
Image: FEMA

Natural Catastrophe Loss Trends in Minnesota

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Natural Catastrophes 2021
$280 bn globally

USA Insured Loss from Natural Catastrophes in 2021: ~$75 bn

Drivers for globally increasing losses from natural hazards

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Global increase in population	From 4 billion (1975) to 7.9 billion (2022)	**Not necessarily problematic** for insurers (premiums grow proportionally with risk)
Improved standard of living	Middle class is growing rapidly worldwide	
Concentration of people / assets in urban areas	Share of urban population is increasing continually: 37% (1975) - 50% (2010) - 57% (2025)	
Settlement and industrialization of vulnerable areas	Especially coastal areas, areas close to rivers	**Problematic** for insurers, if risk models are not adjusted accordingly
Increase of complexity and interdependencies	Increasing complexity of value chains (i.e. production cycles) in industrial facilities	
Changes in weather patterns	Increased frequency / severity of extreme weather events	

Munich Re & the (re)insurance industry's relationship to natural catastrophe risk

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Munich Re facts

- Founded 1880 in Munich
- Gross premiums written (2021): € 59.6 bn
- Consolidated result (2021): € 2.9 bn
- Staff Munich Re Group (2021): 39,281 (thereof 34.2% in Reinsurance)
- Website: www.munichre.com

(Re-)Insurance helps with…

Transfer of knowledge / data; Risk consulting

Risk identification

Risk measurement „price tag"

Risk transfer

Capital provider & Investment support

…for Clients / Industry / Governments / NGOs

Source: Munich Re

Insurance & Climate Risk

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(Re)insurers are exposed to two main types of climate risk…

- Physical Risk (Risk to property)
- Transitional Risk (Risk arising from moving to carbon-free economy)

…and climate risk impacts the insurance industry on both sides of their balance sheets.

- Liabilities:
  - Insurance Portfolios (Primarily property; life & health to a far lesser extent)
  - Insuring fossil-fuel heavy industries, esp. liability around carbon emissions.
- Assets
  - Physical assets (locations of buildings, etc.)
  - Investment risks (esp. owning stock in fossil fuel-heavy industries)

Regulatory agencies are starting to require financial stability “stress tests” around climate risk as well.

Munich Re & Climate

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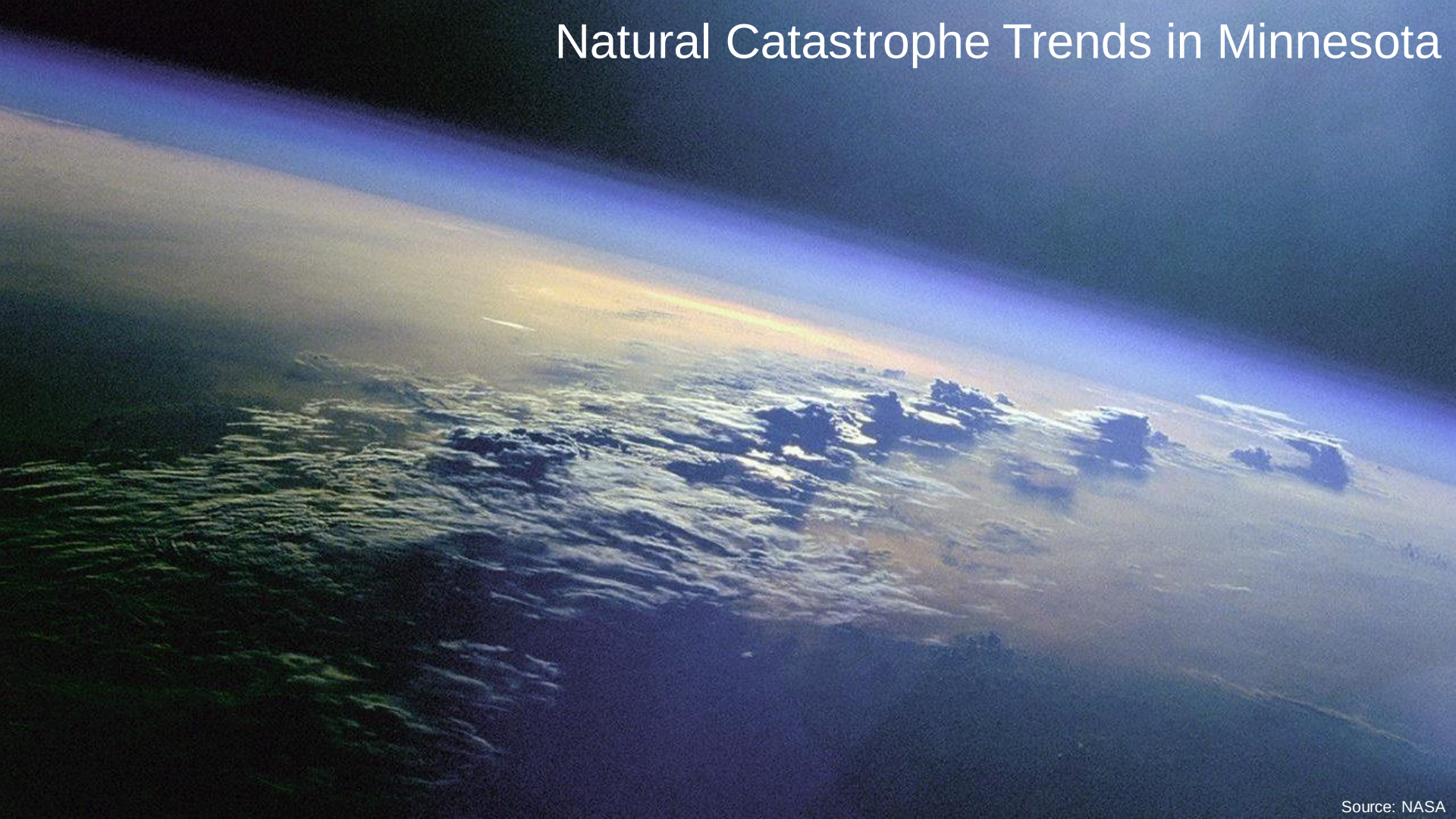
- Created Geo Risks Research Unit in 1973 – first Munich Re publication referring to potential climate change impacts published in mid-1970s.
- Carbon Neutral operations since 2015 globally, Net Zero Emissions by 2050.
- Founder of Desertech Industrial Initiative (DII) – attempt to build massive solar farms in North Africa to provide clean power to EU / ME / NA region.
- Munich Re Foundation – Microinsurance and novel climate risk solutions for developing world.
- Underwriting green power generation (physical equipment & generation guarantees).
- Beginning to divest from, and no longer insuring, fossil-fuel intensive industries.
- Efforts to close insurance gap for flood; new types of insurance & parametric solutions for all natural perils.
- Developing innovative climate risk transfer products.
- Active participant in UN/IPCC and NOAA Climate activities.

