



Catastrophe and Climate

Actuarial Weather Extremes

February 2021

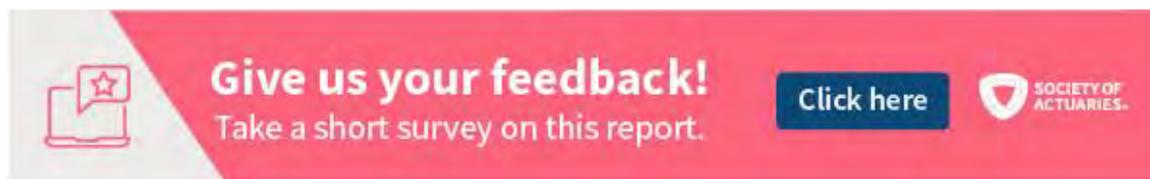




Actuarial Weather Extremes: February 2021

Winter Storm Uri, Continuing Severe Drought Conditions in the Western U.S.

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Society of Actuaries

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Actuarial Weather Extremes: February 2021

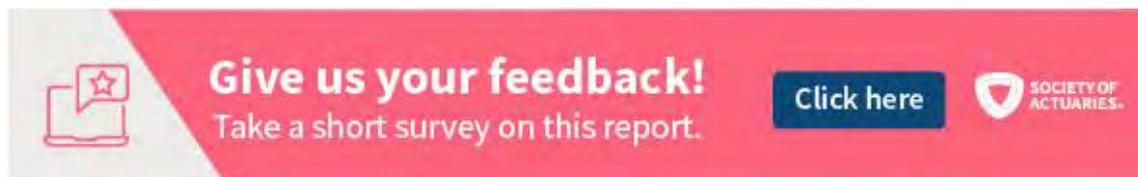
Winter Storm Uri, Continuing Severe Drought Conditions in the Western U.S.

Overview

This report examines two very different weather extremes in the U.S. in February 2021: Severe winter storm and persistent drought. The winter storm impacts are still being estimated and could be extreme in an historical context once finalized. The continuing drought at this time of the year raises concerns for the upcoming seasons as illustrated from the caption of a Washington Post article: [Historic drought deepens in the West as window for rain, show closes: Water supply and wildfire concerns grow for the dry season.](#)¹

Winter Storm Uri: As illustrated in Figures 1-3, the Central and South-Central U.S. was impacted by record cold temperatures and snowfall. Power outages, agricultural losses, and property losses were among the impacts of this storm. Some insured loss estimates place this storm in the same range as insured losses from Hurricane Harvey.²

Continuing Severe Drought Conditions in the Western U.S. In February 2021, in the Western U.S, over 61% of the region was in Severe Drought condition or worse, compared to 3% of the region in February 2020. (See Figure 4). As reported in The Washington Post, it is increasingly likely severe drought will continue, and crop losses, selling of livestock and water restrictions could occur.³



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¹ The Washington Post. March 3, 2021. [Historic drought worsens in the Southwest - The Washington Post](#)

² Insurance Journal. March 1, 2021. [Winter Storm Uri Losses in Texas Expected in \\$10B – \\$20B Range \(insurancejournal.com\)](#)

³ The Washington Post. March 3, 2021. [Historic drought worsens in the Southwest - The Washington Post](#)

Winter Storm Uri

Winter Storm Uri, a North American Storm, in mid-February brought extreme cold conditions and record snowfall to the Central and South-Central U.S. from February 13-17, 2021.

As seen in Figure 1, temperature departures of from 30 to nearly 60 degrees below average occurred in the region. Figure 2 shows many stations which had daily high temperature readings more than 50 degrees Fahrenheit below average during February 15-16, 2021, mostly in Texas.

