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11/24/09
GEO 386G

Final Project: Geodatabase of Mule Mountains Area, southeastern Arizona

Project goal: Develop a geodatabase with vector and raster data for future data organization and analysis.

Vector Data

Geology (digitized from raster imagery)
Roads (downloaded from USGS National Map Seamless Server)
Measured Section locations (collected with RTK-GPS system in the field. This is a very bad dataset collected at the beginning of my field work)
Strikes and dips (field data)

Raster Data

1 arc-second DEM (GRID format downloaded from USGS National Map Seamless Server, resolution 28m x 28m, 32 bits)
1/9 arc-second DEM for Paul Spur (GRID format downloaded from USGS National Map Seamless Server, resolution 3.2m x 3.2m, 16 bits)
Orthophoto (GRID format downloaded from USGS National Map Seamless Server,)
Outcrop photos (JPEG format, collected in the field)

All data downloaded from seamless server contained metadata and .prj files.

Database Organization

A personal geodatabase was created with 1 feature dataset:

1) Geology
    - Faults
    - Topology
    - Outline
    - Unit contacts
    - Polygons (created from topology)
2) GPS
    - GHE_Points – RTK and other field data are stored here for 2 measured sections in my field area. More data collected in November will be imported after postprocessing.

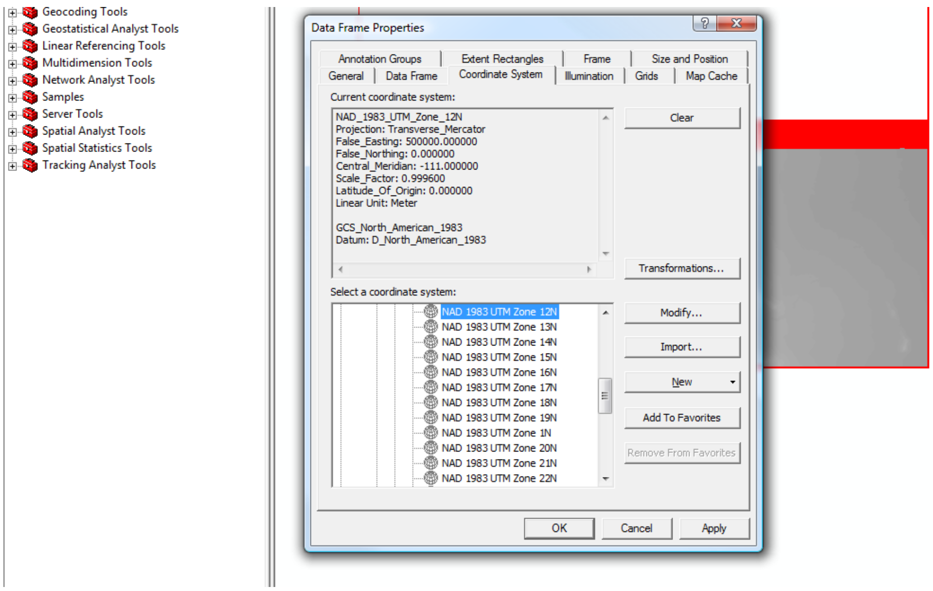
All other shape and layer files were created from pre-existing data.

Data were organized for the global field area (southern Mule Mountains) and for the Paul Spur area of interest.

Processes

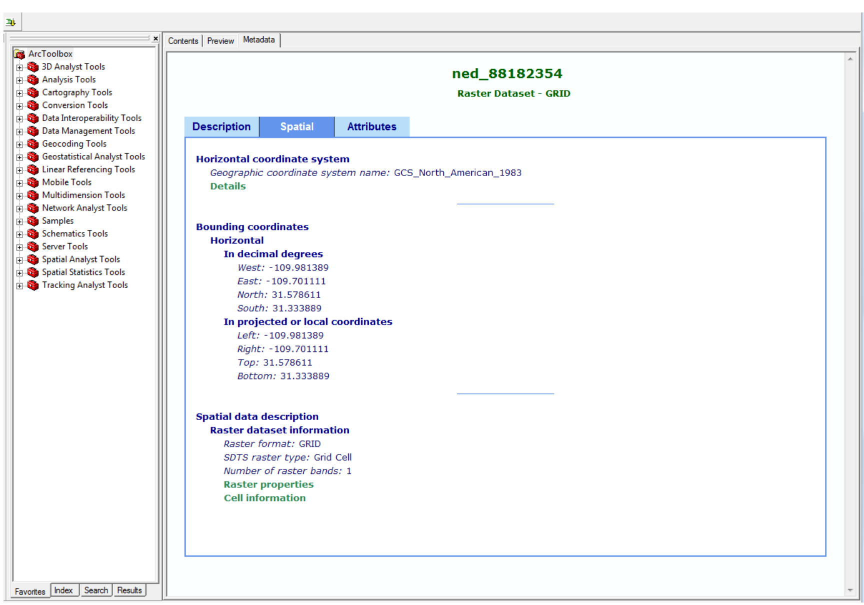
Step 1: Define Coordinate system

Point data were collected in the field in UTM coordinates (NAD83, Zone 12N). I prefer to bring these data in later without having to do any conversion.

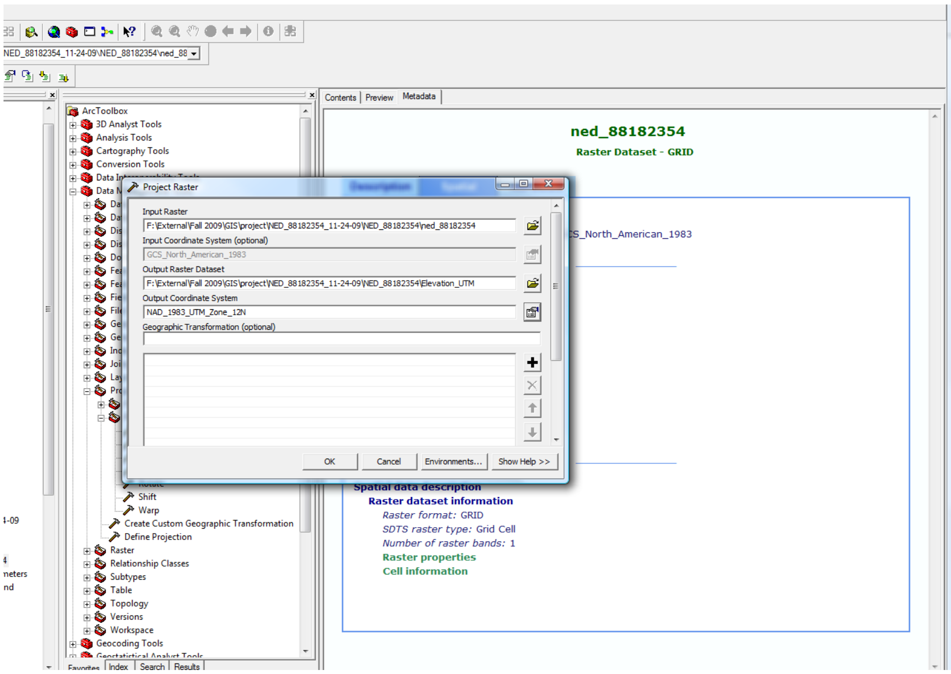


Step 2: Reproject raster/vector data to UTM Coordinate system

Elevation, Road, and orthophoto raster data were downloaded in various coordinate systems. Example – elevation data acquired in GCS NAD83 coordinates:

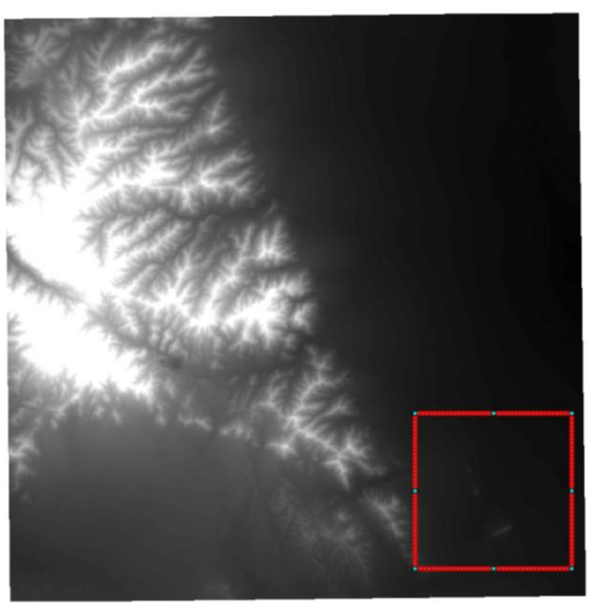


All downloaded raster and vector data were converted to UTM Zone 12 coordinates using ArcToolbox -> Data management tools -> Projections and transformations (for feature and raster)

