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Using the Web Soil Survey: An Online Tool from the USDA

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Introduction

Soils vary across a landscape according to soil-forming factors present in a particular location. To help those involved in land management and planning, the U.S. Department of Agriculture launched the National Soil Survey in 1899 to systematically map changes in soils across the country.

Results were originally organized by county, and the mapping results published in county soil surveys. While the paper surveys were useful, one had to use several maps at different scales to locate the soil-map units for a site-specific location, then cross-reference the mapping unit to tables provided in the survey to obtain information on soil properties. Today, county soil survey information has been converted to a digital format known as the Web Soil Survey (WSS), which is accessible to the public via the Internet.

The WSS provides the USDA's official soil survey data and information in a digital format. The tool was developed and is maintained by the USDA's Natural Resources Conservation Service (NRCS). Information in WSS is generated from the National Cooperative Soil Survey conducted by NRCS. The WSS can provide user-defined, site-specific information on soil properties that can be useful for agricultural producers, conservation professionals, scientists and others.

It is important to note that the accuracy of WSS is determined by the scale of the soil map. Most soil surveys are conducted at a scale of 1:20,000; reading soil data and maps should be performed at the same scale to ensure accuracy. A major advantage of WSS over the original paper surveys is that data can be extracted in digital formats, which can be imported directly into a geographic information system (GIS). The information can then be spatially aligned with other digital information, such as maps, satellite imagery, photographs, and user-specified geographic coordinates obtained from global positioning systems, or GPS. This allows land-resource managers to efficiently aggregate information tailored to a specific purpose or location. For example, agricultural producers can overlay crop yield maps created with yield monitors with WSS information to determine how different soils may affect crop production.

Using the Web Soil Survey

Web Soil Survey can be accessed online at websoilsurvey.nrcs.usda.gov. Click the "Start Web Soil Survey (WSS)" button to open the tool. You do not need an account to use the tool and all data can be downloaded free of charge.

Reports are generated as PDFs, which can be viewed in the browser or downloaded, and GIS data can be downloaded as a ZIP file.

Defining an Area of Interest

The first step to acquiring information from WSS is to define an

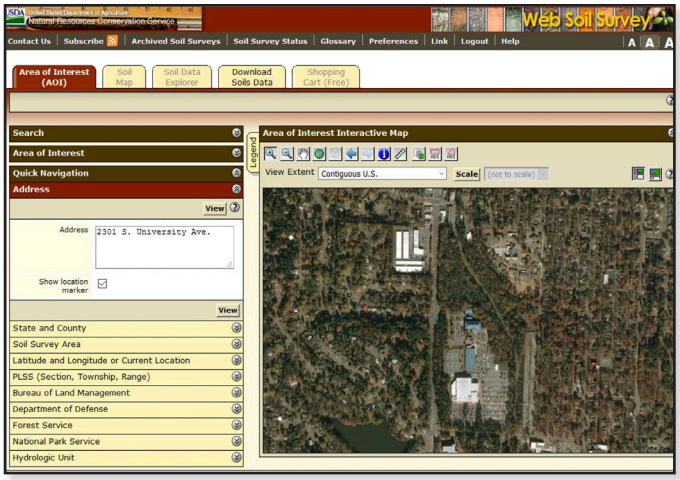

Figure 1. The area of interest (AOI) interactive map and navigation toolbar.

area of interest (AOI). There are a number of ways to do this. The AOI interactive map is first displayed when opening Web Soil Survey (Figure 1). You can navigate to your AOI using the zoom and pan features, or you can enter an address, current location, latitude/longitude, or select from a number of predefined areas, such as hydrologic unit, state, county, and government entity specific boundaries (e.g., National Park Service, Forest Service, Bureau of Land Management, and Department of Defense). Additionally, you can define an AOI by importing a GIS Shapefile (Figure 2).

After navigating to where you would like the AOI to be, you must define the AOI boundary by either using the Define by Rectangle (AOI) or Define by Polygon (AOI) features that are selectable on the AOI interactive map tool bar. Note that if using the Define by Polygon feature, after drawing the AOI, you must double click (or Ctrl-click) to close the polygon.

After the AOI is defined, you can then move forward in viewing and downloading the soils information and maps.

