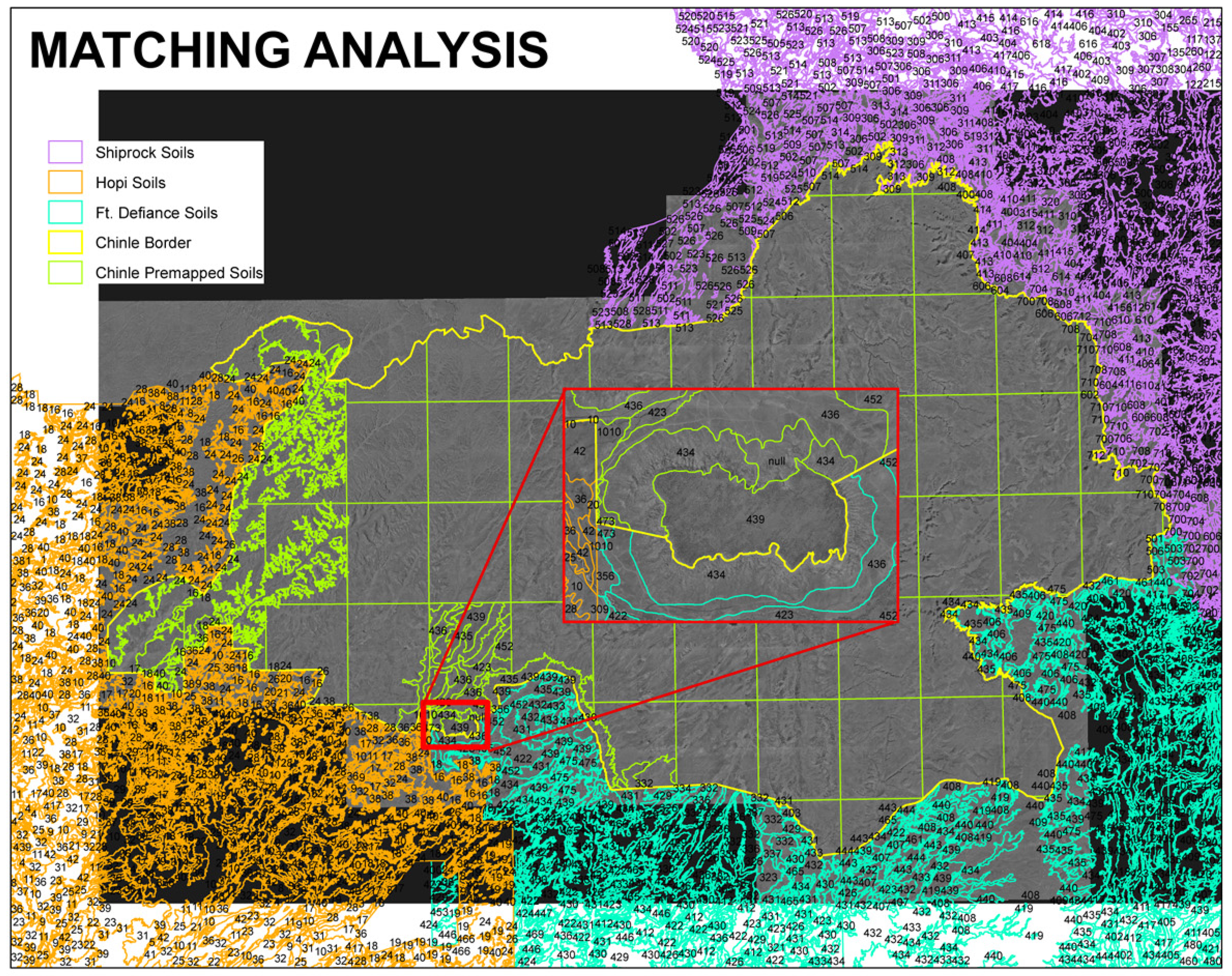
DIGITAL JOINS ON THE CHINLE SOIL SURVEY ON THE NAVAJO NATION

Digital surveys of various vintages surround Chinle enabling digital matching of survey joins from the beginning of the survey. Map unit concepts are already approved and accepted in the adjoining surveys so by beginning mapping along the border the Chinle map units can be approved with minimal field work and documentation. Because the survey is digital the data can easily be released in draft form as it is approved.

