Resiliency and Mitigation Council

Wednesday, June 11, 2025

1:00 P.M.

ARIZONA
DEPARTMENT OF INSURANCE
& FINANCIAL INSTITUTIONS

I. Welcome and Opening Remarks

ARIZONA
DEPARTMENT OF INSURANCE
& FINANCIAL INSTITUTIONS

General Meeting Logistics

- This meeting is being broadcast online and is being recorded.
- The recording and associated meeting materials will be posted on the Council's webpage. Comments in the chat will not be recorded.
- For Council members online, please use the hand raise feature to speak.
- Except for public comment periods, only Council members online will be able to unmute themselves and turn on their camera.
- If public comments are taken, each speaker's time will be limited to provide everyone who wishes to comment the opportunity to do so.
- To comment, fill out a speaking slip or the Google Form (if you are online).

ARIZONA
DEPARTMENT OF INSURANCE
& FINANCIAL INSTITUTIONS

II. Presentation from FortressFire

ARIZONA
DEPARTMENT OF INSURANCE
& FINANCIAL INSTITUTIONS

FortressFire
Wildfire Risk Solutions

Using Fire Science and Data to Deliver Home Resilience and Lower Insurance Rates

FortressFire Presentation to
Arizona Department of Insurance
and Financial Institutions

June 2025

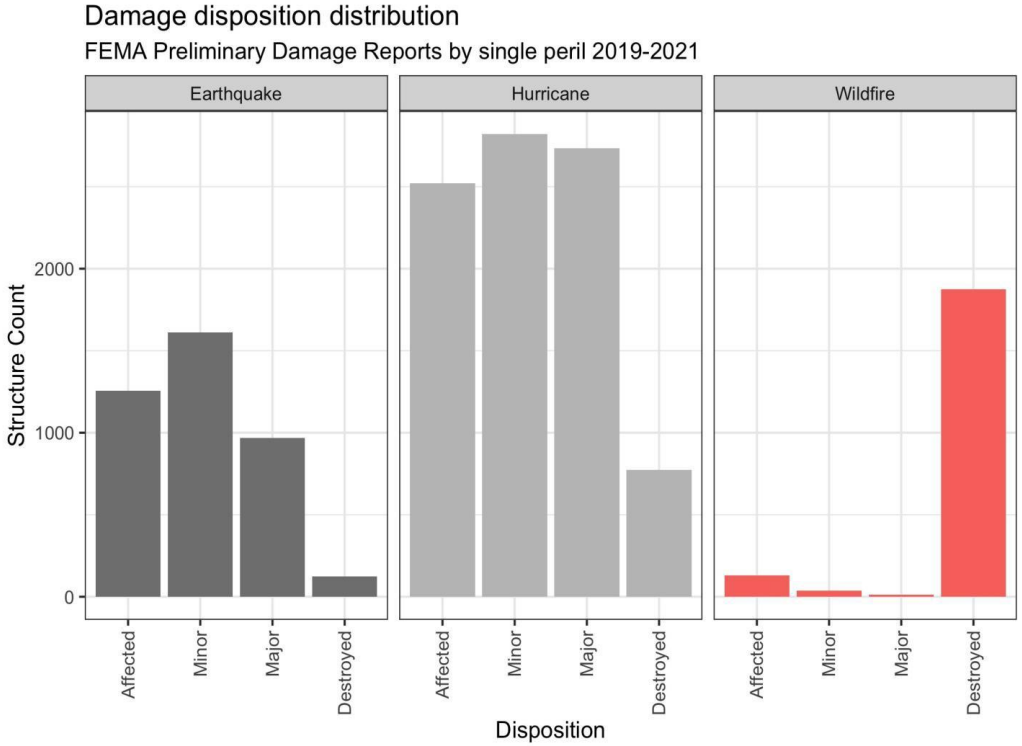
FortressFire: A California-based InsurTech Company

- Founded to **Protect Homes and Commercial Properties** from wildfires
- **Goals to** (1) **Improve Insurance Availability and Affordability** and (2) **Save Homes and Property**
- Provide **Property Owners, Realtors, Insurers, and Lenders** with tools and services to understand wildfire risks scientifically and mitigate the risk to near-zero

The Escalating Wildfire Problem

- 45 million homes are located in wildfire-exposed areas of the western U.S.
- One estimate puts 97% of AZ population in counties with high or very high wildfire risk.
- Securing adequate insurance coverage is increasingly costly, challenging, and may still leave gaps in protection.
- Understanding wildfire risk **to specific structures** and preventing loss is complex
- Wildfire risk affects property owners/sellers, real estate professionals, developers and construction companies, insurance carriers, reinsurers, and lenders

Wildfire Peril Demands Greater Certainty and Precision

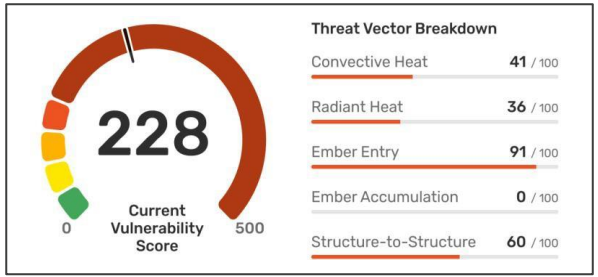


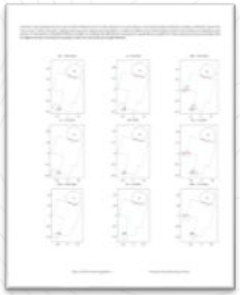
- Unlike other perils, **wildfire outcomes are binary in nature**
- Current wildfire models predict more wildfires that are more severe, and therefore increased losses
- FortressFire's **wildfire vulnerability score** uses energy models to evaluate **5 ignition vectors** and STRUCTURE loss
- After understanding a structure's wildfire vulnerability, **actionable and accurate mitigation** can then **bring the ignition risk to near-zero**

ONLY Protected When All Threat Vectors Addressed

FortressFire tools evaluate and quantify all possible ignition paths – and how to solve them

- Convective Heat (flame touch)
- Radiant Heat (projected energy)
- Ember Entry (through vents)
- Ember Accumulation (on roofs)
- Structure-to-Structure (transfer)





Convective Analysis

Radiant Analysis

Ember Entry Analysis

Ember Accumulation Analysis

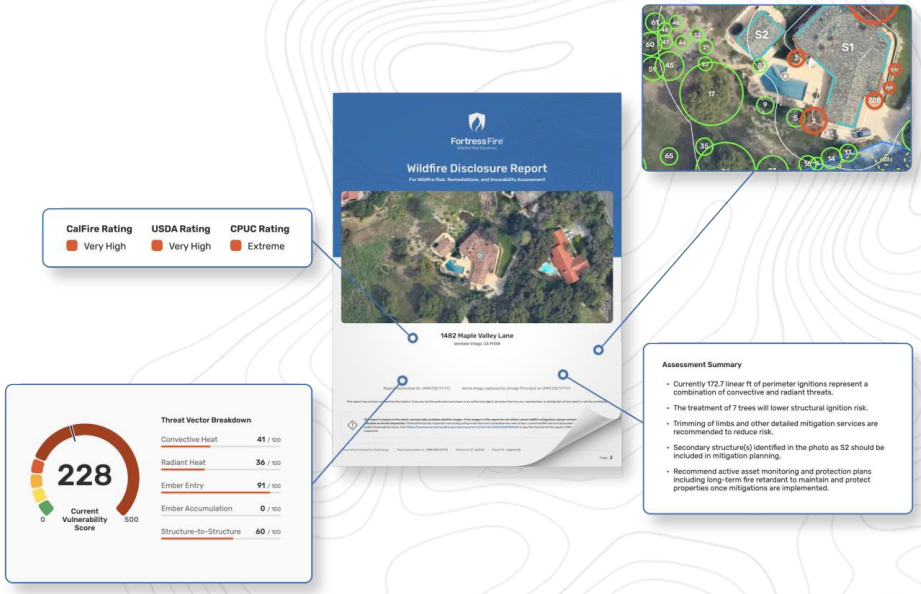
Structure to Structure Analysis

Aerial Risk Report Overview

Determine a structure's wildfire vulnerability score and ignition risk vectors.

Define cost-effective, science-based mitigation actions to prevent the structure from burning.

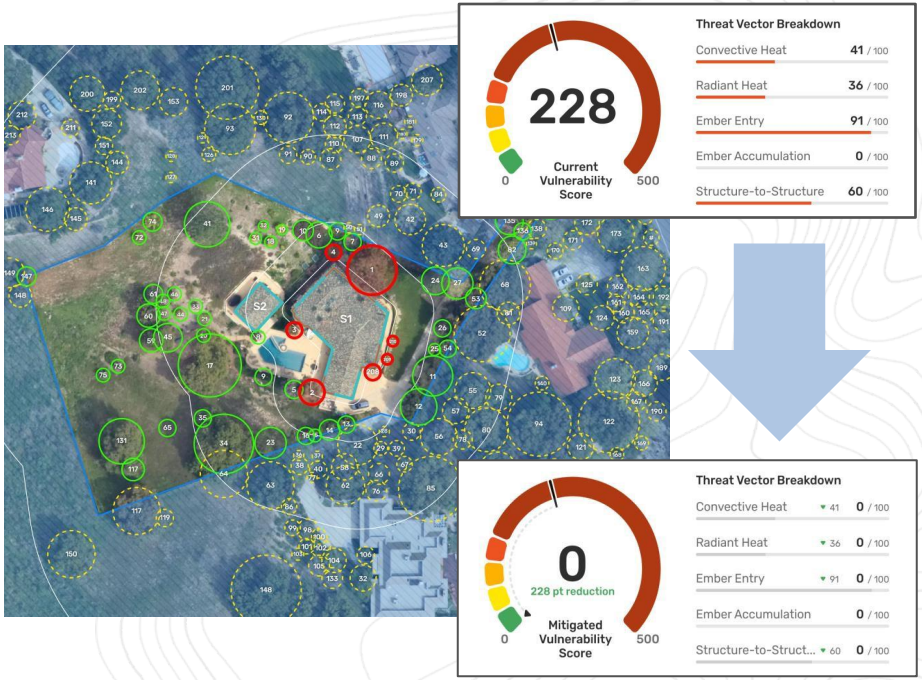
- Use Data: satellite images, topography, and parcel/structure characteristics, and weather
- Model Wildfire Vulnerability: run proprietary thermodynamic fire physics model that understands structure-fuel interactions broken down by five wildfire ignition vectors
- Score Vulnerability: score scaled from 1 to 500 and back-tested against prior fires with F1 score of over 0.90, supports informed insurability conversations
- Delivered: thousands of reports through California Association of Realtors program as proof point



Onsite Inspection Overview

Refine precision of Aerial Risk Report and provide a customized mitigation roadmap for each property, including post-mitigation Vulnerability Score.

- Provides comprehensive data and analysis of a property's condition
- Includes mitigation actions and costs to protect structures from ignition in the wildfire events
- Quantifies post-mitigation PIM (Property Ignition Model) Score as compared to initial vulnerability assessment
- Features ready-to-contract-or-self-perform service quotes to remediate identified failure points
- Complements (but does not replace) fire agency inspections to certify compliance – FF adds structure point-of-view and prescriptive recommendations for risk reduction



Monitoring + Protection Plan Overview

Subscribe to annual plan that provides homeowner alerts, service visits, and weather- triggered event inspections, property preparation, and fire retardant staging.

- Real Time Tracking: vegetation growth, weather, moisture conditions, structural changes, maintenance services, wildfire event data. All of these inform and trigger protection services
- Ensures that property remains in mitigated, wildfire-prepared condition – linked to policy coverage periods or independent of insurance status
- Offers optional onsite fire retardant delivery, storage, and application (additional fees apply)

Residential Customer Success Story

John is a homeowner in San Luis Obispo County.
His property is in an area designated as high wildfire hazard by CAL FIRE.

Insurance Premiums Escalated

John receives an insurance renewal quoting a 73% increase in his homeowner insurance premium.

As a Realtor, he understands that WFDR is available and he orders a report.

Vulnerability Risks Addressed

The report gives property-specific assessment and comprehensive list of mitigations to reduce wildfire risk.

He did the structure hardening and vegetation management recommendations – including tree trimming and removal as well as onsite water storage and vent upgrades.

"The WFDR is so much more helpful than just a CAL FIRE hazard designation."

Savings Realized

Armed with the WFDR and photos of recently completed mitigation actions, John proactively contacted his insurance agent.

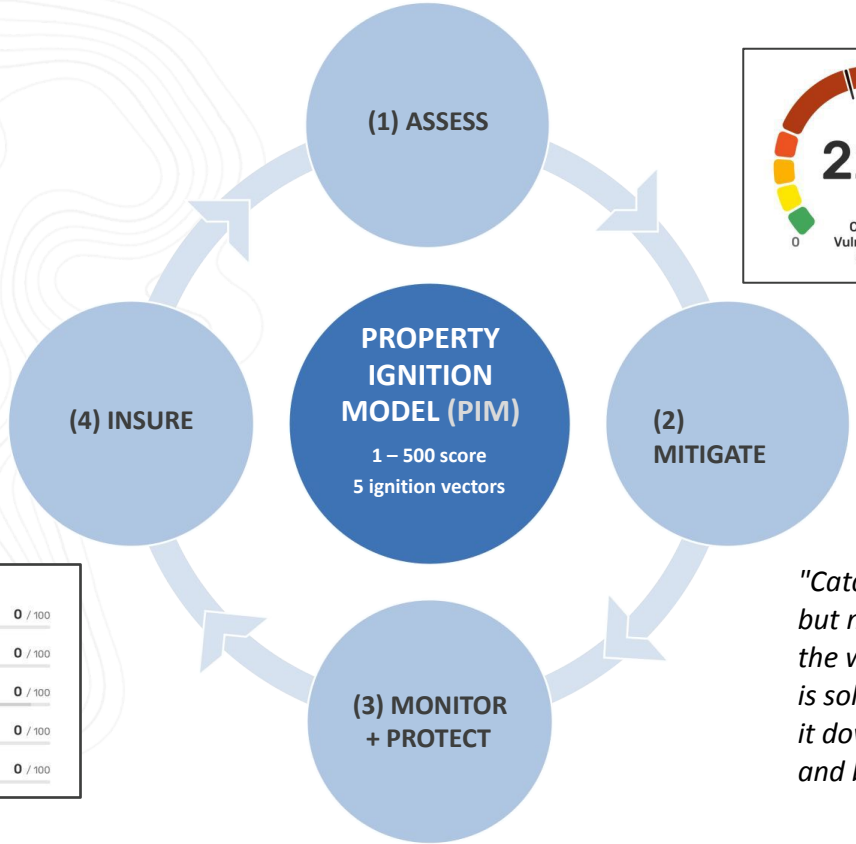
John secured a **$1000 reduction** in the premium he had been quoted.

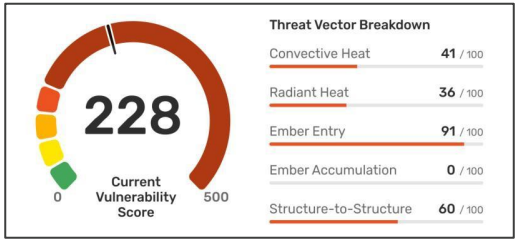
John is also confident that his home is protected from destruction in the event of wildfire.

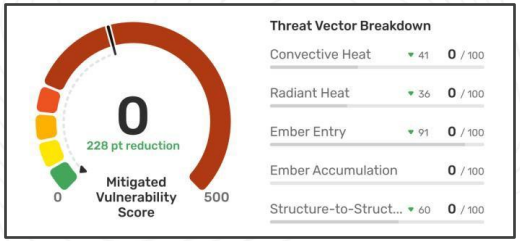
Understanding a property's unique risks and actively addressing vulnerabilities helps homeowners become an active participant in their property's protection and insurability.

A New Standard for Ignition Risk Evaluation

FortressFire identifies vulnerabilities of a specific structure and reduces or removes those vulnerabilities with science-based mitigation, bringing the structure to near-zero risk of ignition and loss in a wildfire







"Catastrophe models are essential but not sufficient to fully address the wildfire problems. The problem is solved by finding the risk and driving it down. And that includes better data and better modeling of mitigation."

- CDI Working Group on Climate Risk

Back-Test Validates FortressFire Model and Score

True Positive Rate:	0.93
True Negative Rate:	0.99
Precision:	0.99
F1 Score:	0.96

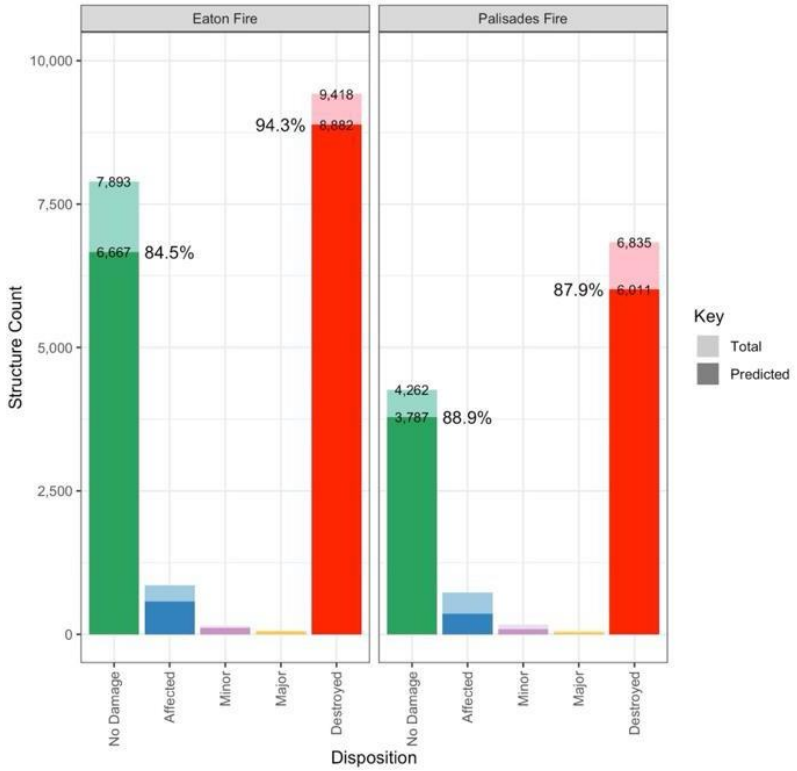
Very High Accuracy In Predicting Which Homes Will Be Destroyed and Which Will Survive Undamaged

Ground truth from sample of 35 fires from CALFIRE damage inspection data validated the accuracy of FortressFire's Vulnerability Model of Structure-Fuel interaction and Mitigation Solutions

Southern California Fires Confirm FortressFire Approach

- FortressFire Model – validated by 35 Back-tests, including Mountain Fire
  - Just as able to correctly predict ignition in 80 mph high winds as in moderate wind conditions
  - Some overprediction of loss for structures that were not destroyed – conservative approach
- LA Fires
  - Managing defensible space alone is not enough
  - Protection requires a combination of vegetation management, structure hardening, and an understanding of all interactions and risk factors
  - Shift required from heavy reliance on firefighters to control blazes > understanding that vulnerable structures are themselves the primary fuels
  - Implications for communities designed for cluster protection, construction / retrofit materials, thermal barriers as well as vegetation management

Back-Test: Eaton and Palisades Fires



- FortressFire analyzed all structures inspected by CAL FIRE within the Eaton Fire perimeter.
- Each structure was blind-assessed by FortressFire technology, its ignition outcome predicted, and then compared to CAL FIRE's disposition data.
- Takeaways
  - Large scale analysis: 30,456 structures
  - Bi-modal outcome distribution noted: No Damage or Destroyed
  - FortressFire technology validated in 80 mph high wind wildfire event
  - High prediction accuracy

The Best Risk Management is Loss Prevention

RISK MANAGEMENT

- Focused on **strategic aspects** of identifying, assessing, and prioritizing losses
- Financially based
- Uses tactics like reduction, segregation, and risk transfer

VS

LOSS PREVENTION

- Focused on **technical elements** of incident prevention based on science
- Asset based
- Uses tactics like detection, resilience, resolution, and avoidance

- Greater insurance access and affordability options for Property Owners
- Better exposure insights > fewer losses, better portfolio management, and new growth opportunities for Lenders and Insurers
- Lower exposure to catastrophes and negative environmental consequences for Communities
- Greater opportunities for community-level resilience and cluster defense

Fire Science, Physics, and Deterministic Modeling = Comprehensive Wildfire Resilience

- **Difference**: We understand how wildfires transfer to structures and solve for vulnerabilities to prevent ignition. We do not attempt to predict the occurrence.
- **Instead**: We *presume* a wildfire, use science to understand how it will ignite a home, and stop ignition.
- Our system is structure-specific, accurate, comprehensive, and cost-effective because it is based on fire physics.
- **Result**: *Lower loss rates* and fewer claims.

Messages to DIFI:
We Solve the Wildfire-Insurance Problem

- FortressFire's tools can stop wildfires from igniting structures, so homes don't burn.
- Our tools precise wildfire risks to each home, mitigates those risks, and provides protections that **stop the fire from igniting the home**.
- When fires do not ignite homes, losses are not incurred, claim frequency is lowered, and the **PROBLEM IS SOLVED**.
- We save families from losing everything in a wildfire because many more homes are spared.
- FortressFire's approach is different, and **our tools are immediately scalable.**

Only Fire Science Delivers Comprehensive Wildfire Resilience

Question + Answer Session

- **Duane Gibson, Senior Advisor**
  dgibson@livingstongroupdc.com
- **Michael O'Dell, Head of Machine Learning**
  modell@fwig.com

III. Presentation from Moody's Corporation

ARIZONA
DEPARTMENT OF INSURANCE
& FINANCIAL INSTITUTIONS

MOODY'S

Wildfire Catastrophe Models Explained: The Moody's Wildfire Model for the United States

Matthew Nielsen

Senior Vice President, Government, Public, and Regulatory Affairs

Moody's Shared Services

Moody's Journey:

- A history of over 100 years of service
- Former RMS (now Moody's) has been modeling catastrophes since 1987
  - Began with California Earthquakes
  - Developed first catastrophe model with Stanford University professors and students
  - Leading provider of catastrophe models to the global insurance industry
- Develops models that synthesize physical science, engineering, actuarial science, and computer technology
- Models available globally for over 350 physical and man-made perils

MOODY'S MOODY'S RATINGS MOODY'S LOCAL MOODY'S FOUNDATION

Cat Model Primer

How do Insurance Actuaries Assess Risk?

