How Critical is Access to Key Facilities (and Vulnerable Populations) in a Flood Event?

Janey Camp, Madeline Allen, Leslie Gillespie-Marthaler, Mark Abkowitz

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Objectives

- Improve understanding of vulnerability and resilience for communities
- Establish and demonstrate a method for evaluating a community's transportation resilience
- Make available a scalable methodology

Case Study Area – Dyer County, TN

- River valley community with history of flooding
- Population ~34,000
  - 24% below age 18
  - 17% over age 65
  - 15% have a disability
  - 10% with no health insurance
  - Approx. 17% in poverty

Flood Warning

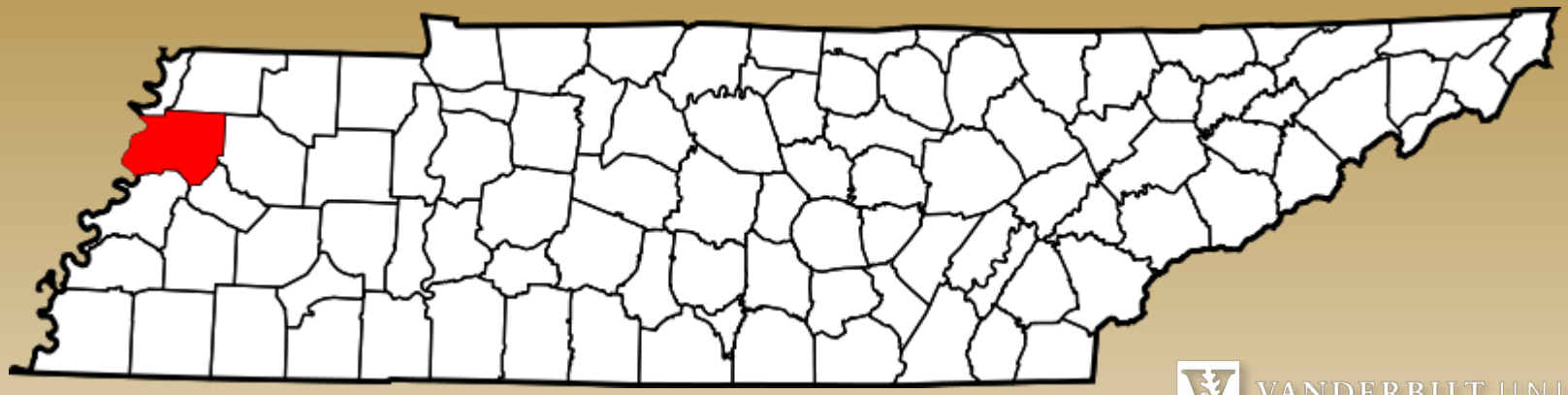
Dyer, Lake, Lauderdale Counties, Tennessee

Minor flooding is occurring ... Flood stage is 32.0 feet ... The river is currently in flood stage and will continue rising to near 35.5 feet by Saturday April 20 ...

Ways to stay safe now

Avoid walking or driving through flood waters. Just 6 inches of moving water can knock you down and 2 feet of water can sweep your vehicle away.

14 hours ago · Sources: National Weather Service, ready.gov



Approach

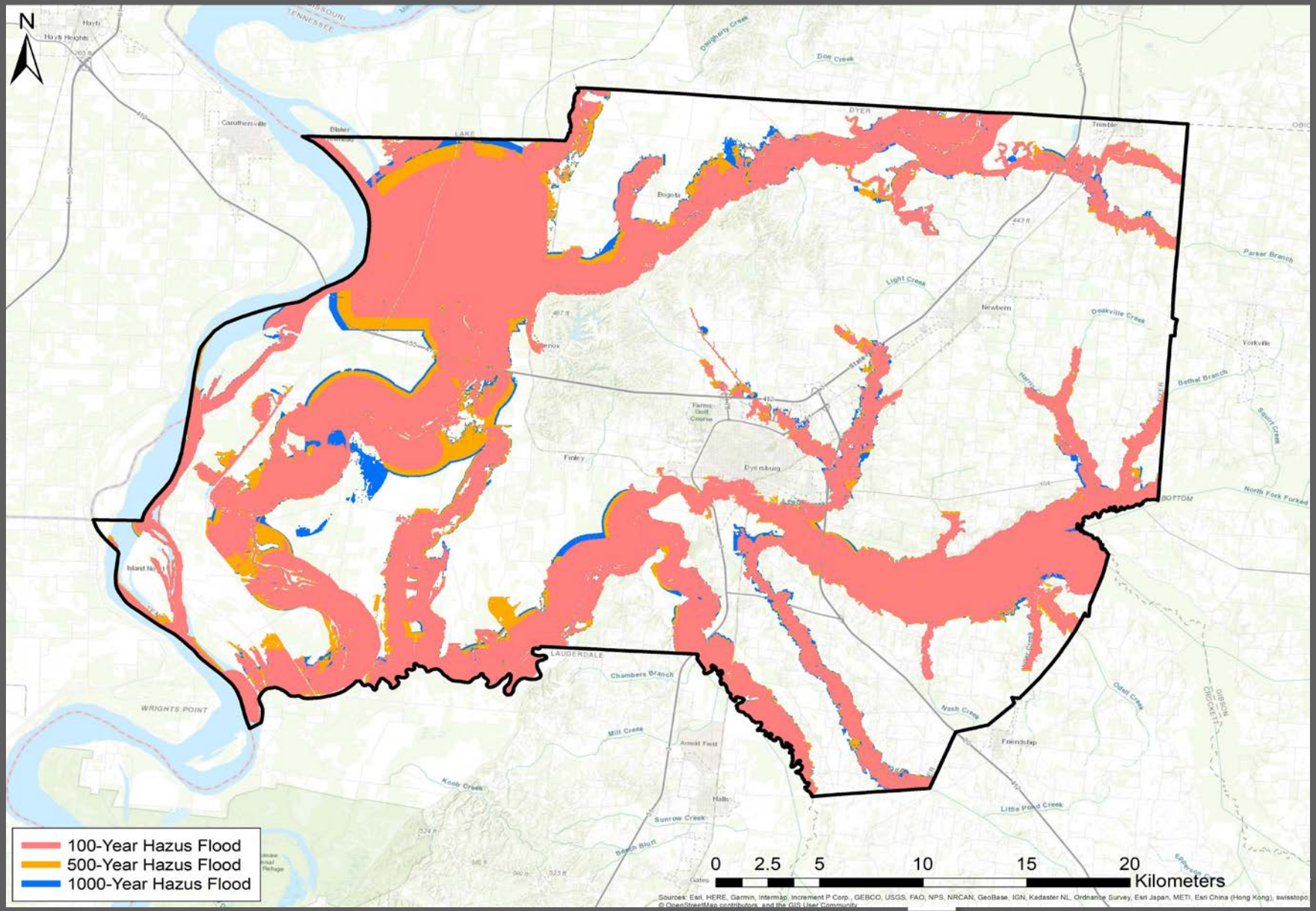
- Perform initial flood loss assessment using Hazus for a range of scenarios
- Evaluate Hazus results, building damage estimates, and essential facility inventory in comparison with other sources of information
- Assess impacts of flood scenarios with a focus on vulnerable populations and transportation systems

