



Research  
Institutes | Fire  
Safety

# The Return of Urban Conflagration

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Fire Safety Research Institute

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## Research Institutes

- UL Research Institutes is a leading independent safety science organization.
- We sense and act on risks to public safety with bold hypotheses and objective investigations.
- Global footprint and a lineage dating back to the formation of Underwriters Laboratories (UL) in 1894 – with fire safety a catalyst.



## Research Institutes | Fire Safety

- FSRI is dedicated to addressing the world's unresolved fire safety risks and emerging dangers.
- As part of UL Research Institutes, we are committed to sharing our fire safety insights with everyone to advance UL's public safety mission of providing safe living and working environments for people everywhere.
- FSRI experts participate in firefighter fatality and near miss investigations by providing fire dynamics and fire suppression analysis.
- Led Comprehensive analysis of the Maui wildfires of August 2023.
- 200+ years of collective experience researching, responding to, managing, and recovering from major fire incidents around the globe.

# Today's Fire Environment



- Faster fire propagation
- Shorter time to flashover
- Rapid changes in fire dynamics

- Shorter escape times
- Shorter time to structure collapse
- Increased exposure problems
- New & unknown hazards

# Natural vs. Synthetic Materials



## HOME FURNISHING COMPARISON



**NATURAL**

 01:00



**SYNTHETIC**



# Comparison of Flame Spread

00:00



Lithium-Ion Battery

00:00

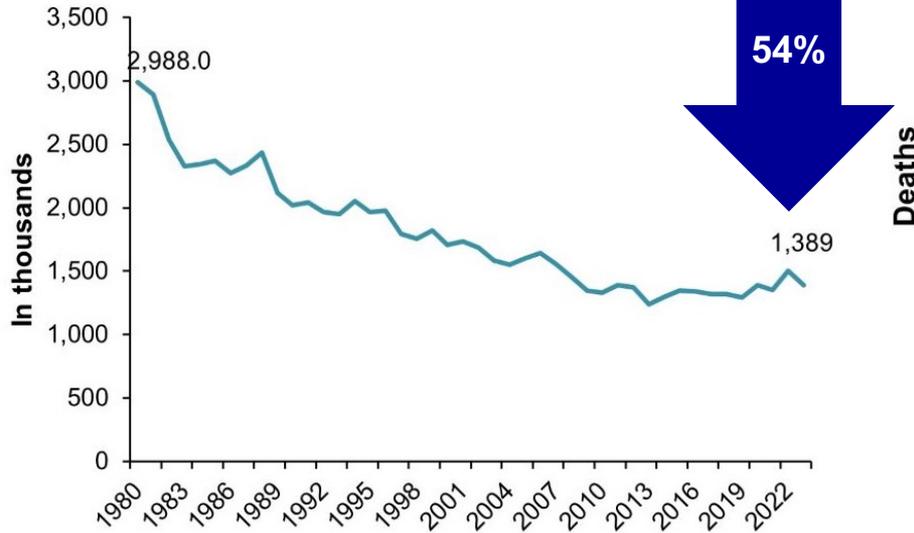


Synthetic Furnishings

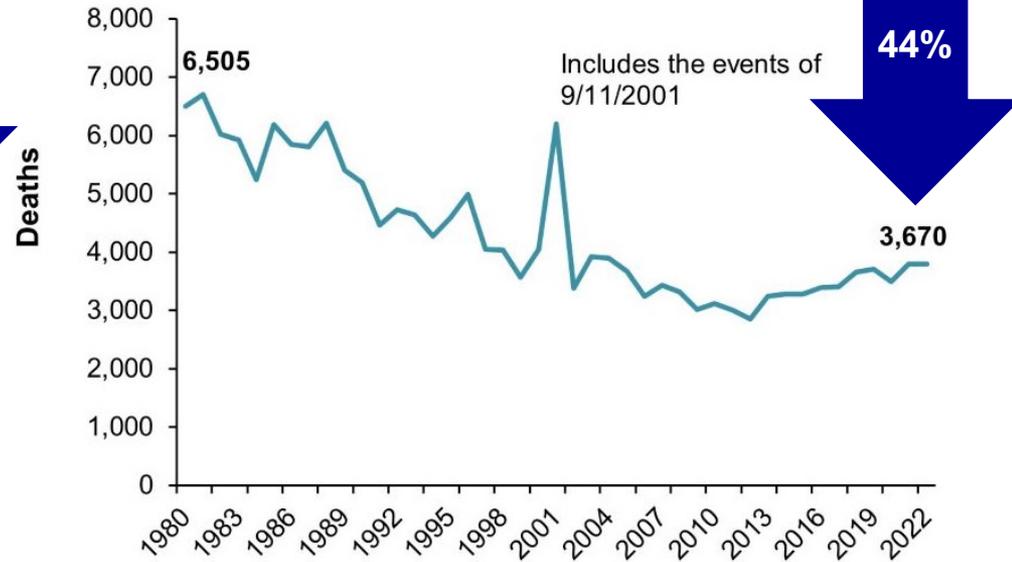
This experiment was designed to intentionally drive a lithium-ion battery into failure to examine the potential hazards of storing and charging e-mobility devices, which have been known to catch on fire and cause explosions.