- Insurance companies need to understand their risk to pay out claims and develop pricing for their policies
  - Actuaries are charged with calculating the risk to an insurance company's portfolio of policies
  - Historical loss experience was traditionally their main source of information used to develop a view of future risk
    - Historical data on wildfires from agencies such as CalFire and the U.S. Forest Service
      - Burn area, ignitions, etc
    - Industry loss data from past fires
      - Total losses and individual location losses
  - For wildfire, historical experience is incomplete, biased towards recent events, lacks information on the loss severity potential

Key Applications of Risk Modeling for Insurers

Portfolio Management

- Determine risk drivers
- Evaluate capital adequacy and needs
- Estimate post-event losses

Risk Transfer

- Determine reinsurance needs
- Structure and inform loss costs for pricing reinsurance contracts
- Modeled data is used commonly between insurers and reinsurers

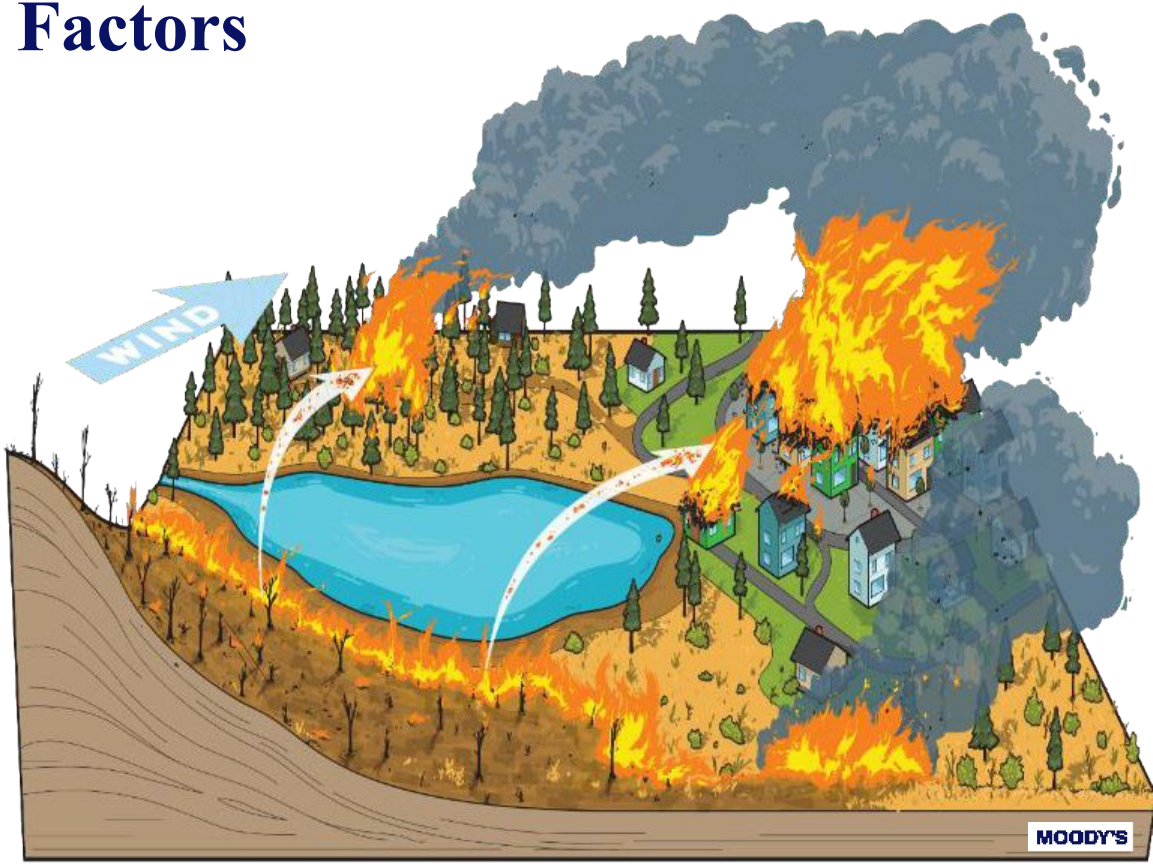
Underwriting

- Analyze policy structures
- Differentiate risks including mitigation features
- Inform guidelines
- Develop loss costs to inform rating

MOODY'S

Wildfire Contributing Factors

Natural environment	Built environment	Human factors
Climatology	Structure density	**Community education**
Local weather	Building materials	Mitigation & preparedness
Topography	Connective fuels	Ignition sources
Landscape parameters	Infrastructure	Fire intervention



Moody's Wildfire Modeling Framework

Stochastic event catalog

Simulate wildfire scenarios

Hazard module

Quantify spatial extent and intensity of heat, ember, and smoke hazards

Exposure module

Apply replacement value of properties at risk for structure, contents, and business interruption

Vulnerability module

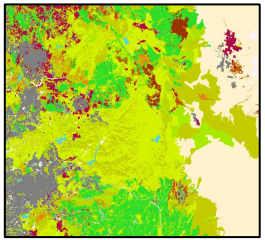
Estimate damage for different vulnerability classes based on material, height, occupancy, year built, and mitigation measures

Financial analysis module

Quantify financial loss

State-of-the-Science Wildfire Hazard Framework

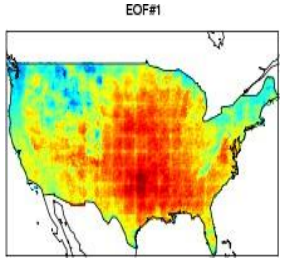
Landscape and fire behavior parameters → Fire weather simulations → Fire ignitions → Fire spread → Ember intensity → Conflagration → Smoke spread



Surface fuels
Canopy fuels
Forest fuels

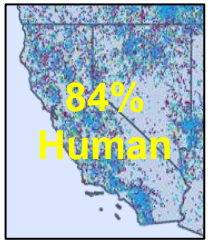
Distance to vegetation

Topography



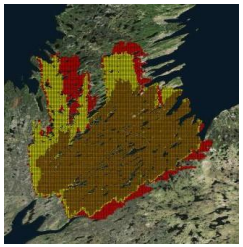
Extreme weather simulations

Climate to date



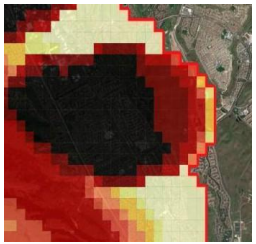
Simulated ignitions from all sources

Utility-triggered events identified explicitly



Realistic fire footprints: Minimum travel-time algorithm

Ember intensity based on ember transport and accumulation



Urban conflagration footprints: Structure-to-structure spread

Smoke emission plus transport and deposition

Fire Spread Main Components

Rate of Spread

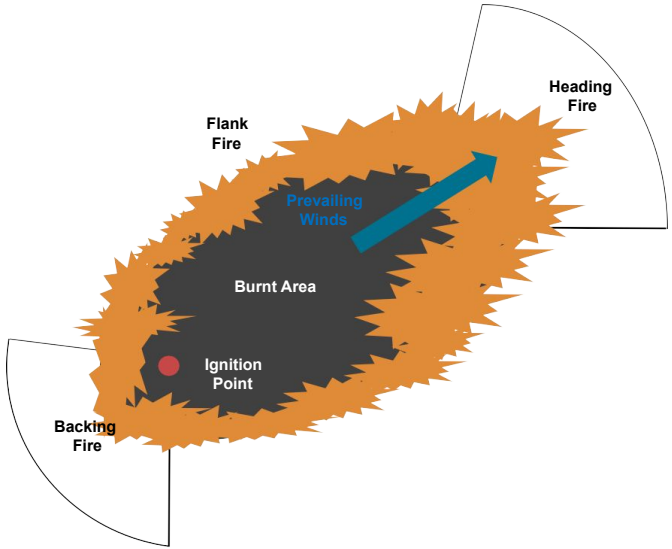
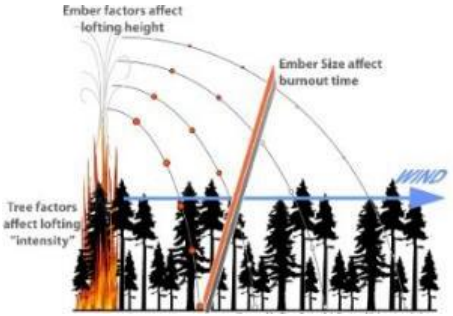


Illustration Credit: RMS

Spotting



Illustrated by Fiona Steele, B.A. Blackwell & Associates

Fire Suppression

http://sustainablenorthwest.org/blog/posts/years-in-the-making-a-solution-for-funding-wildfire-suppression

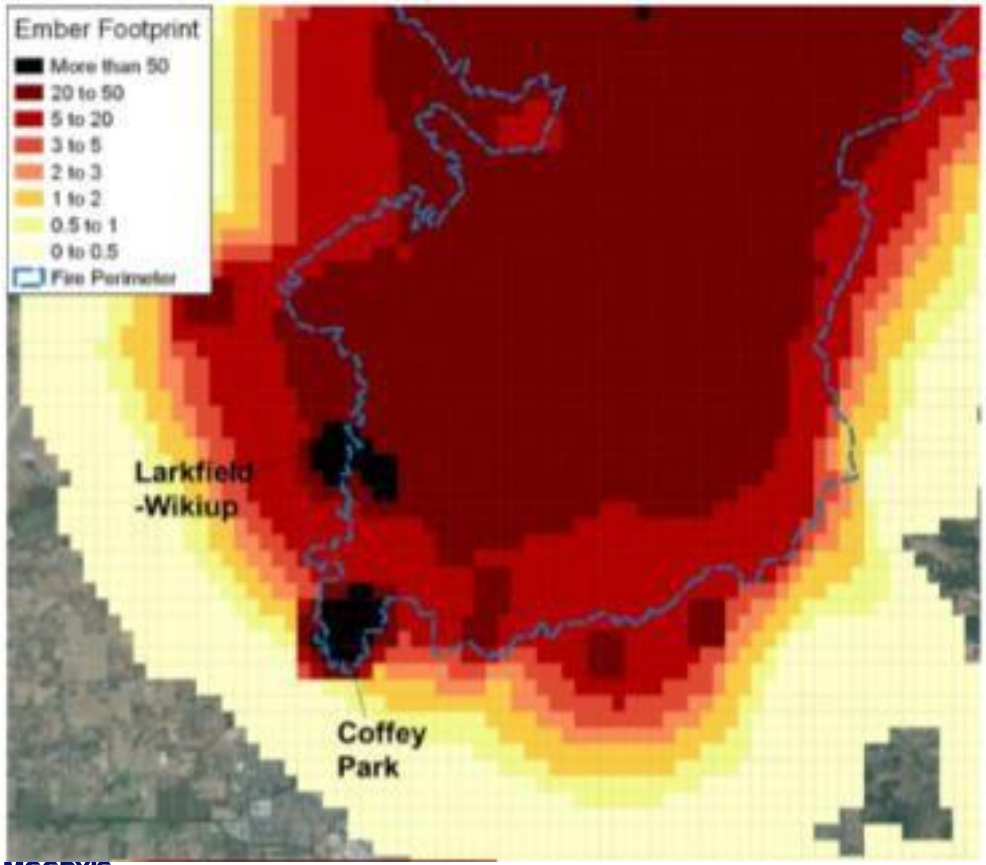
http://www.tvcc.cc/academics/cbwcl/wildland_courses.cfm

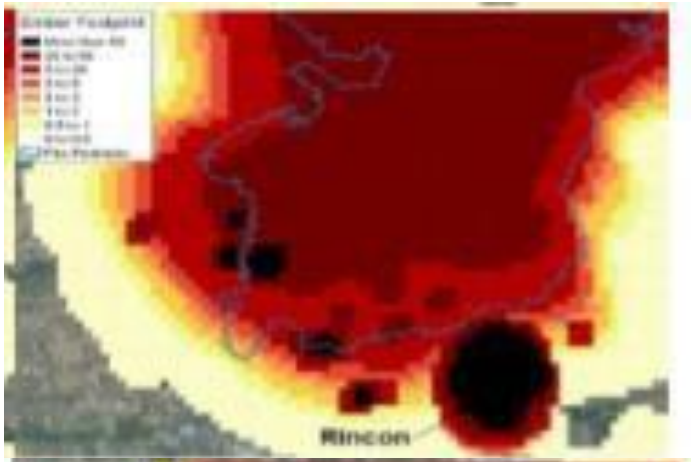
Ember Intensity

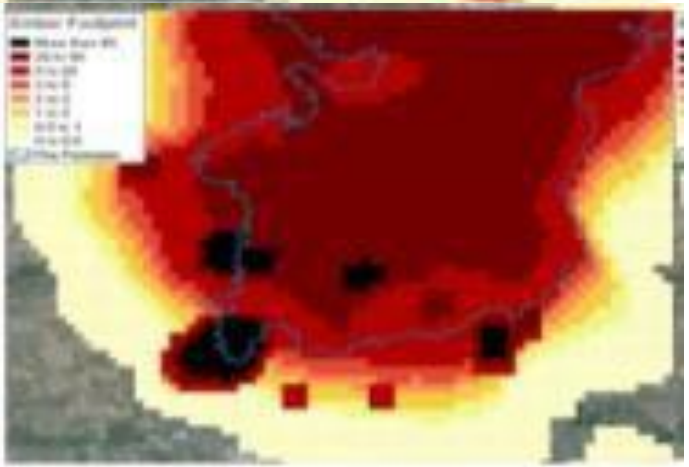
Ember led burning of structures beyond the flaming front

- Can cause damage ahead of flaming front
- Tend to accumulated in vents, gutters, and grooves in roofing
- Embers can travel up to 2 miles in high winds
- Composition of embers depends on what's being burned and strength of winds

Urban Conflagration Drives Tail Risk





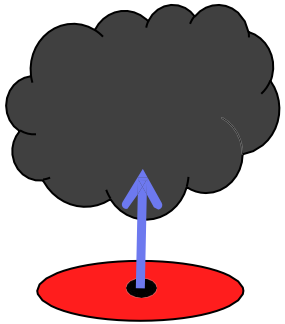


Coffey Park, CA, 2017

Source: Marcio Jose Sanchez/AP Photo

Moody's Smoke Modeling

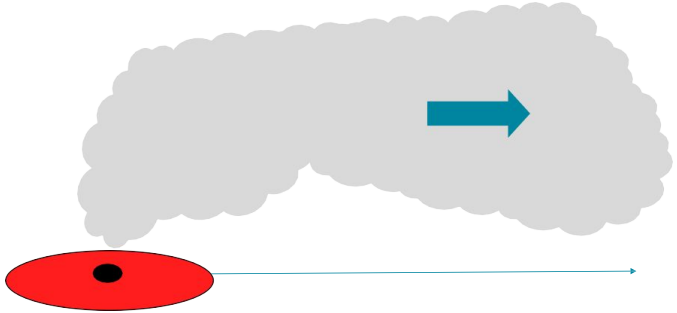
Emission model



Simulated fire footprint

- What is burning?
- How fast?
- Amount of emissions?

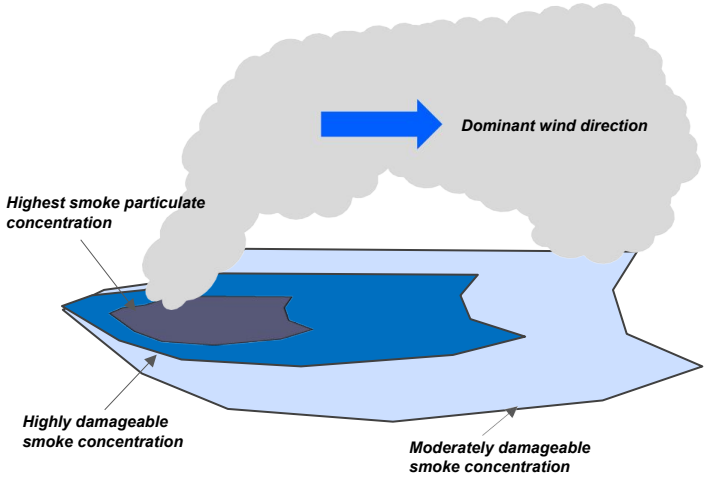
Transport model



Simulated transport condition

- Wind speed/direction
- Concentration downstream

Footprint model



Modeled smoke footprint

- Dominant wind direction and uncertainty
- Smoke concentration over distance
- Smoke dispersion effect

MOODY'S

Smoke Damage

MOODY'S Contents in front of surviving homes in the Palisade Fire region

Individual Building Mitigation

Wildfire-Resistance: Make the "RIGHT" Choices

ES
ed

SIDING
Fiber Cement Board

WINDOWS
Dual-Pane Tempered
Screens

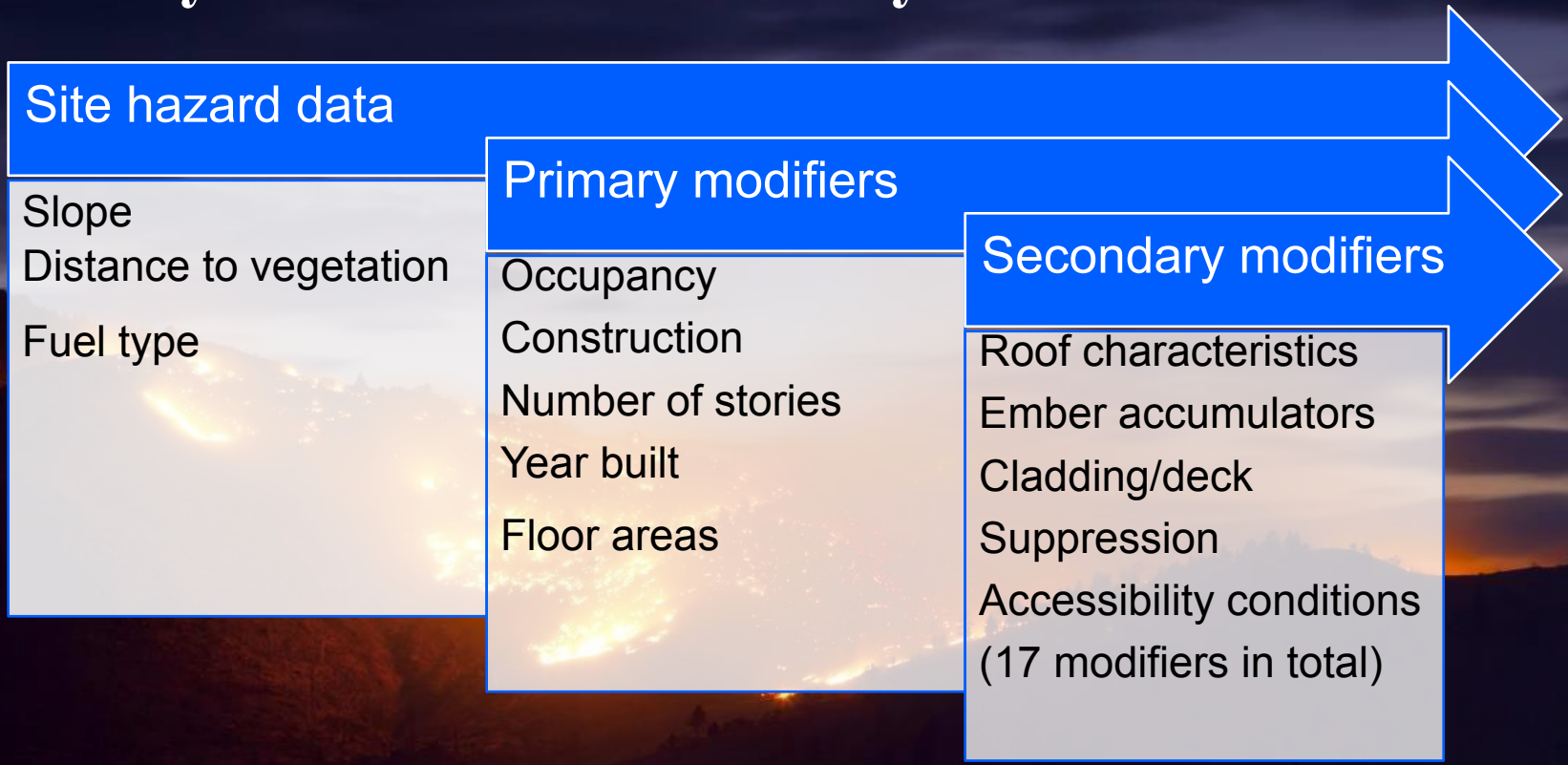
MULCH
Rock

joist space
on joists

Standard spacing

Source: IBHS
https://disastersafety.org/

Moody's Wildfire Vulnerability Framework



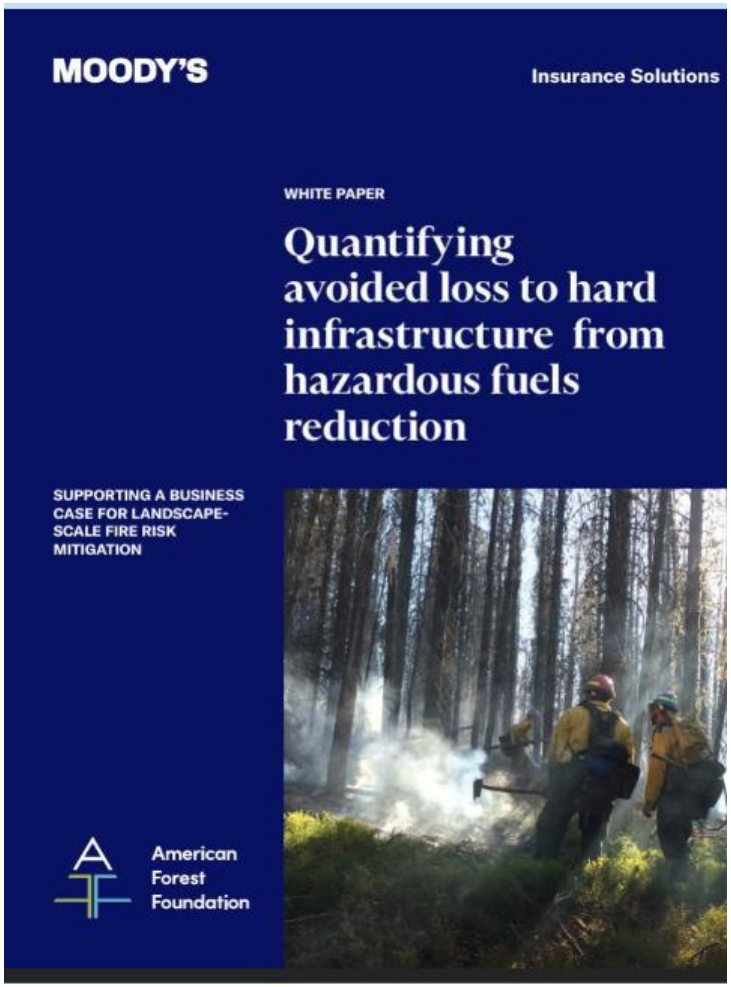
Mitigation Makes a Difference

Grass Valley, CA: Moody's RMS wildfire model analysis for a select community within the Tahoe-Donner HOA postal code: 21–59% reduction in AAL

