

Mapped Flood Zones and the Hydrologic Blind Spot of U.S. Flood Insurance



Jesse R. Andrews¹ • Ali Nejat¹

¹ Department of Civil, Environmental and Construction Engineering, Texas Tech University • jesseand@ttu.edu
Center of Excellence in Capacity-building for REsilient Housing (CECREH)

Assistance-recorded flood burden follows hydrologic susceptibility more closely than mapped zones do, while NFIP uptake remains organized around mapped risk.

THE QUESTION

Does recorded flood burden align more closely with federal flood zones or with broader hydrologic conditions?

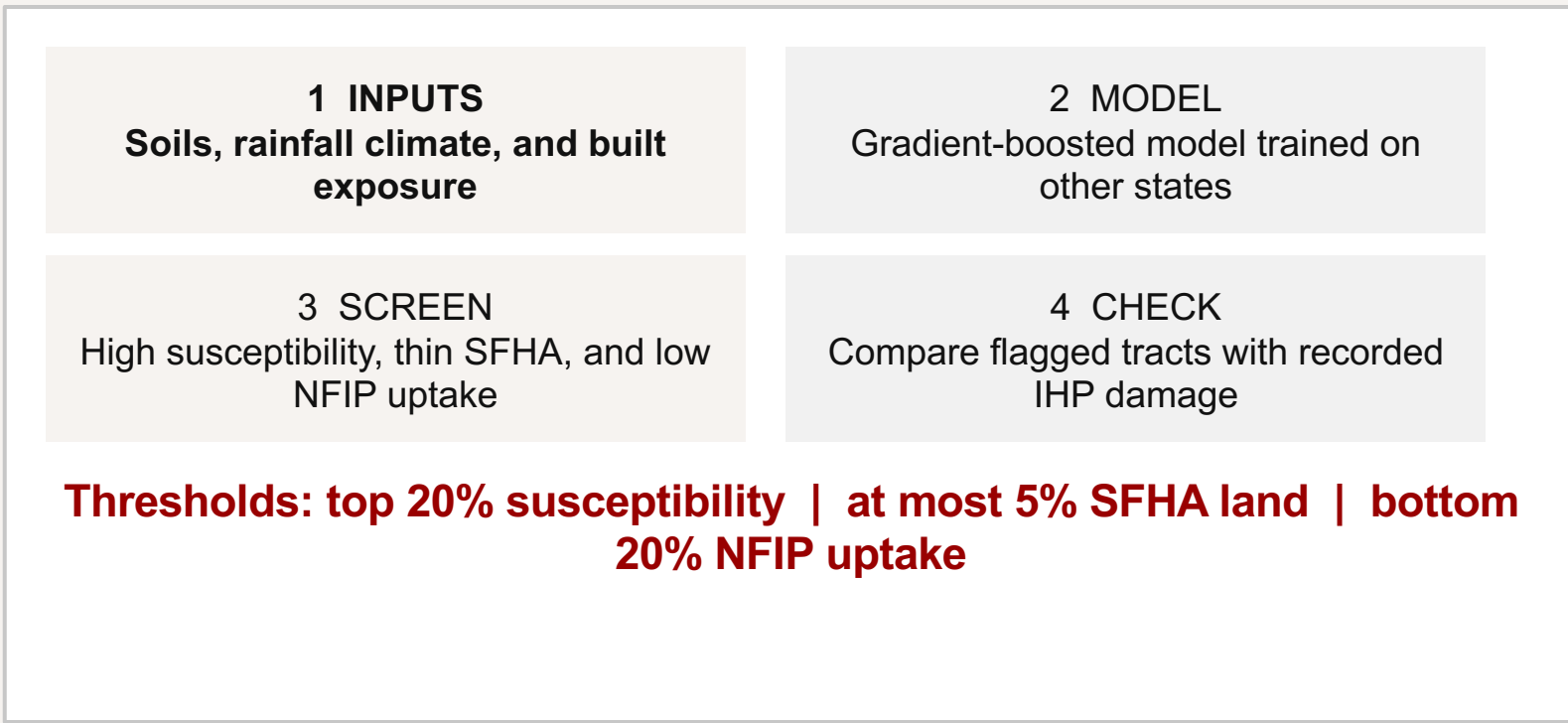
THREE RECORDS

