


Soil and Plant Science Division Fiscal Year 2024




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Introduction

The Soil and Plant Science Division (SPSD), part of the Soil Science and Resource Assessment Deputy Area, provides leadership for the soil survey program and the National Cooperative Soil Survey. The SPSD manages the soil survey program that completes soil and ecological surveys, conducts technical soil and ecological site services, and supports conservation efforts across the United States and its Territories. Other activities include conducting research and training, administering the Plant List of Attributes, Names, Taxonomy, and Symbols, or PLANTS, database, and managing the Soil Climate Analysis Network and Tribal Soil Climate Analysis Network.

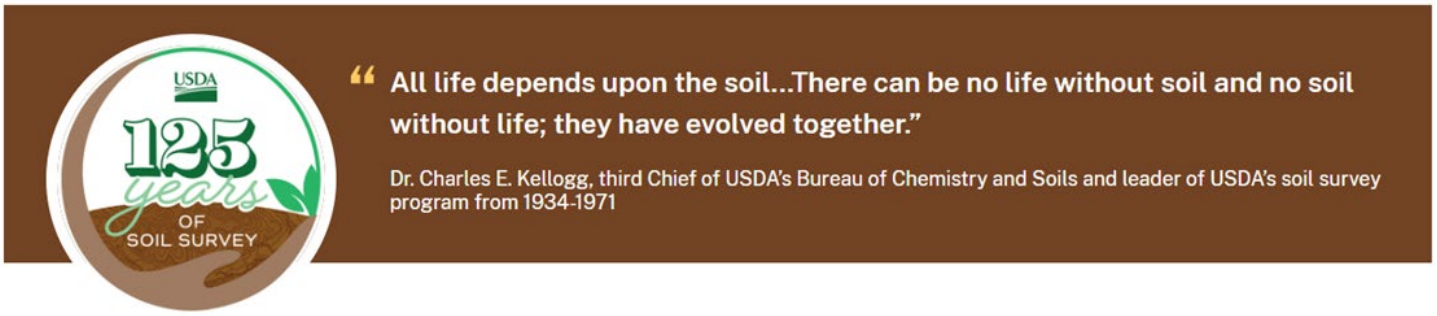
The National Cooperative Soil Survey (NCSS) is a partnership of Federal, State, and local agencies, universities, conservation districts, and private-sector organizations. The strength of the NCSS originates from the collaboration and coordination of technical and operational activities by SPSD staff at national, regional, State, and local levels to advance soil and ecological science. Activities include investigating, inventorying, documenting, classifying, interpreting, promoting, and disseminating soil and ecological site information of the United States and its Territories.

NRCS Celebrates 125 Years of Soil Survey

On May 3, 1899, Congress authorized funds for the U.S. Department of Agriculture (USDA) to investigate the soil resources of the United States in the field and laboratory. By the end of 1899, USDA had mapped 720,000 acres and published four separate soil surveys: Cecil County, Maryland; Connecticut Valley (portions of Connecticut and Massachusetts); Salt Lake Valley, Utah; and Pecos Valley, New Mexico.

Today, the Natural Resources Conservation Service (NRCS), through the National Cooperative Soil Survey, fulfills a legislative mandate to inventory soil resources and keep the survey relevant to ever-changing needs (fig. 1). More information on how soil surveys help guide agricultural development and support community planning and resource development is provided in the NRCS Success Story Exploration, Invention, and Evolution Still Abound After 125 Years of Service.

Figure 1.—Two photographs taken approximately 100 years apart show how the equipment and standards that NRCS staff use to describe soils have evolved and expanded to changing needs, technologies, and innovations, ensuring they remain relevant and effective.



Regional Cooperative Soil Survey Conferences

The National Cooperative Soil Survey (NCSS) held regional conferences in the North Central, Northeastern, Southern, and Western regions. The conferences connect fellow soil scientists and ecologists and provide venues for staff to review activities of the NCSS. Between committee meetings and presentations, conference attendees participate in field tours to learn more about the local resource concerns, soils, and landscapes.

Natural Resources Conservation Service (NRCS) Louisiana and the University of Louisiana at Lafayette hosted the 2024 Southern Regional Cooperative Soil Survey Conference in May. The conference theme was “Our Soils, Our Heritage.”

NRCS Wisconsin and the University of Wisconsin-Platteville hosted the 2024 North Central Regional Soil Survey Conference in June. The conference theme was “Digging into the Driftless – A Dynamic Vision for Resilient Soil Climate and Ecosystems.”

NRCS Montana and Montana State University in Missoula hosted the 2024 Western Regional Cooperative Soil Survey Conference in July. The conference theme was “Soilscapes to Landscapes: Focused Conservation for Reinvigorating Healthy Communities.”

NRCS Massachusetts and Bridgewater State University in Bridgewater hosted the 2024 Northeast Cooperative Soil Survey Conference in late July. The conference theme was “Dynamic Soils and Climate Resiliency — Looking to the Past to Guide the Future.”

Web Soil Survey

Web Soil Survey (WSS) provides soil data and information produced by the National Cooperative Soil Survey (NCSS) (fig.2). Through WSS, users access to the largest natural resource information system in the world, with soil maps and data available online for more than 98 percent of the Nation’s counties. NRCS staff update and maintain WSS as the single authoritative source of NCSS program information.

Figure 2.—The banner on the top of a WSS web page.

Fiscal year 2024 WSS metrics:

- 3,774,074 users with 474,159 data downloads
- Top requested data:
  1. Hydrologic soil group
  2. Farmland classification
  3. Hydric rating
  4. Depth to water table
  5. Land capability class

Historical Soil Surveys and Supplemental Documents

In fiscal year 2024, historical soil surveys were accessed 439,222 times through the Natural Resources Conservation Service Soil Surveys by State web page. This is almost equal to the number of Web Soil Survey downloads. Historical soil survey reports and supplemental documents from 1899 to 2005 are available digitally to ensure the public has access to the data. Since 2005, Web Soil Survey has been the official source for soils information.

Technical Soil Services

In fiscal year 2024, Natural Resources Conservation Service (NRCS) staff completed over 41,000 technical soil service (TSS) instances and 119,000 hours of TSS. The most common TSS activities were technical consultations, highly erodible land determinations and appeals, National Resources Inventory (NRI) support, and off-site wetland determinations. Ninety-four percent of TSS instances supported Conservation Technical Assistance and related programs (Farmland Protection Policy Act and NRI). The most supported Farm Bill programs were the Environmental Quality Incentives Program, the Conservation Reserve Program, and the Agricultural Conservation Easement Program.

Soil and Plant Science Division (SPSD) staff completed 12 percent of the TSS instances nationwide. SPSD staff provide TSS to help our diverse customer base, which includes NRCS staff, such as conservation planners, rangeland specialists, engineers, and resources soil scientists, understand and properly use soil, plant, and ecological site information. Staff help with assessing resource concerns in the field and recommending conservation practices to providing more detailed soil and ecological site information to producers and planners.

Annual Soils Refresh

Once a year, Soil and Plant Science Division (SPSD) staff lead the Annual Soils Refresh process to ensure Soil Survey Geographic Database (SSURGO) information for the United States and its Territories is updated on October 1. SSURGO data is delivered to various Natural Resources Conservation Service (NRCS) conservation applications and tools to support conservation planning and programs. The Annual Soils Refresh involves over 200 SPSD staff and all NRCS State soil scientists.

October 2024 SSURGO information includes the following:

- 3,379 soil survey areas updated
- 270,000,000 acres of new SSURGO data added

- 100 percent of Alaska SSURGO mapped for the first time
- 5,592 new soil map units published
- 25,545 new soil components published
- 99,275 new soil polygons published
- 120 national interpretations published

SPSD staff deliver SSURGO data to the following:

- Conservation Assessment Ranking Tool (CART)
- Conservation Desktop
- Revised Universal Soil Loss Equation – Version 2
- Water Erosion Prediction Project
- Wind Erosion Prediction System
- Tool for Environmental Resource Results Assessment for the Farm Service Agency
- Web Soil Survey
- Soil Data Access

NRCS staff also provide soil services and information delivery support through the Soils Hotline for internal and external SSURGO data customers to ensure the delivery of data and customer understanding of methods of accessing and using data. In fiscal year 2024, NRCS staff received 3,879 emails from SSURGO data customers.

Soil Data Access

Soil Data Access (SDA) is a suite of web services and applications used to meet requirements for requesting and delivering soil survey spatial and tabular data not met by the Web Soil Survey and Geospatial Data Gateway. In fiscal year 2024, SDA received almost 104 million queries (3 queries per second) with approximately 4.6 million of those queries coming from the Conservation Assessment Ranking Tool (CART).

Fiscal year 2024 SDA metrics:

- 103,952,847 queries processed
- 4,644,871 queries processed for CART
- 284,802 queries per day
- 11,866 queries per hour
- 198 queries per minute
- 3 queries per second

Plant List of Attributes, Names, Taxonomy, and Symbols Database Modernization

Natural Resources Conservation Service (NRCS) staff continue to work on the Plant List of Attributes, Names, Taxonomy, and Symbols (PLANTS) application by managing the major multi-year effort to modernize the database and develop a complete content and file manager for PLANTS (fig. 3). The PLANTS database provides basic scientific information for over 35,000 species of plants growing in the United States, Canada, Greenland, Saint Pierre, and Miquelon. PLANTS is one of USDA's most visited websites, annually averaging over 2.5 million users and 12.6 million page views. Critical to the mission of NRCS, the PLANTS website touches on all aspects of conservation planning that involve the need for plant information.