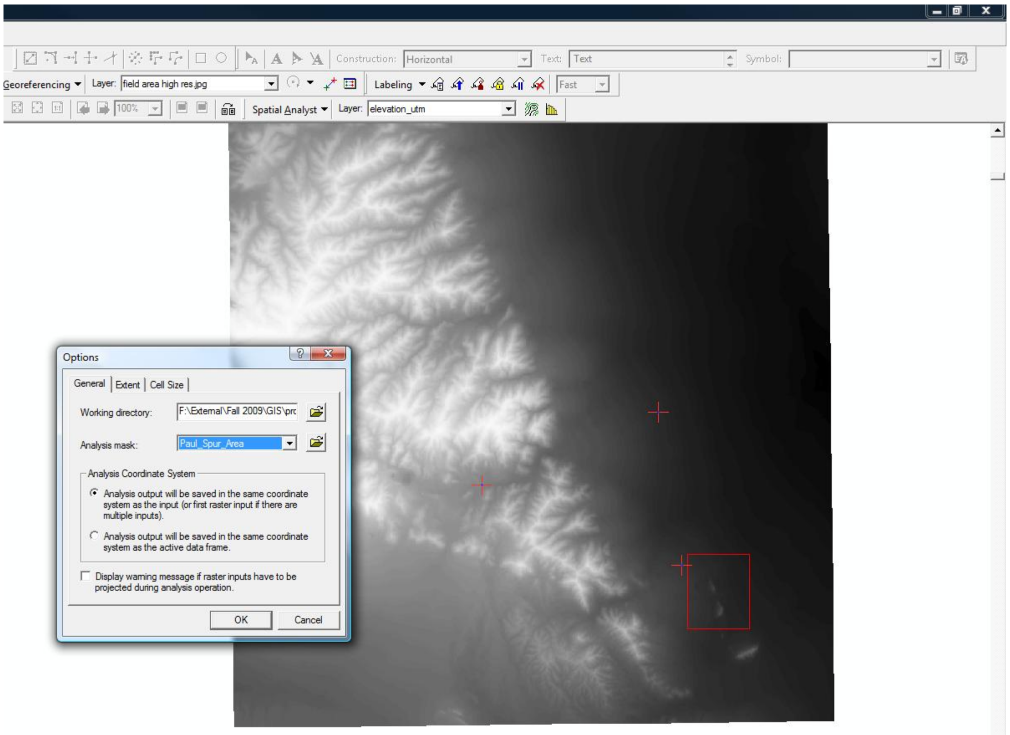


Step 3: Fix elevation data

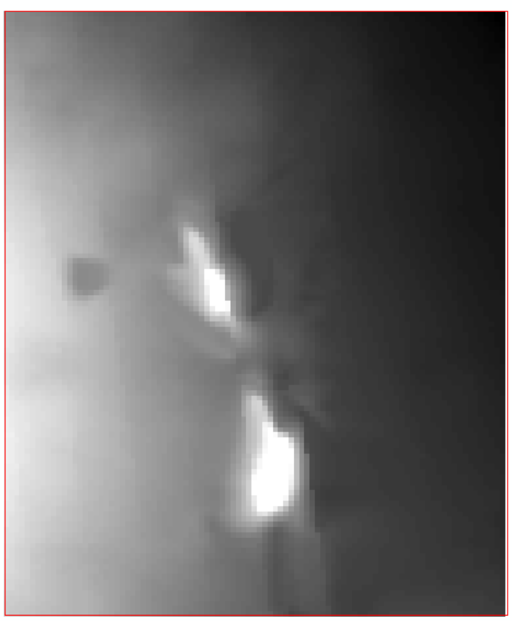
Raw elevation data did not show certain features (outlined in red):



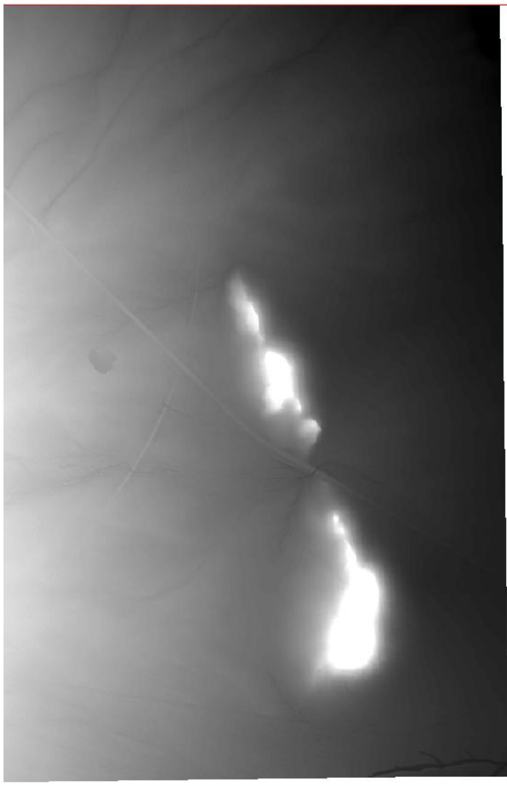
A clipping mask was set up in Spatial Analyst to Paul Spur area of interest and working directory was assigned:



Elevation raster data were clipped to the paul spur AOI using Spatial Analyst raster calculator and made permanent:

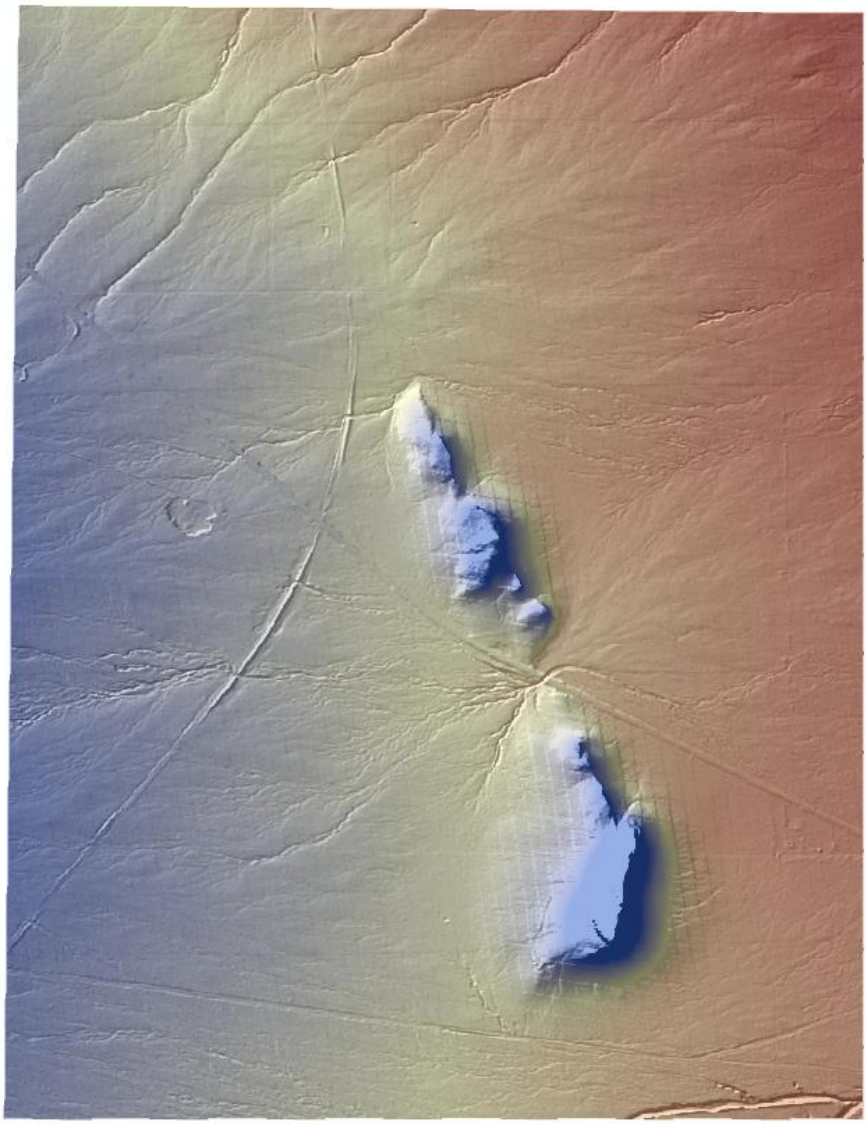


The Paul Spur feature is not well-visualized here, as resolution is 28m x28m. The area of interest is ~2km x 3km.   I found 1/9 arc second data (resolution ~3m x 3m) Imported, reprojected, and clipped to Paul Spur Area of Interest:



Much better resolution for a ~1mi x 2mi area.

