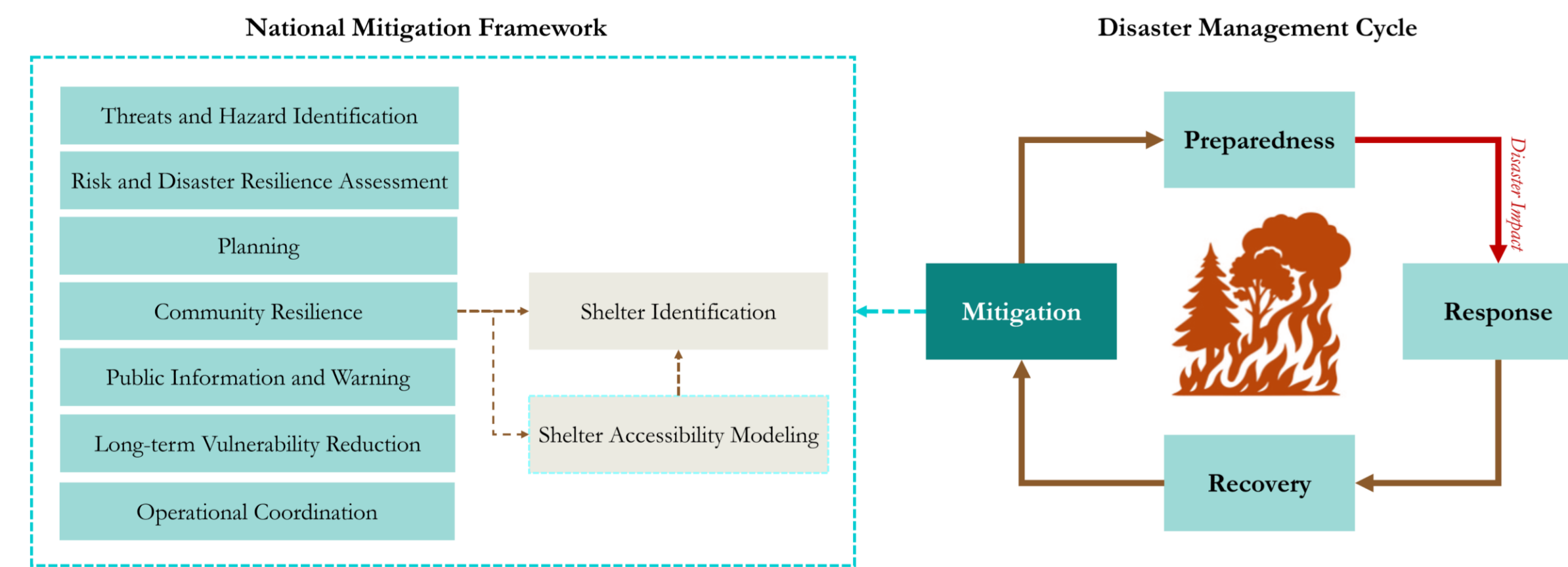
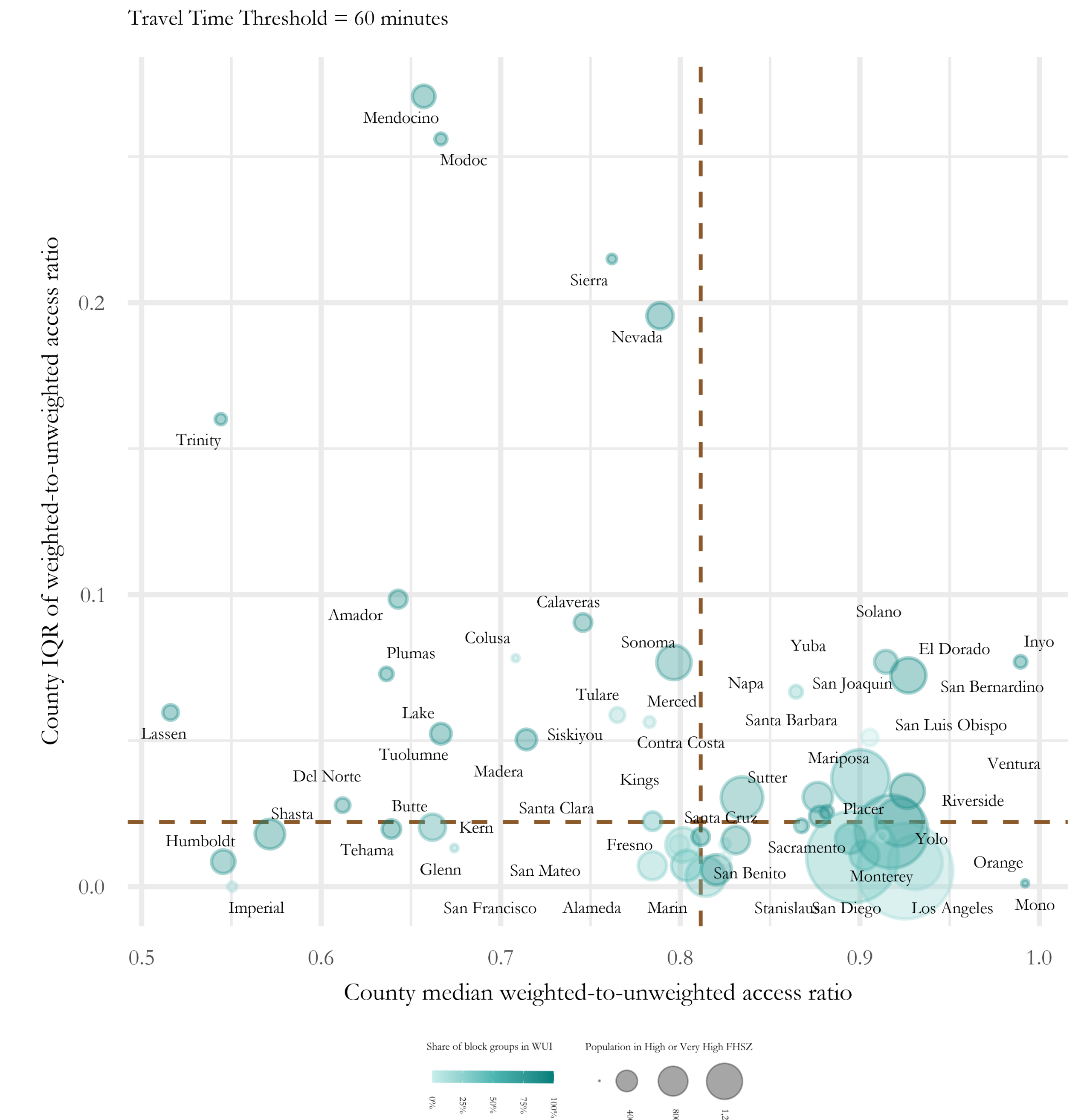




