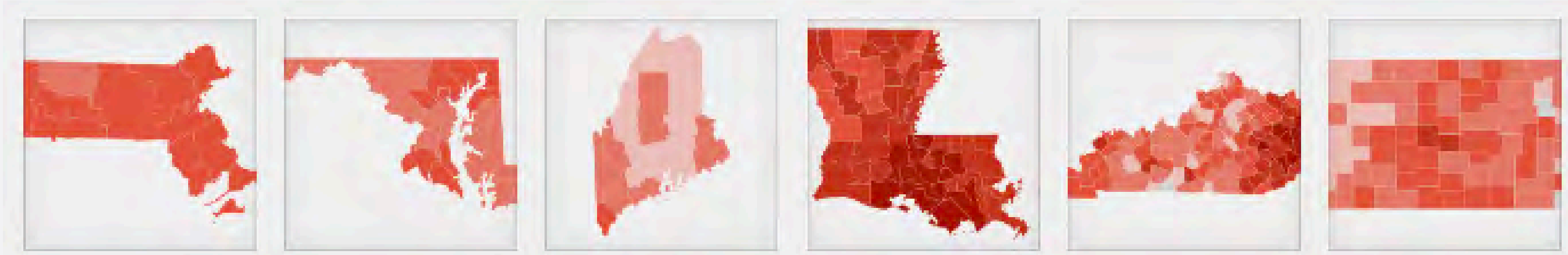
ATLAS OF DISASTER



REBUILD
BY
DESIGN

THANK YOU

FUNDERS

Siegel Family Endowment

with

Rockefeller Brothers Foundation

Tiger Global Philanthropic Ventures

CONTRIBUTORS

Research:

Eleni Myrivili

Hannah Crane

Georgetown Climate Center

Rosa Lander

Sam Horowitz

Graphic Design:

Austin Pena

Haerim Park

Gabrielle Napolitano

Geethanjali MR

Vishal Amler

Xenia Adjoubei

Editing:

Rose Winer

Matthew Greene

Fall 2022

AUTHORS

Amy Chester

Johanna Lawton

PARTNERS

APTIM:

Bridget Huston

Cris Weber

Heather Vollmer

Jane Brogan

Jeff Haney

Paul Tschirky

Samantha Danchuk

Steve Kral

Zhifei Dong

iParametrics:

Ariel Seigel

Jeff Stevens

Paul Pelletier

Mark Homrich

REBUILD BY DESIGN

IPK institute for public knowledge new york university

iParametrics

APTIM

DEAR FRIENDS,

Shortly after Hurricane Sandy devastated the Northeast ten years ago, Rebuild by Design was born. The organization began as an initiative of the federal government that coupled innovation and global expertise with community insight to develop implementable solutions to the region's most complex needs. At the heart of the process was a collaborative research and design challenge that called for the best minds of the world to work with local communities and local governments to address their newly understood vulnerabilities to climate change. In a first-of-its-kind process for the U.S., design teams worked with hundreds of community organizations and government entities to design physical and social infrastructure to address impending risks from extreme weather and sea level rise. That program grew into a family of interdisciplinary experts who recognize that the only way to tackle the challenges of increased vulnerability is to work alongside the communities who are most affected and to ensure every piece of infrastructure we build is designed to enhance communities every day, not just on days of extreme weather.

In the decade since Hurricane Sandy, we have witnessed a shift in public understanding of how climate change will affect our communities. People are seeing the impacts nearly every day on the news and on their doorsteps. Republican and Democrat, coastal and inland, urban and rural communities are all affected. Communities went from scorching politicians who mentioned the words "managed retreat" to asking for buyouts. Our federal government has begun to invest in climate adaptation planning before devastation occurs through programs like FEMA's Building Resilient Infrastructure and Communities (BRIC) and HUD's Community Development Block Grant Mitigation Funds (CDBG-MIT), rather than after. It is no longer an issue we can act on tomorrow; it is an issue we must act on today – right here, and right now – no matter where we are in the world.

However, we still have not seen the level of action necessary to help communities withstand massive devastation from increasingly frequent and intense climate events. Hurricanes Fiona and Ian ravished parts of Puerto Rico and Florida, displacing many and leaving others without power, water, and security – the human and financial toll of which are still unknown. While these might seem like one-off events, we know they are not. Through this research, we learned that 90 percent of U.S. counties have suffered through climate events in the past decade and over $92 billion of tax dollars have been allocated to help those populations recover. Between the infrastructure dollars states already have, those that have been made available through Building a Better America, the American Rescue Plan Act, the Inflation Reduction Act, and new sources proposed in this report, we can rebuild the country we want to see.

This report could not have been created without the incredible partnership of APTIM and iParametrics as well as the generous support of the Siegel Family Endowment, the Rockefeller Brothers Foundation, and Tiger Global Philanthropic Ventures. We have had an unbelievable team of engineers, researchers, finance experts, data managers, and volunteers supporting Rebuild in identifying, analyzing, and synthesizing different data sets and ideas into an accessible compendium of county-by-county climate impacts.

We are so fortunate to work with these partners, and we want to work with you, too. If you are passionate about these issues and are interested in our work, please reach out to info@rebuildbydesign.org to explore how to build climate-forward communities together.

Sincerely,

The Rebuild Team

WE WANT TO WORK WITH YOU!

