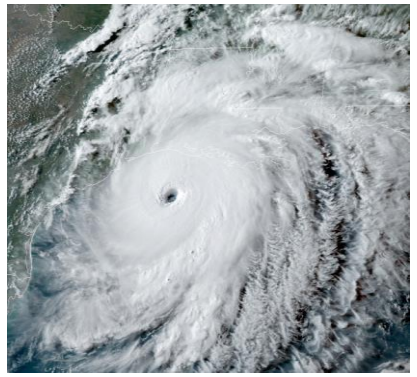
4th Global Expert Forum for Producers and Users of Disaster Related Statistics
28 October - 1 November, 2024
United Nations Conference Center, Economic Commission for Africa, Addis Ababa, Ethiopia

U.S. Billion-dollar Weather and Climate Disasters – in Context

Better understanding disaster costs, hazard risk and resilience over space and time





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U.S Billion-dollar Weather and Climate Disasters

Outline:

- Context - Data Sources - What we are Measuring
- 2023 U.S. Disasters in Historical Context
- Disaster Data, Tools, Mapping
- New and Future Work

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NCEI products span from local to global, and weekly to decadal scales

	Daily/Weekly	Monthly	Seasonal – Annual	Annual to Decadal
Local	Snowfall Impact Index – FEMA, disaster response	Heating & Cooling Degree Days – Energy Sector	Temperature & Precipitation Outlooks – Agriculture	Billion $ Disasters, Climate Extremes Index – Insurance
Regional	Hurricane Tracks – Emergency Planners	Space Weather – Aviation Industry	Drought Outlook – Agriculture	Climate Normals – Construction, Infrastructure, Agriculture
National & Global	Drought Monitor – Agriculture	Global and U.S. Climate Summaries – Numerous Sectors	Annual State of the Climate Reports – Scientists	IPCC & National Climate Assessments – Gov't Policymakers

Different Ways to Measure:

Disasters


Tornadoes


Wildfires


Floods


Droughts


Heat Waves


Snowstorms/Blizzards


Geophysical


Hurricanes & Tropical Storms

Impacts

Human Health and Wellbeing

What's the right

- **Time Scale?**
- **Space scale?**
- **Size scale?**

Business

Public Infrastructure

Private Property

Environmental Capital (incl. ecosystem services)

Measures

Loss of Life

Mental Health

Physical Health

Quality of Life

GDP

Net Economic

Market

Non-market

To capture losses requires a broad array of **public** and **private** data

	Hurricanes/ Tropical Storms	Severe Local Storms	Winter Storms	Crop Freeze	Wildfire	Drought / Heat Wave	Inland / Riverine Flooding
Insurance & Reinsurance	x	x	x		x		x
FEMA – Presidential Disaster Declarations	x	x	x	x	x		x
FEMA – National Flood Insurance Program	x						x
USDA – Risk Management Agency	x	x	x	x	x	x	x
National Interagency Fire Center					x		
Energy Information Administration	x	x	x		x	x	
US Army Corps of Engineers							x
State Agencies / Storm Events Database	x	x	x	x	x	x	x

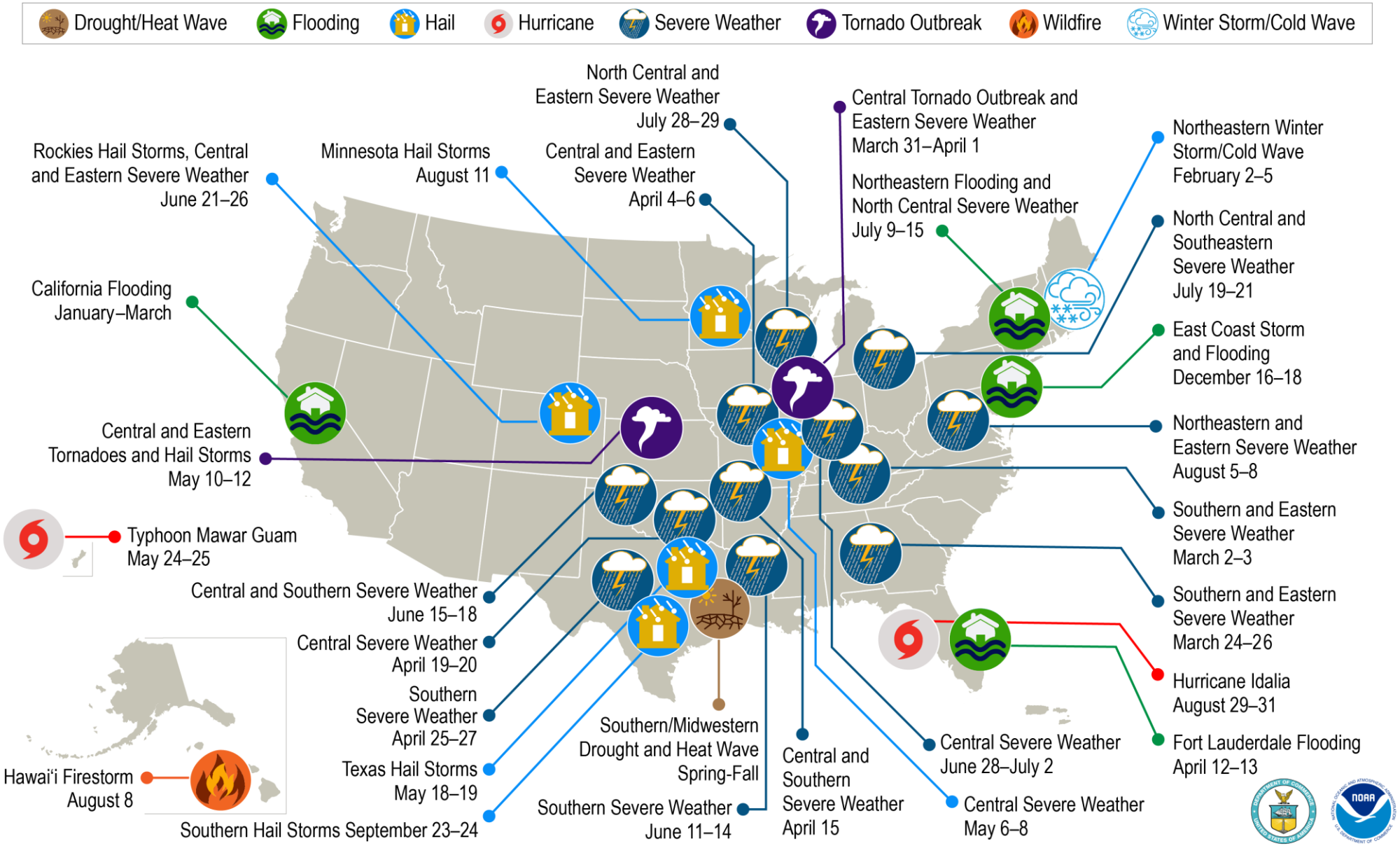
Account for <u>total, direct losses</u> (i.e., **insured** and **uninsured**) for assets including:

- **physical damage** to residential, commercial, and government buildings
- **material assets** (content) within a building
- **time element losses** (i.e., time costs for businesses; hotel costs for loss of living quarters)
- **vehicles, boats, offshore energy platforms**
- **public infrastructure** (i.e., roads, bridges, levees, electrical systems, hydropower)
- **Agricultural / forestry assets** (i.e., crops, livestock, commercial timber, wildfire fighting)

