GEO 327G Semester Project

Urbanization in the Onion Creek Watershed

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Problem Formulation

The Onion Creek Watershed is located southeast of Austin where population and urbanization has been increasing at a sustained rate over the past 10-15 years. Recently, the area has endured numerous flood events, most notably the Halloween Flood of 2013. The Austin City Council has bought out over 300 homes in the watershed since 1999 due to the areas susceptibility to flooding. The goal of this project is to investigate which areas of the Onion Creek watershed have seen the largest increase in impervious cover and determine how much (if any) role urbanization has played in the increase of floods in the area.

Data Collection

Data used was collected from the following sources:

TNRIS (National Land Cover Dataset):

Texas impervious cover data

http://www.tnris.org/get-data?quicktabs_maps_data=1

City of Austin:

Watersheds, County Boundaries, and Creek Lines

ftp://ftp.ci.austin.tx.us/GIS-Data/Regional/coa_gis.html

Data Preprocessing

No preprocessing was required.

ArcGIS Processing

I began by adding the watershed and county boundary files to ArcMap

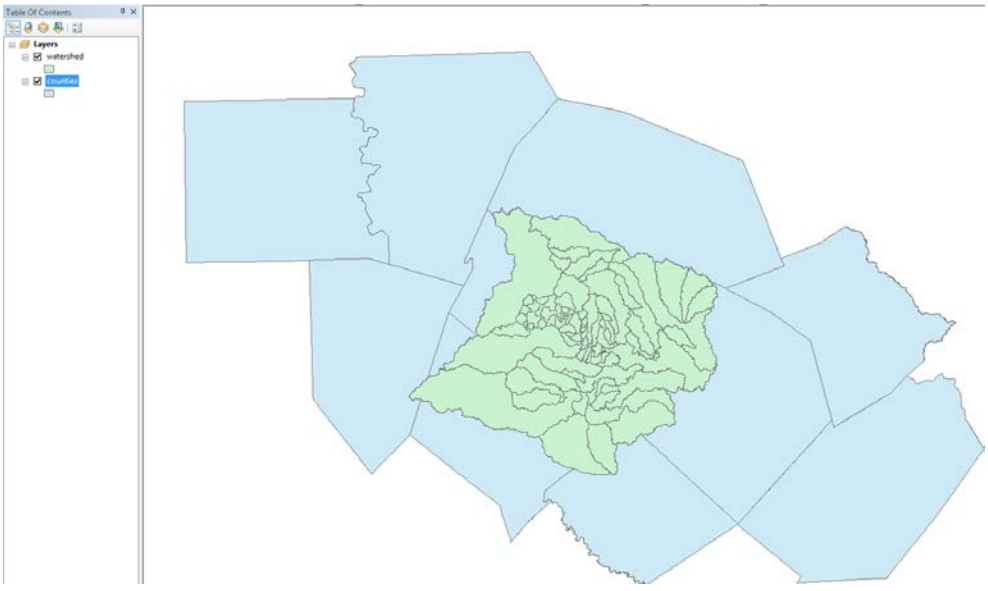

Figure 1: County and Watershed Shapefiles

Next, I selected the watersheds I wanted to observe for this project and dissolved their boundaries. This was done by using the editor toolbar (Edit>select features>merge) and used the Clip tool to clip the county boundaries to the watershed to create a new file “ClipCounty.” I then added label features to the ClipCounty shapefile.

