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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. ■

Annual Data Refresh of Soil Survey Database

The entire official soil survey database was refreshed October 1, 2018. The updated official data is now available for use in implementing national programs affecting landowners and managers. Many national interpretations are also being updated, and their interpretation criteria will be posted as these updates are completed. Eight new national interpretations and four new regional interpretations have been added.

New National Interpretations

Suitability for Aerobic Soil Organisms.— This interpretation assesses the soil's suitability as habitat for aerobic soil organisms. Soil is the habitat for a wide variety of organisms, ranging from microscopic viruses, bacteria, archaea, fungi, and protozoa to micro- and meso-fauna (such as nematodes, mites, and springtails) to macrofauna (such as earthworms, centipedes, and beetles). A healthy soil is a living system that supports an abundant and diverse biological community. This system aids crop production by providing key services and functions, such as nutrient cycling and protection against disease and environmental stress.

Agricultural Organic Soil Subsidence.— This interpretation indicates the rate at which organic soils are likely to subside. Organic soils used in agricultural production are subject to a loss of organic material. This loss is due to oxidation caused by above normal microbial activity resulting from excessive water drainage, soil disturbance, or extended drought. Soil shrinkage and compaction due to dewatering is considered to be

secondary. Any drawdown resulting in water levels below soil surface can result in increased subsidence rates.

Concentration of Salts – Soil Surface.—This interpretation indicates soils that are likely to have concentrations of salts at the soil surface. Excess salts can concentrate when precipitation is sufficient to move salts within the soil but insufficient to move the salts out of the soil. Salts move downward with percolating precipitation, from the generally convex recharge areas of the landscape to the generally concave discharge areas. Excessive salt concentration in the soil surface layer is detrimental to the germination and growth of crops.

Organic Matter Depletion.—This interpretation indicates the propensity of the individual soil properties to influence organic matter degradation. Soil organic matter is the foundation for healthy and productive soils. For organic matter to accumulate in soil, the processes that synthesize organic matter generally need to be greater than the processes that destroy organic matter.

Soil Surface Sealing.—This interpretation indicates the degree of susceptibility to surface sealing. Surface sealing is the orientation and packing of dispersed soil particles that result from the physical breakup of soil aggregates, mostly due to raindrop impact. It can lead to the formation of surface crusts. Surface seals decrease infiltration rates, reduce the amount of available water to plants, diminish natural recharge of aquifers, increase runoff, and decrease crop yields.

Catastrophic Event, Large Animal Mortality, Burial.—This interpretation indicates where to bury deceased livestock resulting from of a large-scale natural disaster, such as a hurricane. The disposal consists of placing the carcasses in successive layers in an excavated and sloped pit. The carcasses are spread, compacted, and covered daily with a thin layer of soil that was excavated from the pit. When the pit is full, a final cover of soil material at least 2 feet thick is placed over the burial pit.

Catastrophic Event, Large Animal Mortality, Incinerate.—This interpretation indicates where to incinerate deceased livestock resulting from a large-scale natural disaster, such as a hurricane. The disposal consists of placing the carcasses in a shallow excavated pit about 91 cm (36 inches) deep or less. The carcasses are spread, compacted, and burned using established industry incineration techniques. Once carcasses are sufficiently incinerated, a final cover of soil material at least 2 feet thick is placed over the burial pit.

Road Construction/Maintenance (Natural Surface).—This interpretation assesses the suitability of soils for Forest Service single-lane system roads that are built to specification with a natural surface. Standard specifications include a grade between 2 and 8 percent, with segments up to 12 percent. Roads are designed to cross the slope and constructed with a cut-and-fill design to maintain grade.

New Regional Interpretations

Displacement Hazard.—This interpretation predicts the hazard of soil displacement from operations of ground-based equipment for forest harvesting and site

preparation. Displacement is the horizontal movement of soil caused by scraping or machine gouging. It can remove the organic forest litter and upper portions of the mineral surface layer, thereby reducing plant nutrient availability and water-holding capacity. The result is a loss of site productivity for forest vegetation.

Puddling Hazard.—This interpretation predicts the risk of soil puddling due to operation of ground-based equipment for forest harvesting and site preparation. Puddling is the loss of soil structure resulting from the squeezing and churning of soil by tires or tracks of heavy equipment. Soil particles become dispersed in water, and after they have dried and settled, the smaller particles form a crust on the surface. Soil puddling reduces porosity and increases bulk density.

Compactability Risk.—This interpretation predicts the soil's susceptibility to compaction from the operation of ground-based equipment for forest planting, harvesting, and site preparation. Typically, the soil must be moist to be compacted. Compaction reduces mostly the amount of large pores in the soil by damaging the soil structure. This adversely affects the soil since large pores are the most effective at transmitting water and air. Compaction also increases the soil strength, which can limit root penetration and growth.

Windthrow Hazard.—This interpretation predicts the hazard of trees overturning from wind. Windthrow is one type of wind damage and is defined as the uprooting of a tree by pivoting on the outer edge of a mass of soil, rock, and roots. Rooting depth contributes significantly to the risk of windthrow. Wetness also contributes. The weight of the soil over the roots can act as a stabilizing anchor.

To find out when surveys in a particular State are updated, visit the Web Soil Survey (WSS), click on the "Download Soils Data" tab, then choose the specific State. WSS will display a list of all soil survey areas. To learn more about soil-related issues, you may subscribe to various topics of interest using a free subscription service through GovDelivery. Email inquiries to SoilsHotline@lin.usda.gov for assistance with GovDelivery and WSS.

Click on the "Contact Us" link in WSS to receive assistance though the Soils Hotline, a state soil scientist, or a local NRCS Service Center. Questions about soils data in a specific State should be directed to the state soil scientist. For more information on the Web Soil Survey, see "I Want Help With…" on Web Soil Survey Home Page or visit the NRCS Soils webpage. ■

Soils with Altitude

By Matt Cole, NRCS soil scientist, Minden, Nevada.

During the week of September 17th, Matt Cole and Andrew Brown, NRCS soil scientists from the Minden and Sonora offices, installed sensors and conducted maintenance at 11 research sites in the White Mountains in eastern California. NRCS is assisting the University of California, Riverside, and professor Dr. Robert Graham with a soil climate study in this area near Bishop, California. The goal of this project is to observe how parent material, elevation, soil chemistry, moisture, and other factors affect soil temperature and moisture and to monitor soil climate change. Soils at 11 sites have been lab sampled, and plant information has been collected along an elevation gradient ranging from 7,000 to over 14,000 feet. These soils formed from granitic, metavolcanic, and quartzite parent material. Collection of soil moisture and temperature data started in 2013, and additional sensors were installed this year. With this year's new sensors up and running, a total of 79 sensors are now collecting data!