1. BEGIN ANALYSIS

Soils generally change gradually across the landscape. By beginning at a point of known soils the changes are easier identified and documented. This methodical approach to soil survey mapping produces a more accurate, fully documented and certifiable survey in far less time than field mapping alone was previously done. Not only is much of the documentation already done, but as changes occur in the soils, the map unit concept is already in place with all the surrounding factors included in the analysis. The process of joining another survey area is dealt with as the survey progresses. A seamless join is automatic. The current ability to view vast areas at a glance quickly resolves many issues that were difficult if not impossible to judge in the non-digital world. As mapping moves in from the border, the known and approved soils move in a wavelike motion. The survey crew will always be working with well documented and known soils.

The method of digitation and survey process of each bordering survey is important to know for digital soil matching. Two surveys bordering Chinle Soil Survey (AZ713) have Soil Survey Geographic Database (SSURGO) certified spatial data on the Soil Data Mart. The Hopi Soil Survey (AZ714) was digitized from a previously hard bound publication with only spatial and some tabular data placed on the Soil Data Mart. The Shiprock Soil Survey (NM717) was published digitally using newer mapping techniques. Shiprock now has a full modern soil survey published digitally on the web. The Ft. Defiance Soil Survey (AZ715) will shortly be published completely on the web. The full publication will be downloadable in a .pdf file. It began the digital process with compilation of the field mapping. The fourth and final border survey, the Navajo Mountain Soil Survey (AZ711) is digitally mapping but is not quite to the stage of completion of AZ715. AZ713 was advised to begin on the AZ715 border because of the stage of completion and modern techniques used. The area where Ft. Defiance and Hopi meet on the Chinle border was chosen for this presentation.

