

Visualizing Floodplain Exposure: Texas Youth Camps and Spatial Risk Patterns

Quick Response Report



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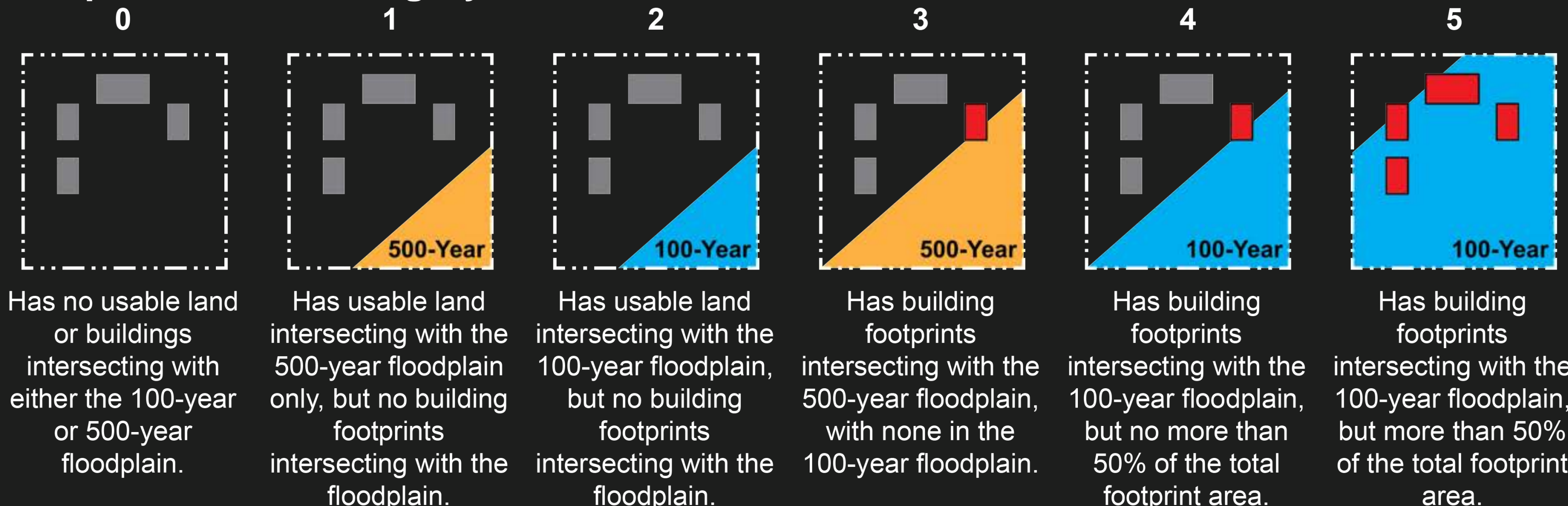
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Where Are At-Risk Camps, And How Many Are There?

Program-based camps, including youth, educational, religious, and recreational camps, operate across the United States and play an important role in child development and community engagement. Despite their significance, these camps are often located in hazard-prone areas with limited infrastructure and emergency response capacity. Different local zones across the country frequently exempt them from the safety regulations applied to schools or residential facilities, leaving them vulnerable to natural disasters, especially flooding.