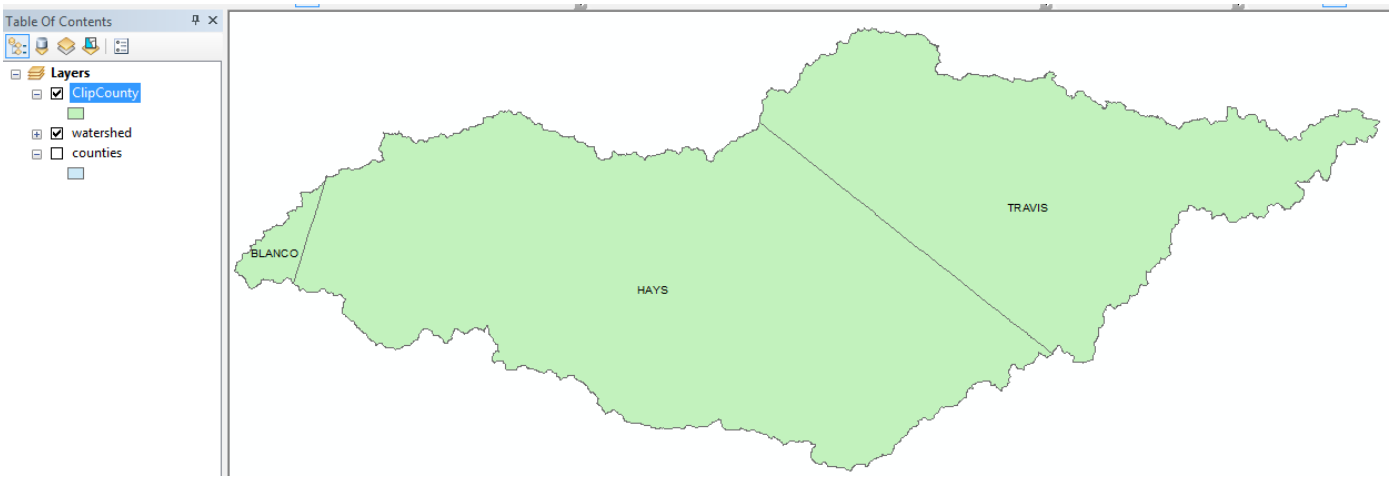

Figure 2: Watershed with county boundaries clipped

After this step, the 2006 impervious cover raster was added to the TOC and its projection was changed to match that of the ClipCounty layer (properties>coordinate system>NAD83 StatePlane Texas Central).

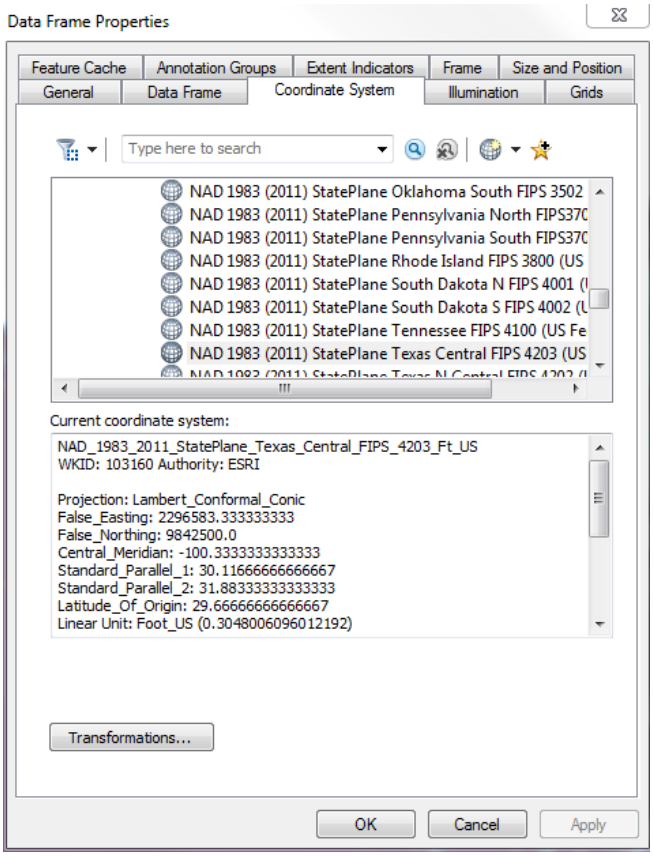

Figure 3: Changing the projection of the original 2006 raster

Using the Extract by Mask tool, the 2006 impervious cover raster was clipped to the ClipCounty shapefile and the resulting raster was named “WSCoverClip.”