Natural Catastrophe Trends in Minnesota



Source: NASA

Trends in Natural Catastrophes
General Predictions

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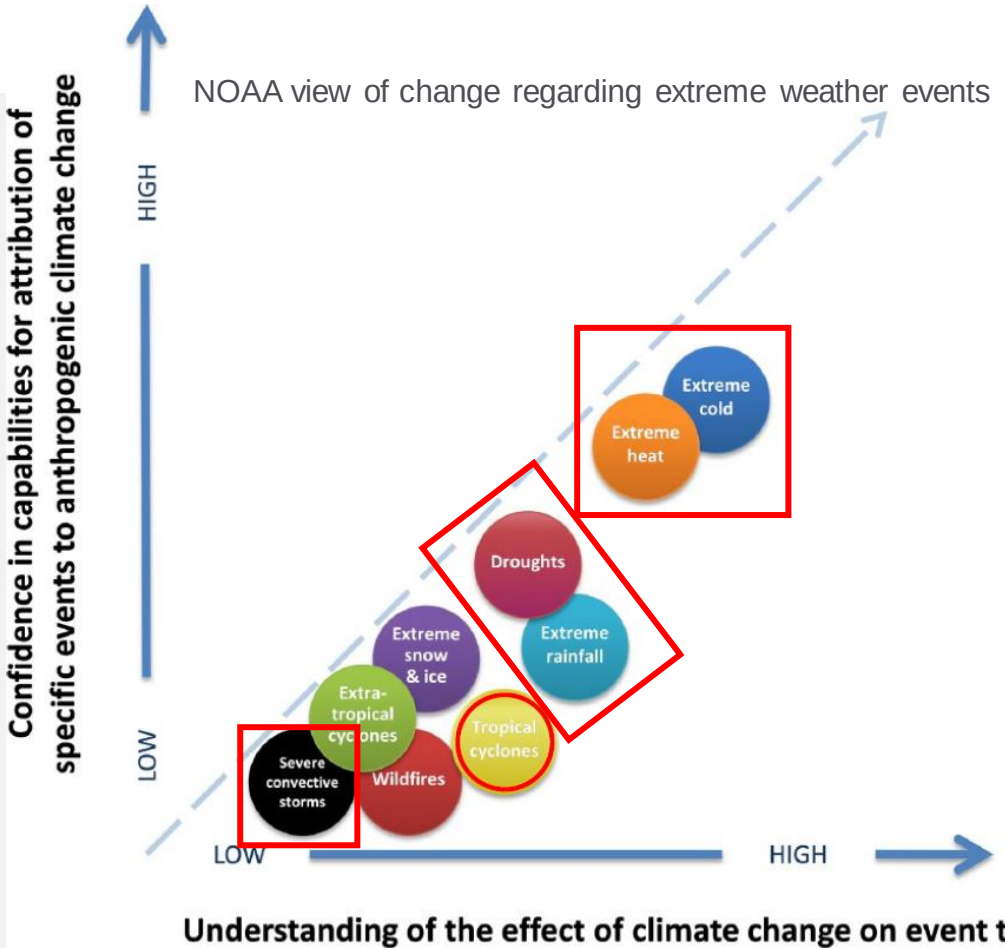
- Most confidence:
  - Changes in frequency of extreme temperatures
  - Sea Level rise
  - Localized changes in severity of coastal flood events.

- Moderate confidence:
  - Changes in hydrological cycle – arid regions will tend to become drier, wet regions will become wetter.

- Least confidence:
  - Changes in frequency & severity of tropical cyclones, winter storms, and severe thunderstorm), with the exception of coastal flooding.

NOAA view of change regarding extreme weather events



Source:NOAA

Summer Maximum Temperature in Minnesota, 1895 - Present (July - September, State Averaged Maximum)

