Fire Susceptibility Analysis
Carson National Forest
New Mexico

Can a geographic information system (GIS) be used to analyze the susceptibility of Carson National Forest, New Mexico to forest fires; the answer is yes. There are plenty of GIS data that can be readily obtained from the internet in order perform such an analysis, and GIS processing software possesses sophisticated tools that can be used to combine and/ or manipulate existing data to evaluate a multitude of inquiries.

GIS data can be collected from numerous locations around the world; the data collected in order to perform this forest fire susceptibility analysis was collected from the New Mexico Resource Geographic Information System Program (RGIS) and the United States Geological Survey (USGS). RGIS is a cooperative program between the New Mexico Information Technology Commission and the University of New Mexico; most of the data collected for this analysis was obtained via their website (http://rgis.unm.edu/): digital elevation models and shape files containing information on vegetation, national forest boundaries, roads, fire stations, towns, etc. I obtained shape files containing fire history information from the USGS via their website (http://www.usgs.gov/).

For this analysis the GIS processing software used was ArcGIS, and a summary of steps involved in creating the final product are as follows:

1) The vegetation of New Mexico and the Carson National Forest boundary shape files, along with others listed later, were obtained (Figure 1)
2) The vegetation of New Mexico shape file was clipped to the Carson National Forest boundary (Figure 2)

3) The vegetation polygons were dissolved in to one count per vegetation type in preparation for conversion to a raster (Figure 3)
4) I converted the polygons to a raster (Figure 4)
5) I determined fire susceptibility ranks based on the burnability of the vegetation type and fire history (Figure 5)
6) I assigned fire susceptibility ranks to the raster by reclassification of the raster—1 being the least likely to burn, alpine tundra etc, and 4 being the most likely to burn, montane coniferous forest (Figure 6)
7) The Fire History shape file was clipped to the Carson National Forest boundary (Figure 7)
8) A Fire History raster was created from the dissolved shape file using the Carson National Forest boundary as a mask and ranked according to the year of the fire—1 being the most recently burned and 4 being unburned forest (Figure 8)
9) A file containing all of the New Mexico fire stations within 100 km of the Carson National Forest boundary was created (Figure 9)
10) A multi-ring buffer was created from each of the fire stations—distances: 25 and 50 km (Figure 10)
11) A shape file containing New Mexico roads was clipped to the Carson National Forest boundary (Figure 11)
12) A 200 meter buffer was created from the file (Figure 12)
13) The fire station multi-ring buffer was clipped to the roads buffer and dissolved (Figure 13)

14) A fire station response raster was created from the new file using the Carson National Forest boundary as a mask, and it was ranked according to proximity to roads and fire stations (Figure 14)
15) The three newly created rasters were used to create the fire susceptibility raster using the spatial analysis raster calculator—each of the raster's values were added to create an overall susceptibility value (Figure 15)
16) The fire susceptibility raster was combined with other files—DEM (digital elevation model raster), lakes, streams, fire stations, roads, towns, and Carson National Forest boundary shape files—to create the final map layout (Figure 16)

This analysis addressed the issue of fire susceptibility in Carson National Forest, New Mexico. The data used to address the issue was collected from multiple places including RGIS and the USGS, and it was the most current data available from these locations. The analysis considered such factors as burnability of the various vegetation types, fire history of the area and proximity to fire stations. With the use of ArcGIS a final map was created to answer the question of fire susceptibility (Figure 16).

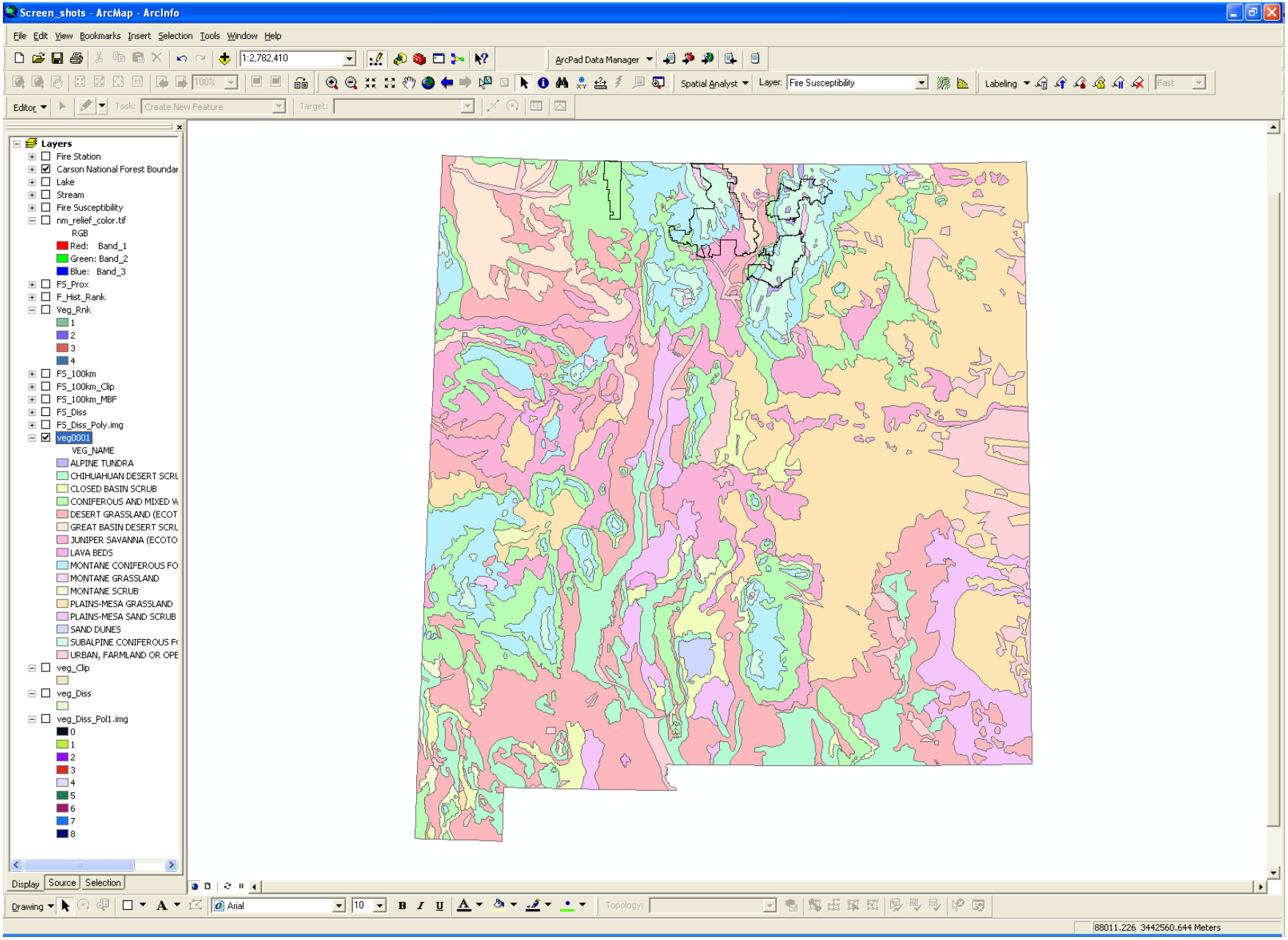

Figure 1: The vegetation of New Mexico and the Carson National Forest boundary shape files

