National Cooperative Soil Survey Newsletter

February 2019
Issue 86

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 articles 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. ■

2019 NCSS National Conference

The 2019 conference will be held June 10 to 13 in Narragansett, Rhode Island, at the University of Rhode Island Coastal Institute at the Narragansett Bay Campus. The 2019 conference theme is "Charting the Future of Soil and Ecological Sciences." Conference highlights will include:

- Aquaculture: Oyster Farming Operation
- Coastal and Riparian Ecosystems
- Field Tour: Coastal Zone Soil Survey and Coastal Erosion
- Fundamental Changes to Soil Taxonomy
- NCSS 120th Celebration
- Urban Soils

The NCSS extends an open invitation for submission of abstracts for presentation. Presentations will take place on Tuesday, June 11. Presenters have the option to submit abstracts for one of the following: (1) oral presentation, (2) poster with lightning talk, or (3) poster presentation. Topics should relate to soils or ecology. The 2019 NCSS Committee will review the abstracts, make the final decisions, and notify each primary presenter the first week of April.

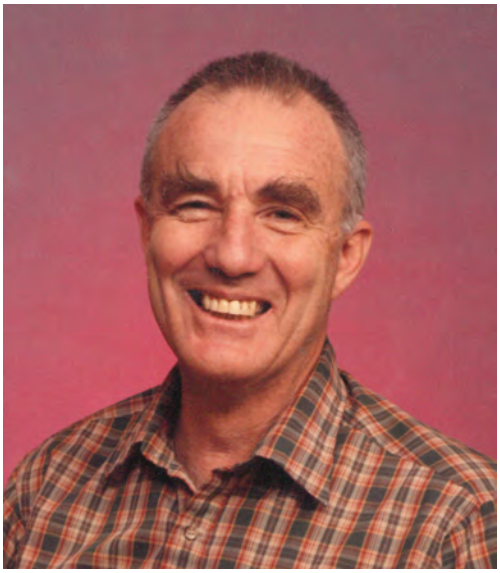
Contact Information

Debbie Surabian (USDA-NRCS); phone: 860-871-4042; email: debbie.surabian@ct.usda.gov

Mark Stolt (University of Rhode Island); phone: 401-874-2915; email: mstolt@uri.edu

For more information, visit the conference website: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/partnership/ncss/?cid=nrcseprd1431071 ■

In Memoriam: Robert B. Grossman



On September 22, 2018, Dr. Robert "Bob" Grossman of Lincoln, Nebraska, passed away at the age of 87. Bob's career with the National Cooperative Soil Survey stretched from the period of Charles Kellogg and Guy Smith to the current era of digital soil mapping. Bob was born in New York City on May 15, 1931. He received his primary and secondary education at Edmeston Central School, New York. He attended Cornell University (1948-54), where he received his B.S. and M.S. degrees. He earned his Ph.D. in 1959 from the University of Illinois.

Bob was first employed by the Soil Conservation Service (SCS) in 1958 and was stationed at the Soil Survey Laboratory in Beltsville, Maryland. He was transferred shortly thereafter to the Soil Survey Laboratory in Lincoln, where he remained as a soil scientist, supervisory soil scientist, and then laboratory head until 1975. In September 1975, he was detailed on a 2-year assignment to the University of Missouri and served as a professor in the Agronomy Department. He then returned to the National Soil Survey Laboratory in Lincoln as a research soil scientist until his retirement in 2004.

Bob worked on projects across the United States that dealt with diverse topics, including dynamic soil properties, carbon sequestration (organic, inorganic, and subaqueous), fragipans, hydrology, bulk density, surface cracking, and laboratory methodology. His specialty was soil physical properties. He wrote about the topic in several journal articles, book chapters, and the 1993 "Soil Survey Manual," of which he was one of the main authors. Bob was one of the primary investigators of the Desert Soil Geomorphology Project (1957-1972), which was recognized with the Kirk Bryan Award of the Geological Society of America in 1983. Bob was creative and known for his innovative methods for measuring soil properties. He was very generous to his colleagues and always encouraged them to reach farther, to see things differently, to do more.

In addition to his scientific research efforts, he was instrumental in other professional activities. Bob led the effort to change the name of the former "Soil Genesis, Morphology, and Classification" division in the Soil Science Society of America to "Pedology." He argued successfully that this name would make it easier for pedologists to emphasize their specialty, for example, hydropedologist or ecopedologist. He was also a founding member of the society for women in soil science. As a teacher, Bob is remembered for the numerous training sessions he taught at the Soil Science Institutes and in the Basic Soil Survey courses. He loved art, literature, and, as a cross-country champ at Cornell, running.

Bob has been described as the "Ben Franklin of Late 20th Century Pedology" in the United States. He is survived by his wife of 55 years, the former Natalie Doris Ross, by sons Paul Michael and Timothy Bruce, and by grandchildren Emily Kieran, Erin, and Ryan. ■

Figure 1.—The Aubrey Cliffs near Seligman, Arizona, are significant nesting grounds for golden eagles.

Installation of Disterheff Soil Climate Station at Aubrey Cliffs

By Jim Harrigan, NRCS soil scientist, Flagstaff, Arizona.

Staff from NRCS Soil Survey Region 8 offices in Flagstaff and Globe, Arizona, installed a soil climate station above the Aubrey Cliffs on November 19, 2018. The station is the third soil climate station on the Coconino Plateau, the landform encompassing the southwest portion of the Colorado Plateau in Arizona. Climate data will be used to better understand the timing of seasonal precipitation and its relationship to soils and plants found on the western Colorado Plateau. The climate station has the capacity to collect data on precipitation and air temperature and on soil moisture at three depths. Probe depths for soil moisture range from the bottom of the soil's A horizon to a depth of 40 inches.

The Disterheff soil climate station is the fourth soil climate station to be installed in Arizona. Harry Hosler, from the Flagstaff Soil Survey Office, has taken on the installation of climate stations in Arizona that could further serve the needs of offices in Soil Survey Region 8. In 2017, Harry assisted the Tucson Soil Survey Office with the installation of a climate station near Quartzsite, Arizona.

Staff at the Globe Soil Survey Office, including Greg Anderson and Amber Riordan, travelled from Globe to Seligman, Arizona, on the morning of the installation to assist with soil probe installation, electrical connections, and solar panel installation. With Greg and Amber's assistance, the climate station was installed in 1 day. Greg also assisted with plant identification in correlation with vegetation in his regional area. Similarities and differences between the Aubrey Cliffs and the Mogollon Rim were noted.

