Wildfire: Challenges and solutions in a shifting paradigm

CAS Virtual Trunk Show
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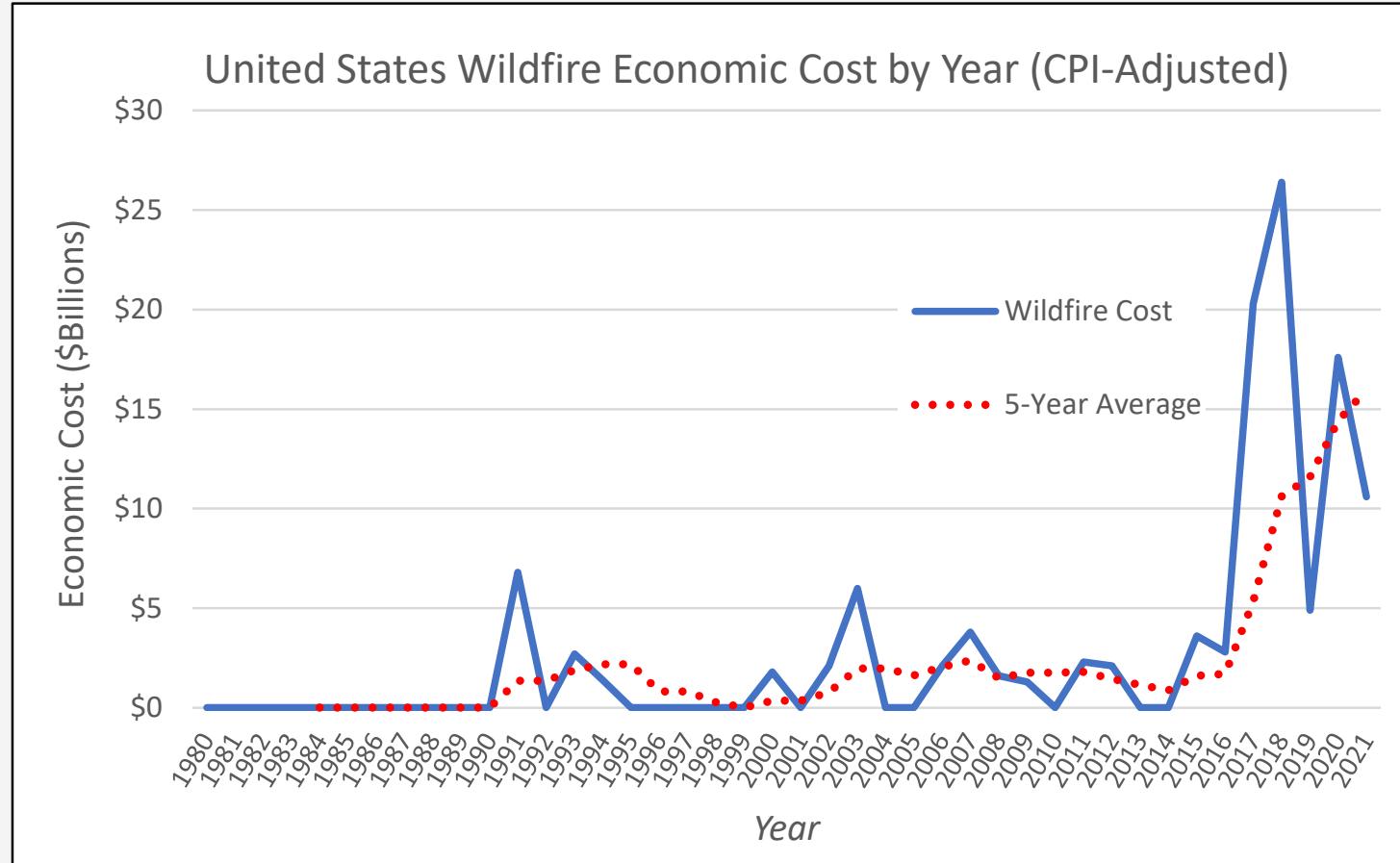
Agenda

- Wildfire risk in the West and California

- The California insurance market

- Data for understanding wildfire risk

- Wildfire mitigation

- What does a solution look like?

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Wildfire Risk in the West

Economic Cost of Wildfire

Wildfires cost billions of economic damage, but not until recently

United States Wildfire Economic Cost by Year (CPI-Adjusted)

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Wildfire Risk by State

California has the most losses, but wildfire is a problem in many western states

State	Wildfire Costs 1980 - 2022 (Billions)	Percentage of U.S. Total
California	$91.32	71.8%
Colorado	$6.71	5.3%
Oregon	$5.30	4.2%
Montana	$3.16	2.5%
Idaho	$3.09	2.4%
Texas	$2.93	2.3%
Washington	$2.74	2.2%
Alaska	$2.10	1.6%
Tennessee	$1.69	1.3%
New Mexico	$1.47	1.2%

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A Worrying Trend

15 of California's 20 most destructive and 11 of the state's 20 largest wildfires have happened since 2015

California's largest and most destructive fires

a Includes wildfires that occurred in 2020 and 2021.
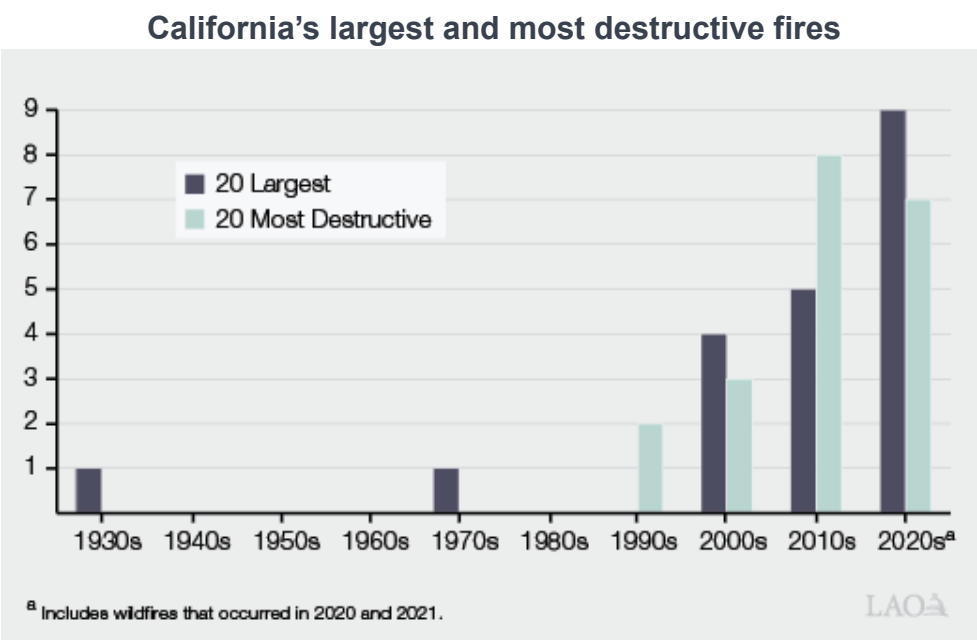
The 2022-23 Budget: Wildfire and Forest Resilience Package (ca.gov)

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Why is California burning so much now?

Climate Change
Change in temperature and rainfall patterns

Historical Suppression
The U.S. Forest Service's fire management policy: the "10am" Rule

Santa Ana Winds
Dry air from the Great Basin area of the West → Southern California

Weather Leading up to 2017
High fuel loads, dry fuels, low humidity, and high temperatures

Growth in the Wildland Urban Interface (WUI)
WUI in the U.S. grew rapidly from 1990 to 2010, from 30.8M to 43.4M houses, a 41% growth.

