National Cooperative Soil Survey Newsletter

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Editor's Note

Issues of this newsletter are available on the World Wide Web (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 Stanley Anderson, National Soil Survey Center, Lincoln, Nebraska. Phone—402-437-5357; FAX—402-437-5336; email—stan.anderson@lin.usda.gov.

NRCS National Soil Survey Center Director Participates in Tanzanian Workshop

From Soil Survey Division, "Weekly Update," February 8, 2010.

During the week of January 24, 2010, Jon Hempel, National Soil Survey Center Director, traveled to Arusha, Tanzania, to attend the African Soil Information Service (AfSIS) workshop. The AfSIS project will supply soil property information, management and fertility recommendations, baselines for important ecological indicators, and the cyber infrastructure needed to provide the information over the Internet. The end user community will be consulted on the proper use of the information for all of sub-Saharan Africa. AfSIS is a member of the GlobalSoilMap.net consortium and will produce soil property information from legacy data (soil profiles and soil maps) based on a 90 X 90 M grid. The information will meet the standards and specifications of the GlobalSoilMap.net project and is designed to be included in the global database. The project is funded by the Bill and Melinda Gates Foundation and the Alliance for the Green Revolution of Africa.

This project is extremely timely as sub-Saharan Africa faces enourmous challenges in land use and environmental degradation issues (fig. 1). Current soils and ecological information will be essential in the effort to arrest these problems.

The Soil Survey Division is working with the AfSIS Project Manager, the International Program Division, and the Foreign Agriculture Service to provide soil science expertise in properly documenting soil profiles and to provide training in using soil taxonomy in the sampling areas. This information is currently not adequately collected.

Figure 1.—Land degradation near Arusha, Tanzania. This accelerated erosion has occurred since 1980 and is endemic across southeastern Africa.

Other NRCS technical expertise (conservation engineering, range management, and soil conservation) could be very valuable in providing demonstrations and education to local communities on techniques that provide a basis for mitigation of land degradation. ■

Ground-Penetrating Radar Investigation in Maine

From Soil Survey Division, "Weekly Update," November 9, 2009.

At the written request of the State Soil Scientist in Maine, Jim Doolittle conducted ground-penetrating radar (GPR) soil investigations in the "Big Woods" portions of Piscataquis and Somerset Counties during the period of October 18-22, 2009. Ground-penetrating radar was used to better characterize the soils surrounding several sampled typifying soil pedons, to assist with the determination of the composition of selected soil map units (by soil depth class), and to assess the adequacy of soil mapping in the "Big Woods."

Soil mapping has progressed at an accelerated pace in northern Maine. The quantity of supporting data on the composition of soil map units has not, however, kept up with the acreage that has been mapped. In northern Maine, GPR is used as a quality-control tool to document map unit composition based on soil depth criteria. Radar data are used to support soil interpretations. In many areas of Maine, it is difficult to examine soil profiles and determine the depth to bedrock. Rock fragments and irregular or weathered bedrock surfaces limit the effectiveness of conventional probing tools. In these areas GPR is a more effective tool to determine the depth to bedrock than conventional soil survey tools. GPR allows the rapid and seemingly effortless collection of large amounts of information on the underlying stratigraphy and/or lithology in the absence of a satisfactory number of cores or sufficient lateral or vertical perspective of exposures or outcrops. GPR interpretations are verified with a limited number soil cores and exposures.

Use of GPR greatly enhances the quality of the soil survey information being developed in this project. ■

NPS Park Spotlight: Great Basin National Park, Nevada

By Susan B. Southard, NPS Liaison, and Bill Dollarhide, retired Nevada State Soil Scientist, Natural Resources Conservation Service.

The NRCS Soil Survey Program of Nevada in cooperation with the National Park Service (NPS) has created a soil survey product for Great Basin National Park that addresses many of the data needs for the NPS to manage critical resources. At the same time, the efforts made by Nevada NRCS and the NPS, as a Federal lands partner, successfully address current Soil Survey Division priorities, including development of ecological site descriptions, assessment of soil carbon, soil survey MLRA updates, and assessment of data quality and completeness. This high-elevation, limited moisture park is a critical and sensitive area in terms of climate change. The new and updated soils data, coupled with updated and new ecological site descriptions, give the park baseline data to model, monitor, and manage for climate change. The updated soils data established 20 new soil series for the MLRA. Additionally, all the photos taken during the course of the survey were hyperlinked to the spatial point documentation layer.

