Register Today for *Envision Tomorrow* American Academy of Actuaries Annual Meeting November 13-14, 2023 – Washington, DC

Featuring

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- **Mona Chalabi**, Pulitzer Prize winning data journalist
- **Rayid Ghani**, distinguished professor in machine learning and public policy
- **Tim Hwang**, expert on AI, machine learning and technology ethics

- Breakout sessions on equity and fairness, climate change and risk, cyber risk, Social Security, Medicaid and Medicare and more.

- Networking opportunities.

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Register by August 30th for early registration discounts

How Climate Risk Applies to All Actuaries

August 9, 2023

Academy Webinar

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- The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

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- This program, including remarks made by attendees, may be recorded and published. Additionally, it is open to the news media.

  If you have questions, please enter them in the "Ask Question" window on your screen.

Presenters

Lisa Slotznick, MAAA, FCAS
Chair, Climate Change Joint Committee and President-Elect

Ken Kasner, MAAA, FCAS
Vice-Chair, Climate Change Joint Committee

Stu Mathewson, MAAA, FCAS
Member, Climate Change Joint Committee

Margot Kaplan, MAAA, ASA,FCA
Member, Climate Change Joint Committee

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Member, Climate Change Joint Commitee

Agenda

Introduction
Glossary of Climate Change Terms and Definitions
Prelude
Property Casualty
Health
Life
Pension/Retirement
Future Projects of Climate Committee

Introduction – Climate Change Joint Committee

Reactive to Requests for Information

- National Climate Assessment Comment Letter
- SEC 2022 Comment Letter
- Department of Labor Comment Letter
- International Sustainability Standards Board Letter

Recent Papers

- Glossary of Climate Change Terms and Definitions
- Climate Risk Pose Broad Impacts on Financial Security Systems

Question 1. What is your practice area ?

- Casualty
- Health
- Life
- Pension/Retirement
- Other

Question 2. How much have you encountered climate change or climate change risk in your work providing actuarial services?

- Core part of my work
- Discussions in planning meetings
- Discussions on coffee breaks
- Not at all

Question 3. In the future, will climate change be an important part of actuarial work?

- Confined to specialized areas
- Impact all practice areas moderately
- A big deal for all actuaries

Introduction—Climate Change Joint Committee

Reactive to Requests for Information

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Recent Papers

- *Glossary of Climate Change Terms and Definitions*
- *Climate Risks Pose Broad Impacts on Financial Security Systems*

Other Academy Climate-Related Committees

- Climate-Related Financial Disclosures Subcommittee
- ACI/ACRI Work Group
- P/C Extreme Events and Property Lines Committee

Glossary of Climate Change Terms and Definitions

Academy Webinar

Glossary of Climate Change Terms and Definitions

- Explanation of various terms relating to climate change appearing in materials published by Academy committees, subcommittees, and task forces.
- To familiarize actuaries with terms they may not be familiar with, and clarify potentially ambiguous or conflicting definitions.
- To also help non-actuaries understand work prepared by actuaries pertaining to climate change and climate change risks.

Some Key Terms and Definitions

- Includes basic words and terms such as “climate change,” “global warming,” “fossil fuels,” “greenhouse gas,” etc.
- Also includes some lesser-known terms and concepts such as “attribution science,” “ESG,” “the Paris Agreement,” “physical risks,” “transition risks,” and “the 2° Investing Initiative.”
- Lastly, includes concepts some actuaries may currently be utilizing in their work, such as ACI and ACRI, Climate Risk Financial Disclosures, NY DFS Climate Risk Scenarios, and NAIC ORSA Manual.

Potential Usage for Actuaries

- For general actuarial services that includes climate change and climate change risks.
- Financial and ESG disclosure work performed by actuaries.
- Analysis of investments, investments strategies, and assets and liabilities that pertains to climate change risks.
- Glossary contains links to underlying sources for additional information.
- Is intended to be updated on a regular basis as new developments relating to climate change emerge.

Climate Risks Pose Broad Impacts on Financial Security Systems

Academy **Webinar**

Climate Risks Pose Broad Impacts on Financial Security Systems—Prelude

- The temperature of the Earth has increased approximately 1.8 degrees Fahrenheit in the past 100 years.
- Sea levels have been rising at the fastest rate after a nearly 3,000-year stable ocean level.
- Sea surface temperatures have risen at the fastest rate in 11,000 years.
- Arctic sea ice levels are the lowest in at least 1,000 years. The melting of glaciers is unprecedented in over 2,000 years.

Climate Risks Pose Broad Impacts on Financial Security Systems—Prelude

- Climate change, currently most obviously related to property and casualty exposures, will have a growing impact on public health and mortality, and may well impact retirement security and pension systems.
- Climate risks include "physical risks," which refers to climactic events such as wildfires, storms, and floods, as well as "transition risks," which result from policies and actions intended to transition the economy away from fossil fuels to a more climate-friendly future.
- Climate risks will be felt differently among those who have the resources to adjust their lives to the impacts versus those that do not. Climate risks will also vary greatly by geography.