Contributing factors:

- Fuel reduction programs
- Reduced fire size
- Reduced ember intensity
- Increased likelihood of effective fire suppression

- $2.5 million wildfire resilience insurance coverage developed for Tahoe Donner Association
- 39% lower premium
- 89% lower deductible



Risk Differentiation

Modifiers for community-level preparedness and mitigation

FIREWISE COMMUNITIES

CWPP Community Wildfire Protection Plan

WILDFIRE ADAPTED PARTNERSHIP

CALIFORNIA FireSafe COUNCIL

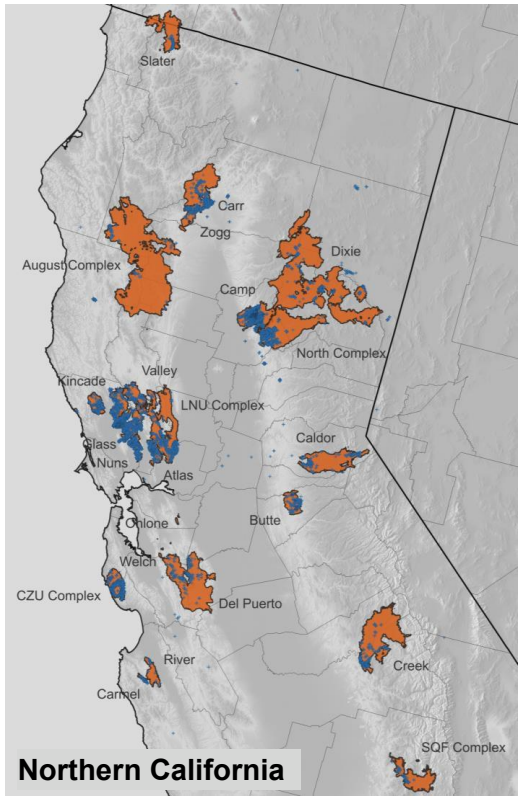
CRR COMMUNITY RISK REDUCTION™

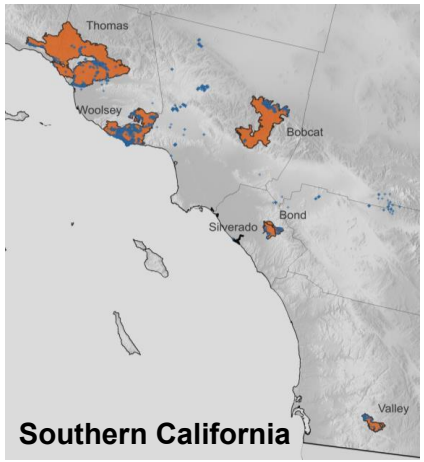
Not all community programs are alike…

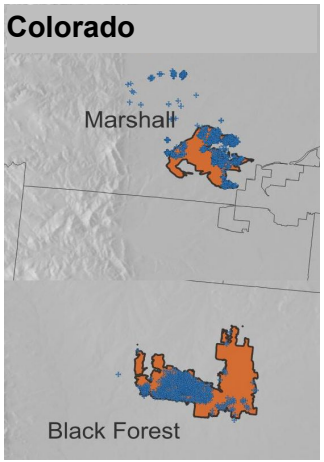
…Variable mitigations, participation, enforcement, frequency of inspections

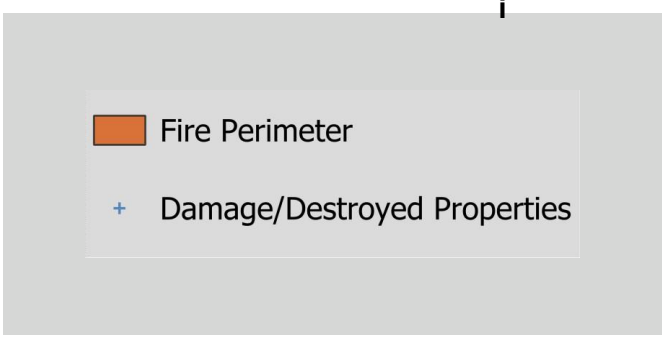
Moody's Vulnerability Calibration

Damaged properties across 30+ historical events









Moody's Partnerships

 Vulnerability Calibration based on Data & Insights from partners & researchers…

Leading Research Organizations

Insurance Industry - Joint Development Partners

Insurance Institute for Business & Home Safety®

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION CAL FIRE SINCE 1885

Regional & National Primaries

Leading (Re)insurance Brokers

Large Reinsurance Companies

Moody's Field Reconnaissance

- **Learnings from *damage surveys* informed & validated model assumptions…**

Double-Paned Window – Mitigation against flames & embers

Ignition risk from Decks / Fences/ Vegetation/ Flammable objects

Partial Damage to Structures

Moody's RMS™ North America Wildfire HD 2.0

Key features

- Probabilistic wildfire simulations of hundreds of thousands of years in the United States
- **Number of events:** Hundreds of millions
- **Coverage:** United States including **Hawaii** and Canada
- Realistic fire, smoke, and ember footprints at **lot-size resolution**
- **Underwriting data** :
  - Wildfire hazard data (distance to vegetation, fuel, urban conflagration risk)
  - Risk score data
  - Loss costs

Key differentiators from other models

- **Explicit ember and smoke** modeling to capture impacts beyond traditional fire perimeters
- **Urban conflagration** captures extreme tail risk events (2017 Wine Country, 2023 Lahaina Hawaii and 2025 LA wildfires)
- **Utility attribution and mitigation**
  - Robust set of secondary modifiers to capture **property and community mitigation** efforts
- **Hours and spatial clauses** in reinsurance treaties
- **Specialty vulnerabiltiies** including industrial facilities, builders risk, marine cargo

MOODY'S

Thank you

MOODY'S

IV. Presentation from National Ready Mixed Concrete Association

ARIZONA
DEPARTMENT OF INSURANCE
& FINANCIAL INSTITUTIONS

Resiliency: Consideration Beyond Code Requirements

Shamim Rashid-Sumar, PE, FSFPE
Senior Vice President, Codes & Standards

BUILD WITH STRENGTH

NRMCA

Contents

- The Impact of Fire and other Natural Disasters
- Definition of Resilience
- Steps to Disaster Resilience
- Quantifying the Benefits of Resilient Construction
- Case Studies
- Conclusions

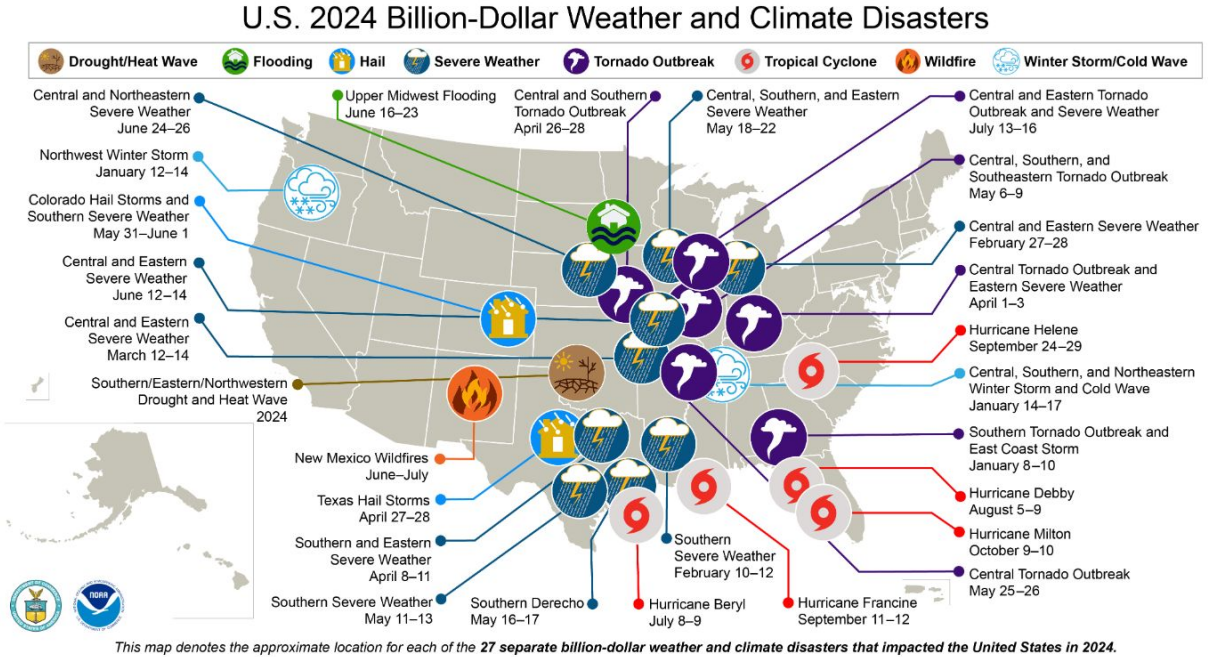
The Impact of Natural Disasters

The Impact of Natural Disasters

For millions of people in the U.S., the consequences of natural disasters have become increasingly real, personal, and devastating.

In 2024, there were 27 separate weather and climate disaster events with losses exceeding $1 billion each across the United States.

2024 is the tenth consecutive year (2015-2024) in which 10 or more billion-dollar weather and climate disaster events have impacted the United States.



*This map denotes the approximate location for each of the **27 separate billion-dollar weather and climate disasters that impacted the United States in 2024.***

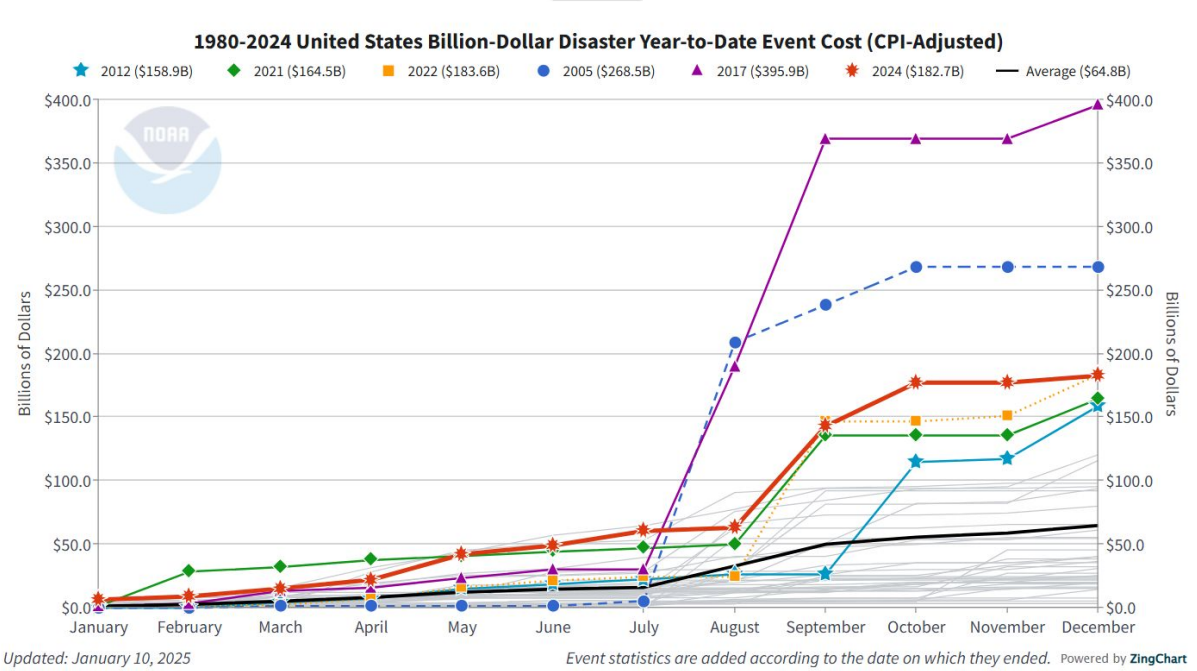
Credit: National Oceanic and Atmospheric Administration
https://www.ncei.noaa.gov/access/billions

The Impact of Natural Disasters

According to the National Oceanic and Atmospheric Administration (NOAA), 2017 was the costliest year on record for natural disasters in the U.S., with a price tag of at least $306 billion.

Requests for federal disaster aid increased tenfold in 2017 compared to 2016, with 4.7 million people registering with the Federal Emergency Management Agency (FEMA).

These once-rare events are becoming more common and costlier according to NOAA. Hurricane Harvey's record flooding in Houston was the city's third 500-year flood event in as many years.



The Cost of Wildfires

According to Verisk Insurance Solutions, 4.5 million U.S. homes are at high or extreme risk of wildfire, with more than two million in California alone.

According to Munich RE, a reinsurer, there have been $23.1 billion in losses to wildfires in the U.S. over the past five years.

2017 was by far the worst year with $17 billion losses and that number will likely continue to grow due to climate change which is creating warmer and drier conditions.

Photo credit: FrozenShutter / iStock

The Aftermath of Wildfires

According to the Bloomberg Businessweek article Why Is California Rebuilding in Fire Country? Because You're Paying for It!, the 1964 Hanley Fire in Sonoma County destroyed 100 homes whereas the 2017 Tubbs Fire, which covered nearly the same area, destroyed more than 5,000 homes and killed 22 people.

The Tubbs Fire was one of 131 across California in October of 2017. By the end of 2017, more than 1 million acres and 10,000 buildings had been destroyed.

Photo credit: Janos Rautonen/Shutterstock

Wildfire Risk

Although recent attention has been on California because of the major wildfires in 2017 and 2025, there are wildfire risks in most states.

According to Forest and Rangelands, the map shows the counties with the greatest risk of wildfires characterized by the higher-than-average annual area burned, structures lost, and homes exposed within the wildland urban interface.

U.S. Wildfire Risk

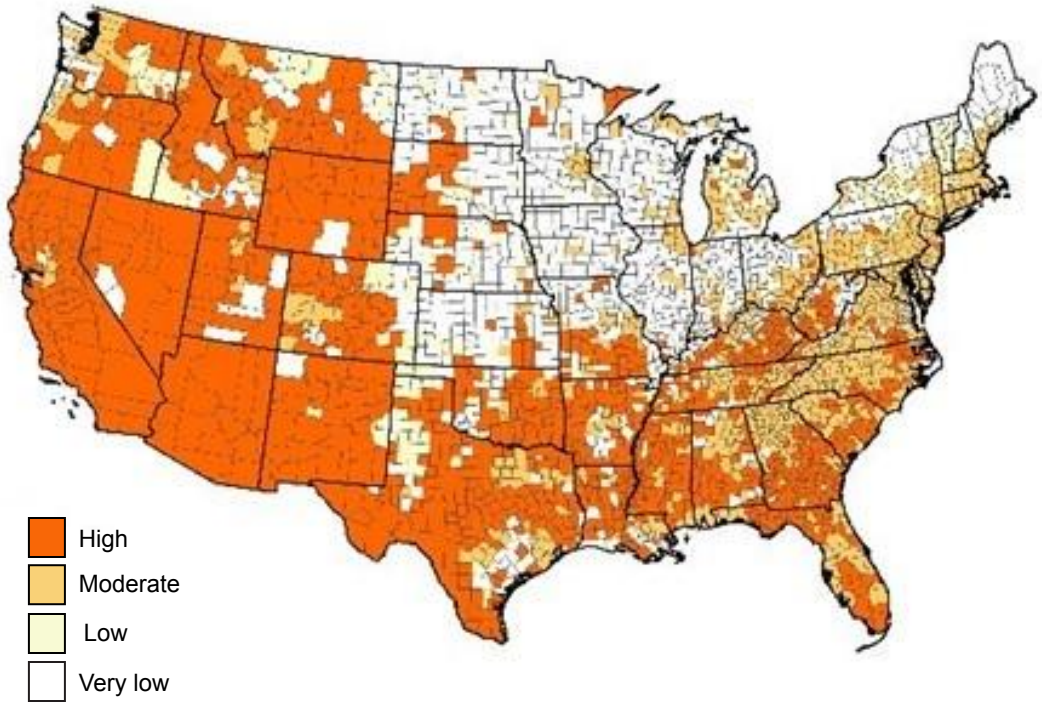


Image courtesy of: https://www.forestsandrangelands.gov/

Proper Damage Due to Fires

According to NFPA, there were 499,000 structure fires in 2017, causing 2,815 civilian deaths, 12,160 civilian injuries, and $23 billion in damages.

NFPA estimates 262,500 fires occurred in homes resulting in 2,290 deaths, 7,470 injuries, and $6.1 billion in damages, and 95,000 occurred in apartment buildings resulting in 340 deaths, 3,130 injuries, and $1.6 billion in damages. Property damages from fires have been increasing over time.

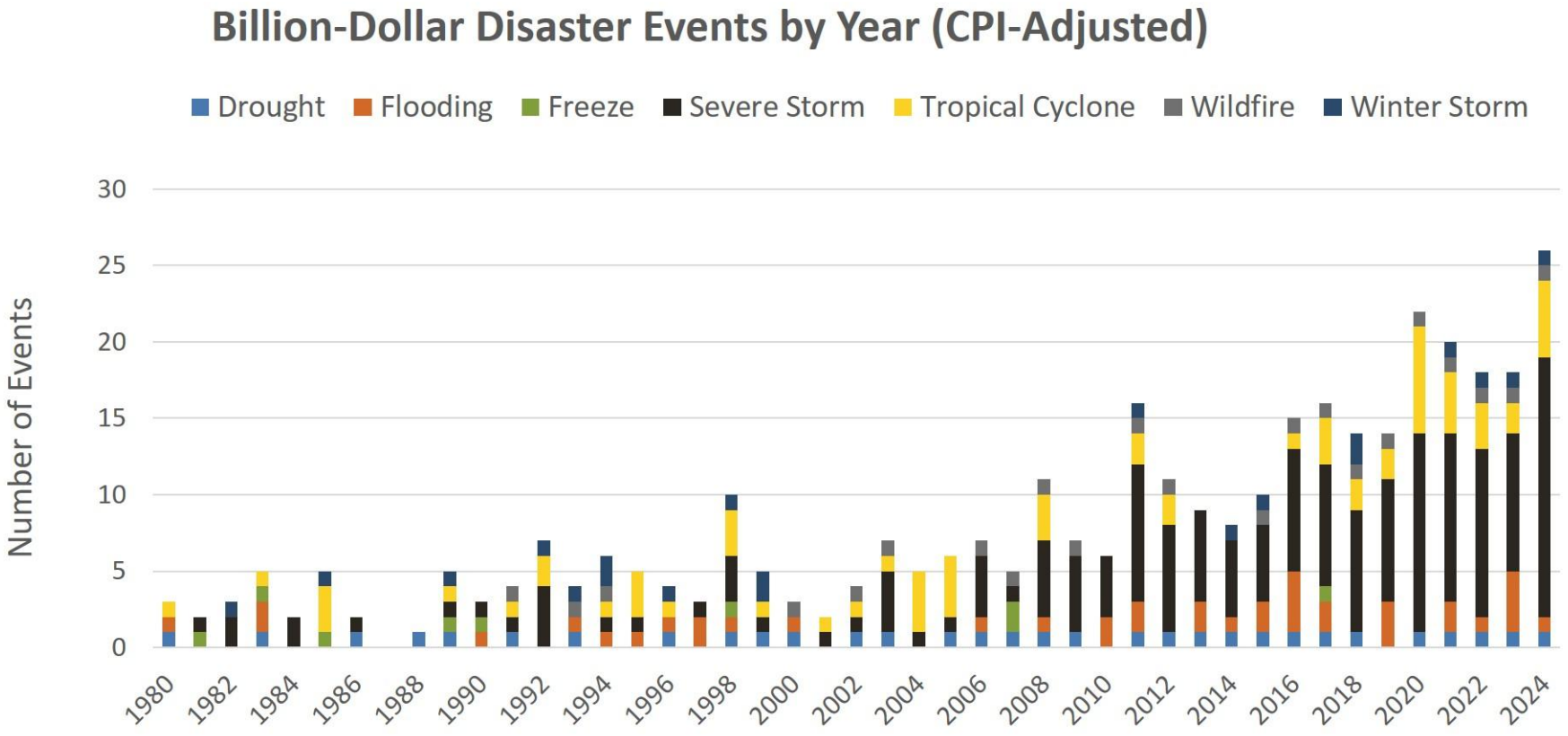
Photo credit: REKINC1980/iStock

Proper Damage Due to Fires

Developers have increased the use of combustible wood-frame construction for multifamily construction (apartments, condominiums, hotels, dormitories, and long-term care facilities) resulting in a rash of fires across the country that are reducing these buildings to ashes, putting lives and communities at risk.

