Honoring Dr. Dick Arnold, Recipient of the Guy Smith Medal

By the Guy Smith Medal Award Selection Committee.

Dr. Richard “Dick” Arnold was awarded the Guy Smith Medal at the 2018 Joint Northeast and South Regional Cooperative Soil Survey Workshop held in June in West Virginia. This award is given by IUSS Commission 1.4. Soil Classification to commemorate Dr. Guy Smith, a university professor, a soil mapper, an internationally traveled taxonomist, and the principal author of the 7th Approximation of U.S. Soil Taxonomy, published in 1975. The Guy Smith Medal is awarded once every 2 years to the person whose body of work has advanced soil classification. Previous award winners are Juan Comerma (2016), Otto Spaargaren (2014), Hari Easwaran (2012), and Rudi Dudal (2010). Dr. Arnold worked with or collaborated with each of the previous awardees.

Dr. Arnold obtained his B.S. in 1952 in Farm Operation at Iowa State University, his M.Sc. in Soil Genesis at Cornell University in 1959, and his Ph.D. in Soil Genesis and Survey at Iowa State University in 1963. He began his academic career in Soil Genesis in 1963-1966 at the University of Guelph in Ontario, Canada. From there, Dr. Arnold took a position in Soil Science at Cornell University in Ithaca, New York, from 1966-1980, and was promoted to professor of Soil Science in 1975. Following that time, he spent 16 years (until 1996) as Director of the USDA-SCS Soil Survey Division in Washington, D.C. During his tenure, several international committees brought about broad changes to Soil Taxonomy through studies of cold soils (Gelisols).
and Aridisols. New soil orders were introduced during his tenure. From 1996 through 2000, he served as Special Assistant to the Chief of NRCS and then to Deputy Chief for Soil Survey and Resource Assessment. He was an instructor at the NCSS Soil Science Institute several times. Dr. Arnold has been retired from USDA since 2000 and now lives with his wife Helen in West Lafayette, Indiana. He is a published author of 45 refereed journal articles, 30 conference proceedings, 5 book chapters, and about 60 other articles and lectures.

Dr. Arnold has been very active internationally, participating in 12 workshops in 10 countries. From 1972 to 2000, he made 40 international trips to teach, review projects, and provide outreach to soil scientists worldwide. He began his international experience teaching geology, soil genesis, and soil classification at the University of Guelph in Canada (1963-1966). Dr. Arnold taught soil classification and pedology in the Philippines in 1976 and soil classification and application of U.S. Soil Taxonomy in the People’s Republic of China in 1982. While at Cornell, he worked with the USAID-sponsored program called TROPSOIL, which aimed to improve Soil Taxonomy to enable and facilitate soil management transfer to soil scientists and countries of tropical regions. At USDA, he was involved in the USAID-sponsored Soil Management Support Services (SMSS), working with soil scientists in developing countries. The SMSS, through the efforts of Hari Eswaran, was an early sponsor of publishing the Keys to Soil Taxonomy. Dr. Arnold was recognized for outstanding contributions as a member of the Board of Trustees for the International Board for Soil Research and Management in Bangkok, Thailand from 1988-1993. He gave formal lectures on soil classification in Bulgaria, Costa Rica, Germany, Great Britain, Hungary, India, Indonesia, Romania, and Russia. Beginning in the late 1980s, Dr. Arnold was an early promoter of the need to understand the role of soil in global change. For years he served as associate editor for the Agronomy Journal and on the editorial boards of CATENA and Pochvovedenie (the Russian soil journal). Selected publications include works published in Brazil, Chile, Mexico, India, Italy, and Russia.

Dr. Arnold was a Fulbright Scholar in 2001-2002 in Moscow, Russia and previously had served as a U.S. Special Liaison to the Russian and former Soviet soil science societies. During this time, he helped soil scientist Maria Gerasimova translate the only English version of the Russian system of soil classification. He was recognized in 1996 as an Honorary Member of the Dokuchaev Soil Science Society, Russian Academy of Sciences. In 2012, Dr. Arnold was the foreigner awarded the Lomonosov Gold Medal in Moscow, the highest award of the Russian Academy of Sciences, for “outstanding contributions to development of theoretical and applied soil science and creation of behavioural models for various world landscapes.”

Dr. Arnold is a Fellow of the Soil Science Society of America and the American Society of Agronomy. He was Chairman of Commission V (Pedology) of the International Society of Soil Science (now IUSS) and a member of the working group on international programs and the World Reference Base for Soil Classification. In 2006, he became an honorary member of the International Union of Soil. He is also an honorary member of the Romanian Society of Soil Science and the Bulgarian Society of Soil Science. In 2014, Dr. Arnold was awarded the Brandwein Medal from the Paul Brandwein Institute,
a non-profit environmental educational entity in Port Jervis, New York “for being a great leader of soil science and especially for encouraging others to get involved in nature.”

According to John Galbraith, Dr. Arnold is a soil philosopher and visionary as well as a world-renowned soil classifier and promoter of good will. His lectures on soil classification come across as much like poetry as science. Dr. Arnold always challenged others to think beyond the constraints of convention while remaining practical.

On his LinkedIn professional web page, Dr. Arnold has posted “I am very fortunate to have met and worked with so many wonderful people in Pedology. I have always wanted to help others do the best they can, and when that happens we all are winners.”

