National Cooperative Soil Survey Newsletter

February 2017
Issue 78

In This Issue—

Strategic Plan Update 1
Building Partnerships on Healthy Soil 2
Soil Survey of Los Angeles County, California, Southeastern Part, Now Available on WSS 4
Important Field Guide Updated 6
Options for Communicating Soil Knowledge 7
Nebraska Soil Monoliths and Soil Judging in the News 11
Soil Scientists Volunteer in Haiti 12
Information Exchange Between NRCS and Cuba Ministry of Agriculture 15
Merit or Myth Project 20
Sacred Soil 21
Nondiscrimination Statement 22

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. ■

Strategic Plan Update

Members of the Strategic Planning Committee for the National Cooperative Soil Survey (NCSS) met via teleconference in January 2017 to discuss the NCSS Draft Strategic Plan. To be successfully implemented, the plan needs to be discussed, formally accepted, and incorporated into the NCSS by-laws at the national conference in Boise, Idaho, in June 2017. By-laws are updated using methods outlined in the "National Soil Survey Handbook." NRCS national leaders and those involved with the steering committee for the national conference will hold a session specifically for the discussion and acceptance of the Strategic Plan. The Draft Strategic Plan can be viewed on the main NCSS webpage at https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/survey/partnership/ncss/.

One of the actions to come out of the Draft Strategic Plan is the development of a Communications Team. This team has been tasked with developing a communications plan for the NCSS and improving the online delivery of information. The team has been meeting about once a month to continue moving forward on its goals. One accomplishment of the team was to provide a poster on the NCSS and its Strategic Plan for the Soil Science Society of America Conference in Phoenix. Currently, the team is working to increase the distribution of updates through GovDelivery. Its next steps are (1) collecting and reviewing historical and guidance documents on the establishment and operation of the NCSS and (2) reviewing the structure of the NCSS webpages hosted by NRCS to determine needed improvements. The team is also pursuing the adoption of a logo and creating informational posters for the NCSS.

NRCS Soil Science Division Director Dave Lindbo is the primary contact for the NCSS. If you have comments or suggestions for the Communications Team, please contact any of the serving members.

NCSS Communications Team Members:

- Jennifer Mason, MLRA soil survey project leader, NRCS, Tennessee—Jennifer.Mason@tn.usda.gov
- Jim Thompson, Professor of Soils and Land Use, West Virginia University—James.Thompson@mail.wvu.edu
- Linda Greene, public affairs specialist, NRCS, Nebraska—LindaM.Greene@lin.usda.gov
- Meredith Albers, resource soil scientist, NRCS, Utah—Meredith.Albers@ut.usda.gov ■

Building Partnerships on Healthy Soil

By Sid Davis, California Assistant State Soil Scientist. Photos by Victor M. Hernandez, NRCS outreach specialist and sociologist, California.

A cooperative effort entitled "Building Partnerships on Healthy Soil" was held in downtown Sacramento on January 11, 2017, by the California Department of Food and Agriculture (CDFA) and USDA–NRCS. The goal of the meeting was to develop a shared vision to coalesce efforts in soil health and climate-smart agriculture. In addition, the partners worked to identify and engage our capacities to advocate for and implement soil health practices for natural resource sustainability and agricultural food production in California.

The joint summit on healthy soils provided a platform to share information on the soil health effort. Far exceeding expectations, the event was standing room only in the CDFA Auditorium and into the overflow room. In addition, hundreds participated by webinar. Karen Ross, Director of CDFA, opened the event by announcing that Governor Jerry Brown provided $7.5 million funding in the 2017–18 State budget, released the day before. California State Conservationist Carlos Suarez stated that "soils are back in the forefront of agriculture, where 10 years ago soils were last

California State Conservationist Carlos Suarez.

on the 'Top Ten' list of priorities by regional stakeholders." "To augment the State of California's contribution, NRCS intends to provide eight temporary positions for technical assistance to facilitate delivery." "This *is* a partnership," Suarez reiterated. "We want this to be science based and well coordinated—no more random acts of conservation."

The day of presentations covered a broad list of agricultural interests and included discussion of climate change and carbon sequestration. Tony Rolfes, California State Soil Scientist, presented information on carbon data from the 75 years of sampling by the NCSS as a baseline for current C stocks. Jeff Borum, coordinator for the California Soil Health Network, East Stanislaus Resource Conservation District, stated that there are 17 compost trials across California in progress. The trials are a cooperative effort with NRCS, the RCDs, and the University of California Cooperative Extension Service to evaluate addition of compost to a variety of farming and rangeland systems. Karen Buhr of the California Association of RCDs pledged support through outreach to local farmers and ranchers to build networks for the Soil Health Initiative in all 58 California counties.

California's agriculture is so varied that growers resist being limited by national efforts in soil health that champion mainly corn, soybeans, and alfalfa. Comments by Dr. Gabriele Ludwig of the California Almond Board included, "We don't have the same issues as Indiana." "For starters, California agriculture is almost exclusively irrigated and suited to Mediterranean-climate cropping, as opposed to most States that receive precipitation during the growing season." "Almonds are frost sensitive, and cover crops are not conducive to heat transfer from the soil," said Ludwig. "Cover crops need to be gone by tree bloom, and a smooth surface is needed to pick up the nuts." Clearly there are challenges in specialty crop interests.

Jeanne Merrill of the California Climate Action Network (CalCAN), an organization that advocates sensible climate policy for agriculture, noted that most farm operations are not staffed to handle the requirements mandated by legislative actions. "There are many rural areas that do not have access to the Internet and a high number of farms that don't use computers at all."

The COMET modeling tool was presented by Amy Swan of Colorado State University. This program can be customized for an individual farm or field with different scenarios of cropping and inputs to gage the carbon footprint. A new release is due out this spring with added practices for vineyards and rice. Dr. Jeff Mitchell, UCCE,

Dr. Karen Lowell, California NRCS Area 2 agronomist, moderating the summit and fielding questions from the audience.

reported huge opportunities for soil health in annual cropping systems and announced that a bold goal on the horizon is no-till lettuce. Dr. Mitchell also stressed the need for controlled-traffic farming and for all to work together toward the common goal, soil health.