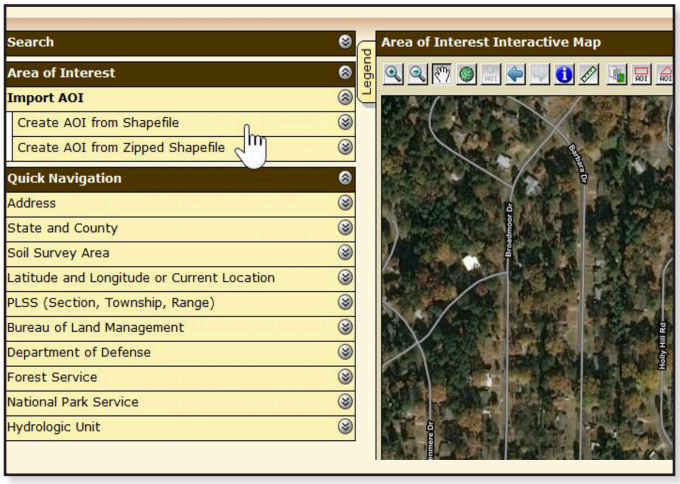

Figure 2. Options for importing an AOI from a Shapefile.

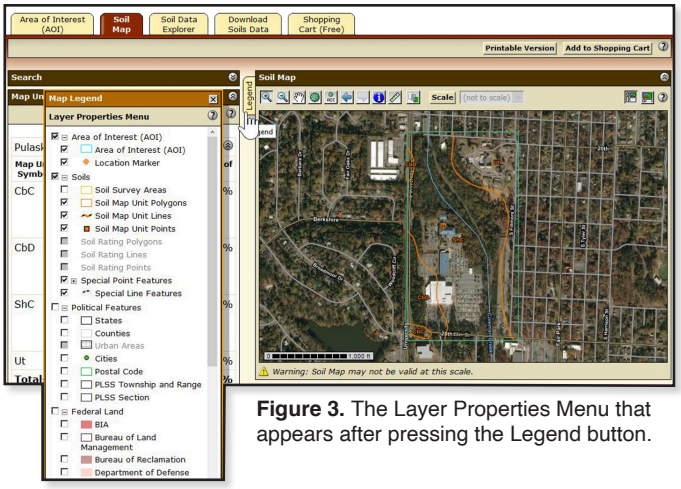

Figure 3. The Layer Properties Menu that appears after pressing the Legend button.

Soil Map

The Soil Map tab will display the soil map units that are contained within the AOI as well as their spatial distribution. The orange lines designate soil map unit divisions within the AOI, and are labeled on the map with a 2-3 letter abbreviation known as the Map Unit Symbol. You can change what layers are visible by clicking the Legend button on the left side of the map (Figure 3).

By using a ruler, you can calibrate the map scale to the monitor's screen resolution. Press the "Scale" button on the "Soil Map" toolbar to calibrate the scale. Once calibrated, press the drop down arrow by the "Scale" button to change the scale of the soil map (Figure 4). Selecting the same scale in which the data was collected (in most cases, 1:20,000) ensures accuracy of the soil data and map interpretation.

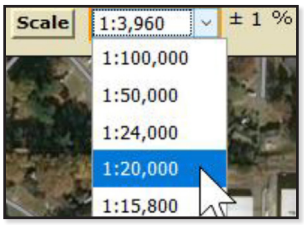

Figure 4. Selecting the scale of the map display.

A PDF version of the map, that includes the soil map unit breakdown in tabular form, can be viewed by selecting "Printable Version" at the top right of the screen (Figure 5). Note that you may need to disable any pop-up blockers for the PDF to appear. You can also "Add to Shopping Cart" if you want to put multiple features onto one report and/or customize the table of contents options that are displayed on the PDF.

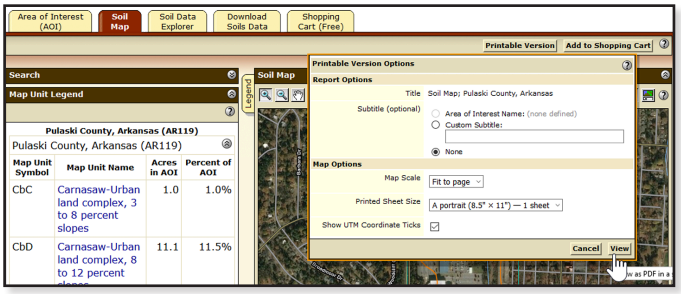

Figure 5. The Soil Map interface and options displayed when choosing "Printable Version" for a PDF report.