- Federal Emergency Management Agency (FEMA) Individuals and Households Program (IHP) flood-damage registrations
- National Flood Insurance Program (NFIP) claims and paid building and contents losses
- NFIP policy terms active at any time in 2024

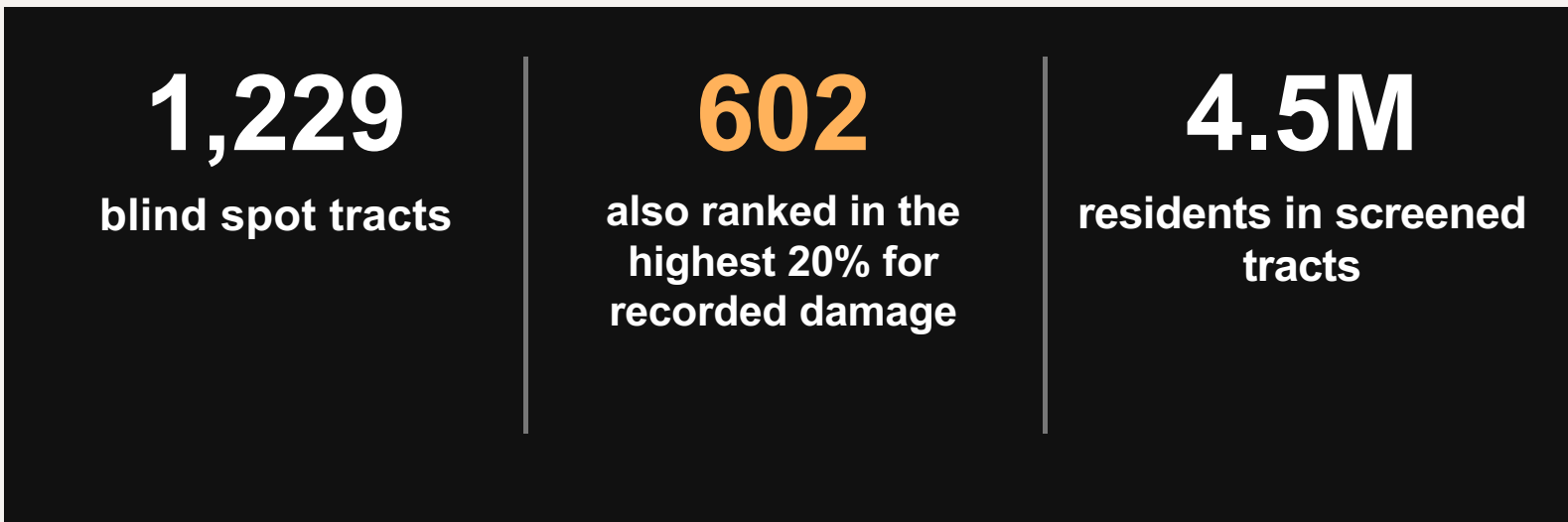
STUDY DESIGN

- 83,360 U.S. census tracts
- Damage records from 2010-2024 and NFIP uptake in 2024
- Public measures of mapped zones, soil wetness and drainage, precipitation, land development, structures, and density
- Each tract was scored by models trained on other states, then the contribution of each group of measures was compared

