Risk-Based Strategies for Managing Wildfire Exposure in a Changing Landscape

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Meet the Speakers

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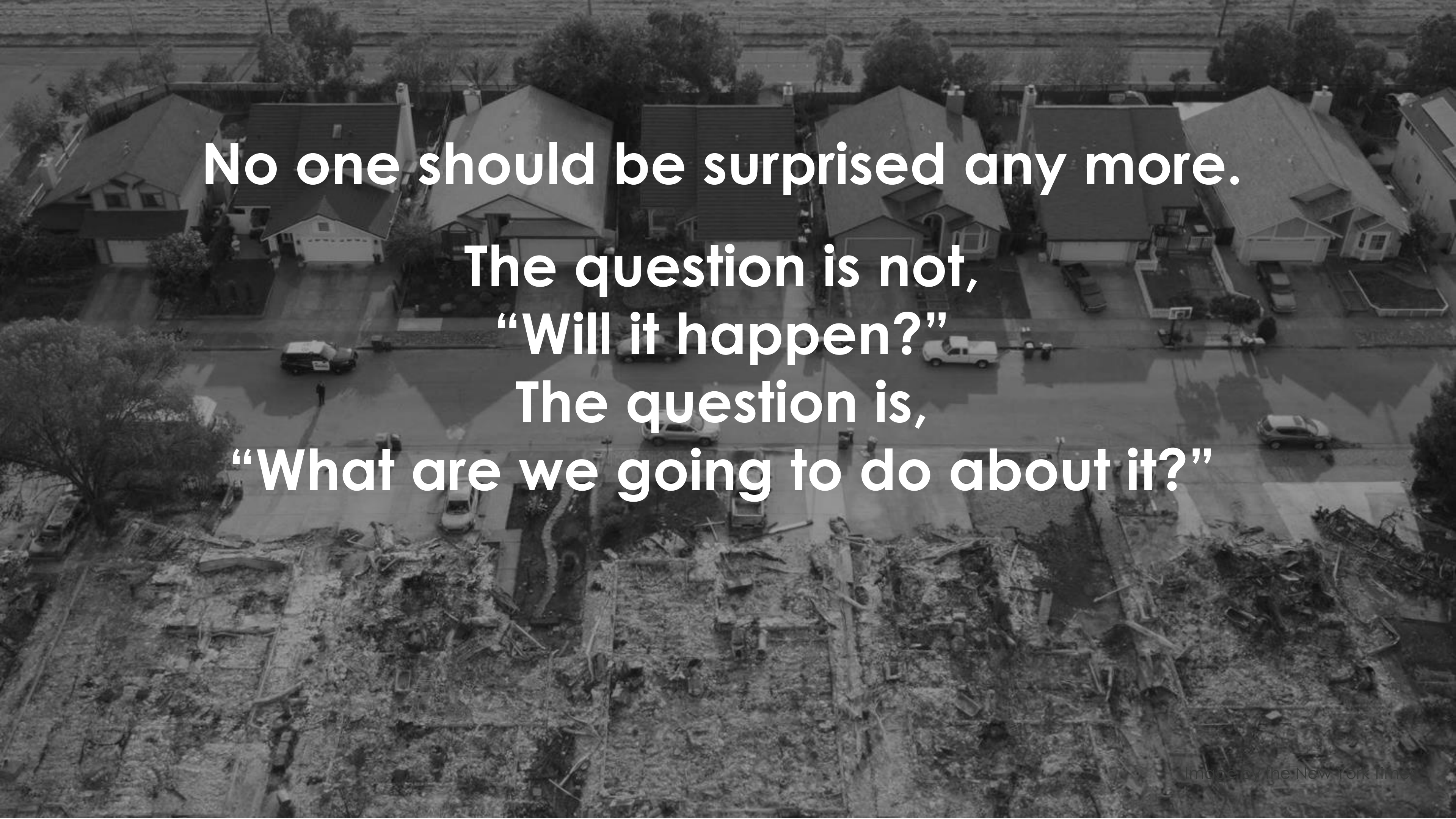
5 of the top 10 California wildfires occurred between 2014 and 2017

More than 10 million acres burned in 2017

USD 18 billion in North American wildfire cat losses since 2014

1. Is wildfire risk increasing?
2. What are my probabilities of loss?
3. Do I understand my risk?


No one should be surprised any more.
The question is not,
“Will it happen?”
The question is,
“What are we going to do about it?”
Image by The New York Times

How Can the Insurance Industry Stay Effective in the Face of Change?

– Changes to market dynamic after 2017 losses
– Increased availability of data and analytics
– Regulatory environment changes

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Today's Agenda

- Wildfire Behavior and Exposure Growth
- How Structure Vulnerability Impacts Risk
- Catastrophe Modeling Process and Use Cases
- Understanding Accumulated Risk
- Putting It All Together

Wildfire Behavior and Exposure Growth

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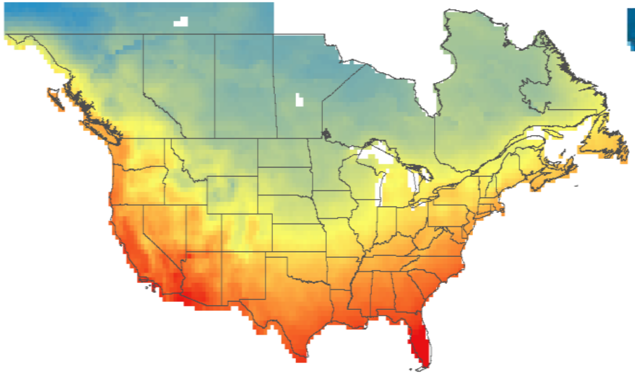
Why Were the 2017 Wildfires Catastrophic?

