National **C**ooperative **S**oil **S**urvey

Newsletter

November 2016
Issue 77

In This Issue—

Editor's Note

Issues of this newsletter are available at http://soils.usda.gov/. Under the Soil Survey tab, click on Partnerships, then on NCSS Newsletters, and then on the desired issue number.

You are invited to submit articles for this newsletter to Jenny Sutherland, National Soil Survey Center, Lincoln, Nebraska. Phone—(402) 437–5326; FAX—(402) 437–5336; email—jenny.sutherland@lin.usda.gov. ■

Santa Fe Soil Survey Crew Assists with SNOTEL Install

By Aaron Miller, soil scientist, NRCS, MLRA Soil Survey Office Santa Fe, New Mexico.

In September, NRCS Soil Scientists Logan Peterson and Aaron Miller assisted the New Mexico State Office snow coordinator with the installation a new Snow Telemetry Network (SNOTEL) station in the Jemez Mountains of New Mexico. The new site is part of the Snow Survey and Water Supply Forecasting Program of the National Water and Climate Center, which administers the automated data collection system. The new SNOTEL, named Garita Peak, was added to the network of over 800 automated data collection sites across high-elevation montane watersheds in the Western United States. In the past decade, soil moisture and temperature information, as well as full profile characterization data, has become critical to the snowpack data modelers and allowed them to produce more accurate water supply forecasts.

Every new SNOTEL install requires a soil scientist to be present to conduct the sampling and help with logistics and instrumentation of a representative site profile (fig. 1). In addition, older stations are slowly being upgraded to include the soil monitoring components. The benefits to the public, in addition to better forecast models, include a robust and growing montane soil dataset with real-time climate records. This dataset will augment the dataset from the similar-type Soil Climate Analysis Network (SCAN) stations—the only other existing and publicly available soil climate data collection. The main difference between SNOTEL and SCAN stations are that SNOTEL sites have a snow-pillow device coupled with a laser-driven depth sensor.

This equipment measures snowpack height and density, allowing a more accurate reading of snow-water-equivalent.

Logan Peterson and Aaron Miller are among the few Soil Survey Division soil scientists that States rely upon to conduct their winter snow surveys. Soils staff from the Santa Fe, New Mexico, Soil Survey Office have been helping the snow coordinator from the New Mexico State office to conduct their winter surveys since 1999 (fig. 2). This duty requires long days of travel into remote backcountry locations to sample snowpack at manual measurement sites—locations without a SNOTEL—during the last week of each winter month. Some of these sites have snowpack records dating back to the 1970s, which provide an extremely useful dataset. These data allow modelers to see long-term trends across high-elevation watersheds and to witness first-hand the effects of climate change on the snowpack and subsequent spring streamflow. In the future, most of these remaining sites will also become automated, and the days of costly, physically demanding manual course measurements will enter the ever-growing book of lost arts.

Data from the newly installed site is online at: http://wcc.sc.egov.usda.gov/nwcc/site?sitenum=1173. ■

Figure 1.—Logan Peterson (right) recording vegetation data to accompany the soil characterization sampling. Pedon S2016NM039001 is shown. It is classified as an ashy, glassy, superactive Vitrandic Argicryoll.

Figure 2.—Team members working to complete the Garita Peak SNOTEL station installation within 2 days.

Learning on an EPA NWCA Project

By Jennifer Wood, soil scientist/soil data quality specialist, NRCS Soil Survey Regional Office 2, Davis, California.

Throughout the summer, Region 2 soil survey staff worked with Environmental Protection Agency (EPA) staff on the National Wetlands Condition Assessment (NWCA) quality assurance review. This review provided both a great learning opportunity for Pathways and intern soil scientists and an opportunity to collect new information about MLRA hydrologic systems. In California, the sampling team included Phil Smith, Hanford, MLRA Soil Survey Office Leader; Rafael Ortiz, soil scientist and recent Pathways graduate; and Nelson Velazquez, soil science intern and graduate student at the University of Puerto Rico at Mayaguez, which is a member of the Hispanic Association of Colleges and Universities (HACU). Also joining the team was Rafael's mother, Damaris Vazquez, Earth Team Volunteer from Cataño, Puerto Rico (fig. 1). In Nevada, the team included Chris Savastio, Minden MLRA Soil Survey Office Leader; Matt Cole, soil scientist; and Andrea Delucchi, Pathways intern from Cal Poly San Luis Obispo, California (fig. 2). Jennifer Wood, Region 2 soil data quality specialist, and the MLRA soil scientists also provided onsite training to the EPA contract scientists to assist them in their soil description and sampling techniques.

Figure 1.—California EPA NWCA sampling team from left to right: Damaris Vazquez, Nelson Velazquez, Rafael Ortiz, Phil Smith, and an EPA contract employee.

