

Determining Indiana's Vulnerability to Tornado Impact and Subsequent Necessary Preventative Actions

Abstract

Indiana is one of many states impacted by tornadoes yearly. A vulnerability analysis based on state infrastructure is needed to determine the potential threat tornadoes impose on the state. Utilizing GIS data of strong tornado pathways that previously touched down in Indiana, and spatially relating them to present day infrastructures, the areas that have the potential to be the most vulnerable are determined. The distribution of hospitals and the population by county are then compared with the most vulnerable zones to determine if action is needed to improve emergency response if a present day tornado threatened the area.

Methodology

The following GIS data was used for the vulnerability analysis:

- Pathways of the three strongest levels of tornadoes (F3-F5) throughout Indiana over the past 50 with five sequential one mile spaced buffers (Figure 1.)

- Interstates and industrial parks with five 2000 ft buffers; airports and power plants with five one mile buffer zones (Figure 2.)

The analysis was conducted (with equal weighting to each factor) to spatially relate the defined data/buffers (Figure 4.) State hospitals with five one mile buffers and population data were compared with vulnerability analysis results (Figure 5.)

Cartographer: Kate Merriam
 Projection: NAD_1983_UTM_Zone_16N
 Created: Summer 2010 for CEE194
 Sources: Indiana Spatial Data Service,
 NOAA, IndianaMap, US Census Bureau

