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In This Issue—

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.

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Soil Interpretations for Today and Tomorrow: Rationale for the New Soil Survey

By Karl W. Hipple, National Leader, Soil Survey Interpretations, and David Hammer, National Leader, Soil Survey Investigations, National Soil Survey Center, NRCS, Lincoln, Nebraska.

The National Cooperative Soil Survey (NCSS) program has passed the century mark and is moving into the future prepared to meet its legislatively mandated goals. Many soil scientists in the Natural Resources Conservation Service (NRCS) are aware of the four primary mandates that define our jobs and the products and services we provide to a variety of internal and external customers. The four mandates are: 1) inventory the nation's soil resources, 2) maintain the inventory, 3) make interpretations for soil and resource use, and 4) provide assistance in using the information. A fifth mandate requires the NCSS to coordinate the activities of the cooperative soil survey. Traditionally, our primary cooperators have been other Federal agencies, State agencies, and universities.

What is the new soil survey?

To many soil scientists soil maps are the NCSS legacy and are the final product. The new soil survey concept, based on major land resource areas (MLRAs), is aimed at developing timely, new, and accurate products and, with a smaller cadre of soil scientists, providing relevant new services to a wider range of customers. These goals define the future of the NCSS. The word *relevance* indicates the most critical aspect of the new focus. Because of the need for more balance, the NCSS is placing more emphasis on mandates 2, 3, and 4 (described in the first paragraph). A redesigned, more balanced soil survey program will be the central focus of the new soil survey.

Reorganizations involving the NRCS members of the NCSS have occurred on a somewhat regular basis during past decades. The NRCS is embarking on a new reorganization that takes soil survey "Beyond the Map." Maintaining maps, enhancing, updating, collecting, and completing soil data, making new and improved interpretations, and helping customers use these products are the redesigned focal points of the NCSS. NRCS is continuing to work towards a full implementation of soil survey MLRAs, the cornerstone of the 1994 reorganization. New technology makes the new program direction possible, and a smaller projected workforce necessitates this change. Internationally, soil survey programs that failed to go beyond the soil map to provide timely products to society have quickly lost both relevance and funding and have failed to survive. For example, England's once proud soil survey program has vanished.

The "new soil survey," as described by Micheal Golden, our current Soil Survey Division Director, is exciting because it focuses on providing customer service and delivering new and improved products. A greater emphasis on soil survey maintenance will anchor new and improved interpretations and services that will be

provided to a broader customer base. The new paradigm also provides the time, initiative, and framework for collecting new and missing soil component data and improving the quality of existing data. The emphasis will be on understanding soil responses to human impacts at a variety of scales. A different approach to data collection and analyses will be required. Benchmark landscapes, their soils, and watersheds will be the focal points for the next generation of soil investigations and data collection as we move from point investigations for classification to a process-based approach.

The field soil survey activities of mapping, describing, classifying, and correlating soils are the primary responsibilities of the MLRA Offices (MOs). In the past, the traditional focus was county-based, project offices under the authority of the State Soil Scientist. The chief role of individual States in the new soil survey is to provide quality soil data, interpretations, and technical services to our customers, many of whom are new users of soil survey information. The new clientele bring new demands for our data and interpretations. The Department of Homeland Security, the Farm Service Agency, planning and zoning commissions, urban planners, and a variety of modelers are now major users within the arenas that previously were dominated by farmers, ranchers, forest and rangeland managers, and engineers.

What is a "completely populated" database?

A "completely populated" database does not mean that every data field is populated. Rather, it means that we have populated every data field that has current relevance for a needed interpretation. We expect that as interpretation needs continue to change in the future, we will continue to add to and change the database. We will evolve to meet customer needs, so a relevant soil database probably never will be "completed." The "completed database" will provide the template for the evolving database that will later be refined by collecting hard or soft data during the maintenance and update activities of the new soil survey. National Bulletin 430-5-7 describes the minimum data set for the current concept of a fully populated database.

Current efforts to populate the database should be completed before senior NRCS soil scientists retire. The tacit knowledge of the collective group of field-experienced soil scientists is a priceless, time-dependent NRCS asset. Only an experienced soil scientist can draw useful inferences from soil maps alone. Experience is required for an understanding of how soil maps are made, how local soils relate to local landforms, and how soil taxonomic classes have been used to design map units. Each generation of soil scientists acquires unique experiences because of the technologies and agency objectives of the time. The current generation possesses unique tacit knowledge because it is the last generation of soil scientists who have completely mapped survey areas "from scratch." Future generations of soil scientists will modify existing soil surveys to meet new user needs. They will acquire a different kind of tacit knowledge and apply it in different ways.