AIR Tubbs Fire Damage Survey 2017

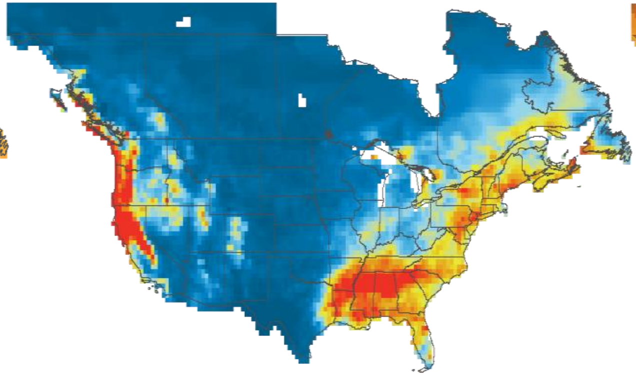
- Fuels resulting from antecedent weather conditions
- Conditions during event
- Wildland-Urban Interface (WUI)

Weather Patterns Drive Variability in Wildfire Activity

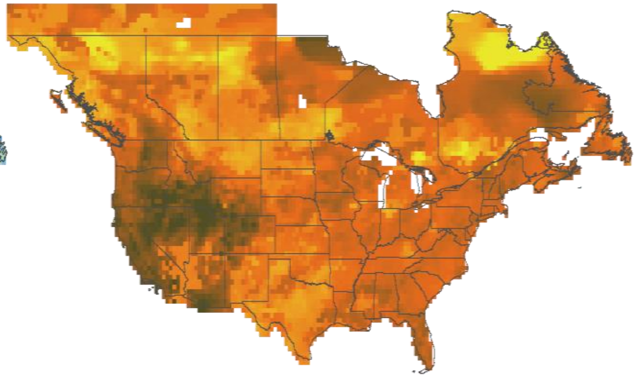
Temperature



Precipitation



Drought



Weather Patterns Drive Fuel Combustibility

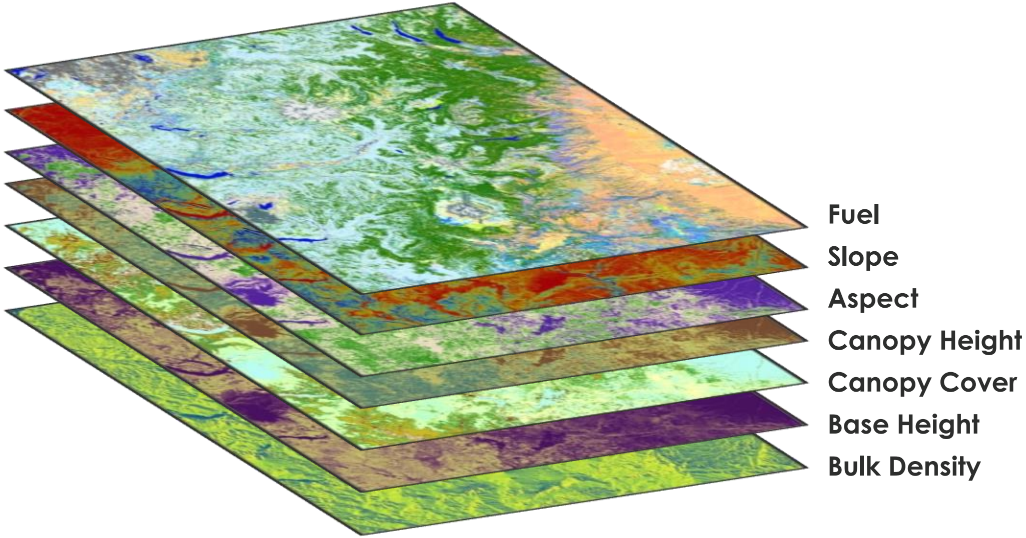
Fine Fuels	Coarse Fuels
Fire behavior is correlated to the drought conditions during the growing season	Fire behavior is correlated to the drought conditions during the fire season
Wet Growing Season = ↑ Fire Activity	Wet Fire Season = ↓ Fire Activity
Dry Growing Season = ↓ Fire Activity	Dry Fire Season = ↑ Fire Activity
	

Fire Ignition Risk Patterns Follow Human Presence

Understanding proximity to roads is one piece of quantifying where ignitions are likely to occur

- Humans ignite the vast majority (84%) of wildfires in the U.S.
- Human-ignited fires account for half of annual area burned
- Human-caused ignitions are more prevalent in the WUI and close to the built environment

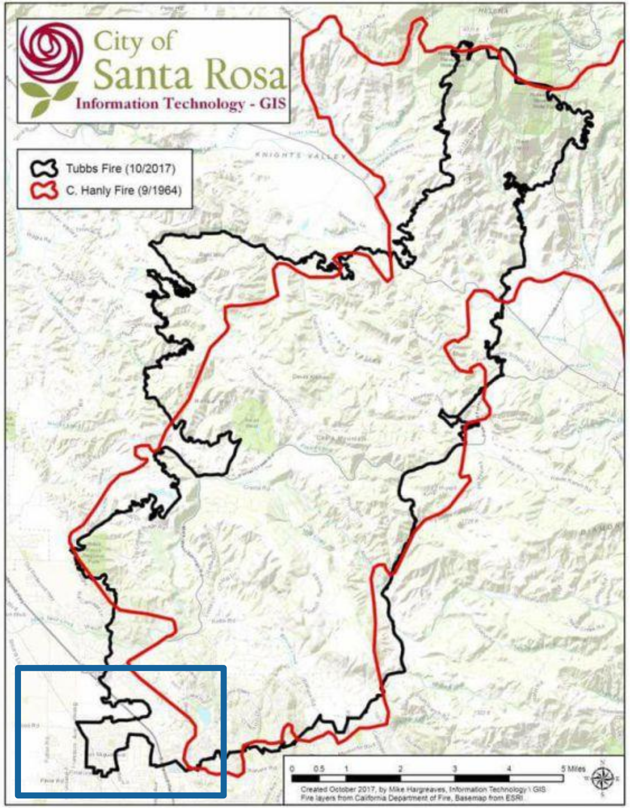
Wind Speed, Fuel, and Topography Contribute to Intensity



Fires with high wind speeds produce higher losses

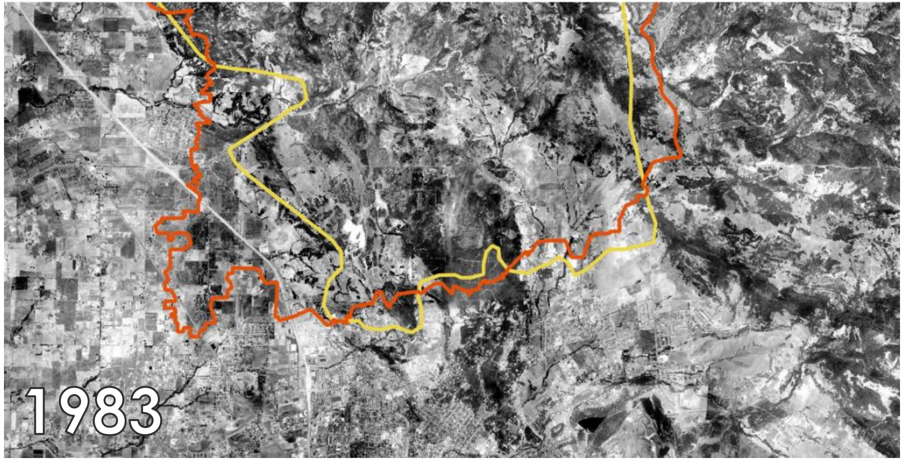
The WUI Is Critical to Understanding Wildfire Risk