Climate Risks Pose Broad Impacts on Financial Security Systems—Prelude

- This paper describes some of the impacts that changes in climate are having that may influence actuarial work by practice area, and focuses on the varying types of impact and how the impacts may cross practice areas over time.
- In addition, this paper may be used by non-actuaries to understand how climate change will impact individuals and society in the property/casualty, life, health, financial markets and retirement arenas. Policymakers and regulators can use the information contained in this paper to help produce more effective regulations and policies.

Property/Casualty

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Property and Casualty Issues

- Several natural hazards affected by climate change
- A number of these will be discussed
  - Hurricanes (tropical cyclones)
  - Severe rainstorms
  - Severe tornadoes
  - Sea level rise
  - Wildfires
  - Drought
  - Winter storms
- Workers' compensation and directors and officers liability also may be affected

Hurricanes

- In the past decade, there has been a significant increase in the number of major hurricanes, especially those that strengthen shortly before landfall.
- Because climate change is causing an increase in the water temperature, especially in the Gulf of Mexico, there has been more fuel for hurricane intensification as storms near land.

Hurricanes

- Four decades of hurricane costs, showing the increases:

U.S. Billion-Dollar Tropical Cyclone Disasters

Decade	Billion-Dollar Disasters	Cost in Billions (CPI adj'd to 2022)	Avg Disaster Cost ($Billions)	Deaths
1982-1991	7	44.3	6.32	214
1992-2001	12	127.1	10.59	324
2002-2011	16	410.8	25.68	2,466
2012-2021	21	610.1	29.05	3,691
Totals:	56	1,192.3	21.29	6,695

Table 2 - Derived from https://www.ncei.noaa.gov/access/billions/events totals as of October 11, 2022

Hurricanes

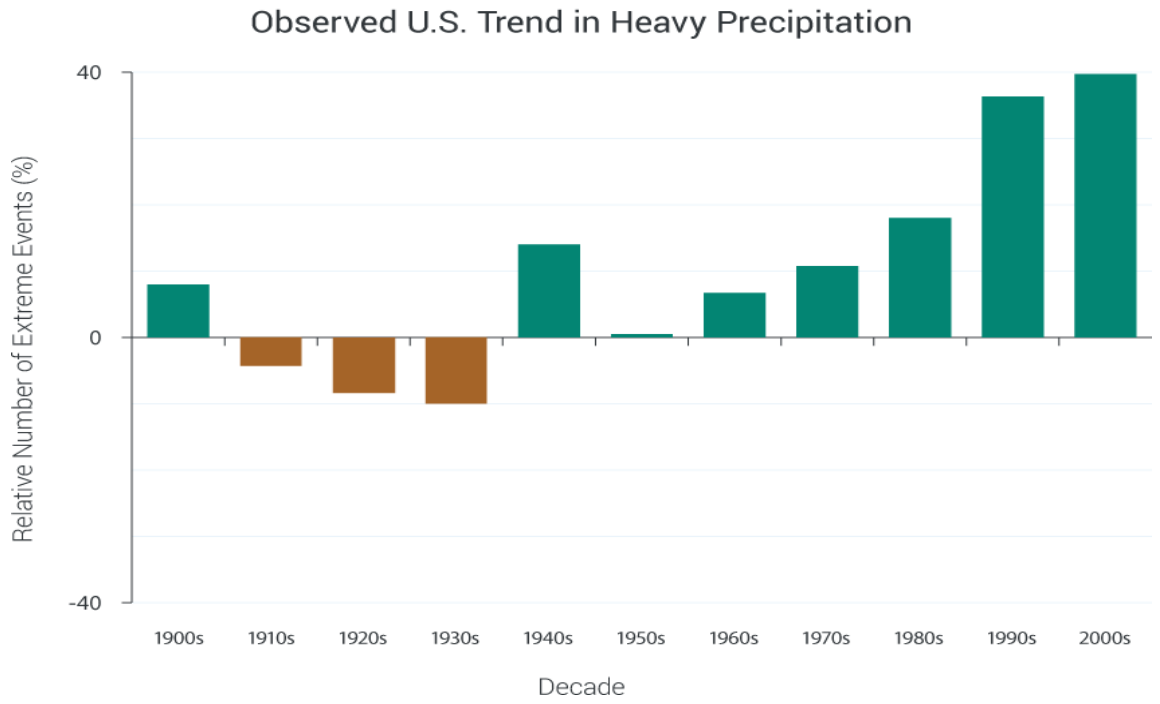
- Florida Panhandle and area between Houston and New Orleans have been particularly affected.
  - Hurricane Harvey (2017)
  - Hurricane Michael (2018)
- Also expected to threaten Northeast, as warmer water may allow storm formation further north.