Not just a California Problem
Smoke affects people's health far and wide

September 12, 2020

Source: NASA

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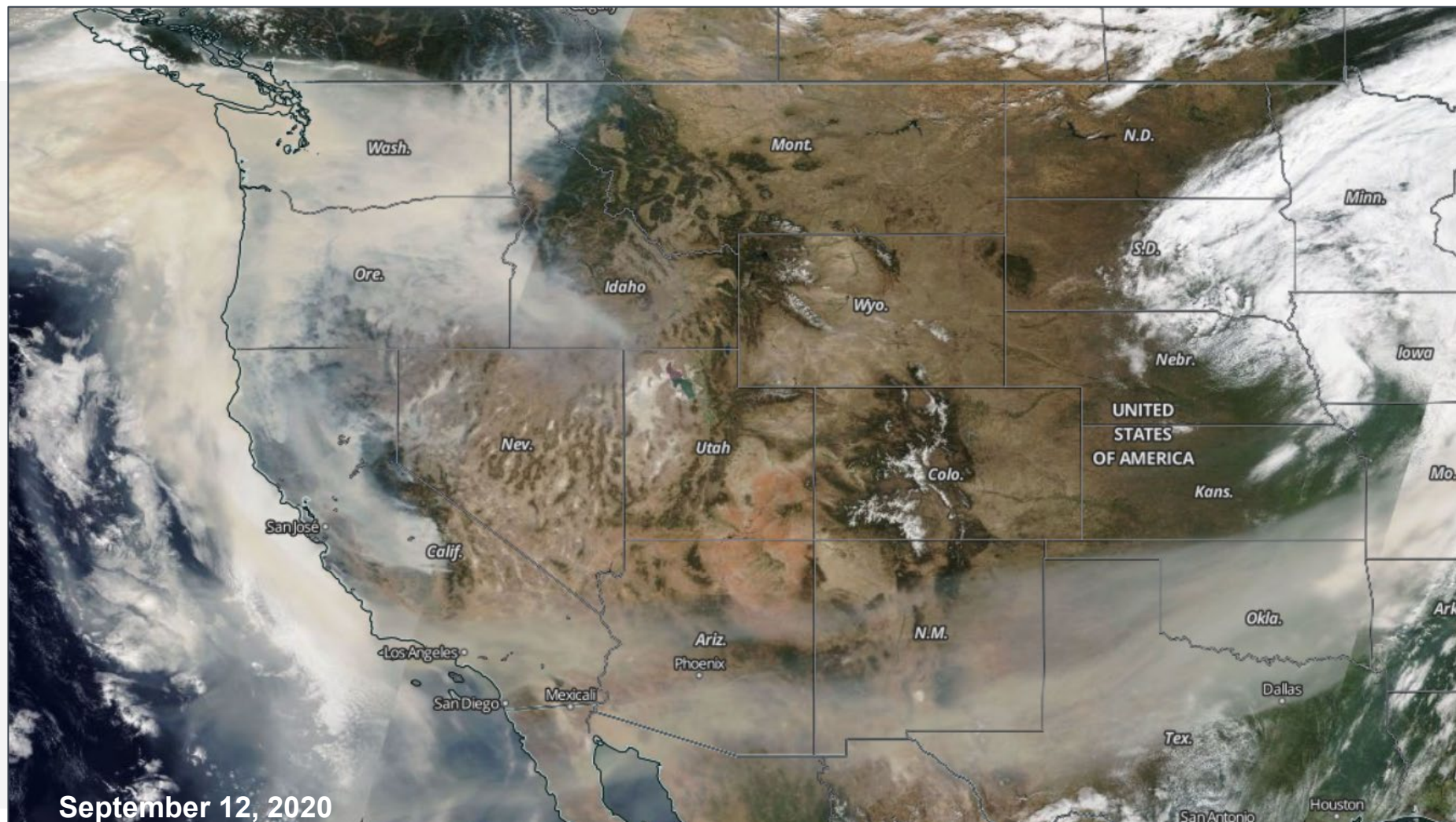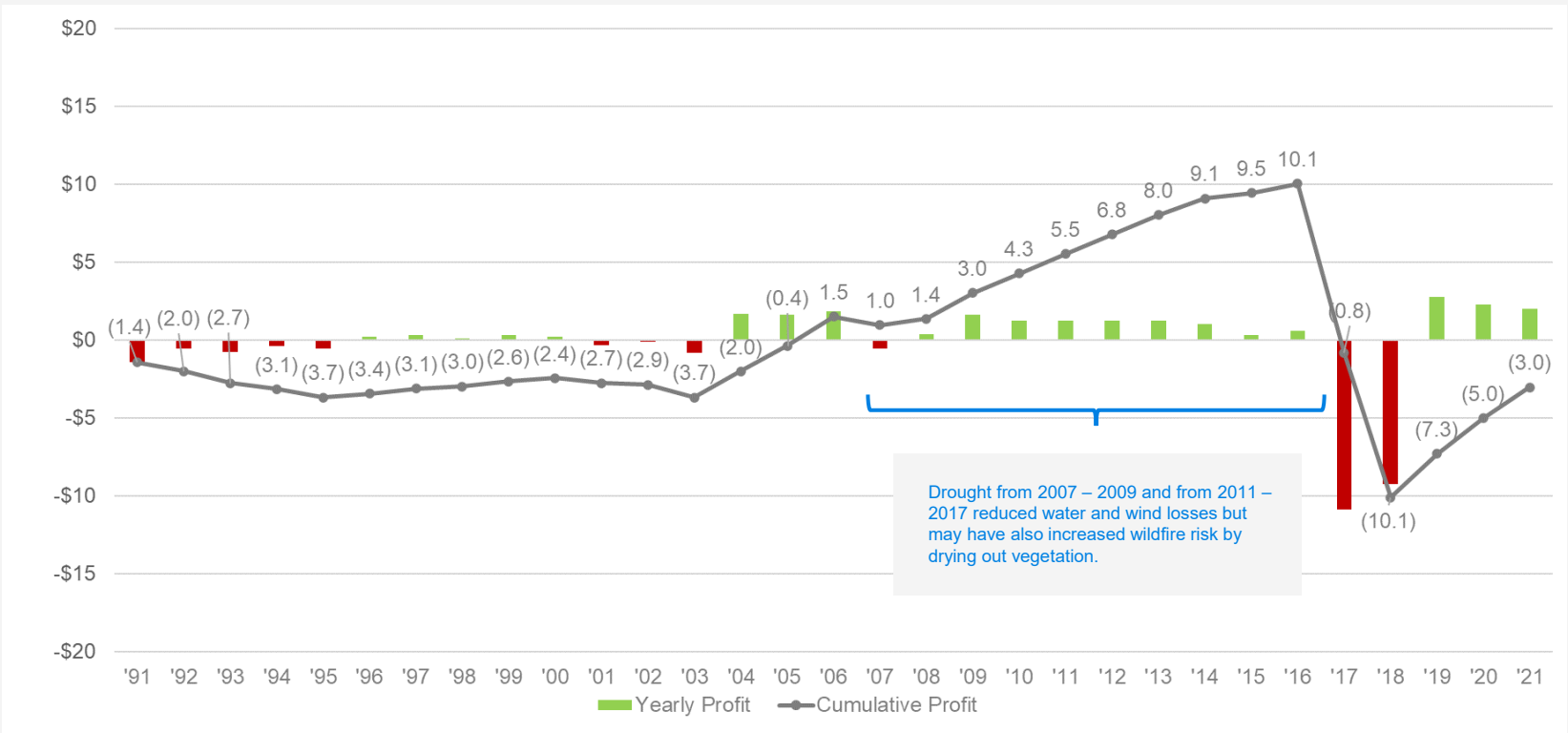
California Insurance Market Implications

Underwriting Impact

Losses in 2017 and 2018 wiped out *twice* the underwriting profit from the past 26 years.

Drought from 2007 – 2009 and from 2011 – 2017 reduced water and wind losses but may have also increased wildfire risk by drying out vegetation.

Legend: Yearly Profit ■ Cumulative Profit ●

Notes:
- 1996 - 2021 data from P&C Combined Industry Annual Statement data from SNL.com.
- 1991 - 1995 Earned Premium and Loss Ratio data from the California Department of Insurance.
- Expense ratios for 1991-1995 are estimated as the average of 1996-1998.
- Profit is based on direct industry earned premium, losses, and expenses.
- Excludes impact of reinsurance and investment income.