# Significant progress over time, but...

## Number of Fires

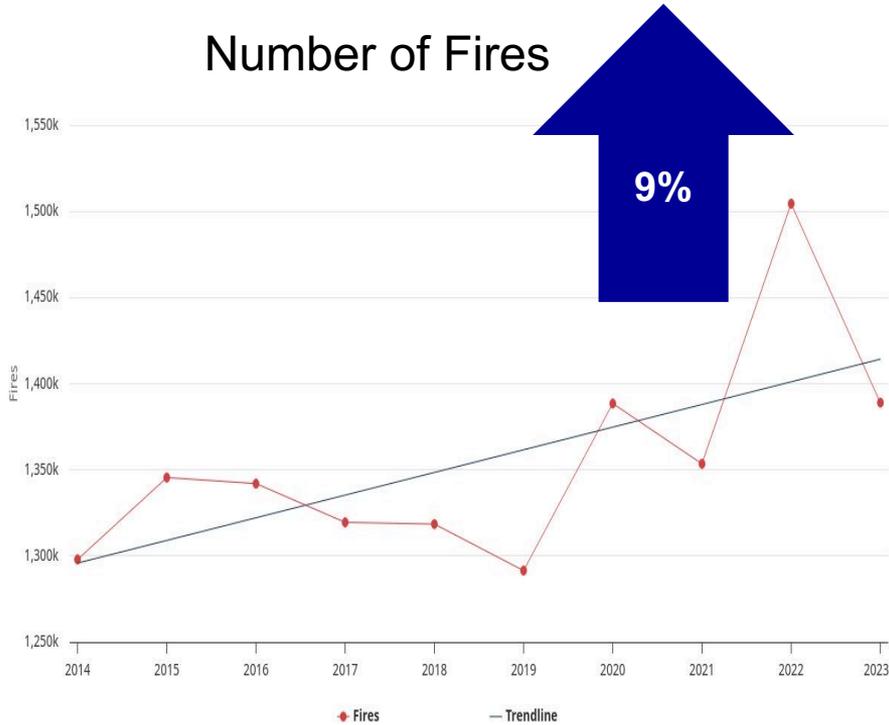


## Number of Fire Deaths

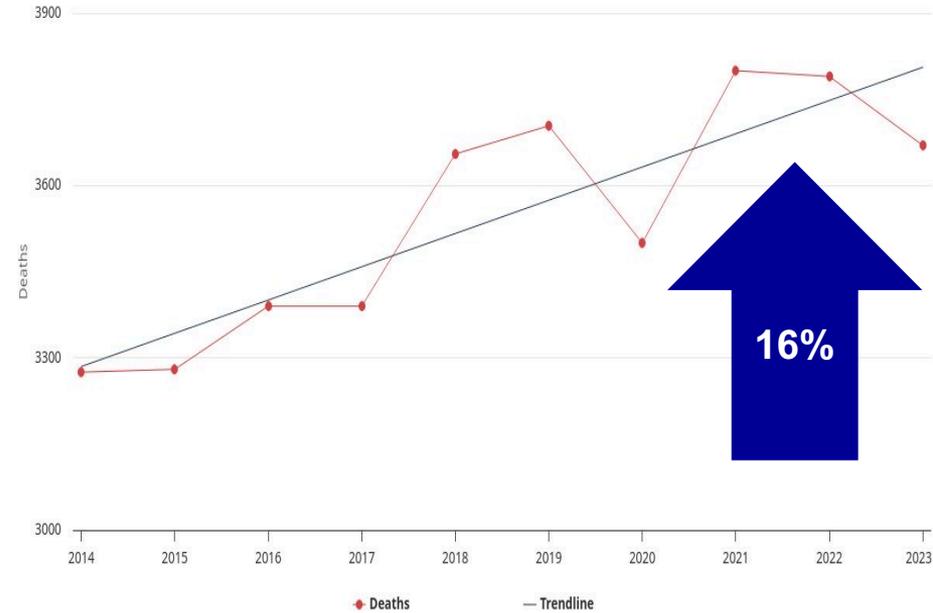


# The last 10 years paint a different picture

## Number of Fires



## Number of Fire Deaths



# Key factors influencing the fire hazard environment of tomorrow

Large fires will persist in the future and become an even greater risk for human safety



**Wildland-Urban Interface**  
(e.g., suburban conflagration  
– fire encompassing all built  
environments in suburbs)

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**Evolving development and  
design of larger buildings**  
(i.e., residential, commercial,  
and industrial structures)

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**New and rapidly changing  
technologies** (e.g., lithium-ion  
batteries in vehicles, energy  
storage systems, hydrogen,  
propane refrigerants)

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# Historical evolution of fire hazards

Building on a long history, FSRI's research focus is as much on emerging fire hazards as enduring ones

1800s – 1900s



- Use of **combustible material & processes**
- **Densely populated** neighborhoods
- **Faulty electrical** wiring
- **Overloaded** circuits
- **Inadequate fire suppression** resources
- **Urban Conflagration & Wildfire** (Chicago, Boston, Baltimore, Big Burn)

2000s – Today

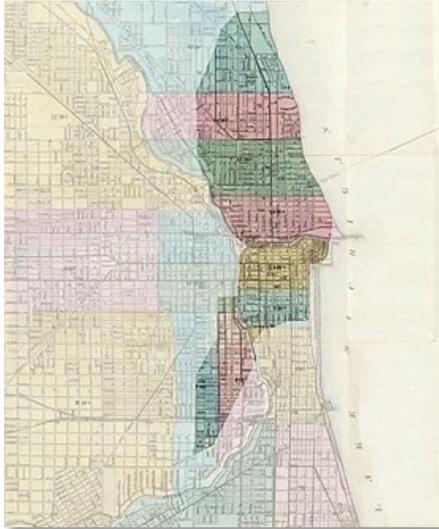


- **Overheating or thermal runaway** in Li-ion batteries
- **EV fire hazards**
- **Electrical faults or mechanical failures** in renewable energy systems
- **Wildland-Urban Interface (WUI)** fires
- **Wildfire-Initiated Urban Conflagration** (Lahaina, Marshall, Chile)

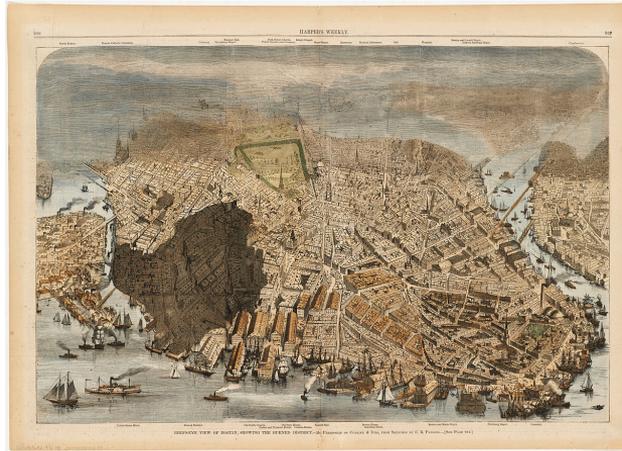
# The “Conflagration Era” – (1860s to 1940s)