New Coastal Zone Soil Survey Exhibit and Display

The National Soil Survey Center’s (NSSC) newly created Coastal Zone Soil Survey (CZSS) exhibit and display is now available for outreach events, conferences, and workshops. The CZSS exhibit had an inaugural showing at the 2018 Joint Northeast and South Regional Cooperative Soil Survey Workshop held June 24 to 29 in Summersville, West Virginia. The exhibit, on display in the poster viewing area at the workshop, was very well received. It next traveled from West Virginia to New Jersey for three events, including a Barnegat Bay Partnership (https://www.barnegatbaypartnership.org/) committee meeting (July 10) and two Save Barnegat Bay (http://www.savebarnegatbay.org/) special workshops (July 13 and 18). Below is a picture of the new CZSS display at the Save Barnegat Bay annual meeting held at the Toms River Library. The display has now made its initial rounds in New Jersey and has returned to the NSSC. Please look for the display at the upcoming Restore America’s Estuary (RAE) 9th National Summit on Coastal and Estuarine Restoration and Management (https://www.estuaries.org/Summit) and the Soils Across Latitudes (https://www.sacmeetings.org/) 2018–2019 International Soils meeting in Long Beach and San Diego, California to be held in December and January, respectively. Please also note that the new CZSS fact sheets make great handouts with the
exhibit. The fact sheets can be downloaded at: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1369610.pdf. The new CZSS display is available for anyone to use. Please contact Linda Greene (LindaM.Greene@lin.usda.gov) if you are interested.

A very special thank you to Dave Hoover and Linda Greene at the NSSC for recognizing and generously supporting the development of the new CZSS exhibit and display, which will be used extensively in the very near future. Another thank you to the CZSS Focus Team for their efforts and collaboration in developing this new display and marketing tool.

For further information on CZSS, go to: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/focusteams/?cid=nrcseprd1319232. ■

Webinar on Web Soil Survey for the National Park Service

By J. Josiah Parsley (soil data quality specialist and Federal lands liaison, St. Paul, Minnesota), Tiffany Allen (MLRA soil survey office leader, Waynesville, North Carolina), and Tammy Cheever (information technology specialist, National Soil Survey Center, Lincoln, Nebraska).

On Wednesday, July 11, 2018, NRCS Soil Science Division staff collaborated with National Park Service (NPS) staff to provide an update on NPS Soil Resources Inventory (SRI) via a webinar as well as provide training on Web Soil Survey navigation and function specific to NPS. The webinar and training were targeted to NPS Unit staff, who are comparable to the staff at the field office level in NRCS. At least 130 individuals registered for the training. The webinar appeared to spark much interest in Web Soil Survey for the attendees.

The most recent, previous webinar engaging NPS staff with this sort of update and information on the NPS SRI program was given in June of 2011 by the NPS SRI Coordinator at the time. Due to the retirement of this coordinator at the end of 2013 and the remaining vacancy of that position within NPS, few updates on new soil tools
and data acquisition and manipulation for users have been made. One goal of the people behind this webinar was to update the NPS Unit staff on the latest public facing products available for their use and to ensure that the staff were aware of the frequency of the soil data refresh. In the past, static maps and products (essentially data “snapshots”) have been frequently utilized, served, and sub-hosted via NPS Integrated Resource Management Applications (IRMA). The trainers encouraged NPS Unit staff to utilize Web Soil Survey in the future.

Many thanks to our counterparts (Jason Kenworthy, Tim Connors, and Hal Pranger) in the National Park Service for allowing us the opportunity to promote Web Soil Survey with the NPS Unit staff. The primary/lead presenter for the WSS portion of this webinar was Tiffany Allen. Tammy Cheever provided much context and perspective during the question and answer session following the webinar. Jo Parsley facilitated the various scoping meetings, coordinated training cadre, and helped in reviewing and guiding the webinar content.

This webinar was recorded for future reference by NPS staff. It can be found in the NPS internal training recordings (accessible only inside of the NPS network) as well as at the following YouTube address: https://www.youtube.com/watch?v=TEqLv09rH_s&feature=youtu.be.

Mud Painting—An Education on Soil Color

On July 14, 2018, NRCS Soil Scientist Shaunna Repking (from Onalaska MLRA Soil Survey Office, Wisconsin) and Earth Team Volunteer Mark Novachek set up a booth at the 10th Annual Youth Outdoor Fest at Veterans Freedom Park in La Crosse, Wisconsin. The booth theme this year was “Soil Color.” Shaunna and Mark crushed soil samples from a variety of local sources and mixed them with water. Everything from black muck to red till to green glauconitic sandstone was used for paint. The kids (and parents!) had fun painting pictures and learning about why soils are certain colors. Participants were also able to draw with soil crayons! Some soil crayons were shaped like fossils and included in a pool filled with “healthy black soil,” which contained real and fake bugs that also could be used in the mud painting. Some of the paintings not collected at the end of the day are now displayed in the entryway of the Onalaska MLRA Soil Survey Office for public viewing.

The Youth Outdoor Fest, a free hands-on event for kids and their families, is hosted by the City of La Crosse—Parks, Recreation, and Forestry Department and the U.S. Fish and Wildlife Service and Friends of the Upper Mississippi. Numerous other local...
organizations and businesses also provide funding, material support, prizes, and activity booths. This year’s activities included Aquatic Invertebrates, Boat Driving, Dog Demos, Dragon-boat Rides, Fish Cleaning, Fish Printing, Fur Identification, Geocaching, Hiking, Honey Tasting, Kayaking, Live Fish, Planting Beans, Pontoon Tours, Eagle Presentation, Storytelling, Rock Climbing, and more.

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**Review of Ecological Site Program in Major Land Resource Area 143—Northeast Mountains**

The NRCS Soil Science Division conducted a review of the Ecological Site (ES) Program across four States comprising MLRA 143: Maine, New Hampshire, Vermont, and New York. This pilot review was an opportunity for Ecological Site Field Staff Jamin Johnson (Dover-Foxcroft, Maine) and Nels Barrett (Amherst, Maine), ES Program Reviewers Kendra Moseley (Davis, California) and Curtis Talbot (Las Cruces, New Mexico), and NRCS Pathways Intern Devon Brodie (Colchester, Vermont) to meet with several members of the technical team. The technical team represented Federal agencies (Natural Resources Conservation Service, Forest Service, and Fish and Wildlife Service), State government (Maine Natural Areas Program, New York Natural Heritage Program, and New York State Adirondack Park Agency), nongovernmental organizations (NatureServe and the Nature Conservancy), and academia (University of Maine). A total of 32 team members, representing 9 organizations across 4 States, participated in the review. The pilot review consisted of a combination of presentations, interviews, and field excursions at three different sites in MLRA 143: Orono Bog (Bangor/Orono Area, Maine), Wild Ammonoosuc River Watershed (White Mountain National Forest, New Hampshire), and Paul Smith’s College in Adirondack Park (Paul Smiths, New York). The intent of this pilot review was to familiarize the technical team with recent advances in ecological site work, test the effectiveness of the ES field keys, and gain insights into the current involvement of technical team members and needed improvements for ES work going forward. A report is being prepared that will highlight specific steps of the ecological site development process. It also will include

