DIGITAL MAP COMPILATION OF THE FT. DEFIANCE SOIL SURVEY

ABSTRACT

The Ft. Defiance Soil Survey is a 3.2 million acre survey of the Ft. Defianc e Agency on the Navajo Nation. The survey was started in the mid eighties. In 2004 the mapping was complete but the maps had not been compiled. The decision was made to compile the maps digitally to save time in the compilation and certification process. The maps were scanned and rectified by a private contractor and the map unit lines were extracted to raster RLC files. This process eliminated the need to digitize each field sheet. The maps were then sent to the NRCS Digitizing Unit in Temple Texas where they were converted to vector shape files and sent back to the soil survey office. Analysis of landforms was done by draping the USGS Digital Elevation Model (DEM) over a hillshade. The shape files were checked for accuracy and any discrepancies between the field sheets and the shape files were corrected. The polygons were checked against the USGS Digital Orthophoto Quad (DOQ). Since the maps were already in digital forma t they could be checked by the State GIS Specialist immediately.

THE CONTRACT

The one hundred fifty seven field sheets were sent to Pixxures Inc. in Colorado. Each field sheet was scanned at 600 DPI and rectified using USGS-DOQQs and USGS-30 meter DEMs. The field sheets were then tiled to 7.5 minute quadrangles at a scale of 1:24,000. The resulting files were TIF files that contained data from more than one field sheet. The files were named according to the USGS quadrangle that they covered. The error measured in ground distance was not to exceed 60 meters for any one occurrence. Those errors, which were few, occurred in areas of steep relief.

Next the polygon lines were extracted from the TIFF files. This process produced raster RLC format files for each quad in the survey. The extraction process could not differentiate between the different colors of lines so all of the lines on the field sheets were extracted as black lines.

The contract deliverables were: two copies of the orthorectified images in TIFF and TFW format, two copies of the RLC files for each 7.5 minute quad area in three different threshold levels (threshold levels correspond to contrast levels and visual appearance), RMSE information for each rectified field sheet and one Mr. Sid file of the mosaiced TIFF files.

One set of these files was sent to Eric Wolfbrandt, Arizona GIS Specialist for Soil Survey and I received one copy. Mr. Wolfbrandt transferred one copy of the RLC files along with the Mr. Sid mosaic to the NRCS Digitizing Unit in Temple, Texas.

CREATING SHAPE FILES

The NRCS Digitizing Unit in Temple, Texas converted the raster RLC files to vector shape files. There were four shape files that covered the entire survey area. Each polygon was attributed with a soil ID and the shape files were clipp ed to the soil survey boundary.

Shown are the four shape files that make up the soil survey area as they were delivered by the Digitizing Unit. There were several areas that did not have polygon lines. In these areas the lines on the field sheets were t oo light to be extracted. The shape files were corrected by digitizing over the DOQ with the field sheets as a guide.

MAP COMPILATION

ArcView 3.0 was used to do the map compilation so that the Minnesota Division of Natural Resources Stream Digitizing Extension could be used. At the time, digitizing using this extension was easier than digitizing in ArcGIS. However, updates in ArcMap digitizing capabilities make that the software of choice now.

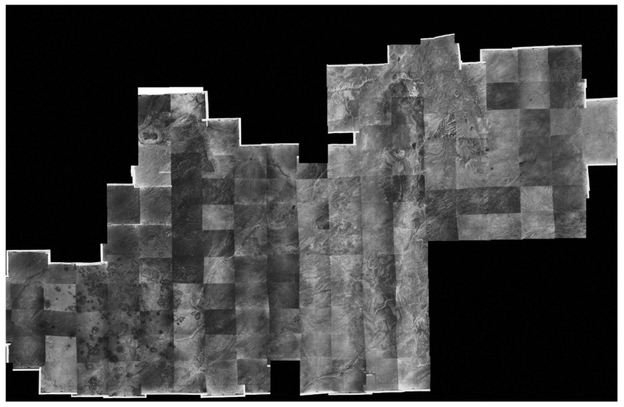
The digital soil polygon lines were checked against the field sheets to verify their accuracy and the missing polygons were digitized. Common soil lines were easily identified by the NRCS GIS Specialist and were corrected by the soil scientist. Jagged lines were also identified and corrected. Net Meeting was used to facilitate communication between the soil scientist and the GIS specialist so that the GIS specialist was able to view the maps in progress. Once the polygons were accurate, each polygon was attributed with the appropriate map unit symbol and queries were run to identify soil polygons that did not have labels. Matches with adjacent surveys were made and the lines joined to within 6 meters on the ground accuracy or better. Polygon lines between the four shape files were also joined.