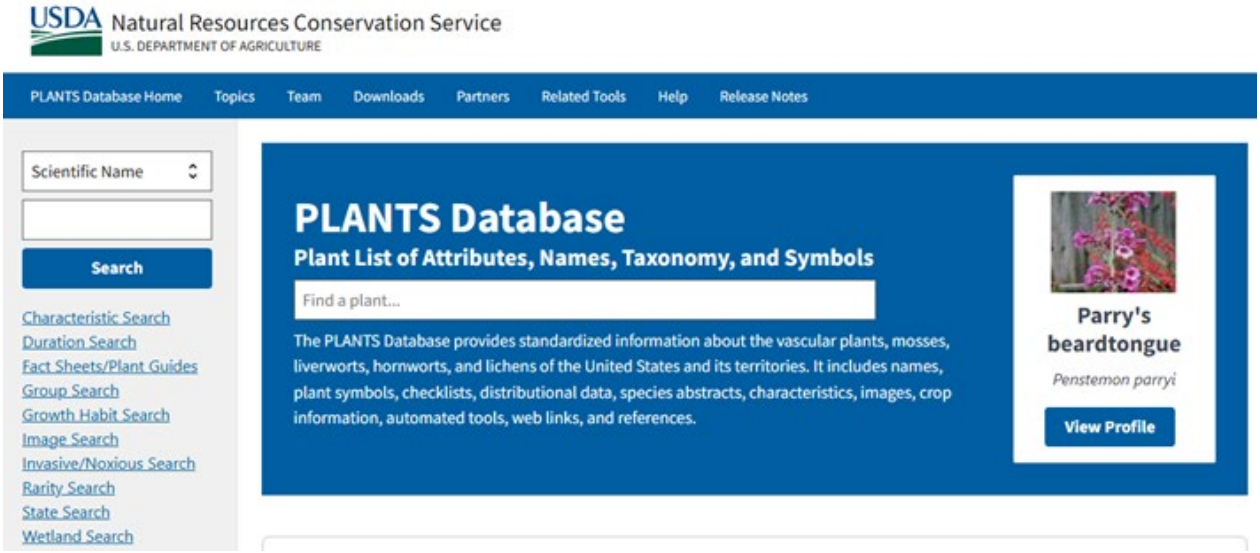


Figure 3.—The PLANTS home page.

Soil and Plant Science Division Trainings

In fiscal year 2024, Soil and Plant Science Division (SPSD) staff delivered 16 centrally funded training sessions and 10 SPSD-sponsored training sessions. A total of 333 participants, including 109 from outside of the SPSD, attended the trainings. Over 90 individuals from across Natural Resources Conservation Service divisions and States, partners and cooperators from Federal, State, and local governments, and universities served as instructors or provided local support to deliver the training. SPSD staff are currently developing multiple new courses to support Agency and Department priorities.

Assisting With Conservation Practice Standards

Soil and Plant Science Division (SPSD) staff contributed to Climate-Smart Agriculture and Forestry mitigation activities by serving on the evaluation team for 16 conservation practice standards. The team evaluated the information and decided if adoption of a practice standard would cause a measurable reduction in greenhouse gas emissions.

SPSD staff also assisted with the development of the Soil Productivity Conservation Risk Index. Conservation planners and land managers can use the index to identify fields at risk of nutrient loss due to extreme soil variations.

Dynamic Soils Hub

Soil and Plant Science Division (SPSD) staff developed the award-winning Dynamic Soils (DS) Hub to expand USDA's capacity to model and report on soil properties that change with conservation management on a human timescale. Through DS Hub, customers receive rapid responses to their requests for science-based property data. It supports the Conservation Innovation Grants, Conservation Stewardship Program, Environmental Quality Incentives Program, and nationwide soil health efforts. Key features of DS Hub include the following:

- Innovative geospatial data user interface that enables users to create new data products from a variety of existing authoritative datasets.
- Access to raster-based maps and web applications and to other authoritative data sources, such as climate data, elevation, and elevation derivatives, for modeling with soil data.
- No-code processing of large data volumes for geospatial modeling.
- Collaboration tools for modelers to work on projects, share data and experiments, and produce scientific models and datasets.
- Capacity for USDA staff to model and report on soil properties that change with conservation management.
- Collection, storage, and delivery of data related to dynamic soil properties and conservation management.
- Quick response to customer requests of science-based soil property data at the Deputy Chief, Chief, and Under Secretary levels.

Ecological Site Inventory

The Soil and Plant Science Division is primarily responsible for ecological site inventory activities. These activities provide the foundational ecosystem knowledge necessary to restore, protect, and conserve land and foster sustainable and resilient economic growth. Currently, 158 of 180 (88 percent) of major land resource areas in the continuous United States have provisional ecological sites published online. The Northeast, Northwest, and South Central Soil Survey Regions have achieved 100 percent completion of provisional ecological sites.

Supporting the Nutrient Management Initiative

Natural Resources Conservation Service (NRCS) staff developed several tools, models, and interpretations to support the NRCS SMART Nutrient Management Initiative, which includes the right Source and Method, an Assessment of site-specific conditions, the right Rate, and the right Timing. As part of the SMART Nutrient Management Initiative, NRCS staff work with farmers to develop nutrient management plans tailored to the unique farm location, soil, climate, crops grown, management conditions, and site-specific factors.

NRCS staff created the Sensitive Area Analysis Tool that uses soil survey data to show areas of a field at risk for nutrient loss that can benefit from site-specific nutrient management plans and other practices to mitigate nutrient losses. Soil conservationists can use this tool with clients in Conservation Desktop.

NRCS staff developed water quality models to provide a public version of the nutrient management soil threshold results used in the Conservation Assessment Ranking Tool. Staff created the soil sensitivity index, an interpretation to rate soils based on their sensitivity for nutrient runoff. Conservation planners use the index to identify soils and areas with greater vulnerability to nutrient runoff.

Raster Soil Surveys Support Land Management Planning

In fiscal year 2024, Soil and Plant Science Division staff supported the development, update, and delivery of Raster Soil Surveys in Florida, Louisiana, Minnesota, North Carolina, North Dakota, Tennessee, Vermont, and Wisconsin to support land management planning. Staff delivered these raster products with tabular data as individual State databases and as part of the gridded National Soil Survey Geographic Database, or gNATSGO, through the NRCS Geospatial Data Gateway website.

Soil Landscapes of the United States

Natural Resources Conservation Service (NRCS) staff delivered 100-meter resolution soil property maps for the Soil Landscapes of the United States (SOLUS). SOLUS100 is a set of 20 soil property maps predicted at 7 depths with uncertainty and accuracy estimates (fig. 4). NRCS staff are working with SOLUS100 property maps to assist with the Soil Vulnerability Index for wind erosion, or rSVIwind, used for Conservation Effects Assessments Program assessments of grazing lands. The model uses SOLUS100 soil properties, including gypsum content, rock fragment content, very fine sand content, clay content, and silt content, that are critical for determining vulnerability to wind erosion.

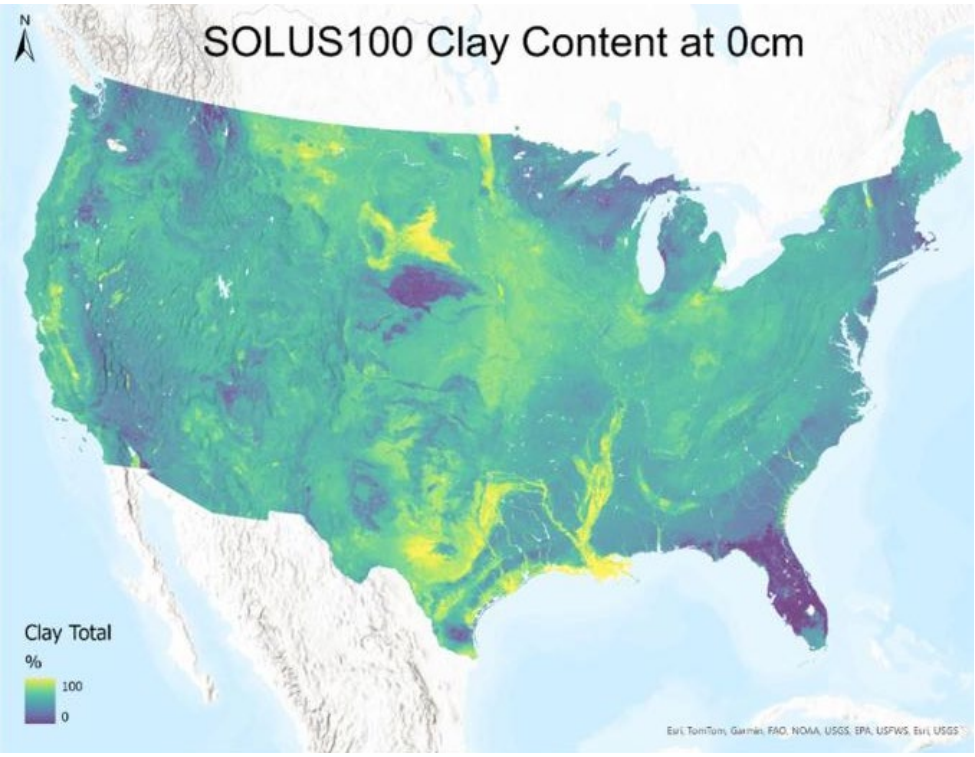


Figure 4.—A SOLUS100 map of clay content predicted at the 0-centimeter depth.

NRCS staff will begin modeling for SOLUS30 (30-meter resolution property maps for the contiguous United States by implementing a space-time modeling framework to explore modeling of dynamic soil properties, such as soil organic carbon. Future modeling plans also include exploring the utility of combining Soil Survey Geographic Database, or SSURGO, and SOLUS data in models to support conservation planning. NRCS staff will share the results with conservation planners to demonstrate the utility of new soil information products and collect feedback to improve customer experience.

Improving Conservation Outcomes

In 1991, the Natural Resources Conservation Service (NRCS) started the Soil Climate Analysis Network (SCAN) as a national pilot study with 25 sites designed to improve conservation outcomes. Various customers use SCAN data to make informed decisions related to irrigation, farming operations, and rangeland management. Today, the network has over 200 sites on private and public lands including 21 sites on Tribal lands as part of the Tribal Soil Climate Analysis Network, or TSCAN, project.