– dubbed by disaster historian Scott Gabriel Knowles

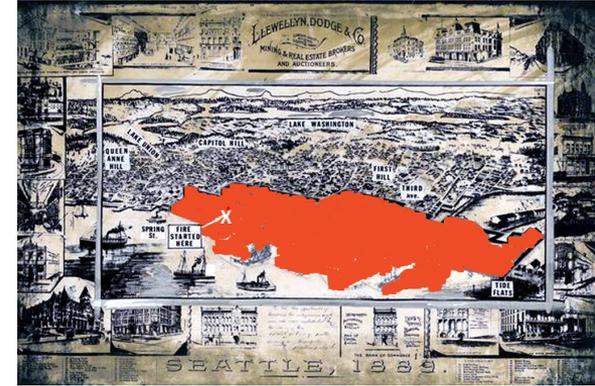
18 of the 20 deadliest fires in American history



Chicago (1871)



Boston (1872)



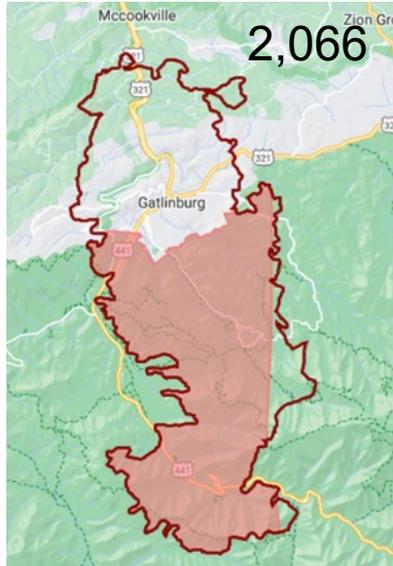
Seattle (1889)



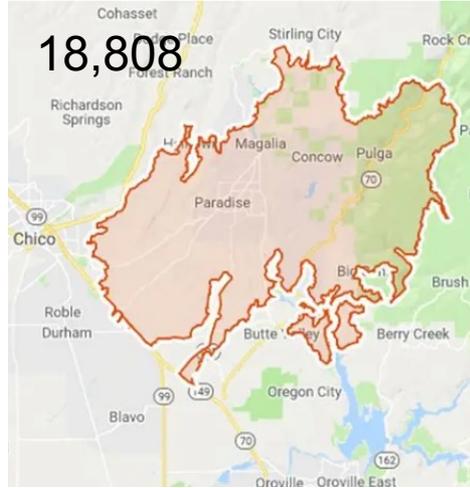
Baltimore (1904)

# The Modern Conflagration Era – (2015 to Present)

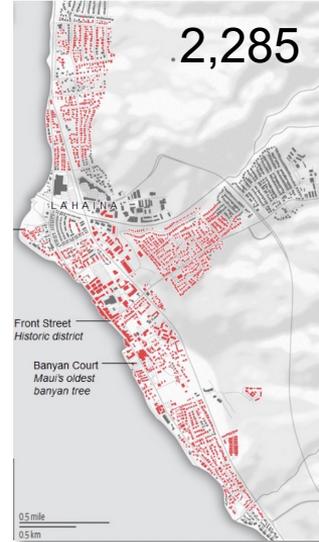
9 of the top 10 fires in the US by structure loss



Gatlinburg, TN (2017)



Camp, CA (2018)



Lahaina, HI (2023)

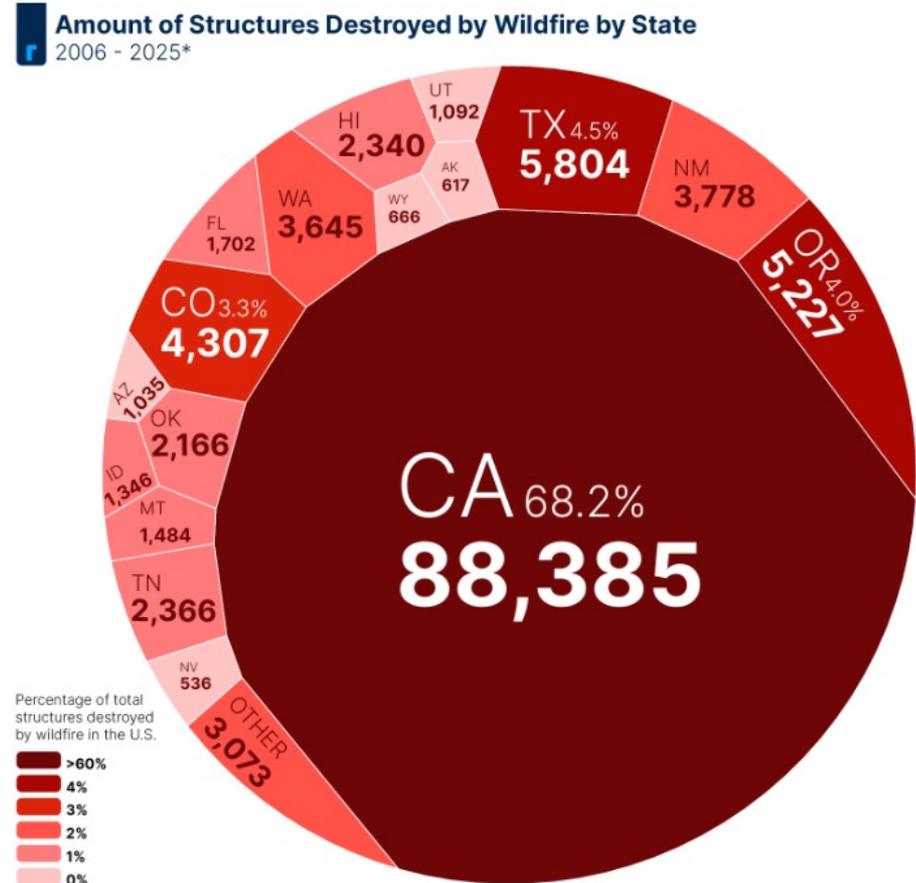


Palisades, CA (2025)  
Eaton, CA (2025)