HAZUS®
EARTHQUAKE • WIND • FLOOD • TSUNAMI

Microsoft

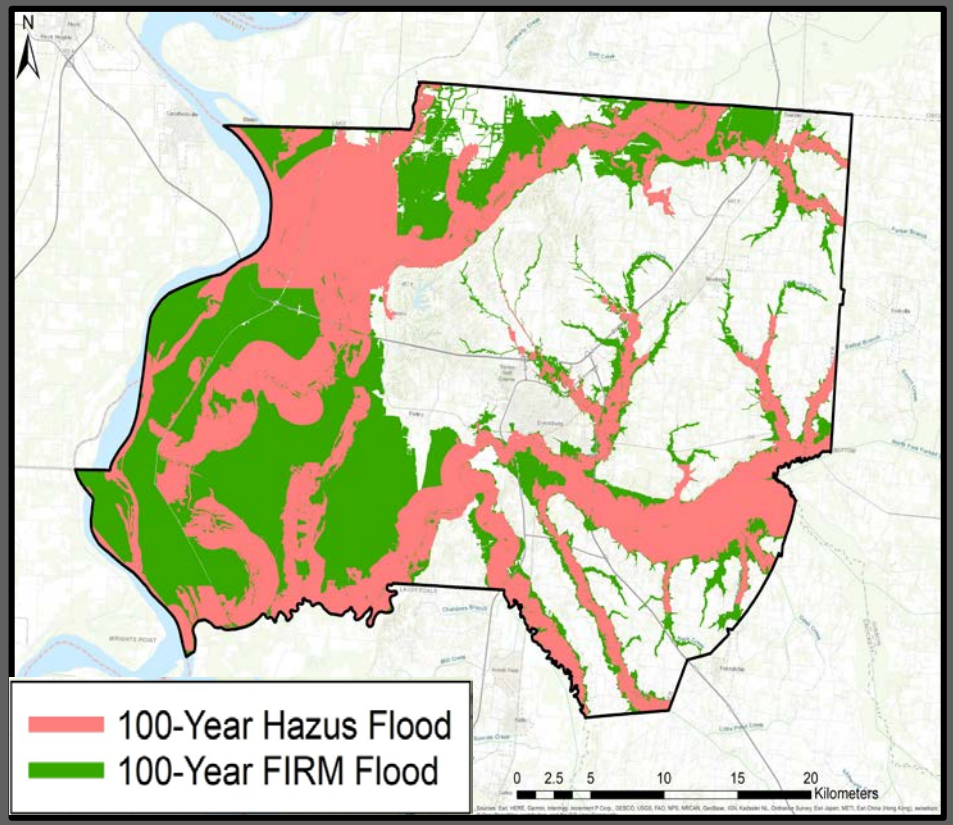
Homeland Infrastructure Foundation-Level Data (HIFLD)