The NRCS is the biggest cooperating partner of the National Coordinated Soil Moisture Monitoring Network (NCSMMN) with Snow Telemetry, or SNOTEL. SCAN is the largest low-elevation in situ monitoring contributor to the NCSMM. Multiple systems, agencies, entities, and individuals using SCAN include the National Integrated Drought Information System, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, Bureau of Land Management, U.S. Forest Service, university cooperators and researchers, drought professionals, and producers interested in weather and soil conditions.

Dynamic Soil Property Work Built on a 30-Year-Old Foundation

The work of Soil and Plant Science Division (SPSD) staff builds on a 30-year-old foundation that goes back to the Soil Quality Institute, a past Natural Resources Conservation Service (NRCS) institute that developed and disseminated tools for soil quality assessment. Dynamic soil properties (DSPs) are soil properties that change in response to land use, management, and natural disturbances. They are indicators of how soils change and function over time.

In fiscal year 2024, SPSD staff provided DSP-specific training to 186 people, planned or completed 340 DSP projects, purchased 342 pieces of DSP-specific equipment, completed 29 DSP presentations, and published the new "DPS Guide, Version 3." They also hosted quarterly DSP meetings, developed a standards subteam, recorded instructional videos, conducted a gap analysis, and developed storage for DSP data.

Lichen Data Updated

University of North Carolina and Natural Resources Conservation Service (NRCS) staff updated the lichen data in the Plant List of Attributes, Names, Taxonomy, and Symbols (PLANTS) database. The team revised the taxonomy, nomenclature, and distribution data for approximately 5,000 species of lichens and provided photograph identifications of lichens. This information is critical as lichens are important indicators of air quality, which is an NRCS resource concern.

Coastal Zone Soil Survey of Lake Mattamuskeet National Wildlife Refuge in North Carolina Helps Reestablish Subaquatic Meadows

At the request of the Lake Mattamuskeet National Wildlife Refuge and North Carolina Wildlife Resources Commission, Natural Resources Conservation Service (NRCS) staff initiated the Lake Mattamuskeet coastal zone soil survey to guide efforts on reducing lake turbidity and reestablishing its once extensive subaquatic meadows. The refuge features the largest freshwater lake in North Carolina and a historic abundance of submerged aquatic vegetation, making the refuge a vital stop on the Atlantic Flyway for migratory waterfowl. In fiscal year 2024, NRCS staff completed data and laboratory analyses, making it the first subaqueous soil survey in North Carolina to be publicly available in Web Soil Survey (fig. 5).

Figure 5.—An NRCS employee describing a soil core.

Rarity Status Updates

Natural Resources Conservation Service (NRCS) and NatureServe staff are working with federal and academic partners to update the rarity status information in the Plant List of Attributes, Names, Taxonomy, and Symbols (PLANTS) database. Throughout 2024, NRCS and NatureServe staff met to discuss the data being prepared on rarity statuses. Monitoring the rarity status of a plant can protect its long-term existence by detecting downward trends or alterations of its habitat.

Salt Desert Moisture and Temperature Regime Updates

At the request of the Bureau of Land Management, Natural Resources Conservation Service (NRCS) staff are working on a set of soil survey projects to reassess the soil map units and soil moisture and temperature regimes along the boundary between two Colorado soil survey areas (fig. 6). Staff are assessing one area called the Douglas-Plateau Area in Colorado, which encompasses parts of the Garfield County and Mesa County soil surveys.

Figure 6.—NRCS staff evaluated the soil shown in the foreground as part of the soil moisture and temperature regime project.

Soil Survey Project Improves Hydric Soils Data in Louisiana

Natural Resources Conservation Service (NRCS) staff raised concerns about a soil map unit that occurs in Major Land Resource Area 133B (Western Coastal Plain) within a five-parish area of northern Louisiana. The map unit, specifically as observed in Union Parish, does not include any hydric minor components; however, based upon local NRCS Louisiana staff wetland determinations and anecdotal accounts, hydric soils have been documented in the soil map units. The technical team elevated staff concerns and developed a soil survey project. The project plan focused on sampling and documenting the Darley gravelly fine sandy loam, 12 to 30 percent slopes map unit. Conservation planners and the public can use the improved data to make better, more informed decisions about their land.

Soil Health and Cover Crop Field Day

Natural Resources Conservation Service (NRCS) staff provided training in soil characteristics and biology at the Soil Health and Cover Crop Field Day (fig. 7). The Shavano Conservation District, which covers over 2.5 million acres, and the Colorado Department of Agriculture sponsored the training.

Figure 7.—An NRCS employee discussing rhizosphere characteristics, soil structure, and soil biology at the Soil Health and Cover Crop Field Day.

Understanding Near Surface Permafrost Dynamics in Alaska

The Bureau of Land Management (BLM), University of Minnesota, and Natural Resources Conservation Service (NRCS) staff are working on the Willow National Petroleum Reserve Area (NPRA) project in Alaska. The project spans nearly 500,000 acres in the true Alaskan arctic tundra in an area being investigated for resource extraction. Staff will collect the data to fulfill the project's goals of gaining a better understanding of near-surface permafrost dynamics and creating high-resolution mapping products in specific areas the BLM has outlined as most likely to be developed. The project contributes to the Soil and Plant Science Division priorities by providing certified soil survey data in an area where there currently is no published information available.

Upper Missouri River Watershed Project

Mesonet is a cooperative project between the U.S. Army Corps of Engineers, University of Montana, and Natural Resources Conservation Service (NRCS). It is a partner-driven system of networked climate observation stations that collect data to support adaptive management of farms, rangeland, water resources, and natural ecosystems with the aim of building resilient and sustainable agricultural, economic, and ecological systems. Mesonet provides critical characterization data for improving soil survey data products in Montana and Wyoming. The closely spaced stations monitor weather, soil moisture, and vegetation response. Near real-time data is transmitted by cellular signals for viewing online through the Montana Climate Office.

In fiscal year 2024, NRCS staff collected soil samples to a depth of 100 centimeters at 19 sites in eastern and central Montana and at 5 sites in Wyoming (fig. 8). Laboratory analyses will include particle-size distribution and rock fragments, bulk density, soil moisture, water content, carbon, cation-exchange capacity, base saturation, salt, soil pH, carbonates, phosphorus, and clay mineralogy.

Figure 8.—An NRCS employee collecting bulk density samples at a Mesonet site.

Kellogg Soil Survey Laboratory Data Essential to Customers

Natural Resources Conservation Service (NRCS) staff from the Kellogg Soil Survey Laboratory (KSSL) maintain and deliver the National Cooperative Soil Survey (NCSS) Characterization Database. The database is a comprehensive soil laboratory dataset of chemical, physical, and mineralogical properties from over 75,000 sample sites, which are the result of 120 years of inventorying soils of the United States and its Territories. A range of customers, including farmers, ranchers, internal USDA staff, other Federal agencies, nonprofit organizations, local governments, and university partners use the database.

NRCS staff use the database to support soil survey classification, soil interpretations, dynamic soil property inventory, land management decisions, and soil health assessment and monitoring. Conservationists use the data to help determine the effectiveness of the Environmental Policy Integrated Climate model, Revised Universal Soil Loss Equation, and conservation practices.

To continue improvements of the NCSS Characterization Database, the KSSL participates in the Food and Agriculture Organization, Global Soil Partnership, and Global Soil Laboratory Network. These partnerships facilitate harmonization of methods of analysis and standards for laboratory quality control and increase capacities of laboratories worldwide to perform soil analysis.

High-Quality Pollinator Information

Staff from the Natural Resources Conservation Service, Agricultural Research Service, Animal and Plant Health Inspection Service, Environmental Protection Agency, United States Geological Survey, and Xerces Society and researchers at the University of Sussex (United Kingdom) finalized the pollinator information shown on the Plant List of Attributes, Names, Taxonomy, and Symbols (PLANTS) database. The deployment of the pollinator information will represent a significant advance in the PLANTS data that will help conservation planners better manage pollinator habitat.

Oregon White Oak Ecological Site Project

Staff from the Natural Resources Conservation Service (NRCS) are working on the East Cascades White Oak ecological site project that focuses on updating 11 ecological sites in the East Columbia River Gorge of Oregon and Washington. The project's goal is to refine and update oak and oak woodland ecological sites within Major Land Resource Area 6 (Cascade Mountains, Eastern Slope) of Oregon and Washington due to high-priority conservation activities and wildlife habitat improvements. The Washington Department of Natural Resources, U.S. Forest Service, Oregon Department of Forests, and Confederated Tribes of Warm Springs will install climate and soil moisture and temperature loggers at four locations in the area to help with the ecological site project.

Invasive Plants of the Caribbean

Staff from the Natural Resources Conservation Service (NRCS) and Effective Environmental Restoration (EER), a nongovernmental organization located in Cabo Rojo, Puerto Rico, worked with the Centre for Agriculture and Bioscience International (CABI) in London to modernize and expand the information in the Plant List of Attributes, Names, Taxonomy, and Symbols (PLANTS) database regarding invasive and noxious weeds, especially in the Caribbean area, which is an underserved region. The group completed 36 invasive species fact sheets, as well as a list of over 5,000 species of plants that

are invasive or potentially invasive in the Caribbean. NRCS staff are reviewing the information provided by CABI and EER for eventual inclusion in PLANTS. In addition, NRCS staff have expanded this effort by reviewing data from the National Herbarium (Smithsonian Institution), as well as other herbaria, to develop a draft list of the over 12,000 species of seed plants from the Caribbean region.

National Resources Inventory Field Data Collection

Natural Resources Conservation Service (NRCS) staff assisted with Natural Resources Inventory (NRI) field data collection in Montana, Washington, and Colorado (fig. 9). For NRI, staff collect and produce scientifically credible information on the status, condition, and trends of land, soil, water, and related resources in support of efforts to protect, restore, and enhance the lands and waters of the United States. This work provides long-term data to support climate resilience and resistance modeling and long-term trend predictions.