# Not just a CA problem

## Symptoms of a conflagration

- Wind
- Dry fuels, especially grasses
- Structure spacing
- Home construction materials
- # of structures on fire before FD intervention



• Source: Headwater Economics

# Lahaina Fire

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- August 8-9, 2023
- 102 lives lost (2 still missing)
- More than 2100 structures destroyed
- Wildfire Initiated Urban Conflagration
  
- The analysis concludes the devastation caused by the Lahaina fire cannot be connected to one specific organization, individual, action or event. The conditions that made this tragedy possible were years in the making.







# Lahaina Summary



- Transition point from wildfire to urban conflagration was approximately 15 homes.
- Tragically, the first area of Lahaina to be impacted by the fire was also the most densely populated, providing the fire with ample fuel from tightly-packed burning structures and vehicles, producing waves of burning embers.
- Every MFD unit was overrun by fire, several apparatus were destroyed and a mayday depleted scarce resources.
- Resource limitations are a common theme across all agencies.
- Communication challenges with the public and amongst responders.
- Extreme conditions across both the natural and built environments during these days in August 2023 combined to create a complex set of circumstances that overwhelmed many systems that are often taken for granted in local jurisdictions around the US.
- If you have dry grass adjacent to a community with the potential for high winds, this could happen to you.

# CA Fires Analysis

- An independent broad-based analysis conducted at the request of the Office of the Governor of California.
- Phase One Report: Data Collection and Incident Timeline
- Phase Two Report: Incident Analysis with Findings and Recommendations