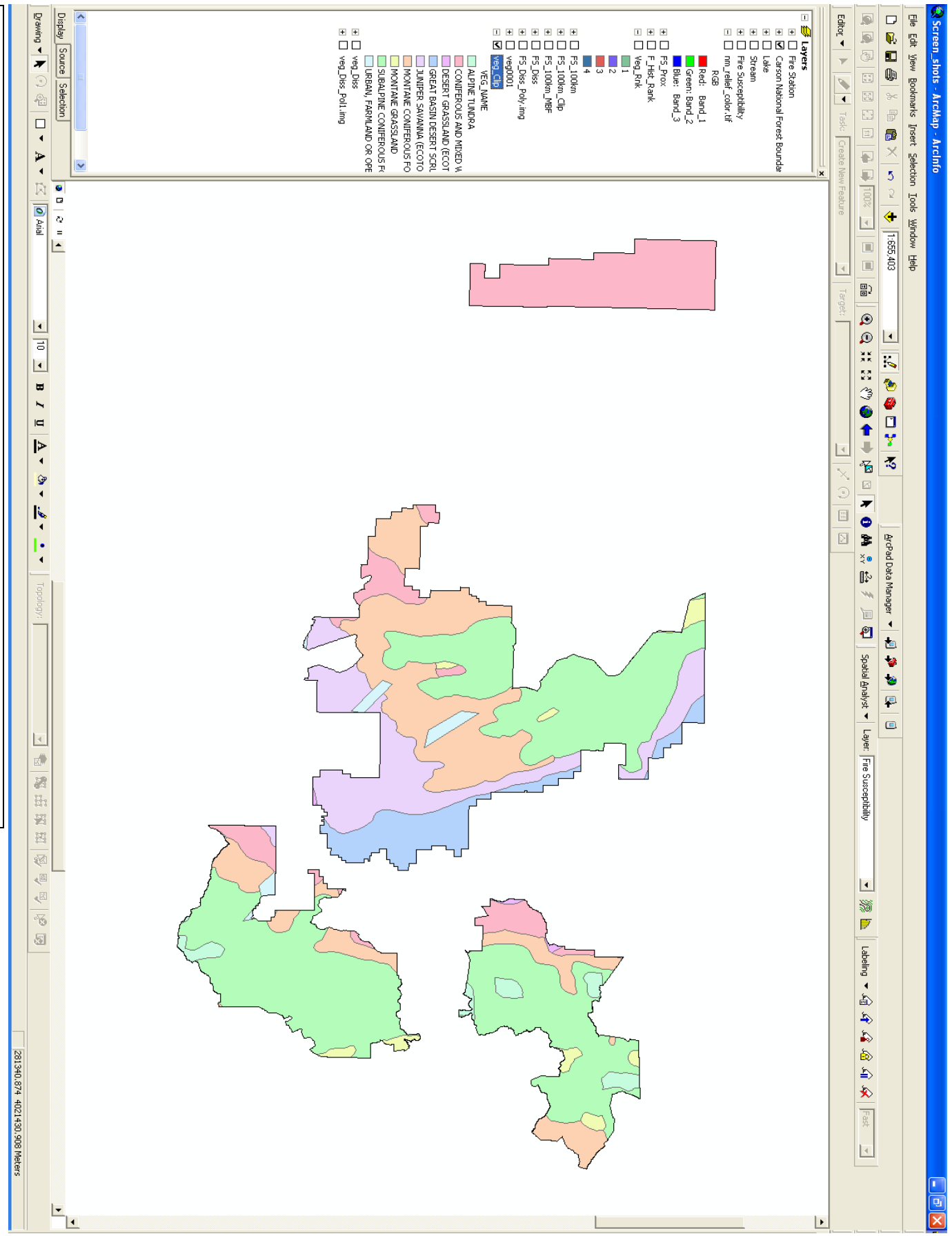

Figure 1: The vegetation of New Mexico clipped to the Carson National Forest boundary

