

Climate Change and Natural Disaster Cost Bibliography

NAR Library Reference Request

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Research Request Details

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Request: A complete list of citations of all the groups (governmental, nonprofit and private) that have conducted a study related to natural disaster insurance costs and climate change. Not only studies based on historic costs, but also those studies that do projections into the future based on climate change factors such as projections of sea level rise.

Government

AECOM (for FEMA). (2013). *The impact of climate change and population growth on the National Flood Insurance Program through 2100*. Los Angeles, CA.

<https://www.aecom.com/fema-climate-change-report/>

“-The total number of NFIP insurance policies may increase by approximately 80% by 2100. The number of riverine policies may increase by about 100%, and the number of coastal policies may increase by approximately 60%.

-The average loss cost per policy may increase approximately 50% by the year 2100.”

U.S. Environmental Protection Agency. (2017). *Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment*. Washington, D.C.: U.S. Environmental Protection Agency.

<https://www.epa.gov/cira>

“The estimated damages to coastal property from sea level rise and storm surge in the contiguous U.S. are \$5.0 trillion through 2100 (discounted at 3%4) in a future without emission reductions. When cost-effective adaptation along the coast is included, the estimated damages are reduced to \$810 billion.”

National Interagency Fire Center. (2018). *Federal Firefighting Costs (Suppression Only)*.

https://www.nifc.gov/fireInfo/fireInfo_documents/SuppCosts.pdf

Table of fires, acreage burned, and costs from 1985-2017.

NOAA National Centers for Environmental Information. (2018). *U.S. Billion-Dollar Weather and Climate Disasters*.

<https://www.ncdc.noaa.gov/billions/>

“The U.S. has sustained 238 weather and climate disasters since 1980 where overall damages/costs reached or exceeded \$1 billion (including CPI adjustment to 2018). The total cost of these 238 events exceeds \$1.5 trillion.”

NOAA National Weather Service. (2014). *Hydrologic Information Center - Flood loss data*.
<http://www.nws.noaa.gov/hic/>

Table of flood loss damages and fatalities from 1903 – 2014.

U. S. Department of Agriculture Economic Research Service. (2016, October 14). *Climate change: Agricultural impacts and adaptation*.

<https://www.ers.usda.gov/topics/natural-resources-environment/climate-change/agricultural-impacts-and-adaptation/>

“As a result of climate-induced changes in productivity and resources, agricultural yield potentials are likely to change. These impacts will affect national and international markets; the prices of food, fiber, and energy; agricultural incomes; and the environment. Farmer responses, possibly aided by policy changes, can help facilitate continued commodity production, conservation of natural resources, and food security in the face of climate change.”

U. S. Government Accountability Office. (2017). *Climate change: Information on potential economic effects could help guide federal efforts to reduce fiscal exposure* (GAO-17-720).

<https://www.gao.gov/products/GAO-17-720>

“According to the President’s budget proposal for fiscal year 2017, over the last decade, the federal government has incurred direct costs of more than \$350 billion because of extreme weather and fire events, including \$205 billion for domestic disaster response and relief; \$90 billion for crop and flood insurance; \$34 billion for wildland fire management; and \$28 billion for maintenance and repairs to federal facilities and federally managed lands, infrastructure, and waterways.¹ According to a May 2014 assessment by the U.S. Global Change Research Program (USGCRP), the impacts and costs of extreme events—such as floods, drought, and other events—will increase in significance as what are considered rare events become more common and intense because of climate change.”

Nonprofit

Ackerman, F.; Stanton, E., A. (2008). *The cost of climate change - What we’ll pay if global warming continues unchecked*. New York, NY: Natural Resources Defense Council.

<https://www.nrdc.org/resources/cost-climate-change-what-well-pay-if-global-warming-continues-unchecked>

“Global warming comes with a big price tag for every country around the world. The 80 percent reduction in U.S. emissions that will be needed to lead international action to stop climate change may not come cheaply, but the cost of failing to act will be much greater. New research shows that if present trends continue, the total cost of global warming will be as high as 3.6 percent of gross domestic product (GDP). Four global warming impacts alone—hurricane damage, real estate losses, energy costs, and water costs—will come with a price tag of 1.8 percent of U.S. GDP, or almost \$1.9 trillion annually (in today’s dollars) by 2100.”

Association of British Insurers. (2005). *Financial risks of climate change*. London: Association of British Insurers.

