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NRCS Natural Resources Conservation Service

National Soil Survey Center

Major Activities—FY 2010

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Subaqueous Soils

Submerged headlands in the Little Narragansett Bay.

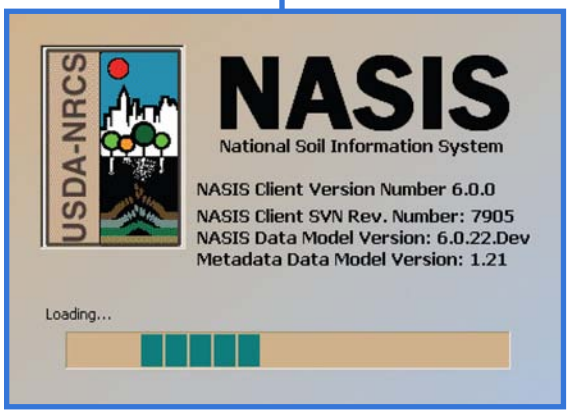
Following this year's distribution of the classification of subaqueous soils in the 11th edition of *Keys to Soil Taxonomy*, NSSC staff has been adapting mapping protocols to subaqueous soils—soils in freshwater and intertidal areas to a depth of several meters.

We do not have consistent and comprehensive baseline data for the Nation's shoreline and shallow water areas. Because of the environment in which they form, subaqueous are a good indicator of many important estuarine properties. As such, these soils can provide information about changes in water quality, past catastrophic events, changes in the type or number of organisms, and changes in sea level.

One of several proposals about subaqueous soils incorporated into the soil survey program this year is the addition of a new drainage class—subaqueous. Previously existing drainage classes did not account for the frequency and duration of wet periods that characterize subaqueous soils. This and other proposals have been incorporated into our standard methodology and NASIS data structure for distribution of subaqueous soil information through existing venues.

Also during fiscal year 2010, NSSC staff attended and supported the 2nd National Workshop on Subaqueous Soils, which focused on discussion of soil interpretations for diverse stakeholder needs, marine classification systems, and data integration with soil taxonomy, standards, ecological site recognition, NASIS, and the National Cooperative Soil Survey (NCSS) program at large. Including subaqueous soils in NCSS mapping protocol and project plans will enable precise mapping and interpretation of these ecologically and economically important areas.

NASIS Development



NSSC personnel serve as soil business area representatives who work with the Information Technology Center (ITC) to develop various components of our National Soil Information System (NASIS). Part of the NSSC role is to maintain the data dictionary (data element names and applicable choice lists) for the NASIS database and to serve as initial testers of development prototypes. NASIS 6.0 was released in March 2010. A number of training sessions

were conducted to introduce State, MO, and field personnel to the new features included in version 6.0. Most of these were conducted as distance-learning sessions.

With the release of NASIS 6.0, users are able to perform the following tasks in support of the Major Land Resource Area (MLRA) soil survey reorganization:

- Develop data for soil map units and map unit components.
- Input site and pedon data either directly or by uploading data from Pedon PC.
- Run reports and interpretations on map unit data.
- Periodically export certified data to the Soil Data Warehouse/Data Mart and Web Soil Survey.
- Manage soil survey projects and record initial mapping and soil survey update activity progress.
- Record Technical Soil Services activities.

During FY 2010, NSSC personnel also worked with the ITC to make numerous changes to the data structure in conjunction with the upcoming NASIS 6.1 release. These changes will accommodate the Rapid Carbon Assessment (RaCA) and Dynamic Soil Properties (DSP) data collection projects. Version 6.1 also addresses a number of issues found in the NASIS 6.0 software and involves a drastic improvement in data editing performance.

Spreadsheet templates have been developed for use in collecting RaCA data. Also, NASIS 6.1 users will be able to upload data previously recorded on these spreadsheets directly into NASIS, where the data are merged with pedon description data from the same sample points. Development of spreadsheets for DSP data collection is underway. It is hoped that NASIS 6.1 will be released in January 2011.

Updated Publications

In 2010, the NSSC produced the second edition of *From the Surface Down: An Introduction to Soil Surveys for Agronomic Use*. This work is available online (ftp://ftp-fc.sc.egov.usda.gov/NSSC/Educational_Resources/surdown.pdf). All sections have been updated and edited, and sections 7 ("Detailed soil information") and 8 ("Location of soil properties and interpretations") have been rewritten with emphasis on Web Soil Survey. The illustrations have been formatted and renumbered (figures 1 through 28) and placed in a new sequence in the text, a sequence that does not include "plates."

