

# Climate Impact on the Municipal Property Market

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## MMA Annual Meeting MIIA Workshop

Hynes Convention Center

Friday, January 19, 2024

2 p.m.- 3:15 p.m.

**KEN WERTZ**

**EXECUTIVE DIRECTOR OF THE  
NATIONAL SCHOOL PLANT  
MANAGEMENT ASSOCIATION  
(NSPMA)**



**MEGAN HART**

**AON GLOBAL HEAD OF ANALYTICS  
AND COLLABORATION FOR AON  
CLIMATE RISK ADVISORY PRACTICE**



**STEPHEN BATCHELDER**

**MIIA MEMBER SERVICES VICE  
PRESIDENT CLAIMS AND RISK  
MANAGEMENT**

**STANLEY CORCORAN**

**SENIOR EXECUTIVE AND MIIA  
EXECUTIVE VICE**



# Workshop Goals

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Understanding how the changing weather patterns impacts property losses

Severity and Uncertainty affects insurability

What we do matters:

- . Facilities Management
- Building Practices
- . Capital Improvement Plans

**AON**

# Climate Change in an Era of Volatility

Megan Hart, PhD, CCRMP,  
CEEM

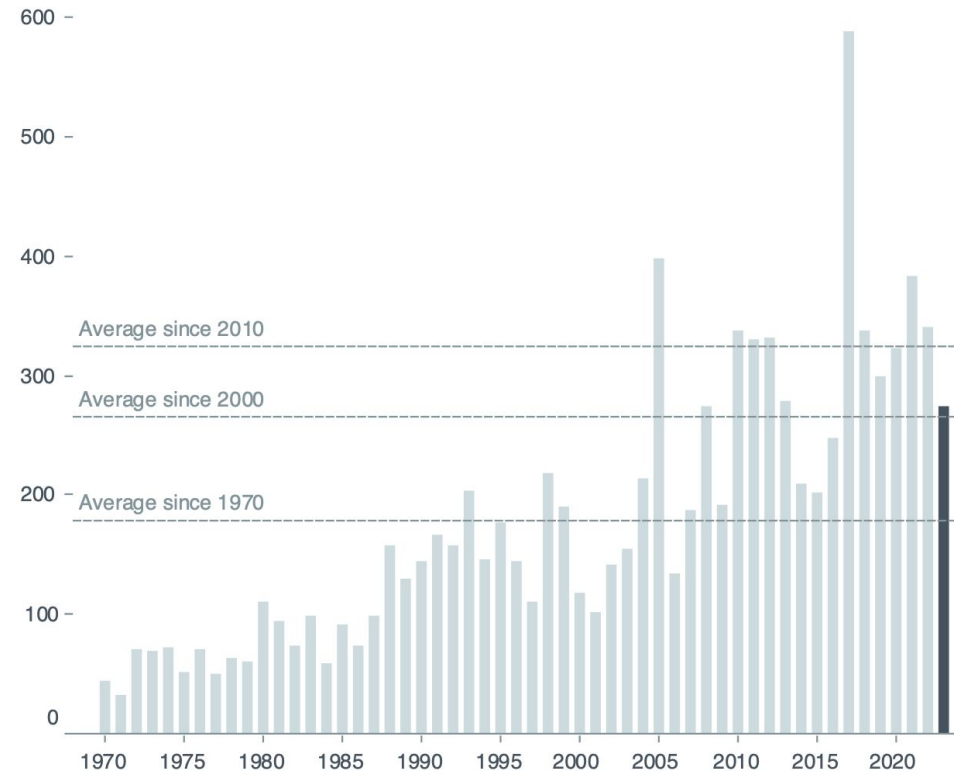
January 2024



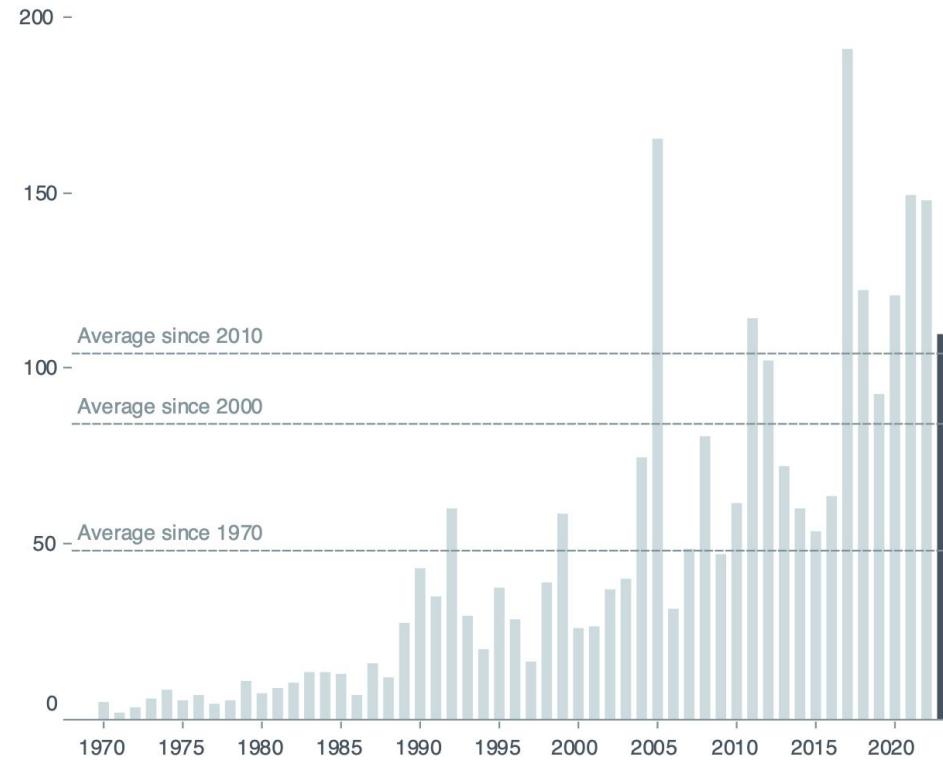
# State the Obvious: Losses are Increasing

## Global Weather / Climate Hazards (1970 –

Economic Losses from Weather-related Disasters (2023 \$ bn)



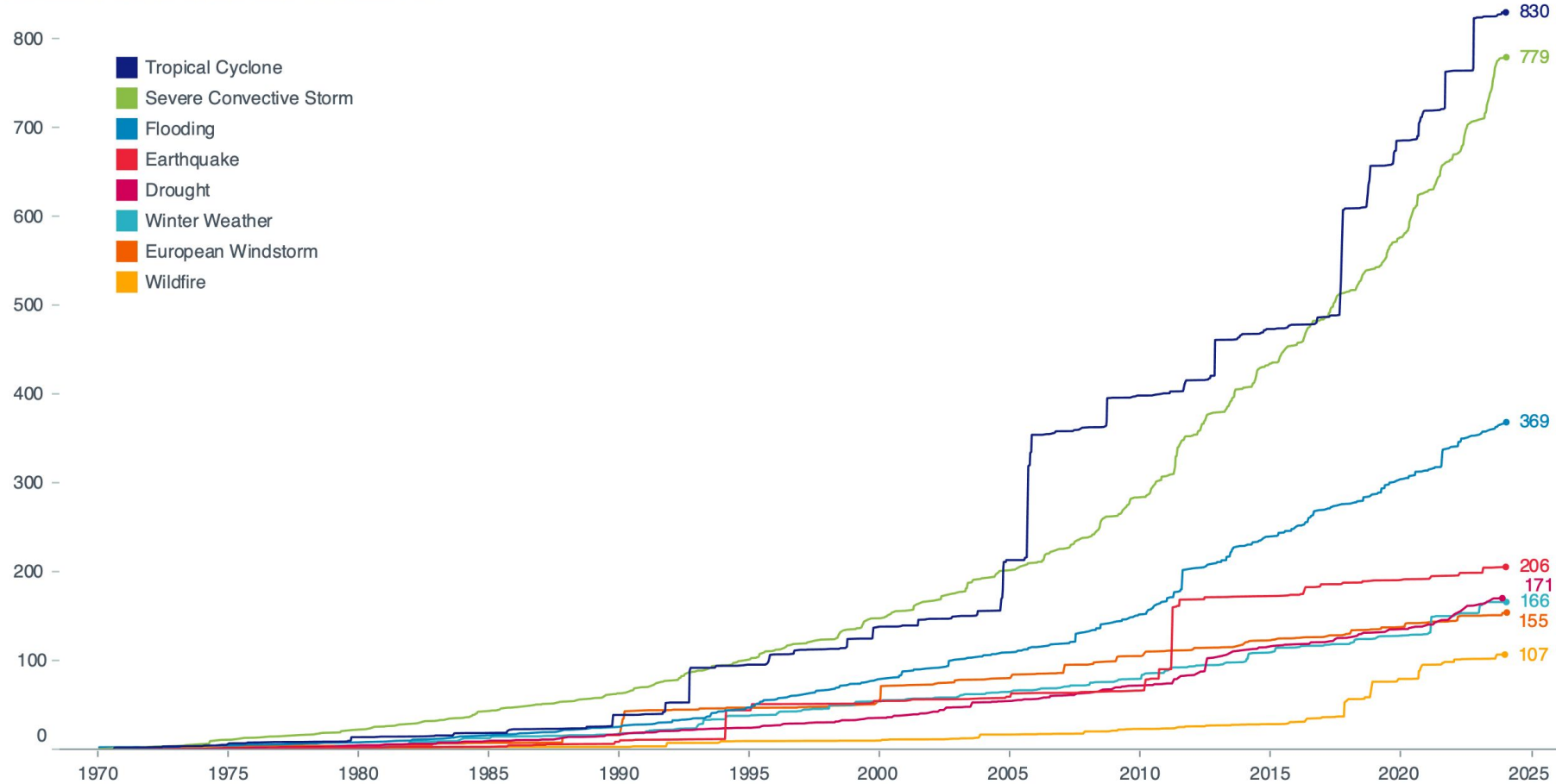
Insured Losses from Weather-related Disasters (2023 \$ bn)



Data: Aon Catastrophe Insight

# What Perils Are Driving the Increased Loss?

Cumulative Insured Losses since 1970 (2023 \$ bn)