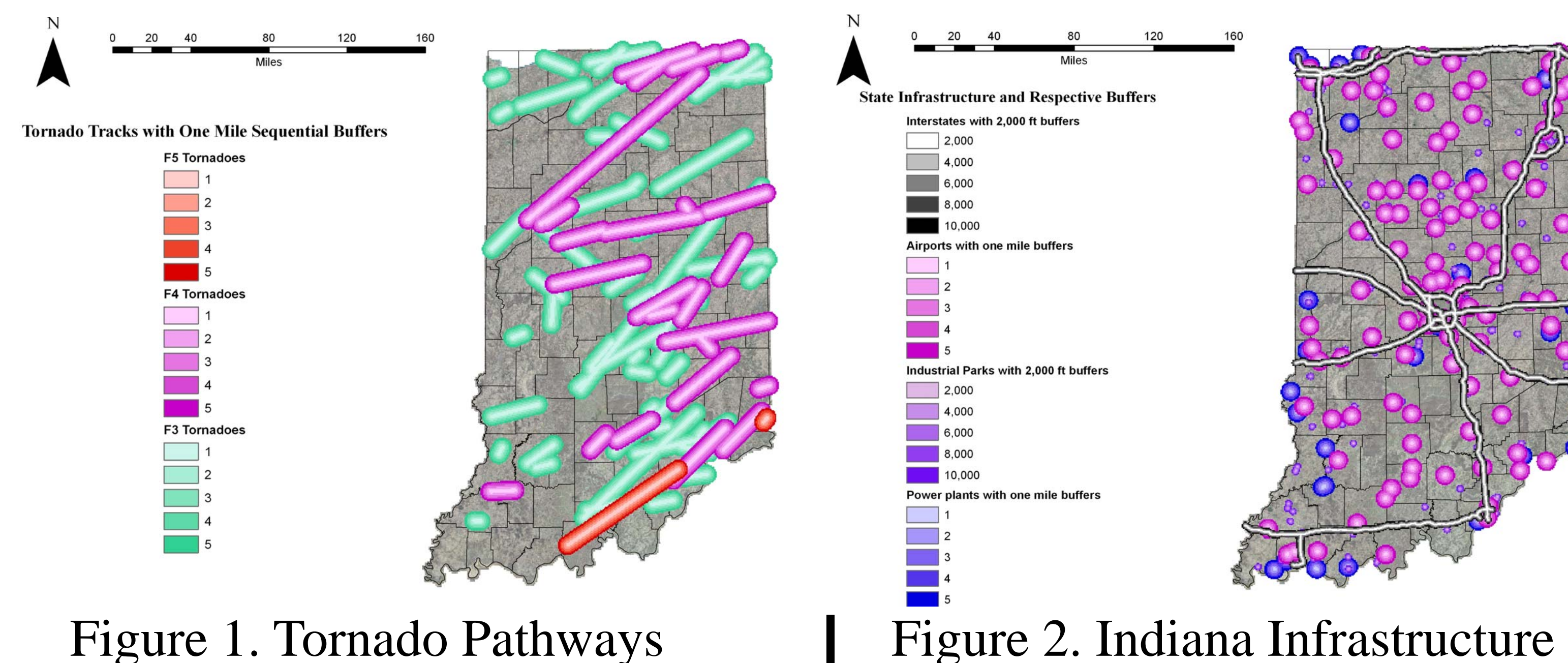


Figure 1. Tornado Pathways

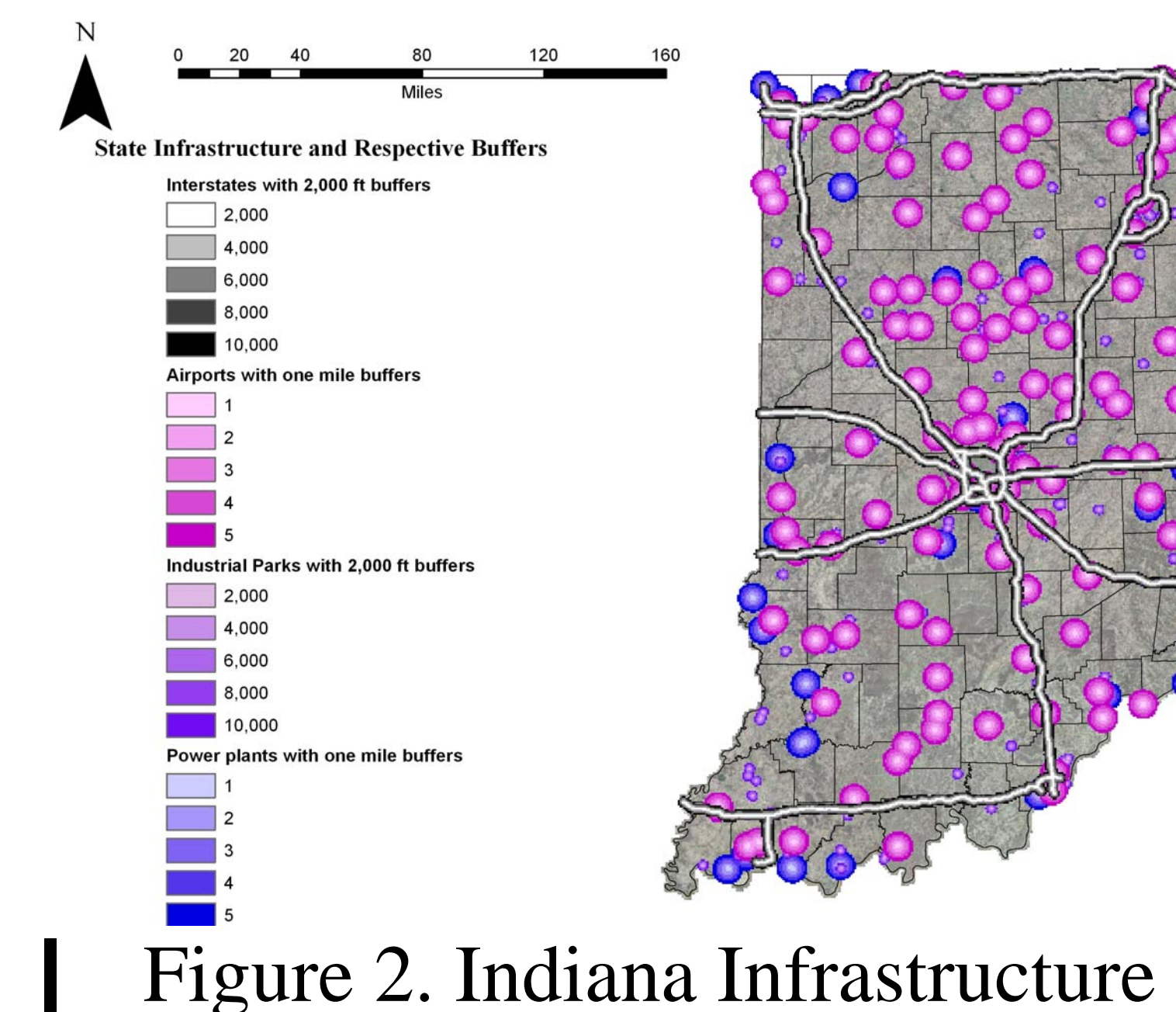


Figure 2. Indiana Infrastructure

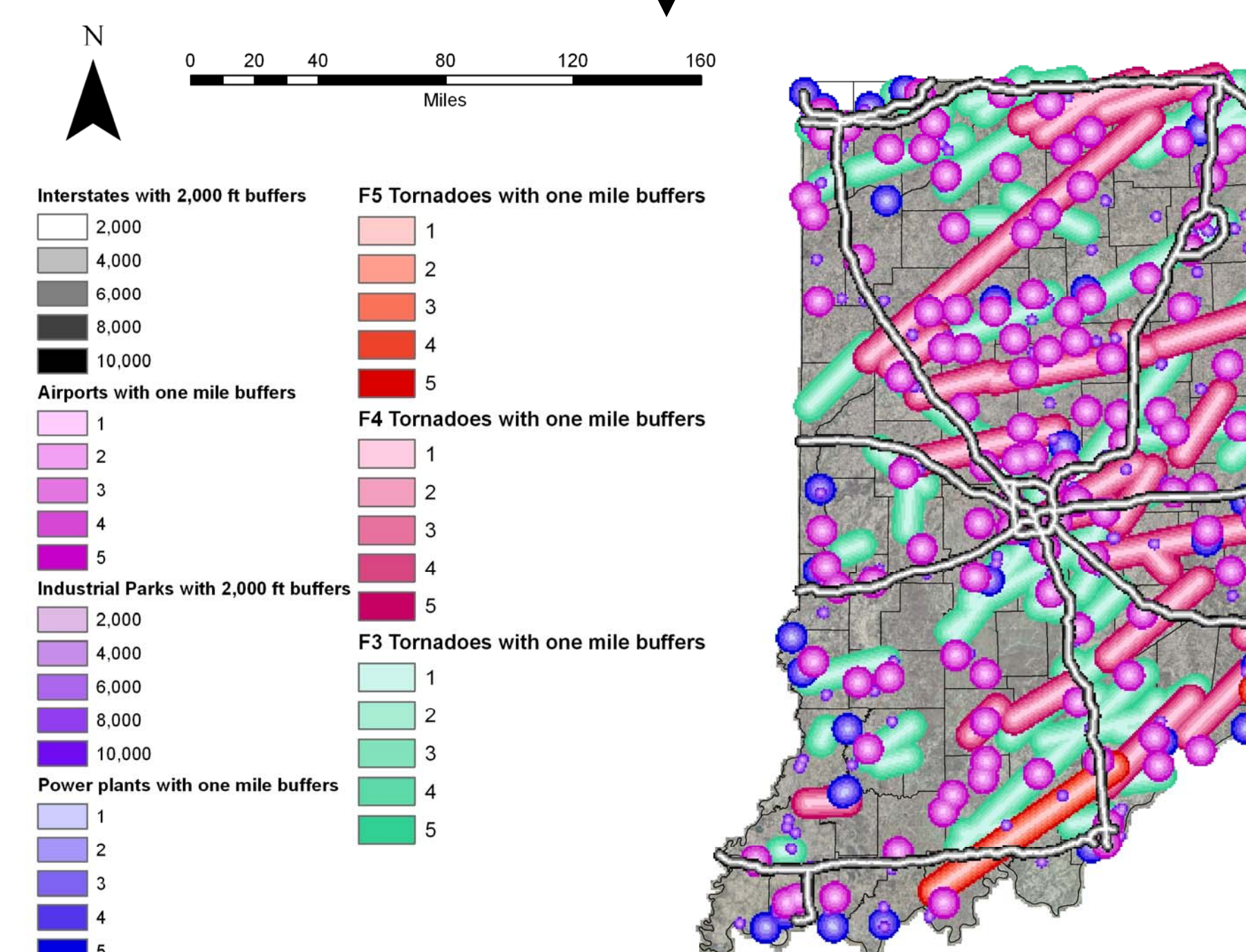


Figure 3. All Vulnerability Factors

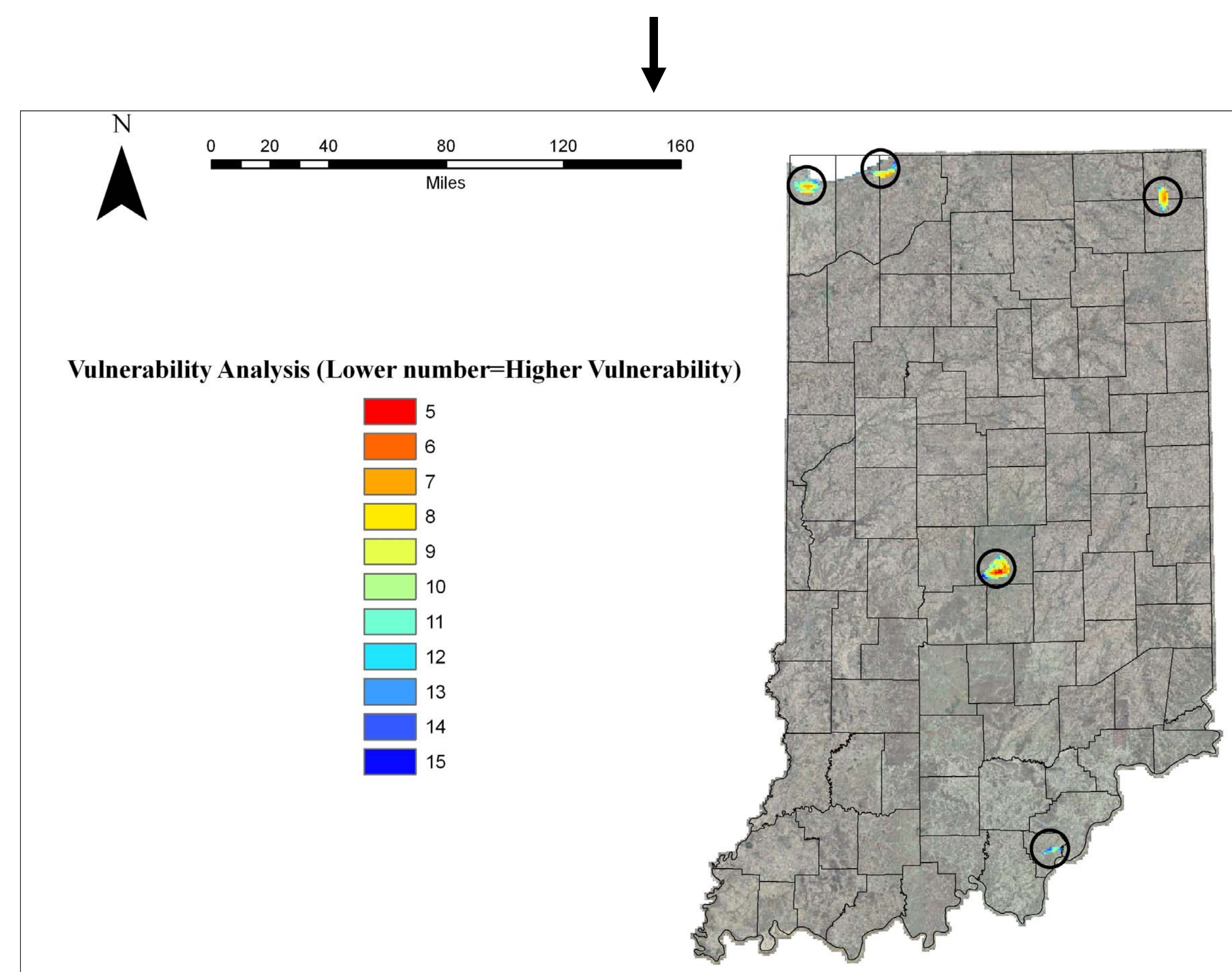


Figure 4. Vulnerability Analysis Results

Conclusions

Based on the pathways of F3 tornadoes, interstate highway locations, and power plant locations, only minimal areas are severely vulnerable to tornado impact. As expected, the areas that are most vulnerable are those close to past tornado sightings and as well as urban areas (i.e. Gary and Indianapolis.) In almost every vulnerable zone, there are numerous hospitals within five miles. However, the area near Hudson has fewer hospitals and the potential need for more is shown.

