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Suitability Layers for Mesonet Stations in Tennessee

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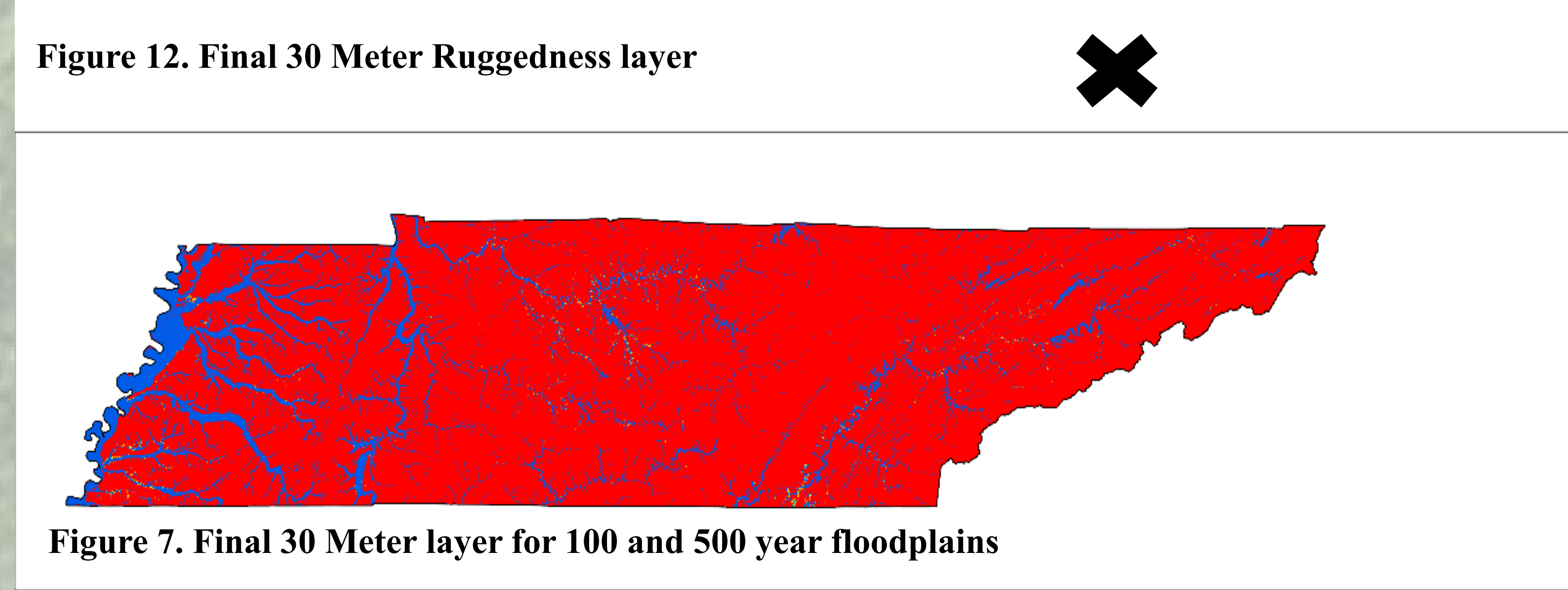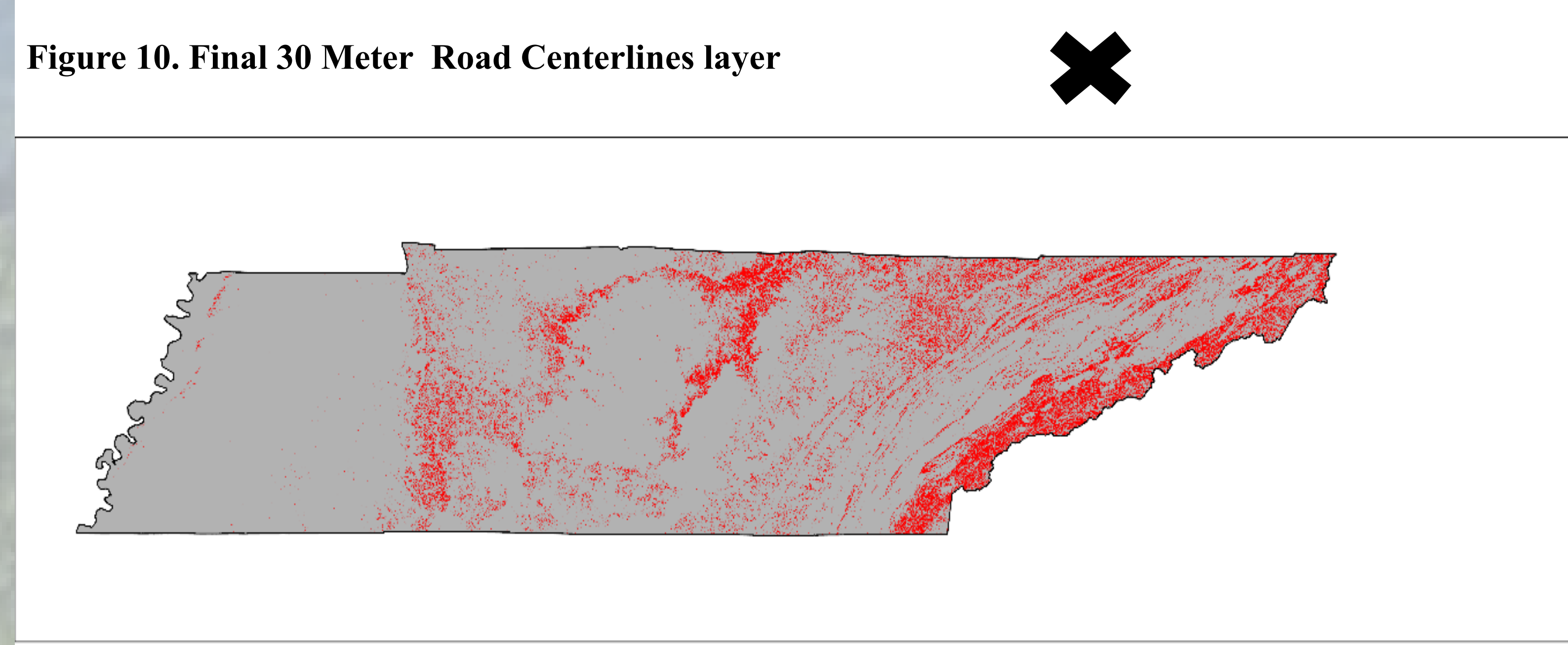