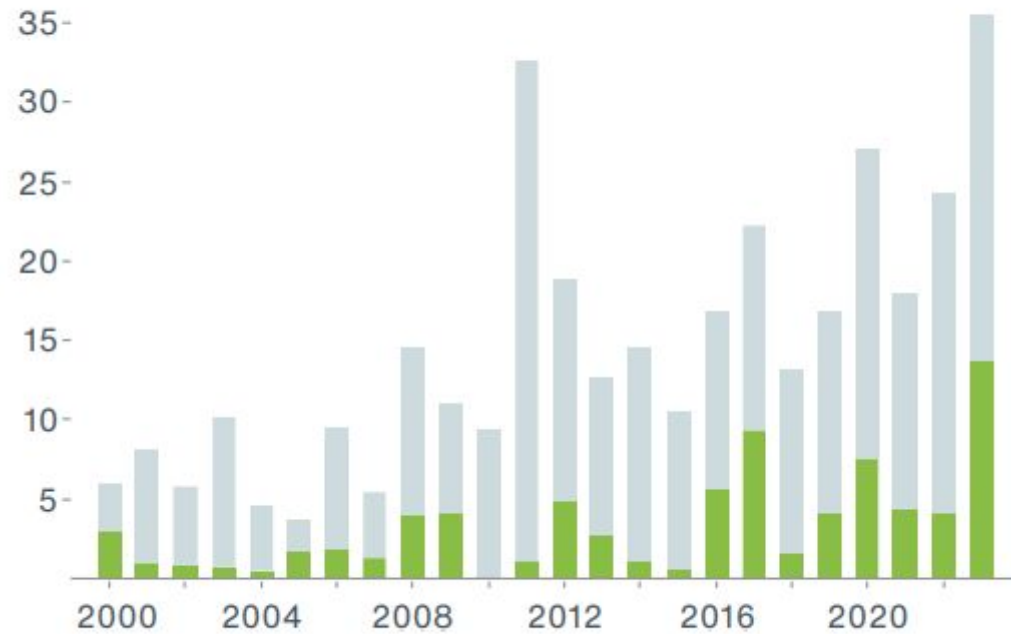
Data: Aon Catastrophe Insight

# U.S. SCS Losses a Dominant Driver of Insured Losses Globally

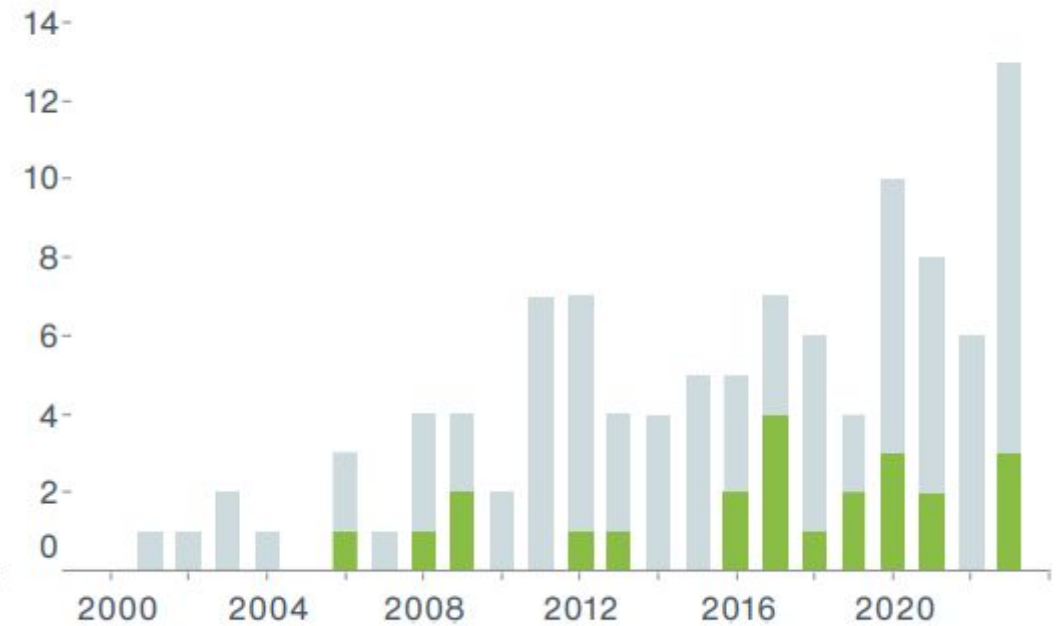
## Q1/Q2 U.S. Insured Losses from SCS

Insured Losses (2023 \$ bn)

