# Introducing AIR's U.S. Wildfire Model

**Tammy Viggato, CEEM**
**Alan Frith, CPCU, ARe, CEEM**

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# Meet Today's Presenters

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Senior Scientist
Research and Modeling

**Alan Frith, CPCU, ARe, CEEM**
Senior Manager
Consulting and Client Services

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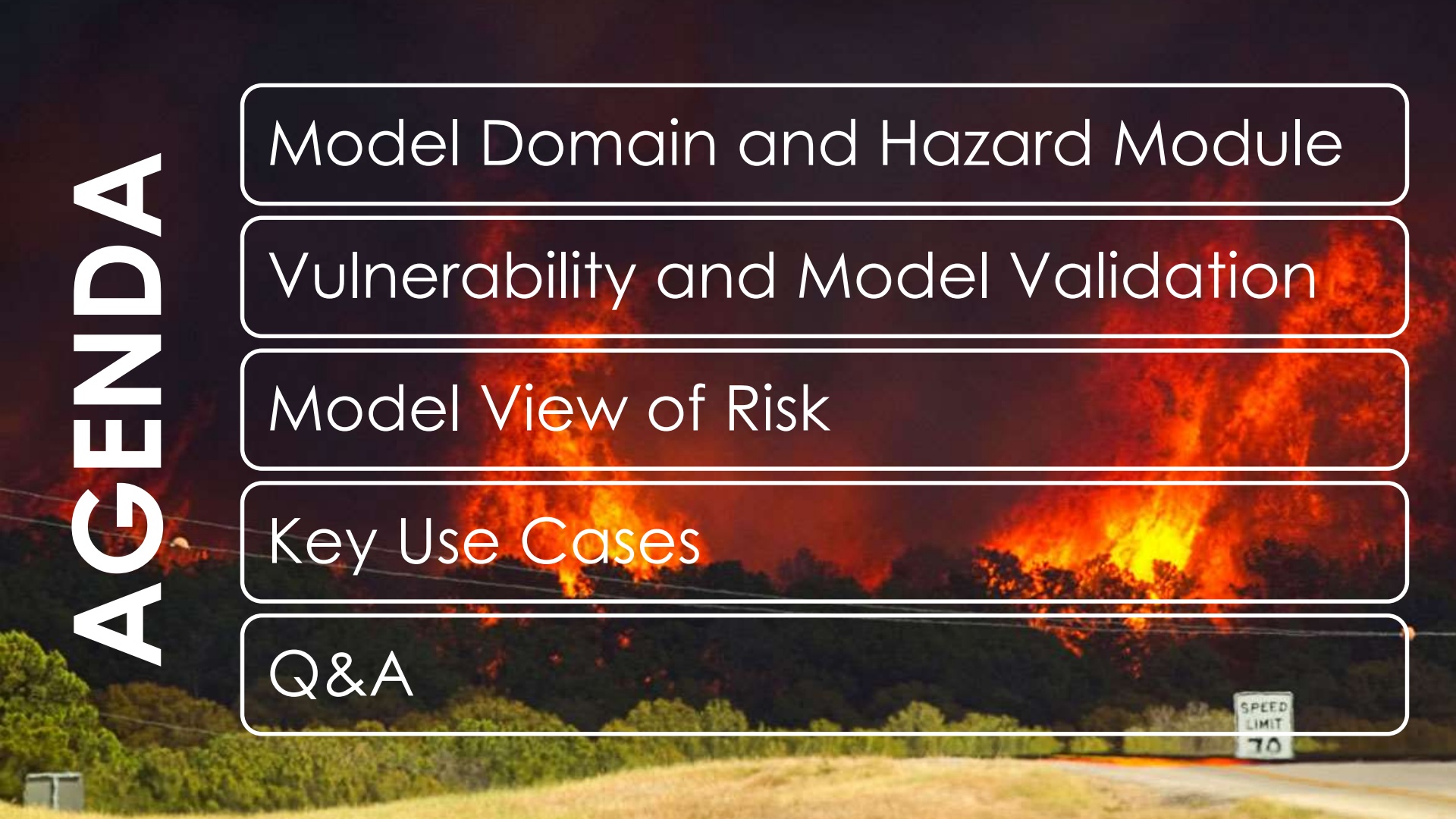
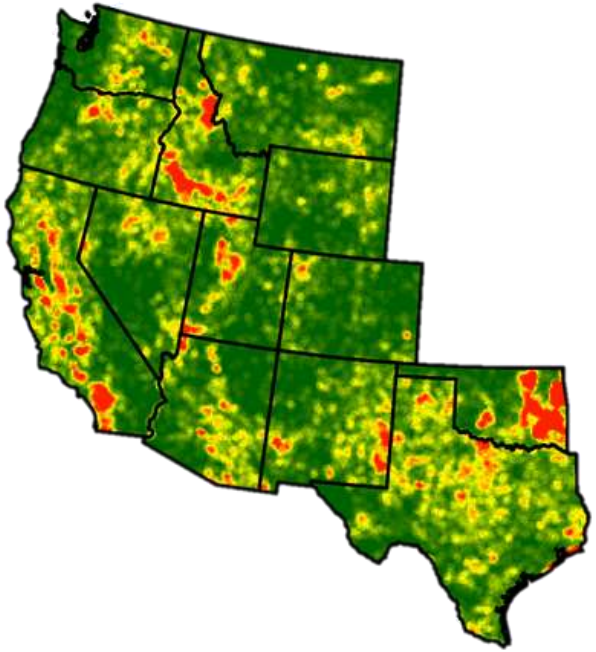
# AGENDA

- Model Domain and Hazard Module
- Vulnerability and Model Validation
- Model View of Risk
- Key Use Cases
- Q&A



# AIR Model Domain



*Historical Ignitions ≥100 Acres (1992–2015)*

**Includes the Top Loss-Causing States:**

California
Texas
Colorado
Arizona
Idaho
Washington
Oklahoma
Oregon
Utah
Montana
New Mexico
Nevada
Wyoming

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# Modeling the Conditions That Lead to Years Like 2017

**AIR Worldwide Damage Survey (Tubbs, 2017)**

- Fuels resulting from antecedent weather conditions
- Conditions during event
- Wildland Urban Interface (WUI)

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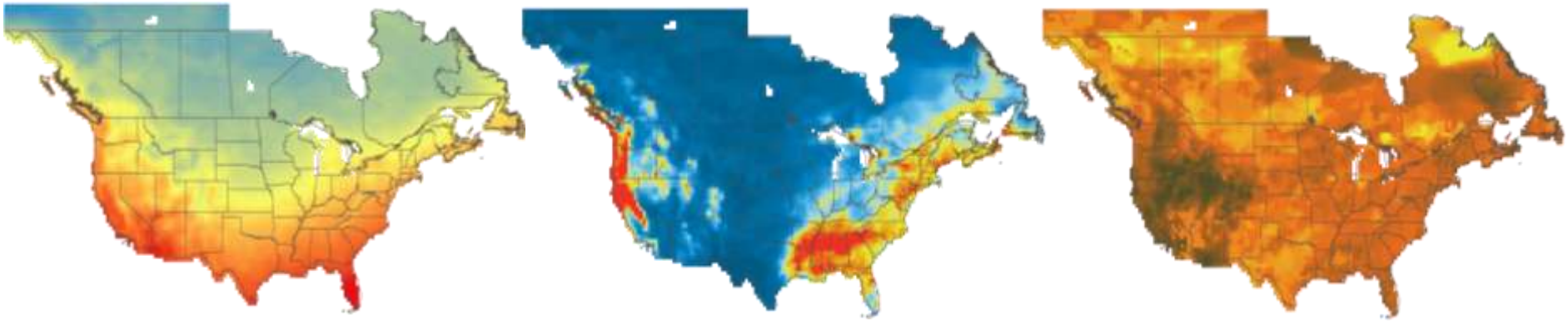
# Weather Patterns Drive Variability in Wildfire Activity

**Temperature** **Precipitation** **Drought**



AIR models weather patterns to maintain natural variability

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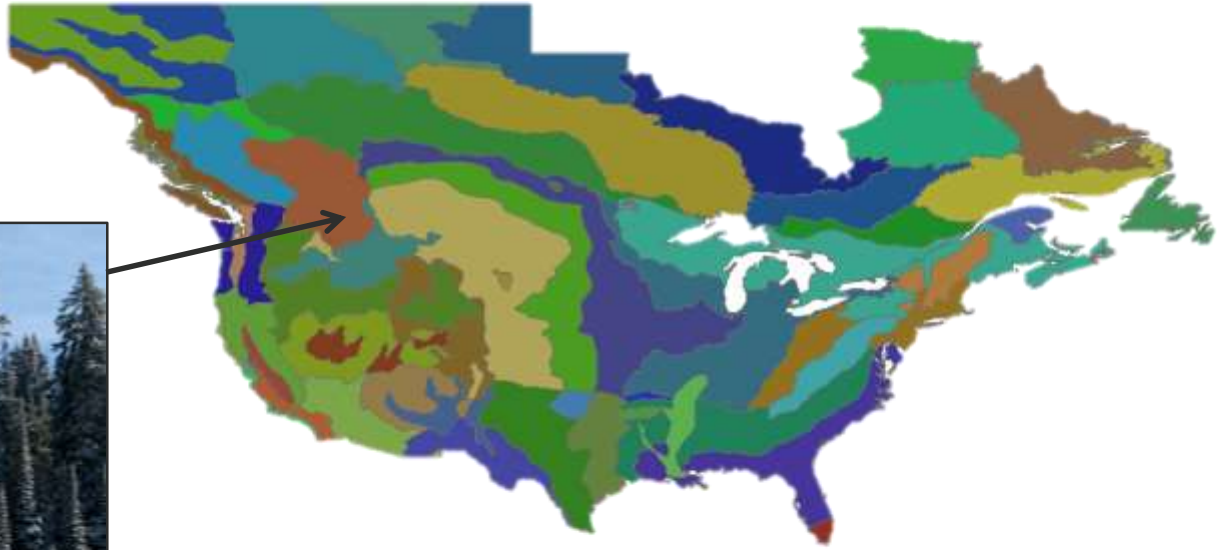
# Wildfire Activity Is Modeled on the Ecoprovince Level

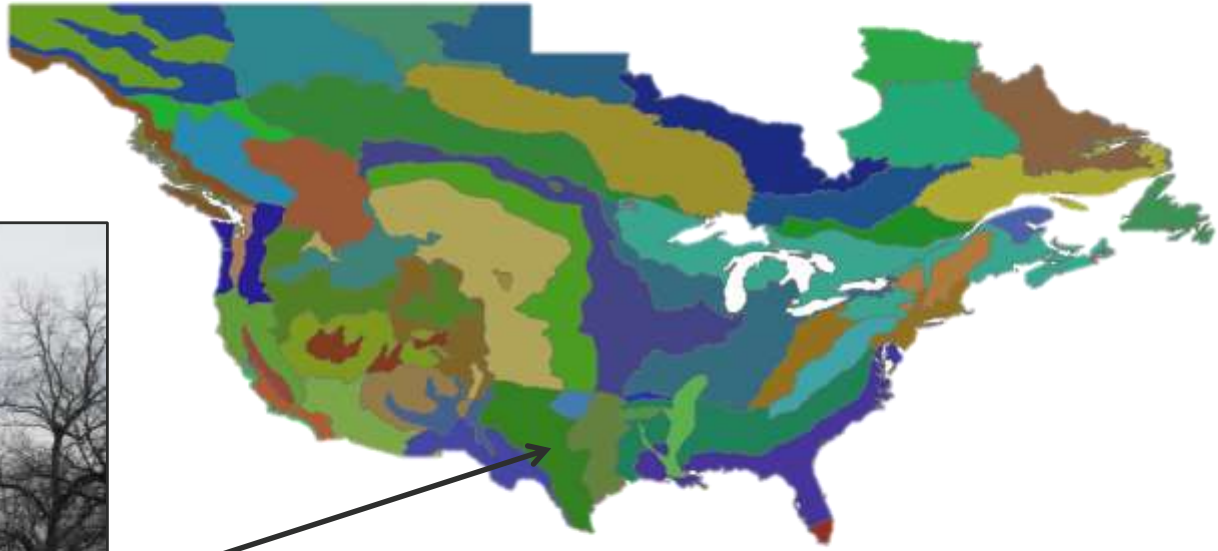
**Northern Rocky Mountain Forest-Steppe**
- **Coniferous Forest**



Ecoprovinces identify regions with similar ecosystems, climate, and vegetation—key drivers for fire behavior

# Wildfire Activity Is Modeled on the Ecoprovince Level

**Prairie Parkland**
- **Subtropical Province**

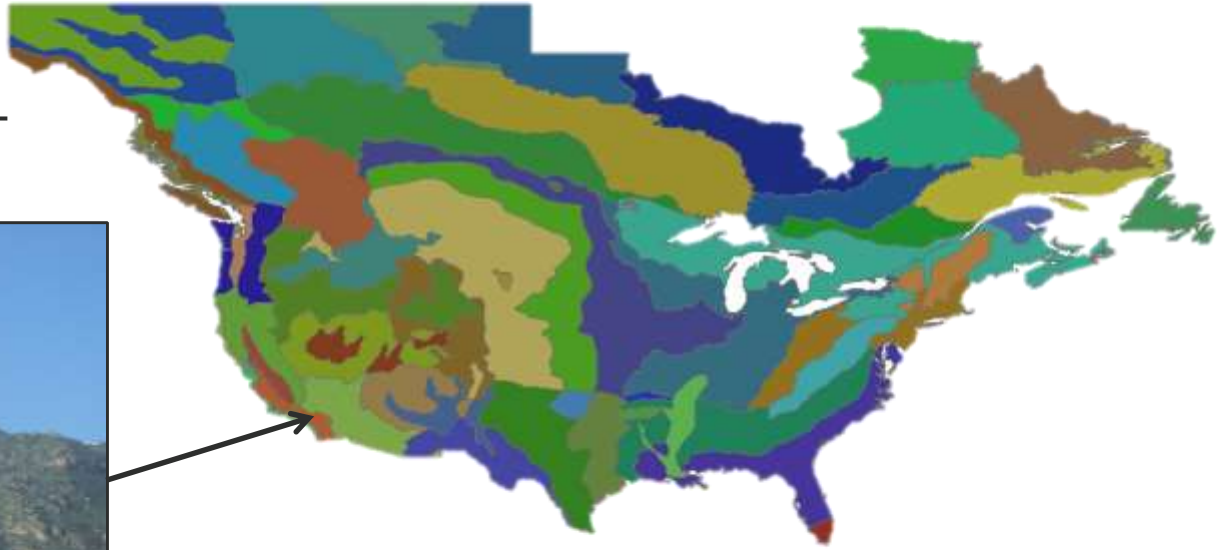


Ecoprovinces identify regions with similar ecosystems, climate, and vegetation—key drivers for fire behavior