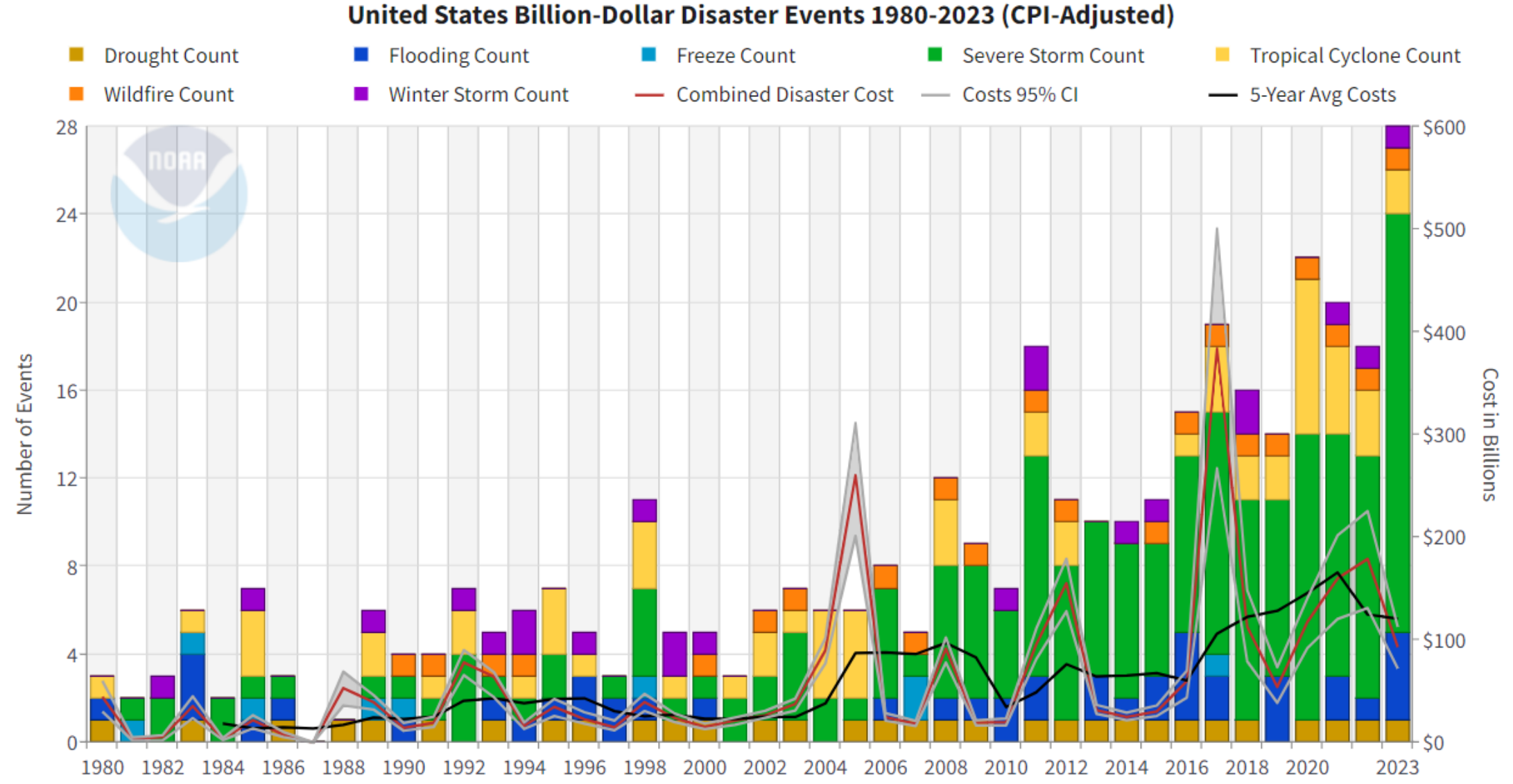
We <u>do not</u> account for:

- natural capital/envn. degradation;
- mental or physical healthcare-related costs;
- all downstream (indirect) costs

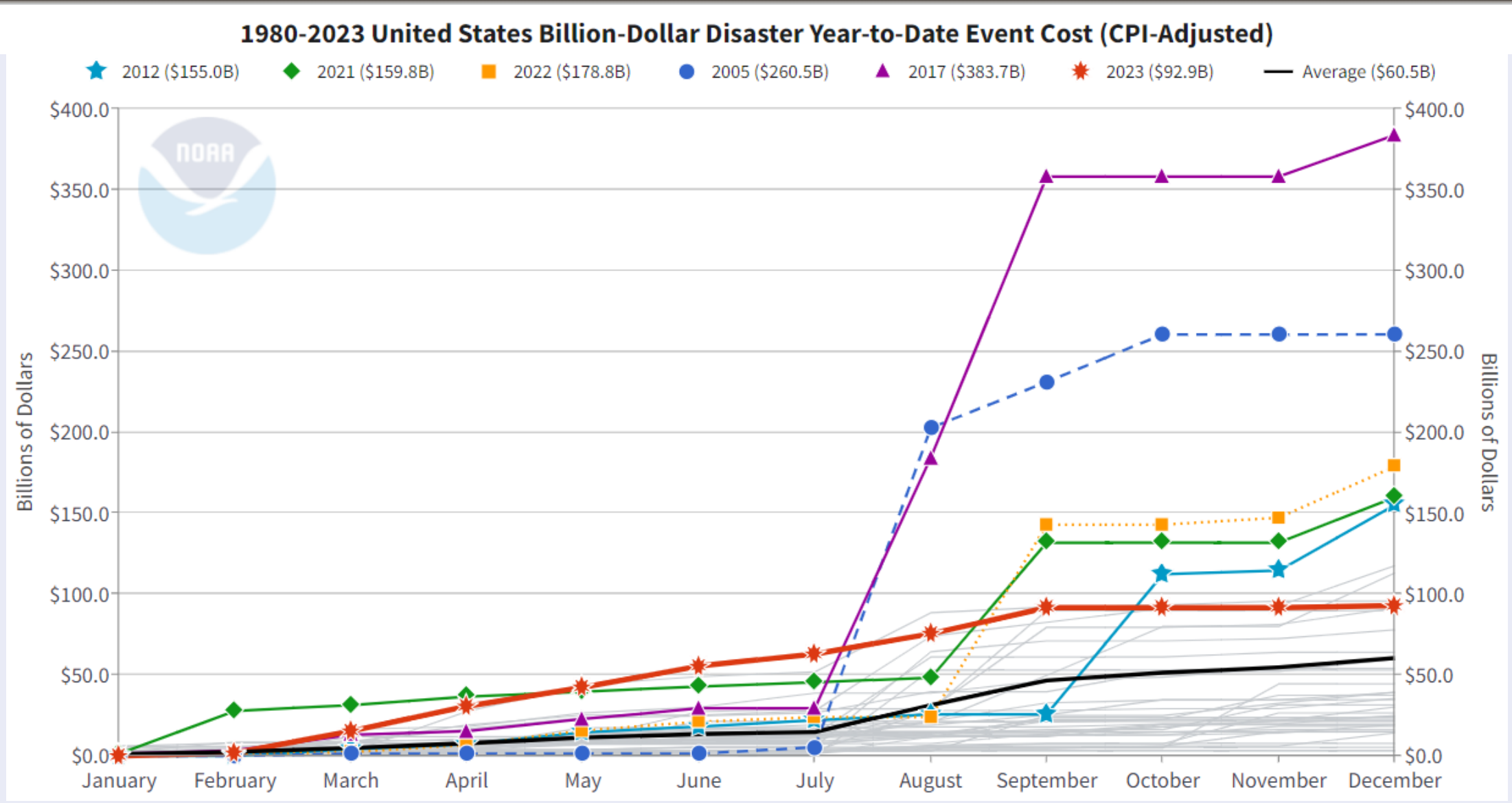
U.S. 2023 Billion-Dollar Weather and Climate Disasters



This map denotes the approximate location for each of the ***28 separate billion-dollar weather and climate disasters that impacted the United States in 2023.***

