USDA United States Department of Agriculture

NRCS Natural Resources Conservation Service

National Soil Survey Center

Major Activities – FY 2009

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Executive Summary

This report describes the major accomplishments of the National Soil Survey Center (NSSC) during FY 2009. The activities described in this report are the responsibility of the staffs at the NSSC, including Classification and Standards, Interpretations, and Soil Survey Laboratory and Soil Survey Research. The major accomplishments include:

- Providing training to NRCS and other soil scientists in mapping, correlating, classifying, and describing soils and in data collection and evaluation.
- Updating the *Keys to Soil Taxonomy*, the standard for soil classification in the U.S.
- Improving the National Soil Information System (NASIS) and Web Soil Survey (WSS), one of the agency's most popular applications.
- Improving soil interpretations that involve soil suitability for ground-penetrating radar, gypseous and organic soils, and the National Commodity Crop Productivity Index.
- Through the Soils Hotline, providing assistance to customers in the use of soil survey products, such as WSS, NASIS, the Soil Data Mart, and the Soil Data Viewer.
- Emphasizing the importance of information about soils through contacts with engineers, community planners, landscape architects, and other professionals and through contacts with students at Science Bowls.
- Providing soil survey information to the public through WSS and through projects that scan older soil surveys and post them on the Web.
- Through the Soil Survey Laboratory (SSL), providing soil characterization data for NCSS projects (125 projects and 3,905 samples in FY 2009). These data support mapping, interpretation, and classification decisions and research projects of NSSC staff and National Cooperative Soil Survey (NCSS) cooperators.
- Improving soil survey through SSL activities, such as development of the Active Carbon Kit, incorporation of all soil characterization data produced by state university laboratories, and development of a method of measuring particle-size distribution in soils that have a high content of gypsum.
- Conducting soil survey research projects. In FY 2009, these included projects involving loess-covered landscapes in Illinois, geochemical characterization data in urban areas, sample site selection in a Wyoming watershed, phosphorus in runoff in two watersheds in West Virginia, and the relationship between soil organic carbon and elevation for Humods and Orthods in Vermont and Maine.

Providing information about soils and soil survey products, improving the delivery and collection of soil data and the interpretations based on those data, and supporting soil survey through SSL activities and soil survey research projects can result in effective application of soil science and thus help to make good land management possible.

Training

The National Soil Survey Center (NSSC) delivered a comprehensive array of training to NRCS and partner agency soil scientists. Two sessions of the 3-week "Soil Geomorphology Institute" were offered. One session was held at Pennsylvania State University and the other at Alabama A&M University. In addition, one session each of "Basic Soil Survey Field and Lab," "Soil Correlation," "Advanced Hydric Soils," and "Soil Technology–Measurement and Data Evaluation" was conducted. Together, these training courses impacted nearly 200 students.

The NSSC, in cooperation with the National Employee Development Center, took advantage of innovative distance learning computer software to develop and deliver four courses. These courses were "Soil Technology–Application of Soil Data Viewer and ArcGIS in Technical Soil Services," "Management of Soil Survey by MLRA," "Technical Soil Services," and "Digital Soil Survey Data Editing and Management." Students and instructors remained at their normal work locations and participated in the course by logging on with their computer. All training was provided live and in an interactive manner. Over 300 students participated in the 16 sessions that were offered. Since no travel costs were incurred by students or instructors, a savings of over $350,000 was realized.

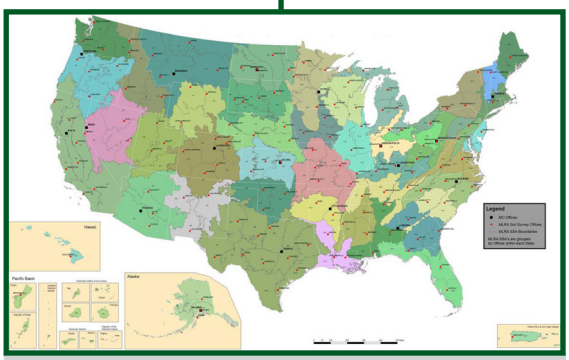
Soils Hotline

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

During this past year, our hotline staff members fielded over 3,500 requests for information or assistance on a wide variety of issues. They provided an extremely high level of service to our customers, resolving over 90 percent of the issues within 2 days, many on the same day or within minutes. All of the voluntarily submitted feedback comments that the customers submitted after working with our hotline staff were positive.