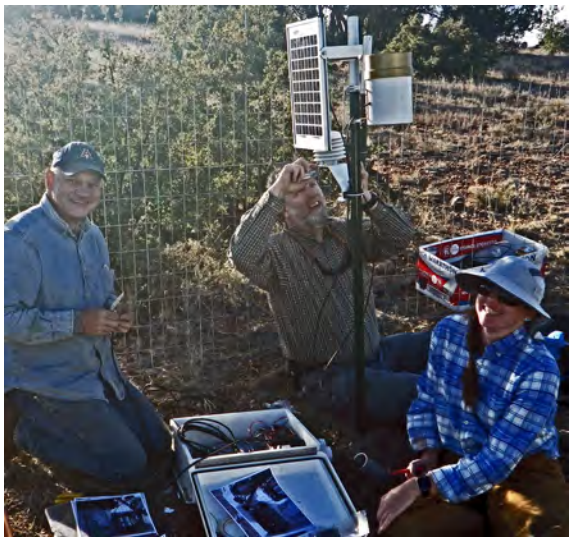


Figure 2.—Harry Hosler (left), Greg Anderson, and Amber Riordan (right), from the Flagstaff and Globe Soil Survey Offices work to install the Disterheff soil climate station.

The Aubrey Cliffs appear to be a northwestern extension of the Mogollon Rim, the prominent ridge that supports much of the largest forest of ponderosa pine. However, the Aubrey Cliffs do not get the full extent of the monsoonal summer rains that fall on the Mogollon Rim, and as a result, the Aubrey Cliffs support pinyon pine and juniper. A greater portion of precipitation for the Aubrey Cliffs is presumed to fall in winter.

The Aubrey Cliffs are home to a diverse set of fauna. They are known to support golden eagles and ferruginous hawks at certain times of the year. Golden eagles nest in cliffs and hunt in open or semi-open areas, as in the juniper and pinyon steppe of the Coconino Plateau. The eagles and hawks help to keep rodent populations in check. At the base of the cliffs, the Arizona Game and Fish Department has established a pilot reintroduction site for the black-footed ferret.

Several javelina (pig-like hoofed animals) were sighted on the day of the installation near the site. Harry commented, “An interesting thing about this sighting is that only a few years ago javelina did not exist this far north. The question is: did they adapt to the colder 6,800-foot elevation or have other factors, such as vegetation changes, allowed them to thrive in these conditions?”

The climate station will also be an important tool in establishing recognition and characterization for the Northern Arizona woodland-steppe climate. Northern Arizona has three major climate zones: the Great Basin Desert, the Woodland Steppe, and the Mediterranean Ponderosa Pine Forest. The best-known climate zone probably is the Great Basin Desert, the smallest zone. Visitors to northern Arizona passing through the desert on Interstate 40 can see the colorful Painted Desert of the Chinle Formation. Highways through northern Arizona typically are constructed across flat desert terrain and valleys, because water gathers in the valleys. In addition, highways, as well as towns, are more easily built on flat terrain. Visitors may also be impressed by the extent of the Mediterranean Ponderosa Pine Forest, covering an area from southern New Mexico into southern Utah. What is frequently missed is northern Arizona’s most extensive climate zone—the Woodland Steppe. This region is the location of wildlife habitat and rangelands for most of northern Arizona, and also for much of

Figure 3.—Javelina observed near the Disterheff site on the day of the installation.

Utah, Colorado, and New Mexico. The dominant woodland-steppe vegetation includes pinyon pine and oneseed juniper. Other plants include Fremont barberry, Apache plume, cliffrose, live oak, and green ephedra. Sagebrush, found in other areas of pinyon-juniper woodlands, is mysteriously absent at the Aubrey Cliffs. Grasses include blue grama, sideoats grama, and muttongrass, along with a mix of grasses and forbs not often seen in the central part of the Colorado Plateau.

Figure 4.—Harry Hosler (from the Flagstaff office) carefully measures excess sensor cables to cut and stow in the climate station datalogger box.

The site was chosen near the typical pedon for Disterheff soil. Disterheff soil appears to have formed in Tertiary playa or fluvial deposits of smectitic clays transported from the adjoining Mt. Floyd volcanic field. Over a period of millions of years, the sediments have been lifted and eroded into a ridge landform that sits on top of the Aubrey Cliffs. Removal of the soil was tough. The soil is clay textured and filled with very rounded rocks throughout. The crew used Montana sharpshooter shovels and rock bars to construct a soil pit to the depth of 40 inches.

Data collected will be well worth the effort. It will serve to establish climate zones and ecological sites in the years to come.

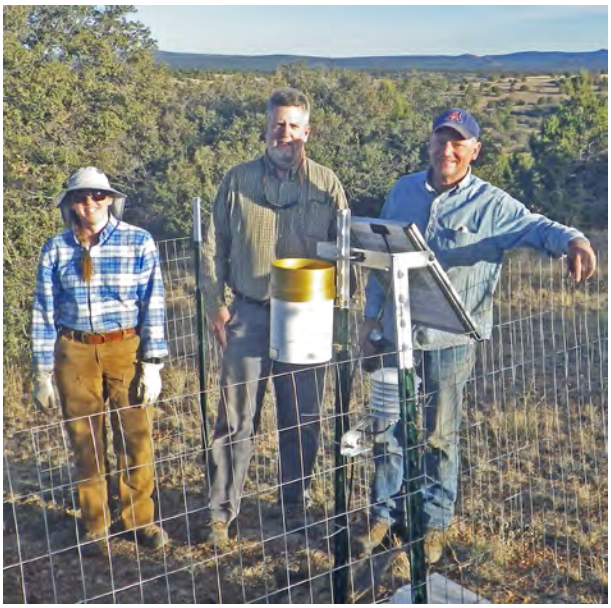


Figure 5.—With work completed, and late afternoon shadows falling over the landscape, the crew pose for one last photo. Staff assisting in soil climate station include (from left) Amber Riordan, Greg Anderson, and Harry Hosler. The South Rim of the Grand Canyon is visible on the horizon.

Harry's Comments

Sorting out local climates on the southern end of the Colorado Plateau is a real challenge. The landscapes are very diversified, and vegetation does not always occur where one would think it should. The Colorado Plateau holds diverse climates because of the effects of extreme elevations—from below 4,000 feet to 12,633 feet, the highest peak. There are large expanses of shallow Kaibab Limestone to the north and west, and the San Francisco volcanic fields crisscross with layer upon layer of basalt, topped with newer cinder cones loaded with tephra glass. We have been collecting climate and precipitation data for almost 5 years at two stations in these areas. We have found some interesting trends. Although 5 years of data may not be

sufficient to indicate all that has been happening for thousands of years, it has given us a baseline to follow. In one instance, we have recognized that the San Francisco Peaks has a rain shadow effect on its eastern grasslands.