A persistent question for those hesitant to apply soil health practices was "Is soil health economically feasible?" Doctor Rodd Kelsey and Doctor Kelly Gravuer, both of The Nature Conservancy, presented data on farming operations using NRCS practices related to soil health. On average, operations using conservation practices, such as cover crops and no-till, realized 5 percent increase in yields annually. The numbers were based on the major commodity crops of the Midwest. Their analysis applied to specialty crops in California showed that the same practices with a 5 percent yield increase translates to 4 to 5 times greater economic return based on market prices. So, improving soil health *does* pay off.

A lively discussion followed, and many participants weighed in on opportunities. Comments from the farming community indicated that the meeting was heavily policy oriented. All agreed, however, that the meeting was a great first step in the direction of creating value-added partnerships for soil health. A meeting to address the question "Where do we go to from here?" was scheduled for later in January. The task ahead is to determine how to make soil health farmer-friendly, including how to provide accessible tools and resources for implementation. ■

Soil Survey of Los Angeles County, California, Southeastern Part, Now Available on WSS

By Randy L. Riddle, MLRA soil scientist, Oxnard, California.

The Templeton MLRA Soil Survey Office recently completed the "Soil Survey of Los Angeles County, California, Southeastern Part," which is now available on the Web Soil Survey (WSS). Fieldwork began in the fall of 2008 and was completed in the spring of 2016. The soil survey crew mapped approximately 681,000 acres, an area with a population of 9.2 million. The landscape was dominated by large cities and surrounding urban sprawl intermixed with pockets of natural areas on hills and mountains. In total, about 80 individual municipalities and census-designated areas were mapped, including the cities of Los Angeles and Long Beach.

The survey team included Randy Riddle (soil survey project leader), Kit Paris (soil data quality specialist), Bev Harben (retired MLRA soil survey office leader), Matthew Ballmer (former project leader), and crew members Genevieve Landucci and Ken Oster. Cooperating organizations included the Santa Monica Mountains Resource Conservation District, the Los Angeles Department of Parks and Recreation, approximately 65 independent municipalities, local agencies, conservation organizations, 6 school districts, golf courses, and private landowners.

The goal of the mapping in Los Angeles was to deliver a soil survey that accurately modeled the current condition of natural and anthropogenic landscapes while maintaining traditional soil survey standards. The soil-landscape model was emphasized in the urban landscape to avoid land-use mapping and interpretations. In total, the survey identified 158 mapping units in the urban landscape. Soils having varying degrees of human modification were observed and documented across a vast urban environment typical to southern California. Trends were identified, and 20 new soils series were established. Among the new series were five that incorporated the classification classes for human-altered and human-transported (HAHT) material from the 12th edition of the "Keys to Soil Taxonomy." To qualify for the new classifications,

Soil scientists waiting for the crosswalk light to change on the trail to the front lawn at Los Angeles City Hall. From left to right: Emmanuel Gonzalez-Hinojosa (soil conservation technician), Genevieve Landucci (MLRA soil scientist), Randy Riddle (soil survey project leader), and Sid Davis (California Assistant State Soil Scientist).

Genevieve Landucci (left), Randy Riddle (center), and Kit Paris (right) discuss proposed map unit concepts during a progress field review in Gardena, California.

the soils required human-transported materials (HTM) with a thickness of 50 centimeters or more. In many cases, the HTM was thicker than 1 or 2 meters.

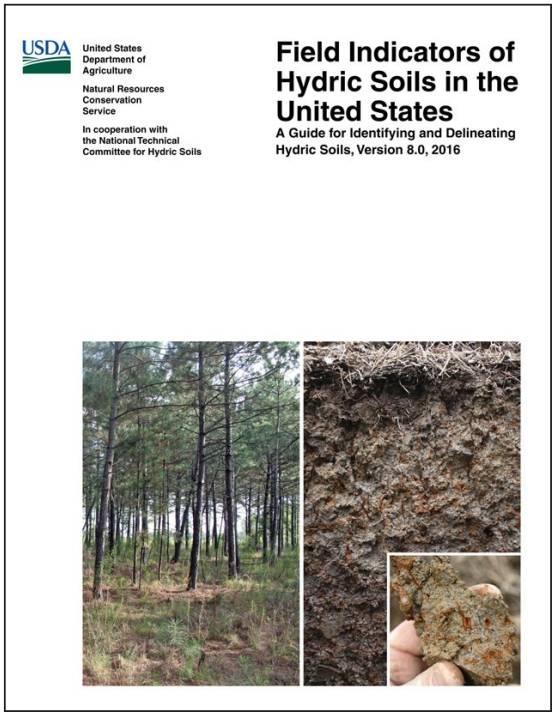
Of the 185 individual soil taxonomic units correlated in the survey, 25 soils types met the HAHT soil classification criteria. Most soils identified in the Los Angeles Basin have intact natural soil properties directly below surface amendments. Natural soils with native surfaces are mostly isolated to vacant hillsides within the cities' public parklands, land conservancies, and nature preserves. To increase the versatility of the data, the survey provides complete component data for both major and minor components.

The data for this survey have been regularly requested by consultants, agencies, civil engineers, community gardens, and conservation groups. Prospective users have requested data for urban planning of various storm-water management projects and for models, development sites, infrastructure proposals (such as high-speed rail), flood-plain restoration projects and proposals, water storage solutions, ground-water recharge, hillside stability studies, and ecological and conservation planning. ■

Important Field Guide Updated

The National Technical Committee for Hydric Soils has updated the "Field Indicators of Hydric Soils in the United States" to version 8.0. Hard copies are available from the NRCS Distribution Center at https://nrcspad.sc.egov.usda.gov/DistributionCenter/product.aspx?ProductID=1323. Electronic copies (PDF) are available at https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/use/hydric/.