Support for MLRA Restructuring Plan

Fiscal year 2009 was the third and final year of the implementation of the Major Land Resource Area (MLRA) restructuring plan. This plan represents a fundamentally different way of conducting soil survey operations in the field as we move from making first-time soil surveys on a county (or similar area) basis to updating existing soil surveys on a physiographic basis through 145 permanent soil survey offices. NSSC staff members updated extensive portions of the National Soil Survey Handbook to reflect policy and procedure changes necessitated by the restructuring.



Map showing MO Offices and MLRA Soil Survey Offices.

In addition, the new training course "Management of Soil Survey by MLRA" was developed and delivered via distance learning technology to over 200 soil scientists. These efforts are a critical part of the successful implementation of the restructuring plan.

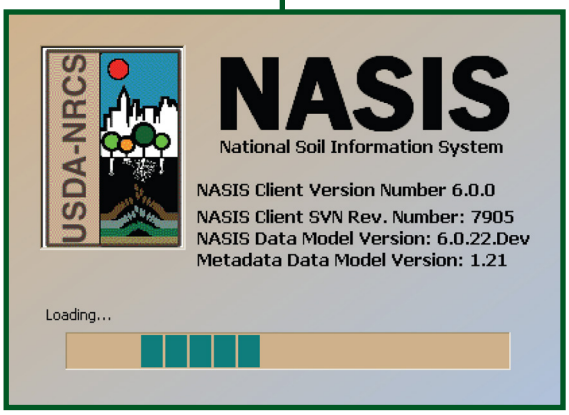
Keys to Soil Taxonomy, 11th edition

Cover picture for the eleventh edition of the *Keys to Soil Taxonomy*.

NSSC staff members completed the technical review of numerous proposed changes to Soil Taxonomy received from soil scientists throughout the USA over the last 3 years. One of the most significant changes accommodates the classification of "subaqueous soils." These soil resources have recently been recognized as critical to the management of our Nation's estuarine resources. Management issues include eelgrass restoration projects, the suitability of dredge material for use on uplands, and the use of aquaculture for shellfish production.

Extensive research and development of soil classification and mapping technology have been carried out in a number of locations, including Maine, Rhode Island, Connecticut, Maryland, Florida, and Texas. Soil scientists in these locations, in consultation with the Soil Classification and Standards Staff at the NSSC, developed the revisions to be included in the next edition of the *Keys to Soil Taxonomy*, which is expected to be released in early 2010.

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. Part of the NSSC role is to maintain the data dictionary (data element names and applicable choice lists) for the National Soil Information System (NASIS) database. During FY 2009, we worked with the ITC to make numerous changes to the data structure in conjunction with the upcoming NASIS 6.0 release.

Also incorporated were numerous proposals submitted by State and field personnel to better describe the soils in their respective areas, such as subaqueous soils and human-modified soils. NSSC personnel served as initial testers of a number of NASIS 6.0 prototypes and interacted with ITC to resolve issues raised by the new software. The software is currently undergoing final testing in preparation for deployment. New NASIS training materials are being drafted.

With the release of NASIS 6.0, users will be able to perform the following tasks in support of the 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.

Web Soil Survey

Web Soil Survey (WSS) initially came online in August 2006. 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. Daily usage continues to increase.

During FY 2009, NSSC personnel worked with ITC personnel to enhance the application in a number of ways. The enhancements include:

- A new search option to help users locate the information they desire;
- An option to download raw SSURGO data for the AOI;
- A glossary of terms used;
- The ability to tile printed soil maps to multiple pages at a user-selected map scale; and
- Use of newer, high-resolution NAIP (National Agriculture Imagery Program) color photography where available.

Development is underway for another release that will allow users to save their AOI boundary for later use or to import an existing digital boundary into WSS for use in setting the AOI.

NSSC Outreach

NSSC staff exhibited at national and international conferences during FY 2009. The exhibits were at conferences of the American Society of Landscape Architects, the American Planning Association, and the American Society of Agricultural and Biological Engineers (ASABE). This participation was part of the NSSC's ongoing outreach effort to introduce the NRCS and its Web-based soils applications to nontraditional customers. The intent of this effort is to increase awareness and use of the agency's soils information databases and to make this information an important part of the education and accreditation process for various professions and professional organizations, including engineers, community planners, and landscape architects.