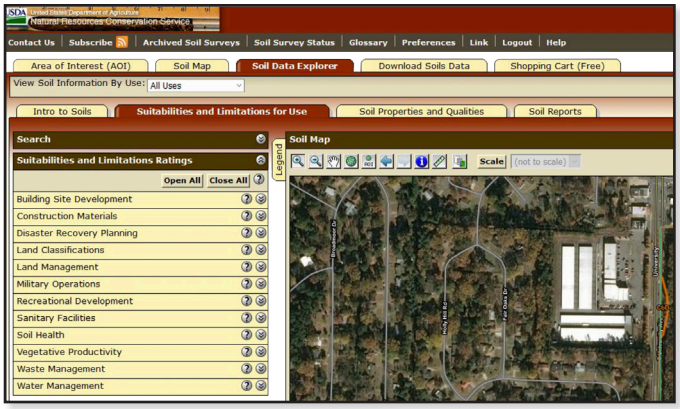

Figure 6. View of the "Suitabilities and Limitations for Use" section of the Soil Data Explorer tab.

Soil Data Explorer

Clicking on the Soil Data Explorer tab reveals four sub-tabs, opening by default onto "Suitabilities and Limitations for Use" (Figure 6). This section allows you to view ratings of the soil within your AOI with regard to certain uses, such as building site development, recreational development, soil health, waste management and many other potential uses.

Expand a category by clicking the downwards-pointing, open arrow button (). For more information about what a certain category is and how the category is rated, click the "View Description" button after selecting the category (Figure 7). Click on the "View Rating" button of a particular category to display a thematic map of that rating within your AOI accompanied by a summary table and description. As with the Soil Map, you can view a PDF version by clicking the "Printable Version" button at the top right of the screen, or "Add to Shopping Cart" if you want to display multiple reports and/or ratings at once.

The "Soil Properties and Qualities" section of the Soil Data Explorer tab displays attributes such as Soil Chemical Properties, Erosion Factors, Physical Properties, Water Features, and more. Within this section, you can view the physical properties of the soil in your AOI — percent clay, sand, silt, organic matter, and surface texture, as well as the pH of the soil, electrical conductivity, and erodibility, just to name a few examples. You can also view the depth to water table and the flooding or ponding frequency.

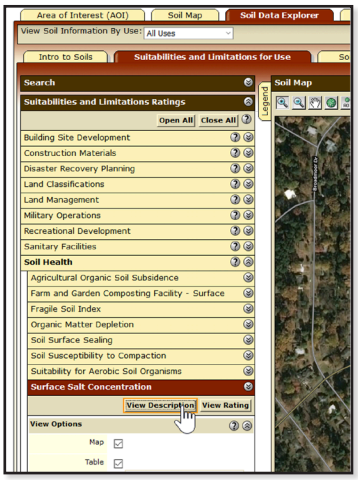

Figure 7. The "View Description" button after a category is selected will provide more detailed information on that particular category.

Most of the data and ratings are estimates or representative values, which means the value of the attribute that is expected, not necessarily measured, at this location. These values are determined from official NRCS soil surveys. Occasionally, a range is indicated by displaying three values, which represent the low, expected, and high values.

Soil Reports

While the "Soil Properties and Qualities" section of the Soil Data Explorer tab is broken down into many individual and specific components, the "Soil Reports" section consolidates those components into more encompassing categories. For example, the "Water Features" category will generate one report that includes hydrologic group, surface runoff potential, water table, ponding and flooding frequency. Likewise, the "Physical Soil Properties" report will include depth, soil texture, organic matter, bulk density, erosion factors and more. There is also an option to view a report of the "Water Quality Index (WQIag) Soil Factors," located in the "AOI Inventory" category, which will provide values necessary when using the Water Quality Index (http://wqiag.sc.egov.usda.gov/), rather than looking up these values individually. Click the "View Soil Report" button after selecting a category to generate the report (Figure 8).