The updated version of the guide includes all changes indicated in the errata for version 7.0. Version 8.0 also includes two general changes to wording to improve consistency and clarity of some indicators. The wording changes have no effect on the requirements of the indicator. The first change was that the word "within" was removed and replaced with "at a depth ≤." For example, indicator F3. Depleted Matrix previously read "… starting within 25 cm…" and now reads "…starting at a depth ≤25 cm… ." The other change was in indicators that previously gave a thickness requirement entirely within a bottom depth. These indicators now state the thickness requirement and the top depth. For example, indicator F6. Redox Dark Surface previously read "…10 cm thick entirely within 30 cm…" and now reads "…10 cm thick starting at a depth ≤20 cm… ." Because these rewordings do not change the requirements of any indicator, a soil that met the indicator as it was previously worded will still meet the indicator and a soil that did not meet the indicator will continue to not meet that indicator. The changes were made in response to confusion over the original wording. They were based on recommendations from users of the guide. ■



Options for Communicating Soil Knowledge

By Tom D'Avello, David Zimmermann, and Suzann Kienast-Brown, NRCS, and Jim Thompson, West Virginia University.

Background

During the first 75 to 100 years of the Soil Survey Program, the vector data model was the most practical means of spatial representation. It remained so even after the initial advent of geographic information system (GIS) technologies. The earliest GIS did not support the vector data model. For these early systems, the raster data format was the sole option for representing geographic features. Although some efforts were made to produce soil maps in a raster format, the maps were only produced as a cartographic exercise. The potential for computer modeling of soil data had yet to be realized, and thus the raster data format did not offer an immediate advantage for use in soil survey.

As GIS software progressed to accommodate vector representation, it was readily adopted to reproduce and develop vector soil maps that previously had been inked on hard-copy media. A humorous quip used to differentiate the two dominant data types was "raster is faster, but vector is corrector." This phrase mainly referred to the fact that the vector data model could more accurately represent specific boundaries but required the increased cost of data input, management, and processing time. However, for soil maps intended to convey data that varies continuously across the landscape, the vector data model (i) has inherent cartographic limits, (ii) conveys information in a limited and commonly unrealistic manner, and (iii) demands intensive management to maintain topology in a GIS. Given the advances in geospatial technologies and the limitations of the vector data model, recent attention has been devoted to adopting ways of representing our soil knowledge using the raster data model.

So, what does the raster data format offer us that the vector model lacks?

The Raster Format

A raster is "a spatial data model that defines space as an array of equally sized cells arranged in rows and columns and composed of single or multiple bands. Each cell contains an attribute value with geographic coordinates contained in the ordering of the matrix" (Summer and Wade, 2006) (fig. 1).

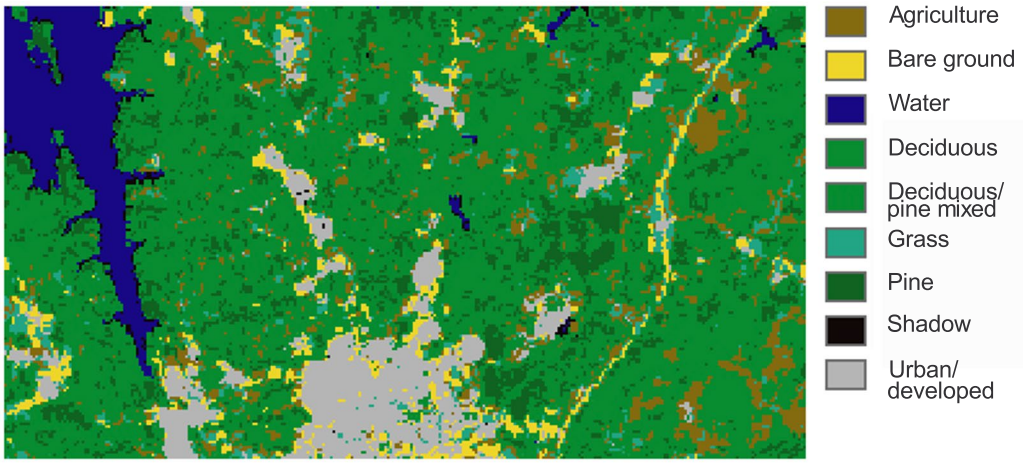


Figure 1.—Graphic example of a raster.

The small size of the cells, known as the spatial resolution, essentially eliminates the cartographic limits of the vector model, i.e., small areas of soils can be represented if desired. Without the constraints of scale-based cartographic limits, many components and small areas of map units that are currently only listed as minor components or inclusions in the database could be identified on the landscape. Showing where these soils occur is a great enhancement to our current model, which just lists or describes where they occur.

One objection to presenting the greater spatial detail is the possibility of misunderstanding the degree of confidence in the detailed representation. All soil map unit delineations, however, are predictions. The small patches that are likely in a raster product are simply predictions that are not cartographically constrained. Raster-driven methods have an important advantage that addresses this issue: the option to calculate uncertainty and provide this information for soil classes or properties.

Raster data can be stored and archived with ease. It allows model inputs and outputs to be consistently maintained during model development and accessed after project completion. If data are properly archived, model results can also be traced back to model inputs and parameters. This benefit of the raster data format adds an element of transparency into map building.

Restricting the soil survey product to one data model (vector) limits our ability to fully represent and convey our soil knowledge to users. If multiple product lines and data models are developed and provided, a wider array of users and user needs could be satisfied.

Raster Opportunities

The use of geospatial techniques for mapping soils is broadly covered by the term “digital soil mapping” (DSM) (McBratney et al., 2003). Such use has progressed as soil scientists have adopted the latest tools to assist in the mapping process. The process of making an inference about a landscape segment (e.g., a soil map unit) from a few point-based observations using the operative soil-forming factors is “modeling.” Whether the soil map is produced using nothing but a bucket auger and an aerial photo or using geospatial software, the process is a modeling operation. The use of DSM methods will increase over time and will eventually cease to be considered distinct, novel techniques. A common component of DSM methods is raster data inputs referenced by various algorithms. From raster inputs come raster outputs.

gSSURGO hybrid.—One option for producing a raster-based soil survey starts with enhancements to a currently delivered product: gSSURGO, which is a 10-meter resolution raster version of SSURGO. This product is essentially a vector-to-raster format conversion. The footprint of gSSURGO could serve as a template (i.e., snap raster) for raster-based data produced for initial and update soil survey projects. The final products would be directly mosaicked into the gSSURGO dataset. This workflow would require virtually no changes to our current database and delivery systems for gSSURGO. One major difference, however, would be the use of the raster output as the final spatial representation rather than as an interim step in the development of a vector product.