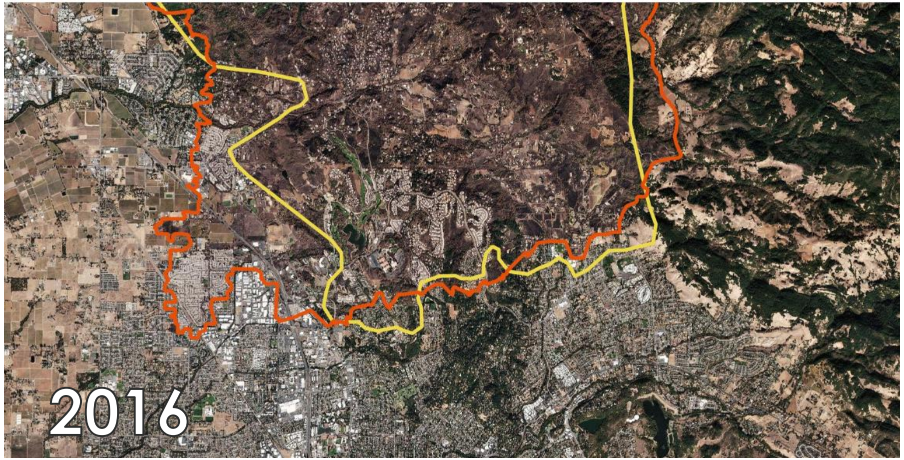
Fountain Grove, AIR Tubbs Fire Damage Survey 2017

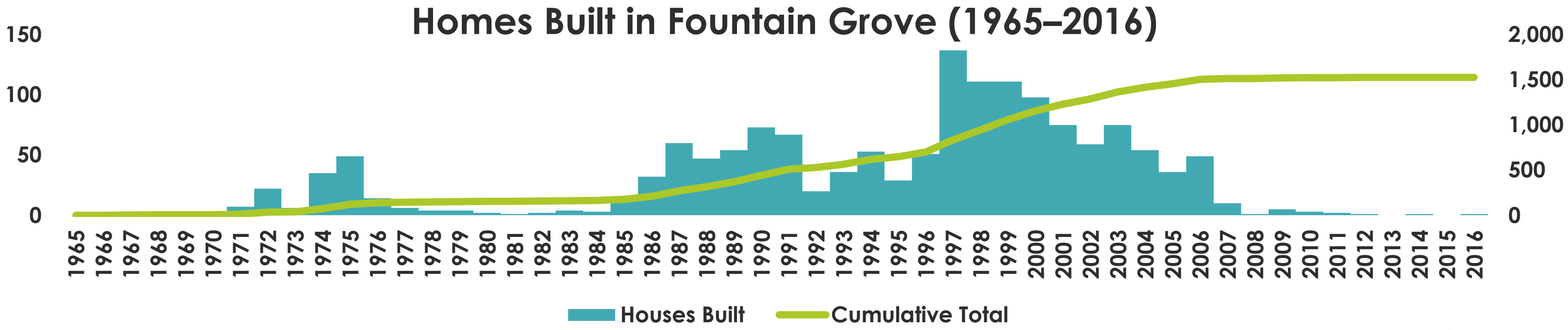


- Residential development intersects with undeveloped wildlands
- Largest economic losses from wildfire will occur in the WUI
  - One-third of U.S. households are located in the WUI
  - 4,000 acres of wildland are converted to WUI *daily*

Northern California Historically Had Hazard, but Not Risk







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

Ember Creation Is the Primary Driver of Structure Ignition

- Material within the fire perimeter is thrown ahead of the main fire front
- Fires can cross roads, rivers, and other natural fire breaks
- Structures are ignited as embers collect on/around them

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How Structure Vulnerability Impacts Risk

Drivers of Structure Loss in Wildfire

- Embers, not flames
- Insurance inspections have traditionally focused on fuels, not the structure itself
- Shift from just hazard identification to mitigation and risk reduction

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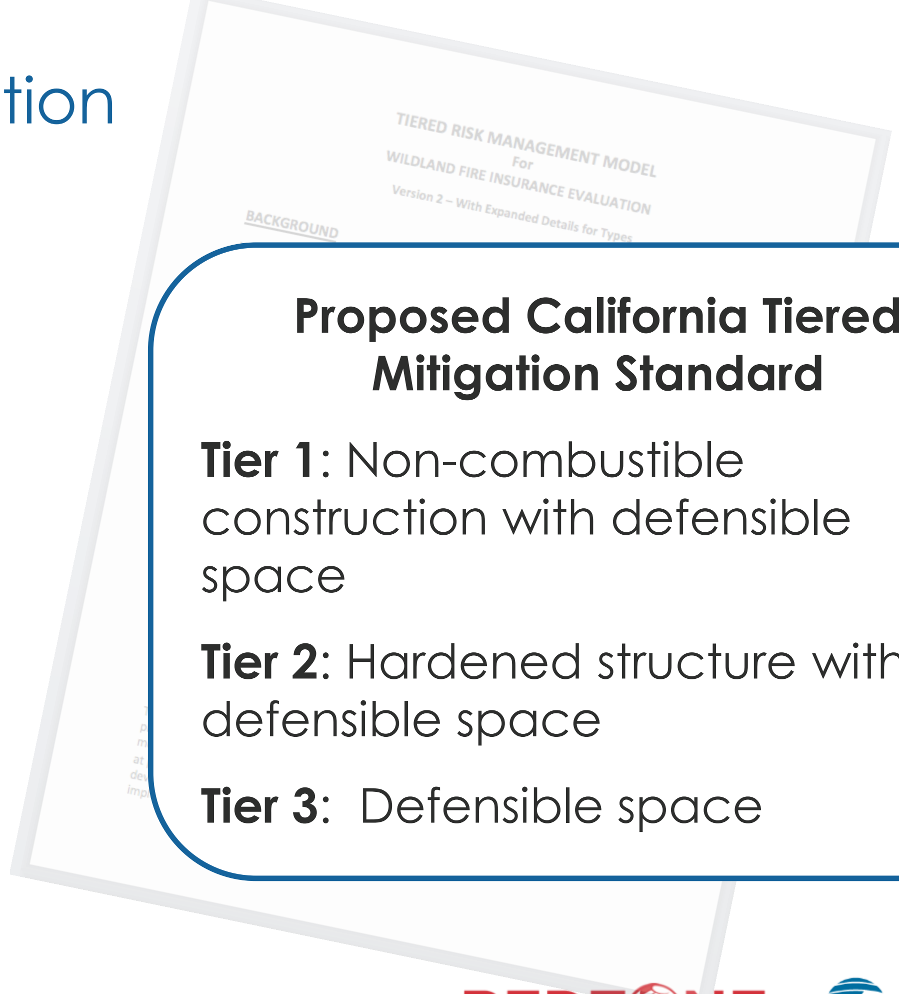
Incorporating Certification