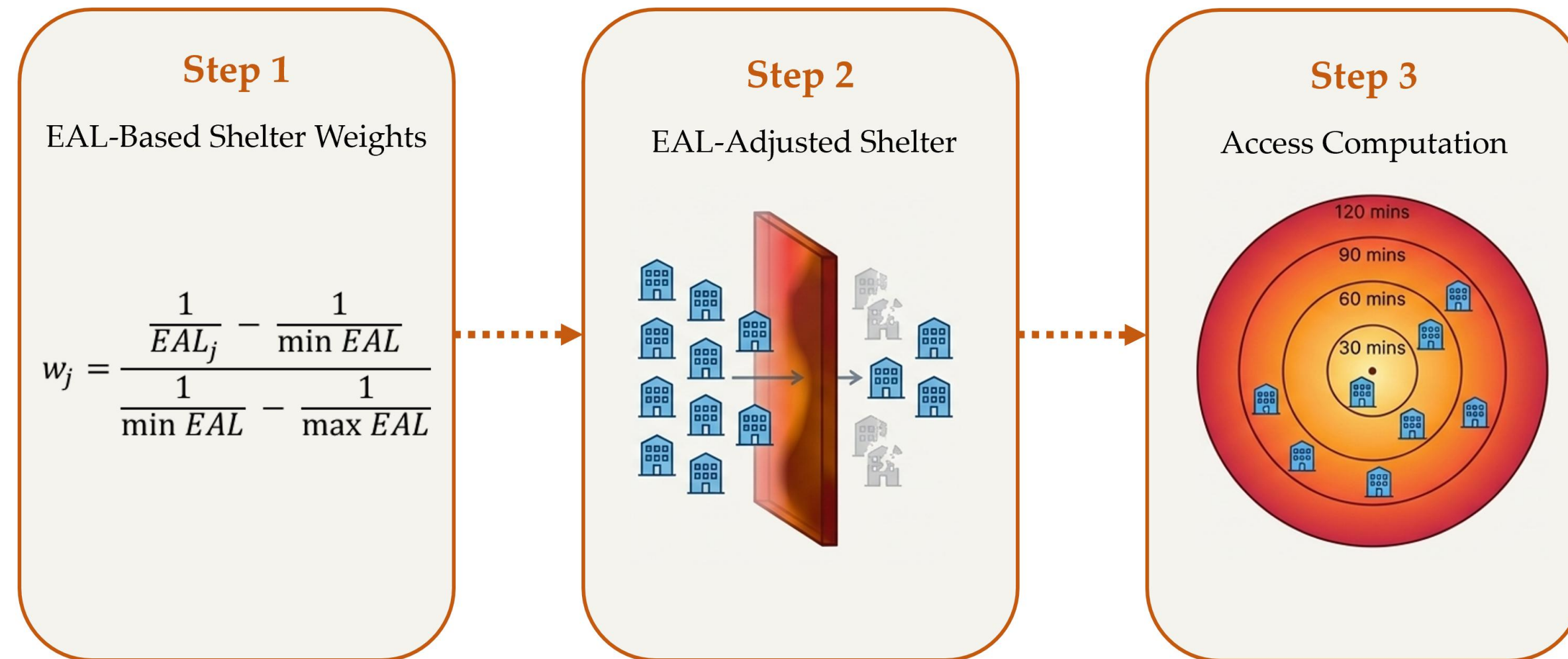
Access to emergency shelters, the ability to reach safe refuge, serves as an emerging metric for identifying at-risk areas and populations, shaping emergency management strategies, and evaluating community resilience in hazard-prone areas. Access reflects the number of shelters individuals can reach within a defined travel time using available transport modes at the moment a disaster strikes. Yet, proximity and network connectivity alone do not constitute meaningful access. The dynamic nature of wildfires defies containment forecasts, shifting rapidly with wind, terrain, and fuel conditions. This volatility can render designated shelters inoperable, cutting off access for populations previously considered covered. Access framework must, therefore, integrate risk exposure and infrastructure vulnerability to avoid planning blind spots that place lives at risk.