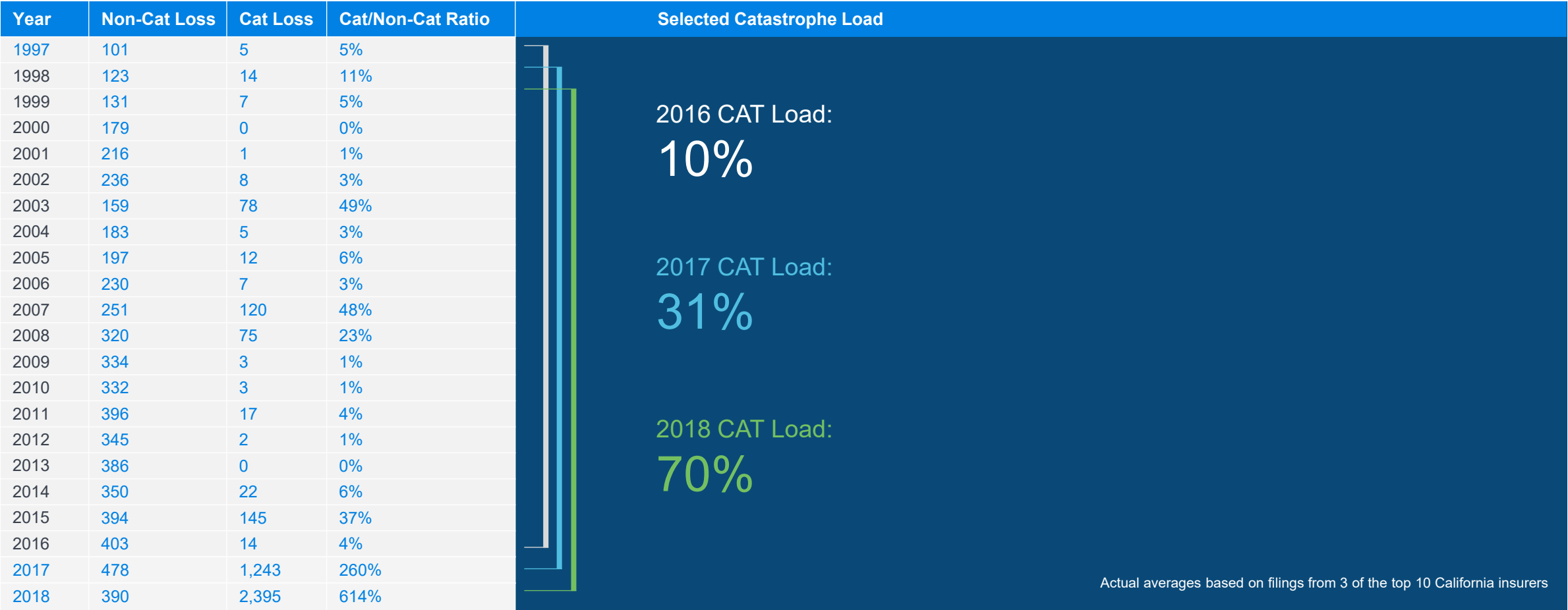Milliman

California Homeowners Rate Changes

Weighted Average Filed Change (%) - Entire Industry
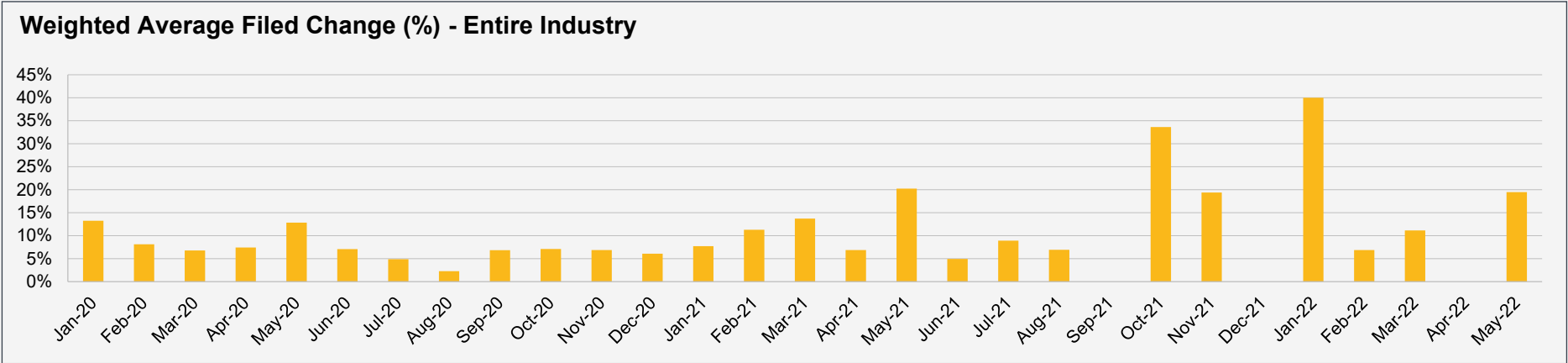
Rate Impact for Entire Industry	Increase	Neutral (NA or 0)	Decrease	Total
Number of Filings	108	53	4	165
% of Filings	65.45%	32.12%	2.42%	100%

Based on 165 filings from 75 companies.

California 04.0 Homeowners filings effective between 01/01/2020 and 12/31/2022.

Count of Policyholders is for companies' average rate change, not all policyholders will be affected uniformly.
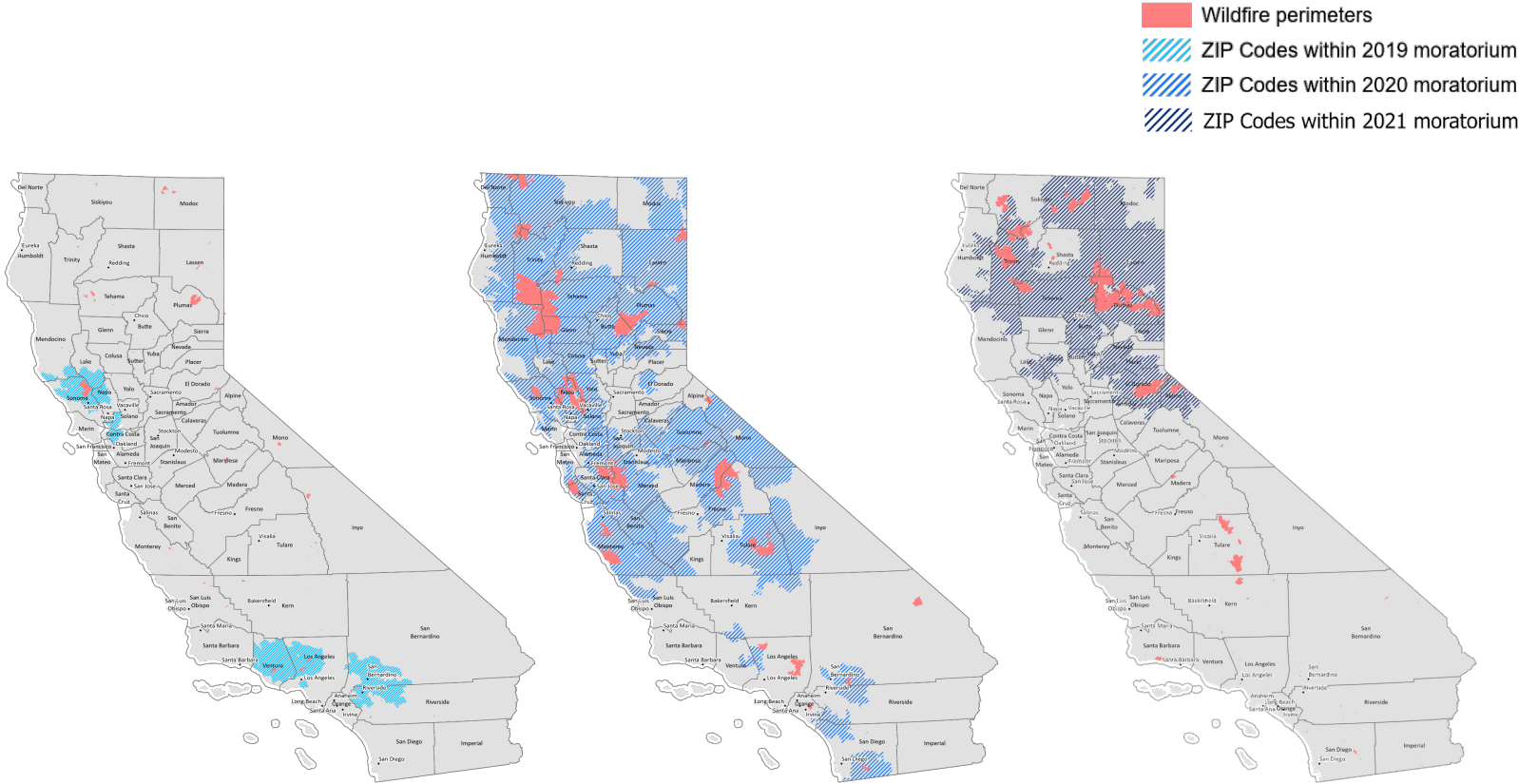
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Calculation of Catastrophe load

Under CCR 2644.5, insurers must use a minimum 20-year average of historical catastrophe losses to calculate a Cat-to-nonCat ratio.

Year	Non-Cat Loss	Cat Loss	Cat/Non-Cat Ratio
1997	101	5	5%
1998	123	14	11%
1999	131	7	5%
2000	179	0	0%
2001	216	1	1%
2002	236	8	3%
2003	159	78	49%
2004	183	5	3%
2005	197	12	6%
2006	230	7	3%
2007	251	120	48%
2008	320	75	23%
2009	334	3	1%
2010	332	3	1%
2011	396	17	4%
2012	345	2	1%
2013	386	0	0%
2014	350	22	6%
2015	394	145	37%
2016	403	14	4%
2017	478	1,243	260%
2018	390	2,395	614%

Selected Catastrophe Load

2016 CAT Load:
10%

2017 CAT Load:
31%

2018 CAT Load:
70%

Actual averages based on filings from 3 of the top 10 California insurers

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CDI Declared Moratoriums on Non-Renewals

Senate Bill 824 (2018)

Single Family Homes (in 000s)		
Year	Inside Moratorium	Outside Moratorium
2019	1,101	7,385
2020	1,642	6,844
2021	261	8,262

Wildfire perimeters
ZIP Codes within 2019 moratorium
ZIP Codes within 2020 moratorium
ZIP Codes within 2021 moratorium

Sources: Cal Fire, US Census

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Growth in California Residual Market

Non-Renewals and the California FAIR Plan

FAIR Plan annualized increases (2018 to 2019)

Insured value	36%
Expected losses	81%

The FAIR plan experienced relatively high growth specifically in wildfire exposed areas.