In California, both NWCA sites were located in the same map unit delineation of an Egbert clay consociation, although they were in different positions in the map unit. The data will provide some insight into the Egbert series concept, as well as illustrating differences in hydrology across the map unit. In the central part of the unit, which is used as a flood overflow area by the nearby sewage treatment plant, the soil profile had an even distribution of pH and absence of carbonates due to the regular flushing of the soil material. On the edge of the map unit, next to an adjacent terrace, there was an accumulation of carbonates in the upper part, presumably due to more infrequent inundation and subsequent concentration of solutes due to evaporation. This catena

Figure 2.—Nevada EPA NWCA sampling team from left to right: Chris Savastio, Adriana Delucchi, Matt Cole, and EPA contract employees.

provides insight into the effect of natural and artificial inundation in this very commonly encountered and intensely managed landform type on the edge of the California Delta.

In Nevada, the quality assurance visits were conducted in two different parts of the State. Both NWCA sites were located in minor component areas of the map units, and it is hoped that the Kellog Soil Survey Laboratory data will provide support for a currently named minor component in at least one of the map units. The strongly aridic nature of the soil climate regime was expressed by the presence of a presumed natric horizon in one of the sampled sites in a backwater channel landform position. Despite apparent periods of inundation from flooding of the main channel, the evaporation and accumulation of salts appears to be a currently ongoing process in that location. ■

Laboratory Characterization Sampling for the Sequoia and Kings Canyon National Parks Soil Survey

By Jennifer Wood, soil scientist/soil data quality specialist, NRCS Soil Survey Regional Office 2, Davis, California.

During the week of June 27, Region 2 soil scientists traveled to both Sequoia and Kings Canyon National Parks to perform laboratory characterization sampling for submission to the Kellogg Soil Survey Laboratory. The soil survey area (CA792) covers both national parks, is funded by the NPS Soil Resource Inventory, and is administered by the Pacific Soil Survey Regional Office (SSR–2) under Dr. Cynthia Stiles in Davis, California. Participants on the trip were Cathy Scott, CA792 project leader; Juliet Baker, project soil scientist; and Jennifer Wood, SSR–2 soil data quality specialist.

The purpose of the sampling trip was to investigate the properties of a soil with a seasonal high water table at a depth between 39 and 78 inches (100 and 200 cm; fig. 1) that has been found in giant sequoia groves. The sampled soils developed in granitic residuum and colluvium in gently sloping and concave landform positions. This is a previously unrecognized series concept in the Sierra Nevada Mountains (MLRA 22A).

Figure 1.—Soil profile with redoximorphic features at a depth of 47 inches (119 cm) and a water table at a depth of 67 inches (170 cm).

Giant sequoias are the largest trees, by volume, in the world. They grow only in the Sierra Nevada Mountains. Most of the remaining groves are protected as State and Federal treasures. Giant sequoia groves occur in the upper part of the mixed conifer zone in the Sierras, between 6,000 and 8,000 feet in elevation, and are most abundant in concave, water-gathering areas of the landscape. While these trees are known to prefer these areas of abundant moisture and moderate temperature, there has been a question about whether soil properties can also help predict giant sequoia distribution. We do not know if these seasonal water tables are unique to the sequoia groves in the Sierras. Sequoias do grow in steeper locations with no seasonal water table, but we presume that these areas are populated with sequoias due to their proximity to the concave positions that act as nursery areas.

Future work to explore this question will include defining the topographic characteristics of sequoia grove areas and identifying where these characteristics occur across, and outside of, the parks. This will help us investigate whether similar soil hydrologic features occur in those areas and whether or not they are unique to the presence of giant sequoia groves across MLRA 22A. ■