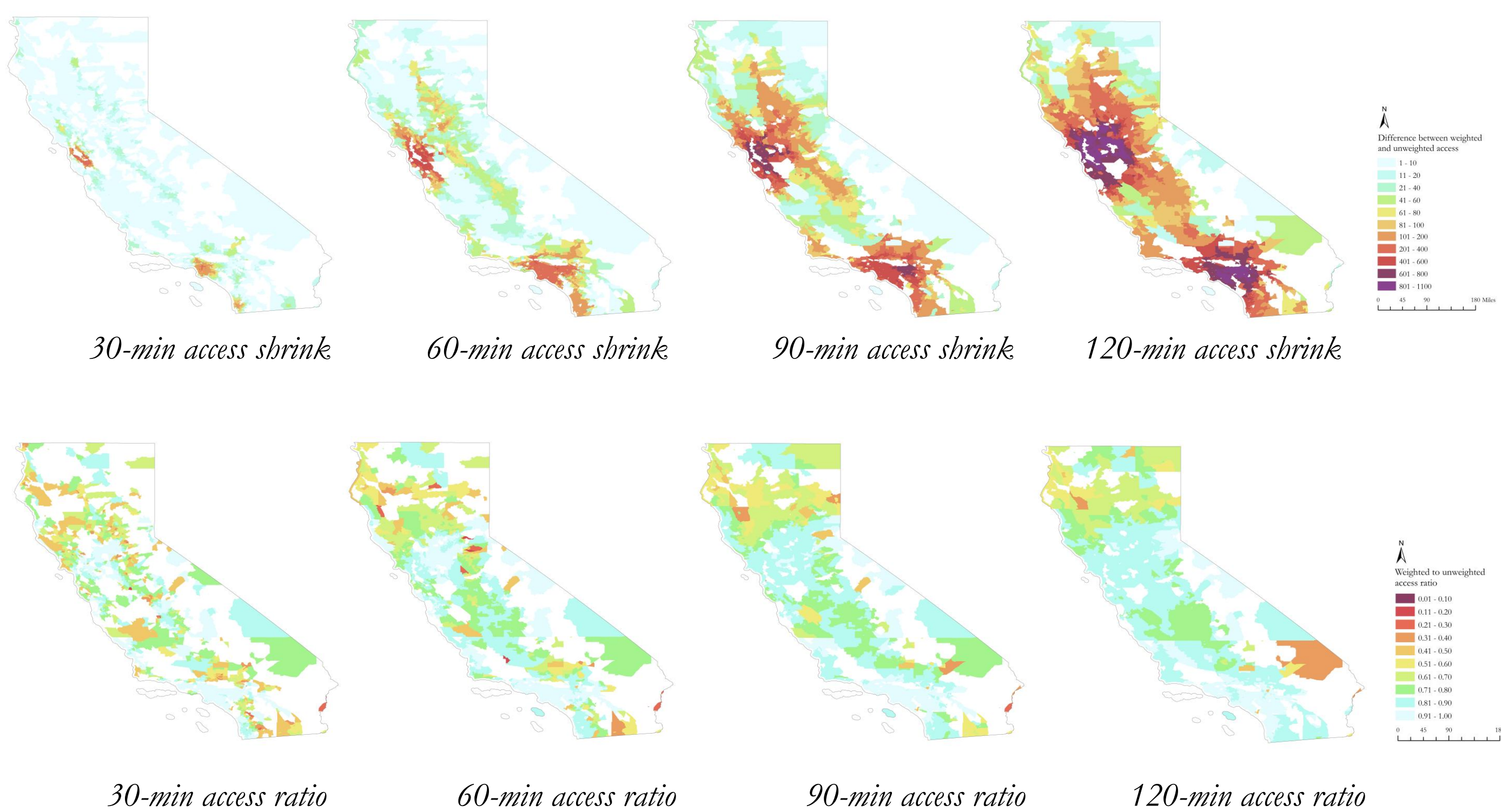
**FIGURE 3** Conceptual positioning of wildfire-weighted access within emergency management and planning.