# Wildfire Activity Is Modeled on the Ecoprovince Level

**California Coastal Range Open Woodland-Shrub**

- **Coniferous Forest—Meadow Province**



Ecoprovinces identify regions with similar ecosystems, climate, and vegetation—key drivers for fire behavior

# Relationships Between Weather and Fire Activity Are Complex and Vary Spatially

## Fine Fuels

**Fire behavior is correlated to the drought conditions during the growing season**

**Wet Growing Season = ↑ Fire Activity**

**Dry Growing Season = ↓ Fire Activity**

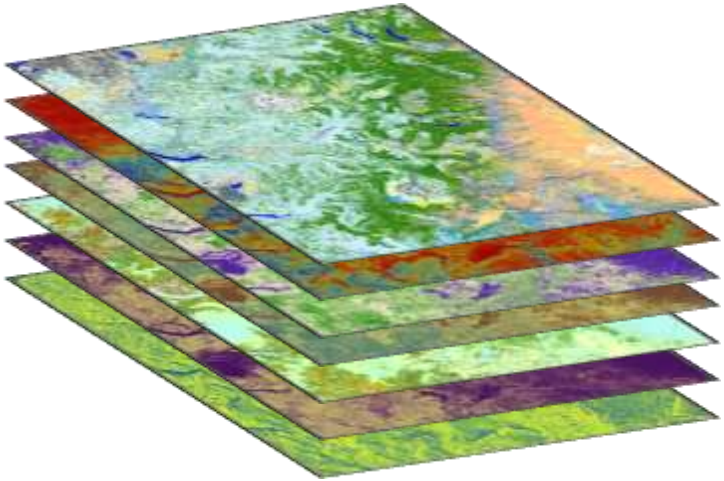
## Coarse Fuels

**Fire behavior is correlated to the drought conditions during the fire season**

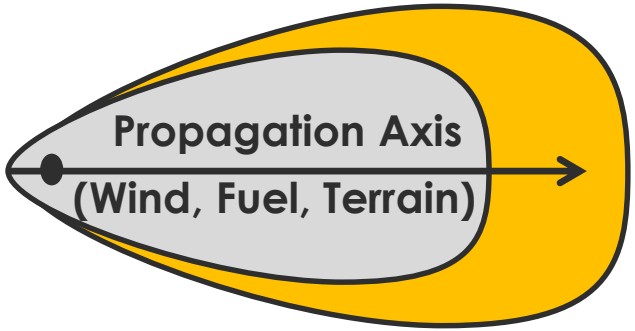
**Wet Fire Season = ↓ Fire Activity**

**Dry Fire Season = ↑ Fire Activity**

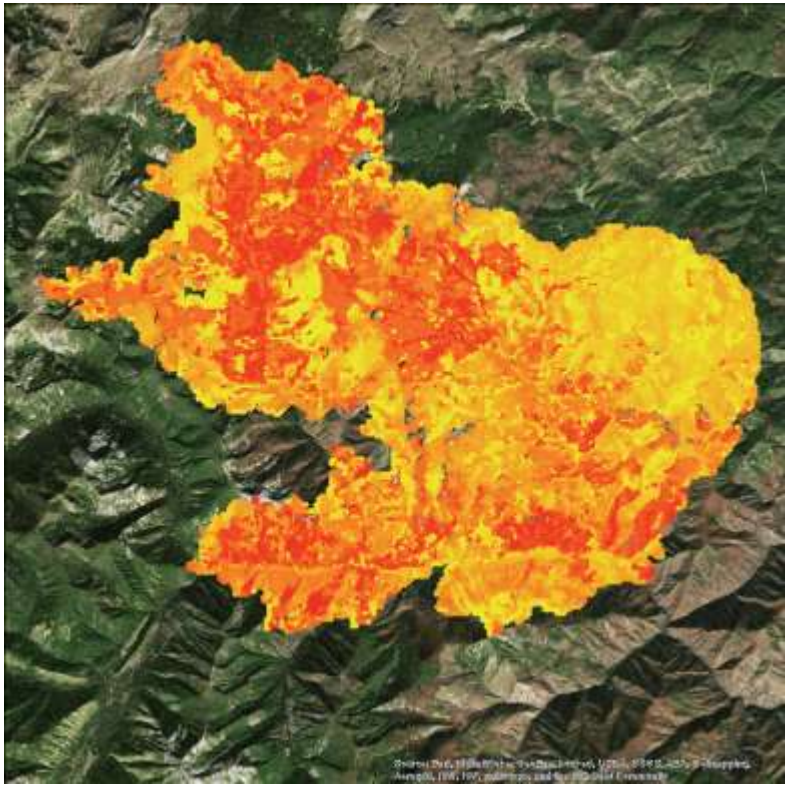
# AIR's Physically-Based Model Realistically Captures Fire Spread Across a Landscape



Fuel Model
Slope
Aspect
Canopy Height
Canopy Cover
Base Height
Bulk Density

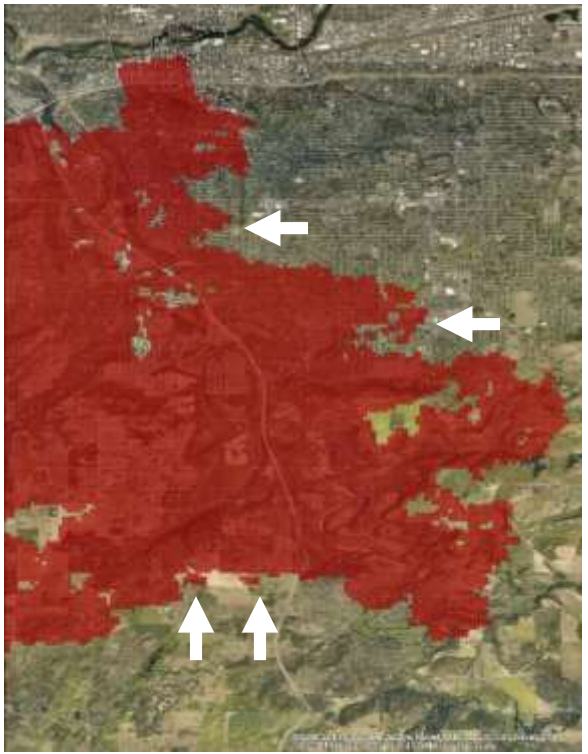



Head of Fire



# Ember Creation Is the Primary Driver of Wildfire Spread in Urban Areas

- Embers are created as materials within the fire perimeter are thrown ahead of the main fire front
- Allows fires to cross roads, rivers, and other natural fire breaks
- Most structures are ignited as embers collect on and around them



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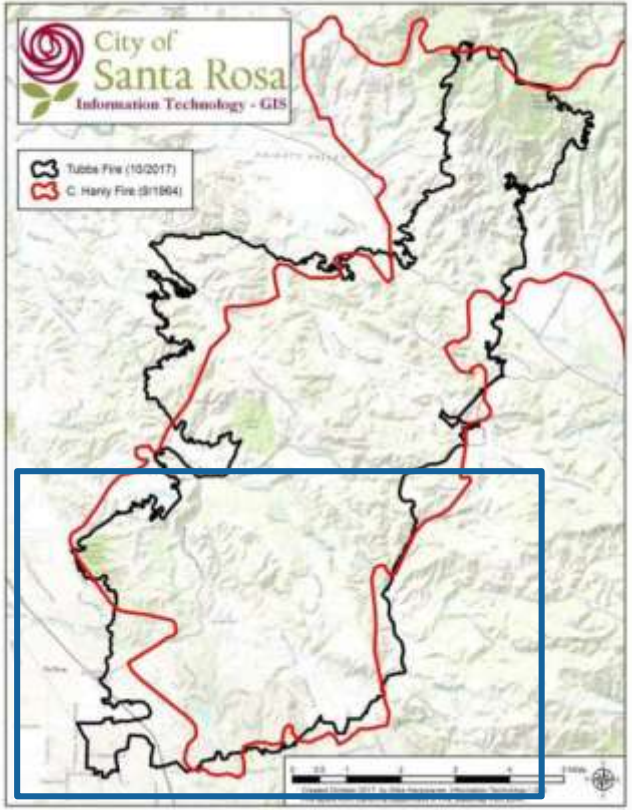
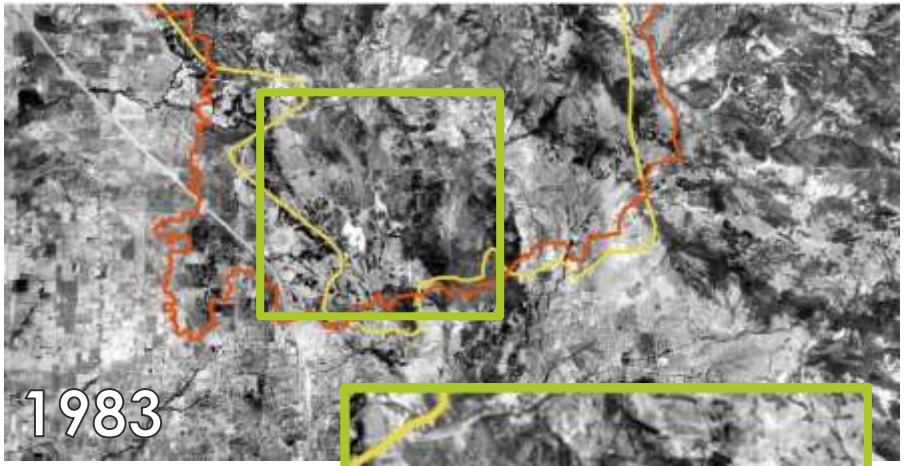
# The WUI Is Critical to Understanding Wildfire Risk

**Fountain Grove, Tubbs Fire Damage Survey, 2017**




- Development intersects with undeveloped lands
- Largest economic losses from wildfire will occur in the WUI
  - One-third of U.S. households are located in the WUI
  - 4,000 acres of wildland are converted to WUI *daily*

# Northern California Has Had the Hazard; However, Risk Is Growing



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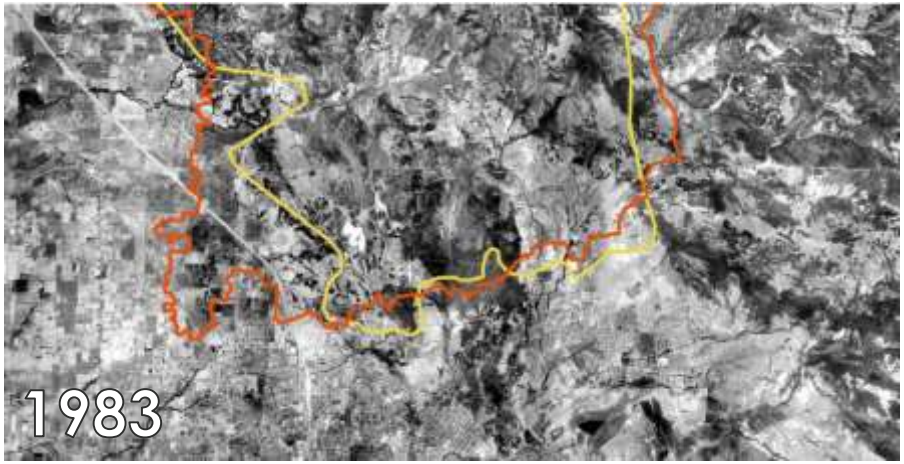

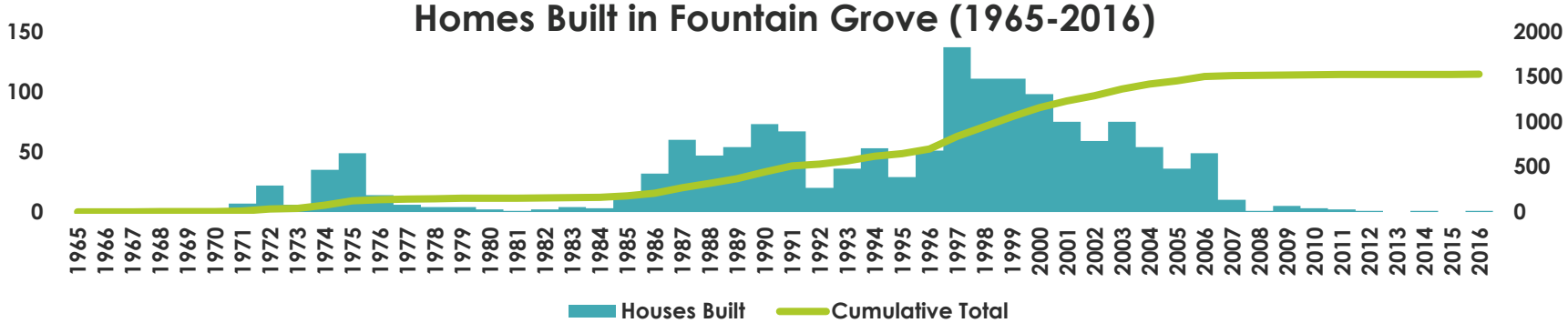


*Source: Sagara, Eric and Kanik, Alexandra (2018). 'Built to burn', revealnews.org*

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# Vulnerability and Model Validation

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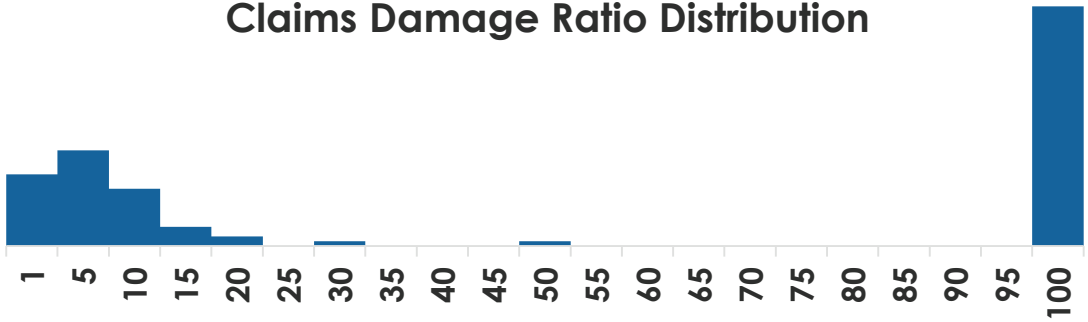
# Binary Damage Pattern Revealed by Damage Survey and Claims Data

Source: AIR Damage Survey (2017)

