



**Climate Change-Fueled  
Weather Disasters:**  
Costs to State and Local Economies

Datu Research  
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## Executive Summary

Earth’s warming climate is fueling the increasing frequency and intensity of weather and climate disasters. A growing body of climate science research suggests connections between anthropogenic climate change and worsening extreme weather events, including hurricanes, floods, severe storms with tornadoes, winter storms, freezes, droughts, and wildfires. Increasingly, these weather disasters result in unprecedented economic costs, making clear the need to invest in bold action to reduce greenhouse gas emissions—the underlying drivers of climate change. In addition, since weather disasters will continue to occur even in the best future climate scenarios, it is clear that we will need to adapt to the impacts of climate change already underway. In the most vulnerable geographies, such action may entail managed retreat—shifting land uses rather than rebuilding in harm’s way.

In this report, we draw on the best available scientific research to show the varying degrees of connection between climate change and each type of weather disaster. To gain insight into the price Americans are paying for worsening weather disasters, we summarize data from the National Oceanic and Atmospheric Administration (NOAA) Billion-Dollar Weather and Climate Disasters database and other public sources.

NOAA has tracked the costs of the most extreme weather events in the United States since 1980, estimating the total direct cost of each event that caused \$1 billion or more in damage (adjusting all costs to 2019 dollars). No state is untouched by these billion-dollar disasters.

Drawing on NOAA’s Billion-Dollar Weather and Climate Disasters database and other publicly available data, we present the costs of nine recent weather disasters across the contiguous United States—including one each from seven NOAA-designated extreme event categories, and a second one from the hurricane category and the flooding category.<sup>2</sup> For each recent disaster selected, we focus on the hardest-hit state among all the states affected; for instance, in the case of Hurricane Harvey in 2017, the disaster severely affected Texas, Louisiana, Mississippi, Alabama, and North Carolina, at an estimated total direct cost of \$130 billion. In our discussion, we feature Texas, which is estimated to account for at least \$100 billion of the total cost. For a list of the disasters we selected, the states severely affected, and the state we feature for each disaster, see Table 1.

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<sup>2</sup> For disaster selection criteria, see Methodology section, page vii.

*Table 1. Selected US Billion-Dollar Disasters, Their Total Direct Costs, and Affected States Featured in This Report*

Year	Disaster	States Severely Affected	Total Direct Costs*	State Featured in This Report
2017	Hurricane Harvey	TX, LA, MS, AL, NC	<b>\$130B</b>	Texas
2017	Hurricane Irma	FL, GA, PR	<b>\$52B</b>	Florida
2018	Severe Weather and Tornadoes	IA, CT, MA, NY, PA, NJ, MD, WV, VA, OH, IN, IL, MO, KS, OK, TX, CO	<b>\$1.6B</b>	Iowa
2016	Inland Flooding Matthew**	NC, FL, SC, GA, VA	<b>\$5B to 10B</b>	North Carolina
2018	Inland Flooding Florence**	NC, SC	<b>\$20 to 50B</b>	North Carolina
2018	Northeast Winter Storm	NY, CT, MD, VA, PA, NJ	<b>\$2.3B</b>	New York
2017	Southeast Freeze	GA, SC, NC, FL, AL, MS, TN, KY, VA	<b>\$1.1B</b>	Georgia
2017	Northern Plains Drought	ND, SD, MT	<b>\$2.6B</b>	North Dakota
2017	Western Wildfires	CA, MT, WA, OR	<b>\$18.7B</b>	California

Source: NOAA 2020. \*CPI-adjusted to 2019 dollars. \*\*States affected and total direct costs are for Hurricane Matthew and Hurricane Florence, respectively; total direct costs are the NOAA-estimated range for NC only.

Harbingers of the future, these costs are borne by homeowners, businesses, farmers, ranchers, taxpayers, and government. In the era of the COVID-19 pandemic, especially, federal, state, and local governments will be hard-pressed to provide adequate resources for response and recovery from weather disasters. As of this writing, COVID-19 federal aid is estimated to be in the range of \$1 trillion to \$3 trillion (Restuccia and Davidson 2020). Even before the pandemic, federal and state disaster resources were already strained, with climate change-fueled extreme weather events increasing in frequency and intensity, and more people living in at-risk locations.

The US Government Accountability Office (GAO) estimates that between 2005 and 2019, the federal government, including FEMA and other agencies, has spent at least \$450 billion on weather disaster assistance, an average of \$30 billion per year (GAO 2019). It is easy to imagine that, in the face of the COVID-19 pandemic, a similar level of aid may not be available for weather disaster assistance.

The rapidly escalating costs of weather disasters are only a lower bound to what is anticipated if greenhouse gas emissions continue unabated and global temperatures continue to rise. Climate models project that even with a moderate increase in greenhouse gas emissions, by the end of

this century, the frequency of Category 4 and 5 hurricanes in the Atlantic Basin could increase by 45-87 percent, putting the continental United States at risk. In the absence of climate policy to rapidly reduce emissions, we can also expect greater frequency or intensity of five other categories of weather disaster (see Table 2).