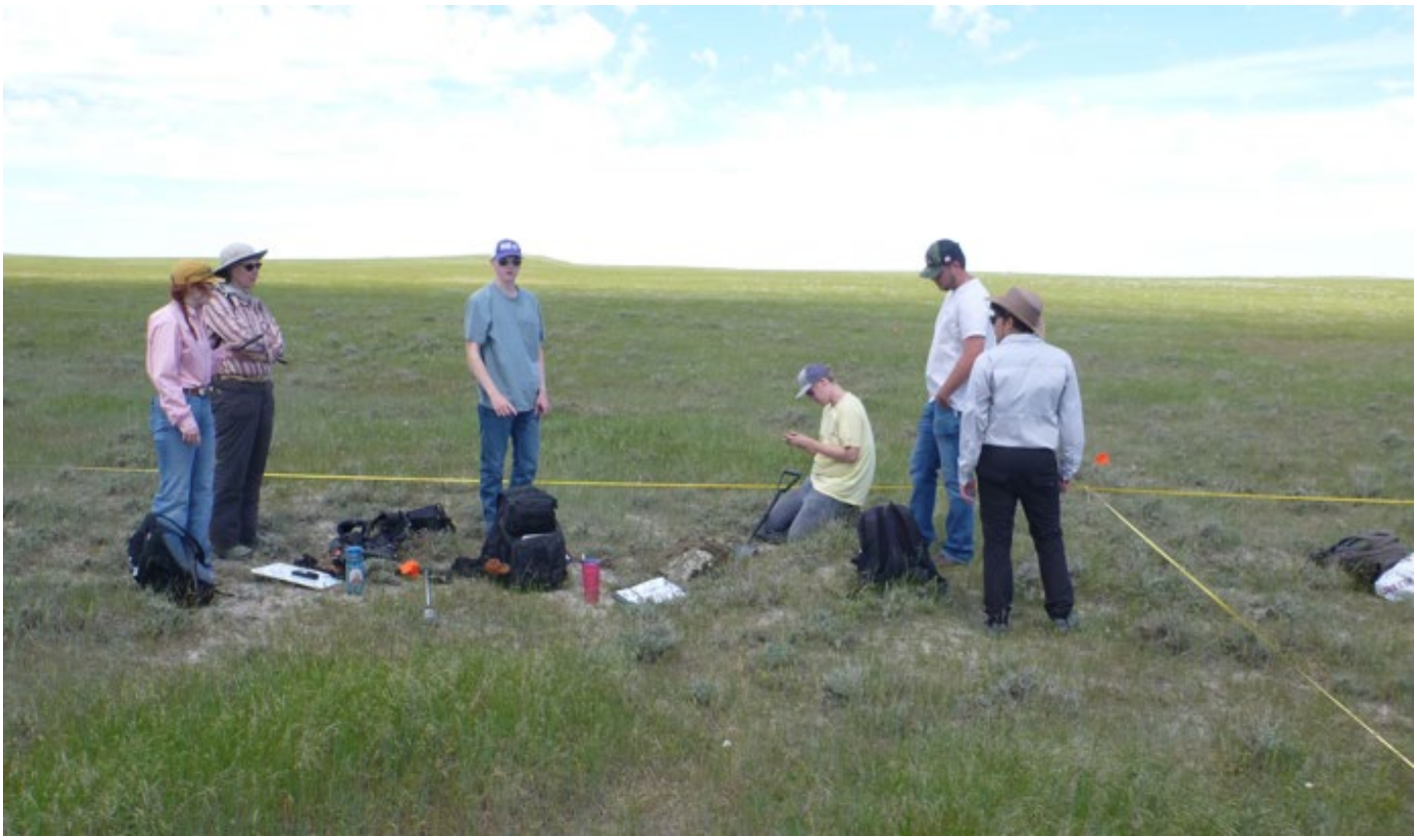


Figure 9.—NRCS staff complete NRI sampling in Carter County, Montana.

Dynamic Soil Property Investigation on the Tennessee State Soil

Natural Resources Conservation Service (NRCS) staff are studying dynamic soil properties on cropped Dickson soils to understand the soil functions and changes occurring because of land use and management changes. Dickson, Tennessee's state soil, is a benchmark soil that covers over 600,000 acres in Tennessee and plays a vital role in agriculture. Most of the Dickson soils have historically been and are currently used for production agriculture. According to the University of Tennessee Institute of Agriculture, Tennessee is set to lose over 2 million acres of agricultural land by 2027.

For this soil survey project, NRCS staff described soil profiles, collected infiltration rates, and gathered samples to determine bulk density and aggregate stability. They also interviewed the landowners to understand the management systems and practices in place over the last 5 years. Data collection and interpretation of dynamic soil properties on these sites will continue into fiscal year 2025.

Ecological Site, Rangeland Health, and Rangeland Inventory Training

Natural Resources Conservation Service (NRCS) staff trained Montana NRCS staff to identify ecological sites, interpret indicators of rangeland health, and conduct rangeland inventory. The students included 20 conservation planners from field offices in the Great Falls, Montana, area. The training had three key outcomes: educating conservation planners on using ecological site descriptions for conservation planning, interpreting state-and-transition models, and assessing resource concerns using indicators of rangeland health (fig. 10).

Figure 10.—NRCS and Montana NRCS conservation staff discuss indicators of rangeland health in the field as part of their training.

Assisting with Conservation Efforts of Apalachicola Bay, Florida

In September 2023, the Natural Resources Conservation Service (NRCS) received a letter from stakeholders and managers of Apalachicola Bay and the Apalachicola National Estuarine Research Reserve (ANERR) in Florida requesting a coastal zone soil survey (CZSS). In the letter, ANERR Research Coordinator Jason Garwood stated,

> It is difficult to express in words how valuable a system-wide soil carbon survey would be to the Apalachicola Bay system. Although a basic survey is the main interest for ANERR and its stakeholders, we were able to quickly gather additional interest for other datasets that could be extracted from these surveys.

The CZSS of the Apalachicola Bay system will encompass Apalachicola Bay, East Bay, St. George Sound, and St. Vincent Sound (fig. 11). Cooperators will use the CZSS data to determine sedimentation rates, biological activity, and the amount of soil carbon in the estuary. The soil survey information is important for planning conservation restoration efforts, aquaculture farming, and other land use decisions in response to climate changes and variability.

Figure 11.—A map of the Apalachicola National Estuarine Research Reserve.

Current and new National Cooperative Soil Survey partners working on this soil survey project include the Florida Department of Environmental Protection, Florida State University Coastal and Marine Laboratory, Florida State University, Auburn University, Florida A&M University, Pennsylvania State University, Apalachicola River Keepers, and Birmingham-Southern College.

Soil Sampling and Moisture Meter Installation at Oregon Snow Telemetry Sites

Natural Resources Conservation Service (NRCS) staff conducted full characterization soil sampling and installed new soil moisture sensors at two Snow Telemetry (SNOTEL) sites in the Cascade Mountains in Oregon. SNOTEL is an automated near real-time data collection network that provides mid- to high-elevation hydroclimatic data from mountainous regions of the western United States. A standard SNOTEL station provides snow water equivalent, snow depth, precipitation, and temperature data.

In October of 2023, NRCS staff completed work on the Roaring River SNOTEL site, and in June of 2024, they finished the South Fork Bull Run SNOTEL site (fig. 12). The addition of soil moisture sensors will modernize the existing network of Oregon SNOTEL sites. The goal is to correlate laboratory measured soil properties to other climatic and weather data, such as rainfall, snow depth, and snow water equivalent, to infer possible plant stress or drought conditions.

Figure 12.—Soil clod samples hanging at the South Fork Bull Run SNOTEL site in Oregon.

Comparing Agricultural Conditions Across Countries

Natural Resources Conservation Service (NRCS) staff continue working with Economic Research Service (ERS) staff to educate geographers and economists on the value of soils data and the proper use of the soil survey data. The ERS staff plan to adapt Pedro Sanchez's Fertility Capability Classification worldwide for use with the Harmonized World Soil Database to make valid comparisons of agricultural conditions across countries.

Assessing Impacts Along the Coast of Somerset County, Maryland

University of Maryland and Natural Resources Conservation Service (NRCS) staff are updating the National Cooperative Soil Survey data along the coast of Somerset County, Maryland. Somerset County is known for its miles of tidal bays and rivers and acres of tidal marshes along the shores of the Chesapeake Bay. Significant wave erosion and degradation as well as sea level rise have affected the county's marshes and shorelines because of their unique location in southeastern Chesapeake Bay (fig. 13). The erosion and degradation have caused changes in the morphology of Somerset County's coastline in recent years, creating a need for NRCS staff to refine the soil survey data in the county.

Figure 13.—The edge of an eroding salt marsh.

On over 1,000 miles of coastline, NRCS staff will develop a spatial shoreline for the soil survey that is consistent with National Oceanic and Atmospheric Administration's Continually Updated Shoreline Product (CUSP). The CUSP dataset delivers a continuous spatial shoreline with frequent updates to support various geographic information system applications. These applications include coastal and marine spatial planning, tsunami and storm surge modeling, hazard delineation and mitigation, and environmental studies, and they may assist in nautical chart updates.

In addition to spatial updates, NRCS staff enhanced the soil map unit information in the National Soil Information System, or NASIS, database with laboratory data collected from over 120 soil pedons. Through a cooperative agreement with NRCS, the University of Maryland analyzed the laboratory soil pedons. The spatial and tabular soil survey information is now available on Web Soil Survey.

Special Soil Investigation for an Alaska Native Regional Corporation

During the summer of 2024, Natural Resources Conservation Service (NRCS) staff received a request to visit a potential building site for Ahtna, Inc., which is 1 of the 13 Alaska Native Regional Corporations established by Congress under terms of the Alaska Native Claims Settlement Act of 1971. The team visited four separate locations to collect full pedon descriptions and soil samples for laboratory analysis. After the field visit, NRCS staff provided Ahtna, Inc., with a custom report of the soil chemical and physical properties of the sites.