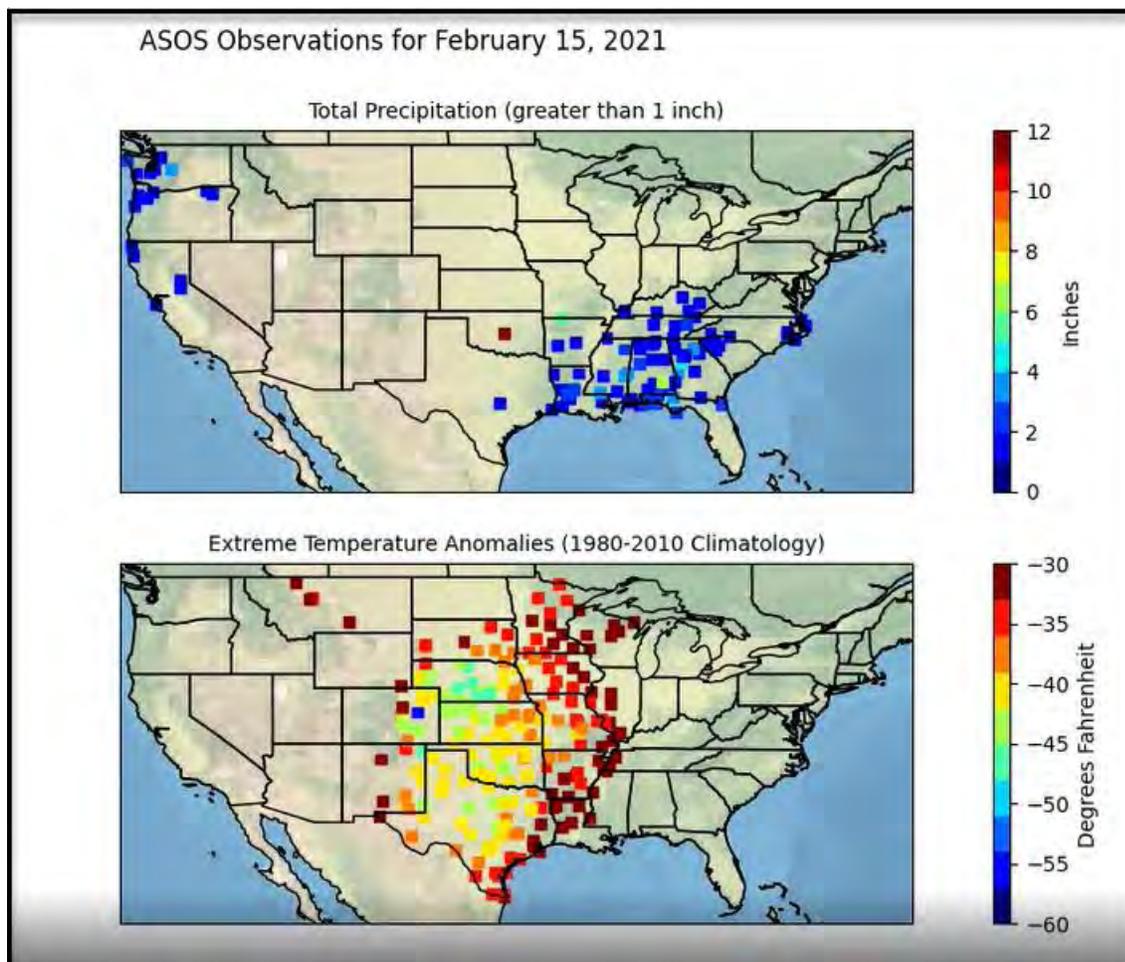
Figure 3 shows stations where snow in excess of daily record snow fall exceeded 6 inches, in the period February 14-17, 2021, also mostly in Texas.

As reported by AGDAILY, some of Texas' biggest agricultural losses from the storm are estimated to be on the order of \$230million+ for Citrus crops, \$228million+ for livestock, \$150million+ for vegetable crops. ⁴

As reported in Insurance Journal, insured losses from Winter Storm Uri in Texas look to be in the \$10 billion - \$20 billion range. This can be compared to Hurricane Harvey, which caused approximately \$19 billion in insured losses in Texas. ⁵

As reported in Time, over 4.3 million customers were without power in Texas on February 15, and another 4.7 million homes and businesses in Mexico were without power for a short time due to cascading effects. ⁶

Figure 1
FEBRUARY 15, 2021 PRECIPITATION AND DEPARTURE BELOW FEBRUARY AVERAGE



Source: Iowa State University Automated Surface Observing System (ASOS), retrieved 2/24/2021:
<https://mesonet.agron.iastate.edu/request/download.phtml>

Click these links for Time-Lapse Animation of Figure 1 plus hourly version of Figure 1

https://drive.google.com/file/d/1-mmR9DyE82Uz1l--eC_DeHzGfIfWdsog/view?usp=sharing