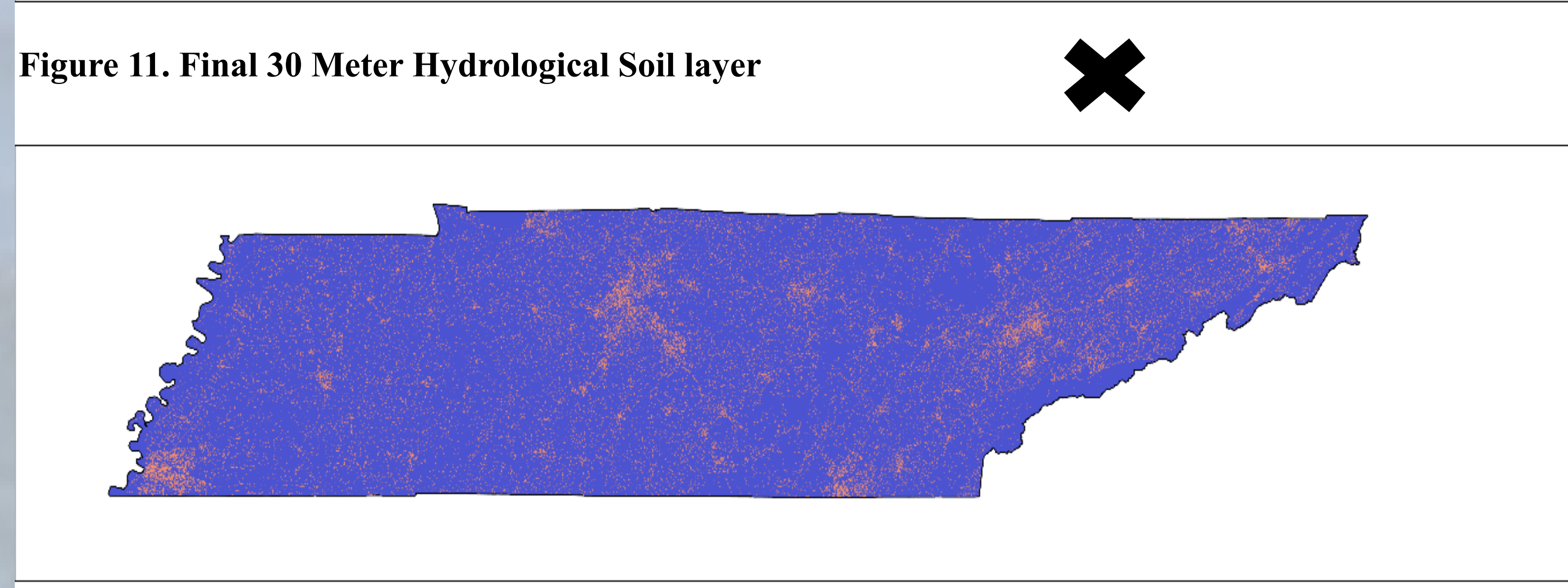
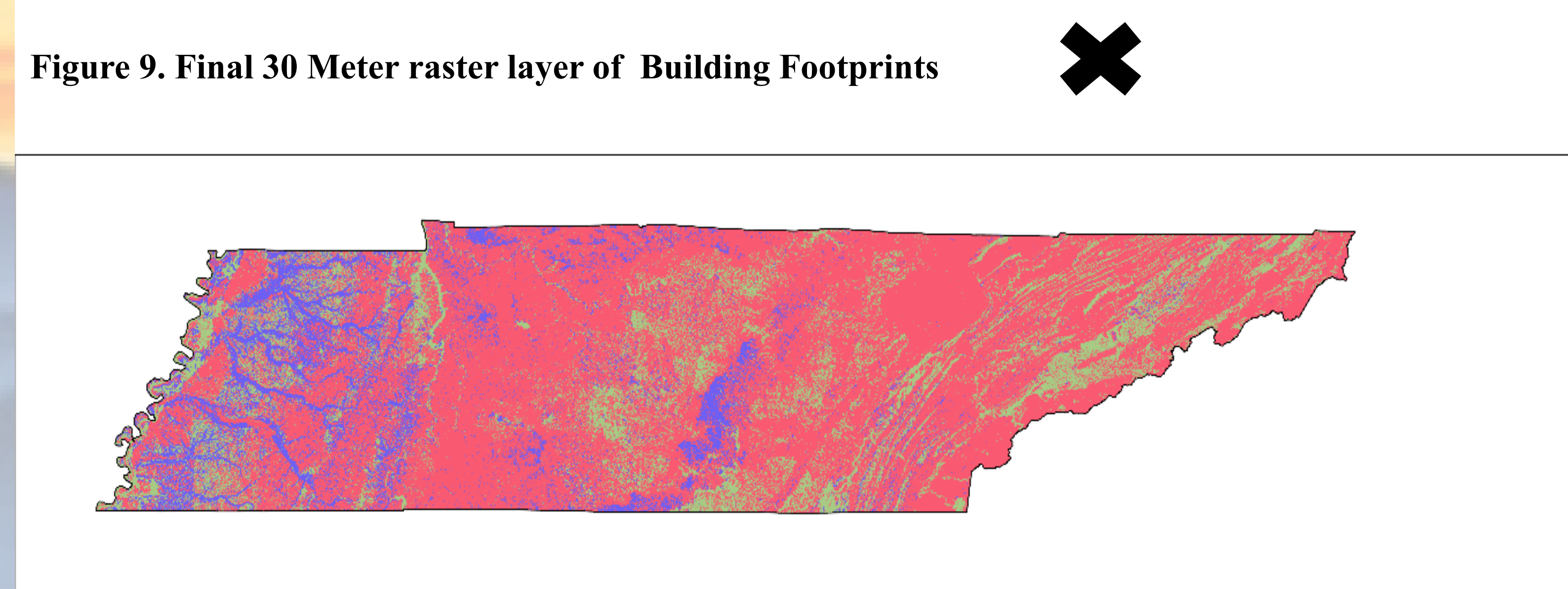Will Tollefson
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Suitability Layers for Mesonet Stations in Tennessee