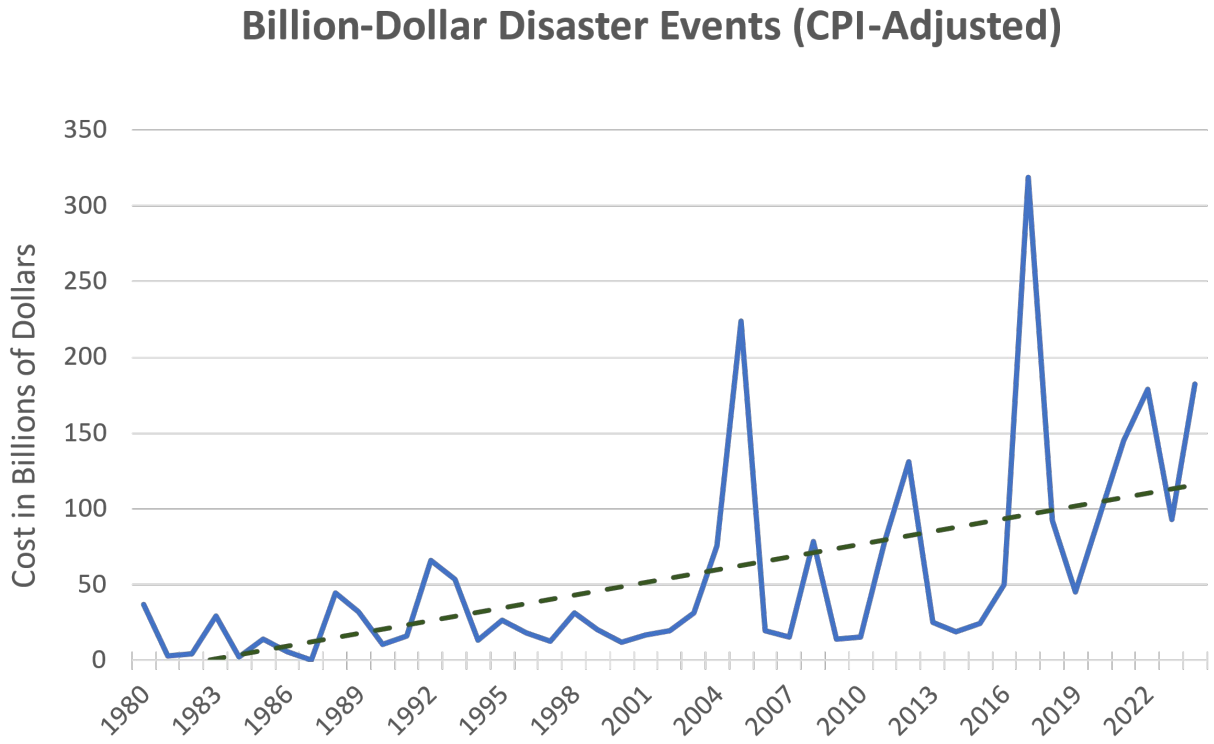
Photo credit: whiterabbit83/iStock

Billion-Dollar Disaster Events on the Rise



You can see in this graph adapted from the NOAA that billion-dollar disaster events are increasing.

Cost of Billion-Dollar Disaster Events

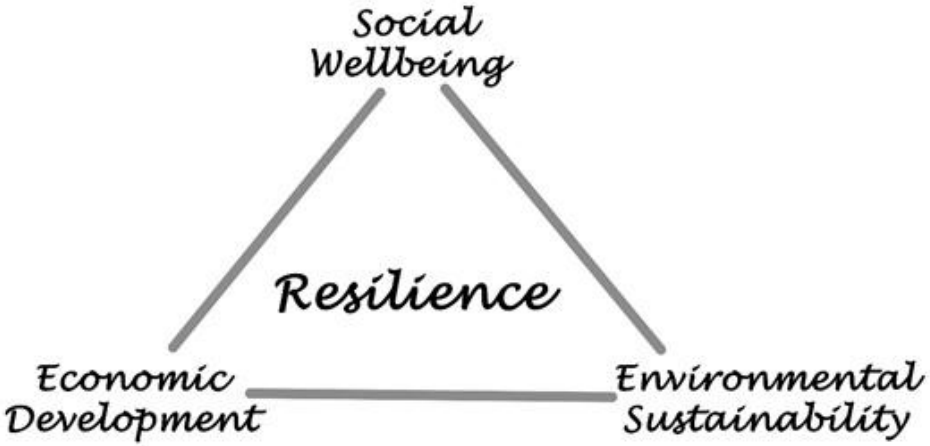


This graph (adapted from the NOAA) shows the upward trend of the cost of disaster events.

What is Resilience?

There are several definitions of resilience. The Urban Land Institute (ULI) defines resilience as “the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events.”

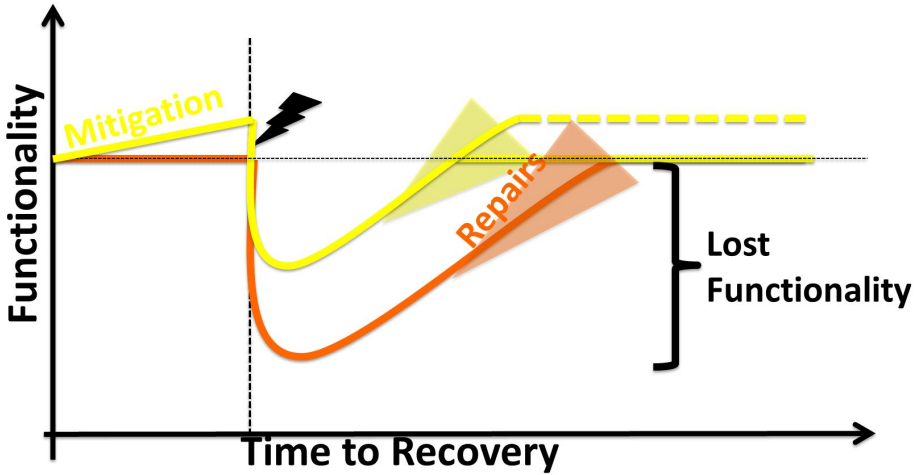
Basically, addressing changes in the environment, whether the changes are natural or man-made, requires actions to mitigate their negative effects and adapt to those changes.



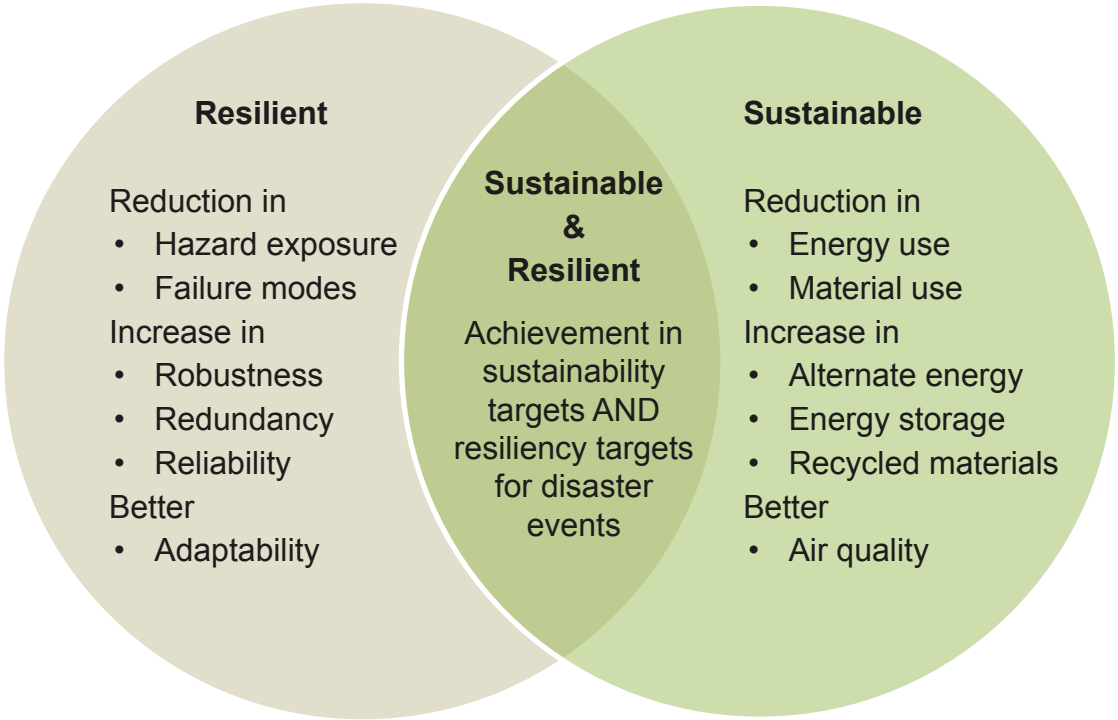
Resilience and Sustainability

For a building to be sustainable, one must consider potential for future use and reuse and design for long-service life with minimal maintenance costs.

There is significant guidance on reducing environmental impacts with green building codes and rating systems such as LEED, International Green Construction Code (IgCC), Green Globes, among others. But the guidance for designing a building to adapt to and mitigate the effects of natural hazards are now only beginning to take shape.

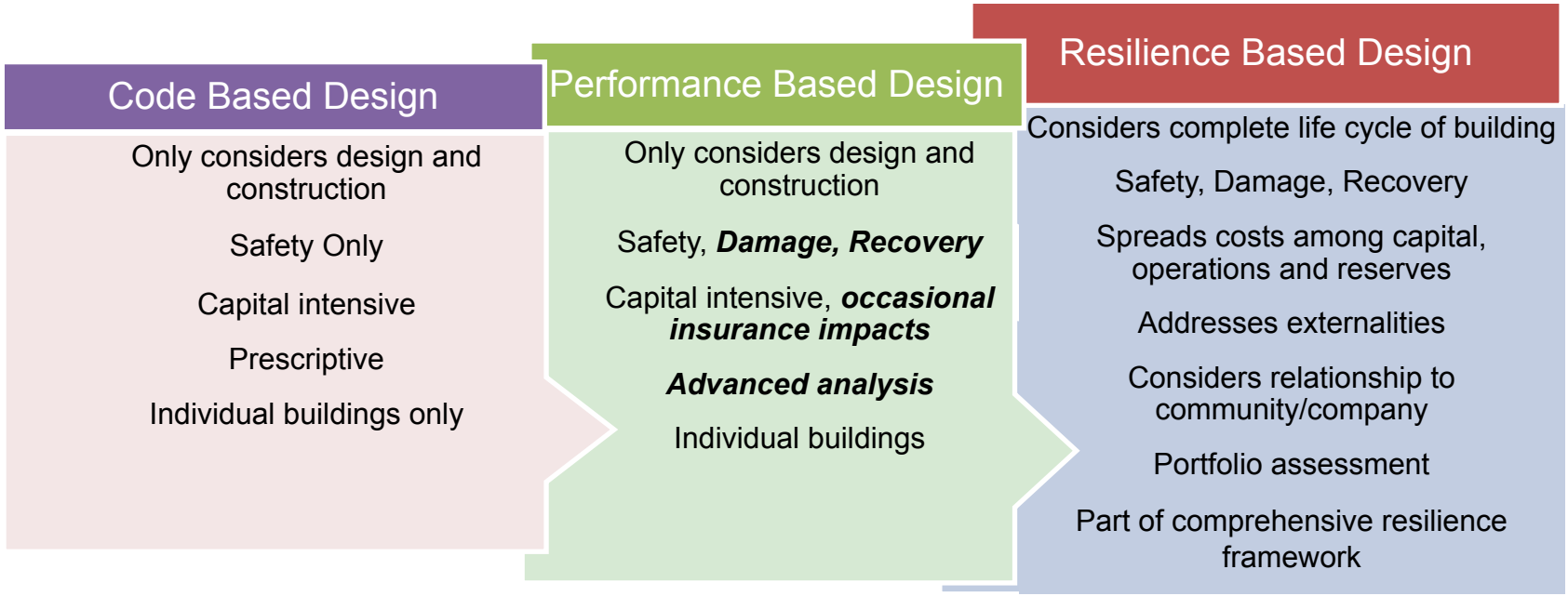


Resilience and Sustainability

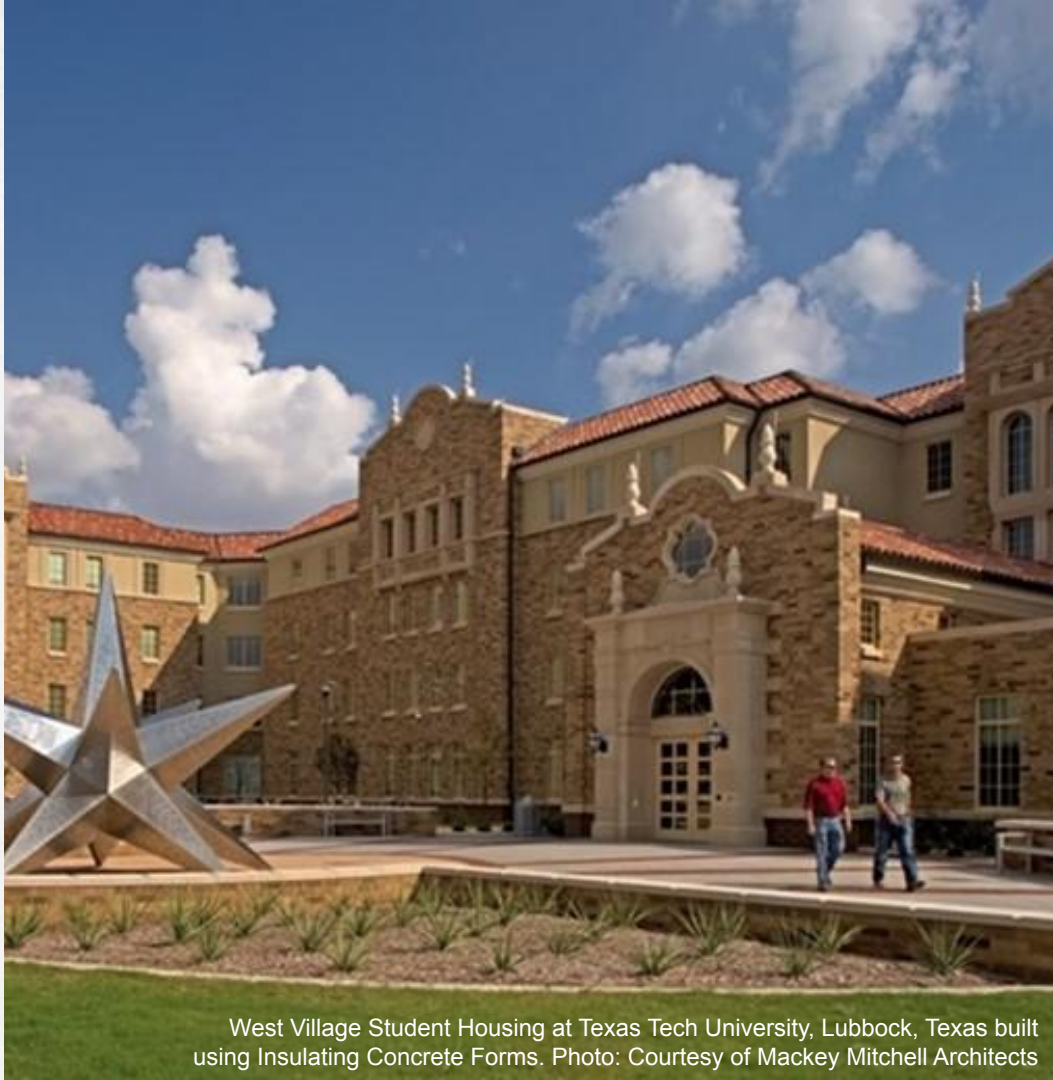


Adapted from Meacham, B.J., and McNamee, M. (2020). Fire Safety Challenges of "Green" Buildings and Attributes, Fire Protection Research Foundation, Quincy, MA, USA.

Evolution to Resilience Based Design



Steps to Disaster Resilience



West Village Student Housing at Texas Tech University, Lubbock, Texas built using Insulating Concrete Forms. Photo: Courtesy of Mackey Mitchell Architects

Steps to Disaster Resilience

The following are steps, combining both voluntary and mandatory mitigation strategies, to achieving disaster resilience:

1. Adopt Updated Building Codes
2. Adopt High Performance Building Standards
3. Incentivize Disaster Resilient Construction
4. Build with Robust Materials

1. Adopt Updated Building Codes

A common misconception is that a new code-compliant building in the U.S. will be resilient against considerable damage after a major hazard event.

This is not always the case. The building code sets standards that guide design and construction of structures for minimum Life Safety, the first step towards resilience.

However, maintaining the functionality of structures after a disaster is also important and building codes do not address functionality effectively.

Sadly, special interest groups have convinced some state legislatures to reduce the stringency or limit the adoption of the latest building code.

2. Adopt High Performance Building Standards

The following are programs and standards aimed at incorporating resilient building techniques into construction to provide an optimum level of protection against a variety of natural hazards:

- Enhanced building codes and standards
- FORTIFIED for Safer Living and Safer Business
- USRC Building Rating System
- REDi Rating System
- RELi Rating System for Resilience

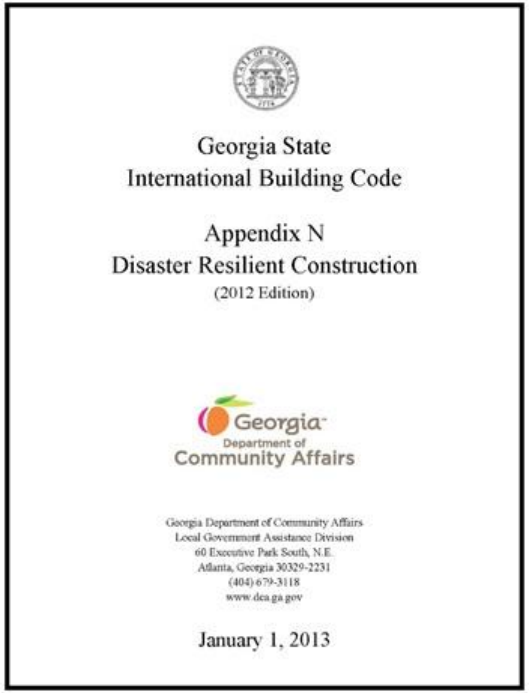

Photo credit: RapidEye/iStock

2. Adopt High Performance Building Standards

Enhanced building codes can be developed and adopted through the building code appendices. The appendices are provided in the International Building Code (IBC) and the International Residential Code (IRC) to offer supplemental criteria to the provisions in the main chapters of the code.

After damaging windstorms in 2008, the Georgia Department of Community Affairs created the Disaster Resilient Building Construction (DRBC) appendices to the IBC and IRC, which form the basis for the Georgia State Building Code.

The DRBC appendices offer an affordable, flexible, and simplified approach to improving resiliency at the local level. Local jurisdictions can adopt the complete appendices to improve building resiliency against flooding and high winds, or they can adopt select sections that apply to specific hazards in their geographic area.


Georgia State
International Building Code

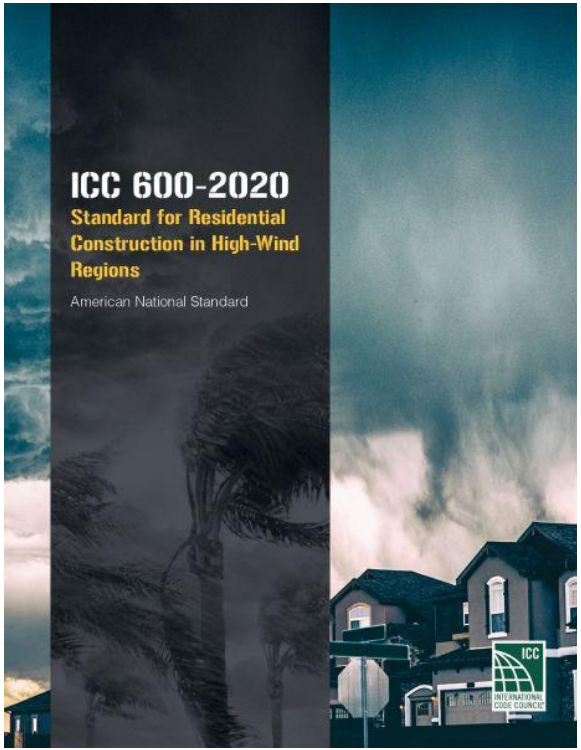
Appendix N
Disaster Resilient Construction
(2012 Edition)

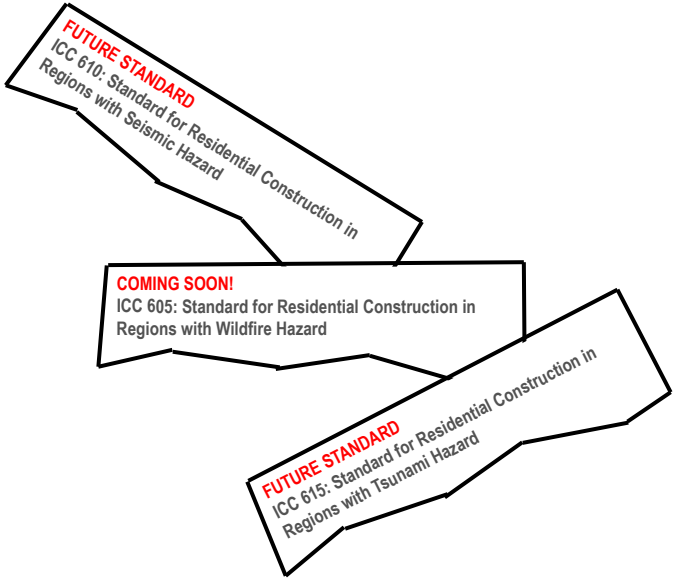
Georgia
Department of
Community Affairs

Georgia Department of Community Affairs
Local Government Assistance Division
60 Executive Park South, N.E.
Atlanta, Georgia 30329-2231
(404) 679-3118
www.dca.ga.gov

January 1, 2013

2. Adopt High Performance Building Standards





ICC Multi-Hazard Resiliency for Residential Construction Committee (IS-MHRRC)
https://www.iccsafe.org/committees/is-mhrrc/

2. Adopt High Performance Building Standards

The FORTIFIED for Safer Living and Safer Business are programs of the Insurance Institute for Business and Home Safety (IBHS).