REBUILD BY DESIGN PARTNERS WITH COMMUNITIES TO DESIGN REGIONAL AND LOCAL PROCESSES THAT CREATE AND IMPLEMENT INFRASTRUCTURE POLICY AND PROJECTS TO PREPARE COMMUNITIES FOR THE WORLD'S MOST PRESSING PROBLEMS.

WE RESEARCH, DEVELOP POLICY, AND EDUCATE THE NEXT GENERATION OF RESILIENCE PRACTITIONERS. DO YOU HAVE A VEXING CHALLENGE THAT NEEDS CREATIVE PROBLEM SOLVING? CONTACT US AT

INFO@REBUILDBYDESIGN.ORG

CONTENTS

THERE IS NO TURNING BACK

Ninety percent of U.S. counties have experienced a federal climate disaster between 2011-2021, with some having as many as 12 disasters during that time. In 2021 alone, the U.S. experienced 20 separate billion-dollar climate disasters with over 688 direct or indirect fatalities.[1] We can do better.

Every corner of the country, every topography, every built and natural environment faces a unique set of climate hazards. The slow onset of climate change impacts, or "stresses," negatively affects public health, well-being, and livelihoods. Then, at a moment's notice, an extreme weather event, or "shock," can drastically compound these challenges.

Around the country, average summer temperatures are rising, putting those without access to cooling appliances or centers – primarily the elderly, low-income individuals, those in manufactured housing, those displaced from housing, and those with preexisting health conditions – at risk of dehydration, stroke, or even death.[2] In urban environments, particularly in environmental justice communities, heat can worsen day-to-day air quality, amplifying the health impacts of noxious gasses or chemicals.[3] Along the coasts, low-lying lands are experiencing salt water intrusion as sea levels rise, which can contaminate drinking supplies, destroy farmland, and erode infrastructure.[4] Coastal and inland fisheries are seeing rapid declines in fish stocks as species migrate to cooler waters, crippling industries.[5] Invasive insects are following the warmer temperatures further and further north, wiping out crops across the Heartland.[6] Wells, aquifers, rivers, and streams are drying up, turning the agriculture industry on its head.[7] The worst is still yet to come.

Though the impacts of climate change are everywhere, they are not experienced equally. "Natural disasters" are not truly natural. Rather, they are the product of a natural hazard and the combination of social, political, and economic stressors. When a climate disaster occurs, underlying vulnerabilities – due to race, ethnicity, gender, age, sexuality, income, or ability – are magnified, creating a greater risk for certain populations. Comprehensive, targeted, climate adaptation infrastructure improvements are needed to ensure we are prioritizing those who have been historically underserved by the government.

Resilient infrastructure investments must be made with the direction of those who need it most – without an eye towards equity, maladaptation practices or inaction pose the risk of deepening socioeconomic divides by negatively impacting the populations who particularly need support. As governments begin to invest in adapting to climate change, it is crucial to look at where inequities create vulnerabilities before, during, and after an extreme weather event. To name a few examples (see more cascading impacts on p.12):

Prior to a major climate event: Lower-income individuals who do not have the resources to evacuate, those who may not trust government (due to language barriers, historic marginalization, or citizenship status), and those whose physical health or ability prevents them from evacuating are at greater risk of negative health impacts, injury, and death.

During a climate event: Residents who are in close proximity to hazardous infrastructure such as wastewater treatment plants or superfund sites are at even greater risk to toxins when the infrastructure malfunctions or breaks down.

Immediate aftermath of a climate event: Those with language barriers, high distrust in government (due to historic disinvestment, fear of arrest, or fear of deportation), and rural communities who have greater distances to emergency services or whose government entities have less capacity face additional challenges in accessing emergency resources – including medical care, food, or shelter – and are more likely to experience physical and emotional trauma due to exposure to additional hazards such as contaminated waters, smoke, pollution, toxic mold, falling trees, live electric wires, and pests.[8]

Longer-term effects of a climate event: Inequalities are exacerbated by the very systems put in place to help recovery. Low-income communities and communities of color often fare the worst, encountering greater barriers to accessing recovery assistance.[9] Lower-income households also typically have less of a financial safety net to withstand additional negative economic impacts that follow an extreme weather event, and may lack insurance or be underinsured.[10] Additionally, federal assistance dollars disproportionately benefit homeowners over renters, who are more often concentrated in lower-income communities.[11] Renters are also more likely to be displaced after an event, as they face evictions and rent hikes from landlords who have to fix their properties. In rural communities, local governments with small staff often do not have the capacity to apply for disaster preparedness funding and can be left out of valuable federal programs. The shocks to a rural county may be more acute due to the smaller scale of their economies, less organizational support, and less capacity to respond at scale.[12]

Effective climate adaptation practices have the potential to lower the risk of climate events to communities while addressing existing underlying vulnerabilities and improving the health, safety, wellbeing, and economic development of those in greatest need. By investing in infrastructure that reduces the impacts of severe weather events before a disaster strikes, communities, the built environment, and the economy will be better prepared for a future with more climate extremes.