The NSSC also prepared version 7.0 of the *Field Indicators of Hydric Soils in the United States: A Guide for Identifying and Delineating Hydric Soils*. Manuscript preparation work was done by Lenore Vasilas, Technical Soils Specialist in National Headquarters, and Stan Anderson, Editor at the NSSC. This publication includes new indicators and effectively illustrates the characteristics of indicators with quality pictures. It is available online (ftp://ftp-fc.sc.egov.usda.gov/NSSC/Hydric_Soils/FieldIndicators_v7.pdf) and has been printed by the Government Printing Office.

Web Soil Survey

Web Soil Survey (WSS) initially came online in August 2005. From its inception until today, WSS has been extremely popular. The application, designed to allow users to display official soil survey information for their select area of interest (AOI), averages about 4,600 users per day nationally, with as many as 7,000 users on a single day.

During FY 2010, NSSC personnel worked with ITC personnel to enhance the application in a number of ways. The enhancements allow users to:

- Save or export their AOI boundary for later use.
- Import an existing digital boundary into WSS for use in setting the AOI.
- Save a link or bookmark to an AOI for later use.
- Embed AOI coordinates in the URL submitted to WSS.
- Enter latitude and longitude coordinates all on one line, in various formats.

Version 2.3 of WSS with these features is scheduled for release in January 2011.

Soil Ecology Branch

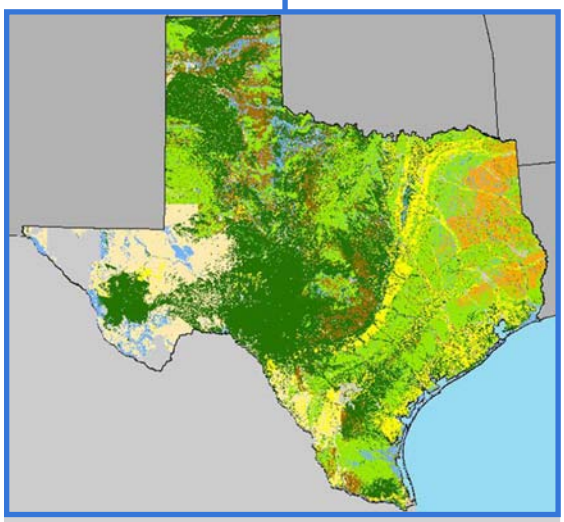
In an effort to accelerate the mapping and description of ecological sites, the Soil Survey Division created a Soil Ecology Branch to be located at the NSSC. Joel Brown was named as the acting National Leader for the new branch. In addition, SSURGO funds were set aside for the hiring of 7 quality assurance positions to be located at the MLRA-RO level and 19 quality control positions to be located at the MLRA-SSO level.

The ecological site South Sandy Slope 9-11" p.z. in a California soil survey.

Efforts in fiscal year 2010 included the naming of two ad hoc, interdisciplinary teams to begin drafting initial plans that will serve as a starting point for the branch staff in fiscal year 2011. One team was charged with developing the ecological site description workflow, particularly emphasizing quality control and quality assurance. The second team was charged with identifying the business requirements for an integrated resources database.

The other major work item for the new branch was the drafting of position descriptions for the branch staff in Lincoln and for the quality assurance and quality control positions. As staffing plans evolved, the new branch inherited soil quality and dynamic soil property responsibilities, in addition to ecological inventory. Near the end of the fiscal year, Susan Andrews was selected as the National Leader of the Soil Ecology Branch, and most of the other positions were filled or are being filled.

Custom ArcTool



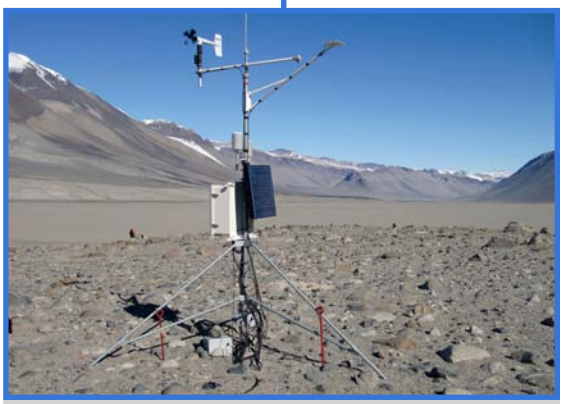
Taxonomic orders in Texas, mapped according to the dominant condition.

