National Cooperative Soil Survey Newsletter

November 2012
Issue 61

In This Issue—

Editor's Note

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

You are invited to submit stories 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.

NCSS Soil Mapping on Federal Park Lands

By Susan Southard, soil scientist, NRCS, National Soil Survey Center.

The Department of the Interior has committed to the development of soil surveys for 270 natural resource park properties. At the end of the last fiscal year, 224 of these properties had completed soil resource inventories that utilized USDA–NRCS soil mapping.

Most of the parks utilize soil survey data provided as part of traditional NRCS county-based soil mapping. The data is clipped from the Soil Data Mart, and a park-specific database is provided using a customized Access SSURGO template.

Park-specific soil manuscripts have also been developed for some parks. The manuscripts include images, soil formation sections, and custom tables developed by the National Soil Survey Center (NSSC) and National Park Service (NPS). The manuscripts are prepared by NSSC staff and reviewed by local NRCS and NPS personnel.

Over the years, a significant number of park properties have been mapped through interagency agreements. These parks can be selected as soil survey areas on the Web Soil Survey. Current, ongoing interagency projects for soil mapping include Glacier National Park in Montana, Rainier National Park in Washington, Voyageurs National Park in Minnesota, and Carlsbad National Park in New Mexico (fig. 1). Approximately 10 other soil mapping projects involving park properties are ongoing. They are in scattered areas, predominantly in western States.

It's nice to get positive feedback on these projects. The NPS soil resource inventory group in Lakewood, Colorado, received the following email message from an NPS park employee in Idaho: "It was like Christmas today! I had no

Figure 1.—Logan Peterson (left), NRCS soil scientist, and Aaron Miller, NRCS soil scientist and project leader for Carlsbad National Park. Scott Woodall, NRCS range ecologist (not pictured), is also working on the project.

idea we were going to get this information at all, much less in an amazing and glossy format! We will create a soil exhibit for our Visitor Center for next summer with the posters. As an archaeologist I refer to soil maps all the time—so I know what I am going to be digging in. The photographs in the soil book with the soil boundaries on them are a great addition. Thank you so much!"

The manuscript for the Soil Survey of City of Rocks National Reserve, Idaho (fig. 2), is available at http://soils.usda.gov/survey/online_surveys/idaho/ID721/CIRO_ID.pdf. ■

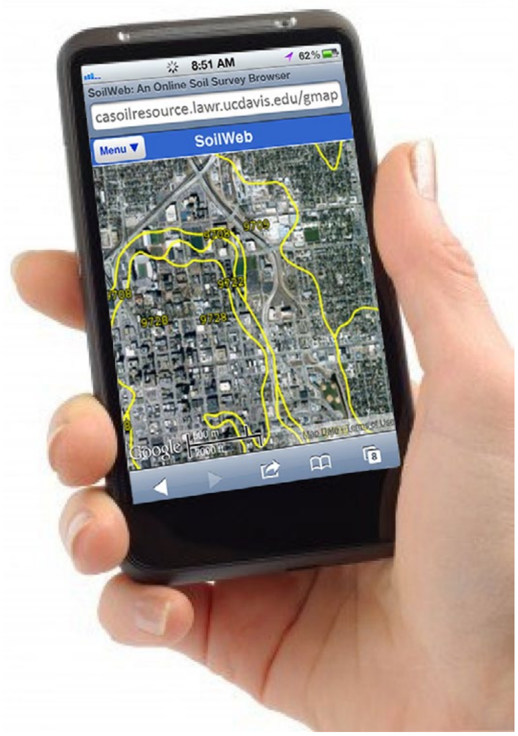
Figure 2.—An image from the Soil Survey of City of Rocks National Reserve, Idaho. The park staff and others find such images especially helpful in understanding the distribution of map units on the landscape.

SoilWeb App Updated

By Linda Greene, ACES enrollee, NRCS, National Soil Survey Center, Lincoln, Nebraska.

Good news for SoilWeb users: A revised version of the application has been released. The application can now be used on multiple types of devices, including desktop computers, smartphones, and tablets. This version makes the application accessible to a more diverse user group anywhere an Internet connection is available.

The original SoilWeb application was released more than a year ago and was accessible only as an iPhone application. But things have changed as of November 2012. The latest SoilWeb is Web based, not a native application that requires a download. It displays soil map unit delineations overlain on Google base maps. Users can view summaries of soil information for their geographic location using the GPS location services of their mobile device or for anywhere soil survey exists using Google's online navigation capability. Also, maps and data are now available for Alaska, Hawaii, and the Pacific Islands. Detailed soils information is seamlessly linked and formatted within the app along with integrated help sections for nontechnical users.



SoilWeb was a collaborative project between USDA–NRCS and the Soil Resource Lab at the University of California, Davis. The SoilWeb smartphone application averages between 500 and 1,000 hits per day by people looking for soils information for the ground they are standing on (through their smartphone's GPS coordinates). It is accessed from every State in the country. The SoilWeb Google Earth application currently averages about 15,000 hits per day. The SoilWeb app was designed to complement the suite of native apps for smartphones and Google Earth. The app is available at http://casoilresource.lawr.ucdavis.edu/soilweb.

Project leaders are currently working to enable the app to add recently updated soil surveys. According to Toby O'Geen, one of the application developers, they are very close. "As of now, some updates and very recent surveys may be missing along with soil suitability ratings for all soil survey areas at this time," said O'Geen. "However, we are very close to a solution."

User feedback can be sent to Toby O'Geen at atogeen@ucdavis.edu. ■

Central States Forest Soils Workshop

By Craig Busskohl, forester, NRCS, National Soil Survey Center, Lincoln, Nebraska.