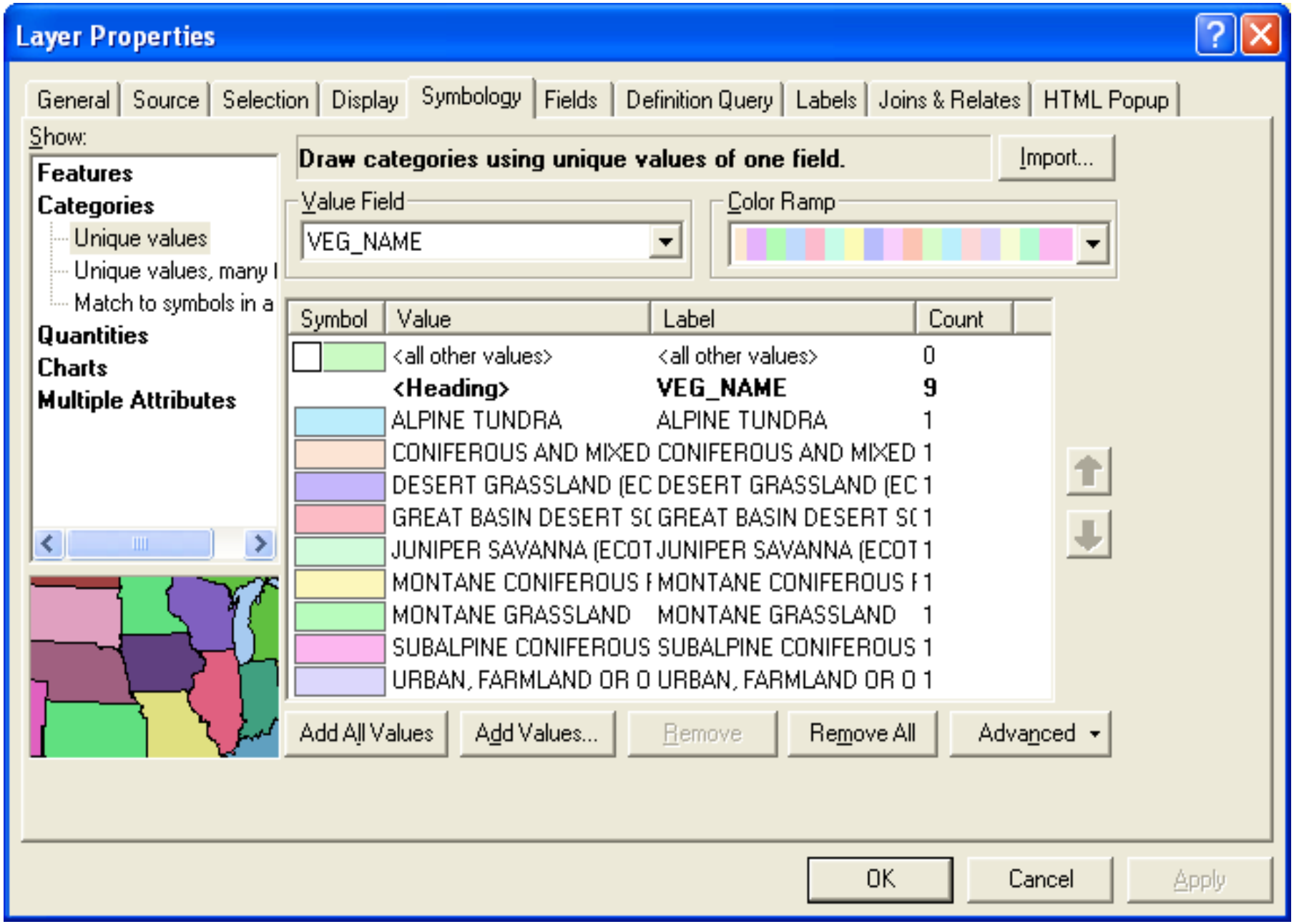

Figure 3: Dissolved vegetation polygons

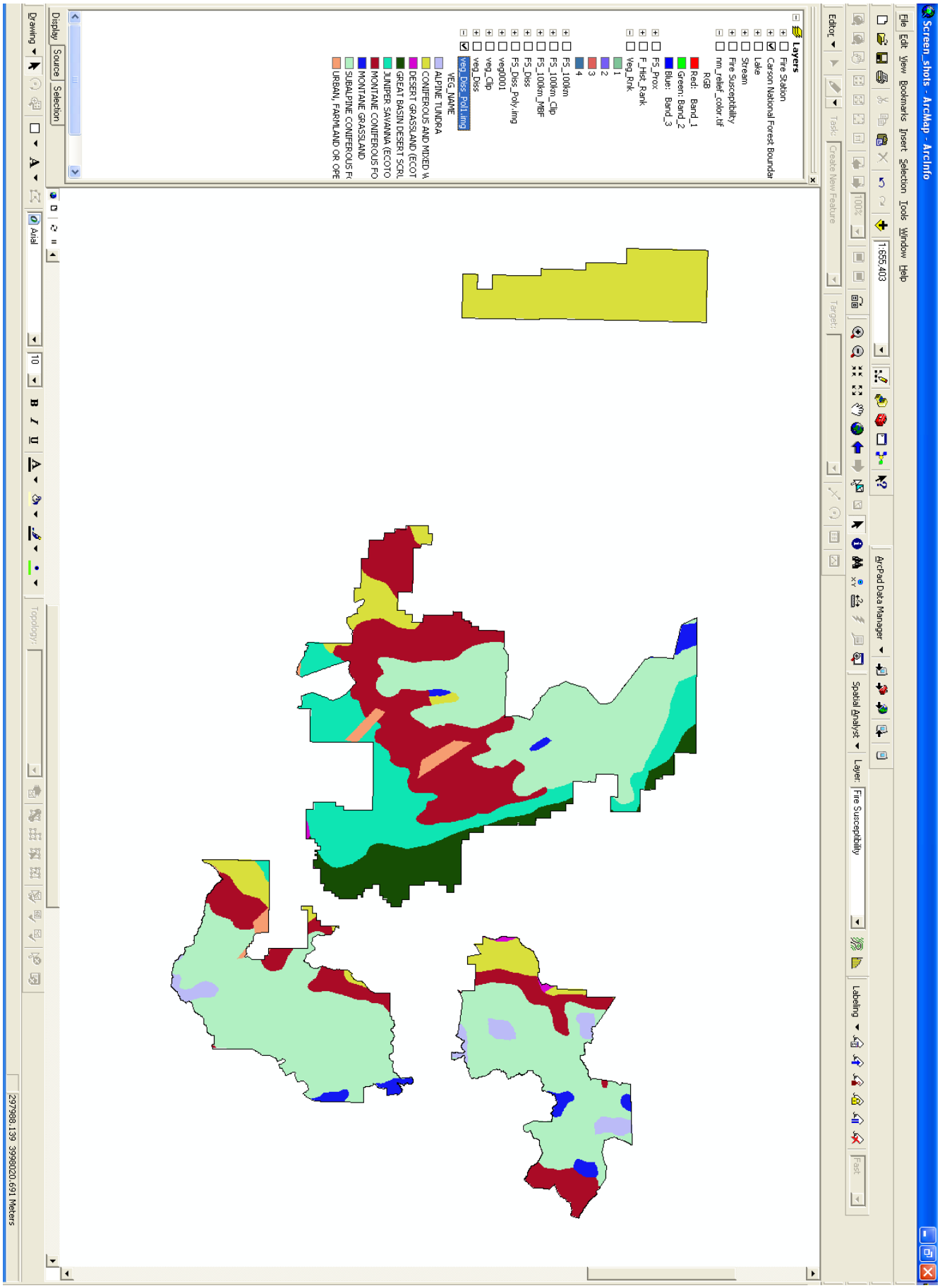

Figure 4: Vegetation polygons converted in to a raster

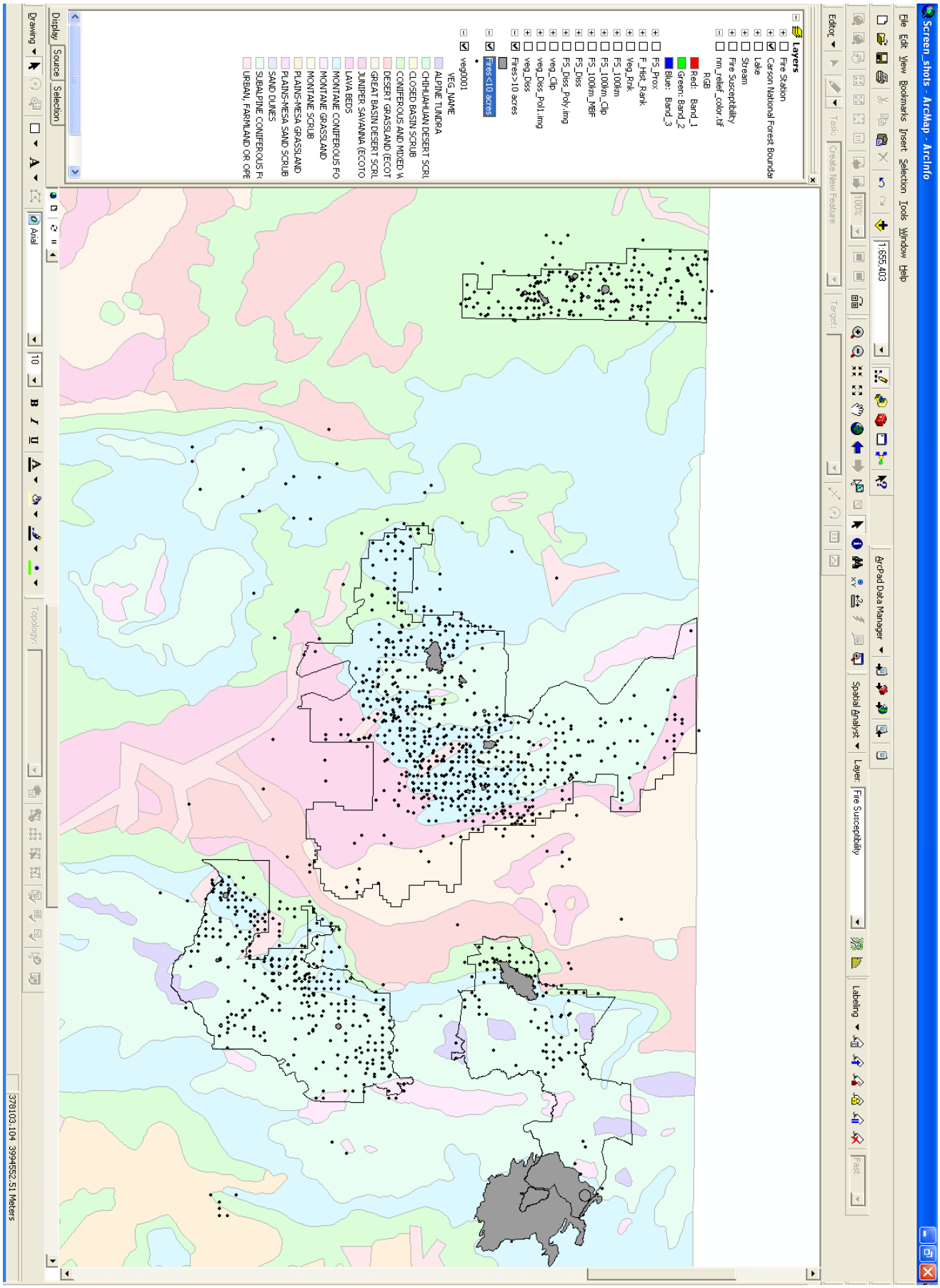

Figure 5: Burn history shape file used to assess the burnability of the vegetation types

