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

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Issue 65

In This Issue—

Editor's Note

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

You are invited to submit 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.

Universal Soil Classification Meeting

The International Union of Soil Science (IUSS) Universal Soil Classification System Working Group held its third workshop in Florianopolis, Brazil, July 31 to August 4, 2013. The 3-day meeting included a field trip to discuss classification of tropical soils and was in conjunction with the Brazilian Soil Science Congress.

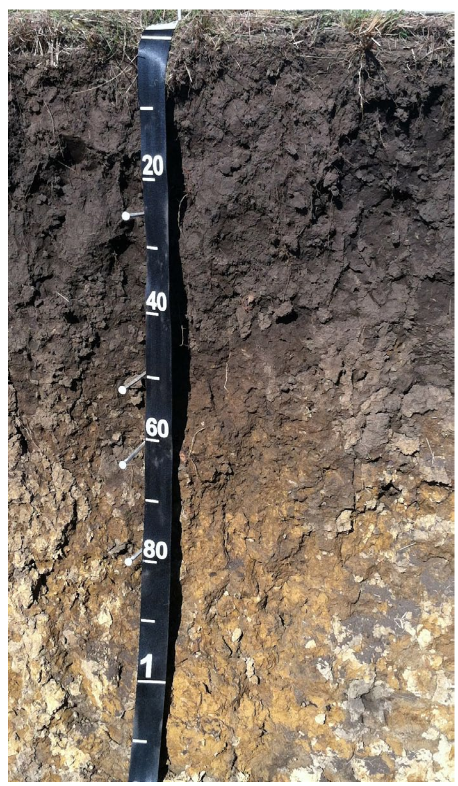
The focus of the workshop was to discuss proposals by the task groups. The task groups that reported were: horizon nomenclature harmonization, diagnostic horizon studies, horizon classification system, global soil group centroid calculation, moisture and temperature regimes, anthropogenic soils, tropical soils, cold soils, salt affected soils, and hydromorphic soils. Most of the discussion centered on the process for calculating global soil groups, the data needs for additional calculations, and the development of global soil groups for tropical soils. Strategic plans were developed to report on progress and proposals at the 20th World Congress of Soil Science in June of 2014. The working group is aiming to complete a first approximation of a Universal Soil Classification System for the 21st WCSS in 2018.

The members of the working group are associated with universities, research institutions, and government agencies from across the world, including Australia, Brazil, China, the European Union, Germany, Hungary, Italy, Russia, Tanzania, Venezuela, and the United States. Those in attendance at the meeting are listed in the table on the following page.

Presentations from the U.S. citizens on the working group and the ensuing discussions provided excellent feedback and information that strengthens the U.S. soil classification knowledge and application, particularly as it relates Soil Taxonomy.

Name	Institution
Dr. Erika Micheli	Szent Istvan University
Dr. Alex McBratney	University of Sydney, Sydney, Australia
Mr. Ben Harms	Department of Science, Information Technology, Innovation and the Arts, CSIRO
Dr. Curtis Monger	Plant and Environmental Sciences Department, New Mexico State University
Dr. Didas N. Kimaro	Sokoine University of Agriculture
Dr. Ganlin Zhang	Institute of Soil Science, Chinese Academy of Sciences
Dr. Humberto Santos	Embrapa Soils
Dr. John M. Galbraith	Virginia Polytechnic Institute and State University
Dr. Luca Montanarella	Joint Research Center, European Union
Dr. Lucia Helena Cunha dos Anjos	Universidade Federal Rural Do Rio De Janeiro
Dr. Peter Schad	Technische Universitat
Dr. Phillip Owens	Purdue University
Dr. Sergey V. Goryachkin	Institute of Geography, Russian Academy of Sciences
Dr. Thomas Reinsch	USDA–NRCS
Dr. Juan Comerma	Invited guest
Dr. James Bockheim	University of Wisconsin–Madison
Alessandro Samuel Rosa	Universidade Federal Rural Do Rio De Janeiro
Michele Duarte de Menezes	Universidade Federal Rural Do Rio De Janeiro
Prof. Marta Fuchs	Szent Istvan University, invited guest
Mr. Vincent Lang	Szent Istvan University, invited guest
Dr. Cornie Van Huyssteen	University of the Free State, South Africa

During the research for and development of the Universal Soil Classification System, the intent of the working group is to encourage continued development of national classification systems, especially those that are already used broadly in the international community. Along this line, the working group has made a formal request to IUSS leadership for Soil Taxonomy to be an IUSS-designated soil classification system, similar to an existing designation by the World Reference Base. This designation could have a very positive influence on further improvement of and the potential for an even wider use of Soil Taxonomy on an international basis. ■



Soils investigated during the workshop: Typic Kandiudults (l.) and Typic Palehumults (r.).

ASA–CSSA–SSSA Annual Meeting

The American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America held their annual meetings November 3 to 6 in Tampa, Florida. The theme of this year's meeting was "Water, Food, Energy and Innovation for a Sustainable World." More than 4,000 people attended the meetings, symposiums, and technical sessions, which covered topics ranging from crop breeding to watershed modeling. Following are a sample of soil-related topics and abstracts from the meeting.

A New Framework for Consideration of Agronomic Systems Within Ecological Sites

By Susan S. Andrews, National Leader for Soil Quality and Ecosystems, National Soil Survey Center.

A new framework is proposed that will help achieve conservation objectives for ecological sites under agronomic uses by: (1) optimizing management, based on land potential, (2) promoting development of innovative management systems, (3) supporting identification of high-priority research needs, (4) improving efficiency of conservation planning, (5) increasing certainty of conservation outcomes, (6) providing flexibility to promote innovative management systems, (7) encouraging private and public investments, and (8) increasing accountability to the public, the Office of Management and Budget, and Congress. Within this framework, called the Land Management Optimization (LMO) model, reference conditions are defined for each agroecological site. An agroecological site is a distinctive kind of land based on reoccurring soil, landform, geological, and climatic characteristics that differs from other kinds of land in its potential to support distinctive ranges of soil functions (as indicated by soil properties) and their responses to natural and human-caused disturbance. The framework will facilitate the collection, interpretation, and application of information on current status (condition) of land relative to two reference conditions: (a) *ecological potential*, the maximum potential for a site with little or no human intervention (as reflected in the status of soil functions) and (b) *attainable potential* for an agricultural product group, such as grains or forage, assuming current technology, market, and regulatory conditions but differing management practices. The framework is currently in pilot status but, once implemented, is expected to immediately increase the usefulness of existing data for managers and provide a roadmap for long-term future data collection.

GlobalSoilMap

By Jon Hempel, Director of the National Soil Survey Center, NRCS, Lincoln, Nebraska.

GlobalSoilMap is a globally coordinated project aimed at producing a set of consistent functional soil properties using digital soil mapping techniques and technology. The data are designed to be used for better understanding environmental degradation, issues of food security and food production, the importance of soils in biodiversity, and the role of soils in areas with little and/or poor-quality water and for quantifying the effect of soils in climate change.

A globally coordinated set of standards and specifications has been produced to help guide the development of the soils data. These standards are designed to address the collation and presentation of finalized products but do not to prescribe how products will be made. A coordinated dataset based on universally accepted standards will provide soils data that can be used to produce consistent information across geopolitical boundaries.

There are five basic tenants to the standards and specifications: 1) the spatial entity, 2) the soil properties to be predicted (and the date associated with the prediction), 3) the uncertainty values for each soil property, 4) the age of the data or information used to estimate the predicted properties, and 5) the validation measure that was used to make the predictions.

The 11 soil properties to be mapped are: 1) total profile depth, in cm; 2) plant exploitable or effective soil depth, in cm; 3) organic carbon, as g/kg; 4) pH (x10); 5) sand, as k/kg; 6) silt, as k/kg; 7) clay, as k/kg; 8) gravel, in m^3/m^{-3}; 9) ECEC, as cmol/kg; 10) bulk density of the fine-earth (<2 mm) fraction excluding gravel, as Mg/m^3; and 11) available water capacity, in mm.

Various countries around the world are actively applying these standards and specifications to produce soils information. The project is being coordinated by a global consortium of institutions that are engaged in the production, research, interpretation, and application of soils data. The standards and specifications are being coordinated by the GlobalSoilMap Scientific Committee.

Symposium—Soil Science Challenges in Land Surface and Global Climate Modeling

By Zamir Libohova, National Soil Survey Center, USDA–NRCS, Lincoln, NE; James A. Doolittle, USDA–NRCS, Newtown Square, PA; Reed Sims, USDA–NRCS, Soil Survey, Colchester, VT; and Thomas R. Villars, USDA–NRCS, White River Junction, VT.

