Date: 9/22/21

Virtual Meeting
CATASTROPHE RISK (E) SUBGROUP
Tuesday, September 28, 2021
12:00 – 1:00 p.m. ET / 11:00 a.m. – 12:00 p.m. CT / 10:00 – 11:00 a.m. MT / 9:00 – 10:00 a.m. PT

ROLL CALL

Wanchin Chou, Chair	Connecticut	Halina Smosna	New York
Robert Ridenour, Vice Chair	Florida	Tom Botsko	Ohio
Laura Clements	California	Andrew Schallhorn	Oklahoma
Judy Mottar	Illinois	Will Davis	South Carolina
Gordon Hay	Nebraska	Miriam Fisk	Texas
Anna Krylova	New Mexico		

NAIC Support Staff: Eva Yeung

AGENDA

1. Discuss its Working Agenda Items—*Wanchin Chou (CT)* — Attachment A

2. Hear an Update from the Catastrophe Model Technical Review Ad Hoc Group —*Wanchin Chou (CT) and Lynne Wehmueller (CA)*

3. Hear Presentation from Karen Clark & Company Regarding KCC US Wildfire Reference Model—*Glen Daraskevich (KCC)* — Attachment B

4. Discuss the Possibility of Allowing Third-Party Models to Calculate the Catastrophe Model Losses—*Wanchin Chou (CT)*

5. Discuss Any Other Matters Brought Before the Subgroup—*Wanchin Chou (CT)*

6. Adjournment

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Attachment A

Priority 1 – High priority
Priority 2 – Medium priority
Priority 3 – Low priority

CAPITAL ADEQUACY (E) TASK FORCE
WORKING AGENDA ITEMS FOR CALENDAR YEAR 2021

Capital Adequacy (E) Task Force

2021 #	Owner	2021 Priority	Expected Completion Date	Working Agenda Item	Source	Comments	Date Added to Agenda
				Carry-Over Items Currently being Addressed – P&C RBC			
1	Cat Risk SG	1		Continue development of RBC formula revisions to include a risk charge based on catastrophe model output:			
			Year-end 2022 or later	a) Evaluate other catastrophe risks for possible inclusion in the charge - determine whether to recommend developing charges for any additional perils, and which perils or perils those should be.	Referral from the Climate and Resiliency Task Force. March 2021	4/26/21 - The SG expose the referral for a 30-day exposure period. 6/1/21 - The SG forwarded the response to the Climate and Resiliency Task Force.	4/26/2021
2	Cat Risk SG	1	Year-end 2022 or later	Evaluate the possibility of allowing additional third party models or adjustments to the vendor models to calculate the cat model losses		7/15/21 - The SG is continue evaluating this item.	12/6/2019
3	Cat Risk SG	1	2021 Spring Meeting	Modify instructions to PR027 Interrogatories that clarify how insurers with no gross exposure to earthquake or hurricane should complete the interrogatories		10/27/20 - expose the propsal for 30 day comment period 3/8/21 - The SG adopted the proposal 2020-08-CR at the Spring National Meeting.	10/19/2020
4	Cat Risk SG	1	2022 Spring Meeting or later	Implement Wildfire Peril in the Rcat component (For Informational Purpose Only)		7/15/21 - The SG is continue studying this item.	3/8/2021

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KCC US Wildfire Reference Model