The program provides enhanced design criteria relative to code minimum and the necessary construction and inspection oversight to ensure high performing structures that are truly disaster resilient.

The IBHS is a not-for-profit applied research and communications organization supported by the insurance industry.

2. Adopt High Performance Building Standards

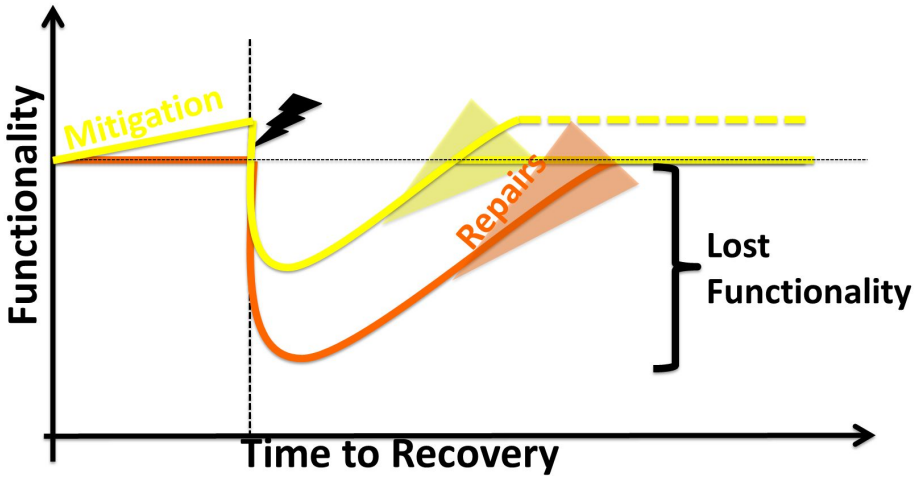
The U.S. Resiliency Council (USRC) is a national organization dedicated to improving the sustainability and resiliency of buildings during earthquakes and other natural hazards.

The performance-based USRC Building Rating System assigns one to five stars along the dimensions of Safety, Damage, expressed as repair cost, and Recovery, expressed as time to regain basic function.

Certified buildings are expected to perform in a manner that will preserve life safety of the occupants, limit damage to repairable levels, and allow functional recovery within a reasonable time period after a major seismic event.

USRC has a rating system for earthquakes and is working on other hazards.

US Resiliency Council
Improving the Built Environment and Promoting Community Resilience



2. Adopt High Performance Building Standards

The REDi Rating System

The REDi (Resilience-based Earthquake Design Initiative) Rating System is a set of specific design performance criteria which aims to minimize building damage and promote contingency planning for utility disruption and other threats to functional recovery. The success of the resulting design in meeting specific monetary loss and recovery time is demonstrated by performing a modified FEMA P-58 loss assessment developed specifically for REDi.

The RELi standard is a point-based system recently adopted by the U.S. Green Building Council (USGBC). It includes many LEED-centric credits along with risk mitigation credits at the building and neighborhood scale. The intent is to provide greater adaptability and resilience to weather and other natural hazards in the built environment as a compliment to LEED. USGBC is currently refining RELi to provide a comprehensive list of resilient design criteria.

3. Incentivize Disaster Resilient Construction

According to Munich RE, insurance companies took a $135 billion hit from natural disasters experienced around the globe in 2017.

Half of all losses were in the U.S., and North America representing 83 percent of all insured losses last year.

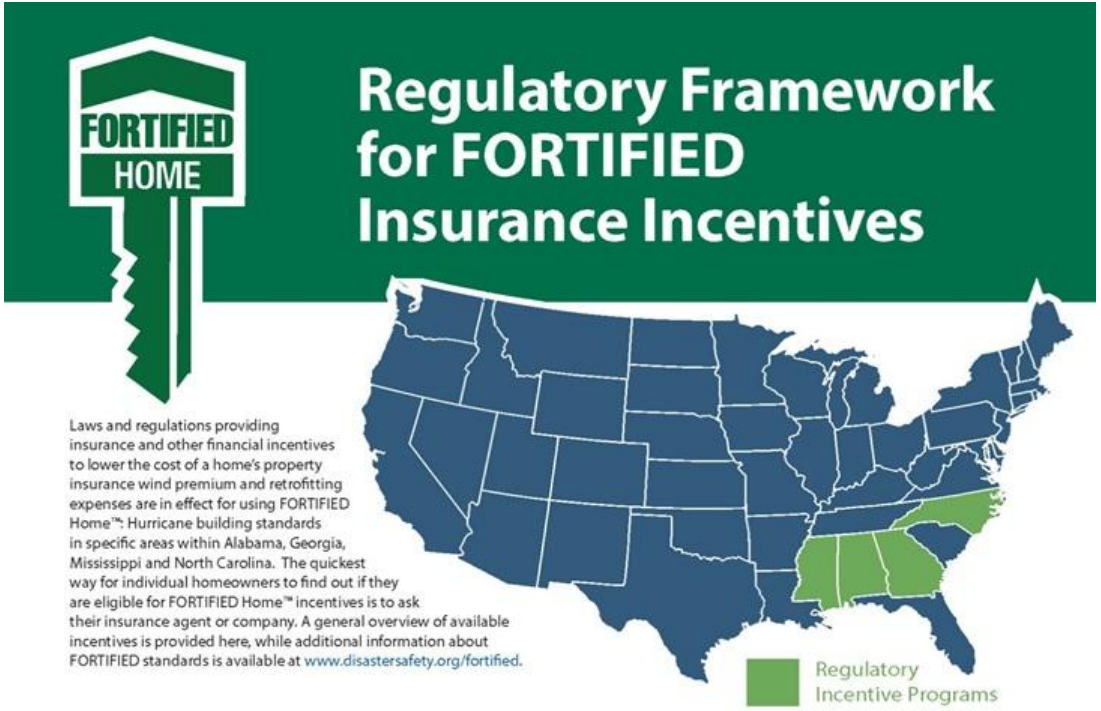
The three successive Atlantic hurricanes—Harvey, Irma, and Maria—cost major U.S. insurers at least $14.5 billion. This made it the costliest year ever for insurers.

Photo credit: Rawpixel.com/Shutterstock

3. Incentivize Disaster Resilient Construction

Resilient buildings reduce the risks associated with property insurance. States can encourage building owners to build resilient structures by legislating insurance premium reductions to all policy-holders if they build to specific resilient design criteria.

Alabama, Georgia, Mississippi, North Carolina, and Oklahoma have enacted such laws. These states now require insurers to lower the cost of property insurance for building to the IBHS FORTIFIED standard.



3. Incentivize Disaster Resilient Construction

Hazard mitigation increases loan security for lending institutions and decreases business interruptions and improved bond ratings for property owners and communities. Therefore, other potential incentives should be encouraged:

- Building permit rebates
- Property tax reductions
- Accelerated local permitting and inspection procedures for resilient properties
- Zoning benefits, e.g. density or height bonuses
- More-favorable developer agreements for the construction of resilient properties
- Revolving loan programs

4. Build with Robust Materials

The last step towards disaster resilience is to build with robust building materials. Some of the qualities of robust building materials include versatility, strength, wind and water resistance, seismic resistance, fire resistance, energy efficiency, and durability.

Structural fires frequently occur after a natural disaster. Of all disasters, fire is by far the most common and the deadliest. The U.S. Fire Administration reports that every year, fire kills more Americans than all other natural disasters combined.


Photo credit: Steven Greaves/Alamy Stock Photo

Build with Robust Materials

Concrete building systems are especially suited to provide resistance to natural hazards. Leslie Chapman-Henderson, president of the Federal Alliance for Safe Homes, called concrete homes “the ideal” for withstanding extreme weather. Concrete has the necessary hardness and mass to resist the high winds and flying debris of tornadoes and hurricanes.

Concrete is fire resistant and non-flammable, which means it can contain fires and will not contribute to the spreading of fire. Reinforced concrete framing systems can be designed to resist the most severe earthquakes without collapse. Concrete doesn’t rot or rust even if it is subject to flooding.

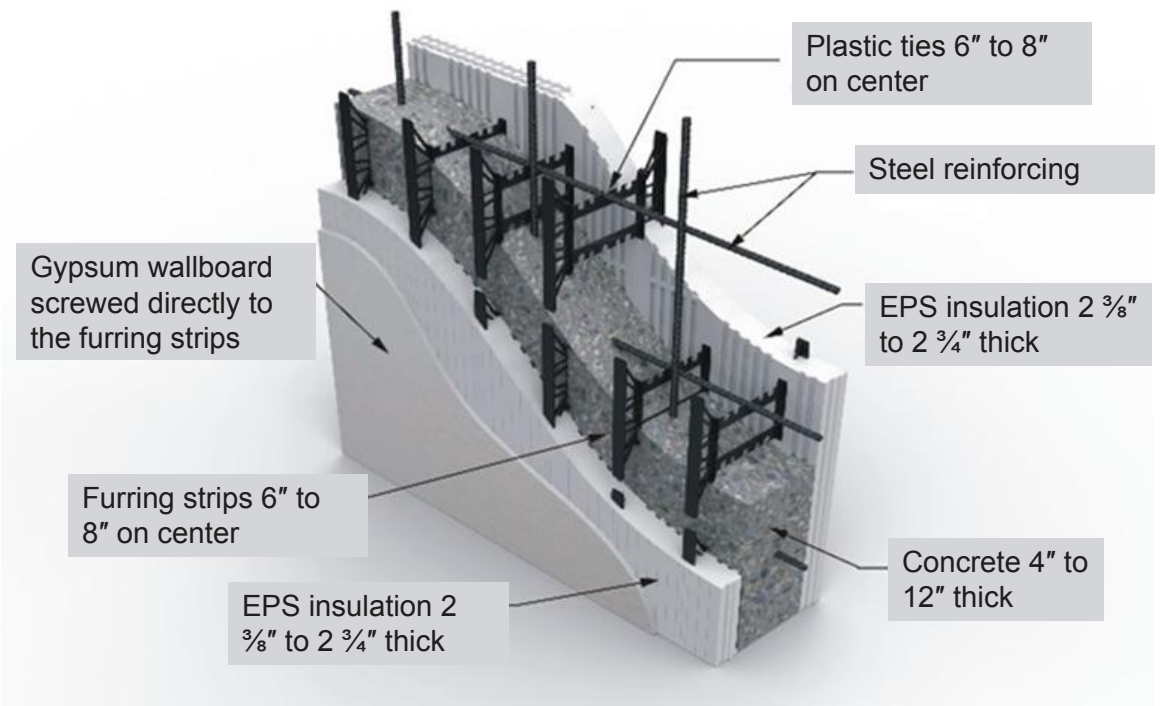
The image shows a tilt-up concrete wall system.

Insulating Concrete Form System

The image shows an example of an insulated concrete form (ICF) wall. In this type of concrete wall, the outer edges are EPS insulation 2 ⅜″ to 2 ¾″ thick. This forms continuous insulation on both sides of the wall.

The interior of the wall is comprised of concrete 4″ to 12″ thick and plastic ties placed 6″ to 8″ on center.

The ties determine the thickness of the total wall as per specs, offer form support during concrete placement, and help to eliminate thermal bridging.



Quantifying the Benefits of Resilient Construction

Quantifying the Benefits of Resilient Construction

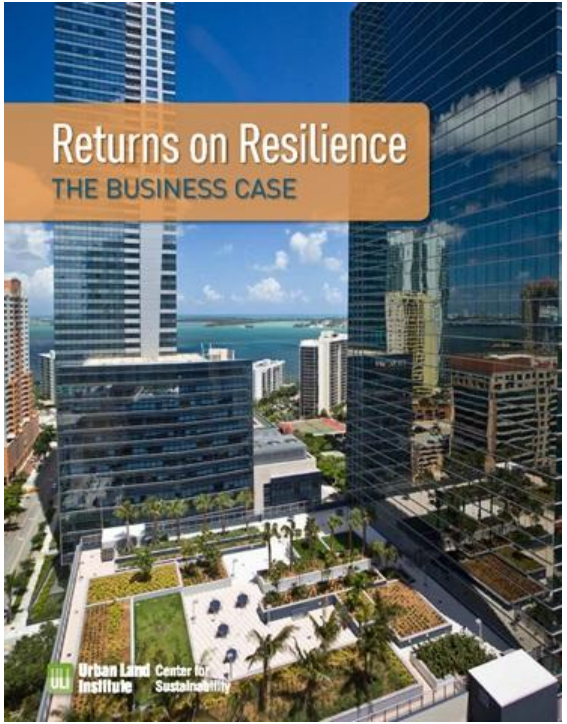
There are several studies that attempt to quantify the benefits of resilient construction:

A. Urban Land Institute (ULI): Returns on Resilience: The Business case
B. NRMCA Insurance Cost Study
C. National Institute of Building Sciences (NIBS)
D. USRC Seismic Performance Study
E. MIT Break-Even Mitigation Percentage Tool

A. Urban Land Institute (ULI)

In their report Returns on Resilience: The Business Case, by the Urban Land Institute, ULI explores the economic benefits of resilient construction. The report presents ten detailed case studies that demonstrate cost savings from implementing resilient strategies.

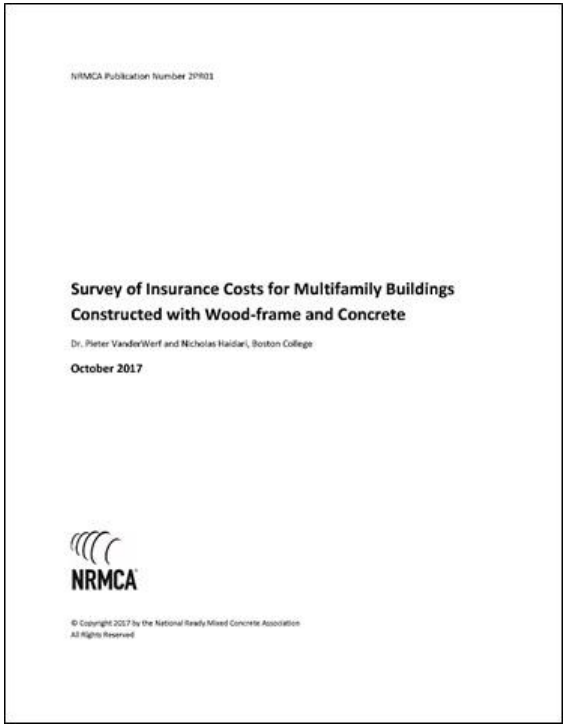
In all cases, the projects were able to demonstrate economic justification for spending more up front to design and build resilient structures.



B. NRMCA Insurance Cost Study

The National Ready Mixed Concrete Association (NRMCA) undertook a research study to understand if insurance companies offered lower insurance rates for structures built using noncombustible materials for both builder's risk insurance and commercial property insurance.

According to a report Total Cost of Fire in the United States by the Fire Protection Research Foundation and the National Fire Protection Association, the total cost of fires in 2014 was $328.5 billion, equaling 1.9% of the U.S. Gross Domestic Product.


NRMCA Publication Number 2PR01

Survey of Insurance Costs for Multifamily Buildings Constructed with Wood-frame and Concrete

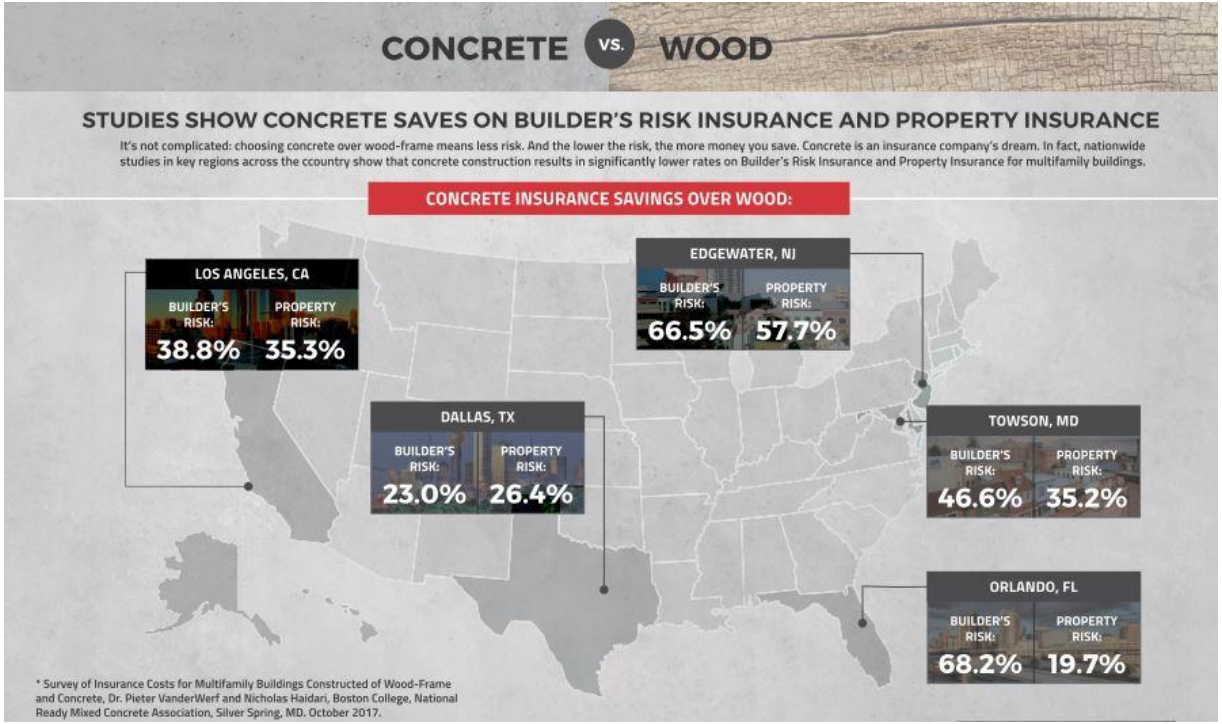
Dr. Pieter VanderWerf and Nicholas Haidari, Boston College

October 2017

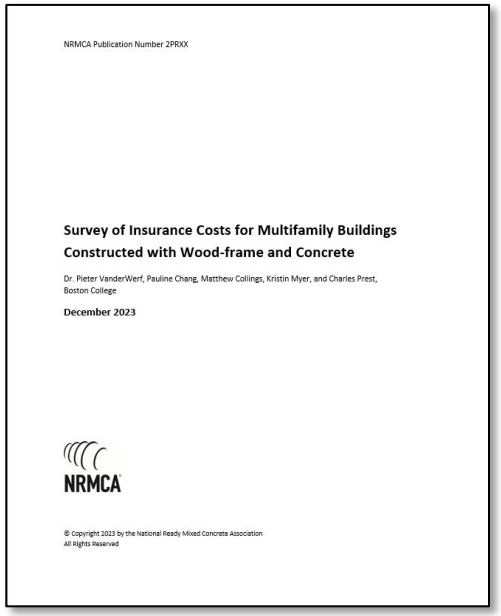
NRMCA

B. NRMCA Insurance Cost Study

The NRMCA study, titled Survey of Insurance Costs for Multifamily Buildings revealed that insurers are aware of the risks of building with combustible construction and the benefits of building with noncombustible construction.



B. NRMCA Insurance Cost Study – 2023 Refresh

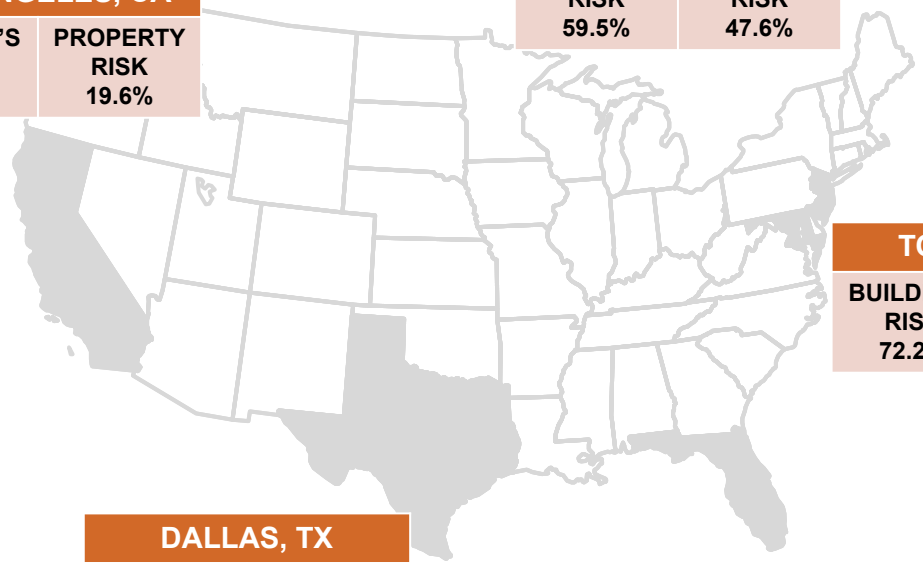

NRMCA Publication Number 2PRXX

Survey of Insurance Costs for Multifamily Buildings Constructed with Wood-frame and Concrete

Dr. Pieter VanderWerf, Pauline Chang, Matthew Collings, Kristin Myer, and Charles Prest, Boston College

December 2023

NRMCA



LOS ANGELES, CA	
BUILDER'S RISK 79.1%	PROPERTY RISK 19.6%

EDGEWATER, NJ	
BUILDER'S RISK 59.5%	PROPERTY RISK 47.6%

TOWSON, MD	
BUILDER'S RISK 72.2%	PROPERTY RISK 39.2%

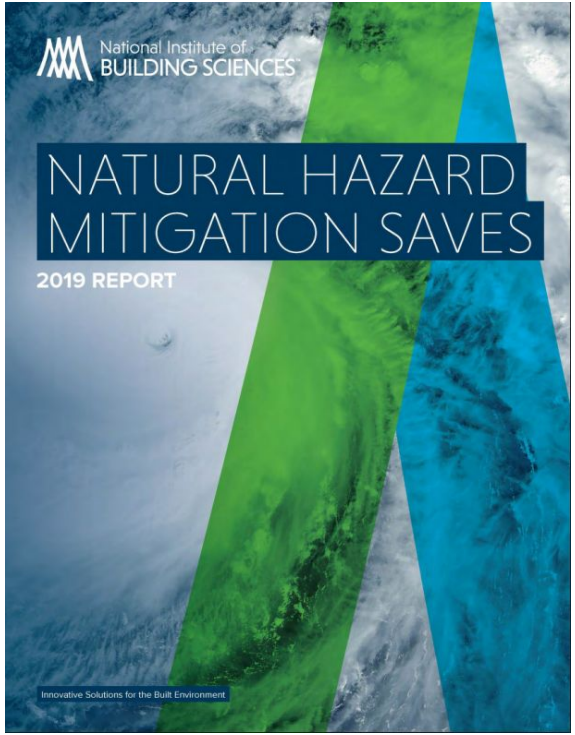
DALLAS, TX	
BUILDER'S RISK 46.8%	PROPERTY RISK 39.7%

ORLANDO, FL	
BUILDER'S RISK 59.4%	PROPERTY RISK 20.0%

C. National Institute of Building Sciences (NIBS)

NIBS updated its “Mitigation Saves” report in 2019, which quantifies the value of designing buildings to exceed the 2015 IBC or IRC for hazards including riverine flooding, hurricane surge, wind, earthquakes, and wildfires with the objective of reducing losses.