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Figure 1. 30 Meter Landcover raster layer of Johnson City

Figure 3. 30 Meter raster layer of Johnson City Building Footprints

Figure 5. 30 Meter Hydrological Soil layer for Johnson City

Figure 4. 30 Meter raster Road Centerlines layer for Johnson City

Figure 6. 30 Meter Ruggedness layer for Johnson City

Figure 2. 30 Meter raster layer for 100 and 500 year floodplains of Johnson City

Figure 8. Final 30 Meter raster layer of Landcover ✖

Figure 9. Final 30 Meter raster layer of Building Footprints ✖

Figure 11. Final 30 Meter Hydrological Soil layer ✖

Figure 10. Final 30 Meter Road Centerlines layer ✖

Figure 12. Final 30 Meter Ruggedness layer ✖
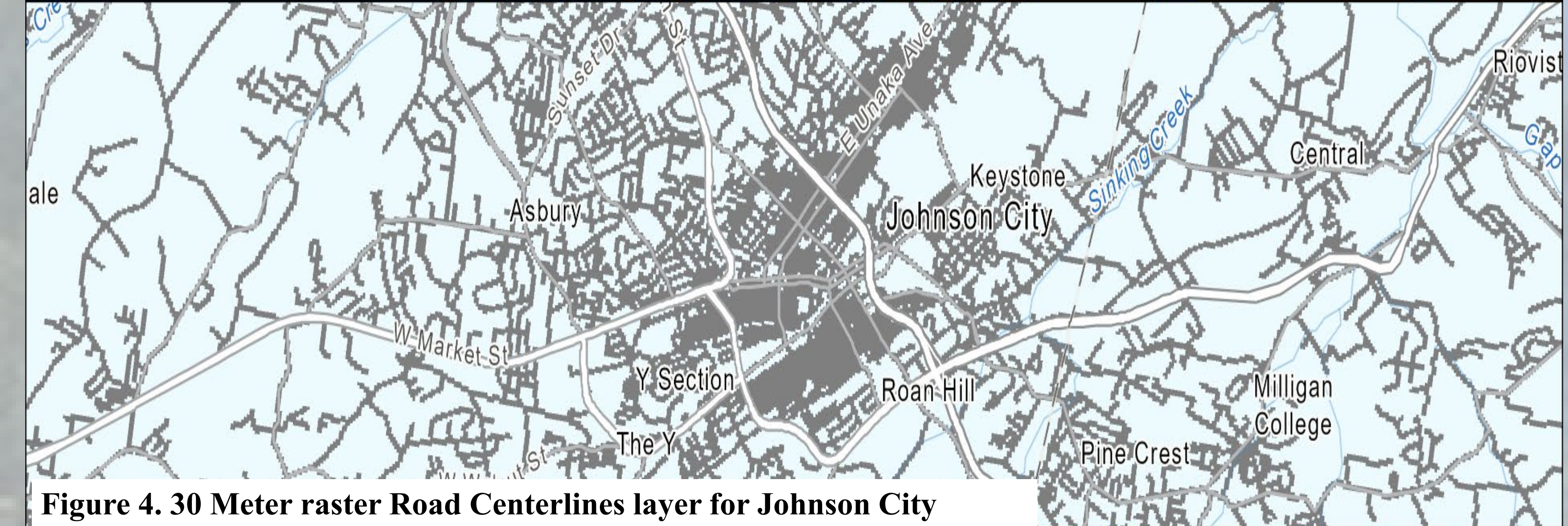