Tropical Agricultural Suitability

Soil and Plant Science Division staff have modeled tropical agriculture suitability using the soil survey database. Staff have developed the criteria to use in the models and tested the results against the plant performance they have seen in the field. Currently, models for plantains, coffee, and cocoa are available on Web Soil Survey.

Lake Mattamuskeet National Wildlife Refuge in North Carolina Requests Technical Soil Services

In fall of 2023, the Lake Mattamuskeet National Wildlife Refuge (NWR) requested technical soil services from Natural Resources Conservation Service (NRCS) staff to understand potential causes for a swan mortality event that occurred at the NWR. Autopsies had shown that some swans had died due to lead toxicosis, a lethal ingestion of lead.

Lake Mattamuskeet is the largest natural lake in North Carolina with over 40,000 acres of historically significant waterfowl habitat and fishing, recreational hunting, and birdwatching area. It is managed by the Lake Mattamuskeet NWR, a series of NWRs in eastern North Carolina focused on providing habitat and forage for waterfowl migrating south along the federally recognized Atlantic Flyway.

The impoundment where the event occurred was historically used for waterfowl hunting as early as 1934 when it was acquired by the Federal Government. Waterfowl hunters used lead shot in the area before the ammunition was outlawed federally in 1991 due to concerns of negative impacts on waterfowl populations and the overall health of the environment.

NRCS staff collected soil cores (fig. 14) and conducted two transects where recent cleaning of the ditches had potentially exposed relict lead shot and another transect where it was not ditched. They took soil samples at a depth of 0 to 15 centimeters and from 15 to 30 centimeters. Staff chose these depths because most waterfowl forage only to a depth of 15 centimeters while swans are capable of foraging to a depth of 15 to 30 centimeters. Each sample was analyzed in triplicate with a portable X-ray fluorescence unit to determine elemental analysis. The readings focused on bismuth and lead. Bismuth, steel, and tungsten replaced lead shot after it was outlawed, so the bismuth reading was of interest to the NWR.

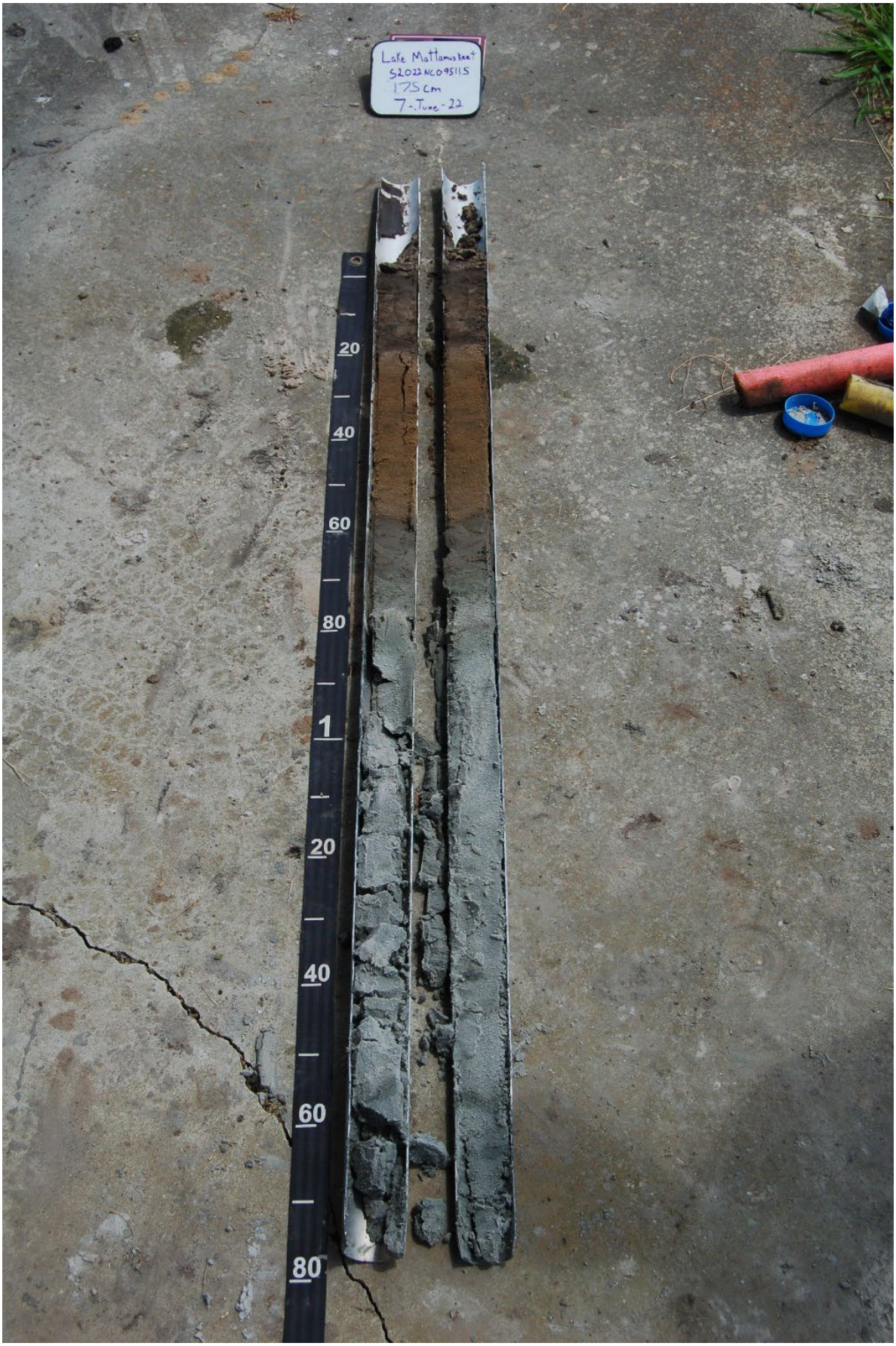


Figure 14.—An open soil core from Lake Mattamuskeet in North Carolina.

Oregon Snow Telemetry Soil Sampling

Oregon Water Resources Department, U.S. Forest Service, Oregon State University, Northwest Climate Hub, and Natural Resources Conservation Service (NRCS) staff installed soil moisture and temperature sensors and collected soil samples at three Snow Telemetry (SNOTEL) sites in Oregon. In October 2023, NRCS staff worked at the Ochoco Meadows and Derr SNOTEL locations (fig. 15). In July, NRCS staff worked at the newly constructed Irish Taylor SNOTEL site that had burned in the Cedar Creek Fire in August of 2022. This effort supported the Oregon Soil Monitoring Initiative to improve the spatial resolution of soil climate data by using existing SNOTEL stations as sites for soil monitoring.

Figure 15.—NRCS staff working at the Ochoco Meadows SNOTEL site.

Soil Data for Conservation Planning in Lincoln County, Colorado

Landowners in Lincoln County, Colorado, wanted to sign up for conservation programs with the Natural Resources Conservation Service (NRCS). However, there was no soils data to use for conservation planning. To assist with conservation planning efforts, NRCS staff mapped approximately 21,694 acres (58 percent) previously labeled as "Area not surveyed, access denied" (ANS) in the "Soil Survey of Lincoln County, Colorado." When ANS map units are listed as "not surveyed" on soil survey maps, it means the specific land within that area has not been individually examined and mapped by NRCS soil scientists, and the detailed soil characteristics for that location are unknown. As a result of this project, local NRCS field offices now have soil survey information that can be used for conservation planning.

Cooperative Subaqueous Soil Survey of Currituck Sound

At the request of the North Carolina National Estuarine Research Reserve (NERR), Natural Resources Conservation Service (NRCS) staff are completing a coastal zone soil survey project for the entire Currituck Sound (fig. 16). The work will focus on National Cooperative Soil Survey partners' priorities including sedimentation rates, biological activity, submerged aquatic vegetation (SAV) inventory and restoration, aquaculture restoration, and coastal carbon stored throughout the estuary.

Figure 16.—Scientists collecting SAV in Currituck Sound.

NRCS staff will collate existing soil resources in the project area, describe and sample soils at additional locations to supplement and maximize available soils resources, and meet with key land managers (Federal, State, and local) as needed. Land managers can use the soil survey data to better understand the subaqueous soil properties of the Currituck Sound estuary system. This data will support efforts to restore SAV and understand soil carbon distribution throughout the estuary. Refuge land managers can use the data to protect strategic areas in and throughout Currituck Sound.

This coastal zone soil survey project is a cooperative effort between the North Carolina NERR, Currituck National Wildlife Refuge, North Carolina Coastal Reserve, Albemarle-Pamlico Sound National Estuary Program, North Carolina State University, and NRCS.

Washington, D.C. Farmer's Market Event

On August 16, Natural Resources Conservation Service (NRCS) State and Soil and Plant Science Division (SPSD) staff highlighted the 125th anniversary of soil surveys with an outreach event that partnered with the U.S. Department of Agriculture (USDA) Farmers Market just outside of the USDA Whitten Building in Washington, D.C. Staff hosted six booths that highlighted the following topics: coastal zone soil survey (CZSS), soils beneath our feet, how soil surveys can help you, technology and urban soil survey, soil painting, and careers and outreach (figs. 17 and 18). A soil survey timeline poster highlighted legislative authorities and key milestones from 1899 to 2024. SPSD staff brought an airboat and parked it on the National Mall as part of the event where they showcased the soil core samples they retrieved as part of CZSS work.

Figure 17.—NRCS staff set up the airboat and booths at the USDA Farmers Market outside of the Whitten Building.

Figure 18.—NRCS staff discussing how to describe a soil core at the USDA Farmers Market outside of the Whitten Building.

Chief's Blog Article

On June 25, Natural Resources Conservation Service (NRCS) Chief Terry Cosby rolled out a success story entitled Exploration, Invention, and Evolution Still Abound After 125 Years of Soil Surveys that topped the list of national blog views in the first 6 months of 2024 with almost 13,900 views. The story not only reached audiences through Farmers.gov emails, but it was also widely received on social media with 3,200 views on X (formerly Twitter) and more than 160 shares on Facebook, including the U.S. Forest Service, Risk Management Agency, Farm Service Agency, and several State NRCS accounts.