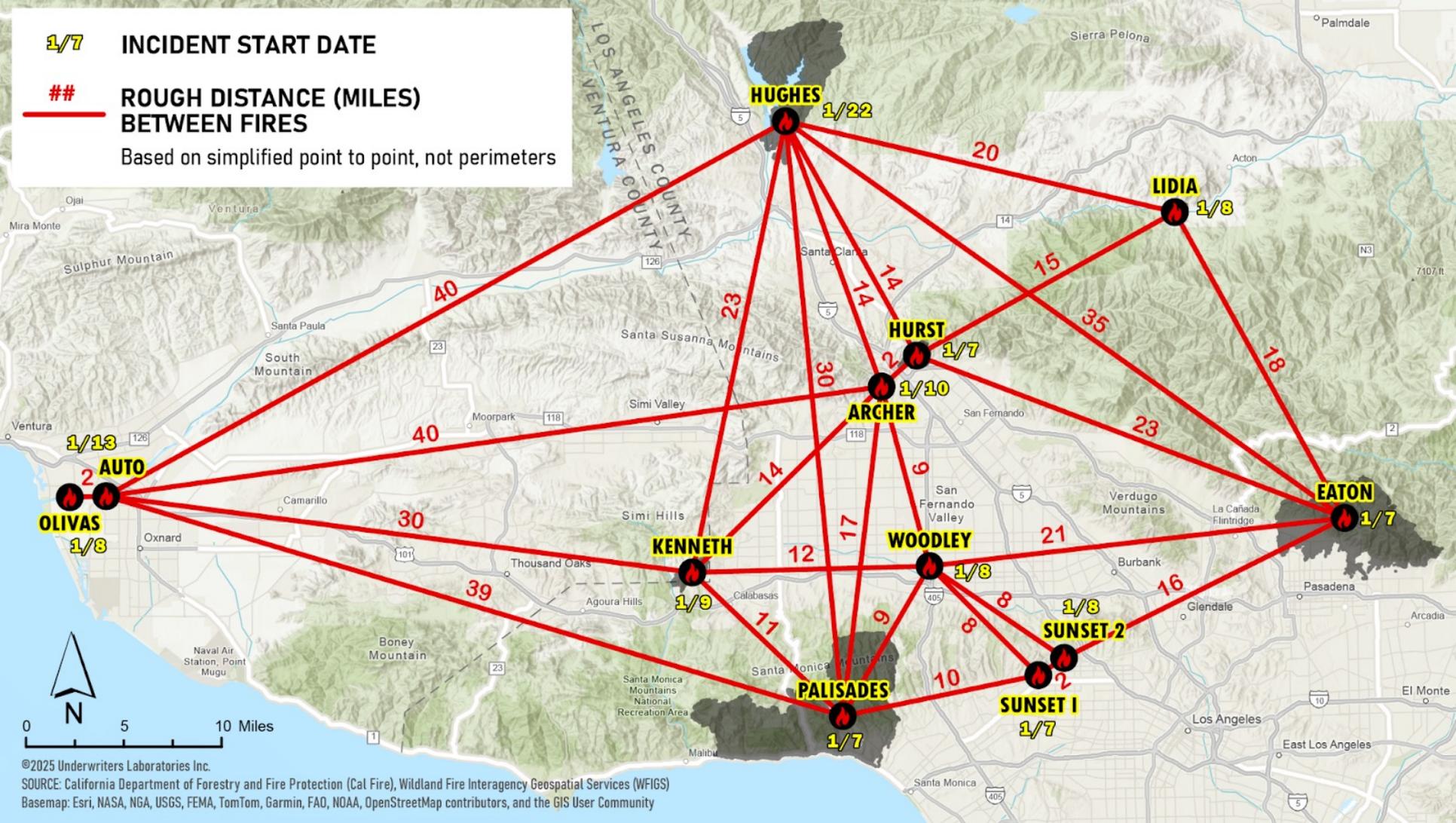
1/7

INCIDENT START DATE

##

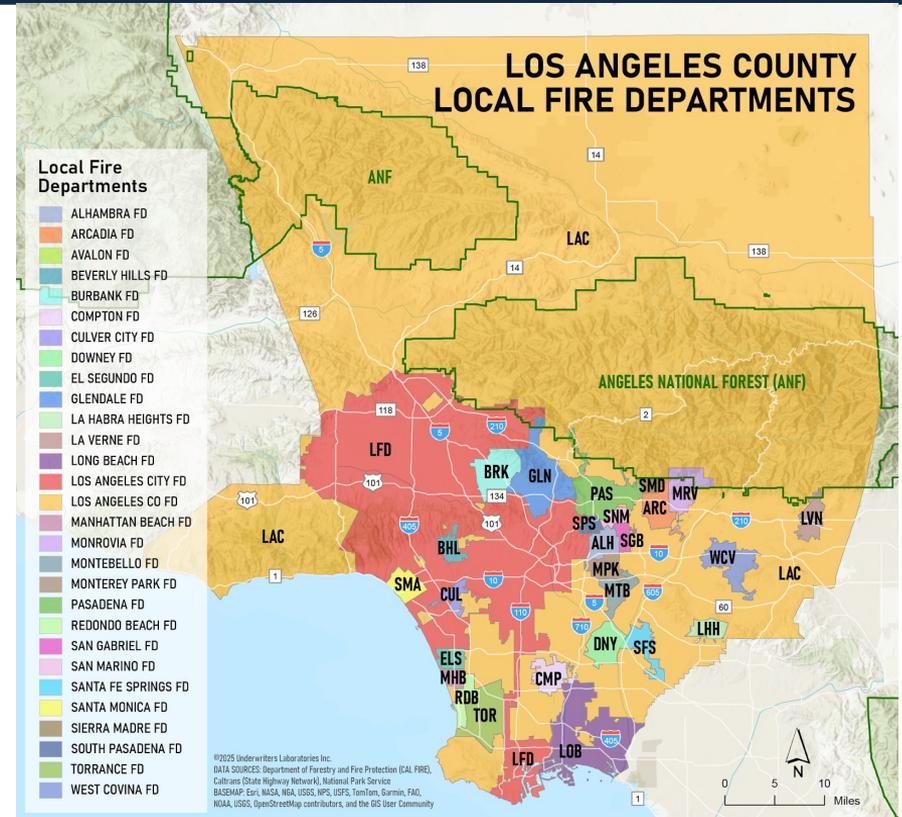
ROUGH DISTANCE (MILES)  
BETWEEN FIRES

Based on simplified point to point, not perimeters



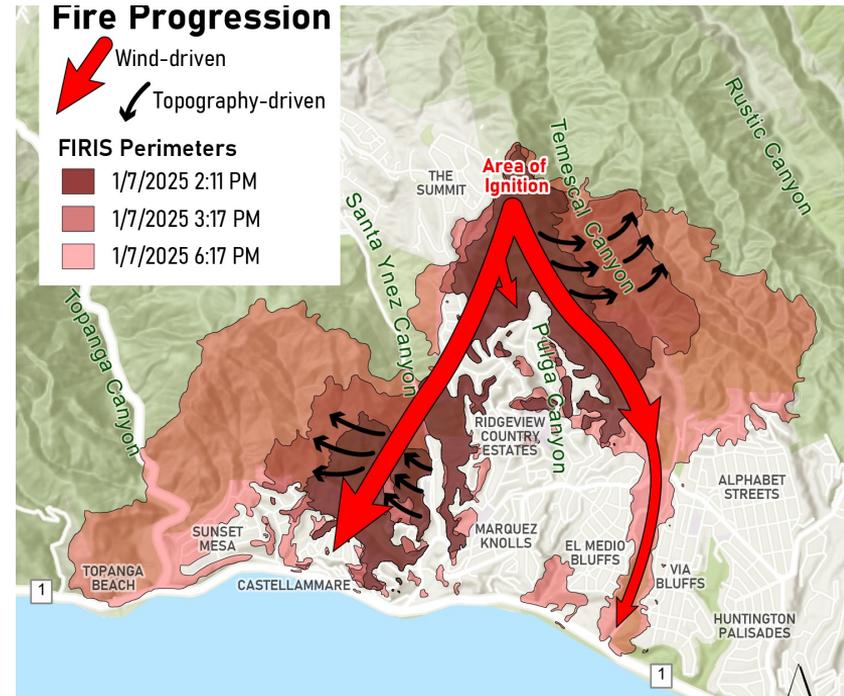
# Agencies & Organizations

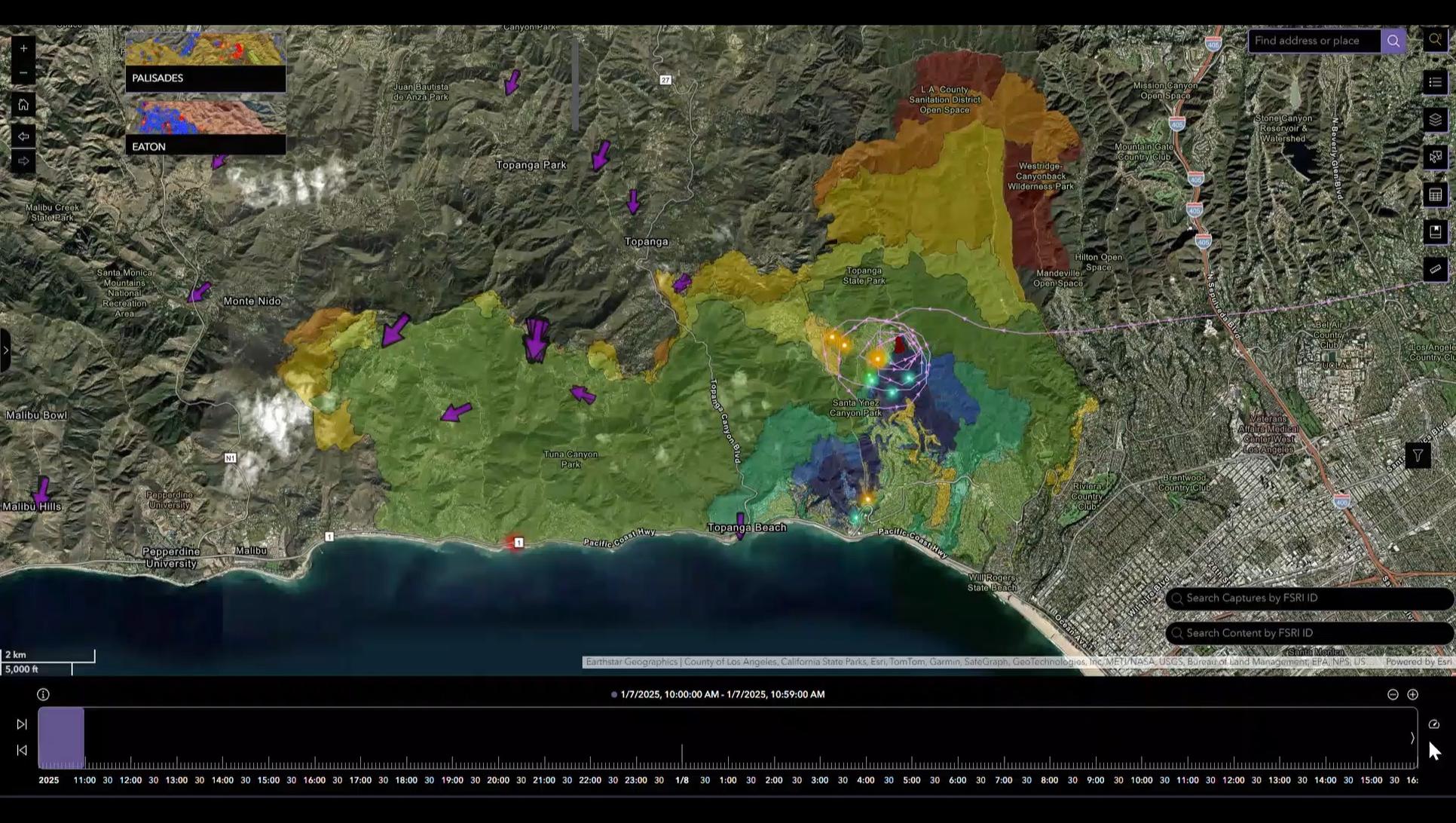
- Fire Service
- Fire Dispatch Centers
- Law Enforcement
- Law Enforcement Dispatch Centers
- Emergency Management Organizations
- CAL FIRE / CAL OES
- Federal Partners
- Aviation Resources
- Private Resources
- Community Fire Brigade
- Community Emergency Response Team
- Weather Service
- Utility Companies (water, power)
- Fuel Management & Treatment Groups
- NGO's



# Fire Progression

- Hour by Hour progression
- Time stamped and GIS located data
  - Aerial and ground-based pictures and video
  - Radio Communication
  - Emergency responder dispatcher documentation
  - Automatic vehicle locating (AVL) applications
  - Weather stations
  - Corroborated personal experiences





PALISADES

EATON

Find address or place

Juan Bautista de Anza Park

Topanga Park

Topanga

Monte Nido

Tuna Canyon Park

Topanga Beach

Santa Ynez Canyon Park

Topanga State Park

L.A. County Sanitation District Open Space

Westridge-Canyonback Wilderness Park

