National Cooperative Soil Survey Newsletter

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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. ■

The 2018 NCSS Regional Conferences are Underway!

West Region

The Western Regional Cooperative Soil Survey Workshop was held in Tucson, Arizona, on May 20 to 25, 2018. The theme of the conference was "Soil, Air, Water, and Conservation Innovations." It was hosted by the Natural Resources Conservation Service, Bureau of Land Management (BLM), U.S. Forest Service (USFS), and University of Arizona.

Highlights of the conference included:

- A pre-conference field tour to the Sonoran Desert, the Madrean Evergreen Woodland, and the Catalina Critical Zone Observatory
- Presentations on dust and human health factors associated with soils and soil survey
- Committee meetings for Soil Survey Standards, Research Needs, Applied Technology, Soil and Ecosystem Dynamics, and Bylaws
- Reports on the national update of Agriculture Handbook 296 on major land resource areas
- Reports from Federal partners, such as BLM, USFS, National Park Service, U.S. Fish & Wildlife Service, and Bureau of Indian Affairs
- A field tour of the Las Cienegas National Conservation Area, Mesquite Management, Prairie Dog Conservation, and the Sonorita Vineyards

More information can be found at: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/partnership/ncss/?cid=nrcseprd1355810.

Northeast and South Regions

The 2018 Joint Northeast and South Regional Cooperative Soil Survey Workshop will be held June 24 to 29 in Summersville, West Virginia. The workshop will be hosted by West Virginia NRCS, U.S. Forest Service – Monongahela National Forest, West Virginia University, and West Virginia partners in collaboration with North Carolina NRCS, North Carolina State University, and North Carolina partners.

The steering committees of both the Northeast and South Regional Conferences decided to collaborate and hold one joint event. The event's location, Summersville, is in central West Virginia, within NRCS Major Land Resource Area 127–The Eastern Allegheny Plateau and Mountains. MLRA 127 extends 382 miles from north to south. It ranges in elevation from about 1,000 feet in the lowest river valleys to almost 4,900 feet at Spruce Knob, which is the highest elevation in West Virginia. The New River Gorge and the New River, which formed the gorge, are a short distance south of Summersville. The gorge and the local soils will be the focus of one field tour.

The workshop location was chosen because it is in an area of the State in which the three West Virginia hosts have various active projects. The workshop agenda reflects the increased diversity of interests of both the host and participating States. The New River watershed begins in North Carolina and ends in West Virginia. This river connects the two host States at a landscape level.

Workshop topic highlights include:

- Overviews of current soil and ecology work within the East
- Field trips viewing soils and landscapes of the Central Appalachian Region: High Elevation Red Spruce, Vernal Pools, and the New River Gorge ecosystem
- Interaction with Federal and academic partners that work with soil survey and ecological landscape-scale inventories
- The latest science in digital soil mapping and other soil mapping techniques
- Career and resume building skills and USA Jobs Workshop

The last topic is part of the student agenda, which focuses on activities of interest to students. Its goal is to attract students to the workshop and expose them to the NCSS with the hope that they will consider careers in soils and ecology. The workshop also offers opportunities to network with collegiate peers and future professionals of multiple Federal and State agencies.

More information about the workshop and how to register can be found at: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/partnership/ncss/?cid=nrcseprd1350810.

North Central Region

The 2018 North Central Cooperative Soil Survey Workshop will be held July 9 to 13 in Brookings, South Dakota. The theme of the conference is "Soil Health and Soil Salinity—NCSS Cooperation in Action." The workshop will be hosted by South Dakota NRCS and the South Dakota State University.

Workshop topic highlights include:

- Field trips viewing fens, worm-worked soils, dairy farms, EROS Data Center, drones, and soil health
- Information exchange among academic, State, and Federal partners in soil survey
- Professional presentations on the latest science in soil survey

Onsite registration starts on Monday, July 9. The workshop concludes Thursday evening, July 12. Field trips are on Tuesday, July 10, and Thursday, July 12. A formal agenda and registration information are being developed.

For more information, go to: http://www.cvent.com/events/2018-north-central-regional-cooperative-soil-survey-conference/event-summary-e0d87d3227644e4991cbaa3e79e3938a.aspx. ■

Dr. Garrett Liles (left) welcomes soil judgers to the ASA-SSSA Region 6 Contest. Photo by Irfan Ainuddin.

ASA-SSSA Region 6 Soils Contest Held in Northern California

By Phil Smith, USDA-NRCS, Hanford, California.