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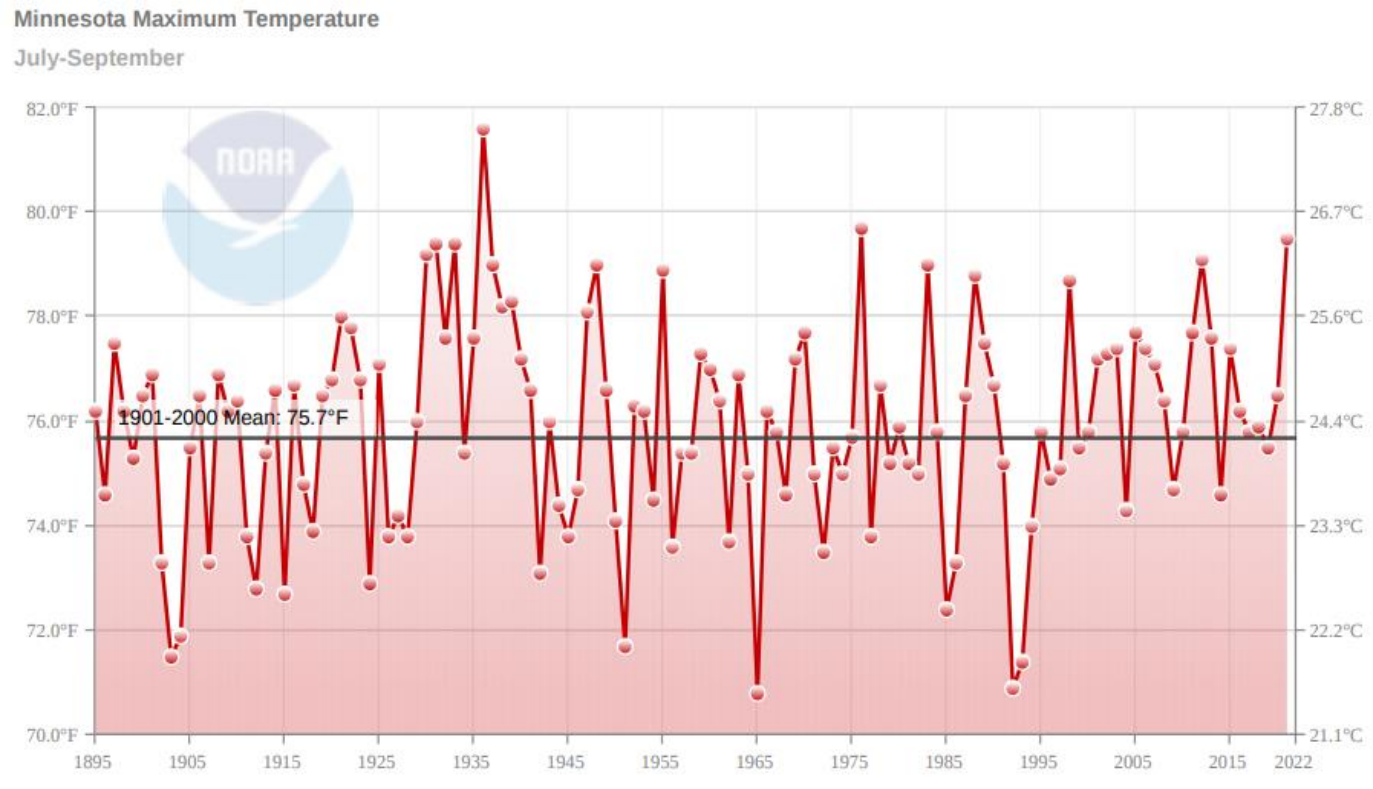
20th Century mean:
75.7 ºF

Mean 1990 – 2021:
76.1 ºF



Source: NOAA

Summer Minimum Temperature in Minnesota, 1895 - Present (July - September, State Averaged Minimum)

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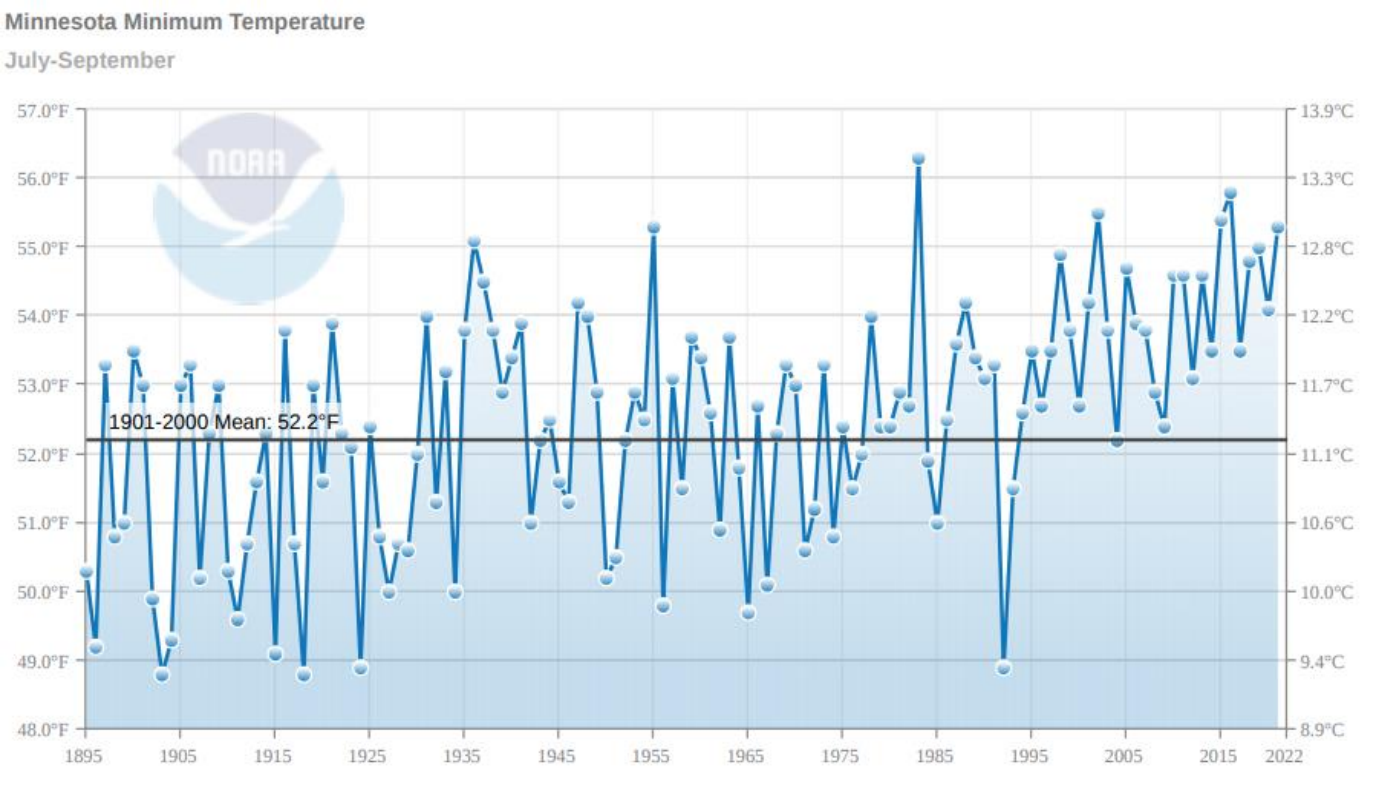
20th Century mean:
52.2 ºF

Mean 1990 – 2021:
53.7 ºF



Source: NOAA

Winter Maximum Temperature in Minnesota, 1895 - Present (December – February, State Averaged Maximum)