At the forefront in meeting the needs of a major soil survey user, the soil survey of Great Basin National Park became the first SSURGO-certified survey in the National Cooperative Soil Survey (NCSS) to include point and line map units as part of its SSURGO dataset. Use of point and line map units permits a full set of soil properties to be reported, with complete map unit descriptions. These updated areas previously were broadly mapped as minor components. Point and line map units identify important information about soils and ecological sites and provide the spatial locations of the features observed in mapping. A point map unit was used in small areas of the new Wayhigh series (Xeric Haplocryepts) in concave areas at high elevations (fig. 1). These areas are less than 5 acres in size.

Figure 1.—A concave area of the Wayhigh series and Alpine Meadow ecological site in Great Basin National Park.

Line map units were used where the newly identified Rippo soil (Mollic Xerofluvents) was mapped along very narrow, mid-elevation drainageways. These areas have a unique ponderosa pine plant community with willows, sedges, and rushes in the understory. This ecologically significant plant community is mapped in complex with wet meadows and riparian aspen communities. Updated and new ecological site descriptions with state and transition models were provided and made available through the USDA Plants Database.

Great Basin National Park lies in eastern Nevada, in MLRA 28A (Great Salt Lake Area). The park ranges in elevation from 6,190 to 13,063 feet. The highest elevation is at Wheeler Peak, the second highest point in the State. Some of the unique park features include 5,000-year-old bristlecone pine trees (fig. 2) that grow on shallow or very shallow soils that formed in calcareous material derived from limestone, dolomite, or related carbonatic parent material. Also, some 2,000-year-old curlleaf mountainmahogany grows on shallow soils that formed in material derived from quartzite. The park has more than 40 caves, including Lehman Hill Caves, which are at an elevation of 7,000 feet and are believed to be the oldest caves in the park. Another feature of the park is Lexington Arch, one of the largest limestone arches in the western United States. Drastic elevation changes, complex soil climate patterns, and unique flora contributed to the extra effort required by the survey crew to identify 20 new soil series out of the 57 mapped in the Great Basin National Park and to describe 43 ecological sites.

Figure 2.—Example of a very old bristlecone pine in Great Basin National Park.

The soil survey of the 77,000-acre Great Basin National Park of Nevada (NV708) had many participants. Bill Dollarhide, retired NRCS Nevada State Soil Scientist and MO Leader, and Tom McKay, retired NRCS Nevada Senior Soil Scientist, entered into an interagency agreement with the NPS Soils Program Manager Pete Biggam to

refresh and customize part of the soil survey of Humboldt National Forest, Nevada, South Part (NV778), which covered more than 1 million acres. The park needed an updated and more comprehensive soils database, new ecological site descriptions, and applicable interpretations for park resource management issues.

Soil scientists Ed Blake and Ian Reed of the Soil Conservation Service completed initial mapping in 1991, with help from Gary Brackley, State Range Conservationist. Dave Polk, Range Conservationist, helped with ecological site identification and development.

The recent update mapping crew included Curt Leet, NRCS Project Leader (fig. 3), and Brien Park and Dave Zimmerman, NRCS soil scientists. Clint Anderson, Rangeland Management Specialist, helped with ecological site identification and development. He was assisted by NPS seasonal employee Jenny Beuerman. Paul Blackburn, MLRA Project Leader, provided part-time assistance.The NPS Soil Resource Inventory team in Lakewood, Colorado, is creating many thematic maps and internal reports from the Great Basin soil survey data for use by the park staff. Of particular interest to National Park Service is calculation of the park's soil organic and inorganic carbon stocks from data in the database. Concentrations of soil carbon vary greatly with elevation, soil climate, vegetation, and mineral weathering. Great Basin National Park soil survey data in the Soil Data Mart (SDM) have been imported into the NPS SSURGO template. A learning curve has been how to use a soil survey that has point and line map units. Soil survey data users must add in the soil map unit points and soil line feature classes from the SDM download in order to see them in ARCMAP. If users are not aware of these additional feature classes, not all the map units in the legend can be displayed. These two feature classes are not, at present, viewable in the Soil Data Viewer or in Web Soil Survey. Therefore, the NPS is developing guidance on how current tools can be used in datasets with point and line feature classes.

Figure 3.—Curt Leet, NRCS Project Leader on Mount Washington, Great Basin National Park, Nevada.

The soil survey of the Great Basin National Park is a wonderful product that is already meeting the needs of its intended users. ■

From the Surface Down, Second Edition, and *Keys to Soil Taxonomy*, Eleventh Edition

By Stanley P. Anderson, Editor, Natural Resources Conservation Service, Lincoln, Nebraska.