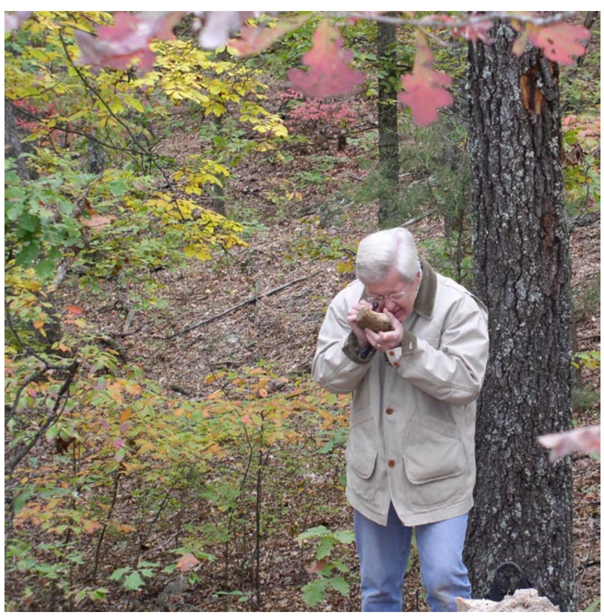
Clear skies and overnight thunderstorms added to the early fall colors for the 32nd annual Central States Forest Soils Workshop. The workshop was held at the Trout Lodge facility of the YMCA of the Ozarks, near Potosi, Missouri, October 9th to 11th. Hosted by the Missouri Association of Professional Soil Scientists, this year's workshop was additionally sponsored by the USDA Natural Resources Conservation Service, USDA Forest Service, Missouri Department of Conservation, Missouri

Department of Natural Resources, and University of Missouri. Attendees consisted of representatives of those organizations plus Missouri State University and the Washington County Soil and Water Conservation District, soil and forestry consultants from Missouri and surrounding States, and several retirees, including the recently retired state soil scientist acting as master of ceremonies.

An introductory session on Tuesday evening included welcomes from Missouri's state forester, acting deputy forest supervisor for the Mark Twain National Forest, and NRCS state soil scientist. Ecological sites (ES) and ecological site descriptions (ESD) were the focus for the session. The hosts from Missouri shared the results and progress from many years of an interagency partnership. The partnership involves a collaboration of local, State, Federal, and conservation organizations. The exemplary work in Missouri provides a template for the acceleration of ESD development in the rest of the eastern United States.

After the opening-night introduction, the workshop was entirely in the field. Participants observed and discussed various landscapes distinguished by different combinations of geology, soils, and vegetation communities. Field trips focused on ecological sites and forest ecosystem management on Missouri Ozark soils. Sites displayed a variety of conditions, including a 20-year savanna restoration project in Mark Twain National Forest, contrasting woodland management practices (chemical, prescribed fire, and thinning) by the Missouri Department of Conservation, the effects of slope aspect on woodland/forest communities in St. Joe State Park, the Devil's Honeycomb "geologic wonder" in Hughes Mountain Natural Area, and a scenic point at one of the highest spots in Missouri. These sites provided a view through much of the stratigraphic column of the Ozarks, from Precambrian igneous soils up through various soils formed in Cambrian and Ordovician limestone, dolomite, shale, and sandstone. As soils and vegetation communities were viewed at each site, ecological dynamics and management practices appropriate for the site were discussed for inclusion in draft ecological site descriptions.

The hard work and long hours invested in preparation and logistics were evident. The speakers, organization, and field trips, including an information-packed guidebook, were all well done. ■



NRCS soil scientist Fred Young intently studies a ped at the Mark Twain National Forest in east-central Missouri.

Reaching Out, Raising Hope—The Combined Federal Campaign

By Cindy Stuefer-Powell, physical science technician and CFC key worker, NRCS, National Soil Survey Center, Kellogg Soil Survey Laboratory, Lincoln, Nebraska.

The mission of the Combined Federal Campaign (CFC) is "to promote and support philanthropy through a program that is employee focused, cost-efficient, and effective in providing all Federal employees the opportunity to improve the quality of life for all." Pledges made by Federal civilian, postal, and military donors during the campaign season support eligible non-profit organizations that provide health and human service benefits throughout the world.

One may give to the CFC either monthly through payroll deduction or with cash (or check) for a one-time donation. Some employees choose to donate a "fair share," which is defined as one hour of pay per month. No gift is too small. Two dollars per pay period (or a cash donation of $52) will provide a month of nutritious lunches for a child in need. A gift of $4 per pay period can provide 4 days of adult care for a memory-impaired person. A gift of $20 per pay period can provide for the annual repair of a wheelchair or a pair of leg braces for someone with muscular dystrophy.

Donors choose who will receive their gift. A list of the CFC approved charities is available for each local campaign area.

The Reaching Out, Raising Hope Campaign ended November 16th, but donations can be accepted until December 31st. Contact your CFC key worker for a pledge form, a list of approved charities in your area, or further information. ■

Banner Year for Kellogg Lab

Fiscal year 2012 was a year of milestones for the Kellogg Soil Survey Laboratory (KSSL), which is part of the National Soil Survey Center in Lincoln, Nebraska.

First, the lab was officially designated as the Charles E. Kellogg Soil Survey Laboratory. Details about the dedication ceremony are available in the August 2012 edition of this newsletter (ftp://ftp-fc.sc.egov.usda.gov/NSSC/NCSS/Newsletters/issue60.pdf).

Second, a video describing the KSSL and its mission, goals, and capabilities was developed in cooperation with the University of Nebraska. Several members of the KSSL staff, as well as other NSSC staff members, contributed to the video, and their efforts resulted in a product that we are extremely proud of. If you have not seen the video, please take a look. It can be viewed at http://www.youtube.com/watch?v=BOW80LICx-M. If you would like a copy on DVD, please contact the NSSC.