Severe Rainstorms

- One effect of climate change is more extreme weather, such as an increase in the intensity of rainstorms
- Some of the effect from increased hurricane intensities
- But, other storm patterns have shown this effect in other portions of the country

Severe Rainstorms

- Chart showing decadal increases in severe rainstorms:



Severe Rainstorms

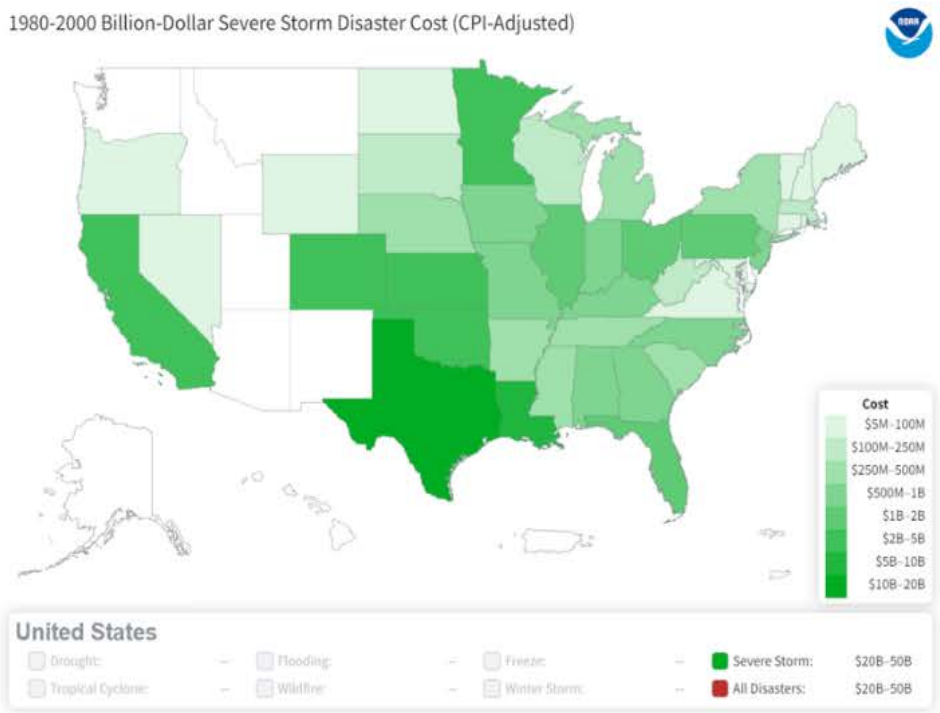
- The Pacific Coast, while hit by drought in recent years, was hit with severe rain caused by “atmospheric rivers” in 2021, 2022, and 2023. This caused severe flooding and landslides.
- Many other parts of the country have also been hit with unusually high amounts of rain recently, causing severe flooding; e.g., Kentucky, Vermont, and Texas.

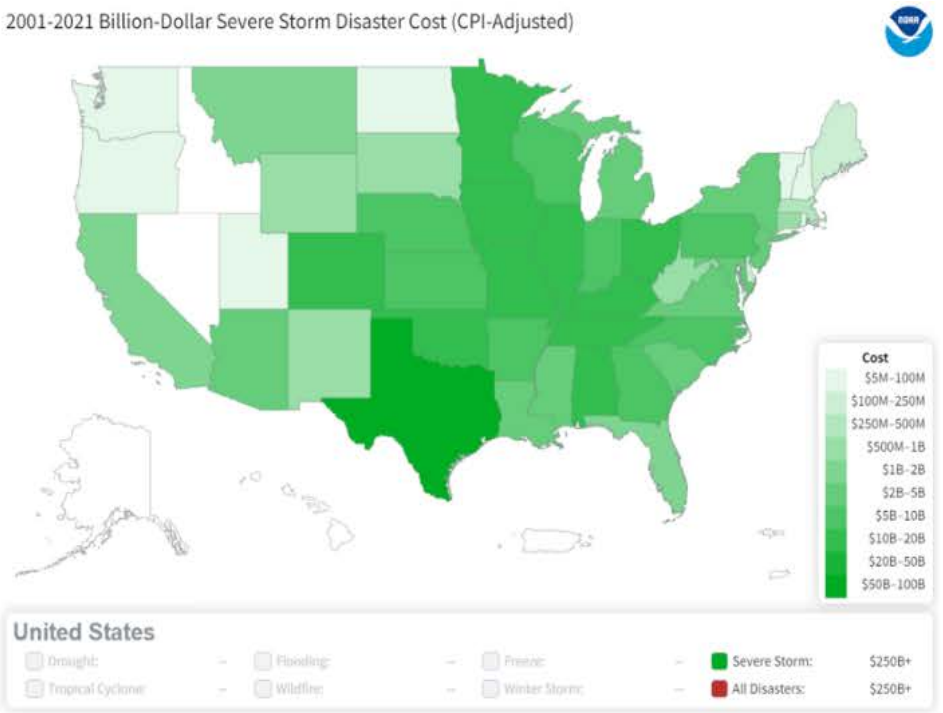
Severe Tornadoes

- In recent years, there has been a significant increase in tornado activity and destructive impacts.
- In addition, the tornado frequency has shifted eastward from the historical “tornado alley” to concentrate on states like Arkansas, Alabama, Mississippi, and Tennessee.