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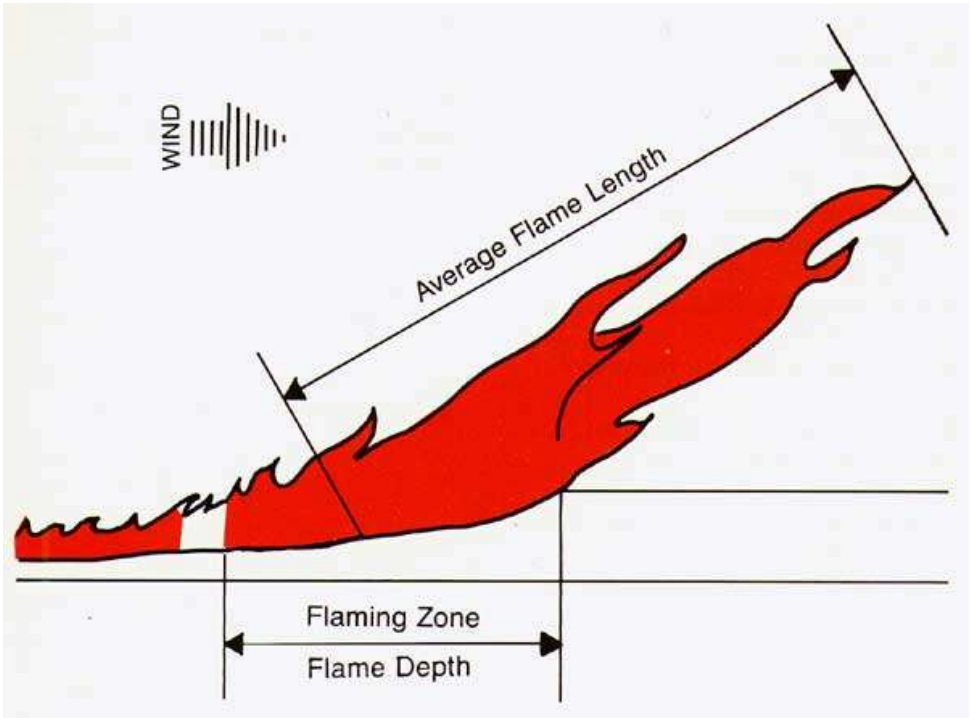
# Building Damage Is Estimated Based on Flame Length

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# Secondary Risk Characteristics Capture Critical Factors that Affect an Individual Risk's Vulnerability to Wildfire

## Property Level

Roof Type

Siding

Skylight and Dormer

Defensible Space

## Community Level

NFPA

FIREWISE USA™

Residents reducing wildfire risks

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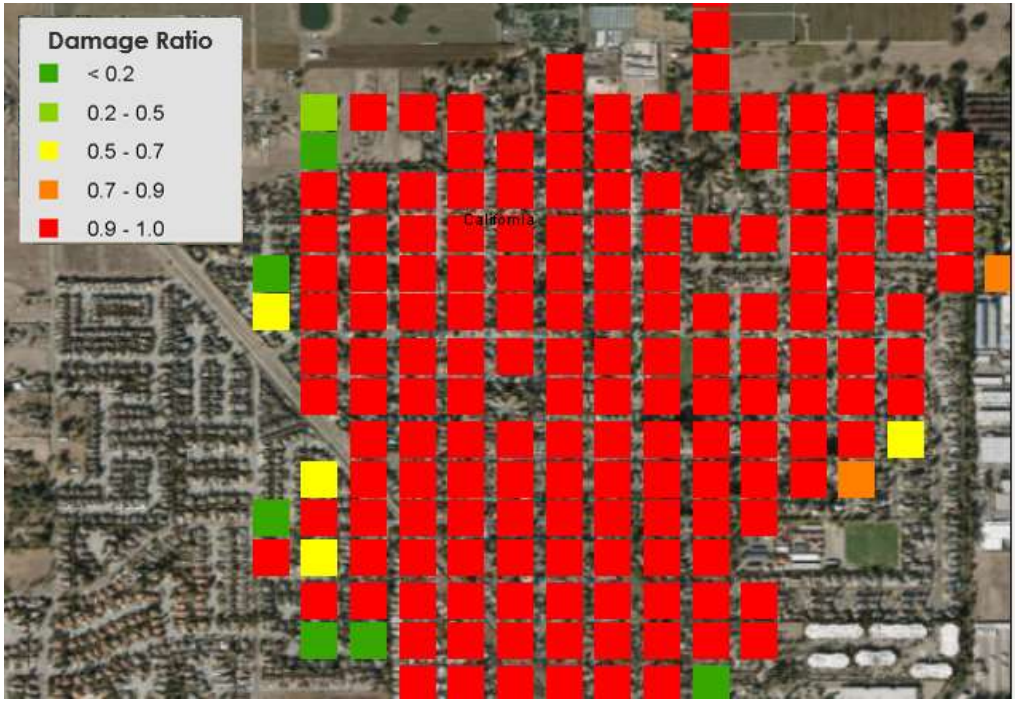
# Modeled Damage Ratio Is Comparable to Observed Damage

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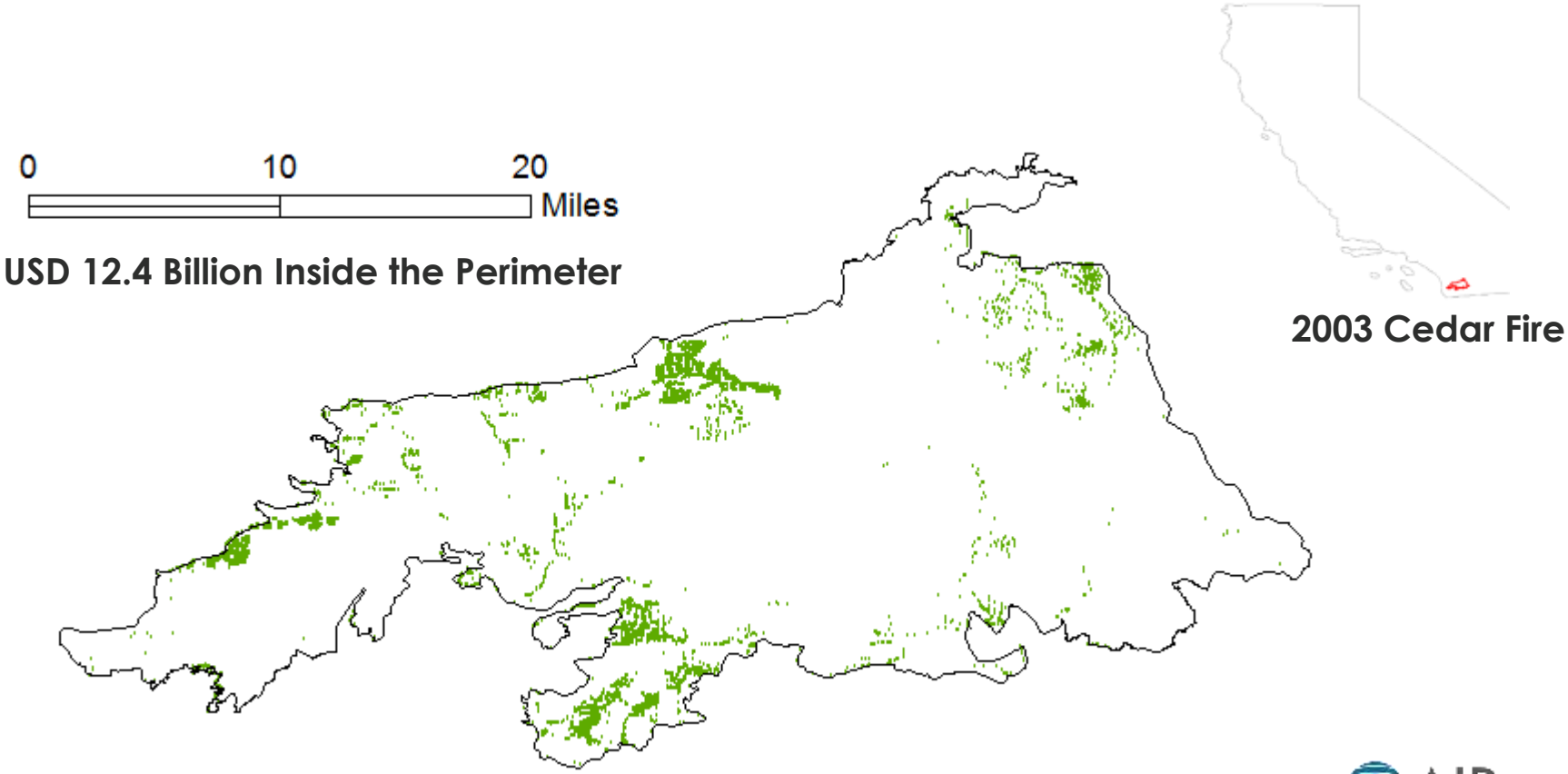
# Burn Scars Are Used to Evaluate Historical Wildfire Losses

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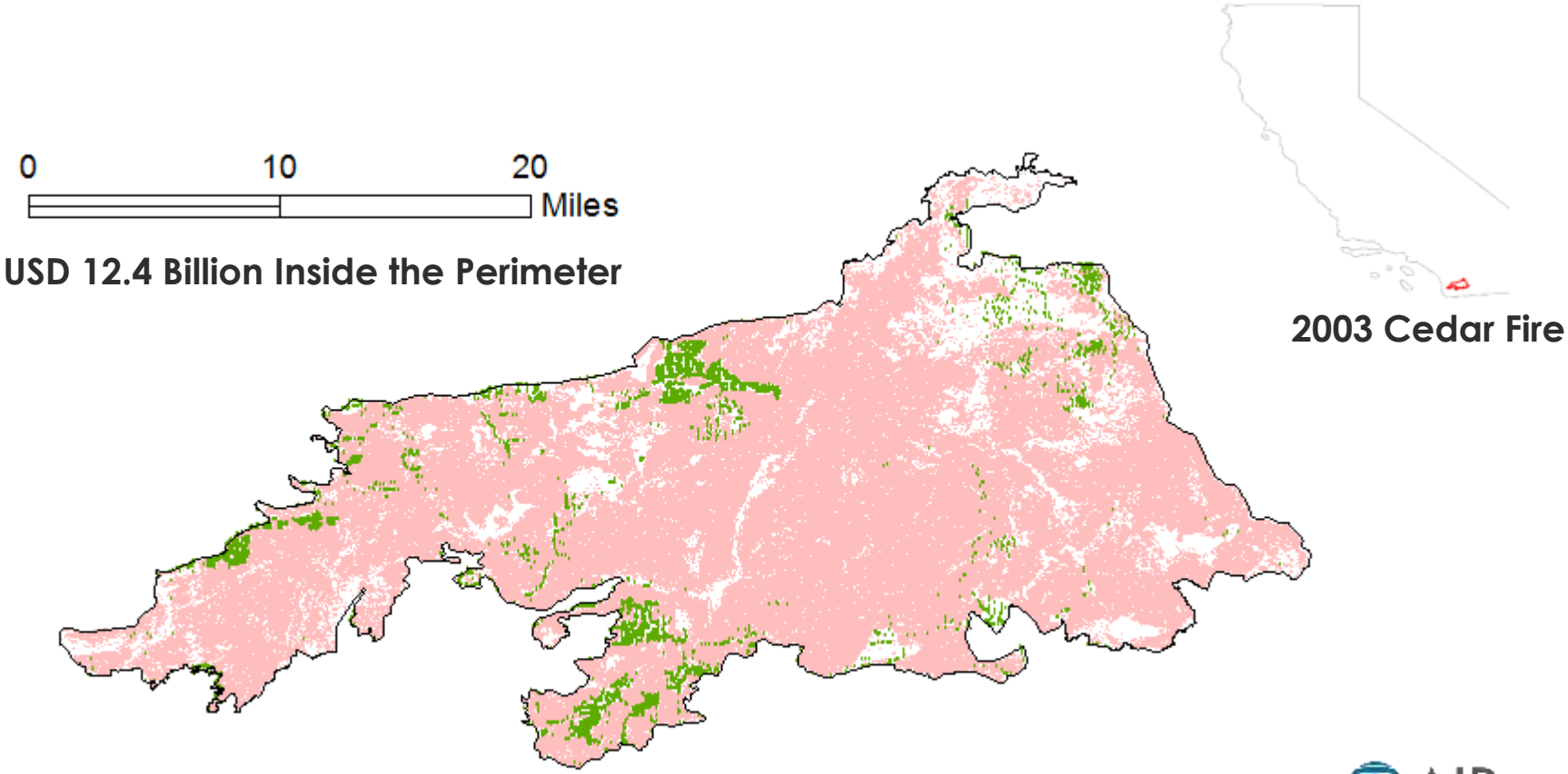


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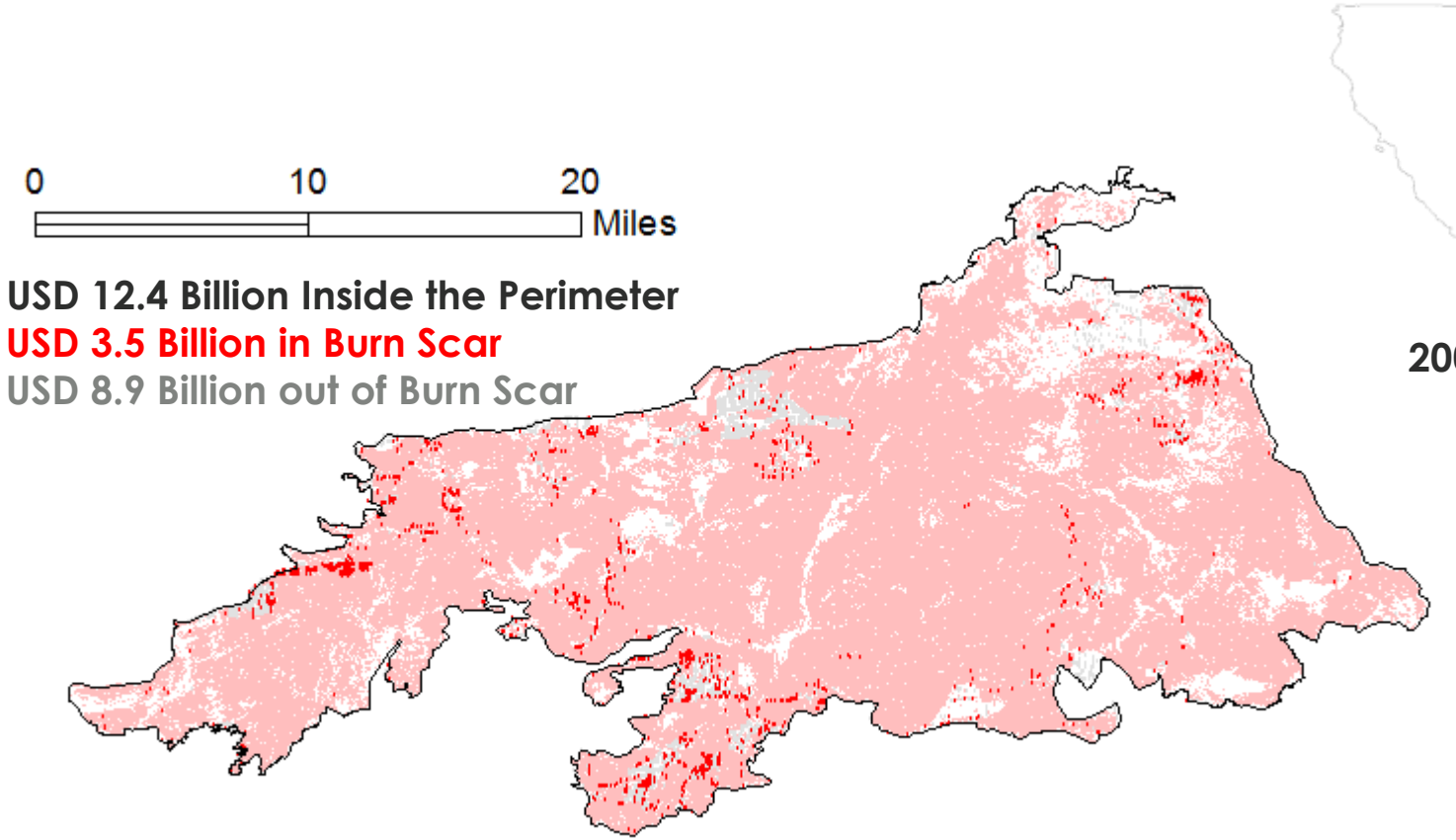