Indicated and Proposed Changes (Effective 02/2022)

Line of Business	Indicated Change	Proposed Change
Fire	+78.2%	+52.0%
Allied	-39.4%	-25.8%
Total	+71.7%	+48.8%

Insurer-Initiated Non-Renewals and FAIR Plan Policies
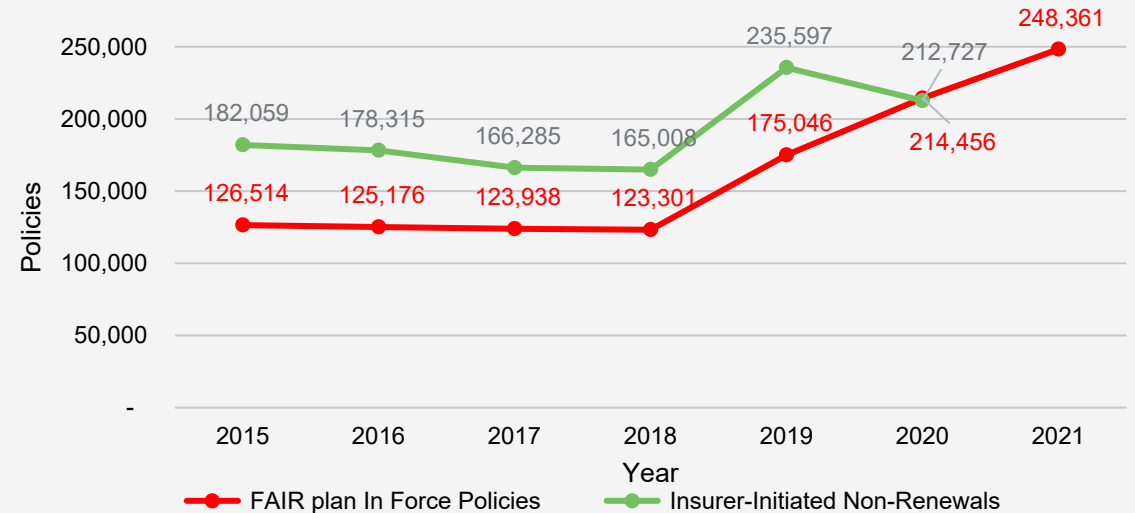
Line chart with y-axis "Policies" (from 0 to 250,000) and x-axis "Year" (2015 to 2021).

FAIR plan In Force Policies (red): 126,514 (2015), 125,176 (2016), 123,938 (2017), 123,301 (2018), 175,046 (2019), 214,456 (2020), 248,361 (2021)

Insurer-Initiated Non-Renewals (green): 182,059 (2015), 178,315 (2016), 166,285 (2017), 165,008 (2018), 235,597 (2019), 212,727 (2020)

Legend: ● FAIR plan In Force Policies   ● Insurer-Initiated Non-Renewals

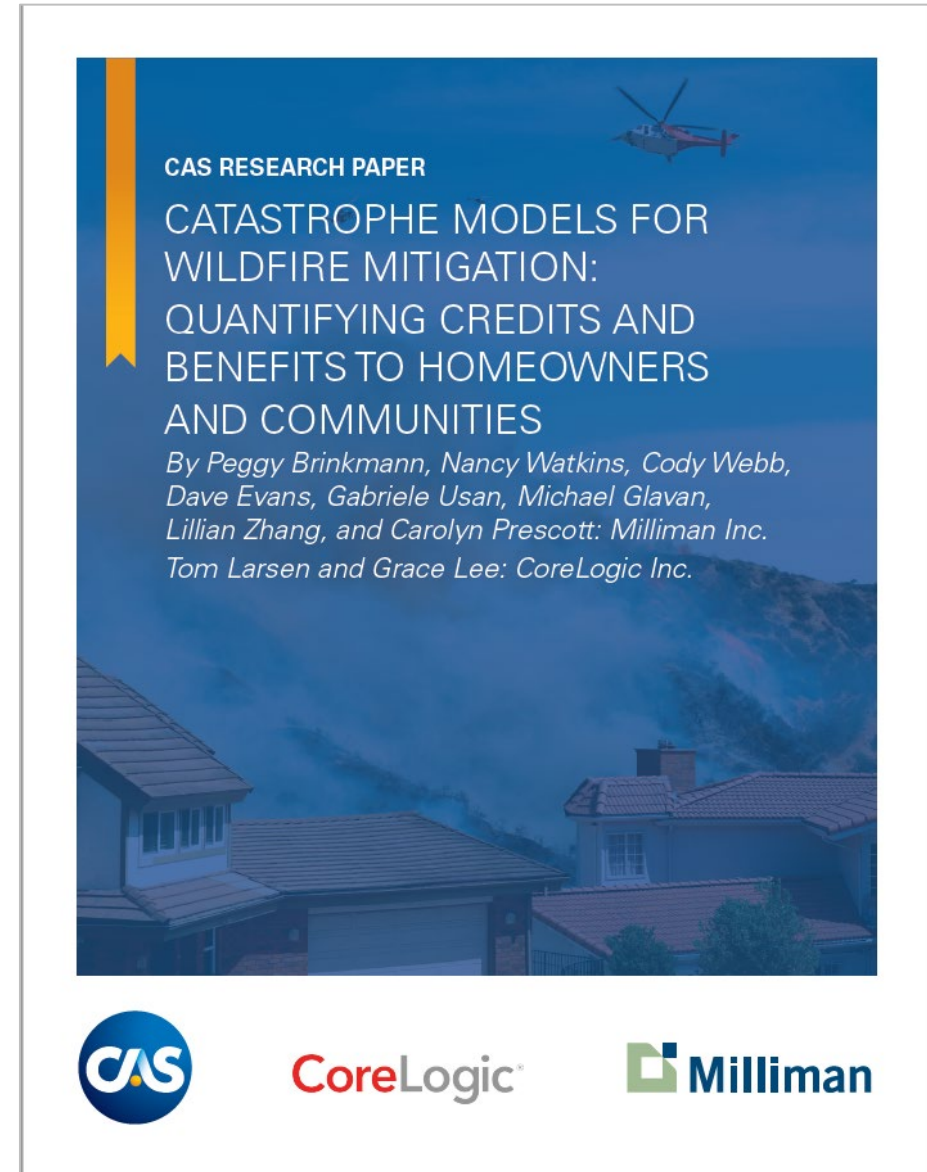Milliman

CDI Regulation on Wildfire Mitigation

Consideration of Mitigation Factors; Wildfire Risk Models

- California Code of Regulations 2644.9 effective October 14, 2022
- New mandatory rating factors for
  - Community-level mitigation designations
  - Property-level mitigation
    - Defensible space
    - Building code/ordinance compliance
    - Class A roof
    - Enclosed eaves
    - Fire-resistant vents
    - Fire-resistant windows
    - Six inches of noncombustible vertical clearance a bottom of building

Casualty Actuarial Society Research Paper

- Produced by Milliman, and Corelogic on behalf of Casualty Actuarial Society

- Published October 25, 2022

- https://www.casact.org/publications-research/publications/cas-research-papers-and-briefs

- Discusses wildfire mitigation, catastrophe models, actuarial considerations for mitigation credits

- Case studies to illustrate analysis methodology and compare effects of different types of mitigation

CAS RESEARCH PAPER

CATASTROPHE MODELS FOR WILDFIRE MITIGATION: QUANTIFYING CREDITS AND BENEFITS TO HOMEOWNERS AND COMMUNITIES

By Peggy Brinkmann, Nancy Watkins, Cody Webb, Dave Evans, Gabriele Usan, Michael Glavan, Lillian Zhang, and Carolyn Prescott: Milliman Inc.

Tom Larsen and Grace Lee: CoreLogic Inc.

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Data for Understanding Wildfire Risk

Who Uses Wildfire Data?