Mission Canyon Open Space

Mountain Gate Country Club

Stone Canyon Reservoir & Watershed

Hilton Open Space

Mandeville Open Space

Balboa Country Club

Los Angeles Country Club

Veterans Affairs Medical Center West Los Angeles

Brentwood Country Club

Riviera Country Club

Will Rogers State Beach

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# Next Steps

- Continue to request, process and analyze data from information requests – ongoing
- Complete Phase 1 Report and Timeline and make publicly available – Next week
- Transition to analysis, finding and recommendation phase of the analysis – Deliver in Q2 2026





# Contrast – Response Capability and Preparedness

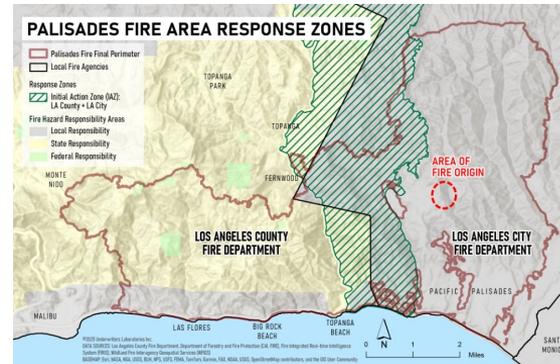
## Maui, HI

- Small response force
  - ~60 Firefighters total (no mutual aid)
  - 13 Police Officers
  - No aircraft
- Lack of experience with WUI fires
- Minimal training
- Minimal preparations



## Los Angeles, CA (Palisades and Eaton)

- Large response force
  - Well over 100 Firefighters from several FD's with mutual aid (LAFD, LAcFD, Pasadena, ANF, etc)
  - Police (LAPD, LAcS, CHP, Local, etc.)
  - Significant aircraft (Palisades, not Eaton)
- Significant experience with WUI fires
- Arguably the most training
- Significant preparations