CLIMATE DISASTERS EXACERBATE ECONOMIC VULNERABILITY

A STUDY BY THE URBAN INSTITUTE FOUND THAT A COMMUNITY HIT BY A MEDIUM-SIZED NATURAL DISASTER LEADS TO A FIVE PERCENT INCREASE IN DEBT COLLECTIONS AFTER ONE YEAR, AND THIS DOUBLES TO 10 PERCENT AFTER FOUR YEARS.[1]

PEOPLE LIVING IN COMMUNITIES OF COLOR HIT BY MEDIUM-SIZED DISASTERS EXPERIENCED AN AVERAGE 31-POINT DECLINE IN THEIR CREDIT SCORE, COMPARED WITH A 4-POINT DECLINE FOR AFFECTED PEOPLE IN MAJORITY-WHITE COMMUNITIES.[2]

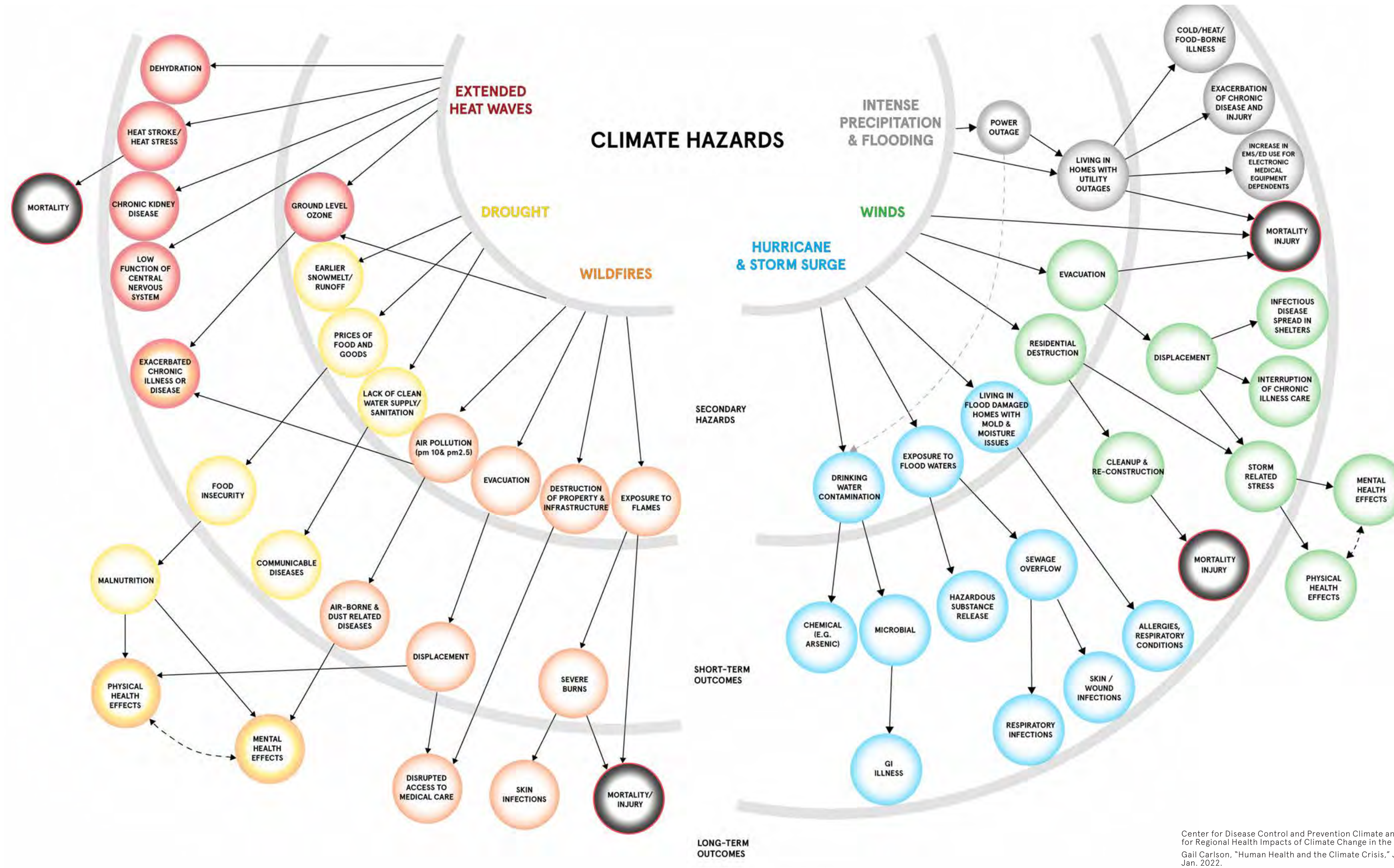
ACCORDING TO A REPORT FROM THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA), 40 PERCENT OF BUSINESSES DO NOT REOPEN FOLLOWING A DISASTER. ON TOP OF THAT, ANOTHER 25 PERCENT FAIL WITHIN ONE YEAR.[3]

THE STUDY ALSO FOUND THAT 90 PERCENT OF BUSINESSES FAIL WITHIN A YEAR OF A DISASTER IF THEY CANNOT REOPEN WITHIN FIVE DAYS OF THE DISASTER.[4]

HOLDERS OF STANDARD FLOOD INSURANCE POLICIES (WHICH ARE UNDERWRITTEN BY FEMA THROUGH THE NFIP PROGRAM) ARE ELIGIBLE FOR $250,000 FOR STRUCTURAL DAMAGE, AND AN ADDITIONAL $100,000 FOR CONTENT. HOUSEHOLDS WITHOUT INSURANCE ARE ELIGIBLE FOR FEMA'S INDIVIDUALS AND HOUSEHOLDS PROGRAM. THE CAP ON THIS AID IS ADJUSTED EVERY YEAR AND WITH DIFFERENT DISASTERS. FOR INSTANCE, FOR HURRICANE SANDY, IT WAS ABOUT $30,000.[5]

1 Urban Institute, "Insult to Injury: Natural Disasters and Residents' Financial Health," 2019.
2 Urban Institute, 2019.
3 FEMA, 2019.
4 FEMA, 2019.
5 NFIP, "Flood Insurance Manual," FEMA, 2021.