The American Society of Agronomy and the Soil Science Society of America's Region 6 Soil Judging Contest was held March 3, 2018, in Butte County, California. This was the third ASA-SSSA Region 6 Contest in as many years since being revitalized in 2016. This year's contest was coordinated by Dr. Garrett Liles, Assistant Professor of Soil Science at California State University—Chico (Chico State). Dr. Liles is also Chair Elect of the Soil Education and Outreach Division of the Soil Science Society of America. The ASA-SSSA Region 6 Soil Judging Contest capped a successful 3-day "soil-ebration" in Butte County, where Dr. Liles and Chico State hosted the California Soil Survey Cooperators Meeting and the Professional Soil Scientists Association of California's (PSSAC) annual field tour. This multi-day "soil-ebration" successfully brought together NCSS cooperators and stakeholders to exchange ideas and identify opportunities for collaboration through presentations, open dialog, and experiencing the dynamic landscapes at the interface of the Sierra Nevada and Cascade mountain ranges in the Northern Sacramento Valley. Aligning the soil judging contest with the NCSS meeting and PSSAC field tour was a very efficient and effective way for soil science professionals to connect with students majoring in agriculture, earth sciences, and related fields.

Humboldt State University debuts in Region 6 Soil Judging. Left to right: Soils Education and Outreach Division Chair Dr. Susan Edinger Marshall with students Miles Ritch, Yoselyn Ayala, and Monica Piña.

USDA-NRCS Soil Scientists Rafael Ortiz (left) and Ann Tan (right) assist PSSAC President David Kelley with distributing SSSA's "I Heart Soil" stickers and PSSAC's "I Dig Soil" stickers, which are very popular among soil judgers.

The Region 6 Soil Judging Contest marked another year of growth and popularity for this hands-on educational and skill-building experience in the western United States. This year the number of participating universities increased to four: Humboldt State University joined California Polytechnic State University (Cal Poly), California State University Fresno (Fresno State), and Chico State, all of which returned from last year's competition. The University of California at Riverside also sent students, for the second consecutive year, so that they too could gain knowledge of soils and geomorphology. Butte Community College provided the contest site, and many Butte students came to observe soil judging in action. In total, 26 students participated in the judging competition. Cal Poly won the team judging portion, and Fresno State won of the group judging event. The top five individuals were awarded trophy plaques for their individual achievements. The regional contest was also a qualifier for nationals; Cal Poly and Fresno State advanced to the National Contest, which was held in Martin, Tennessee, March 18 to 23.

Each year the ASA-SSSA Region 6 Contest has been hosted in the Golden State. California NRCS and Soil Survey Region 2 have been strong supporters, providing technical assistance and personnel to administer the contest. Private consultants, landowners, resource conservation districts, and organizations such as the Professional Soil Scientists Association of California have also provided financial and logistical support.

Soil judging in Region 6 has considerable momentum and is expected to continue to grow. New teams are expected to participate (such as New Mexico State University and UC Riverside) in next fall's regional contest, and Cal Poly has stepped up to host the 2019 national contest. With the enthusiasm and dedication of students, coaches, and home institutions, and support from USDA-NRCS as well as the private sector, the future is bright for soil judging in ASA-SSSA Region 6. ■

NRCS Region 9 Supports the 67th Annual National Land and Range Judging Contest

By Jeremy Dennis, NRCS Region 9, Stillwater, Oklahoma.

The first week of May brought just under 700 4-H and FFA members from 33 States to Oklahoma to compete in the 67th annual National Land and Range Judging Contest. Participants had 2 days of practice at designated sites in Oklahoma City to prepare for the contest. The official contest was held May 3, 2018, on land owned by the Federal Correctional Institute in El Reno, Oklahoma, located in Canadian County. The contest events fell into three categories: Land Judging, Range Judging, and Homesite Evaluation.

Soil scientists from NRCS Region 9 and the State of Texas arrived on Monday to assist the Oklahoma staff in preparation for the contest as well as provide onsite

NRCS Soil Scientists Tyson Morley, Clay Salisbury, and Steve McGowen and Amy Seiger from the Oklahoma Conservation Commission prepare pits at the official contest site.

technical assistance, and they officiated during the final contest. On Monday, practice sites were set up so that judges and coaches could view and assess the soils. Time was also allotted for the practice pits to be scored.

Tuesday and Wednesday were the practice days. Soil scientists and range management specialists assisted the students and coaches as they familiarized themselves with the Oklahoma soils and rangelands at the two practice sites. On Tuesday morning, the coaches were given the answers to the practice pits, enabling them to compare and score the results the students provided during practice. On Wednesday, as the students continued the practice session, a small group of soil scientists led by Steve Alspach, Oklahoma State Soil Scientist, set up the official contest site, which included 16 pits—4 sites with 4 pits at each site.

On Thursday morning, the students were split into groups and the official contest began. Land judging contestants entered several pits (1 to 4 feet deep) to evaluate the qualities of the soil and determine its potential for agricultural production. Range judging contestants visited several rangeland sites to identify plant species and determine the site's value for cattle production and quail habitat. The homesite evaluation event challenged contestants to determine the value of a site for residential development.