Title: Evaluating the Role of Missisquoi Bay Subaqueous Soils for Carbon Storage

Eutrophication associated with high concentrations of phosphorus originating from the agricultural land surrounding Missisquoi Bay has raised concerns about its influence on submersed aquatic vegetation and the overall health of Lake Champlain. Subaqueous soils play an important role in nutrient management, sedimentation, submersed aquatic vegetation, and water quality. A study was made to: (i) characterize physical and chemical properties of subaqueous soils within a portion of Missisquoi Bay, based on ground-penetrating radar (GPR) and soil analysis, and (ii) assess relationships among the subaqueous soil-landscapes based on digital soil mapping (DSM) techniques and analysis of the distribution of radar facies and submersed aquatic vegetation (SAV). Coarse Stratified Sediment and Lacustrine Silt radar facies covered 51 and 41 percent of the study area and were associated with Delta/Nearshore and Lakebed/Bay Bottom subaqueous soil-landscape units, respectively. The sediment composition and stratification of the Coarse Stratified Sediment radar facies reflected the direct influence of depositional events associated with the Missisquoi River delta. This was also confirmed by the observed decrease of P with distance from the delta from 125 to 66 mg kg^{-1} within this facies. The Lacustrine Silt radar facies occurred in relatively deep waters in low-energy depositional areas away from the direct influence of delta depositions. Highest P concentrations of 683 and 990.7 mg kg^{-1} were also associated with this facies. Only 7 percent of the bay area was covered by Organic Soil Material radar facies and associated with the Fringing Peatland subaqueous soil-landscape unit. Less than 1 percent of the bay area was underlain by exposed bedrock. Soil cores confirmed the identity of the radar facies. The majority of the SAV was associated with Delta/Nearshore and Fringing Peatland subaqueous soil-landscape units, which occur under relatively shallow waters.

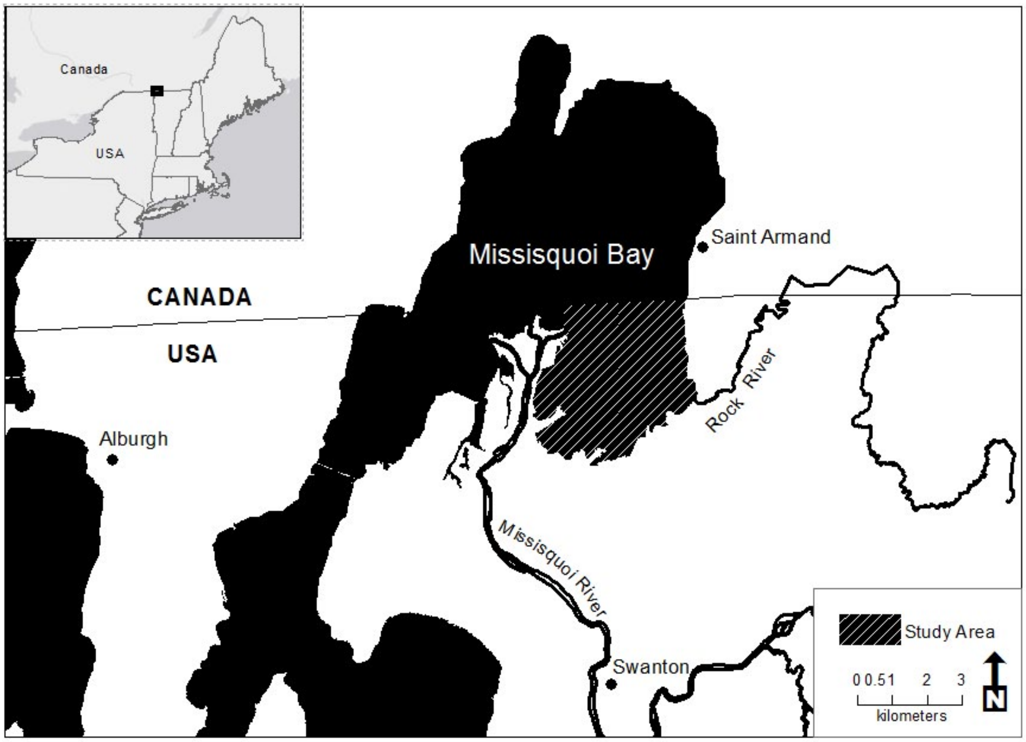


Figure 1.—Study area.

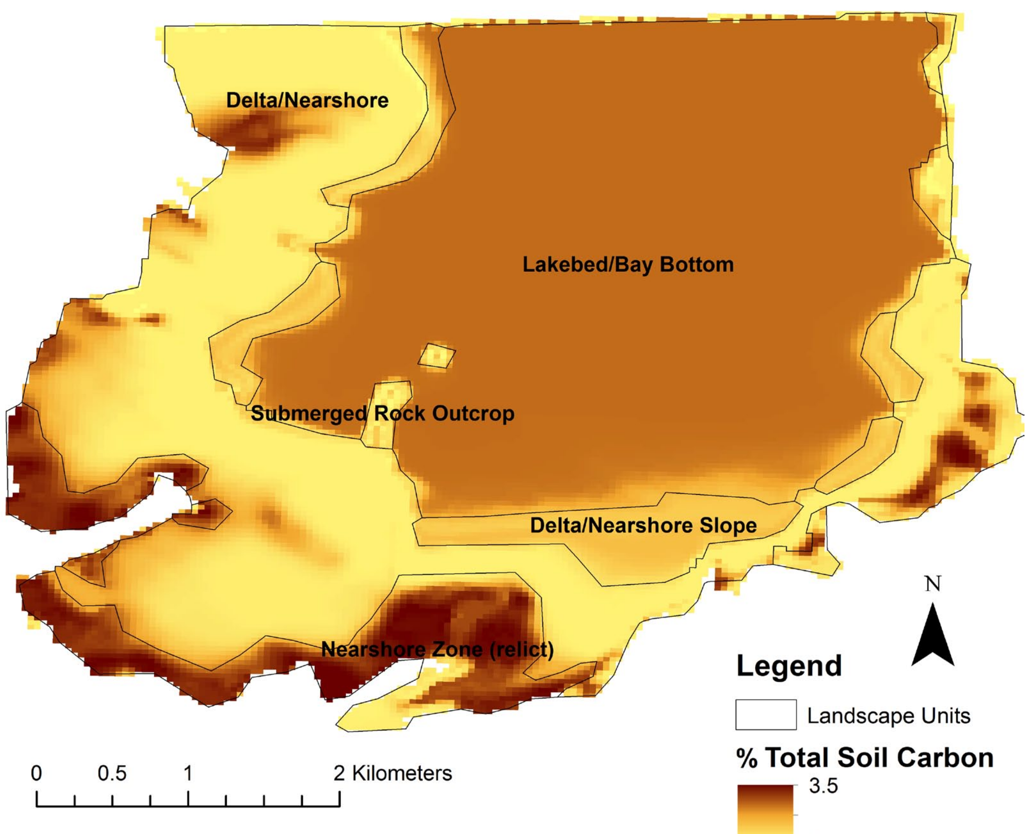


Figure 2.—Predicted subaqueous soil carbon map for the surface layer of Missisquoi Bay.

Disaggregation, STATSGO2 Assessment, and Ecological Sites

By Travis Nauman, Ph.D. student, Plant and Soils Division, West Virginia University, USDA–NRCS Geospatial Research Unit.

Over the last two and a half years, Dr. James A. Thompson (West Virginia University assistant professor of Pedology and Land Use) and I have been working on ways to improve soil survey data in general for projects, such as GlobalSoilMap, and more specifically to integrate survey improvements with ecological site descriptions in the central Appalachians. We have been able to collaborate on this work with a variety of partners, including NRCS, Monongahela National Forest (MNF), the West Virginia Department of Natural Resources, and the Central Appalachian Spruce Restoration Initiative (http://www.restoreredspruce.org). As we have collected data in MNF and worked with different individuals in these areas, it has become clear that there are some common sense management initiatives that could be better realized utilizing local SSURGO updates, new digital soil maps, and new ecological site descriptions (ESD) for these areas. At SSSA, we had the opportunity to present material related both to the methods we are working on to evaluate and improve SSURGO and STATSGO2 (see abstracts I and II) as well as ways to combine these types of soil inventory data with new ecological data being used in ESD development (see abstract III). We feel that there is potential to leverage new types of topography and remote-sensing data (e.g., Landsat) to both improve SSURGO and map ESDs at the field scale (approximately 10- to 100-meter pixel resolution) and possibly even map states within ESDs (e.g., disturbed hardwood state in a formerly mixed conifer-hardwood community). These types of data could prove to be valuable tools for land managers and conservation planners.

Abstract I

Semi-Automated Disaggregation of Conventional Soil Maps Using Random Forests, DEMs and ASTER Satellite Imagery in the Sonoran Desert

By Travis Nauman[1,3], James A. Thompson[1], and Craig Rasmussen[2].