Third, productivity was record setting at the KSSL. The lab received and processed 20,948 soil samples—more than three times the yearly average (based on the lab's 11 years of recordkeeping).

According to Dr. Larry West, national leader for Soil Survey Research and Laboratory, much of the increased workload can be attributed to soil samples related to the Rapid Carbon Assessment and the EPA National Wetland Condition Assessment. Although most of the samples required only limited analyses, the lab completed more than 280,000 individual analyses, which is about twice the number of a typical year. According to Dr. West, most labs do a fraction of that amount.

"For many labs that offer the range of analyses offered by the KSSL, 400 samples or so is a productive year, making this a significant accomplishment," said West. "And at no time was quality compromised.

"Only through the efforts of a cadre of talented and dedicated physical science technicians were we able to address all of the year's data needs and still continue to provide quality data, which is the lab's highest priority," West concluded. ■

Salt- and Sodium-Affected Soils in Hungary

By Joe Chiaretti, soil scientist, NRCS, National Soil Survey Center, Lincoln, Nebraska.

I was privileged to serve on an international assignment in Hungary between September 12 and 21, 2012. The exchange program for this assignment was organized and conducted by Dr. Erika Michéli and her colleagues of Szent István University. Szent István University is the main educational institute of agriculture in Hungary and is located in Gödöllő, a moderate-sized community about 40 kilometers (20 miles) northeast of Budapest, the Nation's capital. My assignment began and ended in Gödöllő. Hungary is about the same size as the State of Indiana. It is one of the oldest European countries and is situated in the Carpathian Basin of Central Europe. Dr. Michéli drafted a program that included field days in several areas of central and northern Hungary to either observe Hungarian forest soils or describe and sample saline-sodic soils formed in grassland ecosystems of the Great Hungarian Plain. We held meetings and field interactions with staff and colleagues from the Soil Conservation Directorate of Hungary in Szolnok and Miskolc, the University of Debrecen-Karcag Research Institute, and the University of Miskolc.

The main objectives of my international assignment were twofold. The first main objective was to observe saline and sodic soils in Hungary in order to understand their classification in Soil Taxonomy (ST), the World Reference Base for Soil Resources (WRB), and the Hungarian Soil Classification System (HSCS). The ultimate goals of this objective are to improve Soil Taxonomy and to incorporate the taxa needed for these soils into the future Universal Soil Classification System. In Hungary, 10 percent of the total land area is influenced by the accumulation in soils of either soluble salts and/or exchangeable sodium. The second main objective was to facilitate the progress of a task group that is working to develop common guidelines for field descriptions of morphology.

On Thursday, September 13—my first full day in Hungary—I was taken to the campus of Szent István University and brought to Dr. Michéli's office in the Department of Soil Science and Agrochemistry. After a quick office orientation, I was escorted by Mrs. Márta Fuchs and Dr. Tamás Szegi to a forested site on the university campus to observe some open soil profiles. The first profile was of a soil formed in a deposit of coarse loess. The soil had an ochric epipedon, argillic horizon, and calcic horizon. It classified as fine-loamy, mixed, superactive, mesic Calcic Haplustalfs in ST, as Endocalcic Cutanic Luvisol (Epidystric) in WRB, and as Lessivated Brown Forest Soil in the HSCS. A second soil pit was also observed nearby and differed by having greater depth to the upper boundary of the calcic horizon. We discussed characterization sampling procedures, horizon morphology, and horizon designations at both of these forest soil pits.

On Friday, September 14, I was taken to an area near the village of Apaj where saline soils have formed on stream terraces in alluvium deposited by the ancestral Danube River. The participants on this day were me, Dr. Michéli, Dr. Szegi, and Mrs. Fuchs, who traveled together from Gödöllő, and Mr. Szabari Szabolcs from Szolnok, who met us at the field site (fig. 1). We excavated a pit on a high terrace of the Danube River in a saline-sodic soil. The soil classified as fine-silty, mixed, superactive, calcareous, mesic Aeric Halaquepts in ST, as Calcic Endogleyic Solonchak (Sodic, Siltic) in WRB, and as Calcareous Solonchak in HSCS. We discussed the significant differences in the criteria between WRB and ST for the diagnostic "salic" horizon. The WRB has a much lower threshold value for electrical conductivity in the salic horizon than does ST. On our return trip to Gödöllő, we stopped to observe the surface of pasturelands that contain numerous anthropogenic microfeatures—in the form of aerial bomb impact craters (fig. 2). The craters are a legacy of the dark last days of World War II when Hungary was occupied by Nazi Germany but was being "liberated"

Figure 1.—Mr. Szabari "Szabi" Szabolcs standing in the middle of a szikpadka (a wind-deflated saline spot) on a high terrace along the Danube River near the town of Apaj. Natural resources within a local unit of the Hungarian National Park system are being degraded by the continued growth in the size of saline spots. Mr. Szabolcs is deputy director, head of soil conservation, and soil conservation inspector in Szolnok, Hungary. (Photo by Márta Fuchs)

Figure 2.—An anthropogenic microfeature on the Great Hungarian Plain resulting from World War II. This impact crater was created by the explosion of a bomb dropped by the Russian air force in an attack on retreating German troops in 1944.

by Soviet Russia. Hungary was under socialist totalitarian rule until the Soviet Union collapsed in 1991.