Q2 Q1



Count of billion-dollar events



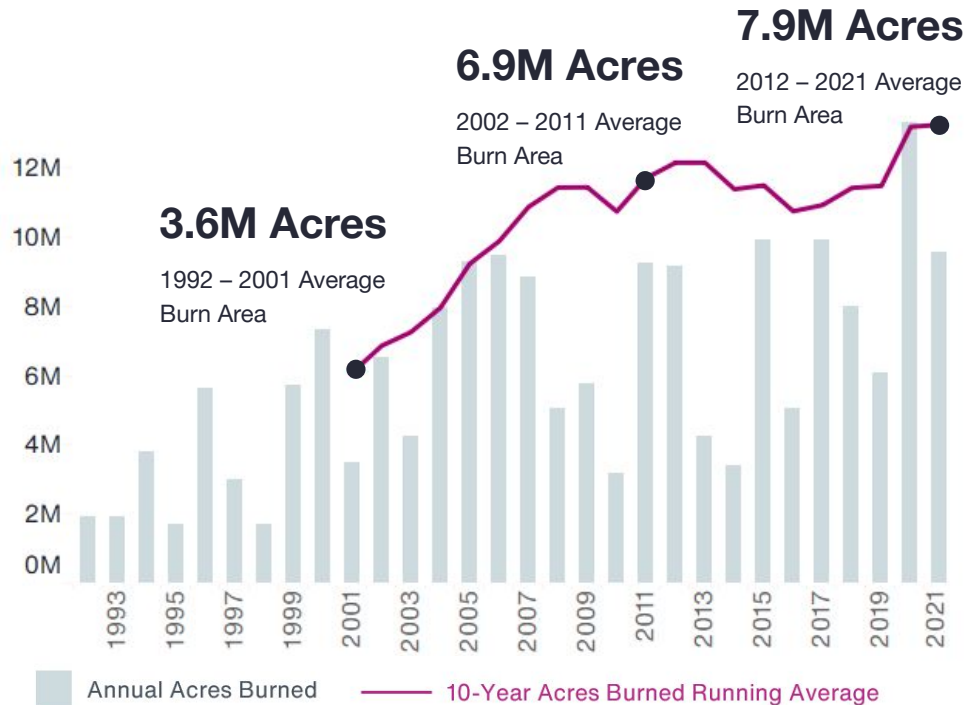
Data: Aon Catastrophe Insight

# Wildfires are Increasingly More Destructive

## Trends Leading to Today's Risk

### Wildfires Are Getting Bigger...

United States Annual Aggregate Wildfire Acres Burned

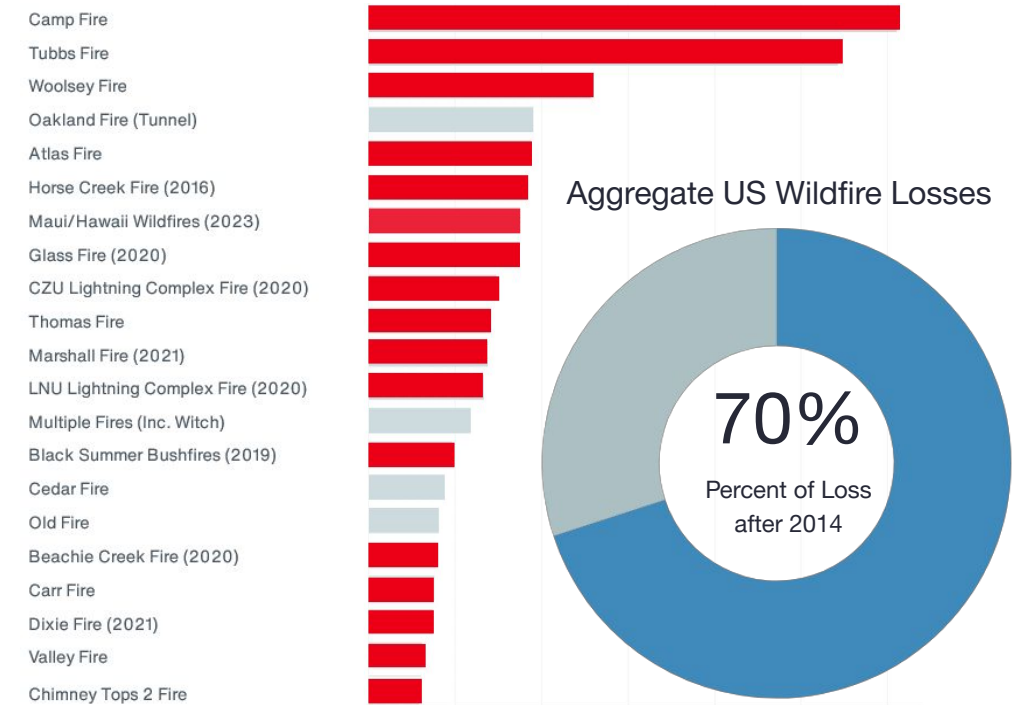


Data: USFS Fire Occurrence Database; NIFC

Graphics: Aon

### Wildfires Are Causing More Loss...

US Wildfire Events Exceeding \$1B in Insured Loss

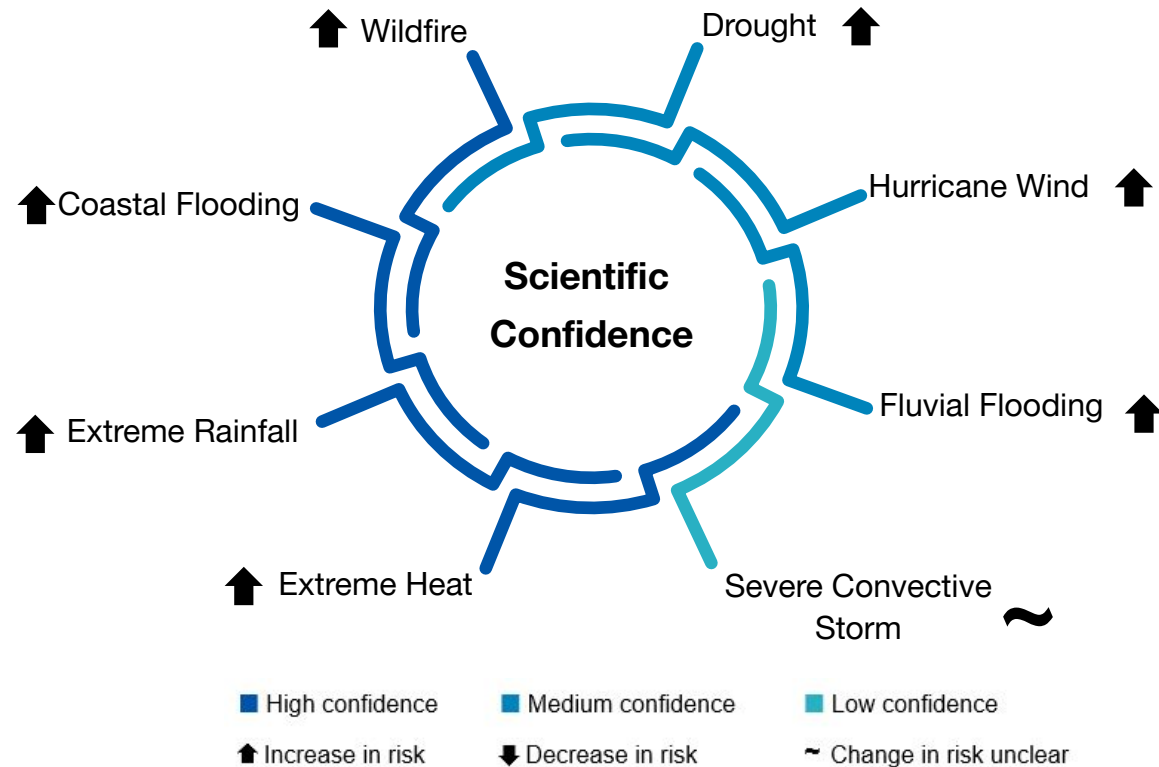


Data and Graphics: Aon (Catastrophe Insight)



# Climate Change Impacts on U.S. Physical Hazards

Assessed by IPCC in Assessment Report 6



# Complexities of Understanding Changing Risk

## Exposure

Where and how we build is critical in understanding potential physical risks posed by natural hazard events

## Attribution

Weather has always and will always occur  
Quantifying the “fingerprints” of climate change remain a challenge despite knowing its existence

## Uncertainty

Varying levels of confidence on climate change influence on individual perils in specific regions



## Hazard

Acceleration of more unusual weather behavior with greater and more impactful incidents on a per event basis

## People

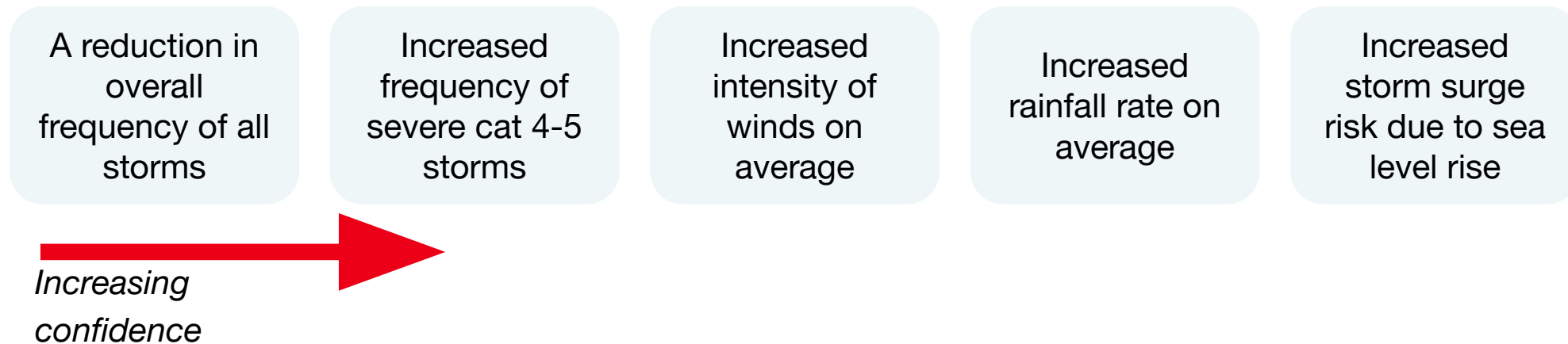
Continued population migration pattern into known high-risk natural peril regions

## Replacement Costs / Misc.

Higher cost of labor and goods adds to recovery / rebuild costs  
Can result in compounded implications to global supply chain

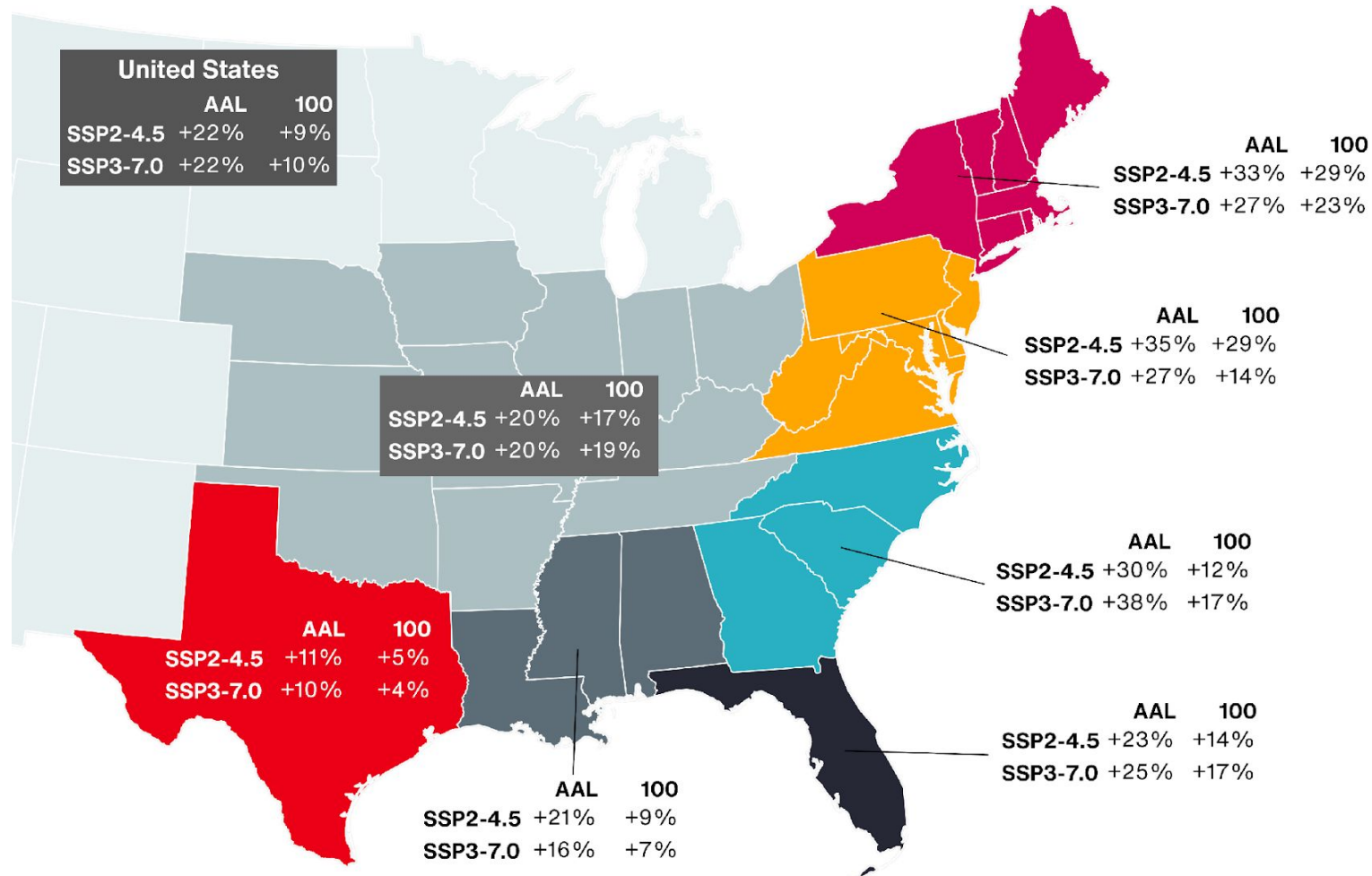
# The Expected Response of Atlantic Hurricanes to Climate Change

Anthropogenic warming will make hurricanes *more impactful* due to increased intensity, higher rainfall rates, and more severe storm surge on average