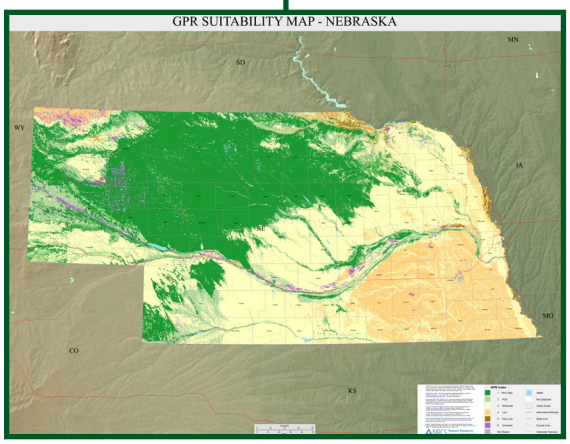
NRCS exhibitors at the international ASABE conference.

The international conference of the American Society of Agricultural and Biological Engineers (ASABE) was held in Reno, Nevada. NSSC staff members along with Nevada soil scientists Doug Merkler and Steve Herriman spent 4 days promoting the agency and demonstrating various Web-based soils applications with the use of computer workstations enhanced with plasma screens for easy viewing and learning. These "hands-on" workstations allowed visitors to use the computers to learn who we are, what we offer, and how to navigate the various online programs. The response was overwhelmingly positive, so much so that NRCS has been invited to submit a proposal to provide a "Continuing Professional Development" workshop at next year's conference in Pittsburgh, Pennsylvania.

The international ASABE conference attracted more than 1,400 participants. Of that number, 257 were from 42 foreign countries as far away as Australia, Bangladesh, Croatia, China, Ghana, India, Libya, Taiwan, and Thailand. Interaction with the international engineering community addressed the NRCS long-standing goal of promoting the National Cooperative Soil Survey as the source of the accepted standards for soil classification and interpretation.

NSSC staff members plan to continue their outreach effort with other engineering organizations, including civil, hydraulic, and environmental engineers.

Soil Suitability for GPR



The protocol for estimating the suitability of soils for Ground-Penetrating Radar (GPR) work was thoroughly revised during FY 2009. The interpretations module of NASIS is now used to make the estimation. The soil depth considered was increased from 100 to 200 cm (40 to 80 inches). The clay amount and type and the salinity criteria were adjusted to better agree with field observations. Statewide maps of GPR suitability are available online (http://soils.usda.gov/survey/geography/maps/GPR/index.html).

GPR maps aid many users, including those involved in pipeline location, investigation of archeological sites, and crime scene forensics. The maps help the user determine what geophysical tools will provide useful information on a particular site.

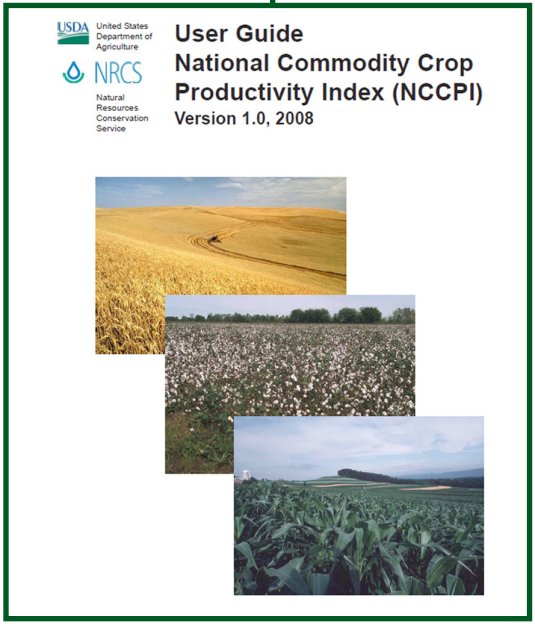
Gypseous and Organic Soils Interpretations

Soils that contain large amounts of gypsum or organic matter in one or more layers have historically caused problems in automated soil interpretations. These problems are caused by the instability of gypseous soils and the lack of dominance of the primary soil particles (sand, silt, and clay) in organic soils.


Gypsum.

During FY 2009, methodology was developed in the soil interpretations generator to allow reasonable results to be produced even if, in some instances, certain soil property data are missing or ambiguous. The results and methodology are currently being reviewed. The intent of the review is to ensure that no unintended output will be produced.

National Commodity Crop Productivity Index (NCCPI and NCCPI Irrigated)



The National Commodity Crop Productivity Index is a model for arraying the soils of the United States on the basis of the inherent capacity of the soil, climate, and landscape to foster sustainable commodity crop production. Results from the initial index, for dryland (nonirrigated) agriculture, are used by USDA, university, and agribusiness people to compare productivity across broad geographic areas. Since a large portion of American agriculture is practiced in areas where natural precipitation is insufficient for crop production, an irrigated module of NCCPI is being developed. This part of the model is currently being tested and calibrated by scientists to improve the predictive accuracy.