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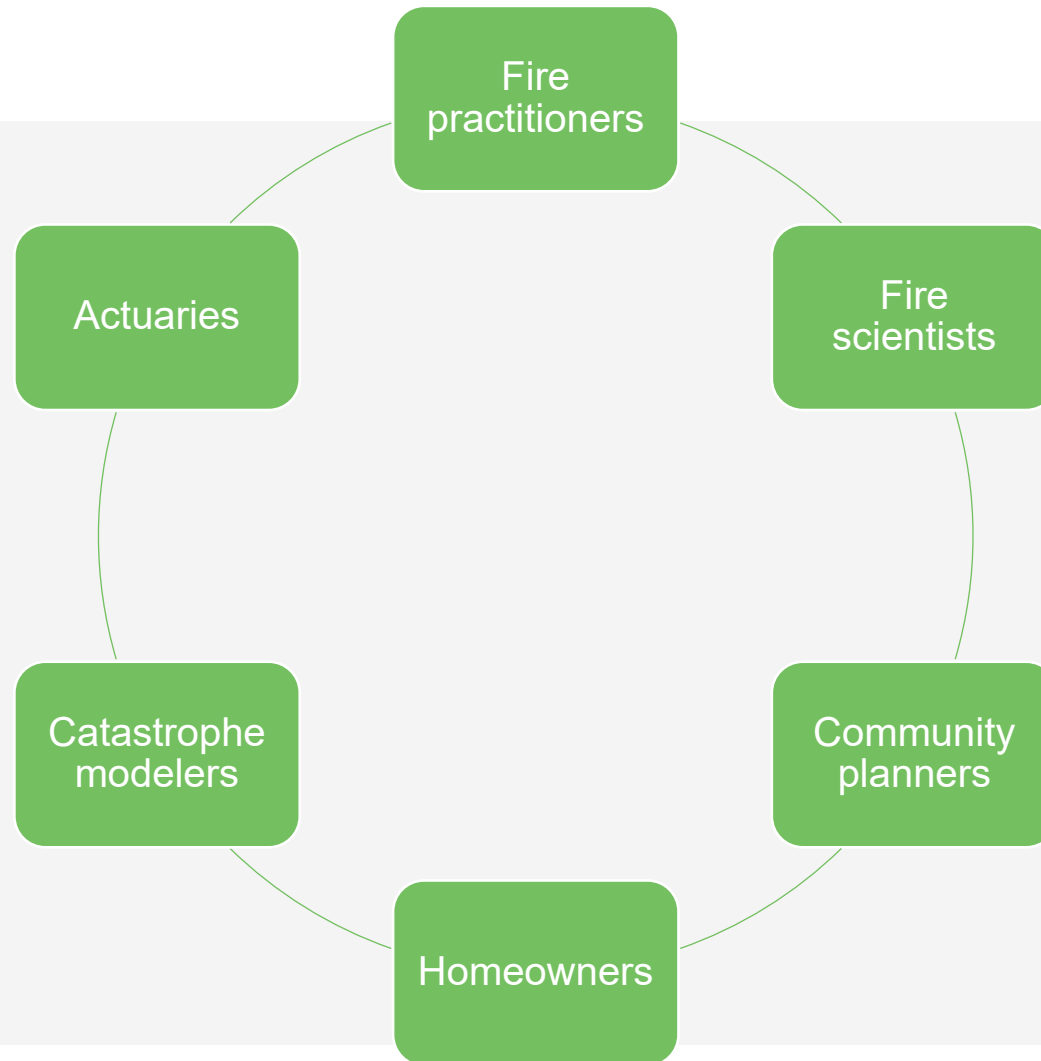
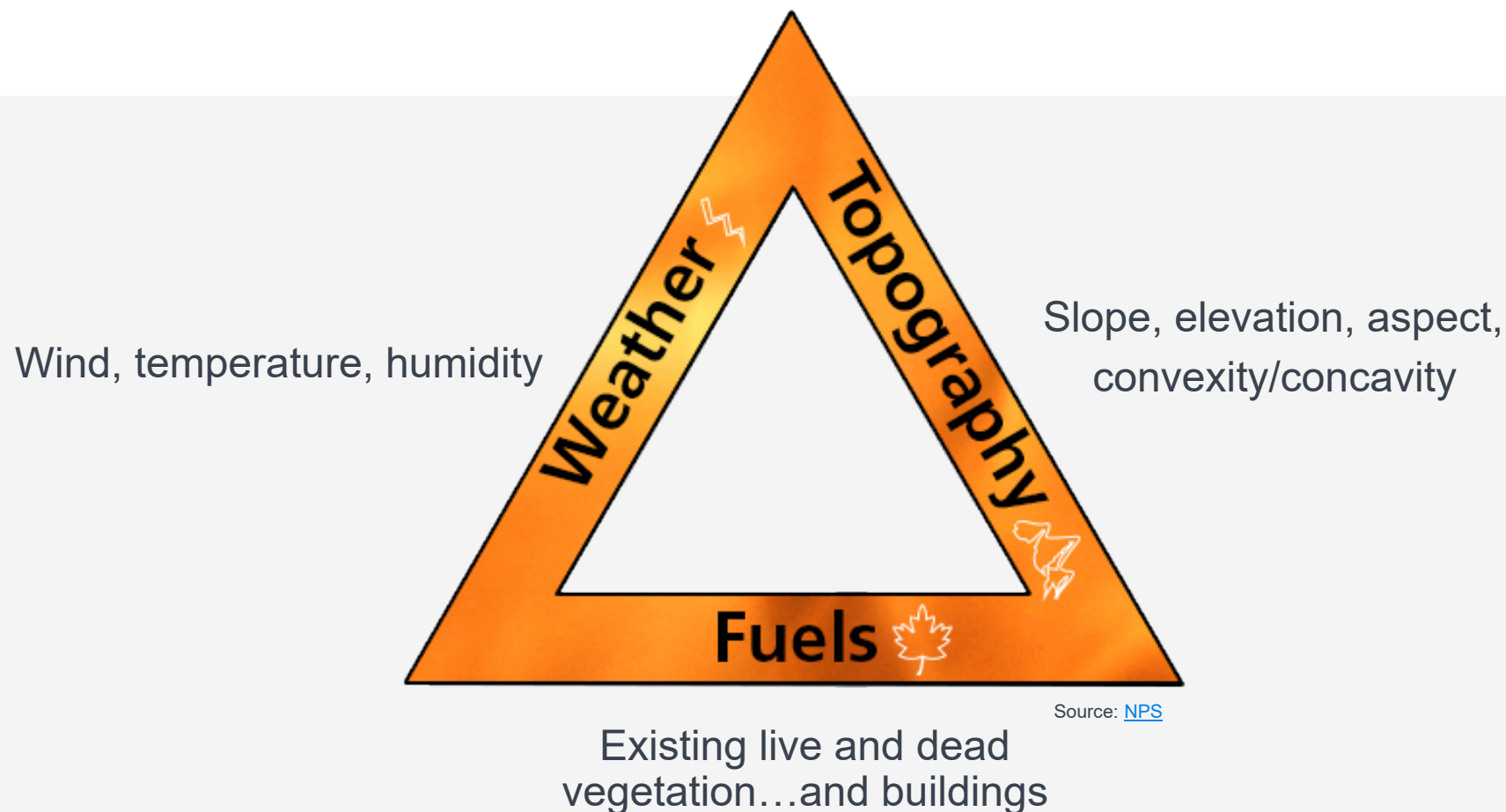# Why Do Actuaries Need Wildfire Data?

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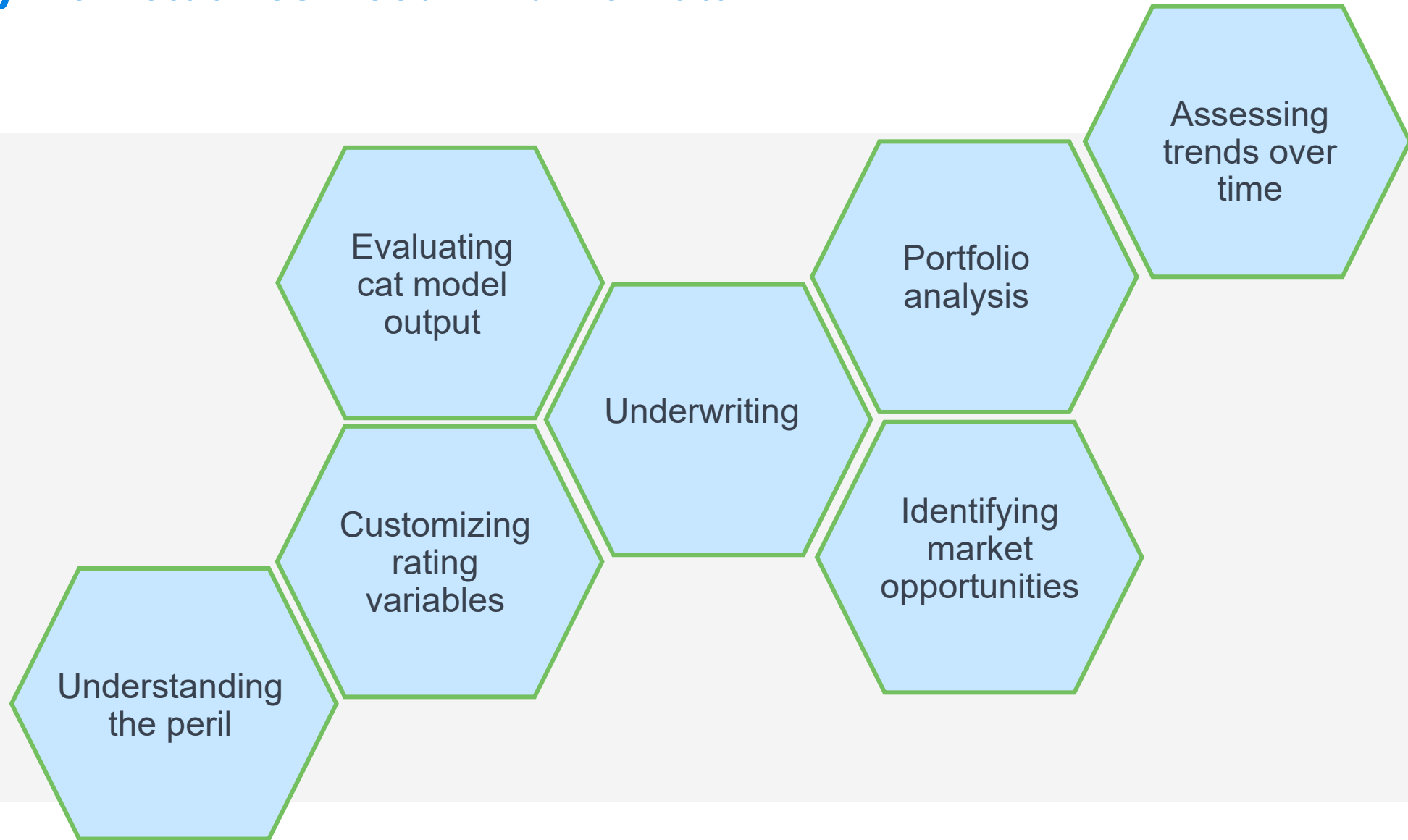
Wildland Urban Interface (WUI)
Areas where human development meets undeveloped wildland and vegetative fuels