CASCADING IMPACTS OF CLIMATE EVENTS



Center for Disease Control and Prevention Climate and Health Program, "Preparing for Regional Health Impacts of Climate Change in the United States," July 2020.

Gail Carlson, "Human Health and the Climate Crisis," Jones and Bartlett Learning, Jan. 2022.

Kathryn Lane, Kizzy Charles-Guzman, Katherine Wheeler, Zaynah Abid, Nathan Graber and Thomas Matte, "Health effects of coastal storms and flooding in Urban Areas: A Review and Vulnerability Assessment," Journal of Environmental and Public Health Volume 2013. http://dx.doi.org/10.1155/2013/913064

Illustration: Geethanjali MR

ENDNOTES

1. Smith, Adam B. "2021 U.S. Billion-Dollar Weather and Climate Disasters in Historical Context." NOAA Climate.gov, www.climate.gov/news-features/blogs/beyond-data/2021-us-billion-dollar-weather-and-climate-disasters-historical.
2. Kenny, Glen P, et al. "Heat Stress in Older Individuals and Patients with Common Chronic Diseases." CMAJ : Canadian Medical Association Journal, Canadian Medical Association, 13 July 2010, www.ncbi.nlm.nih.gov/pmc/articles/PMC2900329/.
3. "Heat Islands." EPA, Environmental Protection Agency, www.epa.gov/heatislands.
4. Saltwater Intrusion: A Growing Threat to Coastal Agriculture." USDA Climate Hubs, www.climatehubs.usda.gov/hubs/northeast/topic/saltwater-intrusion-growing-threat-coastal-agriculture.
5. Goldfarb, Ben. "Feeling the Heat: How Fish Are Migrating from Warming Waters." Yale E360, https://e360.yale.edu/features/feeling-the-heat-warming-oceans-drive-fish-into-cooler-waters.
6. "Climate Change and Invasive Species." NISAW, 8 Mar. 2022, www.nisaw.org/climatechange/.
7. "Drought and Climate Change." Center for Climate and Energy Solutions, 23 Aug. 2022, www.c2es.org/content/drought-and-climate-change/.
8. Zaveri, Mihir, et al. "How the Storm Turned Basement Apartments into Death Traps." The New York Times, The New York Times, 2 Sept. 2021, www.nytimes.com/2021/09/02/nyregion/basement-apartment-floods-deaths.html.
9. Greater Impact: How Disasters Affect People of Low Socioeconomic Status. SAMHSA, 2017, https://www.samhsa.gov/.
10. Krause, Eleanor, and Richard V Reeves. "Hurricanes Hit the Poor the Hardest." Brookings, Brookings, 9 Mar. 2022, www.brookings.edu/blog/social-mobility-memos/2017/09/18/hurricanes-hit-the-poor-the-hardest/.
11. Hersher, Rebecca, and Robert Benincasa. "How Federal Disaster Money Favors the Rich." NPR, 5 Mar. 2019, www.npr.org/2019/03/05/688786177/how-federal-disaster-money-favors-the-richaspeninstitute.org/blog-posts/the-calm-before-the-storm-disaster-planning-and-rural-resilience/.
12. Deaton, Clifford D. "The Calm before the Storm: Disaster Planning and Rural Resilience." The Aspen Institute, 5 May 2022, www.aspeninstitute.org/blog-posts/the-calm-before-the-storm-disaster-planning-and-rural-resilience/.

HOW DISASTERS ARE FUNDED

DISASTER DECLARATION PROCESS

Our new climate reality calls for widespread investments in comprehensive climate adaptation and hazard mitigation. The current process by which federal disasters are declared – and money allocated – represents a time when climate disasters were anomalies. This is no longer the case. The United States needs to catch up to the current reality and rethink how to shift resources to prepare communities before there is human suffering and physical, economic, and social harm to communities.

Over the past ten years, the body of resources available to localities to advance adaptation to climate impacts has grown significantly: community organizations have worked alongside communities in disaster recovery and preparation; research institutions have made more and more data available to communities to better understand their risk; and the U.S. federal government has begun to make strides in incentivizing pre-storm infrastructure investments with grant programs such as Building Resilient Infrastructure and Communities (BRIC), the Hazard Mitigation Grant Program (HMGP), Community Development Block Grant Mitigation Funds (CDBG-MIT), Flood Mitigation Assistance (FMA), and the Community Rating System (CDBG-MIT). However, most federal climate adaptation programs are awarded to a locality that has **already** suffered from a disaster, rather than building community-wide preparedness **before** a disaster occurs.