Both of these models use the soil, climate, and landscape data available in the soil survey database. The impact of each factor on productivity is estimated, and then the collective relationships are integrated into a rating. Soils are rated for corn, cotton, soybeans, and small grains. Statewide maps of the geography of productivity are available online (http://www.ngdc.wvu.edu/soil_survey_atlas/subpage_3/agroecology_and_soil_productivity/national_comodity_crops_productivity_index_nccpi).

Soil Change Guide

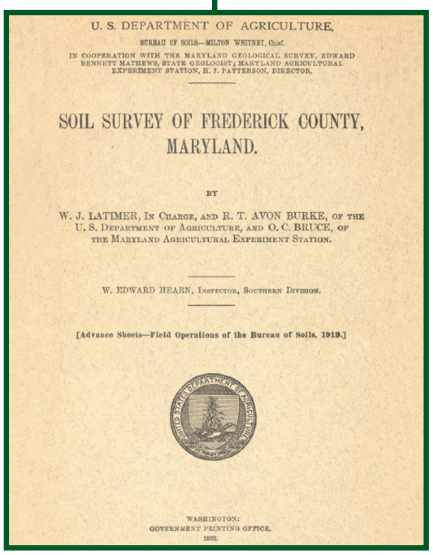
The Soil Change Guide: Procedures for Soil Survey and Resource Inventory, published in FY 2009, is designed to help soil scientists and other inventory specialists collect interpretable data about soil change within the human time scale. The guide describes a sampling system that can be used to measure dynamic soil properties for all major land uses (except for urban uses in areas where the land and soil have been significantly reshaped).

A soil scientist gathering data in the field.

It includes instructions for project planning, field execution, and data analysis and storage. Procedures for gathering general management history on croplands and vegetation data on

other lands are included to verify and validate the management regime or plant community where dynamic soil property data are collected. Vegetation data are also collected to provide context for interpreting dynamic soil properties and contribute to the interpretation of soil-plant-hydrologic interactions.

Soil Survey Publications


U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE MARYLAND GEOLOGICAL SURVEY, EDWARD BENNETT MATHEWS, STATE GEOLOGIST; MARYLAND AGRICULTURAL EXPERIMENT STATION, H. J. PATTERSON, DIRECTOR.

SOIL SURVEY OF FREDERICK COUNTY, MARYLAND.

BY

W. J. LATIMER, IN CHARGE, AND R. T. AVON BURKE, OF THE U. S. DEPARTMENT OF AGRICULTURE, AND O. C. BRUCE, OF THE MARYLAND AGRICULTURAL EXPERIMENT STATION.

W. EDWARD HEARN, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1919.]

WASHINGTON: GOVERNMENT PRINTING OFFICE. 1921.

During FY 2009, a total of 455 soil surveys were posted to the Soil Data Warehouse. Of these, about 50 were new surveys and 405 were scans of older surveys.

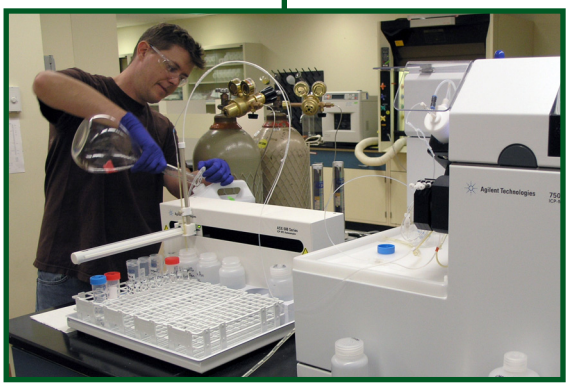
The NSSC is coordinating and reviewing two scanning projects. The first of these, initiated a few years ago, started with surveys around the year 2000 and worked backward in time. The scanner is a contractor in Omaha. This project has scanned more than 1,500 surveys. The surveys from this project that we are now posting were first printed in 1980. Thus, we have posted about two decades worth of these scanned surveys.

The other scanning project is working forward in time from 1899. This project has scanned about 50 old surveys and has another 200 surveys in queue (from 1905 to 1910). The National Cartography and Geospatial Center in Fort Worth is scanning these surveys, and the NSSC will review and post them.

Both of the scanning projects are making a historical record of the valuable soil survey work performed in the past.