Celebration of World Soils Day

On December 5, 2023, Alaska Natural Resources Conservation Service (NRCS) and Homer Soil and Water Conservation District staff celebrated World Soils Day with around 100 students from the Chapman School in Anchor Point, Alaska. Students from the third grade through the eighth grade learned about soil from NRCS staff who presented on soil texture, soil health, local plants and soils, and soil survey work in Alaska.

Success Story at Fort Hall Indian Reservation

Natural Resources Conservation Service (NRCS) staff worked with the Shoshone-Bannock Tribes to use the Tribes' native languages to name six new soil series identified on the Fort Hall Indian Reservation in Idaho. The new soil series are Teppi Paasiwa Tiipe, Pasa Tiipe, Tosa Neekenna, No-Sun, I Sandy, and Patapaikea'aka. In a success story and correlating video, Bryce Griffiths, NRCS soil scientist, and Nolan Brown, original territories and historical research manager for the Shoshone-Bannock Tribes, discuss how NRCS staff and staff from the tribe's Language and Culture Preservation Department worked together to select the names (fig. 19). The video and website success story were released as part of the national 125th anniversary of soil survey celebration, and the story is also featured in the 2025 Soils Planner.

Figure 19.—Bryce Griffiths (NRCS), left, and Nolan Brown (Shoshone-Bannock Tribe), right, discuss soil properties.

Natural Resources Conservation Service Makes Safety a Focus

The Soil and Plant Science Division (SPSD) joined forces with the Farm Production and Conservation (FPAC) safety and health manager to review agency policy guidelines and contribute to overall FPAC policy and safety program growth. Results of this joint effort included developing a safety equipment list, creating new job hazard and risk analysis documents, drafting a "SPSD Safety Handbook," and presenting posters at National Cooperative Soil Survey conferences (fig. 20).

Figure 20.—The Safety Focus Team created a document focusing on safe boat operation in response to the growing number of coastal zone soil surveys.

Assembling a Mid-Infrared Spectral Library

Natural Resources Conservation Service (NRCS) staff are assembling a mid-infrared (MIR) spectral library at the Kellogg Soil Survey Laboratory (KSSL). With over 500,000 specimens, the KSSL is the largest public collection of soil samples in the United States. The KSSL MIR spectral library represents almost 90,000 legacy samples from the KSSL soil archive. NRCS staff will use this library for soil survey activities and technical soil services, such as soil health investigations.

Modeling the Movement of Per- and Polyfluoroalkyl in Soils

Soil and Plant Science Division staff prepared models describing the attenuation and movement of per- and polyfluoroalkyl substances (PFAS), which are a group of chemicals manufactured and used in a wide variety of applications, and exported them to Web Soil Survey. PFAS are resistant to degradation and can be mobile in soils. Staff at soil testing programs use interpretations to help predict where and how fast these compounds might move through soils into ground and surface waters. The primary way of exposure for humans and animals is contaminated water supplies, although PFAS are also taken up by plants and eaten. These chemicals are a concern in urban and rural environments. The team continues to review soil attributes to include in the model and how each would affect the movement of PFAS.

Interpreting the Soil Suitability of Rubber Trees

Due to such factors as plant disease, supply chain disruptions, and climate change, Natural Resources Conservation Service (NRCS) staff initiated an effort to build a public and private partnership to develop a natural rubber industry in the United States. Almost all of the world's natural rubber, which is a critical component of aircraft tires, comes from the rubber tree that grows in the tropical areas of southeast Asia.

NRCS staff initially studied two rubber tree plants: the desert shrub guayule (*Parthenium argentatum*) and Russian dandelion (*Taraxacum kok-saghyz*), also known as TKS, which can grow in cooler climates. These crops require less water than many presently grown crops and may present producers with a viable alternative when water supplies are low. As part of the study, the Soil and Plant Science Division Interpretations Focus Team developed models for two rubber tree plants to indicate the best-suited soils for production. The team determined the criteria to use in the models and then assembled the coding to deliver the results.

Fleet Upgrade for Coastal Zone Soil Survey

As part of the congressionally funded initiative to complete a coastal zone soil survey of Long Island Sound, the Natural Resources Conservation Service (NRCS) acquired an improved and refined fleet of six new coring vessels (fig. 21). NRCS staff incorporated important upgrades into the new vessel design including an increase from 24 feet to 26 feet in length and 21 inches to 31 inches in pontoon height. These upgrades improve stability on the water and increase core transport security by having designated core racks with containment mechanisms around the base. They provide hardened housing for vital vessel electronics and safety equipment and offer thicker pontoon hulls to withstand high-stress environments and maneuvering.

Figure 21.—NRCS staff using a pontoon boat to conduct a coastal zone soil survey.

With NRCS staff seeing an exponential increase in the demand for coastal zone soil surveys, an increase in the size of the coring vessels and upgrading the fleet was necessary. The improved fleet provides NRCS staff with the appropriate equipment, hardware, and crew capacity needed to expand efforts and increase the efficiency of current and future National Cooperative Soil Survey projects, including those in North Carolina, Florida, New Jersey, and Delaware.

Soil Survey Data Assists Landscape Conservation Initiatives

Natural Resources Conservation Service (NRCS) staff completed a soil survey project in the Boeuf Watershed area of Ouachita Parish, Louisiana. In this area, urban sprawl is expanding into prime farmland soils, requiring an evaluation of the soil survey completed 50 years ago. For the project, NRCS staff collected over 200 pedons and assessed more than 600 historical pedons to help assemble soil map unit concepts on about 115,234 acres.

Partners and NRCS staff will use this information to conduct landscape conservation initiatives for the presence of threatened species like the Louisiana pinesnake and red-cockaded woodpecker and rare species like the Bachman's sparrow. Land managers can use the information to better understand the influence of soil relations to landform and vegetation communities on the habitats of these species.

Evaluating Air Quality Resource Concerns Around the Salton Sea in Southern California

United States Department of the Interior (Bureau of Land Management and Bureau of Reclamation) and Natural Resources Conservation Service (NRCS) staff are evaluating soils along the shoreline and shallow water areas of the Salton Sea (fig. 22). The Bureaus have reported water levels dropping in the sea due to a reduction in water caused by the reallocation of surface water to regional cities, drought, and water usage for irrigation. The low water levels have also caused health-related issues to residents and animals in the desert of Imperial County and Riverside County in California. As the exposed wind-erodible playa sediments become airborne, they produce persistent unhealthy air quality, which is an NRCS resource concern.

To examine this resource concern, NRCS staff will collate existing soil resources in the project area, describe and sample additional soil pedons, and meet with key land managers (Federal, State, and local) to address the soil survey data needs. This National Cooperative Soil Survey data is vital for developing a better understanding of the soil properties of the exposed Salton Sea playa sediments and submerged areas that will be exposed in the future. Land managers will be able to rely on soil properties, such as soil texture, to plan dust control treatments, identify where to place soil erosion controls, and determine which wetlands to strategically restore in this unique area. This soil survey data will support land managers' efforts to restore wetlands and control dust emissions on the playa now and in coming years as new areas are exposed.

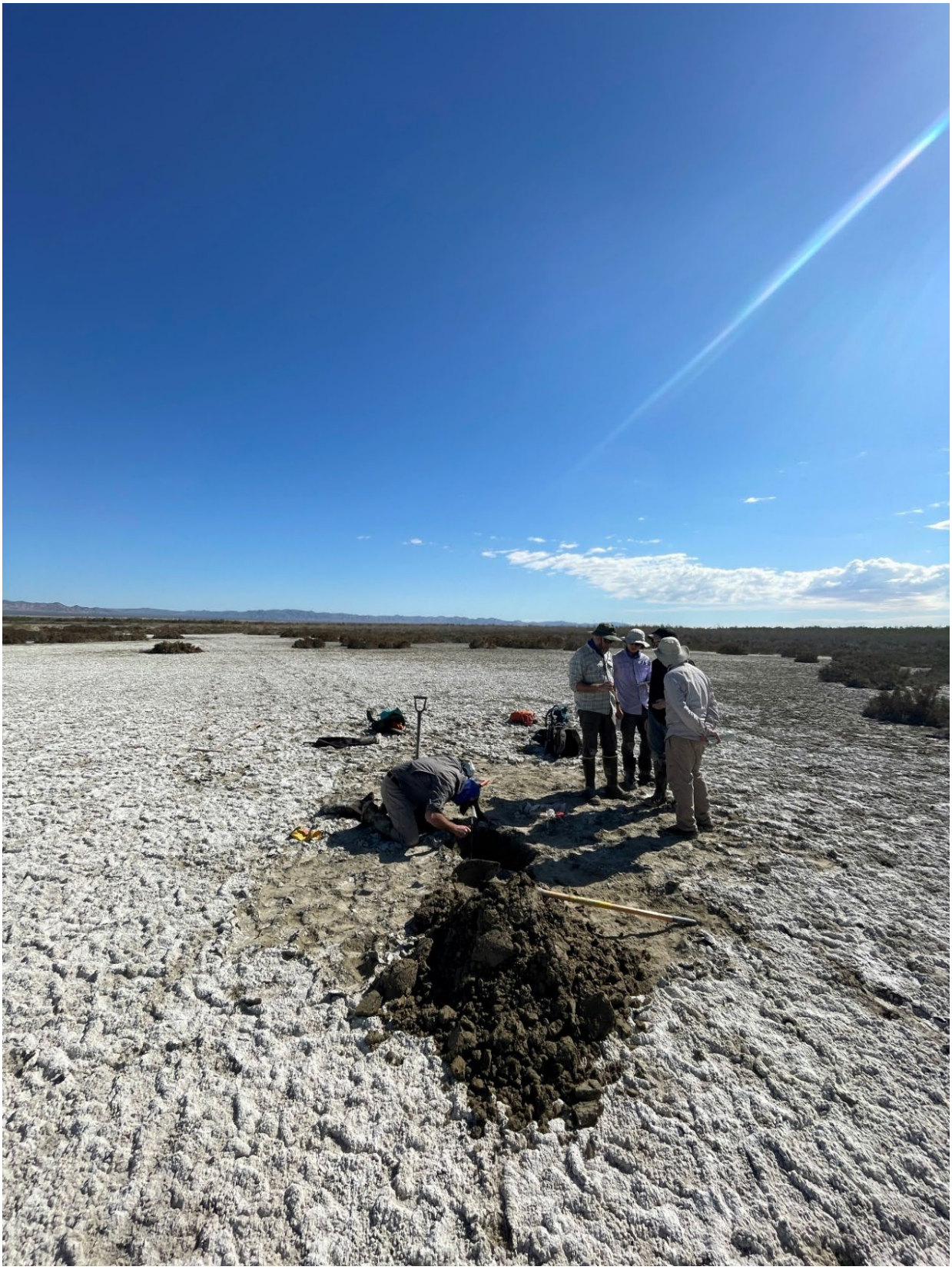


Figure 22.—NRCS staff describing a soil at the Salton Sea in Southern California.