Glen Daraskevich
Senior Vice President

September 28, 2021

The Innovation and Technology Leader in Catastrophe Risk Modeling

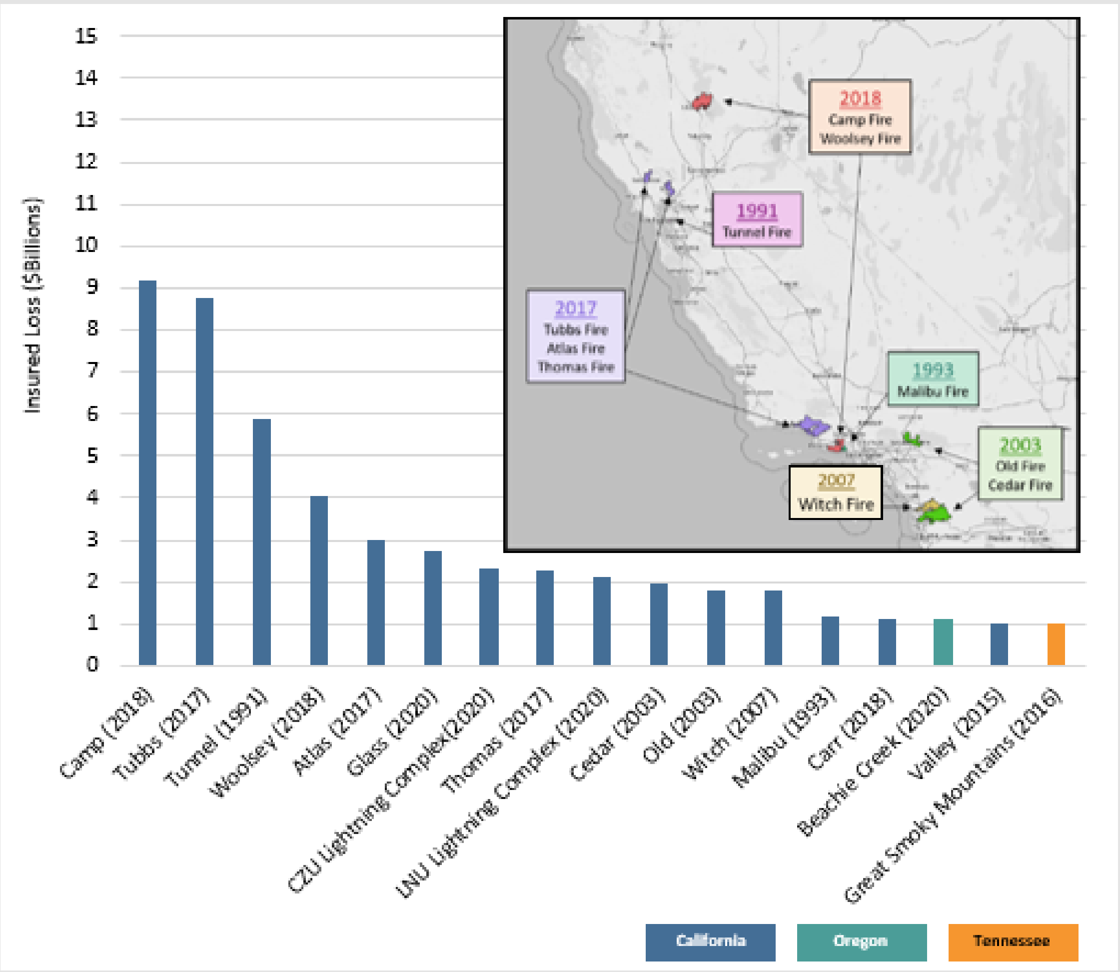
Discussion Topics

- **Current wildfire trends**

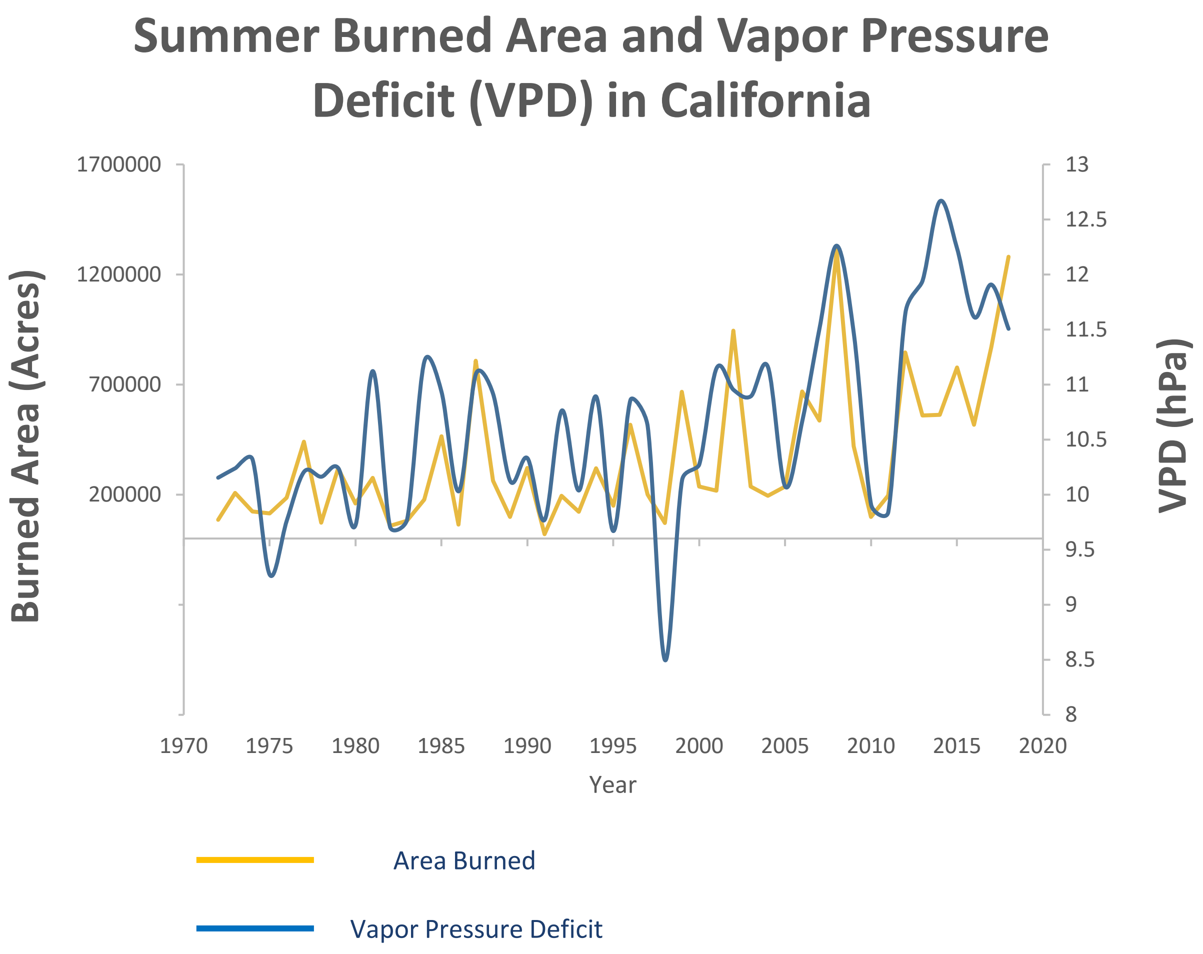
- **Overview of KCC US Wildfire Reference Model**
  - **Hazard Module**
  - **Vulnerability Module**

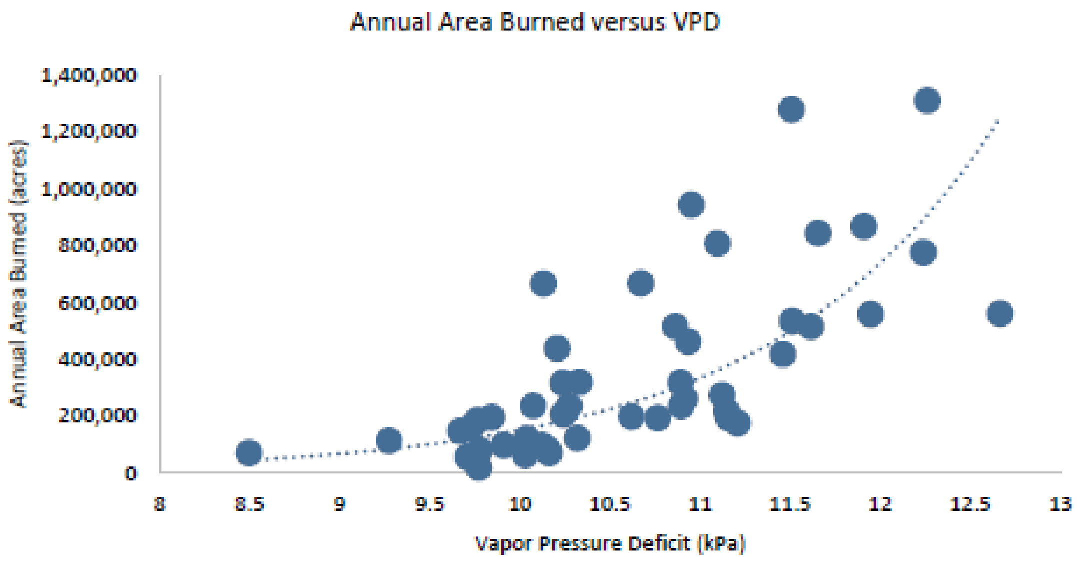
Wildfires are a Major Driver of Insured Losses in the US, Particularly in California

- Since 1985, the 2017-2018 wildfires are responsible for 60% of total loss, and the 2020 wildfires are responsible for 20% of total loss



Observed Relationship Between a Warming Climate and Wildfires

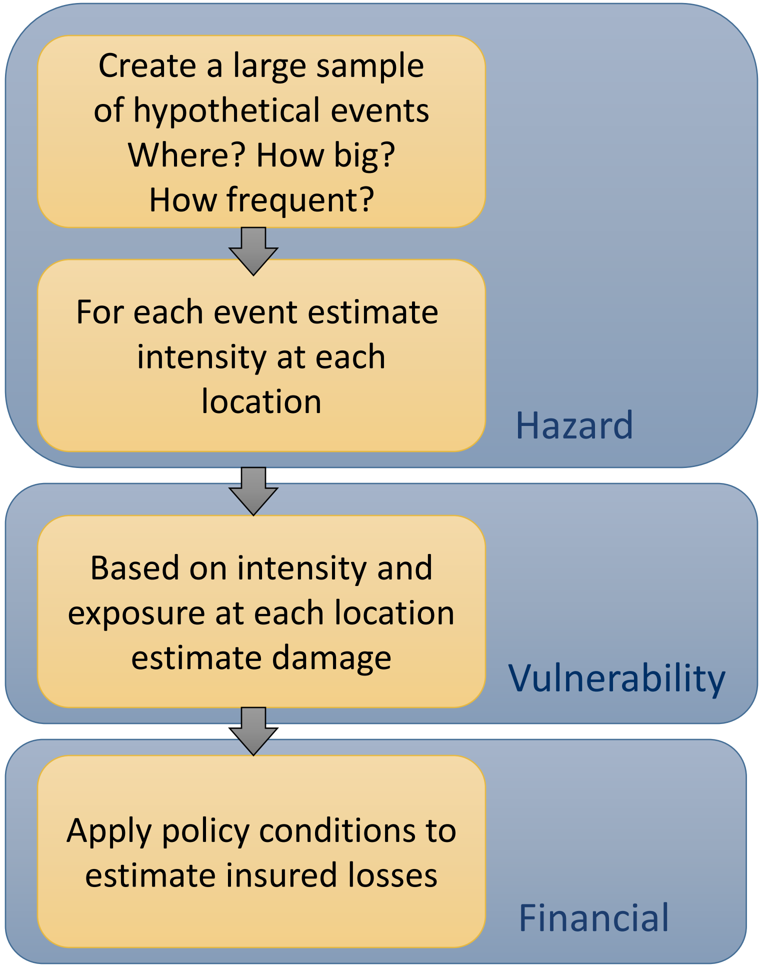




- Area burned in the Western US has increased exponentially in response to past increases in VPD
- Global climate models suggest the VPD in California will increase an additional 10% by 2050
- The observed upward trend in Western US fires will likely persist in a warming climate