Soil Survey Laboratory

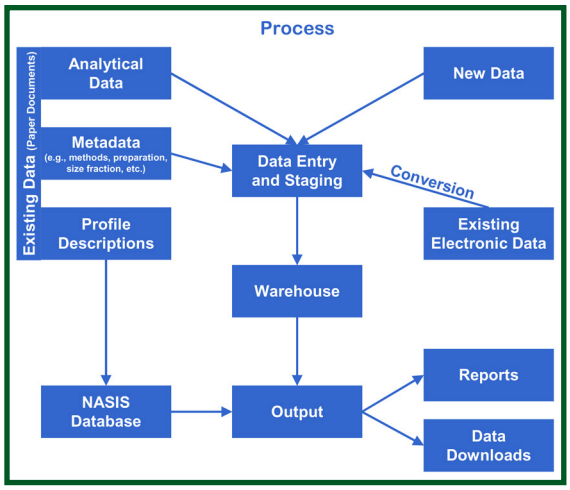
The Soil Survey Laboratory (SSL) is a world-class laboratory facility that supports the National Cooperative Soil Survey (NCSS) through characterization analysis of soils. In FY 2009, the SSL provided soil characterization data for 125 NCSS projects (3,905 samples). These data were used to support mapping, interpretation, and classification decisions as well as research projects of NSSC staff and NCSS cooperators.



Additional activities of the SSL in FY 2009:

– The SSL has developed a kit to enable measurement of active soil carbon in Soil Survey Offices (SSOs). Active carbon is the organic carbon fraction that is most biologically active and has been reported to be very sensitive to changes in soil quality. The Active Carbon Kit was developed to allow rapid measurements and thus minimize changes in active carbon during shipment to a central analytic facility. The SSL has active carbon kits available for distribution on request.

– The SSL has implemented new standard procedures to better evaluate soil quality, including particulate organic matter (POM) and beta glucosidase, a soil enzyme. Both of these soil parameters are sensitive indicators of soil quality and have been reported to be early indicators of soil improvement or degradation.



– The SSL is leading an effort to incorporate all soil characterization data produced by state university laboratories into a common database with the SSL data. To date, characterization data from IN and IL have been incorporated and are available. Data from AL, KY, VA, NY, OH, PA, CA, MN, ND, and AR are being checked before they are added to the database. It is anticipated that data for about 25,000 pedons will be available from these sources when the project is complete. When combined with the data for 30,000 pedons in the SSL database, these additional data will greatly improve the ability to derive valid aggregated data for NASIS and SSURGO.

– The SSL is leading an effort to develop, test, and implement a method of measuring particle-size distribution of soils high in gypsum. The properties of gypseous soils are not well documented because of analytical difficulties caused by gypsum. Development of new methods to characterize these soils will aid interpretation of the best use and management of these important soils.

– The SSL constructed and distributed Iron Reduction In Situ (IRIS) tubes to MLRA SSOs. IRIS tubes are widely used by NRCS, USCOE, USEPA, and state agencies for development of hydric soil indicators and identification of hydric soils. The SSL has also developed and is field testing a Manganese Reduction in Situ (MRIS) tube that is better suited for alkaline soils.

– SSL and Soil Survey Research Staff serve as liaisons between the NSSC and SSOs throughout the country. In FY 2009, the liaisons provided field assistance for characterization sampling and geomorphology, hydropedology, mineralogy, and trace element studies to 25 MLRA Soil Survey Offices. They also provided support to the SSOs through project plan review, data review, and design of sampling strategies.

Soil Survey Research

Following is a brief overview of selected research projects.

Assessing factors of soil development and series differentiation on loess-covered landscapes in southern Illinois: This project, in cooperation with the Carbondale, IL SSO, the IL State Geological Survey, the U.S. Forest Service, Purdue University, and the University of Kentucky, is designed to evaluate factors influencing soil distribution on important loess-covered benchmark landscapes. The study is being conducted on paired forested and cultivated first order watersheds with the following objectives:

- Developing a model of soil distribution on selected benchmark landscapes.
- Assessing factors controlling soil development and spatial variability.
- Evaluating variables that serve as markers of soil type, pedogenesis, and water movement.
- Evaluating natural distribution of trace elements across landscapes.

Similar studies on benchmark soils are planned or are ongoing in southern Indiana and western Kentucky. These studies 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.