In the event of extreme weather, such as a hurricane, flood, wildfire, or drought, states can turn to the federal government for post-disaster recovery funds. This process is outlined in the 1988 Stafford Act, which allows the President of the United States to declare a Disaster if the damage is of such severity that it is "beyond the combined capabilities of state and local governments to respond."[1]

According to the Stafford Act, as amended in May 2021, a "major disaster" includes "any natural catastrophe (including any hurricane, tornado, storm, high water, winddriven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought), or, regardless of cause, any fire, flood, or explosion, in any part of the United States, which in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance under this Act to supplement the efforts and available resources of States, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby."[2]

In the immediate aftermath of an extreme weather event, a state can declare a state disaster. Then, the state can work with FEMA to request a Preliminary Damage Assessment to determine cost of damage, imminent threats to public health and safety, and whether it meets the threshold for a federal declaration. The Governor or Tribal Chief Executive then submits a request for a federal Disaster Declaration to the President of the United States within 30 days of the event. The request includes documentation of the amount and severity of damage, state or Tribal resources allocated, and preliminary estimates and amount requested. FEMA reviews the request and sends a recommendation to the President who makes the final determination. States then qualify for FEMA's disaster response funding and are awarded Individual Assistance (IA) for homeowners and renters and/or Public Assistance (PA) for local and state governments. [See allocation of these resources in the maps starting on p.34 in "Mapping the Impact."]

Under certain conditions that have brought, or are expected to bring, challenges beyond the capacity of the local government, an Emergency Declaration can be leveraged. Federal assistance is then provided to meet the need of the specific emergency or to prevent one from occurring; however, this declaration does not unlock the suite of federal programs to support long-term planning.

In the cases of severe disasters that require additional financial support, Congress may vote to appropriate additional recovery assistance through an allocation through the Department of Housing and Urban Development's (HUD) Community Development Block Grant for Disaster Recovery (CDBG-DR) funding which allows for more flexibility and capacity to localities. Since CDBG-DR is not a permanent program, the funding and the timing is not reliable for immediate needs. It often takes Congress time to determine the amount of CDBG-DR funding to be allocated to HUD. Once funds are allocated by Congress, HUD uses a formula to determine the amount of funds to be allocated to states or local municipalities – requiring that 80 percent of a state's allocation needs to be spent in the most impacted and distressed areas. HUD then publishes the allocation amounts and funding rules in a Federal Register Notice. The Bipartisan Policy Center has calculated that it takes HUD on average 318 days after a disaster was officially declared to release the notice for availability of funding (with funding coming between 76 - 655 days after a disaster).[3]

There are other federal departments that provide disaster response funding, such as Small Business Services, the Department of Agriculture, and the U.S. Army Corp of Engineers – each with their own timeline and process for distributing funds. Additionally, Congress may vote to appropriate additional recovery assistance through allocations to HUD's CDBG-DR, and other authorities from other federal agencies. While imminent threats to public safety and health are factors in the evaluation of declaration requests, the main drivers are physical damage and economic losses. As a result, disasters such as heat waves, which are globally affecting millions of people each summer, do not appear in federal Disaster Declarations, unlocking funding for both short-term emergency needs and longer-term risk reduction.[4]

The U.S. must overhaul its post-disaster application process and shift investments into pre-disaster mitigation.

THE CURRENT SYSTEM IS:

Politicized - **Politics plays a role in post-disaster allocations. Currently, Congress determines how much to spend on a specific disaster (or more often now, a group of disasters).** Congress can choose to allocate additional dollars such as Community Development Block Grant Disaster Recovery (CDBG-DR) to assist impacted localities; however, the timeline for this allocation and the amount of additional funds are solely up to Congress.

Undependable - A majority of disaster risk funding is only available after a presidentially declared major disaster which creates challenges for government agencies that need predictable funding to develop programs. There is also no guarantee that a president will make a declaration, a decision that can be swayed by party politics and election cycles.[5]

Retroactive - Funding is predominantly distributed to areas where there is a "tie-back" to a climate event, meaning a community will have already experienced a major climate disaster when they receive money to implement adaptation strategies.

IMAGE: STATE OF NEW JERSEY

ENDNOTES

1. "How a Disaster Gets Declared." *FEMA.gov,* FEMA, www.fema.gov/disaster/how-declared#:~:text=%C2%A7%C2%A7%20 5121%2D5207%20(the,and%20the%20Commonwealth%20of%20the.
2. "Stafford Act, as Amended." *FEMA.gov*, FEMA - Office of Chief Counsel, www.fema.gov/sites/default/files/documents/ fema_stafford_act_2021_vol1.pdf.
3. Gimont, Stan. "CDBG-Dr Program's Lack of a Permanent Authorization Has Unintended Consequences for Recent Allocations." *Bipartisan Policy Center,* 28 Mar. 2022, https://bipartisanpolicy.org/blog/ cdbg-dr-programs-lack-of-a-permanent-authorization-has-unintended-consequences-for-recent-allocations/.
4. *Selected Federal Financial Assistance for Emergency Response to Extreme Heat: In Brief,* Congressional Research Service, 9 Apr. 2021, https://crsreports.congress.gov/product/pdf/R/R46873. https://digitalscholarship.tsu.edu/cgi/viewcontent.cgi?article=1027&context=jpmsp
5. Gasper, John T. "The Politics of Denying Aid: An Analysis of Disaster Declaration Turndowns," *Journal of Public Management & Social Policy:* Vol. 22 : No. 2 , Article 7, 2015.