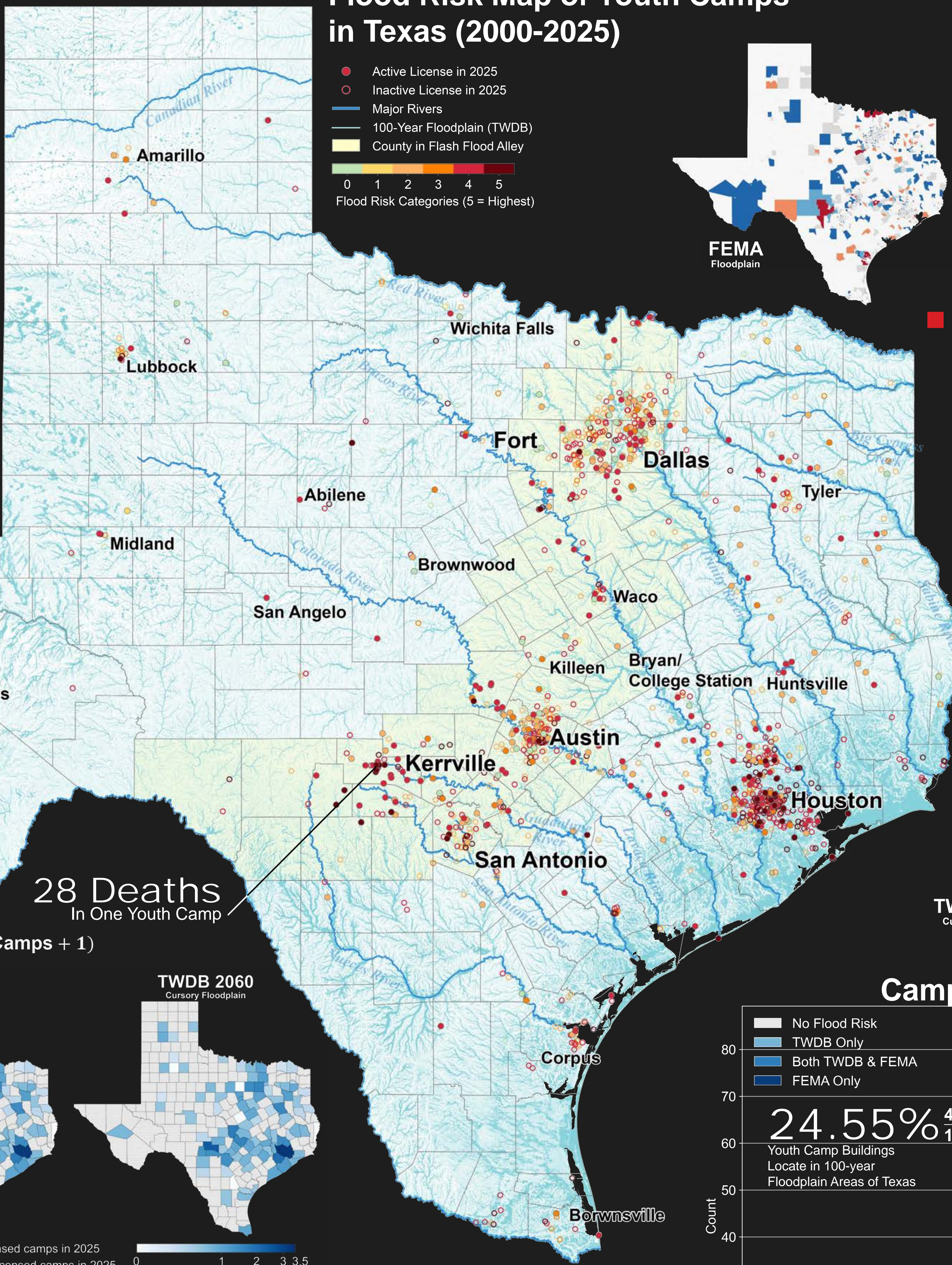
Camp Flood Risk Category



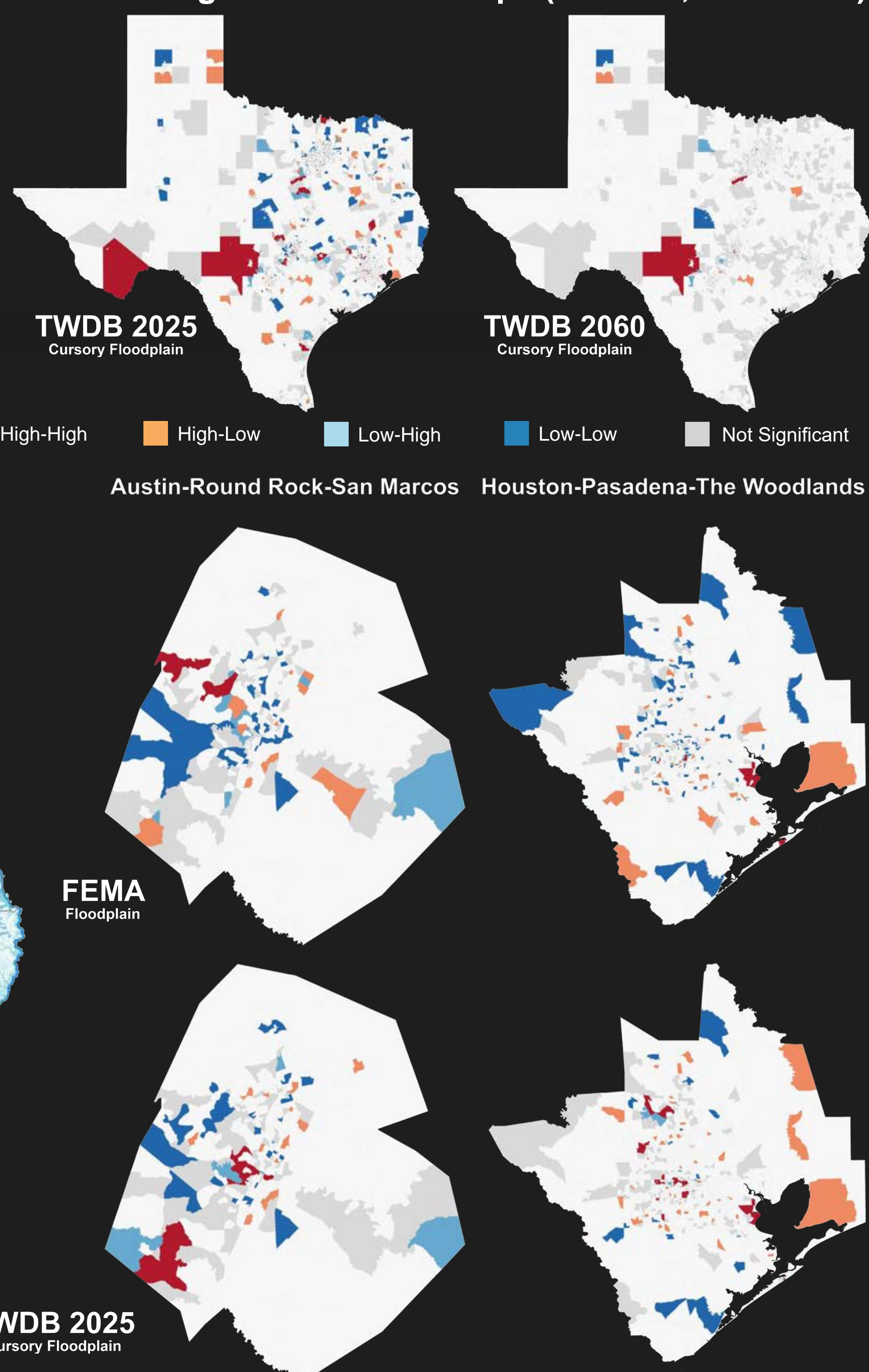
Data Cleaning and Spatial Matching

- 1,734 License Records (Year 2000-2025)
 - Step 1. Record-Point Matching
 - Geocoding using Google API
 - Excluded 62 records without addresses
 - Excluded 253 records with duplicate addresses due to intermittent operation or name changes
 - 1,419 Unique Geo-Points
 - Step 2. Point-Parcel Matching
 - Parcel analysis using TxGIO data
 - 587 situs addresses matched camp records
 - 704 points fell within land parcels
 - 56 manual reviews
 - Excluded 72 missing or duplicate parcels
 - 1,347 Initial Land Parcels
 - Step 3. Parcel-Cluster Matching
 - Distance buffering by owner type
 - 210 public owners: 10 feet
 - 878 private owners: 100 feet urban, 500 feet rural
 - 19 parcels lacked owner information
 - 1,347 Camp Clusters
 - 6,370 Land Parcels
 - Step 4. Cluster-Building Matching
 - Building footprint analysis with FEMA data
 - Buildings identified within clusters
 - Buildings were included when more than 50 percent of their footprint fell within clusters
 - Excluded 46 clusters with no buildings
 - 1,301 Camp Clusters
 - 17,216 Camp Buildings

Flood Risk Map of Youth Camps in Texas (2000-2025)



Census-Tract Clusters of Local Moran's I of High-Risk Youth Camps (Risk 4-5; 2000-2025)