An example of a gSSURGO hybrid is the raster survey of Essex County, Vermont, which is available from the Geospatial Data Gateway. This survey is a detailed raster product developed during an initial soil survey using readily available GIS tools. The product is inclusive of one catena formed in a common parent material and was developed using knowledge-based modeling techniques. Figure 2 shows an area of the Essex County raster soil survey mosaicked into gSSURGO. Using contemporary

methods, the process of updating by catena or common physiographic region would yield data similar to the Essex County raster. Any soil survey product resulting from an MLRA update or initial soil survey project could be mosaicked into gSSURGO. A "disaggregated spatial representation" may be one way to describe the resulting product for MLRA update projects (Nauman and Thompson, 2014).

A product mosaicked into gSSURGO enables the delivery of a spatially explicit representation and interpretation of individual soil components, something not possible with the vector model. The product accommodates the delivery of legacy survey data. It also allows for rapid updates that might focus on areas of less intense mapping or areas where the needs for use and management changed after initial mapping. The product, which includes data developed at multiple resolutions and from different processes, is akin to the best available dataset of the USGS National Elevation Dataset. It is also akin to some of the national NAIP imagery that has fine resolution in urban and high-use areas and coarser resolution in more remote areas. Educational resources would need to be developed to explain the varying levels of detail and the proper interpretation and use of the data. This option would require very little adjustment to our current system because the database needs are identical and the spatial data manipulations are routine.

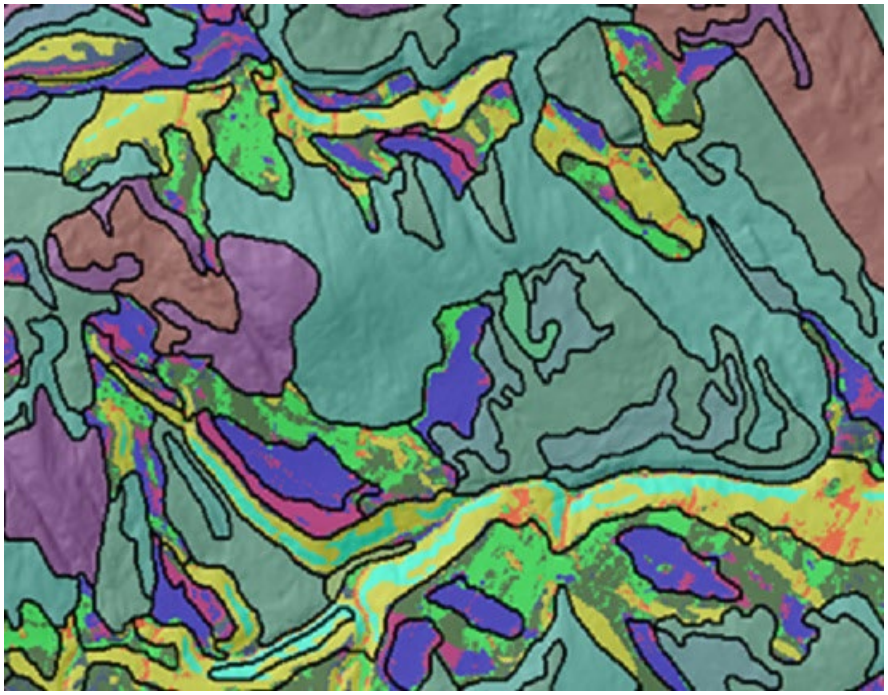


Figure 2.—SSURGO vector lines overlaid with gSSURGO. The detailed areas represent the components of the modeled catena of Essex County, Vermont.

Inclusion of non-soil data.—Currently, our database contains a multitude of non-soil data, such as climatic, terrain, and land cover variables used to generate interpretations. The inclusion of these variables in a relational database associated with polygonal map units is a relic of the pre-GIS period in which the database originated. Populating this data is time consuming and prone to error. In addition, a database is inadequate for representing geographic phenomenon, such as multi-modal distributions (e.g., slope aspect), or continuous data, such as mean annual

precipitation or slope gradient. The capability to utilize separate raster datasets representing pertinent non-soil variables for developing interpretations would improve resulting interpretations and reduce the time and effort required to populate these non-soil data elements. Many of these non-soil environmental layers are produced and maintained by other credible agencies and organizations and could easily be adopted as part of an official raster dataset.

Multidimensional soil properties.—The most comprehensive option for soil raster data would be the complete raster representation of all properties used for interpretations maintained in a multidimensional dataset (Xu et al., 2016). Multidimensional data is captured at multiple times or depths and typically stored in netCDF, GRIB, or HDF format. Each file contains one or multiple variables, and each variable is a multidimensional array that represents data at a given time or a given vertical dimension. For example, a netCDF file can store temperature, humidity, and windspeed for every month from 2010 to 2014 and at each elevation of 0, 1, and 10 meters above mean sea level (ESRI, 2017). For soil survey, this format could store soil temperature, soil moisture content, and other dynamic soil properties at multiple soil depths on daily, monthly, and annual intervals.

The GlobalSoilMap project (IUSS, 2017; Hartemink et al., 2010) has specifications for a minimal dataset of physical and chemical soil properties at predefined depths. These data could be coupled with the multitude of non-soil environmental variables, including climatic, terrain, land cover, and land use treatments, to support interpretations and simulation modeling. The use of multidimensional data formats would be new to the NCSS, but many organizations have been using multidimensional data in an established, operational manner. Such organizations could serve as excellent examples and references (The HDF Group, 2006-2016).