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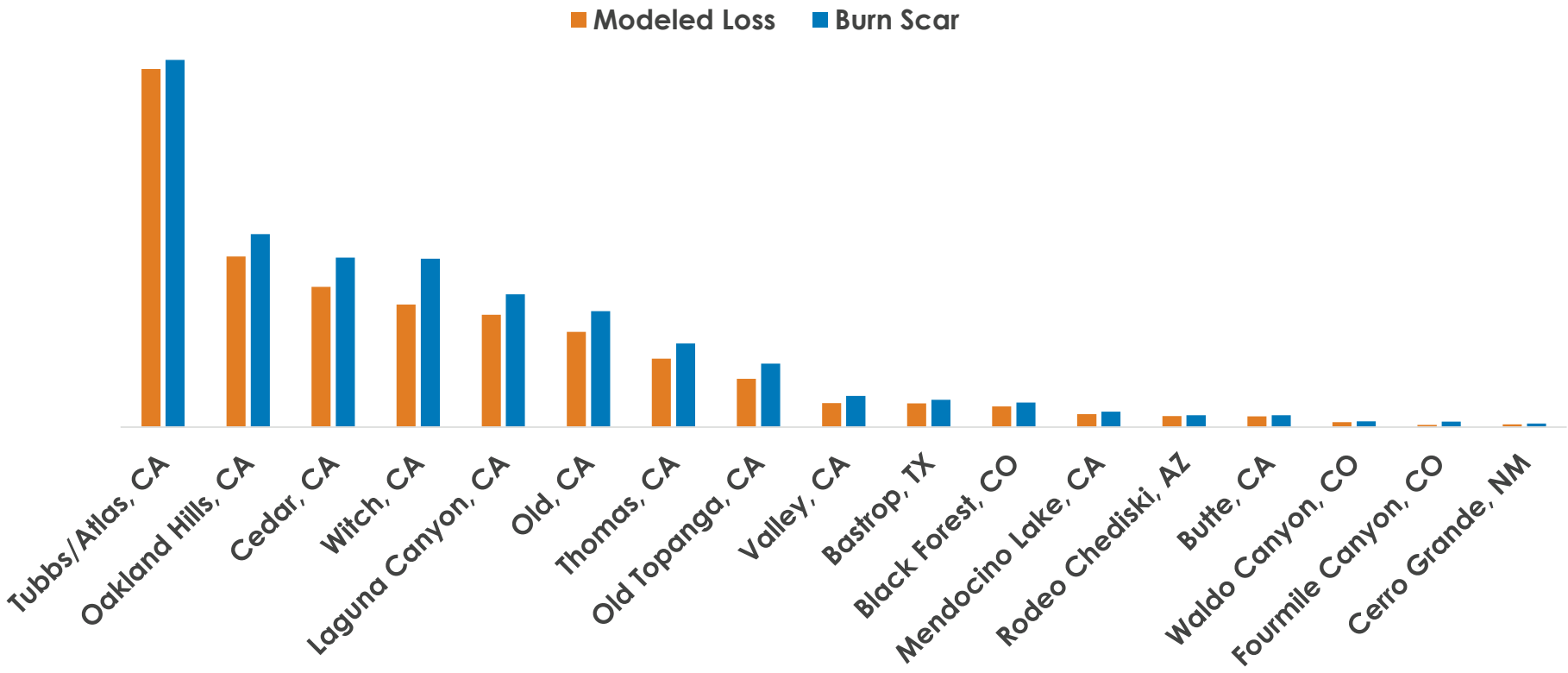
# Modeled Losses Compared to Burn Scar Losses

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*Based on AIR 2017 Industry Exposures*

# Model View of Risk

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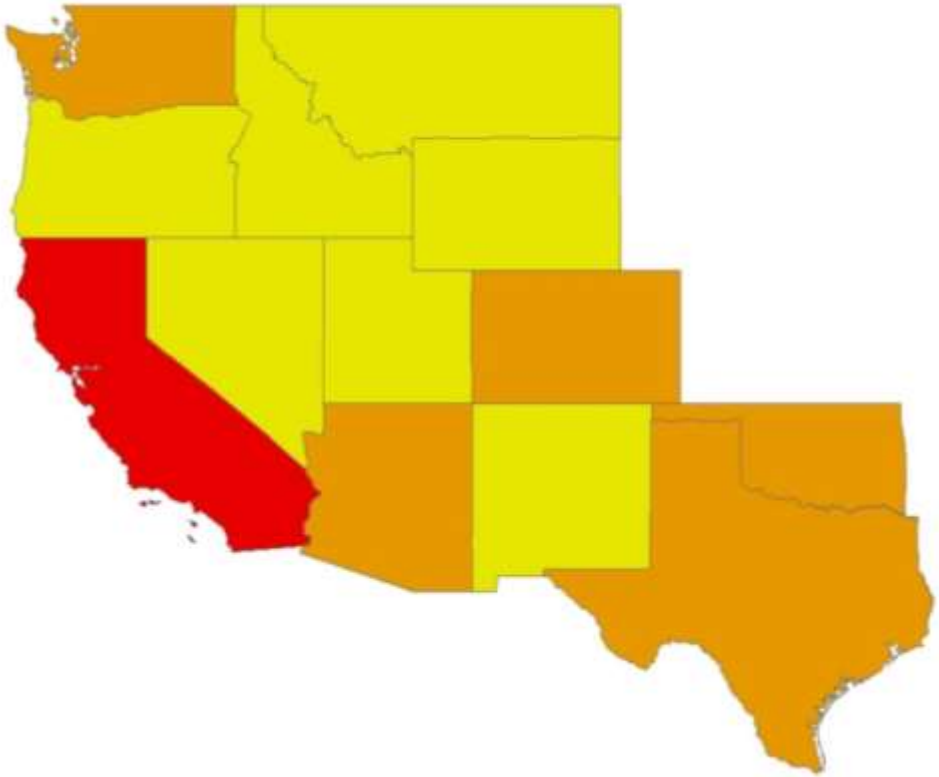
# California Drives AAL Across the Model's 13 States



| State | Percent of Total AAL |
|---|---|
| CA | 66% |
| AZ, CO, TX, OK, WA | 3% - 7% |
| ID, MT, NM, NV, OR, UT, WY | 1% - 3% |

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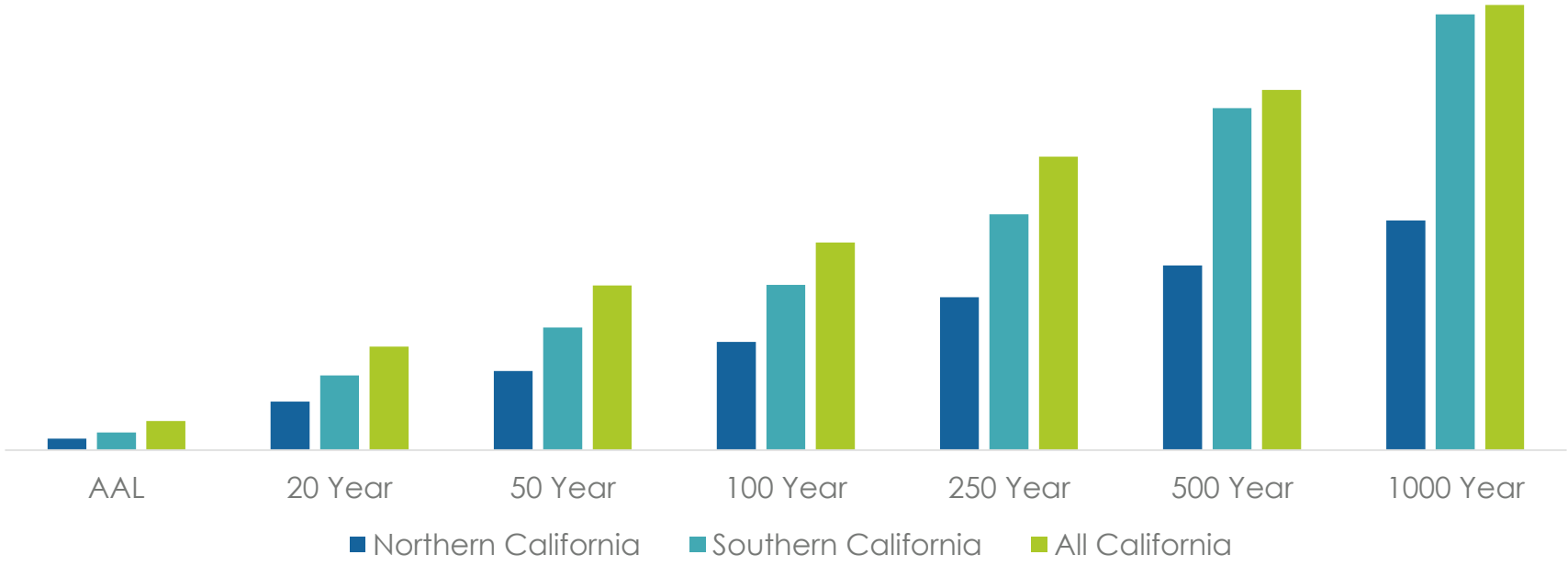
# California Aggregate Return Periods (All LOBs)

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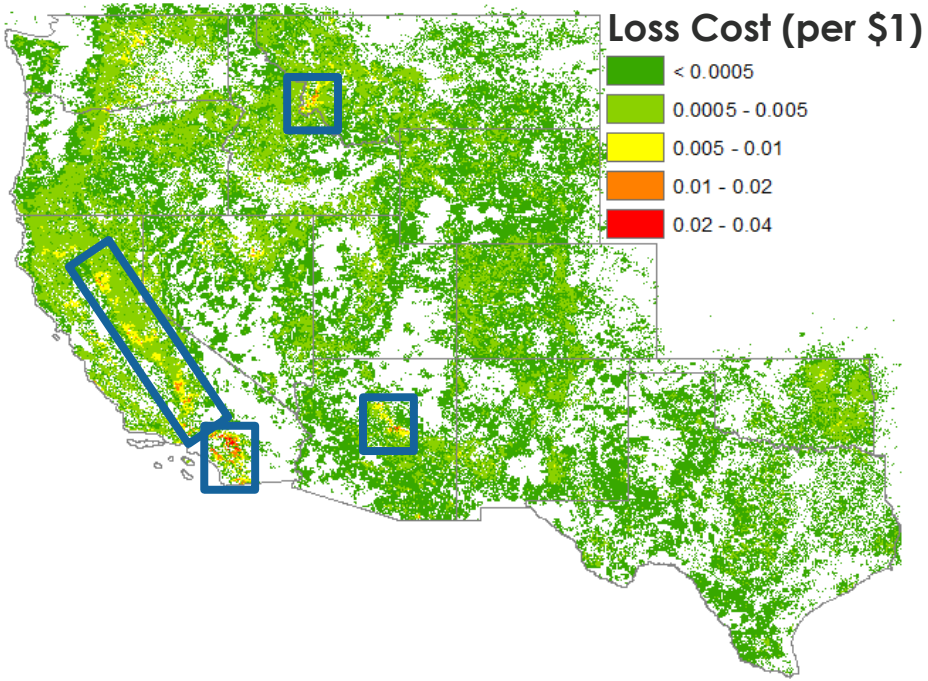
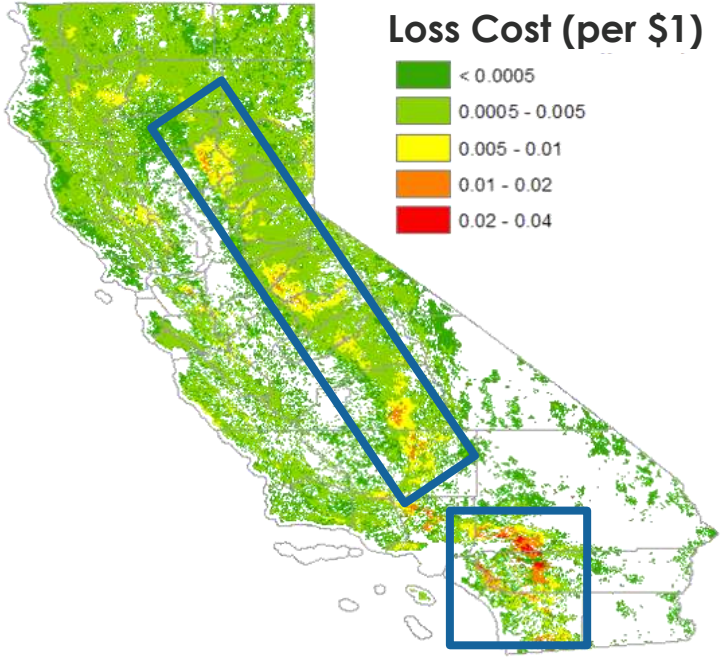
# AIR Wildfire Model Loss Cost Map