<http://insurance.lbl.gov/documents/abi-climate.pdf>

“Focussing on the most extreme storms (losses occurring once every 100 to 250 years), by the 2080s climate change could:

- Increase wind-related insured losses from extreme US hurricanes by around three-quarters to total \$100 – 150 bn. This additional cost would be equivalent to two to three Hurricane Andrews in a single season (at 2004 prices).
- Increase wind-related insured losses from extreme Japanese typhoons by around two thirds to total \$25 – 34 bn (¥2,700 – 3,700 bn). The increase alone would be more than twice the cost of the 2004 typhoon season, the costliest in the last 100 years.
- Increase wind-related insured losses from extreme European storms by at least 5% to \$32 – 38 bn (€25 – 30 bn). This additional cost would be equivalent to the Martin storm in 1999, which cost \$2.5 bn (€2 bn, 2004 prices)."

Divoky, D., Eberbach, S., & Crowell, M. (2012). The impact of climate change on the National Flood Insurance Program. In *Monograph No.6: Sea level rise and coastal infrastructure; prediction, risks and solutions* (pp. 59-77). Reston, VA: ASCE Council on Disaster Risk Management.

<https://ascelibrary.org/doi/10.1061/9780784412008.ch05>

"Owing to the relatively moderate changes anticipated through 2100 for both storm frequency and storm intensity, sea level rise was found to be a major contributor to the potential growth of the coastal special flood hazard area, although that growth would be partly offset by a loss of flood plain area caused by shoreline erosion."

Howard, P. (2014). *Flammable planet: Wildfires and the social cost of carbon*. New York, NY: Institute for Policy Integrity.

[http://costofcarbon.org/files/Flammable Planet Wildfires and Social Cost of Carbon.pdf](http://costofcarbon.org/files/Flammable_Planet_Wildfires_and_Social_Cost_of_Carbon.pdf)

"We predict that future climate change-induced wildfires will cost the United States between \$10 billion and \$62.5 billion annually by 2050, with a middle estimate of \$22.5 billion. This represents roughly 0.06 percent to 0.36 percent of projected U.S. GDP."

Mills, E. (2004). *Insurance as an adaptation strategy for extreme weather events in developing countries and economies in transition: New opportunities for public-private partnership* (Report No. 52220).

Berkeley, CA: Lawrence Berkeley National Laboratory.

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.174.1967&rep=rep1&type=pdf>

"The number of large weather-related events, their costs, and the numbers of people affected by these events has increased precipitously since the 1950s (Figure 7).²¹ Key factors in these increases include population growth, especially in high-risk areas, and other demographic factors as well as increasingly effective observation and statistical reporting systems. Even when we take into account these demographic factors, it is significant that weather-related losses have grown three-times more quickly than non-weather related ones (Vellinga et al. 2001), and the number of people affected has grown even more quickly."

OECD. (2015). *The economic consequences of climate change*. Paris: OECD Publishing.

<https://doi.org/10.1787/9789264235410-en>.

"If no further climate change action will be undertaken, the combined effect of the selected impacts on global annual GDP are projected to rise over time to likely levels of 1.0% to 3.3% by 2060."

Union of Concerned Scientists. *Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate*. Cambridge, MA: Union of Concerned Scientists.

<https://www.ucsusa.org/global-warming/global-warming-impacts/sea-level-rise-chronic-floods-and-us-coastal-real-estate-implications#.XAlds-J7m70>

“Our findings indicate that sea level rise, driven primarily by climate change and even absent heavy rains or storms, puts more than 300,000 of today’s homes and commercial properties in the contiguous United States at risk of chronic, disruptive flooding within the next 30 years. The cumulative current value of the properties that will be at risk by 2045 is roughly \$136 billion... Our analysis finds that by the end of the 21st century nearly 2.5 million residential and commercial properties, collectively valued at \$1.07 trillion today, will be at risk of chronic flooding.”

Watson, R., McCarthy, J.J., & Hisas, L. (2017). *The economic case for climate action in the United States*. Alexandria, VA: Universal Ecological Fund.

<https://feu-us.org/case-for-climate-action-us2/>

“Economic losses from weather events influenced by human-induced climate change and health damages due to air pollution cause by fossil fuel energy production are currently causing an average of \$240 billion a year – or about 40% of the current economic growth of the United States economy.”

Weiss, D. J., & Weidman, J. (2013). *Disastrous spending: Federal disaster-relief expenditures rise amid more extreme weather*. Washington, D.C.: Center for American Progress.