One of the major limitations of Soil Data Viewer is the amount of data that it will handle. This software requires that the tabular data be stored in a Microsoft Access database. In most cases, a state-wide dataset would exceed the file-size limits of this format.

Using a custom ArcTool with a state-wide or larger file geodatabase as input, it is possible to generate very large maps for use in MLRA soil survey updates and data quality control. The file geodatabase does not have the same constraints as the MS Access database.

The “Component Data Map” tool can generate and store ArcMap layer files, which will allow instant access to the data without having to run time-consuming queries each time the map is needed. The tool works by aggregating component level data using either the dominant condition or dominant component method and joining the resulting table to the spatial data. The “Component Data Map” tool can work with shapefiles, personal geodatabases, or file geodatabases. This custom ArcTool was developed at the NSSC using ArcGIS 9.3.1 and Python 2.5.

Antarctica—Soil Climate Change

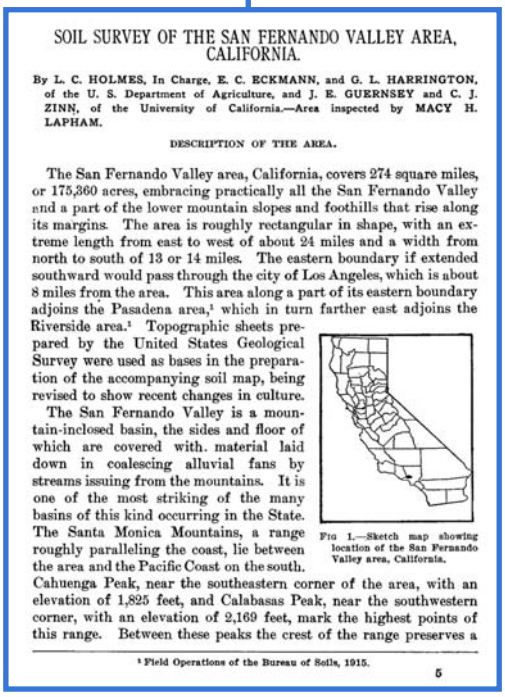


A climate monitoring station in the McMurdo Dry Valleys region of Antarctica.

The NSSC is gathering soil climate data in Antarctica, which is an area that is sensitive to global climate change. A long-term record of soil climate provides base-line information for assessing the effects of climate change and will be useful for defining normal conditions, departures from normal conditions, trends, and cyclic events. Information about soil climate change will have implications for soil management, classification, and interpretations worldwide.

During FY 2010, the NSSC characterized the liquid soil water contents in the seasonally thawed layer (active layer) from seven soil climate monitoring sites in the McMurdo Dry Valleys region of Antarctica. The results showed that water contents are low with very little recharge, are greatly influenced by the local microclimate and topography, and have no significant increasing or decreasing trend over 10 years of monitoring.

Soil Survey Scanning Projects



SOIL SURVEY OF THE SAN FERNANDO VALLEY AREA, CALIFORNIA.

By L. C. HOLMES, In Charge, E. C. ECKMANN, and G. L. HARRINGTON, of the U. S. Department of Agriculture, and J. E. GUERNSEY and C. J. ZINN, of the University of California.—Area inspected by MACY H. LAPHAM.

DESCRIPTION OF THE AREA.

The San Fernando Valley area, California, covers 274 square miles, or 175,360 acres, embracing practically all the San Fernando Valley and a part of the lower mountain slopes and foothills that rise along its margins. The area is roughly rectangular in shape, with an extreme length from east to west of about 24 miles and a width from north to south of 13 or 14 miles. The eastern boundary if extended southward would pass through the city of Los Angeles, which is about 8 miles from the area. This area along a part of its eastern boundary adjoins the Pasadena area,[1] which in turn farther east adjoins the Riverside area.[1] Topographic sheets prepared by the United States Geological Survey were used as bases in the preparation of the accompanying soil map, being revised to show recent changes in culture.

The San Fernando Valley is a mountain-inclosed basin, the sides and floor of which are covered with. material laid down in coalescing alluvial fans by streams issuing from the mountains. It is one of the most striking of the many basins of this kind occurring in the State. The Santa Monica Mountains, a range roughly paralleling the coast, lie between the area and the Pacific Coast on the south. Cahuenga Peak, near the southeastern corner of the area, with an elevation of 1,825 feet, and Calabasas Peak, near the southwestern corner, with an elevation of 2,169 feet, mark the highest points of this range. Between these peaks the crest of the range preserves a

FIG 1.—Sketch map showing location of the San Fernando Valley area, California.