# Similar Outcomes



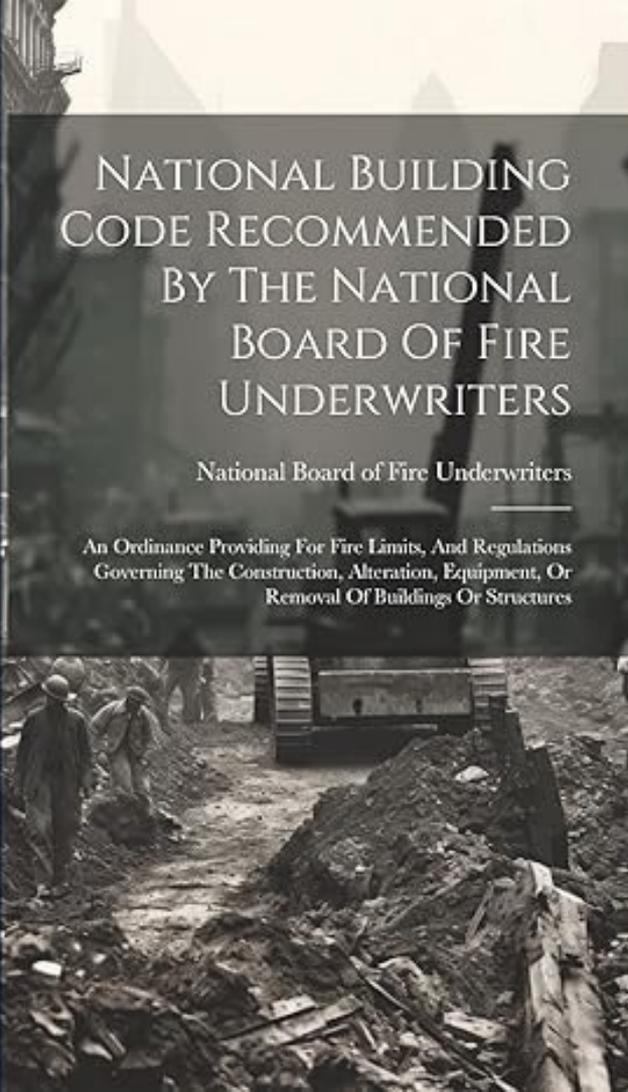
# We have been here before...

The need for housing and rapid development drove the creation of cities (built mostly of wood and combustible construction)

In 1866, a group of insurance underwriters formed the National Board of Fire Underwriters (NBFU)

NBFU introduced the first “model” code written as recommendations to government on how to build safely

Subsequent codes and standards changed how cities were built, ending the first conflagration era.



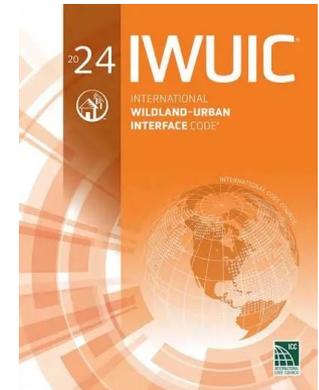
NATIONAL BUILDING  
CODE RECOMMENDED  
BY THE NATIONAL  
BOARD OF FIRE  
UNDERWRITERS

National Board of Fire Underwriters

An Ordinance Providing For Fire Limits, And Regulations  
Governing The Construction, Alteration, Equipment, Or  
Removal Of Buildings Or Structures

# Where are we today...

- Wildfire uninsurability crisis
- Challenges with measuring and pricing risk
- We have evidence-based mitigation that works for defensible space and structural hardening
- Research informing codes and standards, **championed by the insurance industry**, implemented and enforced locally

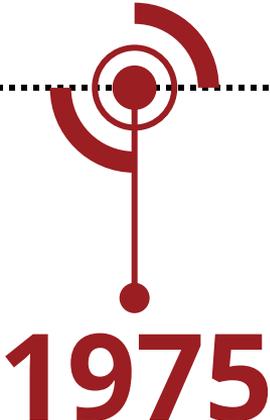


**Fire data is amid the  
largest evolution  
since 1975**

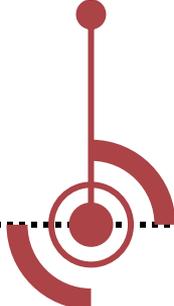
# Legacy Fire Data: National Fire Incident Reporting System (NFIRS)

## NFIRS Begins

*America Burning* released in 1973 lead to the establishments of USFA in 1974 with the Federal Fire Prevention and Control Act in 1974. NFIRS launches in 1975.



1985



## NFIRS 4.0

First public release of NFIRS collected data.

## NFIRS 5.0

NFIRS becomes an “all-hazard” data collection system with the addition of EMS data, wildfire data, and juvenile firesetter module.



1999

2025



## Sunseting NFIRS

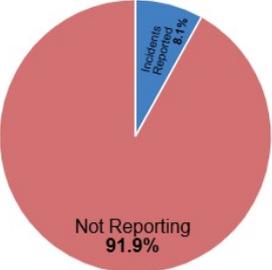
Driven by security concerns, outdated data models, and costs in maintaining code base, at the start of calendar year 2026, NFIRS will sunset, and decommissioning will begin.