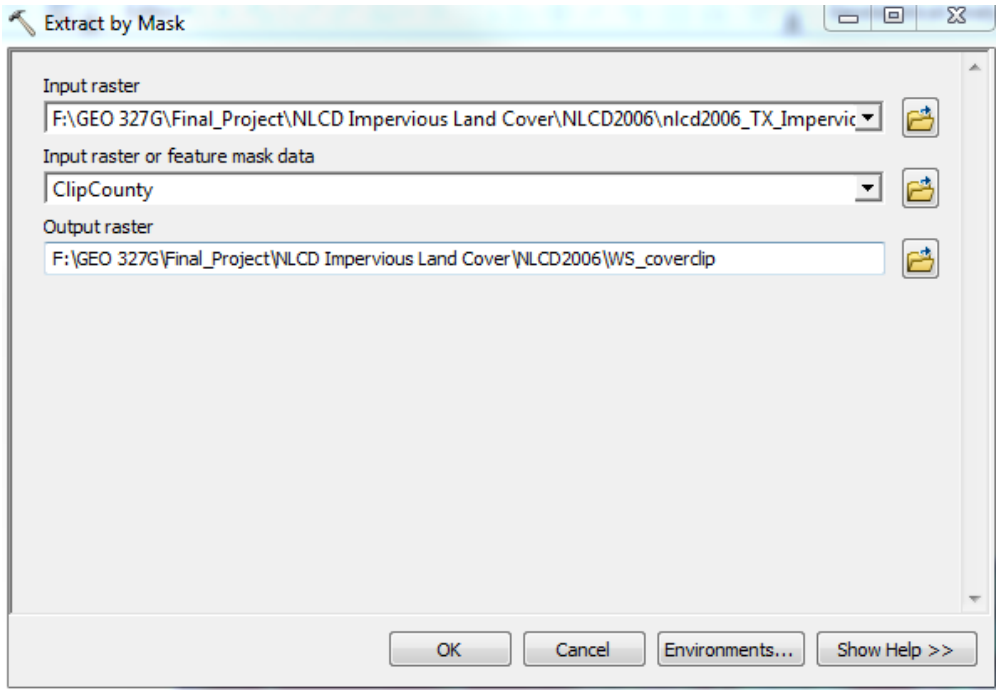

Figure 4: Clipping the 2006 raster to the ClipCounty layer

This raster was reclassified using the reclassify tool in order to rank the data based on my ranking scheme.

