Projecting a Gully on Wilson Ranch Meadow, Eldorado National Forest

By David Russell and Angelina Lasko
Humboldt State University

Introduction

The purpose of this project is to create a digital elevation projection of a gully on Wilson Ranch Meadow in the Eldorado National Forest near Lake Tahoe. The precise location of the gully is at N 38°49'40.0296", W -120°15'19.9152", at 5132 feet elevation in Eldorado County, California. Wilson Ranch is a small inholding in the Eldorado National Forest, and in the 1940's parts of the meadow was logged and clear cut to open up the meadow for more grazing. Over time, this caused numerous environmental concerns. This area is currently a concern to the United States Forest Service (USFS) due to drying of Wilson Ranch Meadow, and would like to restore and rewet this meadow. If this was not of concern, a large amount of native pollinator species and grasses would die due to drought, and it would allow for drought tolerate species to colonize and change the ecology over time of this ecosystem. Also, if this gully is not a priority to restore, then fish and other aquatic species will suffer due to the displacement of water.

Angelina over the summer of 2014 worked as a Soil Science Technician for the USFS on the Eldorado National Forest. One of her side projects during her employment time was to gain knowledge in GIS skills by attempting to create a digital elevation projection of the gully to better understand erosional features and the best way to implement restoration of this area. Also, to gain equipment skills. Although Angelina was unable to finish this project over the course of her employment, she collected enough data for us to finish the project today for this assignment. The end result of this project is to create a Digital Image Projection (DIP) of the

Wilson Ranch gully as precisely as possible, or illustrate a Digital Terrain Model (DTM) of elevation to a greater degree than is currently available with a 10 meter DIM that the USFS currently uses.

Methods

The data collection for the project was measured by the elevation change along five transects across the gully and capture, as best as possible, all the elevation differences using surveying equipment. The area of the gully was divided into 5 transects running east to west across the gully. Each individual transect was surveyed using a benchmark and changes in elevation height where recorded every time there was change in 1 foot. The distance between each change in data and the length of the transect was also recorded. From this data that Angelina collected we will generate a Digital Projection Model (DEM).

After collecting the data this summer, the next step was to find a 10 meter DEM for this location. This was obtained by the USFS in the form of a raster file. After projecting the points of the transects into ArcMap, along with the 10m DEM, we had to decide a route to project our gully more precisely using the measurements acquired this summer through Angelina's data collection. To do this, we first had to create a graph representing each transect as a cross section in Microsoft Excel. Once the cross section for each transect was graphed, a trend line, or slope average was create to average out the parabola that represented the elevation changes over the course of each transect. The average was then divided by the total number of benchmarks used to take the transect. The purpose of this was to create a smoother range of data that could be attributed to a split section of a polyline projected over the surface of the DEM in ArcMap.

Now having an averaged slope line representing elevation changes over distance for each transect, would allow to begin creating the DEM for the gully. The first step in ArcMap to prepare our DEM, was to create a polyline layer connecting each transect point together creating a layer for each individual transect; having 10 points representing the 5 transects taken. After creating the 5 new transect layers, each individual transect was sectioned off using the 'split' tool in the 'Editor' tool bar. Each polyline was split into even sections representing the same number of benchmark elevation changes taken for each transect.

After splitting each polyline into its correlate number of measurements taken-the data for that being in excel-it became time to compile the data from Excel into ArcMap. To do this two new data fields where created for each transect in the attributes table. The new attributes were copied and pasted from the excel sheet with one attribute representing the number of measurements taken per transect over distance, and the second attribute representing the elevation changes for the measurements. The data used here is the average cross section slope line and points from the Excel calculations. Finally, after compiling the transect data into the attributes fields in ArcMap, the Raster Tool was used to convert the polyline data into raster data creating a higher resolution DEM for the gully, using Angelina's data.