The current generation of older soil scientists has made a transition to technologies not previously available, including GIS, GPS, NASIS, and Web soil survey. Thus, this generation has a unique combination of knowledge that can be applied to the current technology. More than half of the field-experienced soil scientists now in NRCS will be eligible to retire in the next 5 years. The NRCS must capture these journeymen's unique and valuable "tacit knowledge" before it is lost. Capturing this tacit knowledge will benefit all future users of soil surveys, including soil scientists who will acquire different tacit knowledge through different experiences. Tacit knowledge, as defined by B.D. Hudson in 1992 ("The soil survey as paradigm-based science," Soil Sci. Soc. Am. J. 56: 836-841), is acquired through years of field soil mapping experience. It is information that is difficult to capture in writing and convey to people who lack experience in the field mapping process. Tacit knowledge has historically been a very important component of the agency's ability to develop interpretations for the complex soil-landscape system.

Who are our customers, and what are their needs?

We really do not yet know the full range of today's users, and the list of these users will change as time passes. The diverse, growing body of soil survey users now includes many individuals and disciplines that either have different perspectives about soils than our traditional clientele or have little previous knowledge of, or experience with, soils. These users want data to solve problems. Accurate, accessible data are fundamental to the evolving mission of soil survey. Data collection and database population are fundamental cornerstones of the NCSS. We have always performed these tasks, but not with the focus and emphasis that we will in the new soil survey. Quality, relevant interpretations will be based on the quality, readily accessible data we will obtain for our clients.

Data are integral to classifying and correlating soils and to making soil maps. Data are fundamental to

developing timely and quality soil interpretations. A soil map shows the kinds of soil on the landscape and their distribution. Interpretations are impossible without quantification of specific soil attributes and knowledge of soil responses to intended management and land use practices. The NCSS product line must include an accurately defined and fully populated database. Various users rely on this database to make relevant and accurate interpretations. In addition, modelers and others use NCSS data in building models and products for their customers. NCSS products must provide all users with accurate information regarding map unit composition, component location on defined landscapes, component soil property information, and component interpretation ratings. Anything less is not sufficient to meet user needs and does not justify taxpayer investments in the NCSS program. The NCSS future is bright because we have the ability to be relevant to a broad group of users.

Quality data are the foundation for our third mandate of making soil interpretations. These interpretations cannot be consistently and accurately generated without precise, accurate data. Some of the entries that are contained in the NASIS (National Soil Survey Information System) data structure are, in fact, interpretations. The values for K, T, and I factors, hydric soil classifications, and prime farmland ratings are examples of national soil interpretations that are currently included in the NASIS database. Guides used to assign soils to specific classes (prime or not prime, hydric or not hydric) or to develop values for erosion factors (K, T, and I) commonly vary dramatically from region to region, State to State, and survey area to survey area. These listed interpretations all qualify as "national interpretations" because they are used by legislatively mandated national USDA programs. Also, they are used for on-the-ground resource planning. Variation in soil data across the nation is a major concern for the Farm Service Agency (FSA) as it administers legislated national farm programs. Congressional funding for most farm programs is based on estimates generated from models of NCSS data. The NRCS is committed to helping FSA meet farm program mandates.

Soil scientists who complete the task of data population need to use NRCS Web utilities on a regular basis to ensure that they are aware of national bulletins. Larger quantities of information and more instructions are now being transmitted via the Web to save time and money. For obvious reasons, NRCS national bulletins must be brief when they transmit requests and instructions. They cannot accommodate a lengthy, detailed discussion. NRCS Soil Survey Division leadership needs to ensure that requests and instructions are clear, so that they can be turned into a planned workload of completed tasks and implemented programs. Wherever possible, NRCS leadership also needs to provide tools for cross-checking and populating databases. More success in meeting these requirements is needed.

Who develops national bulletins?

National Bulletin 430-5-7 (Soil Information for Field Office Technical Guides) was jointly developed at the National Soil Survey Center (NSSC) by the Soil Survey Technical Services and Soil Survey Interpretations staffs and the National Data Management Specialist. The data elements identified in this bulletin are cumulative. Many of the elements were identified and prioritized for population in earlier correspondence. In a few isolated locations, incomplete data population still hampers the national application and utility of RUSLE2 technology. The complete list of data elements is designed to help States to locate overlooked or missing data that is required for Field Office Technical Guide (FOTG) applications.