Results revealed that for every dollar spent on building above code, the amount of money saved ranged from $4 to $7 depending on the hazard.



C. National Institute of Building Sciences (NIBS)

Strategies to exceed minimum requirements of the 2015 building codes include:

- For flood resistance (to address riverine flooding and hurricane surge), build new buildings higher above base flood elevation than required by the 2015 IBC
- For resistance to hurricane winds, build new homes to comply with the IBHS FORTIFIED Home Hurricane standards
- For resistance to earthquakes, build new buildings stronger and stiffer than required by the 2015 IBC
- For fire resistance in the wildland-urban interface, build new buildings to comply with the 2015 International Wildland-Urban Interface Code (IWUIC)

National Benefit-Cost Ratio per Peril for Designing Beyond Code Requirements
(Adapted from NIBS)

Riverine flood	5:1
Hurricane surge	7:1
Wind	5:1
Earthquake	4:1
Wildland-urban interface fire	4:1
Overall benefit-cost ratio	4:1

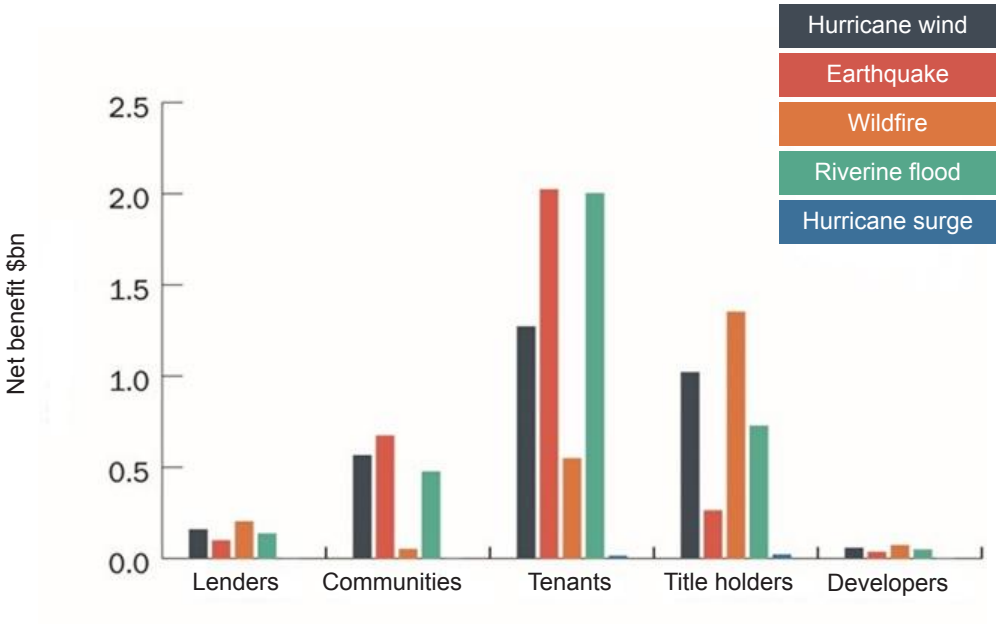
https://www.nibs.org/projects/natural-hazard-mitigation-saves-2019-report

C. National Institute of Building Sciences (NIBS)

The NIBS report suggests that all major stakeholder including developers, lenders, tenants, and communities' benefit from resilient construction.

The greatest benefits are afforded to building owners who don’t have to spend as much to repair and rebuild after a disaster, but there are other benefits also.

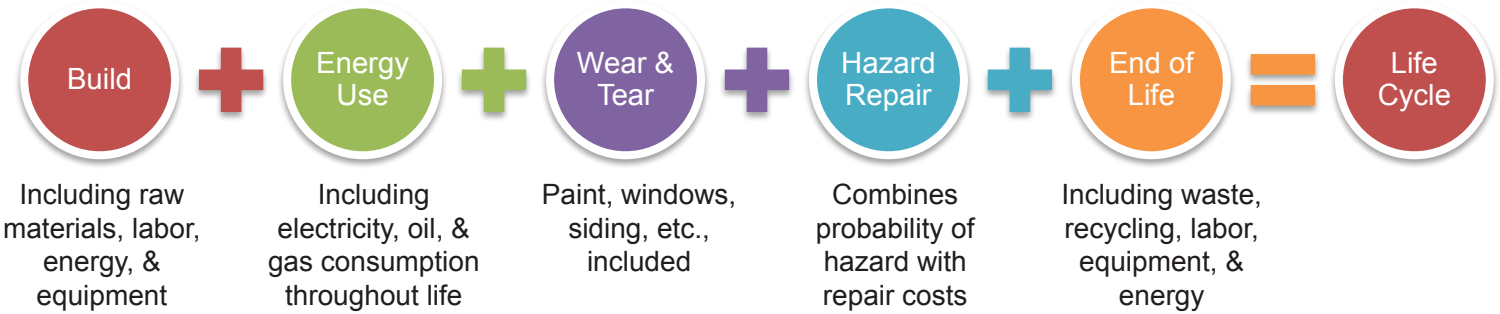
Tenants benefit from having functioning shelter and places to work after a disaster, and the community benefits from reduced cost of disaster recovery both in terms of reduced loss of life and business continuity.



Stakeholder net benefits resulting from one year of constructing all new buildings to exceed select 2015 IBC and IRC requirements or to comply with 2015 IWUIC. Source: FEMA

D. MIT Break-Even Mitigation Percentage Tool

According to MIT Concrete Sustainability Hub (CSHub), this is a diagram of the Life Cycle Cost of Hazard Resilience.

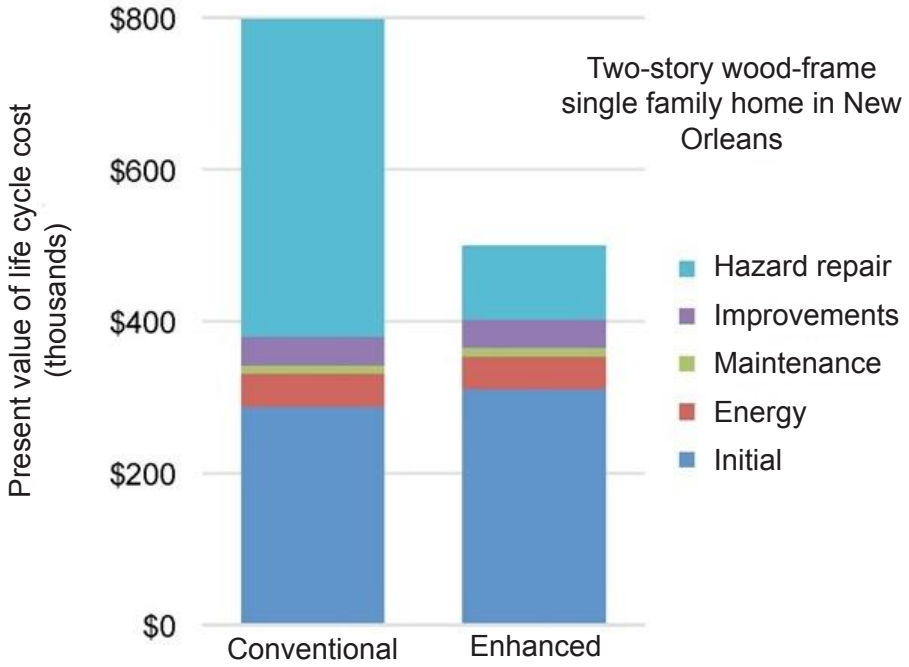


Researchers at the MIT Concrete Sustainability Hub (CSHub) have developed a new tool to calculate the economic benefits of investing in more hazard-resistant structures in hurricane prone areas.

D. MIT Break-Even Mitigation Percentage Tool

MIT's Break-Even Mitigation Percentage (BEMP) tool evaluates the cost-effectiveness of mitigation for a building in a location by factoring in the expected damage a conventional building designed to code would endure over its lifetime.

Then it compares that to the cost of a more resilient, enhanced building design to justify building to a higher standard.



Case Studies

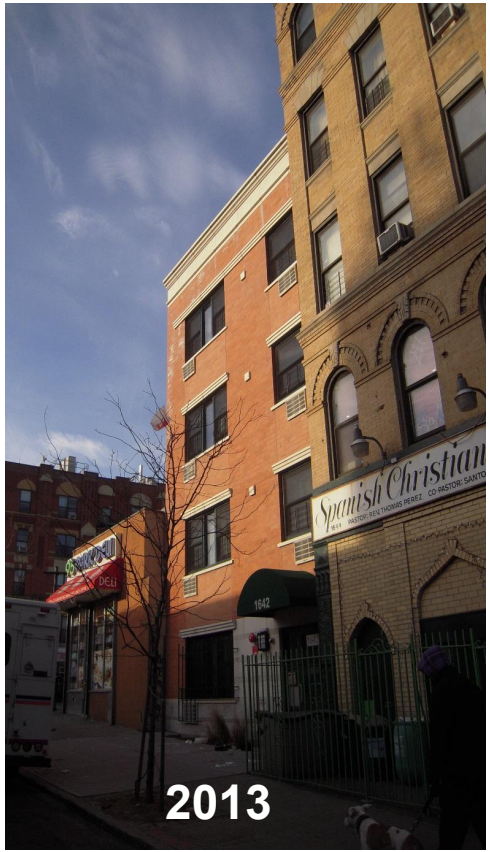
Photo credit: Logix

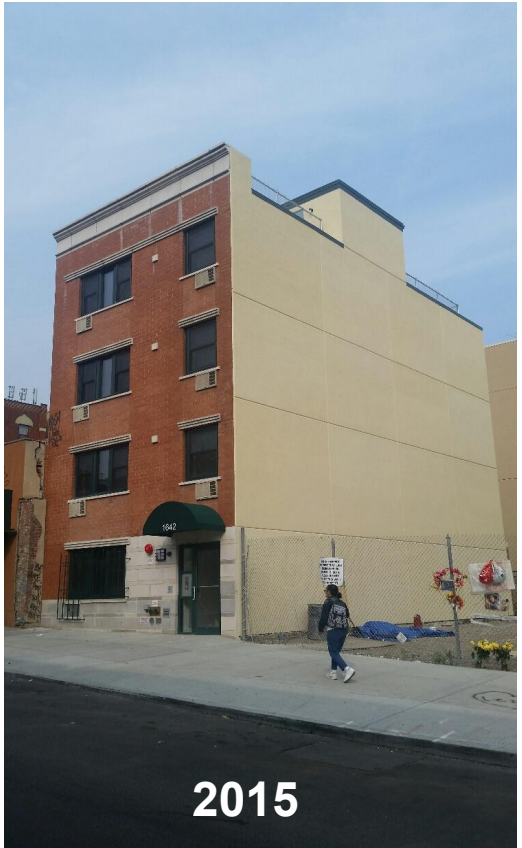
Case Study: Concrete Apartment Building Survives Blast and Fire

Massive natural gas explosion in East Harlem, New York City (2014)

- Destroyed two apartment buildings, vacated four neighboring properties, and shattered windows blocks away
- Nearby, buildings and households affected by the blast
- Eight (8) deaths, 70 injuries and 100 displaced families
- > 250 firefighters, paramedics, and police officers responded
- Local utility was responsible for $153.3 million damages,
- Adjacent ICF concrete building survived a blast and subsequent fire and reopened after repairs.

Case Study: Concrete Apartment Building Survives Blast and Fire





Case Study: Blast Resistance

Photo credits: Insulated Concrete Form Association

Force Protection Equipment Demonstration

- Quantico Marine Corps Base, 2003
- Demonstrate blast resistant properties of ICFs
- ICF reaction boxes with no exterior cladding were subjected to blasts from a 50-pound charge of military grade TNT at distances of 40 feet to 6 feet
- Acceptance criteria
  - Military personnel in the structure survive the blast
- Outcome
  - Limited damage observed to the concrete structure
  - EPS absorbs energy from the shock waves, dissipates energy over time, cushions concrete

Case Study: Noncombustible Exterior Finishes Saves Home from Devastating Wildfire

Wildfire in Laguna Beach, California (2013)

- 17,000 acres of brushland consumed
- 366 homes destroyed; 500 damaged in a single day
- Extreme demand on District's water supply
- $528 million in damages
- 345 engines, 17 dozers, 30 aircraft, 11 hand crews, and 1,968 fire personnel responded
- Santa Ana winds contributing factor
- One single-family home survived due construction and landscape design
  - Stucco cladding
  - Class A concrete tile roof, ends sealed with concrete
  - Double-paned glass
  - Landscaping zones of fire-resistant plants

Photo credit: AP Photo/ Douglas C. Pizac

Conclusion

- There are increased risks posed by natural hazards from weather related, seismic and fire events.
- Resilient construction can address these risks by addressing asset protection and building functionality in addition to life safety.
- A number of approaches exist to mitigating the effect of natural hazards including adoption of updated building codes and high-performance standards, incentivizing disaster resilient construction, and building with robust materials.
- A/E professionals can re-consider minimum code performance and design for improved building performance and natural hazard mitigation, resulting in overall cost savings for the building cycle.

Photo credit: Logix

Questions?

ssumar@nrmca.org

BUILD WITH STRENGTH

NRMCA

Thank You!

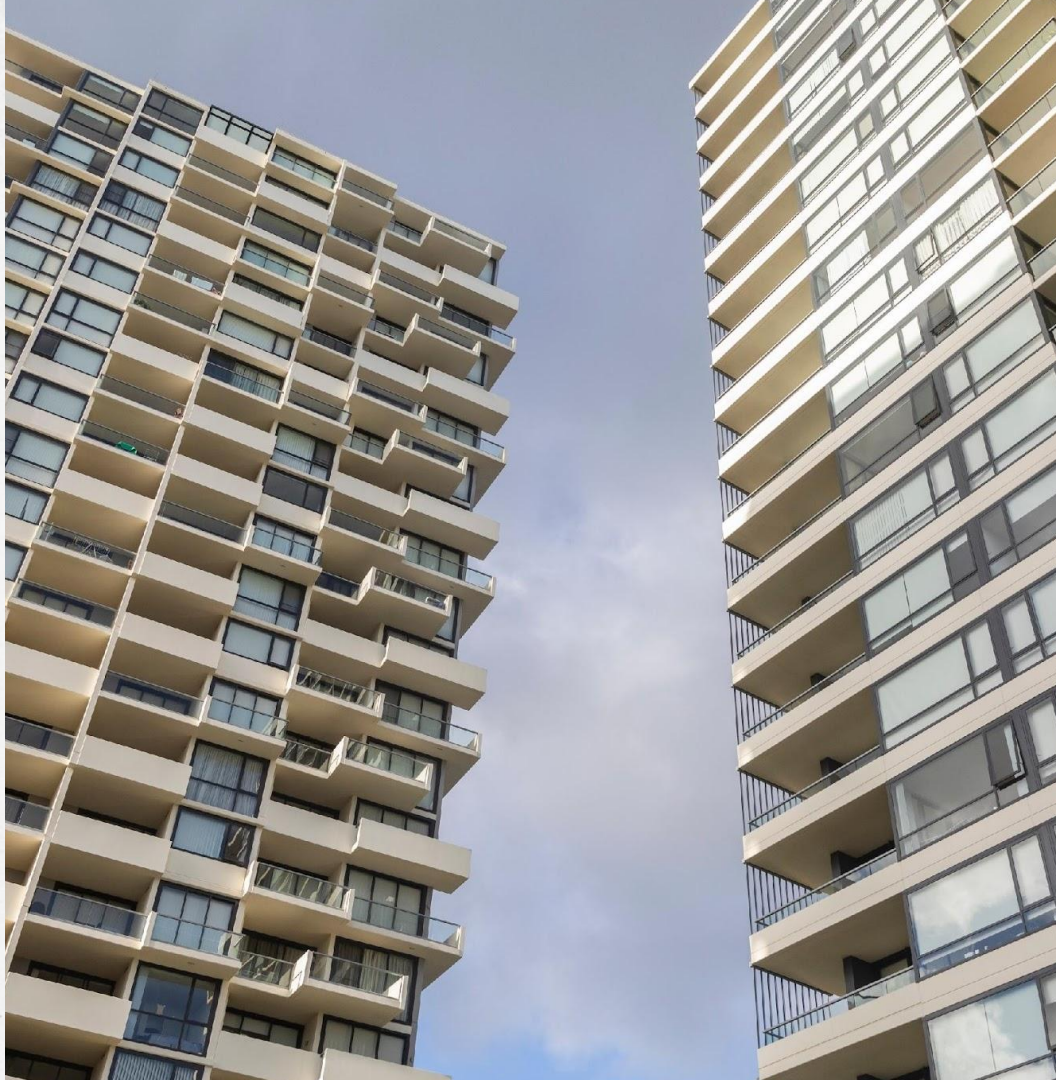
Shamim Rashid-Sumar, PE, FSFPE

Senior Vice President, Codes & Standards

ssumar@nrmca.org

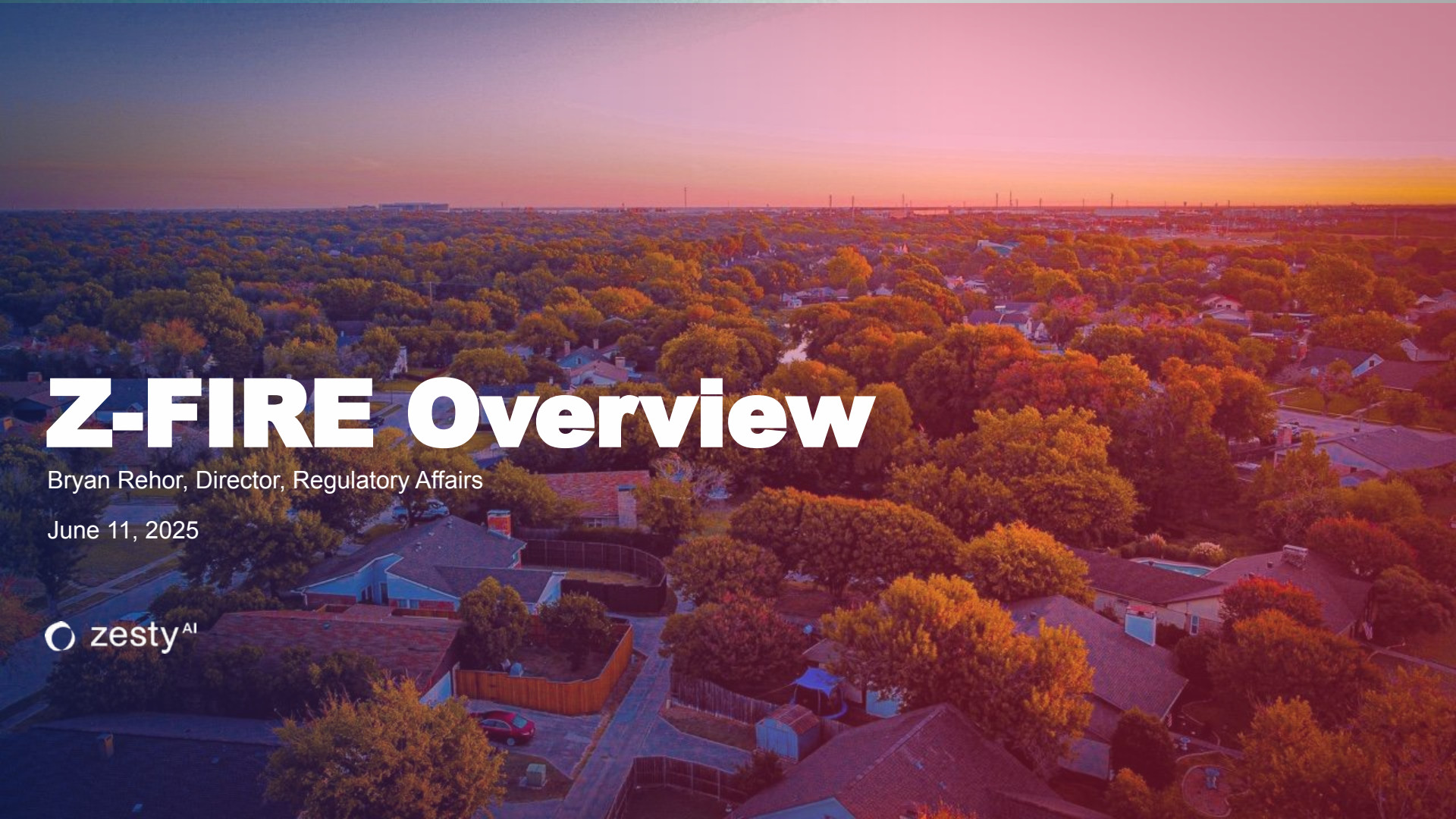
BUILD WITH STRENGTH

NRMCA



V. Presentation from ZestyAI

ARIZONA
DEPARTMENT OF INSURANCE
& FINANCIAL INSTITUTIONS



Z-FIRE Overview

Bryan Rehor, Director, Regulatory Affairs

June 11, 2025

zesty AI

ZestyAI, the property and climate risk analytics platform

200+ Billion Data Points Across 150 Million Residential and Commercial Properties