- Certification is effective when homeowner actions are tracked
- Assessment can be conducted by public safety professional, risk manager, or forester
- Feed back into platform to alter underwriting eligibility and portfolio-level risk


TIERED RISK MANAGEMENT MODEL
For
WILDLAND FIRE INSURANCE EVALUATION
Version 2 – With Expanded Details for Types
BACKGROUND

Proposed California Tiered Mitigation Standard

Tier 1: Non-combustible construction with defensible space

Tier 2: Hardened structure with defensible space

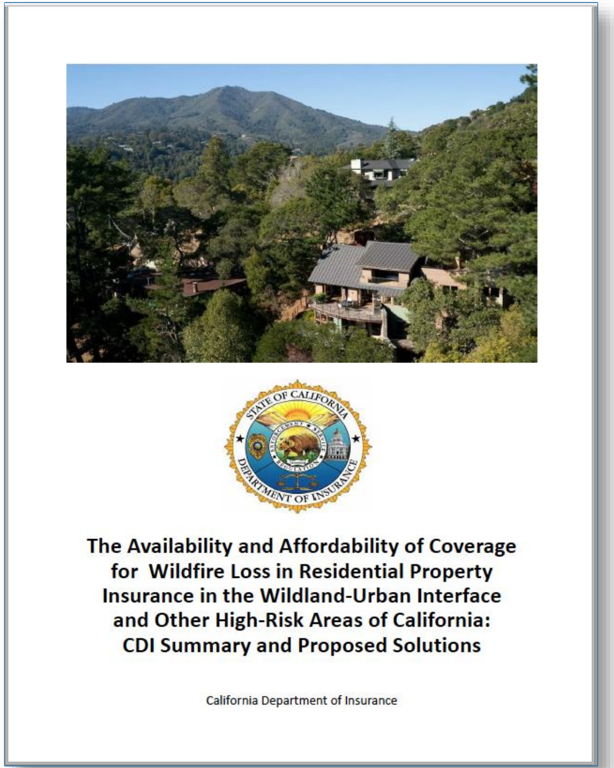
Tier 3: Defensible space

CA DOI Perspective

1. Single score to gate underwriting eligibility creates frustration due to inevitable variability in measuring severity at the property level

2. Advocating for required insurance quote or premium credit based on mitigation requirements

3. Open to new data-driven requirements for homeowners to ease availability of insurance in high risk areas



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Catastrophe Modeling Process and Use Cases