Hazus Inundation Estimates

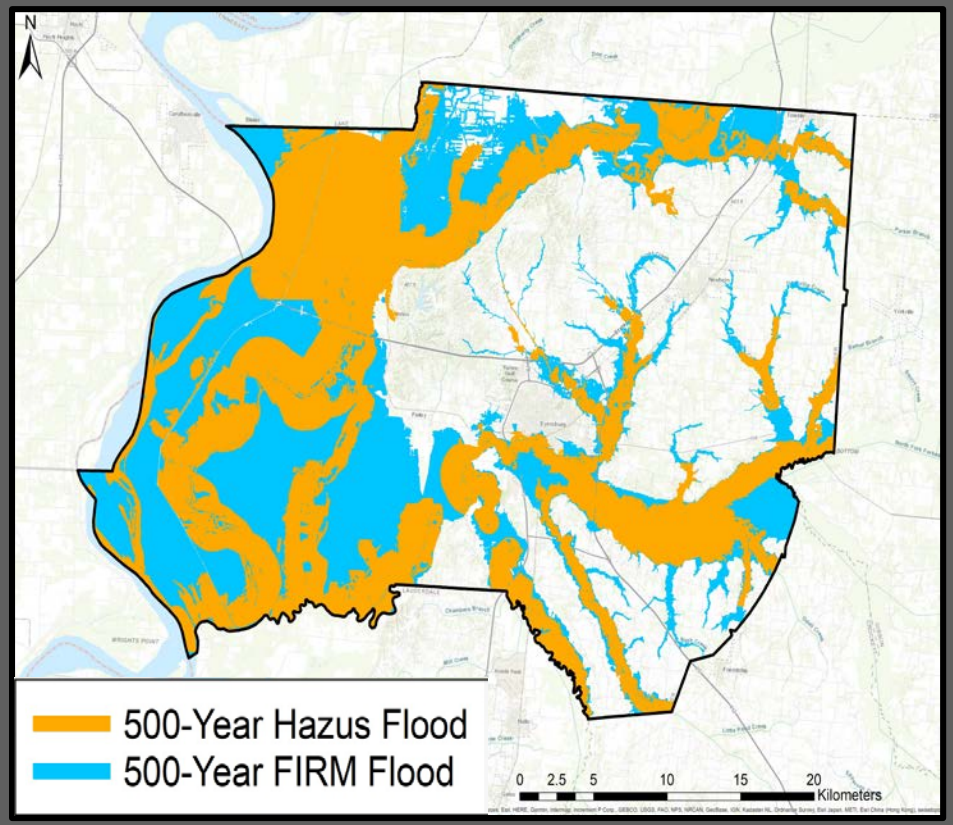


Comparison: Hazus (Level 1) vs FIRM

100-Year



500-Year



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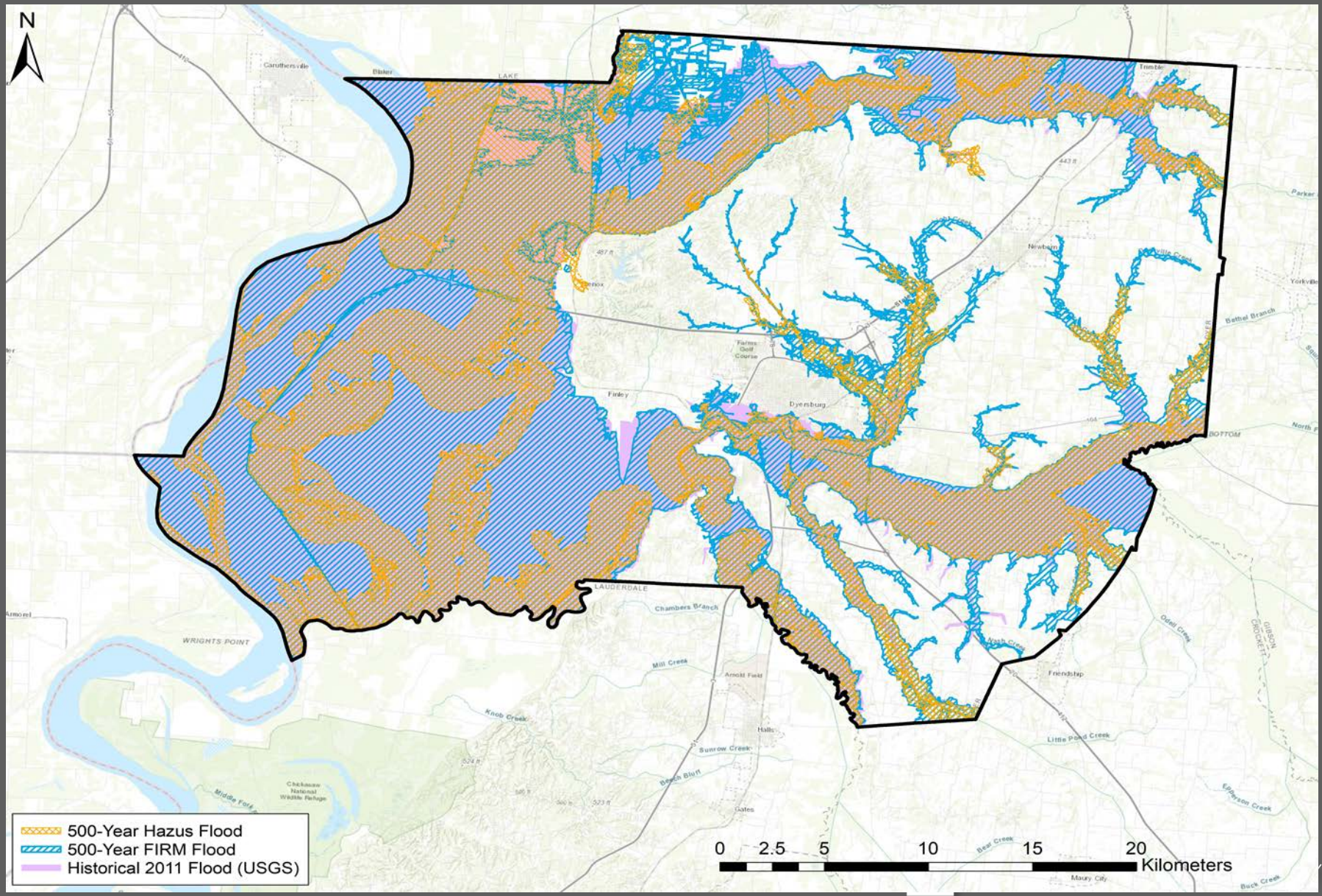
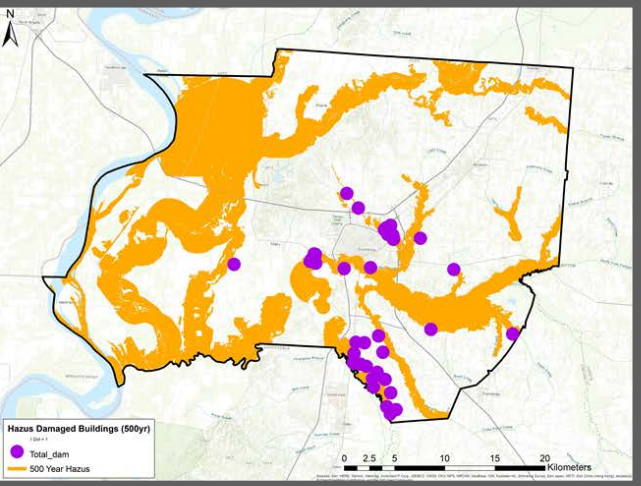
2011 Flood Inundation vs. Hazus