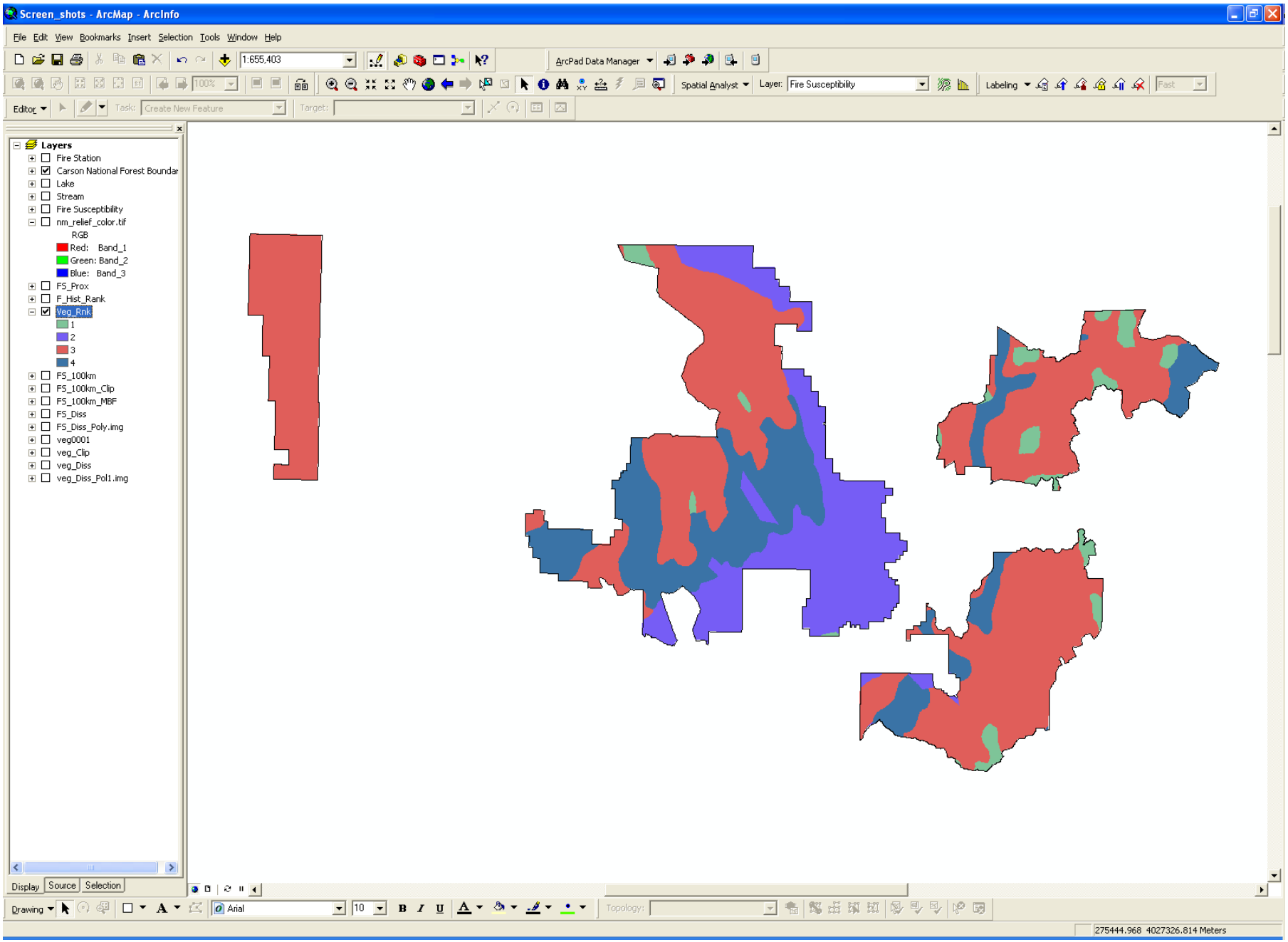

Figure 6: Reclassification of the vegetation raster reflecting fire susceptibility ranks