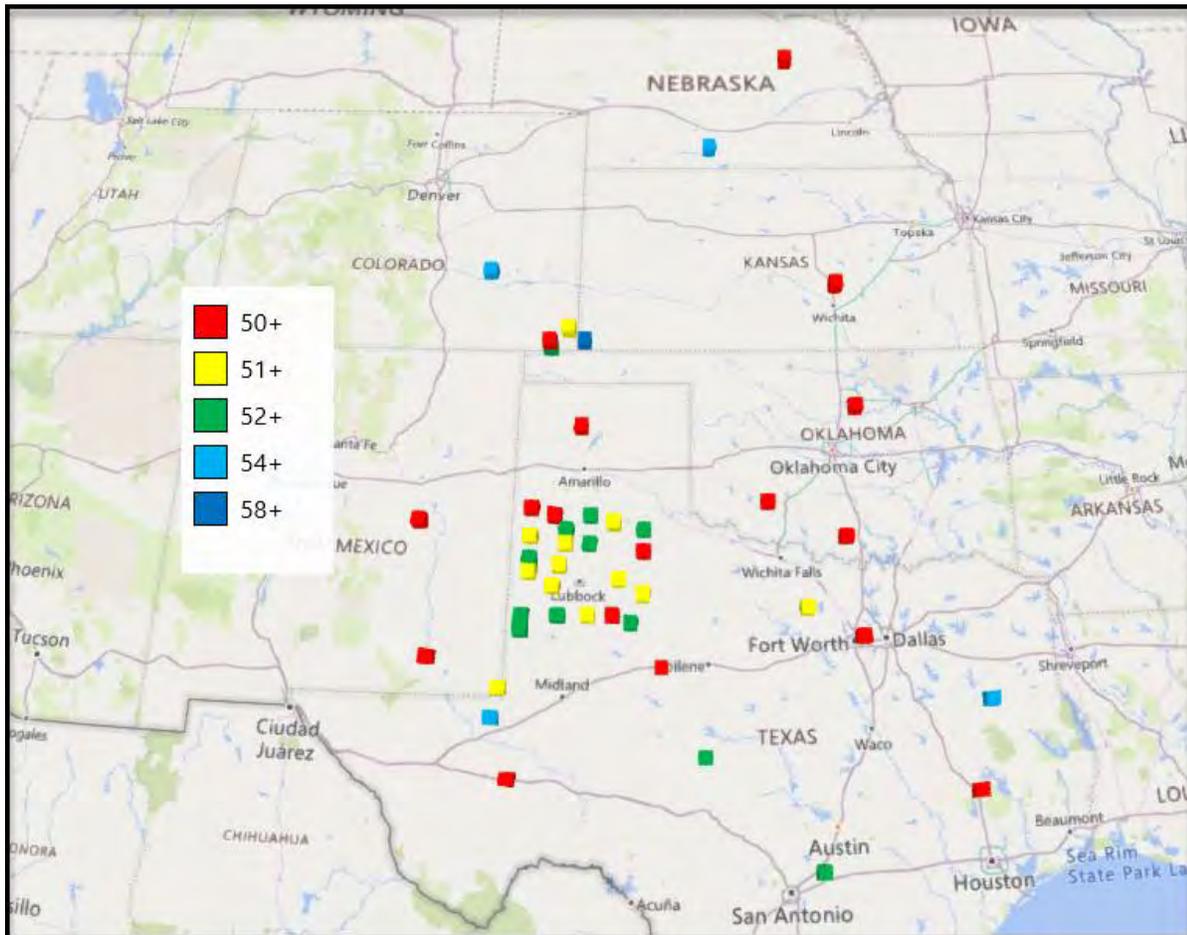
https://drive.google.com/file/d/1YPisSrGAlvDlnd_n851nEYutqqV9agk/view?usp=sharing

Time Lapse animations created by Matthew Self, ASA using ASOS data and Python programming. Data accessed February 24, 2021.

Source: IA State University ASOS, retrieved 2/24/2021: <https://mesonet.agron.iastate.edu/request/download.phtml>