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# Key Use Cases

- Portfolio Management
- Pricing
- Real-Time Event Response

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# Portfolio Management

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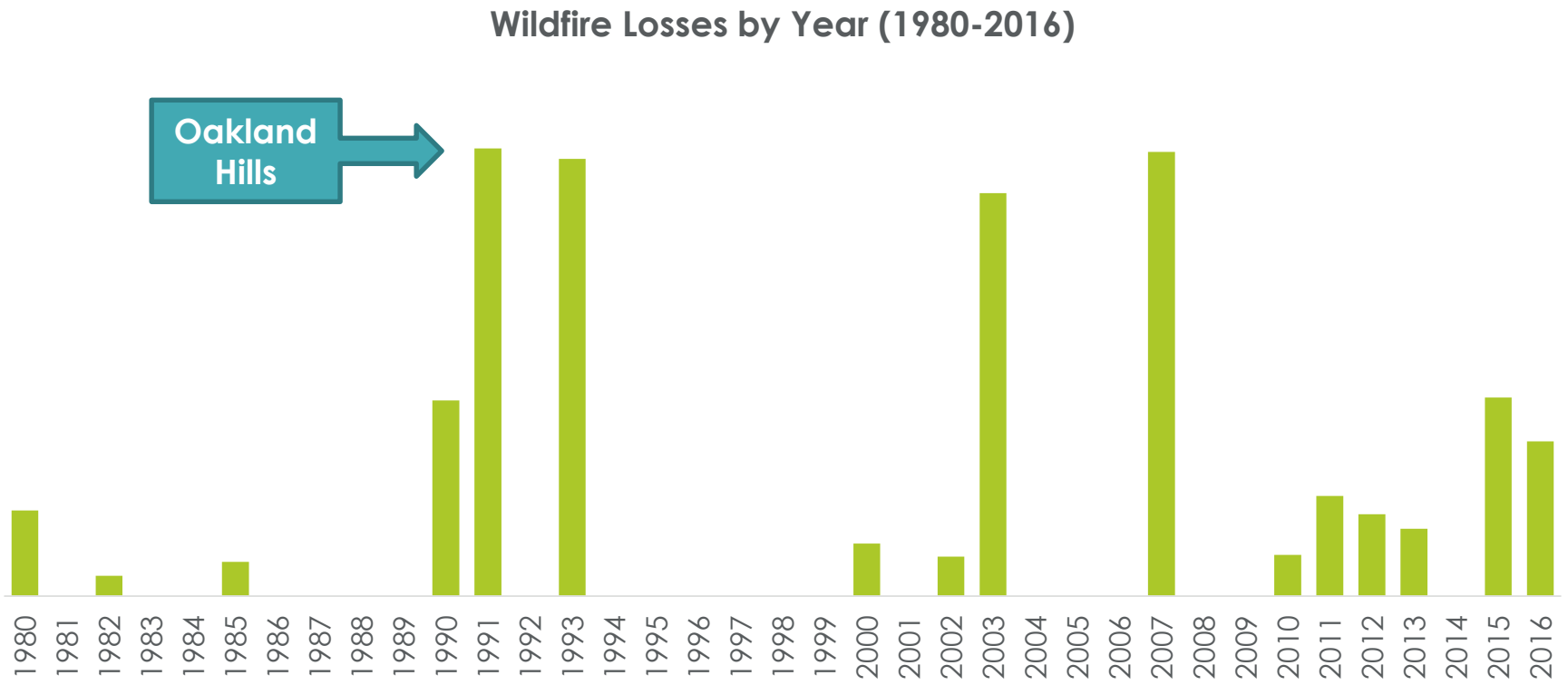
# Historical Loss Experience Doesn't Tell the Whole Story




*Source: PCS, Swiss Re, Munich Re, Aon (trended)*

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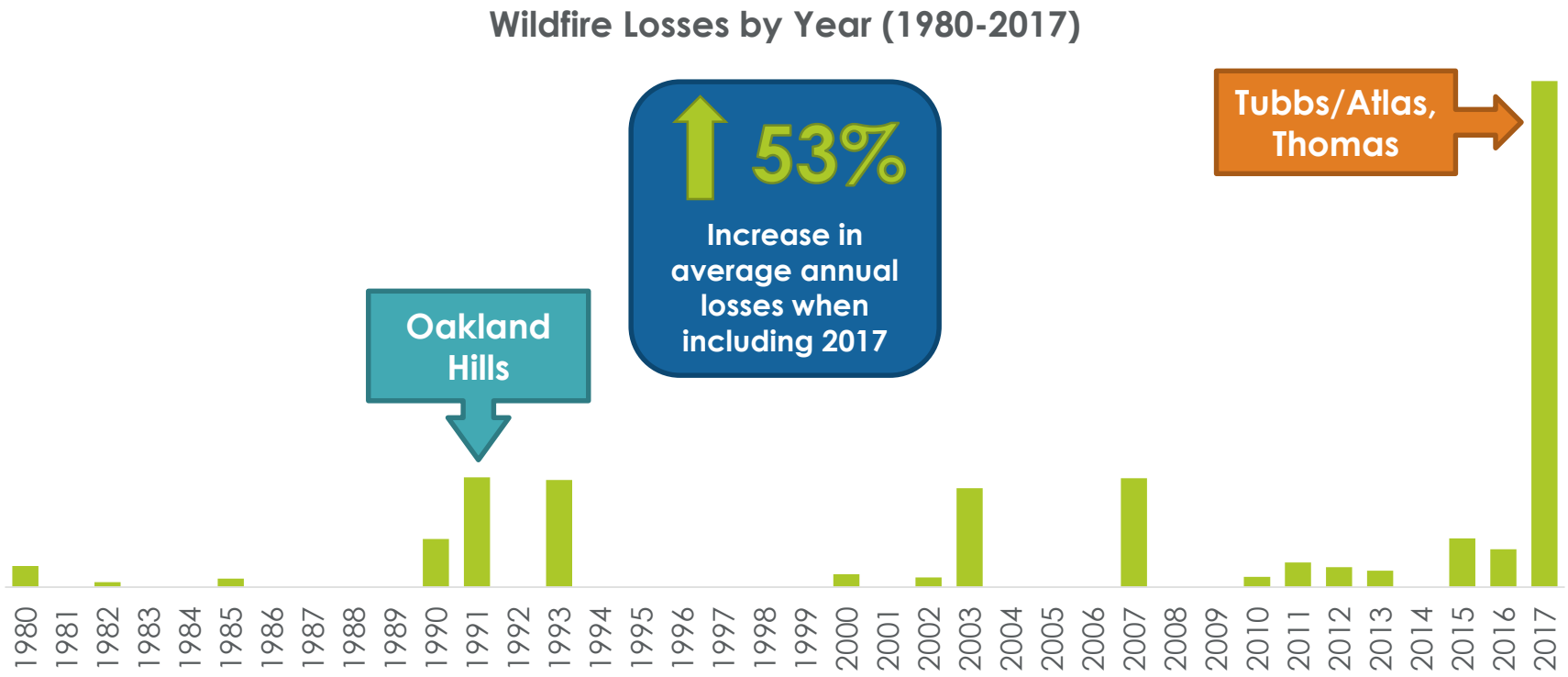


*Source: PCS, Swiss Re, Munich Re, Aon (trended)*

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TheStreet

California's Wild Fires Could Cost Insurance Companies Shocking Amounts

THE WALL STREET JOURNAL.

With California Wildfires, Insurers' Losses Keep Spiraling Higher

NBC BAY AREA

California Wildfires Expected to Cause Record Insurance Loss: Report

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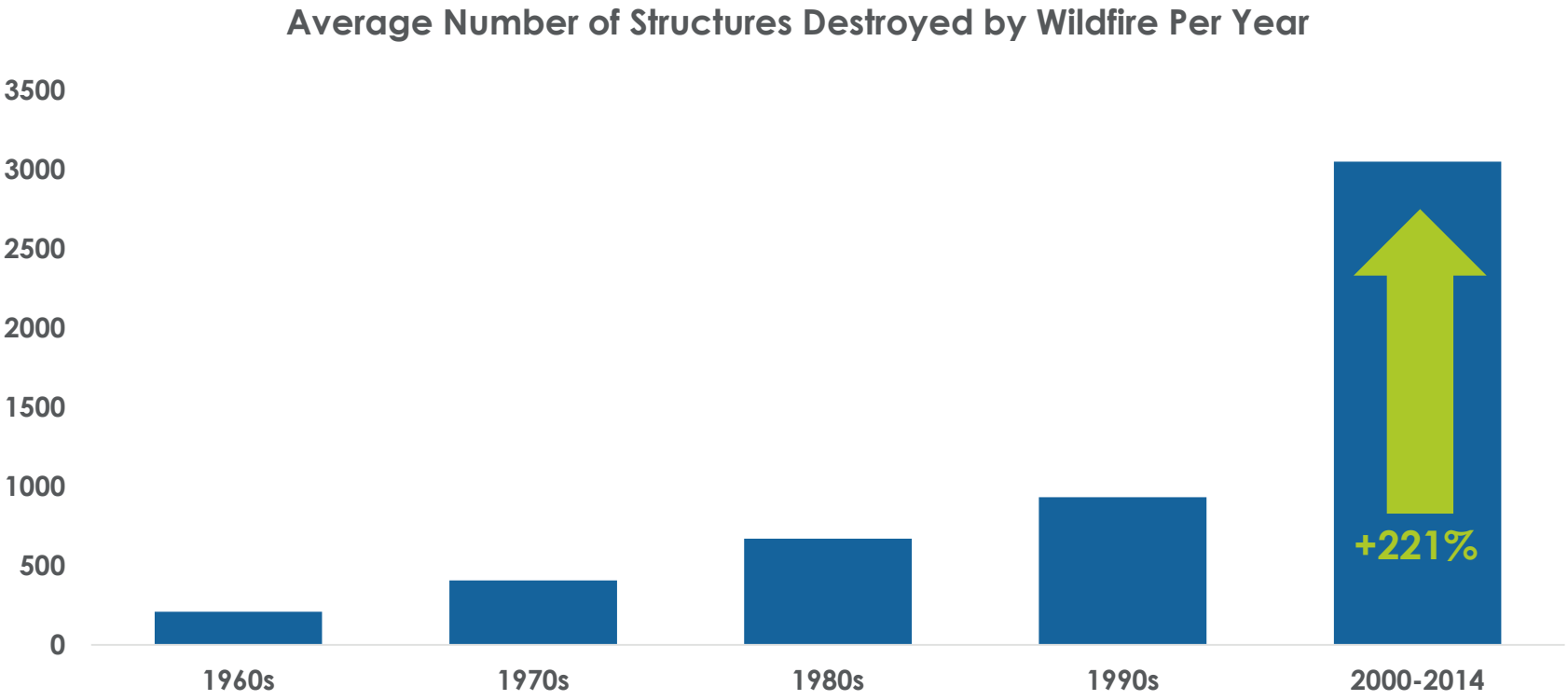
# Explosive Exposure Growth Increases Risk




*Source: IAWF*

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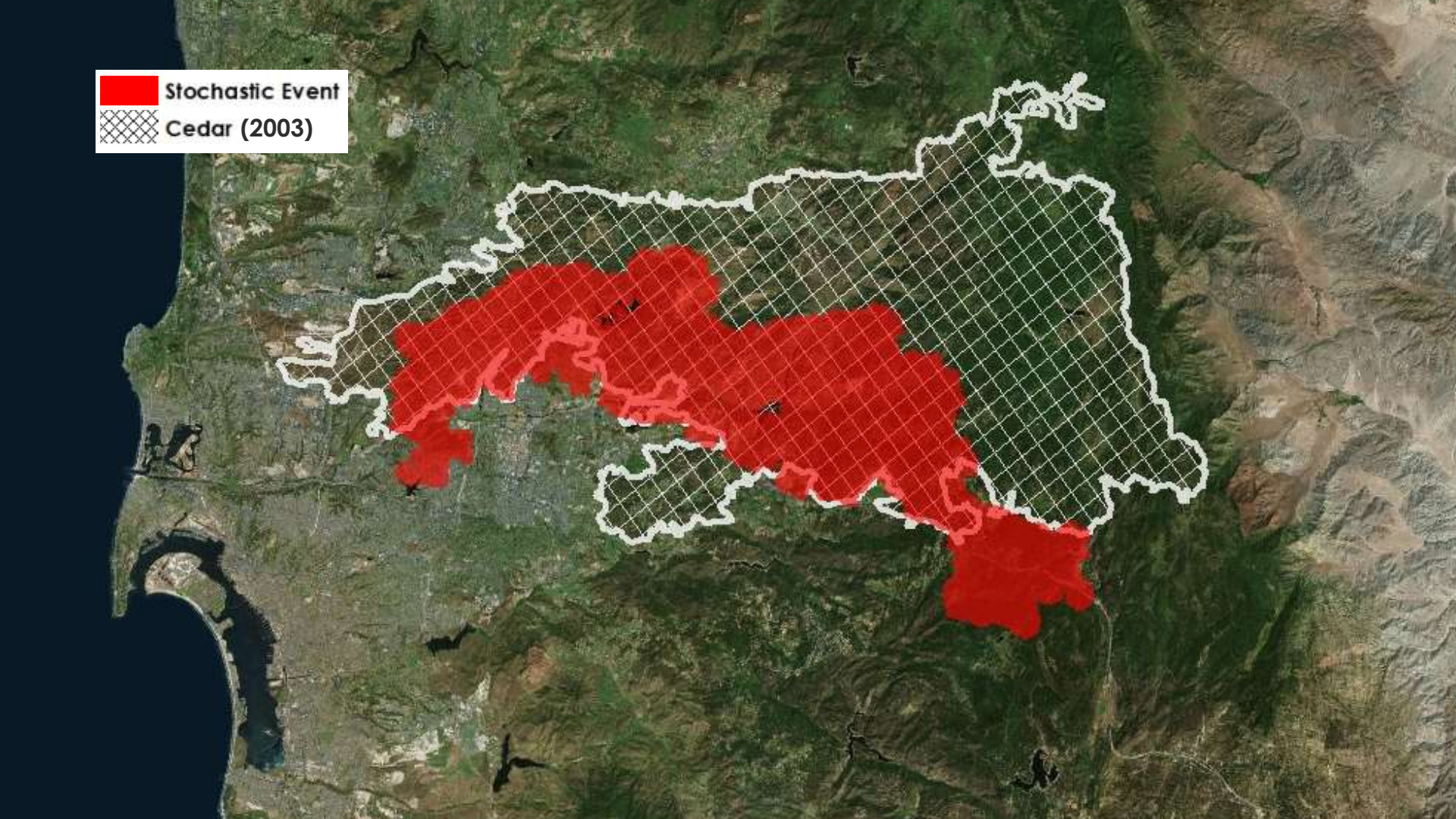
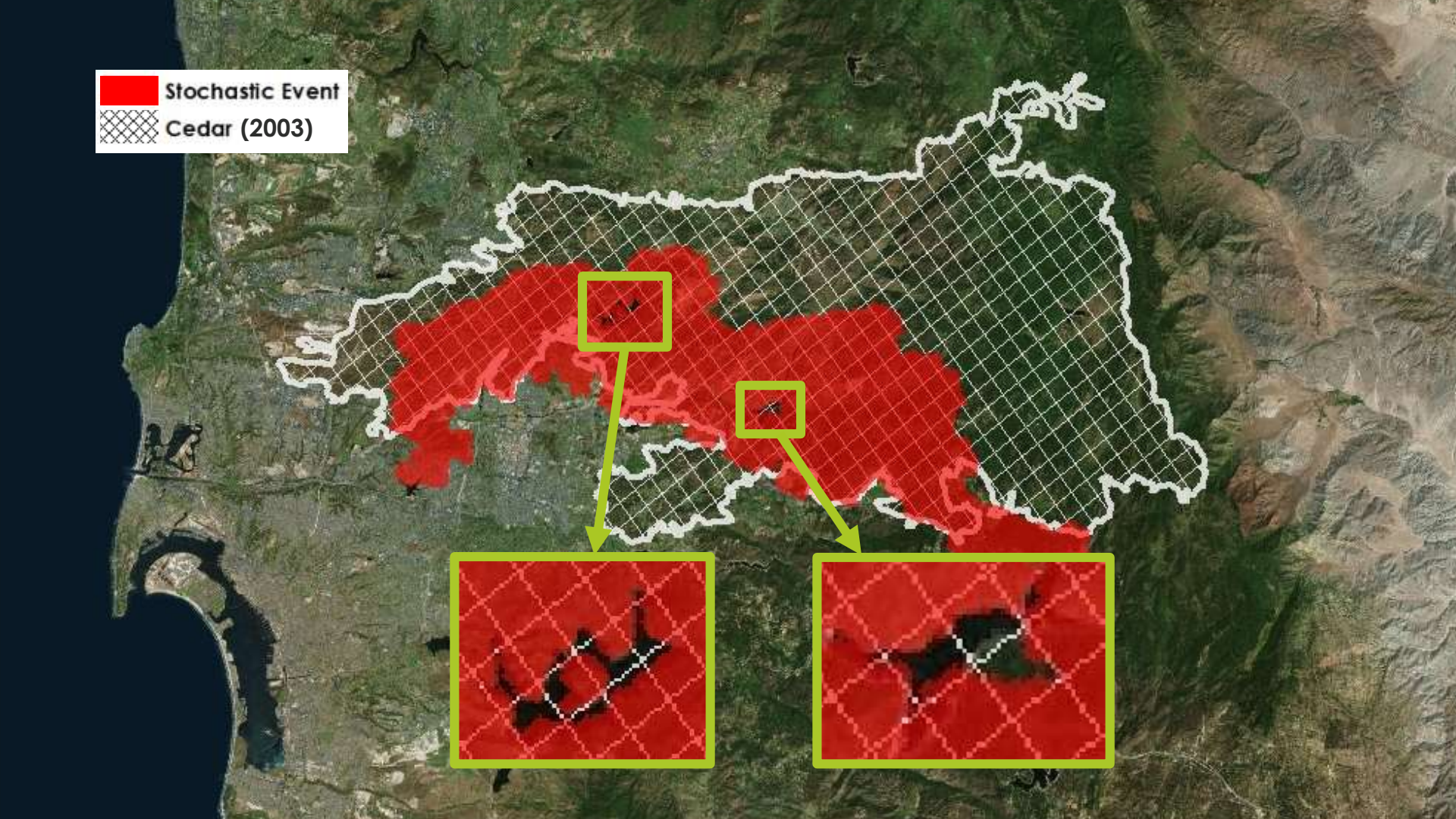