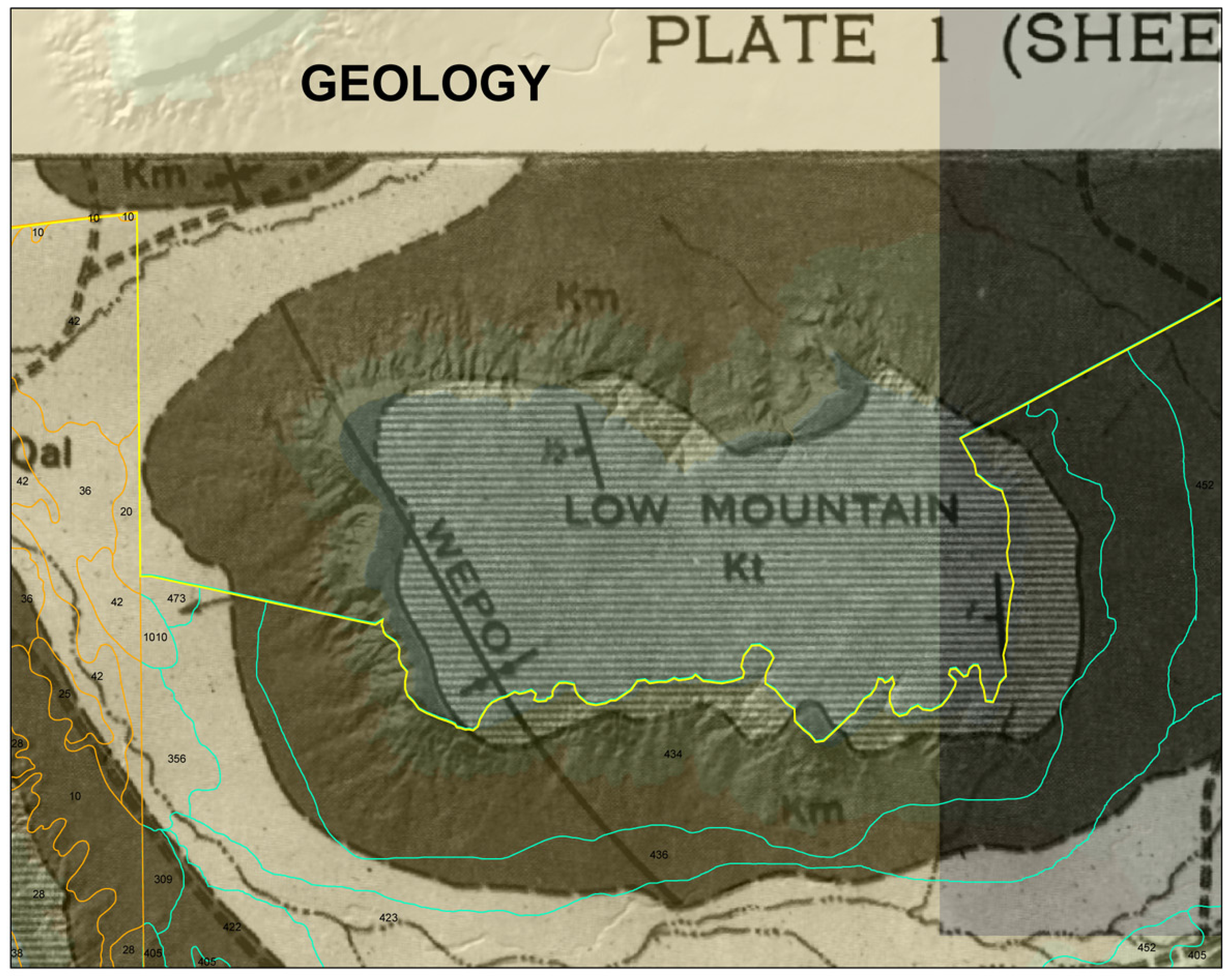


2. IMAGE LAYERS USED FOR DIGITAL FIELD MAPPING

Arc Info offers many tools to assist with the analysis and interpretation of soils for Digital Field Mapping. Although they are very useful during the mapping stage, the end product must fit on the Digital Ortho Photo Quad (DOQ) for the ease of the end user to fit the soil lines. The hillshade made from the digital elevation model (DEM) gives a pseudo 3D affect. Elevation and slope ranges can be easily portrayed by classifying the DEM and draping it over the hillshade. Contour and slope layers can be used similarly. The Digital Raster Graphic (DRG) or topographic quad can be draped over the hillshade to locate landmarks and relate them to landscapes and landforms. Land sat images can be used to determine mineralogy or vegetation of an area. Different images can be used depending on the purpose. To begin a survey it is good to try several setups until knowledge of an area is comfortable. To begin premapping, switch between the hillshade and the DEM draped over the hillshade. A click of the mouse can change the tool used. Observe the map at different scales and under different conditions. The view of landscape and landform relationships to one another at different scales is very useful. For a close-up view of a single landform, use 1:24,000 or for a broad view try 1:100,000. The use of these tools gives the soil scientist a very good idea of what they will find before they go to the field. Field work is verifying what is seen on the screen.

GEOLOGY LAYER

This geology layer was prepared digitally from a survey done in 1968 which was not mapped with digitizing in mind. Care needs to be taken in any analysis made using this map but it is the best available for the Chinle Survey and it is still very useful in the mapping of a soil survey. This slide begins with a hillshade layer with a nine classification Digital Elevation Model (DEM) laid over it. The geology layer at 40% transparency is laid over that. From this view at 1:30,000 scale indicates the Wepo Syncline falls on the edge of Low Mountain with much faulting in the area. The geologic symbol Kt indicates the top of this mountain is Toreva Formation. The Km symbol on the sides of the mountain stands for Toreva Formation and Mancos Shale. The Qal symbol along the streambed indicates alluvium. A first field check might be to verify that there is not a change in the soils at this syncline. There is no indication of such in AZ715 mapping. But it is good to know what the Toreva Formation and Mancos Shale look like on the ground. A further glance at this slide indicates AZ715 found several map units in the Qal. What other factors affect the formation of these soils? Maybe another map setup will provide some clues.



