



# Flood Risk Analysis in West Virginia: Statewide Index Development

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## Introduction

Flood risk comprises three components:

- (1) **Hazard**, encompassing flood frequency, magnitude, depth, duration, and timing
  - (2) **Exposure**, indicating the population and assets prone to the hazard
  - (3) **Vulnerability** or susceptibility of exposed elements to inundation
- (Crichton, 2002; Fedeski & Gwilliam, 2007; Koks et al., 2015)

As part of the **West Virginia Flood Resilience Framework (WVFRF)** funded by the National Science Foundation (NSF), this project takes a comprehensive approach to flood risk assessment by analyzing various indicators within the above groups. It addresses diverse aspects of these components at both county and community scales to develop a statewide risk index.

## Study Area

**West Virginia**, with a population of about 1.8 million in its 55 counties, spans over 24,000 square miles, with approximately 3.4% of this area covered by high-risk (100-year) floodplains.

**32 flood disasters** were federally declared between 1953 and 2023 in West Virginia (FEMA, 2023). The frequency of floods in the state, with each county experiencing numerous flood events, underscores the need for effective flood management and mitigation strategies.

## Methodology

- Selecting 23 flood risk indicators
- Collecting and processing data for the selected indicators at the county level
- Mapping the indicators
- Calculating percentile ranks for each indicator
- Adding percentile ranks for each county to obtain a sum value
- Calculating percentile ranks for the sum values from the previous step to obtain the index scores
- Mapping the index scores at the county level