HOW THE MODEL SCREEN WORKS



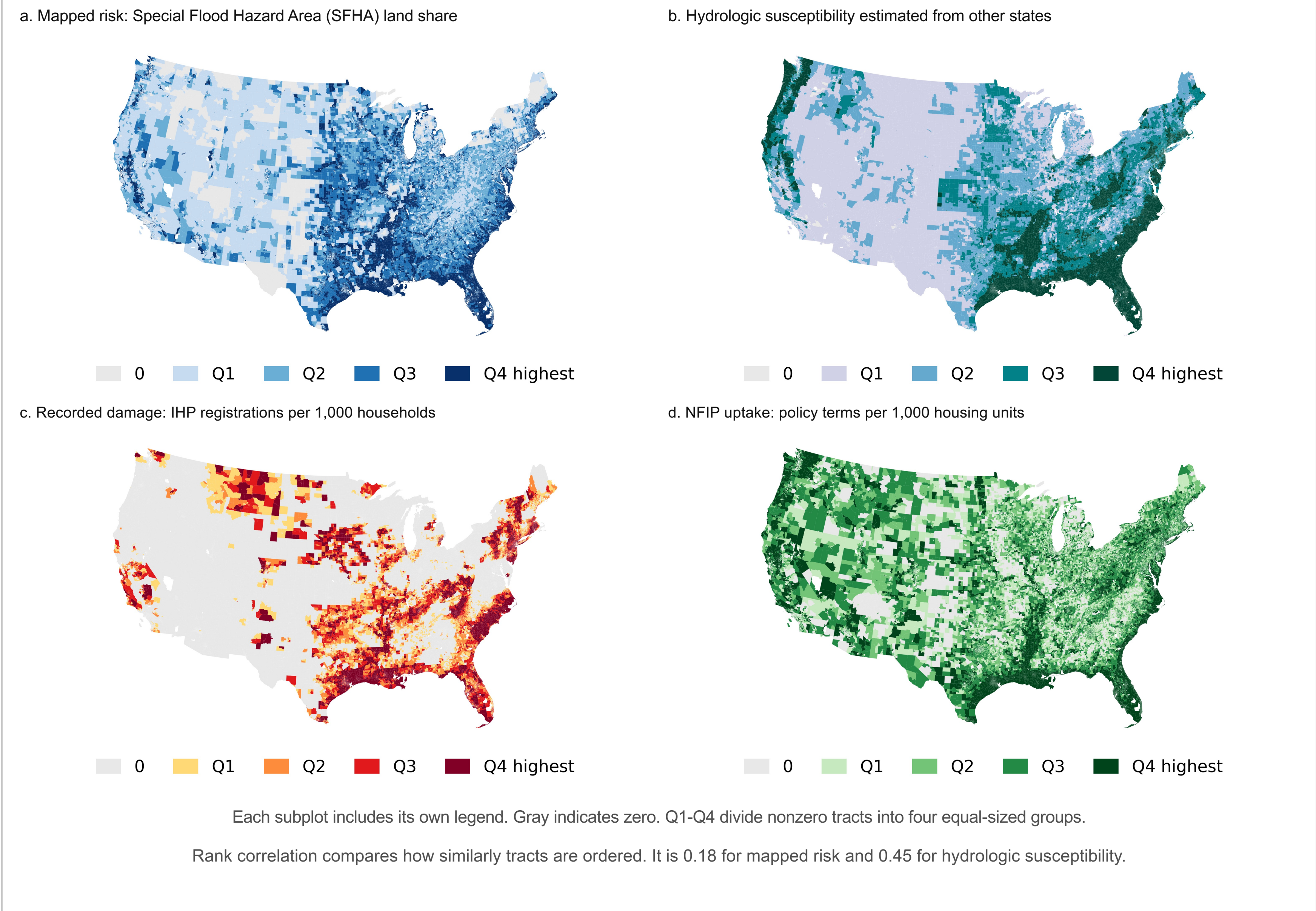
The screen ranks tracts for review. It does not estimate household risk or prescribe insurance coverage.