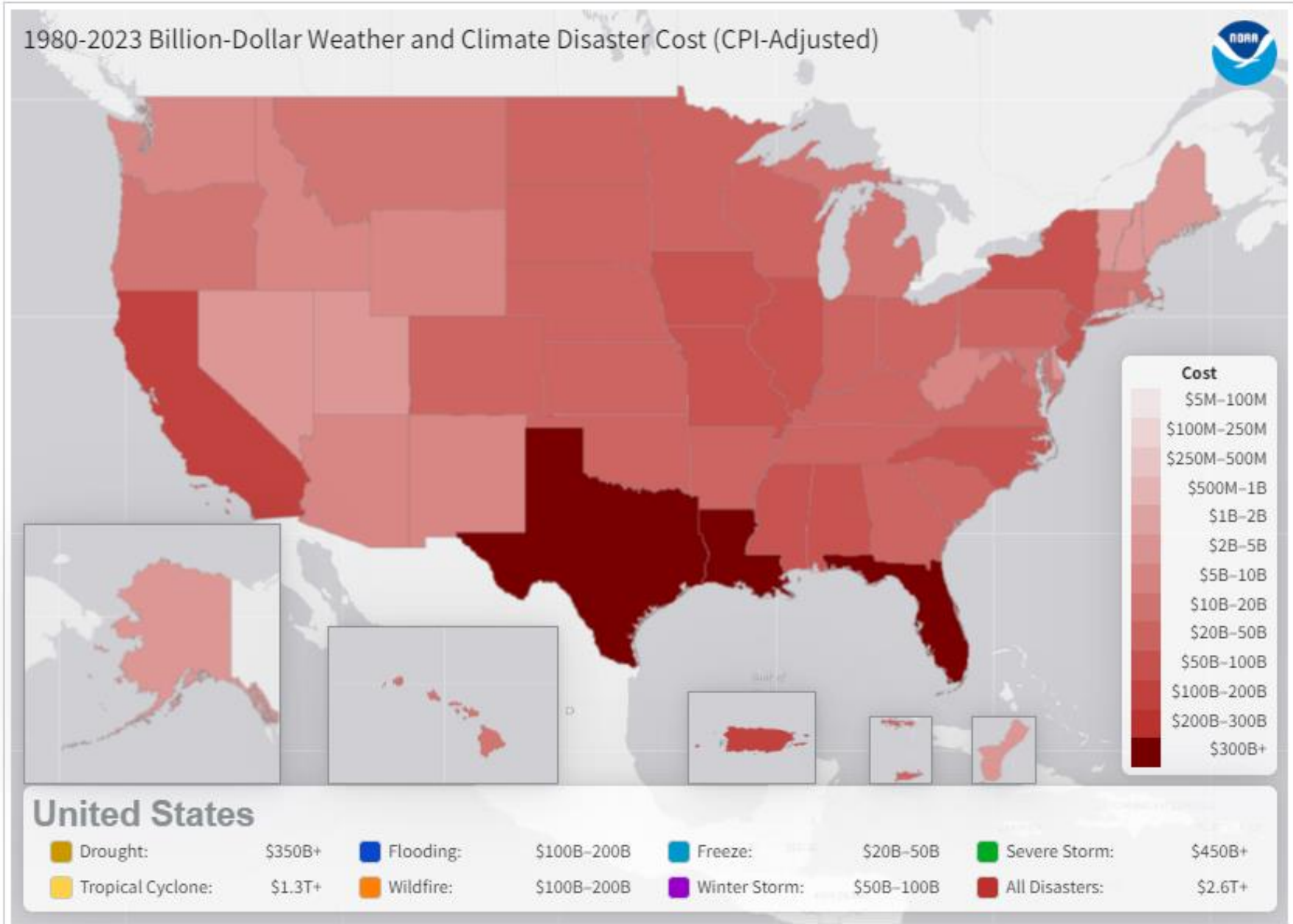


- **5-year annual cost average** (2019-2023) = **$120.6 billion;** disaster costs over the last **7 years** (2017-2023) = **$1.091 trillion**
- U.S. disaster losses are growing ~6% per year, more than twice as fast as gross domestic product (NIBS, 2023)



- **2023** cost total = **$92.9 billion** vs. (1980-2023) annual CPI-adjusted average **$60.5 billion**
- The **top 3 most costly years** for U.S. - **2017** ($383.7 billion); **2005** ($260.5 billion); **2022** ($178.8 billion)

U.S. **South, Central** and **Southeast** regions experienced a higher cost from billion-dollar disaster events

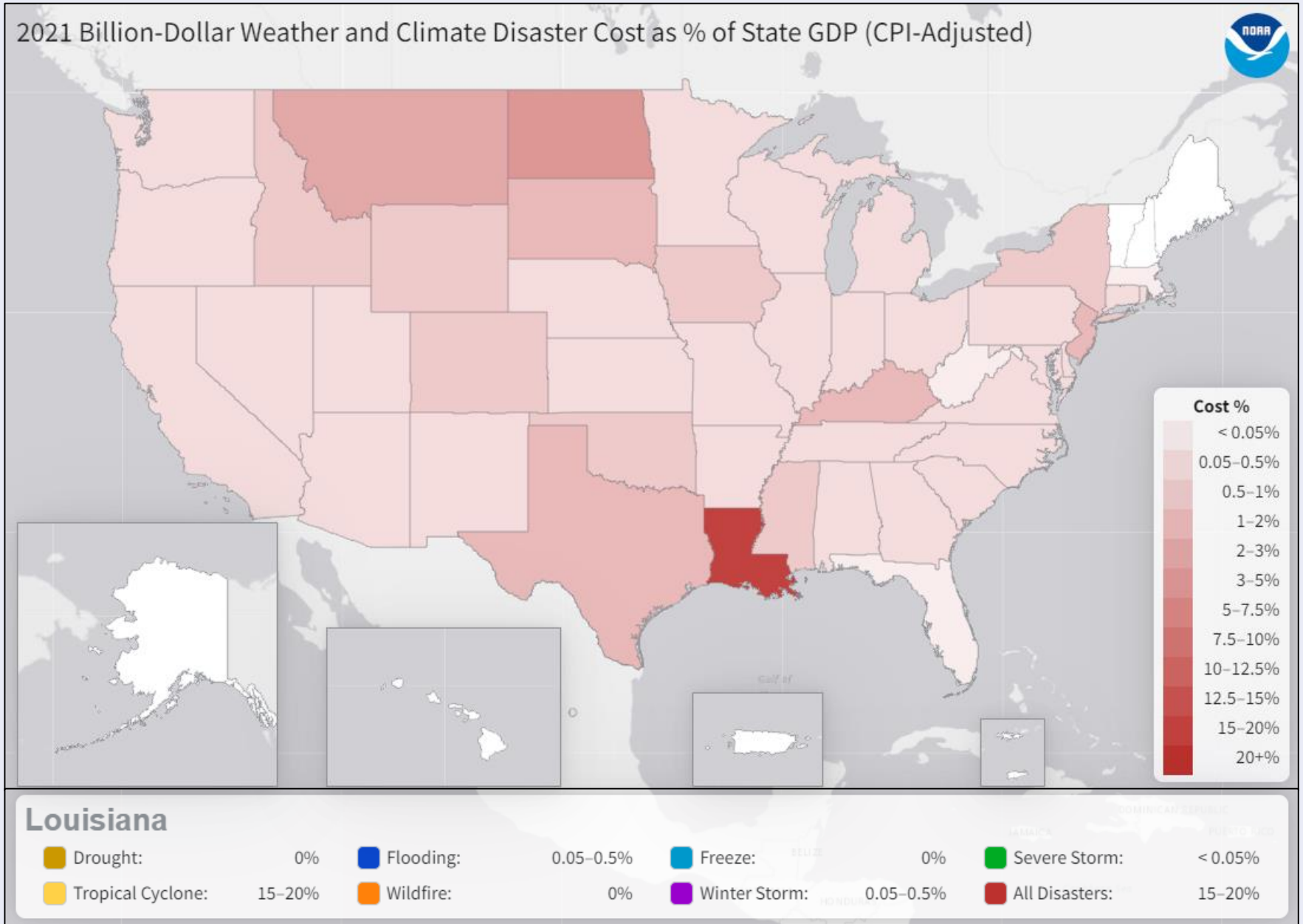


- Reflects the **severity, vulnerability and exposure** of weather and climate events impacting different regions