National Bulletin 430-5-5 (Request for Testing T-factor Generator in NASIS) was developed by the Soil Survey Interpretations staff at the NSSC. It has caused some confusion, but it also has generated an abundance of solid field and scientific input that will assist the NSSC soil interpretations staff when it develops the second and future iterations of T-factor data. Comments received from almost 40 States will be used to refine and improve the model until it is acceptable for national use. Currently, national T-factor criteria comprise nine pages of the National Soil Survey Handbook (NSSH) and are specific to land resource regions (LRRs) and major land resource areas (MLRAs).

Why are national bulletins developed?

Many considerations led to the development of National Bulletins 430-5-5 and 430-5-7. These include:

- the need to update and complete Field Office Technical Guides (FOTG)
- the inability to develop timely, accurate national interpretations for use in national emergencies
- requests from FSA to provide nationally consistent and equitable interpretations and data for use in determinations of farm-program eligibility and in program applications

• requests from the Deputy Chief of Soil Survey and Resource Assessment
• requests from the Director of the Soil Survey Division
• the need to develop timely national interpretations for varying uses

These considerations coincide with the phase-in of the fundamental objectives of the new soil survey.

The recent need to identify interpretations for the disposal of large and small carcasses is related to an initial request from the Director of the Soil Survey Division that was later reinforced by requests for urgent assistance from the Department of Homeland Security. These interpretations were requested in response to damage from Hurricanes Katrina and Rita. A quick response was needed. In national emergencies no time is available for the population of databases prior to the development of maps and interpretative products to be used for disaster mitigation. The NCSS must be prepared to provide products as requested and must expect short notice challenges during or after national emergencies. The NCSS is the best source of soil information and expertise nationally, and we are becoming more and more proficient at "short notice" response. We will continue to refine our abilities to deliver new interpretations on request. In numerous cases, soil data are a single layer in the analyses phase of complex issues. As professionals, we should be proud that we have the knowledge, technology, and skills that are both necessary and sought after in national emergencies. A request for our assistance is an important measure of our "relevance."

A subtle change has been made in the process of developing some soil interpretations. This change is most apparent in the 2005 National Hydric Soil List. A hydric soil interpretation is now made for each soil component instead of for each soil series. This, again, is the future direction and goal of soil interpretations. Much work remains. In most States, interpretations are generated only for major map unit components because of limitations of table size, manuscript length, data availability, and data population. The maintenance function of the new soil survey is the primary tool for collecting missing data and entering it into NASIS. Many of our NRCS customers still envision NASIS data as a soils issue instead of seeing it as the fuel that runs the FOTG for all agency resource planning activities.

Is there more explanation for the recent data requests?

The following may address a few additional issues raised by National Bulletin 430-5-7. A new national Soil Rating for Plant Growth (SRPG) is under development and will use Soil Data Mart data. It is designed to use heat units and soil moisture as criteria. A field-requested and updated Forestry Windthrow Hazard interpretation has been completed. Both the SRPG and Windthrow Hazard interpretations include slope aspect as a criterion. FSA needs defensible computer-generated national K, T, and I factor interpretations for consistent and equitable USDA farm program signups if the agency is to withstand legal challenges to eligibility appeals. "Landform" is a criterion in the national interpretations for carcass disposal in pits and carcass disposal in trenches requested by the Department of Homeland Security. It is also required for all hydric soil component interpretations. Population of landform data provides a new ability to improve existing soil interpretations. Landforms are important to water movement across landscapes and through soil profiles. Properly defined within MLRAs, "landforms" bring the important issue of scale into interpretations in an intuitive, logical way.

How does data population fit within the soil survey long-term vision?

In short, NCSS scientists must not "lose sight of the forest because of the trees." National Bulletins 430-5-5 and 430-5-7 are simply trees in the soil survey forest. The soil survey forest represents the overall goal and vision of the new soil survey to have a relevant and vibrant soil survey program that provides all customers a variety of timely, quality products that meet their needs. The NCSS must be capable of producing timely and accurate soil interpretations at all times. In national emergencies, time is critical to program managers who need access to the best resource data available.