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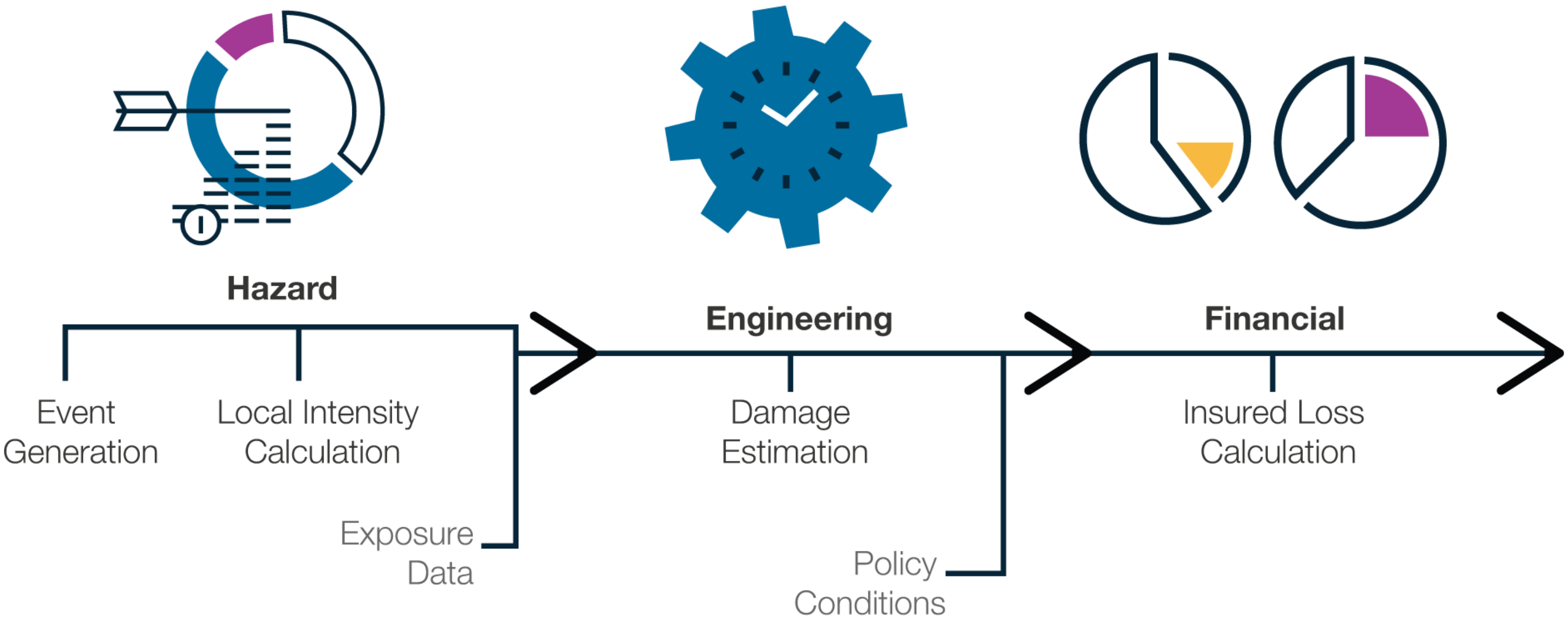
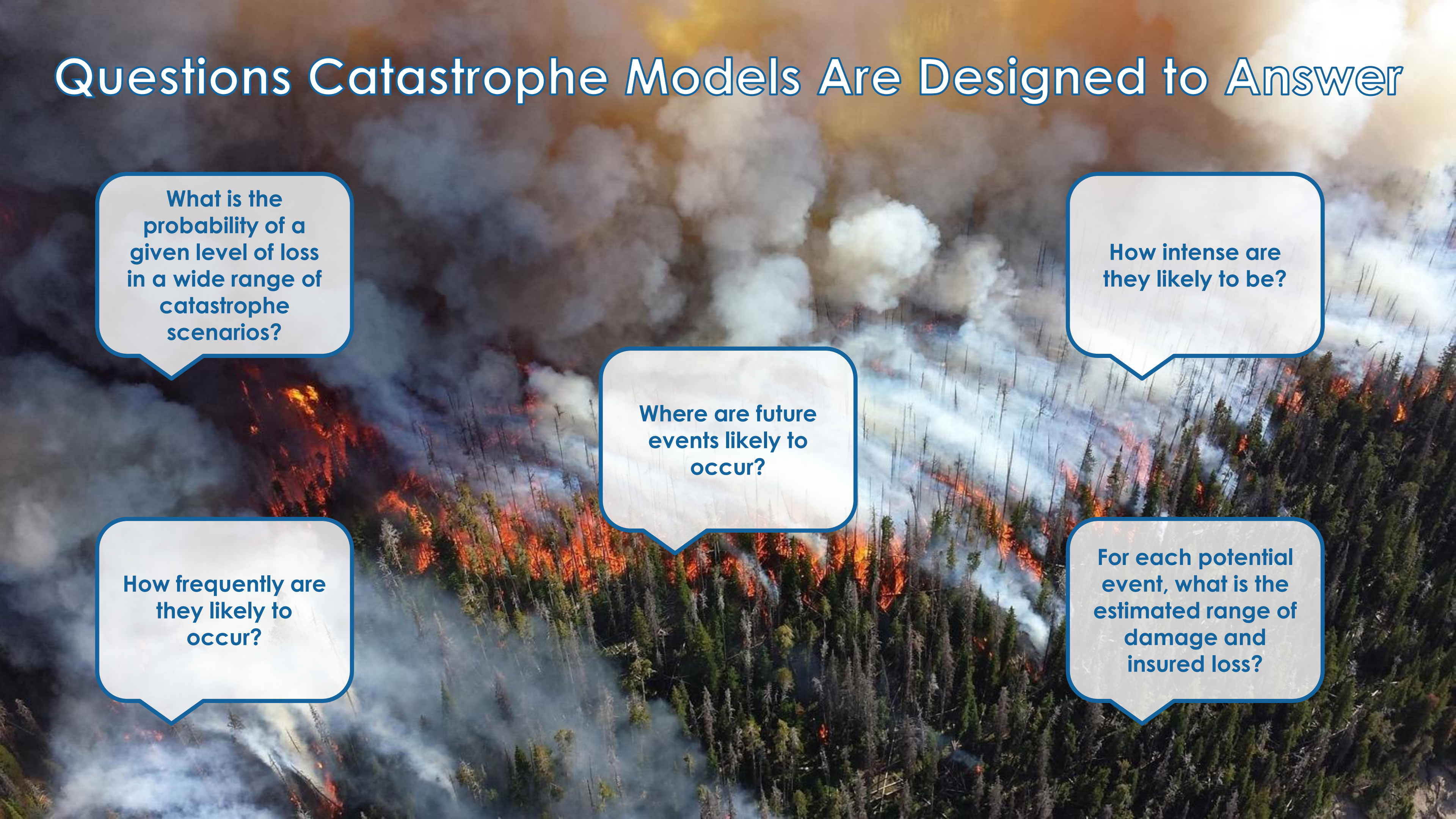
What Is Catastrophe Modeling?

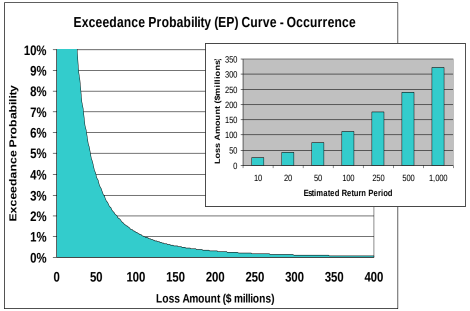



Questions Catastrophe Models Are Designed to Answer
What is the probability of a given level of loss in a wide range of catastrophe scenarios?
How intense are they likely to be?
Where are future events likely to occur?
How frequently are they likely to occur?
For each potential event, what is the estimated range of damage and insured loss?

Catastrophe Models Provide a Wide Range of Outputs

Summary EP Table

Agg/Occ	Perspective	AAL(EV)	SD	20	50	100	250	500	1,000
AGG	Ground Up	6,630,536	24,753,884	30,886,184	65,842,762	95,130,374	167,601,978	225,760,876	371,719,930
	Retained	4,694,386	17,067,704	22,626,276	41,566,458	66,643,214	104,231,455	161,829,671	244,552,125
	Gross	1,936,150	9,400,331	7,081,307	22,815,924	40,152,431	68,563,509	116,955,551	143,440,838
	Net of Pre-Cat	1,936,150	9,400,331	7,081,307	22,815,924	40,152,431	68,563,509	116,955,551	143,440,838
OCC	Ground Up	6,015,196	23,605,984	27,770,160	60,079,085	89,660,760	162,588,072	217,879,127	344,790,310
OCC	Retained	4,229,041	16,363,640	19,909,887	37,191,259	59,281,633	99,172,459	156,816,491	244,536,739
	Gross	1,824,107	8,987,294	6,675,370	22,202,705	39,498,091	68,519,883	111,110,691	140,808,555
	Net of Pre-Cat	1,824,107	8,987,294	6,675,370	22,202,705	39,498,091	68,519,883	111,110,691	140,808,555



Year	Event ID	Peril	Ground Up Mean	Gross Mean
7046	190252	TC	354,521,220,468	329,990,128,579
7726	208487	TC	352,861,090,276	329,408,630,882
9657	260515	TC	315,533,376,782	290,415,112,308
6636	179421	TC	311,391,560,655	286,924,607,423
5082	137043	TC	288,892,594,064	261,430,695,848
7695	207623	TC	277,575,451,393	257,873,322,806
5227	141054	TC	264,574,317,908	241,334,395,213
2859	76992	TC	254,471,024,991	234,848,485,701
373	9943	TC	251,145,478,732	227,156,239,856
8090	218346	TC	241,426,505,957	218,192,035,523
2956	79565	TC	242,405,569,550	216,834,993,072