5. DIGITAL LEGEND BUILDING

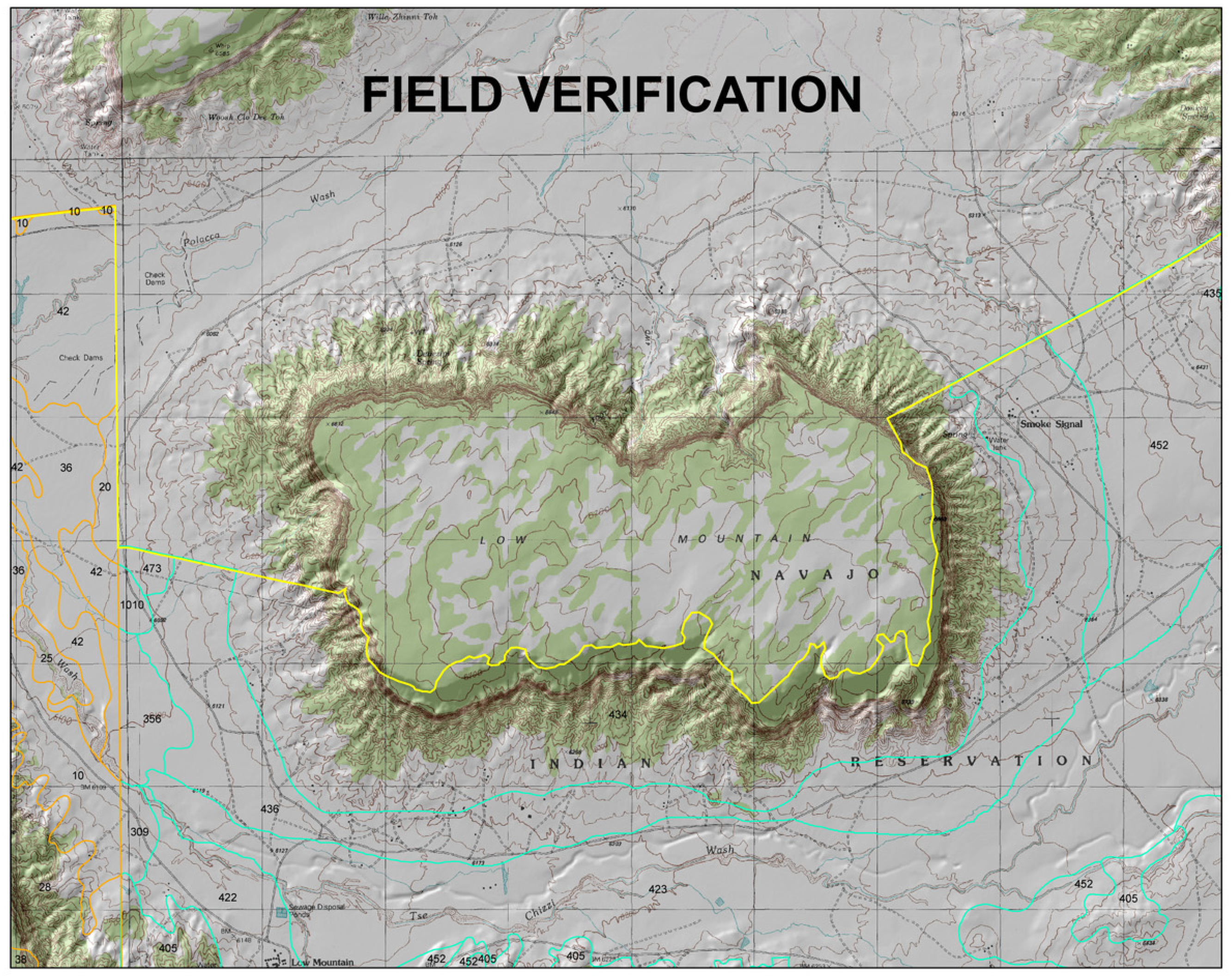
It is easy to follow the border and build a legend within each joining soil survey boundary. Then check for soils that obviously will not carry over, i.e. a soil discontinuity. This is a beginning legend. Now see if soils between adjoining surveys have been matched and approved. Check the map unit descriptions and taxonomic unit descriptions if available. Can these soils be used on the new survey? If not, why not? Now there is something to verify in the field and note digitally. When digitally documented, the analysis and interpretations can be digitally reviewed by other soil scientists via Netmeeting. The digital soil survey is easily understood and updated by other soil scientists so will live long after the soil scientist that did the survey is gone.

