Digital Soils Data Program For North Dakota

by
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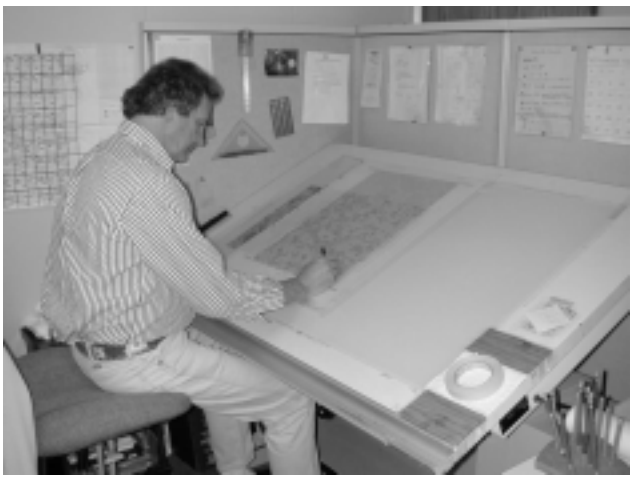
Since 1997, the North Dakota Geological Survey (NDGS) and the Natural Resource Conservation Service (NRCS) have been participating in a cooperative project to compile and digitize the soil resources of North Dakota. Prior to 1997, the North Dakota Soil Conservation Committee was the state agency involved with this project. As of today, approximately half of the acres in the state have been *compiled* and *digitized*. Twenty-six of the fifty-three counties in North Dakota have been *compiled* but only sixteen have been *certified* by the NRCS. Typically, there has been a delay of several months to a year between the time the Geological Survey completes a county and the NRCS *certifies* that county and makes it available to the general public. To help expedite the process the North Dakota Geological Survey has begun releasing digitized data to state and county agencies and consulting companies as soon as we complete them. In addition, due to difficulties in downloading these large county files from the NRCS website, the ND Geological Survey is exploring methods to download soils data for specific quadrangles to a computer disc for interested farmers either without charge or for a very nominal fee.

The NRCS determines the order in which counties will be compiled based on availability of material (photographic base) and available funding or interest expressed by a given county. When either the Geological Survey or NRCS is notified of a specific need or interest in a particular area, we attempt to prioritize that county.

This cooperative program can be grouped into six main tasks: 1) compilation, 2) editing, 3) edge matching, 4) scanning, 5) digitization, and 6) certification.