# Aon and Columbia University Collaboration on Global TC

Regional loss difference from current environment for industry in 2040



**Frequency Factors:** Based on CMIP6 climate model output to provide landfall changes by category and region

**Results:** Only account for future changes to hazard

**Results:** Current exposure and vulnerability maintained

**Scenario:** CRH (Favorable Environment)

**AAL:** Average Annual Loss

**100:** 100 yr Occurrence Exceedance Probability

## Takeaways

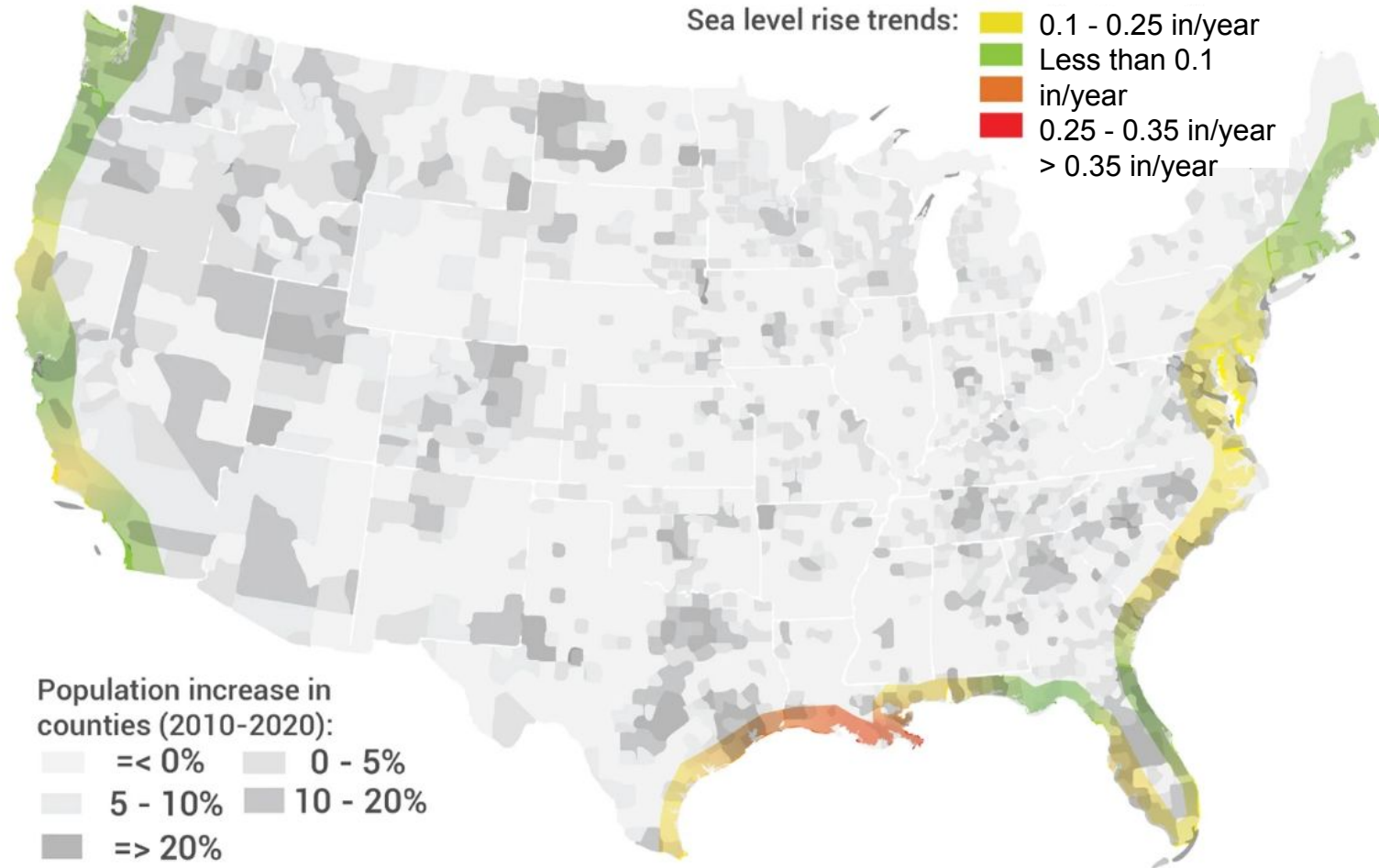
Biggest loss changes: Southeast, Mid-Atlantic, Northeast  
*\*\*Mid-Atlantic & Northeast started w/ lower base losses\*\**

Warmer oceans / atmosphere promotes hurricanes having tropical characteristics at higher latitudes

Global Climate Model (GCM) output does not account for interannual variability or explicit effects of ENSO phase on seasonal activity

Source: Aon (Impact Forecasting)

# Sea Level Rise Threatens Growing Civil Infrastructure



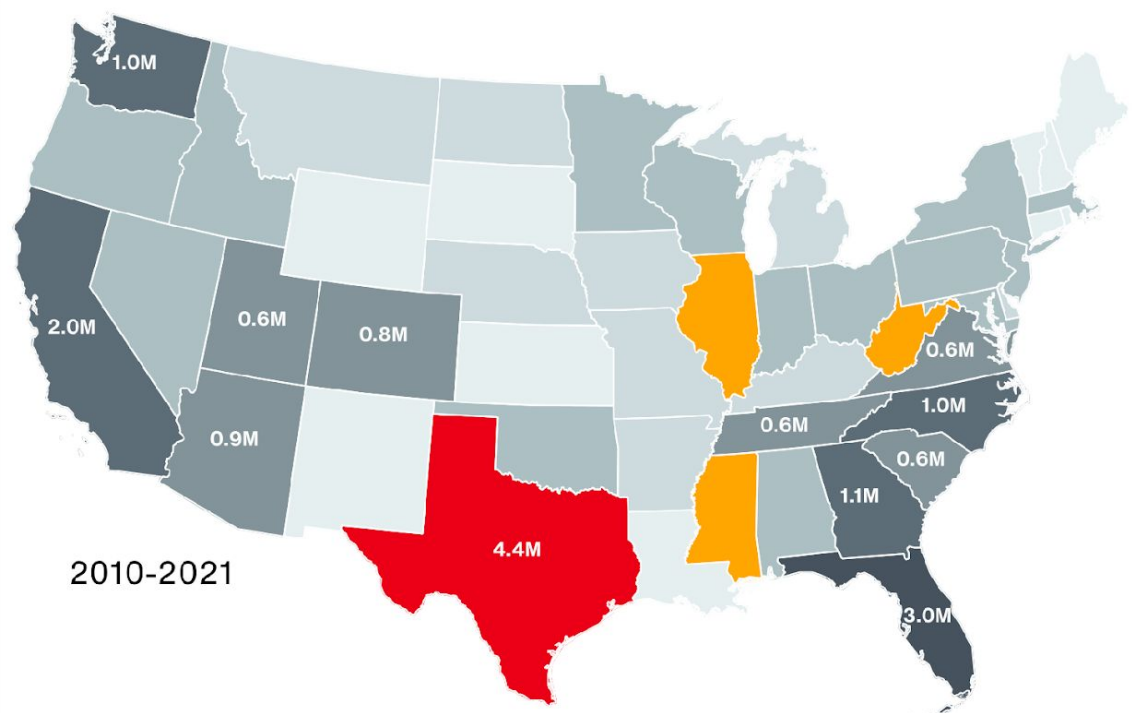
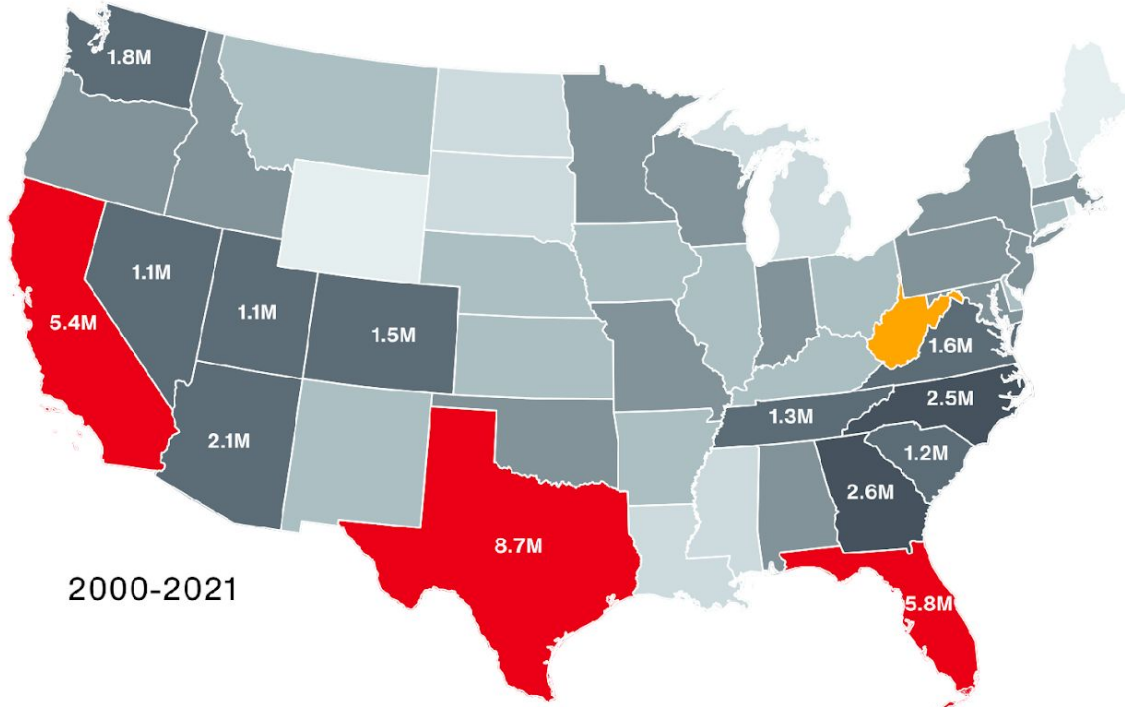
- Coastal infrastructure is especially vulnerable to the effects of sea level risk (SLR) and increased storm surge risk as a result of climate change
- Saltwater intrusion as a result of SLR can lead to significant and unexpected expenses
- Higher water levels and forces cause significant shifts in loads on structures, as well as elevated risk of storm surge inundation and sunny day “nuisance” flooding

Source: Abdelhafez, M.A., Ellingwood, B. & Mahmoud, H. Hidden costs to building foundations due to sea level rise in a changing climate. *Sci Rep* 12, 14020 (2022). Dept. of Civil and Environmental Engineering, Colorado State University - <https://doi.org/10.1038/s41598-022-18467-3>

# Population (Exposure!) Expansion in Higher Risk Areas

## Total Population Growth by State

Data: U.S. Census Bureau  
Graphic: Aon (Catastrophe Insight)

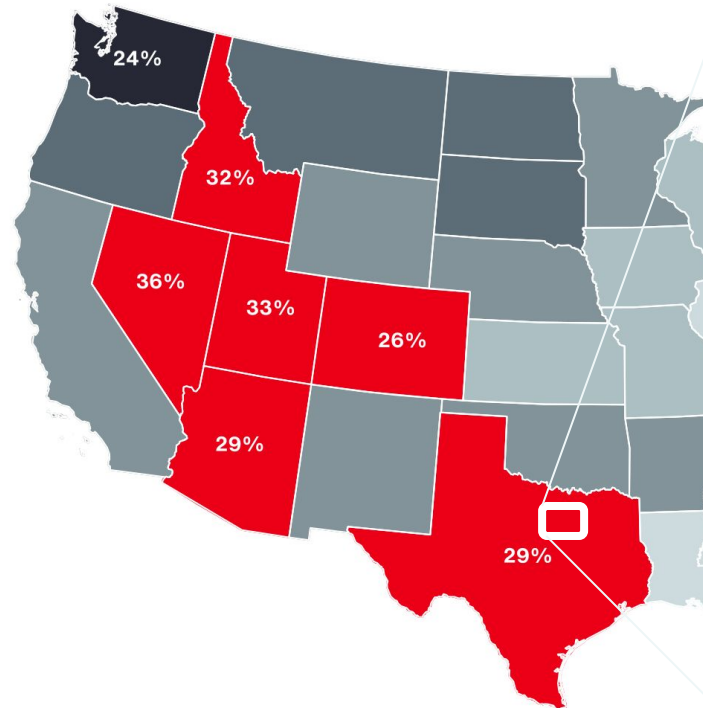


■ Decrease  
■ <100,000  
■ 100,000 - 200,000  
■ 200,000 - 500,000  
■ 500,000 - 1,000,000  
■ 1,000,000 - 2,500,000  
■ 2,500,000 - 5,000,000  
■ >5,000,000

■ Decrease  
■ <100,000  
■ 100,000 - 200,000  
■ 200,000 - 500,000  
■ 500,000 - 1,000,000  
■ 1,000,000 - 2,000,000  
■ 2,000,000 - 4,000,000  
■ >4,000,000

# Population (Exposure!) Expansion in Higher Risk Areas

## Percentage Population Growth by State (2000-2021)



## "Expanding Bullseye" Hail Swath Example Dallas / Fort Worth (Texas) Metroplex



As population grows and the urban footprint expands, the risk of potential damage increases.