FT. DEFIANCE – CHINLE JOINS

715 Musym	713 Musym	Classification
309	318	Jeddito loamy fine sand, 0 to 5 percent slopes (app)
326		Wepo-Ives-Jocity association, 0 to 2 percent slopes (app)
332		Redlands-Monue complex, 1 to 8 percent slopes (app)
334		Moenkopie-Monue complex, 3 to 15 percent slopes (app)
336	385	Sheppard-Monue complex, 1 to 8 percent slopes (app)
337		Monue-Ives complex, 1 to 3 percent slopes (app)
340	337	Jocity fine sandy loam, 0 to 3 percent slopes (app)
356	338	Tewa very fine sandy loam, 1 to 5 percent slopes (app)
361	336	Polacca clay loam, 0 to 3 percent slopes (app)
400	443	Mido-Begay complex, 1 to 8 percent slopes (app)
403		Windwhistle-Bond-Farview complex, 3 to 8 percent slopes (app)
405	416	Rock outcrop-Eagleye-Atchee complex, 35 to 70 percent slopes (app)
406		Parkelei-Hosta complex, 3 to 8 percent slopes (app)
408		Verite-Manuelito complex, 1 to 8 percent slopes (prov)
419		Umbarg-Millpaw complex, 1 to 3 percent slopes (app)
420		Manuelito-Verite complex, 8 to 45 percent slopes (prov)
422		Zia sandy loam, 1 to 5 percent slopes (app)
423		Aquima-Hawaikuh silt loams, 1 to 5 percent slopes (app)
424	594	Penistaja-Begay complex, 1 to 8 percent slopes (app)
429		Penistaja-Tintero complex, 1 to 10 percent slopes (app)
431		Rizno-Tekapo-Rock outcrop complex, 2 to 45 percent slopes (app)
432		Parkelei sandy loam, 1 to 8 percent slopes (app)
433		Plumasano-Parkelei complex, 1 to 15 percent slopes (app)
434		Evpark-Vessilla-Arabrab complex, 1 to 25 percent slopes (app)
435		Parkelei-Arabrab complex, 2 to 8 percent slopes (app)
436		Tintero-Mido complex, 3 to 10 percent slopes (app)
439		Evpark-Arabrab complex, 2 to 6 percent slopes (app)
440		Verite-Rock outcrop-Flutedrock complex, 5 to 60 percent slopes (prov)
443		Venadito clay, 1 to 6 percent slopes (app)
444		Venzuni clay loam, 1 to 10 percent slopes (app)
447	422	Querencia clay loam, 0 to 3 percent slopes (app)
450	413	Travessilla-Rock outcrop complex, 1 to 8 percent slopes (app)
452		Begay-Penistaja complex, 2 to 8 percent slopes (app)
461		Parkelei-Evpark fine sandy loams, 2 to 8 percent slopes (app)
465		Kinusta-Eslendo-Rock outcrop complex, 15 to 70 percent slopes (app)
467		Mido fine sand, 1 to 15 percent slopes (app)
472		Gish-Mentmore complex, 1 to 8 percent slopes (app)
473		Monue very fine sandy loam, 1 to 5 percent slopes (app)
474	508	Kydestea-Zyme-Tonalea complex, 5 to 50 percent slopes (app)
475		Arabrab-Parkelei complex, dry, 3 to 12 percent slopes (app)
501		Akhoni-Retaw complex, 0 to 15 percent slopes (app)
503		Klizhin-Sandark complex, 20 to 65 percent slopes (app)
506		Zilditloi-Nakaibito complex, 40 to 80 percent slopes (app)
999		Water (app)
1010	345	Wepo clay loam, 0 to 3 percent slopes (app)
app – approved		prov – provisional