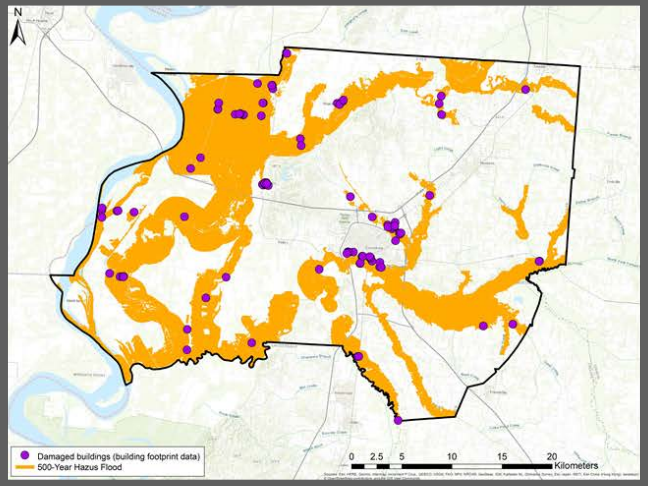


Damaged Building Estimates

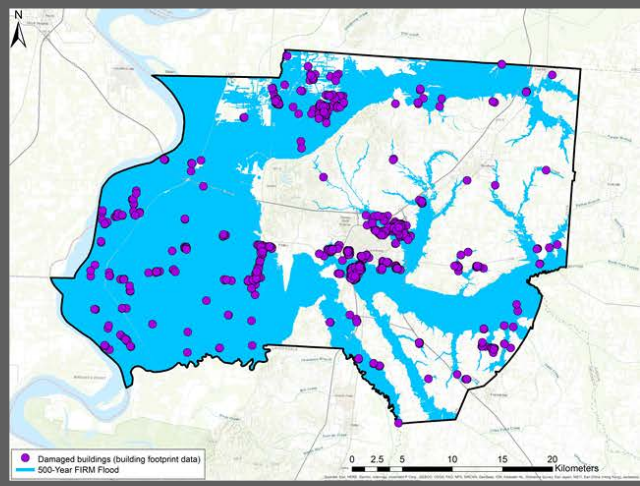
Hazus flood extent
+
Hazus building estimates