[1] Division of Plant and Soil Sciences, West Virginia University, Morgantown
[2] Soil, Water and Environmental Science, University of Arizona, Tucson
[3] USDA–NRCS, National Soil Survey Center, Geospatial Research Unit, Morgantown, West Virginia

Conventional soil maps (CSM) like the USDA–NRCS Soil Survey Geographic (SSURGO) database have provided baseline soil information for land use planning since their inception. Although CSMs have been widely used, modern demands for high-resolution soil information at a field scale are not suitable applications for CSMs in many cases. CSMs lack a realistic representation of soils at that scale because they were created with a polygonal vector mapping format that uses crisp map boundaries and that often aggregates multiple soils types within one mapping unit. These spatial issues with SSURGO create added work for natural resource professionals trying to implement conservation planning strategies that utilize soil survey data. We present a repeatable method to disaggregate SSURGO data into a 1-arc-second (approximately 30-meter pixels) rasterized soil class map that also provides continuous representation of probabilistic map uncertainty and ability to utilize fuzzy membership of classes if soil intergrades are desirable for end users. Methods included training set creation for each original SSURGO component soil class from soil-landscape descriptive language within the original survey database. Training sets were then used to build a random forest predictive model that utilized 54 environmental covariate maps derived from ASTER satellite imagery and the 1-arc-second USGS National Elevation Dataset. Results showed agreement at

70 percent of independent field validation sites and equivalent accuracy between original SSURGO map units and the finer resolution disaggregated map. Uncertainty was mapped by empirically relating prediction frequencies of the underlying trees of the random forest model and the success rates of validation sites.

Abstract II

Developing and Assessing Prediction Intervals for Soil Property Maps Derived From Legacy Databases

By Jordan L Helmick, Travis Nauman, and James A. Thompson, Division of Plant and Soil Sciences, West Virginia University, Morgantown, West Virginia.

The *GlobalSoilMap* project aims to create a global grid of a variety of soil functional properties at a fine resolution. Uncertainty surrounding these property estimates is of utmost importance when utilizing soil maps for predictive purposes. For the initial version of the map being produced of the United States, property values were estimated from the U.S. General Soil Map (STATSGO2) database, which is a broad-based inventory of soil data recorded across the United States. Prediction intervals were developed from the low and high estimated property values provided in the database. For each map unit, this method provided a unique prediction interval that was likely to encompass property values of soils typically found in that map unit. We empirically evaluated these soil property prediction intervals derived from STATSGO2 for three soil properties: organic carbon content, pH, and clay content. Using measured property data from up to 722 pedons from the National Cooperative Soil Survey database, prediction intervals were assessed by modeling their coverage accuracy over a set of external validation data. The effects of soil depth, soil order, temperature regime, and moisture regime on prediction interval coverage were analyzed, and coverage was found to be 87.6 percent for organic carbon, 90.6 percent for pH, and 86.4 percent for clay. It is shown that legacy data from the United States that includes low and high property methods can be used to represent uncertainty in the form of prediction intervals. Coverage based on these methods closely approximates the nominal level of 90 percent specified for *GlobalSoilMap* products. Consistency of these intervals was demonstrated across a variety of soil orders, temperature regimes, and moisture regimes.

Abstract III

Ecological Site Descriptions and Digital Soil Maps for Management in Red Spruce *(Picea rubens)* Communities of West Virginia

By Travis Nauman[1,4], Jason Teets[2], James A. Thompson[1], James W. Bell[2], Henry J. Liebermann[3], and Aaron Burkholder[1].

[1] Division of Plant and Soil Sciences, West Virginia University, Morgantown
[2] USDA Natural Resources Conservation Service, Morgantown, West Virginia
[3] Division of Forestry and Natural Resources, West Virginia University, Morgantown
[4] USDA–NRCS, National Soil Survey Center, Geospatial Research Unit, Morgantown, WV

The USDA–NRCS Soil Survey Geographic (SSURGO) database has provided baseline data for land use planning since the early 20th century. Although SSURGO has been widely used, modern demands for quantitative high-resolution soil information at a field scale limit use of SSURGO. This is mainly due to a polygonal structure and aggregated attribution of soil types. These spatial issues with SSURGO create added work for natural resource professionals trying to implement conservation planning strategies. In forestlands and rangelands, these strategies often use ecological site descriptions (ESDs) to help interpret soil, climate, floral, faunal, and

human interactions into management decision schema. To improve data, SSURGO maps were disaggregated into a 1-arc-second (approximately 28-meters in West Virginia) gridded soil map using digital soil mapping methods. This map allows for creation of uncertainty measures and fuzzy membership of multiple soils at each pixel to better spatially represent soil mapping data for use with ESD in conservation planning. ESDs were developed from field data for parts of Pocahontas and Randolph Counties, West Virginia, to use with the disaggregated SSURGO map. The more detailed soil-ESD map has provided new context into historical extents of red spruce *(Picea rubens)* using podzol soil properties as historical tracers for these communities. Results show potential in constructing restoration and management plans for high-elevation red spruce forest communities in the Central Appalachians. These communities currently exist in greatly diminished extents due to historically intense tree harvest and fire across much of the high Central Appalachians. They serve as a refuge for biodiversity and rare species, such as the Cheat Mountain Salamander *(Plethodon nettingi).*

Revising the Soil Survey Manual

By Kenneth F. Scheffe[1], Janis L. Boettinger[2], Shawn J. McVey[1], Craig Ditzler[1], and J. Cameron Loerch[1].

[1] USDA–NRCS National Soil Survey Center, Lincoln, Nebraska
[2] Utah State University, Logan, Utah

The “Soil Survey Manual” has long been the field soil scientist’s guide to conducting soil survey. Originally assembled by Dr. Charles E. Kellogg in 1937 as Miscellaneous Publication No. 274, the “Soil Survey Manual” has for generations not only guided those who make and interpret soil surveys but also served as a technical source of nomenclature, methods, and procedures for students of soils and other natural resource specialists using soil survey information. The manual, originally published as a paperback, was updated and released in 1951 as Agricultural Handbook #18 and last updated in 1993. The manual is currently out-of-print but remains available for download at http://soils.usda.gov/technical/manual/.

A working group, consisting of soil scientists from NRCS and soils faculty at cooperating universities, was organized in August 2012 and is currently revising the “Soil Survey Manual.” The objectives and purpose of the manual will remain the same as always. This update to the manual will be published digitally and take advantage of the flexibility of digital publishing, including expanded use of graphics and photography, tabular data, hyperlinks to other references and research articles, and adaptability for viewing on such devices as tablets and smartphones.

Because of the technical advances in the science of soils (specifically, in the methodologies for conducting soil inventories and in the data tools for analyzing and displaying soil survey information), the “Soil Survey Manual” needs to be updated to maintain its usefulness. Subject matter experts will serve as guest authors to help develop new chapters and sections addressing remote sensing and digital mapping tools. Significant new areas being developed include: digital soil mapping and geospatial analyses utilizing such tools as satellite imagery, LIDAR data geophysical surveys, and other common tools (such as GPS and GIS); description and mapping of subaqueous soils; description and mapping of human-altered and transported materials (HATM) based on recommendations of the International Committee for Anthropogenic Soils (ICOMANTH); and soil climate monitoring, hardware, data management, and analysis. All chapters of the manual will be revised and updated, but the chapter on the examination and description of soils (chapter 3) and soil interpretations (chapter 6) will be the most notably revised.

The revised “Soil Survey Manual” will have a new delivery format to facilitate timely updating of sections, as needed, and to reduce the production costs. Key features will include availability of digital publishing in a printer friendly format; layout and navigation designed for use on a computer, tablet PCs, and other mobile devices; extensive use of illustrations, diagrams, and photographs to aid in understanding technical and unfamiliar concepts and conditions; internal and external hyperlinks; and ability to search on key words.

Evaluation of the EPIC Model to Predict Soil Moisture and Temperature Regimes

By Candiss O. Williams, research soil scientist, Charles E. Kellogg National Soil Survey Research & Laboratory, USDA–NRCS, National Soil Survey Center, Lincoln, NE.

NSSC scientists presented a paper at the Soil Science Society of America Annual Meetings held in Tampa, Florida, November 4-6, 2013. The presentation entailed a collaborative effort between NRCS and Texas A&M, Blackland Research Station scientists who were charged to develop a validated model to assign soil moisture and soil temperature regimes for taxonomic classification. A modified version of the Environmental Policy Integrated Climate (EPIC) model was used to simulate daily soil temperature and soil moisture at various soil depths. The modified model was validated using measured soil moisture and soil temperature data from the Soil Climate Analysis Network (SCAN) weather stations across the United States. For this presentation, measured soil moisture and temperature data from SCAN soil climate stations located in Arizona, Georgia, Kentucky, New Hampshire, North Dakota, and Washington were compared to soil moisture and temperature data simulated by the modified EPIC model. In addition, predicted soil moisture and temperature regimes classified by the EPIC module were compared to the current soil taxonomic classifications from each of the SCAN stations evaluated. Normal years for the period 1995 to 2010 were evaluated. The results indicate that the modified EPIC model reasonably demonstrated the ability to automate the identification of soil moisture and temperature regimes as currently defined in Soil Taxonomy for these study sites and can be used to predict soil climate regimes in other locations.