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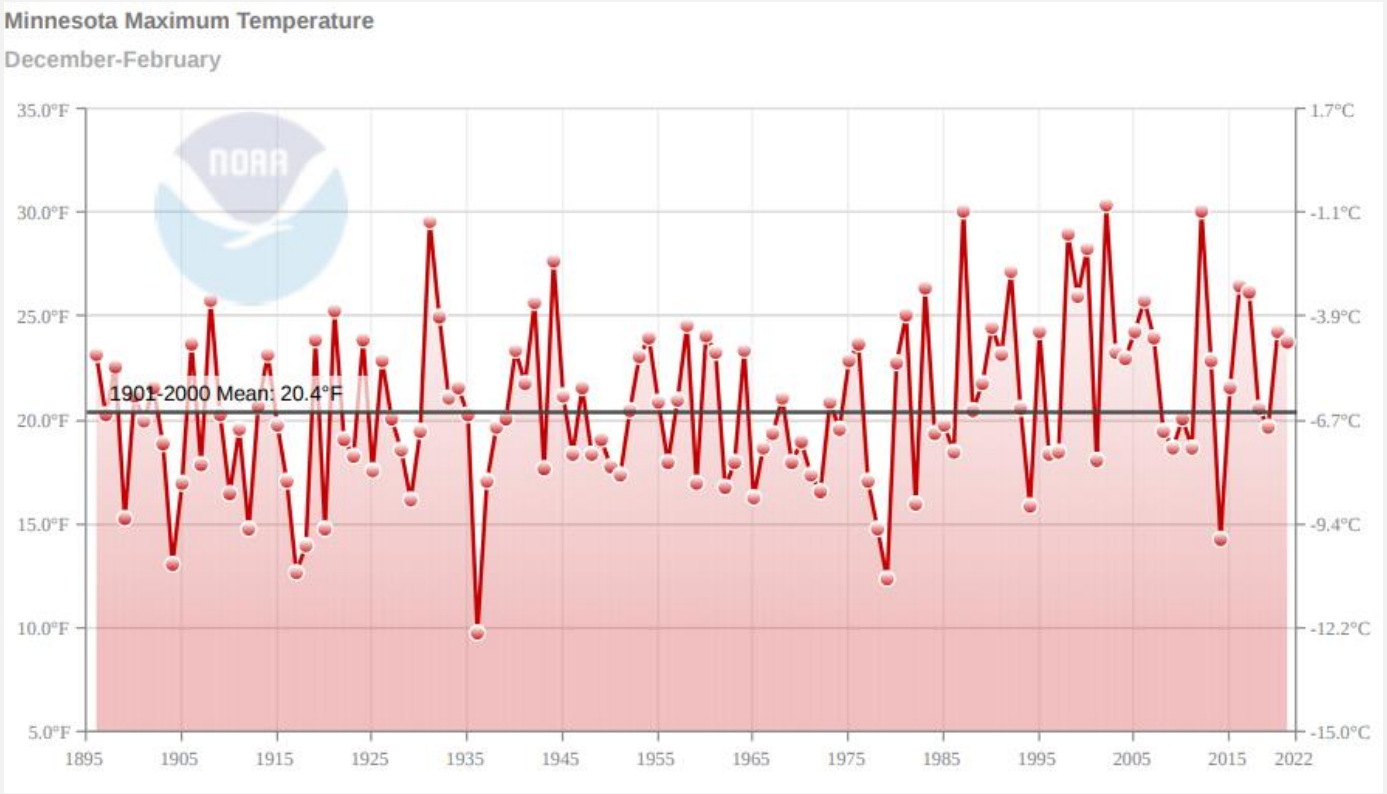
20th Century mean:
20.4 ºF

Mean 1990 – 2021:
22.9 ºF



Source: NOAA

Winter Minimum Temperature in Minnesota, 1895 - Present (December – February, State Averaged Minimum)

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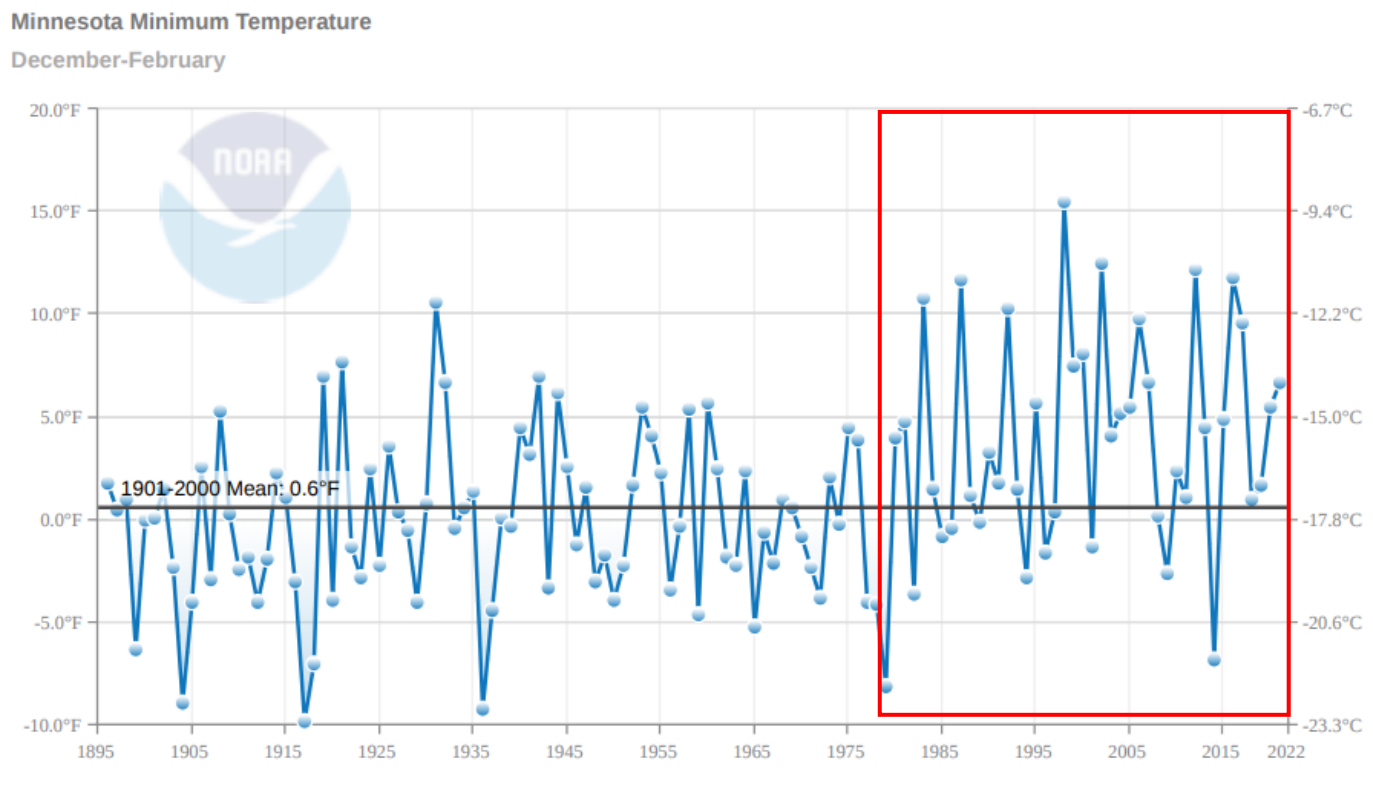
20th Century mean:
0.6 ºF