The raster format greatly expands the capabilities of conveying our knowledge and offers the possibility of providing a relevant, effective, flexible, and interpretable product (Grunwald et al., 2011). By providing raster data as an additional soil information product, we could pursue work in a manner that is more compatible with current earth science data technologies and increase our capacity to develop and deliver significantly updated soil data. These options should be pursued and developed not as replacements to SSURGO, but as additional complementary soil information products that expand our ability to communicate our knowledge of the soil system to a variety of modern soil information users.

References

ESRI. 2017. Multidimensional data in a mosaic dataset. http://desktop.arcgis.com/en/arcmap/10.3/manage-data/raster-and-images/multidimensional-data-in-a-mosaic-dataset.htm [Accessed 22 February 2017]

Grunwald, S., J.A. Thompson, and J.L. Boettinger. 2011. Digital soil mapping and modeling at continental scales—Finding solutions for global issues. Soil Science Society of America Journal 75(4):1201–1213 (SSSA 75th Anniversary Special Paper).

Hartemink, A.E., J. Hempel, P. Lagacherie, A. McBratney, N. McKenzie, R.A. MacMillan, B. Minasny, L. Montanarella, M.L. de Mendonça Santos, P. Sanchez, and M. Walsh. 2010. GlobalSoilMap.net—A new digital soil map of the world. *In* Digital Soil Mapping, Springer, The Netherlands, pp. 423–428.

The HDF Group, 2006–2016. https://www.hdfgroup.org/

International Union of Soil Sciences (IUSS), Digital Soil Mapping Working Group. globalsoilmap.net. [Accessed 22 February 2017]

McBratney, A.B., M.M. Santos, and B. Minasny. 2003. On digital soil mapping. Geoderma 117:3–52.

Nauman, T.W., and J.A. Thompson. 2014. Semi-automated disaggregation of conventional soil maps using knowledge driven data mining and classification trees. Geoderma 213:385–399.

Summer, S., and T. Wade. 2006. A to Z GIS: An illustrated dictionary of geographic information systems. ESRI Press. ISBN: 1589481402.

Xu, H., F. Abdul-Kadar, and P. Gao. 2016. An information model for managing multi-dimensional gridded data in a GIS. *In* IOP conference series Earth and Environmental Science 34, No. 1, p. 012041, IOP Publishing. ■

Nebraska Soil Monoliths and Soil Judging in the News

By Ryan Ragsdale, resource soil scientist, Lincoln, Nebraska.

Soil scientists in Nebraska were busy in 2016. In addition to the normal activities of soil sampling, SDJR projects, and wetland determinations, Nebraska soil scientists were tasked with preparing 10 soil monoliths from across the State in just a few weeks. NRCS employees and members of the Nebraska Society of Professional Soil Scientists (NSPSS) helped collect and prepare the monoliths. The five best monoliths were put on permanent display at the Raising Nebraska exhibit on the State Fairgrounds in Grand Island, Nebraska, in August 2016.

The Raising Nebraska exhibit showcases multiple aspects of agriculture across the State, including soil and water conservation. The displays are well worth seeing for those visiting Grand Island. The Raising Nebraska exhibit is staffed by a Nebraska Extension educator and is open year-round.

Nebraska NRCS Soil Scientists Rebecca Hodges (left) and Isabelle Giuliani (right) gave presentations about the soil monoliths at the State Fair in August 2016.

The process of creating a soil monolith was well documented by film crews from the University of Nebraska. Nebraska State Soil Scientist Neil Dominy and Soil Scientist Casey Latta from the Lincoln MLRA office are prominently featured in the short film. The 2.5-minute recording can be viewed at https://www.youtube.com/watch?v=GXblHE3uznQ.

In October 2016, Nebraska soil scientists in conjunction with the State Natural Resource Districts held seven regional land judging contests and one State land judging contest. 2016 was a record year; there were 7 percent more student participants than the most recent 5-year average. Land judging has a strong history in Nebraska, and student interest keeps growing.

Just a week after the land judging contests in early October, the Midwest Regional Collegiate Soil Judging Contest was held in Lincoln. Approximately 80 students from 6 Midwestern universities participated. This contest required area soil scientists to dig and score 15 soil pits. Casey Latta (Lincoln SSO) dug most of the pits. Bruce Evans (Lincoln SSO), Rebecca Hodges (Aurora field office), John Warner (Salina MO), and Dan Shurtliff (Nebraska SO) scored the profiles. The

most popular soil of the contest was the Fillmore series (fine, smectitic, mesic, Vertic Argialboll). Most of the students had never seen an Argialboll before.

Organizing the contest required a lot of work and would not have been possible without the help of many volunteers from the University of Nebraska, NRCS, and the National Soil Survey Center. In additional to the NRCS employees listed above, Nebraska Resource Soil Scientists (Patrick Cowsert, Ryan Ragsdale, and Isabelle Giuliani) and NSSC employees (Skye Wills, Pam Van Neste, and Jennifer Ingham) played vital roles.

The local National Public Radio station covered the soil judging event. Recently retired Nebraska Assistant State Soil Scientist Dan Shurtliff was interviewed for the story. Photographs from the contest and the NPR story can be accessed at http://netnebraska.org/article/news/1046817/students-test-depths-their-soil-knowledge-regional-contest. ■

Angie Elg (resource soil scientist) and Nizhoni LaFrance (soil conservationist) from the Scottsbluff, Nebraska, field office monitor soil pits at the Nebraska Western Regional Land Judging Contest in October 2016. Photo courtesy of Kristin Dickinson.

Soil Scientists Volunteer in Haiti

By Jacqueline Vega, MLRA soil scientist, Kealakekua, Hawaii, and Janella Cruz, MLRA soil scientist, Paul Smiths, New York.

In 2010, a powerful and devastating earthquake hit Haiti, affecting millions of people. The international response was immediate and provided humanitarian aid from government agencies, non-profit organizations, and other contributing organizations. The catastrophe also sparked our desire to help in some capacity.

It was a long time coming, but in December 2016 we both finally had the opportunity to volunteer in Haiti, where we helped at the RENMEN foundation. A colleague had recommended the foundation and believed our time would be well spent there. RENMEN, which means love in Haitian Creole, is an orphanage located in Bon Repos, 30 miles north of the capitol city Port-Au-Prince. For both of us, this was our first visit to Haiti.