The view west from White Mountain Peak, with the Sierra Nevada in the background.

Additionally, several of the sites are located adjacent to weather stations, which have data (precipitation, wind, etc.) that may be useful covariates for interpretation of the soils data.

Andrew Brown prepares a soil pit to install soil moisture sensors.

The White Mountains are a unique and rugged place to work. They are east of the Sierra Nevada and in a rain shadow (an area that receives little precipitation despite high elevations). Because the area is so remote and has had little human influence, it is ideal for research. For the same reasons, the area is difficult to access—the most remote sites require a 7-mile hike over rough terrain and a climb from 9,000 to 11,000 feet! The White Mountains are also home to groves of bristlecone pine. These trees are some of the oldest on earth, some being 4,000 years or older. The environment is reminiscent of a moonscape in many places, with only bighorn sheep and marmots brave enough to venture in. More people have probably been to the moon (no joke) than some of the local research sites. Luckily, all the sensors are automated, so they can last up to 2 years without maintenance. The highest site, over 14,000 feet above sea level, is near White Mountain Peak. It is interesting that one looks down at the Sierras from that vantage point. The soil at this site is very similar to a Gelisol (the author thinks it might be) because it stays frozen at some depth year-round.

This study is a great example of cooperative efforts between NRCS and universities. NRCS has assisted by lending its expertise in lab sampling, describing

Ancient bristlecone pine trees.

soils, and setting up soil climate monitoring equipment. The National Cooperative Soil Survey benefits by receiving valuable soils information that is difficult to collect. The soils and plant communities of the White Mountains were formed by unique geological and climatic forces and so do not really fit any "molds." The more soils data that can be gathered, the better soil behavior and change can be predicted, not only in the White Mountains but in other places as well. This project continues to provide valuable soils information and will hopefully spawn even more beneficial research in the future. ■

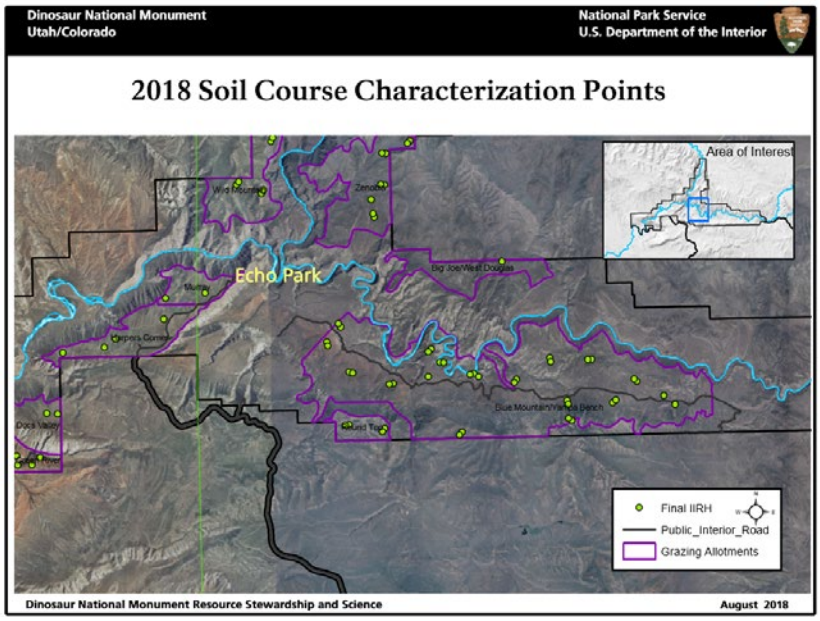
Matt Cole on a return hike after a long day's work.

Agencies and Universities Team Up to Offer a Soil Survey Field Practicum in Dinosaur National Monument

By Kari Sever, soil scientist, NRCS, Fort Collins, Colorado; Andy Steinert, soil survey project leader, NRCS, Fort Morgan, Colorado; Suellen Melzer, assistant professor of Pedology, Colorado State University; and Karen Vaughan, assistant professor of Pedology, University of Wyoming.

Dinosaur National Monument (DNM), located in the rugged northwest corner of Colorado, recently attracted a diverse group of Colorado State University (CSU) and University of Wyoming (UWYO) faculty, undergraduate and graduate students, and professional scientists from NRCS, the Bureau of Land Management (BLM), and the National Park Service (NPS). The 5-day field experience, held September 6 to 10, was part of a Soil Survey Field Practicum course with the objective of providing students with on-the-ground training from field experts in the areas of pedology, range ecology, and archaeology. This diverse and collaborative working group provided a unique experiential learning opportunity, encouraging students to engage in soil science as part of the holistic view required to make effective land management decisions.

The goal of the conducted soil survey work is to assist NPS in the development of ecological site descriptions (ESDs) and ultimately a grazing monitoring program for



three allotments within DNM. The allotment focused on in this trip was on the Yampa Bench. Students learned what criteria are necessary to determine field sites and how to navigate to preselected sites using global positioning systems (GPS). Sites were located off Yampa Bench Road. A 30-to-60-minute vehicle commute and a 30-to-60-minute cross-country hike were needed to reach them. Access to two sites required multiple crossings of the Yampa River over shallow rock bars. Student groups were escorted by an archaeologist to ensure that selected sites did not coincide with those of archaeological interest. As a result, students learned how to recognize cultural resources prevalent in DNM. Finally, small groups of three students practiced their craft and received technical guidance and training from pedologists and soil scientists on how to excavate soil pits, accurately characterize and document soil properties, classify the soils, and collect samples for laboratory analyses.

Students were challenged with using the Keys to Soil Taxonomy to classify soils and using an MLRA LRU key to identify the correct ecological site. This exercise emphasized the value of recording pertinent detailed information while at the excavation site. NRCS Ecological Site Specialist, Dean Stacy (Price, Utah) assisted in pinpointing the correct LRU within MLRA 47 and explained the need for establishing LRU 47E, called “Dinosaur Highlands.”

NPS hosted the field practicum at the primitive base camp in Echo Park Campground, which lies at the confluence of the Green and Yampa Rivers

CSU and UWYO students and faculty and scientists from NPS, BLM, and NRCS who participated in the 2018 Soil Survey Field Practicum in Dinosaur National Monument. Photo by Suellen Melzer.

View looking east: The Yampa Bench (at left) intersects with the faulted Blue Mountain Plateau (ridge at right). The Yampa River is just left of the Yampa Bench (not in photo). The Blue Mountain Plateau is a half-faulted anticline that ends up horizontal at the surface and is a remnant of the floor of the flat valley that existed before the Colorado River changed its course. Photo by Kari Sever.

in the heart of DNM. All faculty, students, and scientists rejoined at camp each day to review highlights of each of the five groups and subsequently submit completed pedon descriptions and collected samples. The NPS staff provided all participants with an interpretive geology lecture, a petroglyph walk, and a flintknapping workshop.