The second edition of *From the Surface Down: An Introduction to Soil Surveys for Agronomic Use* is available online (ftp://ftp-fc.sc.egov.usda.gov/NSSC/Educational_Resources/surdown.pdf). All sections of this work have been updated and edited, and sections 7 ("Detailed soil information") and 8 ("Location of soil properties and interpretations" have been rewritten with emphasis on Web Soil Survey. The illustrations have been formatted and renumbered (figures 1 through 28) and placed in a new sequnce in the text, a sequence that does not include "plates." Paper copies of this document will be prepared when printing funds become available.

The eleventh edition of the *Keys to Soil Taxomomy* also is online (ftp://ftp-fc.sc.egov.usda.gov/NSSC/Soil_Taxonomy/keys/2010_Keys_to_Soil_Taxonomy.pdf) and is being printed through GPO. Printed copies should be available this spring. ■

2010 NCSS Regional Conferences

The places and times of these conferences are as follows:

North Central: Columbus, Ohio—June 14-18, 2010
Northeast: Elizabethtown, Pennsylvania—June 6-11, 2010
South: College Station, Texas—July 12-16, 2010
West: Las Vegas, Nevada—June 21-25, 2010

This information is available online (http://soils.usda.gov/partnerships/ncss/conferences/regional.html). As further details about the conferences become available, there will be links from this site to sites that include information about the agenda, field trips, registration, and lodging. ■

NRCS Soil Scientists Study the Effects of Tillage

By Joanna Pope, NRCS public affairs specialist, Nebraska State Office, Lincoln, Nebraska. Originally published in "NEB NEWS, Newsletter of the Nebraska Natural Resources Conservation Service," Fall 2009.

Soil scientists with the USDA Natural Resources Conservation Service are currently working on a project that will help farmers know how tillage methods impact soil quality. According to NRCS Soil Scientist Dave Kohake, the Dynamic Soils Properties study, based out of Lincoln, Neb., is the first of its kind for NRCS

"In the past, studies have dealt more with the soil's intrinsic properties. This project will focus more on the dynamic soil properties affected by management," Kohake said.

The Dynamic Soil Properties study is focusing on two tillage methods—conventional tillage and no-till. For this study's purposes, a field is considered to have been conventionally tilled any time the soil has been disturbed with full-width tillage implements (i.e., disks, chisel plows, field cultivators). A field is considered to have been no-tilled if it has not had any manipulation to the soil's surface within the past 15 years. A couple organically farmed sites will also be evaluated.

The Dynamic Soil Properties study team, which, in addition to Kohake, includes Casey Latta, Cindy Stiles, Deb Harms, and Bruce Evans, identified five sites for each tillage method across southeast Nebraska with similar soil types. The team has been traveling around to these selected sites throughout the fall to collect soil samples.

Once at the site, the soil scientists prepare the test location by setting up a grid. Within the grid, five sampling pits are dug. The pits are all 16 inches deep. This is the depth where the impact of different farming techniques can be detected.

The soil scientists then begin identifying the different layers of soil. A sample of each layer is taken to the National Soil Survey Center's laboratory, located in Lincoln, Neb., for analysis.

The NSSC lab will check each site's soil samples for several properties, including bulk density and organic carbon content. Organic carbon, according to Kohake, is directly related to soil health.

"The amount of organic carbon content found within soil is the best indicator we have for soil quality. The higher the carbon content, the higher the soil quality or health," Kohake said.

NRCS Soil Scientist Casey Latta identifies soil properties at one of the Dynamic Soil Properties study's test sites in Lancaster County. Photo by Joanna Pope, NRCS.

This study will compare the lab results to show how conventional tillage, no-till, and organic farming methods impact soil properties. The results from this fall's study should be available by next planting season.

Kohake said, "This study should provide some useful information on how different management systems are affecting various dynamic soil properties. Hopefully, the information can be used to make better management decisions in the future for improving soil quality."

For more information about soil quality, visit your local NRCS office or the Web Soil Survey at http://websoilsurvey.nrcs.usda.gov/app/. ■

Interdisciplinary Cadre Developing Soil Change Training Course

From Soil Survey Division, "Weekly Update," December 21, 2009.

An interdisciplinary cadre met in Greensboro, North Carolina, December 8-11, to begin development of the new National Soil Survey Center (NSSC) course "Using Comparison Studies to Inventory Soil Change." This course will describe and demonstrate new procedures for integrated soil, vegetative, and management system data collection. These procedures are called comparison studies and are used to conduct Dynamic Soil Properties (DSP) projects for soil survey and ecological site inventory. Dynamic soil properties (e.g., organic carbon and aggregate stability) are among the soil properties that have the greatest impact on soil quality, soil function, and provision of important ecosystem services. A combination of classroom and field activities will be developed for this course.