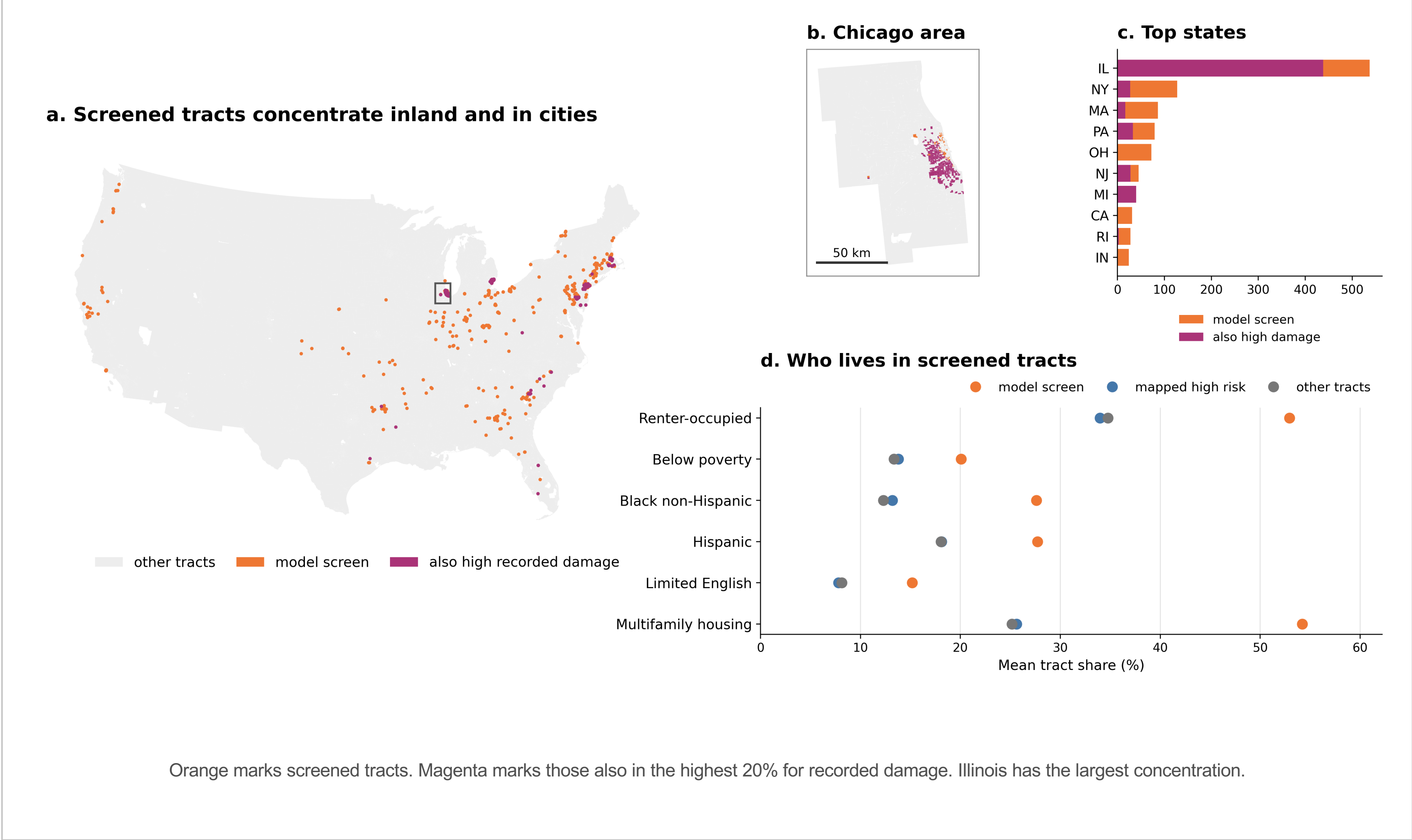
WHAT THE SCREEN CAPTURES

Screened tracts recorded 140,911 flood-damage registrations but only 501 NFIP claims over fifteen years. Mean 2024 uptake was 0.25 active policy terms per 1,000 housing units.