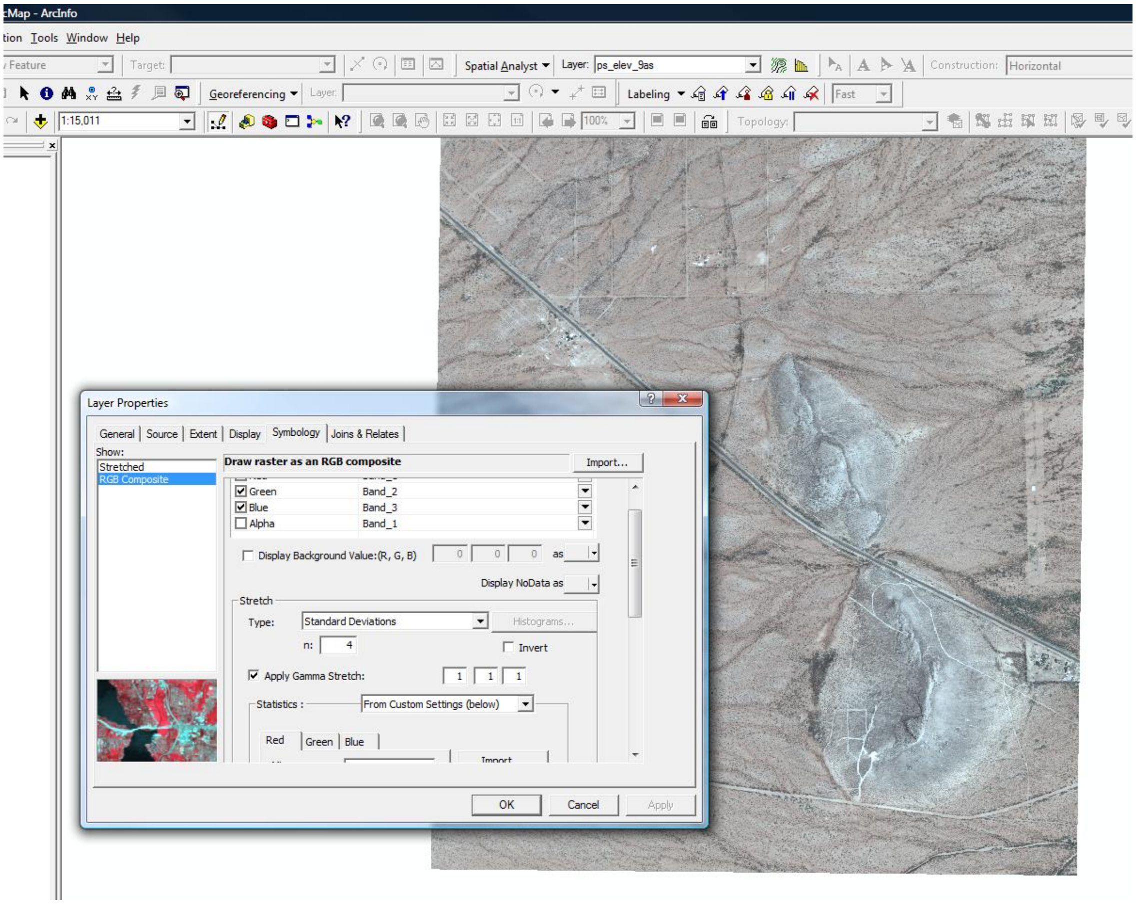
Tweaked the raster data symbology and added hillshade to bring out elevation data for Paul Spur.



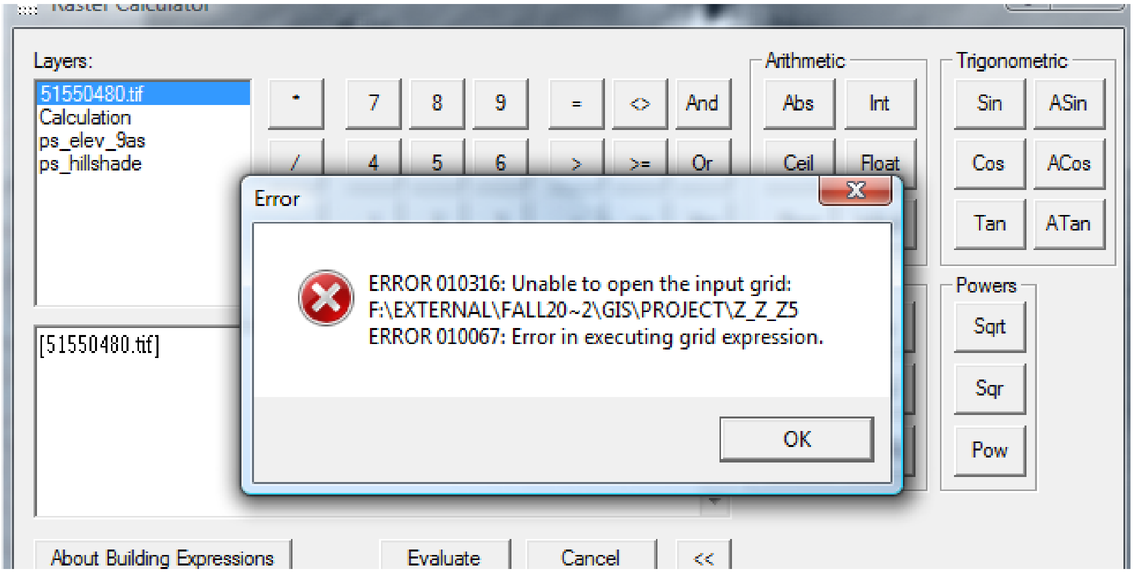
<u>Step 4: Create orthophoto</u>

Reprojected orthoimagery was added to ArcMap:

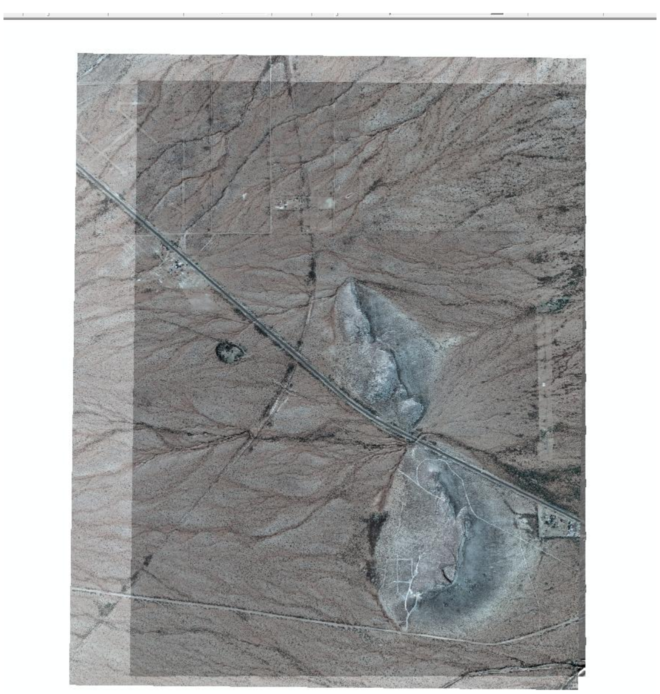
The default symbology yielded poor color quality. The raster data were symbolized to show a more realistic aerial image, using 4 standard deviations in the RGB composite:



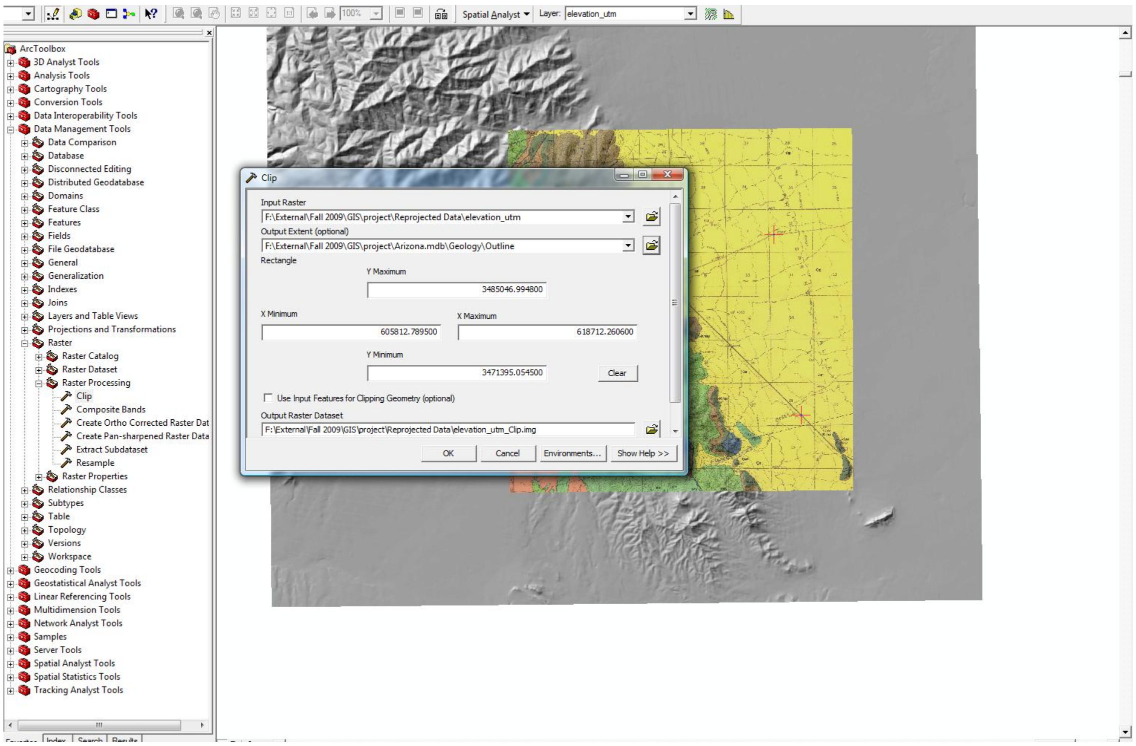
The orthophoto looked faded, but colors were more accurate. Minimum-Maximum stretched yielded a very washed out and red photo. Tweaking the histogram often yielded discoloration. I decided to stick with min-max and apply a hillshade to bring out the relief of the patch reef. I clipped the hillshade to Paul Spur AOI with no problems. However, when I tried to clip the orthoimage from the Spatial Analyst tool in ArcMap, I received the following error:



I made sure the raster was not active in another window and retried, but received the same error.



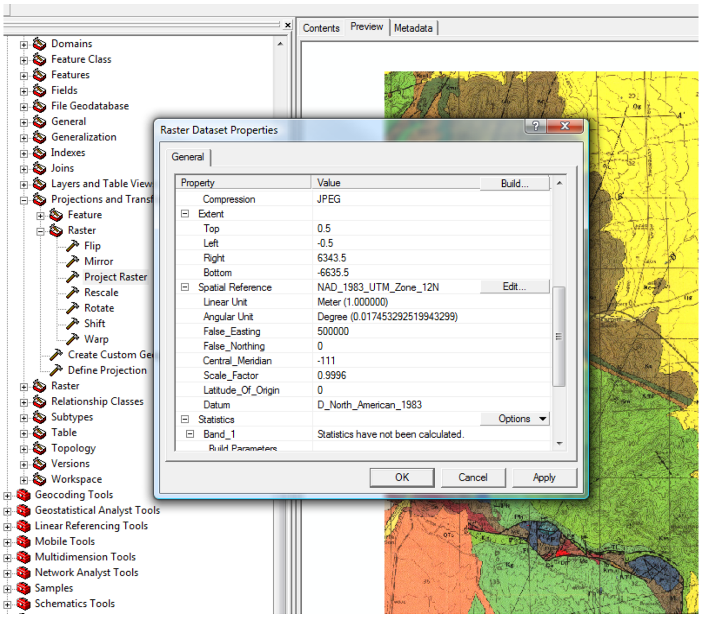
For the rest of the map area, 1 arc-second elevation data were clipped to Outline from geodatabase using clip tool in ArcToolbox for rasters:



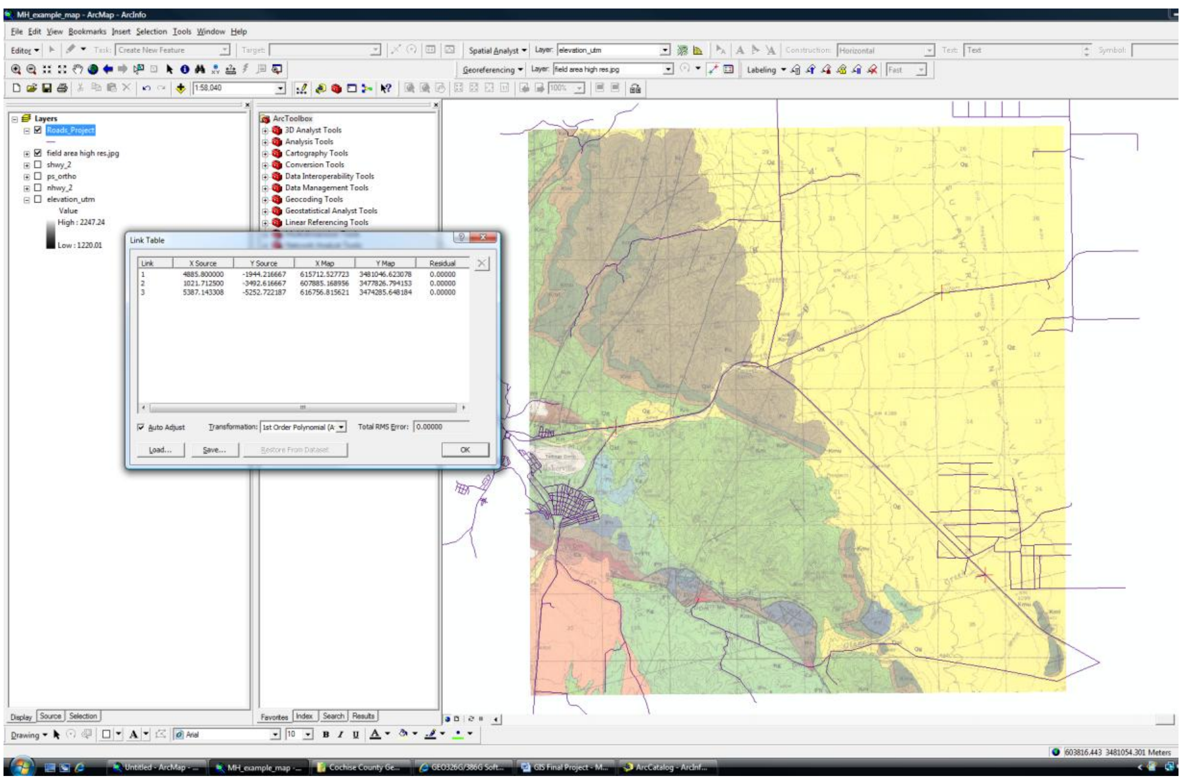
A hillshade was created to use with geologic map below (see above image).

<u>Step 4: Add geologic map image for digitizing:</u>

Spatial Reference was defined in ArcCatalog:



Geology raster was georeferenced w/ Roads vector data (also in UTM zone 12 coordinates) in ArcMap to display in real world coordinates using georeferencing tool.