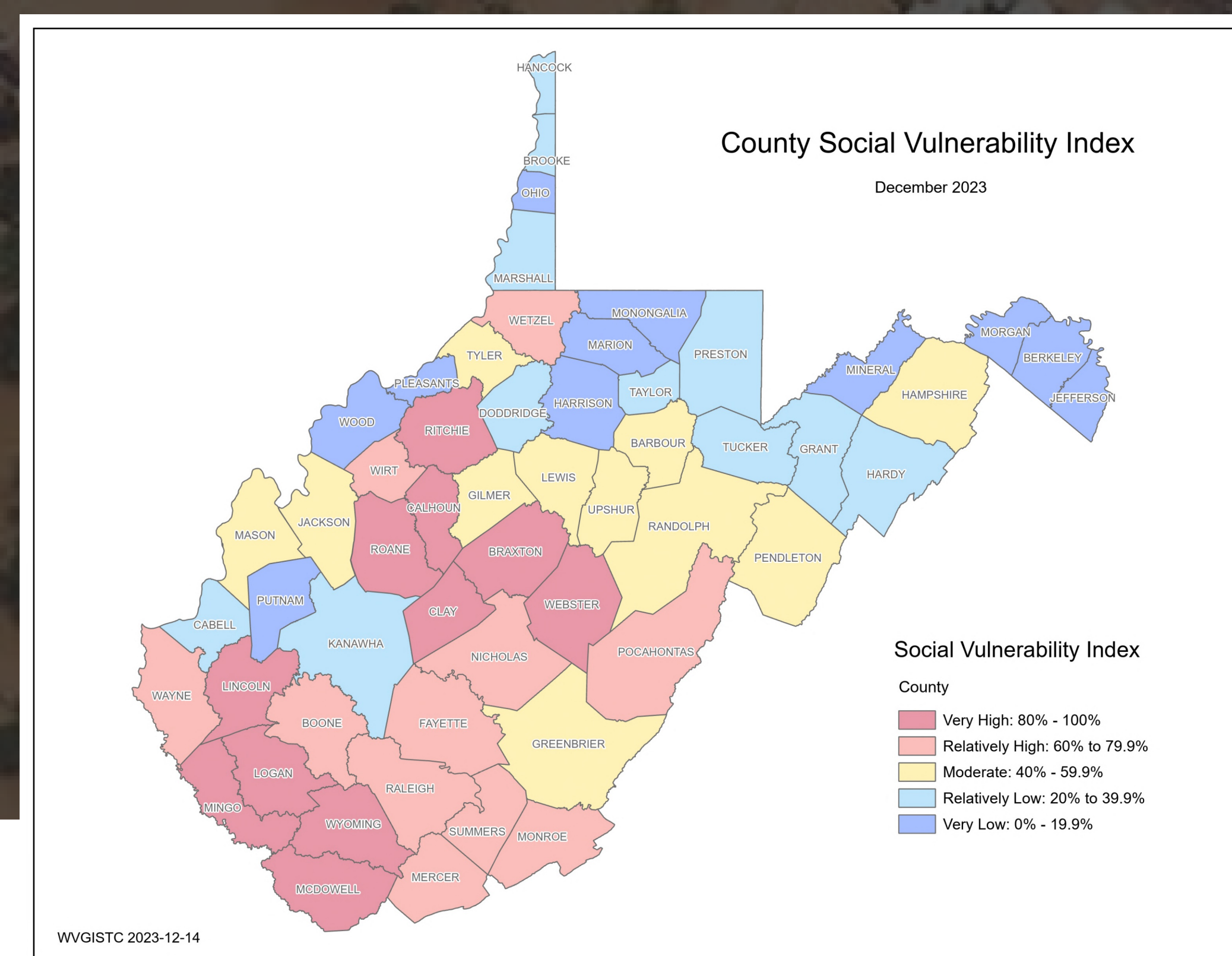
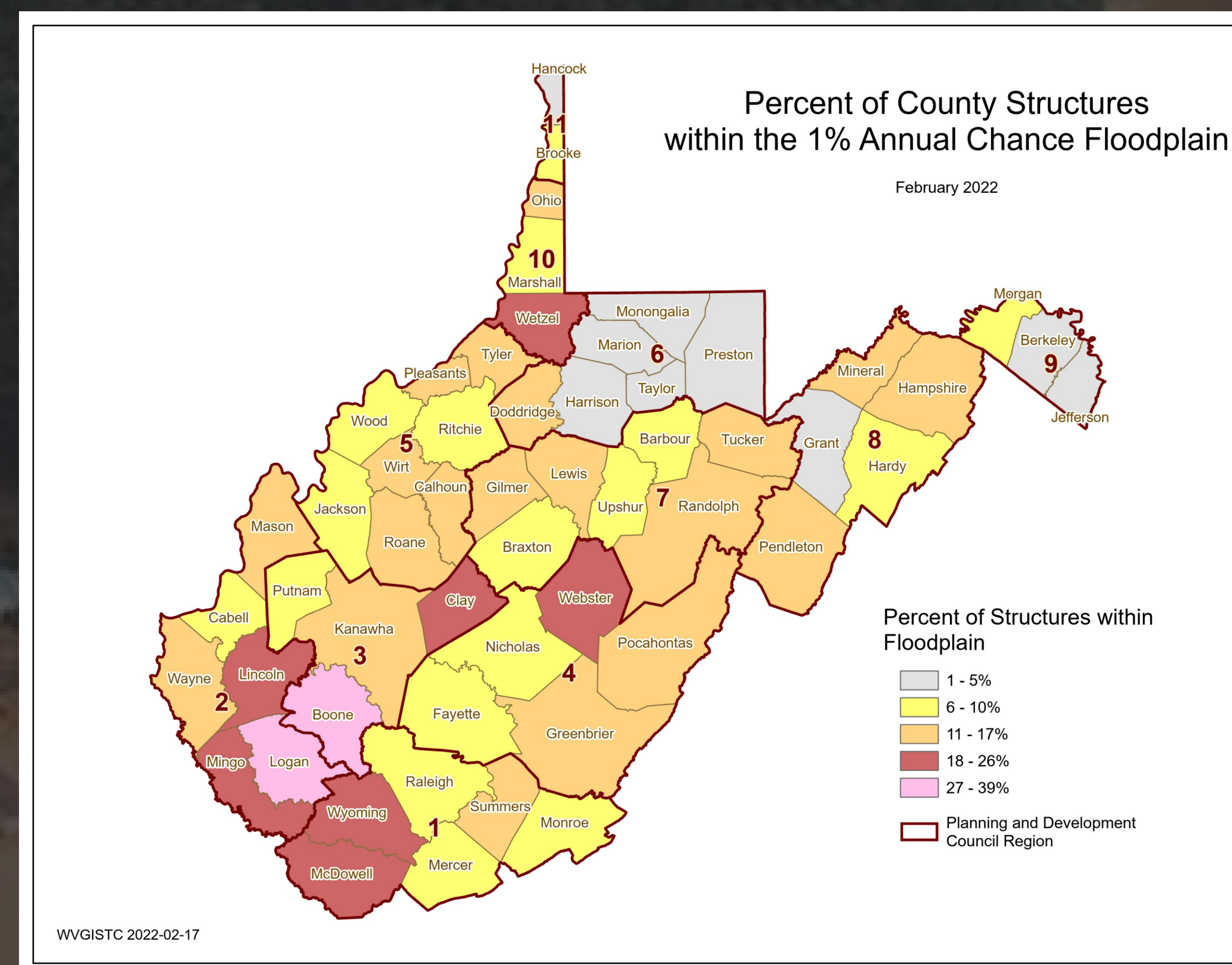