Severe Tornadoes

- These maps show the shift in tornado activity





Severe Tornadoes

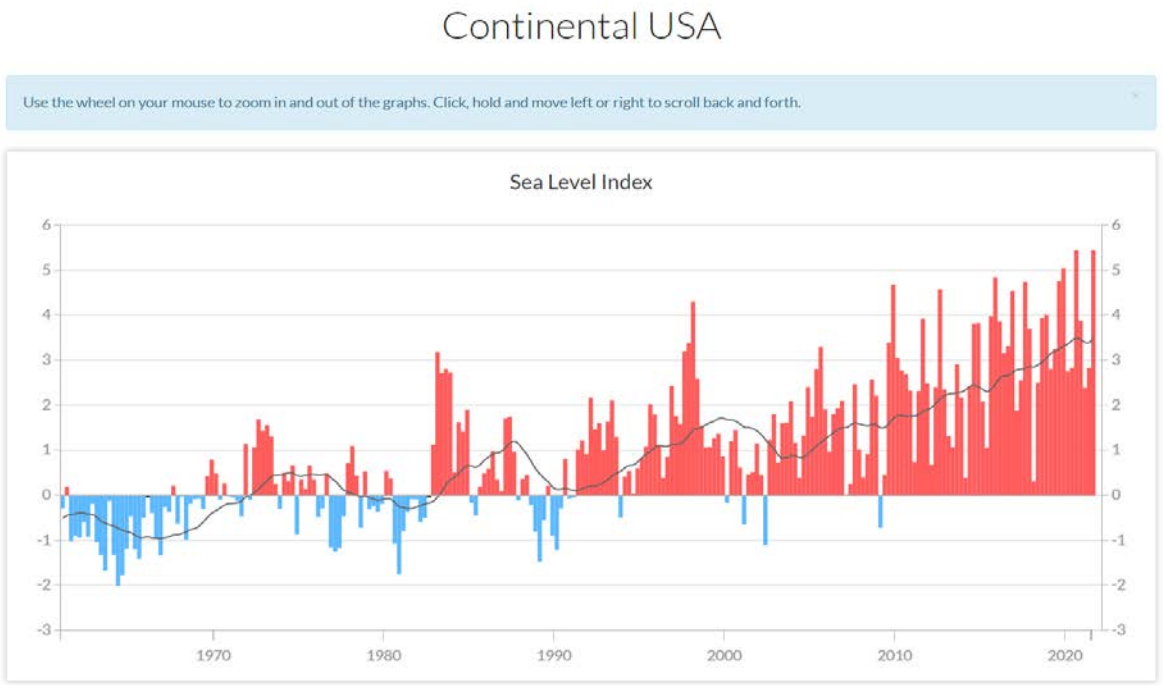
- There has also been an increase in more severe tornadoes (EFT-3 or higher) causing significantly more damage throughout Arkansas, Alabama, Mississippi, and Tennessee.

Sea Level Rise

- Sea level is the most obvious and clear result of climate change
- Easily measured, its steady rise is certain to continue, given the melting ice in Antarctica, Greenland, and the world's glaciers

Sea Level Rise

- This chart, showing the Sea Level component of the Actuaries Climate Index, shows clearly the changes in sea level:



Sea Level Rise

- In the U.S., low-lying coastal properties face an increasing risk of flooding from tropical storms
  - E.g., Superstorm Sandy hitting lower Manhattan
- In additions, many are at risk for “clear-sky” flooding during high tides
  - E.g., Miami Beach has this issue often and is struggling to find a solution

Wildfires

- Recent years have shown a dramatic increase in property damage caused by wild fires
- The following graphics highlight the increase