The NCSS must also be able to work closely with other scientific disciplines and other agencies (all customers) in national or regional emergencies to link soil data with the data from other disciplines in a timely, precise manner. New and/or updated land resource interpretations or products for emergency or routine situations require complete data. Data collection and population are long-term tasks. The NRCS leadership plans to continue to meet current and dynamic customer needs as efficiently as possible. This goal can be met through continued, carefully conceived, balanced, and scheduled requests to the field. Whenever possible, tools that help to identify data gaps and inconsistencies or perform calculations on existing data will be developed at the National Soil Survey Center. When

possible, we will use input and review comments from the field. At our recent teleconference with State Soil Scientists, we agreed to conduct special teleconferences in step with future data requests. The NCSS provides unique, important products and services to society. As a team, we can meet the challenges of the future through the new soil survey paradigm. ■

Power Shortage

By Gary Muckel, Soil Scientist, National Soil Survey Center, NRCS, Lincoln, Nebraska.

Bob Ahrens, National Soil Survey Center Director, recently experienced a power shortage in his house in Lincoln, Nebraska. After hearing popping and crackling sounds, Bob discovered that a power outage had occurred in half of the house's circuits. He then contacted the Lincoln Electric System. Staff from the electric company came to his house in very large boom trucks with spotlights glaring for all the neighbors to see. They quickly diagnosed the problem and repaired the circuits.

Bob's house is located on a highly expansive soil, and Lincoln has been experiencing very dry soil conditions. The main electrical power cables leading to Bob's house were pulled partially away, causing the popping and crackling sounds Bob had heard as well as the loss of power. The electric company indicated that many homes in Lincoln were experiencing power connection problems because of the shrinking of the soil.

These things happen even to soil scientists.

To check your soil conditions, visit the Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/). ■

WSS (Web Soil Survey) suitability and limitation map for dwellings with basements in Robert Ahrens' neighborhood. The color red indicates severe limitations; yellow, moderate limitations; and green, slight limitations.

Robert Ahrens' home in Lincoln, Nebraska, in the foreground. The power connections are not shown in the picture because they are underground.

Web Soil Survey

By Aaron Achen, Editor, MO–15, NRCS, Auburn Alabama.

The "Web Soil Survey" allows you to view official soil information for more than 90 percent of the private land in the United States. The site is at http://websoilsurvey.nrcs.usda.gov/app/.

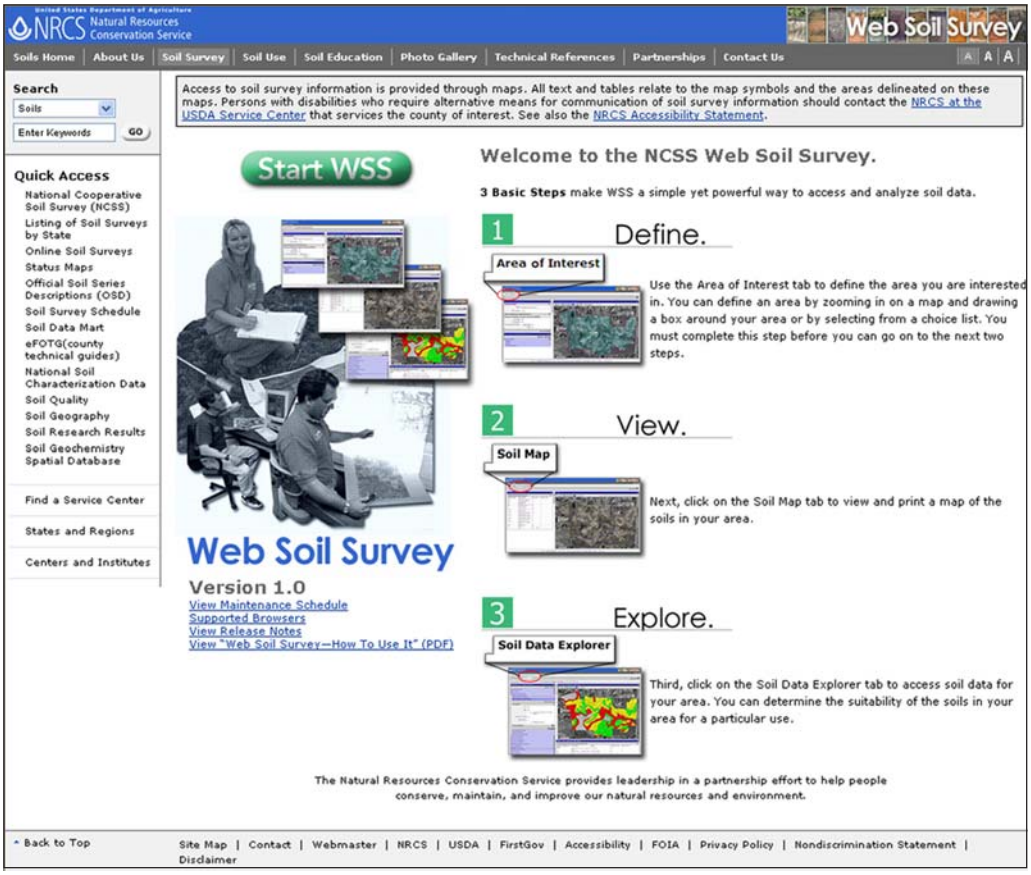
The first step for using the Web Soil Survey is to locate the area in which you are interested. You can select an area in the continental United States, Alaska, Hawaii, the Pacific Basin, Puerto Rico, or the U.S. Virgin Islands. You select an area by zooming in on a locator map or by specifying street address, a county, or a survey area.