Yet insights are not limited to precipitation records. Other factors relate to the soils' available water-holding capacities (AWC), depths to restrictive layers, and soil textures and tephra-glass content. In the 11th century, in what is now Wupatki National Park, the native Sinagua people dryland farmed in these arid soils (now typic aridic 6-10" and ustic aridic, mesic 10-14" precipitation zones). The Sinagua may have used tephra (cinder and ash fragments) as a moisture-retaining mulch on their fields. Prior to the increased farming, there was an eruption of the Sunset Crater Volcano, which enriched the soil and affected AWC. These areas, however, were abandoned in less than 100 years. So what changed? A cycle of prolonged drought was probably a driving factor for the abandonment. This is just one example of how we can correlate the prehistoric factors with the new climate data.

As there were wetter and drier time periods in the past, we must figure out where we are in a long timeline. We need to understand the geology of the Colorado Plateau and the chemistry of the parent materials and their interaction with the local soils and climate. The other area of the complex Colorado Plateau, just north and east of the San Francisco Peaks, is the fluvial-lacustrine deposits of the Painted Desert. These deposits have a complex of salts, sodium, gypsum, and shrinking and swelling clays. We know that past use and management has had severe erosional effects on the soils. Use and management has influenced plant ecology as well.

My hope is that, by using data from these local climate stations in conjunction with our tacit knowledge of soil and plant relationships, we will unravel some of the questions, such as: Why do ponderosa pine and aspen grow in areas that were once classified as aridic ustic (10-14" precipitation zone)?, Why did whole civilizations abandon their farms?, Are there use and management trends that can stabilize eroded lands?, and How long could a weather cycle last?

It will be interesting to see what the climate station at Quartzsite, Arizona, produces. Its data should help to establish a base line of data for future decisions. The temperature was 112 degrees F by 10:00 a.m. the day we installed the Quartzsite station. The Tucson crew—Bill Svetlik, Samantha Carrillo, and Wilma Renken—did a great job despite the triple digit temperatures.

This has been my fourth climate station installation, and I learn something new every time. The installation is not just a physical activity. It starts long before that. One needs to recognize climate trends and soil-plant relationships. For example, is there a representative soil (type location or field characterization in the area)? Most of all, one needs to recognize effects related to physiographic landforms and landscapes. This information is important in determining the best site for a climate station. ■

NRCS Participates in the 2018 Alabama Mississippi Bays and Bayous Symposium

By Jerome Langlinais, NRCS MLRA (major land resource area) soil survey leader, Loxley, Alabama.

NRCS's Coastal Zone Soil Survey Team and the Loxley Soil Survey Office were represented at the Alabama Mississippi Bays and Bayous Symposium https://bbs.baysandbayous.com/en/ by Jerome Langlinais. The conference was held November 28 and 29, 2018, in Mobile, Alabama. This year's theme was "Navigating Waves of Change" and centered on how our world is changing, how we can meet such challenges as rising sea levels and the consequences of population growth, and how we could to quickly provide available data to aid scientific decisions for

restoration and resilience. The conference consisted of more than 450 participants, including scientists, students, resource managers, members of private organizations, and volunteers from locations throughout the northern Gulf Coast. The symposium involved more than 175 presentation sessions and 50 posters highlighting research and current topics. Discussions covered water quality, living resources, habitat management and resilience, impacts of oil spills, and outreach and education. NRCS staff visited with over 50 participants, providing information on Web Soil Survey, mapping for the Coastal Zone Soil Survey, and the recently updated soil survey map of Mobile County. Among the visitors were researchers of gopher tortoise habitat, local oyster growers, Sierra Club members, students, presenters, Environmental Protection Agency employees, private consultants, and staff from the Geologic Survey of Alabama. Many of those who stopped by expressed the necessity for soils data in the marsh and subaqueous environments along the northern Gulf Coast. ■

Jerome Langlinais discusses Web Soil Survey (WSS) with a consultant.

Grand Rapids Soil Survey Staff Assist State with Onsite Wetland Determinations

By Matt Bromley, MLRA soil survey office leader, NRCS, Grand Rapids, Michigan.

Michigan NRCS receives hundreds of wetland reconsideration requests annually, an overwhelming workload for current staff. For the past 6 years, it has requested the assistance of the MLRA (major land resource area) soil survey offices in Grand Rapids and Flint, Michigan. In 2013, all soil scientists at these offices attended Regulatory IV Wetland Identification and Delineation training. This training covered the three criteria for wetland determination: hydrology, hydrophytic vegetation, and hydric soil.

Figure 1.—Aquatic fauna (fingernail clams) are documented as a primary indicator of wetland hydrology. These tiny mollusks are often found in vernal pools and are an important indicator during the driest part of the year, when other indicators may not be present.

Figure 2.—Soil Scientist Jonathan Diaz Cruz (Grand Rapids office) documents the soil while performing a wetland determination.

Every year since 2013, MLRA staff members have each devoted 15 percent of their time (about 300 hours) to the completion of wetland reconsiderations. These reconsiderations are submitted by landowners and operators who disagree with a preliminary offsite determination. The tracts of land that MLRA staff have worked on contain anywhere from 1 to more than 300 acres of wetland delineations, and determinations can take anywhere from a couple of hours to several days to complete. In 2018, staff in the Grand Rapids office completed a total of 61 tracts. The staff included Soil Scientists Jon Quisler, Jonathan Diaz Cruz, and Matt Bromley. Ecological Site Specialist Greg Schmidt also provided many hours of support, identifying plant species both in the field and office.

When recoding wetland hydrology, hydrophytic vegetation, and hydric soil indicators, staff followed the procedures outlined in the "Corps of Engineers Wetlands Delineation Manual" (https://www.lrh.usace.army.mil/Portals/38/docs/USACE%2087%20Wetland%20Delineation%20Manual.pdf) and applicable regional supplements (https://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/reg_supp/). Much of the wetland determination work completed in Michigan occurs during the dry, summer months when secondary and indirect primary indicators must be used due a lack of saturation or water table. The most commonly observed of these indicators are water-stained leaves, aquatic fauna, crayfish burrows, geomorphic position, microtopographic relief, and a FAC-neutral test (which considers wetland vegetation).

Michigan's complex glacial deposits require the use of a wide variety of hydric soil indicators. Some of the most commonly found indicators are Histosol (A1), Depleted Below Dark Surface (A11), Depleted Matrix (F3), Redox Dark Surface (F6), and Dark Surface (S7). (For explanations of indicators, see "Field Indicators of Hydric Soils in the United States" at https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053171.pdf.) A wide variety of wetland types dominated by hydrophytic vegetation were seen this year, including wet meadows, vernal pools, forested swamps, and shrub swamps.