![Figure 1.—The Orono Bog heath zone. Cotton sedge is in the foreground.](image-url)
lessons learned that can increase the value of interactions with partners as well as that of the delivered products. The report will be shared with all regional soil survey offices. Orientation began at the NRCS State Office in Bangor, Maine. Welcoming remarks were made by Obediah Racicot, acting Maine State Conservationist. Each day began with a brief explanation of the review process and expected itinerary. This was followed by a brief overview of the Ecological Site Program, its delivery via Web Soil Survey, how the field keys (used to differentiate ecological sites) were developed for landscape patterns based on soil and vegetation concepts, and what the diagrammatic state-and-transition model represented in terms of dynamic natural processes and changing land use. As separate interviews were conducted, the team discussed the relevance and practical uses of ecological site information to different end users.

The first field excursion was spent exploring the Orono Bog and testing the ML Provisional Ecological Site Field Key. The boardwalk at Orono Bog crosses several ecological sites, including the Mucky Peat Swamp (Bucksport-Wonsqueak soil complex) and the Acidic Peat Wetland Complex (Sebago-Moosabec soil complex), where the wooded fen zone transitions to open heath and moss and sedge bog zones.

The second field stop was in the White Mountains National Forest in the Wild Ammonoosuc River Watershed. Along mountainous side slopes, where soil parent material consists of lodgment till, the technical team visited a Loamy Till Toeslope ecological site and a better drained Loamy Slope ecological site, which correspond to Colonel and Peru soils, respectively. The prevailing vegetation was northern hardwoods with admixtures of spruce and hemlock increasing as drainage worsened downslope. These ecological site concepts were consistent with those developed for an ecological site development project elsewhere in the area by an interagency team that included the Fish and Wildlife Service, NRCS, NatureServe, and the Maine Natural Areas Program. Further agreement was shown in a recent Forest Service study in the Wild Ammonoosuc Watershed, which modelled local ecological units using soil and topographic metrics by means of LiDAR derivatives and the raster-based soil inference engine. In the future, raster soil products, which detail the continual variation of soil properties across the landscape, will be used to improve models and better delineate ecological sites.

The final destination was Paul Smith’s College in the northern reaches of the Adirondack Park. The technical team hiked along the “soils tour” through a variety of ecological sites and evaluated soil-vegetation relationships on different soil parent materials. The soils tour demonstrated how ecological sites are greatly influenced by landscape characteristics, including parent materials such as glacial outwash, lodgment till, ablation till, and organic peat.

Figure 2.—Paul Smith’s heath bog.
Special thanks go out to Nick Butler, Carl Bickford, Roger DeKett, Gerald Smith, Janella Cruz, and Rebecca Fox for their help in organizing meeting spaces and field tours.

Rangeland Health Training Session in Grand Junction, Colorado

By Suzanne Mayne-Kinney, NRCS ecological site specialist, Grand Junction, Colorado.

The Bureau of Land Management’s (BLM) National Training Center held a training course on Interpreting and Measuring Indicators of Rangeland Health in Grand Junction, Colorado, May 22 through May 25, 2018. This training was on version 5 of the document, which is currently in draft form. The course had 54 participants from BLM, NRCS, the Agricultural Research Service (ARS), Colorado State University, and New Mexico State University. Course instructors were Mike Pellent (retired BLM), David Pyke (USGS), Jeff Herrick (ARS), Nika Lepak (BLM), and David Toledo (ARS). Suzanne Mayne-Kinney served as the local expert, and was also a class participant. The experience levels ranged from professionals with 15 to 20 or more years of service on rangelands to students just starting their careers in land management.

Suzanne spent several days working with the local BLM field office ecologist and range conservationists to locate field sites for the training. After field sites that met the criteria for the course were located, Chuck Peacock (MLRA project leader, Grand Junction) verified the soils for the class on the three locations chosen at the request of the national cadre. For training purposes, the cadre wanted to ensure that the

Figure 1.—Students verify the soil and check for compaction (rangeland health indicator 11).
locations had similar soils but different community phases. All three sites were located within 1 mile of each other and in the same soil map unit, on Monogram and similar soils.

The class was taught on three different community phases of the Loamy Foothills ecological site located in Major Land Resource Area (MLRA) 36—Southwestern Plateaus, Mesas and Foothills. The description for this ecological site was completed for the Provisional Ecological Site Initiative in 2017. It was updated with current field data and National Research Inventory (NRI) data at that time. The national cadre updated the rangeland health worksheet during the class to include the changes in version 5.

The first site was untreated and was the closest representative of community phase 1.1 (from the state-and-transition model) that could be located. The plants on site 1 were Wyoming big sagebrush, needle and thread, Indian ricegrass, squirreltail, and bluegrasses. The second site was treated by plowing and seeded in the 1980s. The vegetation at site 2 was Wyoming big sagebrush and very little understory, consisting of mostly crested wheatgrass, cheatgrass, western wheatgrass, and annual mustard. The third site was treated by plowing and seeding in the 1980s and re-treated in the late 2000s with a Dixie harrow. The vegetation at site 3 was Wyoming big sagebrush, crested wheatgrass, Indian ricegrass, squirreltail, and western wheatgrass.