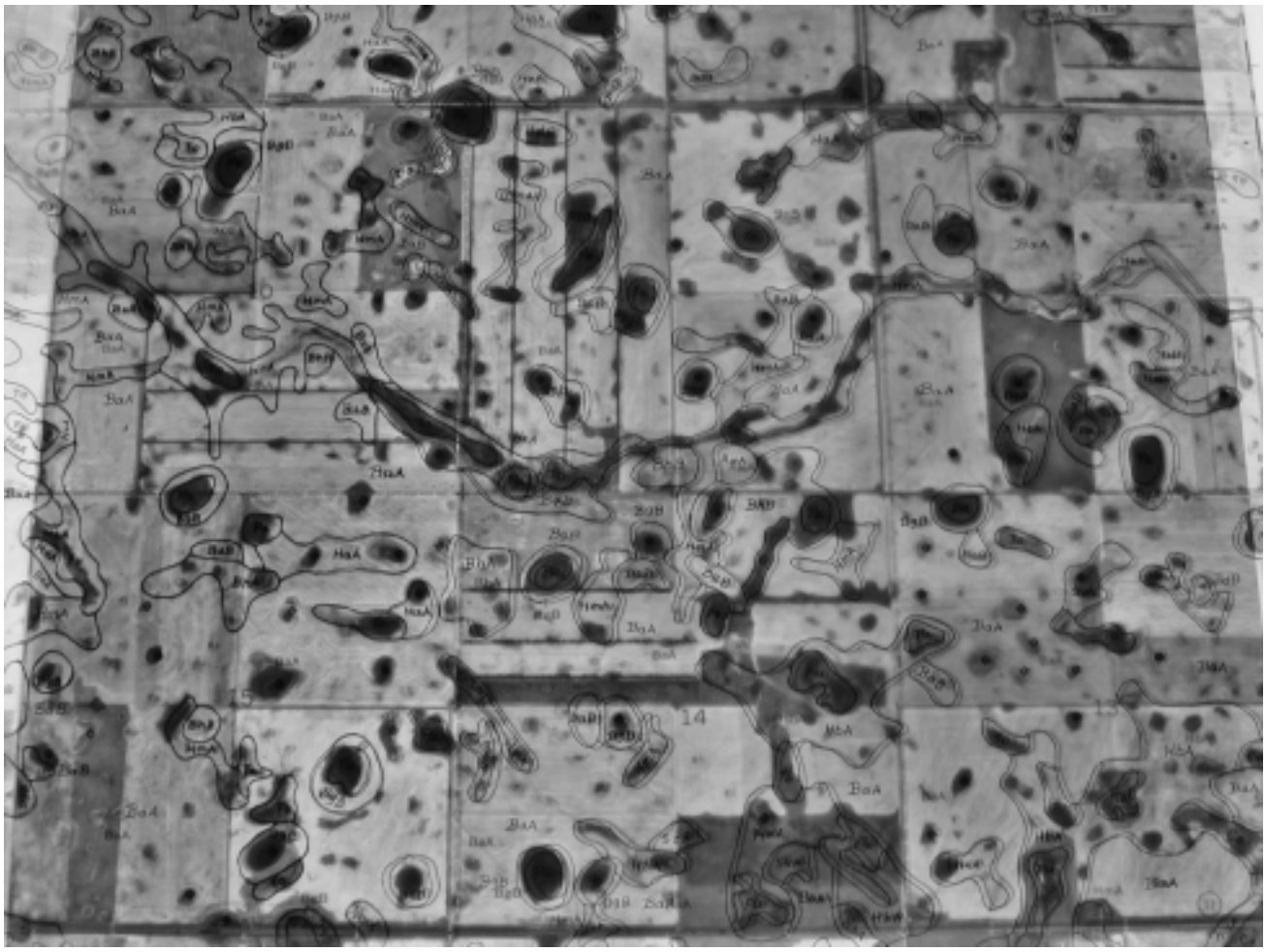
Compilation

The drafting technicians spend approximately 70 % of their time compiling. Compilation consists of transferring soil lines, symbols, and labels from an old orthophotoquad (typically these sheets are right out of the old county soils reports) onto clear mylar using a recent orthophoto quad as the base map. The recent orthophoto base is overlain by the old half-toned orthophotos which, in turn, is overlain by a clear mylar sheet. Typically, there is a ten- to thirty-year difference between the photos and that can make it difficult to line up features. Compilation must be done by hand, rather than computer-aided, because the inherent distortion between the two photo sheets require that the drafting technicians continuously shift the photos to keep them lined up–a difficult, time-consuming task.



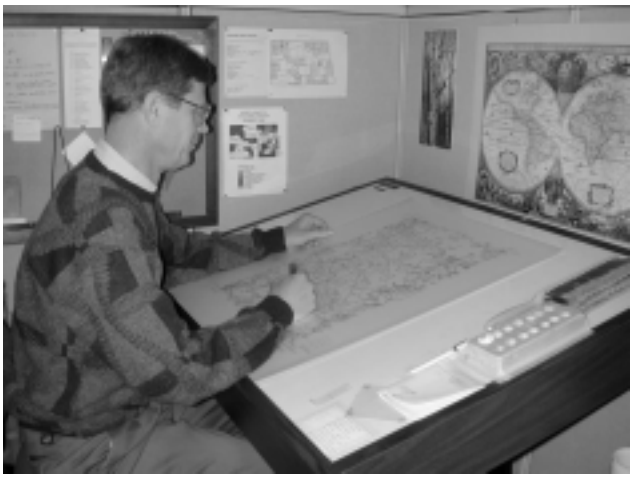
Don Thom and Sheila Glaser are shown compiling one-quarter quad sheets from Renville County.

Compilation of a quarter-quad map from Renville County. The new orthophotoquad, which goes on the bottom, is shown in the middle of the photo; the old, half-toned orthophoto has been peeled to the right, and the clear mylar sheet onto which the soil lines, symbols, and labels are transferred has been peeled to the left.



This is what the drafting technicians see when all the sheets are in place and they are compiling. Note the distortion throughout the photos, especially in the lower right-hand corner. The photos must be continually shifted to align these features.