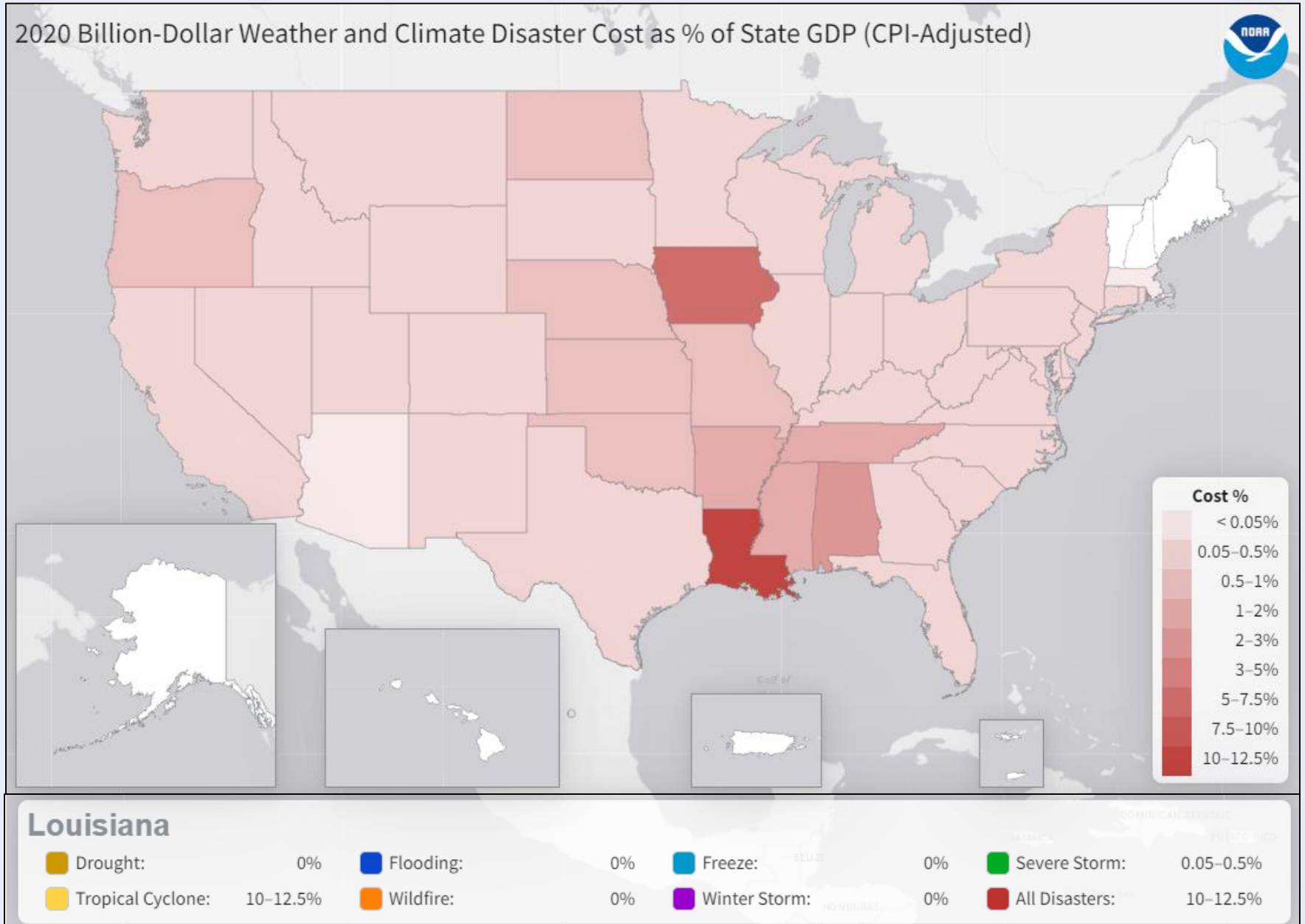
- The **top 3 most impacted states:**
  - **Texas** ($402 billion)
  - **Florida** ($389 billion)
  - **Louisiana** ($304 billion)

- The **relative costs are more acute in Louisiana**, as its population and economic size is much smaller than Texas or Florida.

- Louisiana also has a high frequency of disaster events, which can leads to compounding, cascading socioeconomic impacts.



- The **<u>2021</u> disaster costs** for each state as a **% of that state's 2021 GDP** (economic output)… clear impact from billion-dollar disaster events from the effects of **Hurricane Ida** and other events



- In **2020**, the disaster costs were **10.0%-12.5%** of **Louisiana**'s annual GDP from the effects of **Hurricanes Laura, Zeta, Delta**
- Compound hazards and cascading impacts slow down recovery and increase the cost
- **A powerful derecho on** August 10, 2020, caused damage in Iowa proportional to **5.0% of its 2020 GDP**

Figure 1. 2012-2021 Billion-Dollar Weather and Climate Disaster Costs as a Share of Total State Tax Revenues

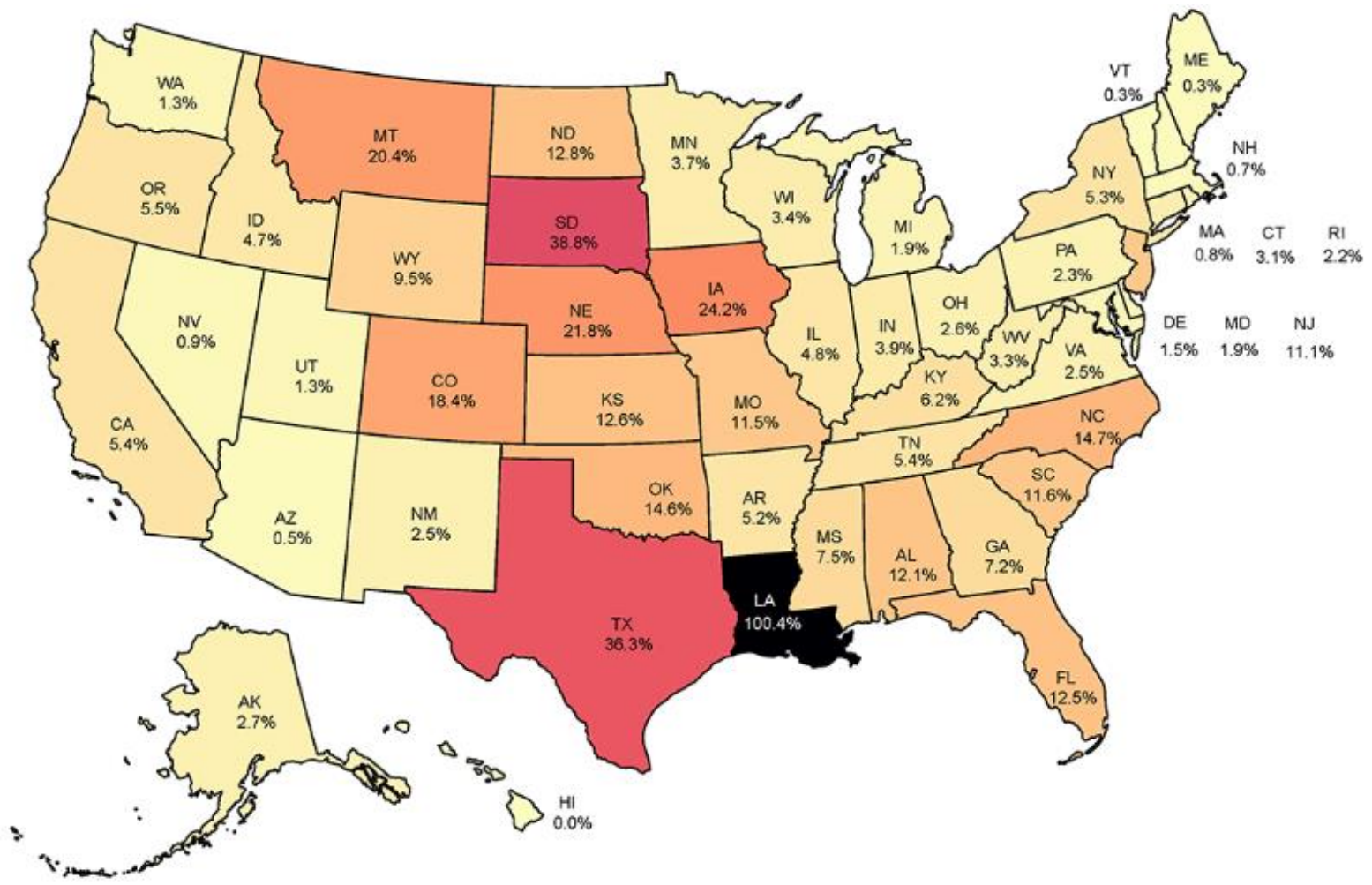


Figure 1 - Costs as a % share of Total State Tax Revenues **-** four factors:

(1) **frequency**, or the number of extreme weather events;

(2) **hazard**, or the intensity of the event;

(3) **exposure**, or the number of firms and households affected by the event; and

(4) **vulnerability**, or the resilience of each firm, household, or local economy to the event.

<u>Each of these factors is changing over time</u>.