Once the soil polygons were checked against the field sheets and DOQs, they were attributed, joined with adjacent shape files and all gaps, overlaps and slivers were corrected. Next, a list was generated of all of the map unit symbols on the maps. Many of the map units had been combined with other map units during the last review, but the maps had not been updated. It was easy to change those map unit symbols to the new symbols using a query in ArcView.

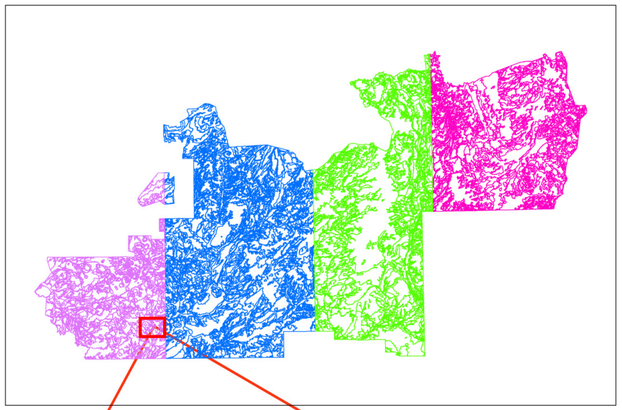
The digitizing process can create gaps between polygon lines, overlaps, and minute polygons called slivers. The GIS specialist used various tools to identify these problems and the errors were corrected. Once these were corrected the maps were checked to make sure all of the joins were attributed properly and lines were matching.

Certain errors that occur during hand compilation are eliminated by digital compilation: line quality and labels are consistent, illegible labels are eliminated, there is no broken line work, soil labels can not be placed outside a polygon and you can't have two soil labels for one polygon.