Figure 2

DAILY HIGH TEMPERATURES 50 DEGREES FAHRENHEIT BELOW DAILY AVERAGE DURING FEBRUARY 15-16, 2021



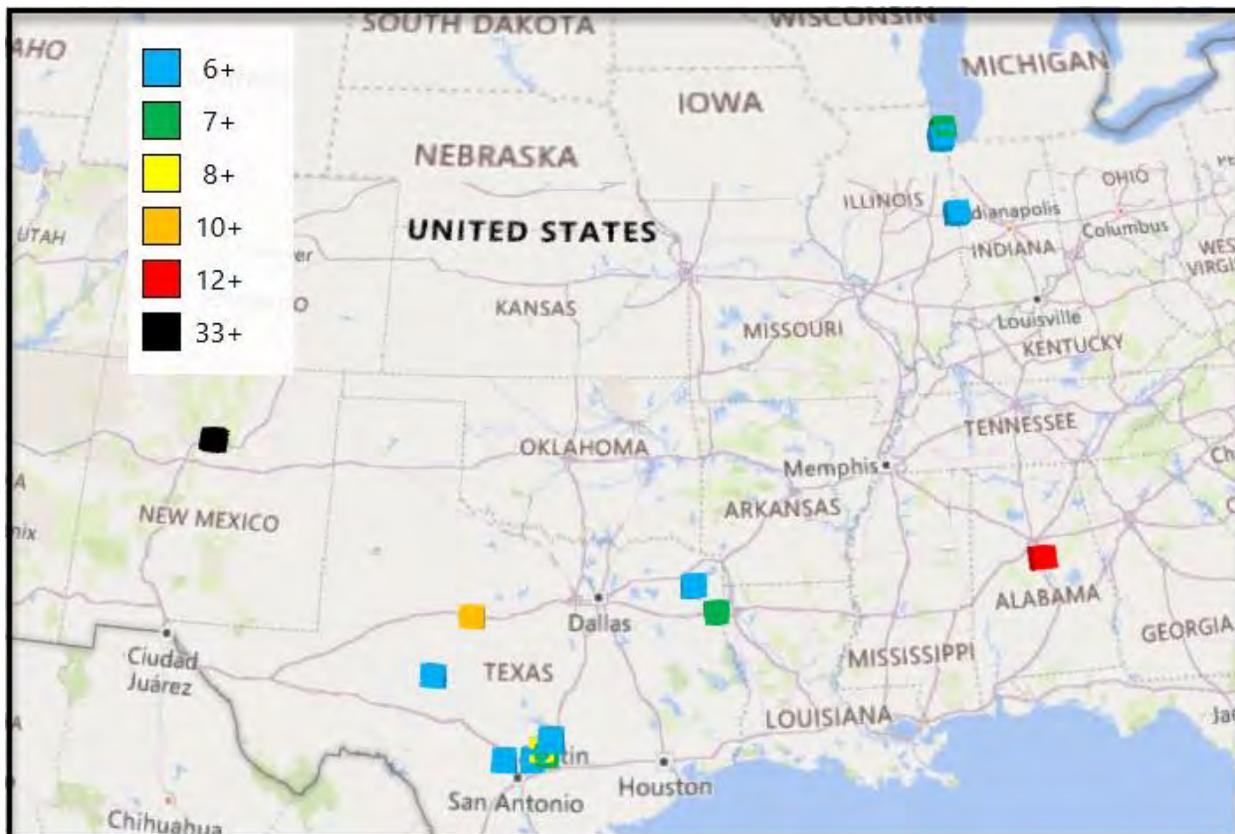
Source: Global Historical Climatology Network (GHCN) station data (Accessed March 5, 2021). ftp://ftp.ncdc.noaa.gov/pub/data/ghcn/daily/ghcnd_all.tar.gz

⁴ AGDAILY. March 17, 2021. [Initial Texas ag loss estimates from Uri exceed \\$600 million | AGDAILY](#)

⁵ Insurance Journal. March 1, 2021. [Winter Storm Uri Losses in Texas Expected in \\$10B – \\$20B Range \(insurancejournal.com\)](#)

⁶ Time. February 15, 2021. [Texas Power Outage: 5 Million Affected After Winter Storm | Time](#)