\*Totals include Collin, Dallas, Denton, Ellis, Hunt, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise counties

Adapted from Ashley, et al (2014)

Data: U.S. Census Bureau  
Graphic & Analysis: Aon (Catastrophe Insight)

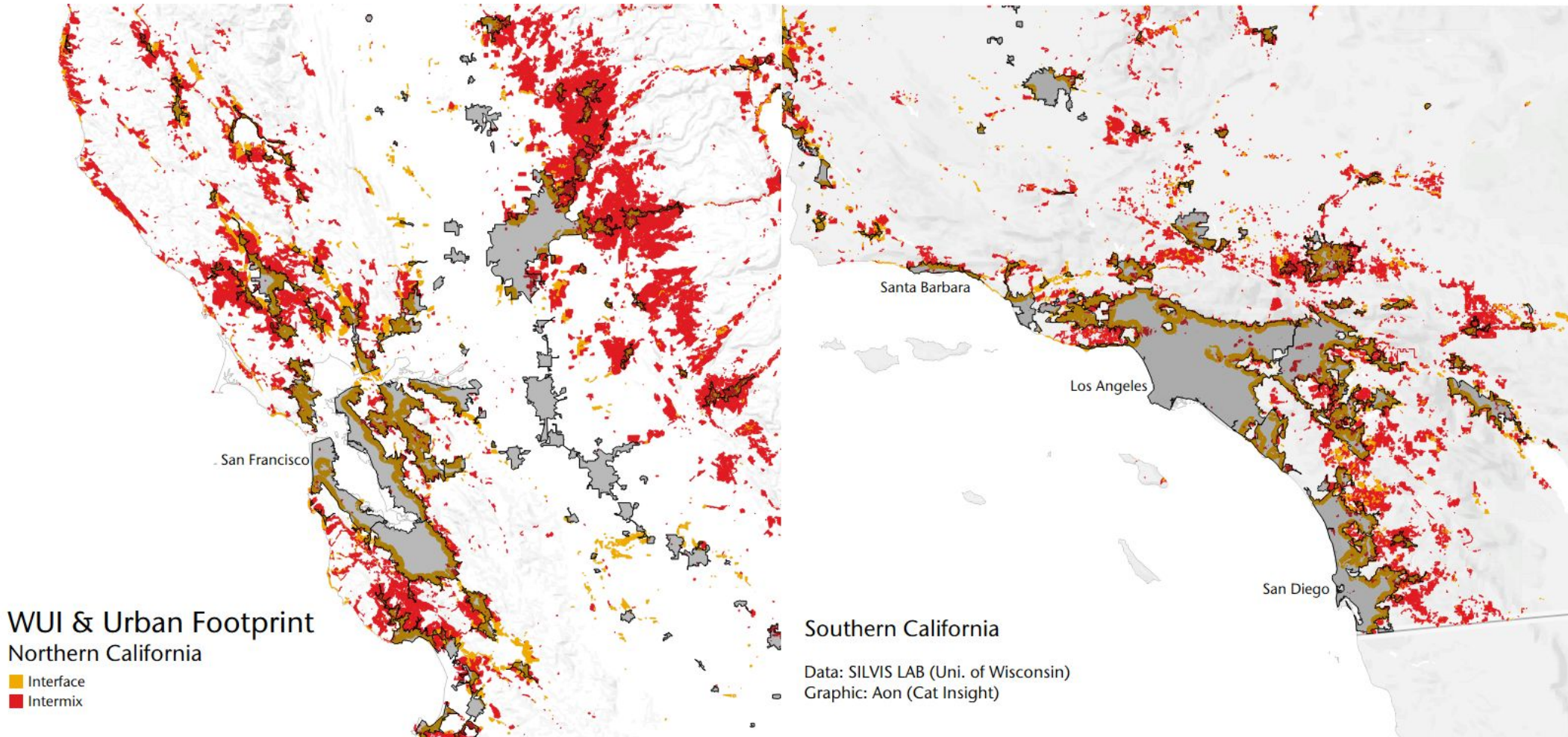


Data: U.S. Census Bureau

Graphic: Aon (Catastrophe Insight)

- An expansion of the urban footprint, as shown above, will increase the likelihood that an event will impact the city, **increasing event frequency**
- An increased concentration of exposure within the urban footprint will increase the aggregated loss total of an event, **increasing event severity**

# Expanding Urban Footprints Contribute to Wildfire Loss



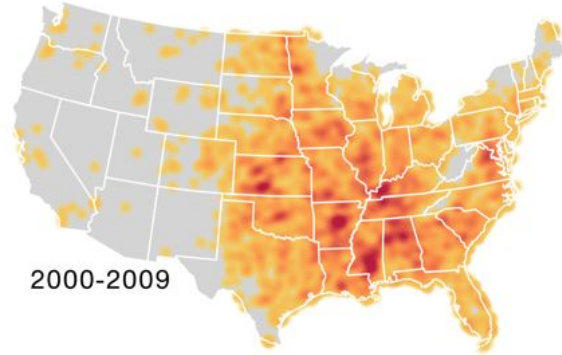


# Interannual Variability (and Bias!) of Local Severe Storm Reports

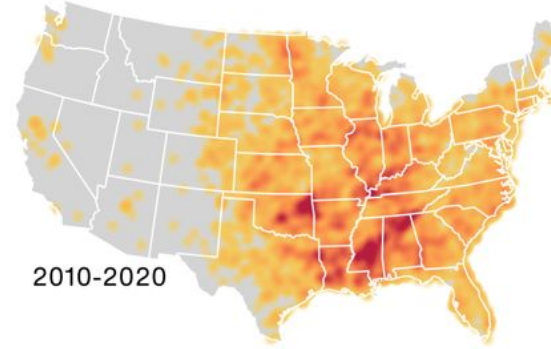


## Tornado

F/EF1+



2000-2009



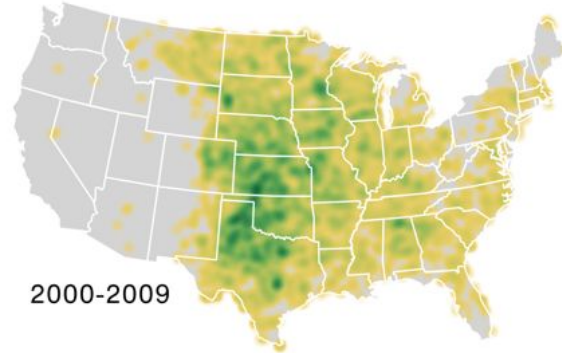
2010-2020

Eastward shift in tornado alley threatens a larger population

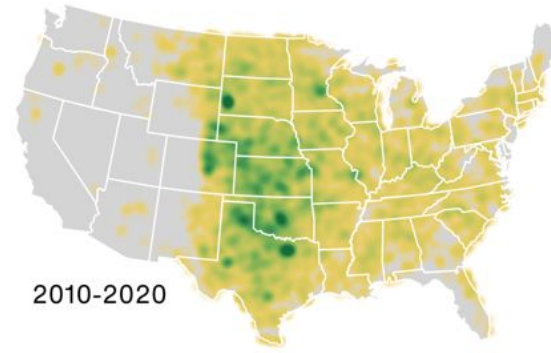


## Hail

≥2 inches



2000-2009



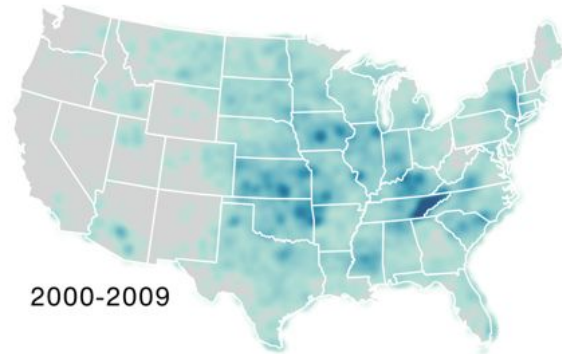
2010-2020

Evidence of increasing trends in severe hail east of the Rockies

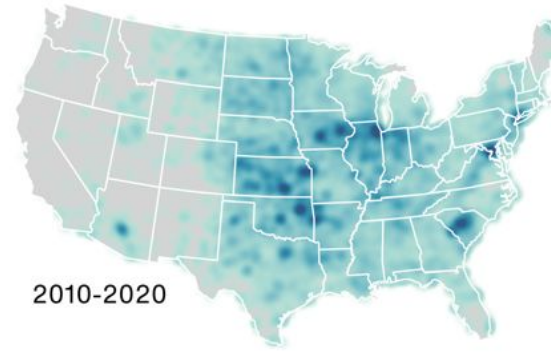


## Damaging Wind

≥58 mph



2000-2009



2010-2020

Increasing trend in number of damaging wind reports across the central and eastern U.S.