*Table 2. US Weather Disaster Projections in Absence of Climate Policy to Reduce Emissions*

Disaster	Projected Changes of Extreme Weather Events in Absence of Climate Action
<b>Hurricanes</b>	Climate Models project a 45-87% increase in the frequency of Category 4 and 5 hurricanes in the Atlantic Basin by century's end for a moderate increase in greenhouse gases (Knutson et al. 2013). Some of the most dangerous hurricanes were formerly designated as storms with a one-percent likelihood of occurrence in a given year. Scientists find that, with climate change continuing at current rates, such storms could happen every 5-10 years (Emanuel 2017).
<b>Severe Storms</b>	Scientists anticipate an increase in the frequency of storms, particularly over the Midwest and Southern Plains. An increase in storm intensity is expected due to changes in temperature, humidity, and wind, which control the intensity of convective storms (USGCRP 2017b).
<b>Floods</b>	As the world continues to warm, scientists anticipate continued increases in heavy precipitation events, suggesting a likely increase in flood disasters—with significant variations geographically (IPCC 2013b). By the end of the century, the area of the one-percent-annual-chance floodplain could increase by about 30 percent, with the most extensive changes being in the Northeast and the Great Lakes regions (USGCRP 2017a).
<b>Freezes</b>	In a warming world, researchers expect vulnerability to crop-damaging freezes to increase, with early onset of spring occurring (Barcikowska 2019) by mid-century, at nearly twice the rate previously observed (Labe, Ault, and Zurita-Milla 2017). Unless the last freeze date also changes at that same rate, the agricultural economy is at risk of large-scale losses (Reidmiller et al. 2018).
<b>Drought</b>	With continued rising temperatures, scientists anticipate longer dry periods in semi-arid regions of the midlatitudes and subtropics, such as the US Southwest (IPCC 2013a). Scientists suggest that increased evaporation due to rising temperatures may outpace increased precipitation, leading to more frequent and intense drought conditions across the continental United States (USGCRP 2017d). Researchers at NASA and Columbia University suggest the US Southwest could experience “megadroughts” that last over 30 years (Gray and Merzdorf 2019).
<b>Wildfire</b>	Climate models project a continued increase in frequency and intensity of wildfires with rising temperatures (Kenward, Sanford, and Bronzan 2016). Higher wildfire risks are expected across the West and Southeast. Scientists suggest that in the western United States, by mid-century, the area burned each year could rise by a factor of 2-6 times from present levels (Reidmiller et al. 2018).

Key takeaways from this report include the following:

- 1) **Since 1980, the number of extreme weather events per year has increased fourfold, and the annual direct cost of the disasters has increased fivefold.** During this period, the United States has had a total of 258 such weather and climate “billion-dollar” disasters, at a total direct cost of more than \$1.75 trillion (NOAA 2020a).
- 2) **Since 1980, the direct costs of one US disaster category—hurricanes—have increased eleven-fold.** Driving factors include climate change and shifting land-use patterns that place more people and properties at risk. The population in counties prone to hurricane damage grew at least 22 percent faster than the overall US population. The Congressional Budget Office (CBO) projects that by 2075, 10 million people will be living in hurricane-damaged counties (CBO 2016).
- 3) **All 50 states have suffered from at least one billion-dollar weather disaster, but in five unlucky states, all seven types of disaster have hit repeatedly.** North Carolina, Georgia, Alabama, Mississippi, and Texas have each endured several billion-dollar hurricanes, severe storms, floods, winter storms, freezes, droughts, and wildfires (NOAA 2020a).
- 4) **As the world continues to warm, climate change-fueled weather disasters will become more frequent, more severe, and more costly.** In the absence of climate action, we can expect a future with many more billion-dollar hurricanes, floods, severe storms, climate-damaging freezes, drought, and wildfires. For every 1°C of warming, future damage is projected to cost roughly 1.2 percent of Gross Domestic Product (GDP)—an amount that, in 2019 terms, would be roughly \$257 billion annually. This scenario can be significantly mitigated by substantially reducing greenhouse gas emissions.
- 5) **Since it is only possible to slow the rate of future warming—but not reverse it, at least in the coming decades—it is crucial to adapt, build resilience, and in some cases, retreat from disaster-prone areas.** Adaptation and resilience projects such as elevating buildings or rebuilding coastal wetlands are a worthwhile investment in limiting damage from future disasters. Protecting people from areas that repeatedly get flooded or burned may require relocating rather than continuing to rebuild.

The extreme weather events highlighted in this report are increasing in frequency, severity, and cost to taxpayers. Mitigating the driving force of climate change—greenhouse gas emissions—requires federal, state, and local governments to take immediate action. Meanwhile, the impacts of climate change are already underway; we can no longer rely solely on mitigating greenhouse gas emissions to prevent future damages. In the face of continued, climate change-fueled weather disasters, it is also critical that government leaders take preemptive action to adapt vulnerable communities to our changing climate.