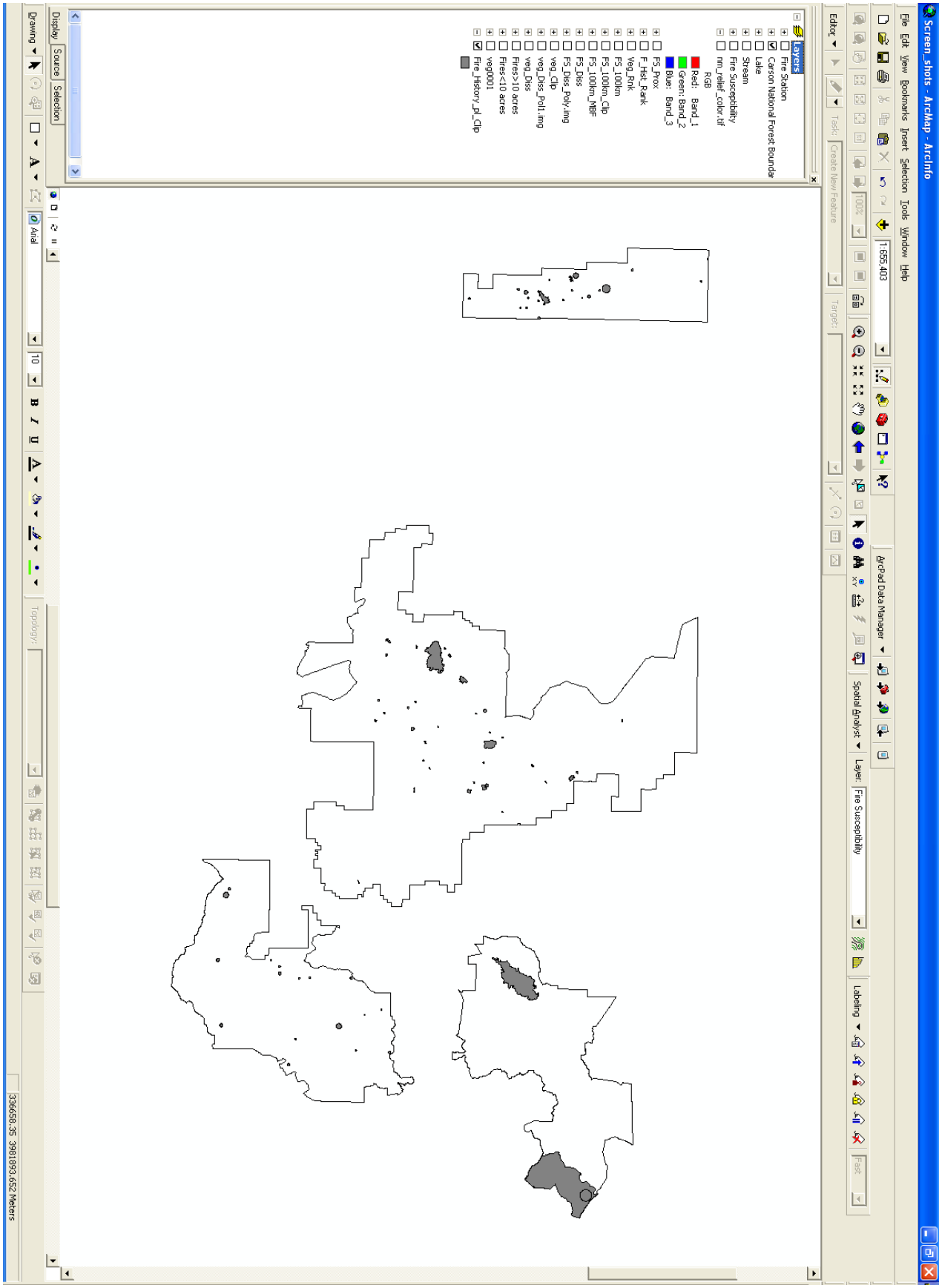

Figure 7: Fire history shape file clipped to the Carson National Forest boundary

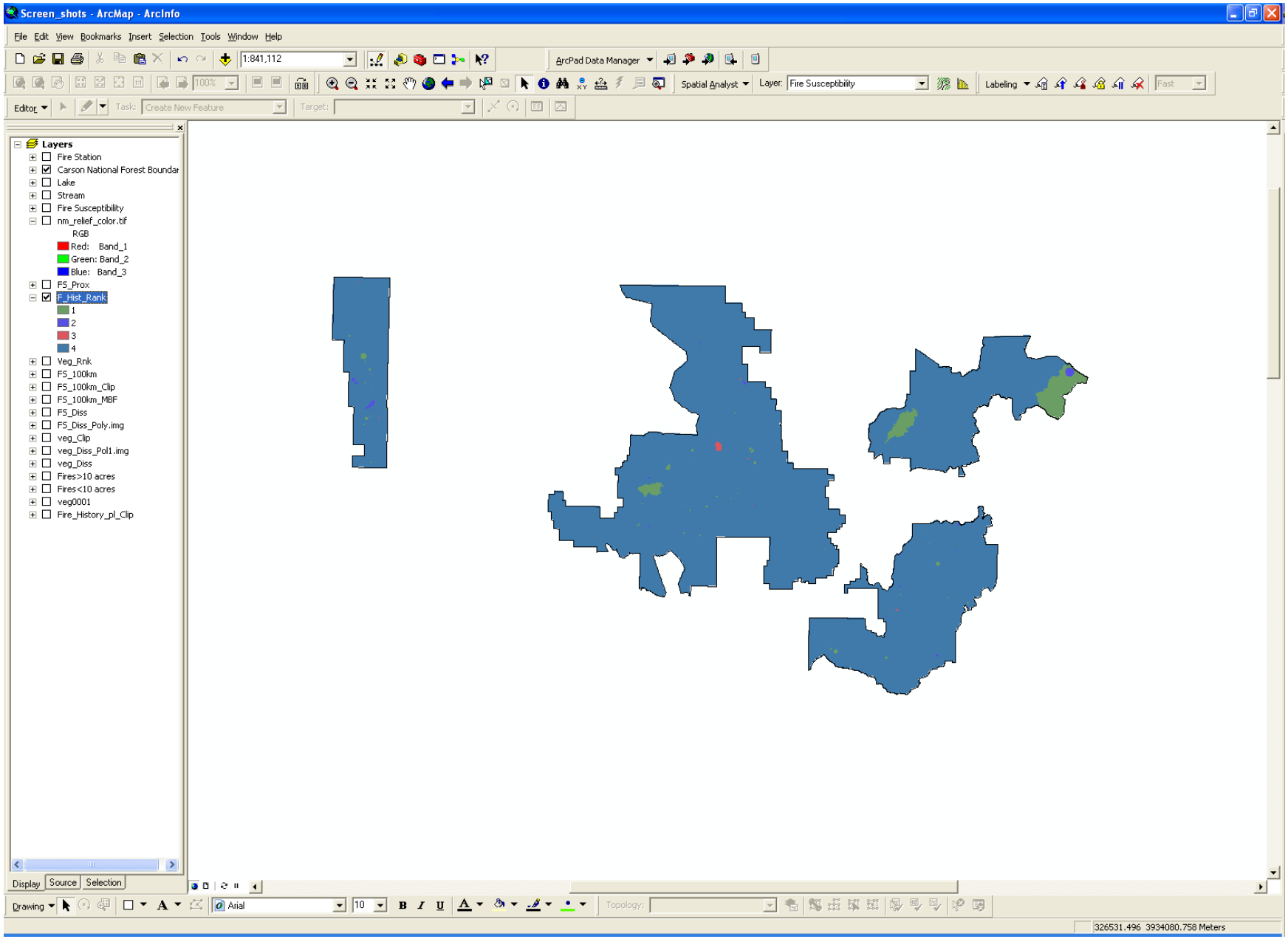

Figure 8: Fire history raster created from the shape file, masked to the Carson National Forest boundary, and reclassified reflecting fire susceptibility ranks

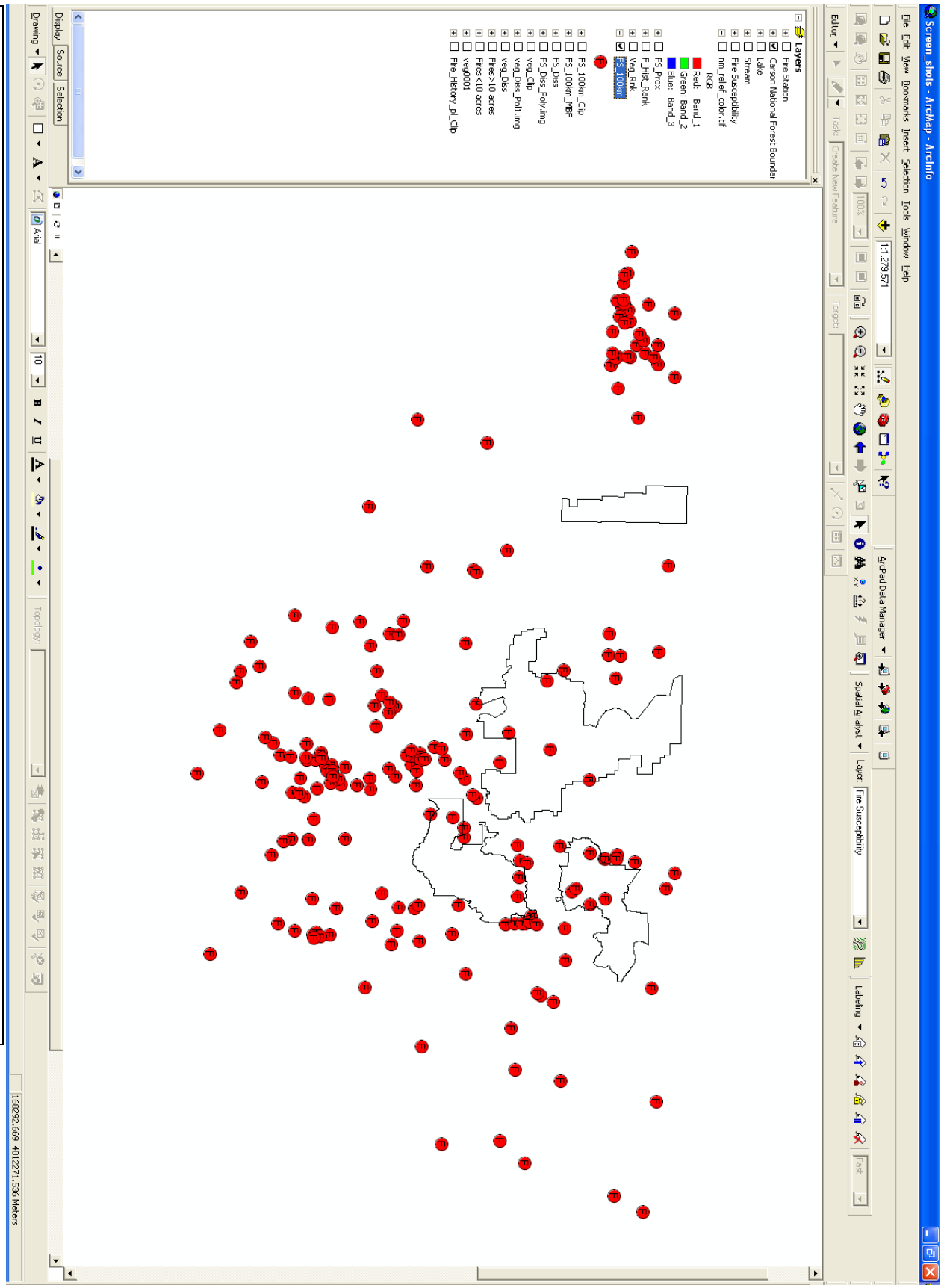

Figure 9: Shape file containing the New Mexico fire stations with in 100 km of Carson National Forest

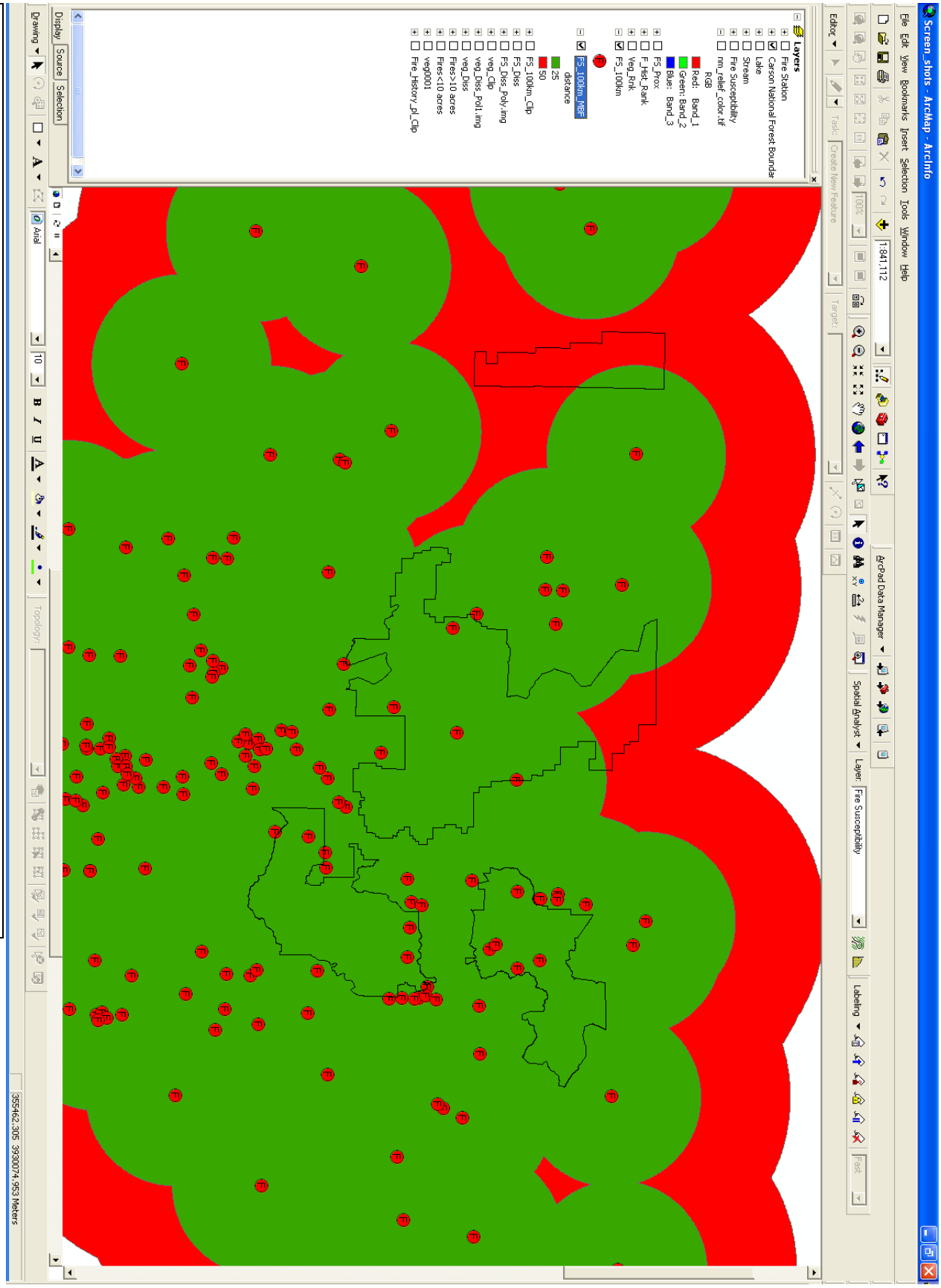

Figure 10: Multi-ring buffer created from each of the fire stations—distances: 25 and 50 km