Contestants familiarizing themselves at the practice sites.

A ceremony was held Thursday evening at the National Cowboy and Western Heritage Museum to honor both team and individual winners in each category of the competition. Each category included FFA and 4-H awards.

This year the national team championship trophies in Land Judging were awarded to the FFA Chapter of Gunter, Texas, and the Barbour County 4-H Club of West Virginia. National individual championship trophies in land

Contestants (future soil scientists) make soil determinations during the contest.

judging were awarded to Dylan Taylor of the FFA Chapter of Senora, Texas, and Luke Farnsworth of the Barbour County 4-H Club of West Virginia.

The national team championship trophies for homesite evaluation were awarded to the FFA Chapter of Hico, Texas, and the Wessington Springs 4-H Club of South Dakota. National individual championship trophies for homesite evaluation were awarded to Devin Gonzales of the FFA Chapter of Hondo, Texas, and Katelyn Winberg of the McCook County 4-H Club of South Dakota.

Contestants (future range management specialists) make range determinations at the official site.

The national team championship trophies in range judging were awarded to the Hondo FFA Chapter and the Meade County 4-H Club of South Dakota. National individual championship trophies in range judging were awarded to Preston Twilligear of the Hondo FFA Chapter and Ryan Wilen of the Meade County 4-H Club.

Coaches and judges, as well as site preparation assistance, were provided by Region 9 staff, including Soil Scientists Tyler Kemph and Tyson Morley (Altus, Oklahoma); Soil Scientist Jeremy Dennis and Range Management Specialist Colin Walden (Stillwater, Oklahoma); Steve McGowen, Chris Hobbs, and Justin Morgan (Woodward, Oklahoma); and Texas Soil Scientists Richard Gelnar and Jamey Douglass. NRCS Oklahoma State Staff included Oklahoma State Soil Scientist Steve Alspach and Resource Soil Scientists Troy Collier, Clay Salisbury, Jake Boyett, and Carl Woods. Various other agencies and cooperators from Oklahoma also participated.

Steve Alspach summed up the importance of the contest very well: “These contestants represent the next generation of farmers, ranchers, conservationists, and land managers. Events like this are as much an opportunity for us to introduce high school students to a potential career with USDA as they are a STEM learning experience for them.” STEM is a curriculum focused on the disciplines of science, technology, engineering, and mathematics.

One of the local television stations filmed some of this event. To view footage, go to: http://kfor.com/2018/05/04/studying-oklahoma-dirt-the-national-land-and-range-judging-competition/. ■

Wisconsin Earth Team Volunteers Receive Awards

By Tivoli Gough (public affairs specialist) and Shaunna Repking (MLRA soil scientist), NRCS, Onalaska, Wisconsin. Pictures by Amanda Ludois, Wisconsin NRCS.

Wisconsin NRCS celebrated National Volunteer Week by thanking and honoring its Earth Team volunteers and active Earth Team NRCS employees. An appreciation ceremony was held on April 18, 2018, at the Aldo Leopold Foundation and Leopold’s farm in Baraboo, Wisconsin. The top two Wisconsin volunteers, Anna Walter and Mark Novachek, won their awards by volunteering with the Onalaska MLRA Soil Survey Office. After the ceremony, participants enjoyed a tour of Aldo Leopold’s famous land and shack, written about in *A Sand County Almanac*.

Anna Walter accepting her awards from Angela Biggs, Wisconsin State Conservationist.

Anna Walter won an Earth Team award for volunteering 691 hours in FY 17. She is also a National Award recipient for the 4,018 hours she donated during her 5 years volunteering with NRCS. Most of her volunteer work (95 percent) involved entering pedon and lab data into Pedon PC, which were then uploaded to NASIS.

Mark Novachek won an Earth Team award for volunteering 598 hours in FY 17. Since his start in June 2017, he has donated over 1,262 hours. He has spent 99 percent of that time entering pedon and lab data into Pedon PC. The rest of the time he has spent preparing lab samples, organizing paper files, and helping with random office work. ■

Soils Display Wins the PRISM Award

The American Marketing Association recognized the National Soil Survey Center's newly created exhibit with its highest recognition, the PRISM Award. The multi-use exhibit displaying soils was 1 of 160 entries competing in the category of "Trade Shows—Exhibiting." The entries were judged by industry experts, and the awards were based on numerical ratings of various aspects of the exhibits, namely, strategy, tactics, results, and quality of works.

The soils display was designed to serve both large and small exhibiting opportunities as well as have the flexibility to provide one message or several messages. This “mix and match” concept has proven to be successful and productive as the Natural Resources Conservation Service becomes more and more involved in exhibiting both as a stand-alone Federal agency and with the USDA family. Having an exhibit that can meet the needs of each trade show cuts down on costs as well as wear and tear on the support structure.