[1] Field Operations of the Bureau of Soils, 1915.

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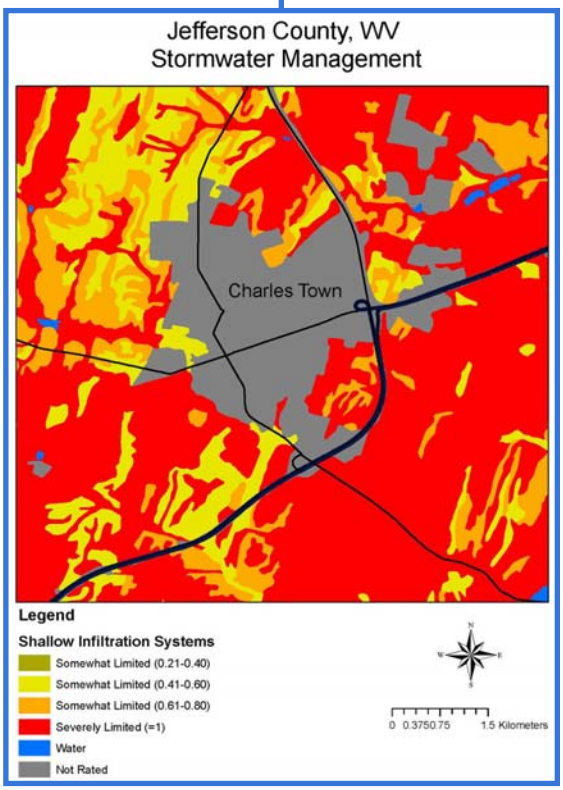
The NSSC coordinates and reviews two scanning projects. The first of these started with surveys with publication dates of 2000 and worked backward in time. The scanner, a contractor in Omaha, sends scans of text and maps to the Geospatial Research Unit in Morgantown, West Virginia, where they are assembled into PDF files. These files are reviewed by editors at the NSSC and are then posted to the Web. About 1,730 surveys have been scanned by this project. These date back to 1975. During fiscal year 2010, about 290 of these surveys were posted.

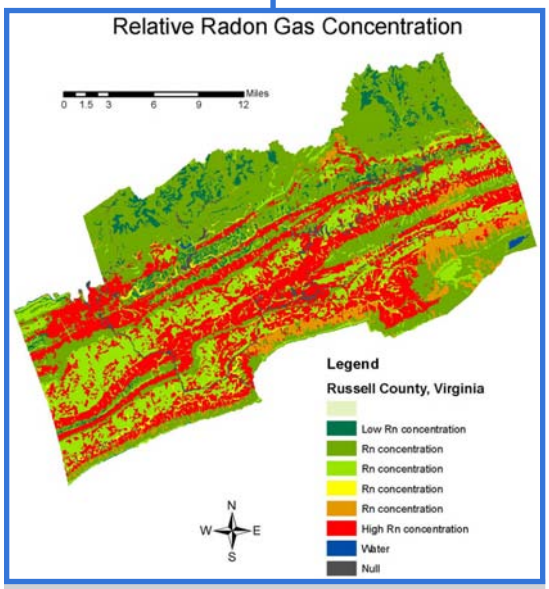
The other scanning project works forward in time, starting with surveys published in 1899. The National Cartography and Geospatial Center in Fort Worth scans these surveys, and editors at the NSSC review them, ensuring that they are ready to be posted to the Web. About 75 of these surveys have been reviewed, mostly in fiscal year 2010.

West Virginia Stormwater Management Interpretations

A suite of stormwater management interpretations was developed at the NSSC in 2010 for the West Virginia Department of Environmental Protection, in collaboration with the Agricultural Research Service's Appalachian Farming Systems Research Center, the West Virginia Natural Resources Conservation Service, and the University of Akron. Recent revision of stormwater management regulations require all municipalities to ensure that systems are in place, so that a 1-inch precipitation event does not generate runoff from new development. The kinds of systems addressed are deep infiltration, shallow infiltration, lined retention system, and unlined retention system.