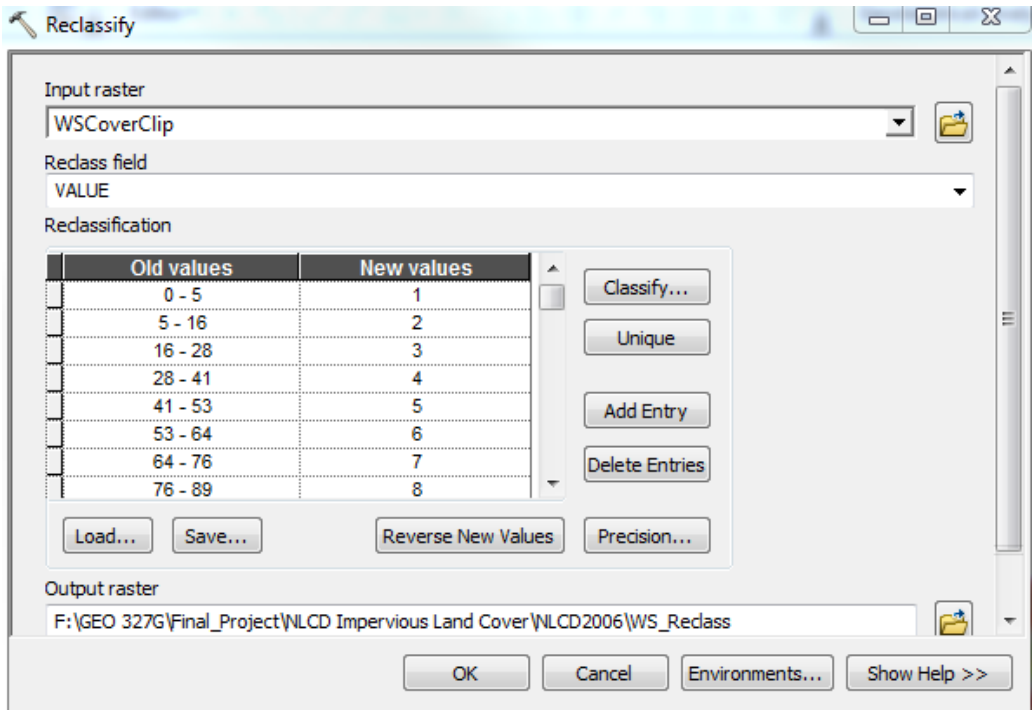

Figure 5: Reclassifying the WSCoverClip Raster

Making the ClipCounty layer 75% transparent shows that the majority of the impervious cover is in Travis County

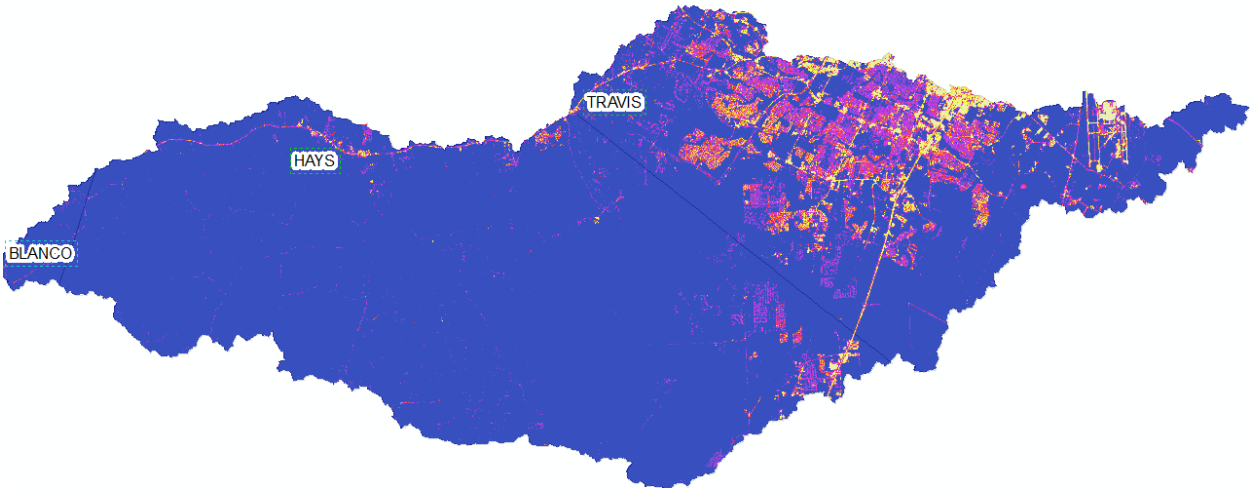

Figure 6: Reclassified 2006 Impervious Cover raster

The same procedure was applied with the 2001 and 2011 impervious cover datasets.

After all the impervious cover rasters were created, using the raster calculator I subtracted the 2001 raster from the 2011 raster to get a raster that represents the change in impervious cover between those years. This was done using the raster calculator.