Hazus flood extent
+
Microsoft building analysis



FIRM flood extent
+
Microsoft building analysis



70% more

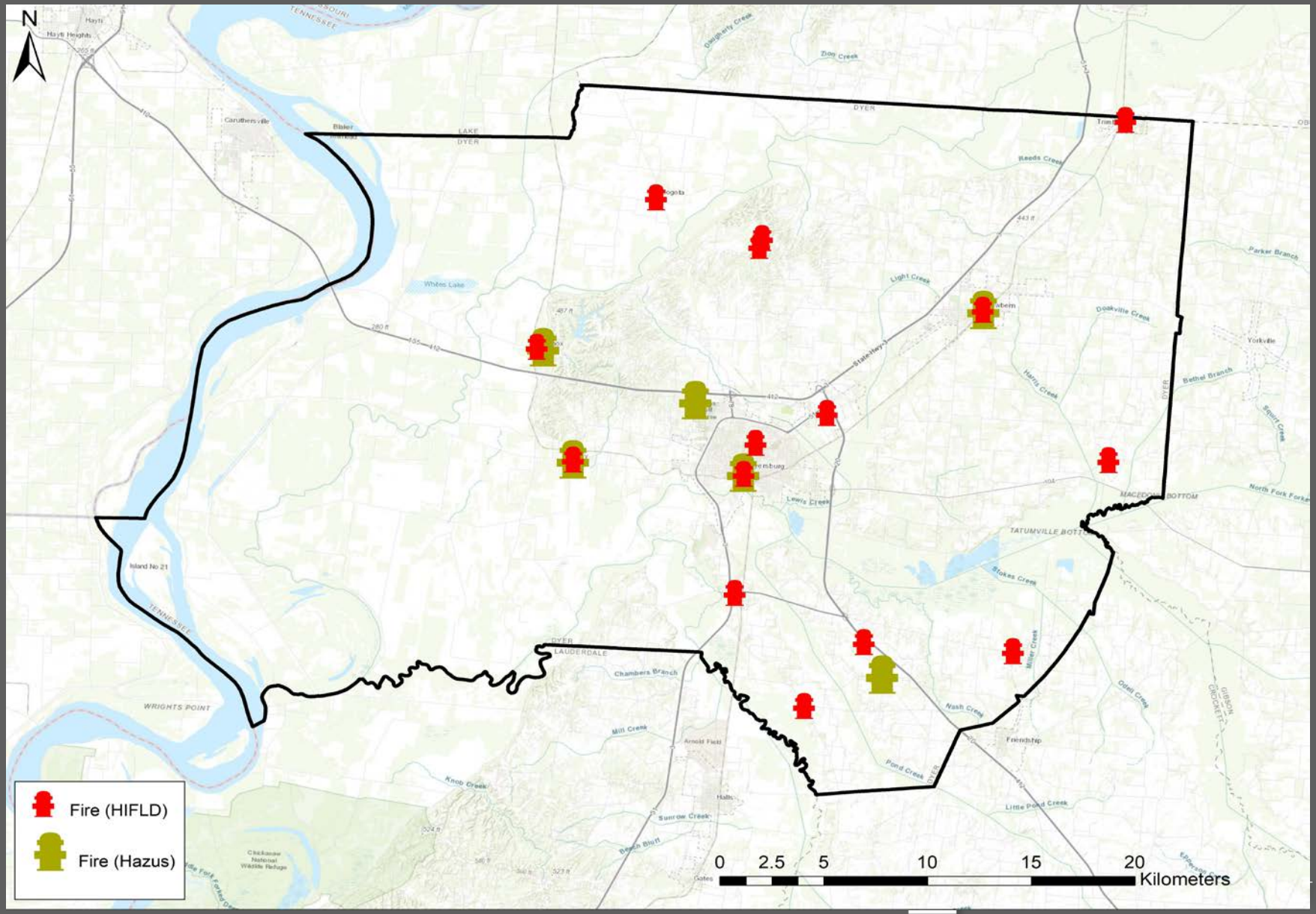
9 x more

16 x more

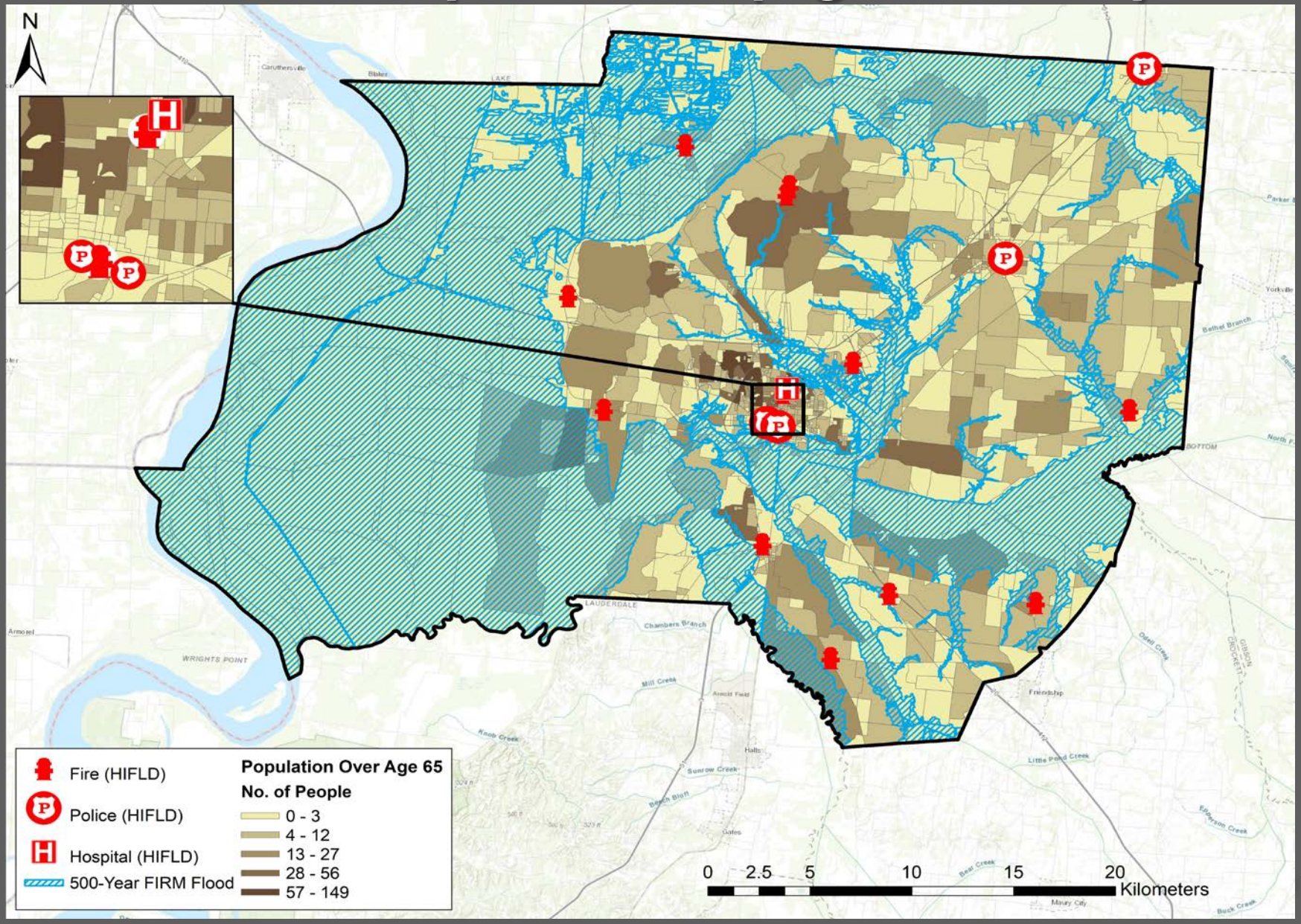
Hazus flood boundaries		FIRM flood boundaries
Hazus results (# affected buildings)	Microsoft building footprint analysis results (# affected buildings)	Microsoft building footprint analysis results (# affected buildings)
75	128	1,194