The American Marketing Association (AMA) is the pre-eminent force in marketing for best and next practices, thought leadership, and valued relationships worldwide. Visions Exhibit was the contractor that produced the exhibit and served as a guiding hand through the entire process. ■

Soils Training for Conservation Planners

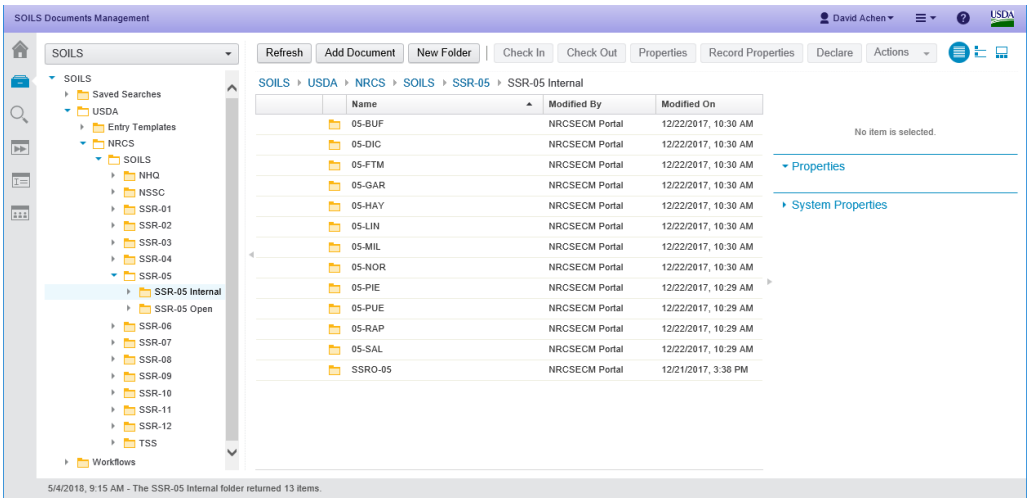
By Al Averill, NRCS State Soil Scientist for Massachusetts and Vermont.

Critical to effective conservation planning is the ability to interpret and apply soil survey information and to understand soil properties that influence soil behavior, limitations, and suitability for various uses and applications. In March 2017, a requirement for conservation planner certification entitled “Basic Soils & Web Soil Survey to Interpret Land Capabilities & Limitations” was added to conservation planner designation curricula.

Participants having fun while interpreting soil monoliths.

To meet this requirement for conservation planners in Massachusetts and Vermont, a training curriculum was developed encompassing three parts: classroom session, field session, and demonstration of ability to use Web Soil Survey (WSS).

The classroom session alternates between presentations and hands-on learning activities. Information is provided about the nature and variabilities of the soils in the participant’s locality and the concepts of drainage class, soil-landscape relationships, and soil mapping, including the various types of soil survey map units. The presentation of each topic is followed by an applicable participant activity: identification of the parent material and drainage classes of soil monoliths and the landscape locations where they would likely occur, delineation of landscapes and landforms on a topographic map of the participant’s area of responsibility, and evaluation of map unit composition, soil behavior, similar and dissimilar components, and map unit naming. ■



ECM Document Manager Training

On April 10, staffs of Soil Survey Regions 5 and 9 received training on the new Enterprise Content Management (ECM) Soils Document Manager. The 4-hour session was delivered in person and by teleconference and Skype. The participants received instruction on the use and purpose of the system and were asked to provide feedback on how to improve the system and the training. The training included PowerPoint presentations, videos, live demonstrations, and participant activities. Topics included how to upload and download files, how to use file properties to search for files, how security permissions work, and how to find instructional materials.

Enterprise Content Management is software that manages files and websites across a large organization. The part of the USDA ECM that is currently being rolled out to the NRCS Soil Science Division is the Soils Document Manager. The name further explains the system:

Soils—NRCS Soil Science Division and NRCS soil scientists working in technical soil services.

Document—Electronic files; for example, JPG, DOCX, PDF, and PPTX files.

Manager—Software to store, index, maintain versions, control access, share, and publish.