OVERLOOKING THE DEADLIEST RISK: EXTREME HEAT

"One reason we pay so little attention to heat waves is that American disaster policy is designed to insure property, not to promote human health or protect life."
-Eric Klinenberg

Extreme heat is the number one weather-related cause of death in the U.S.,[1] and yet it has never been the cause of a federal Disaster Declaration.[2] According to an analysis of provisional mortality data collected by the Centers for Disease Control and Prevention (CDC), heat was a contributing factor in 1,577 U.S. deaths in 2021 – a 56 percent jump from 1,012 in 2018.[3] It is estimated that about 800 people died in Washington and British Columbia as a result of record-breaking hot temperatures in neighborhoods that lacked the infrastructure to cool its residents.[4] Heat wave frequency and duration has risen steadily from an average of two heat waves per year during the 1960s to six per year during the 2010s and 2020s,[5] with the last eight years being the hottest on record.[6]

In addition to being linked to growing mortality rates, extreme heat can lead to a number of negative health impacts such as heat stroke and kidney failure (see p. 12). According to the Center for Disease Control (CDC), older adults, infants and children, those with chronic conditions, lower-income individuals, athletes, outdoor workers, and pregnant women are disproportionately affected by increased heat.[7] Urban areas have additional challenges due to dense concentrations of concrete and pavement instead of natural areas, known as the "urban heat island effect." Urban centers can be up to 10-15°C higher than in their rural surroundings.[8] Within cities, areas with less green space, often BIPOC or low-income communities are likely to experience greater exposure to extreme heat, with higher rates of adverse outcomes.[9]

Increased and prolonged heat events also have economic impacts. Under baseline climate conditions, the U.S. could lose an average of approximately $100 billion annually from heat-induced lost labor productivity, which could double to nearly $200 billion by 2030 and reach $500 billion by 2050.[10] This includes loss of agriculture due to lower labor productivity and lower crop yields.

Federal Disaster Declaration data does not reflect the severity of extreme heat occurrences, because these events do not cause major property damage – a threshold to determine a federal Disaster Declaration. Heat primarily causes damage to physical bodies, resulting in loss of life or labor. For example, Nevada, the state with the lowest number of disaster occurrences, and Arizona, ranked 40th in disaster occurrences for the last decade (see p. 654), have the highest deaths from heat illnesses from 2018-2021. In those four years, heat has been among the causes of death for 571 people in Nevada and 1,298 people in Arizona.[11] That's 4.54 and 4.46 deaths per 100,000 residents respectively – compared to the U.S. average of 0.35 per 100,000 residents over the same period. Additionally, it should be noted that deaths caused by extreme heat are likely undercounted, as there are no comprehensive mechanisms for healthcare providers to track or report heat-related deaths. Often, mortality data ascribes the cause of death to an underlying health condition or cascading effect (such as wildfires and droughts), not to the extreme heat event which exacerbated conditions.

Climate mitigation efforts through carbon reduction targets are essential to slowing the rate at which global temperatures are rising; however, these efforts must be coupled with heat adaptation investments to protect people **now** from the temperature thresholds we've already surpassed. Further, additional policy changes are needed to the way governments and scientists communicate heat risk. Recently, California became the first state to rank heat waves, as is the practice for other extreme climate events such as hurricanes, so its residents understand their exposure to this deadly risk. Globally, Seville, Spain, became the first city to implement a heat wave naming and categorization system to better communicate risk[12] and enable the government to respond with effective and appropriate heat risk reduction interventions. Athens followed with a similar pilot project focusing on the most vulnerable populations.[13]

As we move toward investing in climate infrastructure, we can integrate heat infrastructure along with flood infrastructure by building nature-based solutions to simultaneously reduce flood risk to communities and reduce the urban heat island effect. The U.S. must prioritize local investments to lower extreme temperatures. Cooling stations, increased tree canopy, and investments in green roofs are examples of mitigation measures that can lower extreme heat. Building heat adaptation should also be folded into existing energy-upgrades of the building sector, as all mitigation efforts can be most effective through mitigation/adaptation combined initiatives. However, until heat is understood to have equally severe effects as other weather-related disasters, governments will continue to underinvest in heat hazard mitigation.