Larry West Named 2013 Soil Science Society of America Fellow

Dr. Larry T. West was recently named one of the 2013 Soil Science Society of America (SSSA) Fellows at the Society’s annual conference, held in Tampa, Florida.

West recently retired as the National Leader for Research and Laboratory at the USDA–NRCS National Soil Survey Center Kellogg Soil Survey Laboratory. He received B.S.A. and M.S. degrees from the University of Arkansas and a Ph.D. degree from Texas A&M University.

Fellow is the highest recognition bestowed by SSSA. Society members nominate worthy colleagues based on their professional achievements and meritorious service. Only 0.3 percent of the Society’s active and emeritus members may be elected as Fellow. ■

USDA–NRCS Haiti Pilot Soil Survey Initiative

In accordance with the Haiti Ministry of Agriculture's plan to meet short- and long-term human capacity development goals in natural resource conservation, the Natural Resources Conservation Service (NRCS), in consultation with the Foreign Agriculture Service (FAS) and the U.S. Agency of International Development (USAID), proposed to conduct a pilot soil survey as part of the capacity-building effort in Haiti. The objective of the project is to assist the Haiti Ministry of Agriculture and the Faculty of Agriculture and Veterinary Medicine in leading and supporting the development of soils inventory and soils information delivery tools, which will enhance agricultural productivity and natural resource conservation. The pilot project consists of a detailed (second order) pilot soil survey on a 3,000-hectare segment of the Cul-de-Sac area in Haiti. The project will include interpretations for urban planning, grazing, forestry, land restoration, and agricultural production. Project participants will be trained to conduct soil survey inventories and disseminate soil information that will have practical applications for agricultural production, conservation planning, environmental stewardship, and climate change mitigation. This information will be made accessible to all end users, including agricultural producers, policy makers, and land use planners; financial and other institutions; and scientists and engineers involved in infrastructure development.

Following the approval of the project by USAID, it was agreed that selected leaders and scientists from Haiti should visit the U.S. to learn firsthand what it takes to initiate and successfully implement a soil survey program. Thirteen participants traveled to the U.S. under the Cochran Fellowship Program coordinated through FAS. The training was a mix of classroom and field trip sessions tailored to meet the needs of the visitors in their quest to develop a soil survey program in Haiti that would address food and natural resource concerns. The study tour was conducted in three phases: phase I included a 2-day working session with national leaders at the USDA/NRCS National Headquarters in DC, phase II involved a week-long combined session for both the Haitian leaders and specialists, and phase III was an additional week of in-depth training for the Haiti GIS, database, and laboratory specialists.

The Haitian delegation was headed by Louis Buteau, Technical Advisor to the General Director, Haiti Ministry of Agriculture. Other members of the leadership team were Director of Forest and Soils Jean Pierre-Louis Ogé, Defense (Protection) and Soils Restoration Service Director Donald Joseph, Assistant Director of Forest and Soils Jean Serge Antoine, Soil Scientist Pierre Karly Jean-Jeune, and Dean of the Faculty of Agriculture and Veterinary Medicine (FAMV) Jocelyn Louissaint. Other participants included GIS specialists, database managers, and soils laboratory specialists.

Thursday, August 14, 2013, began with presentations and discussions of activities by the Foreign Agriculture Service. They centered on the history, purpose, and guidelines of the Cochran Fellowship Program and expectations during and after participation in the program.

In the afternoon, the visitors were welcomed by Thomas Reinsch, Leader for World Soil Resources, and Ann Mills, Deputy Under Secretary, Natural Resources and Environment, USDA, who expressed her support as well as that of the Secretary of Agriculture. On behalf of the Chief of NRCS Jason Weller, Thomas Christensen, Associate Chief for Operations, also welcomed the delegation and explained the role of USDA and NRCS in natural resources conservation, climate change, and environmental stewardship. To provide background information for NRCS leaders, the leaders of the Haiti delegation made presentations on the state of agriculture; the history of soil conservation, soil studies, and projects; and the most pressing natural resource concerns in Haiti. This was followed by a chronicle of the evolution of soil survey in the U.S. by Mike Golden, Deputy Chief for Soil Survey and Resource Assessment and architect of the Haiti Soil Survey Initiative.

Charles Kome, coordinator, Haiti Soil Survey Pilot Initiative, accompanied the delegation from Washington DC to Lincoln, Nebraska, for phase II of the program. The delegation spent Saturday, August 17, on a bus tour that showed them typical landscapes, landforms, and vegetation around Lincoln. The tour ended with a stop at the Tecumseh County Fair.

Phase II of the study tour began with a formal opening ceremony on Monday, August 19, at the National Soil Survey Center (NSSC). The ceremony was attended by more than 100 people. Attendants included representatives of the senators from Nebraska. Ray Ringlein, small business outreach coordinator from Senator Johann's office, and Neil Moseman, agriculture and energy policy director from Senator Fisher's office, gave very informative presentations on Nebraska agriculture.

After the opening ceremony, the national leaders at NSSC summarized their program mission and activities in support of the U.S. soil survey and explained how the different expertise tie together in gathering, processing, and delivering soil information to a diverse clientele. For the rest of the day, Phil Shoeneberger (resource soil scientist) discussed various soil inventory techniques and Jon Hempel (Director of NSSC) and Zamir Libohova (soil scientist) showed innovations in digital soil survey technology applicable to Haiti.

On Tuesday morning, August 20, the group took a field trip to an ideal outdoor ecological laboratory—the Spring Creek Prairie Audubon Center. Director of the Center Kristopher Johnson and Habitat Program Manager Ben Mullarkey explained the purpose and history of the center and the scope of work involved in preserving the rapidly vanishing native prairie. Phil Schoeneberger and Doug Wysocki, soil scientists from NSSC, took advantage of the variability of landforms and landscapes at the Spring Creek Prairie to demonstrate how landscape models and hydrology are used to conduct soil surveys at sites with different soil types and various soil interpretations. The conservation lessons learned at the center were profound and very applicable because high population pressure in the world, and specifically in Haiti, has resulted in widespread destruction of natural ecosystems. The Spring Creek Prairie visit was featured on the front cover of the Lincoln Journal Star newspaper: http://journalstar.com/news/local/haitian-visitors-dig-deep-for-soil-clues-in-nebraska/article_dfeb4b62-9221-56c1-aec4-e4ab41c0d18f.html.

The afternoon was spent touring the Kellogg Soil Survey Laboratory complex, where the delegation learned how the laboratory staff uses both very sophisticated and very simple equipment to support soil survey activities. The visitors were shown how submitted samples were received, coded, and processed. This was followed by information on the array of chemical, biological, mineralogical, and physical analyses. In addition, data storage and management of soils information delivery tools for a diverse clientele were explained.

Wednesday, August 21, was dedicated to presentations and discussions at the National Soil Survey Center led by Rebecca Burt, Joe Chiaretti, Paul Finnell, Mike Robotham, Bob Dobos, and Charles Kome. Topics included soil analyses, classification, and database management; soil interpretations; agricultural uses of soil information; conservation planning; forestry; and non-agricultural uses of soil information.

Thursday, August 22, the delegation took guided field trips to Prairie Pines, the Community Crops Program Center, and the farm of Dave and Deborah Welsch. At Prairie Pines, the Director J.R. Brandle, professor of natural resources at the University of Nebraska—Lincoln, explained the purpose of Prairie Pines for natural resource education, its history, current and future land use plans, collaborative efforts with partners, and the relevance of soil information in their operations. The use of a riparian forest buffer to control streambank erosion was an eye-opener to the visitors, who intend to use soil information, forestry practices, and related erosion-control measures in overcoming soil erosion, a major natural resource concern in Haiti.

At the Community Crops Program Center, Tyler Magnuson, the farm production coordinator, described the program, which was designed to train beginning farmers. He discussed the onsite management of vegetable crops, organic vegetable production methods, use of cover crops, and other operation details, emphasizing the importance of soil survey information for sustainable land management. At this location, Mike Kucera (agronomist at NSSC) and Tyler Magnuson conducted a hands-on demonstration on the use of the "Soil Quality Bucket" to assess soil quality and discussed the use of such information in making management decisions. The Haitians found that the scale of the Community Crops operation was very similar to the scale of farm operations in Haiti.