The goals of the document manager are to expand the range of information delivered over the Web Soil Survey and to improve document management for NRCS Soils operations. The document manager can currently be used to share files within Soils and to track quality assurance. The first phase of software development (FY 17) built the “file cabinet” to store and manage the files. The next phase will connect the virtual file cabinet to NASIS and to the WSS and other online applications. ■

New Job Aid Video for Rock and Other Fragments

A new video job aid called “How to Describe and Sample Fragments in the Field” is now available on YouTube at https://youtu.be/Wz1PhFHpsCQ. The video explains how to sample and describe rock, pararock, and other fragments in the soil and how to determine and describe the quantity of these fragments on a volume and weight basis using NCSS methods and references. The fragment content in soils is measured for several applications, including determining available water capacity, cation-exchange capacity, saturated hydraulic conductivity, and structure

and porosity. It also affects the management of the soil and is used as interpretation and classification criteria. This video was designed to improve the quality and completeness of samples being submitted to the Kellogg Soil Survey Laboratory. It was developed by the National Soil Survey Center through a cooperative agreement with the University of Nebraska—Lincoln. The Center has produced six video job aids with the University since 2011. To date, there have been almost 77,000 online views from a worldwide audience. ■

Kids Visit the NSSC

On April 26, the National Soil Survey Center played host to the sons and daughters of employees as part of the national "Take Your Child to Work Day." Children accompanied by their parents visited the Center to see what their parents do as well as learn about the Center's mission and its commitment to healthy soil. Ranging in age from 5 to 13 years, the boys and girls spent the afternoon visiting administrative and lab staff. They also got the chance to experience working with soil in some hands-on activities. ■

Skye Wills shows second graders how soil acts as a filter, helping to improve our water supply.

Outreach Program Continues

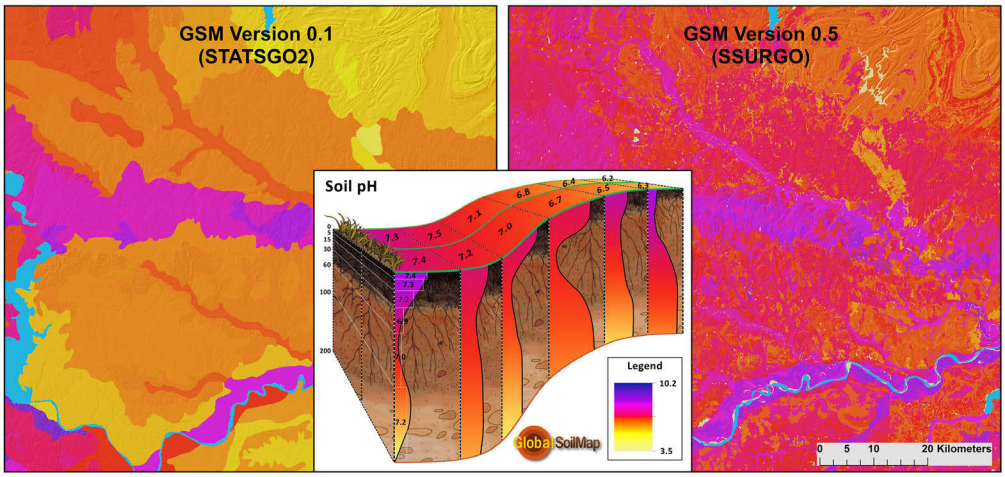
The National Soil Survey Center (NSSC) once again participated in the "Soil Day" activities for Roper Elementary School, in Lincoln, Nebraska. Staff from both the Center and the Nebraska State Office invited all six second-grade classes to join in a learning experience that showed the importance of soil and how it impacts their daily lives.

Skye Wills, NSSC soil scientist, introduced the children to the infiltration process and how soil helps clean their water supply. Mike Kucera, NSSC agronomist, staffed the water cycle station and demonstrated how various farming practices can either create or eliminate the problem of erosion. Aaron Hird and Greg Shanahan, soil scientists from the Nebraska State Office, led the children in a hands-on experience in which they built their own miniature soil profile.

In Nebraska, the science curriculum starts in the first grade and continues into high school. For several years, NSSC has participated in various learning opportunities at public schools and plans to continue to make these efforts part of the Center's ongoing outreach program. ■

GlobalSoilMaps Released

The USDA-NRCS National Soil Survey Center (NSSC) has announced the release of new U.S. soil property maps. The maps meet the requirements for Tier 2 GlobalSoilMap standards by providing estimated soil properties on a block-average grid cell size of 100 x 100 meters. The estimated soil properties are organic carbon, pH 1:5 water, clay, silt, sand, coarse fragments, effective cation-exchange capacity, bulk density (for the soil fraction less than 2 mm and for whole soil), available water capacity, and soil depth. Each soil property is represented by mean



or representative values. Upper and lower limit values also are considered at 90% confidence intervals. The estimated soil properties are provided for six standard soil-thickness layers: 0-5 cm, 5-15 cm, 15-30 cm, 30-60 cm, 60-100 cm, and 100-200 cm.