- Imagery
- Building Permits
- MLS
- Climatology
- Historic Losses

ZestyAI Platform

- Climate risk models proven to split risk
- Comprehensive property insights
- Highest coverage and accuracy

Property Insights

- Digital Roof
- Location Insights
- Roof Age

Risk Mitigation

- CA Compliance Prefill
- Concentration Management

Peril-Specific Models

- Z-FIRE
- Z-HAIL
- Z-WIND
- Z-STORM
- Z-WATER

Superior New Business Underwriting

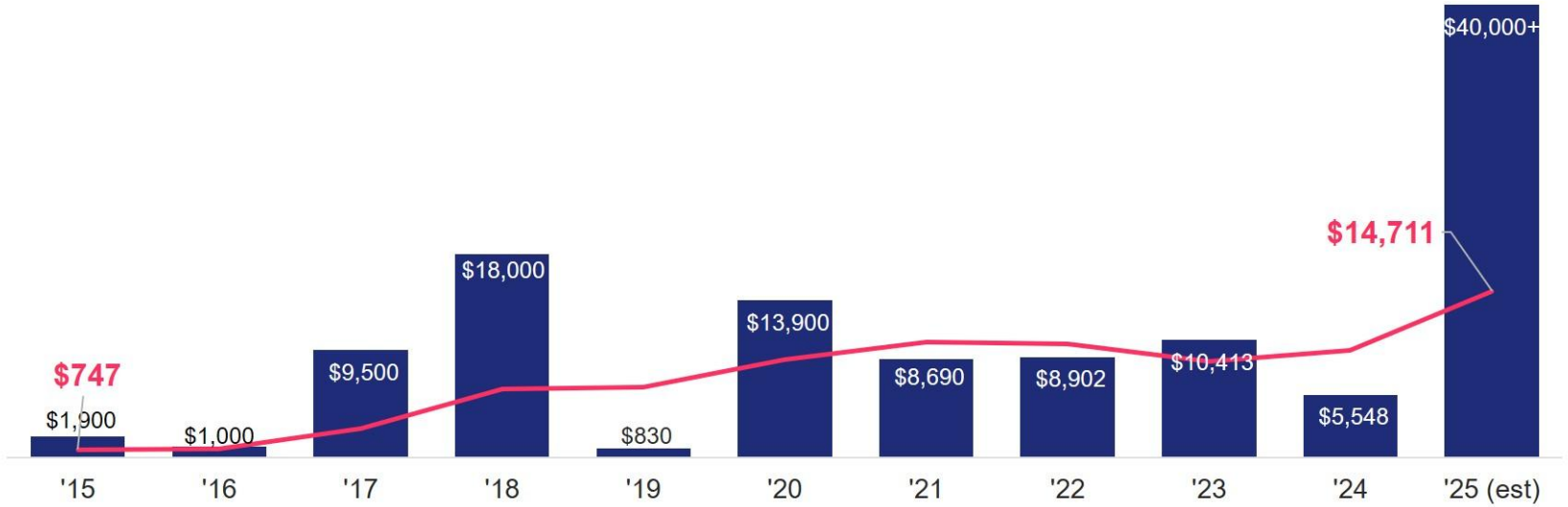
Improved Rating

Risk Analysis

Maintaining the highest standards of compliance and transparency

Wildfire losses have grown 35% annually over the past decade

US Insured Wildfire Losses, Annual Total and 5-Year Moving Average ($M)

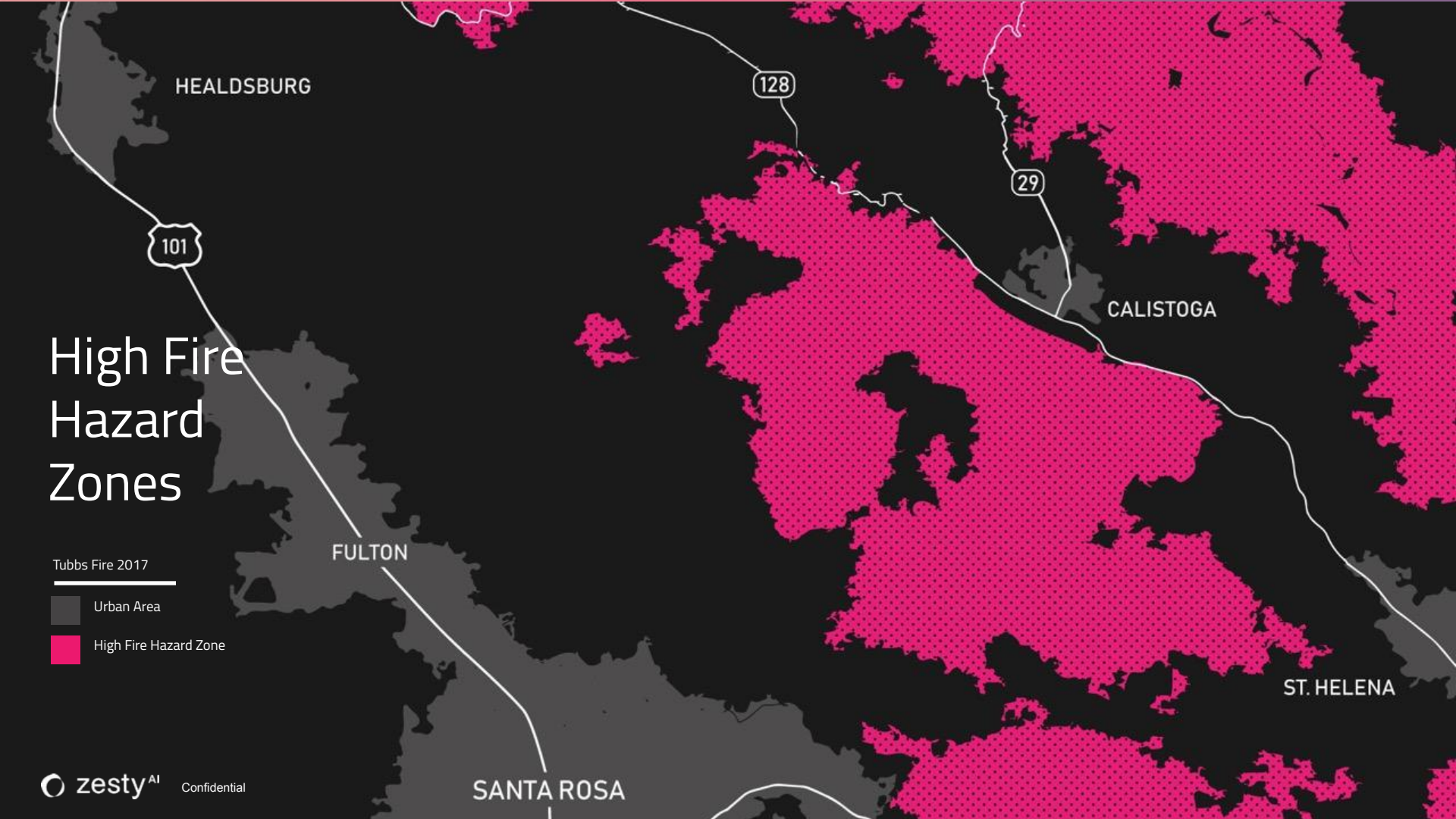


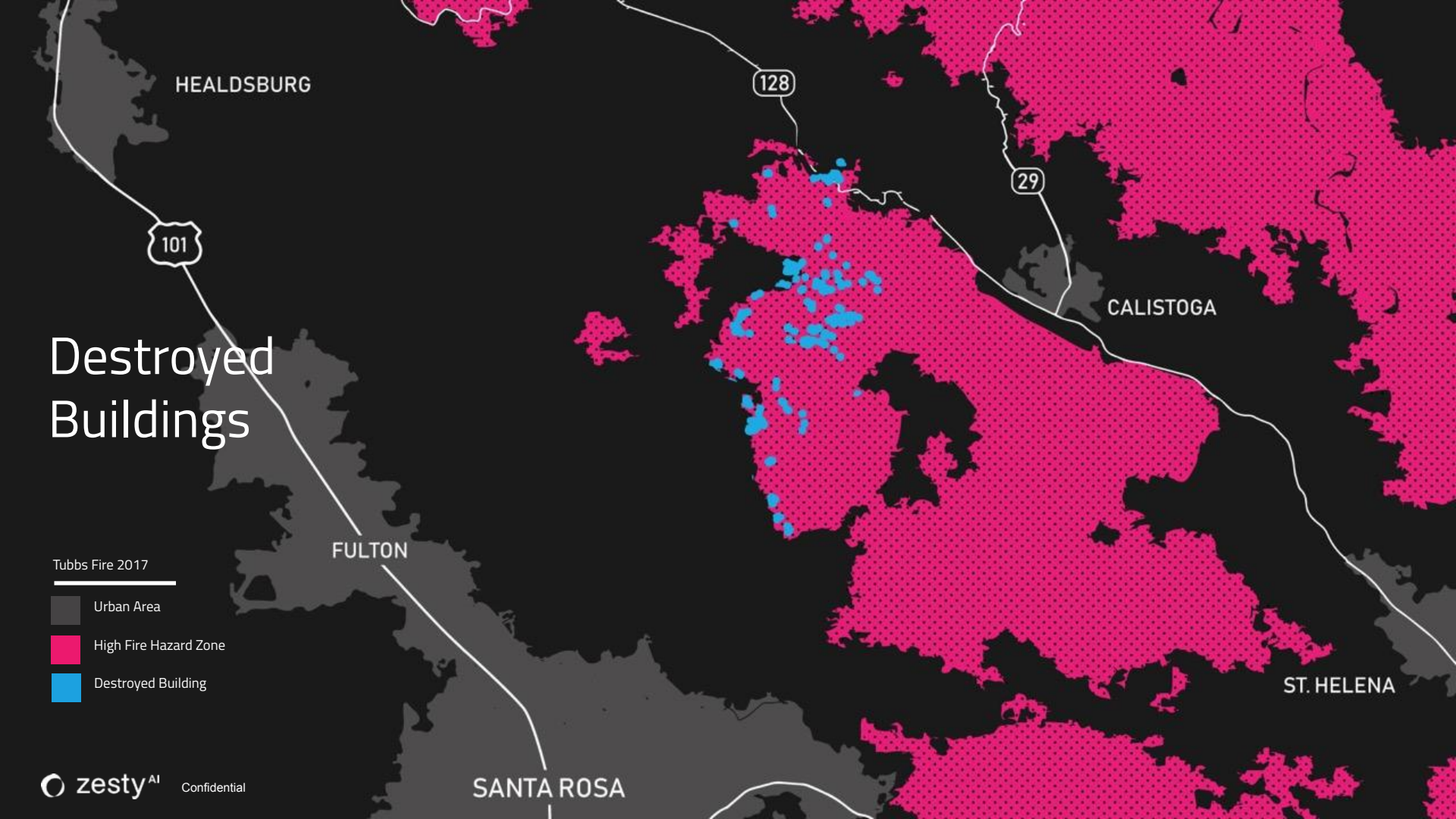
Source: Insurance Information Institute

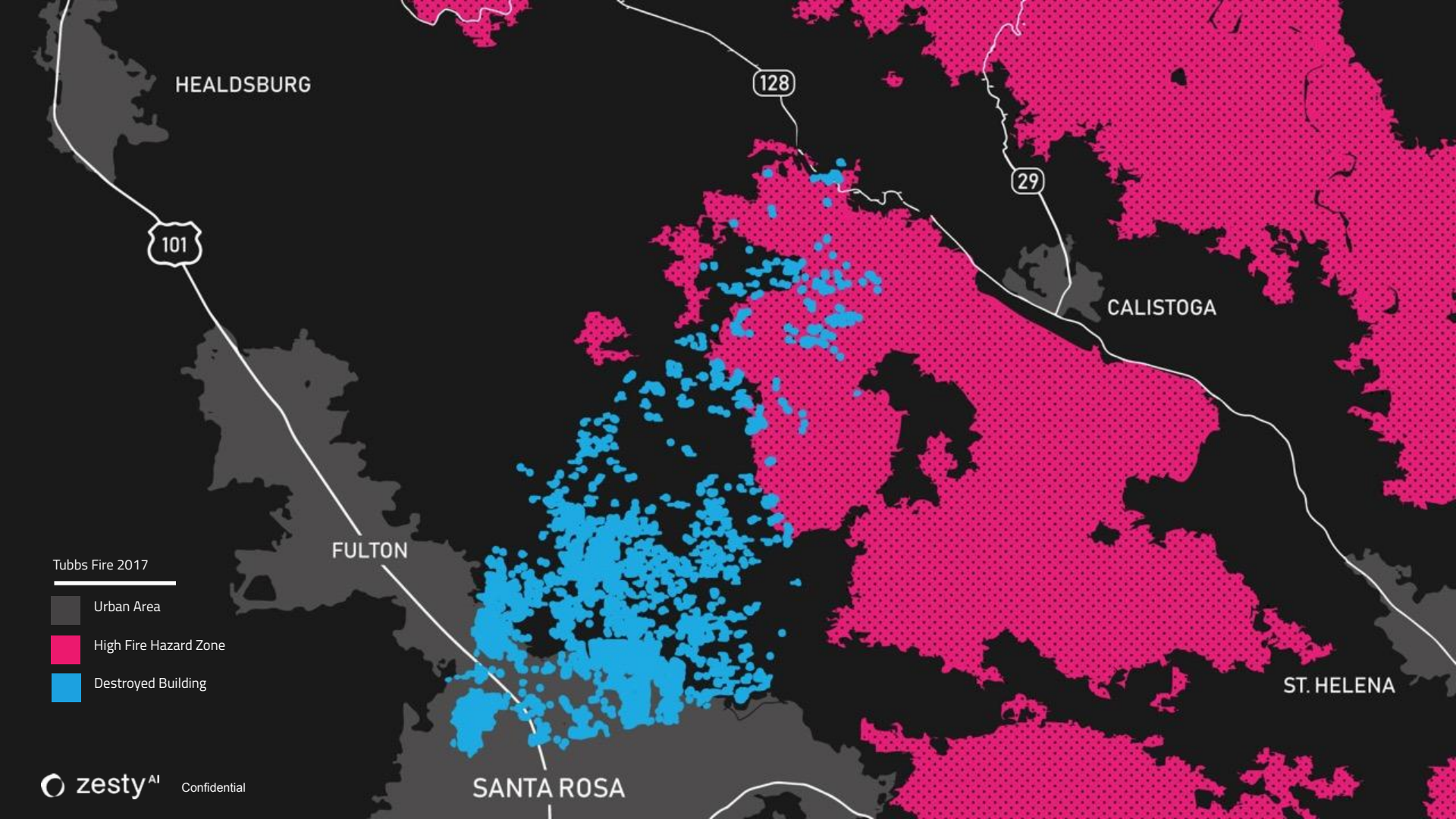
Population Growth | Expansion into the WUI | Inflation | Drought

zesty AI


HEALDSBURG
128
29
101
CALISTOGA
Sonoma
County
FULTON
Tubbs Fire 2017
Urban Area
ST. HELENA
SANTA ROSA


HEALDSBURG
128
29
101
CALISTOGA
High Fire Hazard Zones
Tubbs Fire 2017
Urban Area
High Fire Hazard Zone
FULTON
ST. HELENA
SANTA ROSA


HEALDSBURG
128
29
101
CALISTOGA
Destroyed Buildings
FULTON
Tubbs Fire 2017
Urban Area
High Fire Hazard Zone
Destroyed Building
ST. HELENA
SANTA ROSA



zesty AI

Z-FIRE - The World's Largest Wildfire Loss Database

1500+
Wildfire Events Across North America

20
Years of Wildfire History in North America

100
Years of Wildfire History in California

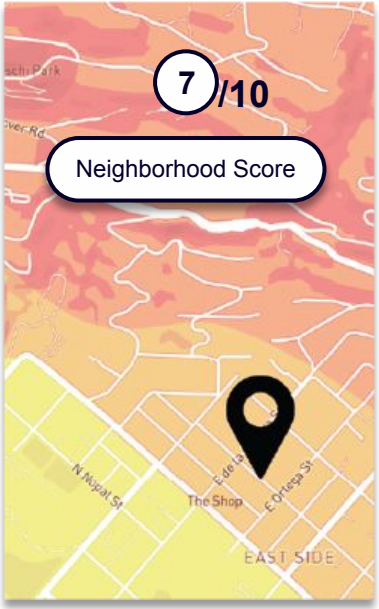
10
Years of Damage Data within Fire Perimeters

Z-FIRE

zesty AI

A Granular Approach to Wildfire Risk Scoring

Two Property-Level Risk Scores and Risk Modifiers



Score indicative of the **annualized probability** of being involved in a future **wildfire event**

Each Property receives a score of **1 to 10**

Up to **3 risk modifiers** listed (e.g., slope, wildfire history, precipitation, temperature, etc.)

Conditional probability of a property being damaged, were the property to be involved in a future wildfire event

Each Property receives a score of **1 to 10**

Up to **3 risk modifiers** listed (e.g., roof material, vegetation density in multiple defensible zones etc.)

Z-FIRE Wildfire Risk Score

Building Density and Vegetation Density at the Property Level

Building and Vegetation Outlines Generated by ZestyAI's Artificial Intelligence Models

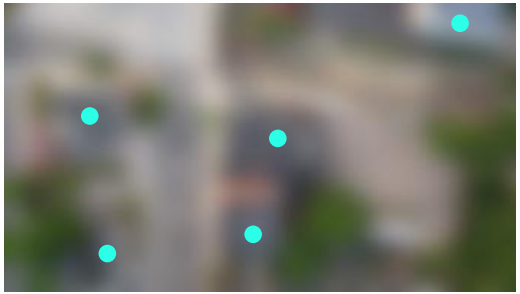
Primary defensible zone defined as 0 to 30 ft around a building Secondary defensible zone defined as 30 to 100 ft around a building

Wildfire Risk Assessment - Then & Now

Milliman

Full Report Available Upon Request

Traditional Models



ZestyAI Z-FIRE

Model	Simple Algebraic	**Predictive, ML-based**
Resolution	1X	**10,000X**
Focus	Regional	**Property-specific**

3.6X Lift
Predictive Power

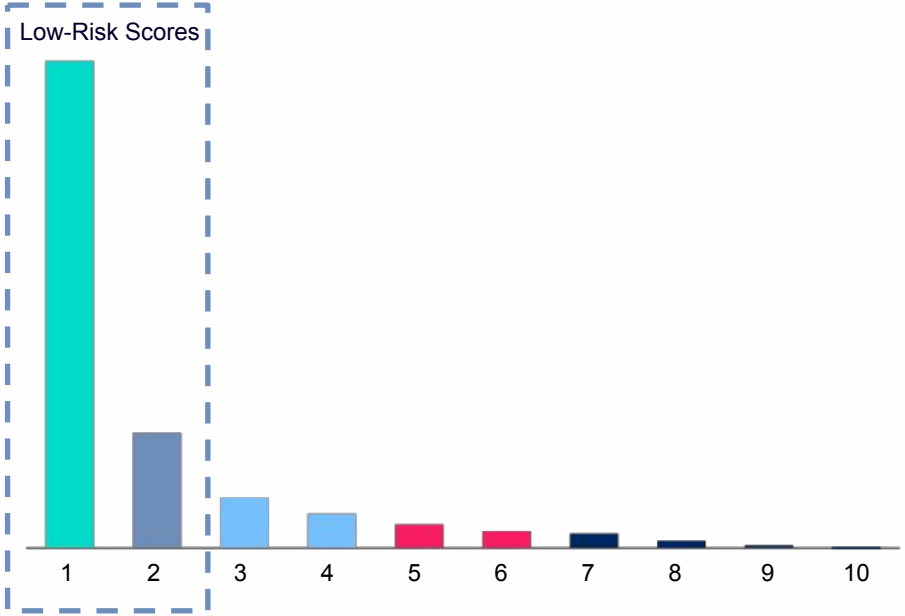
44X Incremental Lift
Predictive Power

zesty AI

Level 1 Scoring: Distributions and Associated Probabilities - Arizona

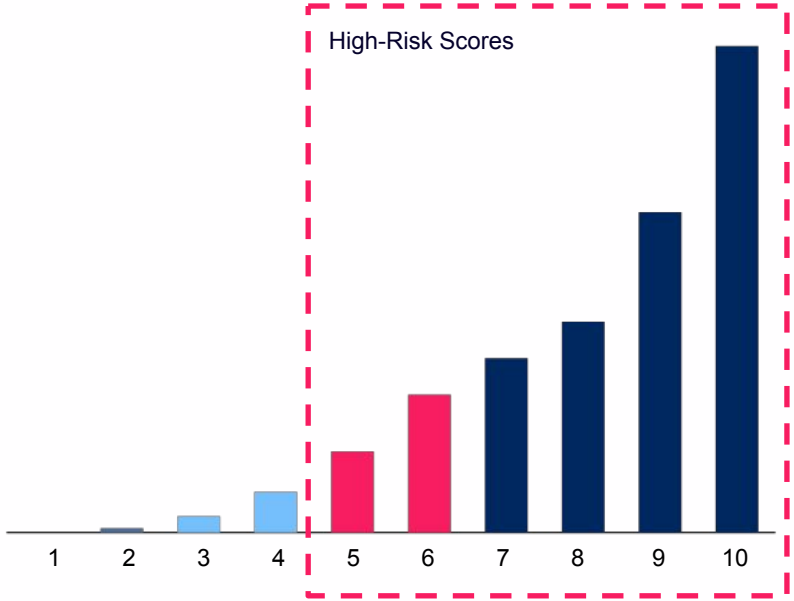
Distribution of all AZ properties by Z-FIRE™ L1 score