FT. DEFIANCE – CHINLE – HOPI JOINS

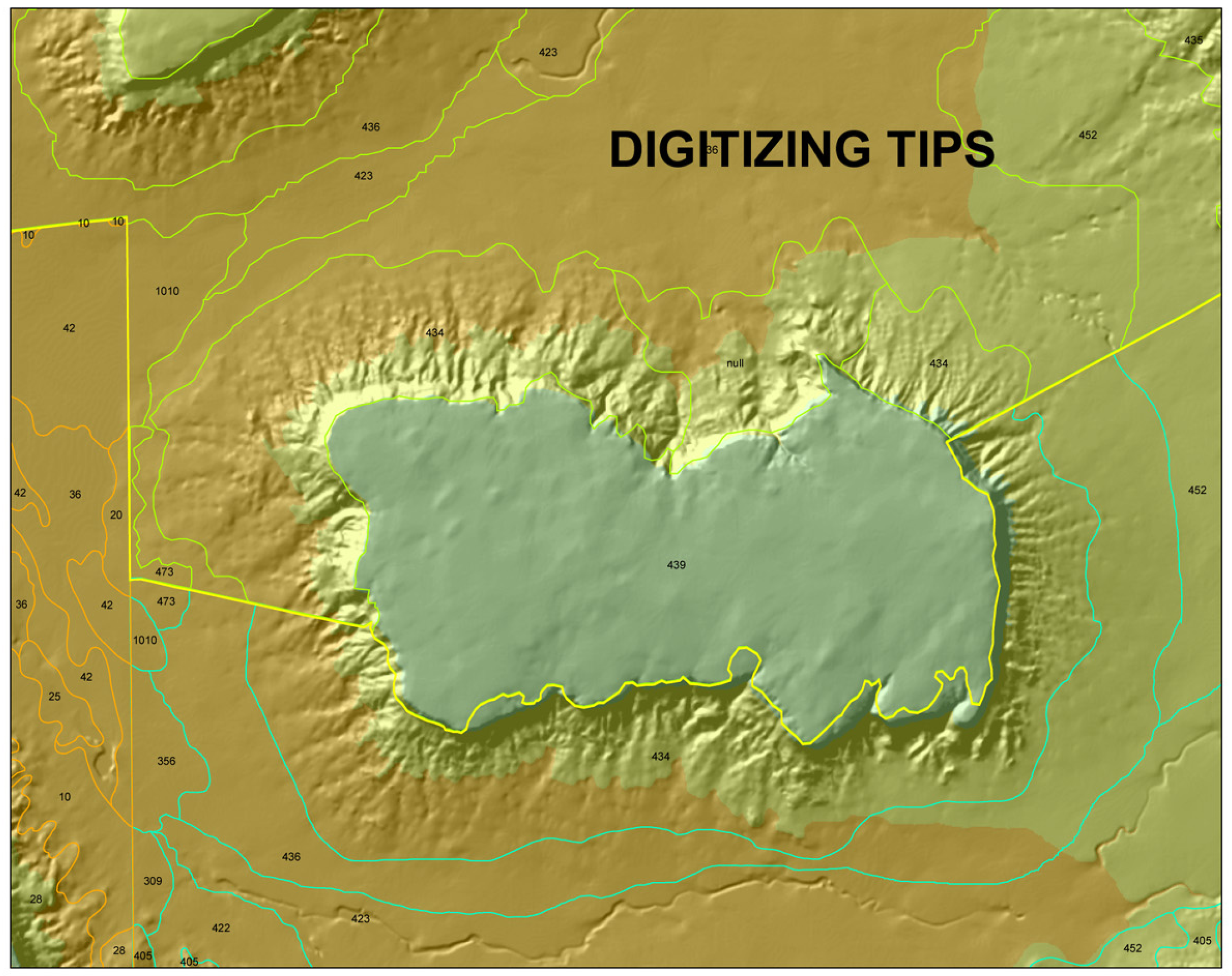
715 Musym	713 Musym	714 Musym	Classification
309	318	10	Jeddito loamy fine sand, 0 to 5 percent slopes (app)
340	337	11	Jocity fine sandy loam, 0 to 3 percent slopes (app)
474	508	16	Kydestea-Zyme-Tonalea complex, 5 to 50 percent slopes (app)
467		17	Mido fine sand, 1 to 15 percent slopes (app)
400	443	18	Mido-Begay complex, 1 to 8 percent slopes (app)
473		20	Monue very fine sandy loam, 1 to 5 percent slopes (app)
		21	Naha loamy sand, 0 to 3 percent slopes
424	*594*	24	Penistaja-Begay complex, 1 to 8 percent slopes (app)
361	336	25	Polacca clay loam, 0 to 3 percent slopes (app)
447	422	26	Querencia clay loam, 0 to 3 percent slopes (app)
405	*416*	28	Rock outcrop-Eagleye-Atchee complex, 35 to 70 percent slopes (app)
336	385	32	Sheppard-Monue complex, 1 to 8 percent slopes (app)
356	338	36	Tewa very fine sandy loam, 1 to 5 percent slopes (app)
		37	Torrifluvents, 0 to 2 percent slopes
450	413	38	Travessilla-Rock outcrop complex, 1 to 8 percent slopes (app)
	508	40	Ustic Torriorthents, 10 to 35 percent slopes
1010	345	42	Wepo clay loam, 0 to 3 percent slopes (app)