- Exceedance Probability (EP): The probability that a loss will exceed a certain amount in a simulated year
- Average Annual Loss (AAL): The average of all modeled events, weighted by their probability of annual occurrence

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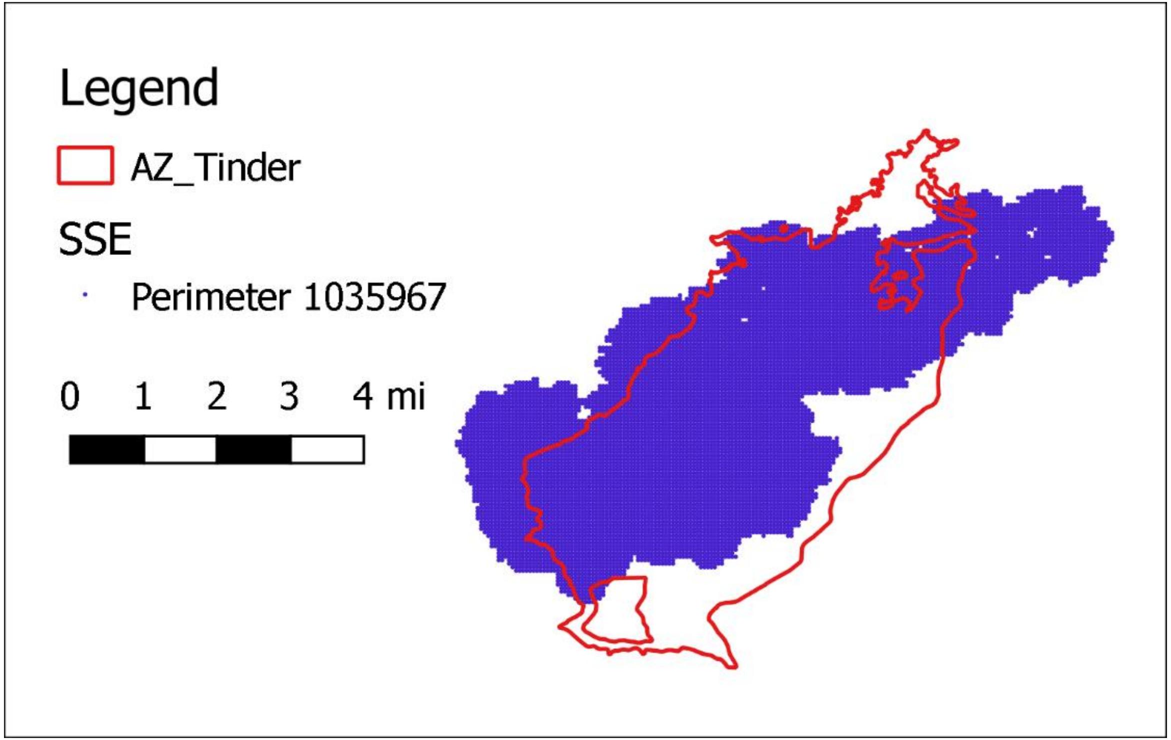
Similar Stochastic Events (SSEs) Support Understanding of Hazard Concentration and Real-Time Loss Estimates



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How (Re)insurers Use Model Output

Enterprise Risk Management

- Manage the impact of catastrophe risk on surplus
- Communicate with rating agencies
- Accumulation/risk-aggregation management

Risk Transfer

- Use models to evaluate reinsurance purchases
- Streamline efficiency of communication with reinsurance intermediaries

Pricing

- Use model outputs in rate filings and in pricing of individual policies or programs

Underwriting

- Catastrophe model outputs used for risk selection and pricing at the point of sale

Claims

- Advance planning, resource deployment, and post-event communications

Portfolio Optimization

- Identify areas to grow or retract using model-based risk metrics
- Perform model-based analyses to understand and manage the drivers of catastrophe risk

Understanding Accumulated Risk

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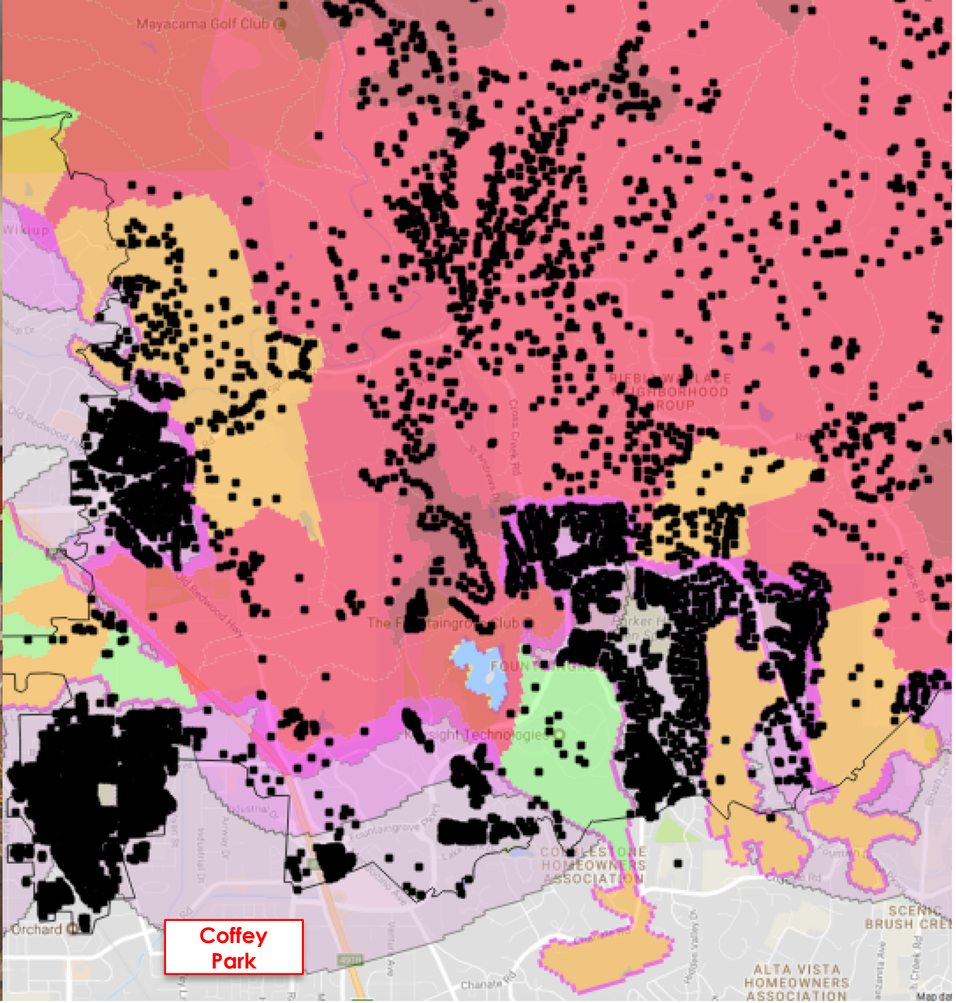