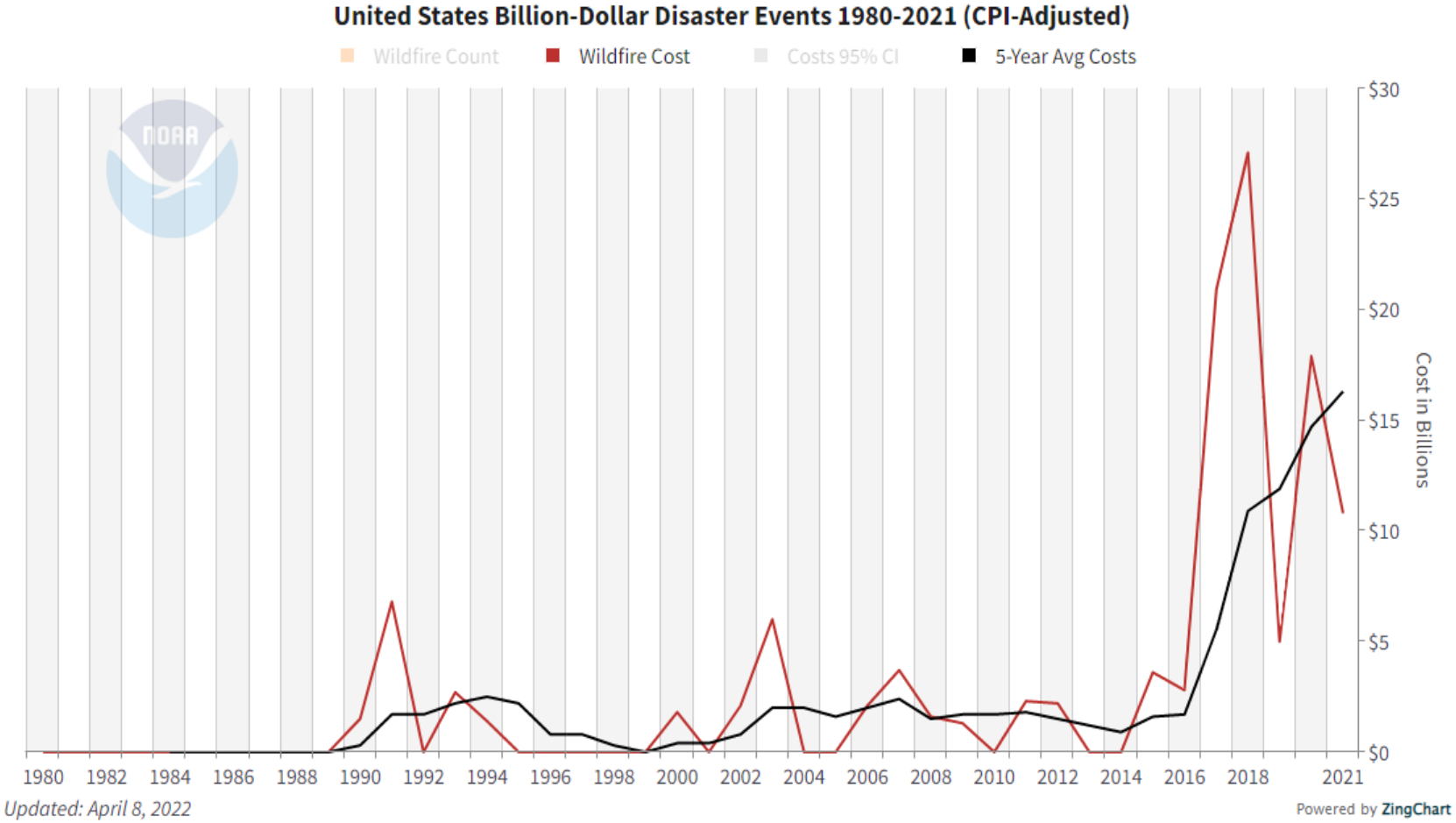
Wildfires

U.S. Billion-Dollar Wildfire Disasters

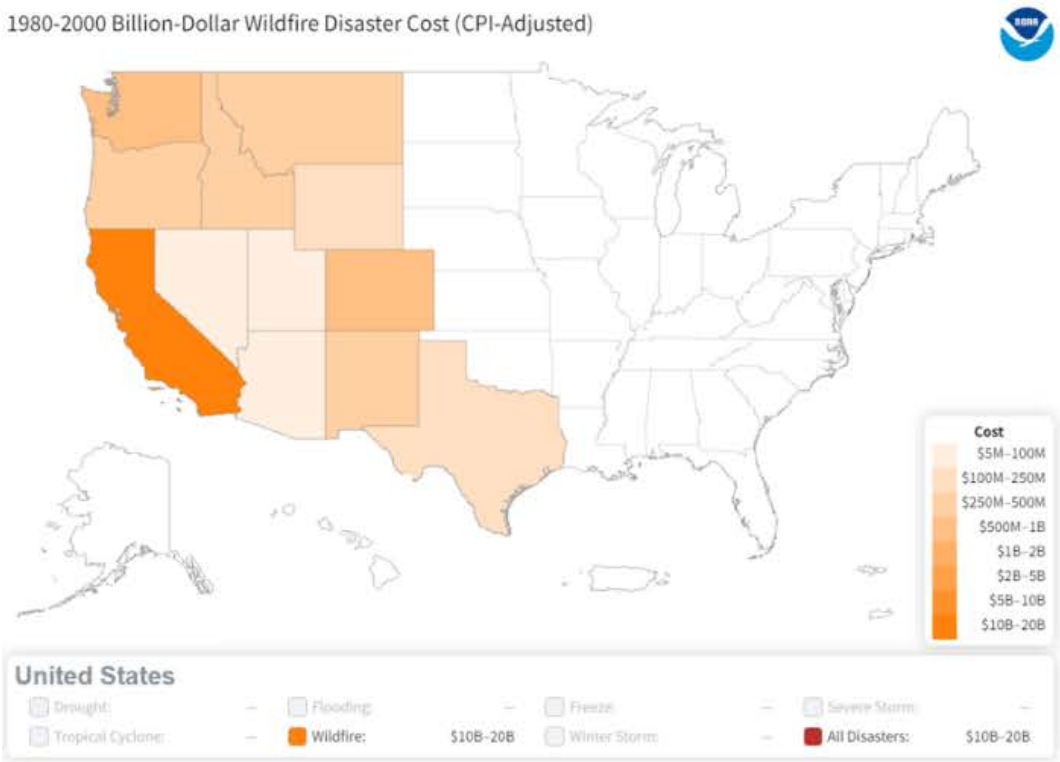
Decade	Billion-Dollar Disasters	Cost in Billions (CPI adj'd to 2022)	Avg Disaster Cost ($Billions)	Deaths
1982-1991	2	8.6	4.31	42
1992-2001	3	6.0	2.01	4
2002-2011	7	19.6	2.81	114
2012-2021	8	92.9	11.61	258
Totals:	20	127.1	6.36	418