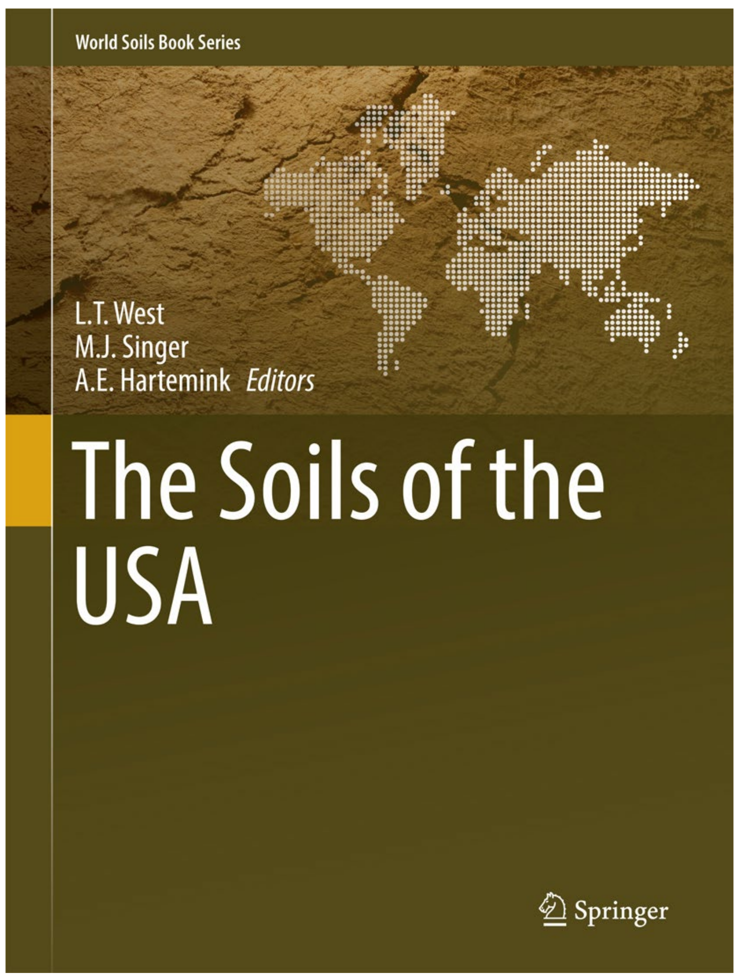
Figure 2.—Cathy Scott (left) and Julie Baker (right) excavating a pit in a giant sequoia grove.

The Soils of the USA—New Release in the World Soils Book Series

By Susan Southard, soil scientist, NRCS, Davis, California.

On November 8, at the Soil Science Society of America (SSSA) national meetings in Phoenix, Arizona, Springer Publishers orchestrated a book launch for the new publication *The Soils of the USA*. It is the first book with comprehensive coverage of the soils of the U.S. published since 1936, according to a Springer press release. The editors-in-chief and some chapter authors and contributors were on scene for the big reveal. Dr. Larry West, retired NRCS soil scientist and former lead of the Kellogg Soil Survey Laboratory in Lincoln, Nebraska; Dr. Michael Singer, soils professor emeritus from the University of California, Davis; and Alfred Hartemink, professor of soils, University of Wisconsin, Madison, served as the book editors. Many National Cooperative Soil Survey partners, NRCS employees who contributed to the book, and other interested individuals had the opportunity in Phoenix to meet publisher representatives and also had a chance to exchange stories on the effort to get the book completed.

The first four chapters give a broad overview of soil science, soil formation, soil survey, soil properties, and soil classification. The rest of the book is divided up into chapters based on the broad land resource regions and major land resource areas. The final chapters provide insights into human land use, soil change, and future challenges and directions for soil science, soils research, education, and soil survey. The book contains 285 color and black-and-white images, graphs, block diagrams, and maps (many of which were originally prepared for soil survey manuscripts and presentations as part of the National Cooperative Soil Survey efforts from all over the country).



The Soils of the USA is part of the Springer Publishing World Soils Book Series, which publishes books containing details on soils of a particular country, bringing together soil information and soil knowledge in a concise and reader-friendly way. For more information visit: http://www.springer.com/. ■

Latest Version of Web Soil Survey (3.2) Now Available

By Linda Greene, NRCS, Lincoln, Nebraska.

The hugely popular Web Soil Survey (WSS) website recently released its latest version—3.2. Originally introduced in 2005, the latest update provides improvements and enhancements that help users at all levels be better informed and prepared when making land use decisions. Developed by USDA, Natural Resources Conservation Service (NRCS), this web-based application provides a wealth of soils information, data, and soil survey maps—all free and downloadable. Visit and see for yourself at: http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.