Radon Gas Content in Soils

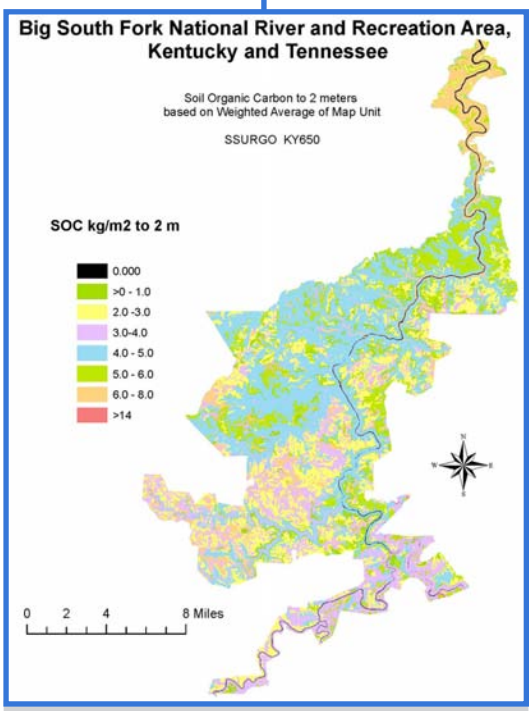


Prototype model output depicting the relative radon content of the soils in Russell County, Virginia.

An interpretation initiated at the NSSC in 2010 is being developed using the soil survey database (NASIS) to model the radon gas content of soils at the soil survey area geographic database (SSURGO) scale. Radon gas in homes is recognized as a leading contributor to lung cancer in the United States. Being able to approximate the radon content of soils will assist in planning for mitigation during home construction and will help to make people aware of a potential hazard in existing homes. The prototype model uses scientific research findings applied to the soil properties in the database, including pedon information. The major contributors to the content of radon gas are organic coatings, oxide films, and the parent material. Soil water content and porosity moderate the flow of the gas.

Liaison to the National Park Service (NPS)

NSSC employees worked with many of our National Cooperative Soil Survey partners during fiscal year 2010. For example, they helped to develop computer methods to derive and report baseline soil carbon stocks for all 272 properties included in the National Park Service Soil Resource Inventory. They also provided onsite soil training to NPS employees and technical review of NPS soil surveys.



Map of the soil organic carbon inventory.

Training

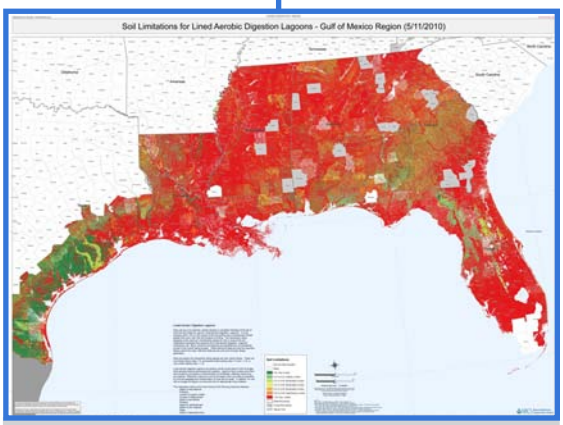
Students from the Basic Soil Survey class.

During fiscal year 2010, the NSSC provided training opportunities to 619 soil scientists, 309 in classrooms and 310 via distance learning. The training included:

- NASIS 6.0
- Rapid Carbon Assessment
- Soil Geomorphology Institute
- Digital Soil Survey Data Editing
- Digital Soil Survey Data Management
- Management of Soil Survey by MLRA
- Soil Correlation
- Technical Soil Services
- Basic Soil Survey Field and Lab
- Advanced Hydric Soils (held in New Mexico to address issues unique to the Southwest)
- Application of Soil Data Viewer and ArcGIS to Technical Soil Services
- Soil Technology—Measurement and Data Evaluation
- Remote Sensing for Soil Survey Applications

The NSSC also prepared a new long-range Soil Survey Division training plan and developed training plans for newly employed soil scientists and for summer employees assigned to soil survey offices. These will help provide consistent training across the country. Also, more than 90 on-the-job training modules are now online which can help soil scientists as they develop training plans for new employees.

Deepwater Response



Green indicates few and red indicates many soil limitations for the development of "Lined Aerobic Digestion Lagoons." Data source is Soil Data Mart snapshot (12/30/2009) 10 meter gridded SSURGO.