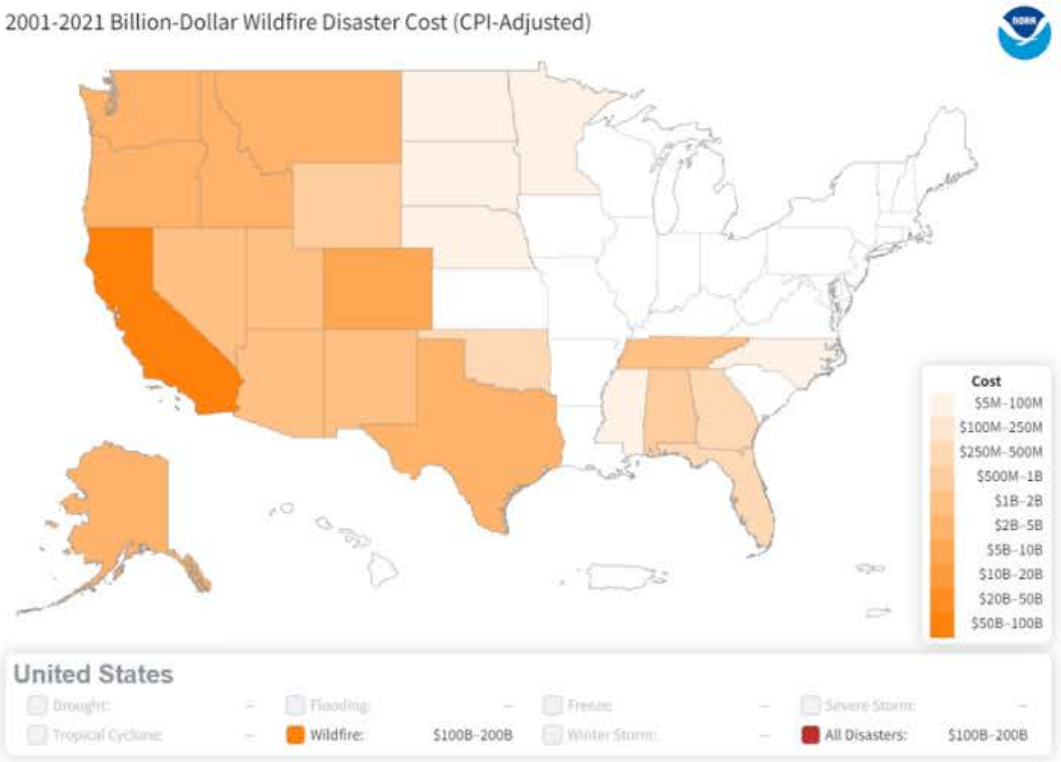
Table 4 - Derived from https://www.ncei.noaa.gov/access/billions/events totals as of October 11, 2022

Wildfires



Wildfires





Wildfires

- The volatile weather patterns driven by climate change have led to very dry and windy conditions, resulting in historic fires along the Pacific Coast and the Mountain West
- Notably, fires in California and Colorado have caused unprecedented fire damage
- The Paradise Fire in California and the Marshall Fire in Colorado showed that damage in not restricted to mountainous areas
- This problem has been highlighted by the recent actions of California insurers to drastically restrict their homeowners writings