There are 17 indicators for rangeland health that are used to describe the ecological status of rangelands. The indicators are used to record patterns and assessments for three attributes of rangeland health assessment—soil and site stability, hydrological function, and biotic integrity. The intended use of this protocol is to provide early warning of resource problems on rangelands as well as serve as a communication tool. It is not intended to monitor land or determine trend, make management decisions, or identify the cause of resource problems. It is used to assess how ecological processes (water cycle, energy flow, and nutrient cycle) are functioning on a site in regard to the ecological potential.

One change in provisional version 5 of Interpreting and Measuring Indicators of Rangeland Health affects rangeland health indicator 15.
(annual production). It now will be required to do an annual total production estimate on the site being evaluated. The provisional version at this time requires a production estimate from at least five locations in the evaluation area. Suzanne demonstrated to the class how to collect annual production and helped students determine production estimates.

Another change in the new version is the addition of a worksheet to help with rangeland health indicator 12 (functional/structural groups). It is recommended that this worksheet be added to each ecological site’s rangeland health worksheet. The worksheet helps in defining the relative dominance of each structural/functional group and lists the species that occur within those groups. The plants can be placed into functional groups according to life cycle (annual or perennial), photosynthetic pathways, or nitrogen-fixing ability. Examples of structural groups are growth form (tree, shrub, grass, forb, and height of plants), clonal form (rhizomatous vs. bunchgrass), rooting form for forbs (tap vs. fibrous), and biological soil crusts. Inappropriate groupings include plant palatability, color of foliage or flowers, and origin (native vs. introduced).

Overall, participants found the class very informative. The national cadre commented on how smoothly the class went and how enjoyable this session was.

NRCS Represented at Ecological Society of America Conference

By D. Charles Stemmans, II, NRCS Soil Survey Region 7, Opelousas, Louisiana.

NRCS Soil Science Division was represented at the 2018 Ecological Society of America conference (https://esa.org/neworleans/) by Louisiana State Soil Scientist Mike Lindsey and Ecological Site Inventory Specialist Charles Stemmans. The theme of the conference was in “Extreme Events, Ecosystem Resilience and Human Well-being.” For the society’s 103rd annual meeting, which was held this August in New Orleans, Louisiana, more than 3,500 attendees from across the globe convened to impart, discuss, and share the latest in essential ecological research and discovery. The NRCS staff talked with over 90 conference attendees, provided handouts on Web Soil Survey (WSS) and ecological site descriptions (ESDs), and created a QR Code with the URLs for conference attendees to scan (see image below). They discussed various topics, including availability of basic soils data, specific soil data questions, ESD availability on the new EDIT website (https://edit.jornada.nmsu.edu/page?content=about), how to contribute to the development and review of ESDs, careers within NRCS, and soil health. Mike and Charles found time to attend some
of the sessions, which were quite interesting and diverse. The booth was in the main expo hall along with the poster presentations, which changed daily, and the career fair presentations. Many attendees commented on having used WSS. Some attendees had experience with ESDs, and many asked when ESDs for their area of interest would be completed.

Pictured above: QR code that attendees could scan to get the URLs for WSS and EDIT.

Early Concepts and Work Toward the National Soil Information System (NASIS)

By Jim Culver, retired soil scientist.

The following remarks are based on my personnel experiences, documents that were part of my personnel working files that I retained after retirement, and selected research of other pertinent documents. I had the opportunity to draw on a vast range of soil survey experiences over a period of many years.

From 1957 through 1968, I was in various locations doing field mapping, as a soil survey project leader and a member of the State soils staff in Oklahoma. During the period of 1968 to 1971, I was soil survey specialist and assistant state soil scientist in Iowa. From 1971 through 1988, I was state soil scientist in Nebraska. During the period 1988 to 1990, I was head of the soils staff at the Midwest Regional Technical Service Center.

In 1990, I joined the National Soil Survey Center (NSSC) as National Leader for the Soil Survey Quality Assurance Staff. This staff had national responsibility for quality assurance of all soil correlations and editing of all USDA-NRCS National Cooperative Soil Survey documents published by the Government Printing Office (GPO). Through the process of several reorganizations, I had other job opportunities at the NSSC and National Headquarters. Positions held included Assistant Director of Soil Survey Division, member of the NSSC Steering Team, Acting Director of the NSSC, and member of the Midwest Regional Oversight and Evaluation Team. I retired in January of 2000.

In the early 1970s, Keith Young, Assistant Director of Soil Survey Interpretations on the Soil Survey Division staff in Washington, D.C., worked with the Statistical Laboratory staff at Iowa State University (ISU) in the development of electronically prepared tables to be included in soil survey publications of the USDA Soil Conservation Service (SCS). Prior to this effort, interpretative tables for individual soil survey manuscripts were prepared and typed manually. Good relationships had been established with the Statistical Laboratory at ISU through their productive work in assisting the USDA Soil Conservation Service with the National Resource Inventory.

The Soil Conservation Service prepared a working agreement with ISU to assist in development of electronic input of soils information from the States so that more soil surveys could be published each year. Input forms such as the SCS-Soils-5, the ability to retrieve soils information in various formats using the SCS-Soils-6, and the computer input and distribution of Official Soil Series Descriptions (OSDs) were developed. These tools were a tremendous help to States and the SCS soil survey editorial staff in increasing the production and quality of published soil surveys. In about 1975, the regional soil survey offices were equipped with a Linolex machine so that they could electronically prepare the interpretative tables of soil survey manuscripts for publication by GPO.
During the 1950s, 1960s, and 1970s, the standards used in soil survey field work, correlation, and preparation of the soil survey manuscript were largely included in the USDA Soil Survey Manual of 1951, soil survey memoranda, and individual State guides. In 1983, the National Soil Survey Handbook incorporated the soil survey memoranda and other standards into one document. The revised Soil Survey Manual of 1993, in association with the National Soil Survey Handbook, provided quality standards for the making and publishing of soil surveys. The entire system was very productive, resulting in the publication of a large number of soil surveys by GPO during the 1980s and through the mid-1990s.