AIR TEMPARTURE ON JULY 13, 2022

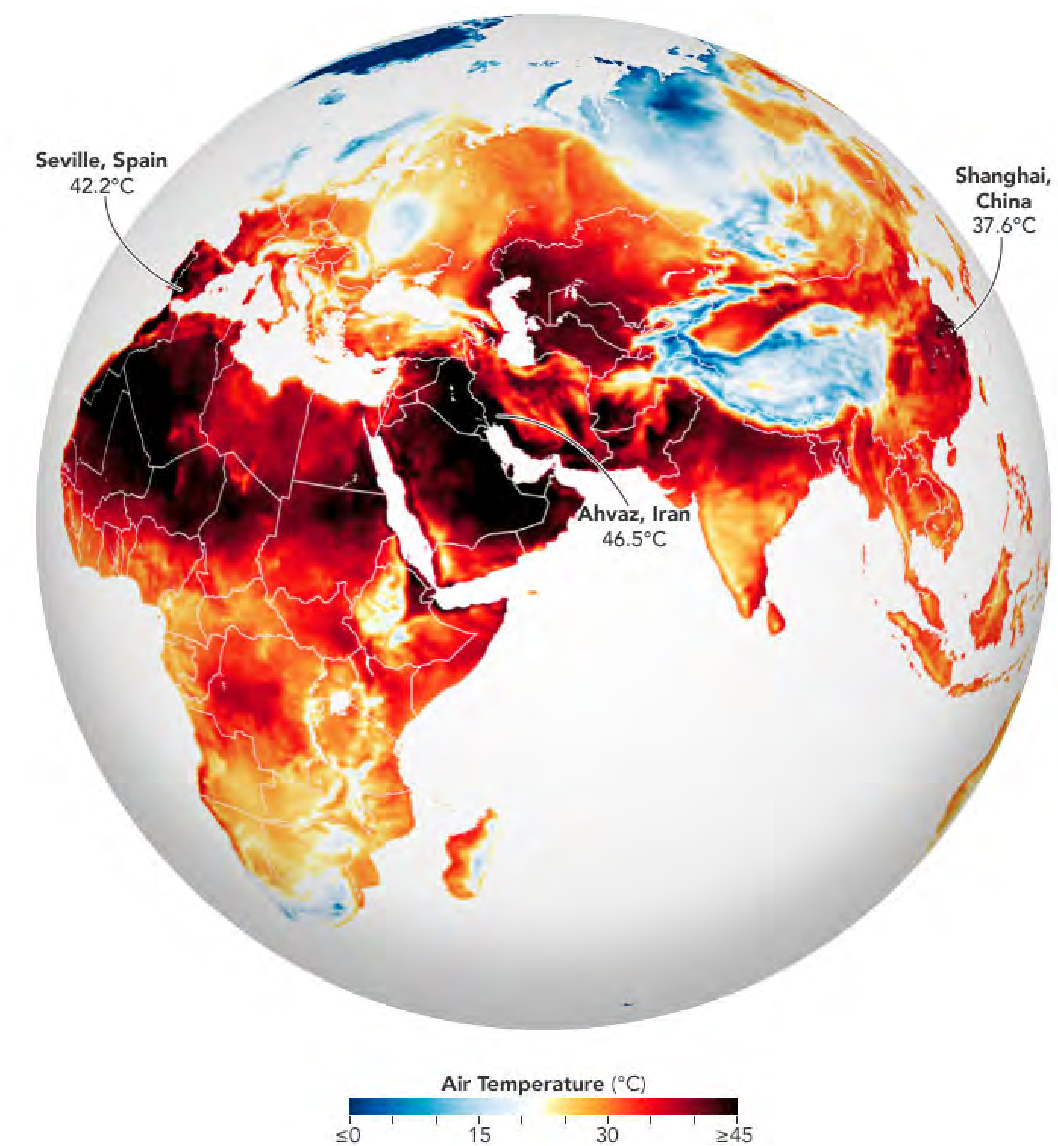


IMAGE: NASA EARTH OBSERVATORY

THE OUTSIZED IMPACT OF DROUGHT

Extreme heat, when coupled with lack of precipitation over an extended period of time, can lead to drought, directly impacting water supply for households and ecological habitats, as well as agriculture, transportation, and energy, among other sectors. Decreased streamflow, dry soils, and large-scale tree deaths can lead to habitat degradation, as well as the increased spread of wildfires, and flash floods as soils become less water absorptive (for more information about the cascading impacts of drought, see p.12).[1]

Drought not only impacts those whose lives and livelihoods depend on the water supply; its negative economic repercussions extend to the rest of the country and beyond. Periods of drought lead to reduced agricultural production, which, in addition to creating financial losses for farmers, creates variability in price and accessibility of food. The food supply chain is further disrupted, as low water levels make it harder for ships to access ports. Likewise, the supply of other critical goods and services can be stalled, if not halted, for extended periods of time. For example, in the summer of 2021, Rotterdam, Europe's biggest port, experienced major droughts lowering the river depth to the extent that large cargo ships could not access the port, contributing to challenges in the global supply chain.[2]