On Monday, September 17, I travelled with Mrs. Fuchs by car from Gödöllő to meet once again with Mr. Szabari Szabolcs at his office near the city of Szolnok. We met Mr. Szabolcs and proceeded to a site on a farm near the village of Zagyvarékas. A large soil pit had been excavated in an area of a field that was having management problems. We examined, photographed, described, and sampled the soil profile (figs. 3 and 4). The soil classified as fine, smectitic, mesic Sodic Calciusterts in ST and as Calcic Mollic Sodic Endogleyic Vertisol (Humic, Hypereutric, Pellic) in WRB. The management problems on the soil may be due as much to unfavorable physical properties as to chemical properties.

Figure 3.—Profile of a sodium-affected soil with a high shrink-swell potential located on a high terrace of a tributary of the Tisza River near the town of Zagyvarékas. This soil has a mollic epipedon (0 to 47 centimeters), slickensides and wedge-shaped peds (25 to 135 centimeters), and a calcic horizon (80 to 105 centimeters). It classifies as Calcic Mollic Sodic Endogleyic Vertisol (Humic, Hypereutric, Pellic) in the World Reference Base for Soil Resources and as fine, smectitic, mesic Sodic Calciusterts in Soil Taxonomy.

Figure 4.—A close-up view of wedge-shaped peds bounded by small slickensides, which are common in the soil at a depth of about 60 centimeters. Masses of secondary calcium carbonate have accumulated within some wedges and have disrupted the fabric of the Bknss1 horizon.

On Tuesday, September 18, we visited a farm near the village of Jaśzapáti, where another soil pit had been excavated for us in a portion of a field having management problems. We examined, photographed, described, and sampled the soil profile. The soil classified as fine, smectitic, mesic Vertic Natrustolls in ST, as Endocalcic Mollic Salic Endogleyic Vertic Solonetz (Humic) in WRB, and as Steppe-like Meadow Solonetz in the HSCS. Soluble salts formed visible efflorescence of needle-shaped crystals (probably Na_2SO_4) on the dried, undressed walls of the soil profile. The maximum content of soluble salts was located below an overlying natric horizon but in conjunction with a calcic horizon.

We then travelled by car eastward to the city of Karcag and visited the Karcag Research Institute of the University of Debrecen. We met with the current director, the previous director, and several staff members. The Karcag Research Institute is situated in the driest part of Hungary and deals mainly with research for the development of farming on the clayey and commonly saline-sodic soils of the Great Hungarian Plain. We were given a tour of an array of experiments using weighable lysimeters by Györgyi Kovács and her colleagues. We were also shown a presentation on the geomorphic history and soil-formation processes in the region by Dr. Lajos Blaskó. We were then taken to two field sites on Institute property to observe a classic Solonetz soil and a Chernozem soil. We spent most of our time examining the Solonetz soil. It classified as fine, smectitic, mesic Vertic Natraquolls in ST, as Calcic Mollic Vertic Solonetz (Humic, Siltic) in WRB, and as Meadow Solonetz in the HSCS. The diagnostic horizons were mollic (0 to 30 centimeters), natric (5 to 50 centimeters), and calcic (85 to 110 centimeters).

Late that afternoon at the Karcag Research Institute, I was introduced to Dr. Endre Dobos and Mr. Tibor Bialkó. That evening, they transported me by car from Karcag to the city of Miskolc.

On Wednesday, September 19, Dr. Dobos and Mr. Bialkó conducted a quick tour of the area around the city of Miskolc. They explained the history, geomorphology, geology, and common soils of the area. We had a quick lunch of lángos, a Hungarian fast food made of fried bread topped with cheese, bacon, or other goodies. From Miskolc, we drove to the nearby village of Alacska, which is located in the sloping, highly dissected eastern foothills of the Bükk Mountains. The foothills around the village are used for farmland, viticulture, and horticulture. Dr. Dobos has been using the Alacska area for pedological studies and field tours for several years. We observed three soils exposed in large pits that had been opened for the last month as part of a field excursion of the Hungarian Soil Science Society. The soils were all very deep and fine textured and had vertic intergrade properties (slickensides and high linear extensibility) and redoximorphic features. The soil at site 1 classified as fine, smectitic, mesic Aquertic Haplustalfs in ST and as Endostagnic Endovertic Luvisol (Colluvic, Ruptic) in WRB. It showed signs of both subsurface compaction and surface water erosion from farming operations. The soil at site 2 classified as fine, smectitic, mesic Aquertic Paleustalfs in ST and as Endostagnic Endovertic Luvisol (Epieutric) in WRB. It also displayed signs of surface water erosion. This soil had prominent skeletans of uncoated silt grains on faces of peds (pseudogley) in the argillic (argic in WRB) horizon. The soil at site 3 was on a valley floor and classified as fine, smectitic, mesic Cumulic Vertic Endoaquolls in ST and as Bathivertic Gleyic Phaeozem in WRB. Minor amounts of artifacts (brick and concrete with diameters of 1 to 3 centimeters) were in the upper horizons. My local hosts then took me to the Miskolc train station and placed me on a westbound train back to Gödöllő.

On Thursday, September 20, I gave presentations on soil quality and soil change to two classes of Dr. Michéli's master's degree students.

I departed Hungary on Friday morning, September 21, to return to the United States.

I thoroughly enjoyed the work with my Hungarian colleagues and look forward to future collaborations with them. Like much of Europe, Hungary has a very long history, a unique cuisine, an interesting language, a beautiful capital city, and warm, friendly people. My memories of this international detail will surely sweeten with time.

Soon after returning to Nebraska, I began exchanging follow-up information with the Hungarians on the taxonomic classification of the soils we observed. Dr. Michéli and her Ph.D. candidate, Mrs. Márta Fuchs, will be communicating with me on the technical details for a paper on calculating taxonomic distances of salt- and sodium-affected taxa in Soil Taxonomy and the World Reference Base for Soil Resources.