Technical Soil Services on an Abandoned Cranberry Bog in New Jersey

The U.S. Fish and Wildlife Service (USFWS) requested technical soil services from Soil and Plant Science Division (SPSD) soil scientists to assess soils for potential restoration of an abandoned cranberry bog at the Edwin B. Forsythe National Wildlife Refuge (Forsythe NWR) in Stafford Township, New Jersey (fig. 23). The USFWS restoration plan includes restoring natural hydrology to the bog with the primary goal of restoring an Atlantic white cedar forest that is within the New Jersey Pinelands.

Figure 23.—An abandoned cranberry bog in New Jersey.

Established by Congress as the first National Reserve, the New Jersey Pinelands National Reserve is an internationally recognized United States Biosphere Reserve. It encompasses over 1-million acres of farms, wetlands, and forests, including Atlantic white cedar forests that are a critically important habitat type within this ecologically unique region. Atlantic white cedar forests were once widespread on the Atlantic coastal plain but have been reduced to approximately 20 to 25 percent of their former range because of logging, habitat destruction, and saltwater intrusion due to sea level rise.

Soil investigations by SPSD soil scientists and Forsythe NWR biologists showed organic soils with very thin layers of human-transported sands from the historic cranberry cultivation. Organic soils are ideal for Atlantic white cedar habitat and, therefore, are likely well suited for Atlantic white cedar restoration once hydrology is restored. Atlantic white cedar was already beginning to establish in areas where bog elevation was slightly higher and soil conditions relatively drier.

SPSD soil scientists gave USFWS staff a final report summarizing the findings of the technical assistance. The report provided soil interpretations of restoration potential and limitations to develop and implement a successful restoration plan based on the site's soil characteristics.

Soil Survey of St. Louis, Missouri

Natural Resources Conservation Service (NRCS) staff are working on modernizing the soil survey of the city of St. Louis to meet a high user demand for soil information throughout the city. They are currently collecting field data to document soil and ecological patterns across the landscape to develop soil interpretations and reports (fig. 24). There is a high spatial variability of soil properties in the area, so NRCS staff are using innovative methods and deploying new technology to increase the level of detail and accuracy of soil survey information.

Figure 24.—An NRCS soil scientist collecting soil samples in a residential area.

Technical Assistance at the John Heinz National Wildlife Refuge in Philadelphia, Pennsylvania

At the request of Pennsylvania State University (PSU) and the U.S. Fish and Wildlife Service (USFWS), Natural Resources Conservation Service (NRCS) staff conducted a technical soil service investigation within Darby Creek. Located in Philadelphia, Pennsylvania, Darby Creek is an impounded area of the John Heinz National Wildlife Refuge. The Refuge was established as America's First Urban Refuge in 1972 to preserve, restore, and develop a natural area known as Tinicum Marsh (fig. 25).

Figure 25.—A tidal marsh soil at the John Heinz National Wildlife Refuge.

To overcome the challenges of the area, NRCS staff used an airboat to gather soil samples in otherwise inaccessible areas. PSU and USFWS staff will analyze the samples for carbon, per- and polyfluoroalkyl substances, and microplastics. After this technical soil service, NRCS staff received a request from the Environmental Protection Agency to collect additional soil samples in Darby Creek.

Soil Survey of Raleigh, North Carolina

North Carolina Natural Resources Conservation Service (NRCS) and Soil and Plant Science Division staff are working to modernize the soil survey of Raleigh, North Carolina, an area that has experienced significant growth and alteration. Published in the 1960s, the soil survey had areas mapped as urban land and miscellaneous areas with no associated soils data. NRCS staff are developing new map unit concepts and urban soil series to recognize and identify the interpretive differences and limitations between native, undisturbed soils, and soils affected by intensive, long-term development.

Soil Survey of Ithaca, New York

Cornell University staff, local stakeholders from municipalities, nongovernmental organizations, and Natural Resources Conservation Service (NRCS) staff are collaborating to produce a soil inventory in New York to meet local needs. NRCS staff are conducting a soil survey of Ithaca, New York, and part of Tompkins County, to provide initial soil survey data for all unmapped areas. NRCS staff are analyzing soil data and using innovative technology and equipment, such as the Indicator of Reduction in Soils (IRIS) films, ground-penetrating radar, electromagnetic induction, and portable X-ray fluorescence.

Soil Inventory in the Cape Fear Estuary

The University of North Carolina Wilmington (UNCW) requested a coastal zone soil survey of the Cape Fear Estuary to better understand the relationship of subaqueous soils and per- and polyfluoroalkyl substances (PFAS) (fig. 26). Natural Resources Conservation Service (NRCS) staff conducted soil sampling and chemical analysis of the estuary to produce a coastal zone soil survey that is now available on Web Soil Survey.

UNCW staff will use the soil data to further investigate the persistence and effects of PFAS in subaquatic, high-energy environments. NRCS staff will continue soil survey inventory work on the terrestrial wetland areas in fiscal year 2025.

Figure 26.—A lighthouse at Cape Fear.

Supporting Conservation Planning for Resource Concerns in the Banana River Lagoon

University of Florida (Whitney Lab for Marine Bioscience), Florida Department of Environmental Protection, St. Johns River Water Management District, South Florida Water Management District, and Natural Resources Conservation Service (NRCS) staff completed a cooperative coastal zone soil survey (CZSS) of Banana River Lagoon (fig. 27). Cooperating agencies will use the CZSS of Banana River Lagoon and future CZSS inventories in the area to determine sources of harmful algal blooms, select subaquatic vegetation restoration sites, mitigate fish and manatee mortality events, and identify potential shellfish aquaculture restoration activities. Future CZSS inventories are set to occur in the Mosquito River Lagoon, North Indian River Lagoon, and Central Indian River Lagoon parcels.

Figure 27.—Soil cores collected in the Banana River Lagoon.

Soil Survey Project of Camden County, New Jersey

At the request of New Jersey Natural Resources Conservation Service (NRCS) and the Camden County Soil Conservation District, NRCS staff completed a soil survey project in Camden County, New Jersey, to support conservation planning and urban agriculture. NRCS staff modernized the soil mapping in the urban core of Camden and surrounding areas initially mapped in 1964. During the project, NRCS staff established 29 new soil map units and identified 3 new soil series to provide more detail for natural resource managers and food producers.

Evaluating Salt Marsh Restoration with New Jersey Bay Islands Initiative

New Jersey Bay Islands Initiative (NJBII) staff requested conservation technical assistance (CTA) from Natural Resources Conservation Service (NRCS) staff to evaluate actively eroding tidal salt marshes in Barnegat Bay, New Jersey. As part of the investigation, NRCS staff collected soil, water, vegetation, and other resource data that is used when making salt marsh protection and restoration decisions (fig. 28).

Figure 28.—Four NRCS staff describe a vegetated tidal marsh soil.

During the CTA, NRCS staff discovered a nest of saltmarsh sparrow (*Ammodramus caudacutus*) eggs. Saltmarsh sparrows are endemic to tidal salt marshes of the Atlantic coast from Maine to Florida. The sparrows breed exclusively in the narrow, high-marsh zone threatened by destruction and degradation, underscoring the importance of preserving and restoring the marsh habitat on these islands.

After collecting the field information, NRCS staff provided a summary of the data to a design group tasked to develop a project plan for protecting and restoring the critical and fragile islands. NJBII staff will review several conservation approaches, including thin-layer placement and a living shoreline, that will provide important ecosystem services and infrastructure protection to the area.

Soil Survey of Pittsburgh, Pennsylvania

Allegheny County Conservation District, City of Pittsburgh, University of Pittsburgh, and Natural Resources Conservation Service (NRCS) staff have initiated soil survey operations in the urban core of Pittsburgh to modernize soil survey data in the Pittsburgh area. Soil survey data in Pittsburgh was originally published in 1981 and mostly ignored soil alterations related to human activity in the city. NRCS staff are focusing on areas with limited or no soils information and enhancing mapping in surrounding areas to better align with current soil conditions. Expected outcomes include modernized urban soil and ecological information that will provide more detail than the currently published data.

NRCS Chief Terry Cosby met with NRCS staff and local partners to discuss the project scope and tour urban agriculture in the city. They reviewed technical soil services data and discussed how conservation planners can use the soil data to help urban producers manage soil in high tunnels.

Community Outreach in Niagara County, New York

In August 2024, Natural Resources Conservation Service (NRCS) soil scientists and ecologists hosted an event to initiate soil survey mapping in unmapped areas of Niagara County, New York, and provide community outreach. Attendees included Soil and Plant Science Division quality assurance staff, New York NRCS soil science staff, and local high school teachers.