N=2.7M Residential Properties



85% of Arizona distribution falls within very-low or low risk scores

Probability that the Property will be involved in Wildfire Perimeter – *Annualized*



Risk of inclusion in a wildfire perimeter increases above a score of 5

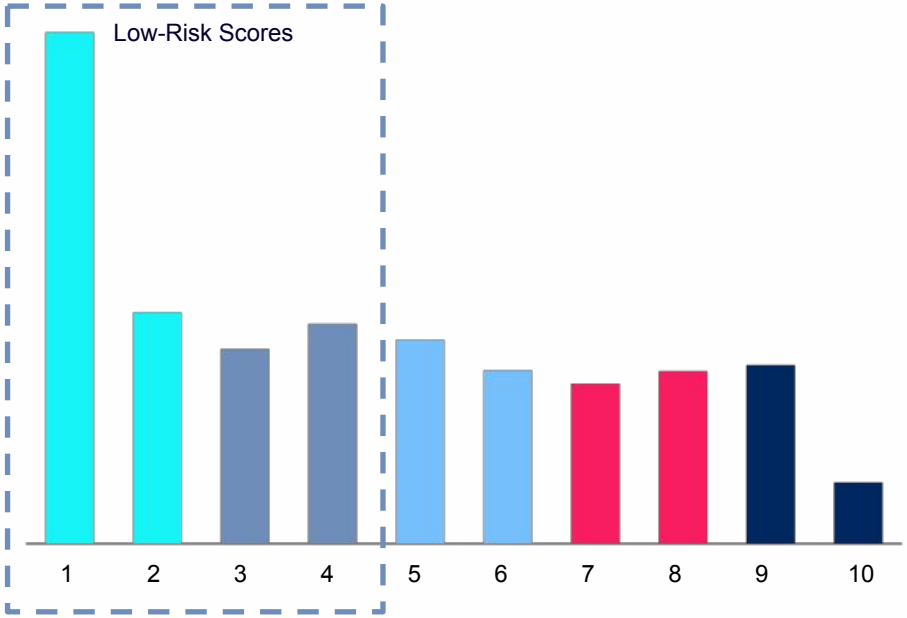
Very Low | Low | Medium | High | Very High

zesty AI

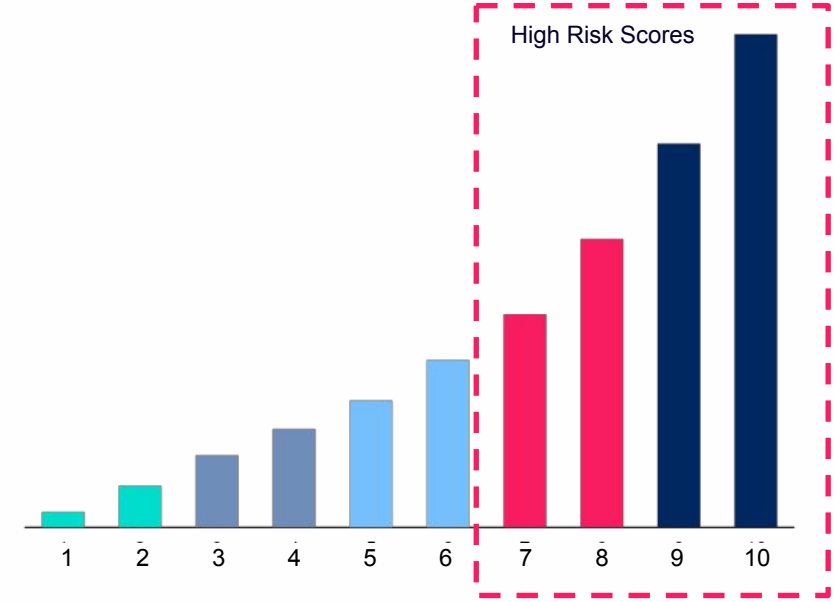
Level 2 Scoring: Distributions and Associated Probabilities - Arizona

Distribution of all AZ properties by Z-FIRE™ L2 score

N=2.7M Residential Properties



Probability of Structural Damage to the Property if involved in a Wildfire



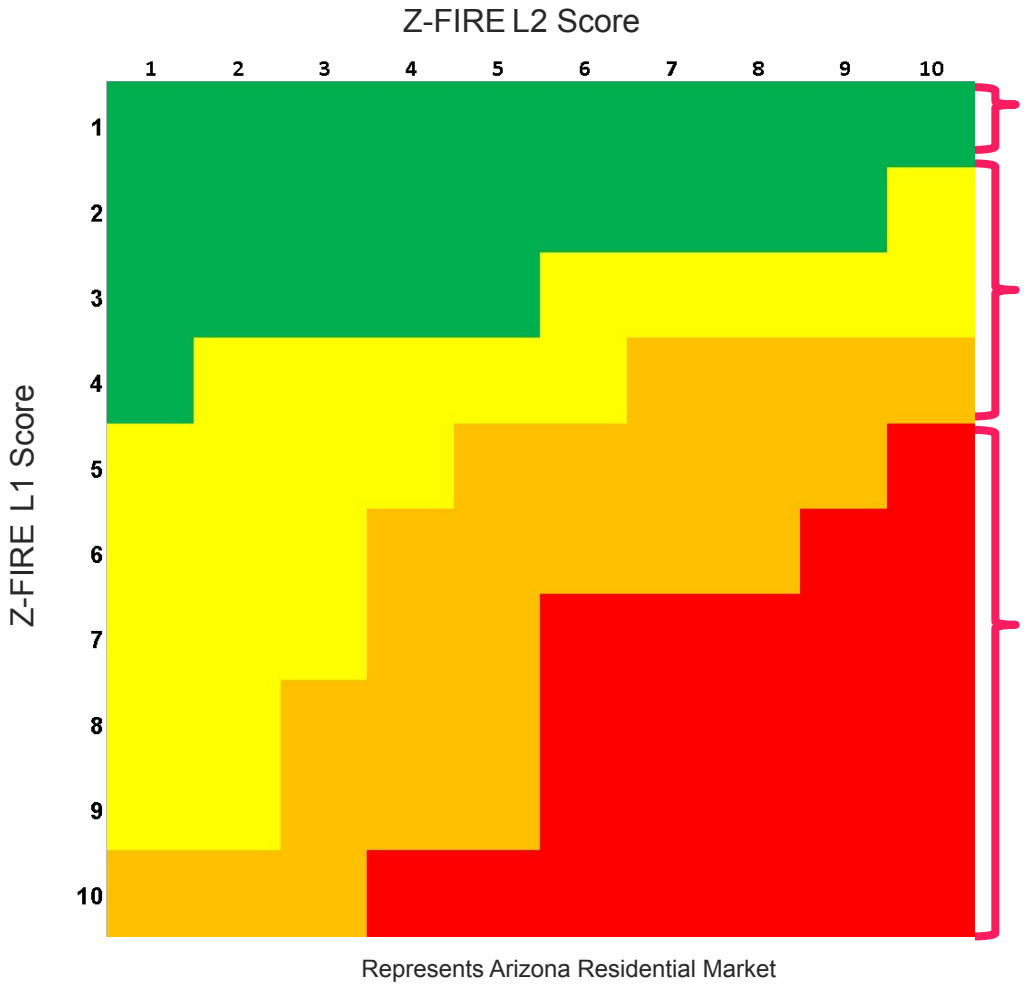
Expected damage rate increases for higher L2 scores

Very Low | Low | Medium | High | Very High

zesty AI

Z-FIRE

Granular Risk Assessment

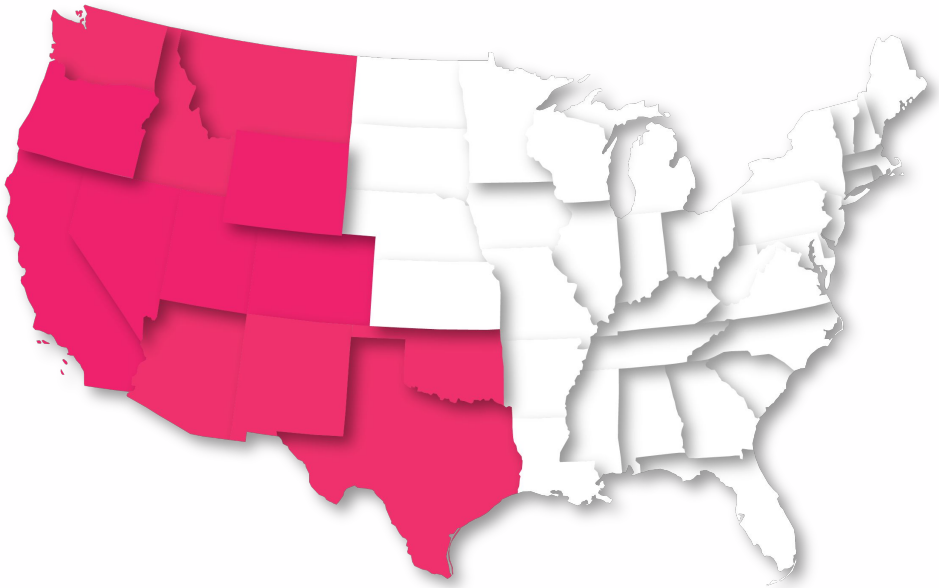


Z-FIRE Adopted for Rating & Underwriting Across US West

Strong Regulatory Support As Evidenced By Widespread Adoption

Z-FIRE provides scores in all 48 contiguous states

Z-FIRE™ Has Been Adopted Across the US West



Adopted for Rating and/or Underwriting

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

zesty AI

Z-FIRE enables data-driven underwriting and rate segmentation for 1,000+ property insurance transactions every day in Arizona.

*Average daily volume June 1, 2024 – May 31, 2025

Transparency & Mitigation

Z-FIRE Delivers Homeowner Transparency

Mitigation Options

- Embedded Scenario Planning
- Available Mitigation Options
- Transparent Credit / Discount
- Implementation Optionality

Appeals Handling

- Dedicated Appeals Process
- Cached Scores
- Mitigation Verification
- Scores Refreshed 3X Per year

Score Transparency

- Applicable Score
- Relative Position
- Range of Scores
- Score Reasons

Embedded Delivery Options

- REST API (For Direct-to-Consumer App integration)
- Accessible Web Application
- Batch Processing

What? When? How?

Z-FIRE and Homeowner Mitigation

Level 2 score accounts for property specific mitigation efforts

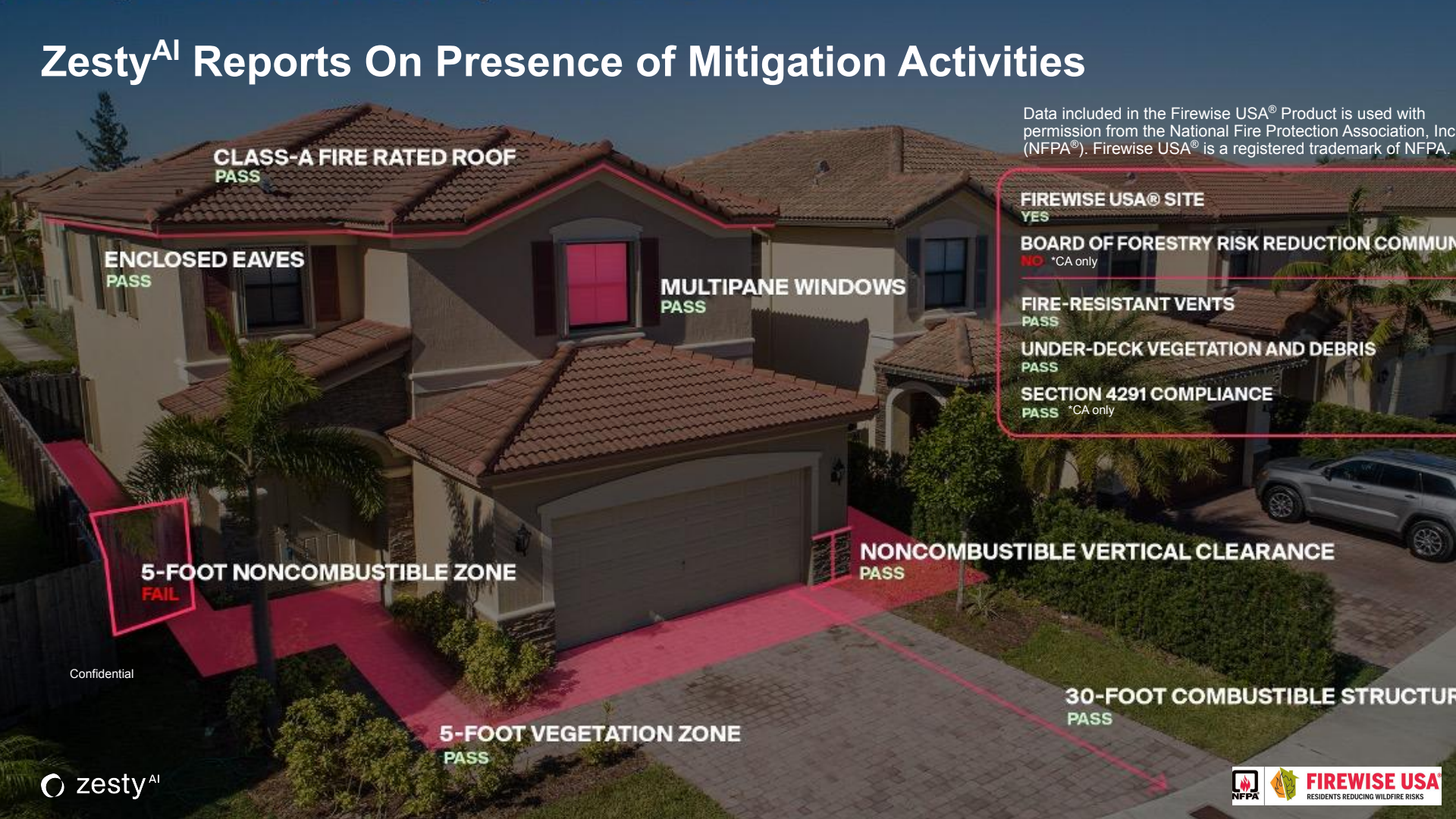
June 2nd 2019

May 19th 2021

Removal of vegetation is automatically captured by L2

- **Z-FIRE automatically accounts for Homeowner mitigation efforts,** removes the need for human validation and appropriately sizes the benefits of the change
- **Imagery is refreshed quarterly** and captures multiple mitigation strategies such as fuel management and retro-fits
- **Zesty has a dispute process** which can be tailored to your operations which enables “disputed scores” and “scenario planning” on demand

Zesty[AI] Reports On Presence of Mitigation Activities



Data included in the Firewise USA® Product is used with permission from the National Fire Protection Association, Inc (NFPA®). Firewise USA® is a registered trademark of NFPA.

FIREWISE USA® SITE
YES

BOARD OF FORESTRY RISK REDUCTION COMMUN
NO *CA only

FIRE-RESISTANT VENTS
PASS

UNDER-DECK VEGETATION AND DEBRIS
PASS

SECTION 4291 COMPLIANCE
PASS *CA only

zesty[AI]

NFPA FIREWISE USA
RESIDENTS REDUCING WILDFIRE RISKS

Model Performance

Z-FIRE

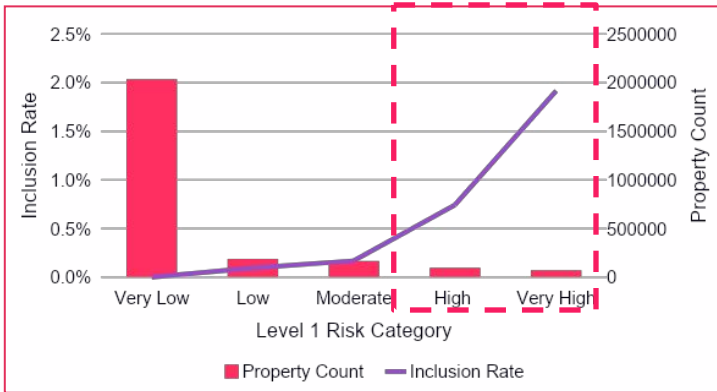
AZ Model Performance - 2009-2019 Wildfires

57 wildfires such as:

- **Monument**
- **Tinder**
- **Willow**
- **Sawmill**
- **Tenderfoot**

Z-FIRE Performance

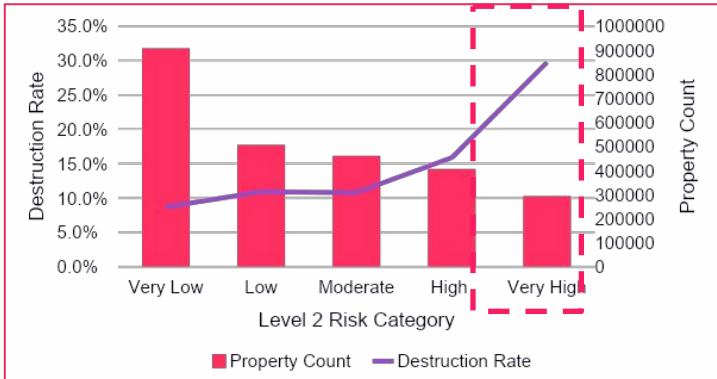
Distribution of properties, by Z-FIRE Level 1



82% of all buildings involved in a wildfire were deemed **'High' or 'Very-High' risk.** 'Very-High' risk areas were 12,987 times more likely to be included in a wildfire area than 'Very Low'

Z-FIRE Performance

Distribution of properties, by Z-FIRE Level 2



Properties deemed **'Very-High' risk** by Z-FIRE L2 were **three times as likely to be destroyed** by wildfire than properties deemed 'Very Low."

Williams Fire (April 2023)

Location: Hereford, AZ

- **Level 1 Score: 5/10**
- **Level 2 Score: 7/10**

Top Drivers of High Score:

1. **1916 construction**
2. **41% Vegetation 0-30 feet**
3. **31% Overhanging Vegetation**

Pre-Event

Post-Event

Result: Destroyed

zesty AI

Confidenti

Williams Fire (April 2023)

Location: Hereford, AZ

- **Level 1 Score: 7/10**
- **Level 2 Score: 3/10**

Top Drivers of Low Score:

1. **1% Vegetation 30-100 feet**
2. **5% Vegetation 0-30 feet**
3. **0.92 degrees slope**

Pre-Event

Post-Event

Result: Survived

Confidenti

zesty AI

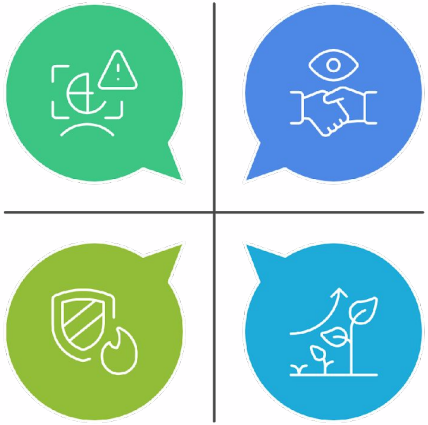
Z-FIRE: Fostering a Safe and Healthy Arizona Market

ZestyAI supports a healthier insurance market in Arizona by enabling fair, transparent wildfire risk assessment that improves pricing, encourages mitigation, and helps maintain coverage availability.

1

Risk-Based Precision

Empowering insurers to price accurately and fairly using AI-driven, property-specific wildfire risk scores.



2

Regulatory Partnership

Advancing a shared vision with Arizona regulators: safer communities, stable coverage availability, and reduced wildfire losses.

3

Protection Through Prevention

Supporting homeowner mitigation with transparent scoring, clear incentives, and dispute resolution tools.

4

Market Stability & Innovation

Helping carriers stay in the market through smarter underwriting, balanced risk pools, and scalable deployment across the state.

Thank You

Bryan Rehor

Director, Regulatory Affairs

Regulatory@zesty.ai

VI. Council Remarks & Discussion

ARIZONA
DEPARTMENT OF INSURANCE
& FINANCIAL INSTITUTIONS

VII. Public Comments

ARIZONA
DEPARTMENT OF INSURANCE
& FINANCIAL INSTITUTIONS

Public Comment Logistics

- If you have not done so, please fill out a speaking slip or the Google Form (if you are online) to comment.
- Online comments will be taken after in-person comments.
- Online attendees will be able to unmute themselves and turn on their camera.
- When providing comments, please first identify yourself and who you are representing, if applicable.
- The Council will not be answering any questions during the public comment period but may request that any matters presented be reviewed by Council staff or placed on an upcoming agenda.

ARIZONA
DEPARTMENT OF INSURANCE
& FINANCIAL INSTITUTIONS

VIII. Closing Remarks and Next Meeting Logistics

ARIZONA
DEPARTMENT OF INSURANCE
& FINANCIAL INSTITUTIONS

Next Meeting Logistics

- The Council will normally meet monthly on the second Wednesday of each month at 1:00 P.M., **unless otherwise noted in the agenda**.
- The next meeting is:
  - Wednesday, July 9, 2025

ARIZONA
DEPARTMENT OF INSURANCE
& FINANCIAL INSTITUTIONS

Contact Information

For inquiries or witten comments, please contact Resiliency and Mitigation Council Staff: RMCouncil@difi.az.gov

Council Webpage: https://difi.az.gov/resiliency-and-mitigation-council*

* Includes a link to sign up for the Council's mailing list.

Use the camera on your phone to scan this code for a direct link to the Council Webpage

ARIZONA DEPARTMENT OF INSURANCE & FINANCIAL INSTITUTIONS