Stochastic Event
Cedar (2003)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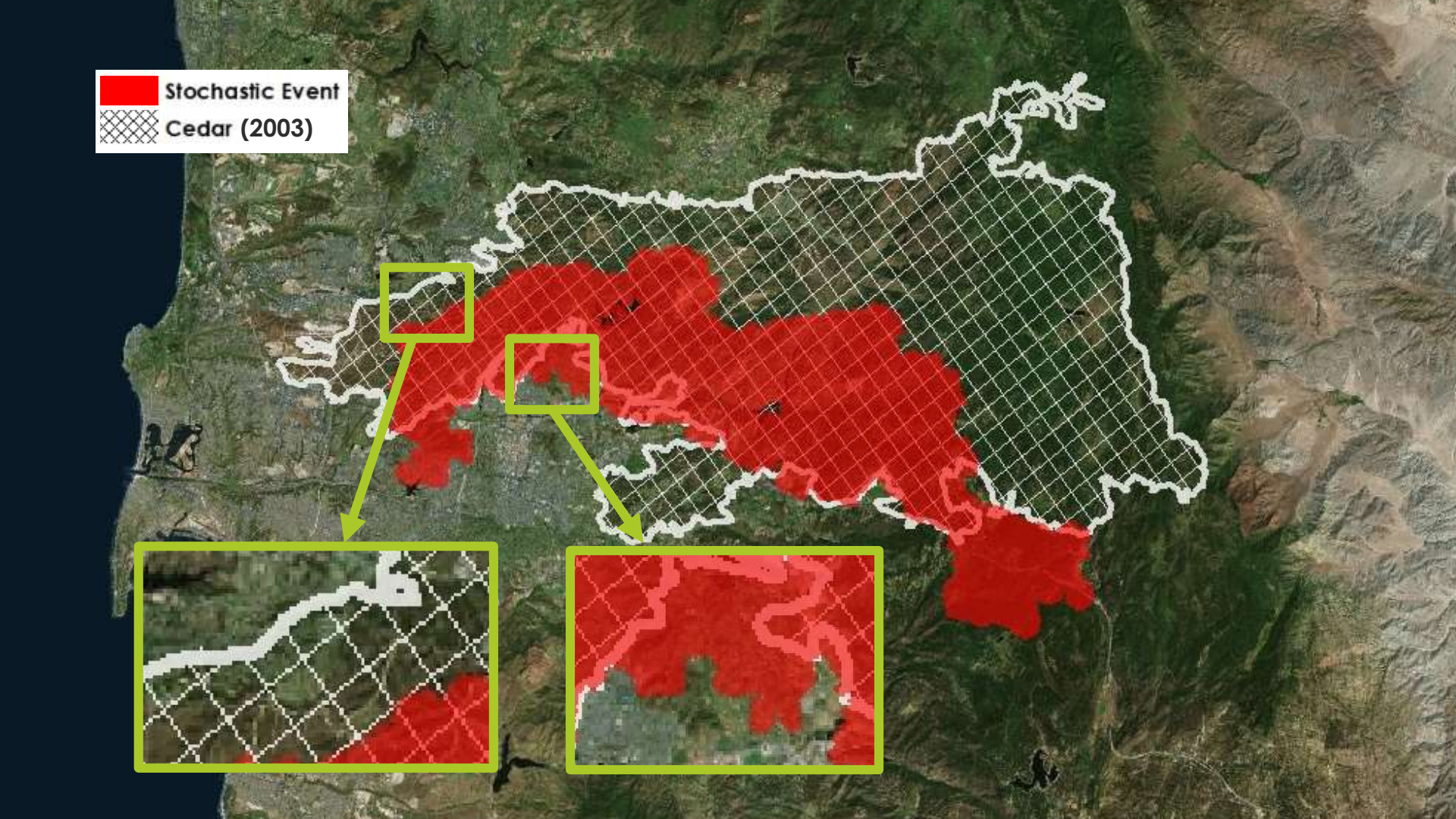
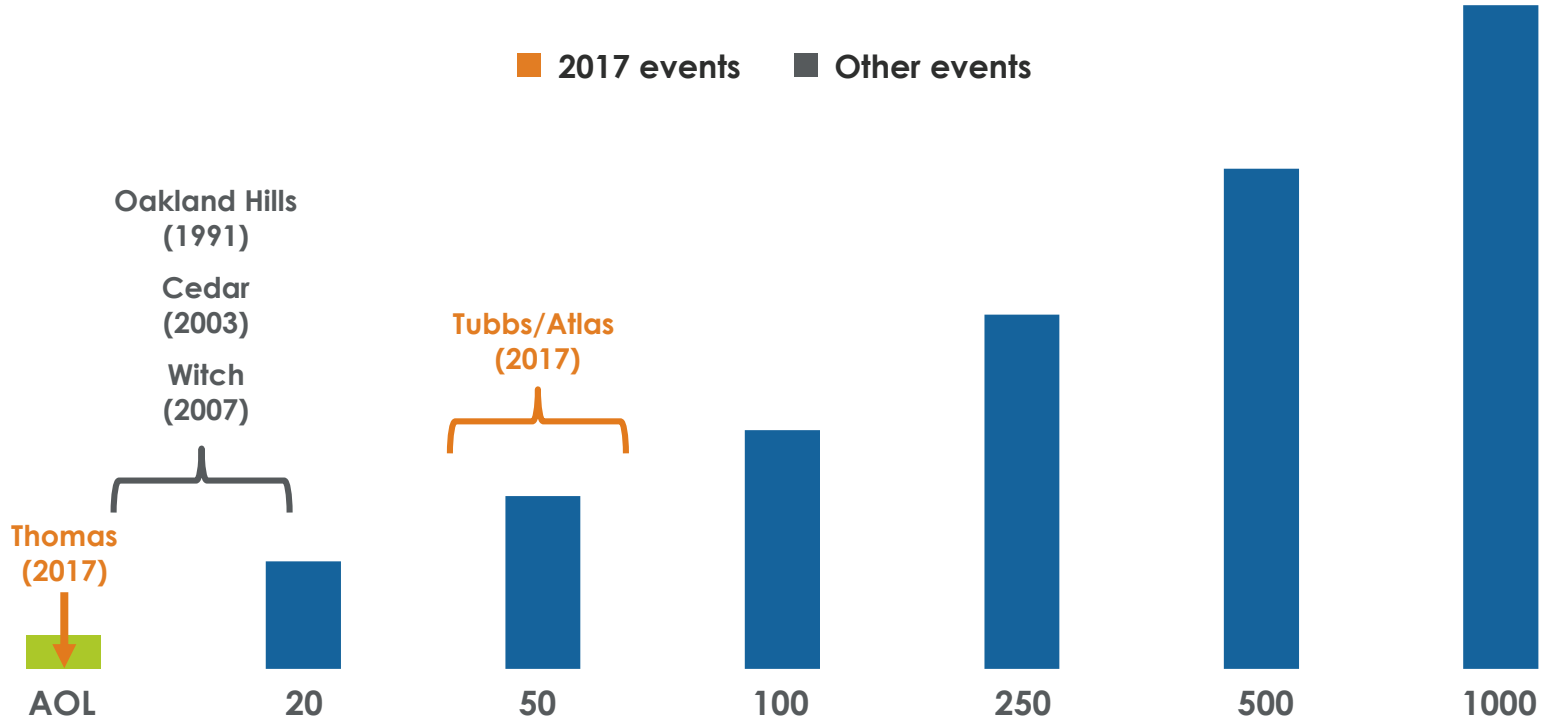

Stochastic Event
Cedar (2003)

# Occurrence EP Curve for AIR Model Domain




*AIR Modeled Gross Losses Using 2017 Industry Exposures*

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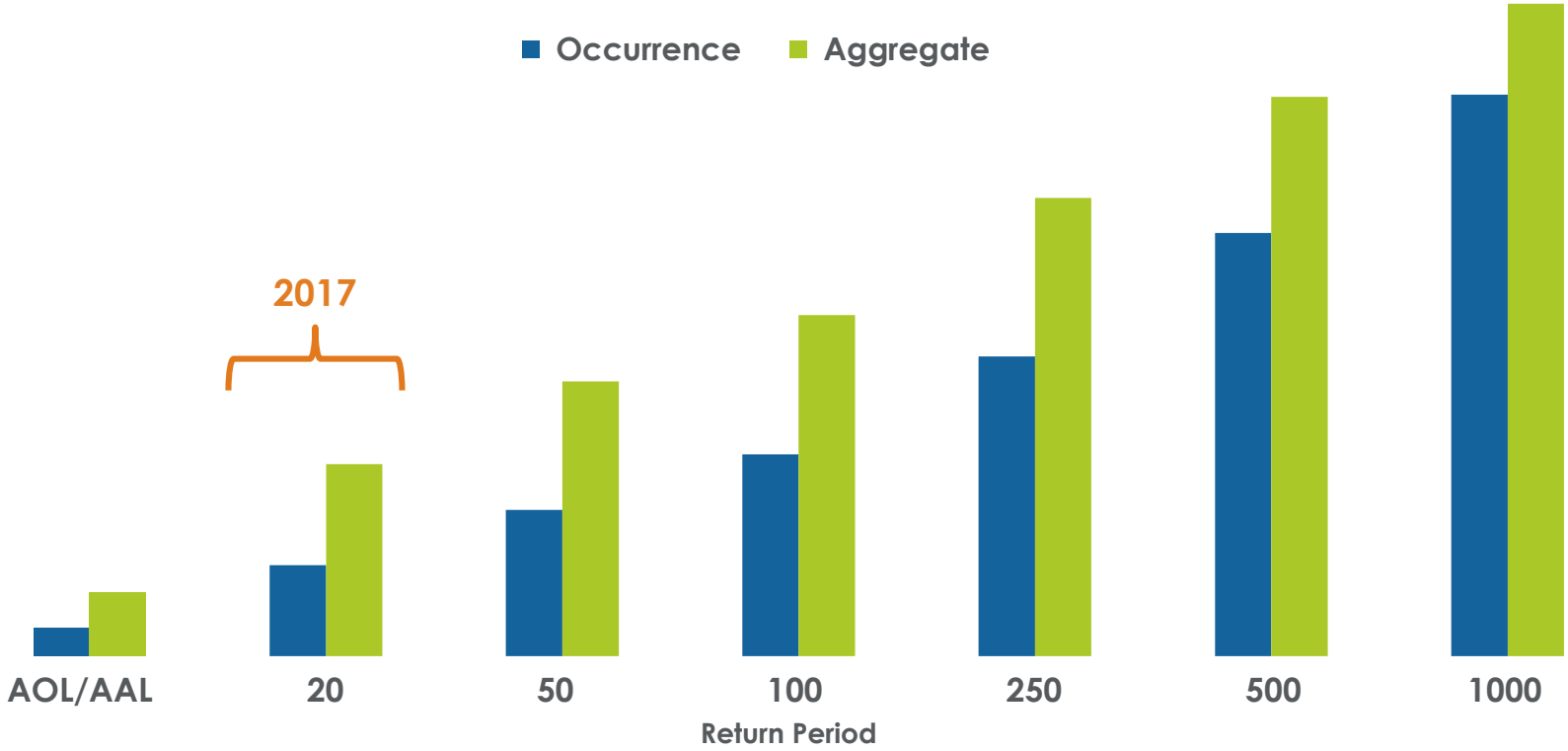
# EP Curve for AIR Model Domain