Figure 7. Final 30 Meter layer for 100 and 500 year floodplains
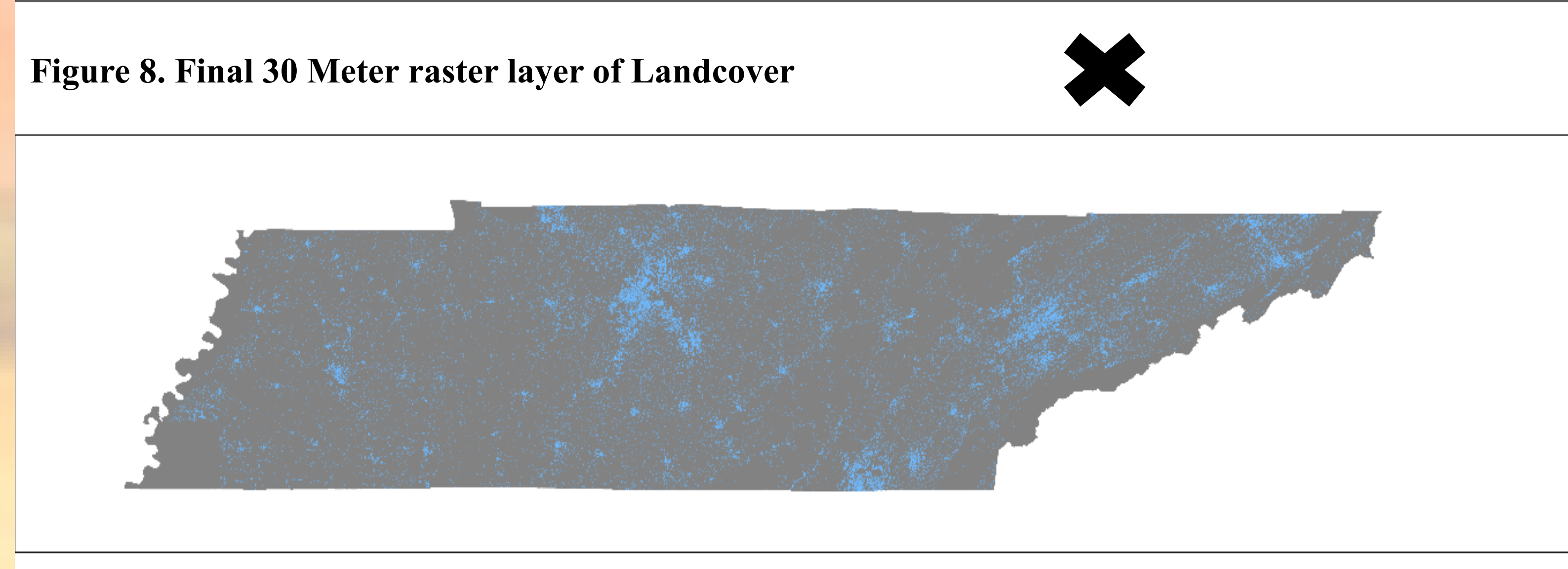