The property maps are based on U.S. General Soil Map (STATSGO2, Version 0.1) and the soil survey geographic database. For areas where SSURGO is unavailable, STATSGO2 (Version 0.5) is used. The support data for GSM V0.1 and V0.5 are the same as those for gridded STATSGO2 and gridded SSURGO, respectively. However, the data processing for GSM versions follows the GSM specifications and differs from gSTATSGO2 and gSSURGO with respect to standardized soil thicknesses, which are derived from spline function, grid resolution, soil property units, and projections. The use of these data is subject to the same limitations as those specified for STASGO2 and SSURGO. The data is available at:

https://nrcsgeoservices.sc.egov.usda.gov/arcgis/rest/services/GlobalSoilMap_v01_STATSGO2
https://nrcsgeoservices.sc.egov.usda.gov/arcgis/rest/services/GlobalSoilMap_v05

Additional information on GlobalSoilMap, SSURGO, and gSSURGO can be found online at:

Description of the Global Soil Map Database
Description of the SSURGO Database
Description of the gSSURGO Database

The raster map layers can be viewed in several online web map service platforms. This allows use from a broader range of client applications (such as QGIS, ArcGIS Java Script Arc Map, Arc GIS Explorer, AutoCad Civil 3D, Google Earth, Geoportal Map Viewer, and ERDAS Apollo). The raster map layer data can be readily combined with other national, regional, and local raster layers, such as the National Land Cover Database (NLCD), the National Agricultural Statistics Service (NASS), Crop Data Layer, or National Elevation Dataset (NED).

Scientists from the NSSC in Lincoln, Nebraska; the Geospatial Data Unit and the West Virginia University in Morgantown, West Virginia; and the USGS Earth Resources Observation and Science Center (EROS) in Sioux Falls, South Dakota, developed the database. The USDA-NRCS National Geospatial Center of Excellence (NGCE) in Ft. Worth, Texas, compiled and released the database for various delivery platforms. ■

Coastal Zone Soil Survey Video

The video “Coastal Zone Soil Survey: A Pedologic Frontier” is now available on the YouTube channel of the National Soil Survey Center at https://www.youtube.com/user/nrcsnssc (Google: YouTube National Soil Survey Center). The video describes the subaqueous soil survey of Rhode River, a 1,000-acre sub-estuary of Chesapeake Bay. It demonstrates delineation of landforms from bathymetric maps, selection of transects, and description of soil cores and describes development of pedogenic models for Chesapeake Bay.

The video is an adaptation of a presentation at the 2018 Coastal Zone Soil Survey Work Planning Conference. The presentation and video were made by Barret Wessel, Ph.D. candidate at the Department of Environmental Science and Technology at the University of Maryland, with the support of Professor Martin C. Rabenhorst, Graduate Program Director.

One remarkable aspect of the video is how well it links subaqueous soil mapping to traditional mapping. It clearly illustrates that the underlying principles of subaqueous soil survey are the same as the underlying principles of traditional soil survey. To quote Barret, “Subaqueous soils in the Rhode River do correlate well with landform position, which is a continuation of the pedological concepts that have been developed over the past century or so. It’s no different. As long as you understand the soil-forming factors, then if you map the landscape you can map the soils.” ■

Reconsidering the First Soil Survey Produced in the USA—and Contemplating Future Soil Survey Products

By Tom D’Avello, Donald Parizek, David Zimmermann, NRCS, and James Thompson, West Virginia University.

Soil surveys were authorized in the United States by the U.S. Department of Agriculture Appropriations Act for fiscal year 1896. Four soil surveys were initiated in 1899: Cecil County, Maryland; the Connecticut Valley, Connecticut and Massachusetts; Salt Lake Valley, Utah; and the Pecos Valley of New Mexico. These surveys had focused objectives: the Maryland and Connecticut Valley surveys concentrated on tobacco production and the Utah and New Mexico projects concentrated on irrigation potential. These surveys were also conducted quickly. For example, the soil survey in the Connecticut Valley was started in the summer of 1899. Over the span of 3.5 months, an inventory of approximately 256,000 acres was completed. The primary objective of the work was mapping areas of “tobacco soils,” but “incidentally all soil areas were surveyed” (Dorsey and Bonsteel, 1899). The county-wide soil surveys of the early 1900s were pursued in a similar, accelerated manner.

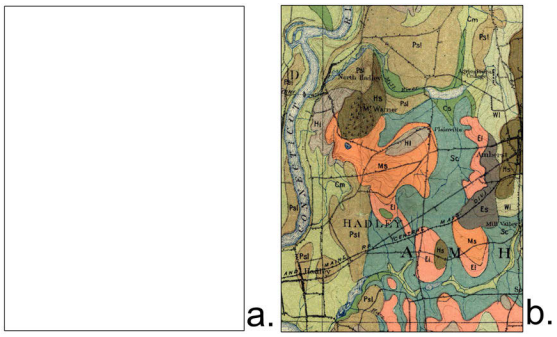


Figure 1.—Published soil knowledge of the Connecticut Valley area prior to (a) and after (b) the 1899 soil survey.