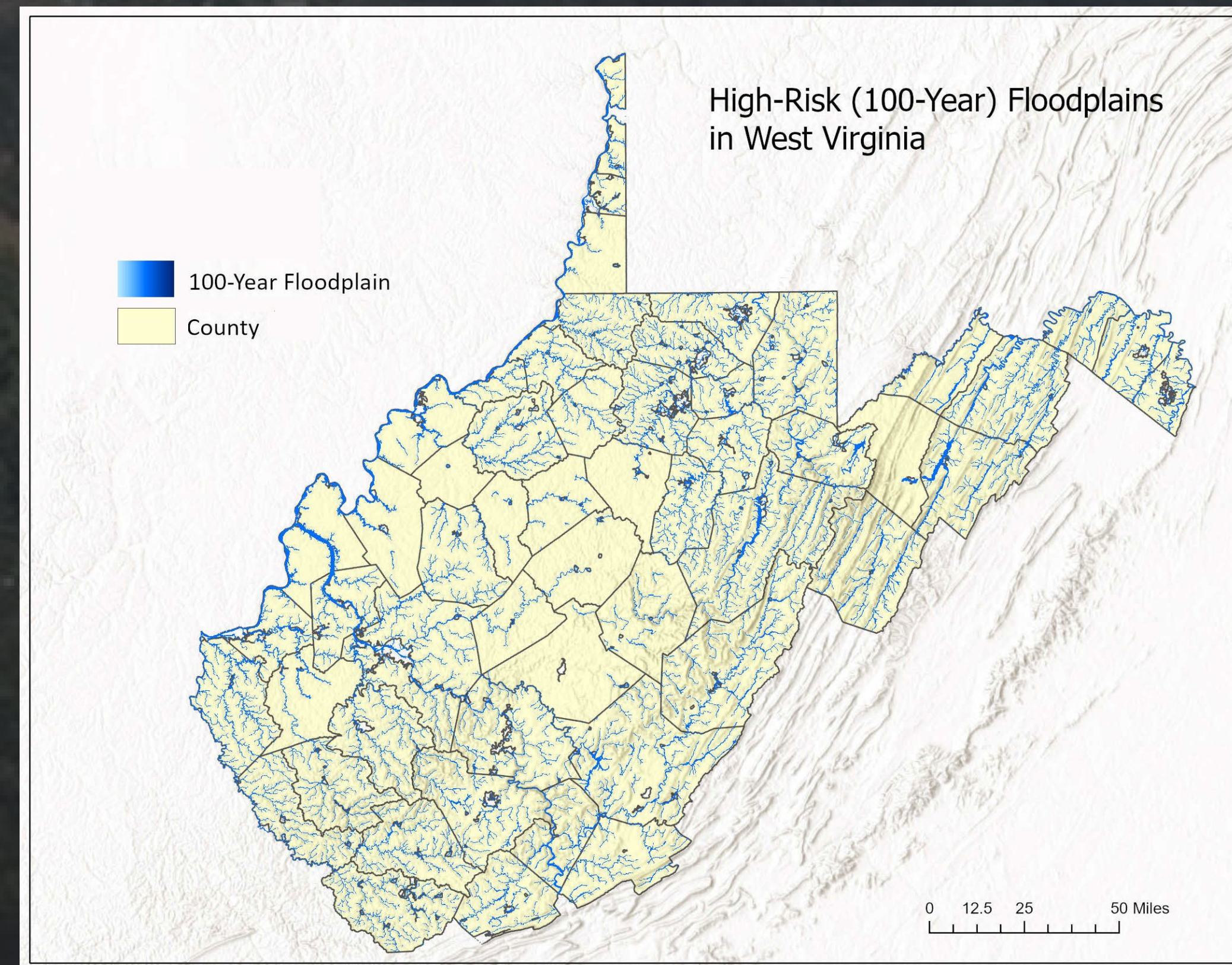
$$\text{Percentile Rank} = \frac{\text{Rank} - 1}{N - 1} \times 100$$