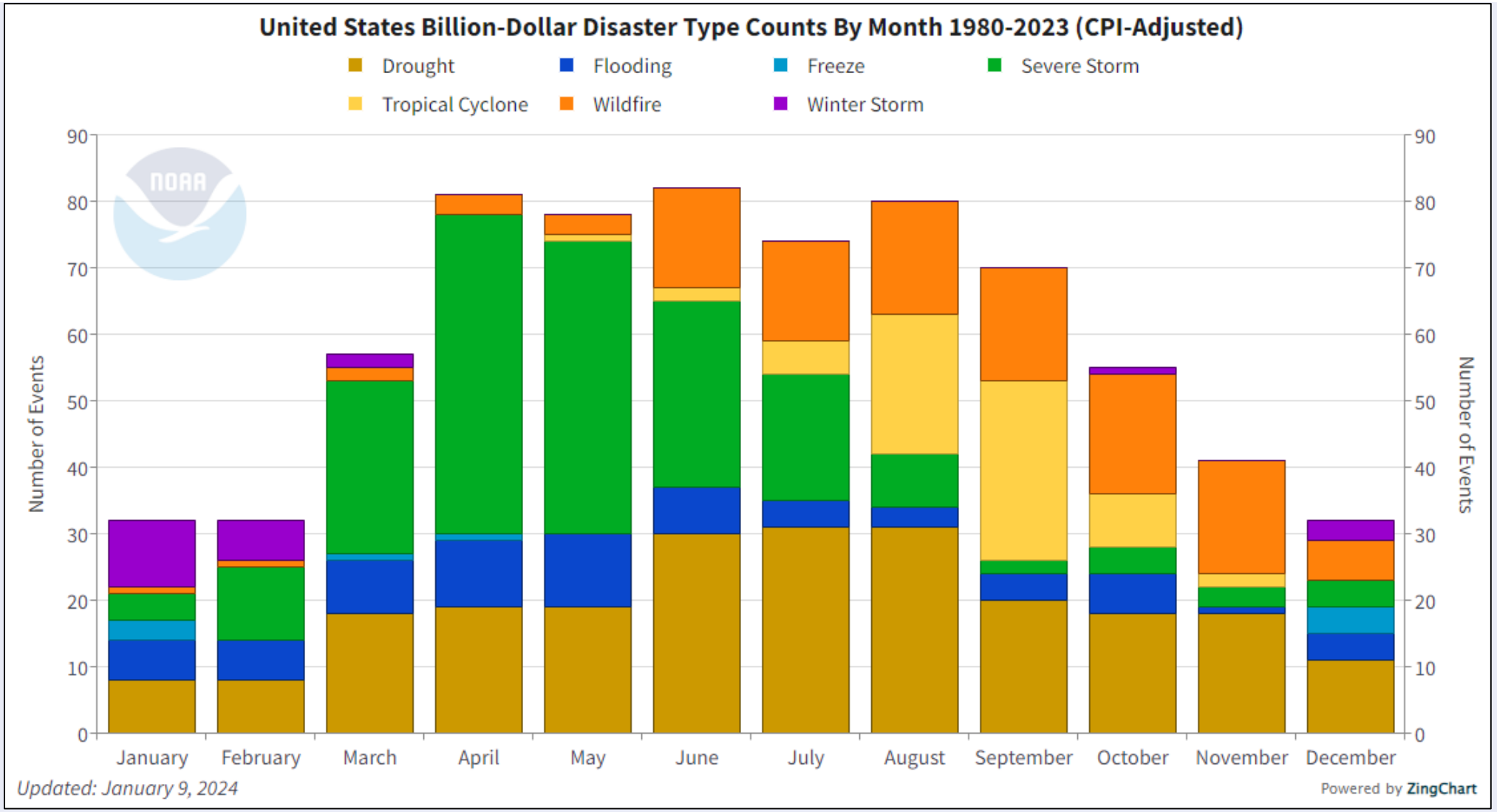
Source: **Brunetti, Celso, Benjamin Dennis, Gurubala Kotta, and Adam Smith (2023). "Analyzing State Resilience to Climate Change," FEDS Notes. Washington: Board of Governors of the Federal Reserve System, September, 07, 2023, https://doi.org/10.17016/2380-7172.3342.**

From **1980 - 2023**, the U.S. has experienced **376** distinct billion-dollar weather & climate events

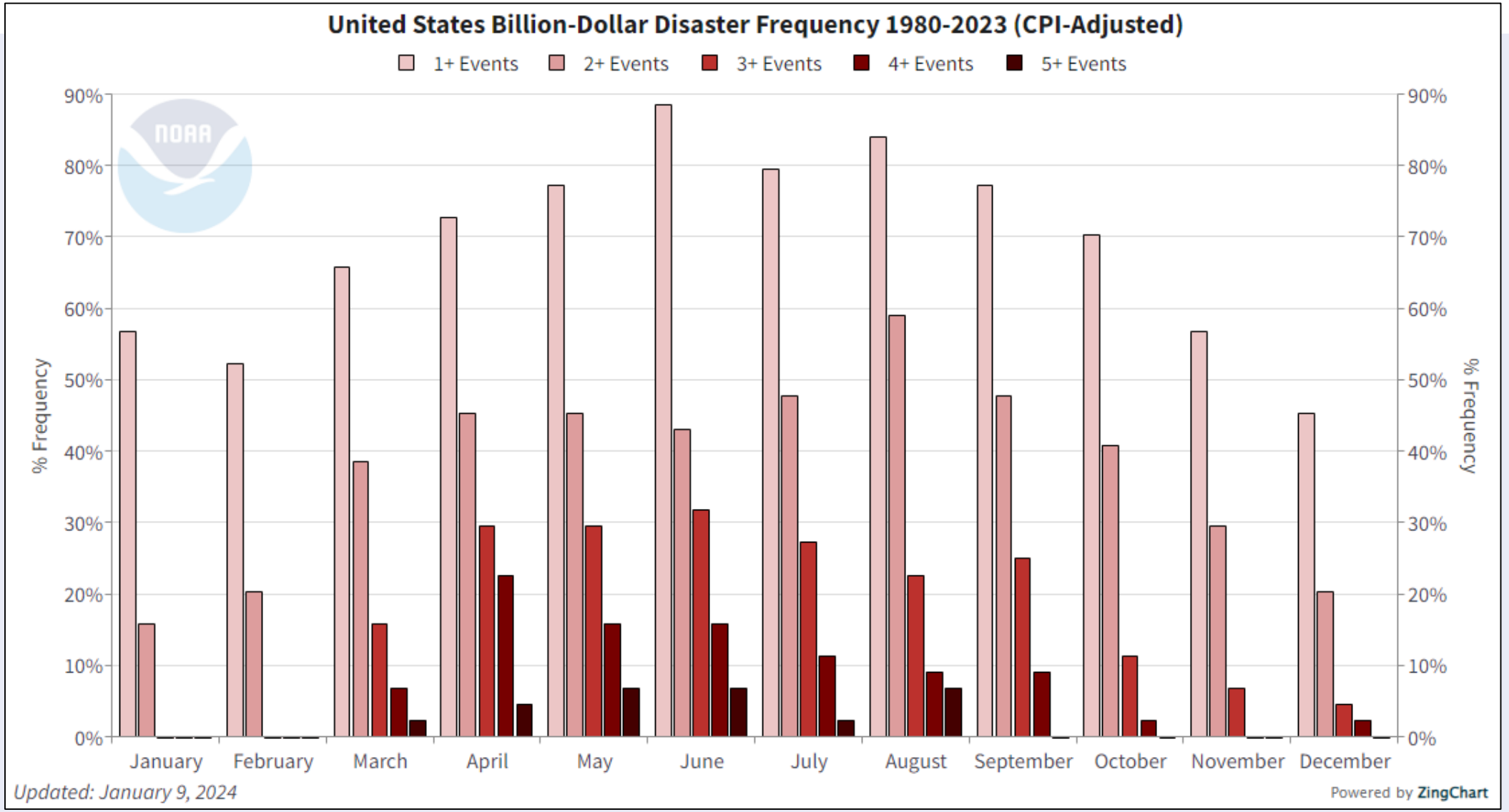
Disaster Type	Events	Events/ Year	Percent Frequency	Total Costs	Percent of Total Costs	Cost/ Event	Cost/ Year	Deaths	Deaths/ Year
Drought	31	0.7	8.2%	$352.9B CI	13.3%	$11.4B	$8.0B	4,522†	103†
Flooding	44	1.0	11.7%	$196.6B CI	7.4%	$4.5B	$4.5B	738	17
Freeze	9	0.2	2.4%	$36.4B CI	1.4%	$4.0B	$0.8B	162	4
Severe Storm	186	4.2	49.5%	$455.2B CI	17.1%	$2.4B	$10.3B	2,094	48
Tropical Cyclone	62	1.4	16.5%	$1,379.3B CI	51.8%	$22.2B	$31.3B	6,897	157
Wildfire	22	0.5	5.9%	$142.4B CI	5.4%	$6.5B	$3.2B	535	12
Winter Storm	22	0.5	5.9%	$98.3B CI	3.7%	$4.5B	$2.2B	1,402	32
All Disasters	**376**	**8.5**	**100.0%**	**$2,661.1B CI**	**100.0%**	**$7.1B**	**$60.5B**	**16,350**	**372**