Mean 1990 – 2021:
4.51 ºF



Source: NOAA

Palmer Drought Severity Index in Minnesota, 1895 – 2021
Monthly Average Value

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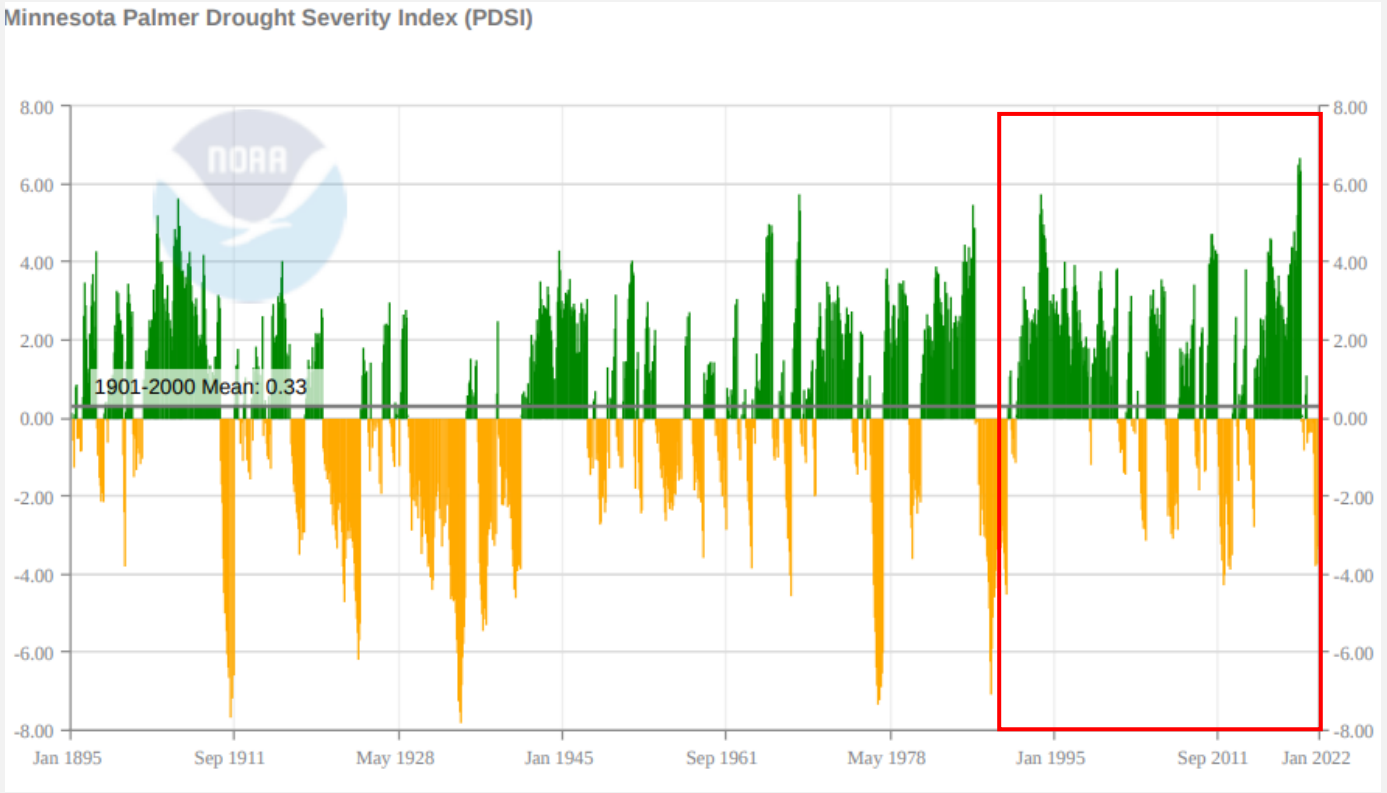
20th Century mean:
0.33

Mean 1990 – 2021:
1.28



Source: NOAA

Insurance Impacts of Heat / Drought

- Physical property damage:
  - Agriculture (plants and livestock)
  - Wildfires
- Business Interruption :
  - Shifts in growing seasons and ranges, crop migration
  - Low water levels that prevent river navigation
  - Disruptions in power generation from nuclear plants
  - Hydro Power Issues
- Human Health:
  - Heat stress in urban environments
  - Possible encroachment of new disease vectors