Figure 3
SNOW IN EXCESS OF DAILY RECORD DURING FEBRUARY 14-17, 2021

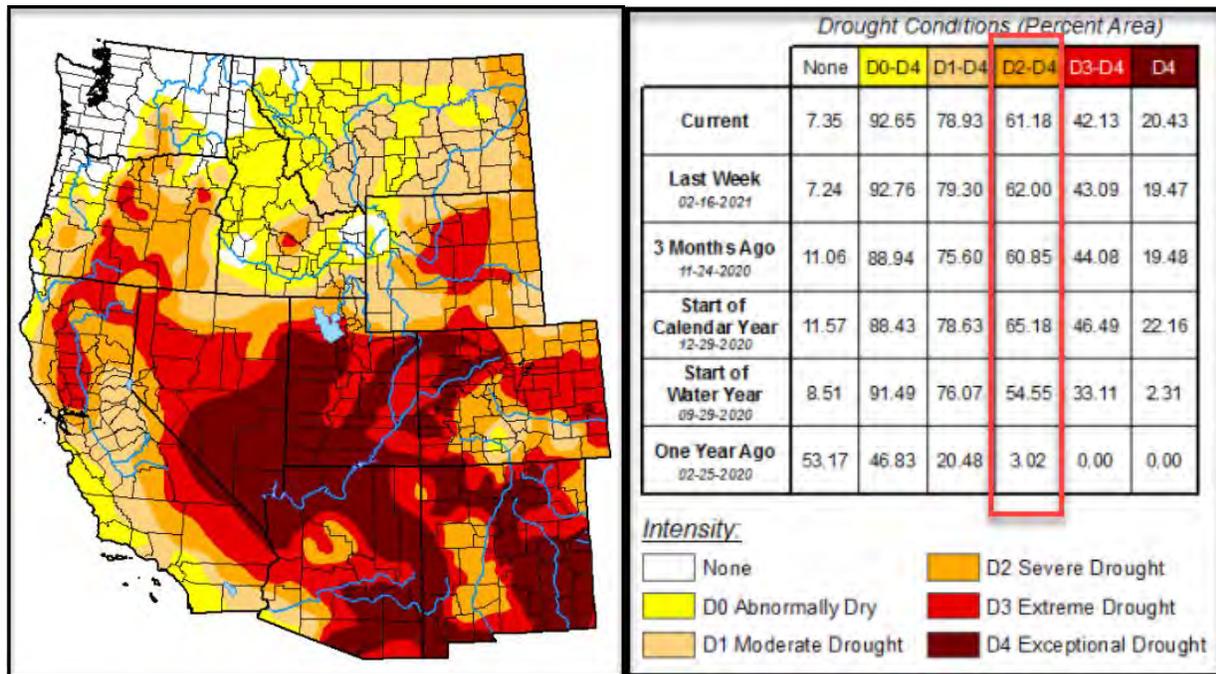


Source: GHCN station data (Accessed March 5, 2021). ftp://ftp.ncdc.noaa.gov/pub/data/ghcn/daily/ghcnd_all.tar.gz

Continuing Drought Conditions in the Western U.S.

Figure 4 shows February 23, 2021 Western U.S. drought conditions. Compared to February 2020, more than 20 times the area was in a Severe Drought condition or worse with over 61% in February 2021 vs 3% in February 2020. Impacts related to crop losses, livestock and water restrictions could be expected to occur.⁷

Figure 4
WESTERN U.S. DROUGHT CONDITIONS ON MARCH



Source: US Drought Monitor. February 23, 2021. [Map Archive | United States Drought Monitor \(unl.edu\)](https://www.drought.gov/Map-Archive)



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⁷ The Washington Post. March 3, 2021. [Historic drought worsens in the Southwest - The Washington Post](https://www.washingtonpost.com/news/energy-environment/wp/2021/03/03/historic-drought-worsens-in-the-southwest/)

Rough Assessment of the Losses Caused by the Recent Extreme Weather

Economic and insured losses are often difficult to estimate in the immediate aftermath of an extreme weather event. With the passage of time, the extent of the losses gradually becomes clearer.

Winter Storm Uri

As reported by AGDAILY, some of Texas' biggest agricultural losses from the storm are estimated to be on the order of \$230million+ for Citrus crops, \$228million+ for livestock, \$150million+ for vegetable crops.⁸

As reported in Insurance Journal, insured losses from Winter Storm Uri in Texas look to be in the \$10 billion - \$20 billion range. This can be compared to Hurricane Harvey, which caused approximately \$19 billion in insured losses in Texas.⁹

As reported in Time, over 4.3 million customers were without power in Texas on February 15, and another 4.7 million homes and businesses in Mexico were without power for a short time due to cascading effects.¹⁰

Data

Snow, and temperature data used in this report was obtained from the **Global Historical Climatology Network** ("GHCN") weather database, which provides daily weather observations from over 100,000 weather stations worldwide, covering over 180 countries. The database is publicly available through the National Oceanic and Atmospheric Administration (NOAA) via the following FTP site:

ftp://ftp.ncdc.noaa.gov/pub/data/ghcn/daily/ghcnd_all.tar.gz

Filename: [ghcnd_all.tar.gz](#)