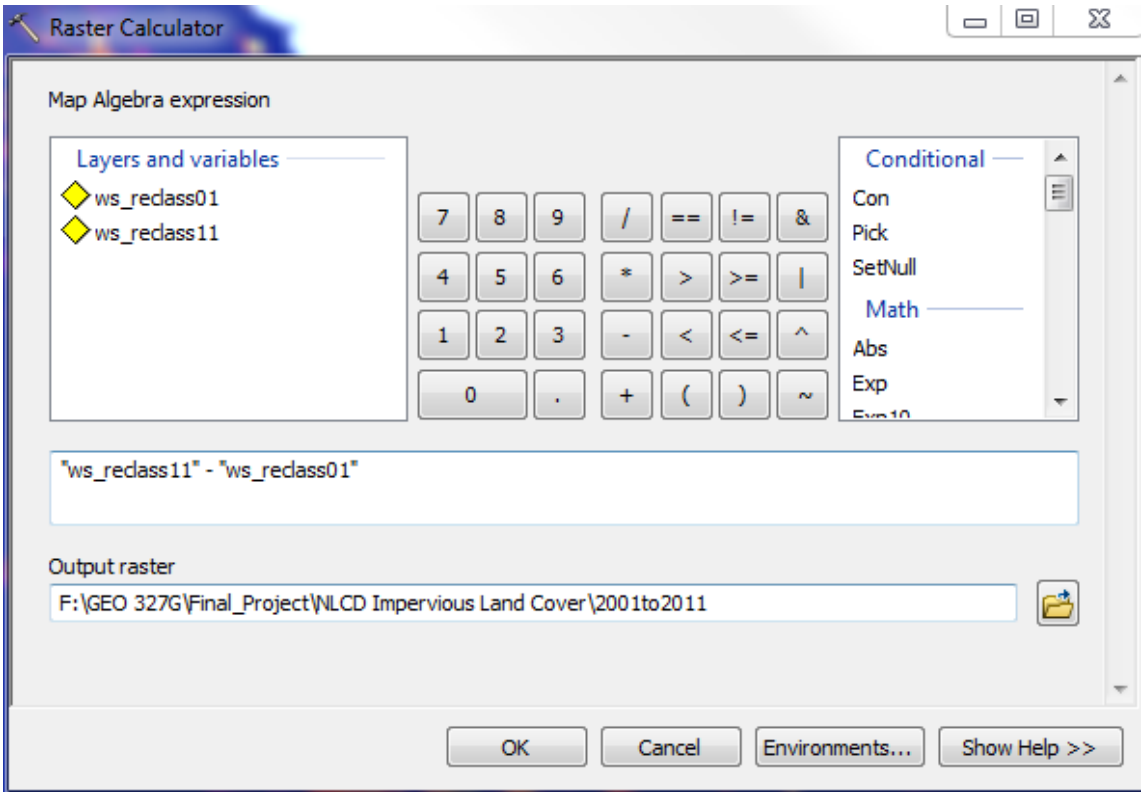

Figure 7: Raster algebra to create a raster that represents the change in impervious cover

The resulting raster shows that some areas actually had some decreases in impervious cover, but the vast majority had no change or a positive change.

The final step was taking the Creeks_lines shapefile and clipping it to the county line shapefile using the same process as described before. Onion Creek was then selected and its symbology changed to differentiate it from the other streams. This procedure was followed again for Figure 9.

After the final change raster was created, the clipped and resampled 2011 raster was analyzed to determine what percentage of land in the watershed was 100% impervious. Using the Value Attribute Table, it was determined that is raster included 991,998 total cells, and 6,099 of those were completely impervious and 864,923 had no impervious cover, leaving 120,976 cells that fell somewhere in between. Each cell was 30x30 meters, so nearly 5.5 km^2 is completely impervious, 778 km^2 has no impervious cover, and 109 km^2 falls in between.

Conclusion

It is evident that the vast majority of the urbanization that has taken place in the Onion Creek watershed has been in Travis County (western portion). Over the study period, Hays and Blanco counties have seen relatively insignificant amounts of urbanization. Also noteworthy is that the southernmost areas of the watershed (including Buda and Kyle) are urbanizing faster than anywhere else, though the already established residential areas closer to Austin are becoming more impervious, as opposed to spreading impervious cover. What was a little surprising was that only 0.7% of the area in the watershed was completely impervious, and 87% had no cover at all. In light of this, I suspect that urbanization is not the sole reason that the Onion Creek watershed has seen so many floods. I think it is reasonable to assume that the watershed is intrinsically prone to flooding and that continued urbanization in Travis County is exacerbating the issue.