Source: California Division of Forestry

Heavy Precipitation Events are Trending Upwards

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Images: Houston Chronicle

Selected Extreme Precipitation / Flash Flood Events in the U.S., 2014 - 2019

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- Pensacola, Florida: 20” of rain over April 29 & 30 2014
- Detroit, Michigan: 4-6” of rain in a 4-hour period on August 11 2014.
- Islip, New York: 13” of rain in a single day on August 13, 2014.
- Phoenix, Arizona: 4-5” of rain on September 7, 2014.
- Texas/Oklahoma: Large region of 20+” in May 2015
- Houston: 17”+ on April 19, 2016.
- West Virginia: 8-10+ in 12 hours on June 23, 2016
- Ellicott City, Maryland & Princeton, NJ: 6” in 2 hours on July 30, 2016
- Central Louisiana: 10-20”+ of rain over 2 days, August 12-13 2016.
- Winter 2017: Record rainfalls across northern California.
- Southeast Missouri: 12+” rain on April 29, 2017.
- Hurricane Harvey: 60” rain over 5 days in Houston, TX in August 2017
- Ellicott City, MD (AGAIN!): 8” rain on May 27, 2018
- Northern Wisconsin: Up to 15” from June 14-18, 2018
- Madison, Wisconsin: 10-15” in 24 hours on August 21, 2018.
- PA / MD / VA: 10+” in Chesapeake Bay region, September 10, 2018
- Hurricane Florence: Up to 35” during event, September 2018.
- Arkansas / Missouri / Mississippi Floods: Spring 2019

Thunderstorms

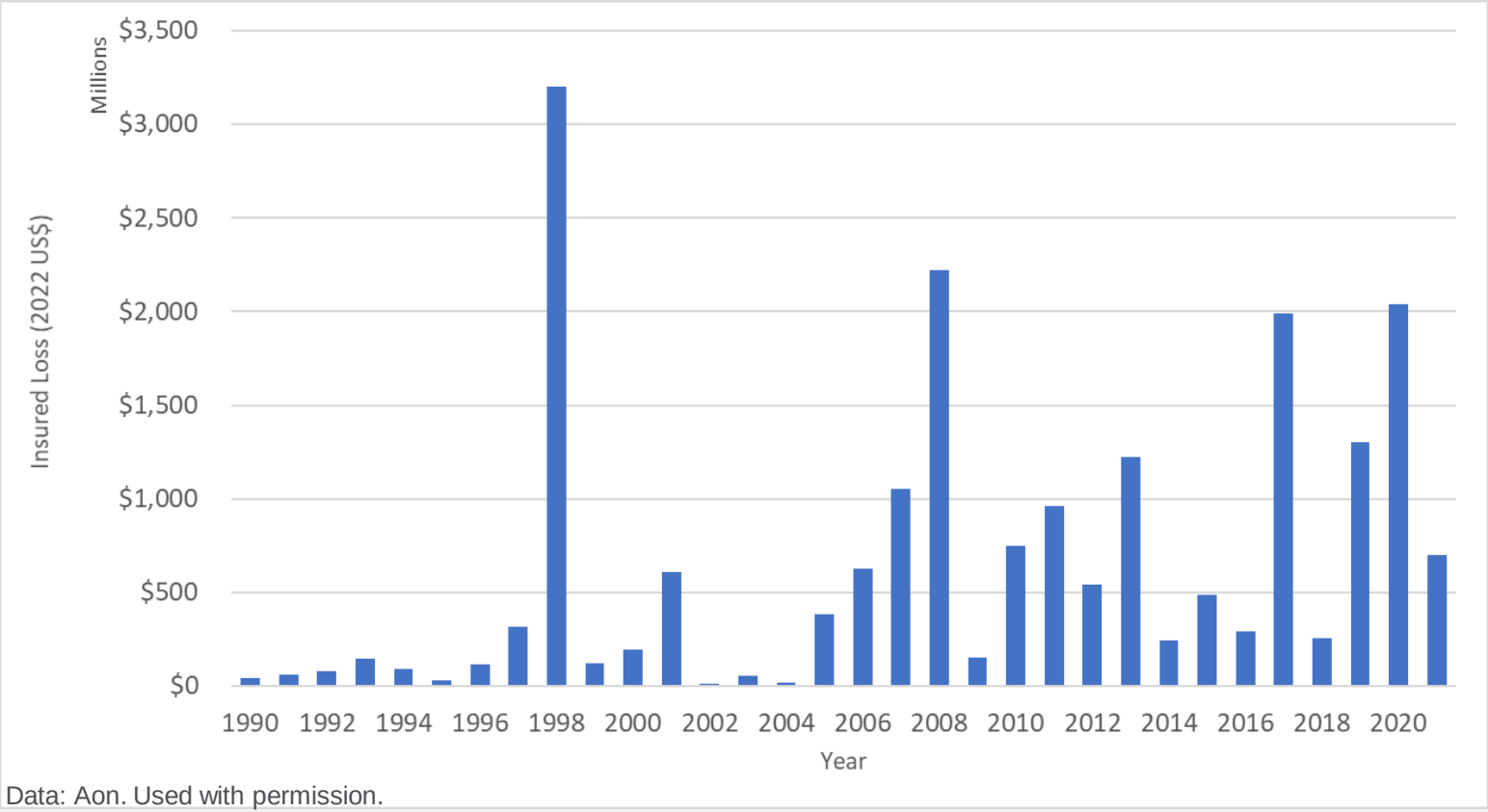
- Thunderstorms and associated hazards are small-scale and local in nature.
- Increased atmospheric moisture and heat will likely increase the number of days per year that severe thunderstorms are possible in certain areas of the globe.
- There have been shifts in US severe thunderstorm climatology over past several decades:
  - Tornadic activity has shifted eastward
  - # tornado days / year is decreasing but # tornadoes per outbreak increasing
  - Regional increases in large hail

Photo: NOAA

Natural Catastrophe Trends in Minnesota
Summary

- Temperature Extremes:
  - Minimum temperatures are rising faster than maximum temperatures, most dramatically in winter.
- Hydrological Cycle:
  - General trend toward wetter conditions in Minnesota, but occasional severe droughts will still occur.
  - More frequent extreme precipitation events leading to severe flash flooding.
- Windstorms:
  - No obvious climate trends today, with time warmer & moister environments will increase number of days per year where severe thunderstorms are possible.
  - No obvious trends in winter storm frequency / severity.

Insured Losses due to Natural Catastrophes in Minnesota, 1990 - 2021



Data: Aon. Used with permission.