Components of the KCC Wildfire Reference Model

Catastrophe Model



Catastrophe Model Results – Loss Table

Sim Year	Event ID	Loss ($ million)
1	1	253
1	2	41
2	1	5
3	1	1627
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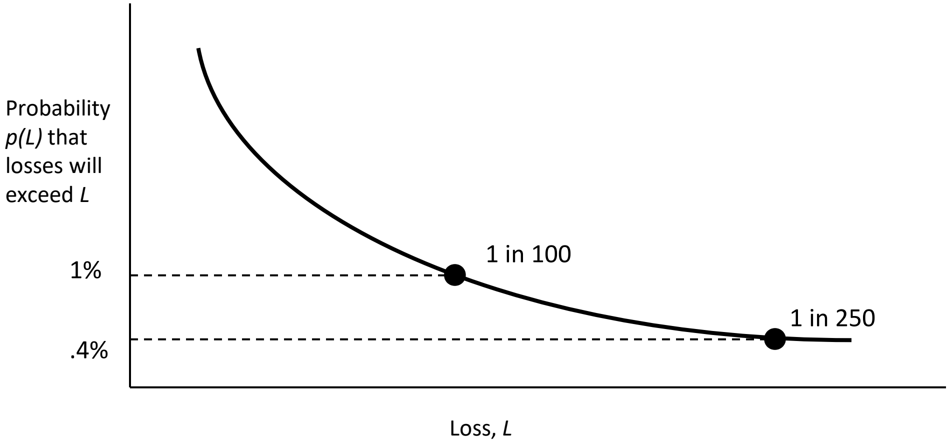
Catastrophe Model Results – Loss Exceedance Probability (EP) Curve



Factors That Influence Fire Spread and Propagation

- Fuel type and characteristics
- Moisture
- Climatological winds
- Topography
- Branding and spotting
- Building-to-building burning
- Fire suppression activities

Wildland Fuels

- Wildlands have **2 main fuel layers**

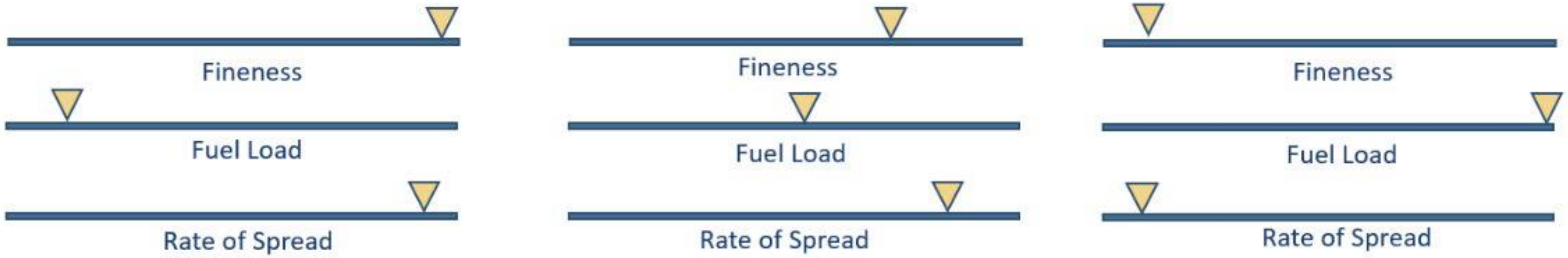
- **Canopy Fuels**
  - Needles/leaves, branches

- **Surface Fuels**
  - Leaf/needle litter, branches, logs, shrubs, grass

Different Surface Fuels Characteristics Influence How Quickly a Wildfire Can Progress

- Fuel load - density of a single unit of fuel which determines the length of time a fuel will burn and the intensity of the fire
- Fineness - relative size of the fuel particles which impacts the speed at which the fuel absorbs heat and will ignite
- Rate of spread – how quickly a fire can progress
- KCC classifies fuels according to the Scott and Burgan fire fuel model

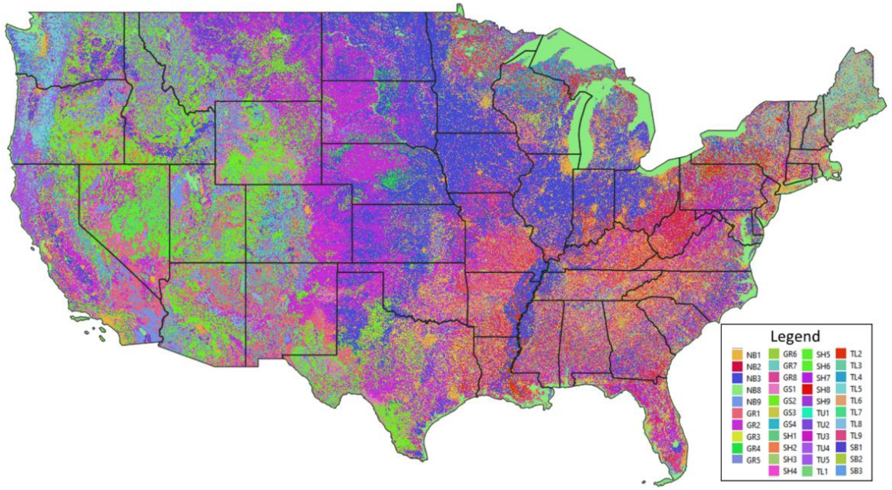
Grass | **Shrubs** | **Slash**



Fuel Types Included in the KCC Model

Fuel Model			S=Static D=Dynamic	Fuel Load 1-h	10-h	100-h	Live herbaceous	Live woody	Fineness 1-h	Live and dead herb.	Live woody	d Fuel bed dept	m Dead fuel moi of extinction	Characteristic SAV	Packing Bulk density	Relative packing ratio
				tons/acre					ft²/ft³			ft	%	ft²/ft³	lb/ft³	
GS2	122	Moderate load, dry climate grass-shrub	D	0.5	0.5	0	0.6	1.0	2,000	1,800	1,800	1.5	15	1,827	0.08	0.35
GS3	123	Moderate load, humid climate grass-shrub	D	0.3	0.25	0	1.45	1.25	1,800	1,600	1,600	1.8	40	1,614	0.08	0.33
GS4	124	High load, humid climate grass-shrub	D	1.9	0.3	0.1	3.4	7.1	1,800	1,600	1,600	2.1	40	1,631	0.28	1.12
SH1	141	Low load, dry climate shrub	D	0.25	0.25	0	0.15	1.3	2,000	1,800	1,600	1.0	15	1,674	0.09	0.36
SH2	142	Moderate load, dry climate shrub	S	1.35	2.4	0.75	0	3.85	2,000	--	1,600	1.0	15	1,672	0.38	1.56
SH3	143	Moderate load, humid climate shrub	S	0.45	3.0	0	0	6.2	1,600	--	1,400	2.4	40	1,371	0.18	0.64
SH4	144	Low load, humid climate timber-shrub	S	0.85	1.15	0.2	0	2.55	2,000	1,800	1,600	3.0	30	1,682	0.07	0.30
SH5	145	High load, dry climate shrub	S	3.6	2.1	0	0	2.9	750	--	1,600	6.0	15	1,252	0.07	0.21
SH6	146	Low load, humid climate shrub	S	2.9	1.45	0	0	1.4	750	--	1,600	2.0	30	1,144	0.13	0.39
SH7	147	Very high load, dry climate shrub	S	3.5	5.3	2.2	0	3.4	750	--	1,600	6.0	15	1,233	0.11	0.35