Objectives of all parties and participants were reached within the 5-day soil survey field practicum. CSU and UWYO faculty provided students the opportunity to gain the technical experience needed to work in interdisciplinary teams and address relevant and current land management decisions using systems thinking. NPS and BLM have 27 new sites with completed soil pedon descriptions and archaeological clearances for inclusion into ESDs. NRCS accomplished its mission to provide technical assistance to farmers, ranchers, and landowners to aid them in conservation of resources. In addition, by providing hands-on soil survey field guidance in this diverse group setting, NRCS was able to extend outreach, raise awareness, and educate others about soils, soil survey,

Students from two groups work together to complete a soil pit description, while NPS Archaeologist Tanachy Bruhns observes. Photo by Kari Sever.

Kari Sever scribes and prepares a soil texture sample while Than Dam and Will Bowers focus on other data collection activities at a soil pit. Photo by CSU Student Bo Collins.

and the programs and services the agency offers. As a bonus, NRCS has a new pool of potential recruits.

Many artifacts were observed during the site screening prior to site excavation. If artifacts were encountered, the sites were recorded and the soil pits were relocated by the archaeologist to avoid any disturbance.

Comments by Participating Students

"The trip to Dinosaur National Monument is definitely one of the most memorable and formative experiences I have had as a CSU student. I learned a ton about field methods for describing soil and I also became much more familiar with how to use the Keys to Soil Taxonomy to classify soils based on their morphology. It was so nice to be able to work through the

View from the Harding Hole Overlook of the Yampa River and the geological beauty held within DNM. The thick golden tan layers are the Weber Sandstone, which consists of solidified dunes from a Sahara-style sand desert that blanketed the area about 300 million years ago. Crossbedding in the ancient dunes can be seen at almost any location near the bluffs of the Yampa Bench. The Yampa River reflects historically low water levels, which affect water use permits throughout the region. Photo by Andy Steinert.

whole pedon description sheet with experienced NRCS soil scientists and get a sense of their workflow and thought processes."

Dylan C.—Senior, Colorado State University

"This field experience with NRCS gave me an invaluable opportunity to gain knowledge and insight from experts in the field."

Travis B.—Masters Degree Candidate, Colorado State University

"I really enjoyed my time in Dinosaur National Monument during this field soils course—I made new friends, professional connections, and a desire to return to the monument to recreate on my own time, in addition to honing my soil description skills. This course was an amazing opportunity to work with a lot of people with a range of different backgrounds for a common purpose: to fill data gaps to ensure our public lands are being managed with sound scientific knowledge. It's not often that you can get a bunch of college folks, NRCS, BLM, and NPS folks working together and sharing experiences in one place. This adventure allowed a great sharing of knowledge and experience and is something that I would do again in a heartbeat!"

Ryan S.—Masters Degree Candidate, Colorado State University ■

Fieldwork and Documentation of Restoration and Recovery of Meadow 63 Years After Crew Work

By Philip Smith, MLRA (major land resource area) soil survey leader, and Kerry Arroues, Earth Team volunteer, NRCS, Hanford, California.

Documentation of work after more than 60 years is unusual. It is even rarer that the individual who accomplished that work can revisit it and document its effects, especially in a relatively inaccessible meadow, at an elevation of 8,700 feet, in the Sierra Nevada. Terry Cook is one of those rare individuals. Accompanied by

Figure 1.—Ellis Meadow (foreground) is a wet, montane basin meadow with hydrologic connections to the Kings River in Kings Canyon (just below clouds). Photo by David Smith, retired NRCS soil scientist.

Figure 2.—Terry Cook (foreground) and Joe Osborn, dig out sediment at dam site in the summer of 1955.

two other soil scientists and an archaeologist, he revisited meadow restoration work completed under his leadership 63 years before.

Ellis Meadow (fig. 1) in Kings Canyon National Park, California, is a gently sloping, wet, montane basin meadow. It is 31 acres in size and at an elevation of 8,700 feet. The meadow had experienced significant erosion resulting from grazing practices decades ago. Photos from 1955 illustrate the poor condition of Ellis Meadow at that time. They show severe erosion near the outlet of the meadow where six small drainages merge before exiting down the mountainside. Hydrologic connections downslope from this meadow include Sugarloaf Creek, the Roaring River, and, further on, the Kings River in Kings Canyon. Kings Canyon is more than a mile deep and has some of the steepest vertical relief in North America. In 1953, the National Park Service (NPS) selected three people from Cal Poly, San Luis Obispo, California, for the Soil and Moisture Conservation crew to work in Ellis Meadow and other meadows in the area. In 1955, Terry Cook was selected as crew chief and, in turn, selected his own crew from the Cal Poly Soil Department. The crew installed erosion-control measures on the six small merging drainages to slow the flow of water through the meadow and trap sediment before it could be transported downstream. They also constructed and installed a wood log dam at the lower end of the meadow.

The crew constructed the dam by first digging sediment out of the dam site and then sawing down a tree (fig. 2). A block and tackle was used to pull the tree into place. Four log segments were cut, then wired and anchored together with posts.

In the six small gullies that flowed into the meadow above the main log dam, the crew installed basket checks (fig. 3). To construct the checks, they dug a curved trench across each of the gullies and installed approximately six posts, which were braced or wrapped with strong wire and tied together. Each post was connected to separate buried anchor posts and wire. The crew placed chicken wire on the upstream side and laid branches and thatch over top to reduce the velocity of water and trap sediment. They installed approximately 36 posts using this

Figure 3.—Terry Cook (left) and Joe Osborn view their work, after installing a basket check and post structure to trap sediment and reduce erosion in Ellis Meadow (1955). Photo by Glenn Shrader, crew member.

Figure 4.—Terry Cook, in September 2018, stands near the outlet of Ellis Meadow on a log dam constructed under his leadership as Soil and Moisture Conservation crew chief in 1955. Note the boulders are the ones shown in the 1955 photo (fig. 2).

procedure. In 2004 and 2018, only two posts were located that had not been buried by new sediments or vegetation.

Conditions and erosion-control measures implemented in 1955 had been photodocumented in 1955, 1975, 2004, and 2016. The photos were used to illustrate the efficacy of the work. Documentation of the project with soil descriptions and soil samples was not accomplished until Soil Scientist Philip Smith, retired NRCS Soil Scientists Terry Cook and Kerry Arroues, and NPS archaeologist Keith Hamm teamed up in September 2018.