Challenges around Natural Catastrophes, Resiliency, and Insurance

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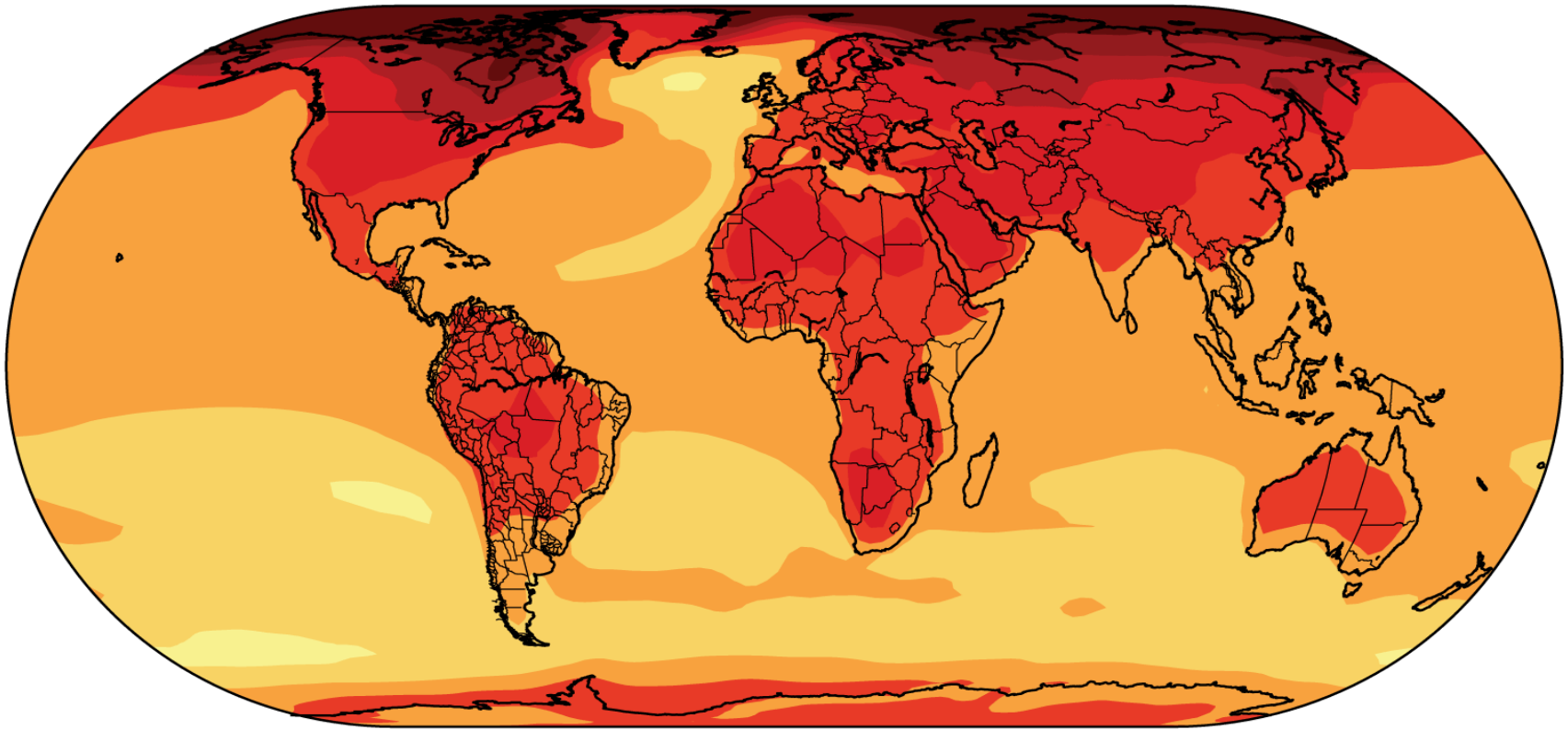

Image: IPCC

Socioeconomic Factors: We don’t build to withstand current weather extremes, let alone possible future extremes.

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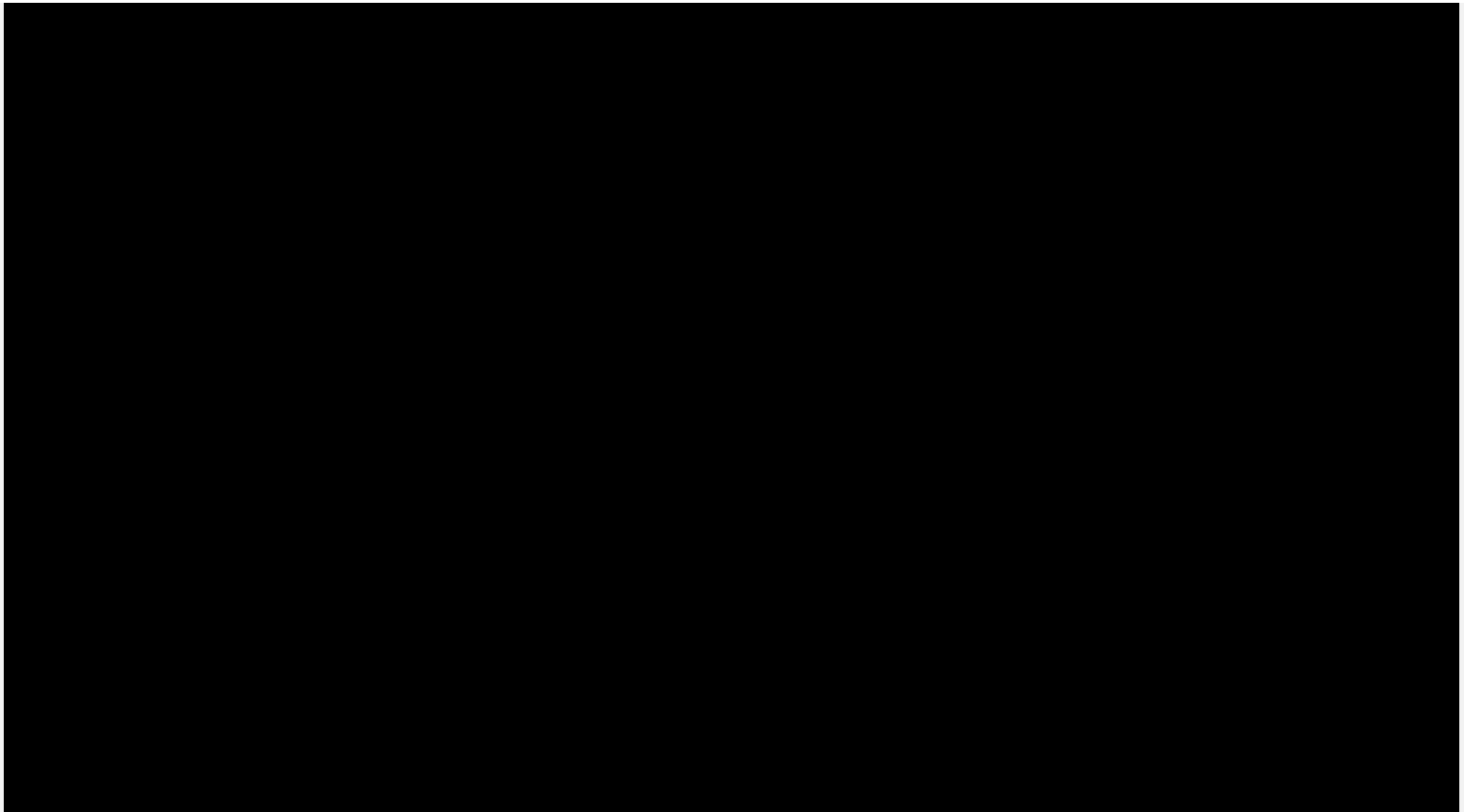