Wetlands provide a variety of important functions, including flood protection, ground-water recharge, nutrient and pollutant removal as

Figure 3.—MLRA Soil Survey Office Leader Matt Bromley (Grand Rapids office) records the location of a wetland documentation point.

well as wildlife habitat for unique plant and animal communities. Approximately half of Michigan's natural wetlands have been lost since the area was settled. Protection of the remaining wetlands is an ongoing effort, and accurate identification and delineation of these areas is a critical step in that process. For the foreseeable future, the MLRA staff plans to continue to provide this service to the State. ■

Training and Soil Sampling in the Mississippi Coastal Marsh

By Sandy Page, NRCS soil scientist, Loxley, Alabama.

A multi-faceted soil sampling and training exercise was conducted October 23 to 27, 2018. The objective was to gather data in Major Land Resource Area (MLRA) 152A and assist researchers at the Grand Bay National Estuarine Research Reserve (GB NERR). Participants included local and regional NRCS soil scientists, GB NERR research scientists, and members of the Professional Soil Classifiers Association of Mississippi (PSCAM) and the Professional Soil Classifiers Association of Alabama (PSCAA).

The environs of the National Estuarine Research Reserve (NERR) include significant areas of coastal marsh, freshwater marsh, maritime forest, bayous, swamps, pine savannas, and coastal low flatwoods that straddle the Mississippi-Alabama State line. These habitats provide an ideal setting for a variety of important research projects. For example, NERR staff and collaborators are monitoring fluctuations in marsh elevations with respect to sea level rise, along with the potential impacts and the natural response of the marsh and its denizens to these changes. Other projects include Ecology of Special Habitats (including salt pannes, shell middens, and submerged aquatic vegetation), Ecology of Tidal Marsh Vertebrates, Monitoring Ecosystem Effects of Atmospheric Mercury, and Coastal Plant Ecology and

Figure 1.—Members of PSCAM and PSCAA who attended the Grand Bay training and service exercise: (left to right, standing) Delaney Johnson, Chris Hatcher, James Curtis, Larry Kichler, Dr. Henry Langston, Mike Lilly, Joey Koptis, Ed Janak, Sandy Page, and Greg Brannon and (left to right, kneeling) Steve Goode, Cooper Nichols, Jerome Langlinais, Rachel StoutEvans, Allen Curry, and Joxelle Velazquez.

Figure 2.—These pine savannas are often characterized by hydric soils.

Figure 3.—*Spartina alterniflora* (smooth cordgrass) and *Juncus roemerianus* (needlegrass rush) in the brackish marsh.

Mapping. The NERR at Grand Bay encompasses extensive areas of estuarine marsh and pine savannas. However, soil characterization data is sorely needed for the environmentally sensitive and important habitats of these coastal marsh areas of Alabama and Mississippi.

The Venue

The Grand Bay National Estuarine Research Reserve (GB NERR) and the Grand Bay National Wildlife Refuge (GB NWR) are co-located. GB NERR is in the southeast corner of Jackson County, Mississippi, while GB NWR partially overlaps and extends into Mobile County, Alabama. GB NERR is managed by the Mississippi Department of Marine Resources (MDMR) as part of the National Oceanic and Atmospheric Administration Office for Coastal Management. Other partners and stakeholders include Mississippi State University, University of Southern Mississippi, Mississippi Department of Environmental Quality, the Mississippi Secretary of State's Office, and the Nature Conservancy. GB NWR is dedicated to protecting one of the largest remaining expanses of wet pine savanna habitat.

A Brief History

In 2017, PSCAM membership decided that during the fall annual meeting they would assist ongoing research at GB NERR by providing soil information. There were several active research projects that would benefit from having such information. NRCS personnel from the Loxley Soil Survey Office joined in

Figure 4.—Area near the mouth of Cumbest Bayou. Pine island is in background.

this effort. In the exercise in the fall of 2017, several soil scientists realized the need for available data and soil describing protocols for these unique environments. This realization and recent activities involving NRCS coastal marsh evaluation projects resulted in a return trip to the coastal lowlands at GB NERR in October 2018. In addition, increasing the effort towards subaqueous soil mapping seems to be receiving support from leadership of NRCS's Soil and Plant Science Division. Added to the mix was a request to the PSCAM membership from Dr. Mark Woodrey, Ph.D., research coordinator at GB NERR, that they provide soil data on a recently acquired part of the reserve that had been developed for homesites at one time but had since been abandoned and had reverted to nature following severe hurricane damage several years ago. A grant to restore wetlands and natural habitats in these impacted areas generated a need for more detailed soil information.

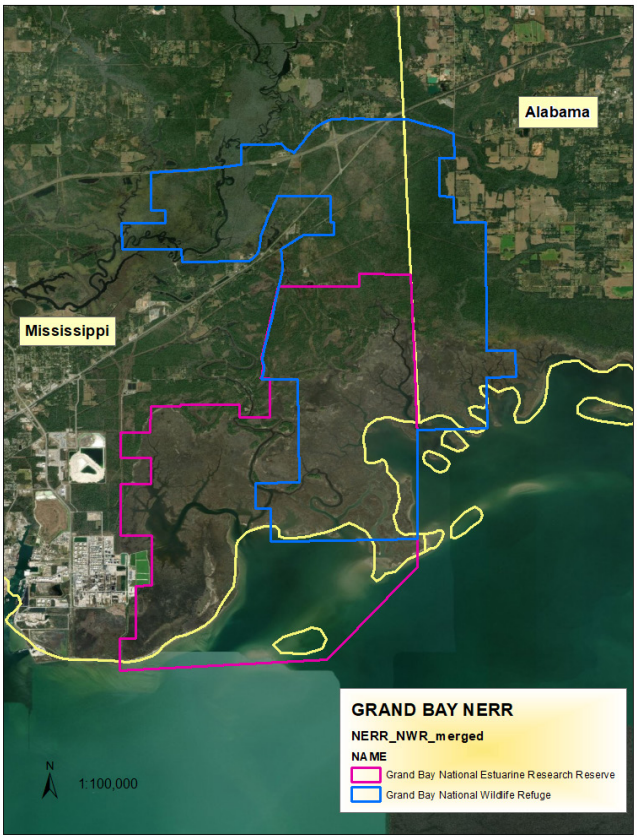


Figure 5.—The Grand Bay National Estuarine Research Reserve (pink) is co-located and overlaps with the Grand Bay National Wildlife Refuge (blue) just east of Pascagoula, Mississippi.