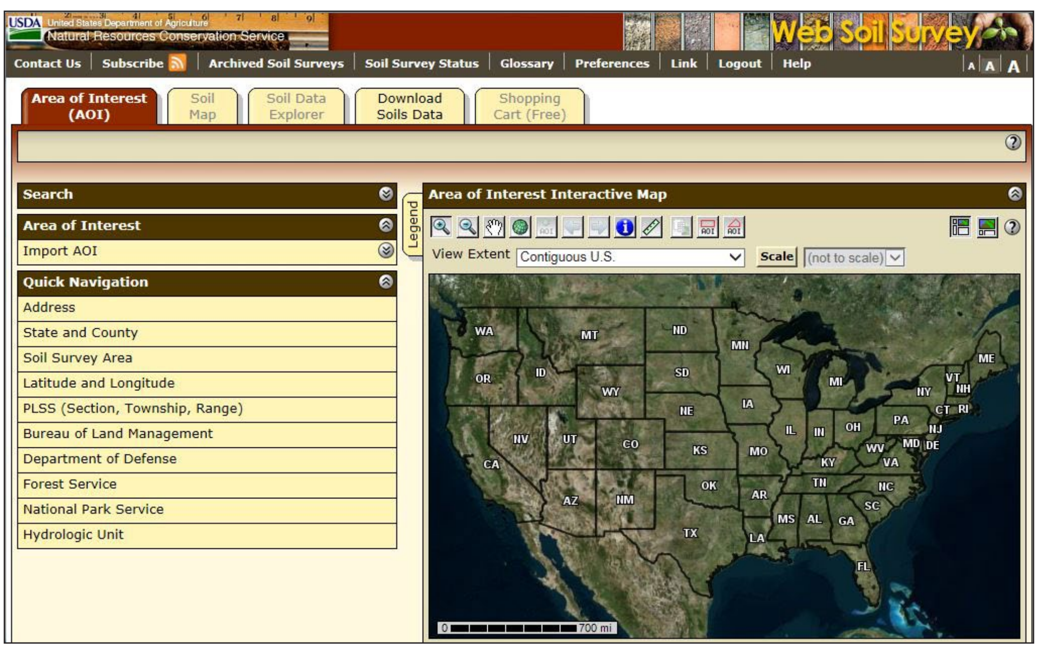
Users will be happy to learn that the 3.2 version now has a "Use Quick Map" function added to the Preferences menu. This feature allows quicker map drawing with fewer limitations. Other improvements and enhancements include:

- Internet Explorer v.11 is now the minimum standard for WSS. Chrome and Firefox can also be used.
- Areas of interest (AOI) can now be imported for use in WSS, along with field names to identify the various parcels.
- Thematic maps created for the AOI can now be downloaded using a WMS or a WFS service to use on a local GIS software application.
- AOI downloads now contain the thematic maps created during the session.
- Scale warnings are now displayed on the screen and on printed maps whenever the user zooms beyond the scale of mapping.

All WSS 3.2 new features and fixes can be seen at: http://websoilsurvey.sc.egov.usda.gov/App/NewFeatures.3.2.htm

Since its beginning, Web Soil Survey has attracted a wide array of online visitors from all over the world. During its first few months, the site averaged a respectable 1,000 users per day, but now it averages more than 7,000 users a day. As a soil science, web-based application, it is easy and intuitive, giving the novice users the ability to get started and achieve their objectives.

Soil surveys and all the data and maps needed to produce them provide critical information for land use decisions, both on the farm and in the city. Whether a



developer is looking to purchase land or a farmer is considering alternative crops, soil survey data is a critical element in the equation to produce profits while protecting natural resources.

Providing soil information to anyone with a computer has been a major achievement for NRCS. The agency remains committed to continuing the effort and anticipates that the customer base will continue to grow as the agency continues to make the site better and better. ■

Web Soil Survey FY–2017 Refresh: By the Numbers

By Paul Finnell, NRCS soil scientist, Lincoln, Nebraska.

The Web Soil Survey is the most frequently accessed USDA web portal. It is fed by the multi-billion dollar value NASIS database system. The FY–17 soils refresh data is now complete and available on the Soil Data Mart and the Web Soil Survey.

The humble beginning of Web Soil Survey was as a “soft release” in August 2005. It was a cooperative effort in which the software and data were hosted on the ESRI web farm. In January 2006, WSS was moved from the ESRI web farm to the NRCS web farm. From that early beginning, the following was a “green sheet” estimate of potential usage: *Web Soil Survey was released in August 2005 providing easy user access to soil survey maps and tables for about 3/4 of the country and is 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 and the number of first year unique visitors will exceed the number soil survey copies printed in the last 6 years. Additional functionality and information will be added to Web Soil Survey over the next year, reducing the number of hard copies that will need to be printed and decreasing the time it takes to make the information available to the public. (Estimating a total of 3,300 survey hardcopy publications, multiplied by the approximately 1,000 copies produced per survey is about 3.3 million total books since 1957).*

The growth has far exceeded those early expectations. After 10 years, WSS has become the number 1 USDA web portal providing soils information to an international community. The above statement was updated to read: *In 2015, the Web Soil Survey website logged over 2.9 million user visits (a 7.15 percent increase over 2014) and averaged over 242,000 visitors per month. Over 524,000 customized soil reports for individual small portions of the country were developed through Web Soil Survey in 2015 (a 4 percent increase from 2014). At the end of 2015, the total number of visits to the website since its initial release in 2005 topped 18 million. Working in conjunction with Microsoft Bing, the revised application now displays soil map unit delineations overlain on Microsoft Bing imagery. Users can view summaries of soil types for any geographic location where NRCS soil data exists. Detailed information on the named soils is now seamlessly linked and formatted within the application.*

There has been a substantial increase in the number of horizons and components, as shown in Table 1.