The staff at the Statistical Laboratory at Iowa State University was very proactive and competent in developing and testing new techniques to improve the electronic use of soil survey information. They were experienced in handling large volumes of data received from the States and used this data in the preparation of several versions of Conservation Needs and Natural Resources Inventory reports at the national and State levels.

Harvey Terpstra, on the Statistical Laboratory staff at Iowa State University, was one of the leads who worked with Keith Young, soil scientists on the National Soil Survey Division staff, and other soil scientists on the regional and State soils staff in development of the SCS-Soils–5 and SCS-Soils–6 forms and many other aids to the production process of publishing soil surveys. One distinct advantage of working with the staff at ISU was that we as soils scientists could tell them what we wanted as end results and they were able to do the technical programing to meet project objectives. If what they produced was not quite what we as soils scientists needed to do the job, they were most willing to go back to the drawing board and make needed improvements.

In the mid-1980s, a computer application known as the State Soil Survey Database (SSSD) was developed and implemented in each State office. Data in SSSD was download from the national database at ISU for the respective State. Having the data locally allowed the soils staff in each State to begin managing the data for their State themselves instead of relying on the staff at ISU to do so.

In the late 1980s, it was decided that a computer system with more capabilities and flexibility than SSSD was needed for local management of soil survey data and information. Business analysis was begun to identify specific requirements and needs of the new system. With this new system, ISU would no longer manage the data on a national basis. The data would be totally developed and managed by the individual State soils staff.

As part of a shift in the way SCS, and later NRCS, dealt with computer application development, the decision was made to develop the new system for preparing soil survey information at the new USDA Federal Computer Center in Fort Collins, Colorado. This electronic format was a significant shift in how business was done. The total effort was summed up under the acronym NASIS (National Soil Information System).

The National Soil Survey Center in Lincoln, Nebraska and the NRCS office in Fort Collins were the two meeting places where the soil scientists and computer programmers carried out most of the initial planning of NASIS. The planning included discussions on the standards for soil survey business, the kinds of products wanted from NASIS, and other expectations for NASIS. The old system at the Iowa State University Statistical Laboratory was out. A new system had to be built from the ground up.

This process began in earnest in 1989. During the late 1980s and well into the 1990s, there were many meetings, teleconferences, correspondence, telephone calls, and trips by project members back and forth between Lincoln and Fort Collins. Jim Fortner, soil scientist at the NSSC, once remarked that it was 500 miles and 8 hours on the road with a firm foot at the pedal between Fort Collins and Lincoln.
There were commonly extreme differences in concepts and guiding principles during the early meetings on NASIS, some of which were documented. The soil scientists at the NSSC had well defined ideas on the direction that the staff at Fort Collins should go in getting NASIS started. Heated discussions occurred at more than one meeting as people tried to come to a consensus. There were also strong differences among some of the staff at the NSSC on concepts and what was needed in NASIS. The early years were often “rocky” but the NASIS project was on a timeline and certain elements had to be completed if the project was to be successful.

The challenging differences made everyone take a second look at how we go about making and using soil survey products and what our expected needs will be in the future. Even though the differences may have slowed down the initial process of getting NASIS started, I am convinced that collectively we all did a better job because of them. I was impressed by how hard each of the involved soil scientists and computer staff worked. All were dedicated to developing a successful end product. The result of these earlier trials and testing was the development of a quality NASIS. I believe that most of the soil scientists would say “job well done.” The initial deployment of NASIS occurred in 1994–1995 with the conversion of data from each State’s SSSD system to the new application.

Documents referred to in this article came from my personal files. They include the years of 1989, 1990, 1991, 1992, 1993, 1994, and 1995 and a 2006 document by Harvey Terpstra, from Iowa State University, entitled “Soil Database History at ISU.” There were no doubt files in other locations, but most of them probably have been lost over time. The NSSC Library has a copy of the NASIS National Standard for Soil Classification and Interpretation Draft Requirement Statement – Revised, dated August 23, 1994.

I did not throw out any of the documents I had, even those with content I may not have agreed with. Several of the documents have handwritten comments of various nature. Most people would consider these documents covering the past of the national standards for soil classification and interpretation of little importance. However, they do record to some extent the long hours of work, the creative thinking, and some of the processes used in building a successful NASIS.

A special thanks to Jim Fortner and Steve Scheinost, retired soil scientists, for their review and suggested comments.

Editor’s Note

This article is part of the Post Guy Smith Interviews. The NSSC Soil Survey Standards staff is conducting a series of interviews to capture the knowledge of distinguished pedologists. The goal is to collect the stories behind the evolution of the Soil Survey Program and the advances in soil science and soil classification. These interviews are a follow-up to the Guy Smith Interviews: Rationale for Concepts in Soil Taxonomy, published in 1986.

Local Clays Once Used to Make Pipes

By Milton Vega, NRCS soil scientist, Tolland, Connecticut.

Dr. Brian Jones, State Archaeologist for Connecticut, and Caitlin Kingston, undergraduate student at the University of Connecticut, recently visited Connecticut NRCS soils staff (in Tolland) because they wanted to scan various artifacts using the office’s portable X-ray fluorescence device (pXRF). The collected data helped to determine the location of the soil materials used to make the artifacts.
Milton Vega helped scan 21 colonial clay tobacco pipe pieces, 6 brick pieces, and 8 pieces of Native American pottery to produce a baseline dataset. Of the 21 tobacco pipe pieces, 16 were found at the Lt. Hollister site in South Glastonbury, Connecticut, 2 were found in Maine, and the 3 remaining pipes were from the UCONN Norris Bull Collection, which were collected in Connecticut (fig. 1). All the pipes were thought to be made from clay soil materials located in the Chesapeake Bay area of Virginia. The brick and Native American pottery pieces were from Windsor, Connecticut, and the Lt. Hollister site in South Glastonbury, Connecticut. One brick piece from an entirely different geographic region (San Juan, Puerto Rico) was used as an outlier for comparison.