The Loxley Soil Survey Office personnel, in conjunction with officers of the Professional Soil Classifiers of Mississippi, saw this return trip as an opportunity to maximize data acquisition and submitted a suggestion to the PSCAA membership to help their colleagues. Leadership of NRCS Soil Survey Regions 7 and 3 also recognized the possibilities of heightening the awareness of Coastal Zone Soil Survey (CZSS) methods and equipment for the many NRCS personnel that would gather for this exercise. This concurrence of events resulted in a full week of searching for suitable soil sampling sites, demonstrating vibracore sampling, describing profiles from sampling tubes, and describing soil profiles in the human-modified flatwoods and pine savannas. Prior to the trip to GB NERR, much energy was expended in logistical preparations and gathering aluminum core tubes, boats, safety equipment, and soil sampling gear.

Objectives

The effort at Grand Bay had four interrelated objectives:

1. PSCAM wanted to provide soil information to researchers and managers at the NERR facility.
2. The NRCS personnel from Loxley wanted to obtain characterization data of coastal marsh habitats that stretch across Alabama and Mississippi as part of an MLRA project.

3. NRCS leadership from the Southeast Region wanted to enhance awareness and provide training for CZSS and subaqueous soil mapping.
4. On-the-job training for the first three objectives would broaden the knowledge base of soil scientists who do not have much experience in these unique environments.

There are many critical properties and features of brackish soil regimes that need data along the Gulf Coast. They include:

- pH change of anaerobic to aerobic situations
- Sulfidic material presence; susceptibility to creation of acid sulfate soils
- *n* value (fluidity; a measure of soil's bearing strength)
- Salt chemistry, including Na, Mg, S and effects on habitat
- Organic matter percent
- Organic matter properties (identifying material as highly, moderately, or slightly decomposed)
- Fiber content, rubbed and unrubbed
- Particle-size components (mineral or organic)
- Influence of the above factors on ecological habitats
- Improved accounting of carbon sequestration in inundated habitats (blue carbon stocks)

To meet the objectives, equipment was needed. Two experienced subaqueous soil mappers and leaders of the NRCS CZSS team—Greg Taylor, NRCS senior regional soil scientist, and Rob Tunstead, soil survey leader in Hammonton, New Jersey—discussed needs with MLRA Soil Survey Leader Jerome Langlinais and helped procure needed sampling equipment, including a vibracore, aluminum sampling tubes, a tripod, and block and tackle for extraction. Two NRCS aluminum flat-bottom boats were located. One boat had a well in the bottom over which a 10-foot tripod was mounted. Using the tripod, a person could insert a core tube into sediments under the boat.

Project Evolution

The Friday before the training week, Jerome Langlinais and Soil Scientist Sandy Page conferred on site with Dr. Mark Woodrey, research coordinator at GB NERR, and Dr. Jonathon Pilcher about their needs and suitable locations to collect soil data. It was determined that Cumbest Bayou would provide convenient access to estuarine habitats that contained brackish marsh, maritime forest, salt pannes, and shell middens. Dr. Woodrey also provided a guided tour of areas he wanted investigated for remediation in the pine savanna and flatwood habitats north of the NERR facility building. Monday, the aluminum coring tubes arrived at NERR. They had been collected in Lousiana and transported and delivered by soil scientists and PSCAM Leaders Dr. Henry Langston and Rachel StoutEvans. The group made an exploratory reconnaissance trip by boat into the marsh and located sites where vibracore equipment could be used for

Figure 6.—Greg Taylor and Rob Tunstead demonstrate the vibracore.

Figure 7.—Cooper Nichols, Jerome Langlinais, and Aaron Friend (left to right) extract a core sample along the shoreline of the marsh. Image at right—the core sample exposed.

successful core extraction without support of a boat for a base. On Tuesday, Greg Taylor, Rob Tunstead, and Regional Director Debbie Anderson arrived with the vibracore equipment, including block and tackle, for inserting the aluminum core sampling tubes, extracting the samples, and documenting them. Data Quality Specialists Aaron Friend and Alison Steglich arrived from the NRCS Alabama State Office and were joined by NRCS Soil Scientist and current PSCAA President Cooper Nichols. The first day in the field, three core samples were extracted.

This was a learning expedition. Participants learned that dragging the tripod rigging into the marsh was more time-consuming and labor intensive than running the boat equipped with the tripod up to the edge of the shoreline and inserting the core tube through the well in the boat. They learned that extracting a full 200-cm core was problematic when underlying sediments are clayey and the fluidity is slight or non-fluid. They learned that, for the sake of safety and efficiency, a crew of at least four people is needed to handle the equipment and record observations and that at least one person needs to be strong and tall enough to attach the extraction rigging to the top of the tripod.

Wednesday was also spent in the field, in the marsh. The flotilla included three boats: one designed to house the tripod core extraction gear and two to transport other gear and personnel. One of the boats belonged to MDMR and was piloted by two NERR botanists in the morning. Dr. Woodrey joined the group in the afternoon to observe the operation firsthand. Four more vibracore samples were extracted and three additional pedons described in levee positions along Cumbest Bayou. Over these 2 field days, 10 pedons were described and 3 of them were considered worthy enough for samples to be sent to the Auburn University Soil Testing Lab for

Figure 8.—Left: Jerome Langlinais observes while Rob Tunstead, Aaron Friend, and Cooper Nichols insert the aluminum tube attached to vibracore. Right: Alison Steglich hoists the tube using block and tackle mounted to a tripod.

characterization. All the vibracore sample tubes were returned to the NERR facility and stored upright until they could be described. On site, however, basic site information was collected on a modified subaqueous soil profile description sheet, including information related to inside and outside tube length so that potential settling of the soil sample could be monitored. Once extracted, the tubes were capped at both ends to retain all the sample during transport, to preserve moisture and soil chemistry, and to prevent oxidation.

Thursday brought the arrival of several more PSCAM and PSCAA members along with some heavy rain. The rain curtailed field observations of the vibracore assembly but allowed time to focus on the process of soil profile description. Electric shears were used to cut open the aluminum tubes on opposing sides. Once the two cuts were made, a sawing motion from one end to the other with a thin wire inserted between the cuts enabled the describer to separate the tubes in half, exposing two equally good profiles. One profile was used for describing. The horizons of the other profile, if desirable, were bagged and tagged to be sent to the soil lab.

The official PSCAM meeting began on Thursday afternoon with a classroom presentation that focused on soil sampling in the marsh. A Loxley Soil Survey sampling expedition in March of 2018, led by Professor Joey Shaw, Auburn University, provided an opportunity to learn about desired data products and logistical considerations for sampling in the brackish marsh. Some of the lessons learned were presented to the joint PSCAM and PSCAA participants.