Logistics for the recent work included carrying equipment both on and off trail to a base camp, a difficult climb with backpacks up a lateral moraine above the East Fork of Sugarloaf Creek, and a hike through a series of stringer meadows leading to Ellis Meadow. On the day after the climb up the lateral moraine, the team began the work of describing and sampling the soil in a relatively undisturbed location and in an area where wire basket checks and posts were installed for erosion control in 1955. The soil and current meadow conditions were photographed, the fifth time since 1955 that the work of the Soil and Moisture Conservation crew at Ellis Meadow was photodocumented.

In September 2018, the meadow appeared to be in excellent shape (fig. 4). It had sedge and tall grass vegetation and no apparent severely eroded drainages. Soil descriptions and photos document a dark-colored A horizon with significant increase in carbon since the erosion-control structures were installed (fig. 5).

Laboratory analysis of the soil samples will further document bulk density, carbon, texture, and other soil characteristics that will be part of the factors used to determine whether the goal of restoring the function of Ellis Meadow has been accomplished. The Soil Moisture and Conservation crew work that took place 63 years ago appears to have been a resounding success. The data acquired will be incorporated into the soil survey

Figure 5.—Soil profile at the lower end of Ellis Meadow, in an area significantly and positively impacted by basket and check post structures. The structures trapped sediment, resulting in a pronounced accumulation of carbon in the A horizon.

Figure 8.—(Left to right) Archaeologist Keith Hamm and Soil Scientists Kerry Arroues, Terry Cook, and Philip Smith celebrate a successful trip documenting the soil restoration that took place 63 years earlier.

of Sequoia and Kings Canyon National Parks that is currently in progress and being conducted by the MLRA soil survey office in Sonora, California.

Terry Cook will be presenting this recent work and the history of Ellis Meadow since 1955 at the Soil Science Society of America's International Soils Meeting in the Symposium—Great Images and Papers in Soil Science History. The meeting will be held in San Diego, California, on January 8, 2019. His presentation seesion at the meeting will be illustrated through photos, measurements, and the memories of the soil scientist who was there. ■

Northern International Livestock Exposition: Fourth-Grade Style

NRCS soil scientist Raven Chavez (Soil Survey Region 5, Miles City, Montana), along with several soil conservationists from around Montana, presented soil and soil health information at the 2018 Northern International Livestock Exposition (NILE). The education portion of the event was held October 15 to 17 at the MetraPark Arena in Billings, Montana. Nearly 2,000 fourth-grade students from around the State attended to learn about soils, livestock, erosion, and anything else concerning rangeland and crops.

Raven was in charge of teaching more than 700 students about soils and soil health. The groups of students were first asked if they thought soil was important. Although most agreed that soil was important, others took some convincing. Once Raven explained how toilet paper comes from trees, which grow in the soil, almost everyone decided that soil was indeed important (except the few that claimed they

do not use toilet paper at all). After chanting “The soil is alive!” all 700+ students were convinced that taking care of the soil was something worth their time. The students then learned about the five principles of soil health through analogies related to their daily lives. The ideas of “diversity” and diversification of crops were compared to the importance of not restricting their diet to only doughnuts; the idea of minimizing disturbance of the soil was related to their ability to control the urge to touch new and shiny things; the idea of keeping the soil covered and maintaining living roots was related to a previous presentation at the erosion tanks; and the importance of additions of fertilizer was discussed as it related to livestock “poop” (a concept that grossed out some).

The groups were then huddled around the Soil Tunnel for a brief discussion of physical, chemical, and biological soil properties. Texture, particle size, and pH were pointed out on the tunnel. The students also learned about the nitrogen cycle and the importance of livestock poop. To wrap things up, the students gave some examples of big and small creatures living in the soil and were asked to repeat the five principles of soil health again. Those who could name off all principles received “I Dig Healthy Soil” stickers. The stickers proved to be an effective motivator, helping the students to pay attention and encouraging questions. All the groups were very interested and well behaved. ■

NRCS Promotes Healthy Soils at Farm Aid 2018

After 32 years and 18 States, Farm Aid made the stop in Connecticut for its 33rd anniversary, and NRCS was there to help celebrate. Since 1985, Farm Aid has raised money to provide immediate and effective support services to farm families in crisis. Now Farm Aid’s online Farmer Resource Network connects farmers to an extensive network of organizations across the country that can help them find the resources they need to access new markets, transition to more sustainable and profitable farming practices, and survive natural disasters.

NRCS was invited to host a display about information pertinent to the Farm Aid audience. With the Distribution Center’s soil health tunnel in tow, NRCS spread the word about healthy soil. Many people took advantage of a trip through the tunnel. Debbie Surabian, state soil scientist for Connecticut and Rhode Island, helped staff at a display co-hosted by NRCS and American Farmland Trust. The table top rainfall simulator (image at right) was used to teach attendees about healthy soil properties and practices. ■

Figure 1.—A wheat/fallow and CRP field located in Lincoln County, Colorado.

Colorado MLRA Offices Work Together to Collect Soils Data on Different Land Management Practices

By Amber Wyndham, NRCS soil scientist, MLRA office, Pueblo, Colorado, Soil Survey Region 5.

NRCS's Pueblo and Fort Morgan MLRA (major land resource area) offices worked together to collect soil samples for lab characterization data and dynamic soil properties on three different management practices. Three pits in areas of the same soil were described on cropland, CRP (Conservation Reserve Program) land, and rangeland in MLRA 67B (fig. 1). Soil samples were collected from each