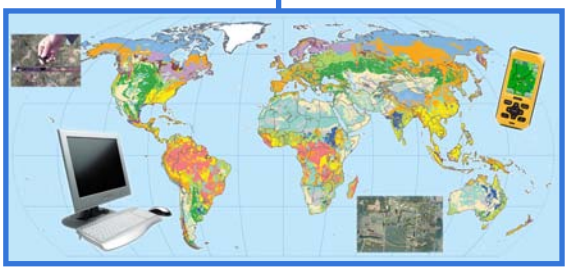
Soil Survey Division staff in NHQ and the NSSC (Lincoln, Nebraska, and Geospatial Research Unit in Morgantown, West Virginia) responded to the Gulf States Oil Spill Event/Incident called "Deepwater" on May 4, 2010. Over a period of 9 days, about 28 map and GIS data products were prepared using the newly minted gridded SSURGO (10 meter resolution) R&D GIS data and other related information, such as National Land Cover Database (NLCD 2001) and Protected Areas (http://www.databasin.org). In addition, three new soil fuzzy interpretations were developed: ODS-Lined Aerobic Digestion Lagoons, ODS-Land Application of Oil Spill Sludge, and ODS-Lined Oil Sludge Landfill (Area). Map products were created in three views: Gulf centered (1:1,000,000 or 1:1,800,000), State centered (1:500,000), and Mississippi Delta centered (1:250,000). Also, a 50-mile buffer inland from the Gulf Coast was used to "clip" the gridded SSURGO, and several surface horizon soil property themes were prepared to support Emergency Response work in the Gulf States. Map products were delivered in hardcopy and PDF format to Chief White.

Soils Hotline

The NSSC provides support to users of a wide array of soil survey development and delivery products, including Web Soil Survey, the National Soil Information System (NASIS), the SC/OSD maintenance tool, Soil Data Viewer, PedonPC, Soil Data Mart, the Official Series Descriptions Web site, the National Soil Characterization Database, the Center's Sharepoint site, and the Center's Web site at http://soils.usda.gov.

During fiscal year 2010, the hotline staff fielded over 4,000 requests from worldwide customers seeking information or assistance on a wide variety of issues. The staff provided an extremely high level of service, resolving over 90 percent of the issues within 2 days, many on the same day or within minutes. All of the voluntarily submitted feedback was positive.

Soil Business Systems

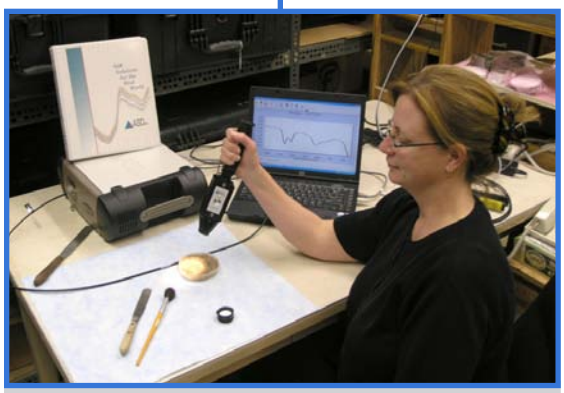


In August of 2010, David Hoover was selected as the National Manager for the new Soil Business Systems Branch. This new section of the NSSC will incorporate the functions of the West Virginia Geospatial Research Unit, Fort Collins soil business integration and development, and Lincoln computer programming and support and public presentation of data and information.

Major business functions and projects to be covered by Soil Business Systems include:

- SBAAG operations
- Web Soil Survey development
- NASIS Help Desk support
- Soil Data Mart and Soil Data Access development
- Soil Landscapes of the U.S. project
- National Soils Geospatial Database development
- Digital Soil Mapping course development
- National gridded soils data integration
- University soil lab data entry project
- LIMS and NASIS support and integrations

Soil Survey Laboratory



A technician tests one of the multiple visible-near infrared (VNIR) spectrometers procured for the nationwide Rapid Carbon Assessment project.

The Soil Survey Laboratory (SSL) is a world-class laboratory facility that supports the National Cooperative Soil Survey (NCSS) through characterization analysis of soils. In FY 2010, the SSL provided soil characterization data for 139 NCSS projects that included 1,360 pedons and 6,743 samples from 36 states and several other countries. These data were used to support mapping, interpretation, and classification decisions as well as research projects of NSSC staff and NCSS cooperators.