Table 1.—Total Number of Records per Annual Refresh

Records	FY–17	FY–16	FY–15
Legends	3,270	3,263	—
Map units	306,558	305,165	303,815
Components	1,043,057	1,022,195	966,616
Horizons	3,173,354	3,043,776	2,829,698

The past 5 years have been spent on the specific Soil Data Join Recorrelation (SDJR) Initiative, which focused on evaluating map units within the MLRA, harmonizing and updating the information to today's standards, and identifying the future workload. Of the 313,000 total map units, over 65,000 map units were reviewed and condensed to almost 15,000 map units with over 650,000,000 acres reviewed. That is a significant accomplishment! The 2012–2016 SDJR Initiative may be complete, but there is still work on the remaining 1.6 billion acres to complete the initial mapping and continue the evaluation. Initial mapping also remains a priority. The SDJR Initiative was created to evaluate the initial mapping to identify future workload and the specific work needed to improve the soil survey inventory. Post-SDJR projects are to be designed to clearly identify what work is necessary (on the map unit or landform) and the specific locations to collect that needed information. After the 5-year SDJR Initiative, over 645 million acres have been improved (see table 2).

Table 2.—SDJR Initiative Accomplishments (as of August 1, 2016)

Year	SDJR map unit acres
2011	284,001
2012	14,427,075
2013	101,510,290
2014	185,324,790
2015	196,076,535
2016	147,717,008
Total	**645,339,699**

Other accomplishments include:

- The SDJR Initiative reduces the number of duplicative map units in the NASIS (transactional) database. This is an overhead reduction providing over 19,000 fewer map units to maintain and populate:
    - 53,536 traditional map units before SDJR;
    - 12,690 harmonized MLRA map units after SDJR; and
    - 40,846 duplicative map units reduced.
- Of the 3,262 surveys, 2,840 surveys have been impacted by the SDJR Initiative, leaving only 422 untouched by SDJR.
- Over 11,200 SDJR projects were developed during the 5-year SDJR Initiative.
- Over 22,000 unique map unit names have been harmonized.
- Before the SDJR Initiative, there were commonly two and sometimes three components in each map unit—typically one or two major components and one minor component. These major components each had an average of three layers populated with limited soil properties.
- After the SDJR Initiative, there are an average of five fully populated components in each map unit with six or seven horizons of fully populated soil property data.

The 5-year SDJR Initiative, 2012–2016, has made significant positive changes in the data as shown by comparing figures 1 and 2.

Soils staff can use these data to publish local and State news articles on the updated soil survey. Images contrasting the changes in FY–17 refresh to a previous year are very educational. Talk to the regional directors and soil survey leaders in your State to gather ideas on map units that showcase improvements in "political boundary joins" or improvements on "soil horizons and its properties" or "specific interpretations" pertinent to your State. Provide images to your State leadership team to explain the improvements being made in the soil survey. Showcase the changes from the historical three soil "layers" to today's standard using soil "horizons." Whatever method chosen to educate people about soils, it is imperative to show the refresh with the new and improved data as the NRCS Official Soil Survey Data. ■