Maps

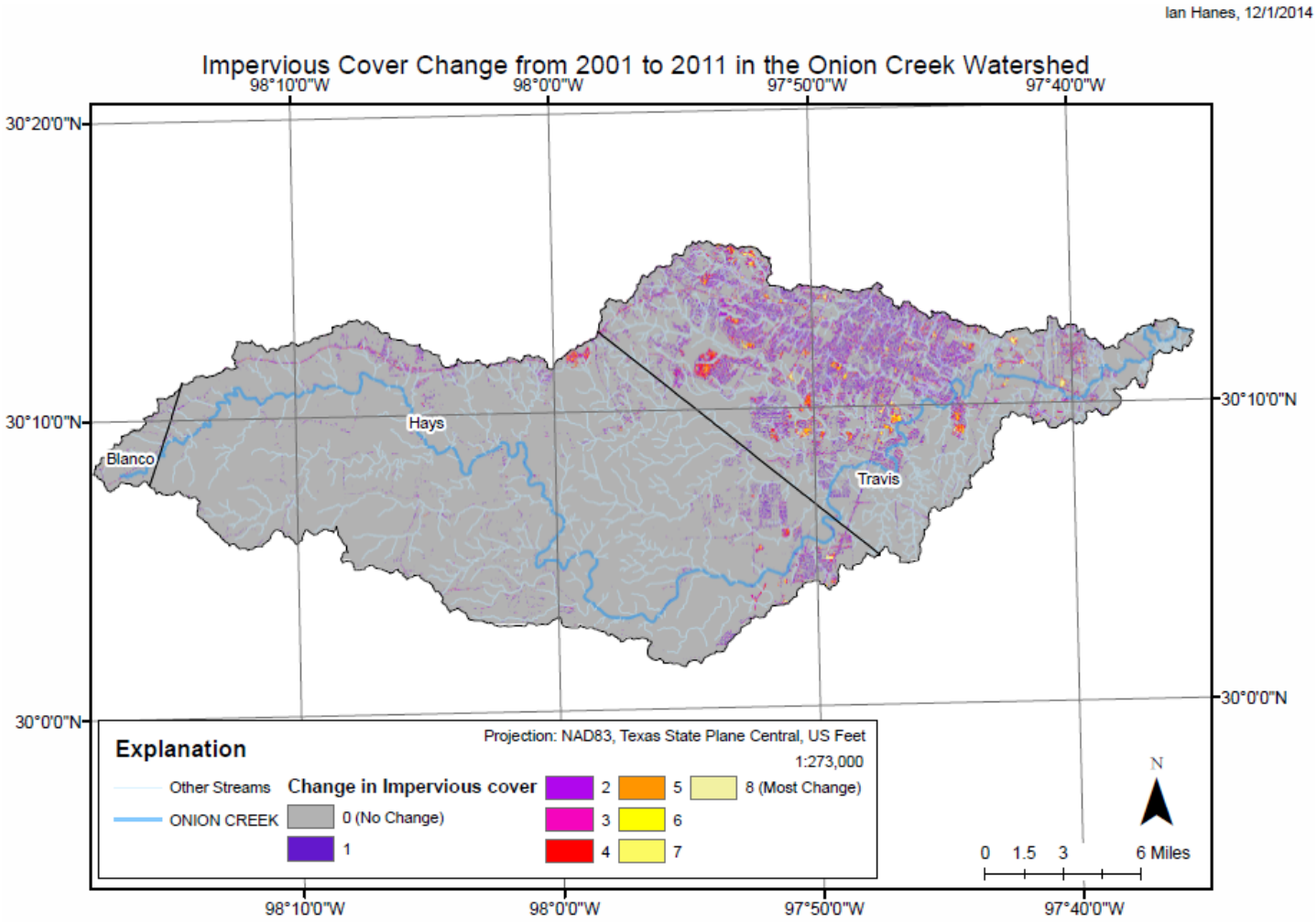

Figure 8: Final Map displaying the change in Impervious Cover