**FIGURE 4** County-level positional overview of weighted access disparities across travel time thresholds.



**FIGURE 1** Three-step approach employed for shelter location weighting and access analysis.



**FIGURE 2** Spatial patterns of access loss, and the ratio of weighted to unweighted access across travel-time thresholds in California. The figure illustrates how both absolute and relative losses become more pronounced as more distant facilities are considered.



- Shelter access is highly spatially clustered. The strong and significant spatial lag indicates that wildfire-weighted access is shaped by neighboring conditions, reflecting the geographic concentration of wildfire risk and shelter infrastructure rather than isolated local factors.
- Income and vehicle access drive inequity. Low-income and carless households have significantly lower weighted shelter access, showing that economic and mobility constraints dominate evacuation feasibility more than proximity alone.
- Demographic correlations reflect urban concentration. Positive associations for minority, elderly, and child populations capture proximity to urban infrastructure, not assured evacuation safety, as functional and behavioral barriers remain.

This study presents an **EAL-informed access framework** that incorporates wildfire EAL into shelter access assessments, improving on traditional methods that use unweighted facility counts. By considering the likelihood that shelters remain operational during wildfires, the framework shifts the focus from nominal proximity to evacuation feasibility. Applied statewide in California, the analysis produces three main findings. **First**, accounting for wildfire risk consistently reduces effective shelter access and increases within-county inequality, especially during time-limited evacuations. **Second**, counties with large populations in High and Very High FHSZ and significant WUI development face persistent access disparities that are not addressed by extending travel-time thresholds. **Third**, although EAL-weighted access does not show systematic racial disparities, significant inequities exist by income and vehicle ownership, suggesting that mobility resources and socioeconomic factors, rather than proximity alone, determine evacuation feasibility.

These results show that average access metrics can mask concentrated vulnerability and that evacuation feasibility varies significantly by location, population group, and time frame.

### ACKNOWLEDGMENT

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