Soil Geospatial Database Enhances Soil Mapping

By Sharon W. Waltman and Daniel P. MacDonald

The National Soil Geospatial Database (NSGD) will enable the National Cooperative Soil Survey (NCSS) to deliver consistent, reliable soil information to golf course superintendents and others in a timely manner for a desired area of interest, overcoming the former county-to-county disparities.

In the past three years, the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) Soil Survey Division recognized the need to geospatially enable the traditionally nonspatial National Soil Information System (NASIS) and to implement a Major Land Resource Area–wide (MLRA region) approach to update of detailed soil survey information.

This effort requires a more institutional use of Geographic Information System (GIS) tools in the daily work of field and regional soil survey staff, compared to the current ad hoc approach.

Technically speaking, NSGD is a national collection of timely, consistent, accurate, reliable and fully attributed soil spatial layers needed to conduct soil survey operations and deliver soil data and information that meets customer's needs (data content). The transactional connection and processes between the spatial and attribute data are transparent to users during development, quality control/quality assurance, delivery and use of these data. (More can be learned about the National Cooperative Soil Survey or NCSS at http://soils.usda.gov/partnerships/).

Presently, traditional county level soil survey information is provided by NRCS to the public through the Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/), the Soil Data Mart (http://soildatamart.nrcs.usda.gov/), and Soil Data Access (http://sdmdataaccess.nrcs.usda.gov/). These sources provide useful information related to soil productivity, soil physical and chemical properties, and soil classification. Current soil survey information often possesses some disparity in attributes for similar soils between and among individual county level soil surveys. This characteristic is an artifact of the county by county approach historically used to prepare soil survey maps and manuscripts.

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The NSGD and MLRA approach to soil survey should enhance the ability to deliver consistent, reliable soil information to internal and external customers in a timely manner for an appropriate area of interest.

Because GIS applies geography to complex problems, it's a framework for understanding the relationships and interdependencies of events and conditions. The geographic approach avoids a narrow focus that often characterizes current approaches to solving problems. Though geography has been largely misunderstood and underappreciated in the United States for many decades, it is the science for understanding the physical and cultural patterns of the world.

Applying a geographic approach through the use of GIS enhances collaboration across organization by improving data sharing, workflows and communication. Managing data effectively means avoiding duplication, maintaining currency, and providing timely and appropriate access to data. Early GIS

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users struggled with the relative scarcity and expense of data. The availability of geospatial data, in terms of quantity, quality and variety, has grown exponentially. Consequently, the benefits of centrally managing this data are greater than ever."

The main idea given here is to fully utilize the geographic attributes of whatever business process is at hand. For the NCSS, it is to fully utilize the geographic attributes of soils. The access to and manipulation of the soil geography attributes (spatial objects) such as the area, perimeter, and unique identifier for soil map unit polygons will effectively accomplish the geospatial enablement of the traditional NASIS system.

These attributes involve the geometry of mapping soil polygon vectors on the surface of the earth to create published soil maps and provide geospatially related soil landscape data needed for modern scientific analysis, and the associated information gathered along the way. These associated data include the geographic coordinates of pedon descriptions and pedon laboratory sampling sites as well as vectors of soil transects of landscape segments.

It is that new soil attribute, "geography," that provides the needed context for scaling and validating consistency of field measurements to detailed soil maps, to generalized soil maps, to Major Land Resource Areas (MLRA regions) to better describe the Nation's soil resource. Geospatial Aggregation or "scaling" is the process of developing generalized soil maps (General Soil Map of the United United, also known as STATSGO2 or GSM) and in turn even broader MLRA Regions from the detailed Soil Survey Geographic Data base also known as SSURGO.

The soil geospatial objects (vector polygons, lines, points) feature-level attributes allow for assignment of GSM and MLRA region values that facilitate the geospatial scaling process. This access to feature level attribution is anticipated to assist in improving communication of various geographic concepts in the NSGD, including the linkage of pedon point measurements to the SSURGO map unit polygons.

Some of the goals of NSGD are:

- More consistent, accurate and reliable soil geographic data products.
- Scalable data model for detailed soil surveys that allows rapid response to queries from state/regional/national leaders.
- Linkage to useful GIS-based tools that provide consistent and timely evaluation of soil survey mapping.
- Seamless national soil geographic data.

In 2006, a test-bed team of national, regional and field staff were charged to research and develop the design for a science-based, geospatially integrated NSGD. This system is required to be logically accessible by USDA-NRCS staff from field to national levels for data gathering, development, manipulation, analysis and management of soil geospatial data and associated attributes as it relates to NCSS program delivery. These staffs were located across the nation.

Through testing and interview of these staffs, soil mapping workflows and an initial conceptual model were prepared. This team represents the overall NCSS staff that includes about 500 field soil scientists who are charged with the development/update of about 35 million SSURGO polygons and all associated attributes nationwide.

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