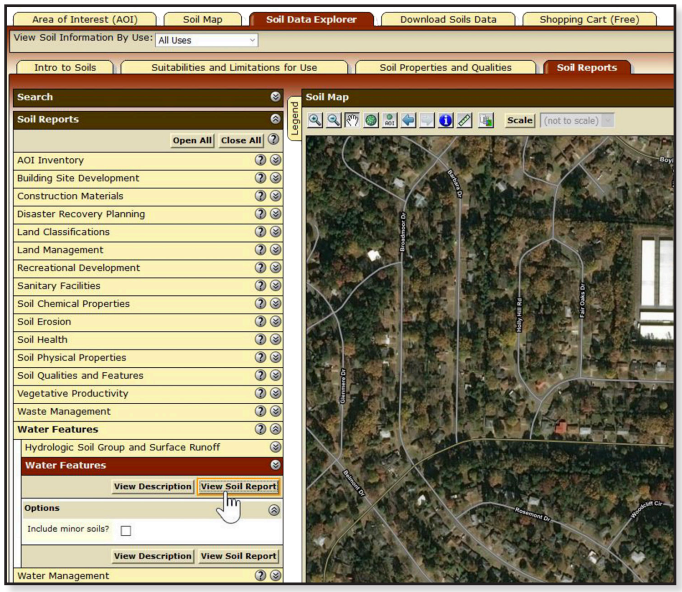

Figure 8. The "View Soil Report" button of the Soil Reports section, located in the Soil Data Explorer tab.

Download Soils Data

Click the "Download Soils Data" tab to download tabular and spatial soils data. With a defined AOI, the AOI is automatically selected by default for your data download. The tabular data format is the Soil Survey Geographic Database (SSURGO) and the spatial data format is an ESRI Shapefile. Click the "Create Download Link" button to generate a ZIP file that contains a soil

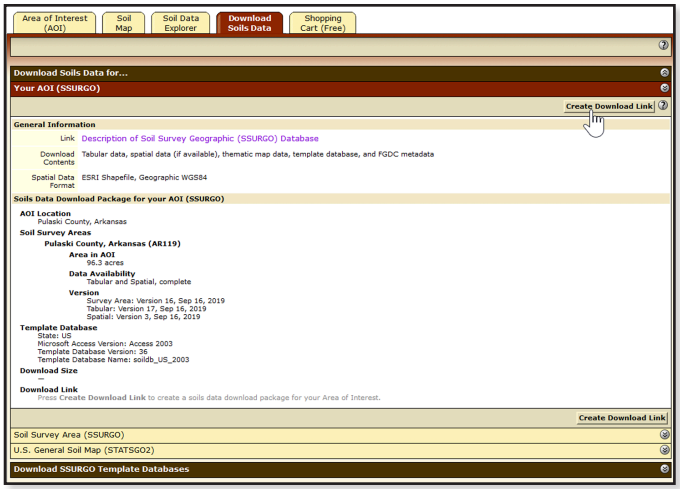

Figure 9. The "Create Download Link" button located within the "Download Soils Data" tab.

data package for your AOI (Figure 9). Alternately, you can also select "Soil Survey Area (SSURGO)" which you can define by a state or county rather than AOI (Figure 10).

Conclusion

Web Soil Survey is a useful tool that allows users to easily access a myriad of representative soils data. The customizable map area allows for specific selection of a user's desired location within the appropriate scale. The tool offers soils data in both individual components and consolidated groupings. Being able to create a PDF provides a clear, quick, and informative display of soils data. Web Soil Survey also offers a straightforward method of downloading GIS soils data for a specific location.

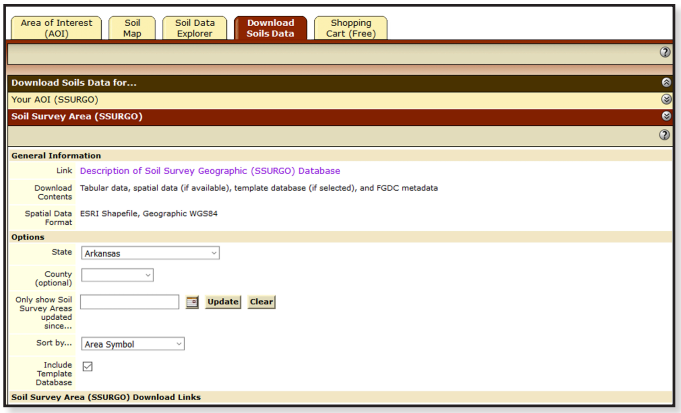

Figure 10. Selection of soils data from the Soil Survey Area (SSURGO).

References

United States Department of Agriculture, Natural Resources Conservation Service. 2020. Soil Survey. https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/survey/. Accessed on June 13, 2020.

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