As part of this outreach event, NRCS staff discussed how they will provide the cities of Niagara Falls, North Tonawanda, and Lockport with certified soil survey data for areas where there is no published information available. Currently, city and county agencies and departments are working with NRCS staff to secure access and permission to collect soil data in city and state parks, cemeteries, vacant lots, and private residences. NRCS staff will use historical data, maps, and imagery to review past land uses and data gathered from boring and construction logs to map highly urbanized and industrial areas with limited access.

Investigating Soil Salinization Along the Delaware Bay Coast

Maryland Natural Resources Conservation Service (NRCS) staff requested conservation technical assistance from Soil and Plant Science Division (SPSD) staff to investigate soil salinization on thousands of acres of low-lying farmland in the coastal areas of Maryland, Delaware, and New Jersey. Producers in these areas are experiencing coastal saltwater intrusion that has resulted in reduced yields and increased mortality of corn and soybeans. Saltwater intrusion is the movement of saline water into terrestrial soils and groundwater aquifers, and it primarily results from rising sea levels and coastal storm surges.

For the investigation, SPSD staff sampled the Hammonton soil series, a common soil located along the Delaware Bay, in low-lying areas from 0 to 2.5 meters in elevation. Staff gathered soil samples to compare soil physical and chemical properties of saltwater-affected cropland with those of abandoned saltwater-affected cropland and a reference state of cropland not affected by saltwater intrusion. SPSD staff investigated if soil salinization has eliminated native vegetation (creating Atlantic white cedar “ghost forests”), degraded native ecosystems, and promoted the expansion of invasive and nuisance species, such as common reed (*Phragmites australis*), into former croplands.

NRCS soil survey information and conservation technical assistance in coastal areas like these in Maryland, Delaware, and New Jersey are critical to supporting Farm Bill conservation programs for producers whose lands are affected by soil salinization that results from coastal saltwater intrusion. Farm Bill programs support landowners with climate change adaptation plans by offering conservation easements on tidal fringe uplands as a buffer against rising sea levels.

Denver County, Colorado, Soil Survey

Natural Resources Conservation Service (NRCS) staff are actively working on the Denver County, Colorado, soil survey that includes the city of Denver. This project will contribute to the Soils2026 Initiative by providing certified soil survey data in an area where there currently is no published information available. From 2018 through 2021, NRCS staff collected field data from more than 850 sites in city parks, recreation areas, golf courses, cemeteries, greenbelts, urban gardens, and private residences (fig. 29). Through a cooperative agreement, Colorado State University students assisted with entering the field data into the National Soil Information System, or NASIS, database. NRCS staff will use the field and lab characterization information to develop soil maps that identify the degree and extent of human influence.

Figure 29.—A soil profile collected from an urban garden in Denver, Colorado.

Soil Survey of the Lower Los Angeles River Watershed, California

Natural Resources Conservation Service (NRCS) staff completed fieldwork for an urban dynamic soil property project stemming from research by the University of California, Riverside; Texas Tech University; U.S. Forest Service; Safe, Clean Water Program in Los Angeles County, California; and a nonprofit organization. NRCS staff targeted the Hueneme soil series and management practices in the lower Los Angeles River Watershed to compare dynamic soil properties under three surface treatments including classic lawn groundcover, artificial groundcover, and native groundcover. Conservation planners will use the soil data to better plan urban conservation practices.

Soil Science Society of America Tour

Natural Resource Conservation Service (NRCS) staff hosted a tour of anthropogenic soils as part of the Soil Science Society of America's International Annual Meeting in St Louis, Missouri. Participants from across the United States and other countries took part in a tour of human-altered soils and discussed methods soil scientists use to map urban soils.

During the tour, NRCS soil scientists presented information about the proposed Artesols soil order and demonstrated new technologies soil scientists use to describe and map urban soils. They also discussed the importance of providing urban land users and managers with soil survey mapping, soil property data, and ecological site information. Finally, they described how NRCS is meeting the increased need and demand for soil information in urban areas to manage soil water infiltration, runoff, and resources for agricultural purposes, such as converting a vacant lot to a community garden (fig. 30).

Figure 30.—NRCS soil scientists speaking at the Soil Science Society of America tour.

Soil Survey of the Twin Cities Metropolitan Area, Minnesota

The University of Minnesota (UMN) and Natural Resources Conservation Service (NRCS) staff are working on a soil survey of the Twin Cities Metropolitan Area in Minnesota. NRCS contracted UMN to collect and summarize soil survey field data. In April, UMN team members hosted a project kickoff meeting. NRCS staff conducted an initial field review in June to address expectations and review standards. In August, NRCS staff visited numerous sites with UMN team members to provide on-the-job training and meet with partners to assemble a list of agreed-to items to steer future work on this project. With the first field season complete, the team of UMN graduate students have successfully described and characterized soils throughout the city.

Soil Survey of Milwaukee, Wisconsin

Partners from Milwaukee city and county parks and cemeteries, private landowners, and Natural Resources Conservation Service (NRCS) staff collaborated on a soil survey of Milwaukee County, Wisconsin, to gain access to properties within the 54,000-acre project area. NRCS staff have collected over 200 soil descriptions (fig. 31) by using a data-driven approach to collect important data, such as field measurements of saturated hydraulic conductivity to investigate the movement of water in soil, that are challenging to quantify in urban soils. This project is part of the Soils2026 Initiative to provide certified soil survey data in an area where there currently is no published information available. When published, the soil survey information will be used by conservation planners, arboriculturists, and community and backyard gardeners to address resource concerns.

Figure 31.—Artifacts observed in a spoil area at a cemetery in Milwaukee, Wisconsin.

San Antonio Carbon Project

In 2019, San Antonio became the second major city in Texas to adopt the climate goal of net-zero carbon emissions by 2050. To assist with this goal, Natural Resources Conservation Service (NRCS) staff are collecting carbon data for the City of San Antonio Parks and Recreation and the Greater Edwards Aquifer Alliance. The data will be used to establish a baseline of carbon stocks sequestered in the soils within city boundaries. The soil survey project's objective is to complete mid-infrared (MIR) analyses of approximately 500 soil samples collected during fiscal years 2022 and 2023. NRCS staff will then create MIR calibration models for soil property estimations of soil organic carbon and inorganic carbon data.

Soil Inventory of Coal Strip Mine Land

Natural Resources Conservation Service (NRCS) staff completed the first year of a 2-year project designed to evaluate and update lands with coal mining activity, unrestored and restored, in southeastern Iowa in Major Land Resource Areas 108 (Illinois and Iowa Deep Loess and Drift) and 109 (Iowa and Missouri Heavy Till Plain) (fig. 32). NRCS soil scientists partnered with the Iowa Mines and Minerals Bureau to develop soil data products that will meet the needs of other government agencies and conservation customers. Staff are collecting soil data on unrestored and restored mine areas to develop components and map units that will aid in soil use and land planning. NRCS staff will also update the soil mapping to better delineate the coal mine areas.

Figure 32.—Mine spoil from a coal mine in Iowa.

Technical Assistance for an Aquaculture Producer in Mantoloking, New Jersey

New Jersey Natural Resources Conservation Service (NRCS) staff requested conservation technical assistance from Soil and Plant Science Division (SPSD) staff for an aquaculture producer in Barnegat Bay near Mantoloking, New Jersey. The producer's land consists of tidal salt marsh and a shallow artificial lagoon, which are used as a shelter from heavy weather when processing oysters. The lagoon has experienced sedimentation that limits use of the lagoon, and the salt marsh is degrading, including vegetation dieback and elevation loss (fig. 33).

Figure 33.—A degraded salt marsh with dieback and open water.

The producer is working with NRCS conservationists to apply for Environmental Quality Incentives Program funding to dredge the lagoon to increase its navigability. The dredged material will be used to raise the elevation of the degraded marsh and create a living shoreline to protect the marsh from further platform and edge erosion.

SPSD soil scientists evaluated the marsh soils for suitability of dredge material placement and elevation enhancement and the subaqueous soils in the lagoon for the suitability of the land application of dredge material. The soil scientists estimated the water depths in the lagoon for the New Jersey NRCS state engineer, who calculated the volume and texture of materials (sands or silts) to be dredged. SPSD soil scientists gave the conservationists a final report summarizing the findings of the investigation to develop and implement a successful conservation plan with the producer.

Congressionally Directed Spending Provides a Coastal Zone Soil Survey of Long Island Sound

On Friday, March 11, 2022, President Biden signed a bill into law authorizing congressionally directed spending for the Natural Resources Conservation Service (NRCS) to conduct and publish a coastal zone soil survey for the Long Island Sound Estuary System in Connecticut and New York. Managed by Soil and Plant Science Division (SPSD) staff, this National Cooperative Soil Survey project will provide crucial information to help manage, restore, and protect the Long Island Sound and its coastal areas.

In 2022, NRCS staff began collecting subaqueous soil cores from diverse landforms around Stonington Harbor in New London County, Connecticut. The field work progressed from east to west across the Connecticut portion of Long Island Sound and ended in Southport Harbor in Fairfield, Connecticut, in December 2023.

University of Connecticut and Rhode Island staff conducted laboratory analyses on select soil samples, including analysis of coastal blue carbon (CBC) stocks. Measurements of CBC stocks across Long Island Sound will help predict CBC sequestration rates and losses.

NRCS also contracted with the National Oceanic and Atmospheric Agency to provide topo-bathymetric data as a base map for the coastal zone soil survey. NRCS staff used this data to develop soil-landscape relationships for mapping.

Under the guidance of the SPSD, 40 SPSD soil scientists and ecologists from across the country shared equipment, expertise, and knowledge to collect over 750 data points in all four coastal counties of Connecticut. Data point collection in the field focused on shallow water estuaries, bays, shore faces, tidal creeks, tidal marshes, and tidal rivers (fig. 34). In October 2024, NRCS staff published the Connecticut Long Island Sound coastal zone soil survey to Web Soil Survey.

Figure 34.—NRCS scientists collecting tidal marsh soil samples.