FLOOD HAZARD INDICATORS		
Declared Flood Disasters	Floodplain Area Ratio	Median Flood Depth

PHYSICAL INDICATORS							
Floodplain Buildings to Total Buildings Ratio	Building Count in High-Risk Floodway Ratio	Buildings in Flood Depths > 10 ft	Floodplain Building Median Value	Exposed Residential Count Ratio	Pre-FIRM Buildings in Floodplain Ratio	Manufactured Homes Ratio in Floodplain	One-Story Buildings Ratio
Floodplain Buildings with Basements Ratio	Low-Value (<\$10K) Floodplain Buildings Ratio						

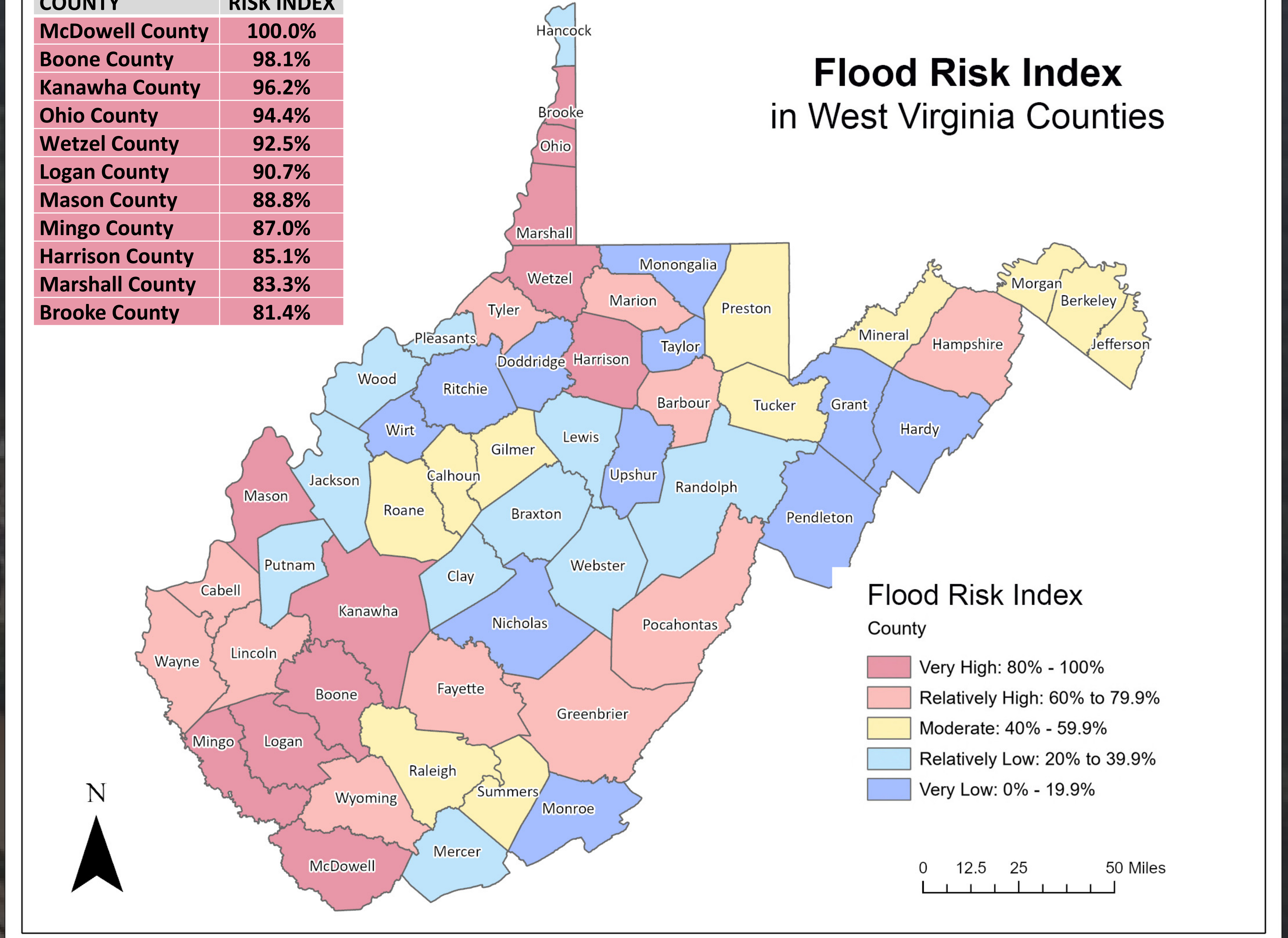
CRITICAL INFRASTRUCTURE		PHYSICAL LOSS	
Floodplain Essential Facilities	Floodplain Community Assets	Median Building Damage in Floodplain	Substantial Damage Ratio
Inundated Roads Ratio		Building Debris Tonnage	

PEOPLE/SOCIAL INDICATORS			
Displaced Population Ratio	Floodplain Population Ratio	People in Need of Short-Term Shelter	WV Social Vulnerability Index (SVI)



## Results

COUNTY	RISK INDEX
McDowell County	100.0%
Boone County	98.1%
Kanawha County	96.2%
Ohio County	94.4%
Wetzel County	92.5%
Logan County	90.7%
Mason County	88.8%
Mingo County	87.0%
Harrison County	85.1%
Marshall County	83.3%
Brooke County	81.4%



## Discussion

- A cross-section of an ongoing project
- Structure data based on the building-level risk assessment (BLRA) of Feb. 2024 at the WV GIS Tech. Center
- Demographic data based on the Census Bureau's American Community Surveys, 5-year estimates of 2021
- The final product to include more risk indicators in addition to mitigation.
- The West Virginia Social Vulnerability Index (WV SVI), developed as a stage of this project, can be a valuable tool for identifying the most disadvantaged counties with higher vulnerability to flood disasters in the state.

## Conclusion

Mapping and spatially analyzing the West Virginia flood risk index will offer a more comprehensive understanding of the risk landscape, highlighting significant areas of concern in the state. This information will be crucial for developing strategies to reduce flood risk and implementing effective mitigation measures. The final product will be accessible through an interactive online tool, providing insights at both county and community scales. For more information, please scan the QR code.