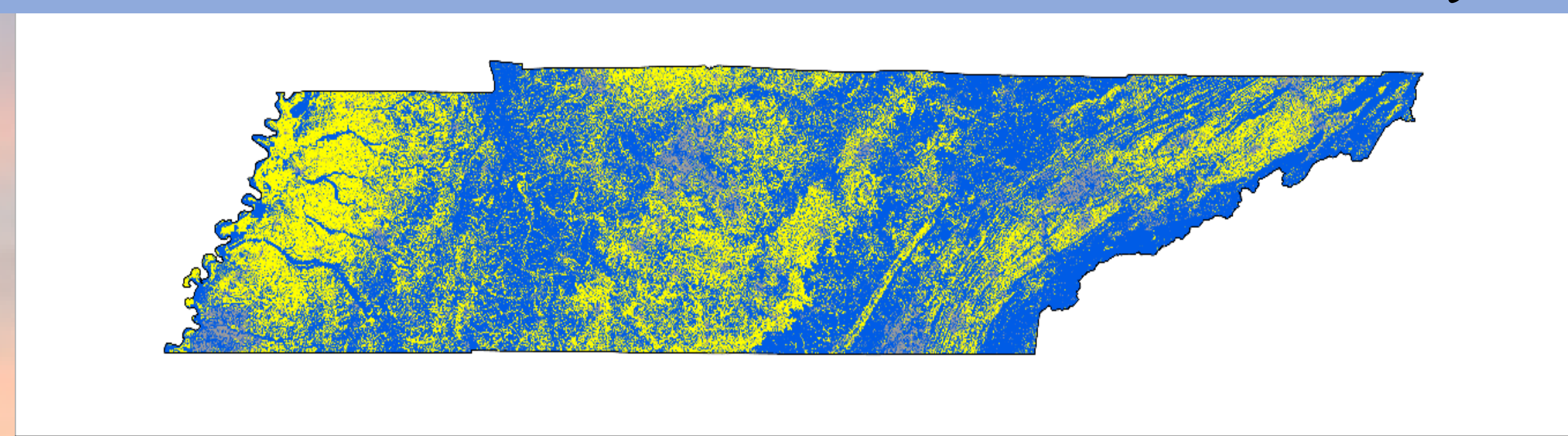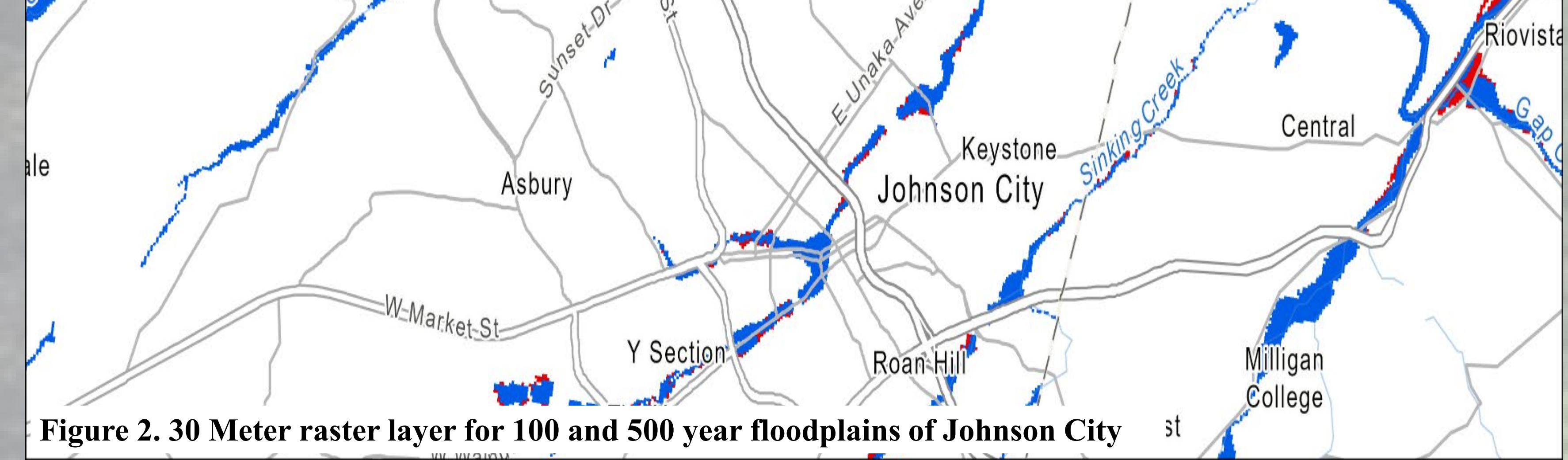