Results

Figure 1, Project Location

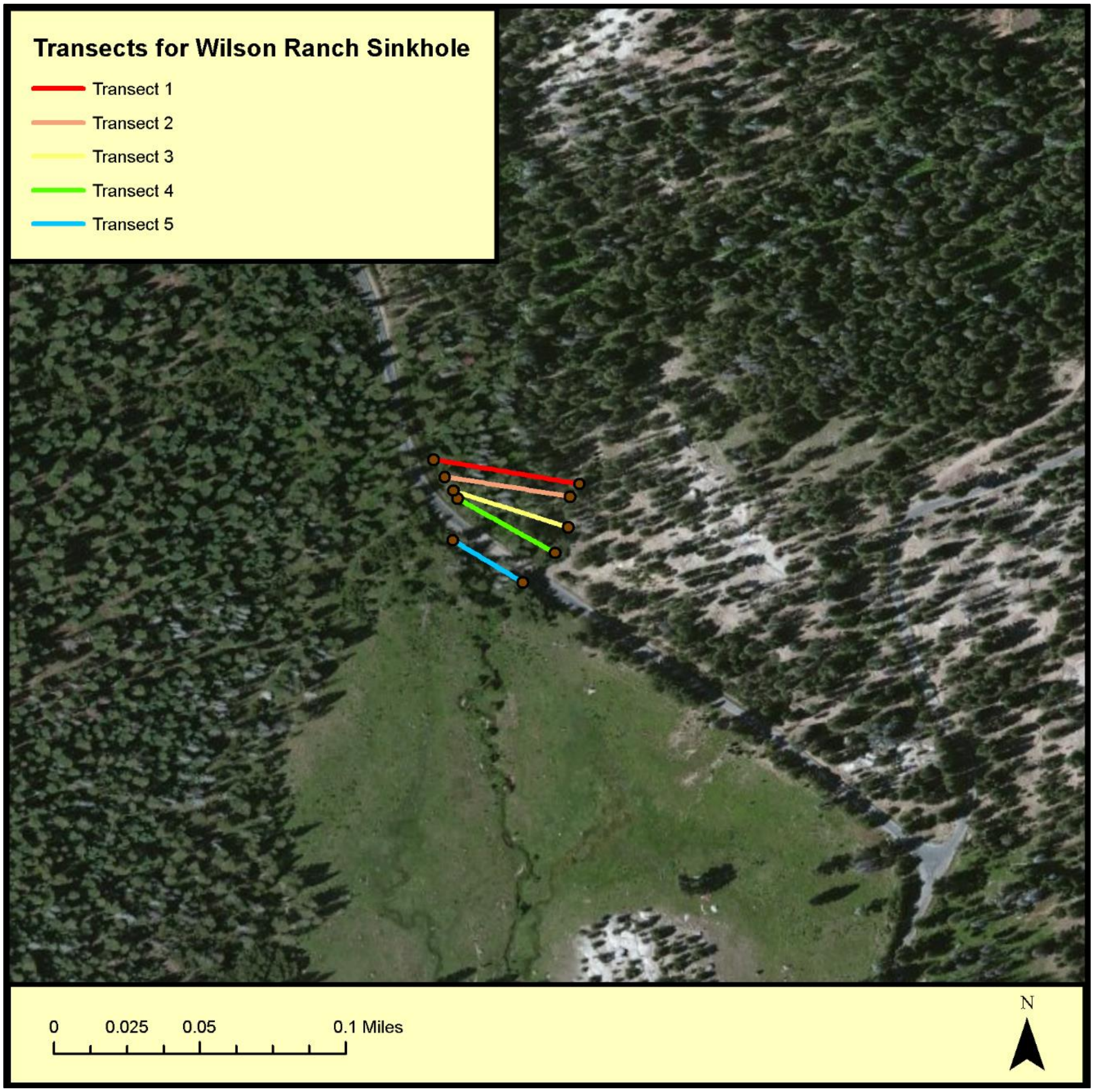

Figure 2, Imagery of Transects

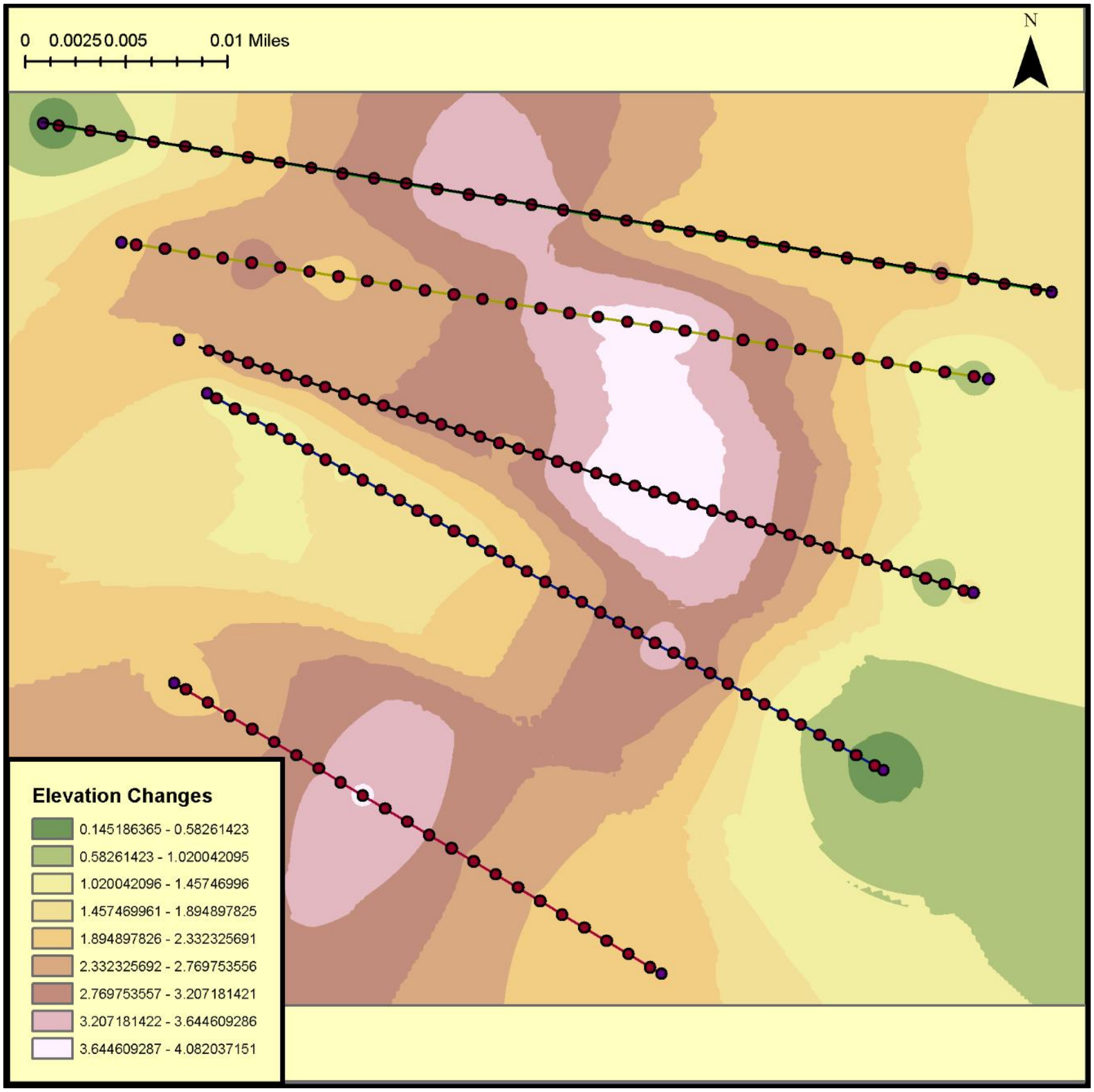

Figure 3, Final DEM of Project Site. Note Elevation Changes =-1(X), Values are actually negative.

Conclusions

Projecting the gully into a DEM was harder to replicate than anticipated. The projection for the DEM was created with assistance of a lab instructor. We had difficulties with the Z values when projecting the DIP because the elevation numbers should have been negative. We overlooked this issues when creating the projection and document the calculation necessary to correct the error in Figure 3's caption. Having more lab time to work on projects will allow for more help and from instructor, which will allow for a better final result.

References

ESRI 2011. ArcGIS Desktop: Release 10. Redlands, CA: Environmental Systems Research Institute.

Microsoft. Microsoft Excel. Redmond, Washington: Microsoft, 2013. Computer Software.