The next step is to view a map of the soils in the area you selected. Soil maps are not yet available for all areas. The maps that are available consist of aerial photography overlain by lines that indicate the boundaries of the various types of soil. A list of the soils is included for each area, and the map can be saved and printed.

The third step is to explore the information associated with the soils. The Web Soil Survey can display the properties and qualities of the soils. It can also show interpretations about the suitabilities and limitations of the soils for many uses. Examples of properties and qualities include available water capacity and pH. Examples of suitabilities and limitations include interpretations about how productive the soils are for various crops and about how well the soils would function as a site for buildings. The information can be displayed in tables and, in many cases, on maps.

Complete, composite publications and full-sized maps are also available for a limited number of survey areas.

The Web Soil Survey is replacing the familiar, traditional paper copies of soil survey reports. As new and updated soil surveys are completed, NRCS is distributing the results of these surveys by means of the Web Soil Survey instead of as books. The Web Soil Survey allows NRCS to update the information more rapidly and ensures a single source for official data. People without computer access can acquire soil survey information from an NRCS field office or local library. ■



Smithsonian Soils Exhibit

By Gary Muckel, Soil Scientist, National Soil Survey Center, NRCS, Lincoln, Nebraska.

This landmark exhibit will reach more than 6 million visitors a year with the message of soil science and education. The Missouri state soil monolith is a prototype now on display at the National Museum of Natural History. As a small portion of the entire exhibit, the other state soil monoliths (on loan from USDA, NRCS) will be formatted similarly and unveiled when the exhibit opens in 2008, depending on funding.

For more information, see the Smithsonian Soils Exhibit Web site (http://www.soils.org/smithsonian/). ■

An example of the Smithsonian Soils Exhibit.

Gutknecht Applauds Launch of Web Soil Survey Site

Survey analyzes soil data for public, private land use and development

By Jon Yarian, Communications Director, Office of Congressman Gil Gutknecht (MN-01).

Washington D.C. - November 28, 2005 - Congressman Gil Gutknecht (MN-01) today participated in a ceremony in Kasson, Minn. recognizing the launch of the new Dodge County Web Soil Survey site. The website will analyze soil data and provide secure public access to the national soils information system.

"This site will be an invaluable tool for Dodge County farmers, homeowners and businesses," said Gutknecht. "Now anyone with access to the internet can find up-to-date, accurate information on the land we use every day."

The site was created by the National Cooperative Soil Survey, a partnership of local, state and federal agencies working together to collect soils information. The website has been designed with three easy-to-use features (Define, View, and Explore) and operates much like internet sites that provide locator and directional information.

Congressman Gutknecht spoke at the event at Digger's Bar & Grill in Kasson, praising local soil conservationists for their work on the project. Gutknecht was joined by Dodge County Commissioner Klaus Alberts, State Soil Specialist Greg Larson, and other local officials for the ceremony. For more information about the Dodge County Soil Survey, please contact Mark Kanable, District Conservationist at (507) 374-6364.

Gil Gutknecht is Chairman of the House Agriculture Subcommittee on Department Operations, Oversight, Dairy, Nutrition and Forestry, Vice Chairman of the House Science Committee, and a member of the House Government Reform Committee. ■

Publication of New USDA Handbook 296

By Stanley P. Anderson, Editor, National Soil Survey Center, NRCS, Lincoln, Nebraska.

The USDA handbook entitled *Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin* is currently in interagency review. It will be published during the spring of 2006 in at least two of the following forms: a CD copy, a Web copy, and a printed copy.

The following passage from the introduction indicates the purpose of this handbook:

> The information in this handbook provides a basis for making decisions about national and regional agricultural concerns, identifies needs for research and resource inventories, provides a broad base for extrapolating the results of research within national boundaries, and serves as a framework for organizing and operating soil surveys and resource conservation programs.