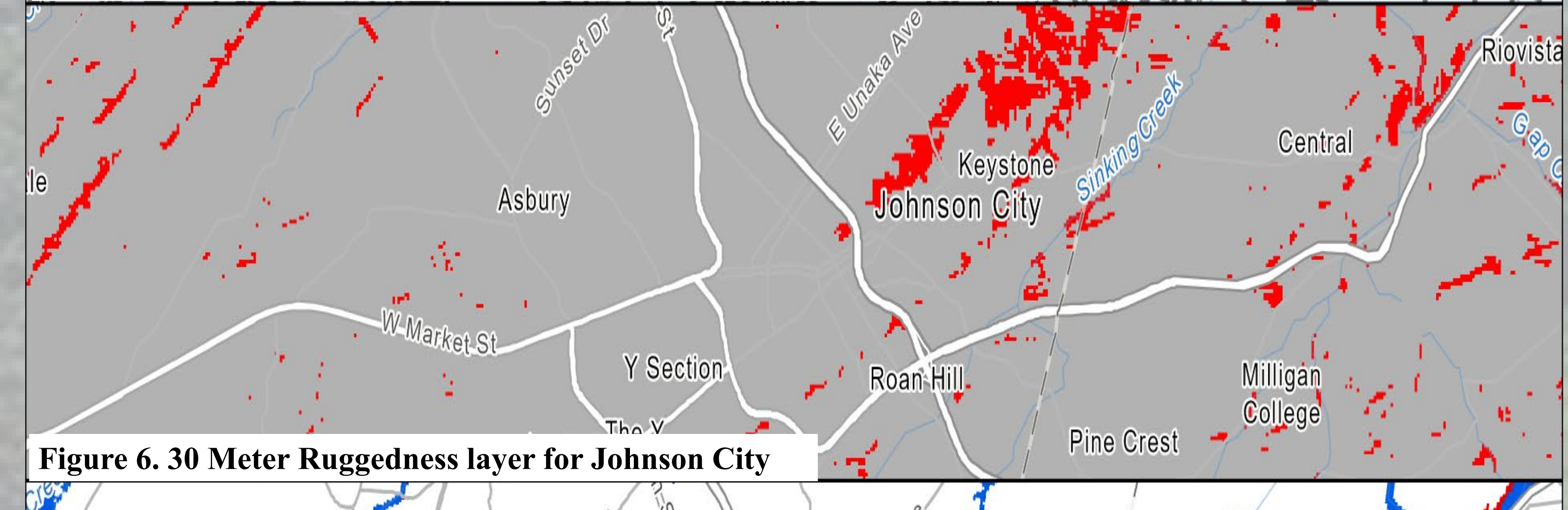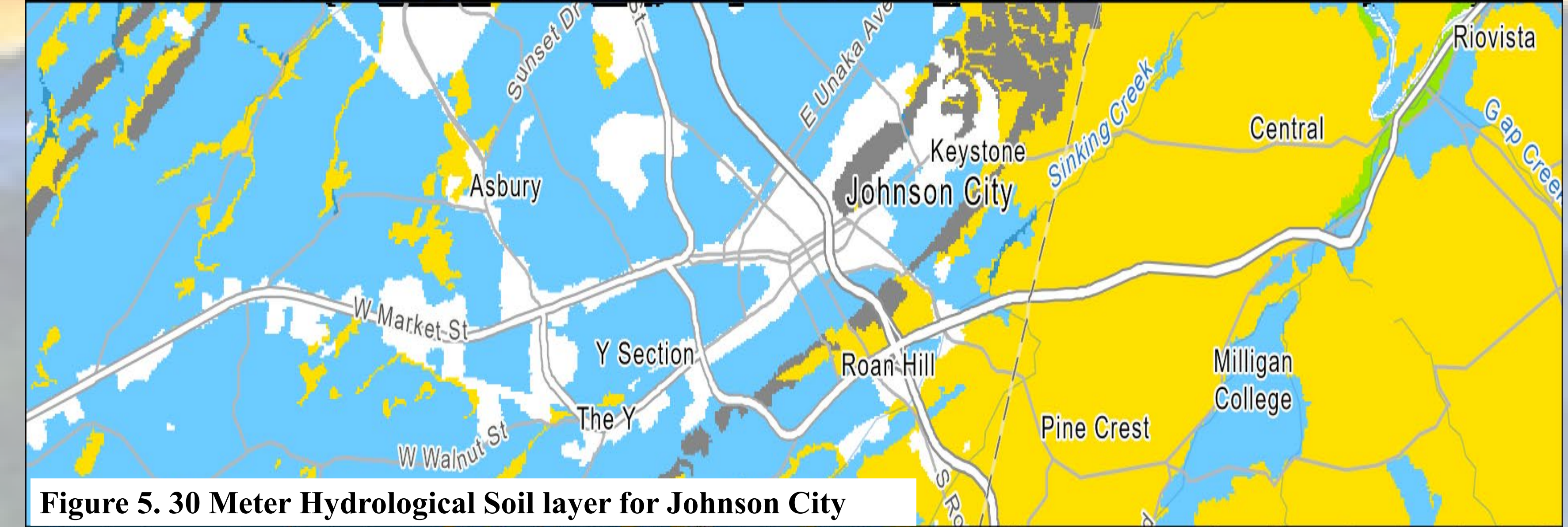