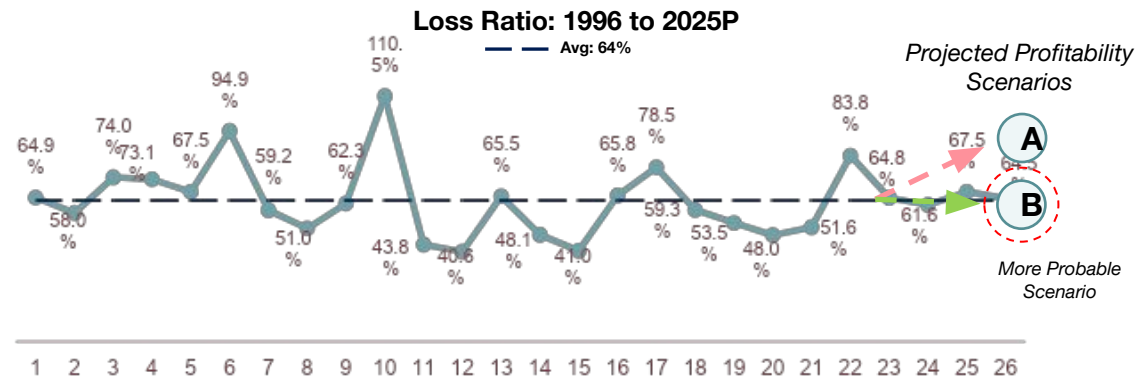
# What Does All This Mean for the (Re)Insurance Industry?

Natural disasters have numerous effects beyond the immediate damage to property and infrastructure, affecting access to (re)insurance and negatively impacting profitability

## Property Insurance Loss Activity and Profitability

Property insurers **have not experienced a highly profitable year since 2016**, and while the market began to stabilize in early 2022, **increasing severity and frequency of weather-related perils** (such as Hurricane Ian and H1 2023 SCS events), as well as the **continued inflationary environment, have caused additional headwinds**

Source: S&P Capital IQ



Market participants in disaster-prone areas are being challenged to address rising systemic risk and growing volatility by identifying ways to reduce risk from natural catastrophes

# Climate's Impact on the Municipal Property Market

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## What we are seeing...

- Increase in convective related storms in the northeast creating lightning strikes, power surges, and torrential rainfalls overwhelming existing drainage systems
- Year-round exposure to water related losses
  - American Meteorological Society Journal – June 15, 2016
    - Northeast “Warm Season” – April through September
      - **30-40% increase in mid-level precipitation**
- Designated Catastrophes by Insurance Services Office (ISO)
  - CAT2172 – 10/25/2021 – 10/27/2021) “Bomb Cyclone” - 90 mph winds (38 towns)
  - CAT2212 (1/15/2022 – 1/18/2022) – Freeze-up Event (17 towns)
  - CAT2273 (12/21/2022 – 12/25/2022) – Freeze-up Event (9 towns)
  - CAT2318 (2/2/2023 – 2/5/2023) – Freeze-up Event (52 towns)
  - CAT2361 (8/4/2023 – 8/8/2023) – Flooding Event (5 towns)
  - 9/11/2023 – Flooding Event (11” rainfall) – Leominster area
  - CAT2383 – (12/16/2023-12/18/2023) – Wind/Flooding Event (18 towns)

# Financial Impact

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**Climate change will impact property insurance pricing, terms and reinsurance worldwide**

**The insurance industry is in a state of evolution as a result of increasing climate loss trends**

**Reduction in risk from a vulnerability perspective is going to be much more important moving forward with your property insurance placement**

**FACILITY**

**MANAGEMENT**

OPERATIONAL FINANCE

PROPERTY PEOPLE

SAFETY SPACE

ADMINISTRATION MANAGER

STANDARD COMMUNICATION

INFRASTRUCTURE BUSINESS

CLEANING

ORGANIZATION

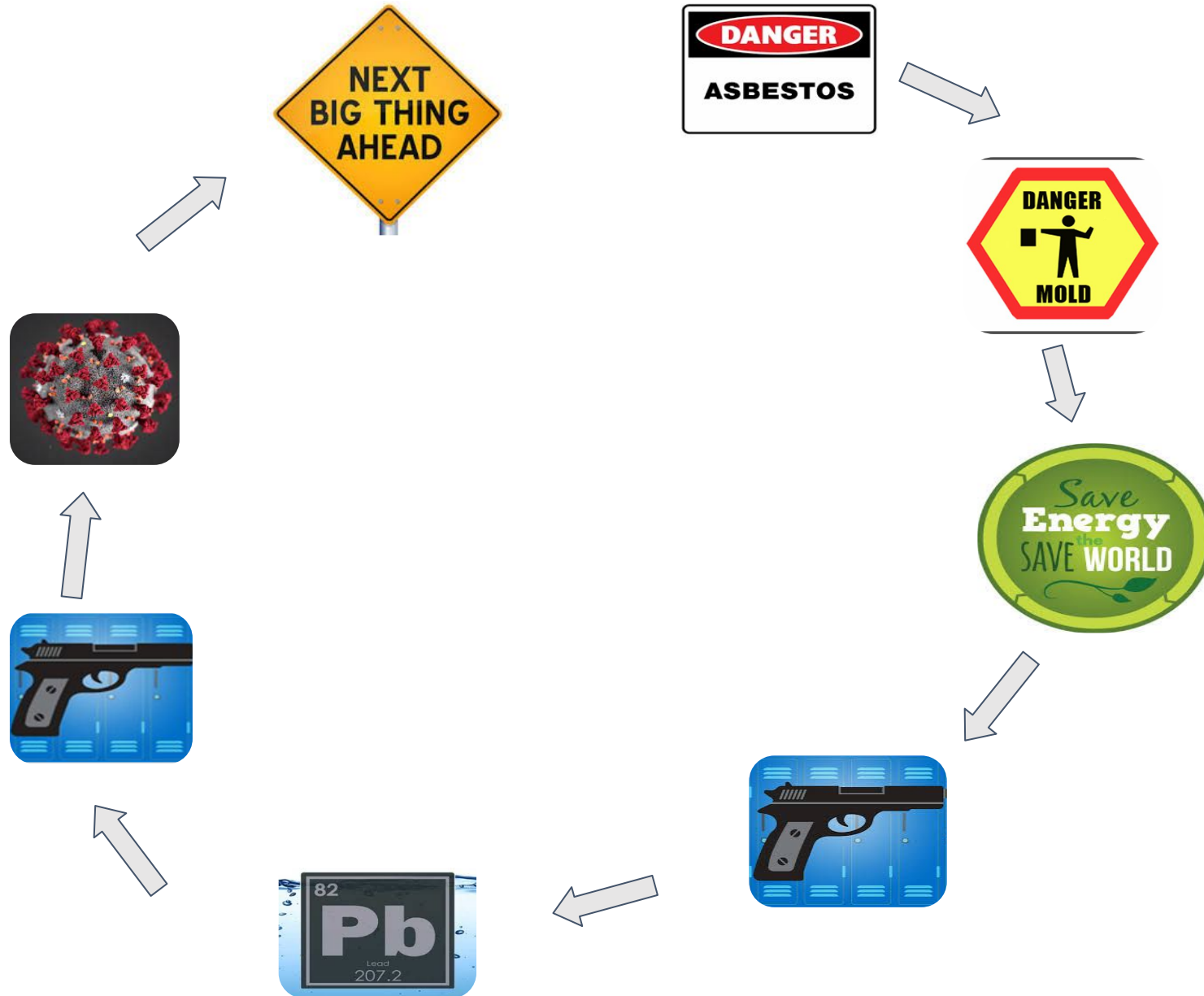
COORDINATION

SECURITY PROCESS

MAINTENANCE

DEVELOPMENT

# Priorities Change...



# Priorities Change...



# M&O Budget

## Operations

## Capital

Staffing

Employees

Contracted

Utilities

General

Reactive

Mandated

Planned-Preventative

Special Projects

Equipment Life Cycle

Energy Project

Major Replacement



# Recommended APPA\* STAFFING STANDARDS

## APPA's Levels of Service Establishing Parameters

<b>Level</b>	<b><u>Maintenance</u></b>	<b><u>Custodial</u></b>	<b><u>Grounds</u></b>
<b>1</b>	Showpiece Facility	Orderly Spotlessness	State of the Art
<b>2</b>	Comprehensive Stewardship	Orderly Tidiness	High Level
<b>3</b>	Managed Care	Casual Inattention	Moderate Level
<b>4</b>	Reactive Management	Moderate Dinginess	Moderately Low-Level
<b>5</b>	Crisis Response	Unkempt Neglect	Minimum Level

\* Formerly known as: Association of Physical Plant Administrators

# Recommended APPA STAFFING STANDARDS

## APPA's Levels of Service Establishing Parameters

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# Deferred Maintenance



total cost  
**\$542 billion**

There are **100,000** public elementary and secondary schools in the U.S.

SOURCE: U.S. Green Building Council,  
National Center for Education Statistics  
2013 DESERET NEWS GRAPHIC





# Massachusetts School Building Authority

*Funding Affordable, Sustainable, and Efficient Schools in Partnership with Local Communities*

About Us ▶

Working With Us ▶

Building With Us ▶

Policies, Forms & Guidelines ▶

Our Programs & Initiatives ▶

Your School ▶

News & Events ▶

Public Records ▶

English ▼

## Maintenance and Capital Planning

The MSBA has instituted many reforms to make the MSBA's school construction and renovation grant program more effective, efficient, and user-friendly for school districts and to ensure the long-term viability of the program. A vital component of these reforms is to protect the over \$20 billion investment in school facility construction and renovation projects throughout the Commonwealth in the past 25 years, through active and on-going maintenance of school facilities by the school districts. The MSBA has adopted criteria based on industry best practices as a prerequisite for MSBA funding and evaluation criteria for the determination of the allocation of maintenance incentive reimbursement points on eligible projects. The following information describes the activities and practices that the MSBA believes are part of a strategy for maintenance and capital planning and budgeting to ensure the long term operation of school facilities. In addition, information is provided to explain the scoring methodology of the maintenance and capital planning rating system.