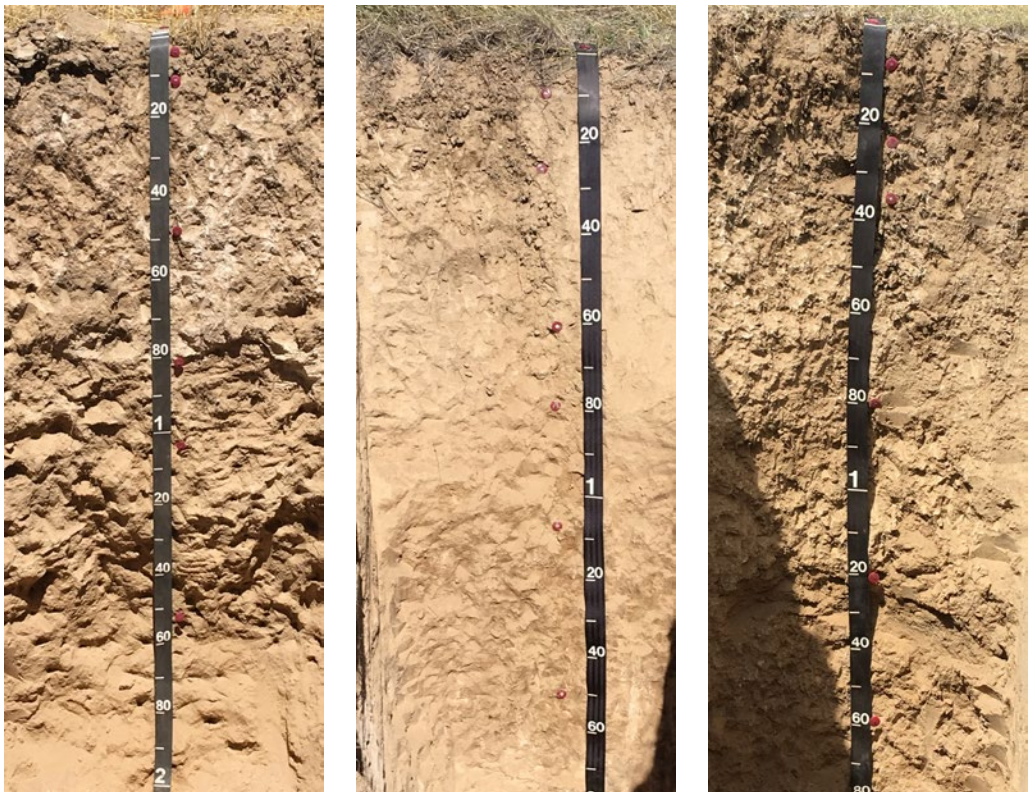


Figure 2.—Soil profiles from cropland (left), CRP land (center), and rangeland (right).

Figure 3.—Soil with a plow layer under cropland (left) compared to same soil in an area in CRP for almost 30 years (right).

horizon and sent to the Kellogg Soil Survey Laboratory in Lincoln, Nebraska, for standard laboratory analysis. It can be difficult to locate the same soil in areas of three different management practices in close proximity to one another. This unique opportunity allowed us to conduct a comparison study between management practices (figs. 2 and 3). Additional analysis included organic and inorganic carbon, aggregate stability, total nitrogen and phosphorus, soil enzymes, permanganate extractable carbon, and particulate organic matter. Data on surface bulk density and soil carbon dioxide respiration were collected in the field (fig. 4).

The cropland site, recently harvested for a wheat crop, showed signs of poor soil structure, little organic matter, and a definite plow layer. The second soil pit, in a field that has been in CRP for almost 30 years, had improved structure, organic matter, and deep roots. The third soil pit, in an undisturbed area on native rangeland, had a deeper and darker A horizon and better structure than the disturbed sites.

After collecting the soils data, this soil will be reclassified from an Aridic Ustorthents to an Aridic Haplustalfs. The change in taxonomy will affect soil interpretations and provide landowners with updated soils information to better assist with land management decisions. This sampling event was also a great learning opportunity for five NRCS Pathway students: Katherine Gerdes and D.J. Cunningham (soil science students), Tess Cronin and Amanda James (range conservation students), and Eun Bae (engineering student). These students had the opportunity to see

Figure 4.—Fort Morgan MLRA Leader Andy Steinert and Region 5 Soil Data Quality Specialist Paul Rindfleisch collect data.

firsthand the soil sampling process. The sampling effort studied the effects of different management practices on the dynamic properties of soil. The data collected is used to update the soils database, providing soils information to landowners that will assist them in land management decisions. ■

Price Field Review and Technical Assistance

By M. Dean Stacy, ecological site specialist, Price, Utah, Soil Survey Region 4.

The Price MLRA (Major Land Resource Area) Office conducted a field review for the soil survey area of Emery County, Utah, Eastern Portion (UT625) September 10 through 14, 2018. Individuals that took part in the review were Region 4 Soil Data Quality Specialist Steve Jelden, MLRA Office Leader Jedd Bodily, Project

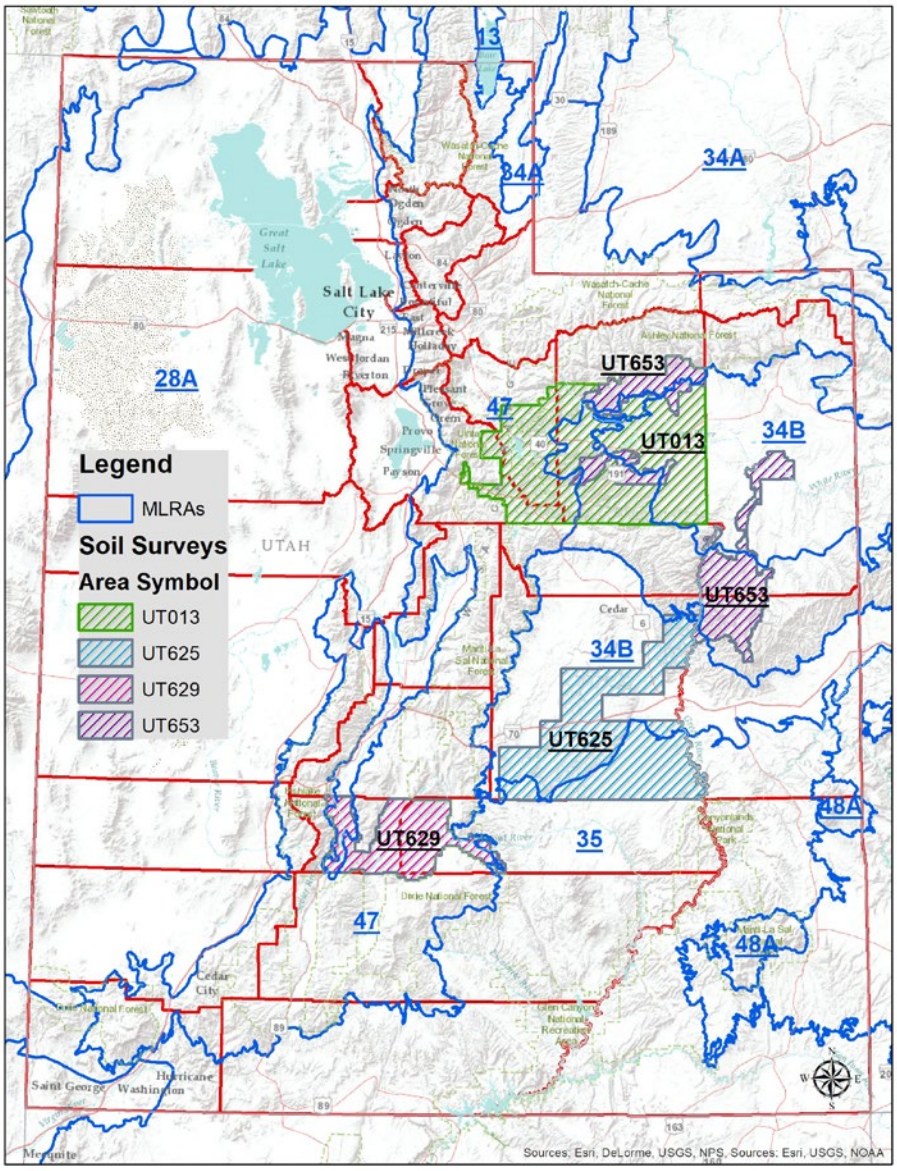


Figure 1.—Utah MLRAs and the Price MLRA Office's active soil surveys.