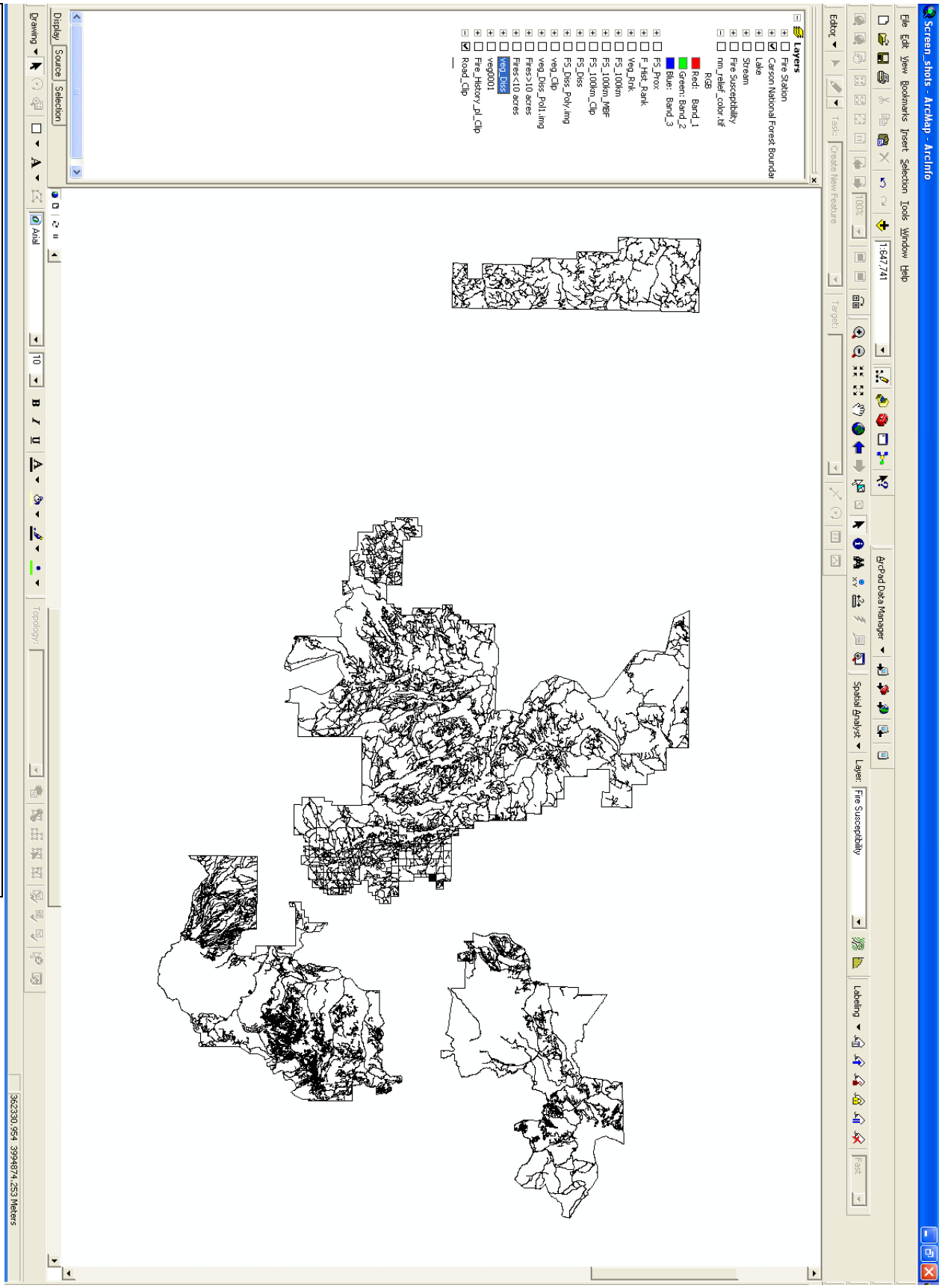

Figure 11: New Mexico roads shape file clipped to the Carson National Forest boundary