The plan is to select appropriate salt- and sodium-affected taxa in ST and WRB, choose differentiating properties, and calculate taxonomic distances for analysis.

The NRCS Soil Survey Program in the United States benefited by the communication and information exchange that occurred during the assignment. The exchange directly benefited our taxonomic classification system and our soil survey standards. It allowed us to test our taxonomic criteria outside of the U.S. and to incorporate new concepts into developing global standards for soil descriptions. U.S. agriculture will benefit because we improved our understanding of soils that are closely related to similar soils in the U.S. Great Plains States. This understanding will help us to better describe, classify, and interpret soils in our soil survey program. It also facilitates progress toward improving Soil Taxonomy and the future development of a Universal Soil Classification System. ■

NRCS Team Receives EPA Award

The NRCS Soil Support Team received national recognition from EPA's Office of Water for remarkable commitment to improving the science of wetlands monitoring, assessment, and management. Through an interagency agreement between NRCS and EPA, more than 6,000 soil samples from more than 1,100 wetland sites were analyzed over a 14-month period. The data collected will aid in efforts to design and implement practices to help preserve and manage the Nation's wetlands. Team members included Leander Brown, Richard R. Ferguson, Edward Griffin, Phillip King, Steve Monteith, Chris Smith, Lenore Matula Vasilas, and Larry West. ■

Michael Scozzafava (left), EPA, Office of Water; Nancy Stoner, acting assistant administrator, EPA, Office of Water; Richard Ferguson, analytical chemist, USDA, NRCS; Michael H. Shapiro, principal deputy assistant administrator, EPA, Office of Water.

Fieldwork Begins for the Soil Survey of Sequoia and Kings Canyon National Parks

By Jennifer Wood, soil data quality specialist, NRCS, Davis, California.

Fieldwork for the soil survey of Sequoia and Kings Canyon National Parks, California, commenced in July of this year. The survey area is located in Major Land Resource Area (MLRA) 22A, the Sierra Nevada Mountains. Funding for the soil mapping is provided through the National Park Service's (NPS) Soil Resource Inventory Program. NPS is a Federal partner in the National Cooperative Soil Survey. The synthesis of soils information for benchmark landscapes in the MLRA is also a component of the National Soil Survey Center's Bay Delta Soil Systems Study, which was recently launched as part of the larger NRCS Bay Delta Initiative. Data collection in this soil survey use, as well as further develop, the models of soil formation developed for the entire MLRA over the last century.

Soil mapping began in the northern section of the survey area, which can be accessed from both the east and west sides of the Sierra Nevada Mountains. Teams of two or three soil scientists and two ecological site specialists, with mules that carried equipment, backpacked into the survey area. They made three mapping trips, each lasting 9 to 11 days, and collected over 100 pedon and site descriptions. Chris Savastio, soil scientist at the Sonora, California, MLRA soil survey office, is the project leader. The other soil scientists were Cathy Scott, Sonora MLRA soil survey office project leader; Kerry Arroues, Hanford MLRA soil survey office project leader; and Benjamin Marshall, Dylan Beaudette, Emily Meirik, Julie Baker, and Michelle Stropky (figs. 1 and 2). The ecological site specialists were Dave Evans, Marchel Munnecke, and Alice Miller. National Park Service archaeologists Keith Hamm and David Nichols

Figure 1.—NRCS soil scientist Michelle Stropky (left), NRCS soil scientist and MLRA project leader Cathy Scott, park ranger Dave Gordon, NRCS soil scientist Chris Savastio, and park ecologist Erik Frenzel.

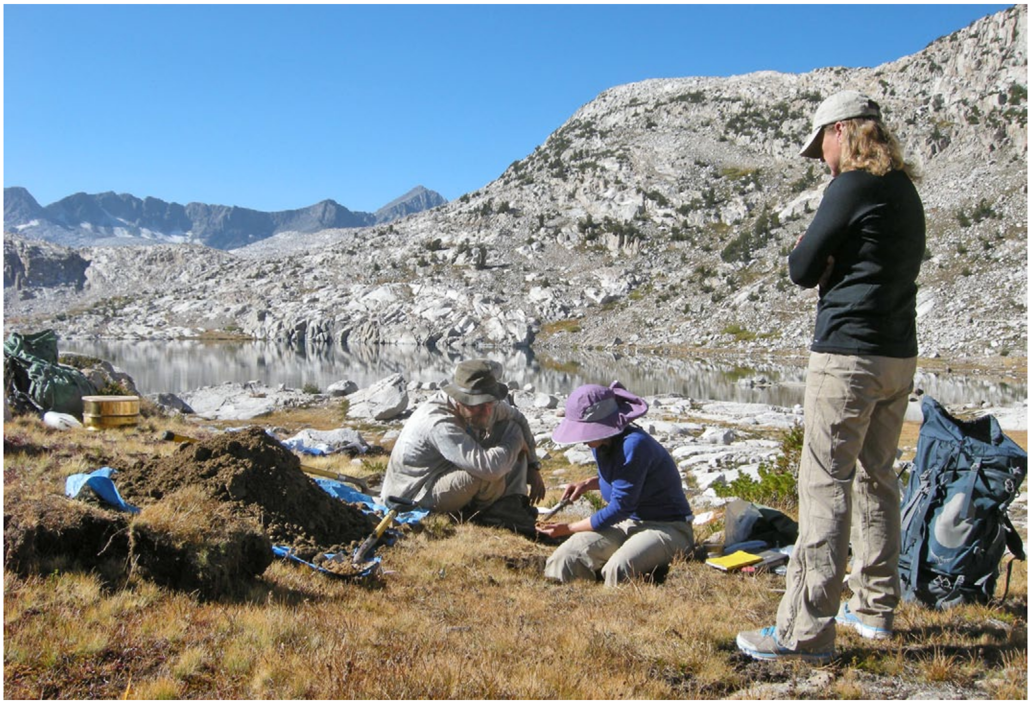


Figure 2.—Chris Savastio, Jennifer Wood, and Cathy Scott sample a lake basin soil. The soil is somewhat poorly drained and moderately deep. It formed in slope alluvium over residuum.

accompanied the teams and cleared all pedon locations before digging. A fourth trip crossed the survey area from east to west and consisted of 8 days of collecting soil samples for submission to the Kellogg Soil Survey Laboratory. Jennifer Wood, soil data quality specialist at Davis, conducted initial field review activities.