After visiting the Community Crops Program Center, the group went to see the organic livestock/cropping management system owned by David and Deborah Welsch at Milford, Nebraska. David and Deborah discussed their conservation plan based on the different soil types and cropping systems on their farm and demonstrated the differences in corn and soybean performance based on soil survey information. Mike Kucera, Ross Scott (NRCS resource conservationist), and Mark Willoughby (NRCS resource soil scientist) reviewed the importance of soils information and interpretations in developing conservation plans for various soil types and landscapes. On the Welsch alfalfa farm, Mark Willoughby demonstrated the use of the hydraulic probe in soil core sampling, which the visitors found extremely interesting. The field visit ended with a trip to the John Deere dealership in Seward, Nebraska, where the group examined various types of farm equipment and discussed the role of farm mechanization in achieving food security.

On Friday, August 23, the Haitian leadership team held a meeting with the NSSC leaders to discuss strategies for implementing a soil survey in Haiti and the nature and duration of technical assistance during and beyond the project.

1 - Rony BIEN-AIME
2 - Marie Yvane FLEURY
3 - Jacques Philémon MONDÉSIR
4 - Jocelyn LOUISSAINT
5 - Charles Kome
6 - Pierre Karly JEAN JEUNE
7 - Donald JOSEPH
8 - Shawn McVey
9 - Elda DERONNETTE CAJUSTE
10 - Louis BUTEAU
11 - Rose Erda EUGÈNE
12 - Ernso THOMAS
13 - Jean Serge ANTOINE
14 - Jean Pierre-Louis OGÉ
15 - Barbara JEAN

For phase III, from August 26 to 29, eight of the delegates remained in Lincoln for more specialized training at the National Soil Survey Center. These delegates consisted of GIS specialists, database mangers, and laboratory specialists. They worked closely with NSSC specialists on issues relating to laboratory procedures, database development, standards and specifications, digital soil mapping, GIS, interpretations, and soil quality. The visitors worked in groups, organized according to specialty, in the mornings and then regrouped in the afternoons to summarize how all their skills and functions fit together in various soil mapping activities.

Tammy Cheever, NSSC computer specialist (center), welcoming the Haitian database specialists to the NASIS world.

During phase III, the specialists also spent time shadowing professionals in their respective fields to learn how they conduct day-to-day business and to discuss ways they could apply acquired skills to their situation at home.

Some significant developments since the NRCS Cochran Fellowship Study Tour include:

- The Ministry leaders held a series of meetings with landowners in the project area.
- Office space and equipment, including 10 computers, were acquired.
- Pro formas for the purchase of laboratory and field equipment were procured.
- Arrangements were made for the transfer of the Bas-Boen Laboratory to the Ministry of Agriculture, Natural Resources and Rural Development (MARDNR).
- FAMV and the Ministry began screening Haiti applicants for pilot soil survey training.
- The Minister designated a project coordinator to report to him directly on the project.
- USAID/FAS approved funding for a technical project leader or embedded advisor.
- Pro formas for the acquisition of equipment and supplies were submitted to USAID Haiti to accelerate project implementation.
- Participants from the study tour briefed the Minister of Agriculture on their experiences.

- The Minister of Agriculture endorsed the project and promised to provide all the support needed for a successful implementation of the project.
- Arrangements for transportation and other resources needed for the pilot project were finalized.
- A public awareness campaign was started to facilitate entry of project participants onto private lands.
- Funding for support for personnel engaged in the pilot soil survey activity was procured.
- Technicians to be trained in soil survey and soil information management and dissemination were selected.
- Selected documents were translated into French to facilitate training.

Charles Kome is making plans to travel to Haiti soon to ensure that everything is ready for Tony Rolfes (Assistant Director for Soil Science and Natural Resource Assessments, USDA–NRCS, Pacific Islands Area) and Nathan Jones (MLRA soil survey leader, Pierre, South Dakota), who will begin their detail in Haiti, conducting hands-on soil survey training, this fall.

The Cochran Fellowship Study Tour allowed Ministry and University leaders from Haiti to see first-hand how soils information technology is developed and used to enhance agricultural productivity and natural resource conservation and promote environmental stewardship. During the visit, members of the delegation were introduced to soil mapping techniques ranging from basic to digital. ■

NRCS–USFWS Memorandum of Agreement Reaps Benefits for Public and Private Lands

To provide clear, comprehensive, and science-based guidance so our lands are sustained for future generations, the Natural Resources Conservation Service (NRCS) recently partnered with the U.S. Fish and Wildlife Service (USFWS) to develop ecological site descriptions (ESD) and ecological site inventories (ESI) in the northern forest refuges of the United States—specifically in Maine, New Hampshire, Vermont, and Massachusetts. The Memorandum of Understanding (MOU) signed by both agencies puts into place work designed to collect critical data, assist with landscape analysis, and provide technical assistance and quality control in relationship to the area's natural resources. Ultimately, the partnership will provide outcomes that contribute to understanding the thresholds for irreversible change and soil carbon sequestration, while identifying potential options that could help with adapting to climate change.

Soil and ecological site data provides information and interpretation for management and restoration actions, biological and conservation planning, and Farm Bill implementation. According to NRCS, ESDs and ESIs provide the best scientific information available so that landowners can make informed choices—choices designed in the best interest of the land. An ecological site has been defined as a "distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation and in its ability to respond to management actions and natural disturbances." The differences between ecological sites are strong enough to influence the success or failure of a management action or affect the types of ecosystem services or benefits that are provided by a land area. In the long term this can make the difference between success and failure when managing our natural resources.

Thanks to the partnership, USFWS will be able to increase the scope of work and the acreage covered, thereby benefiting more private landowners, local governments, and land use planners as well as public lands. In addition, the agreement provides a higher level of efficiency thanks to a larger and better equipped and trained workforce. The partnership will also help to eliminate redundancy since the agencies have common objectives. USFWS staff has expertise in wildlife and wildlife habitat as well as in habitat requirements that are useful in making ESD management recommendations. NRCS is the perfect collaborator because its soil science staff has expertise in developing ESDs. This partnership will result in a higher return on the country's natural resource investment. A win-win for everyone involved. The MOU will not expire until September 2019. ■

Soil Survey of the Boundary Waters Canoe Area Wilderness

By Larissa Schmitt, soil scientist, NRCS, Duluth, Minnesota.

For the 2013 field season, the Duluth MLRA office in Soil Survey Region 10 was charged with a national pilot project of collecting raster soils data in the Boundary Waters Canoe Area Wilderness (BWCAW). NRCS and the U.S. Forest Service collaborated on this digital soil survey project. Traditionally, most soil surveys have involved intensive fieldwork and have produced a vector product. NRCS is now moving ahead and using technology to make soil surveys as raster products.

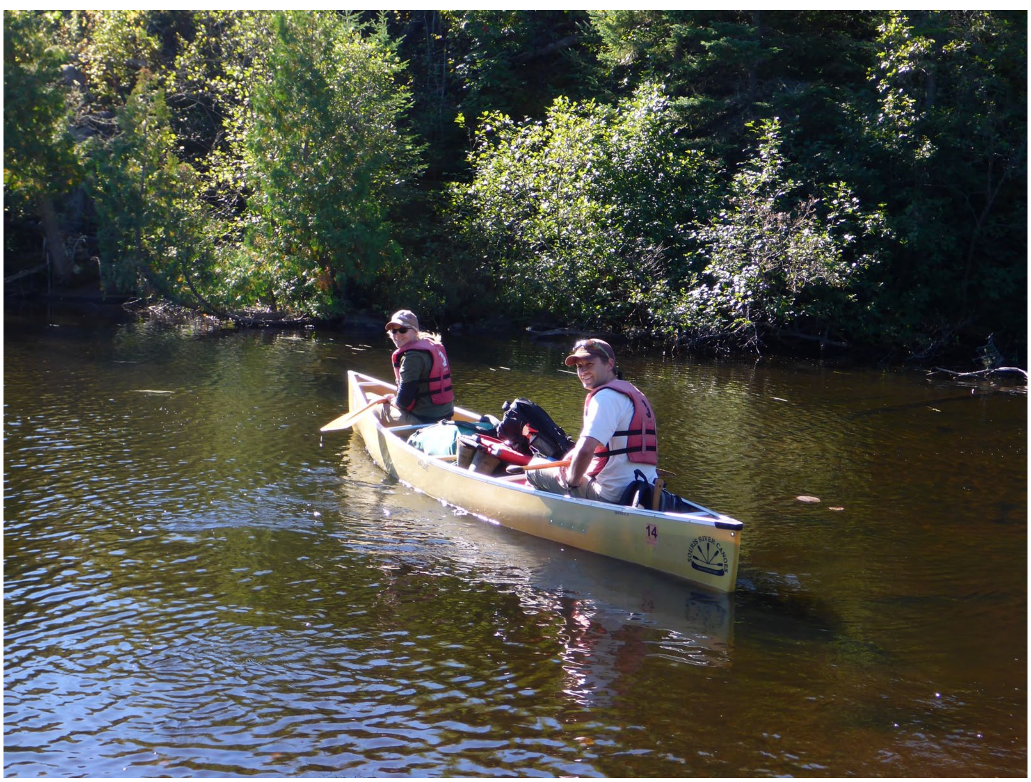
Team members (left to right) were, in the back row, Tim Nigh (Earth Team volunteer), Kyle Steele (NRCS ecological site specialist, Albert Lea, MN), Dennis Meinert (Earth Team volunteer), and Michael England (NRCS soil scientist, Onalaska, WI) and, in the front row, Dan Nath (NRCS soil scientist, Rochester, MN) and Jim Barott (USFS soil scientist, Ely, MN).