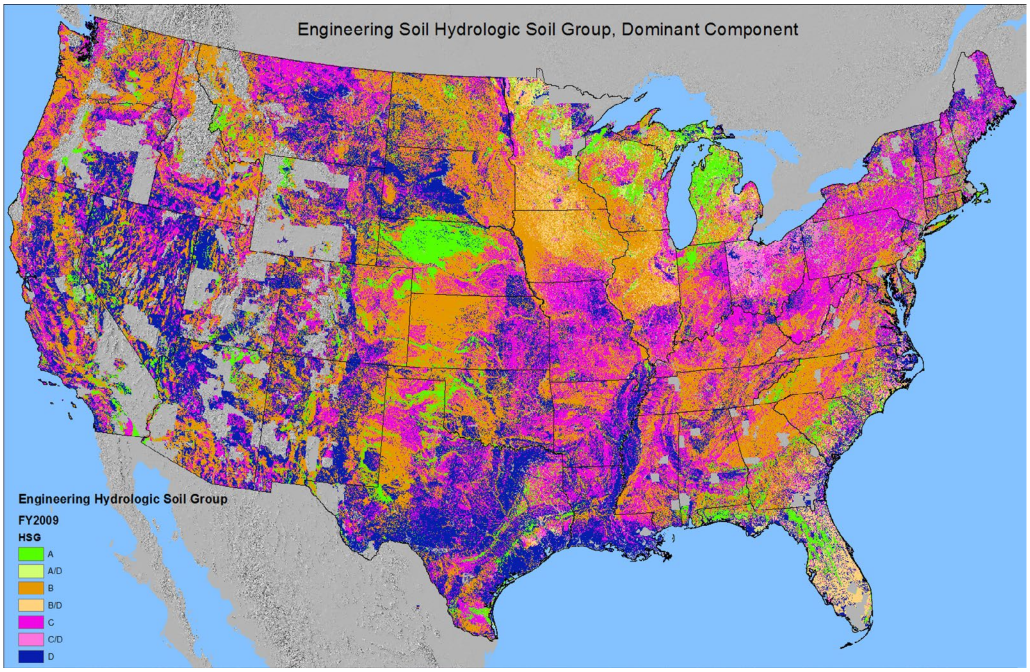


Figure 1.—Map of FY–2009 Engineering Soil Hydrologic Soil Group, Dominant Component.

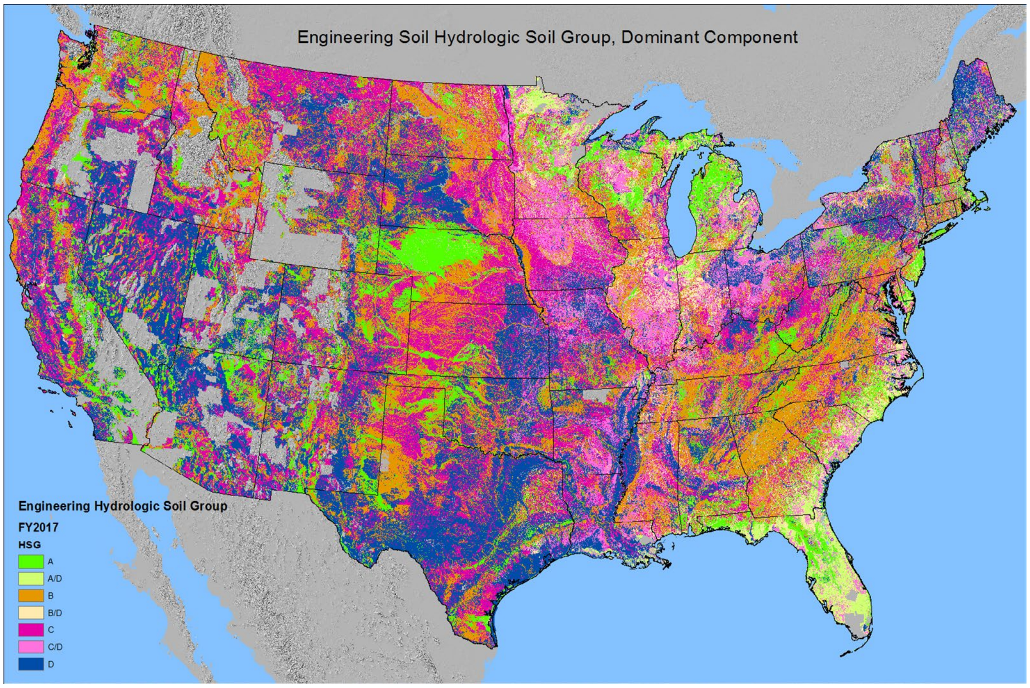


Figure 2.—Map of FY–2017 Engineering Soil Hydrologic Soil Group, Dominant Component.

Use of X-Ray Fluorescence in Urban Soils

By Edwin Muñiz, soil scientist, NRCS, Somerset, New Jersey.

The portability of X-Ray Fluorescence (XRF) technology has made it possible to deliver onsite soil interpretations for use and management in urban soils. In the XRF method, material is exposed to an X-ray beam and the emitted energy is simultaneously detected in the form of fluorescence characteristic to each element. In addition to studies on trace metals, XRF has been used in evaluating pedogenic processes, physical and chemical soil properties, plant tissue, and other applications. However, in this study the focus was on trace metals and their spatial variability. Spatial variability is a result of land use history, the effects of the surrounding environment, and what is transported and deposited by runoff and the prevailing winds.

In order to capture the spatial variability in a study area, it is necessary to develop a consistent but dynamic method that can be adjusted to multiple scenarios. The collection of information at two or more depths is advisable in order to capture vertical variability within the root zone and to determine the potential for leaching losses. Typically, the assessment starts in the office. Staff look at aerial photographs and topographic and geologic maps, compile information of past land use, and plan for the density of data collection. The history of the area is important not just for data collection but for safety as well. For example, the site may be a reclaimed landfill, or a smelting factory may have been on or near the site. In the majority of the cases, it is a residential area surrounded by parks and businesses.