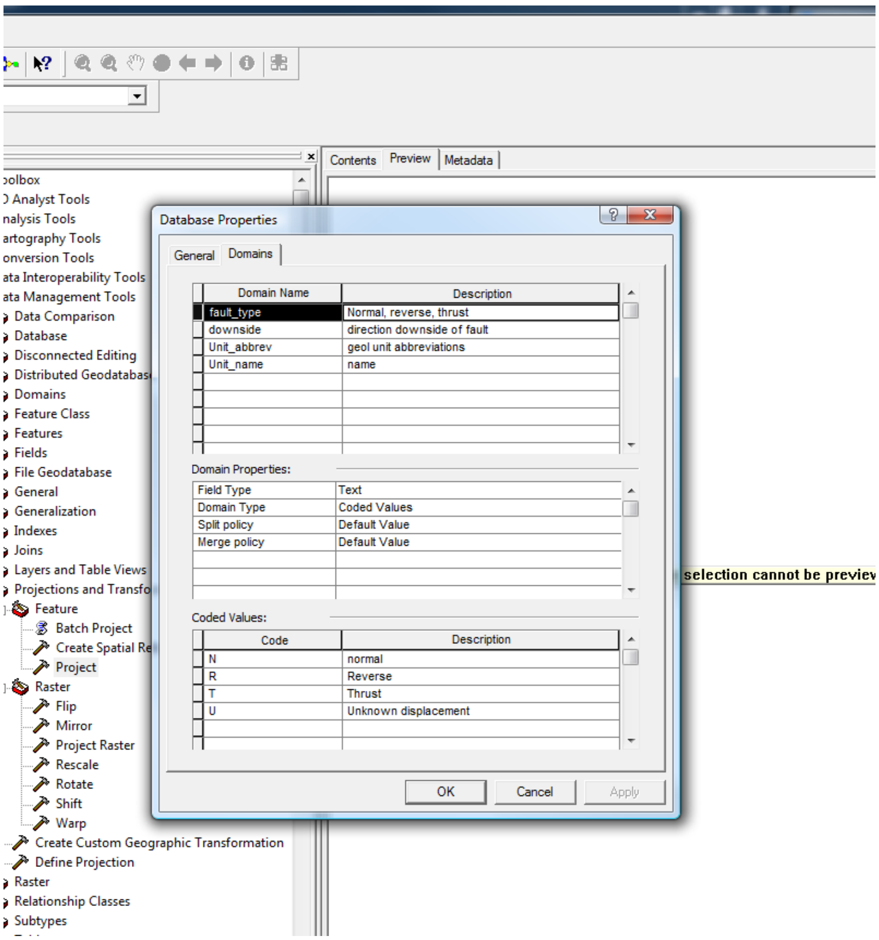


<u>Step 5: Create Geology geodatabase for digitizing</u>

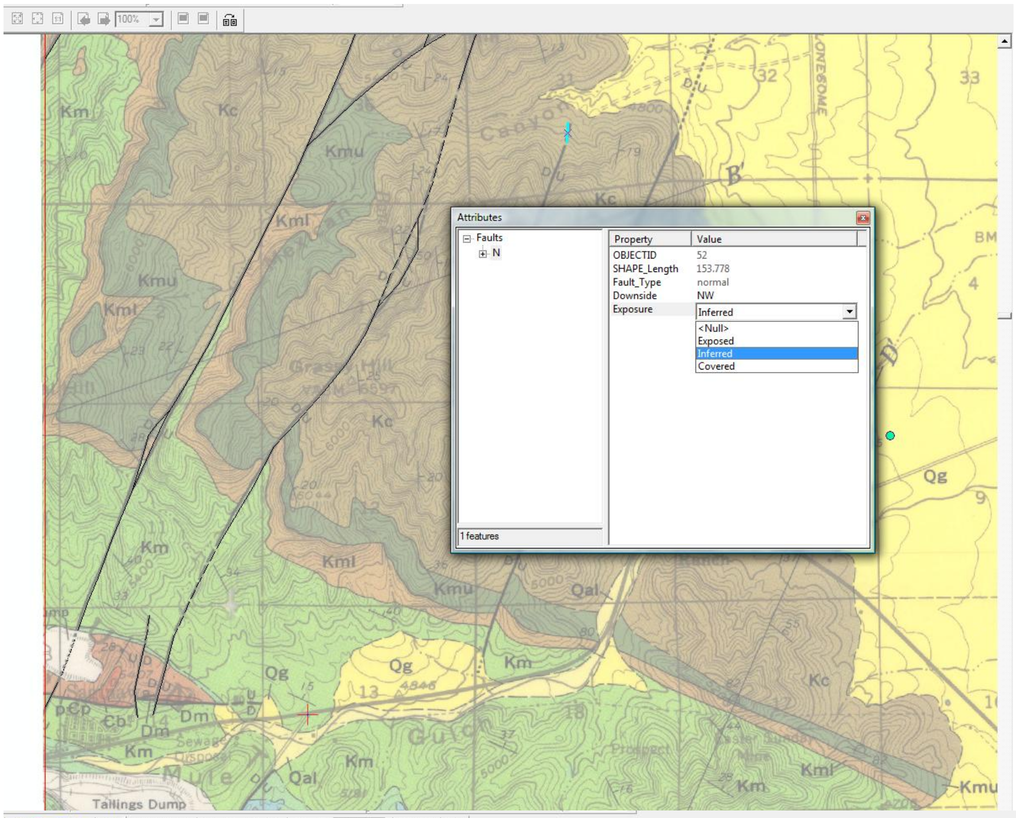
1) Feature classes were created in Arizona personal geodatabase

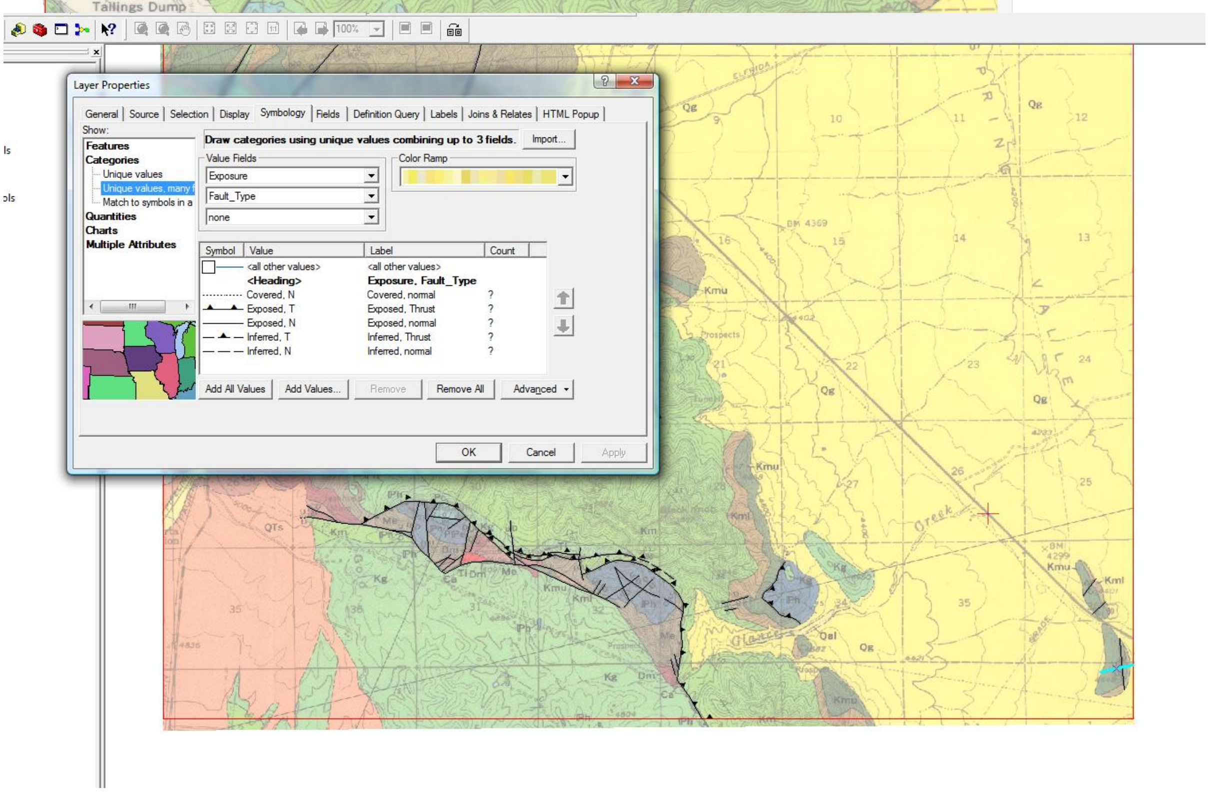
New Geology feature data set
Faults (line)
Outline (polygon)
Rock contacts (line)

2) Domains were created for data entry after digitizing and attach to feature classes as needed:

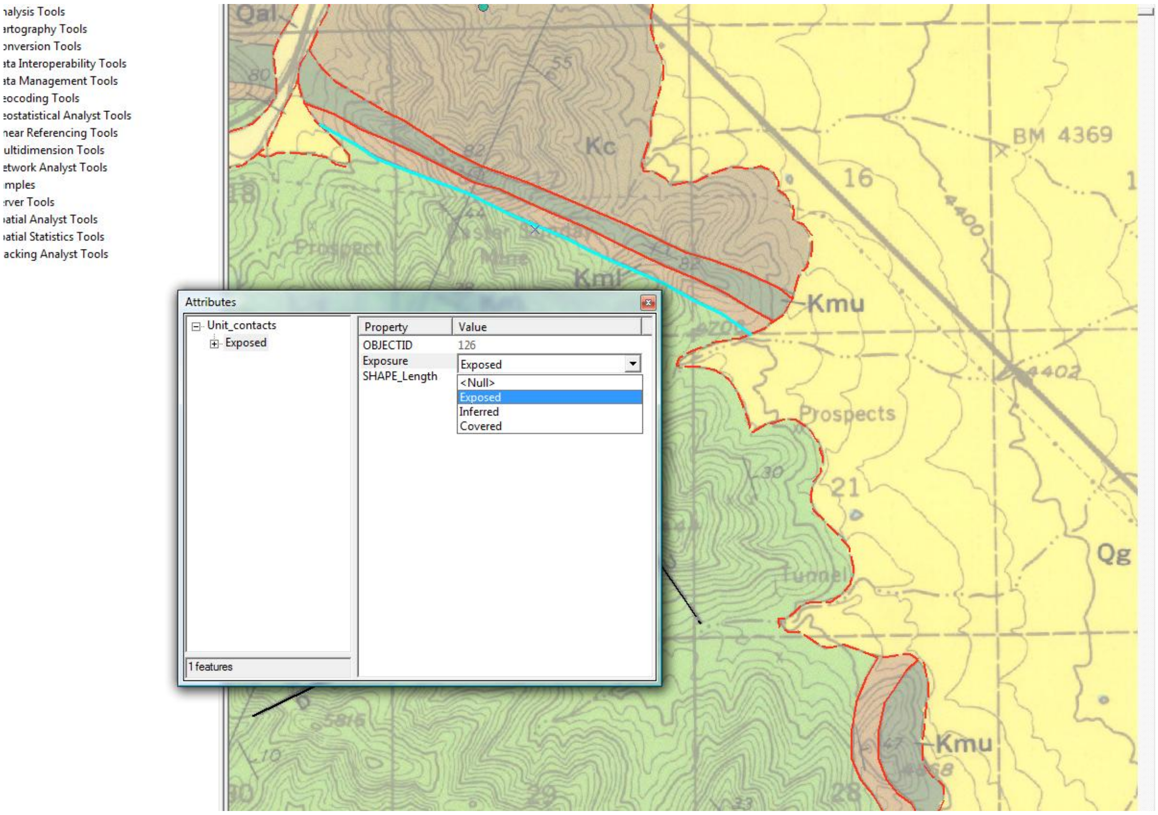


Faults were digitized, attributed and symbolized:

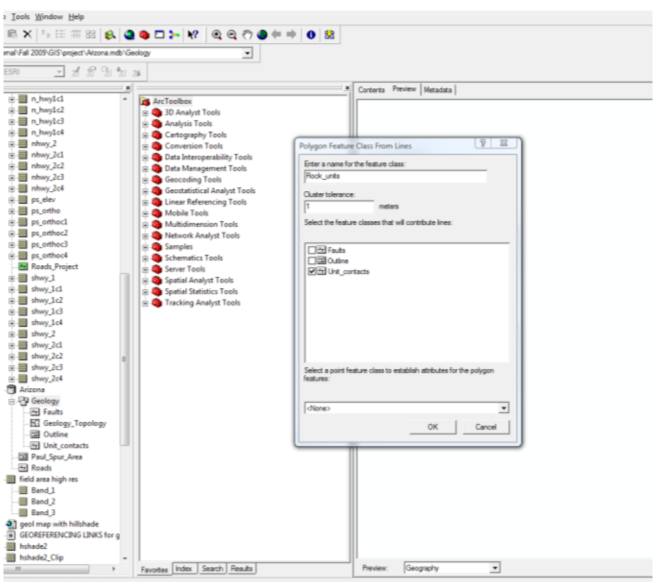




Unit contacts were digitized, set snapping VEE for faults, contacts, outline) and defaults:

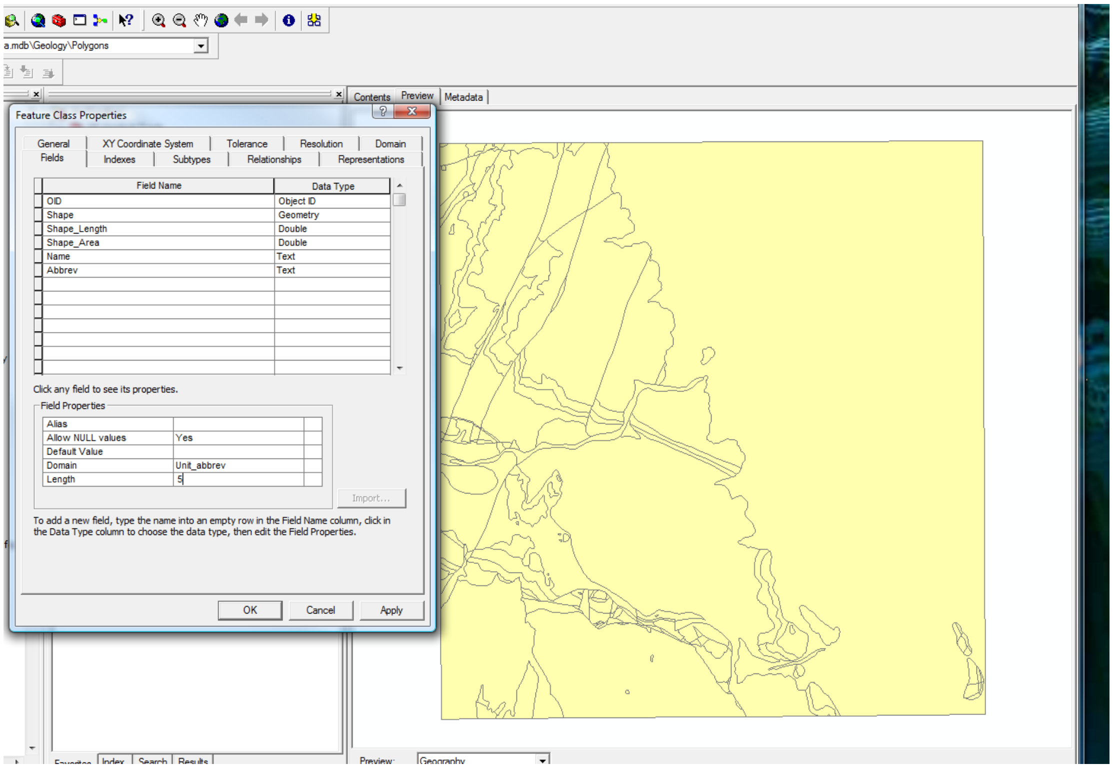


A topology was created from faults and contacts and errors were fixed. NOTE: Did not include dangle rule because I could not fix the point errors, even though lines were snapped together while digitizing (trust me I checked snapping because I did this twice).

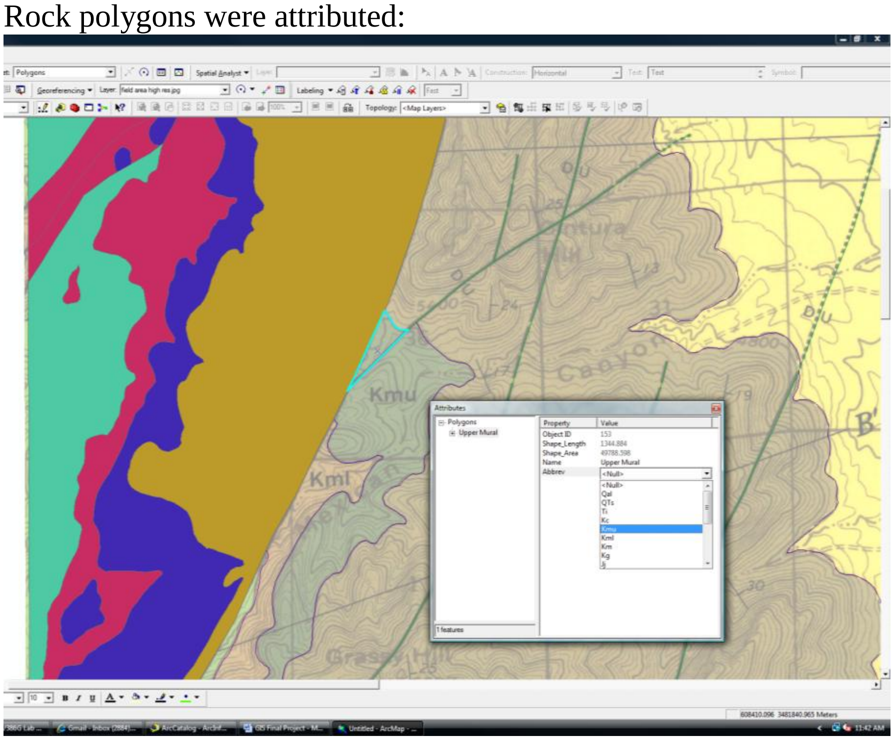


Rock unit polygons were created from topology using BOTH faults and contacts.