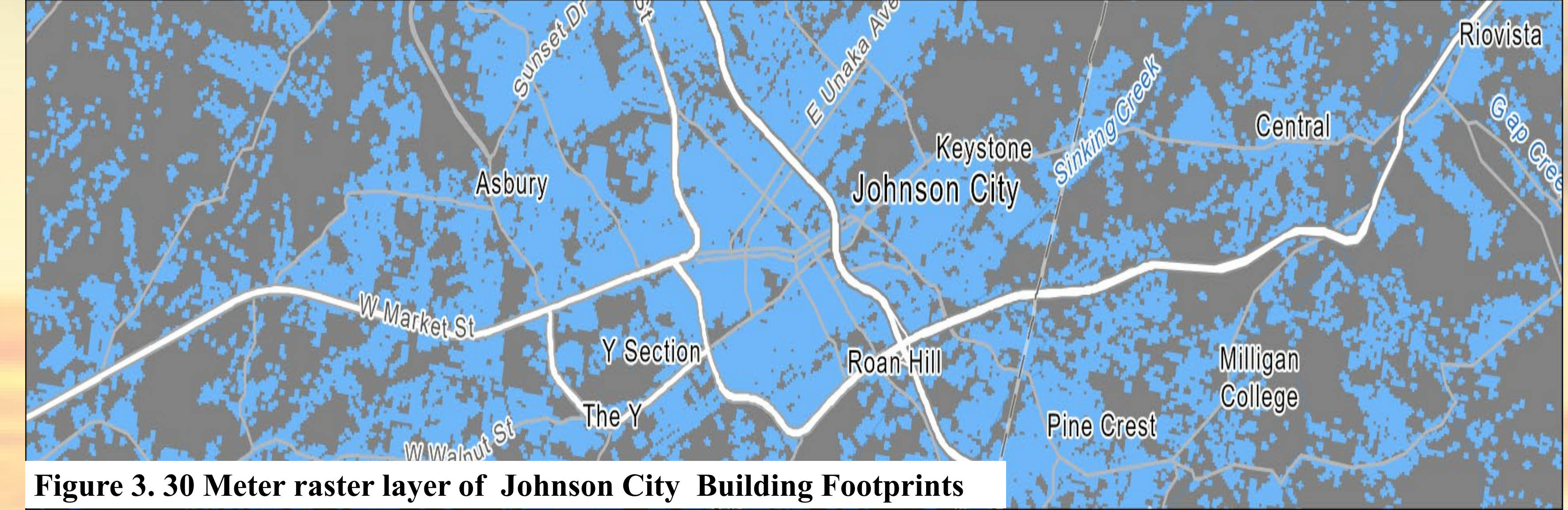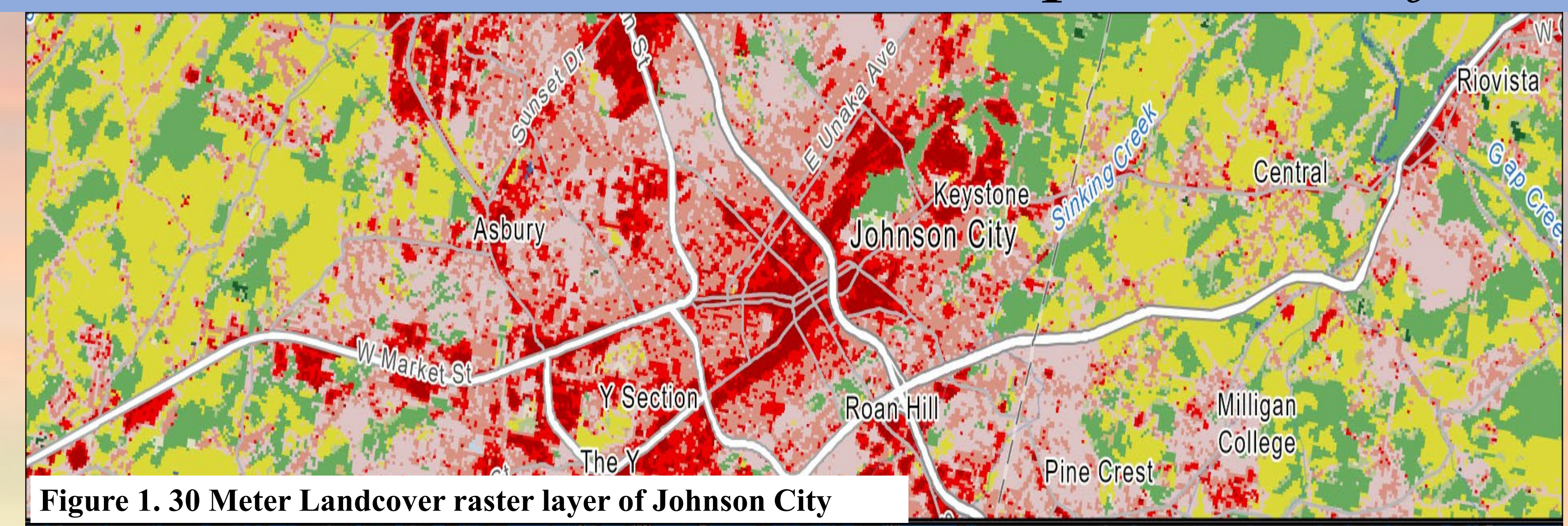
Abstract