<https://www.americanprogress.org/issues/green/reports/2013/04/29/61633/disastrous-spending-federal-disaster-relief-expenditures-rise-amid-more-extreme-weather/>

“The Center for American Progress conducted an analysis and found that the federal government—which means taxpayers—spent \$136 billion total from fiscal year 2011 to fiscal year 2013 on disaster relief. This adds up to an average of nearly \$400 per household per year... As climate change accelerates, so will federal spending on disaster relief and recovery, which will ultimately be paid for by taxpayers.”

World Health Organization. (2018). COP24 special report: health and climate change.

<http://www.who.int/iris/handle/10665/276405>.

“In economic terms, the benefit of reduced emissions would be equivalent to savings of US\$ 244–564 billion, or 1–2% of the GDP of the Region (at purchasing power parity). The saved costs of treating illness (US\$ 34.3 billion) would amount to 6–14% of the total economic benefit.”

Private

AON Benfield. (2017). *Weather, Climate & Catastrophe Insight: 2017 Annual Report*.

<http://thoughtleadership.aonbenfield.com/Documents/20180124-ab-if-annual-report-weather-climate-2017.pdf>

“Economic losses arising from natural disasters in 2017 were among the highest ever recorded on a nominal, inflation-adjusted, and normalized basis. The USD353 billion total was just the second year on record to ever surpass USD300 billion on an inflation-adjusted basis, joining 2011 with losses of USD486 billion. In terms of economic losses resulting solely from weather disasters, 2017 became the costliest year ever recorded at USD344 billion. This was higher than the USD294 billion incurred in 2005.”

CoreLogic. (2018). *Natural hazard and catastrophe solutions*.

<https://www.corelogic.com/solutions/natural-hazard-risk.aspx>

“We help you proactively manage your natural hazard and catastrophe risk with reports and data that help you evaluate the risk of one or several properties. We can also provide a

composite score of hazards associated with a single property or your entire portfolio. The models developed by our Ph.D.-level scientists answer three critical questions. What could happen? What if it happened? And what did happen?”

Moody's Investor Service. (2018). *Climate change risks outweigh opportunities for P&C (re)insurers*. https://www.moodys.com/research/Moodys-Climate-change-heightens-key-risks-for-PC-insurance-reinsurance--PR_380898 (attached to email).

“The property and casualty (P&C) insurance and reinsurance sectors have significant exposure to the economic consequences of climate change. Risks arise primarily from weather-related catastrophe exposures, potential claims on liability policies, and investments... Climate scientists expect the frequency and severity of weather-related catastrophe events to increase at higher temperatures and/or greater extremes in temperatures as sea levels rise.”

Munich RE. (2018). *NatCatSERVICE analysis tool*.

<https://natcatservice.munichre.com/>

Munich RE. (2018). *Climate change and natural disasters topic page*.

<https://www.munichre.com/topics-online/en/climate-change-and-natural-disasters.html>

“Many decades of acquired experience in researching, documenting, analysing and evaluation of natural catastrophes have made the NatCatSERVICE one of the most valued data sources for information on natural loss events worldwide. This unique archive provides comprehensive, reliable and professional data on insured, economic and human losses caused by any kind of natural peril.”

Holzheu, T., Lechner, R., Tamm, K., & Fan, Y.Y.I. (2018). *Swiss Re Sigma, No. 4*. Zurich: Swiss Re Institute. http://www.swissre.com/media/news_releases/nr20180410_sigma_global_insured_losses_highest_ever.html

“Underwriting conditions remain soft in 2018, particularly in commercial insurance, but are passing through an inflection point. This is in part due to the large hurricane losses in 2017 which set the stage for a price correction. An active hurricane season in the North Atlantic, and a series of wildfire, thunderstorm and severe precipitation events across different regions pushed global catastrophe (cat) claims to the highest level ever recorded in a single year. Total insured losses from natural catastrophes and large man-made disasters in 2017 were an estimated USD 144 billion. The hurricanes Harvey, Irma and Maria, and wildfires in California, resulted in significant losses in US Property and Casualty (P&C) re/insurance. The insured losses from the three hurricanes alone were estimated to be USD 92 billion. US insurers’ non-life underwriting results were also hit by USD 19 billion in claims resulting from tornadoes and convective storms, and USD 13 billion from the California wildfires.”

I hope you found this information helpful. Please let me know if you have any questions, or if you need any additional information.

Kind regards,
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