*AIR Modeled Gross Losses Using 2017 Industry Exposures*

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# Pricing

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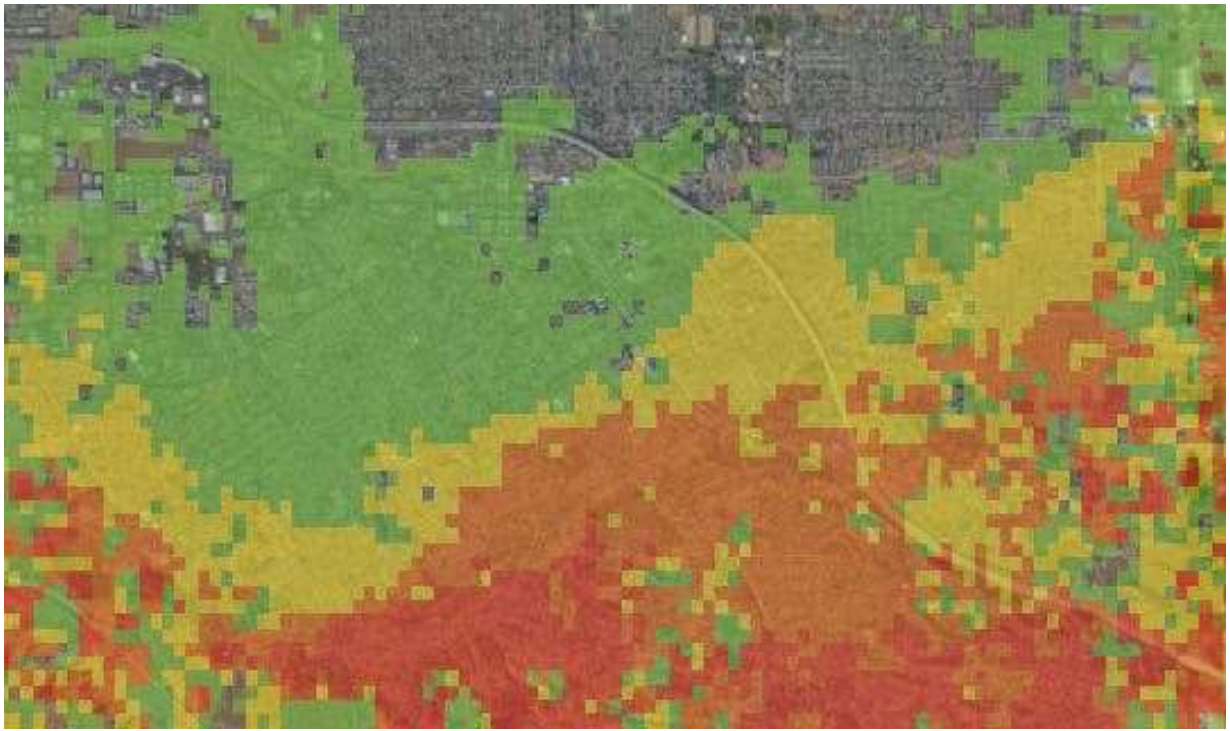
# Loss Costs Can Inform Rating Plans



*Loss cost map produced using AIR's Touchstone® software*

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# Pricing Use Case: Secondary Risk Characteristics

## Property Level

Roof Type

Siding

Skylight and Dormer

Defensible Space

## Community Level

NFPA

FIREWISE USA™

Residents reducing wildfire risks

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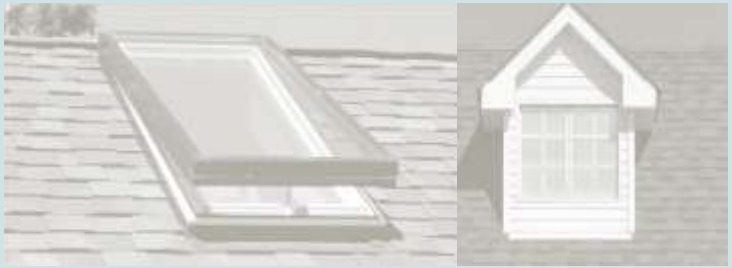
# Pricing Use Case: Secondary Risk Characteristics

| Property Level | Community Level |
| --- | --- |
| Roof Type |  Siding |
|  Skylight and Dormer | **Defensible Space** |
| | NFPA FIREWISE USA™ Residents reducing wildfire risks |

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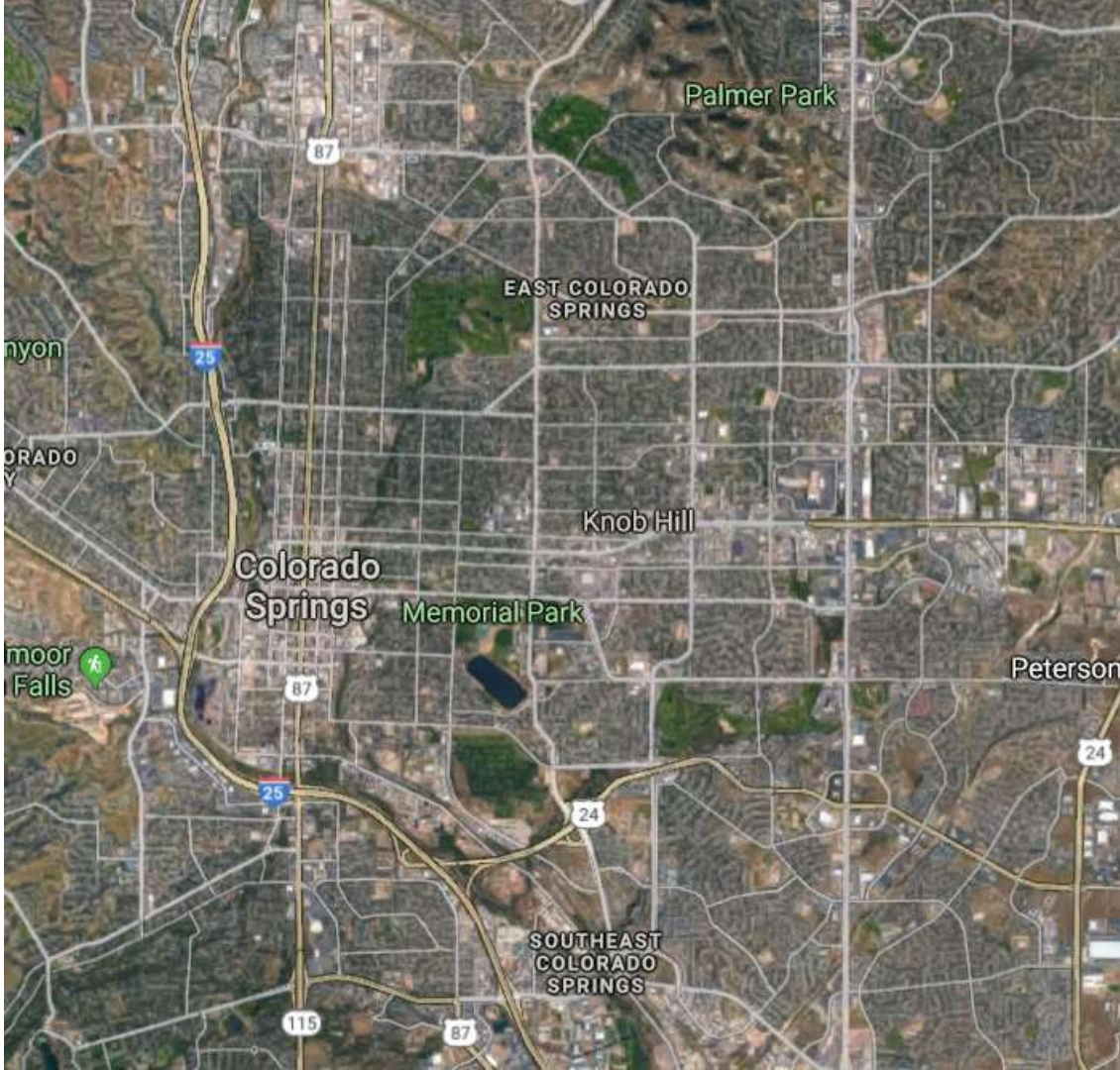
# Pricing Use Case: Notional Data

- Single family home
- USD 250,000 replacement value
- 5% deductible

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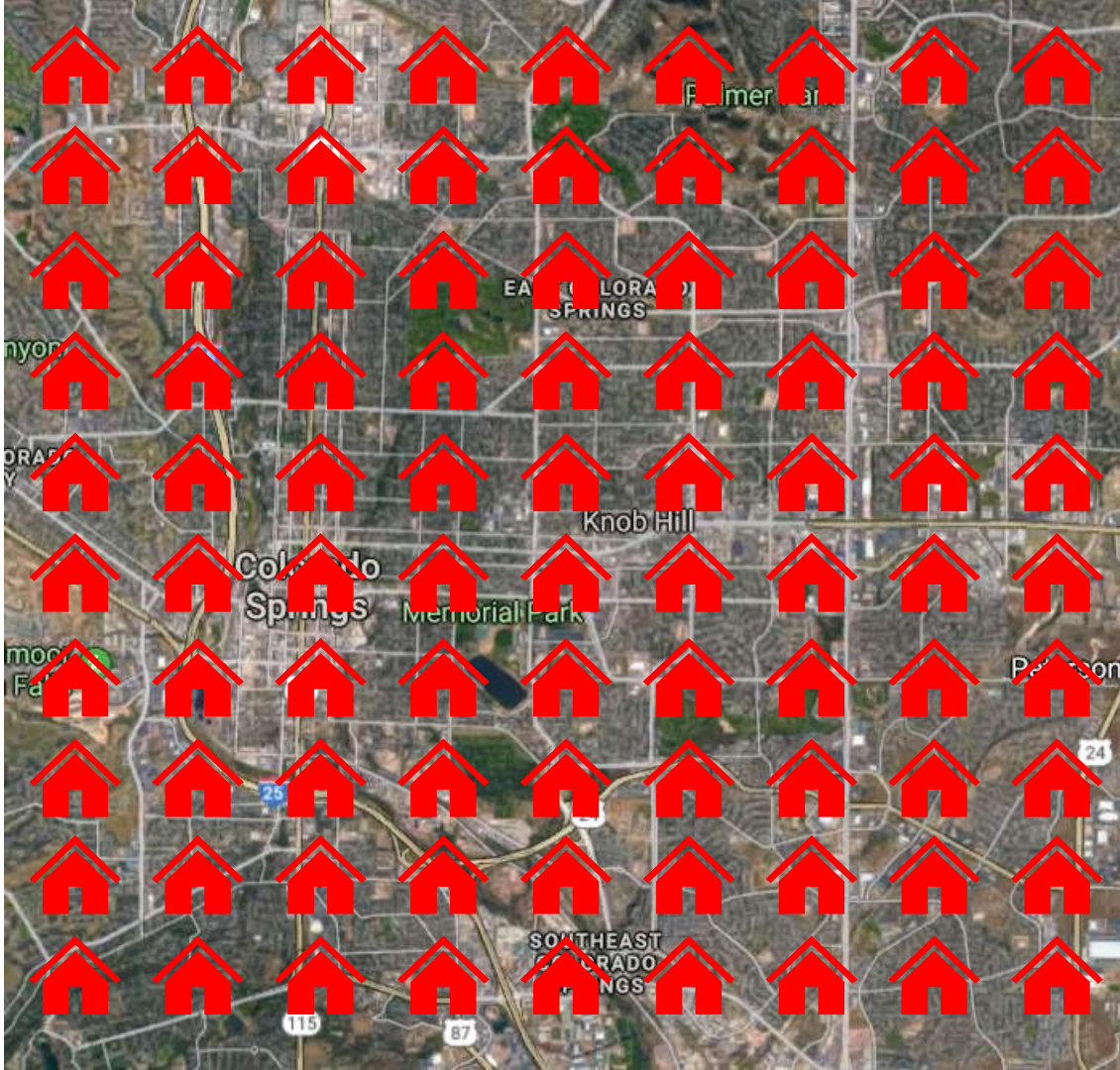
# Pricing Use Case: Notional Data

- Single family home
- USD 250,000 replacement value
- 5% deductible

No defensible space

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# Pricing Use Case: Notional Data

- Single family home
- USD 250,000 replacement value
- 5% deductible

No defensible space

Defensible space up to Zone 3

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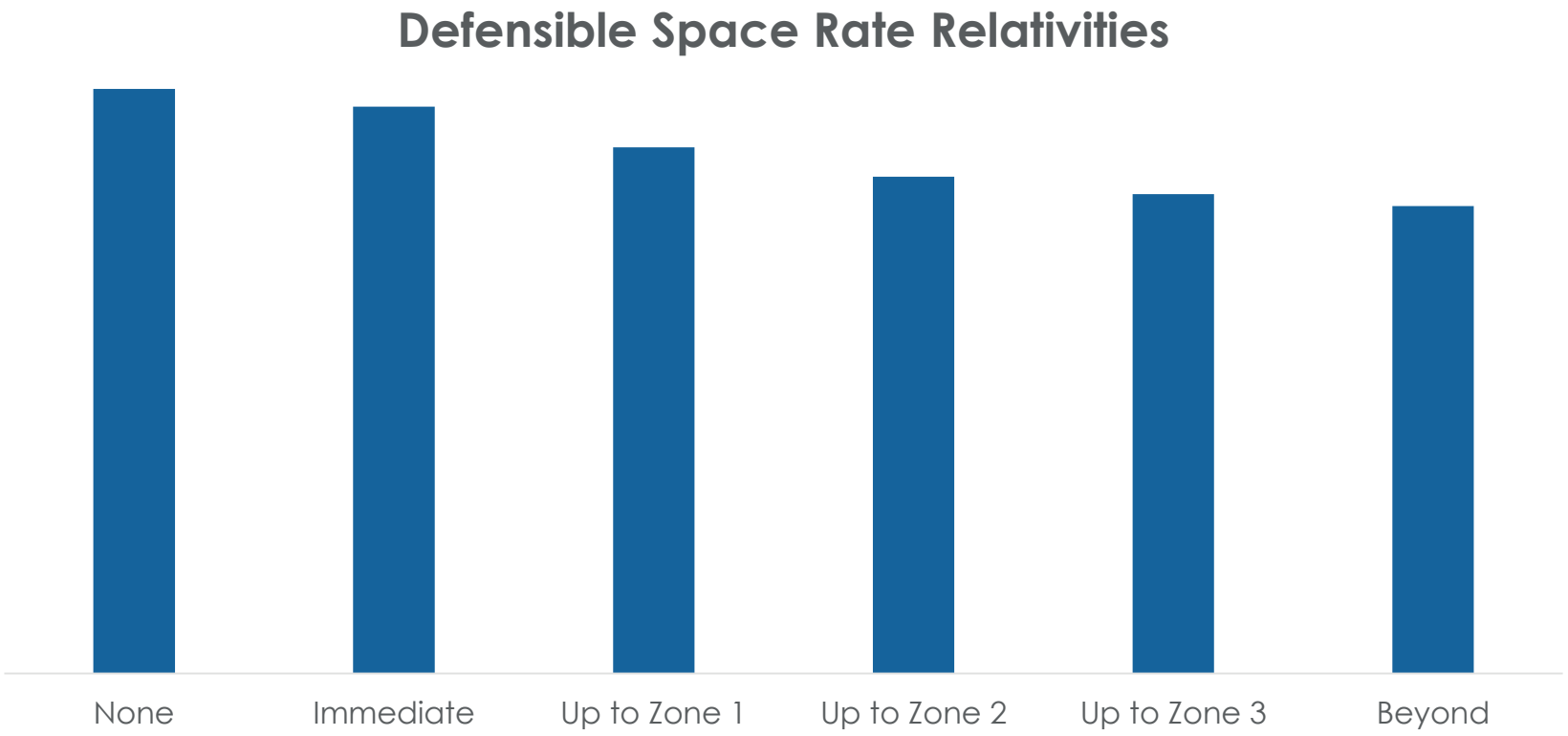
# Premium Credits Incentivize Mitigation

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# Verisk: FireLine®

**FireLine** provides a score, derived from an objective assessment of an exposure's propensity to burn in the event of a wildfire, based on the most current assessment of vegetative fuels, slope, and road access. Available in 13 U.S. states and two Canadian provinces*.