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Fire Behavior in the Wildland Urban Interface

Wind, temperature, humidity

Slope, elevation, aspect, convexity/concavity

Source: NPS

Existing live and dead vegetation…and buildings

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Data to Evaluate Wildfire Risk in the WUI

- ❑ Existing vegetation and fuels
- ❑ Terrain
  - ▪ Slope, elevation, aspect
- ❑ Weather data
  - ▪ Wind, temperature
- ❑ Climate data
  - ▪ Fuel moisture, drought
- ❑ Local fire history
- ❑ Fire suppression resources
  - ▪ Fire fighting capacity and skill
  - ▪ Difficulty of access, roads
- ❑ Individual and community mitigation actions

Wildfire Risk

HAZARD   X   VULNERABILITY

LIKELIHOOD   INTENSITY   EXPOSURE   SUSCEPTIBILITY
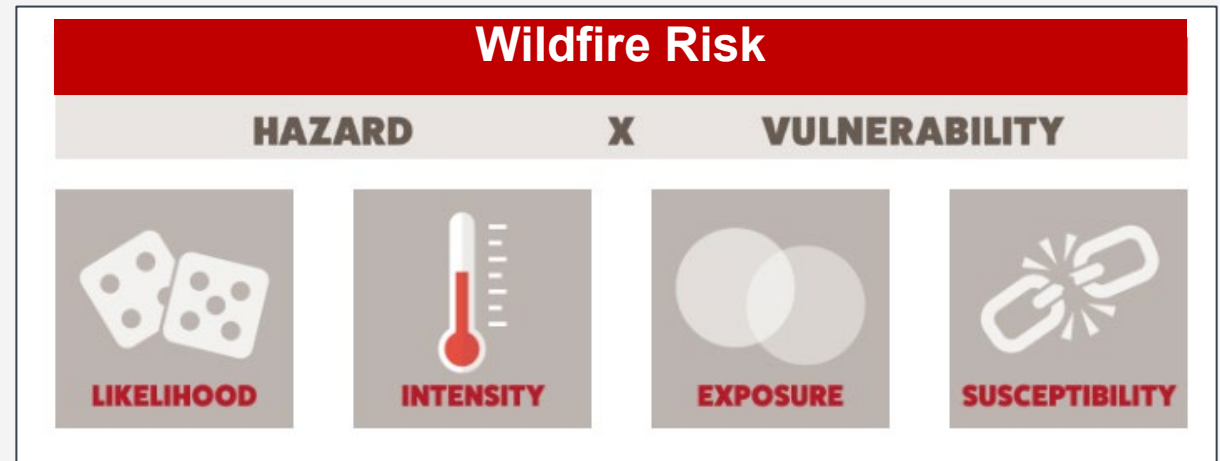
Source: Wildfire Risk To Communities, USDA, USFS

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Example: LANDFIRE
Open data on vegetation, terrain, fuels, disturbances, and fire regimes

"LANDFIRE (LF), Landscape Fire and Resource Management Planning Tools, is a shared program between the wildland fire management programs of the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior, providing landscape scale geo-spatial products to support cross-boundary planning, management, and operations."
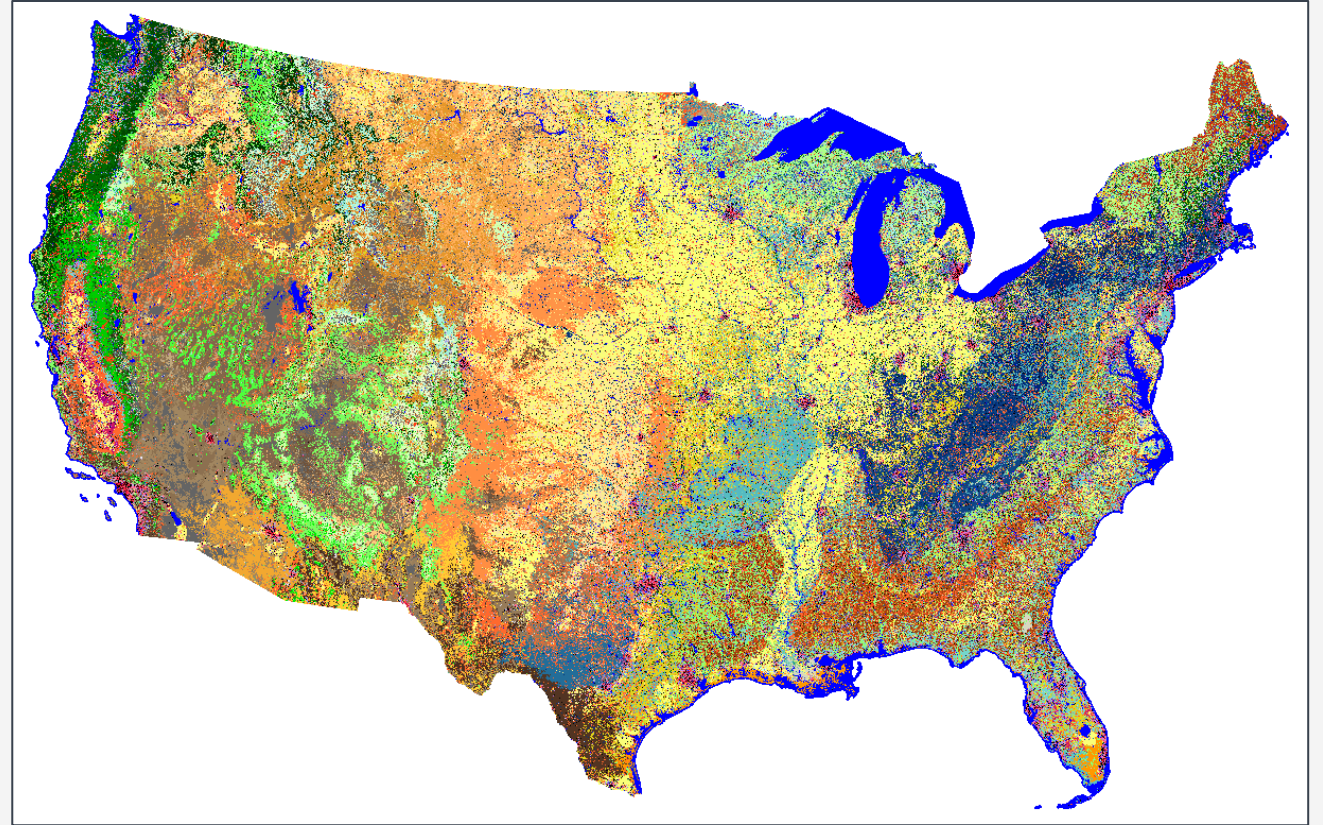

Existing Vegetation Type mapped at 30m resolution for entire USA, source: LANDFIRE 2016

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Example: Wildfire Risk to Communities

Open data and resources to help communities understand, explore, and reduce wildfire risk.

15 data layers:

- Risk to homes
- Ignition probability
- Exposure type
- Conditional risk
- Conditional flame length
- Flame length exceedance probability
- Wildfire hazard potential
- Housing unit density
- Population density
- Building coverage
- Building exposure
- Housing unit exposure
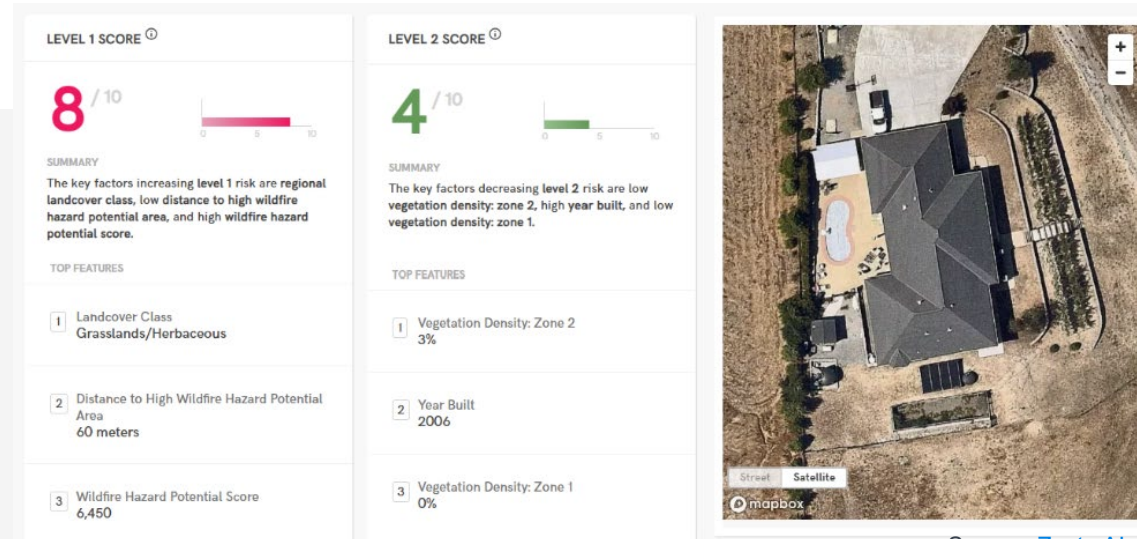- Housing unit impact
- Housing unit risk
- Expanded risk areas
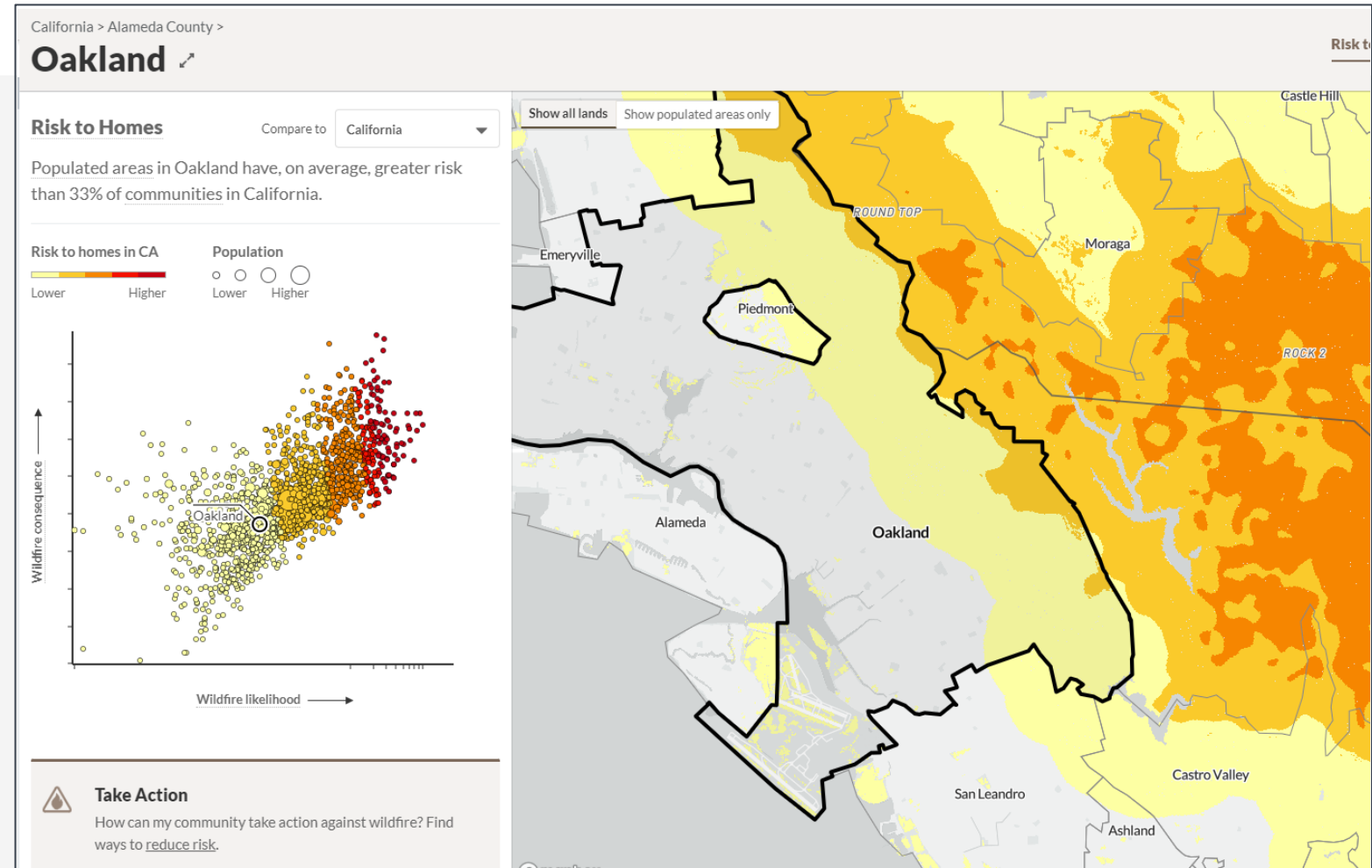
Wildfire Risk to Homes, Oakland, CA, Source: USFS/USDA

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Example: Proprietary Risk Scores

- ❏ zesty.ai Z-Fire
  - ▪ AI machine learning model
  - ▪ Topography, climate data
  - ▪ Satellite imagery to assess building materials and surrounding vegetation

Source: Zesty.AI

- ❏ CoreLogic Wildfire Risk Score
  - ▪ Variables: slope, aspect, fuel, surface composition
  - ▪ 30x30 m grid
  - ▪ Updated annually

Source: CoreLogic

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Know the Data Limitations

- ❑ Resolution
  - ▪ Wildfire risk is *exceptionally* granular
- ❑ Vintage
  - ▪ Climate very different than in the past
  - ▪ Construction, fires that have occurred since created
- ❑ Update cycle
  - ▪ Vegetation grows and dies changes frequently
  - ▪ Home hardening
- ❑ Availability
  - ▪ Local, state, national?
- ❑ Use restrictions
  - ▪ "Non-commercial use only"

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Data Limitation Example - resolution
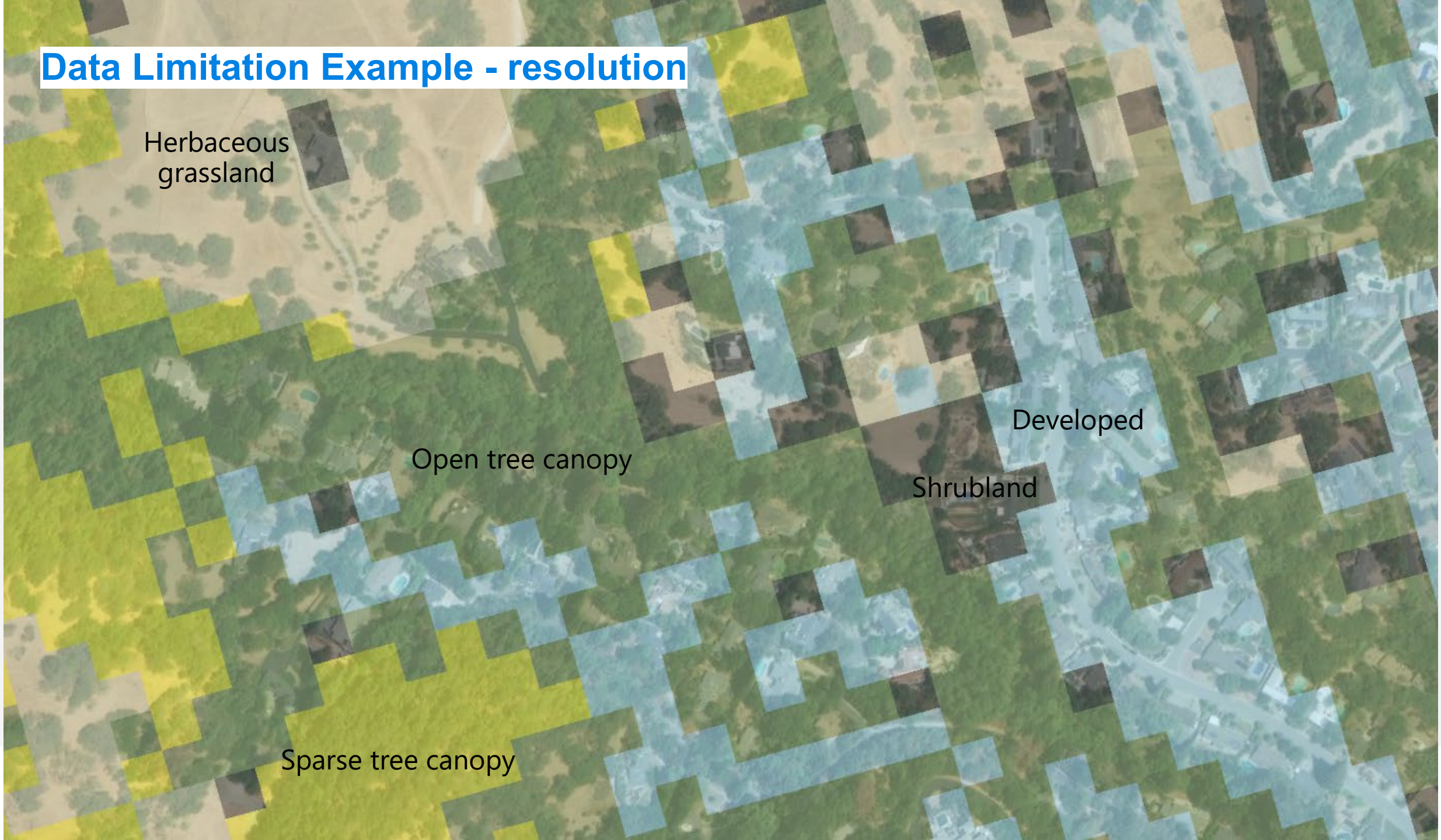
Data Limitation Example - resolution

Mitigating Wildfire Risk

What is Wildfire Mitigation?