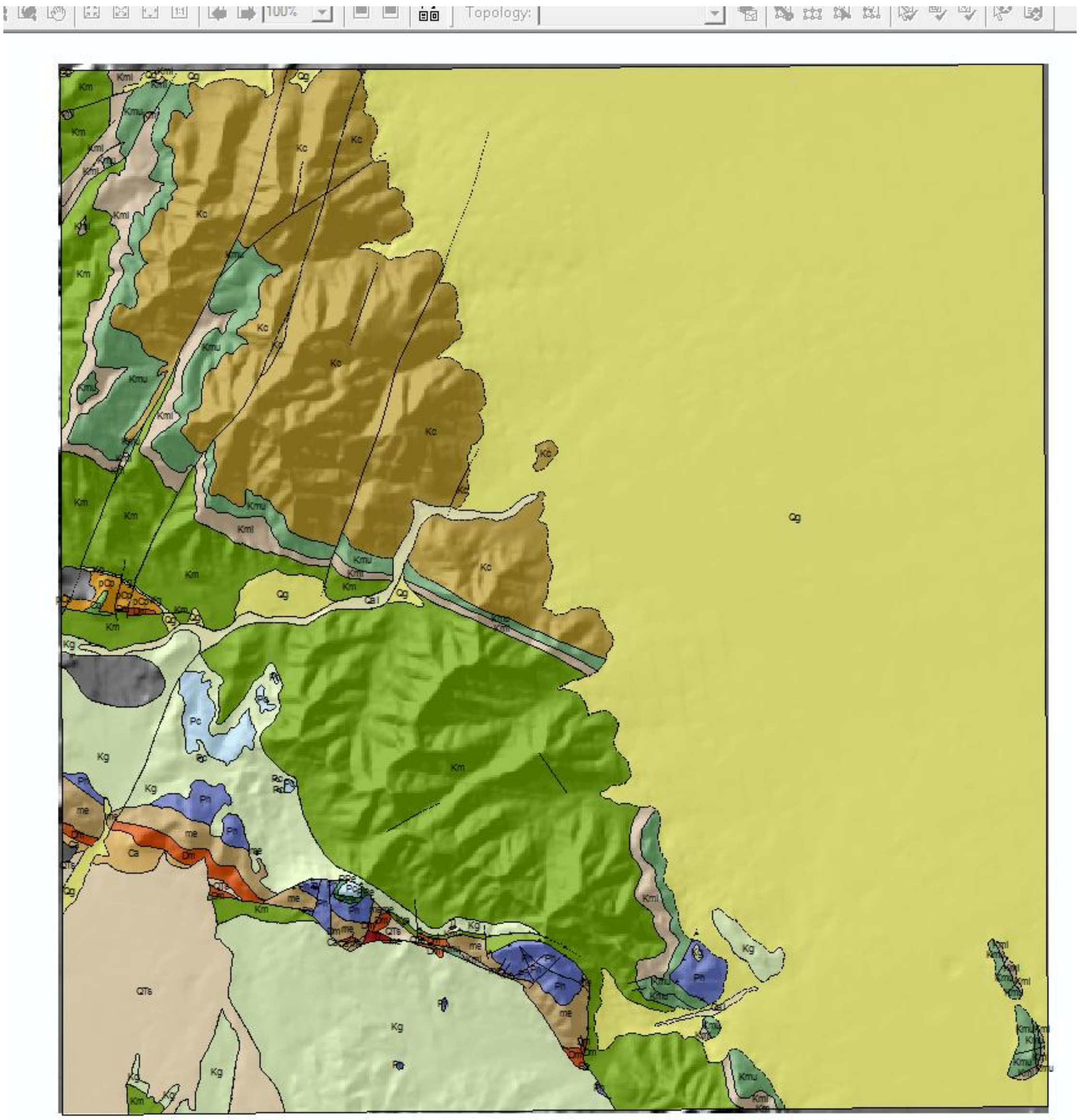
Unit name and abbreviation fields were added to new polygon feature class:



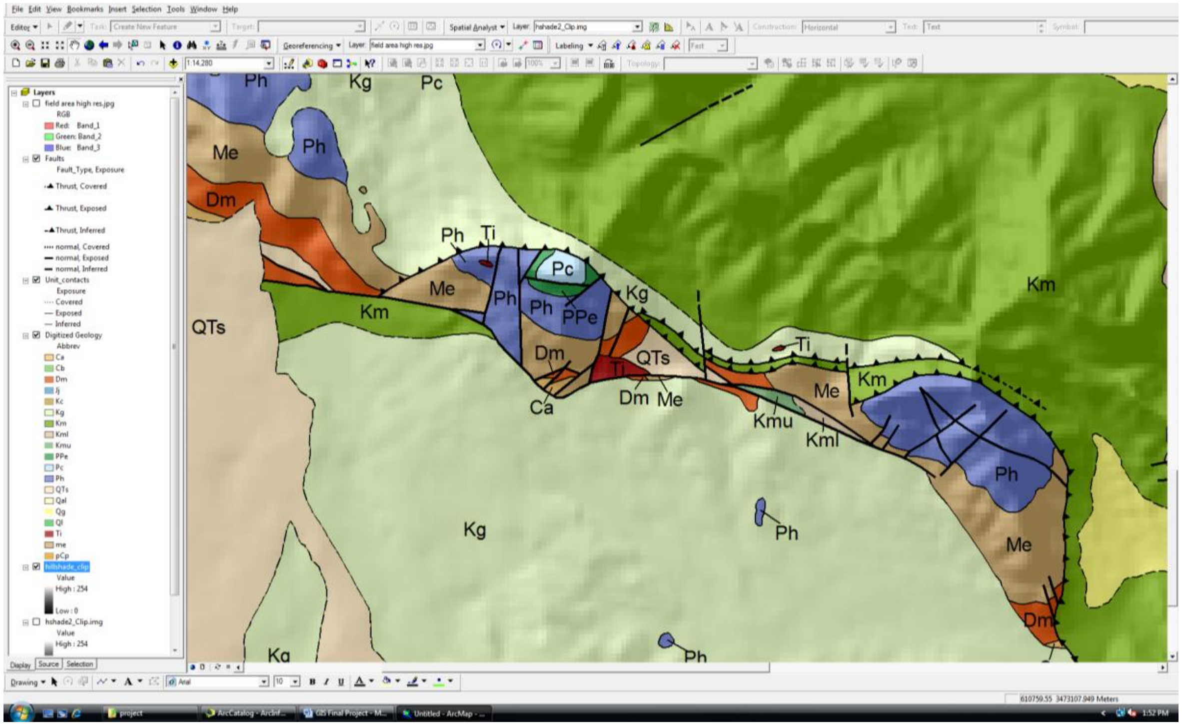
Rock polygons were attributed:



Made geology polygons transparent and added the hillshade layer calculated from the elevation raster and applied labels to polygons layer: properties -> label by unit_abbrev:

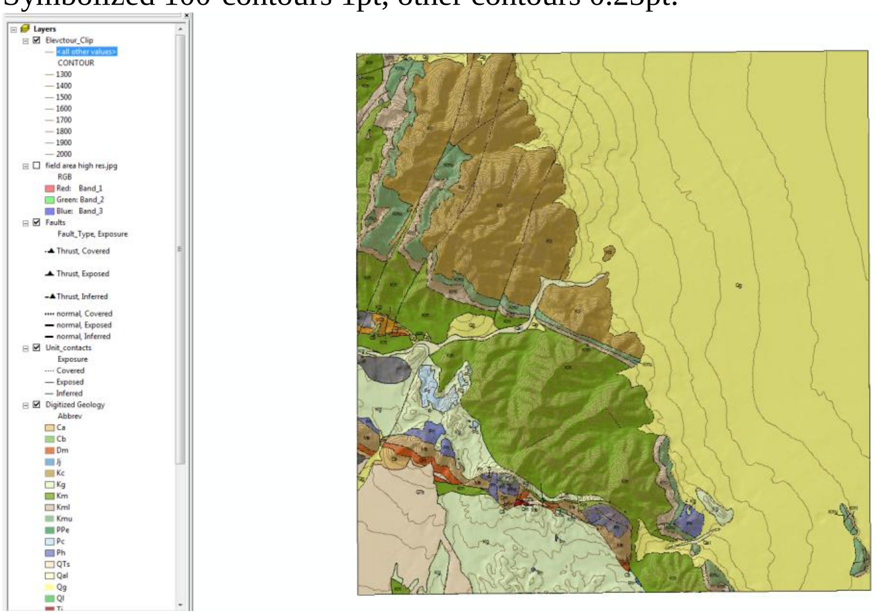


Converted labels to Annotation to make labels neater in congested areas:



Extracted Elevation contours from DEM: Spatial Analysis -> Surface Analysis -> contour, using Polygons feature class as the mask.