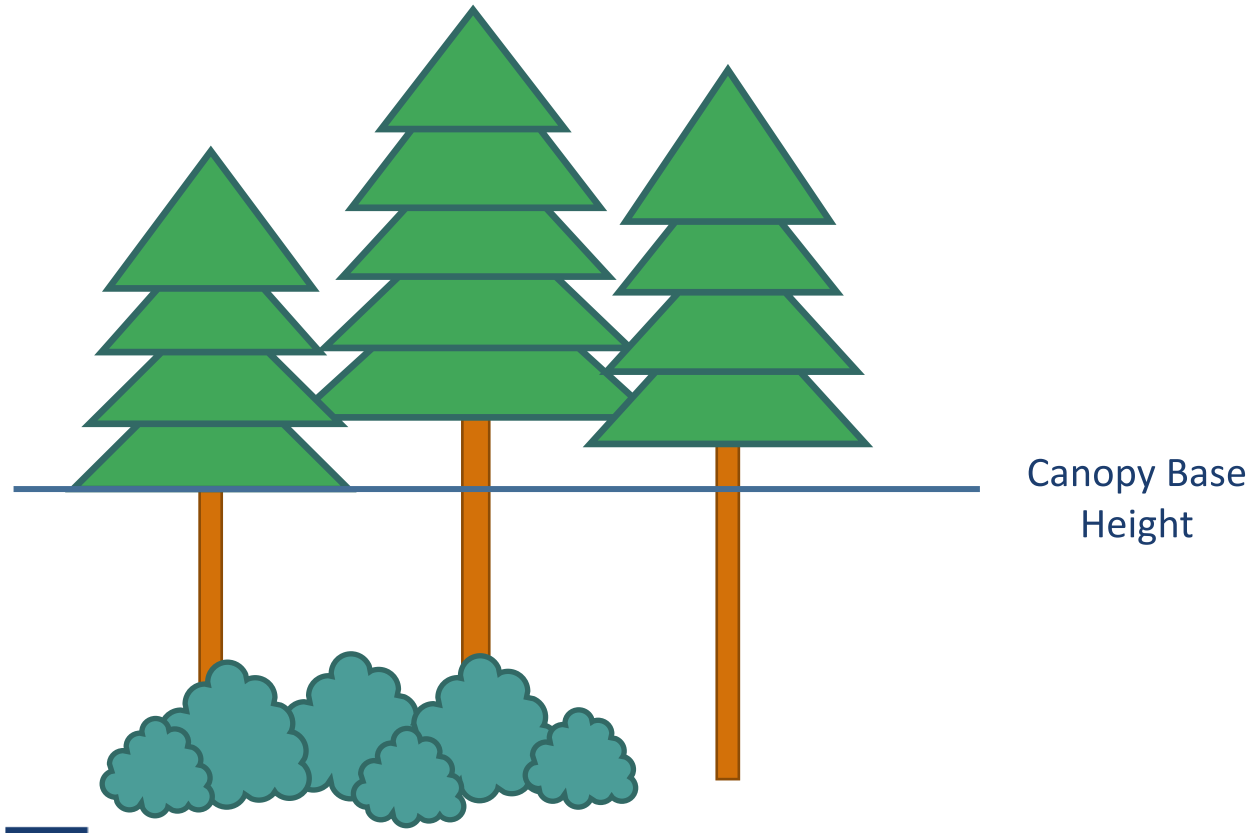
Partial list of fuels included in the model



Distribution of fuels across the US

Modeling Wildfire: Surface and Crown Fires

- **Not every fire is a crown fire!**
- **Surface fuels** can burn independently of the canopy
- Under certain conditions, a surface fire can ignite the canopy, causing a **crown fire**



Active Crown Fire

Surface Fire

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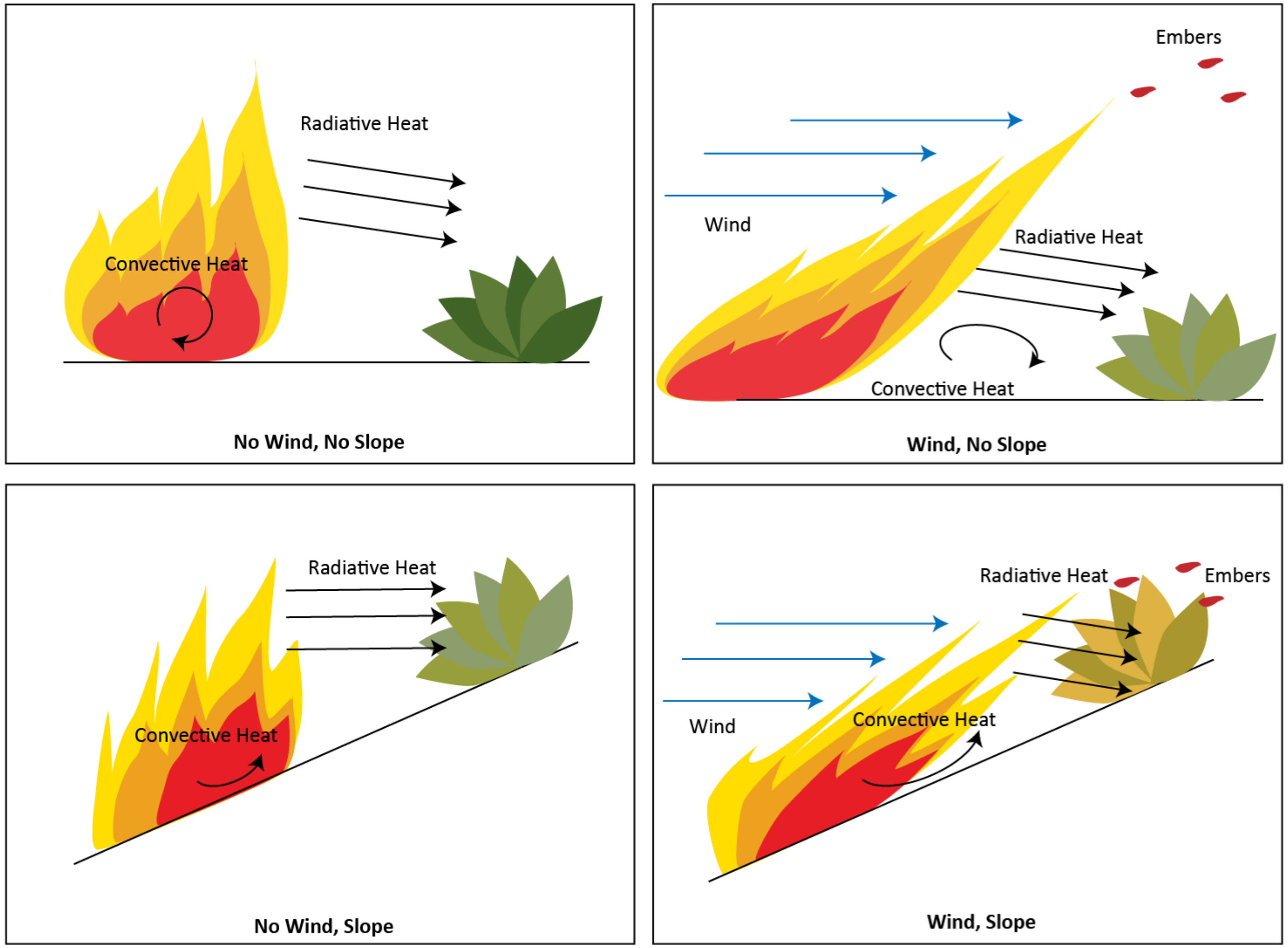
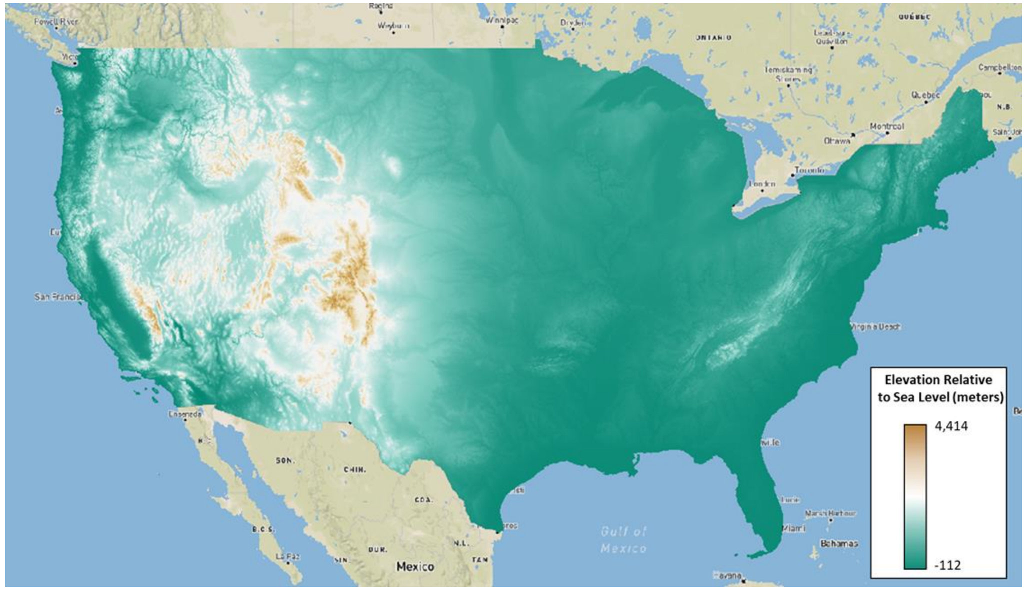
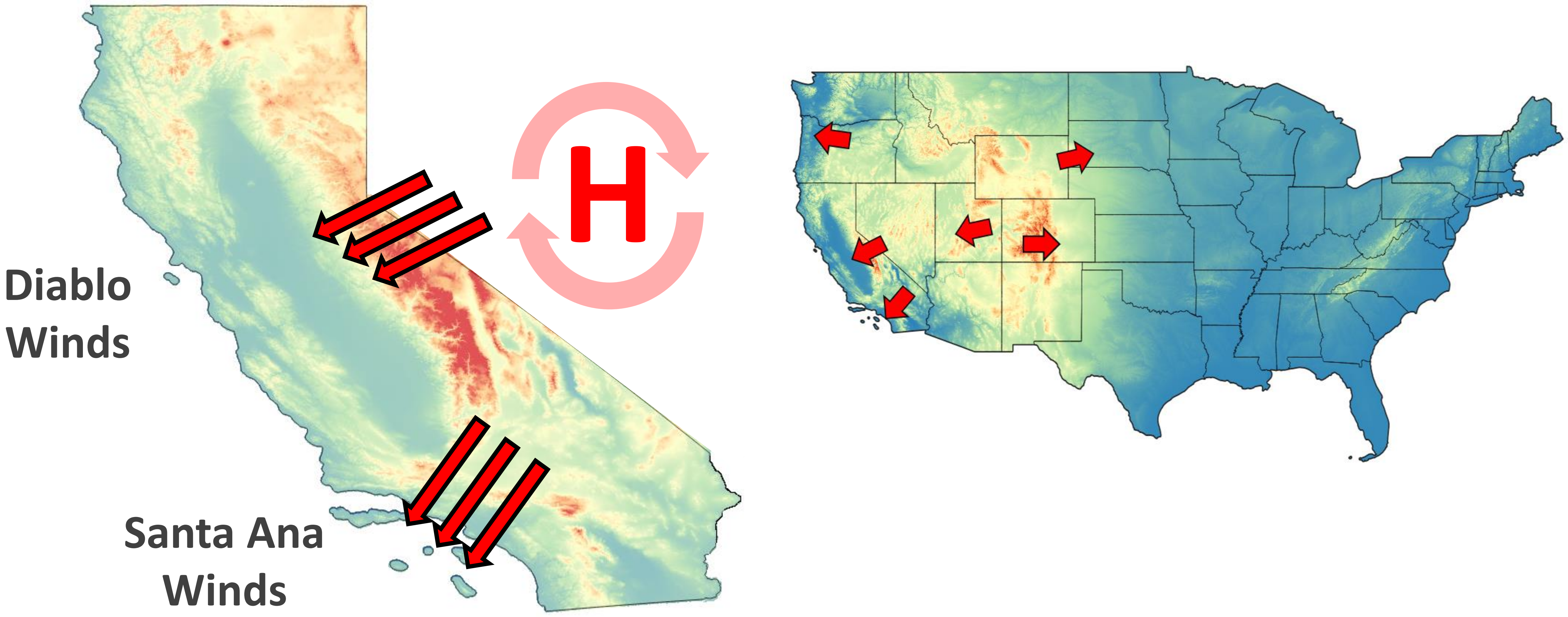
Increasing Wind and Slope Accelerate Fire Spread