The RENMEN foundation is a non-profit organization registered in Florida. The foundation's mission statement is "To promote a healthy and loving home environment for the many abandoned, malnourished, and impoverished children of Haiti. To empower Haitian youth to recognize their talents and dreams so they may reach their long-term goals and be self-reliant." The foundation provides housing, education, and

Jacky Vega and Haitian children at RENMEN foundation.

health care services. Currently, there are 45 children and young adults residing at RENMEN. They range in age from newborn to 24 years old. They are multi-lingual, knowing Creole, French, and English.

Volunteering in Haiti was one of the most unique experiences of our lives. During our visit, the children at the orphanage were on Christmas break, which allowed plenty of time for them to play and for us to enjoy time with them. These children showed a lot of generosity, sharing, caring, and love towards one another and everyone around them. They were happy and had a glow, playing and laughing without any worries in the world. They were so welcoming, and they wanted to hug you and hold on to you. It was an enriching experience.

We brought educational materials, including the coloring book “Sammy Soil,” for all the kids so they could express their creative side. The coloring book focuses on soil and water conservation by illustrating the importance of conserving our natural resources. The Sammy Soil story explains the importance of conserving soil, using cover crops, and avoiding tree cutting. The children loved the Sammy Soil history and were totally involved with the book. It was very rewarding to see children enjoying the activity of soil illustrations and to watch the kids make the connection of their use of colors with nature and conservation.

On our last day of volunteering, we celebrated the International Day of Soils with the kids. The World Soil Day (Journée Mondiale de Sol, in French) was originally celebrated on December 5th. Luckily for both us soil scientists, we got to celebrate it a second time with the Haitian children. We created posters in English and French that the children could color. The children worked in teams, and at the end of the activity, the team leaders presented their poster to everyone. The group dynamics throughout the activity brought everyone joy!

Children participating in teams to color World Soil Day posters.

We are very grateful to Florence Renmen Thybulle (former CEO and founder of RENMEN) for allowing us to share time with the children of RENMEN. It was an unforgettable experience for the both of us. Ultimately, it was a mutual learning experience for all. Going out and engaging with children and receiving a reciprocal kind of engagement bridges people together with hope and love. ■

Information Exchange Between NRCS and Cuba Ministry of Agriculture

By Linda O. Scheffe, conservation agronomist, NSSC, Lincoln, Nebraska.

In December 2016, a group of NRCS employees traveled to Cuba to develop relationships and exchange information regarding soil management and irrigation. The group consisted of Dr. Linda Scheffe, conservation agronomist, National Soil Survey Center, Lincoln, NE; John Tiedeman, agricultural engineer, Redding, CA; and Chayla Rowley, civil engineer, Steamboat Springs, CO. Jeromy McKim, a USDA-APHIS representative who was stationed in Cuba for several months, also participated. The USDA team met with staff from the Ministry of Agriculture (MINAG) departments of Soils and Fertilizers, Irrigation and Drainage, and Agroforestry; researchers from the National Soils Institute and the Agricultural Engineering Institute; municipal and provincial technical experts of MINAG; and cooperatives and producers in the Havana Province. The visit was the fourth subject-matter-expert exchange between Cuba's Ministry of Agriculture and the U.S. Department of Agriculture since the start of the normalization of diplomatic relations. It was the first engagement with the Soils and Fertilizers Department and the Irrigation and Drainage Department of the Ministry of Agriculture as well as the National Soils Institute.

On December 12, the team had a courtesy visit with the Chargé d'Affaires and Deputy Chief of Mission. NRCS was encouraged to explore future possibilities for continued collaboration with the Cuban Ministry of Agriculture. In the afternoon, the team proceeded to MINAG for an opening meeting to review the week's agenda. Following introductions, the NRCS team recounted the work of NRCS's founder, Hugh Hammond Bennett, with Cuban soils in the 1920s and the importance of this work in the Agency's beginnings. A copy of the soils report published in 1928 was presented to the Cuban colleagues. The Cuban colleagues appreciated the team's prior research and familiarity with Cuban references and articles as well as their ability to speak Spanish, which facilitated the information exchange process. At the close of the meeting, the NRCS team presented the Cuban counterparts with copies of the presentations and with many NRCS resources in Spanish and English, including information on soil conservation, Soil Taxonomy, field guides, irrigation, agroforestry, and conservation practices.

On December 13, the participants met at MINAG and then traveled to the National Soils Institute at Boyeros. Approximately 30 soil specialists, including several soil microbiologists, met for presentations by various specialists, including the institute's Director Dr. Luis Agustin Gomez Jorrin. Topics included interactive conservation websites with databases, biofertilizers, future strategic development plans for the institute, methods of interacting with the public, and a general overview of the institute and its mission. The NRCS team presented the basics of Agency functions, discussed soil management and sustainability, and shared innovative approaches to technology exchange with farmers in developing sustainable farming systems. There were several good discussions on current issues in Cuba, including erosion, salinity, and compaction, and on advances made in urban and organic agriculture.

In the afternoon, the participants traveled to the Agricultural Engineering Institute. About 15 irrigation specialists met with the NRCS team for presentations on irrigation and drainage by the institute's Director Dr. Aymara García López and the NRCS team. The mission of the institute is "to promote the scientific-technological development of comprehensive agricultural engineering systems that promote the harmonious implementation of irrigation and drainage, mechanization, energy technologies, postharvest, environmental conservation, and rural construction based on the efficient use of natural resources, and to contribute to the food security of the country." The NRCS team presented information on the Agency's typical planning and design flow,

an overview of various irrigation systems, and boxless spring development. The participants discussed some issues in Cuba, including drainage, salinity, and drought, and also advances made in surface irrigation and energy conservation.