Video: Institute for Business & Home Safety

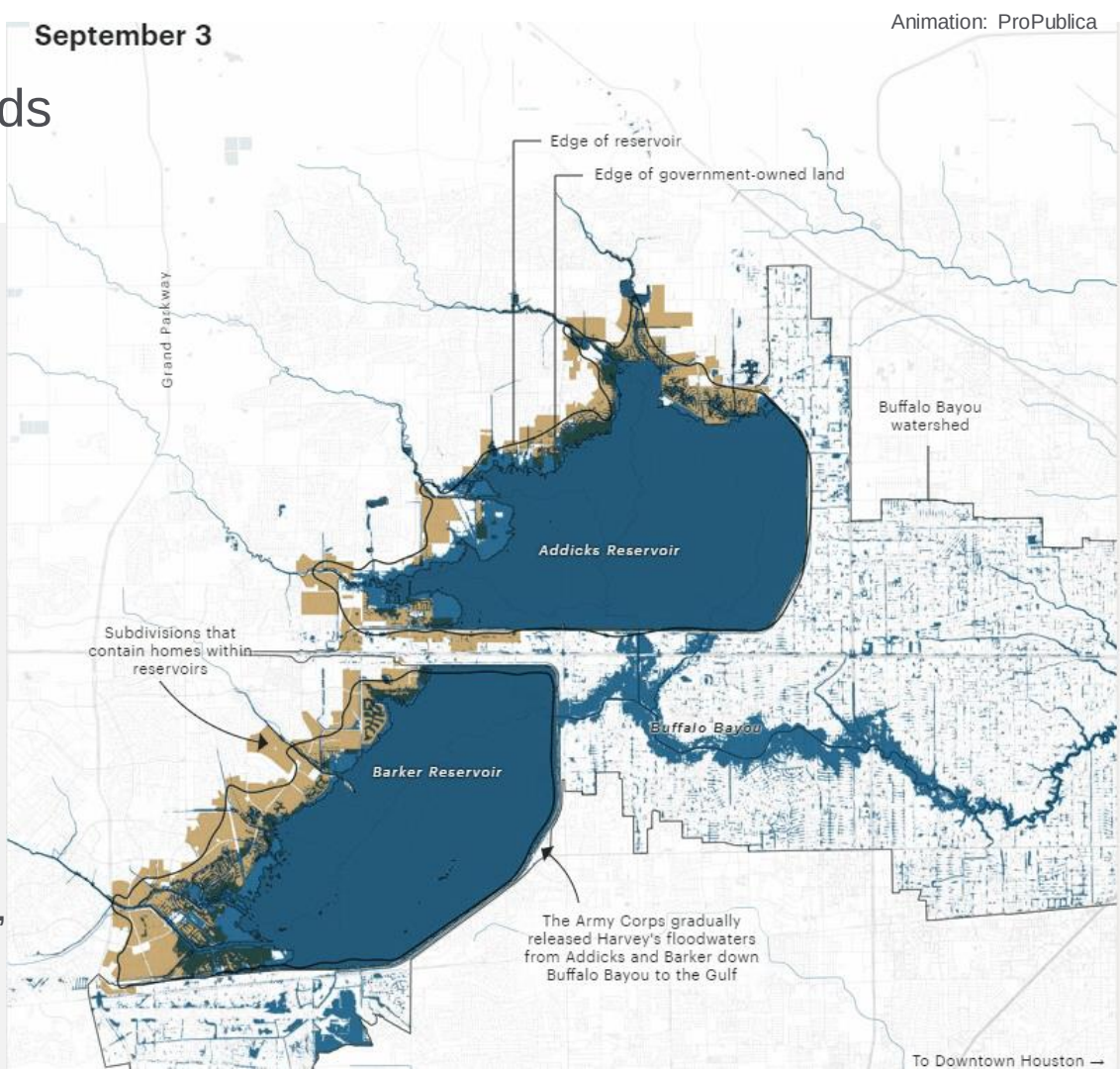
Impact of Socioeconomic Trends on Flooding

Land Use & Development Practices

Urban and suburban sprawl has created problems for severe flood potential across the United States.

- Reduction or modification of natural drainage patterns
- Development of flood plains
- Potential for levee failures

Increased heavy rain events, along with land use decisions and societal behavior, will likely increase loss severity of some future flood events.



Natural Catastrophes, Resiliency, and Insurance

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- How can insurers and reinsurers improve their resiliency to tomorrow's natural catastrophes?
  - Changes in investment strategy / asset mix.
  - Understanding how potential climate risk impacts will change the performance of your property insurance portfolio, particularly with respect to natural catastrophes.
    - Adjust catastrophe risk models (where possible) to reflect future conditions, if possible.
    - Public sources of information, NOAA, etc.
    - Improved data capture around insured risks to improve modeling.
  - How does insurance industry work with state DOIs to get them comfortable with the concept of sophisticated prospective ratemaking tools?

Disclaimer

Thank you for your attention!

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