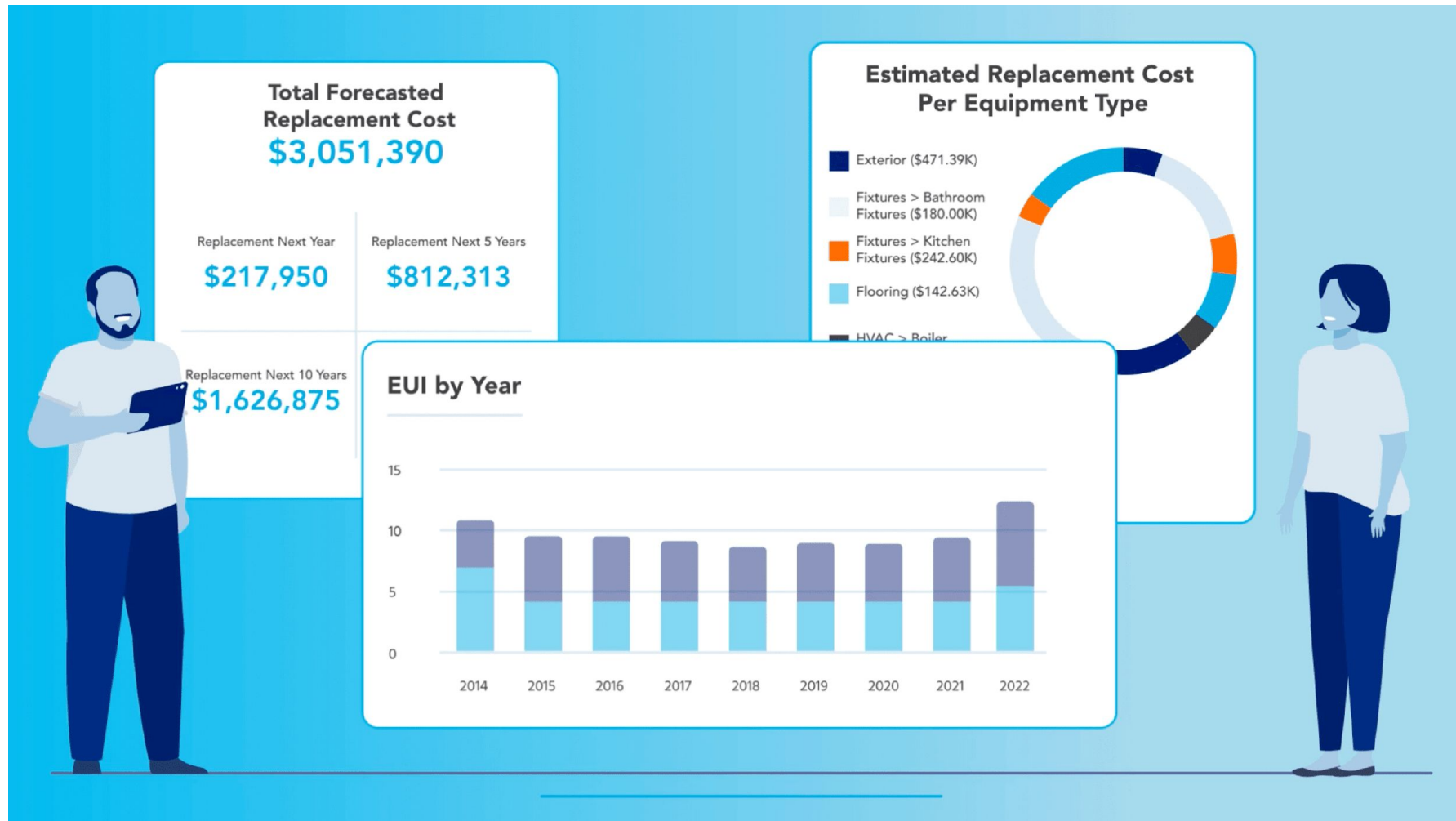
- [Best Practices for Maintenance and Capital Planning](#) (PDF)
- [Explanation of the methodology for evaluating Maintenance and Capital Planning](#) (PDF)

### Eligibility Period - Module 1

- ▶ Maintenance and Capital Planning
- ▶ MSBA Enrollment Methodology

# Facilities Condition Assessment

## You Don't Know What You Don't Know





TOP 5 BENEFITS OF EXISTING BUILDING COMMISSIONING

01 Increased Comfort for Building Occupants



02 Energy/GHG Savings



03 Air Quality Improvements



04 Longer Equipment Life



05 Building Operator Training/Knowledge



# Know your Buildings - Tail of Two Schools

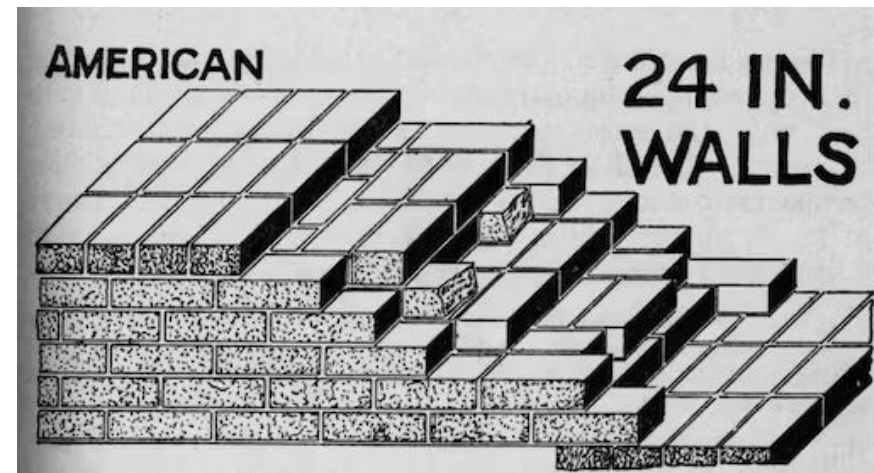
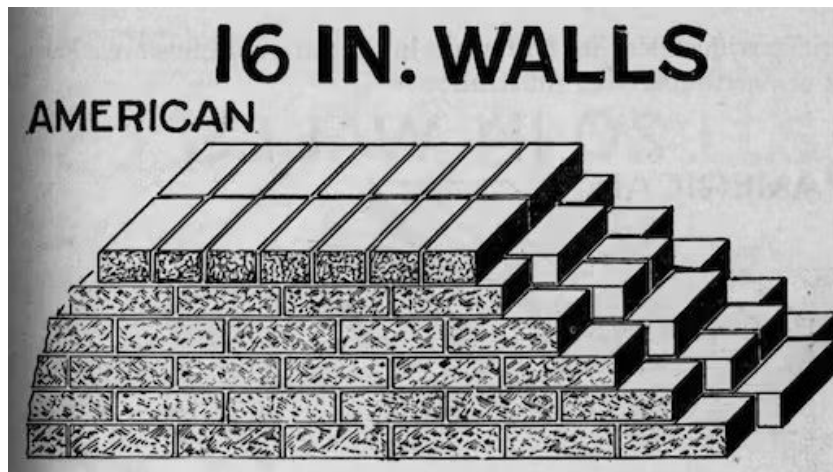
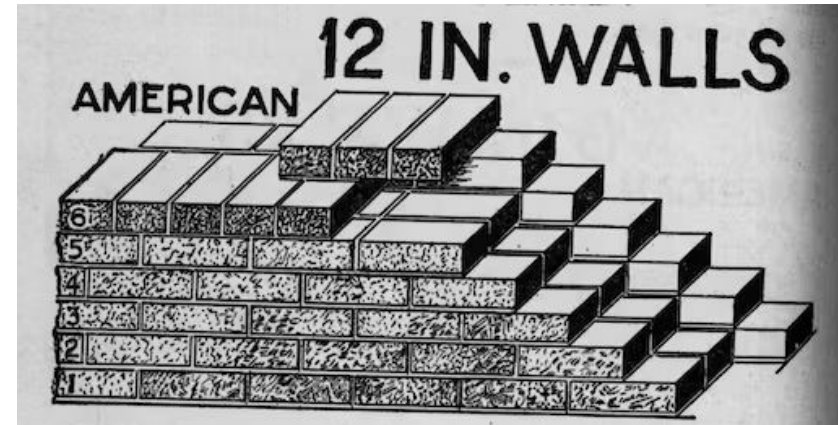
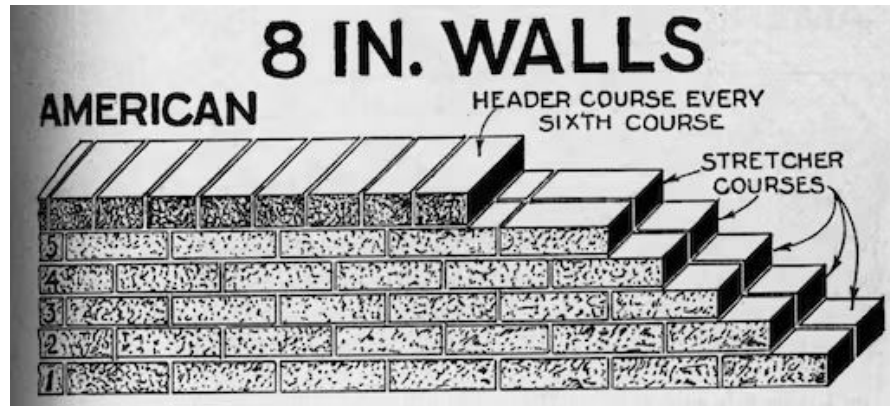