### Simple Score, Multiple Uses

- UW eligibility
- Pricing
- Inspection
- Marketing
- Customizable

### Leading Science and Technology

- Satellite/Remote sensing
- Machine learning
- Digital mapping

### Granular and Reliable

- Property-specific scores
- Frequent updates reflect latest risk landscape
- Most extensive validation with post-wildfire data

### Multiple Delivery Options

- Geographic information systems (GIS)
- On-line (ISO Passport® system and API)
- LOCATION® (database)
- ProMetrix®
- Touchstone®

*US - AZ, CA, CO, ID, MT, NV, NM, OK, OR, TX, UT, WA, and WY; Canada - AB and BC*

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# Real-Time Event Response

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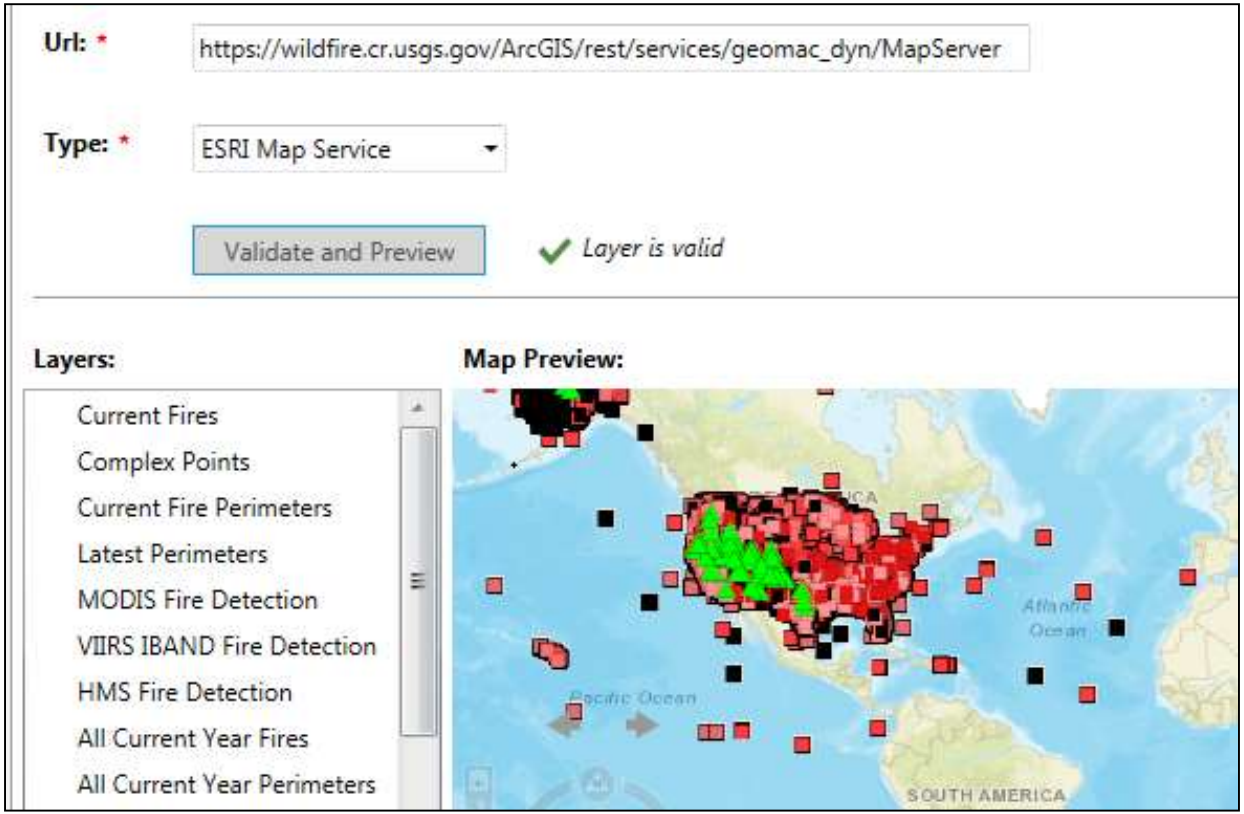
# Connect to Live GeoMAC Feed with Touchstone

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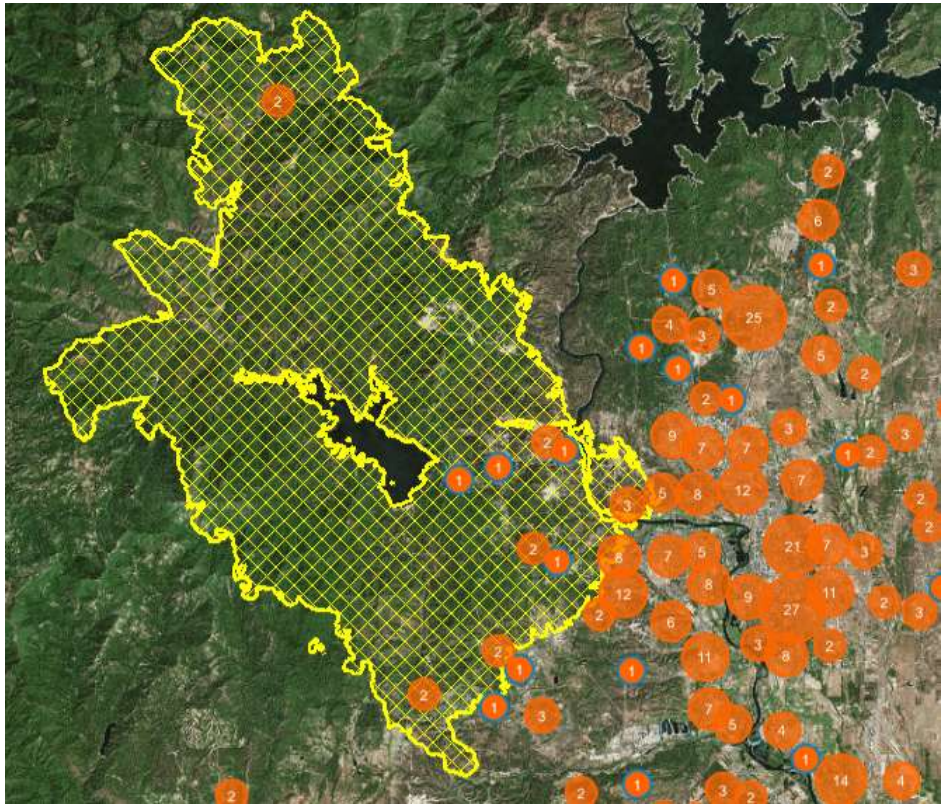
# Visualize Fire Perimeters in Relation to Exposure Data



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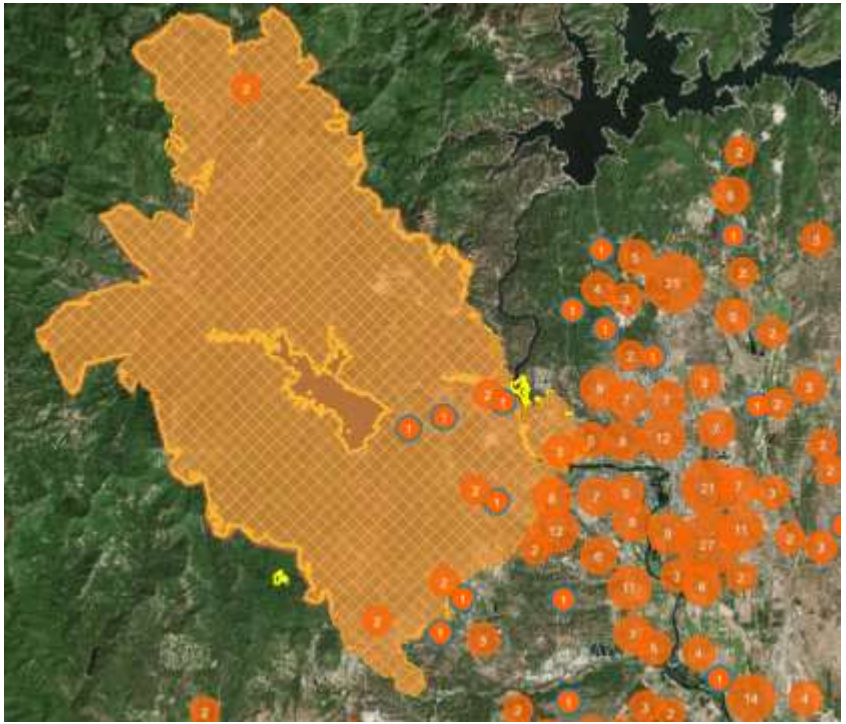
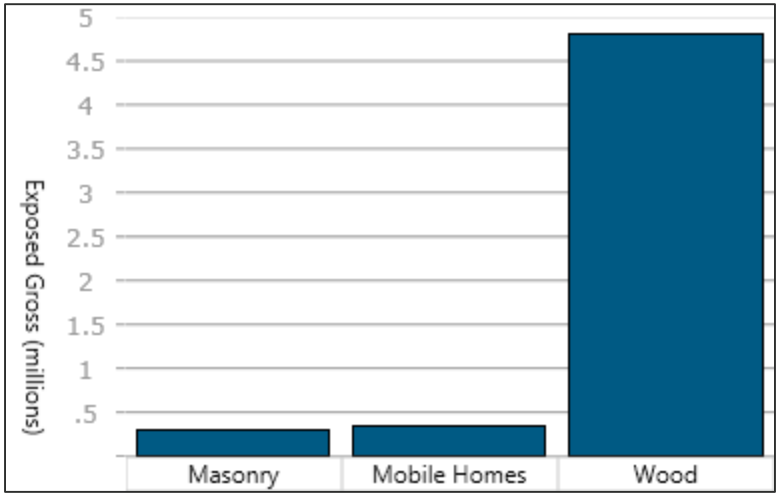
# Use Custom Shapes to Understand Accumulations of Risk Within the Perimeter of Live Events



| Accumulator Na | Risk Count Sum | Total Replacement Value Sum | Exposed Gross Sum |
|---|---|---|---|
| Carr Fire July 30th | 18 | 6,371,776 | 5,504,349 |

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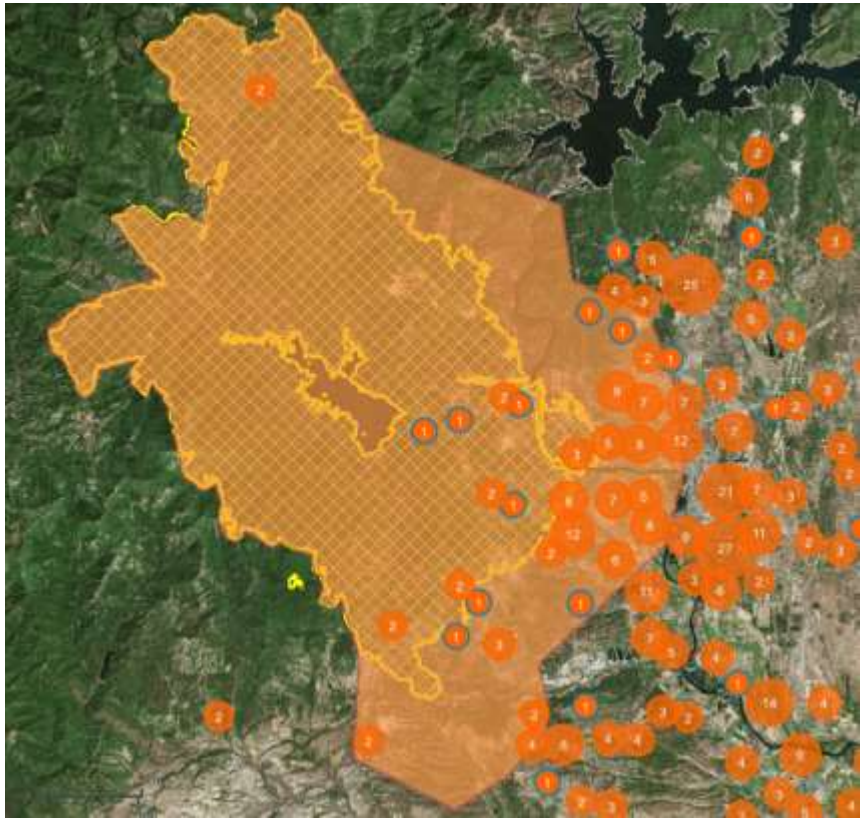
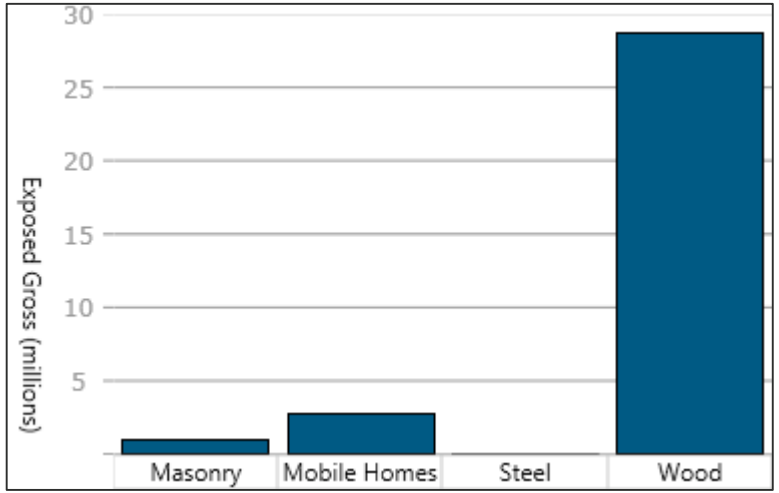
# Perform Sensitivity Studies to Account for Fire Spread



| Accumulator Nam | Risk Count Sum | Total Replacement Value Sum | Exposed Gross Sum |
|---|---|---|---|
| Carr Fire July 30th | 18 | 6,371,776 | 5,504,349 |
| Carr Fire July 30th Sensitivity | 122 | 37,847,527 | 32,801,123 |

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# Thank you for attending!

**A recording of today's webinar and a copy of the slide deck will be available shortly.**

**If you have any additional questions, please reach out to your account representative or wildfire@air-worldwide.com**

**To learn more about how AIR's models can enhance your risk management strategy, visit our website: www.air-worldwide.com**