The interagency work plan specifies order 3 and 4 mapping in general and order 2 mapping in ecologically important areas, which include stream terraces and flood-plain steps (colloquially known as meadows) (fig. 3). About 70,000 acres of mostly

Figure 3.—An area that was previously designated as Rubble land miscellaneous area. In the new survey, such areas will have a higher-order component name and horizon data so that interpretations can be made.

glaciated granitic mountains and valleys were mapped (fig. 4). The acreage ranged from about 8,000 to 12,000 feet in elevation and included lodgepole pine-dominated forests and alpine environments above the tree line. U-shaped valleys, polished domes, glacial erratics, and glacial till deposits abound in the majestic, lake-dotted landscape. The soils in the meadow areas are highly variable, ranging from well drained to very poorly drained and from mineral to organic. A desirable outcome of the mapping would be a model that uses soil-forming factors to predict the distribution of the various types of meadow soils. Soil temperature sensors were placed at all sample locations and near one of the park climate stations in the mapping area. More soil climate data stations are planned for other locations in the survey area. The data from these stations will establish a soil climate baseline for the study of changes in ecology related to elevation and climate. ■

Figure 4.—Very deep, moderately well drained glacial till soil. This soil has a densic horizon at a depth of 110 centimeters. The horizon perches water and has developed cemented redoximorphic features.

Field Investigations in the Sacramento-San Joaquin Delta

By M.A. Wilson, research soil scientist, National Soil Survey Center, Lincoln, Nebraska; K.D. Arroues, MLRA soil survey leader, Hanford, California; and D.W. Smith, director of the Soil Science Division, Washington, DC.

The watershed of the San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) encompasses 38 million acres and consists of all or parts of eight major land resource areas (MLRAs). The area includes the combined watershed of the Sacramento and San Joaquin Rivers. The importance of the soils and water in this area cannot be emphasized enough. Agricultural production in the area is valued at over 28 billion dollars annually (fig. 1), and the water that moves through the area serves as drinking water for 22 million people.

This past year, a study of the soil systems of the entire watershed was initiated by the California NRCS soils staff, university personnel, and the National Soil Survey Center. This research project is studying selected, important benchmark landscapes and soils within the watershed. The goal of the study is to improve our understanding of pedogenic and soil functions within the MLRAs of the area. The specific objectives include (1) improving the accuracy and precision of soil maps and interpretations and creating accurate ecological site descriptions for the area; (2) understanding the relationship and properties of modified soils, soil health, and dynamic soil properties in the region; (3) improving our understanding of hydrologic properties, flows, storage, water-use efficiency, and nutrient pathways; and (4) providing an opportunity of field training for soil scientists. The results of this project will directly assist the NRCS National Conservation Initiative for one of the most important estuaries in the United States.

One overarching goal of the project is to foster interaction among soil scientists, agronomists, ecologists, biologists, and others from different agencies and universities. The data from the project will also be useful to future digital soil mapping and watershed modeling efforts, including models used in the USDA Conservation Effects

Figure 1.—Corn production on Webb Tract, an island in the center of the Sacramento-San Joaquin Delta. Mt. Diablo is in the background.

Assessment Project (CEAP), which quantifies the environmental benefits and other effects of conservation practices.

This past year, much of the focus of the initial field investigations and sampling for laboratory analysis has been within the Sacramento-San Joaquin Delta (also known as the California Delta), which is at the confluence of the Sacramento and San Joaquin Rivers. The Delta lies just east of San Francisco and is generally bounded by the cities of Sacramento, Davis, Stockton, Tracy, Antioch, and Rio Vista (see map).

Prior to its conversion to agriculture, the Delta was the largest system of wetlands on the west coast of the United States (fig. 2). It consisted principally of tidal,