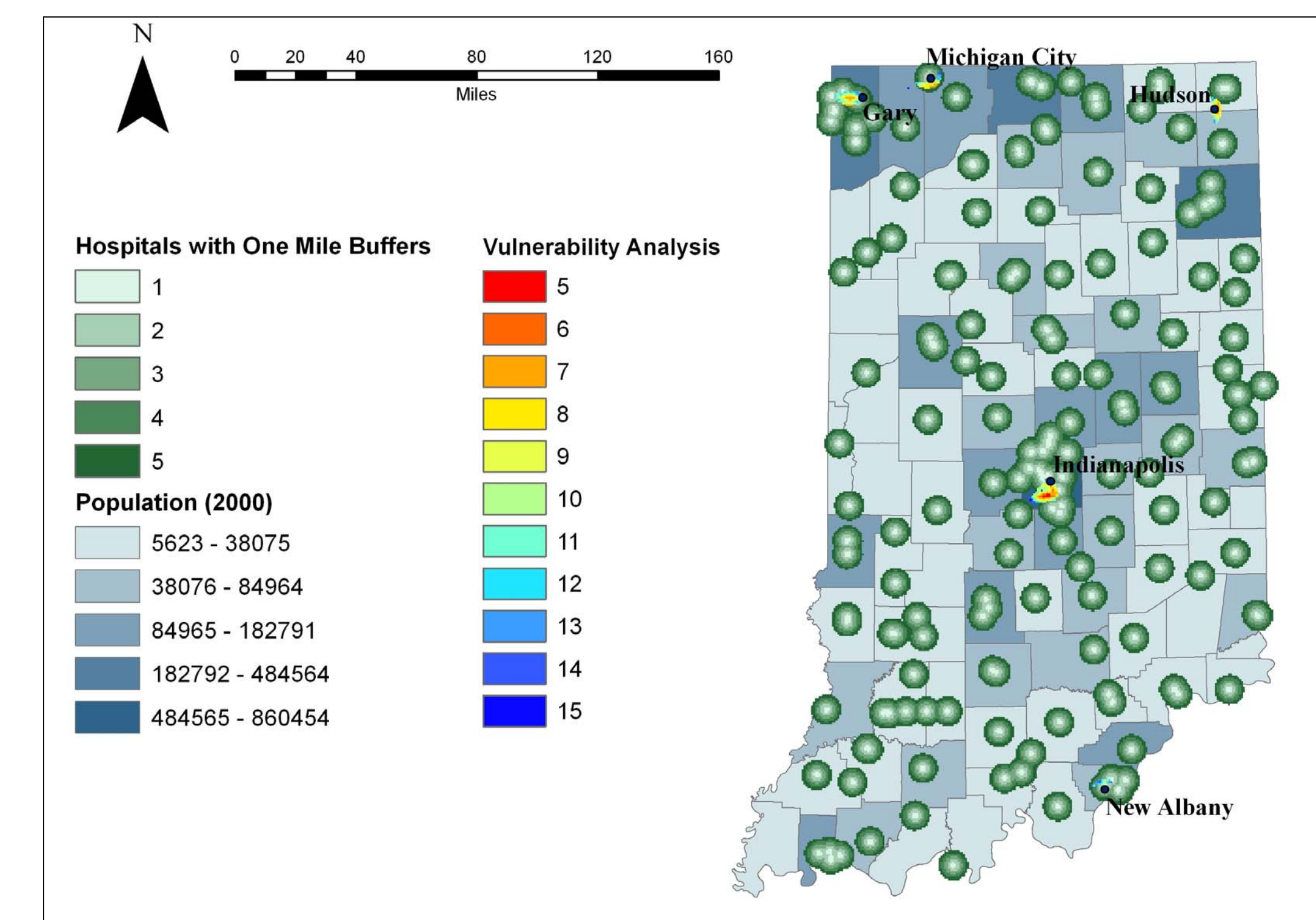


Figure 5. Population and Hospital Locations Relative to Vulnerable Zones

Future Work

The vulnerability analysis conducted was limited and only worked accurately if all data layers were overlapping. More data must be provided to conduct a full analysis on all areas of the state. Additionally, should further studies continue, a weighted analysis could be proven useful.

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