Additional activities of the SSL in FY 2010:

- The SSL procured and distributed visible and near infrared diffuse reflectance spectrometers (VNIR) to each MO in the conterminous U.S. to support the nationwide Rapid Assessment of U.S. Soil Carbon for Climate Change and Conservation Planning (RaCA). VNIR spectroscopy is an emerging soil analysis technology that can be used to predict selected soil properties through statistical models developed between VNIR spectra and known values of the property of interest. For the RaCA effort, VNIR spectra are being collected for horizons from about 30,000 sample points at 6,000 locations across the U.S., and these spectra will be used to predict total carbon and calcium carbonate equivalent. The VNIR spectra from these sites as well as others can also be used to predict other properties for which statistical models are available. The SSL has implemented collection of VNIR spectra as a standard analysis for all samples submitted to the laboratory, and these spectra will be the basis for prediction models for total carbon and calcium carbonate equivalent as well as other properties, including clay content, gypsum percentage, and cation-exchange capacity.

- The SSL is cooperating with the National Oceanic and Atmospheric Administration (NOAA) on a project to monitor soil temperature and moisture at multiple depths at a network of sites across the U.S. Soil samples are being collected from each site for characterization at the SSL. Similar characterization for SCAN and SNOTEL climate monitoring sites has been an ongoing activity of the SSL.

- The SSL initiated a cooperative project with U.S. Environmental Protection Agency to assess the quality of wetlands at 900 sites across the Nation. Contributions of the SSL to this project in 2010 were primarily development of sampling protocols and methods for laboratory characterization of samples from hydric soils at each site. Sample collection and analysis are scheduled for fiscal year 2011.

- The SSL is leading an effort to combine soil characterization data produced by state university laboratories with SSL data into a common National Cooperative Soil Survey Soil Characterization database. To date, characterization data from AL, FL, IL, IN, MO, OH, and PA have been incorporated and are available in the NCSS database. Data from KS, KY, VA, NY, CA, MN, ND, and AR are being assembled and checked and should be available in fiscal year 2011. The NCSS database will probably include data for about 50,000 pedons when the project is complete.

- The SSL completed revision of SSIR 45, *Soil Survey Laboratory Information Manual*, a descriptive guide to soil characterization data. This document will be released in fiscal year 2011.

Soil Survey Research

Following is a brief overview of selected research projects.

Training Rapid Soil Carbon Assessment MO coordinators on bulk density sampling techniques.

Rapid assessment of U.S. soil carbon for climate change and conservation planning (RaCA): This nationwide project has two main objectives: 1) to evaluate differences in soil carbon associated with differing soil properties, agricultural management systems, ecosystems, and land uses and apply these differences to improving existing decision support tools and 2) to develop a science-based and statistically valid baseline inventory of soil carbon stocks for the U.S. This inventory will be used to evaluate and document the capacity of U.S. soils to sequester carbon and to develop decision support tools to aid planners, policy makers, and producers with conservation planning decisions. The assessment includes an initial inventory of soil carbon stocks from existing SSURGO and laboratory data and field assessment of soil carbon stocks for horizons to 1 m using VNIR technology for soil carbon evaluations and bulk density measurements by traditional methods. The inventory will include about 30,000 sample points at 6,000 locations that represent benchmark and other important soils under different land covers, ecological states, and/or agricultural management conditions. Protocols for site selection, site description, data collection, and data storage have been developed, and sample collection and analysis are underway. Completion is scheduled for fiscal year 2011. Products from this project will include 1) a preliminary estimate of U.S. carbon stocks based on existing data; 2) a statistically valid and scientifically defensible inventory of amounts and distribution of U.S. carbon stocks stratified by soil and state of ecological site, agricultural management system, and land cover; and 3) a publically accessible soil carbon database that can be used for model validation and development.

Assessing factors of soil development and series differentiation on loess-covered landscapes: This project, in cooperation with the Carbondale, Illinois, SSO, the Illinois State Geological Survey, the U.S. Forest Service, Purdue University, and the University of Kentucky, is designed to evaluate soil properties and factors influencing soil distribution on important loess-covered benchmark landscapes. The study is being conducted on paired forested and cultivated first order watersheds and includes intensive landscape analysis, pedon sampling, and field measurement of soil hydraulic properties. This study will provide the basis for enhancing interpretations of soils in this region by developing a better understanding of soil distribution, water movement across landscapes, and the natural distribution of trace elements.