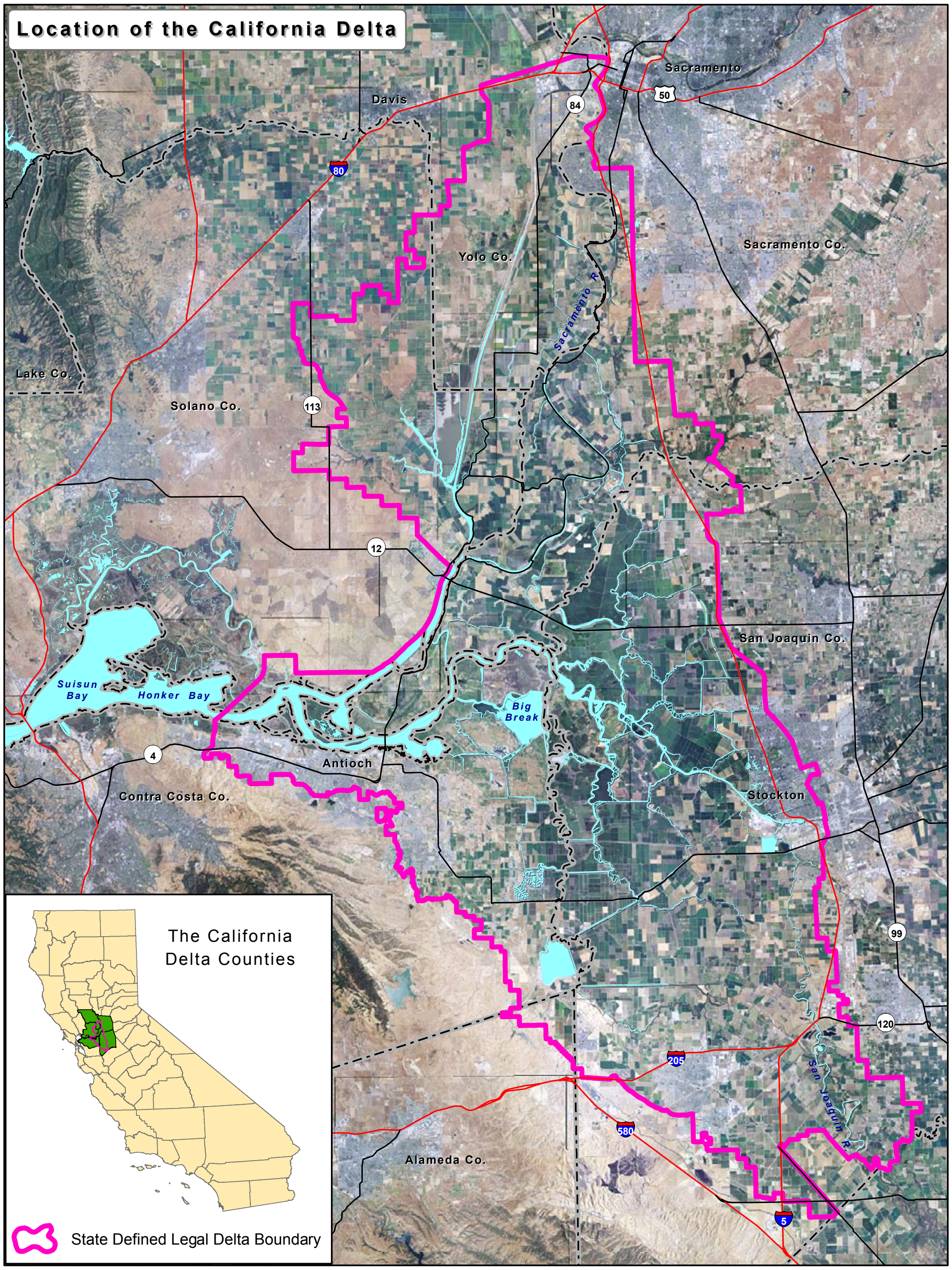


Figure 2.—Jersey Island Ferry, which provides transportation to Bradford Island and Webb Tract.

freshwater emergent wetlands dissected by large tidal channels. Surrounding these tidal wetlands were areas of non-tidal perennial and seasonal wetlands, grasslands, and oak savannas (Whipple et al., 2012). Vegetation on the tidal emergent wetlands consisted principally of a freshwater sedge called tule *(Schoenoplectus acutus,* http://plants.usda.gov/java/profile?symbol=SCACO2). Cultivation began after a Federal act passed ownership of the land from the Federal to State government in 1848. The State began to sell the land as swamp in parcels that were initially limited to 320 acres. The first levees consisted of low dikes made using wheel barrows and shovels, but these hand-made levees were soon reconstructed with clayey alluvium taken by dredges from channel bottoms (Weir, 1950; Thompson, 2006).

By 1920, most of the soils on these islands between levees were drained and used for agricultural production. The soils were principally organic in composition, and the proportion of organic to inorganic materials in a location varied based on hydrogeomorphic position (Drexler et al., 2009a). Peat has been accreting for over 6,000 years, and early reports suggest that the organic material was initially 9 meters thick in the center of islands (Drexler et al., 2009a; Drexler et al., 2009b). Records of subsidence (initiated in 1922) demonstrated that soils were subsiding at rates of up to 12 centimeters a year during the period of 1920 to 1940, principally through oxidation of the organic materials (Weir, 1950). Multiple causes of subsidence were responsible for this loss of volume. Historically, poor management has also played a big role in loss of organic matter. For example, in the past soils were burned every few years in the upper 10 to 15 centimeters to destroy weed seeds and kill pests.

Today, the Delta is an important and ecologically sensitive agricultural area with over 470,000 acres of farmland separated by over 1,100 miles of levees into 57 tracts or islands (Ingebritsen et al., 2000). Soils in this area produce a diversity of crops, including corn (fig. 3), asparagus, and tomatoes. These islands of agricultural land still exist due to constant maintenance of the levees and drainage ditches. This system of levees and channels is a major component of California's water delivery system, preventing influx of brackish seawater and thus allowing for relatively fresh water to move into the California aqueduct system (Brooks et al., 2012; Hundley, 1992).

Figure 3.—An irrigation system for corn in the Delta.

The islands are generally saucer shaped, with a greater amount of subsidence in the center. The subsidence has resulted in the land surface lying below sea level (the level of water in channels). From a vantage point on top of levees, it is noticeable that the water level in the channel on one side of the levee is commonly several meters above the land surface on the other side of the levee. Thus, maintenance of the levee system is critically important to prevent the irreversible flooding of islands and loss of thousands of acres of farmland that could occur from a single break in a levee. Flooding still occurs; for example, 19 square miles of productive farmland was flooded in 2004 (Thompson, 2006). Despite conservation efforts to minimize loss of organic matter, subsidence also still occurs, ranging from 0.5 centimeter to 3 centimeters per year (Deverel and Leighton, 2010; Deverel and Rojstaczer, 1996). Between 55 and 80 percent of the peat is estimated to have been lost from the farmed islands (Drexler et al., 2009b). Current agricultural preservation measures for these organic-rich soils include use of a cover crop, reduced tillage, and flooding following seasonal harvest of the crop. Using the soils for rice production has been shown to slow the rate of subsidence and loss of carbon (Hatala et al., 2012). Wind erosion is also an issue for the low-density organic soils, and tillage and harvesting operations can result in loss of soil material.

