RAY (Resilience Assistant for You): An Accountable GeoAI Agent for Place-Based Disaster Intelligence

Ask a disaster question in plain words, and get a spatial analysis on a map that anyone can check

EAR Lab
Explore & Resolve

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01 WHAT IS RAY?

After a disaster, a **planner** must decide where inspection teams go first, and a **resident** wants to know what is known about their street. Both are GIS questions, yet few people can run the analysis. **RAY** is a web GIS with an AI agent. It puts public data for four disasters on one hexagonal grid, and it answers questions asked in plain words by running spatial tools.

MAP
Damage, people and hazard layers on one H3 grid

ANALYZE
Hot spots, priority ranking, distance to care

ASK
A question in words becomes a spatial plan

MAIN IDEA
The language model plans; GIS tools compute; a harness checks. No number on the map is written by the model.

02 DATA AND METHODS

Damage
CAL FIRE inspections: 18,428 structures in the Eaton Fire

People
CDC Social Vulnerability Index, 2020 Census, OpenStreetMap care sites

Hazard
Sentinel-2 burn severity, fire perimeters since 1980, FEMA history

Data plane
- Public data, four disasters
- One config file per event
- Every file hashed and logged

→

Agent plane (RAY)
- Any open language model
- Plans over 11 spatial tools
- Sees results, never raw data

→

Presentation plane



one web app for residents and planners

Steward Harness *the code between the model and everything else*

Question (in plain words) → Plan (written by the model) → **Plan check** (every step authorized) → Run tools (on the H3 grid) → **Answer check** (numbers match results) → Answer (each number cited)

EXAMPLE

Asked "Where should inspectors go first in the Eaton Fire?"

Plan `join_layers` → `rank_priority` → `distance_to_facility`

Answer 25 tiles on the map, holding 39% of destroyed structures (step 2)

1 One grid
H3 resolution 9 hexagons, about 0.1 km². Points are counted per tile, never shown per parcel.

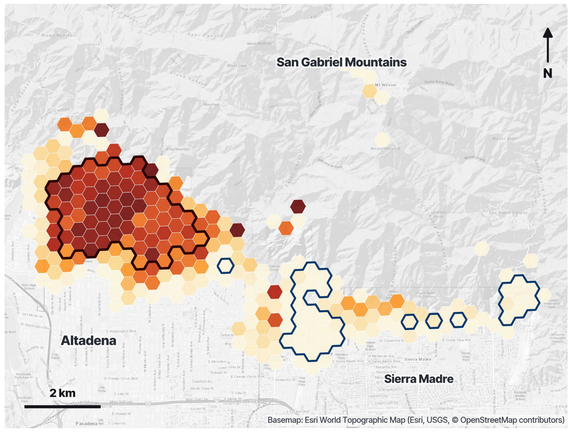
2 Overlay by cell
Tract, census, facility and satellite layers join on the cell index.

3 Spatial tools
Gi* hot spots, multi-criteria ranking, grid distance to care.

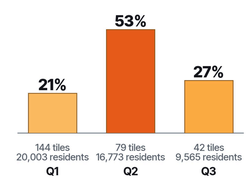
03 SPATIAL ANALYSIS Eaton Fire, January 2025

18,428 structures · 265 tiles

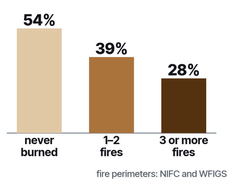
A Where did structures burn? HOT SPOTS



Destroyed share by SVI quartile (Q1 = least)



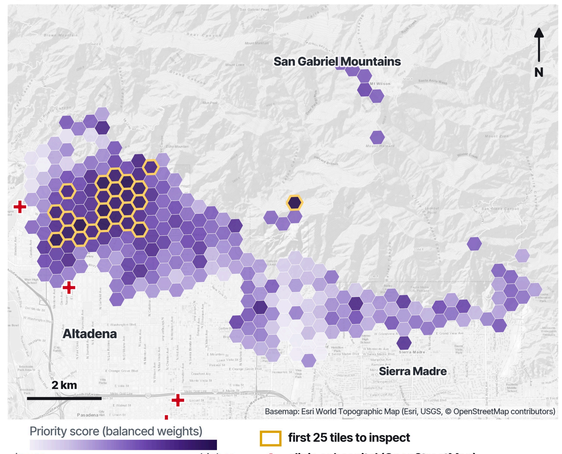
Destroyed share by earlier fires



fire perimeters: NIFC and WFIGS

Gi* finds a **hot spot of 66 tiles in Altadena** and cold spots along the eastern foothills. Tiles that had never burned before lost the largest share of structures.