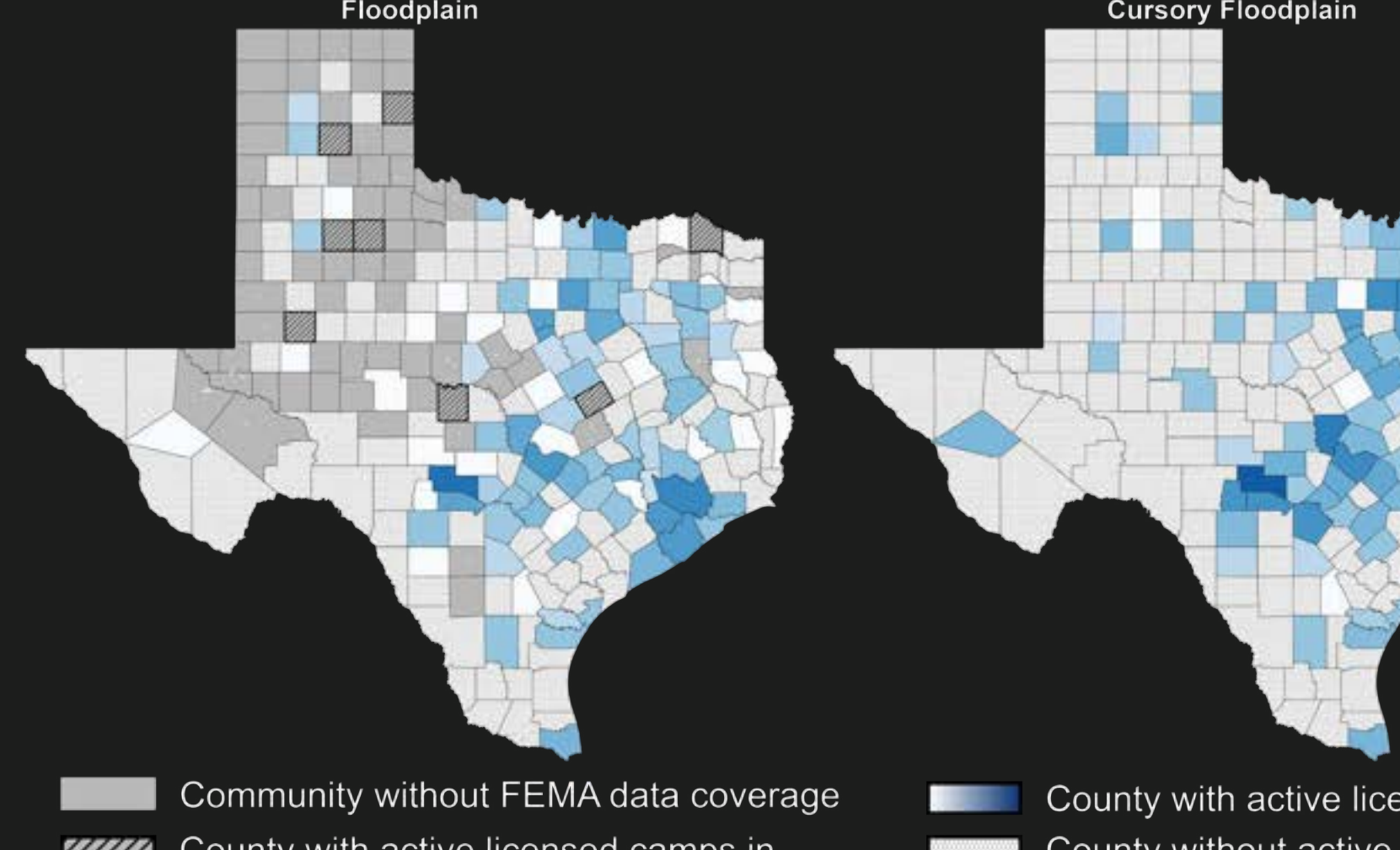
Deadliest U.S. Inland Flooding Since the 1976 Big Thompson River Flood in Colorado