Wildfires

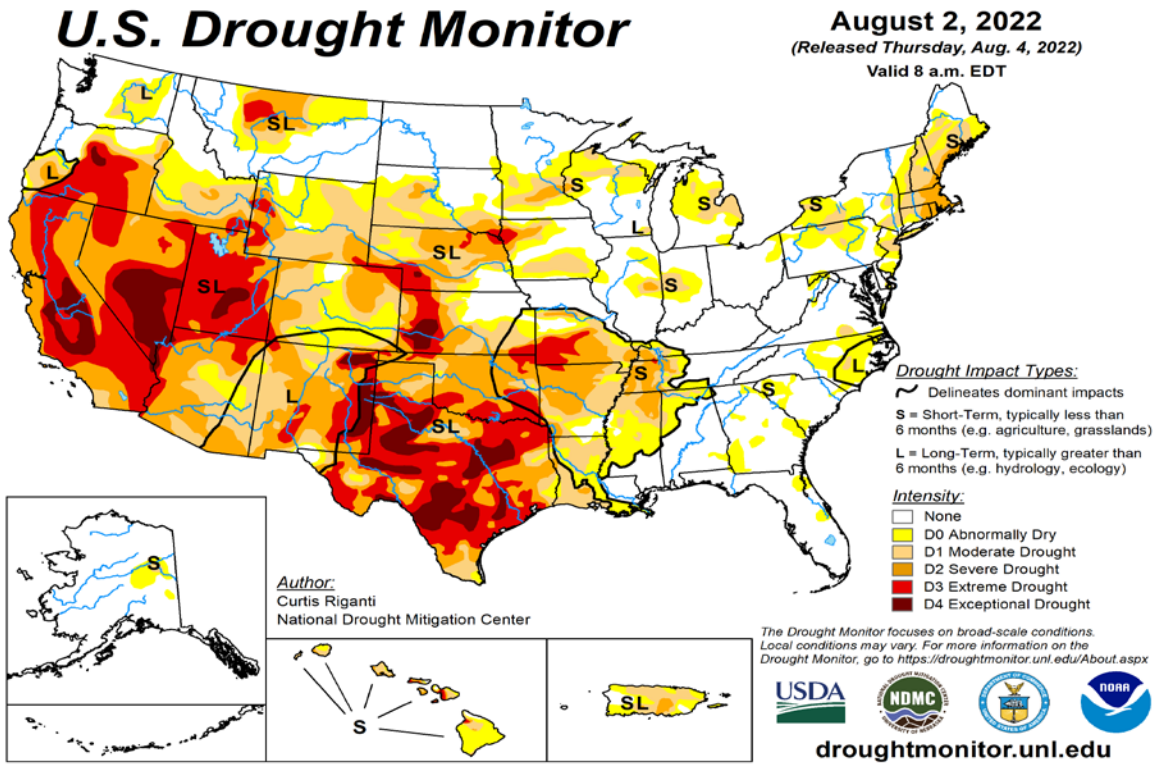
- For a further discussion, refer to *Wildfire: An Issue Paper—Lessons Learned from the 2017–2021 Events*, published by the Academy's Extreme Events and Property Lines Committee

Drought

- Drought has been widespread throughout the country recently, particularly west of the Mississippi
- Climate change has exacerbated the severe swings of weather causing long stretches of dry weather in those areas

Drought

- A map of the drought areas in the U.S., as of August 2, 2022:



Drought

- The principal economic impact is a large loss of crops and livestock
- This leads to increased payment for crop insurers

Winter Storms

- In recent years, there has been an increase in damaging winter storms
- This is primarily an insurance issue in the South, where infrastructure is not built to withstand the freezing temperatures, heavy snow, and strong winds
- Also, there has been an increase in the severity of Nor'easters, causing significant damage to the Mid-Atlantic and New England coastal states

Workers' Compensation

- For Workers' Comp, climate impacts and transition risks can be significant
- If a carrier reduces or stops writing business for coal or other energy-sector-related employees, there could be a drop in premium or shift to residual markets
- The potential variation in expected premium could become an emerging industry risk

Directors and Officers (D&O) Liability

- For D&O liability, there may be transition risks related to climate change risks and how they are handled
- Shareholders could sue if the lack of properly mitigating climate risks leads to losses in profitability, or even insolvency
- Costs associated with these suits may be covered by D&O liability insurance

Human Health

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Health Impacts of Climate Change

- All climate events have an adverse impact on health
- Community-wide health risks from heat, floods, and wildfire
  - Power outages, inability to work or get to work
  - Expanded range of infectious disease (vector-borne illness)
  - Food insecurity (drought, impassable roads), homelessness
- Impact on individual health varies by
  - Age
  - Income / occupation
  - Health status
  - Geography

Health Impacts of Climate Change—Heat

- Recent heat events in the U.S.
  - June 2021—Northwest heat dome, record highs, 96 deaths in Oregon
  - June, July 2023—record-breaking heat waves across the U.S., Northeast heat dome
- Critical factors influence the impact of heat on health
  - Age
  - Income / occupation
  - Health status
  - Geography

Health Risks from Heat—Age-Related

- Age and heat risk
  - Children
    - Harder to regulate body temperature
    - Higher risk of dehydration
    - Vulnerable to asthma and allergies
  - Elderly
    - Body's cooling mechanisms not at peak performance (blood circulation, sweat glands)
    - Heat exhaustion or heatstroke can present quickly; dangerous when living alone

Health Risks from Heat—Income & Occupation

- Income level / occupation and heat risk
  - Lower-income families may not have air conditioning or ability to relocate for relief
  - Outdoor occupations (farming, construction, delivery services)
  - Homelessness is the biggest risk factor

Health Risk from Heat—Personal Health Status

- Pregnancy—body temperature already higher;
  - Mom: heat exhaustion, heatstroke, kidney damage, fainting
  - Baby: reduced blood flow in uterus, preterm birth
- Diabetes—more susceptible to dehydration, heat exhaustion, and heatstroke
- Cardiovascular conditions—heart works harder in higher temperatures
  - Sweating puts more stress on the heart
  - ACE inhibitors (medication) can remove fluids from the body and exacerbate the dehydration and heat risk

Health Risk from Heat—Personal Health Status

- Respiratory conditions
  - Lungs in a weakened state have a greater risk of dehydration and shortness of breath
  - Higher heat with pollen and humidity are triggers for those with asthma, allergies, COPD
- Kidney function—kidneys play a vital role in maintaining hydration
  - Dehydration risk from extreme heat greater with weakened kidney function
  - Could lead to kidney failure (mix: dehydration, low blood pressure, NSAID use, exercising in extreme heat)