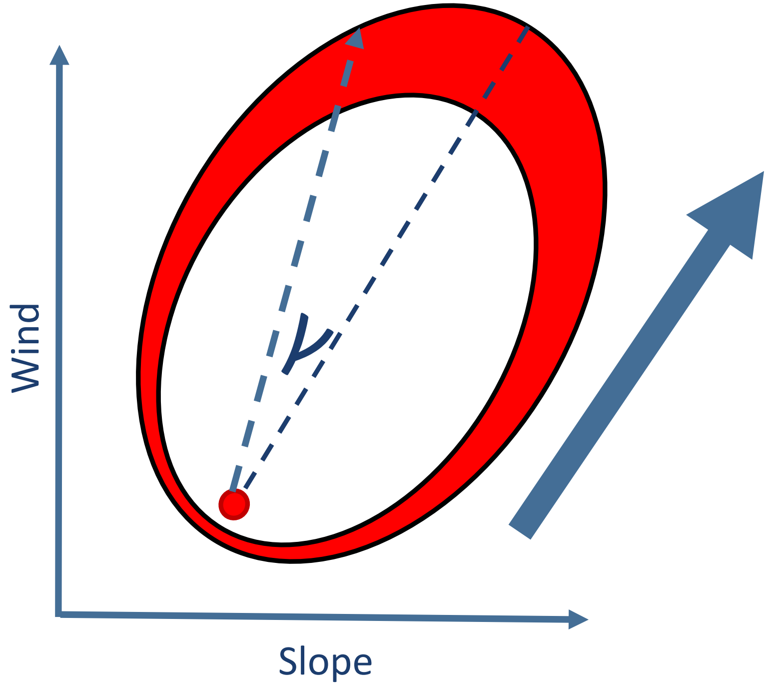
Slope is calculated using 30-meter elevation data