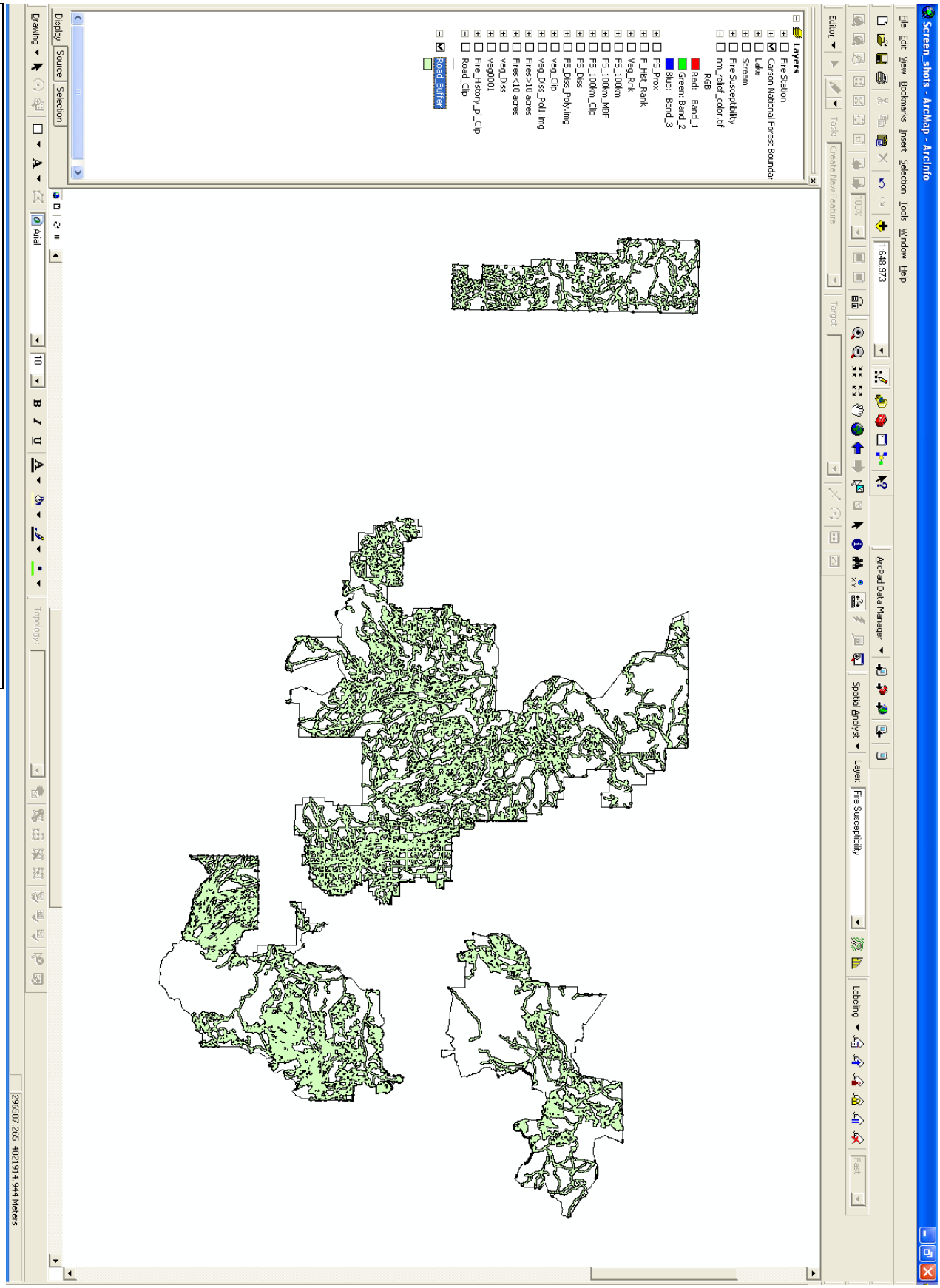

Figure 12: A 200 meter buffer shape file created from the roads file

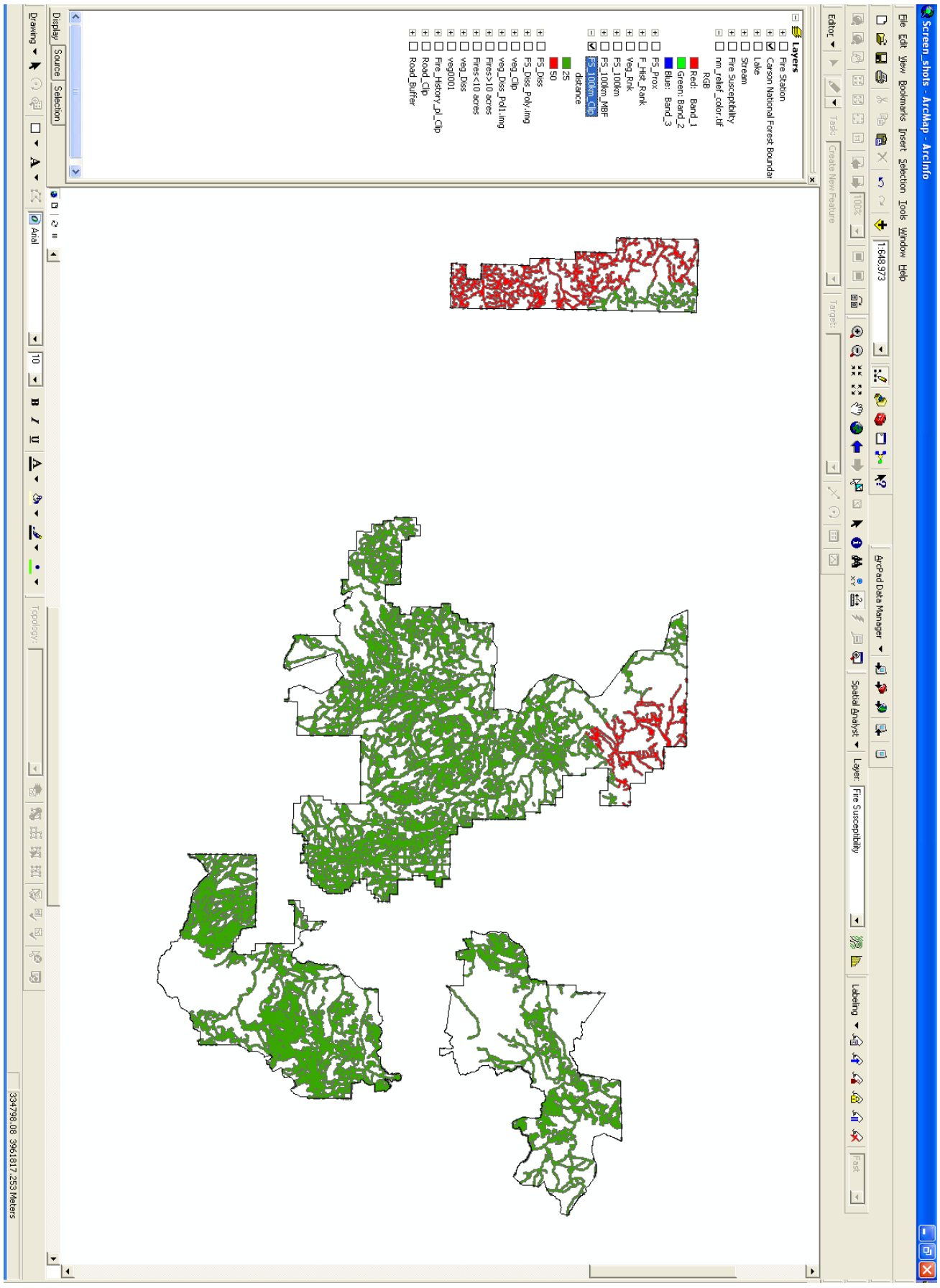

Figure 13: The fire station multi-ring buffer clipped to the roads buffer and dissolved

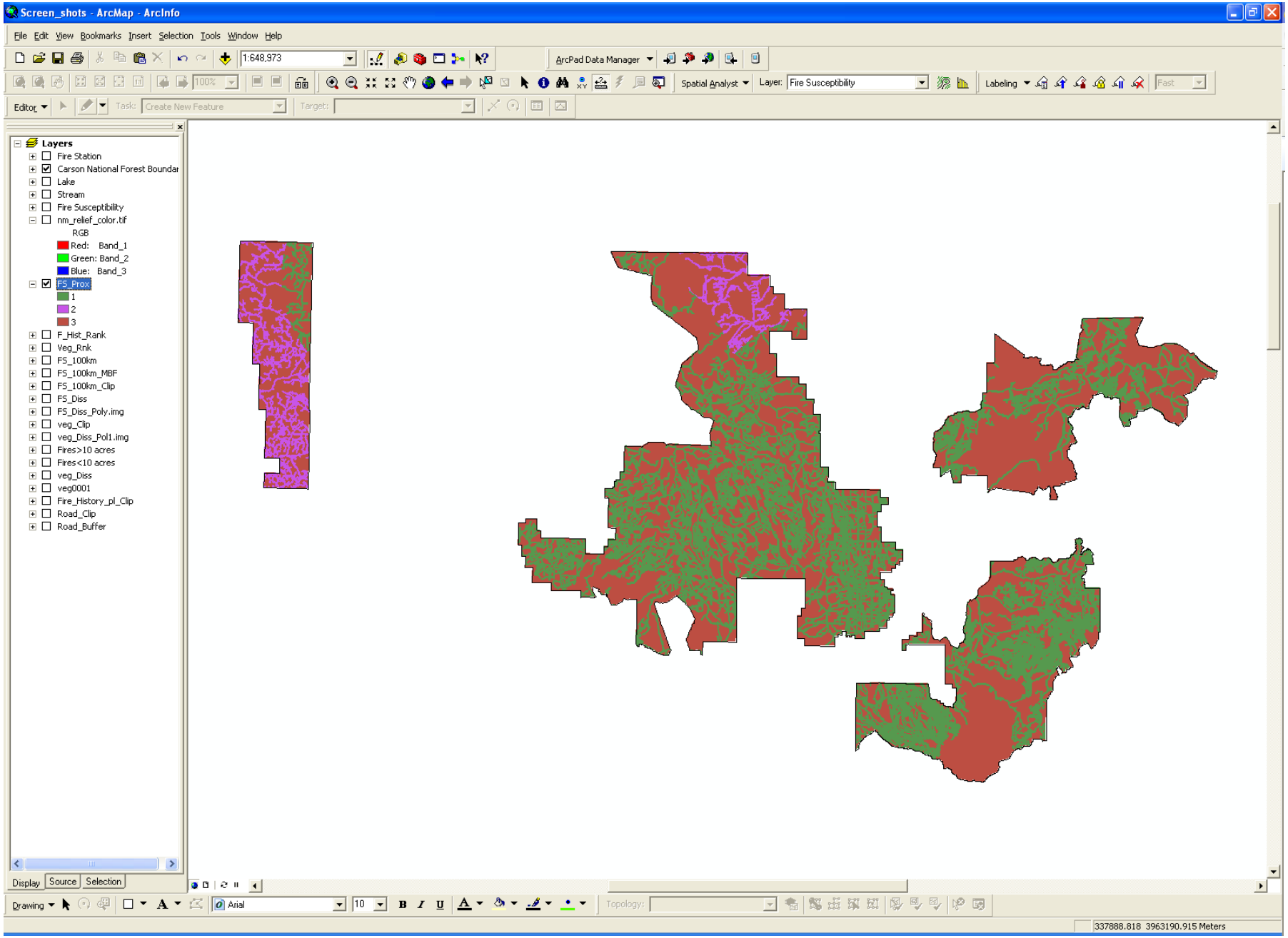

Figure 14: Fire station response raster created from the new file (Figure 13) using the Carson National Forest boundary as a mask, and ranked according to proximity to roads and fire stations