†*Deaths associated with drought are the result of heat waves. (Not all droughts are accompanied by extreme heat waves.)*

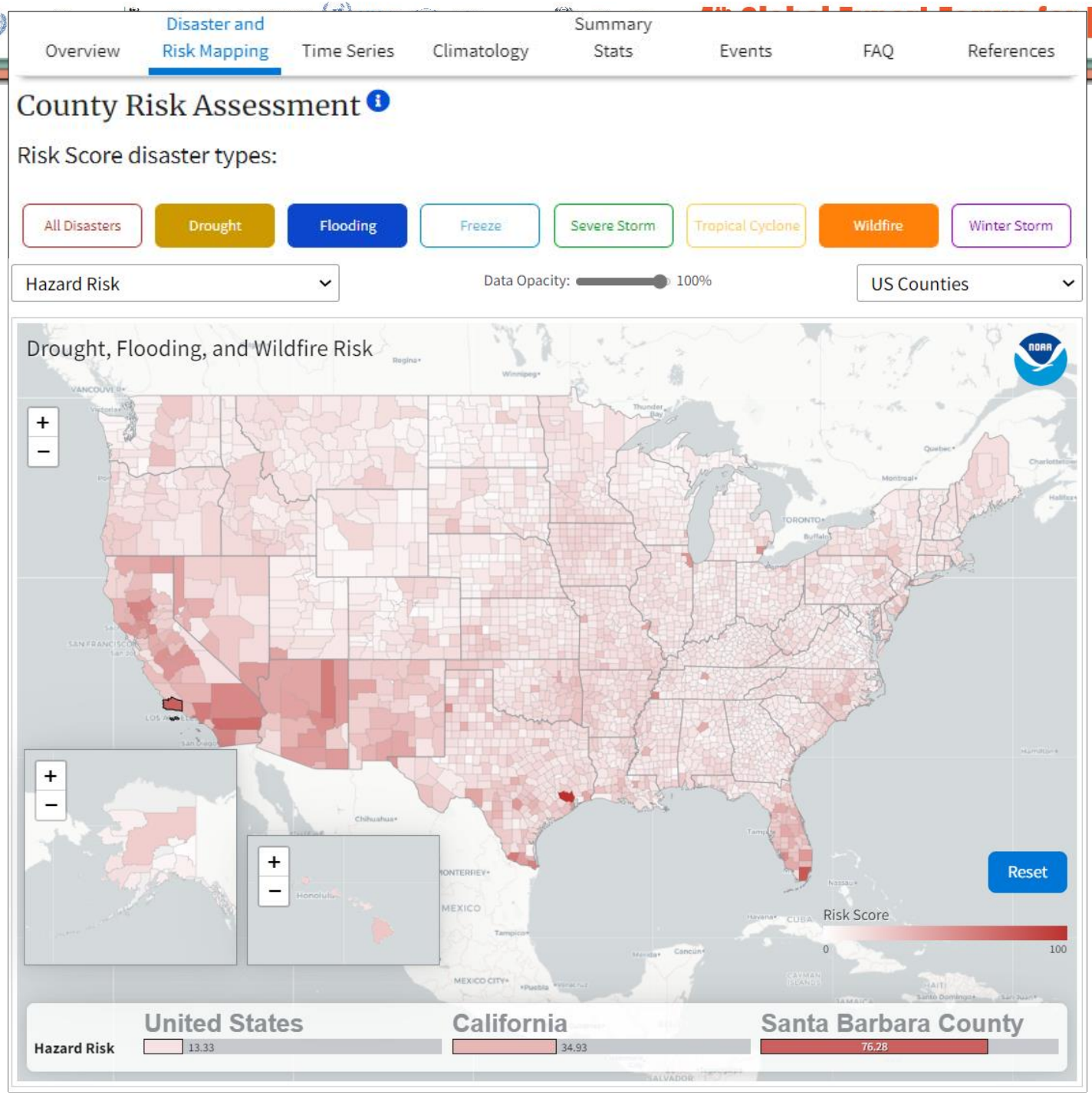
Flooding events (river basin or urban flooding from excessive rainfall) are separate from inland flood damage caused by tropical cyclone events.



- Visualizing the 44-year **frequency of climatology of extreme**, damaging events across the Nation.
- A way for decision-makers to understand which types of large events typically occur at what times of year, by region.



- In recent years, there **were just 18 days** on average between billion-dollar disasters **compared to 82 days in the 1980s**.
- Shorter time intervals between disasters often mean less time and resources available to respond, recover and prepare for future events.
- This increased frequency of events produces cascading impacts that are particularly challenging to vulnerable socioeconomic populations.

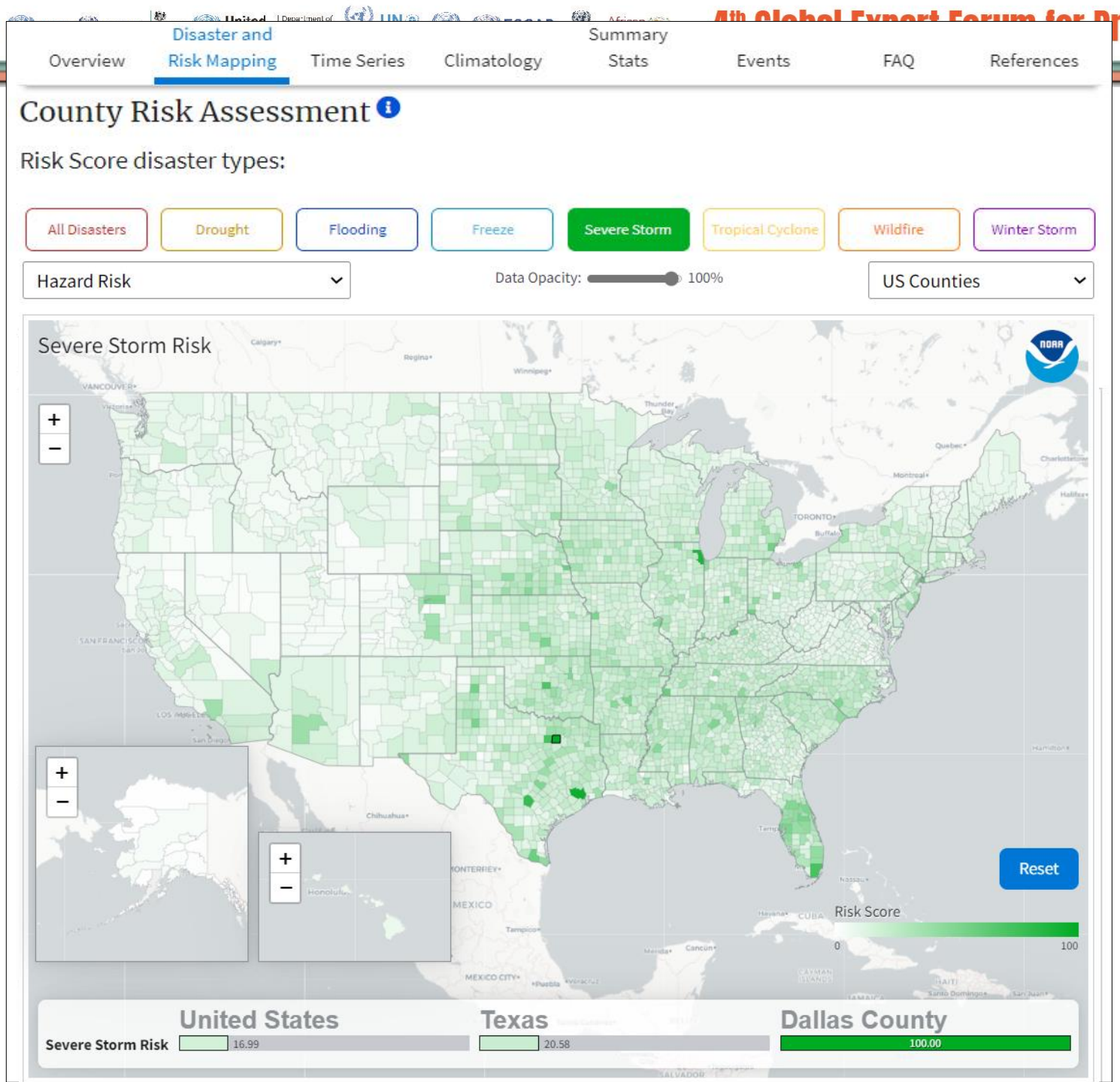


Compound hazard county risk (Drought, Wildfire and Flooding)

Each region faces **unique hazard combinations…**

In the U.S. Southwest, drought-enhanced wildfires often produce mountain-side burn scars, which then enhance debris flows from heavy rainfall and can worsen flood damage.