- Building footprints from Microsoft building footprints made available in 2018
- Note: Building footprints below 950 ft^2 were excluded from analysis, no distinction was made between residential or commercial/industrial

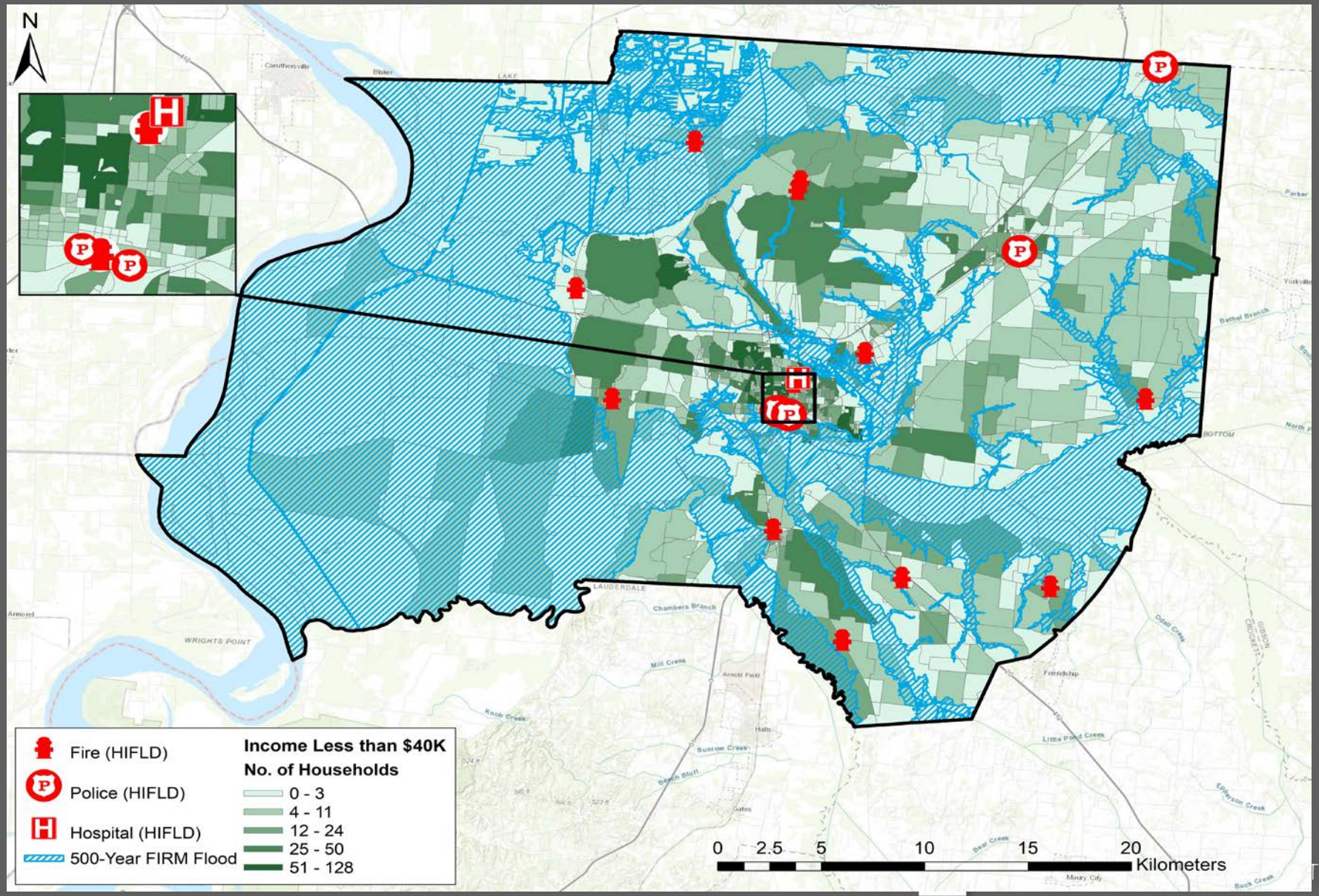
Essential Facilities – Hazus vs. HIFLD



Vulnerable Populations (Age Over 65)