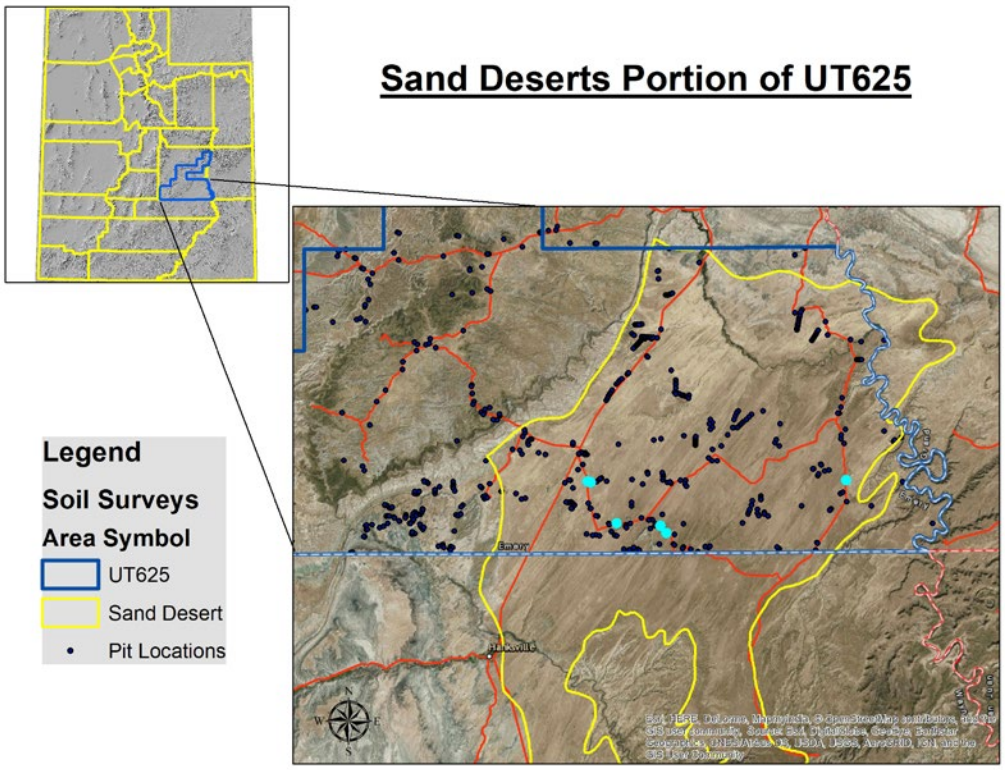


Figure 2.—Areas of sand sheets and dunes in soil survey area of Emery County, Utah, Eastern Part.

Leader Steve Cromer, Soil Scientist Kristi Mingus, Ecological Site Specialist M. Dean Stacy, and USGS Soil Scientist Travis Nauman. The group visited and discussed 10 map units as well as their associated ecological sites.

The Price Soil Survey Office is responsible for parts of MLRAs 34B—Warm Central Desertic Basins and Plateaus, 48A—Southern Rocky Mountains, 35—Colorado Plateau, and 47—Wasatch and Uinta Mountains. The office is currently finalizing the soil surveys of Duchesne County, Utah (UT013); Uintah and Ouray Indian Reservation Utah (UT653); and the Loa-Marysvale Area, Utah (UT629) (see figure 1). In 2017, the crew started initial soil survey work for the soil survey of Emery County, Utah, Eastern Part (UT625). This field review (UT625) took in portions of MLRAs 34B and 35, which encompass approximately 1,380,000 acres in all. The moisture regimes within this survey range from typic aridic (5 to 8 inches of precipitation per year) to ustic aridic (8 to 12 inches of precipitation per year) and aridic ustic (12 to 16 inches of precipitation per

Figure 3.—Plant community dominated by sand sagebrush and Indian ricegrass.

year), and elevations range from approximately 4,000 to 8,000 feet. The temperature regime for the entire survey area is mesic. One of the main questions at the start of the survey was whether to map it as order 3 or order 4.

On Day 1, the group visited several locations within NOTCOM (soil mapping not completed) map units. The first stops were within areas of sand sheets and sand dunes in the southeastern portion of the survey area (fig. 2). The predominant winds in this area are from southwest to northeast, as evident in figure 2.

In this area, there is a vast amount of land on the sand sheet that has relatively low variability in soil types and ecological sites. This fact is important in determining how much detail is needed for a soil map of this area. Common soils in the area are Typic Haplocalcids and Typic Torripsamments, all of which were correlated to Ecological Site R035XY115UT—Desert Sand (Sand sagebrush). Figures 3 and 4 show two different states and community phases within this ecological site.

As the group moved towards the eastern boundary of the area of sand sheets and dunes, they noted the dominant aspect of the plant community change to blackbrush (fig. 5). Typical soils for this site are classified as fine-loamy, mixed, superactive, mesic Typic Haplocalcids.

Figure 4.—An active dune state. The plant community is dominated by Havard oak, Torrey's jointfir, and sand sagebrush.

Figure 5.—Plant community dominated by blackbrush. Ecological site is R035XY121UT—Desert Sandy Loam (Blackbrush).

On Day 2, the crew moved to the western portion of the survey area, in the Moroni Slopes area of western Emery County. The first two map units discussed were e055 and e106, which have Mussentuchit, Goblin, and Swell soils as major components. All components displayed a high concentration of gypsum. Before the review, a few samples were sent to the Kellogg Soil Survey Laboratory in Lincoln, Nebraska. Lab results proved 30 to 90 more percent gypsum in certain By or Byy horizons. The soil survey crew viewed the lab data on site to help them calibrate the soil properties (color, gypsum crystal concentrations, pH, etc.) with known percentage gypsum and so assist with future soil descriptions. Possible ways to determine pedogenic gypsum versus geogenic gypsum were also discussed. Soils were classified as Leptic Haplogypsids (pedogenic gypsum) and Lithic Haplogypsids and Typic Haplogypsids (geogenic gypsum). The associated ecological sites were

Figure 8.—Landscape of the Neveset soil. The corresponding ecological site is Semi-desert Shallow Loam (Utah juniper/pinyon).

Figure 9.—Landsape of the Farb soil in map unit h035. The corresponding ecological site is Desert Shallow Sandy Loam (Shadscale).