Editing



Upon completion of the compilation phase, all sheets are thoroughly checked for line accuracy and correct label and symbol placement. An edit sheet of mylar is placed over the compiled sheet and all lines are physically retraced to insure that all polygons close correctly. The correct position of all symbols and labels is also verified. Approximately 20% of the drafting technician's job is spent editing other's work.

Bob Shjeflo is shown editing a quarter-quad sheet. Compilation is done with rapidigraph ink pens, but felt-tip pens are used on the edit sheets to save both time and money.

Edge Matching

All four edges of a sheet are aligned with adjoining sheets to ensure that all of the soil lines are properly aligned from one sheet to another. When needed, small adjustments are made so that lines connect from one sheet to another.

Steve Kranich shown edge-matching three quarter-quad sheets in Renville County.

It takes approximately three months for the Geological Survey to compile, edit, and edge-match the soil maps in an average-size county. After we complete this task, the maps are sent back to the NRCS for an edit by a soils scientist. Upon approval of the NRCS soil scientist, the sheets are sent to a private firm and the soil lines scanned into a digital format.

Digitizing

The digital scan is returned to either the Geological Survey office for completion or, occasionally, it is sent to an NRCS office in Montana to be digitized. Digitizing consists of entering all attributes (labels and symbols) into the proper place on the soil maps in the computer. The quadmaps are geo-referenced to real-world coordinates at this time so they can be used in conjunction with various other layers. The Geological Survey uses ArcInfo to digitize these sheets.

Elroy Kadrmas using ArcInfo software to digitize (adding attributes) a quad sheet in Ramsey County. Approximately 40% of Elroy's time is spent adding attributes to the digital product.

Certification

Once all the sheets in a county have been digitized they are sent to an NRCS office in Bozeman, Montana. Personnel in the Montana office edit the digital product with diagnostic software programs, make any necessary corrections, generate a county-wide soils map, and create related data tables. Once this task has been completed, the county is Soil Survey Geographic (SSURGO) certified and archived in a NRCS office in Fort Worth where it is available to the general public.

USERS OF NORTH DAKOTA'S DIGITAL SOILS DATA

Where available, digital soils data in North Dakota is used by a number of state, federal, and county agencies, geotechnical consultants, and individual landowners. John Nowatzki, Water Quality Specialist at the Extension Ag & Biosystems Department, NDSU, uses the digitized soils data to develop computerized applications of assessment systems. To date, he has developed three systems: 1) potential groundwater contamination by pesticides, 2) potential surface water contamination by pesticides, and 3) potential groundwater contamination by nitrogen. John has made 26 presentations across the state to audiences totaling 950 people and has found widespread interest in this data. In 1999, he conducted nine workshops for farmers using this data. A number of individuals have expressed interest in digital soils data to John in relationship to irrigable crops, potential crop yields, potential septic drainage problems, and in one instance an agricultural lender asked yield potentials for specific crops in order to help a farmer develop a cash flow statement. Nineteen local companies and organizations have used the maps that Nowatzki generated using digital soils data.

Some North Dakota farmers are beginning to use digital soils data to assist in precision farming, a method which integrates GPS and GIS systems to accurately, therefore economically, apply fertilizers and pesticides to a field. Landowners have also used digital soils data to explore areas suitable to grow irrigated seed potatoes as well as determine cash rent payments.

The State Land Department, along with various organizations, have used digital soils data for land assessment and grazing and range evaluations. Geotechnical consulting firms have used digital soils data for environmental assessments such as siting disposal sites and sewage systems. A number of university departments are using digital soils data in a variety of ways including as teaching tools and to assist in climate modeling. County Soil Conservation Districts use the digital soils data for planning agricultural practices on land within their counties as well as non-point source (EPA 319 program) projects. The Red River Basin Watershed Initiative (a consortium of state, federal, and county agencies) has requested digital soils data for the Red River Valley as soon as it becomes available to assist with their project. The County Tax Assessors for several counties are utilizing digital soils data at this time and at least one engineering consulting firm is currently assisting several counties with tax assessment. Pipeline companies have used digital soils data to assist in selecting pipeline corridors. Irrigation boards have used digital soils data to assess irrigation potential of areas around the state.