THE FOUR GEOGRAPHIES DO NOT ALIGN

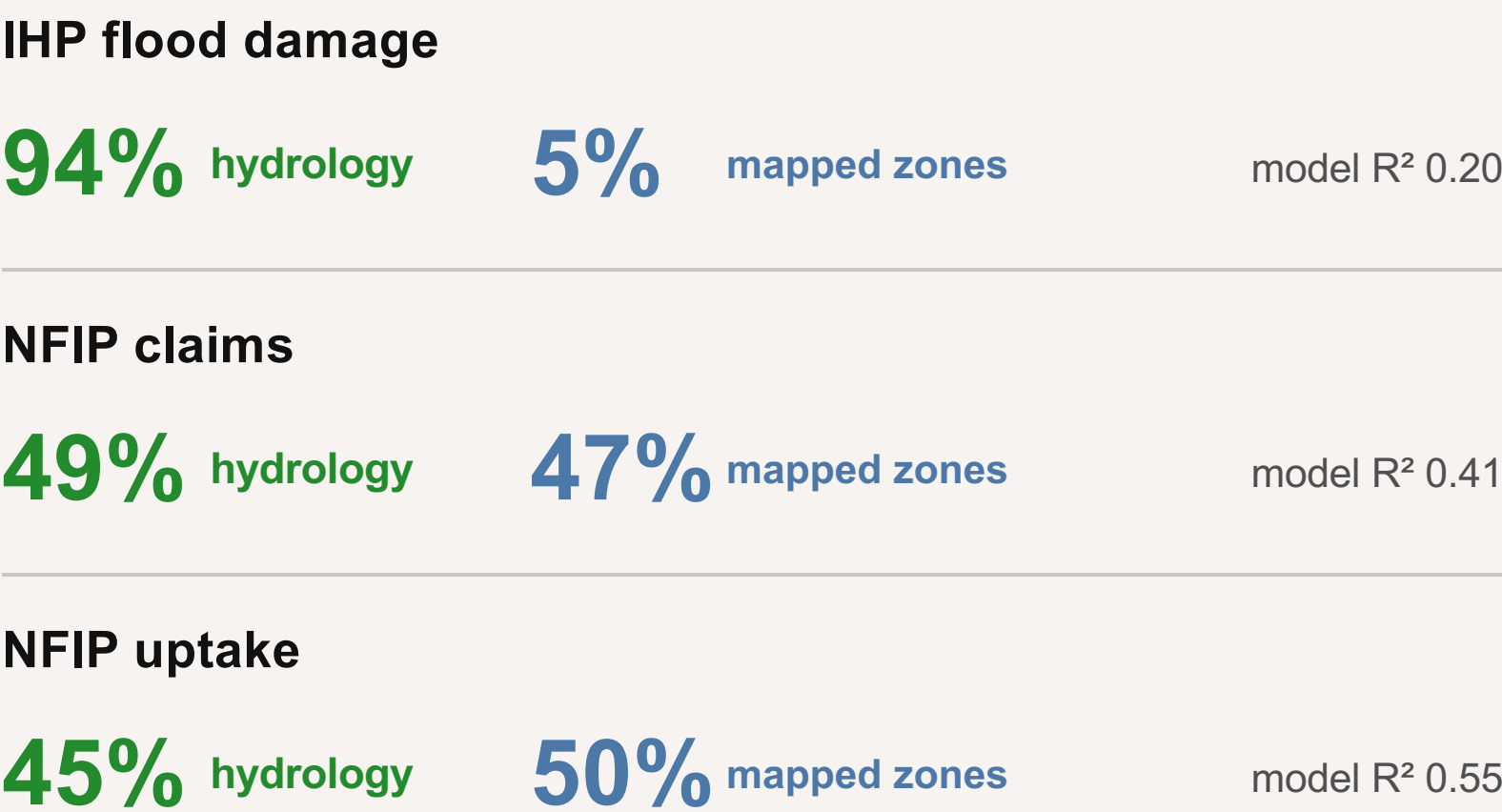


THE BLIND SPOT IS URBAN AND INLAND



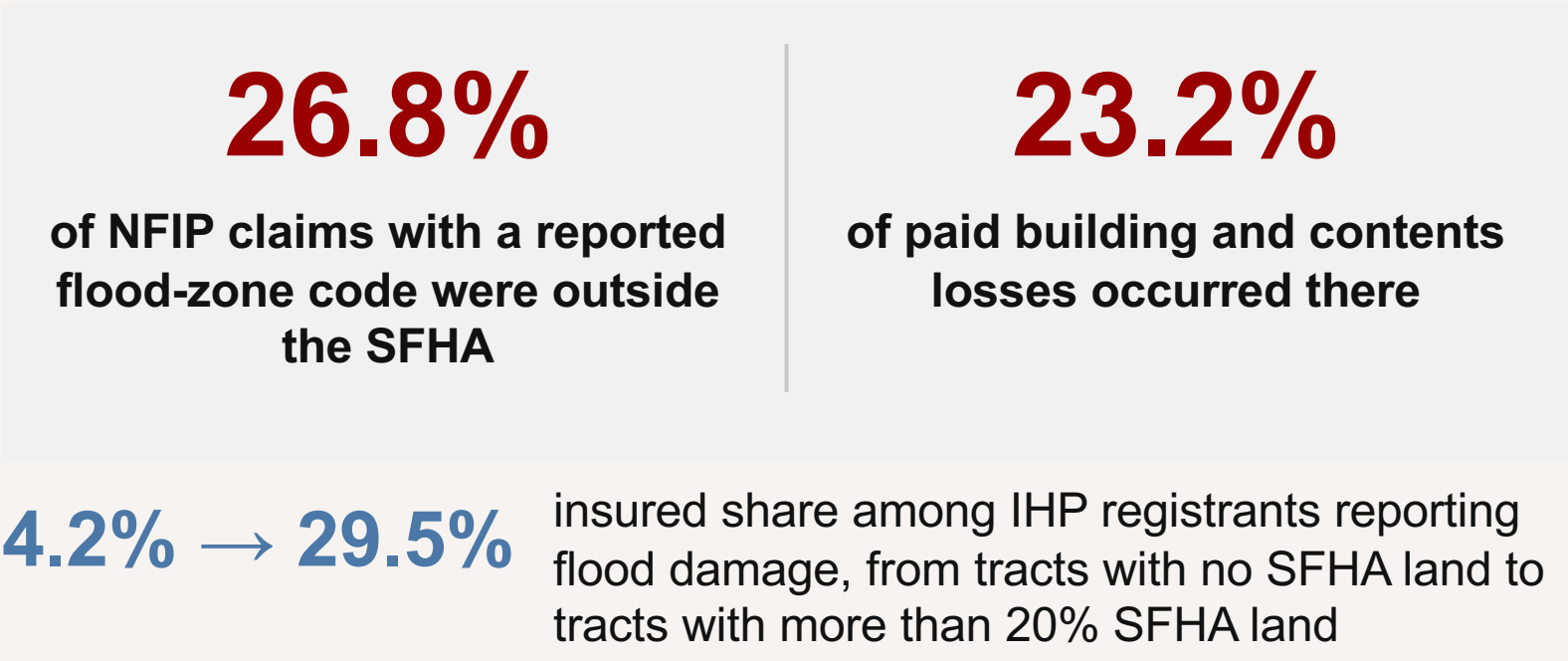
THE SIGNALS DIVERGE

Contribution to each model's explained variation. R^2 is the share of tract-to-tract variation explained by the full model.