Health Risk from Heat—Personal Health Status

- Behavioral health—extreme heat leads to many mental health problems (escalation)
  - Increases in sleep disruption, stress, irritability, depression
  - Increases in aggression, violence, alcohol / drug use
  - Increased sense of desperation, risk of suicide attempts
  - Some medication (antidepressants, antipsychotics) can cause increased sweating, increased risk of dehydration

Health Risk from Heat—Geography

- Geography and heat risk
  - Northern regions—people not used to extreme heat; greater vulnerability to sudden, extreme temperature increase
  - Adapting to warmer temperatures easier when it is expected
  - Urban areas trap more heat (less greenery, more cement and dark roads)
    - Reduced air quality (increased respiratory illness)
  - Disadvantaged groups (insurance, access)

Health Impacts of Climate Change—Conclusion

- Implications for:
  - Individuals—education, learn ways to adapt
  - Communities, governments—education; assistance (shelters, reconstruction)
  - Employers—education and safety measures
  - Actuaries—climate risk is not just in the rearview mirror; the impact on experience is recurring
    - Plan to recognize extreme weather impacts in medical plan costs, trends
    - Study population segments, seek data sources, consider implications for mortality improvement trends

Health Impacts of Climate Change—Conclusion

- Implications for:
  - Health care delivery systems—climate risk already incorporated into their risk management studies and plans (government and private sector)
  - Disadvantaged groups
- Frequency of extreme weather events is increasing
  - What frequency is appropriate to assume for rating? Trending?
  - Auditors could soon ask for disclosures (how extreme weather events are incorporated into liabilities, rates, etc.)

Climate Impact on Health—Future Planning

Source	Tool	Use
For Local Government and Other Entities		
CDC	Heat Response Plans	Emergency Planning
	Heat & Health Tracker	Real-Time ER utilization
HHS	emPOWER	List of Medicare members at risk in event of equipment power outage.
For Individuals		
OSHA	Heat Safety Tool	Real-Time Heat Indexes
OSHA/CDC	Instructional Pamphlets	How to identify heat-related illnesses and how to prevent them: https://www.cdc.gov/disasters/extremeheat/warning.html https://www.cdc.gov/disasters/extremeheat/heattips.html https://www.osha.gov/sites/default/files/publications/3431_wksiteposter_en.pdf
Medicare	SSBCI	Heat-related support
Medicare Advantage	Supplemental Benefits	e.g., portable ACs

Life

Academy **Webinar**

Climate Impact on Mortality—Fundamentals

- As with health, climate heat impact on mortality is dependent by a person's health condition, income, age, and time spent in direct sunlight. However, anyone can die from heat if not taken seriously.
- High deaths correlate to areas with low A/C usage (Europe / U.S. Northwest).
- Medicare and Medicaid populations are the most vulnerable.
- Severe under-reporting of heat-related deaths as heat is considered a contributing factor but not the cause of death in death records.

Climate Impact on Mortality—Adaptation

- Avenues that can reduce heat-related deaths:
  - Education
  - Self-preservation
  - Potable water
  - Reliable power grid

Climate Impact on Mortality—Future Projections

- Future estimates of 250,000 deaths / year related to climate change, but bigger estimates are starting to appear—for 2022, Europe 61,600; U.S. only 150?
- Heat-related deaths are currently the No. 1 cause, but other causes will build as well.
- Actuaries will need to build their own historical data and projections.

Pension/Retirement

Academy Webinar

Pension Practice—Derivative Impacts From Climate

- Investment trends and strategy impact retirement options
- Funding of state and local defined benefit plans
  - Migration pattern changes
  - Economic downturns
- Plan fiduciary obligations
- Social Security impacts

Investment Trends

- Impact on capital markets—i.e., economic volatility
- Investment strategy—ESG consideration
  - Environmental, social, and governance
  - Climate disclosures
  - Fiduciary obligations
- Investment returns on defined benefit plans
- Investment risks on defined contribution plans

Funding of State and Local Defined Benefit Plans

- Migration patterns
  - Historical movements to states impacted by heat and hurricane—Arizona and Florida
  - Change in these patterns may impact local economy and resulting funding
- Economic Downturns
  - Climate changes result in downturns, funding impact
- Investment Returns
  - Dependency on prudent strategy of considering associated investment risks that climate may impact

Plan Fiduciary Obligations

- Plan Trustees
- Selecting investments in a prudent manner
  - Do ESG considerations meet the investment criteria?
  - Do “climate change” considerations in investment selection decrease returns?
  - For DC plans that offer ESG investments, are additional educational materials needed?

Social Security

- Funding dependent on wages from current workforce
  - Impact of economic downturns
- Increase in disability-related retirements due to health impairments without increases in mortality
- Delivery of benefits as outlined in Social Security Sustainability report

Future Projects for Climate Change Joint Committee

- Equity issues
- Adaptation
- Protection gap
- Mitigation

Questions?