The data collection density can be adjusted on site based on the concentrations of trace metals found in the first few readings and by the soil composition and consistency. In our experience, there is always a possibility of finding higher concentrations of trace metals, as well as higher pH levels, when the soil material is mixed with construction debris. In addition to XRF readings, collecting a few pH measurements is recommended, as this can provide an idea of metal mobility.

The following is an example of vertical and horizontal spatial variability and the correlation with construction debris. In this study, the density in data collection was not too high since it was possible to make a good correlation between XRF readings and the type of soil material from the beginning. Figure 1 shows the total lead (Pb) concentrations in the soil surface (left) and subsurface (right) and how the

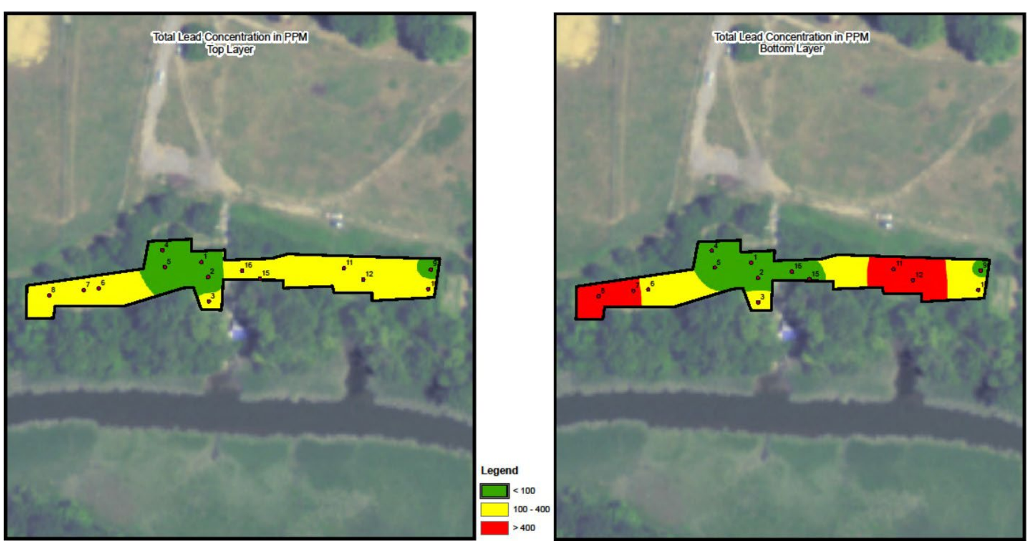


Figure 1.—Spatial variability for total lead concentration at two depths.

concentration increased with depth. Figure 2 shows the density of anthropogenic coarse fragments (artifacts) on the soil surface. Even those areas with Pb concentrations between 100 to 400 ppm are still suitable for growing vegetables if

Figure 2.—Anthropogenic coarse fragments on the soil surface. (Photo by Richard Shaw, New Jersey State Soil Scientist)

some best management practices (BMPs) are followed, such as using mulch as a barrier with bare soil. When construction debris was found in the soil profile (fig. 3), the concentration of total lead was greater than 400 ppm. In this case, the soil in this area is not recommended for food-crop production. However, alternative uses are recommended, such as using raised beds lined with landscape fabric and filled with clean soil or creating flowerbeds for pollinator habitat.

In conclusion, portable XRF is an excellent soil-screening tool that rapidly provides the type of information needed in the urban environment to make responsible decisions on use and management. ■

Figure 3.—Anthropogenic coarse fragments in the soil profile. (Photo by Richard Shaw, New Jersey State Soil Scientist)

Geophysical Investigations 1983 to 2015: Online

By Jim Doolittle, NRCS, retired.

The National Soil Survey Center has put together a posting of several of my trip reports covering geophysical investigations from 1983 to 2015. During this period, I worked in all 50 States, Puerto Rico, Guam, the Northern Marianas, and several foreign countries (Canada, El Salvador, Jamaica, and Israel). The trip reports document the development of ground-penetrating radar (GPR), electromagnetic induction (EMI), and associated technologies in soil surveys, soil investigations, and archaeological and engineering projects. They are arranged in separate folders by year, State, and activity. In the “activity” folder are trip reports discussing 48 types of field investigation using EMI and 59 types of field investigation using GPR. While the focus is on soils and soil surveys, field investigations run the gamut from agricultural waste monitoring to wetland restoration and involve such novel endeavors as the detection of animal burrows, human bodies, buried ordnance, and tree roots; the examination of failed septic tanks and rural abandoned mines; and the management of golf greens and vernal pools. Unfortunately, some of the earlier reports are missing, including the records of the pioneering GPR work of the Soil Conservation Service in the soil surveys of Florida (1981–1985). Reading through these files, one will appreciate the considerable advances that have been made in instrumentation, computational capabilities, data processing, interpretative and display systems, and the expanding integration of these geophysical tools with other technologies (e.g., field computers, global positioning systems [GPS], and geographical information systems [GIS]). The names of soil scientists that participated in investigations are included in each report.