Symbolized 100-contours 1pt, other contours 0.25pt:

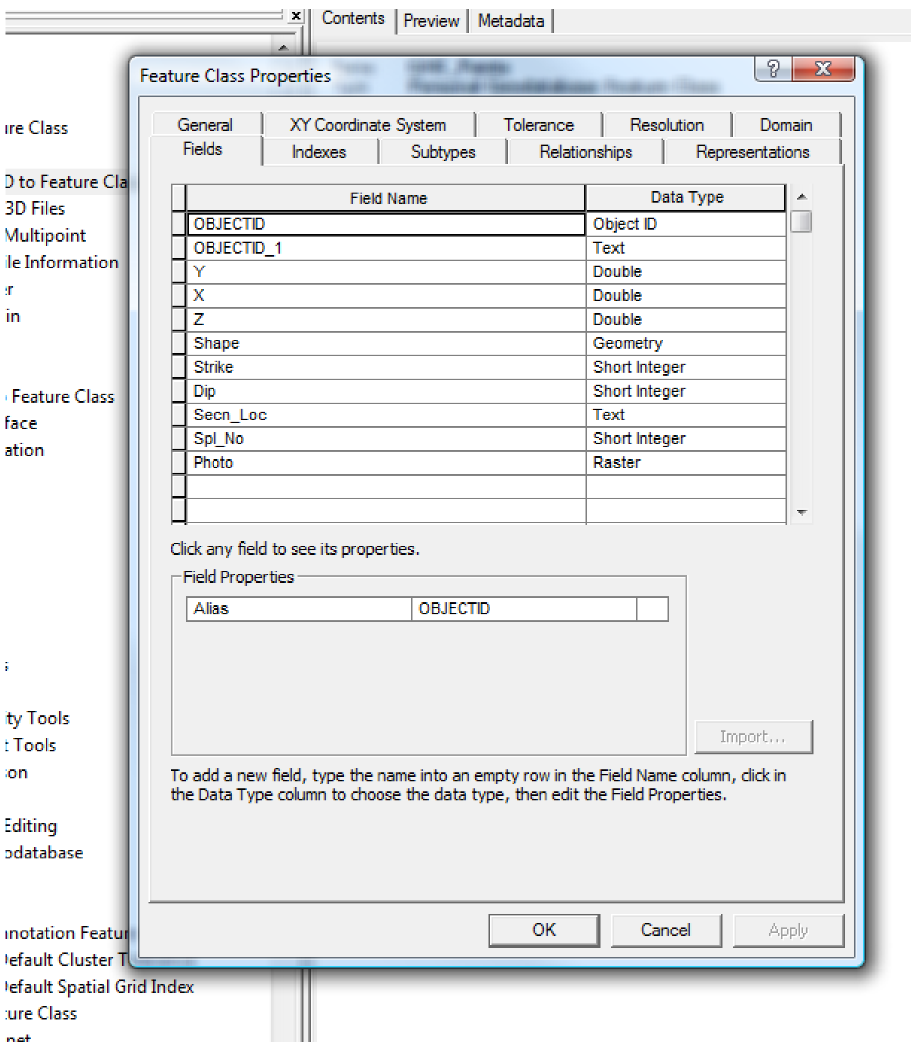


Final geologic map includes digitized geology polygons, unit labels, elevation contours, UTM grid at 2000m X/Y spacing, hillshade, and roads (see attached map).

<u>Step 6: Import XYZ data and add fields for data storage</u>

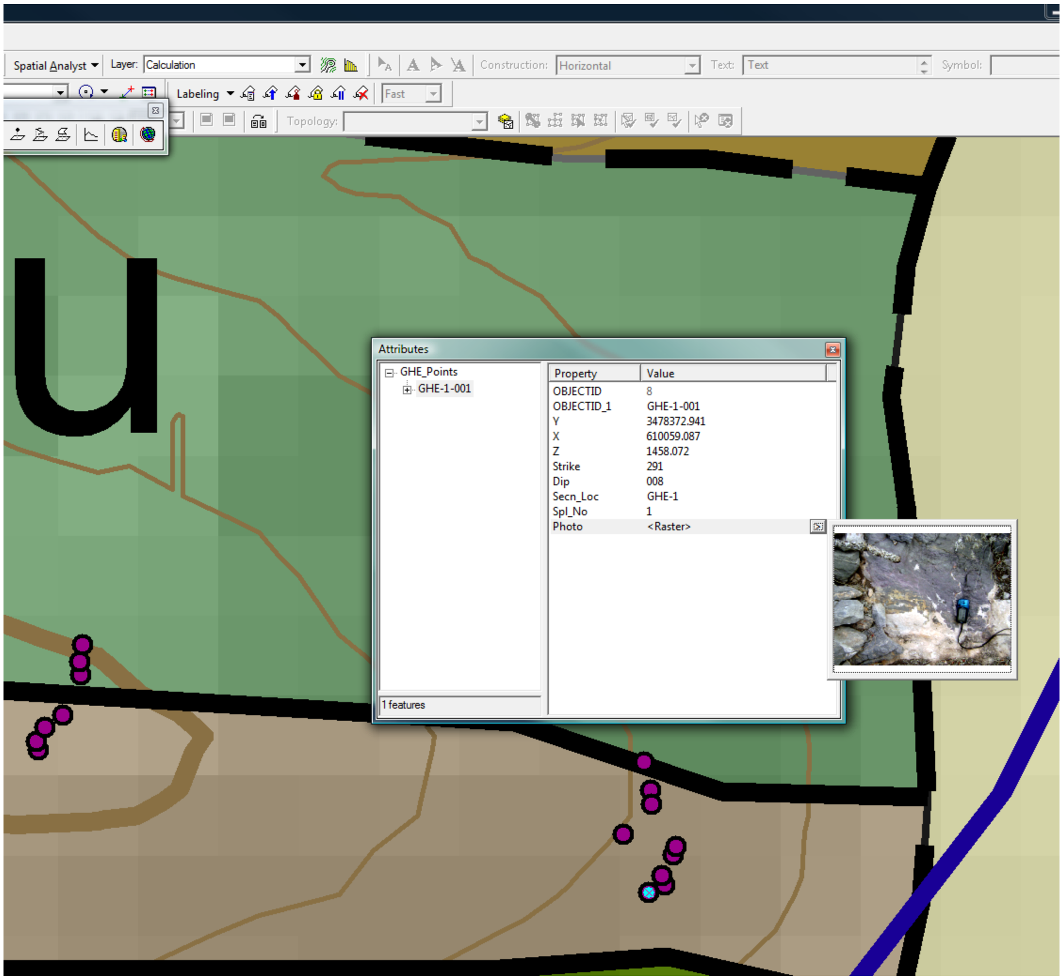
1) In ArcToolbox: 3D Analyst Tools ->Conversion -> From File -> ASCII3D to Feature Class. Created GHE_Points feature class for 2 measured sections that were calibrated with RTK GPS points. Data were collected with Trimble RTK-GPS during Summer, 2009.

2) Add fields to store other data:
Strike (short integer – with strike domain)
Dip (short integer – with dip domain)
Secn_loc (text) – name of measured section
Spl_No (short integer) – stores number of samples taken for section
Image (raster) – outcrop photos or photomicrographs from thin section



3) Add feature class to ArcMap and populate fields with data from measured sections. NOTE: This is a terrible data set. I collected RTK points of facies contacts and not

samples and strikes and dips like I should have. The dataset is thus VERY incomplete – I still need to get my other post-processed data collected in November from BEG staff.



4) Could not figure out how to filter the data to filter to show which points have photos, but it would be nice to have a map of GPS points with field photos so I can look at vertical facies trends. It would also be nice to store more than one photo for each point, but I could not figure out how to do this either – I tried creating multiple raster fields but that was not allowed; also tried to add another photo but the first photo was overwritten.

Geologic Map of the southern Mule Mountains Cochise County, Arizona