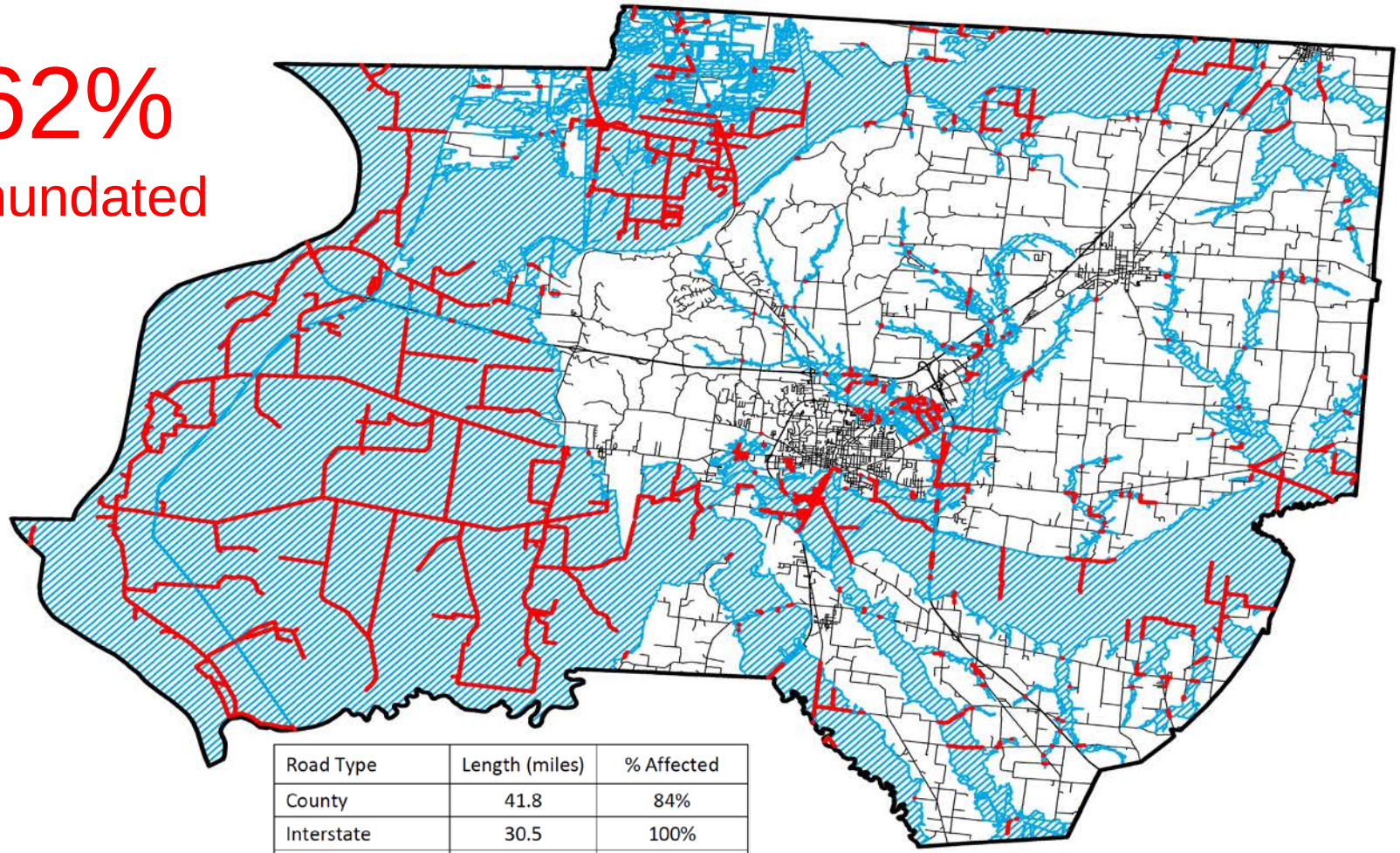


Vulnerable Populations (Low Income)