R035XY126UT—Desert Shallow Gypsum (Torrey's jointfir), R035XY142UT—Desert Very Shallow Gypsum (Torrey's jointfir), and R035XY106UT—Desert Gypsum Loam (Torrey's jointfir).

On the next stop on Day 2, map units 100 and 200 were proposed. Both map units are on similar landforms (structural benches) and have similar map unit concepts in different precipitation zones. Map unit 100 is a desert map unit, consisting of loamy and loamy-skeletal Lithic Torriorthents with corresponding ecological sites R035XY118UT—Desert Sandy Loam (Four-wing saltbrush) and R035XY118UT—Desert Shallow Loam (Shadscale). Map unit 200 is a semi-desert unit, consisting of Ustic Calcigypsids, Ustic Haplocambids, and Ustic Haplocalcids, and most of its soils fall within a lithic depth subgroup. The corresponding ecological sites are R034BY227UT—Semi-desert Shallow Loam (Black sagebrush), R034BY227UT —Semi-desert Shallow Loam (Black sagebrush), and R034BY227UT—Semi-desert Shallow Loam (Utah juniper/pinyon) (fig. 8).

On Day 3, the crew visited the area west of Goblin Valley State Park on Little Wild Horse Mesa. This area joins to the soil survey of Henry Mountain and consists of badlands from both the Mancos Shale Formation and the Brushy Basin Member of the Morrison Formation. These badland hills and soils formed from salty shales. Discussions of how to most accurately describe the salty nature of these soils ensued as the crew stopped to describe a soil that had a Btknyz horizon. Describing and mapping the salts accurately is important since erosion of these badland hills and soils can contaminate waterways with salts.

Map unit h035 was also visited and discussed. This map unit has three major components: the Farb soil, which is a Lithic Torriorthent and associated with ecological site R035XY130UT—Desert Shallow Sandy Loam (Shadscale) (fig. 9); rock outcrop; and an undetermined component that will reflect gypsum and calcium carbonate accumulation.

Figure 10.—Steve Cromer displays highly weathered gypseous parent material he found while sampling in Emery County, Utah.

The final map unit the crew visited was e169, which consists of two major components: Tusher soil and Teabush soil. Both soils have the same classification (coarse-loamy, mixed, superactive, mesic Typic Haplocalcid) and corresponding ecological site (R034BY115UT—Desert Sandy Loam (Indian ricegrass)). ■

Tennessee Selected to Test the Ecological Site Framework

The potential to better use ecological site information, ecological site descriptions (ESDs), and state-and-transition models (STMs) in the 9 Step Conservation Planning Process on all land uses was recently evaluated by the Ecological Site/Conservation Planning Team. ESDs provide land managers the information needed for evaluating the land as to suitability for various land uses, capability to respond to different management activities or disturbance processes, and ability to sustain productivity over the long term. STMs also describe in concise terms the potential plant communities, alternative states (e.g., cropland and pasture), range of resource conditions (e.g., states and phases), and processes (e.g., time, triggers, succession, disturbances, management activities and practices) related to transitions in each land use.

NRCS State Agronomist Patricia Thurman, Cartographer David Barker, Soil Scientists Gabe Krantz and Preston Evans, and Agronomist Mike Kucera visit a pasture field in MLRA 123.

A recently approved white paper entitled “Ecological Site Framework to Support Conservation Planning on all Land Uses” calls for the concepts proposed to be applied at four different locations across the United States. The

NRCS Resource Soil Scientist Anthony Khiel and NRCS Agronomist Mike Kucera exit a corn field in Jefferson County, in MLRA 128.

goal is to test concepts on ecological sites with multiple land uses; develop practical, simple, and useful products for conservation planners and clients during these tests; and provide a testbed for ongoing development of EDIT (ecological site database) and CDSI (Conservation Delivery Streamlining Initiative). The State of Tennessee was selected as one of the four locations. Three of its major land resource areas (MLRAs) were selected for evaluation: MLRA 134, MLRA 123, and MLRA 128.

Tennessee contributed greatly to the launch of this pilot project. During the last week of August, it hosted Mike Kucera, NRCS agronomist and leader of the Ecological Site/Conservation Planning Team, for meetings on the project. The week began with a brainstorming session that included NRCS staff representing the State, major land resource areas (MLRAs), and headquarters and NCSS cooperators. A full week of field days followed. Ecological Site Specialists Barry Hart, Anita Arends, and Belinda Ferro each worked with one of three selected MLRAs to select properties for field visits and plan field days. The field visits were productive; multiple land uses were identified that could be incorporated into agricultural state-and-transition models.

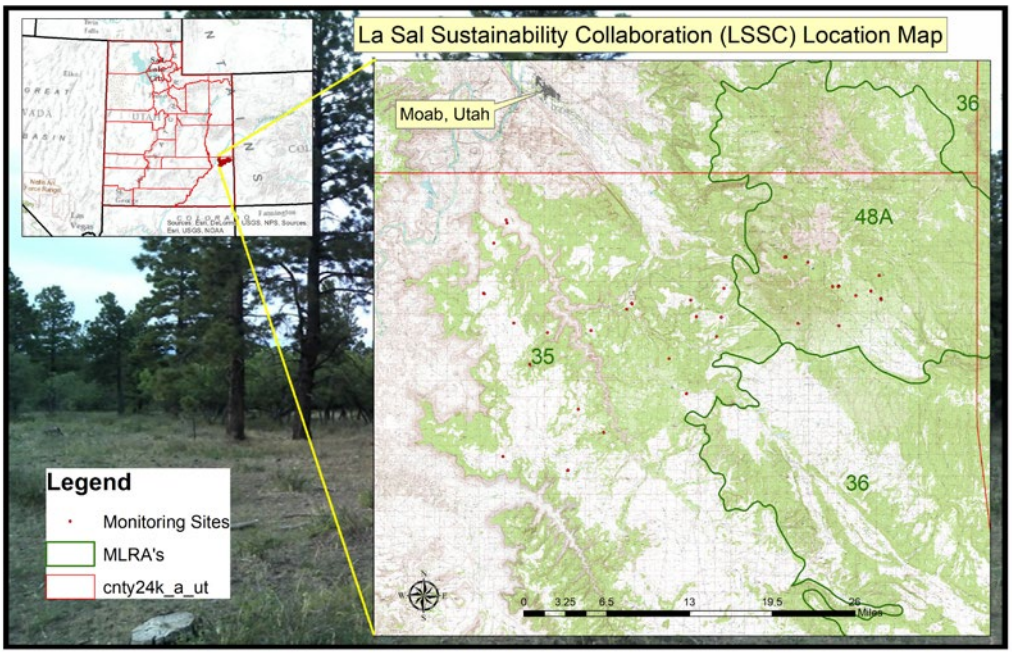
Quarterly meetings were proposed to maintain the starting momentum of the project. The first one was held in October. ■

NRCS Regions 4 and 8 Form Southern Utah Partnership for Ecological Monitoring

By M. Dean Stacy, NRCS ecological site specialist, Soil Survey Region 4, Price, Utah.