Mesonet stations are environmental monitoring systems used to examine environmental features such as Precipitation, Temperature, Insolation, Soil Moisture, and Localized Hazards. A network of Mesonet stations is an integral part of weather and climate monitoring, and the data produced are essential for agriculture, planning, transportation, and other industries. Tennessee is one of the few states without a Mesonet; a bill currently before the state assembly includes funding for such a system. Therefore, this research describes development of a Mesonet suitability layer for Tennessee that can be used to guide placement of individual Mesonet stations across the state, taking into account spacing, terrain, land use, construction suitability, and other factors. Land cover, road centerline, roughness, elevation, flood zone, building footprint, and soil type data were obtained from USGS, FEMA, NLCD, and the Tennessee state database to create each layer. Using ArcGIS Pro, each data layer was converted to a raster and then masked to the state of Tennessee at 30-meter resolution to ensure proper alignment of data overlays. The combined overlay map will identify zones that meet suitability criteria, and it is expected that multiple areas in each county will be suitable such that a complete Mesonet can be sited across the state. This study provides important information needed for final placement of Tennessee's future Mesonet stations, which will provide essential weather and environmental monitoring data important for Tennessee.

Not Suitable ⟶ Highly Suitable

Figure 13. Final 30 Meter Overlay of all figures multiplied by each other
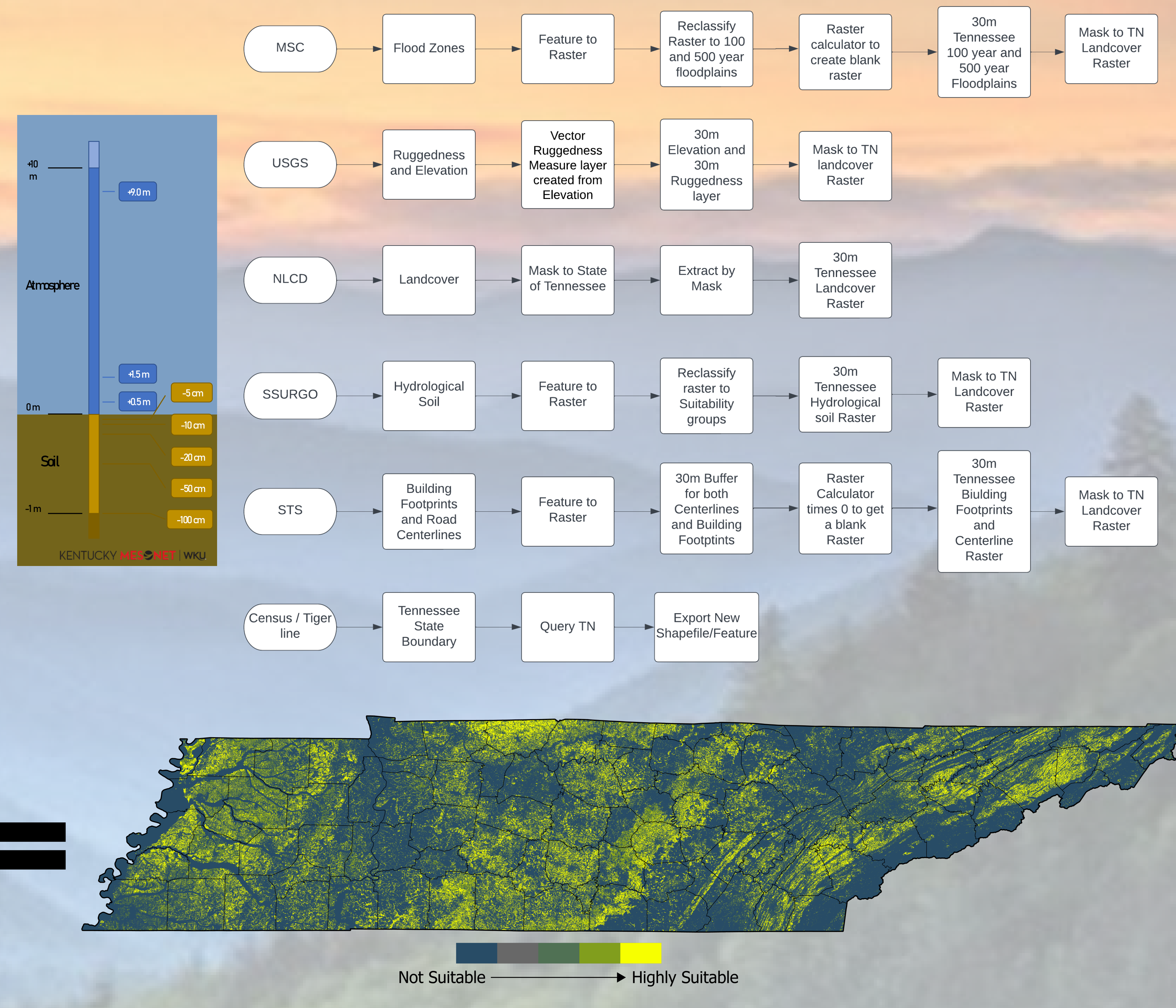
Conclusion

After resampling all layers to a 30 meter resolution raster, they were multiplied to determine which areas throughout Tennessee are suitable for Mesonet stations. Next, the feasibility layer will be created using similar methods, allowing us to identify areas that are both suitable and feasible (i.e., land ownership, cell coverage, co-location possibilities, etc.). A final report with the top 10 locations in each county will be created for the Tennessee Emergency Management Agency and US Army Corps of Engineers. The TN Mesonet will drastically improve weather observation and monitoring across the state.

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