Automated Surface Observing System (ASOS) temperature and precipitation data

The steps below show how to get the hourly temperature and precipitation at the STL Airport, as an example, from the Iowa State University Automated Surface Observing System (ASOS):

IA State: <https://mesonet.agron.iastate.edu/request/download.phtml>

- 1) Select "Missouri ASOS" as the network and click "Switch to Network"
- 2) In the list of available stations, select the "[STL] ST. LOUIS" station, and click "Add Selected"
- 3) In the "Select From Available Data" section, choose the "Air Temperature [F]" and "1 hour Precipitation [inch]" options.
- 4) Set the date range to 2020-October-1 and 2020-October-31 (or whatever range is desired)
- 5) Select "Yes" for "Include Latitude + Longitude"
- 6) Click "Get Data" at the bottom

⁸ AGDAILY. March 17, 2021. [Initial Texas ag loss estimates from Uri exceed \\$600 million | AGDAILY](#)

⁹ Insurance Journal. March 1, 2021. [Winter Storm Uri Losses in Texas Expected in \\$10B – \\$20B Range \(insurancejournal.com\)](#)

¹⁰ Time. February 15, 2021. [Texas Power Outage: 5 Million Affected After Winter Storm | Time](#)

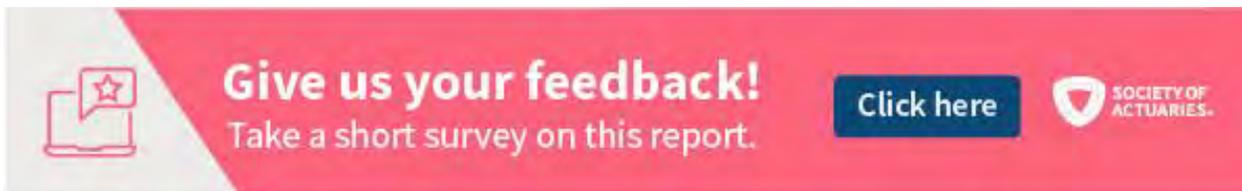
These steps would give you the results from the URL below.

https://mesonet.agron.iastate.edu/cgi-bin/request/asos.py?station=STL&data=tmpf&data=p01i&year1=2020&month1=10&day1=1&year2=2020&month2=10&day2=31&tz=Etc%2FUTC&format=onlycomma&latlon=yes&elev=no&missing=M&trace=T&direct=no&report_type=1&report_type=2

Acknowledgments

The authors wish to thank Matthew Self, ASA for his ongoing contributions to the monthly data available for analysis for this report.

Feedback



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About The Society of Actuaries

With roots dating back to 1889, the [Society of Actuaries](#) (SOA) is the world's largest actuarial professional organizations with more than 31,000 members. Through research and education, the SOA's mission is to advance actuarial knowledge and to enhance the ability of actuaries to provide expert advice and relevant solutions for financial, business and societal challenges. The SOA's vision is for actuaries to be the leading professionals in the measurement and management of risk.

The SOA supports actuaries and advances knowledge through research and education. As part of its work, the SOA seeks to inform public policy development and public understanding through research. The SOA aspires to be a trusted source of objective, data-driven research and analysis with an actuarial perspective for its members, industry, policymakers and the public. This distinct perspective comes from the SOA as an association of actuaries, who have a rigorous formal education and direct experience as practitioners as they perform applied research. The SOA also welcomes the opportunity to partner with other organizations in our work where appropriate.

The SOA has a history of working with public policymakers and regulators in developing historical experience studies and projection techniques as well as individual reports on health care, retirement and other topics. The SOA's research is intended to aid the work of policymakers and regulators and follow certain core principles:

Objectivity: The SOA's research informs and provides analysis that can be relied upon by other individuals or organizations involved in public policy discussions. The SOA does not take advocacy positions or lobby specific policy proposals.

Quality: The SOA aspires to the highest ethical and quality standards in all of its research and analysis. Our research process is overseen by experienced actuaries and nonactuaries from a range of industry sectors and organizations. A rigorous peer-review process ensures the quality and integrity of our work.

Relevance: The SOA provides timely research on public policy issues. Our research advances actuarial knowledge while providing critical insights on key policy issues, and thereby provides value to stakeholders and decision makers.

Quantification: The SOA leverages the diverse skill sets of actuaries to provide research and findings that are driven by the best available data and methods. Actuaries use detailed modeling to analyze financial risk and provide distinct insight and quantification. Further, actuarial standards require transparency and the disclosure of the assumptions and analytic approach underlying the work.

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