Over the past year, current soil surveys for the Delta area have been evaluated, sites of representative soils located, and samples collected for laboratory analyses. Also, a geophysical survey was conducted for each of the sampled sites using both ground-penetrating radar and electromagnetic induction. The sampled pedons had surficial organic layers that ranged from 1 to 3 meters in thickness over mineral soil material (fig. 4).

In 2011, fourteen sites in the Delta were evaluated and sampled for the Rapid Carbon Assessment project. In 2012, the Kellogg Soil Survey Laboratory conducted field and laboratory characterization investigations throughout the watershed. Results of these recent investigations will provide an improved understanding of the properties of benchmark soils in the area and of the impact of land use on water quality and soil health. Once the laboratory results are available and lab and

Figure 4.—Kerry Arroues (left), MLRA soil survey leader, and Mike Wilson, research soil scientist, after a day of sampling Histosols in the Delta.

geophysical data evaluated, more decisions can be made regarding a research strategy to better understand the distribution and properties of soils in the watershed. Due to the vintage of the published soil surveys and the paucity of laboratory data from past soil surveys, knowledge of soils in this area will be greatly improved by this updated work. Results of this research by the Soil Survey Division and our cooperators will be critical to preservation of this valuable resource of agricultural soils and wetland habitat.

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Nebraska State Range Judging Contest

By Curtis Talbot, rangeland specialist, NRCS, National Soil Survey Center, Lincoln, Nebraska.

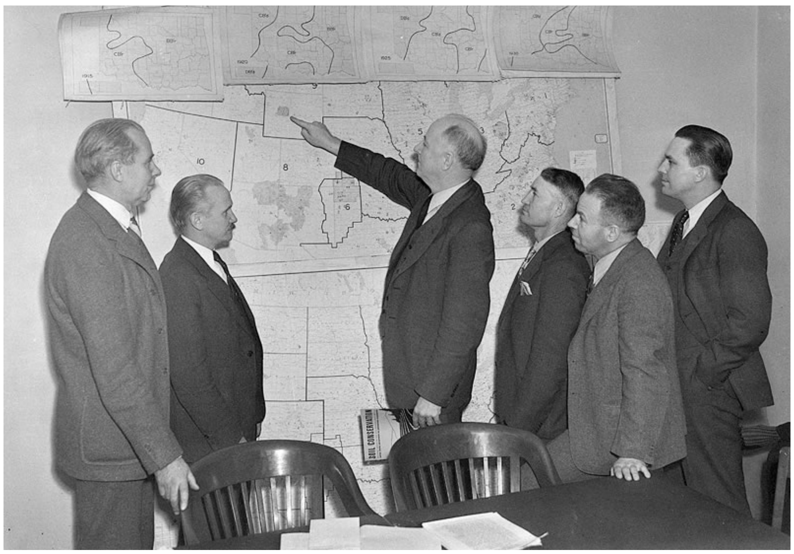
The Nebraska State Range Judging Contest was held in Stanton, Nebraska, on September 26th. This contest gives students in FFA and 4-H an opportunity to learn about and display their knowledge of Nebraska rangelands. Over 1,100 students competed in 5 area contests, culminating in the State contest, where over 350 students participated. The contest is sponsored by the Nebraska section of the Society for Range Management, NRCS, the University of Nebraska Extension Service, and the Nebraska Association of Natural Resource Districts. Numerous volunteers from across the State contributed their time.

Historically, Nebraska was once covered by a vast amount of rangeland, interrupted in places by woodlands along rivers and streams. Today, rangeland is still the major land category, covering about 46 percent (nearly 23 million acres) of the State. Combined with seeded pastureland (2 million acres), the grasslands occupy about 50 percent of the State.

Although youth are the primary participants in range judging, contests can be a challenging and effective learning tool for both youth and adults. An important objective is for the participants to better understand rangeland ecosystems in order to make proper management decisions. Contests teach some basic principles of range ecology, including soil-plant interactions, plant-animal interactions, and plant succession. Learning to judge range provides effective tools that are used to manage the range resource. ■

The Legacy Continues…

The recent Ken Burns' documentary "The Dust Bowl" referenced the beginnings of the agency that eventually became the Natural Resources Conservation Service. In doing so, the film discussed how Hugh Hammond Bennett, director of the Soil Erosion Service, placed Henry Howard Finnell, soil scientist, in charge of the Dalhart Wind Erosion Control Project. Finnell's research led the conservation efforts for the entire Dust Bowl. H.H. Finnell participated with H.H. Bennett in the recovery effort and the formation of the agency. Through years of service to the agency, Finnell became known as the "Watchdog of the Dust Bowl" and went on to become head of Region VI for the Soil Conservation Service. He died in 1960. The film revealed a legacy of commitment to the land by the Finnell family. Paul Finnell, soil scientist and national soils database manager at the National Soil Survey Center, is a distant cousin of Henry Howard Finnell. ■



A historical photo shown in the "The Dust Bowl." Henry Howard Finnell, soil scientist, is second from the left. Hugh Hammond Bennett is pointing at the map.

Paul Finnell (center) at recent training on soil correlation.