3. FIELD VERIFICATION

Before going to the field, prepare a quick map to help locate the soils studied. This map lays the 40% transparent topographic quad over the hillshade. The actual roads may be very different than those indicated on the map. Try using a real time Global Positioning System (GPS) to make a road layer on your first trip. Not only does this save time learning your way around, but field notes can be made as attributes to the road map and uploaded into the survey itself. The more data collected digitally the more data available for analysis and the quicker the data can be processed.

Many soil scientists are more familiar interpreting the topographical quadrangles than the DOQs or hillshades. To train the eye, take a hard copy of this map to the field, make notes on it, and then compare them to the digital notes made. Other combinations can be used to build a firmer digital concept of the actual soils in the survey area.



4. DIGITIZING TIPS

Digitizing techniques and softwares go through constant change and improvements. AZ715 used Arc View. AZ713 reviewed Arc View but decided Arc Map had many advantages.

- It is easier to digitize if a strong concept of the landscape and soils are well formed first.
- Build a polygon feature class in the survey geodatabase with the survey boundaries and topographic quad grid for digitizing.
- In the attribute table add a field called "musym".
- Accuracy will build while digitizing in Arc Map as lines are easily changed. Polygons will change constantly and by the time all decisions are made; lines will be right where they need to be.
- Border lines need NOT be perfectly matched until the soil lines are finalized with topology edits.
- Begin with a complete polygon using the grid lines. Do not change the border lines!
- 90% of the digitizing will be done with auto complete or cut polygon commands.
- Use the topo grids to contain your work in a manageable unit.
- To carry a polygon across the line, select the polygon on either side and do a 'merge'. The line will disappear.
- Use 'streaming' mode. Set the parameters at 50 m between nodes for most lines.
- If the line goes crazy, build another polygon around the line, do a merge and the new line takes over.
- Start with a major landform such as a mesa top or a valley.
- If the polygon is a big one, cut it short. Append a polygon to it and do a merge to make it larger or select the polygon and do a cut polygon to make it smaller.
- Identify the possible map unit in the attribute table. The beginning point for analysis is then ready to put together.
- Study the border soils and pick a map unit you can see falls into the new survey and digitize a polygon following similar landforms.

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DEPARTMENT OF INTERIOR
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