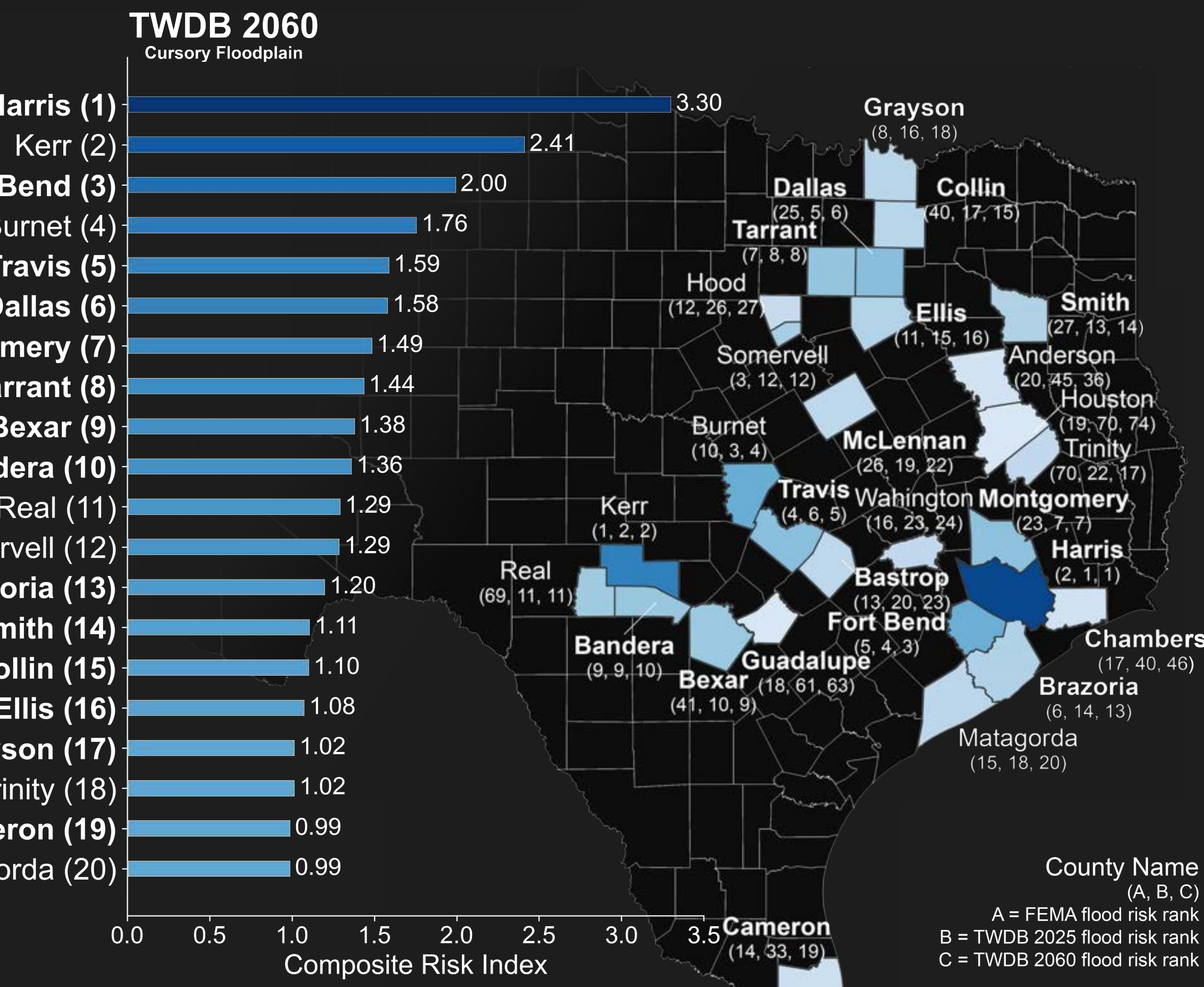
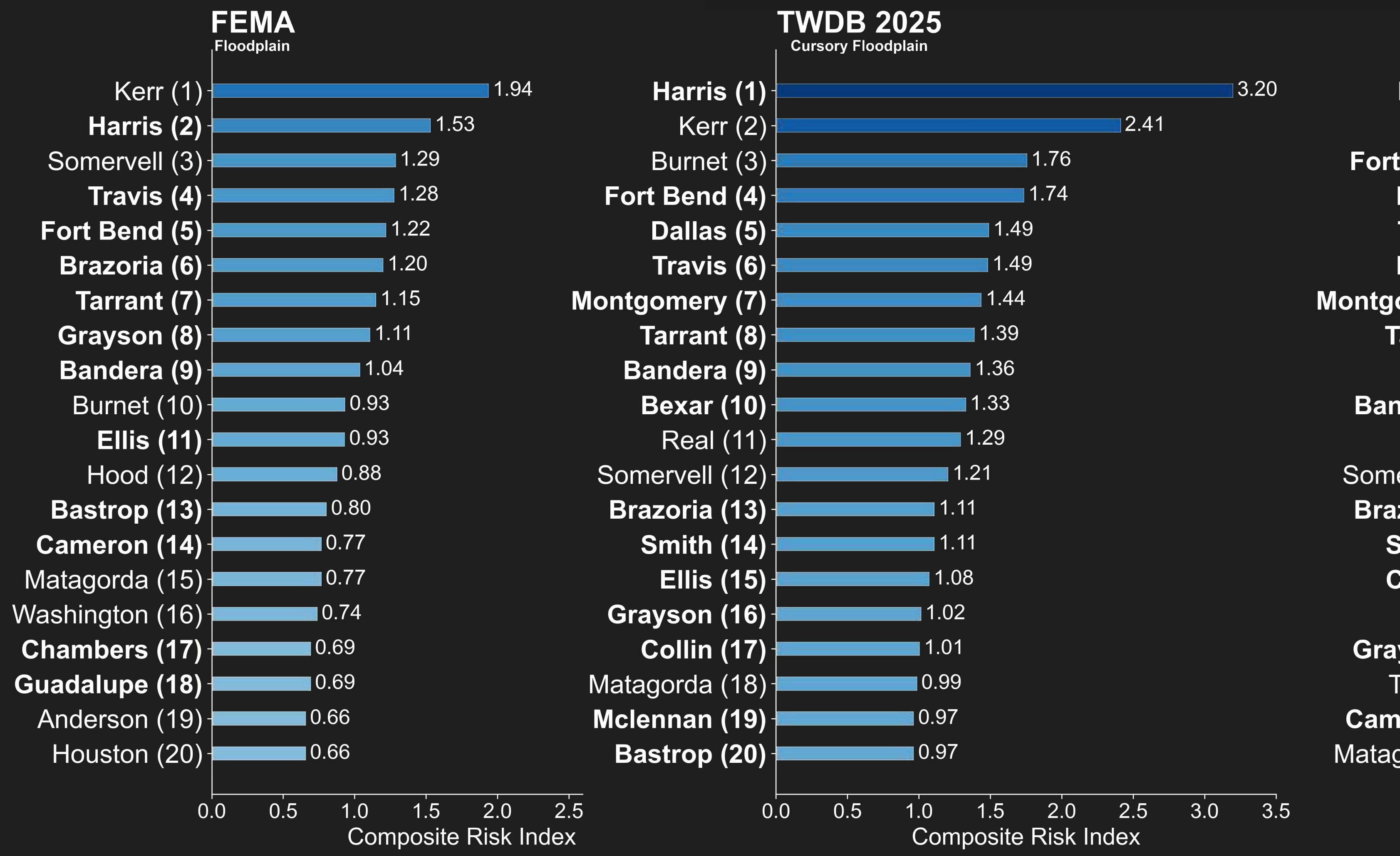
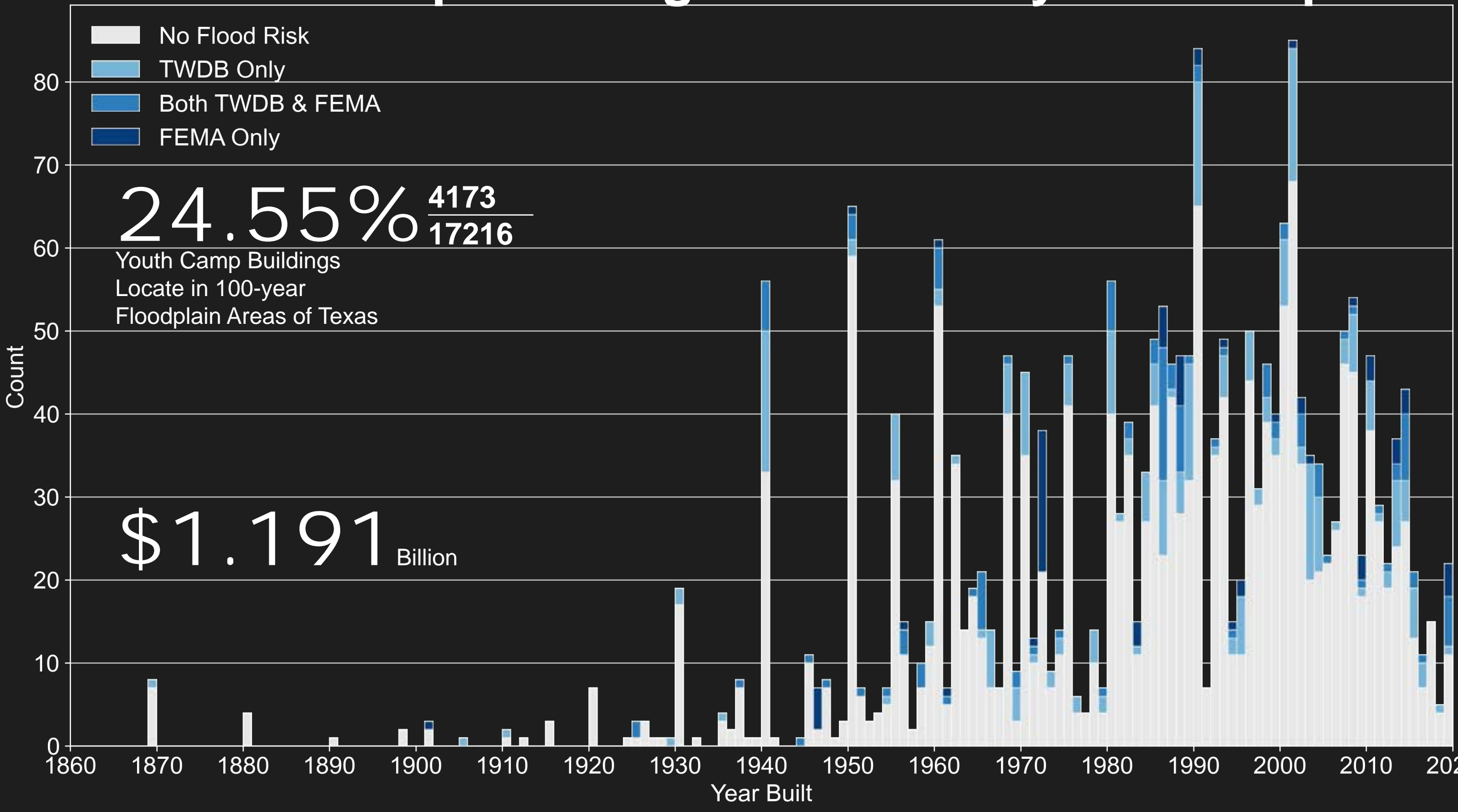
County Level Risk (Active in 2025)

$$\text{Avg Risk} = \frac{\sum \text{Camp Risk Levels}}{\text{Total Camps}}$$

$$\text{Composite Risk Index} = \left(\frac{\text{Avg Risk}}{5}\right) \times \log(\text{Total Camps} + 1)$$



Camp Building Year VS 100-year Floodplains



Takeaways

- Using state floodplain data instead of federal maps changes license renewal outcomes for 90 camps, increasing potentially non-compliant licensed camps in 2025 from 93 (FEMA) to 183 (TWDB).
- 8 licensed youth camps lack FEMA floodplain coverage entirely, demonstrating regulatory blind spots when federal data are used alone.
- Over 34 licensed camps have greater flood exposure than the site of the 2025 fatal youth camp disaster, indicating that extreme risk is not isolated or atypical.
- Buildings in the 100-year floodplain at licensed camps represent \$613M (FEMA) to \$1.19B (TWDB) in depreciated replacement value, with losses concentrated in a small number of sites.
- Spatial clustering of at-risk camps differs between state and federal floodplain datasets, suggesting systematic underestimation of youth camp flood risk in federal maps.

Bold Text = Metropolitan county (part of a Metropolitan Statistical Area, MSA) | Regular Text = Non-metropolitan county

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