Compared to SSURGO, the original surveys are broad in spatial and taxonomic contexts. However, these early surveys were vast improvements on the prior knowledge of the soil resources of these areas and the inconsistent means that knowledge was presented to the public (fig. 1).

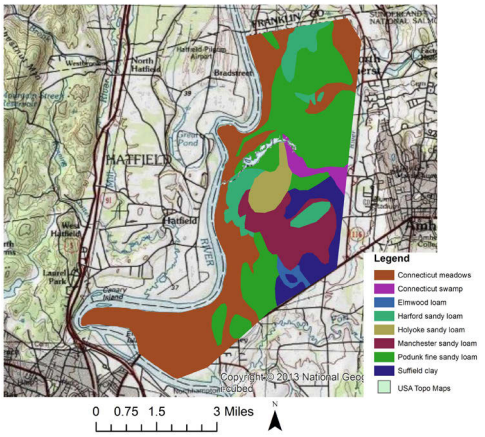
We were curious to know how the first soil survey conducted in the U.S.A. compares to present-day SSURGO (Soil Survey Staff, 2017). In order to make a comparison, field sheets from the 1899 survey were transformed using a polynomial transformation, vectorized, and attributed. The legends for both surveys were simplified to eliminate phases, and the resulting polygons with common lines were dissolved. An area of 14,805 acres in the vicinity of Amherst, Massachusetts, was clipped from both surveys to ensure common extents, and a polygon union was performed. The 1899 survey had 8 map units, and the 2017 survey had 31 phase-free map units (fig. 2, top images).

Soil scientists from Region 12 performed a correlation and assessment to rate the goodness of fit between the 1899 and current SSURGO soil map units, assigning an ordered ranking of Good, Fair, and Poor to the intersected map units (fig. 2, bottom image). The interpretation of the fit was based on a combination of soil profile morphology, parent material, and taxonomic similarity with an emphasis on the effect of overall physical and chemical properties on the suitability and limitations of the soils. The results indicate 44 percent of the area had a Good fit, 26 percent had a Fair fit, and 30 percent had a Poor fit.

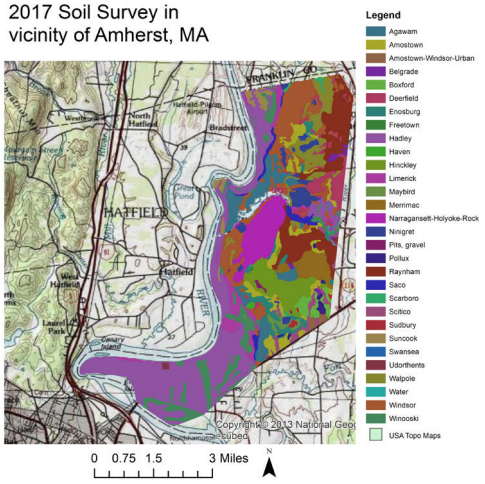
Two soil scientists completed the first survey using a horse-and-mule-drawn buggy, screw augers, blank paper, and the instruments for conducting a plane table survey (fig. 3). They were on their own with few colleagues, limited local tacit knowledge, no aerial perspective, and no predefined standards. Despite these comparatively limited tools and a mapping rate about five times greater than typical for producing the modern, progressive surveys, the first survey did a decent job about 70 percent of the time.

What does this have to do with 2018? There are still about 450 million acres of unmapped lands 119 years after the inception of soil surveys. Continuing the traditional production approach at our current staffing levels would require 40 to 50 years to complete the inventory of unmapped lands. The resulting data would be a perpetuation of the patchwork nature

1899 Soil Survey in vicinity of Amherst, MA



2017 Soil Survey in vicinity of Amherst, MA



Goodness of fit comparing 1899 and 2017 Soil Surveys in vicinity of Amherst, MA

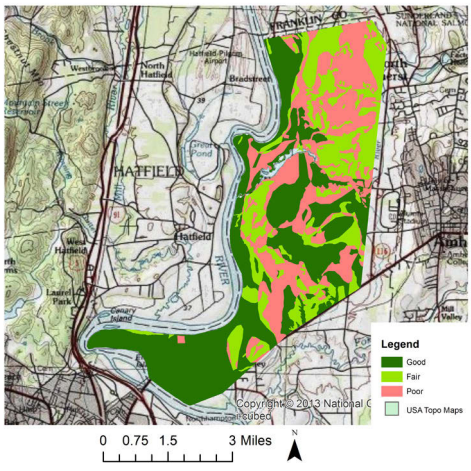


Figure 2.—Thematic soil maps for 1899 and 2017, and the comparison of the two soil surveys.