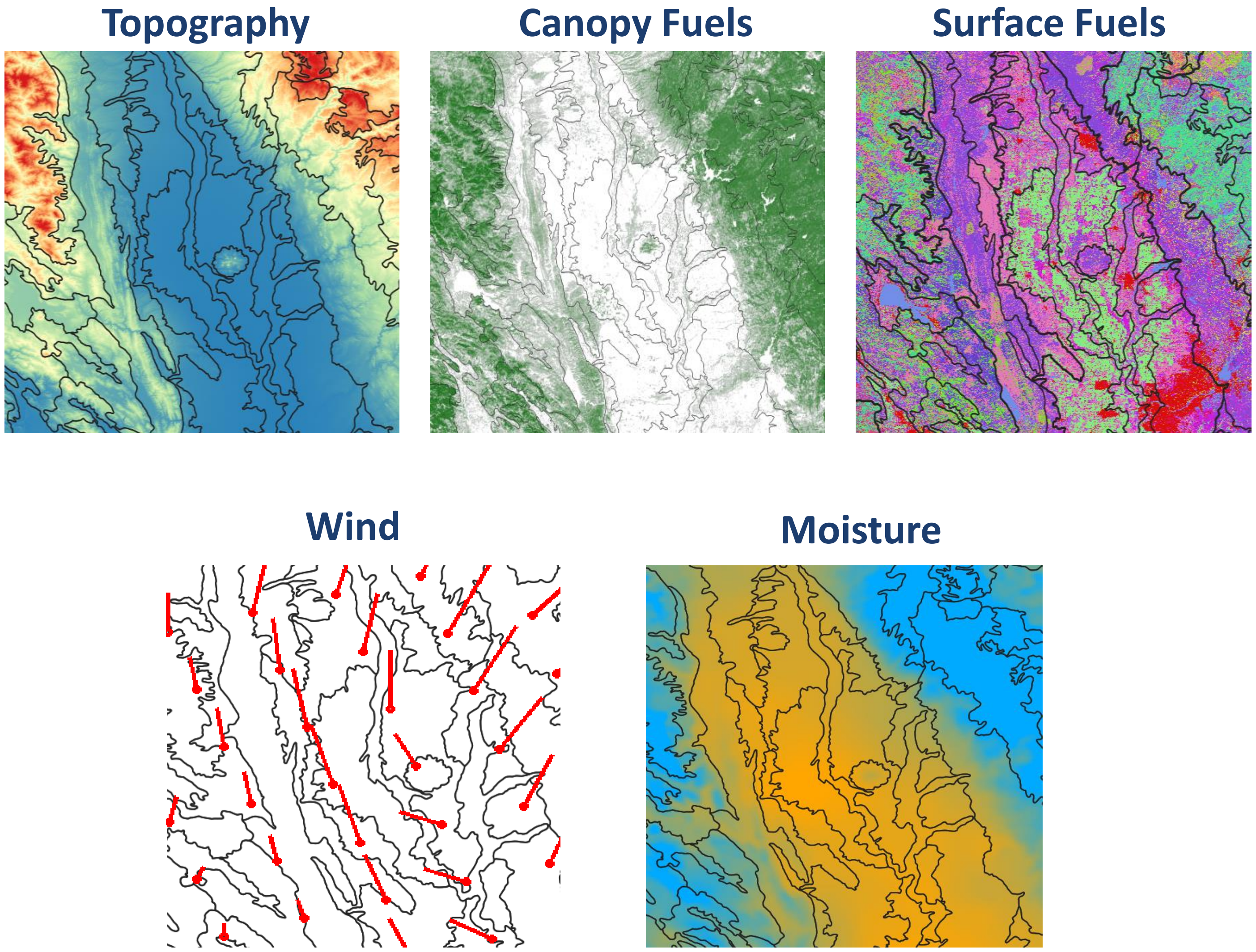
Katabatic Winds Are A Primary Driver of Severe Wildfire Events



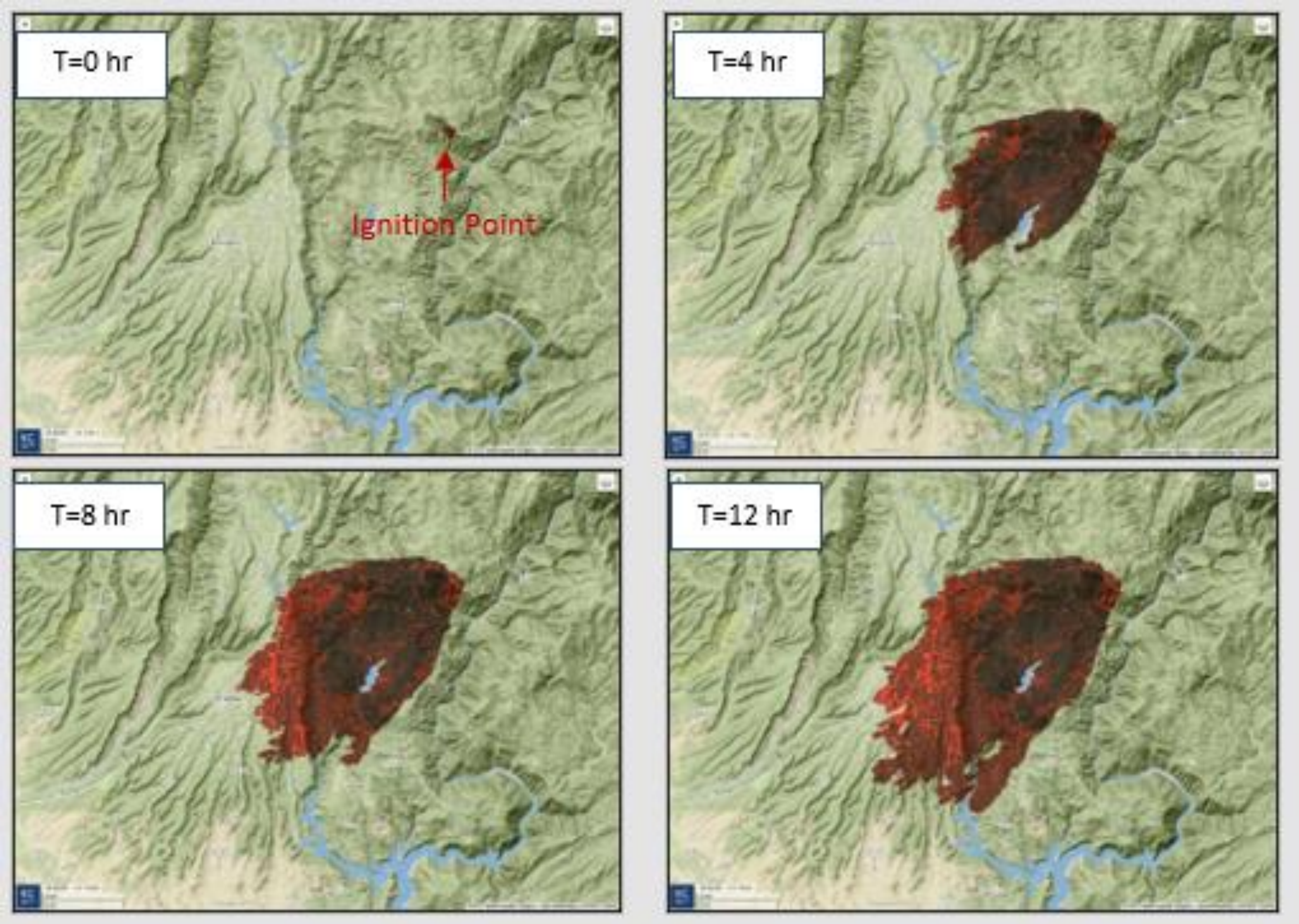
Simulating Surface Fire Spread – Point Ignitions

- In uniform conditions, fires are **circular**
- **Slope and wind** cause a fire to become **elliptical**
- With realistic topography, wind, and fuels, a new front can be modeled using Huygens Principal
- As a fire front evolves every point along the front acts as a new ignition point