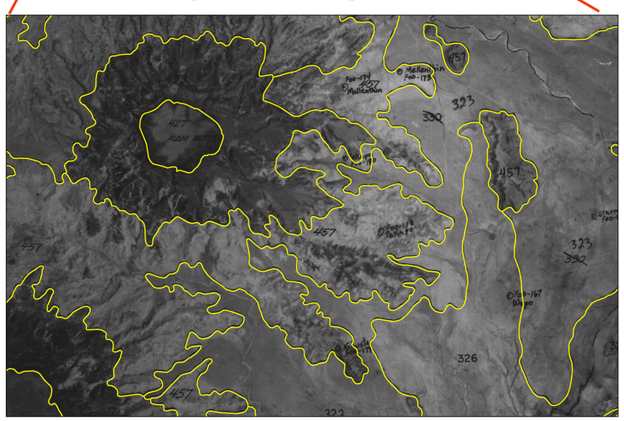
Mosaic of the Field Sheets



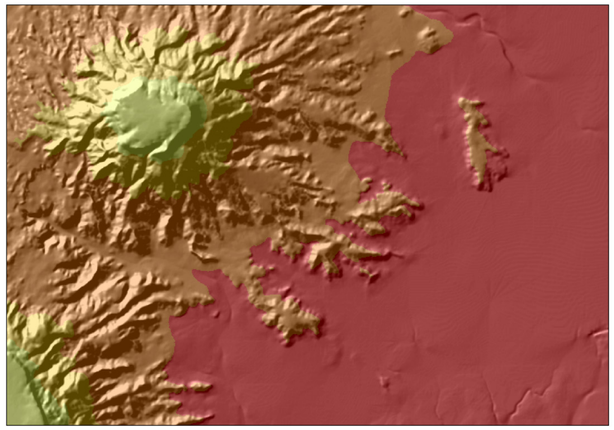
Soil Polygon Shape Files



Map Compilation



DEM Over a Hillshade

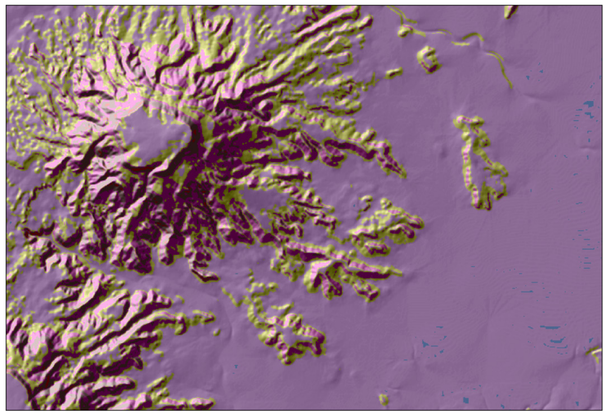


HILLSHADES

Hillshades are helpful in defining land forms. With the DEM theme selected Spatial Analyst was used to create a hillshade. The soil polygon theme was laid over the DEM which was laid over the hillshade. The DOQ was the bottom layer. By arranging the themes in this manner the DEM and hillshade could be turned on and off to show the DOQ below. This technique was used to verify soil polygon lines.

The DEM is usually stretched. To create elevation breaks the DEM was classified (layer properties, symbology) into nine elevation classes and a color ramp was chosen that illuminated the breaks in elevation. In order to see the topography of the hillshade the DEM theme was set to 30 to 45 percent transparency.

Slope Overlayed on a Hillshade

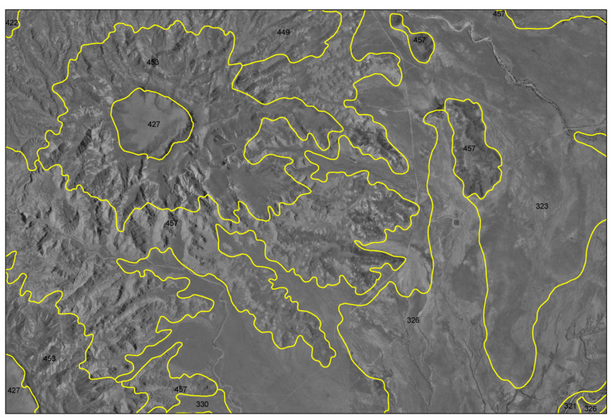


SLOPE

With the DEM theme selected a slope layer was created using Spatial Analyst (choose percent not degrees). The slope breaks were adjusted to the desired slope ranges (layer properties, symbology). Instead of using one of the color ramps, individual colors were chosen for the various slope breaks so that the change in slope could be seen easily.

The slope layer was laid over the hillshade layer and the transparency was set so that the topography of the hill shade layer showed through the slope layer. The slope theme was used to determine the range in slope breaks in the same way that the DEM was used to determine elevation breaks.

Finished Product Overlayed on DOQ



THE FINAL PRODUCT

After the maps have been checked by the State GIS Specialist they are sent back to the NRCS Digitizing Unit along with a list of all of the map units in the survey. They will mosaic the four shape files into one shape file and match the edges between the four files and the adjacent SSURGO certified surveys. Using a command in ArcInfo called “matchnode” they will snap all of the end points to create perfect joins.

After they have completed those steps they will review the file for errors. If they find any errors the file will be sent back to the soil scientist to correct. Once the file is free of errors it is sent to the State GIS Specialist for final review.

According to Chris Holle at the NRCS Digitizing center receiving the files in the RLC format saved the digitizing unit time in the beginning of the process. The majority of time in the final stages of the process is spent sending the imagery back and forth for corrections and most of the problems they have are with matching the lines. Because the data is already in digital format and the lines have been matched those steps will be eliminated. If there are corrections to be made the files can be emailed back and forth.

Certification of the spatial data will be done after the final correlation is completed.

Department of the Interior, Bureau of Indian Affairs, Navajo Region
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