Application of U.S. soil survey geochemical characterization data to urban areas: One focus of soil survey updates is urban soils, which are in areas where natural patterns of soil distribution may have been altered by anthropogenic disturbance, often with the addition or deletion of organic or inorganic constituents. Characterization of properties of soils in urban settings and analysis of chemical signatures in the soils can help to determine the source and degree of alteration, the anthropogenic history of the site, and proper interpretation of soil limitations and the best use and management. These data also allow sites to be reliably evaluated for potential contamination by trace elements through comparison with data from similar soils with natural elemental concentrations.

Evaluation of a novel protocol for sample site selection; Beaver Creek watershed, Wyoming: This project, in collaboration with WY SSO, USDA-ARS, West Virginia University, and Utah State University, is designed to evaluate the use of remotely sensed data, including high-quality Lidar, to design an efficient and statistically based sample scheme. This area was chosen because of the need for data to be used in an evaluation of sources of and potential solutions for soil and water contamination associated with coalbed methane extraction. The sample scheme that was

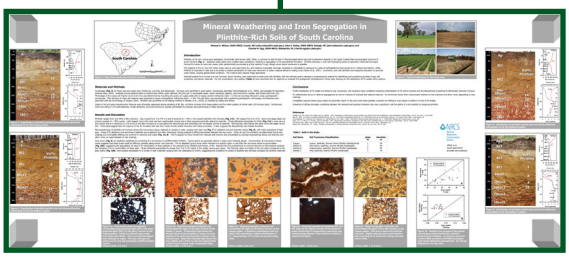
developed ensured that all landscape and environmental conditions were represented with a minimal number of samples from accessible areas. This statistically unbiased sampling protocol is applicable to other areas with similar data and will increase sampling efficiency and reliability.

Phosphorus in runoff from two watersheds in the Lost River Basin, West Virginia: The loss of nutrients in runoff from soils treated with heavy applications of manure is a major cause of poor surface water quality in the United States. The Lost River Basin has the highest density of poultry houses in the county, and most of the P-rich manure produced in the basin is applied on the land. The objectives of this project were to predict the loss of water and P from soils by runoff and to estimate the impact on water quality through use of soil survey information and a simple model. The procedure predicted total runoff, total P loss from fields, and P concentration in runoff with reasonable accuracy and was useful for identifying the soils that are most susceptible to P loss in runoff. Rapid identification of these soils and land uses allows the staff required for lengthy site-specific studies to more accurately evaluate P loss and the effects of remediation programs to be focused in areas with a high risk of this loss.

Relationship between soil organic carbon and elevation for Humods and Orthods in Vermont and Maine: This project, in cooperation with the St. Johnbury SSO, evaluated relationships between organic carbon contents of spodic horizons and landscape attributes, including elevation, in an effort to improve mapping consistency. No statistically significant or reliable relationship was found between discernable landscape features and soil organic carbon. These results confirmed that consistently separating Humods and Orthods on the landscape is difficult. This difficulty results in combinations of series representing the two suborders as similar components of a single map unit.

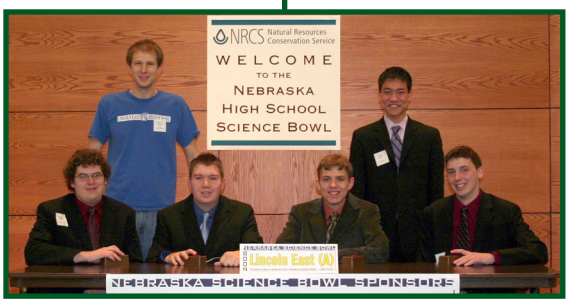
Research Publications and Presentations

In 2009, the NSSC staff effectively communicated research findings to the scientific community and the public through more than 35 research publications and presentations. These include articles in scientific journals, book chapters, oral presentations, and posters.



Topics include soil change, soil water movement, use of geophysical methods to evaluate soil properties, geochemical characterization of urban areas, characteristics of soils with high gypsum and other salts, soil sampling strategies, distribution of fragipans in loessial landscapes, fate of nitrogen and phosphorus in small watersheds, new and improved analytical methods, use of digital mapping techniques in soil survey, crop productivity indices, and changes in agricultural knowledge. Copies are available on request.

Science Bowl



Soil Survey Research and Laboratory Staff members are currently providing leadership for organizing and implementing the Junior High and High School Science Bowls. In FY 2009, a total of 40 teams participated in both events, making them among the largest Science Bowls in the United States.

The Science Bowl competitions are an effective method of introducing junior high and high school students to scientific and ecological concepts and employment opportunities. The NSSC involvement provides the opportunity to introduce these students to career opportunities in soil science, soil conservation, and related fields.