These reports can be found at: [http://go.usa.gov/xKeQb.](http://go.usa.gov/xKeQb) ■

Over the last 35 years, significant advancements have been made in GPR and EMI technologies and in soil data collection and interpretation. Once interpreted by hand on strip charts in the field (A), GPR data are now interpreted in the office using sophisticated processing software (B). Once recorded by hand on surveyed grids (C), EMI data are now recorded on-the-fly using data loggers, GPS, and highly mobile platforms (D).

“Pedon Vault” for ESRI Survey123 Mobile App

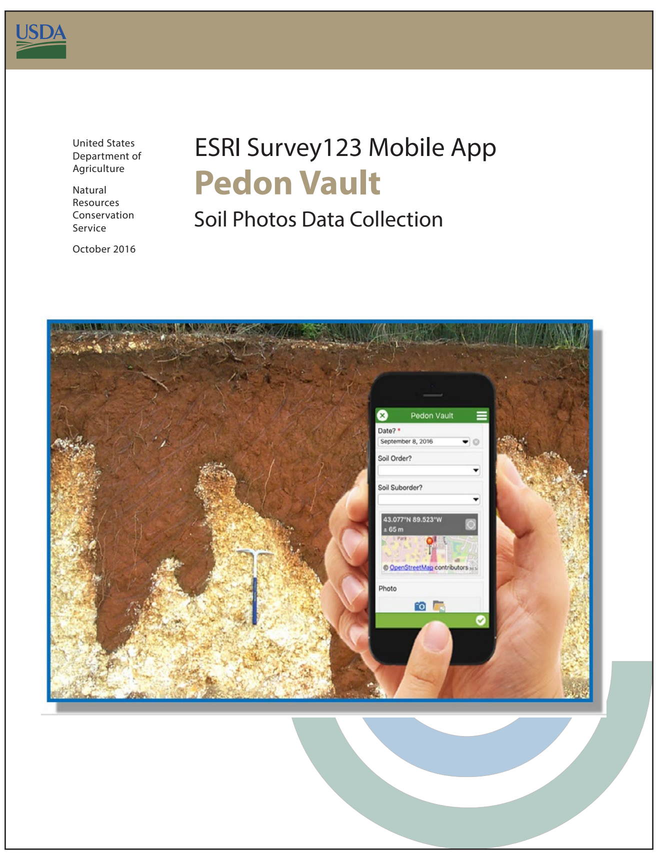
By Linda Greene, NRCS, Lincoln, Nebraska.

USDA, Natural Resources Conservation Service, Wisconsin, and NRCS, National Soil Survey Center, Lincoln, Nebraska, have developed and made available a new application entitled “Pedon Vault.” The first of its kind, the new app offers a national database of field sites that display good soil profile exposures and accompanying data.

The application can display a large collection of three-dimensional soil samples and the characteristics of the samples’ horizons. Pedon Vault gives users nationwide a method to share data by populating a national database of sites. It can be used by educators, scientists, farmers, landowners, schools, soil judging teams, and many others, according to Jason Nemecek, Wisconsin State Soil Scientist. According to Nemecek, the app records soil exposures across the country and populates a national database. Interested users can identify field sites that demonstrate good soil profiles with accompanying data.

Pedon Vault also offers valuable insight into soil profiles and is a great step toward citizen scientist involvement with the national soils program. According to Dave Hoover, NRCS National Leader for Soil Business Systems, the app allows users to download and keep local surveys for review and use. They also are able to record, document, and upload photos and to share and update soil profile data around the country. Users can pinpoint locations using location panels, full screen maps, and latitude and longitude for current locations. Map and text settings are customizable.

A step-by-step user guide to the application is available as a downloadable PDF. The guide is online at: http://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=nrcseprd1295214&ext=pdf. ■



Hardcopy Publications

By Linda Greene, NRCS, Lincoln, Nebraska.

Good News! The Spanish translation of the 12th edition of the *Keys of Soil Taxonomy* is now available in hard copy. Previously, this 12th edition was only available online as a downloadable PDF.

Also, the English version of the *Keys to Soil Taxonomy,* 12th edition, and the *Field Book for Describing and Sampling Soils* were reprinted. Hardcopies are again available.

You can order any or all of these publications by contacting the NRCS Distribution Center at (888) 526-3227 or https://nrcspad.sc.egov.usda.gov/distributioncenter/. ■

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