Figure 3.—An early soil survey crew from the 1899 era.

of our current product and would present the same limitations as our current vector data model. Our current challenges are analogous to the challenges presented by the 1899 soil survey of the Connecticut Valley. This area was remapped in 1981 as part of the modern, progressive soil survey and improved again to produce the current SSURGO product. If we assume that the spatial and tabular representations of the Connecticut Valley could be improved beyond the original 1899 survey, we can accept the idea that as our technology and knowledge advances, we will be able to improve beyond our 2018 soil survey products.

Our goal as the National Cooperative Soil Survey is to create a complete, consistent, correct, comprehensive, and current inventory of the soil resources of the United States. This will require mapping in new ways and at accelerated rates, becoming comfortable developing and providing multiple product lines of soil information to the user community, doing it as an iterative cycle, and improving with each repetition as our knowledge grows.

Oliver Wendell Holmes did not toil with soil scientists, but his quote is applicable to the domain of soil survey: “Every year, if not every day, we have to wager our salvation upon some prophecy based upon imperfect knowledge.” We can never attain perfection with soil survey. However, any inventory we make on previously unmapped areas will be an improvement over “no information.” Our current knowledge, tools, and institutional infrastructure can be applied to produce progressively improved versions of our soil resources, much like the knowledge represented by the first soil survey in the United States.

References

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Left image—Duck Creek study site outside Pinedale, Wyoming. Right image—The profile is composed of silty clay textures with no observed redoximorphic features. It is strongly effervescent when moist because it is approximately 75 percent calcium carbonate. Colors (using Munsell charts) are 10YR 7/1 and 10YR 8/1 in the upper part to 10YR 7/6 in the subsurface. Soil pH is 8.4, organic C content is 0.02 percent, and total Fe is 0.5 percent.

Hydromorphology of Highly Calcareous Hydric Soils in Western Wyoming

By Matthew King and Karen Vaughan, University of Wyoming.

Together with NRCS Soil Scientists (Dan Mattke, Riverton, Wyoming); Dan Perkins, Kim Cumella, Pinedale, Gabe Fancher, and Dillon Gray (Pinedale, Wyoming) and James Bauchert (Casper, Wyoming) and Range Conservationist (Karen Clause, Pinedale), we have been exploring the chemical, physical, and hydrological properties of highly calcareous hydromorphic soils in Sublette County, Wyoming (Major Land Resource Area 34A). Several sites presented challenges regarding the identification of redoximorphic features in soils that meet wetland hydrology and hydrophytic vegetation criteria.

The objectives of this study were to: (1) determine the limiting factor(s) in the development of redoximorphic features in the calcareous soil profiles, and (2) create an environment that encouraged the formation of redoximorphic features by amending the soils with iron (Fe), organic carbon (OC), or both. We hypothesized that the low inherent organic matter and/or Fe content in these soils was preventing the formation of visible iron concentrations traditionally used in hydric soil determinations. To test this, we developed a mesocosm study to create a synthetic environment in which these features would form. Soil cores were extracted from one of four study sites and brought to the lab for manipulations.

Dan Perkins, Dan Mattke, and Mathew King (left to right) extracting core samples.

Mesocosms were arranged into four completely randomized blocks. Each block was amended with either 2 % Fe by weight ($FeCl_3$), 36 mg l^{-1} **o**rganic C ($C_6H_{12}O_6$, dextrose), or Fe+OC ($FeCl_3$ and dextrose). An additional block was not amended and served as control.

Left image—Shovel sample of highly calcareous soils. Right image—Mathew King (left) and Gabe Fancher describing and sampling a site.

Mesocosms were inundated for 16 weeks in the laboratory. Oxidation-reduction (redox) potential and pH were measured weekly, and soil temperature was measured throughout the study period.

Redox potential and pH values indicated that the mesocosms were reduced with respect to iron after the first week of inundation. Redoximorphic features formed in the mesocosms amended with Fe+OC and Fe (>20% distinct or prominent Fe concentrations on out-surface of core) but not in the cores treated with only OC or nothing (control, <0.2% D or P Fe concentrations). In summary, we were able to create an environment in which iron redoximorphic features could form and iron is the limiting factor in the development of iron-based redox features**.** This does not solve the problem of field identification of features *in situ*, however, IRIS tubes do function as expected at the sites. The National Technical Committee for Hydric Soils is planning a site visit to this area in June 2018.

Core sample after cutting.

If you have similar issues with highly calcareous soils in your region, please contact Karen Vaughan (karen.vaughan@uwyo.edu) to discuss potential involvement in the next phase of this study. We also have a parallel field study that is being conducted to examine the spatial arrangement of these soils in the landscape. To view the slides presented at Matt King's M.S. thesis defense, visit http://www.uwyopedology.com/uploads/6/0/9/8/60988507/king_2018_defense_presentation.pdf. ■

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