With the abundance of tobacco in the 1700s came a demand for pipes, which were mainly manufactured out of white clay and terracotta. Pipes were mostly imported from Europe. As imported goods became more expensive, however, colonists looked for a new source and soon took up the trade of pipe making using local clays.

Emanuel Drue was a well-known tobacco farmer and pipe maker in Maryland during the 1700s. Kiln remnants found on his property are evidence of one of the first pipe kilns established in the New World (Luckenback and Cox, 2004). Prior to this

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**Figure 1.**—Left to right: pipe fragments 20, 16, and 18 from the Lt. Hollister site and two pipe fragments found in Maine. Photo courtesy of Caitlin Kingston.

**Figure 2.**—Graph showing amounts of rubidium (Rb) and strontium (Sr), by Caitlin Kingston. There is a distinction between the red pipes in Sr and Rb levels. Pipe 18 (Hollister) has a composition similar to other red pipes found in Connecticut. Pipe 15 (Maine) and pipes 16 and 20 (Hollister) have similar compositions and are clumped together in the graph. Pipe 14 (Maine) is somewhat higher in Rb and Sr.
discovery, it was thought that all pipes were imported from Europe. Drue had two main pipe styles, the “Chesapeake” and the classic English-style pipe. His pipes had distinct embellishments; some had stamps on them and others had a simpler roulette pattern around the bowl. A kiln or kiln remnants have yet to be discovered in Connecticut.

Early settlers of the Connecticut River valley learned to grow tobacco from the Native Americans. By the 1640s, they were actively growing tobacco in the fertile sandy soils and favorable climate of the valley using seed obtained from farms in Virginia. An important trading port was established at the confluence of the Farmington and Connecticut Rivers in what is now the town of Windsor, Connecticut. Mills, tobacco farming, and brick making all flourished in the region. These activities were the main economic drivers from the mid-1600s to the early 1900s (Mangan, 2018). Bricks were mainly imported from England until the discovery of a deposit of clay 2 to 5 miles wide launched the enterprise of brick making with local clays. For this reason, it is believed that some of the pipes found at the Lt. Hollister site were fabricated using local clays.

In the production of ceramic goods, the main raw material is clay; but another important component, which complements such products, is feldspar. These minerals are silicates of aluminum that contain sodium (Na), potassium (K), calcium (Ca), and barium (Ba) and are used as a fluxing agent for glazes (Ellis, 2018). The U.S. Geological Survey report of 1910 stated that Connecticut was the highest feldspar-producing State in the country. The quarry owned by Lewis Howe was one of the largest production sites of feldspar in the country and was located a few miles from the Lt. Hollister site. Thus, the abundance of feldspar in local Connecticut glacial clays could have been used to make ceramics in the 1650s (Kingston, 2017).

Data from the pXRF study suggests that the sources of clay material used to make clay pipes, ceramics, and bricks are not all in the Chesapeake Bay area. In figure 2, the large mustard-colored circle depicts a marked difference between the feldspar constitution of native pottery and the rest of the artifacts. Native pottery has higher concentrations of rubidium. The purple circle in figure 2 indicates that most of the red pipes have higher amounts of feldspar with strontium, in contrast with pipes 16 and 20, which were found near the Lt. Hollister site. These pipes are analogous to pipes 14 and 15, which were found in Maine, and are hypothesized to be from the Chesapeake Bay area. Further research is needed to determine if clay pipes were ever manufactured in Connecticut from local clay deposits. Tobacco farming, brick making, and manufacturing all continue to this day in the Windsor area of the Connecticut River Valley. This area was also the location of one of the original soil surveys of 1899.

References


Map of the Month
By Curtis Monger, Linda Greene, Tammy Umholtz, and Aaron Achen, National Soil Survey Center.

The value of soil survey maps and the influence they have on the health and wealth of planet Earth are often overlooked. Simply put, the world’s population takes for granted the importance of the ground we stand on. Soil maps have always been critical for conservation and “Helping People Help the Land.” The Map of the Month is designed to generate awareness about the relationship between historic maps and today’s environmental triumphs. The map is posted on the USDA Soils website (https://www.nrcs.usda.gov/wps/portal/nrcs/site/soils/home/), and a hard-copy hangs near the front door of the National Soil Survey Center in Lincoln, Nebraska.

Each of these maps has historical significance. Some illustrate the work of noteworthy soil scientists; others show information that provided insight and direction for doing the right thing for the land. Whether the scientific community is addressing erosion or global warming, soil survey maps and the story they tell are foundational for how we treat the land.

Map for July: Hugh Hammond Bennett in Alaska (1914-1916)
Hugh Hammond Bennett is most widely known as a champion for making the Nation and the world aware of the perils of soil erosion. During the first part of his career, however, he was a mapper, a soil scientist, and a pedologist. Although most of his work was in the southeastern United States, he made some of the first soil maps of Alaska, as shown by July’s map, a 1914 soil map of the Kenai Peninsula, Alaska (image to left). This map not only shows the soils (including some organic soils, some alluvial soils, and many cryic soils), it also shows the extent of the glaciers in 1914. It is an example of the scientific value of USDA historical soil maps. Eighty-seven percent of the nearly 4,000 soil surveys made from 1890 to 2008 have been scanned and are available online at the NRCS Soils website (https://www.nrcs.usda.gov/wps/portal/nrcs/site/soils/home/).

Map for August: Quantity of Carbonate in the Soil
August’s map (image to right) shows the concentration of calcium carbonate in the soils of Nebraska. Calcium carbonate (CaCO₃), like soil organic matter, stores carbon dioxide from the atmosphere. This is important because excess carbon dioxide
is a major driver for climate change. In the past, research has focused on using no-till farming and other management techniques to remove excess carbon dioxide from the air and store it in soils as organic matter. Current research includes how to remove excess carbon from the atmosphere and store it in soils as CaCO₃.