The BWCAW is a million-acre wilderness area managed by the U.S. Forest Service. It lies within the boundaries of the Superior National Forest in northeastern Minnesota and has over 4,000 lakes within its boundary, making water quality a very high priority. There is no soils data for approximately 595,000 acres of this wilderness area. This gap in soils data means incomplete water quality data.

The BWCAW landscape consists of till-mantled bedrock uplands and lacustrine material from Glacial Lake Agassiz. Soils developed in Rainy Till, which was deposited by the Rainy Lobe approximately 10,000 years ago during the Wisconsin age. Low-lying areas between the uplands consist of lacustrine material from Glacial Lake Agassiz or organic bogs. Bedrock in this region is Precambrian and consists of granite, gabbro, and basalt. The main soils catena in the BWCAW classifies as skeletal, making the collection of samples challenging.

The BWCAW soil survey is a unique project in many aspects, but a key distinction is the extreme remoteness. The wilderness area is not accessible by roads. A few lakes allow motorboats, but most of the area is only accessible on foot or by paddle (canoe or kayak). Traveling in the BWCAW requires paddling skills and the portaging of canoes and camping gear. Along with having no roads, the area has neither electricity nor cell phone service. Due to the vastness of the BWCAW and the work load, crew members went into the BWCAW on expeditions that involved wilderness camping at primitive campsites.

Over the course of the field season, 13 trips were made, ranging in duration from 4 to 10 days and including 2 to 6 crew members. Crews were a collaboration of Forest Service and NRCS employees, including soil scientists, ecological site specialists, soil conservation technicians, and Earth Team volunteers. Teams traveled to pre-selected sites to gather data on soils and vegetation. A total of 28 people worked on the BWCAW soil survey project.



Crew members Betsy (Oehlke) Schug (NRCS soil scientist, Baxter, MN) and Evan Ingebrigtson (NRCS soil conservation technician, Baxter, MN) in the main mode of BWCAW transportation.

Challenges that crew members faced on the Boundary Waters project included:

- Working in a remote wilderness area that is only accessible by canoe or on foot,
- setting up, breaking down, and transporting a wilderness camp,
- transporting soil-sampling tools,
- portaging canoes and packs that weighed up to 80 pounds,
- navigating in dense boreal forest,
- canoeing and bushwhacking to sample points,
- collecting sample points in glacial till soils with greater than 35 percent coarse fragments, and
- contending with such forces of nature as rain, wind, sun, heat, black bears, ground wasps, and mosquitoes.

Even though this project presented many challenges to data collection, the season was still very productive. Crew members collected data at over 200 sites. This winter, the modeling team will be analyzing the field data and developing a raster predictive model. ■

Workshop to Build Soil Interpretations Cadre Held at NSSC

By Shawn McVey, soil scientist and National Training Coordinator, USDA NRCS NSSC, Lincoln, NE.

The planning workshop “NASIS—Designing and Developing Soil Interpretations” was held September 10 to 12 at the National Soil Survey Center (NSSC) in Lincoln, Nebraska. The intent of the workshop was to build a cadre from some of the agency’s highly skilled NASIS users who are working with soil interpretations. The workshop tapped the collective knowledge of nine employees from nine different States and centers to identify best practices needed for designing, developing, reporting, and mapping soil interpretations as well as diagnosing problems with interpretations within the framework of the NASIS database.

The new cadre finalized the set of topics and the agenda for future sessions of the course “NASIS—Designing and Developing Soil Interpretations.” Topics will include soil properties, interpretations, and fundamentals for the development of a soil interpretation; use of case studies to research, build, and test an interpretation; interpretive statements; criteria tables; fuzzy systems and fuzzy math; mechanics of NASIS interpretations; and reporting of interpretive information via tables, exports, and maps.

The training objectives are focused on two areas. The first area is the training of the participants to build soil survey interpretations using the NASIS database system, including property script writing, choosing appropriate evaluations, and devising rules. The second area is the training of the participants to review interpretive criteria and components for appropriateness, completeness, and function.

Participants’ evaluations indicated the application of the training to their work, including design and development of interpretations, maintenance of existing interpretations, modern testing of old interpretations, and the ability to assist with new national interpretations. The training increased everyone’s knowledge of techniques for developing interpretations.

This course will be the third and highest level of a three-part interpretations training series. The series starts with “NASIS—Understanding Soil Interpretations,” which targets all soil scientists at the GS-9 grade level and above who use NASIS. This course provides basic background information on the soil interpretations process. The next course is “Science of Interpretations,” which targets ecological site specialists, resource soil scientists, assistant state soil scientists, and state soil scientists. It focuses on the process of soil interpretation development, including the identification of key soil attributes and rating criteria. The first and second levels of training are conducted solely online, using distance learning techniques. ■

New SCAN Sites in Texas

For farmers and ranchers across Texas, the weather plays a key role in their operations. They can't control the weather, but now they can plan around it better because of the weather data being gathered by the Natural Resources Conservation Service (NRCS) in Texas.

The installation of Soil Climate Analysis Network (SCAN) weather stations was viewed as an opportunity to assist with conservation planning efforts across the State as well as a potential to use climate data for soil survey activities. NRCS State Conservationist Salvador Salinas supported this effort and approved the project. A three-step approach was used to accomplish the placement of SCAN sites across Texas.

Step 1.—Procure all the equipment needed for the SCAN sites. James Gordon, NRCS state soil scientist, coordinated the procurement of equipment to install nine new SCAN sites across the State. The procurement of equipment for these sites was a major undertaking and took a collaborative effort. Working closely were Tony Tolsdorf, hydrologist, National Water and Climate Center; Nadine Shock, NRCS secretary; Suzanne Root, NRCS secretary; Judith Weber, contracting officer for National Centers Servicing Unit; and Mike Reed, physical science technician for MO–9.

Step 2.—Coordinate the placement of the SCAN stations. Gordon and Drew Kinney, NRCS GIS specialist and soil scientist, established nine memorandums of understanding, including six for Texas A&M AgriLife Research, two for NRCS Plant Materials Center, and one for USDA Agricultural Research Service. This partnership allowed for the SCAN sites to be spatially distributed across Texas while placing the stations on key soils important to agricultural production and research.

Step 3.—Install. Kinney led the field installation team and coordinated all field activities. NRCS Texas was assisted by, and provided travel funding for, Drew Kinney, James Gordon, Tony Tolsdorf, and NRCS Soil Scientists Deb Harms (Lincoln, NE), Cathy Seybold (Lincoln, NE), Cole Patton (Abilene, TX), Clark Harshbarger (Robstown, TX), and Riley Dayberry (Stephenville, TX). Installation at various locations was completed over a period from September 9 to 19.

The data from these stations will provide a valuable long-term record of soil climate analysis and may serve as baseline information for climate change. Furthermore, data collected from these stations will be used for natural resource assessments and research projects as well as conservation and soil survey activities. The stations were equipped with sensors to collect data on precipitation, air temperature, relative humidity, wind speed and direction, and solar radiation.

During FY–2014, soils at the sites will be sampled for full characterization and soil temperature and moisture probes will be installed at depths of 2, 4, 8, 20, and 40 inches. The current data for the stations is available on the website of the National Water & Climate Center (NWCC) at http://www.wcc.nrcs.usda.gov/scan/. ■

James Gordon carrying the antenna for installation on the tower by Tony Tolsdorf. (Picture taken by Drew Kinney.)

Importance of Ground-Penetrating Radar Outside Soil Survey

NRCS specialists in GPR often provide assistance outside of the agency for projects unrelated to conservation. GPR has been used in archeology studies (to locate grave sites and artifacts), in forensic crime scene investigations (to locate buried evidence), and in paleontology studies (to locate buried bones).

NRCS Crime Scene Investigations: Forensic Analysis Using Ground-Penetrating Radar

By Debbie Surabian, state soil scientist, Tolland, CT, and Jim Doolittle, research soil scientist, National Soil Survey Center.