The La Sal Sustainability Collaboration (LSSC) was formed in 2014 to address ecological, social, economic, and administrative concerns on 285,000 acres just south of Moab, Utah. The area consists of mostly public land intermixed with small private parcels. It is managed for multiple uses, including cattle grazing and recreation. The main goal of the LSSC is to bring multiple agencies and stakeholders together to work toward holistic and sustainable management of this area. The group was originally formed by the Utah Department of Agriculture and Food Grazing Improvement Program and Grand Canyon Trust. Other members of the LSSC include San Juan County, Trout Unlimited, Utah Division of Wildlife Resources, La Sal Livestock, and BLT Livestock. Representatives from the Bureau of Land Management (BLM), Forest Service, School and Institutional Trust Lands Administration (SITLA), and NRCS also attend meetings and provide expertise.

One of the key components to large-scale land management is the collection of monitoring data. Monitoring ecological indicators across the landscape will



Location map of the LSSC's monitoring sites.

provide feedback to inform management changes. The LSSC has included an in-depth monitoring plan, which was created over the course of a year through numerous meetings among members and advisors, as part of its final report and recommendations. The monitoring plan includes 30 sites spread throughout the LSSC's area of interest, in both upland and riparian areas (see figure above). These sites were established and measured in 2017 and will be measured every 3 to 5

Keith Crossland (NRCS), Jeff Fenton (NRCS) and Staci Williams (UDAF-GIP) examine map unit components and associated ecological sites. The map unit component at this location is Musofare channery loam. The ecological site associated with this component is R035XY206UT—Semi-desert Gravelly Loam (Utah Juniper-Pinyon).

Keith Crossland (NRCS) and Jan Reinhart (UDAF-GIP) dig a pit to identify the map unit component—Richens loam. The associated ecological site is R048AY503UT—High Mountain Clay. Elevation is 10,012 feet.

years into the future. To inform the LSSC of the impacts of cattle grazing and wildlife browsing throughout the area, seven of the monitoring sites will include measurements both inside and outside of cattle and wildlife exclosures.

Identifying the soil components and the ecological site in areas where monitoring data are collected is crucial to understanding the ecological potential of the area and interpreting the results of long-term monitoring. While BLM and the Forest Service have already identified the ecological sites in some locations within the LSSC's area of interest, many of the LSSC monitoring sites still need ecological site verification.

An area of Ecological Site R048AY004UT—Semi-wet Fresh Meadow.

In January 2018, Vic Parslow (soil survey office leader, NRCS Region 8, Richfield, Utah) was contacted by the Utah Department of Agriculture and Food, Grazing Improvement Program (UDAF-GIP). UDAF-GIP requested assistance in identifying map unit components as well as the associated ecological sites. In May and July 2018, Vic, as well as Keith Crossland (soil scientist, Region 8) and Jeff Fenton (ecological site specialist, Region 8) accompanied UDAF-GIP to the La Sal area in southeastern Utah. These trips were to locations at lower to mid elevations of MLRA 35 (Colorado Plateau) that were readily accessible during that time of year. The trips also allowed Jeff optimal opportunity to identify vegetation while it was actively growing to help in the identification of the appropriate ecological site.

In August 2018, the Region 8 soils staff and UDAF-GIP planned another trip to the area; however, this time the locations were in the higher elevations of the La Sal Mountains. To expedite the data collection, the partners decided to split into two groups. Dean Stacy (ecological site specialist, Region 4) was asked to accompany and assist the second group of soil scientists. The La Sal Mountains lie within Major Land Resource Area (MLRA) 48A—Southern Rocky Mountains. The field visits that summer were beneficial to UDAF-GIP and other partners as the map unit components and appropriate ESDs were identified with great confidence. ■

Workshop on Forested Wetland Soils in Connecticut

In August, NRCS, the Connecticut Department of Energy and Environmental Protection's Division of Forestry and Wetlands Management Section and the Society of Soil Scientists of Southern New England hosted workshops on forested wetland soils at the University of Connecticut. Forestry practices in Connecticut occur in virtually every municipality and frequently require the use of heavy equipment in and around wetlands and watercourses. When planning or executing forestry operations and practices, best management practices (BMPs) need to be considered. BMPs include stream crossing techniques, erosion-control measures, and seasonal practices.

The workshop was a day-long event. The morning consisted of a series of presentations and activities covering an overview of forestry BMPs and ecological site descriptions, online planning tools (such as LIDAR, CTECO, and Web Soil Survey), and a review of forestry-related requirements and responsibilities under the Connecticut Forest Practices Act and the Inland

Jacob Isleib, NRCS soil scientist, pumps water from the Woodbridge soil pit so attendees could observe the redoximorphic features and examine the dense till layer (Cd horizon).

Wetlands and Watercourses Act. In the afternoon, the site of an active forest operation was visited. The site visit allowed participants to view, among other things, soil profiles and stream crossing measures. ■

Soil and Water Conservation Society's Summer Meeting and Workshop

On August 10, the Soil and Water Conservation Society's Southern New England Chapter hosted the 2018 Summer Meeting and Coastal Erosion Workshop at the South Kingstown Land Trust Barn in Wakefield, Rhode Island. Speakers and topics included:

Teresa Crean, community planner and coastal management extension specialist with the Coastal Resources Center (CRC) and Rhode Island Sea Grant at the University of Rhode Island's Graduate School of Oceanography. She discussed the Shoreline Change Special Area Management Plan (BeachSAMP) and Coastal Resiliency Tools.

Debbie Surabian describes a soil profile to workshop attendees.

Janet Freedman points to coastal erosion along the sandy beach of Matunuck.

Samantha Apgar, PhD student in Ecology and Evolutionary Biology at the University of Connecticut. She presented her research titled "Tidal marsh bird nesting adaptations and consequences as sea levels rise."

Dr. Bryan Oakley, assistant professor in the Environmental Earth Science Department at Eastern Connecticut State University and a part-time researcher in the Department of Geosciences at the University of Rhode Island. He spoke about shoreline change in Rhode Island and coastal erosion maps (available at http://www.beachsamp.org/coastal-erosion-maps/).

Debbie Surabian, state soil scientist for Connecticut and Rhode Island. She gave an overview of the Coastal Zone Soil Survey.

Janet Freedman, coastal geologist at Coastal Resources Management Council of Rhode Island. She led the field tour of coastal erosion along the sandy beach of Matunuck. ■

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