Modeling Spodosol distribution in northern Idaho: This project, in cooperation with SSOs in Moscow, Idaho Falls, and Coeur d' Alene, Idaho, and the University of Idaho, is designed to evaluate Spodosol distribution and properties in northern Idaho. Earlier soil inventories of soils

in these mountainous landscapes did not recognize the presence of Spodosols. It is anticipated that Spodosols will dominate on certain landforms that can be effectively predicted with GIS landscape analysis techniques. If landscape modeling adequately predicts distribution of this important group of soils, the distribution and associated ecosystem properties of the soils can be inventoried more accurately and efficiently.

Organic soils in ecologically important fens in South Dakota: Fens, which are wetlands fed by ground water, are on glacial moraines in eastern South Dakota and elsewhere on the Midcontinent. Because fens are ground-water discharge sites, the wetlands are rich in calcium and bicarbonate, and their soils have accumulations of calcium carbonate. The nearly permanent saturated conditions and presence of calcium carbonate in these fens result in organic soils that are non-acidic and support unique plant communities. The Redfield MLRA SSO has initiated a project in cooperation with the NSSC, South Dakota State University, and the University of Soil Dakota to evaluate the soil and ecosystem properties and hydrology of these unique soils and ecosystems. This project is expected to yield significant insights on long-term carbon sequestration (both organic and inorganic) in the understudied and poorly understood geomorphic settings of fens.

Carbon quantities and dynamics in high-altitude andic soils of the Pacific Northwest: The NCSS in cooperation with Washington State University, the University of Idaho, Oregon State University, the University of Nevada at Reno, the U.S. Environmental Protection Agency, Oregon Water Enhancement Board (OWEB), and the U.S. Forest Service has initiated a project to evaluate soil carbon quantities and dynamics and watershed management in high-altitude andic soils of the Pacific Northwest. Criteria for classification and management zone assignment are poorly defined and require refinement for assessment purposes. The project will enhance our understanding of these soils and ecosystems and aid in ongoing inventories of soil carbon stocks on these landscapes.

Prediction of P concentration in runoff: Research soil scientists at the NSSC are assessing the effectiveness of a modeling technique used to evaluate soil influences on and predict P concentration of runoff from farm fields in a watershed in southeast Nebraska. Data collected to date suggest that the technique is applicable for water-quality evaluations of small watersheds.

Hydropedological evaluations of the Shale Hills Catchment, Pennsylvania: The NSSC is cooperating with Pennsylvania State University in evaluation of the hydropedology of the Shale Hills Catchment, which has been designated by the National Science Foundation as a Critical Zone Observatory. The critical zone, which extends from the outer vegetation canopy to the base of active ground water, is that portion of the Earth that supports life and is being increasingly impacted by human actions. The objective of the hydropedological studies is to develop a better understanding of water movement in the soils and regolith on these extensive landscapes. Researchers from the NSSC are contributing to this effort through soil and landscape analysis with ground-penetrating radar and electromagnetic induction as well as traditional soil and landscape analyses.

Distribution of asbestos in soils: Research soil scientists from the NSSC are cooperating with scientists from the University of Idaho to evaluate the form and distribution of asbestos in soils. In addition to the most common asbestos mineral, chrysotile, five amphibole minerals commonly occurring in soils and rocks are known to pose a health hazard because of their size and morphology. The goal of this project is to examine the distribution and morphology of amphiboles in the sand fraction of soils using the existing NCSS soil characterization database. Preliminary evaluations suggest that the amphibole minerals are ubiquitous in soils across the U.S. Samples from the NCSS archive will be evaluated by optical, x-ray diffraction and elemental analysis techniques to quantify the composition and morphology of amphibole minerals occurring in soils. Results from the project will help to better define and clarify "asbestos" terminology for regulatory purposes when minerals occur in natural settings, as compared to when they occur in an occupational setting.

Research Publications and Presentations

In fiscal year 2010, the NSSC staff made 35 research publications and presentations available to the scientific community and the public. These include articles in scientific journals, book chapters, books, and presentations at various meetings.

Topics include the Drygyp soil series, dynamic soil properties, effect of additions of gypsum on the solubility of nutrients, effect of applications of manure on nitrogen contamination, effects of land management on soil and water quality, electromagnetic induction, fragic soil properties, geochemistry of artifactual coarse fragments, geomorphology of soil landscapes, ground-penetrating radar, loss of P by runoff from watersheds, manganese indicator of reduction in soils in a calcareous fen, pedogenesis on a low-relief plain, plinthite in soils, sampling protocols for frozen soils, the Sangamon Paleosol, the Sangamon-Loveland complex, saturated hydraulic conductivity, spodic material, soil carbon, subaqueous soils, and Ultisols.