapping in a layer covering the entire state of Oregon. Information regarding the pilot project is available from the NRCS Oregon State Office, State Soil Scientist, at 503-414-3200.

2.4 INTEGRATION WITH OTHER STANDARDS

The layout of this standard conforms to the OGIC layout template developed for the Oregon Framework Themes. Further, it is directly developed from the OGDS, with which it is partnered under the Oregon Geosciences Framework Theme. The documentation component of this standard is based on adoption of and full integration with the SGDS- FDGC standard.

2.5 TECHNICAL AND OPERATIONAL CONTEXT

2.5.1 DATA ENVIRONMENT

The data environment for the OSFL is a vector model of polygons, lines, and points linked to relational database content. Digital soils data elements are assembled in a variety of proprietary geospatial formats. The state exchange medium is the ESRI file geodatabase, a data structure relating polygons, lines, points and feature attribution (including shape geometry). To take full advantage of the OSFL, the user must properly link the file geodatabase feature classes to the descriptive content in the tabular relational database. The data environment of the relational database will be Microsoft Access 2003 format.

The Web Soil Survey (WSS) website provides ready access to certified SSURGO and STATSGO2 data used in the OSFL. SSURGO is available by soil survey area, STATSGO2 data is available as a statewide download. In each case the spatial data is in shapefile format, the tabular data is in ascii text files.

2.5.2 REFERENCE SYSTEMS

Soils map information is commonly assembled and overlaid on a U.S. Geological Survey Digital Orthophoto quadrangle (DOQQ). DOQQs are typically provided in the Universal Transverse Mercator coordinate referencing system. However, for the OSFL, all soils information will be stored and exchanged in the custom Oregon Lambert Projection. This is the adopted standard projection among Oregon state agencies. Specific parameters of this projection can be found at http://www.gis.state.or.us/data/format.html

2.5.3 INTEGRATION OF THEMES

Soils are mapped on the basis of climate, hydrology, biology (esp. vegetation), elevation, slope, landform, geology and other environmental factors. The integrative nature of soils mapping means that features (point, line, polygon) of the OSFL will locally to regionally show strong correspondence to Framework Layers carrying spatial information (e.g. vegetation map unit boundary) of these environmental factors.

2.5.4 ENCODING

Soils data incorporated into the OSFL will be encoded according to the SGDS-FGDC, adopted by the Soils Committee. Data dictionaries describing the specific format for the OSDS align with those currently published by the NCSS.

2.5.5 RESOLUTION

The resolution of the OSFL will vary according to the original reference soils map(s). The range of scales is initially 1:24,000 (SSURGO) and 1:250,000 (STATSGO2). As future NCSS SSURGO mapping is completed the proportion of 1:250,000 scale data will diminish.

2.5.6 ACCURACY

This standard supports varying levels of positional accuracy, as implied by the range of original reference map scales. The accuracy of interpreted soils information varies with the scale of its base map. Soil map unit interpretations from the original written explanatory reference materials are carried directly into the relational database without reinterpretation, thereby promoting attribute accuracy.

2.5.7 EDGE MATCHING

The concept of seamless geometry is not compatible with integration and maintenance of data from both SSURGO and STATSGO2 since these data sets use disparate map scales. However since the two datasets share a common schema many thematic maps can be shown across the landscape.

Improvement in edge matching will occur as the OSFL continually incorporates new SSURGO mapping as progressive soil surveys are certified.

2.5.8 FEATURE IDENTIFICATION CODE

Both individual SSURGO surveys and STATSGO2 carry a unique feature identification code (FID) to identify polygons. These are potentially dynamic identifiers that can change as multiple soil surveys are merged. The Areasymbol attribute can be combined with the FID before merging to provide a unique identifier after merging surveys.

In addition each soil map unit polygon carries a non-connotative MUKEY attribute. This is the primary key that connects the polygon instance to the relational database.

2.5.9 ATTRIBUTES

2.5.9.1 POLYGONS

Polygons are geospatial objects that represent the boundaries of soils map units that have been mapped by a soil scientist and digitally encoded. Each polygon is uniquely identified according to the Feature Identification Code described in Section 2.5.8.

2.5.9.2 LINES

Lines are geospatial objects that represent the azimuths and locations of linear soils features mapped by a soil scientist and digitally encoded. Lines are uniquely identified according to the Feature Identification Code described in Section 2.5.8.

2.5.9.3 POINTS

Points are geospatial objects that identify the location on the ground of soils- related feature sites. Points are uniquely identified according to the Feature Identification Code described in Section 2.5.8.

2.5.10 TRANSACTIONAL UPDATING

The Oregon NRCS State Office serves as the data steward for the OSFL. NRCS will update the dataset on an annual basis or when new SSURGO certified data is available. Updates will include any newly certified SSURGO surveys and any modifications or additions to the attribute database.

2.5.11 RECORDS MANAGEMENT

Versions of the OSFL will be tracked by Oregon GIS Framework Coordinator, DAS/CIO Geospatial Enterprise Office. At a minimum, the OSFL versions will satisfy the archiving mandates applying to Oregon State agencies.

2.5.12 METADATA

The OSDS uses the metadata standard for the SDGS-FGDC geospatial data. Metadata detailing the characteristics, content, and quality of soil map information is provided.

Links to the SDGS-FGDC metadata standard are found in the References section of this document.

SSURGO database schema examples appear in Appendices A and B.

Metadata recommendations for site-specific soil surveys are described in the proposed Oregon Site-Specific Soil Mapping Standards, Soils FIT, 2009.

2.5.13 DATA PROVISIONING

Oregon NRCS will provide the spatial data as a feature class in a file geodatabase. The SSURGO muaggatt table will be joined to the feature class so approximately 35 attributes will be available for symbolizing the data.