On December 14, the participants met at the Ministry of Agriculture and traveled to Guanabacoa to visit several demonstration areas for soil, water, and forest conservation. The demonstration areas are referred to as "polygons." The Ministry of Agriculture documentation explained the basics of the program:

> *"Cuba's agricultural system has seen many structural changes over the past decades. A development from small-scale to large-scale industrial monoculture practices was followed by a return to small-scale farming. To combat soil degradation from the previous decades of monocultures, Cuba initiated a country-wide program, based on principles of sustainable land management (SLM). Since 2009, SLM demonstration areas (polygons) have been introduced to ensure the implementation of integrated conservation and melioration technologies for soil, forest, and water resources at a farm production level."*

The demonstration areas utilize agro-ecological practices and have grown to represent almost every combination of cropping system, soil, and climatic region across all types of land tenure. The major forms of land tenure, besides urban types of garden and patio agriculture, include Agricultural Production Cooperatives (CPA), Credit and Service Cooperatives (CCS), Basic Cooperative Production Units (UBPC), and State farms. The State owns the land for all of these. The CCS farms (up to 67 hectares in size), which are collectively farmed, are the most recently developed, quickest growing, and most productive. Because of the increasing productivity, the Cuban government is letting these CCS farmers use (rent) additional State-owned land. The landowners pool their resources to buy inputs, tractors, etc. Economic, social, technological, and environmental indicators are being monitored on a polygon basis.

The first stop in Guanabacoa was Campo Monumental Finca Estrella, a State-run farm consisting of 12 hectares of fruit orchard and 7 hectares of agroforestry species.

Terraces with vetiver grass (left) rock barriers (right) at Finca Estrella.

The farm has slopes of about 5 to 12 percent. Erosion control includes rock barriers, terraces with vetiver grass, and organic residue management. This polygon was established in 2010. At present, 100 percent of the conservation practices are paid for by the State (through the National Program for Soil Conservation and Melioration). The Cubans, however, expressed interest in NRCS cost sharing for conservation practices. There was discussion on getting landowner buy-in and how to tie money to that. The NRCS team shared the idea of Plant Materials Centers, which service several U.S. States. This polygon has its own plant nursery, but some do not. Soil compaction issues were discussed. No till would be an item of further exploration.

The second stop was at UBPC Polygon, Cooperativa Victoria Uno 26 de Julio. Miguel Fletes is the cooperative's president. Liliana Suarez is the agronomy technician who provides technical assistance to the polygon, along with other technicians from MINAG. This polygon, established in 2010, is comprised of 1,300 hectares and produces coffee, papaya, tomatoes, sweet potatoes, and other fruits and vegetables. Contour farming and terraces (with king grass barriers) are used in addition to composting, vermiculture, biofertilizers, biopesticides, and surface sprinkler irrigation. Sprinkler irrigation is supplied via an engine-driven portable pump, PVC and polyethylene pipe, and above-ground sprinkler risers. Water conservation could be improved through uniformity of application.

It was suggested that the NRCS conservation practice of multi-story canopy could be beneficial in these types of farming systems. A hard copy of the Hawaii Tropical Agroforestry Guide as well as electronic copies of other NRCS resources on agroforestry were provided later. Further exchange of indicators for evaluation of sustainable farming systems was discussed. Also discussed were integrated approaches to soil survey, conservation planning, and watershed planning. The possibility was raised of holding exchange workshops on sustainable farming systems in both Cuba and the United States. The workshops could include farmers and participation from researchers and agencies. Due to the limit on land area for any single farming operation, the Cubans expressed more interest in workshops that focused on smaller scale technologies.

Information was shared on the California Irrigation Mobile Lab program. The Cubans could potentially develop a similar program to perform system evaluations based on requests from landowners or operators. Although the equipment (pumps and tractors) in Cuba is older than that in California, the owners and operators have learned the maintenance needed to keep it operating. Most or all land preparation, including tillage, is conducted on the contour, often using oxen. The use of terracing, slope lengths, and vegetative barriers seems to be well understood and adopted.

On December 15, the participants met again at MINAG. They traveled to the Havana Provincial Office of MINAG, then to two farms, and finally back to MINAG for the final closeout meeting. Several presentations were provided at the provincial office. The presentations addressed organic and urban agriculture within the Havana Province. There are approximately 86 organopónicos (organic raised-bed operations), 318 huertos intensivos (organic operations without raised beds), 211 casas de cultivos (greenhouses), 13 semiprotegidos (totally shaded operations), and 150,000 patios (house gardens) in Havana Province. There are two demonstration polygons in the province. Dairy, chicken, and hog manure are available and utilized; however, sewage water apparently is not utilized in the production of vegetables.

The first farm visit was to a State-run organopónico, Oar Playa, in west Havana. Approximately 25 vegetable crops are grown on 4 hectares in raised beds (made from tile roof). Management includes compost, biofertilizers, manures, biological controls, and micro-sprinkler irrigation using well water. The team learned that the seed is bought from Japan and that the native soil at the site has a shallow hardpan layer, hence the raised beds and shallow-rooted vegetable crops.

Raised beds at Oar Playa.

The second farm visited, CCS Efrain Mayor, is part of the ANAP (National Association of Small Farmers). There are 25 farms in the cooperative. The members of the cooperative share equipment and credit. Water and soil samples are paid for by MINAG. CCS Efrain Mayor consists of 30 hectares farmed by a father and son. In an elaborate greenhouse, they grow sweet peppers with drip irrigation, raised beds, fertigation, and acid cleaning of the drip. Other crops include lettuce, cucumber, tomato, beets, and fruit, such as plantain and mango. Due to the farm's success, the Cuban government is letting them farm another 14 hectares of State-owned property adjacent to their current operations.

Efrain field and greenhouses.

CCS Efrain Mayor is an example of more intensive farming, using such inputs as synthetic fertilizers and herbicides. The greenhouse systems are well constructed, providing all-season climate control. Irrigation is provided from pond storage supplied by runoff and underground spring flow. Pressure for drip irrigation is supplied by a Soviet-built, electric, motor-driven pumping plant.

The Cubans shared that they are evaluating the balance between increasing production (intensive methods) and long-term sustainability. While soil types and textures vary, there were noticeable differences between the organic and intensive farms. The day wrapped up with a closeout meeting at MINAG.

Closeout group at MINAG.