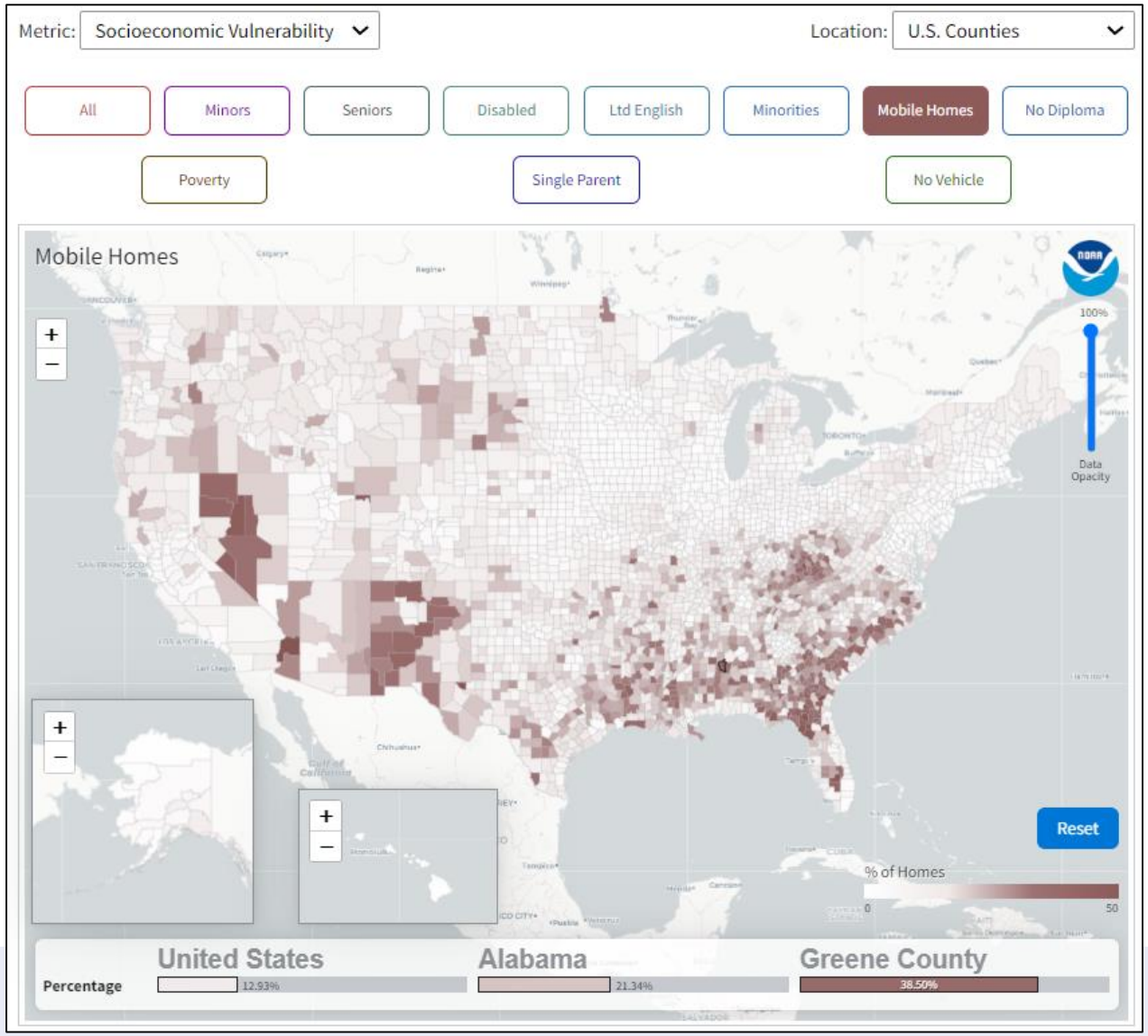
As noted in Fifth National Climate Assessment **"Climate change is also increasing the risk of multiple extremes occurring simultaneously in different locations that are connected by complex human and natural systems."**

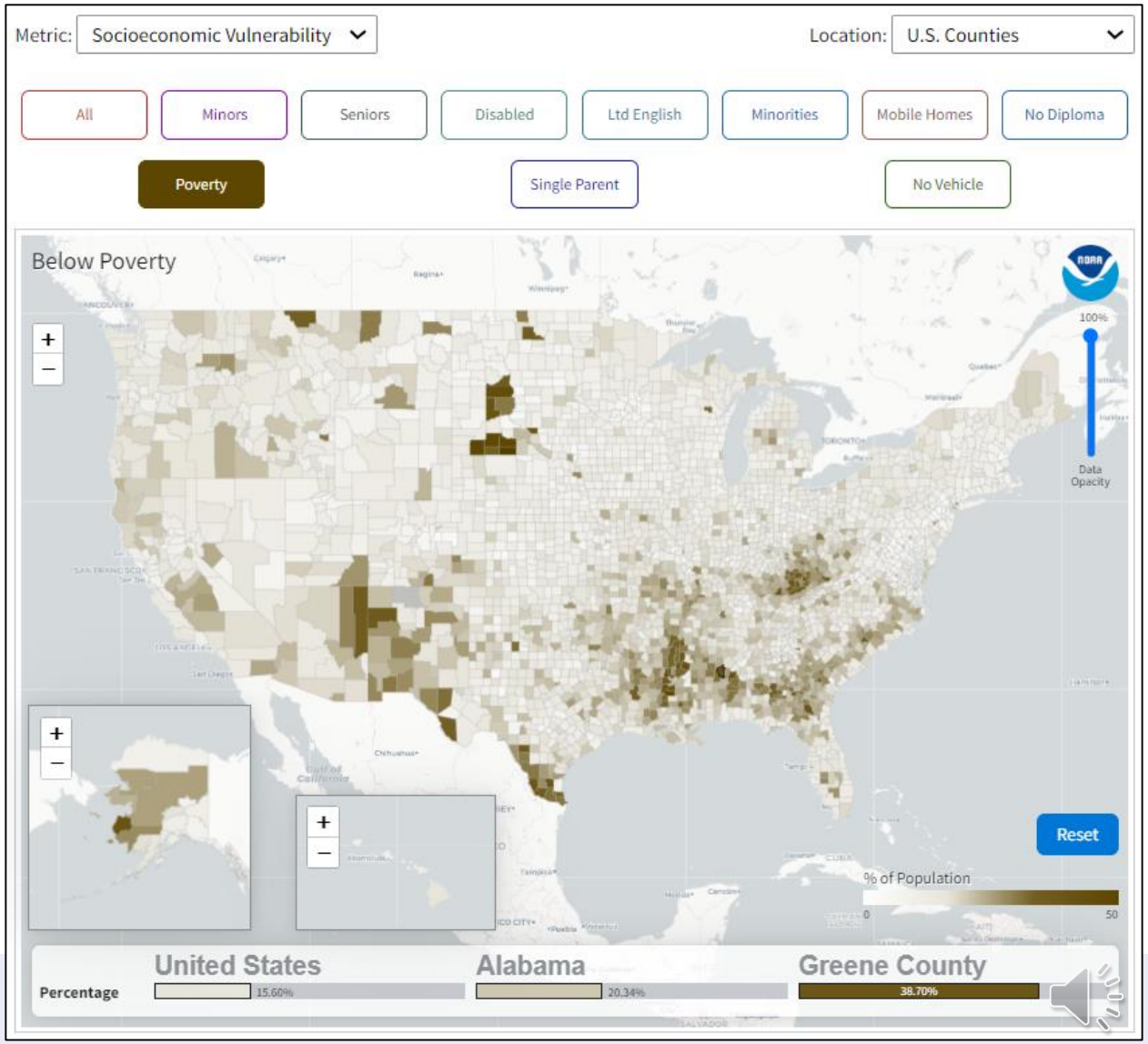


This map provides county risk scores for combined **severe storm events** (i.e., **tornado, hail, high wind damage)** reflecting a county's annualized hazard frequency; its potential hazard cost related to building value, crop value and population exposure; and its social vulnerability and resilience to recover from hazard impacts based on dozens of socioeconomic variables.