Actions taken to reduce or eliminate the damaging effects of a wildfire on a property, community, or ecosystem

❑ Vegetation management

- ▪ Creation of buffer areas surrounding a community
- ▪ Mechanical clearing of vegetation
- ▪ Parcel landscaping to improve defensible space

❑ Water supply development

❑ Firefighter access improvement

❑ Infrastructure / home hardening

Milliman and CAS study found that the combination of parcel mitigation and community fuels reduction efforts could decrease the wildfire average annual loss (AAL) by 62%

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Individual mitigation

- Fire rated roofs
- Buffer around the home
- Remove items under deck
- Add/upgrade vent screens
- Remove back-to-back rows of fencing
- Replace combustible fencing/gates

- Trim trees
- Replace sidings
- Enclose eaves
- Fire-resistant deck
- Upgrade windows
- Enclose under-bay windows
- Use metal gutters instead of vinyl ones

Source: Wildfire Ready – DISASTERSAFETY.ORG

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#DefensibleSpace in Action

Individual Mitigation - IBHS Wildfire Prepared Home
Defensible Space + Home Hardening

Community mitigation

❑ Coordinated planning and action to reduce fire risk throughout a community

❑ Fuels and vegetation management beyond the individual parcel

- Parks, open spaces

- Reduce / minimize fire pathways into the WUI

❑ Building codes and ordinances

❑ Citizen fire councils

❑ Community Wildfire Protection Plans (CWPP)

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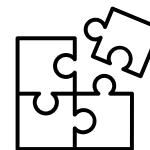
Community mitigation
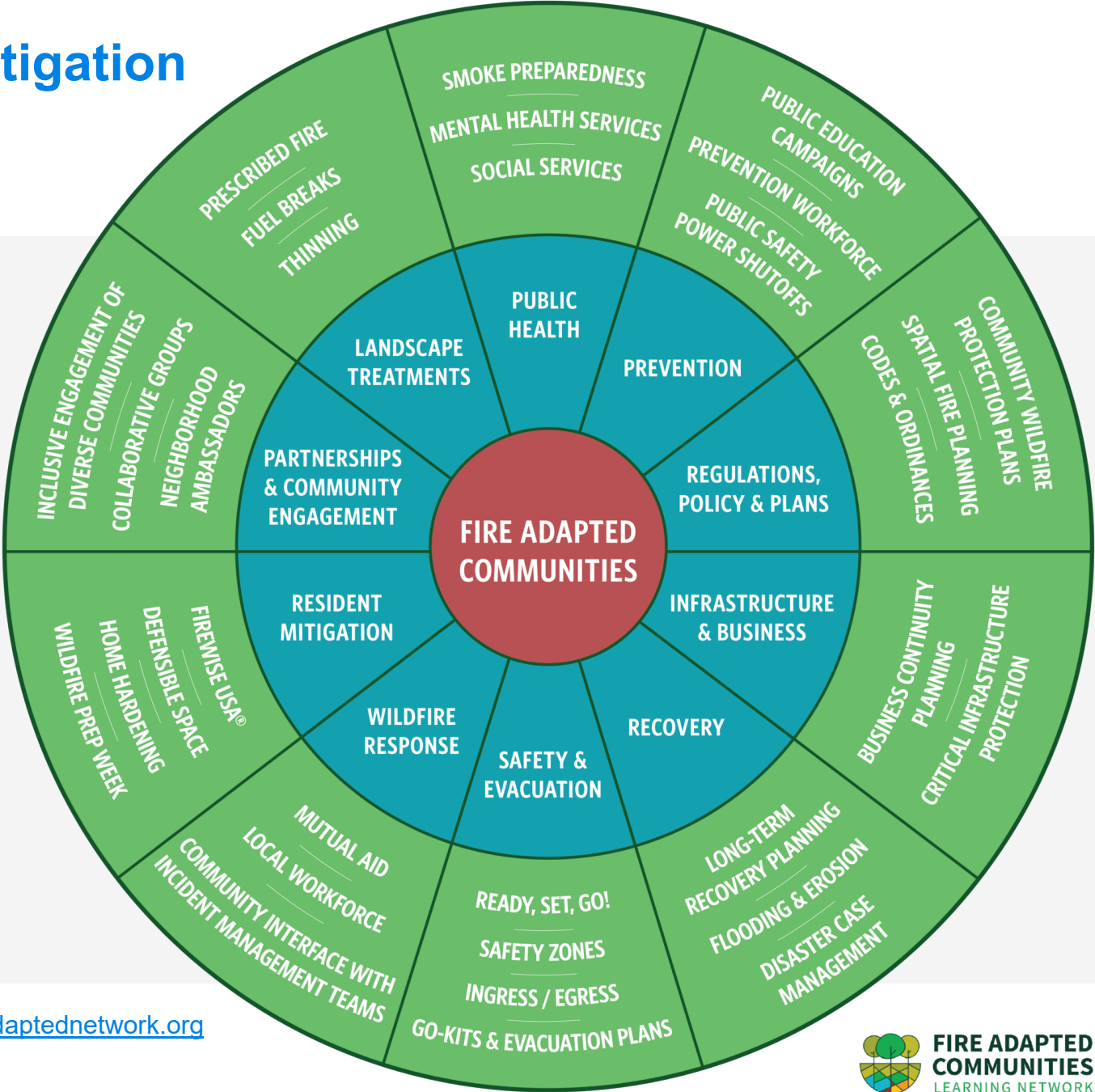
Source: fireadaptednetwork.org

What Would a Solution Look Like?

Putting the Pieces Together

Working towards a shared goal of reducing life and property loss in the WUI

Players:

- Fire practitioners
- Fire scientists
- Insurance carriers
- CAT modelers
- Regulators
- Homeowners
- Communities

Mitigation Actions:

- What are the most important for reducing risk?
- How do we get individuals and communities to take these actions?
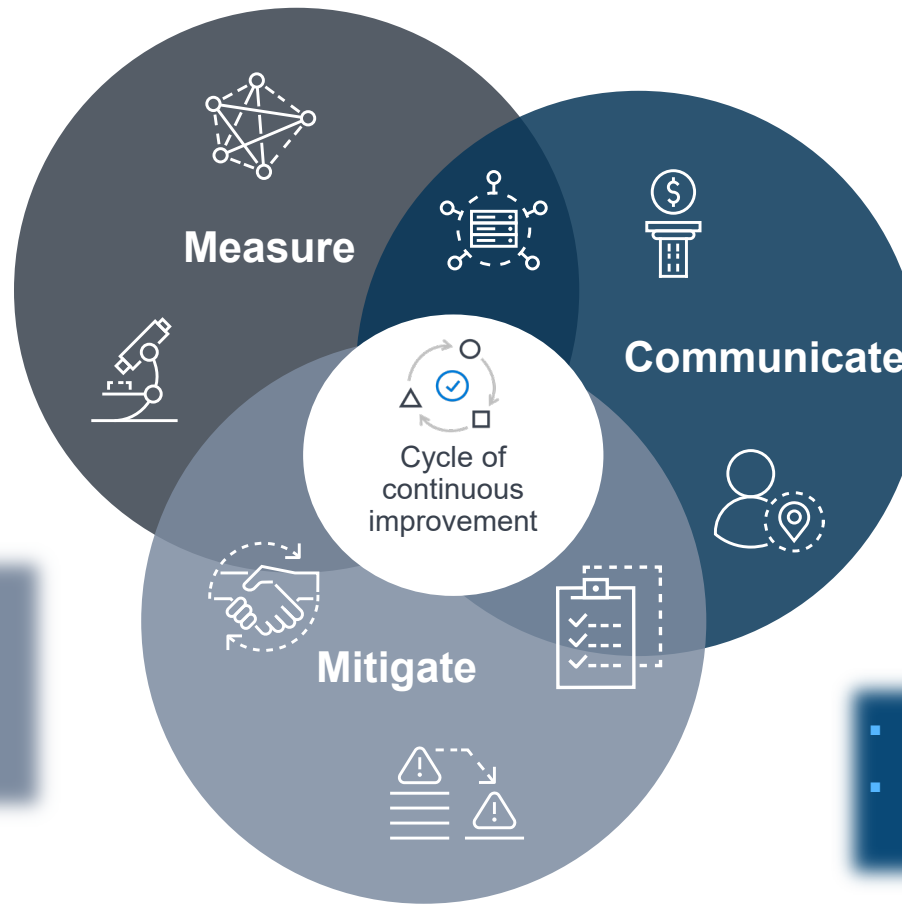
Data:

- How do we measure risk and success?
- Who collects the data?
- How do we keep it current, comprehensive, consistent, and cost beneficial?

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Wildfire risk mitigation – the big picture

What does "solving the problem" look like?

- Establish parcel level mitigation standards
- Establish community level mitigation and fire protection standards
- Improve fire science and research

- Establish wildfire open data commons
- Build mitigation visibility into cat models
- Send risk signals through insurance pricing and underwriting
- Prioritize high-impact, low-cost mitigations

Measure

Communicate

Cycle of continuous improvement

Mitigate

- Coordinate with public/private landowners
- Identify funding sources
- Implement mitigations
- Improve comprehensive protection capabilities

- Understand barriers to adoption
- Build mitigation visibility into public protection, policies and standards

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Questions?

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