The following discussion points were given to participants for consideration when gathering data in inundated soil environments:

- Decomposition processes in the tidal marsh
- Brief overview of sulfidization process
- Overview of the “cheat sheet” for identifying important soil properties in tidal marsh environments (including identifying organic vs. mineral material, fluidity, odor, pH, and EC (electrical conductivity))
- Marsh sampling examples from Mobile County, Alabama, from NRCS and Auburn University
- Inundated and subaqueous description sheets

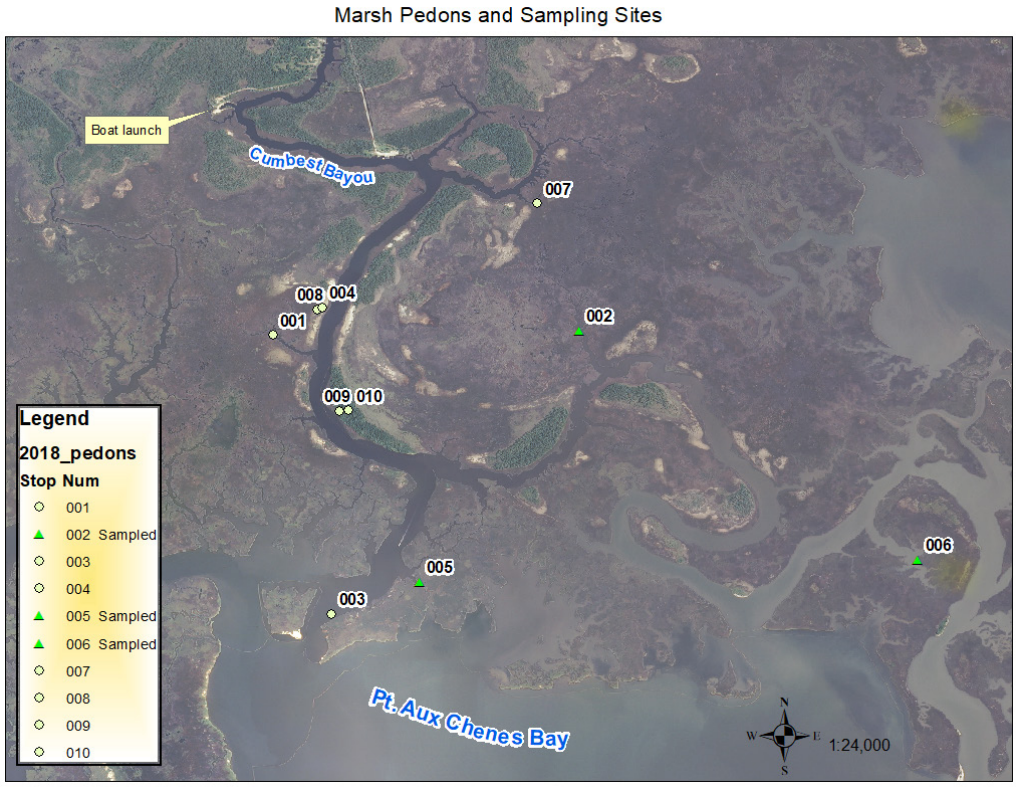


Figure 9.—The green triangles (stops 002, 005, and 006) show the locations of pedons sampled for characterization.

Also briefly covered in the classroom (for those helping with the wetland restoration project) were considerations of what to be aware of when describing soils in the savanna and flatwoods environments of the lower Gulf Coast:

- The internal soil drainage class
- The presence of a perched or apparent water table
- Classification of soil as hydric or nonhydric (if hydric, what is indicator)
- The possibility of a discontinuity, as suggested by an abrupt change in particle size or soil structure
- The particle-size constituents (including clay percent, silt percent, and sand fraction)
- The structure of horizons below a meter
- A subsoil with fragic properties
- A subsoil with significant plinthite
- The elevation above mean sea level or the nearest stream
- The chance of flooding or ponding and possibility of storm surge
- The nature of the vegetation (such as pine productivity and facultative wetland plants or obligate vegetation)

Following the classroom presentation, all participants gathered under the NERR facility equipment shed to open and describe the core samples.

After the deluge on Thursday, the weather broke and several tasks and personnel were divided up for Friday's mission. One crew returned to the marsh with all the people who had arrived on Thursday. They were guided by NERR Research Coordinator, Dr. Mark Woodrey. Another land-based crew headed for the flatwoods and savannas to describe profiles within the restoration sites. Mike Lilly, Larry Kichler, and Sandy Page remained behind in the equipment shed to cut open and describe the last three remaining core samples.

Figure 10.—Rob Tunstead demonstrates the electric shears as Jerome Langlinais, Aaron Friend, and Dr. Langston observe.

The land crew, tasked with providing soil information on possibly disturbed old homesites, consisted of Dr. Henry Langston, Rachel StoutEvans, Delaney Johnson, Allen Curry, and Ed Janak. Soil and site information was collected for five pedon descriptions and included presence of human-transported material, hydric soil indicators, hydrology indicators, water table depths, and vegetation components.

Accomplishments

The consensus was that all four objectives were met. Regarding training, a heightened awareness of several aspects of CZSS was certainly achieved with all participants. Including data collected in 2017, GB NERR now has about three dozen pedon descriptions within its boundaries. Once the lab data are available, a much better understanding of estuarine soil chemistry, Soil Taxonomy for inundated soils, and prevalence of organic matter vs. mineral constituents should emerge.

Figure 11.—Dr. Woodrey, assisted by Joey Koptis, launches the MDMR boat.

Results

Substantial progress was made towards obtaining soil survey information along the coastal zone of Alabama and Mississippi. Once the needed lab data analyses are completed and the data is stored in the National Soil Information System (NASIS), the following deficiencies will be corrected:

Figure 12.—Cooper Nichols inserts a Macaulay peat augur into the marsh as (left to right) Jerome Langlinais, Joey Koptis, Chris Hatcher, James Curtis, Greg Brannon, Steve Goode, and Dr. Woodrey observe.

- Outdated soil survey information with very little lab data for salt or brackish environments
- Absence of characterization data addressing the potential for creation of acid sulfate soils
- Ecological site data that has no substrate or soil component attributes
- Marshland map units, as associations or consociations, with absent or sketchy transect or pedon locations
- Potential erroneous data in NASIS, including outdated classification (Handsboro series) and mis-characterization (such as horizonation and inability to calculate soil properties dependent on salt chemistry data)
- Minimal experience and lack of training of local NRCS personnel in coastal environments
- Insufficient equipment to accomplish the gathering of pertinent coastal zone soil information
- Need for more data to predict blue carbon stocks in inundated habitats
- Need for enhanced information to use in ameliorating potential impacts of sea level rise ■

CZSS Focus Team at the 9th National Summit on Coastal and Estuarine Restoration and Management

By Andrew Paolucci, NRCS soil scientist, Soil Survey Region 2, Sonora, California; Rob Tunstead, NRCS soil scientist, Soil Survey Region 3, Hammonton, New Jersey; and Maggie Payne, NRCS resource soil scientist, Wareham, Massachusetts.