Within USDA-NRCS, ground-penetrating radar (GPR) is commonly used to assist archaeologists in assessing sites that will be impacted by conservation projects. The installation of conservation practices, such as nutrient management systems, filter strips, streambank stabilization, and terraces, involve soil disturbance. Due diligence is required by NRCS to identify archaeological features located within areas that will be impacted by these earth-moving projects. As part of NRCS's reasonable and good faith efforts, GPR is often used to rapidly and methodically determine whether any significant archaeological features are located within areas that will be impacted by conservation projects.

Though infrequent, it is not uncommon for NRCS soil scientists who operate GPR systems to also become involved in forensic and crime scene investigations.

Figure 1.—Debbie Surabian and Jim Turenne discuss GPR survey strategies with a Rhode Island Bureau of Criminal Identification detective in the basement of a South Providence building. At right is the elevator shaft where human bones had been discovered by construction workers. (Photograph courtesy of The Providence Journal.)

Ground-penetrating radar is often used by crime scene investigators and evidence recovery specialists to provide quick, comprehensive subsurface coverage of crime scenes, reduce search areas, and locate clandestine burials and buried evidence. In several investigations, NRCS soil scientists have been called upon to render soil and geophysical assistance at crime scenes. The soil scientist's knowledge of soils and interpretive GPR skills are often indispensable to crime scene investigators and evidence recovery specialists in their search for clandestine burials and buried evidence. Recently, NRCS soil scientists responded to two separate requests to assist crime scene investigations in southern New England.

During recent reconstruction of a building in South Providence, Rhode Island, workers uncovered human skeletal remains buried in the basement beneath the concrete floor of an elevator shaft. The concrete floor had been laid during the early 1980s. After 3 days of slow and methodical sifting through the shallow grave, investigators found an identification card, an old pack of cigarettes, shoes, a jacket with a fur collar, and a bullet. Detectives and crime scene investigators needed to know if there were additional human bones buried beneath the concrete floor.

Knowing of NRCS's work with GPR in southern New England, the Director of the Rhode Island State Crime Laboratory and the Providence Police Department requested GPR assistance. As a public service, Debbie Surabian and Jim Turenne (soil scientist, Warwick, RI) were dispatched to the crime scene. Both Debbie and Jim are experienced radar operators and have each assisted various police departments in searching for clandestine burials. Working in relatively urbanized States, these soil scientists are very familiar with human-altered or anthropogenic soils.

In the South Providence investigation, crime scene investigators wanted to use GPR to non-destructively reduce the search area and identify features beneath the concrete floor that could represent additional clandestine burials. In a matter of hours, the basement floor was systematically surveyed with GPR. Although no recorded reflection pattern appearing on radar profiles could be conclusively identified as a clandestine burial, the radar images did reveal the location of what appeared to be a refilled trench under a portion of the basement's concrete floor. In addition, an anomalous reflection was identified at a depth of about 50 centimeters along one side of this apparent refilled trench (see figure 2). These subsurface features immediately

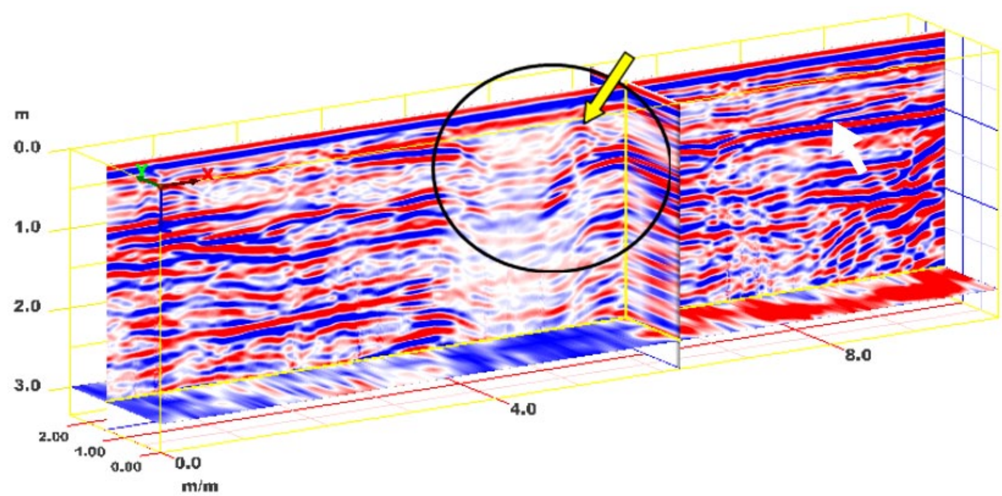


Figure 2.—In this three-dimensional fence diagram of the subsurface beneath a portion of the basement, an "area of interest" has been enclosed by a black circle. This suspected area coincides with an area of re-poured concrete. The yellow arrow indicates a subsurface anomaly, which was later identified as a concrete block that had been buried beneath the concrete floor. The white arrow indicates the top of the natural stratified fine sands and depth of the water table.

attracted the interest of detectives and crime scene investigators. On further examination of the basement floor, it became evident that the concrete over these features identified and located by GPR was a newer mix. An excavation of this site, however, revealed that a buried concrete block had produced the anomaly and that there was no evidence relating to a criminal activity within the refilled trench.

In another cold-case, the Connecticut Office of State Archaeology and a local police department requested GPR assistance from NRCS to survey an alleged crime scene. This is the second time police had visited the site seeking evidence based on a witness's description of what happened in this neighborhood. The witness, as a child in the 1950s, described vividly a man carrying a child's body from the truck of his car and bringing it into his home where he was digging in the garage. In 1987, following the witness's testimony, the police excavated portions of the garage floor looking for the child's remains, but found only chicken bones.

This past summer, working with new evidence, the Manchester Police Department reopened this cold-case and revisited the site to collect evidence. The garage has long since disappeared, but police were interested in other areas of the backyard. Desiring a GPR investigation of the site, but not having their own GPR unit and operator, the Manchester Police Department contacted the State archaeologists, who then informed the Connecticut NRCS State Office of this request. Shortly after this request, Debbie Surabian, Jim Doolittle, the Connecticut State Archaeologist, and a team of detectives and crime scene investigators arrived at the suspected home site.

As at the crime scene in South Providence, a detailed GPR survey was completed across all assessable areas of the backyard in a matter of a couple of hours. Although no recorded GPR reflection pattern could be conclusively identified as a burial, several locations having anomalous reflection patterns were identified and marked for the Manchester Police.

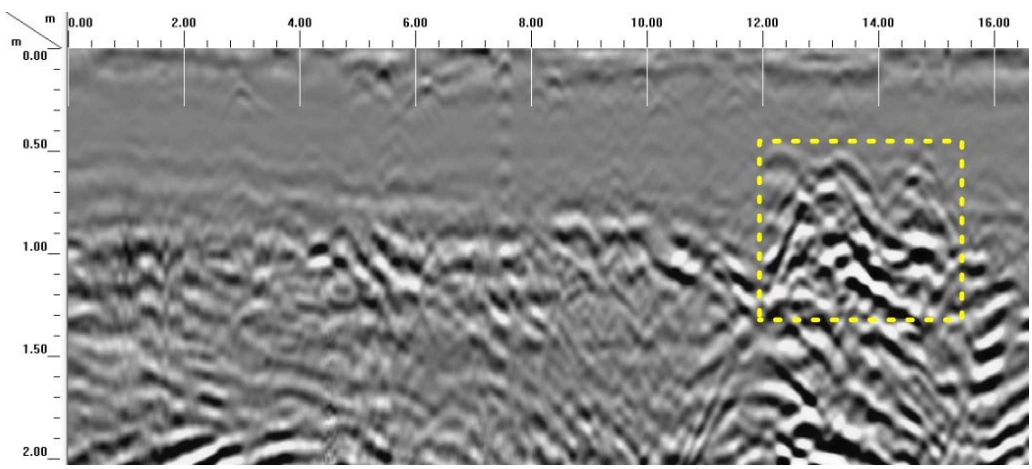


Figure 3.—At the Manchester site, because of the strong contrast with the surrounding soil matrix, depth, and location behind the house, this anomalous reflection pattern (enclosed by the segmented yellow-colored lines) caught the eye of the soil scientists and was recommended for ground-truth excavation.

Several months later, the sites identified by GPR as having anomalous subsurface features were excavated by the Connecticut State Archaeologist, a forensic anthropologist, and student volunteers from Quinnipiac University. At each of the identified locations, a larger area was excavated to discover not only what the GPR had detected but what it had not. At each of the locations identified by GPR, disturbed soils and discarded artifacts were uncovered. However, no evidence associated with the cold-case was found after 2 days of digging. The Manchester Police Department was satisfied that they, with the help of NRCS, the Connecticut State Archaeologist,

Figure 4.—Shortly after the GPR survey, a group of volunteers assisted the Connecticut State Archaeologist and the Manchester Police Department in excavating locations that had been identified by GPR as having anomalous and suspected subsurface features. (Courtesy of Detective Max Cohen, Manchester Police Department.)

and the group of student volunteers, had exercised due diligence and conducted a thorough search of the suspected site for the alleged clandestine grave.