KCC Event Footprint Progression for the Camp Fire



How KCC Incorporates Branding and Spotting

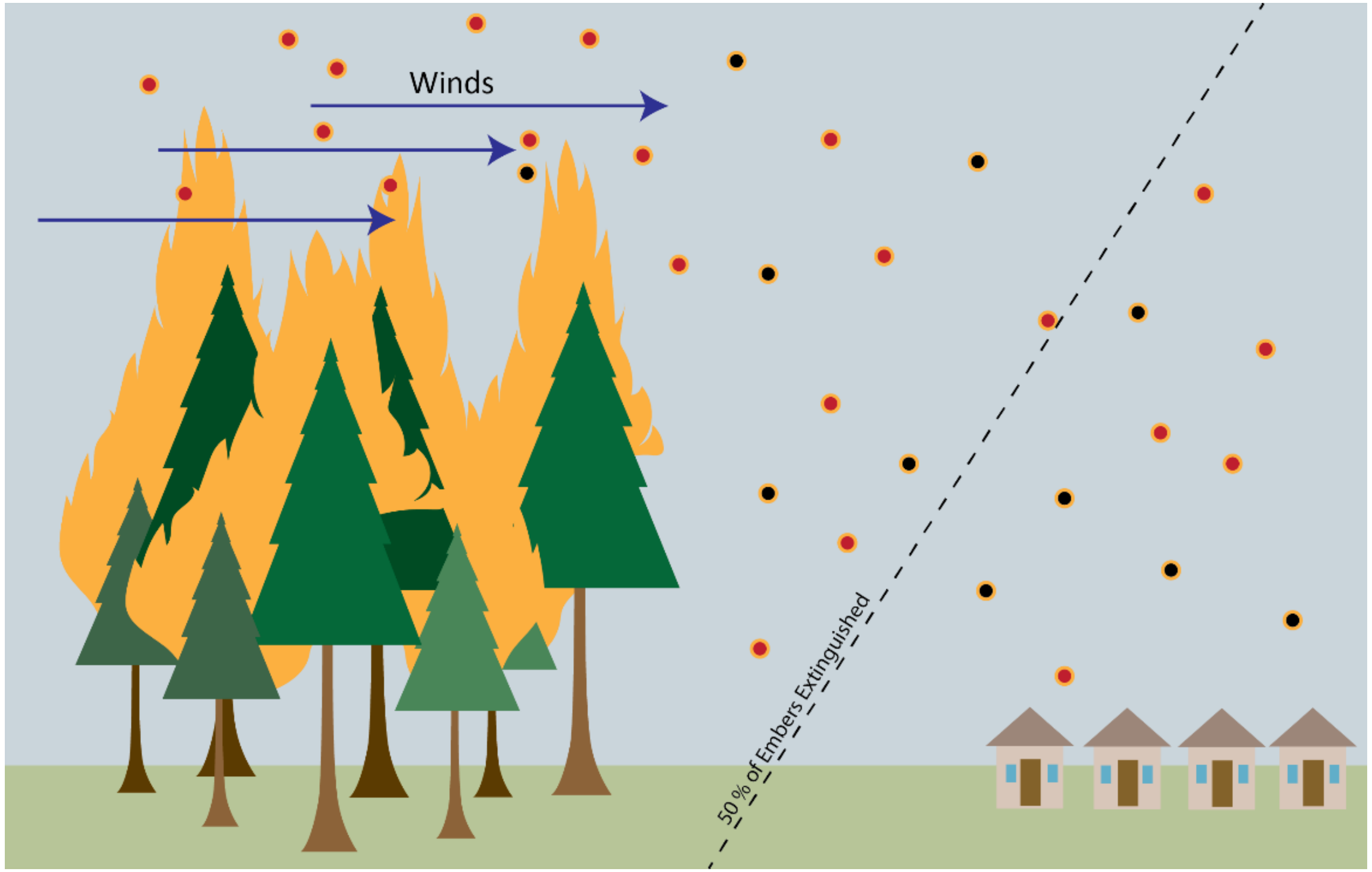
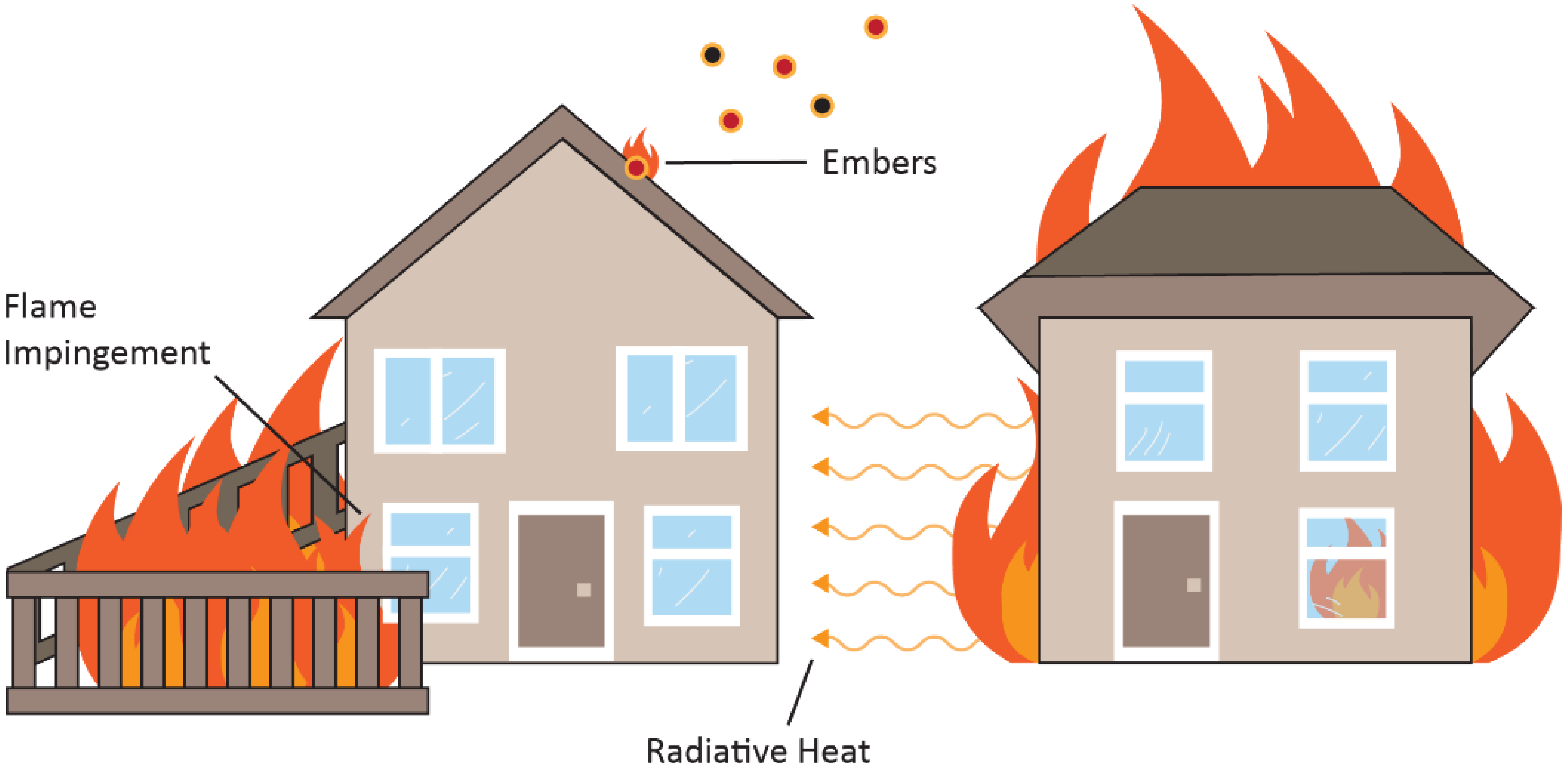


Illustration of how embers move when carried by winds with farther flung embers less likely to be ignited than those close

Urban Conflagration – Capturing Building-to-Building Burning in the Model



Wildfire Vulnerability Module

Vulnerability Functions Address Damage to the Building's Structure, Exterior, and Interior Elements

- ## Primary Attributes
  - Construction type
  - Occupancy type
  - Number of stories
  - Age of structure
  - Community Fire Rating

Secondary Characteristic
Defensible Space
Roof Coverings and Assemblies
Ventilation Type
Eaves and/or Overhangs
Wall Siding Type
Glazing Type
Sprinkler Type
Decks and Other Attached Structures

Metal (top-left) and clay tile (top-right) roof covers are non-combustible; asphalt shingles (bottom-left) and wood shingles (bottom-right) are combustible unless specifically reinforced