The 9th National Summit on Coastal and Estuarine Restoration and Management was held December 9-13, 2018, in Long Beach, California. It was cohosted by Restore America's Estuaries (RAE) and the Coastal States

Figure 1.—Presenters at the oral session on coastal zone soil survey. From left to right: Rob Tunstead (NRCS), Maggie Payne (NRCS), Chelsea Duball (University of Wyoming), and Andrew Paolucci (NRCS).

Organization (CSO). The theme of the summit was "Investing in Our Coasts: Environment, Economy, Culture." The summit included more than 6 days of field sessions, workshops, presentations, and other activities covering a wide array of topics related to coastal restoration and management. It included more than 110 presentation sessions, featuring over 500 speakers who presented on topics such as fish passage, habitat conservation, saltmarsh restoration best practices, and blue carbon science.

One session, moderated by Chelsea Duball, a Ph.D. student from the University of Wyoming, focused on coastal zone soil survey (CZSS) as a tool for planning estuarine and coastal restoration. Members of the Coastal Zone Soil Survey Focus Team—Rob Tunstead, Maggie Payne, and Andrew Paolucci—presented in this session. Three other members of the team—Greg Taylor, Skye Wills, and Zamir Libohova—also contributed greatly to the content of several of the presentations.

The CZSS session provided information about coastal zone soil survey, its uses, and the many NRCS projects going on in coastal areas around the country to an audience of around 40 scientists, students, and other members of the coastal community. One specific project that is national in scope addresses deficiencies in the current soil survey database related to blue carbon in the coastal zone soils. The value of "blue carbon," or carbon stored and sequestered in coastal ecosystems, was also discussed in many other oral sessions at the summit. For more information about CZSS, the focus team, or the National Coastal Blue Carbon Assessment Project, visit the team's webpage at the link below.

Overall, the summit was a success. Members of the CZSS Focus Team were able to network in the presentation session, at the CZSS exhibit booth, and throughout the summit with other members of the scientific community and learn how soil survey can help conserve and protect these ecosystems. The next RAE summit will be held in December 2020 in Fort Lauderdale, Florida.

Figure 2.—A great blue heron walks on the railing of a boardwalk in Long Beach, California, symbolizing the intertwined economic and ecological benefits that coastal areas provide.

Webpages

Coastal Zone Soil Survey Focus Team: https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/ocusteams/?cid=nrcseprd1319232

Restore America's Estuaries: https://www.estuaries.org/

Coastal States Organization: http://www.coastalstates.org/ ■

Aldo Garcia Takes 1st at the SSSA Soil Texturing Contest

By Philip Smith, NRCS Soil Survey Region 2, MLRA (major land resource area) soil survey office leader, Hanford, California.

Aldo Garcia, an intern at the Hanford MLRA Soil Survey Office, captured the first place ranking in the Soil Texturing Contest at the SSSA Annual Meeting in San Diego, California. Five samples of varying textures from different regions of the United States were judged. Participants competed by listing the percentages of sand and clay for each sample, as well as naming the respective USDA textural class. Seventy people from around the globe participated in the contest, including approximately 40 professionals, 20 undergraduates, and 10 graduate students.

Aldo Garcia in action at contest, texturing soil in conference exhibit hall.

Contest winner Aldo Garcia is currently a graduate student at California State University, Fresno (Fresno State), where he is pursuing a master's degree in Plant Science. He earned his bachelor's degree in Plant Health from Fresno State in May 2018. While an undergraduate, Garcia learned to describe and texture soils as a member of the Fresno State Soil Judging Team, coached by Certified Professional Soil Scientist Michael Sowers. As a soil judger, Garcia honed his soil texturing skills while competing in three regional soil judging contests in California as well as three national contests, at Kansas State University, Northern Illinois University, and the University of Tennessee at Martin.

Since December 2016, Garcia has worked as an Earth Team volunteer for the USDA-NRCS Soil and Plant Science Division at the Hanford office, located in California's San Joaquin Valley. In the summer of 2018, Garcia worked with the Hanford soils crew as a USDA-funded intern via the Water Resources Institute (WRI) at California State University of San Bernardino. As both a WRI soil science intern and as an Earth Team volunteer, Garcia practiced his soil texturing skills while describing and sampling soils and assisting with two soil characterization projects.

This year's soil texturing contest was organized by subcommittee members of the SSSA Early Career Task Force texturing contest, namely Chris Baxter, Kristi Meier, and Rachel Leege. John Lawley (Utah State University) and the North American Proficiency Testing Program provided the laboratory-analyzed samples and the supplies for the contest. ■

2018 Madera Annual Youth Workshop

By NRCS Soil Scientists Andrew Paolucci (Sonora, California) and Rafael Ortiz Vazquez (Hanford, California), Soil Survey Region 2.

The 26th Madera Annual Youth Workshop was held at the San Joaquin Experimental Range Station (O'Neals, California) on Thursday, November 15, 2018. This workshop was organized by Dennis Dudley, NRCS California rangeland

Figure 1.—The several tools, maps, and samples on display at the soil station.

Figure 2.—Andrew Paolucci discusses his position with NRCS in California to one of the three groups of high school students at the workshop.

stations where they actively participated in demonstrations on forestry, rangeland management, and soils. With assistance from Fletch Nelson and Nikki Smith (California NRCS), students collected forest stand measurements, such as tree height, diameter, and basal area. At the rangeland station, students measured herbaceous production with assistance from Dennis Dudley and from Rebecca Ozeran and Neil McDougald (farm advisors with University of California Cooperative Extension).

Rafael Ortiz Vazquez and Andrew Paolucci staged a soil demonstration to teach students about soil morphology and mapping. Several tools, soil and rock samples, maps, and even a large soil pit were set up at the station to keep the students engaged. In the first half of the presentation, the instructors educated the students on the importance of proper soil management and the five factors of specialist, with assistance from Cal Fire (California Department of Forestry and Fire Protection), University of California Cooperative Extension, the USDA Pacific Southwest Forest and Range Experiment Station, and other NRCS personnel. The audience consisted of high school students enrolled in advanced placement environmental science or chemistry.

A light overcast of wildfire smoke blanketed the skies as students arrived at the workshop. The day began with a presentation on relationships of mountain lion and deer by Don Neal (U.S. Forest Service, retired). Don discussed some of his research conducted in the central Sierra Nevada in California, where he investigated mountain lion home-range use and density. Following this interesting presentation, Frank Bigelow (Cal Fire) kept the students engaged with a talk about vegetation management and fire. Frank discussed historic and present-day fire regimes in California as well as how forest management can influence fire behavior. As the Camp and Woolsey fires were wreaking havoc in other parts of the State, these two topics were very relevant.