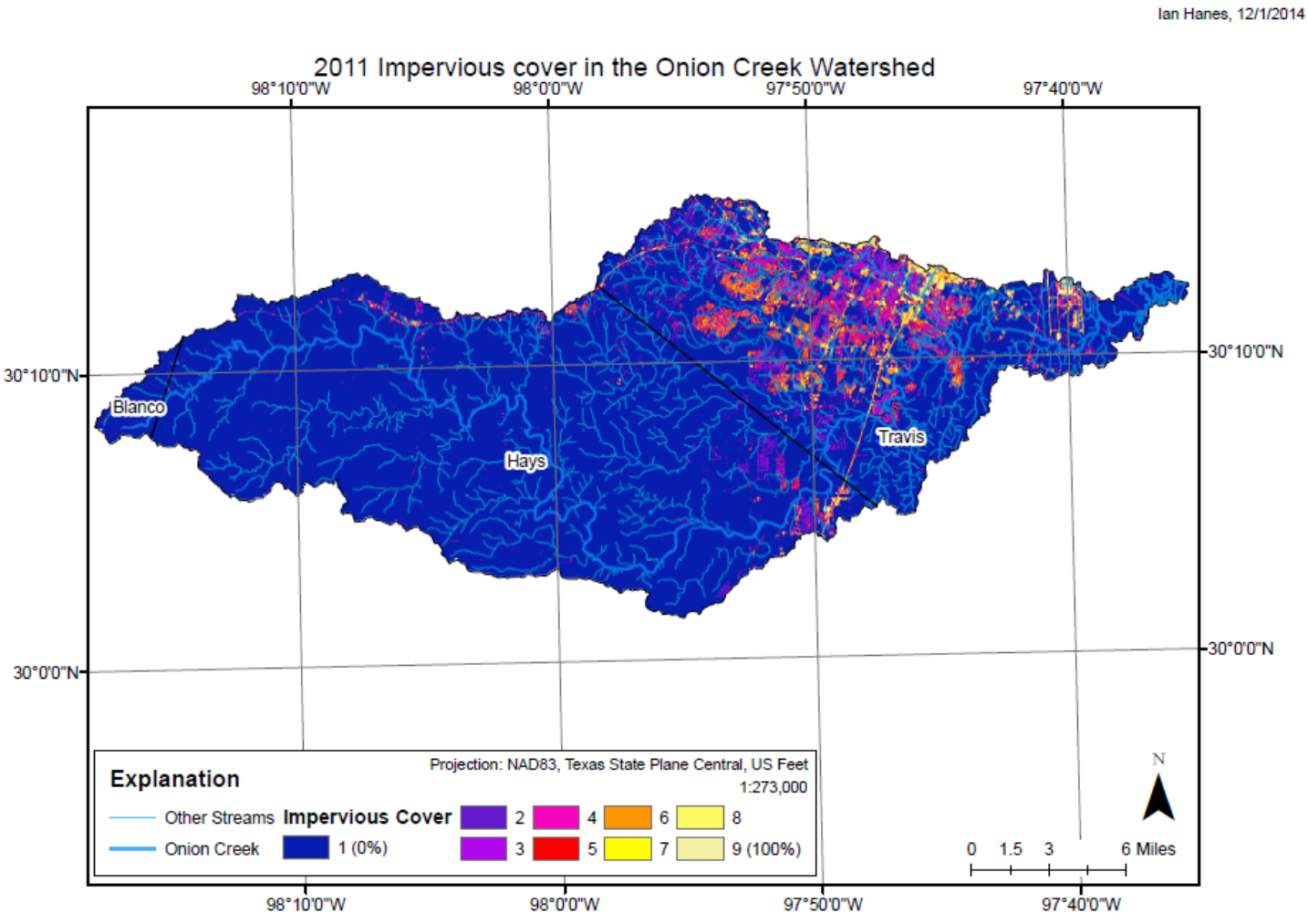

Figure 9: Total Impervious cover in the Onion Creek watershed in 2011