Cadre members represent the intended course audience and include soil scientists, a forester, a range management specialist, an agronomist, and an NRI specialist. The East, Central, and West National Technology Support Centers, the Soil Quality Team, the NSSC, an MLRA project office, and a State NRI Coordinator were all represented. Marc Crouch is the Technical Coordinator, and Susan Andrews and Arlene Tugel are advisors. After taking the course, participants will be able to:

- Describe how land use and management affect soil properties, soil functions, soil quality, and ecosystem services.
- Define key concepts related to soil change.
- Apply simple conceptual cause and effect models (example-state and transition models) in project development and analysis.
- Develop a dynamic soil properties project plan and complete required planning documents according to procedures in the *Soil Change Guide*.
- Apply standard methods for plot selection and soil and vegetation data collection.
- Process project data, including database entry, error checking, and data evaluation.
- Interpret project results, applying key concepts related to soil change.
- Integrate DSP projects into appropriate MLRA SSO project plans.

A course prerequisite is the National Employee Development Center (NEDC) course "Soil Quality Assessment and Applications for Field Staff." ■

Soil Scientists Assist Archeologists in Washington, D.C.

From Soil Survey Division, "Weekly Update," November 30, 2009.

On Saturday, November 21, 2009, Jim Doolittle (Research Soil Scientist, National Soil Survey Center) and Amanda Moore (State Soil Scientist, Maryland) used ground-penetrating radar and electromagnetic induction to assess two sites and identify promising areas for archaeological excavations in the Fort Circle Park (owned by the National Park Service) in northwest Washington, D.C. The sites are located in the vicinity of the Battle of Bladensburg, which occurred during the War of 1812. This project is being led by the Benjamin Harrison Society, which is a 4-H affiliated group dedicated to teaching students about history, historical preservation, and conservation. Also participating in this investigation were research staff members from the Smithsonian Institution in Washington, D.C. Students were introduced to the geophysical methods and operated the electromagnetic meter. Sites were identified for future archaeological investigations by students and archaeologists assigned to the Smithsonian Institution. This activity provided an opportunity for the Soil Survey

Division staff members to provide assistance to some nontraditional customers and to interact with some students who normally might not be aware of USDA-NRCS. ■

Providing New Soil Survey Products to the GIS Modeling Community—National Atlas of Ecosystem Services Project

By Sharon W. Waltman, Soil Scientist, Spatial Data Specialist, National Resources Conservation Service, National Soil Survey Center, Morgantown, West Virginia.

Scientists from USDA-NRCS, Soil Survey Division, along with the U.S. Geological Survey (USGS) and the U.S. Environmental Protection Agency (USEPA), sponsored a meeting of international and national modelers at the USGS EROS Data Center in Sioux Falls, SD, to discuss the anticipated contribution of gridded soils information to the National Atlas of Ecosystem Services. The meeting took place on January 20 and 21. Representatives from Agri- and Agri-Food Canada, GlobalSoilMap.net, USDA (Economic Research Service and NRCS), West Virginia University, USGS, and USEPA attended the meeting. The local hosts in South Dakota included Deanna Peterson, State Soil Scientist; Curtis Elke, Assistant State Conservationist for Field Operations; and Bruce Kunze, Resource Soil Scientist, and Norman Bliss, Physical Scientist, with EROS Data Center. We thank these folks for their warm hospitality, despite the cold of an ice storm that caused our meeting to be held at the hotel on day one (fig. 1).

Figure 1.—International and interagency cooperation was at work to remove 2 days of freezing rain from Anne Neale's rental car before departure for the EROS Data Center in Sioux Falls, SD, on 1/21/2010. Ice scrapers include, from left to right, Scott Smith (Agriculture Canada), Bob Dobos (USDA-NRCS), and Anne Neale and Yongping Yuan (USEPA).

The purpose of the meeting was to: 1) introduce NRCS scientists to the GIS Simulation Modeling Community, 2) invite USGS-EPA to participate in NCSS, 3) document requirements of modelers for soil information, 4) develop a "short list" of themes to be developed, 5) develop standard methods of data summary for SSURGO themes, 6) develop data structures and means of delivery for the resulting gridded SSURGO data themes, and 7) explore future GlobalSoilMap.net applications for North America.