Cuba has the infrastructure and human resources to facilitate the integration of research, innovation, technology transfer, and technical scientific service from the national level to the provincial, municipal, and field levels. It has put an extreme emphasis on soil microbiology and the production and use of biofertilizers, which the National Soils Institute has developed. Biopesticides and earthworm cultures have also been developed. Advances have been made in the area of biological diversity and energy conservation. The NRCS team raised the potential issue of heavy metals in soils used for urban agriculture but learned the National Soils Institute is monitoring for this problem and working on preventative solutions. The Cubans showed considerable interest in how NRCS funds projects and in the Web Soil Survey. They have soils mapped to the 1:24,000 level in most places plus more detailed maps on some study farms.

Excellent exchange discussions were held regarding soil management, soil conservation, agroforestry, irrigation, drainage, soil survey, conservation delivery, and sustainable farming systems. Discussions included conservation issues, opportunities facing Cuba, and advances in urban and organic agriculture using biofertilizers, vermiculture, biopesticides, energy conservation, and surface irrigation. Due to the drastically reduced availability of chemical inputs from outside sources, Cuba developed locally produced, and in most cases biological, substitutes. This includes biopesticides (microbial products) and natural enemies to combat insect pests; resistant plant varieties, crop rotations, and microbial antagonists to combat plant pathogens; and better rotations and cover cropping to suppress weeds. Scarce

synthetic fertilizers are supplemented by biofertilizers, earthworms, compost, other organic fertilizers, animal and green manures, and the integration of grazing animals.

The Cubans have in-depth knowledge of irrigation and drainage systems but lack materials and other resources needed to set up appropriate systems across the nation. Due to the country's increasingly sporadic and intense weather patterns, they are also beginning research related to climate change. In the future, they wish to collaborate more on this and on subsurface drainage and desalinization practices. MINAG's Irrigation and Drainage Department has a history of international collaborations and expressed a strong interest in collaborating with the U.S. on drainage systems and methods of computation. The irrigation water supply in Cuba depends on surface storage reservoirs and wells, both of which have limited supplies, particularly in drought years. In its reliance on irrigation, Cuba is similar to the western United States. Cuba is also challenged by intense tropical storms, which can cause severe erosion and damage to infrastructure.

In addition to those follow-up opportunities mentioned above, soil systems studies and their relation to watershed planning could be an important follow-up item. Another item could be assistance with archiving and analyzing the 50 or more years' worth of soil samples collected by the Cubans. The establishment of a soils laboratory in Cuba could be a potential future collaboration. Other collaborations could include nutrient management plans and comprehensive nutrient management plans for animal feeding operations. Integrated soil, water, and plant tissue sampling and interpretation would also be advisable. Further discussion of future collaboration will be made with NRCS leadership and technical disciplines as well as partners. ■

Merit or Myth Project

The Merit or Myth (MoM) project provides support to the South Dakota Natural Resources Conservation Service's ongoing soil health initiative. NRCS staff are working on this project through an agreement with the University of South Carolina with Dr. Robin "Buz" Kloot, research associate professor, and with Barrett Self, graphic designer. Although NRCS South Dakota has made great strides in the promotion of soil health principles and practices, many producers are concerned that these ideas will not work for them. The concerns primarily involve management issues, such as too much residue, low soil temperatures, too much soil moisture in spring, weeds, and basic economics. The project aims to engage producers, scientists, and conservationists across the State in addressing these specific concerns. Buz and Barrett travel across South Dakota, interviewing farmers, ranchers, scientists, and soil health experts. Their conversations are about the misconceptions (myths) regarding soil management and about how real farmers and ranchers have adapted their management, leading to healthier soils (merit) in South Dakota.

MoM's primary medium is video promoted through diverse social media channels. Since its official launch in August 2016, MoM has produced a variety of online content. Through the MoM website at http://meritormyth.com/, you can access the MoM Facebook and Twitter sites. The site also has a blog and links to MoM podcasts and video logs.

NRCS South Dakota employees who are involved with the project include State Conservationist Jeff Zimprich, State Agronomist Marcia Deneke, Area Resource Soil Scientist Kent Cooley, Area Agronomist Eric Barsness, Public Affairs Officer Colette Kessler, State Soil Health Specialist Jeff Hemenway, Area Agronomist Jason Miller, and State Soil Scientist Nathan Jones. ■

Sacred Soil

By Drew Kinney, Soil Survey Regional Director, Temple, Texas.

I sit in my doctor's office while he rambles on about family history, then he pauses and asks, "What do you do"?

I reply, "I'm a soil scientist."

The doctor's eyes light up, and his assistant fidgets and straightens. The doctor leans forward and says, "I've got to show you something I think you'll find interesting" and nods to his assistant. She hurries out of the room, and I begin thinking about what usually happens in these circumstances—the person comes in with a dying plant and asks me what's wrong with it. When she returns, to my amazement she hands me a small picture frame with 5 vials of soil. On each vial is a typed label: Utah Beach, Pointe du Hoc, Omaha Beach, Sainte Mere Eglise, and Angoville Church. Beneath the vials is a small string laying on a white silk background. A small typewritten sign reads "101st ABN D-Day Parachute Silk." My hands tremble, my mind races. I'm holding in my hands samples that have been consecrated by American Soldiers in an event that defined our society today. I can only think of the soldiers and what they went through and realize that I have that indescribable pain in my chest, somewhere between sorrow, pride, and honor.

As I get myself together, the soil scientist in me begins to come to. I notice the yellow gray quartz of the Normandy sands; the deep, dark organic staining of the Sainte Mere Eglise sample (how fertile that area must be); and the reddish tint of the sample from Pointe du Hoc. In my nearly 30 years as a soil scientist, I doubt I will ever hold a more precious collection of soil samples. I am humbled beyond words. I am the luckiest soil scientist in the country.

Sadly, I never got the name of the soldier that collected the samples. I seem to remember the doctor mentioning he had passed. I do know this, wherever he lays, he lays in sacred soil. ■

Nondiscrimination Statement

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by:

mail: U.S. Department of Agriculture
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410;
fax: (202) 690-7442; or
email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender. ■