Following a short break for lunch, students took a trip to the outdoor

Figure 3.—Rafael Ortiz Vazquez explains the morphology of the soil profile he excavated for the workshop.

soil formation. Several bedrock-derived soils from the Sierra Nevada foothills were compared to their parent rocks, while soil properties such as pH, color, and texture were discussed. Several students easily recognized which soils were derived from metamorphic rocks and which were derived from volcanic (igneous) materials.

The later part of the soil demonstration focused on the typical job responsibilities of a soil scientist working for NRCS. Rafael explained how his position in the San Joaquin Valley, where he mainly works on soil survey update projects, is much different than Andrew's, where he mainly works on initial soil surveys. Although their responsibilities may differ, Rafael and Andrew stressed to the students the importance of soil survey for making proper land management decisions. Following this discussion, the students learned how to describe and sample soils using the pit the instructors excavated earlier in the day. Students were able to color, texture, and use sieves to separate the different mineral soil fractions. Lastly, the group discussed the soil classification system and how both field and remotely collected data are used to create soil maps.

As the workshop came to an end, the students and instructors walked back to the vehicles to make their way home. Rafael and Andrew discussed future opportunities with the teachers and other presenters, and both left the workshop feeling like they had convinced some students to pursue a career in soil science. ■

Soil Judging Practice Pits Tour at SSSA Meeting

By NRCS Soil Scientists Philip Smith (Hanford, California) and Randy Riddle (Oxnard, California), Soil Survey Region 2.

The Soil Science Society of America sponsored the Soil Judging Practice Pits Tour, a preconference, professional tour held in conjunction with the annual meeting in San Diego, California. The tour was a prelude to the 2019 National Soil Judging Contest to be hosted by California Polytechnic State University, San Luis Obispo (Cal Poly). It was organized by Dr. Gordon Rees of Cal Poly and Dr. Randy Southard of the University of California, Davis. Dr. Rees led the organization of field preparations as well as the execution of the tour and was assisted by fellow Cal Poly Professor Dr. Daniel Johnson. NRCS Soil Scientists Randy Riddle and Philip Smith also provided support. Soil Conservationist Axel Sanchez and the NRCS field office in San Diego County facilitated landowner permissions and site access. Rancher John Austel with 4J Horse and Livestock hosted the tour at his ranch, which is nestled in the hills east of San Diego.

Figure 1.—Dr. Gordon Rees gives instructions and an overview at the start of the Soil Judging Pits Tour.

Thirty-eight participants attended the tour. They included undergraduates who will compete at the National Soil Judging Contest later this year, soil judging coaches, professional consultants, and others interested in getting into pits to learn about soils and soil judging firsthand. Student participants received a special rate, thanks to

the Bouyoucos Funds from the Agronomic Science Foundation. Upon arriving at the ranch, participants split into four groups. The groups rotated through four pits, evaluating the soils at each site.

Dr. Gordon Rees and Philip Smith each led groups comprised mostly of undergraduates through the pit rotation and focused their tours on the collegiate soil judging experience. These two groups essentially experienced a mock soil judging contest. The students were timed with rotations in and out of the pits as they filled out their scorecards. At each pit, students described soil horizonation, texture, color, structure, consistence, redox features, and effervescence. They also evaluated important soil profile interpretations and site characteristics, classification to Soil Taxonomy's great group level, and the family particle-size class. Interpretations for dwellings without basements, septic tank absorption fields, and the California Storie Index rating were also determined.

Figure 2.—Students from Kansas State University and University of Wisconsin–Platteville collect horizon samples during the mock soil judging contest.

Figure 3.—Undergraduate students celebrate after completing the mock soil judging contest. Participants were from Iowa State University, Kansas State University, the University of Minnesota, and the University of Wisconsin—Platteville. In addition, undergraduates (not shown) from the University of Tennessee at Martin participated in the newcomers soil judging group.

Dr. Daniel Johnson led a group which focused on introducing soil judging to newcomers. This group consisted of individuals who had little to no experience in soil judging but were interested in getting involved and potentially starting teams at their respective institutions. Randy Riddle led a group comprised of professional soil scientists, professors, and soil judging coaches who also judged the soils. This group engaged in more technical discussions, such as the taxonomic classification of the soils. All four groups filled out soil judging scorecards. The group leaders reviewed the score card keys and engaged the groups in discussion following each 60-minute pit rotation.

The Soil Judging Practice Pits Tour was a great educational experience and fun for all. It also allowed participants to become familiar with California soils as well as the manual and scorecard that will be used in the upcoming National Soil Judging Contest, which will be held during the week of April 14. ■

Soil Tunnel: The Origin

By Jim Turenne, Assistant State Soil Scientist of Rhode Island, NRCS.

In recent years there have been numerous articles and stories on the use of a "soil tunnel" to teach young people about soils. So where did the idea of soil tunnels originate? England.

Here is the story: In the early 1990s, the soil survey of Plymouth County, Massachusetts, had two young volunteers, Nicola Shirt and Richard Bonner from England, for a summer internship. Nicola and Richard wanted to learn about soils and assist with the soil survey. One day during a trip to an elementary school to talk to the students about soil, they mentioned how they use an education display called a soil tunnel to get kids excited about soils. They said it was a simple table with panels that kids would crawl through like they were a worm to see what a soil profile looks like. With that concept in mind, Soil Survey Project Leader Peter Fletcher went to work in his wood shop designing a soil tunnel. The tunnel, a table with panels on the sides, included hands-on experiments on the top, where kids could feel the soil and build mini profiles. After kids learned about the soil, they could put on a headlamp and crawl through the tunnel. In the tunnel, they could see roots and rocks hanging down, soil horizons, and creatures that lived in the soil. After the tunnel's first visit to a school, we knew we had a hit—the kids loved it!

Survey staff then worked with the Massachusetts Plymouth Conservation District on an education program that included taking the tunnel to a school for a week and having an instructor come to classes to learn about soils. The district employed soil educators and created a teaching package. Thousands of kids crawled through the soil tunnel as it travelled throughout the State. An educational video was made and distributed by Massachusetts Agriculture in the Classroom and featured at a national meeting of Earth Team volunteers. The tunnel even made its way to Washington DC and

Figure 1.—Meredith Ashworth, soil scientist, with the original soil tunnel in Washington DC.

Figure 2.—Peter Fletcher, soil survey project leader for Plymouth County Soil Survey, with the soil tunnel in Roxbury, Massachusetts.

was set up at the Capitol. Teachers loved having the display in their rooms and would tell us stories of kids wanting to spend their recess sitting in the tunnel rather than playing outside.

As the survey came to an end and staffing shortages hit, the original soil tunnel was set up at the Marion Massachusetts Children's Museum. It remained there for several years until it was retired. ■

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