KCC Community Fire Rating Implementation

Fire Breaks

CALIFORNIA FireSafe COUNCIL

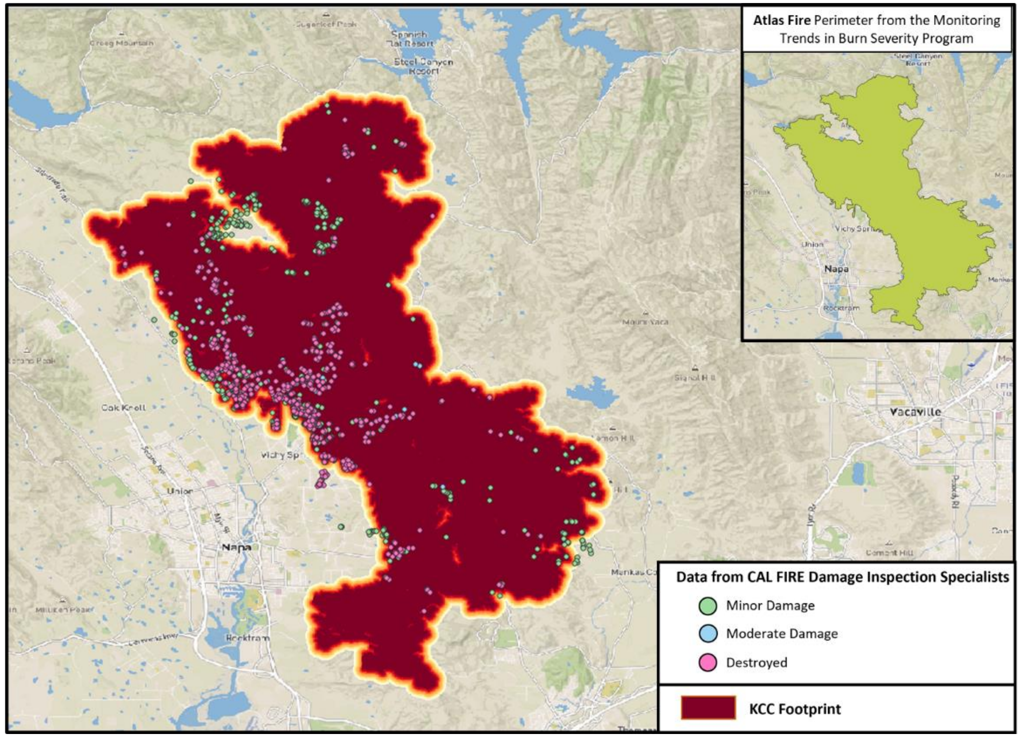
Participation in wildfire mitigation program

Fire Lookout

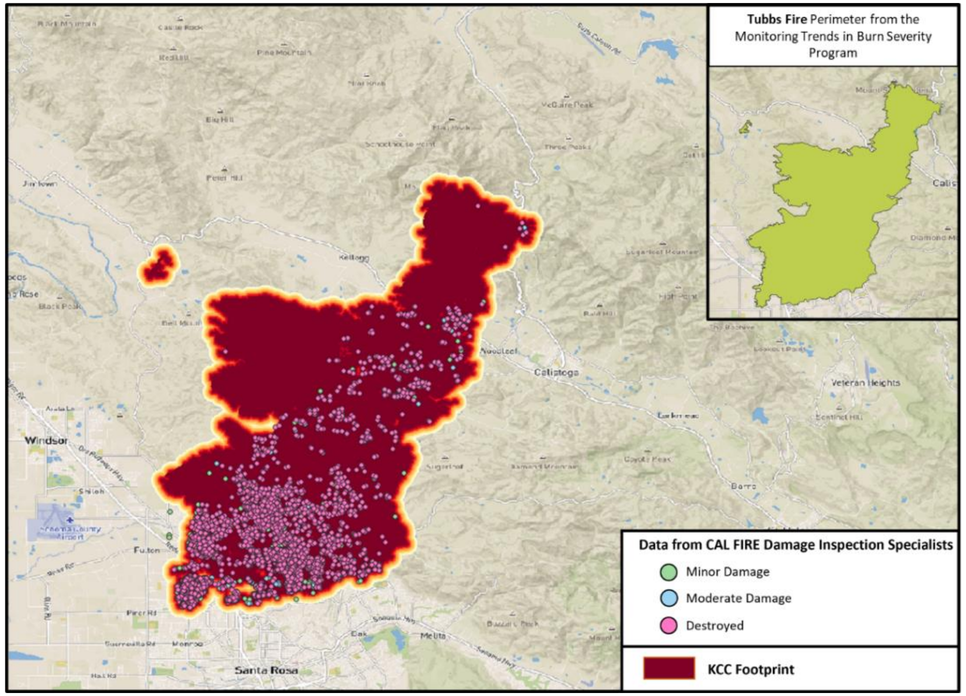
Community accessibility

Model Validation

Detailed Validation of the Spatial Extent of Simulated Wildfire Footprints

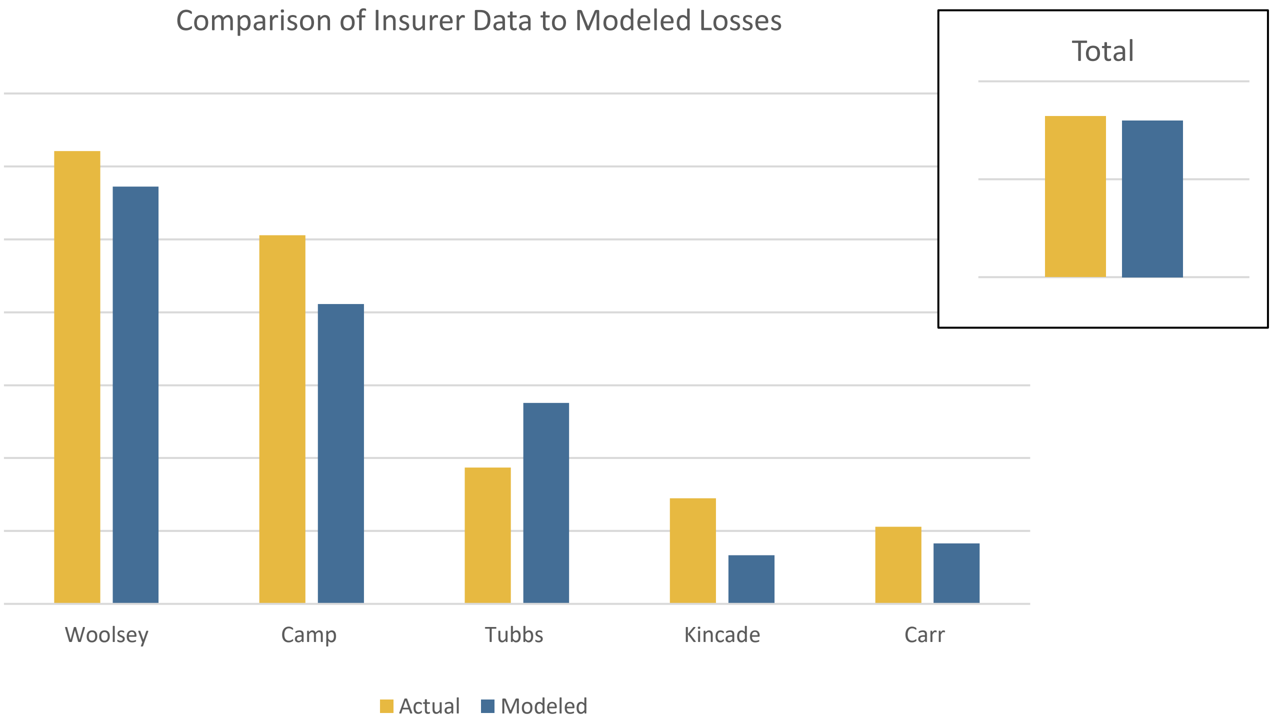


KCC footprint validation for the Atlas Fire



KCC footprint validation for the Tubbs Fire

Insured Loss Validation Has Been Performed for Individual Clients at both a Policy and Event Resolution



Summary

- Wildfires are an increasing driver of insured losses
  - Observations indicate a warming climate results in increased wildfire activity
  - Global climate models suggest the VPD in California will increase an additional 10% by 2050

- The KCC US Wildfire Model employs a physical modeling approach
  - The hazard module incorporates high resolution data including local fuel type and characteristics, climatological winds, topography, and impacts of branding and spotting
  - The vulnerability module accounts for community, parcel, and building resolution information that influences structure survivability including construction materials and occupancy type, age of structure, roof materials, defensible space, and community fire rating

- The KCC US Wildfire Model has undergone meticulous validation of simulated events versus historical footprints and detailed evaluations of insurer claims data at an event and location resolution

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