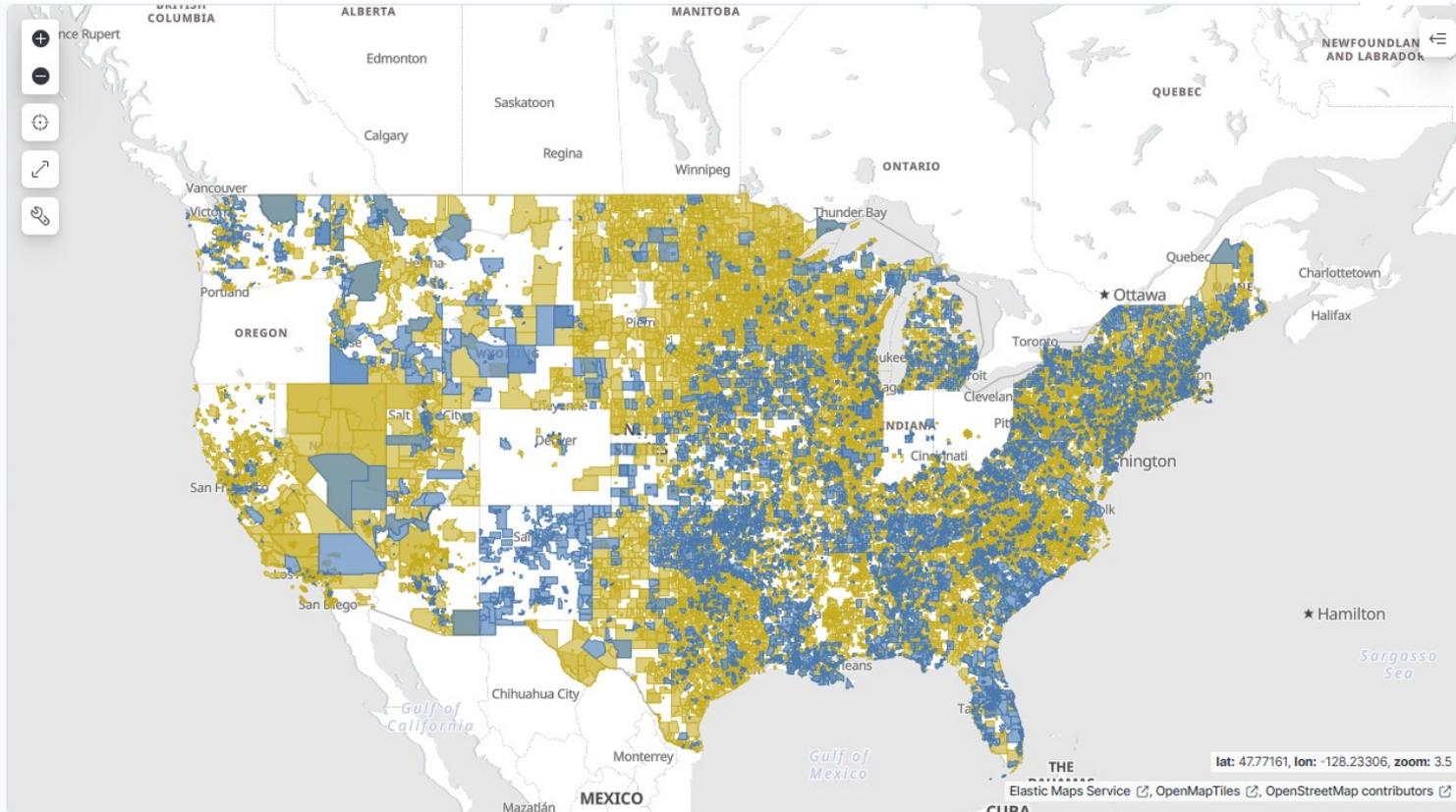
# National Emergency Response Information System



**The goal of NERIS is to empower the local fire and emergency services community** by equipping them with near real-time information and analytic tools that support data informed decision-making for enhanced preparedness and response to incidents involving all hazards.

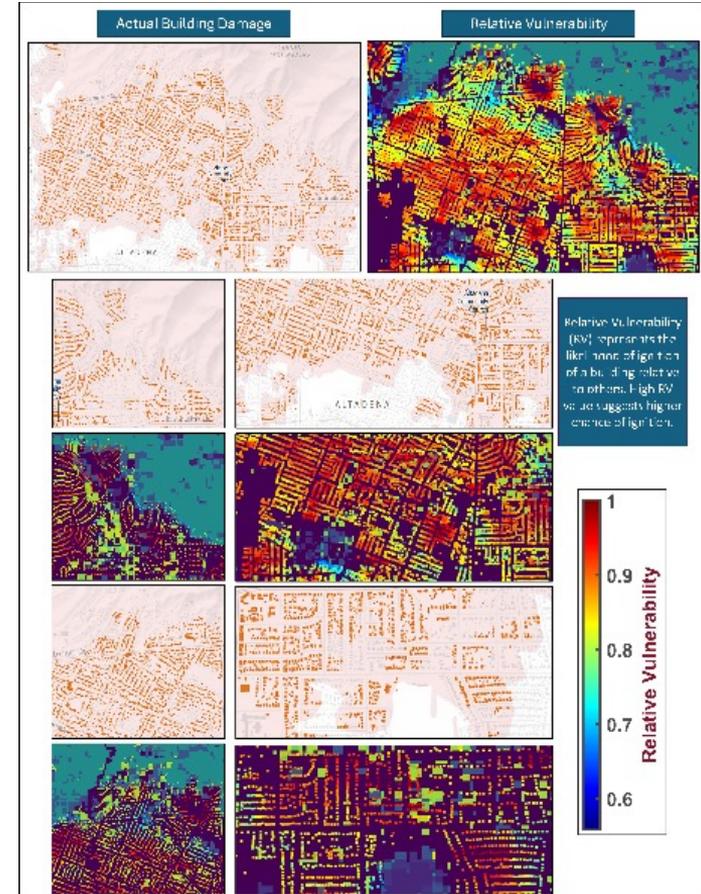
# Current State of NERIS

Verified Departments	Unverified Departments	Inactive Departments
6,233	14,047	11,049
Departments Reporting Departments		
2,521		
Total Reported Incidents		
426,158		
Reporting Status ⓘ		
		



# Also coming soon: National fire risk solution

- Comprehensive of **all types of fire and environments**.
  - Single Structure: Vulnerabilities and Risks
  - Urban: Structure to Structure Spread/Urban Conflagration
  - Wildland-Urban Interface (WUI) and Wildland-Urban Intermix
  - Wildland
- **Ensemble of models** for each type of environment, leveraging best available data assets.
- **Understand the impact of different mitigations** on the community vulnerability in a network setting, at parcel and structure level, **within the immediate first due area**.
- Accounts for **how atmospheric conditions alter risk** accounting for the likelihood of ignition, wind and weather, and vegetation characteristics.
- **Designed to integrate** with NERIS.





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# Thank you

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[FSRI.org](https://www.fsri.org)