**1900 - .....**

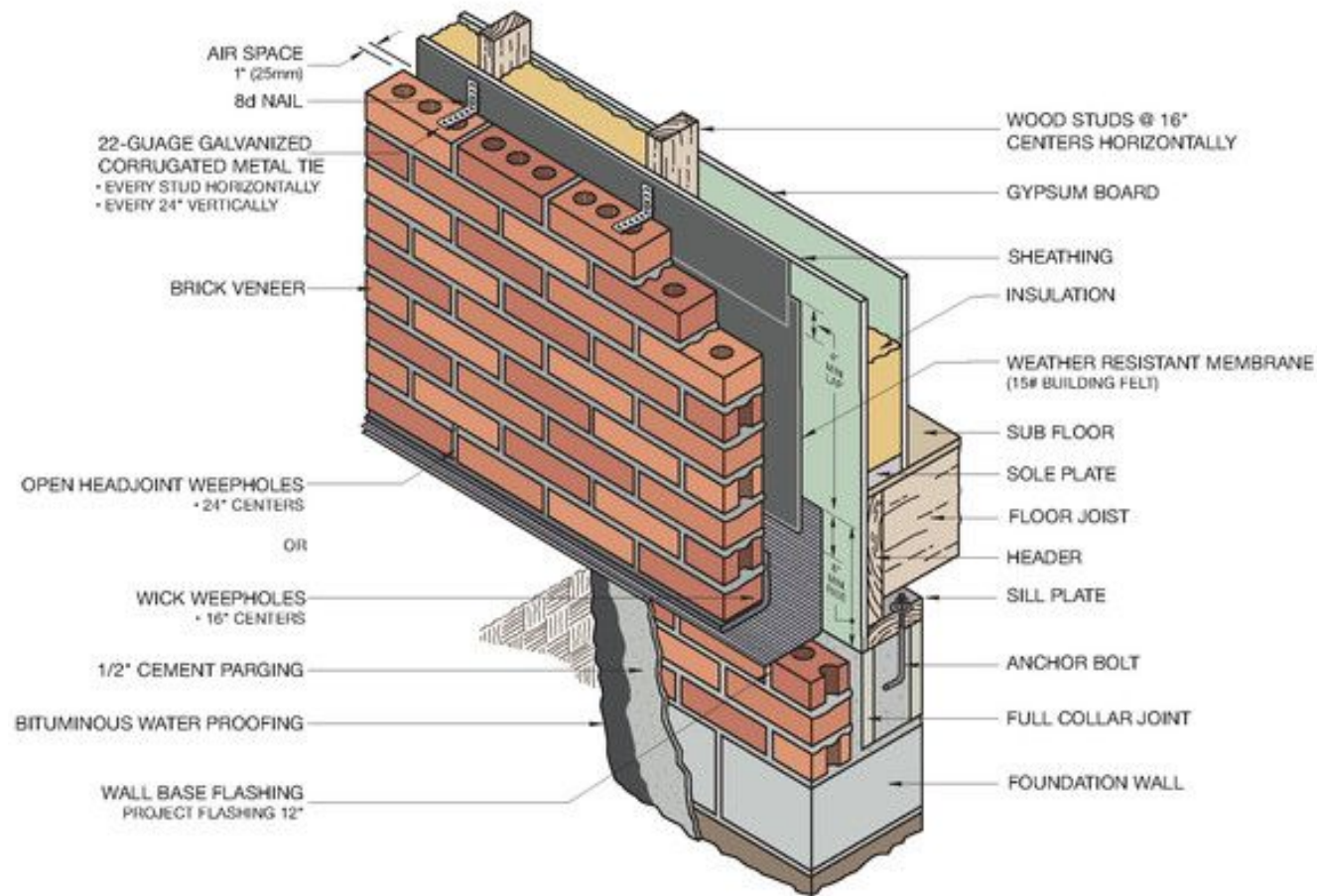
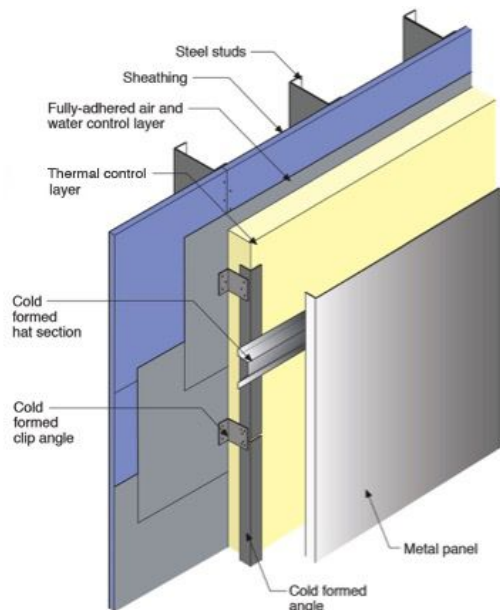
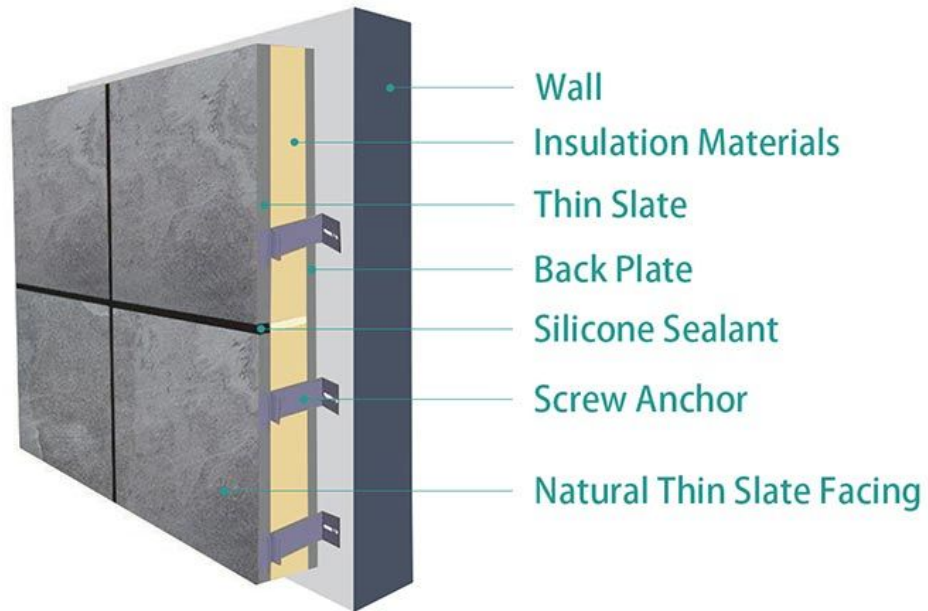


**2015 - beyond**

# 1800s - 1920s Solid Brick







# Wood Over Time



## CHAPTER 16 - STRUCTURAL DESIGN - AMENDMENTS

The ninth edition building code became first effective on October 20, 2017 and, with a shortened concurrency period, the new code came into full force and effect on **January 1, 2018**.

The new, ninth edition code is based on modified versions of the following *2015 International Codes as published by the International Code Council (ICC)*.

**1604.11 and Table 1604.11** Add section and table as follows:

**1604.11 Snow, Wind and Earthquake Design Factors.** Ground snow load,  $p_g$ , ultimate design wind speed (three second gust),  $V_{ult}$ , and earthquake response accelerations for the maximum considered earthquake,  $S_s$  and  $S_1$ , for each city and town in the Commonwealth shall be as given in Table 1604.11.

**TABLE 1604.11 SNOW LOADS, WIND SPEEDS AND SEISMIC PARAMETERS**

City/Town	SNOW LOADS		BASIC WIND SPEED, $V_{ult}$ (mph)			SEISMIC PARAMETERS (g)	
	Ground Snow Load, $P_g$ (psf)	Minimum Flat Roof Snow Load, $P_f^1$ (psf)	Risk Category I	Risk Category II	Risk Category III or IV	$S_s$	$S_1$
Abington	35	30	122	132	143	0.196	0.065
Acton	50	35	114	124	134	0.213	0.070
Acushnet	30	30	129	138	149	0.172	0.059
Adams <sup>2</sup>	60	40	105	115	120	0.172	0.069
Agawam	35	35	109	120	128	0.174	0.065
Alford <sup>2</sup>	40	40	105	115	120	0.169	0.066
Amesbury	50	30	113	123	134	0.267	0.078
Amherst	40	35	106	118	125	0.172	0.066
Andover	50	30	114	124	135	0.247	0.075



# Building Code Study and Local Floodplain Action Guide

Learn about this collaborative project to promote flood resilience in Massachusetts

In October 2023, the Healey-Driscoll Administration released its 2023 Statewide Hazard Mitigation and Climate Adaptation Plan, a federally mandated plan known as ResilientMass that details over 125 actions state agencies can take, individually or through partnerships, to ready Massachusetts for the impacts of climate change. Among the most significant climate hazards facing Massachusetts are flooding from precipitation and coastal flooding and erosion due to sea level rise. Learn about this collaborative project between the Executive Office of Economic Development (EOED), the Executive Office of Energy and Environmental Affairs (EEA), the Department of Conservation and Recreation (DCR), and the Office of Coastal Zone Management (CZM) to strengthen Massachusetts' resilience to flooding.

- **Current Base Energy Code** = IECC 2018 with MA amendments (to be updated in 2023)
- **Updated Stretch Code** = IECC 2021 with MA amendments + Stretch Code amendments



*Current Energy Code Options*

- **Specialized Code** = IECC 2021 with MA amendments + Stretch Code amendments + Specialized Code appendices

# M&O Budget

## Operations

## Capital

Staffing

Employees

Contracted

Utilities

General

Reactive

Mandated

Planned-Preventative

Special Projects

Equipment Life Cycle

Energy Project

Major Replacement



**Geothermal HVAC**

- Maximized HVAC Efficiency
- Reduced Energy Use
- Eliminates On Site Combustion
- 60 Wells – 500 Feet Deep



**Solar Photovoltaics Array**

- Maximized Available Roof PV
- Modeled Energy Generation
- Zero Energy Performance



**High Performance Kitchen**

- 100% Electric / Fossil Fuel Free
- Highly Efficient Appliances and Refrigeration



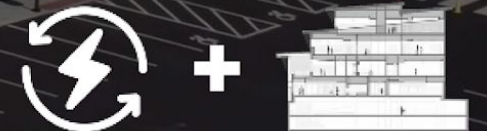
**Ultra Tight Building Envelope**

- New Roof, Walls and Windows
- Building Pressure Test
- Reduced Building Energy Loss
- Enhanced Daylight Access



**Fresh Air Heating Ventilation & Cooling**

- Improved Ventilation
- Local Filtration + MERV Filtration
- UV Lighting
- Energy Recovery
- Occupant Health + Wellness



**Energy Modeling + Enhanced Envelope**

- Data-Driven Design Decisions
- Optimum Building Orientation
- Significant Utility Incentives
- Performance: <20 EUI

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# QUESTIONS



# Workshop Goals

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Understanding how the changing weather patterns impacts property losses

Severity and Uncertainty affects insurability

What we do matters:

- Facilities Management
- Building Practices
- Capital Improvement Plans