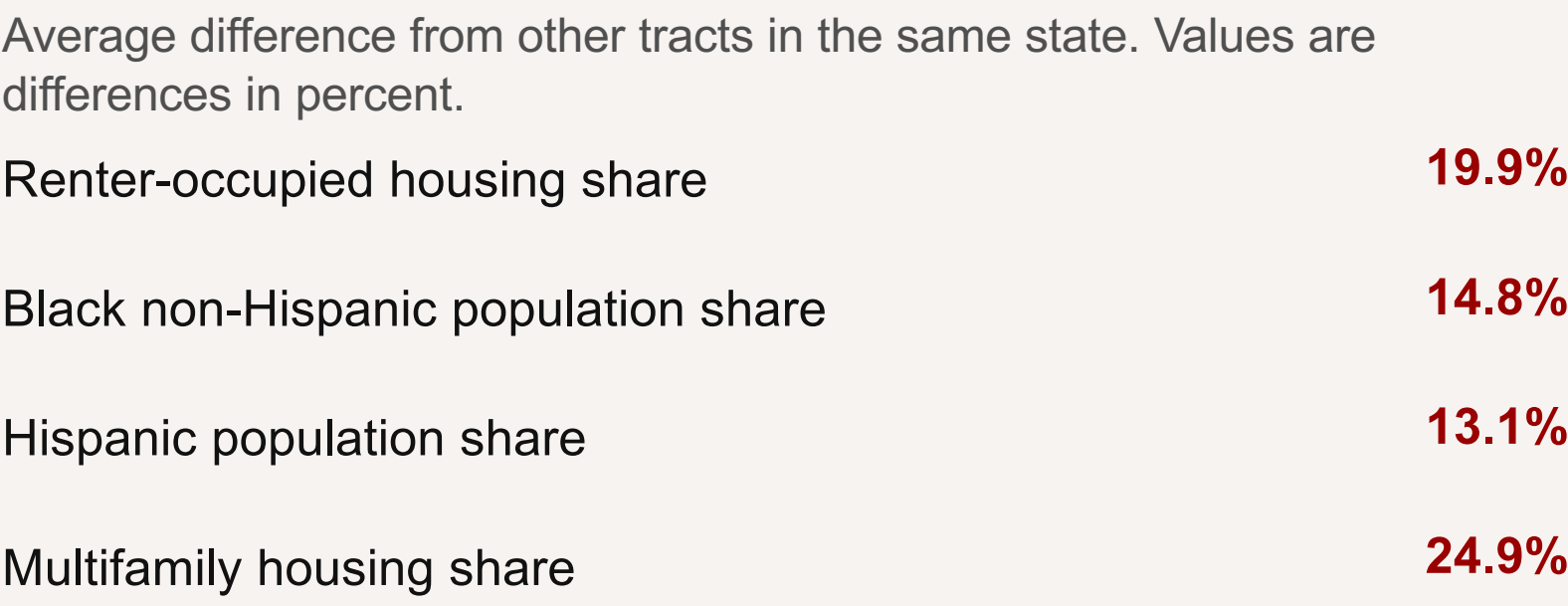


CAN IHP MODEL FIT IMPROVE?
Yes. Additional before-event inputs raise R^2 for states not used in training from 0.20 to 0.24. Adding realized event rainfall raises it to 0.30. Event rainfall is excluded from the screen because it describes floods after they occur.

DAMAGE FALLS OUTSIDE MAPPED HIGH RISK



WHO LIVES IN THE BLIND SPOT



WHAT THIS MEANS

- Target map review and risk communication where mapped risk is thin
- Focus renter-facing contents-coverage information in screened tracts
- Report NFIP uptake alongside hydrologic susceptibility

These results support supplementing the regulatory floodplain. They do not show that SFHA maps fail at their intended riverine and coastal function. IHP registrations also reflect disaster declarations and access to assistance.

Flood maps organize insurance. Hydrologic conditions better locate assistance-recorded damage.