**Tribal Soil Climate Analysis Network (TSCAN)**

By Michael A. Wilson, senior scientist, NRCS, Lincoln, Nebraska; Suzanne Baker, resource conservationist, NRCS, Walton, New York; Deb Harms, hydrologist, National Water and Climate Center, NRCS, Portland, Oregon; and Barry A. Hamilton, National Tribal Relations liaison office, NRCS, Washington, D.C.

The Tribal Soil Climate Analysis Network is a cooperative effort between NRCS, the Bureau of Indian Affairs (BIA), and selected tribes to coordinate placement of climate stations on tribal lands. The goals of the project are (1) to provide localized soil and climate data to selected tribes around the United States for agricultural and forestry management decisions, (2) to strengthen tribal outreach to support production management as well as STEM education, and (3) to connect tribes with local entities (NRCS, BIA, USDA Climate Hubs, universities, cooperative extensions, and the National Oceanic and Atmospheric Administration) to build and strengthen partnerships and alliances both locally and nationally.

The success of this project depends on the effort of many people. Support and assistance are provided by BIA; NRCS National Headquarters, Soil Science Division; National Water and Climate Center; and the USDA Climate Hubs.

![Image of Tribal SCAN station on the Lower Brule Reservation, South Dakota.](image)

**Figure 1.—Tribal SCAN station on the Lower Brule Reservation, South Dakota.**

![Image of components of the TSCAN station.](image)

**Figure 2.—Components of the TSCAN station.**
The selection process was administered by the NRCS Outreach and Advocacy Office through the regional and state conservationists. The goal is to install up to 30 stations over the next 2 years. The project is under the technical direction of the NRCS National Water and Climate Center. Deb Harms and her staff have selected components to create the stations and are providing training on installation as well as providing follow-up assistance so that tribes and NRCS staff can complete other installations. TSCAN stations are modified SCAN stations; they are similar instruments but their components have been altered to make the stations more compact (https://www.wcc.nrcs.usda.gov/about/mon_scan.html).

TSCAN stations monitor soil temperature and moisture at three depths, as well as multiple atmospheric parameters. The data is stored and later made available online through the NRCS Soil Climate Analysis Network (SCAN) website. This project also includes development of a web-based platform that will improve the utility of

Figure 3.—Hands-on instruction during the South Dakota installation. Left to right: Alex Rebentisch (electronics technician, Oregon), Jim Turenne (Rhode Island Assistant State Soil Scientist), Garry Schaefer (SCAN hydrologist, retired, Oregon), Chris Borden (Wisconsin State tribal liaison), and Cassius Spears, Sr. (Rhode Island Narragansett tribal liaison).

Figure 4.—The Hanford Soil Survey Office staff installing a TSCAN station on the Tule River Reservation in California. Left to right: Sean Day (Pathways intern and Fresno State student), Allen Curry (resource soil scientist), Rafael Ortiz (MLRA soil scientist), Aldo Garcia (Water Resources Institute intern and Fresno State student), and Philip Smith (MLRA soil survey leader).
data from the entire SCAN and TSCAN network by linking these data to online tools applicable to agricultural production. The tools include information on growing degree days, livestock heat index, and water deficit—information that helps producers make informed decisions. These data and online tools will also help tribal students enhance their scientific understanding of climate and land use and the associated technology.

The Soil Science Division staff is needed to assist with selection of an appropriate location on the reservation, describe the site and soils from a pit near the TSCAN station, and conduct sampling of horizons for laboratory characterization. Samples will be shipped to the Kellogg Soil Survey Laboratory for complete analysis.

Three 3-day TSCAN training sessions were scheduled for 2018 for tribal representatives and NRCS staff to provide oversight of the installations. The first two sessions were at the Tule River Reservation in California (June 19 to 21) and the Lower Brule Sioux Reservation in central South Dakota (July 10 to 12). The final training site will be at the Pamunkey Indian Reservation near West Point, Virginia from September 11 to 13. The training is both observational and hand-on. It focuses on two principle activities: (1) assembling and installing the station, and (2) sampling soils. There are no formal presentations, but time is allocated to discuss soil properties, climatic conditions, measured parameters, and use of data. There is sufficient time for informal group discussions in the field about the use of climate and soils data in making decisions related to land use. The goal of the training is to provide participants with first-hand knowledge on how to assemble and install the station, on the station's components and how they function, and on possible issues that may occur over time.

Since the training in South Dakota, stations have been deployed to the Narragansett Indian Tribe in Rhode Island and the Bad River Band of the Lake Superior Chippewa in Wisconsin.

The installation of these stations is an important first step in providing climatic data to an underserved community. With the assistance of the Climate Hubs and BIA, NRCS hopes to ensure that tribes and other local communities will know how best to use these data in the future. ■

Cooperative Soil Health Effort to Sample Soil in Fergus Falls, Minnesota

By Kristin Brennan (soil health specialist), Dan Wing (senior regional soil scientist), and Joe Brennan (soil data quality specialist), St. Paul, Minnesota.

The Minnesota Department of Natural Resources (MN DNR), Minnesota NRCS soils staff, and Soil Science Division Region 10 staff teamed up on a dynamic soil property (DSP) project in June 2018. This collaborative sampling effort studied the impacts of varying management practices on DSPs. DSPs are soil properties characterized by changes resulting from human activities, such as soil structural impacts due to tillage disturbance or compaction due to farm equipment traffic. Minnesota DNR recently established a policy that effectively eliminated the use of tillage and GMO crops on DNR land leases to promote regenerative farming practices. This DSP sampling project was undertaken to capture the “time zero” status of soil quality before the transition from conventional practices to a soil health management system. Laboratory analyses will compare chemical, physical, and biological soils data for three soil-landscape positions under three different management systems. The scenarios are: (1) undisturbed perennial pasture, which was established in the late 1980s; (2) conventional cropland, which has been cropped since 1887 and is now transitioning to a no-till system with cover crops; and (3) newly established pasture with the integration of livestock.
In addition to providing detailed information on management systems, these data will support a soil survey update project in the area. The update project (Major Land Resource Area 102—Fergus Falls Till Plain Formdale Catena Study, Re-correlation and Investigations) aims to collect baseline data on dynamic soil properties while improving the current soil inventory that is delivered to the public through Web Soil Survey. Estimated soil property data will be revised according to representative lab data from the study area and will be related to change in land use.