- 50% of the structure losses in the Tubbs Fire were in urban areas
- Accurately classifying the WUI ember risk dramatically improved these estimates: 96% of the burned homes were classified as *at risk*

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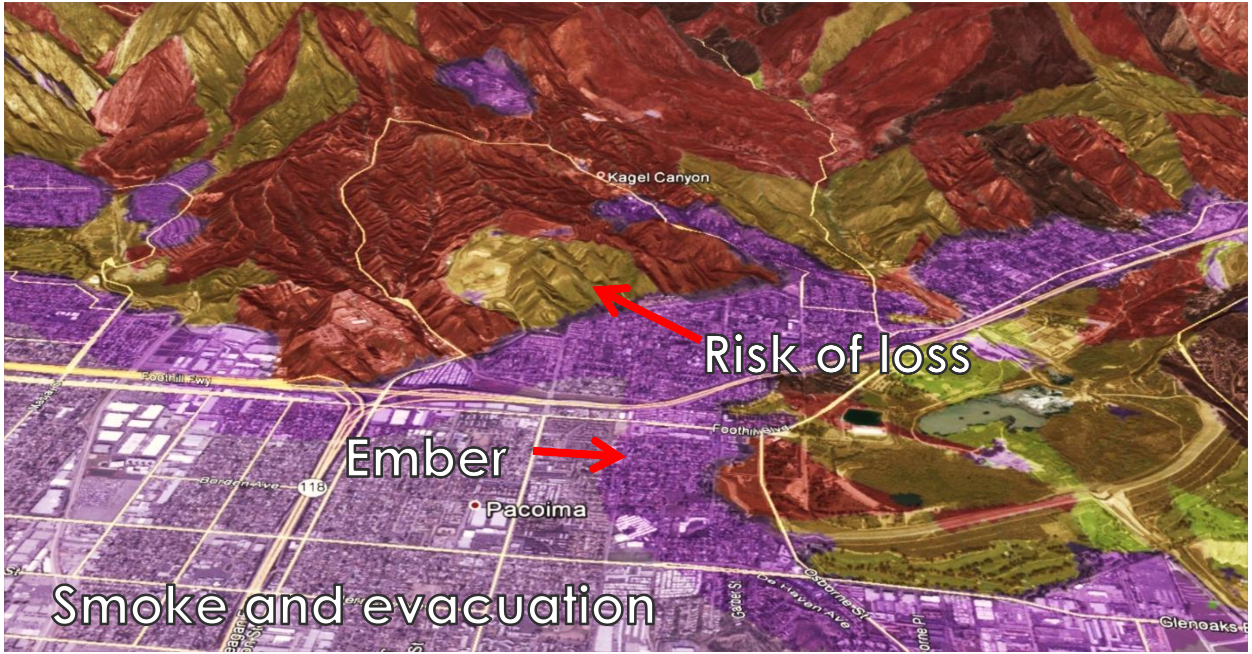
Understand the Comprehensive Risk



- Incorporate fire frequency and severity for more accurate assessments of loss potential
- Identify potential for ember showers and structure-to-structure ignition
- Provide an overall score and AALs to inform underwriting decisions

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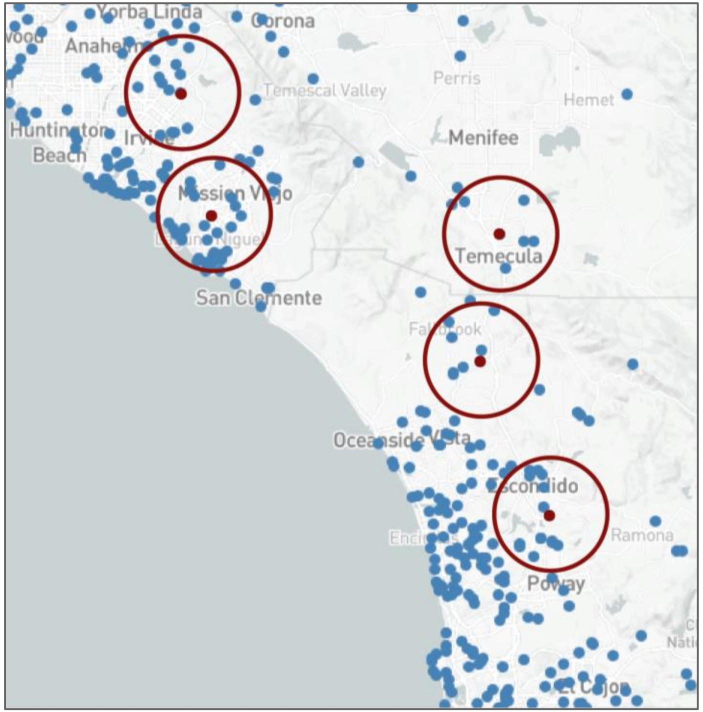
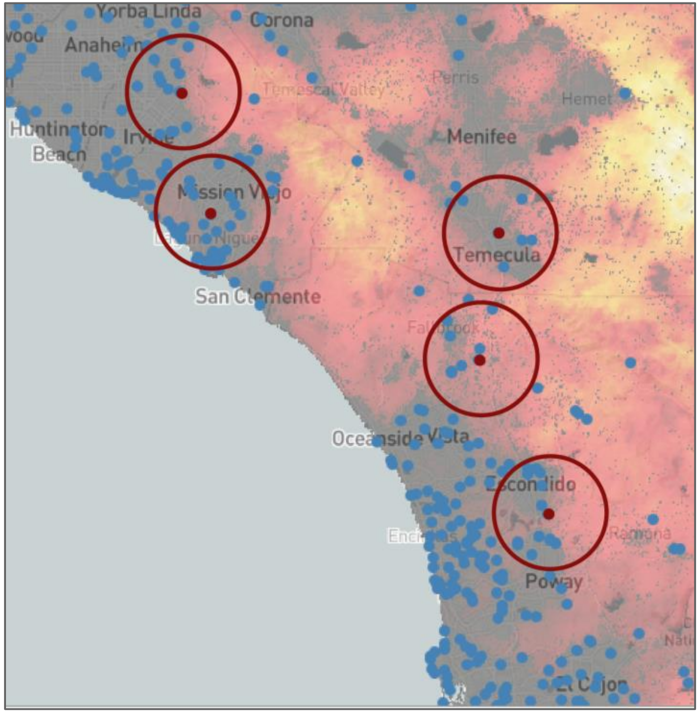
Accumulation by Proximity vs. Risk