NRCS will also provide ESRI ArcGIS Desktop 10.x lyr files for the following interpretations:

- Suitability for Dwellings with no Basements (Dominant Condition)
- Farmland Class (Dominant Condition)
- Soil Hydrologic Group (Dominant Condition)
- Irrigated Land Capability Class (Dominant Condition)
- Non-Irrigated Capability Class (Dominant Condition)

NRCS is open to providing a limited number of additional lyr files if needed.

3.0 DATA CHARACTERISTICS

The data characteristics detailed below are subject to revision, based on continuing refinement of the OGDM. The data characteristics described in this section represent the minimum set of graphical and non-graphical attributes required to meet this standard.

3.1 MINIMUM GRAPHIC DATA ELEMENTS

Are described in the SDGS-FGDC.

3.2 MINIMUM ATTRIBUTE OR NON-GRAPHIC DATA ELEMENTS

Are described in the SDGS-FGDC.

3.3 OPTIONAL GRAPHIC DATA ELEMENTS

None specified at this time.

3.4 OPTIONAL ATTRIBUTE OR NON-GRAPHIC DATA ELEMENTS

None specified at this time.

4.0 REFERENCES

Federal Geographic Data Committee (FGDC), 1997. Soil Geographic Data Standard.
https://www.fgdc.gov/standards/projects/FGDC-standards-projects/soils/soil997.PDF (accessed 02/24/15).

SSURGO/STATSGO2 Metadata and Documentation, (accessed 02/25/2015.)

USDA-NRCS Soils Home Page, (accessed 02/25/2015.)

USDA-NRCS Web Soil Survey, create customized soil maps, print reports, view or download soil survey report text, create maps of soil properties and interpretations. Download soils data. (Accessed 02/25/2015.)

Proposed Oregon Site-Specific Soil Mapping Standards, OGIC Framework Soils Committee, 2009.

Appendix A: SSURGO spatial metadata schema example, mupolygon table

SSURGO 2.3.2
Tables and Columns

Table Physical Name: mupolygon
Table Label: Mapunit Polygon

Seq	Column Physical Name	Column Label	Logical Data Type	Physical Data Type	Not Null?	Size	Precision	Minimum	Maximum	Units of Measure	Domain Name
1	areasymbol	Area Symbol	String	Varchar	Yes	20					
2	spatialversion	Spatial Version	Integer	Int	Yes						
3	musym	Mapunit Symbol	String	Varchar	Yes	6					
4	mukey	Mapunit Key	String	Varchar	No	30					

This table records all of the soil map units of a soil survey area that are represented as one or more polygons. This table is not like other tabular data tables that are delivered as ASCII delimited files. How the information is delivered depends on the spatial format that was requested at the time the corresponding soil survey area was exported. Spatial information is typically delivered in GIS vendor specific format, and more than one output file may be produced when the information for this spatial entity is exported. Consequently, no spatially oriented columns are shown, because the name and number of columns necessary to portray spatial characteristics vary depending on spatial format.

This table is documented in order to show attributes that will always be available when working with the corresponding spatial entity in a GIS. These attributes have two purposes. One purpose is to identify each instance of the corresponding spatial entity. The other purpose is to identify each instance of the corresponding tabular entity. The tabular entity corresponding to a map unit polygon is represented by a record in the Map Unit table.

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SSURGO 2.3.2
Tables and Columns

Table Physical Name: mapunit
Table Label: Mapunit

Seq	Column Physical Name	Column Label	Logical Data Type	Physical Data Type	Not Null?	Size	Precision	Minimum	Maximum	Units of Measure	Domain Name
1	musym	Mapunit Symbol	String	Varchar	Yes	6					
2	muname	Mapunit Name	String	Varchar	No	175					
3	mukind	Kind	Choice	Varchar	No	254					mapunit_kind
4	mustatus	Status	Choice	Varchar	No	254					mapunit_status
5	muacres	Total Acres	Integer	Int	No			0		acres	
6	mapunitlfw_l	Low	Integer	Smallint	No					meters	
7	mapunitlfw_r	RV	Integer	Smallint	No					meters	
8	mapunitlfw_h	High	Integer	Smallint	No					meters	
9	mapunitpfa_l	Low	Float	Real	No		1	0.1	10	acres	
10	mapunitpfa_r	RV	Float	Real	No		1	0.1	10	acres	
11	mapunitpfa_h	High	Float	Real	No		1	0.1	10	acres	
12	farmlndcl	Farm Class	Choice	Varchar	No	254					farmland_classification
13	muhelcl	HEL	Choice	Varchar	No	254					mapunit_hel_class
14	muwathelcl	HEL Water	Choice	Varchar	No	254					mapunit_hel_class
15	muwndhelcl	HEL Wind	Choice	Varchar	No	254					mapunit_hel_class
16	interpfocus	Interpretive Focus	String	Varchar	No	30					
17	invesintens	Order of Mapping	Choice	Varchar	No	254					investigation_intensity
18	iacornsr	IA CSR	Integer	Smallint	No			5	100		
19	nhiforsoigrp	NH Forest Soil Grp	Choice	Varchar	No	254					nh_important_forest_soil_group
20	nhspiagr	NH SPI Agr	Float	Float	No		1	0	100		
21	vtsepticsyscl	VT Septic System	Choice	Varchar	No	254					vt_septic_system_class_2007
22	mucertstat	Map Unit Certification Status	Choice	Varchar	No	254					mapunit_certification_status
23	lkey	Legend Key	String	Varchar	Yes	30					
24	mukey	Mapunit Key	String	Varchar	Yes	30					

The Mapunit table identifies the map units included in the referenced legend. Data related the map unit as a whole are also given.

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Oregon Soils Data Standard
Soils Framework Implemention Team
Version 2.0