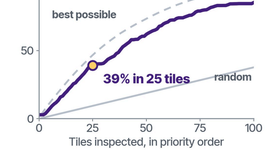
B Where to inspect first? PRIORITY



Score = weighted mean of four criteria

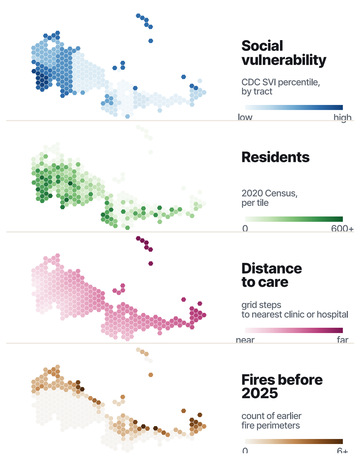
Damage	destroyed share
Vulnerability	CDC SVI percentile
Residents	2020 Census
Distance to care	H3 grid steps

Destroyed structures reached



Ranking by damage, vulnerability, residents and distance to care reaches **39% of destroyed structures in 25 of 265 tiles**; random tiles reach 9%. Planners move the weights and the map re-ranks.

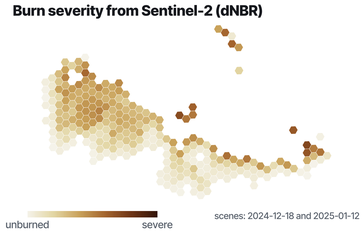
C Four layers, one grid OVERLAY



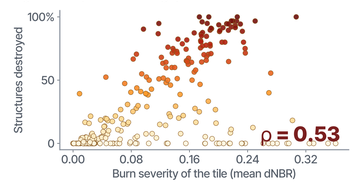
Tract, census, facility and fire-history data share one cell index, so any layer can be compared with any other, tile by tile.

D Satellite or inspection? REMOTE SENSING

Burn severity from Sentinel-2 (dNBR)

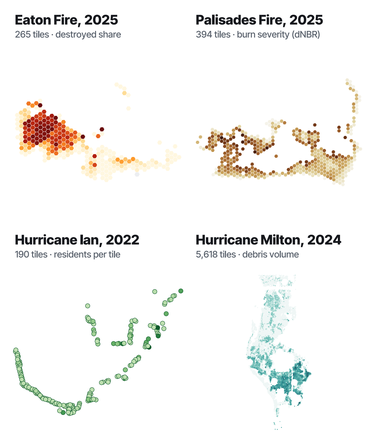


Against inspected damage, 264 tiles



Only partly (ρ = 0.53). Burn severity sees burned vegetation better than burned houses: its 25 most severe tiles hold **6%** of destroyed structures.

E Four disasters SAME GRID



Two fires and two hurricanes use the same grid and the same tools. A new event needs **one configuration file**.

04 THE WEB GIS

Address lookup RESIDENT



An address returns a plain-language summary of its tile, and what is not known.

Priority map PLANNER



The top ten tiles re-rank live as a weight slider moves.

Ask in words BOTH



The agent writes a multi-step spatial plan; each number links to its step.

3D scene PLANNER



Street photographs of a tile become a 3D scene in the browser.

05 CAN YOU TRUST IT?

ACCESS
0
of 2,526 results built on restricted data were released

NUMBERS
91%
of 10,440 injected numeric errors were refused

MAP READING
44–46%
of 114 map questions answered by vision models without the tools

06 TAKEAWAYS and try it

1. **A shared hexagonal grid** turns damage, people and hazard data into layers anyone can overlay and compare.
2. **Spatial tools, not the model, produce the answer:** hot spots, priorities and distances are computed, then explained.
3. **GIS that explains itself:** every number cites its analysis step, and a refused question names its rule.

Try the live map runs in a browser

Code and paper open source, MIT

One-minute video with narration

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