Day one introduced the concept of using a nation-wide detailed soil survey geographic database (SSURGO) layer in a "value added" gridded format. Screen draws for gridded SSURGO at 10-meter resolution can be as much as 800 times faster than the vector screen draws for a statewide view. Modelers desire using soils information in a gridded format for ease in combining with other gridded layers, such as land cover and terrain, within their GIS simulation models and often prepare their own national gridded versions of SSURGO in an independent, *ad hoc* fashion. Modelers also desire that the soil data do not change until their model "runs" are complete (stable for a year or so). Presentations identified needs for soil data in the following GIS simulation models: LandCarbon (USGS), GEMS—General Ensemble Biogeochemical Modeling System (USGS), Farm Bill Models (ERS), Ecosystem Performance and Soil Carbon calculations (NRCS and USGS), and Digital Soil Mapping (DSM) techniques in use in Canada and GlobalSoilMap.net.

Day two opened with Anne Neale (USEPA) introducing the National Atlas of Ecosystem Services, in which many important natural and cultural resource data layers are assembled and organized in a network of 12-digit HUCs for the United States. Many Federal partners support this online atlas along with the nonprofit partners National Geographic Society and NatureServ. This project strives to provide information that ensures that ecosystem services are considered in the land-use decision-making process. See http://www.landscope.org/. The soil data themes identified by the modeling community as essential are those targeted for incorporation into this project.

Rounding out day two were presentations on the needs for soils data in the Landfire (WXFIRE) project of USGS, Models for Future Land Cover Change using IPCC (Intergovernmental Panel on Climate Change) scenarios (FORE-SCE and CLUE) of USGS, Global Evapotranspiration (ET) and Hydrologic Models (GeoSFM) of USGS, GHG (Greenhouse gas) Mitigation landscape models (EPA and NRCS), Biofuel impact on land use (EPA), NCCPI (National Commodity Crop Productivity Index) of NRCS, and National Rapid Carbon Assessment Stratified Sampling Design (NRCS) and Landform mapping using Terrain Models (NRCS and USGS). Discussions on data-serving technologies related to high-resolution, national grids also took place among EROS, EPA and NRCS staff.

The major requirement identified in the meeting was for the national simulation modeling community to have a simplified product that uses a set of standard layers to provide data on basic physical soil properties (%S, %Si, %C, available water capacity, effective rooting depth, soil productivity, and soil carbon). In the mid-1990s, the generalized State Soil Geographic Database (STATSGO) was used as a source for input parameters for many of these models. Today, the modelers seek higher resolution information available from the detailed SSURGO source to improve their predicted results. This work group (fig. 2) and others not present at this meeting hope to prepare an NCSS document of "best practices" for preparation and calculation of these physical and productivity parameters for use in GIS simulation models. An early draft is anticipated for review in 2010.

The group will prepare a National Atlas of Ecosystems Services presentation (PowerPoint and poster) for each of the Regional National Cooperative Soil Survey meetings that will take place in June and July 2010. USGS and USEPA representatives will attend these meetings and begin to play a more active role in the

National Cooperative Soil Survey. They bring much expertise in terrain analysis and GIS modeling, and they seek the knowledge of NRCS pedologists to perform “best practices” when using the detailed SSURGO product.

For more information on this topic, contact Dr. Larry West (larry.west@lin.usda.gov).

Figure 2.—Participants in the January 2010 National Atlas of Ecosystem Services Project for Gridded Soils Meeting. *Row 1* (seated): Dr. Mark Johnson, USEPA Corvallis, OR; Yongping Yuan, USEPA Las Vegas, NV; Scott Smith, Agri- and Agri-Food Canada, Vancouver, British Columbia; and Dr. James Thompson, West Virginia University, Morgantown, WV. *Row 2*: Melanie Bliss (wife of Norman Bliss); Sharon W. Waltman, USDA-NRCS, NSSC, Morgantown, WV; Anne Neale, USEPA, Research Triangle Park, NC; and Dr. Skye Wills, USDA-NRCS, NSSC, Lincoln, NE. *Row 3*: Steve Peaslee and Robert Dobos, USDA-NRCS, NSSC Lincoln, NE, and Dr. Norman Bliss, EROS Data Center (USGS), Sioux Falls, SD. In attendance but not pictured: Dr. Larry West and Jon Hempel, USDA-NRCS, Lincoln, NE; Robert MacMillan, GlobalSoilMap.net, ISRIC, Netherlands; and Bruce Kunze and Curtis Elke, USDA-NRCS, Brookings, SD.