The sampling team included over 20 people representing multiple government agencies and multiple disciplines. Staff included soil scientists from four MLRA (major land resource area) soil survey offices (Wisconsin, Minnesota, and North Dakota), Minnesota and North Dakota NRCS State soils and grazing staff, MN DNR, and the Soil Science Division Region 10 staff, as well as several volunteers and student trainees who helped in the data collection. The sampling was conducted on MN DNR property near Fergus Falls during the week of June 25 to 29, 2018. Over 600 soil samples were collected across 27 sites. Samples will be analyzed for a comprehensive suite of physical, chemical, and biological characteristics (including bulk density, carbon content, aggregate stability, water-holding capacity, infiltration, and temperature) to determine how management practices affect the continued capacity of soil to function and sustain plants, animals, and humans.

The soil survey update project will revise soil information for over 500,000 acres within the NRCS Mississippi River Basin Healthy Watersheds Initiative Area, including the Chippewa and Sauk focus area watersheds, and the Red River Basin Initiative Area. The resulting updated data will bring consistency to soil survey data in the area while improving estimated soil properties with lab analyzed data.

In addition to the updated soils information, a raster soil survey product will be published to the USDA-NRCS Geospatial Gateway for the project area. This product will provide supplementary soil survey information at higher resolution. Raster data can provide an improved depiction of variability in soil properties and interpretations for planners, modelers, policymakers, and other stakeholders in land management.

This is one of the first NRCS collaborative sampling efforts.
to examine dynamic soil properties in Region 10 and Minnesota. Future DSP sampling efforts will be combined with MLRA update projects to update existing soil survey data. This collaborative effort brought together experts in soil survey, conservation, soil health, and ecology to provide an excellent cross-training opportunity for staff with different levels of experience and knowledge. Four soil conservation interns from area offices received valuable on-the-job training along with the opportunity to learn about the local soils involved with the project.

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**Nevada Assessment of Soil Health (NASH) Program Kicks Off in 201**

By Jim Komar, Nevada State Soil Scientist.

Nevada NRCS is venturing out to learn more about the dark matter of the soil universe—the soil life that lies within our soil systems—and how to assess and manage our soils to maintain soil quality and health. Wind erosion, droughty soils, a limited water supply, plant adaptability, salinity, and soil productivity are all significant concerns for Nevada’s estimated 680,000 acres of irrigated cropland. Together with
our producers and partners, we aim to “unlock the secrets” of our Nevada soils to ensure the sustainability of agriculture in Nevada for generations to come.

**NRCS’s NASH Program**

Securing the health of Nevada soils means assessing and managing soil to ensure optimal function now and in the future. With this vision in mind, the Nevada NRCS Soil Health Cadre has teamed with NRCS’s Soil Health Division, Cornell University, and the Nevada Division of Forestry (NDF) to initiate elements of the NASH program. The program has the following goals:

- Develop and refine soil health assessment tools for Nevada
- Identify appropriate plant materials and determine how best to integrate them into Nevada agriculture
- Partner with cooperators across Nevada to create a network of farm and ranch demonstration sites
- Contribute to the National Soil Health Assessment Initiative

**The NASH Program in Action**

Following is a brief rundown of NASH program activities begun in 2018.

*Cover Crop Trials and Applications*

A cooperating producer in Smith Valley, Nevada, sought assistance from NRCS to identify short-term cover crops solutions between spring wheat and winter wheat. A trial was installed by Great Basin Plant Materials Center (GBPMC) staff in June 2017 and included 35 varieties of 13 species and 5 mixes. Cover crop trials are an integral component of the GBPMC program.

A cooperating producer in Sparks, Nevada, sought assistance from NRCS in soil health assessment and testing. In 2018, the producer successfully planted 7 acres of cover crop using a 5-way mix aimed at improving soil tilth and structure in the heavily used field.

A cooperating producer in Fallon, Nevada, sought assistance from NRCS in soil health assessment and testing for more than 60 acres of his new farm. They requested conservation technical assistance in 2018 to plant 1 acre of tillage radish and about 15 acres of a 2-way cover crop mix to break up soil compaction and improve soil organic matter content. The producer later requested soil health assessments on five additional farm fields to develop conservation planning prescriptions for implementation in 2019 and 2020.

*Cooperating Producers Across Nevada Solicited for Soil Health Demonstration Projects*

Soil health assessments and soil testing by Cornell University’s CASH laboratory were completed on about 25 acres of irrigated pasture in O’Neil Basin, Nevada.
Soil health assessments and soil testing were completed for a 16-unit complex of hoop houses growing truck crops. Soil compaction, carbon balance, and water management issues were front and center with this high-volume truck farming operation in Caliente, Nevada.

Soil health assessments and soil testing were completed on a 24-acre alfalfa-grain rotation subject to side-by-side contrasting tillage and residue management strategies in Moapa Valley, Nevada.

Soil health assessments and soil testing were completed on a fallow field about 1 acre in size in Gardnerville, Nevada. A multi-species cover was planted.

Soil health assessments and soil testing were completed on an irrigated alfalfa field about 40 acres in size near Ely, Nevada.

Soil Health Assessment Initiative

Nevada is contributing to this nationwide initiative by collecting data useful in setting regional baseline values for key soil health attributes. Three treatments representing the range of locally accepted farming practices have been applied on plots established at the Great Basin PMC in Fallon. Documenting key soil health attributes and field response over the next 3 to 5 years will also improve NRCS’s soil health management planning efforts in the region.

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