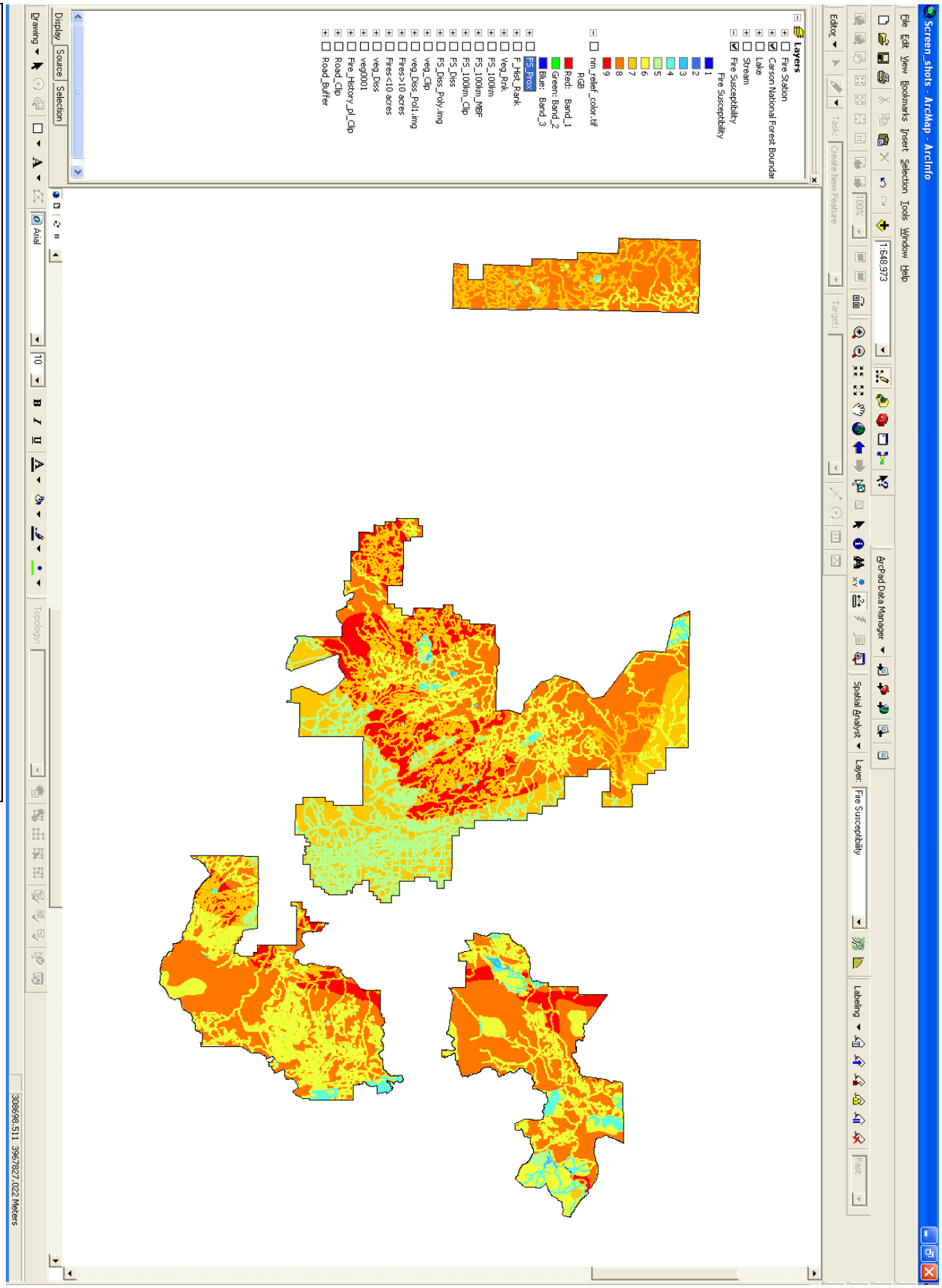

Figure 15: Fire susceptibility raster created from the three newly created rasters

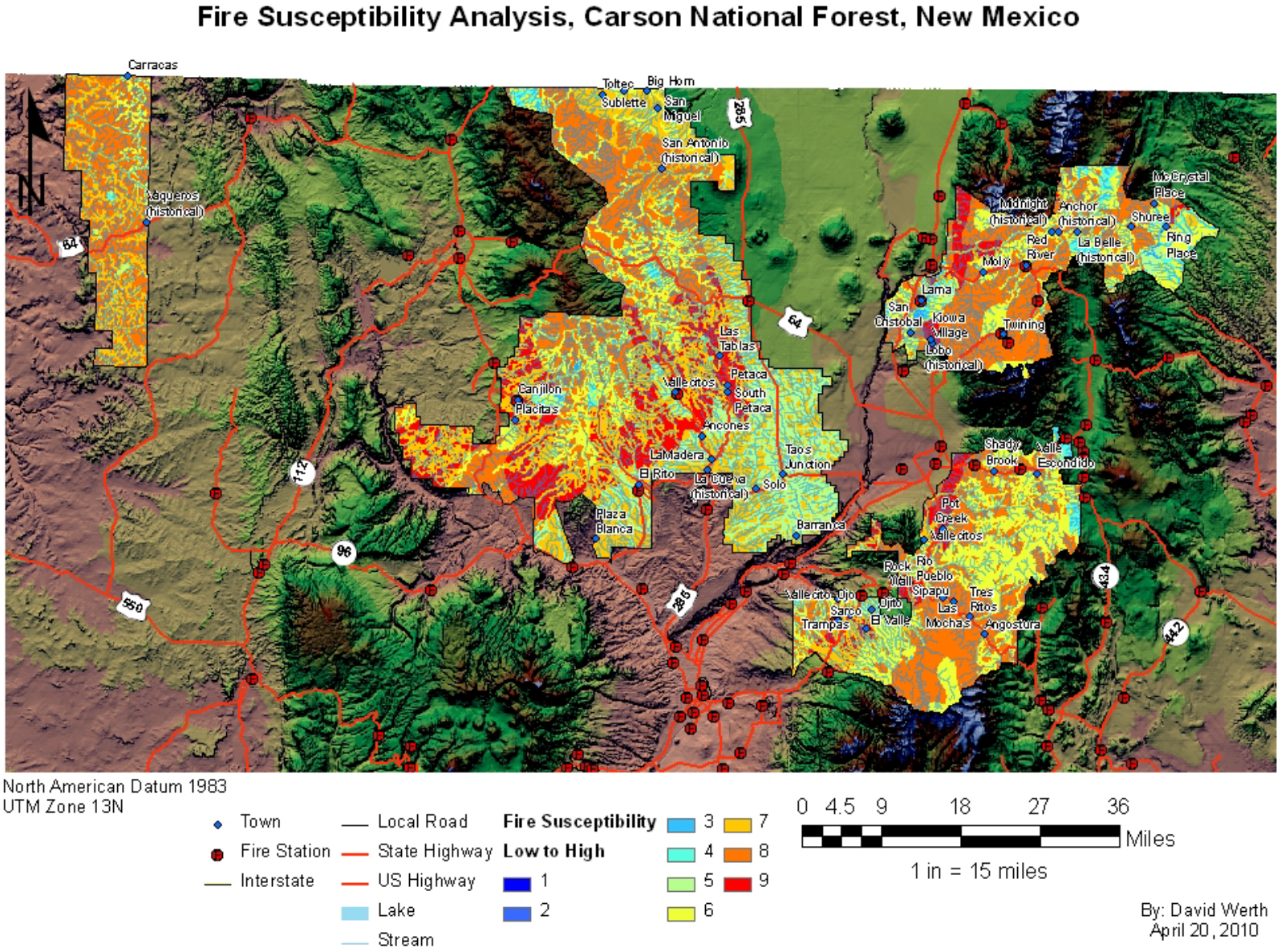

Figure 16: Final map layout