Accumulated liability using policy proximity

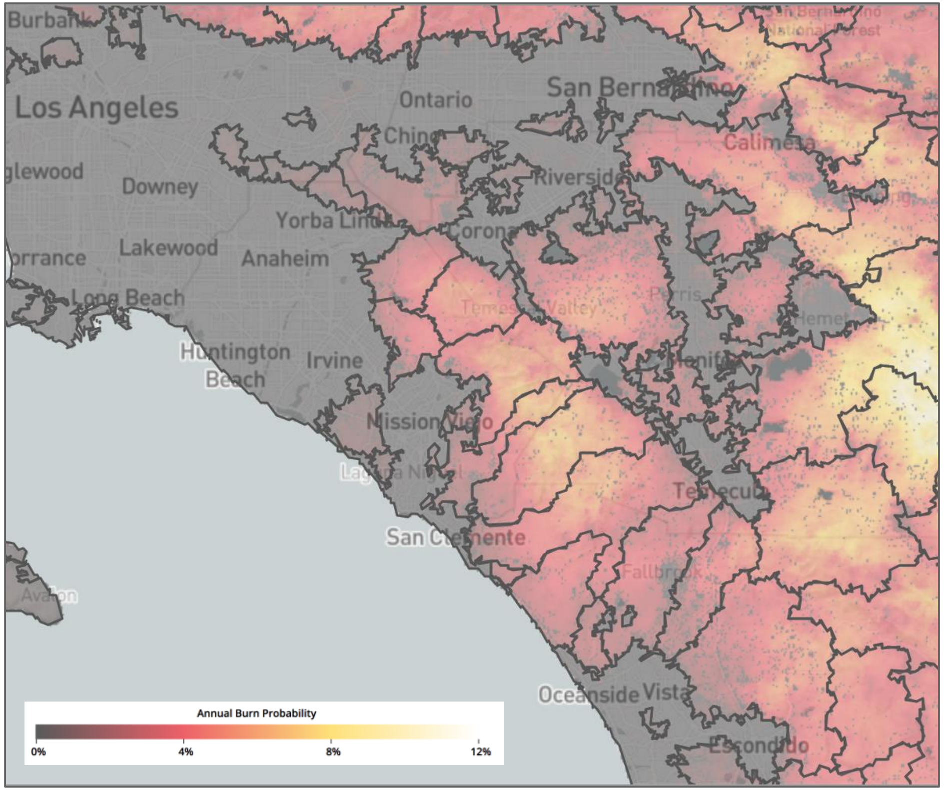


Proximity-based zones on wildfire risk map



Defining Correlated Risk Zones

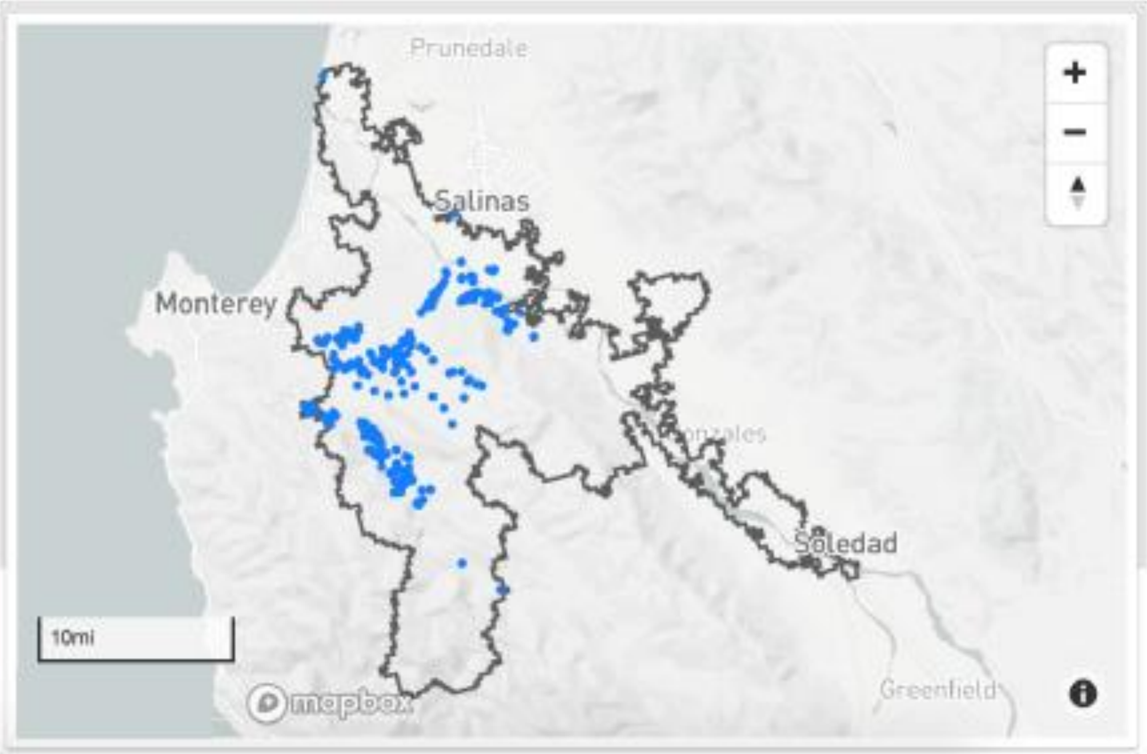
- 10,000 years of wildfire simulations
- 25 years of historical perimeters
- Ember risk and hazard data for the WUI



Correlated Risk Zones: Context for "Dots on a Map"

Zone Analysis

274	**$345m**
Policy Count	Total Insured Value
1.97%	**$2.1m**
Max Burn Probability	Probable Maximum Loss



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Putting It All Together

Applying New Tools to Wildfire Risk Management

- ✓ Physically-based catastrophe modeling
- ✓ Risk-based accumulation modeling
- ✓ Underwriting support
- ✓ Portfolio management and optimization
- ✓ Targeted decision support