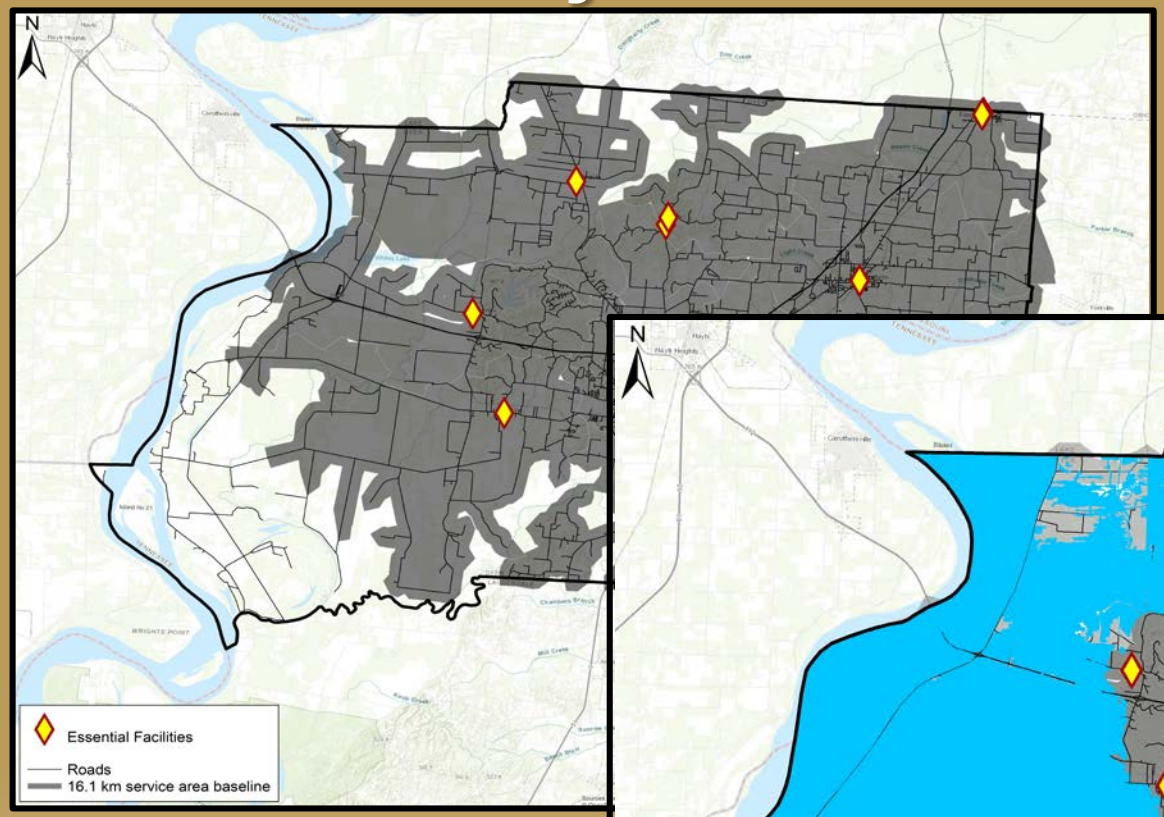
Roadway Impacts

62%
inundated

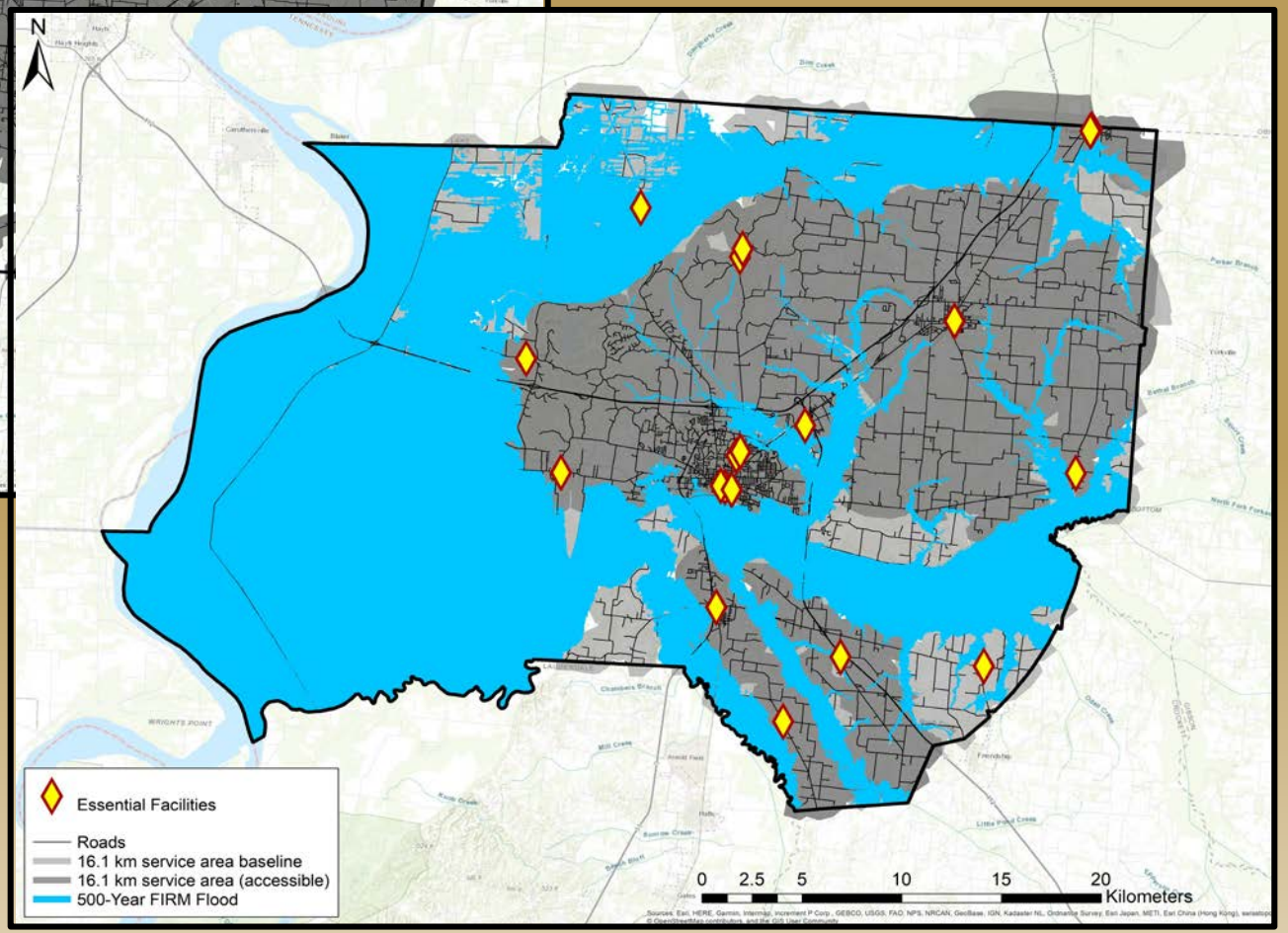


Road Type	Length (miles)	% Affected
County	41.8	84%
Interstate	30.5	100%
Common Name	451.0	52%
State Recognized	168.3	86%
U.S.	111.3	95%
Not Categorized	85.0	45%

Accessibility to Critical Facilities



47% Decrease in Service Area



ArcGIS Network Analyst was used to compute baseline service areas, defined as the area that can be reached within 16.1 km (10 miles) of an essential facility

Conclusions

- Understanding community vulnerabilities can be improved by augmenting with additional data sets
  - Hazus underestimates Flood extent, damaged buildings, and essential facilities (in a Level 1 analysis, which is most common for communities with limited resources)
- GIS analysis can be used to identify transportation system impacts and network disruptions
- Knowing that your essential facilities are “safe” may not be enough

Thank you!

Janey Camp
Janey.camp@Vanderbilt.edu

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