The map highlights that **Dallas County, Texas has a very high score for severe storm risk** due to its historic frequency of being impacted by these events in addition to having a large urban population and valuable exposure, which further increases the damage potential for severe storm impacts and costs.

Vulnerability Mapping (Integrating CDC socioeconomic vulnerability metrics)





New product enhancements:

- Multi-hazard risk & socioeconomic vulnerability mapping

Ongoing product enhancements:

- Sub-billion dollar event analysis (down to $100 million in damage)
- Exposure and Vulnerability: GDP, Total Tax revenue, other indices
- Consideration of non-market losses & environmental degradation
  (i.e., wildfire smoke on mortality / morbidity; long term health impacts post-disaster)

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Sendai Targets

Mortality

People affected

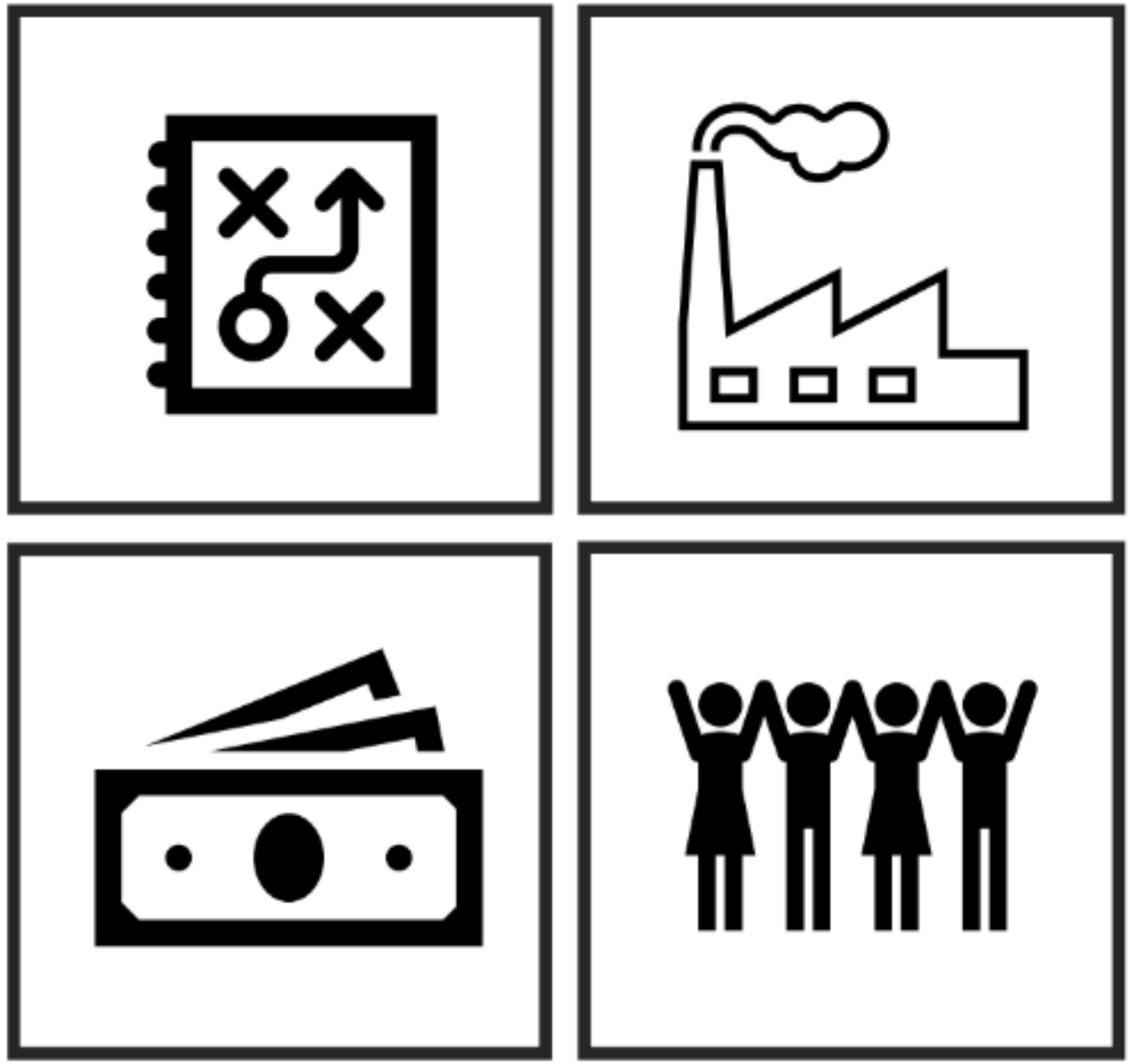
Economic Loss

Critical Infrastructure & Services

Disaster Risk Reduction Strategies

International Cooperation

Early Warning & Risk Information



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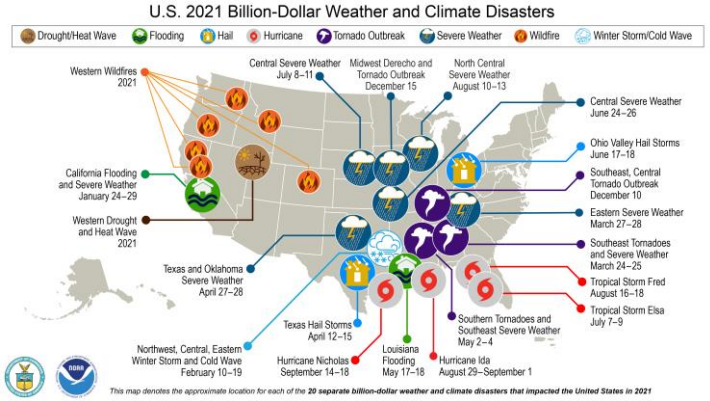
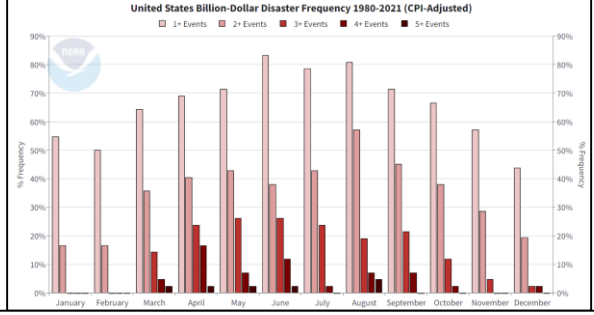
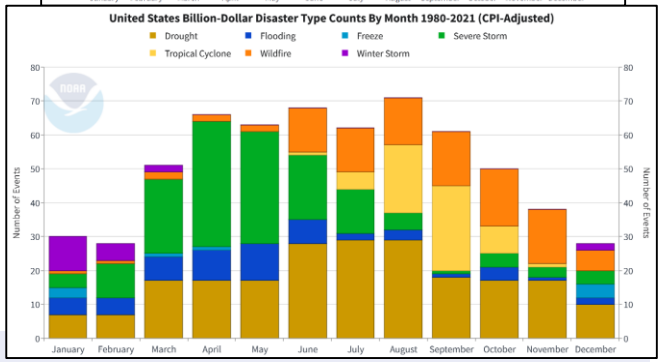
For interactive data, charts, mapping, and disaster summaries (1980-2024):
www.ncei.noaa.gov/access/billions







New county & census tract risk mapping:
www.ncei.noaa.gov/access/billions/mapping

For more detail on disasters, county data, methodology, and uncertainty, see:

NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2024). https://www.ncdc.noaa.gov/billions/, DOI: 10.25921/stkw-7w73

Smith, A., and R. Katz, 2013: U.S. Billion-dollar Weather and Climate Disasters: Data Sources, Trends, Accuracy and Biases. Natural Hazards., DOI: 10.1007/s11069-013-0566-5

Smith, A., and J. Matthews, 2015: Quantifying Uncertainty and Variable Sensitivity within the U.S. Billion-dollar Weather and Climate Disaster Cost Estimates. Natural Hazards., DOI: 10.1007/s11069-015-1678-x

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