While these GPR investigations did not deliver the imaginary results that are often portrayed on television and movies, GPR did provide powerful insight into the subsurface and invaluable assistance to forensics specialists. The search for clandestine burials is often a labor-intensive, time-consuming, expensive task. Rather than excavating entire crime scenes, the use of GPR had quickly, noninvasively, and effectively reduced the search area to a few points of interest. In both of the aforementioned cold-cases, crime scene investigators and evidence recovery specialists were, with NRCS GPR assistance, satisfied that they had taken appropriate and reasonable actions to recover any physical evidence deposited at these scenes.

The contribution of NRCS soil scientists to forensic science is not always in the field. In September 2013, Maxine Levin (National Liaison to National Cooperative Soil Survey, NHQ) participated in the 7th International Conference of the Soils of Urban, Industrial, Traffic, Mining, and Military Areas (SUITMA 7) in Torun, Poland. During this conference, Maxine Levin gave a presentation by Debbie Surabian entitled “Soil Scientists in the World of Forensics.” The presentation was well received, and several of the attendees requested copies to supplement their classwork curriculum on forensic soil science.

NRCS soil scientists have also been invited to lecture at the Henry C. Lee Institute of Forensic Science at the University of New Haven. This institute is considered a world leader in the arena of public safety and forensic science. The Institute’s goal is to make the criminal justice system more effective through training, research, consulting, and education. At the week-long “Forensic Anthropology and Human Remains Workshop,” NRCS soil scientists educate police detectives, graduate students, civilians working with cadaver dogs (also known as HRDs or Human Recovery Dogs), and forensic scientists on how soils and GPR can be used in locating and examining clandestine graves.

Soil and forensic archaeology partnerships are mutually beneficial for field projects and educational presentations. Working with archaeologists and forensic specials, NRCS soil scientists and GPR operators have had rewarding experiences that enriched their practical knowledge, GPR methodology, and interpretive skills. Conversely, archaeologists, forensic specialists, and law enforcement personnel have become increasingly aware of the importance of soil and spatial soil variability in their crime scene investigations. ■

A Whale of a GPR Tale

By Debbie Surabian, state soil scientist for Connecticut and Rhode Island, USDA, Natural Resources Conservation Service.

Soil scientists look at a multitude of soil features, some of which are bizarre. Recently, at the University of Rhode Island (URI) Bay Campus in Narragansett, soil scientists used GPR to locate the burial site of two whales. In 1967, two whales, a sperm whale and a little piked whale, were found dead on Quonochontaug Beach in Charlestown, Rhode Island. The stranding of these two whales is mentioned in the book “The Mammals of Rhode Island” (J. Cronan and A. Brook, 1968, Rhode Island Division of Conservation). Shortly after being stranded, the whales, each about 15 feet long, were buried end to end along the beach at a depth of about 4 feet. The URI Graduate School of Oceanography is interested in conducting a paleontology dig to recover and reconstruct the dissociated bones of these skeletons and to learn more about the whales. The question is “Where on the beach are these bones located?”

To avoid haphazardly digging and to greatly reduce exploration time and needless ground disturbances, the graduate school chose to pinpoint the location of the bone concentration by conducting a systematic survey using GPR. Ground-penetrating radar has been used in vertebrate paleontology to locate the fossilized and partially fossilized bones of dinosaurs and mammoths, so why not whale bones?

After several GPR traverses across a confined portion of the beach, an interesting and anomalous radar reflection pattern was observed on one radar profile. Without too far a stretch of the imagination, the radar reflection pattern shows the outline of a buried whale. The geometry of this reflector suggests the shape and dimensions of the whale with its head facing south towards the outbuilding on the beach. The location of the anomaly also coincides with the suspected burial site of the sperm whale. The radar operators, expecting that radar reflections from a concentration of bones would have a jagged, more irregular appearance, were perplexed by the smooth outline of the reflector. The smooth outline suggests that the GPR may be responding to a layer of physiochemically altered soil materials, possibly the whale’s spermaceti (a wax esters) or a blubber oil residue, which is dominantly wax. A paleontological dig will help confirm how much decomposition took place and what the radar record truly identified. ■

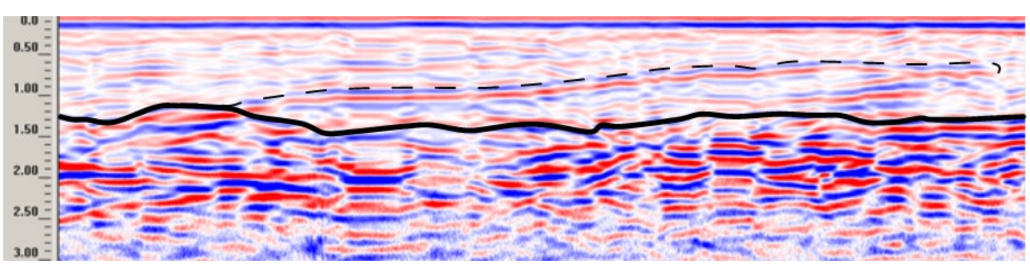


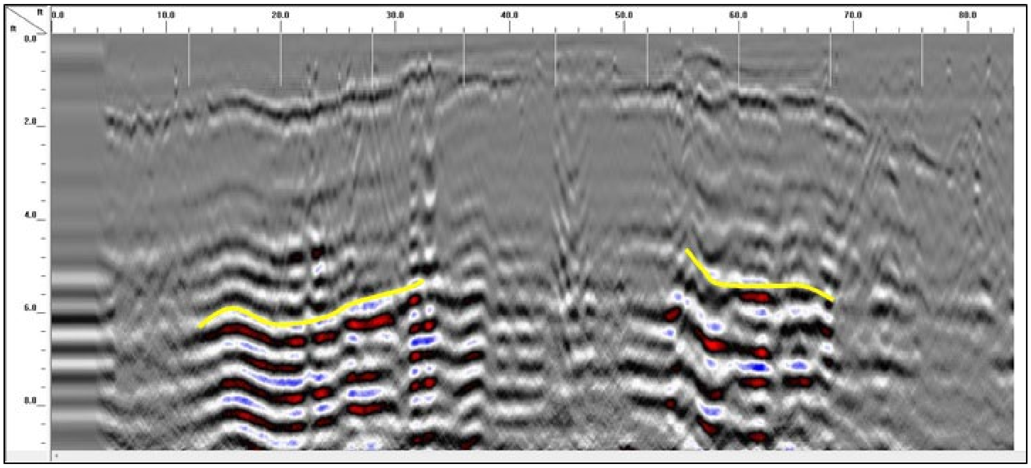
Figure 2.—On this radar profile, the dashed line indicates a reflector whose location and shape suggest the remains of a sperm whale. This moderate-amplitude reflector deepens towards the left from a depth of approximately 0.5 meter to 1.4 meters below the surface. The thick black line indicates an interface separating strongly contrasting stratigraphic layers.

Assistance from USDA–NRCS to an Archaeological Study in New York City

By Edwin Muñiz, assistant state soil scientist, and Dr. Richard K. Shaw, state soil scientist, New Jersey.

The New Jersey NRCS soil staff conducted a geophysical investigation at Joseph Rodman Drake Park in Bronx, New York. Drake Park, named after the 19th century poet, is located in Hunts Point, which was once the site of Weckquaesgeek Indian Village. The park became the burial ground for the Hunt, Leggett, and Willett families, whose names are associated with the settlement and development of the Bronx. (More information is available at: http://www.nycgovparks.org/parks/josephrodmandrakepark/history). In addition, Philip Panaritis, project director for the federally funded Teaching American History project, provided information indicating the possible location of slave burial sites outside of the main family cemetery. The park is located on a small till knoll surrounded by anthropogenic material over tidal marsh. The purpose of the project was to collect data using geophysical analysis to locate any areas of interest. Data were collected using the ground-penetrating radar (GPR) in a grid pattern. After the data were post processed, it was possible to locate four areas of interest for potential further archaeological investigations. This investigation is one more example of the importance and the relevance of GPR technology and the value of technical soil services to our non-conventional customers. This opportunity opened the doors for outreach to the urban community in Hunts Point, providing an introduction to NRCS that led to other services with the local school and community garden and promoting healthier living in the city. ■

A small cemetery within Joseph Drake Park in Bronx, New York.



Vertical “anomalies” for potential archaeological studies.

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