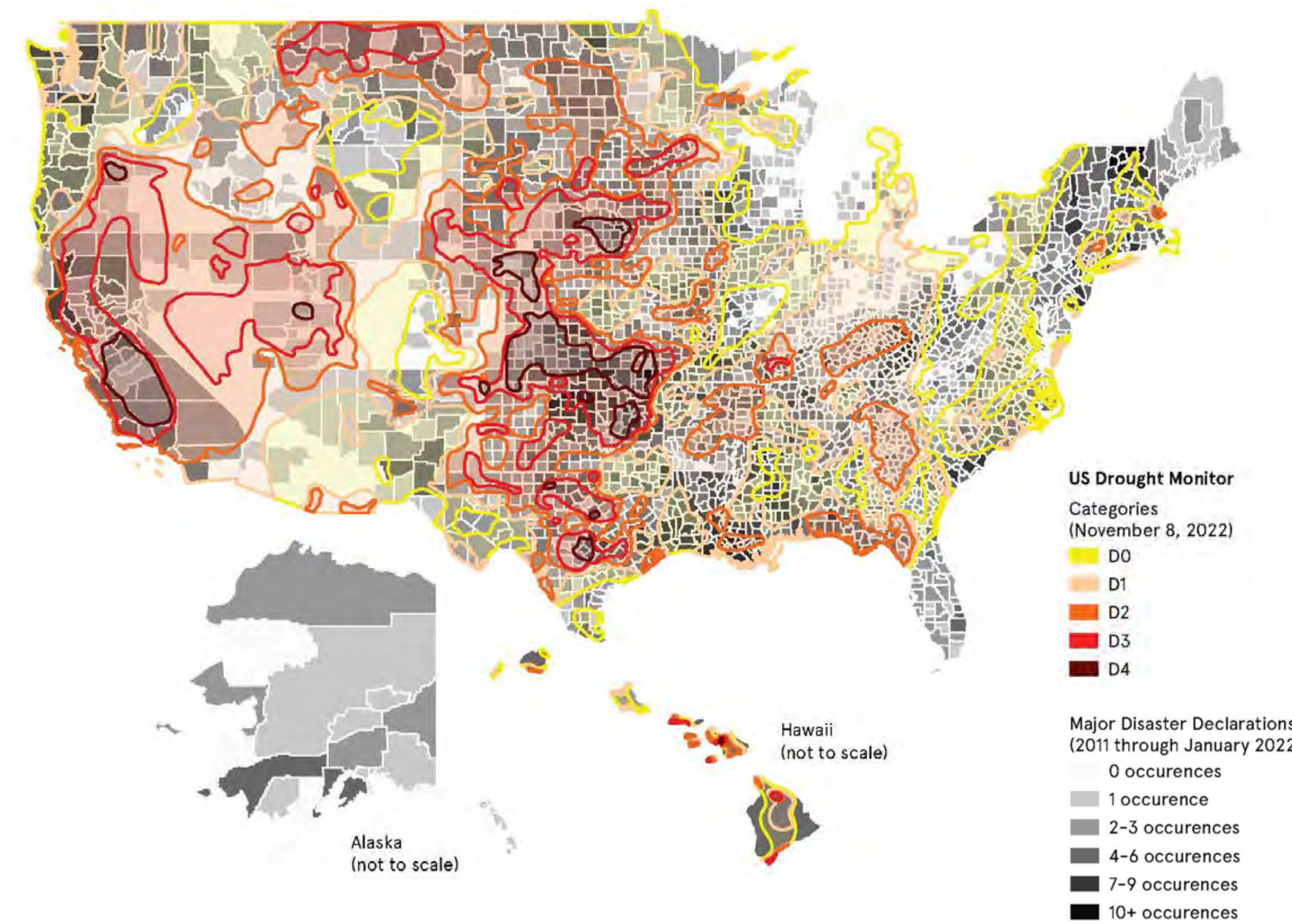
Ongoing water shortages further contribute to increasing carbon dioxide levels in the atmosphere and amplify the human made causes of the climate crisis. Water shortages, particularly in reservoirs, can reduce the amount of energy output of hydroelectric dams, resulting in further reliance on more carbon intensive energy sources.[3] Additionally, ecosystems under stress due to lack of water absorb less carbon dioxide, resulting in even higher annual carbon emissions.[4]

As heat waves are becoming more frequent and precipitation more variable, the frequency and duration of droughts in the U.S. are also on the rise.[5] Since 2000, the Southwest United States has been experiencing an unprecedented period of extreme drought.[6] From 2011 to 2020, the U.S. experienced nine billion-dollar drought events.[7]

Drought conditions that substantially affect farmers causing severe production losses are eligible for disaster declarations from either FEMA through the traditional federal declaration process, or the USDA, through one of two different processes. A Fast Track Secretarial disaster provides an "automatic designation" when any portion of a county meets a severe drought level substantially affecting local agriculture, coupled with an "intensity value" that exceeds eight weeks or other factors. Non Fast Track disasters are found in counties that have a 30 percent production loss of at least one crop, or challenges accessing loans.[8] Disaster Declarations qualify government support in loans or grants for agricultural losses.

Consequently, the disaster declaration data used in this report does not capture all drought-related occurrences and costs, as it only utilizes events declared and funds obligated through FEMA. The available data likely also undercounts the frequency of drought disasters because federal declaration processes were designed to respond to major events that completely overwhelm local governments. However, the slow-onset nature of droughts make it challenging to tie them to a start and end date and to prove direct economic losses during that time bound period.

U.S. DROUGHT AND DISASTER DECLARATION OCCURRENCES



Data Sources: U.S. Census Bureau, Federal Emergency Management Agency, National Drought Mitigation Center, U.S. Department of Agriculture, National Oceanic and Atmospheric Administration | Map courtesy of iParametrics

The above map overlays 2022 U.S. drought data over county-level disaster declaration data from 2011 to January 2022. The map shows that some areas with relatively low disaster counts have experienced recent severe droughts. For example, Fresno County and Madera County in California have each received one disaster declaration (due to wildfires) since 2011.

Conversely, some counties with high frequencies of disasters from other climate hazards are also experiencing severe drought, and should therefore utilize a multi hazard approach in their climate adaptation efforts. For example, Craig County in Oklahoma has experienced 10 disasters since 2011, due to severe storms, tornadoes, straight line winds, and flooding. To date, Craig County has not received a FEMA disaster declaration due to drought, though the severity of drought on the U.S. drought monitor suggests it will need to be accounted for in forthcoming adaptation measures.

ENDNOTES (HEAT)

1. Klinenberg, Eric. "Heat Wave: A Social Autopsy of Disaster in Chicago," University of Chicago Press, 2015.
2. Tran, Andrew, and John Muyskens. More Dangerous Heat Waves Are on the Way: See the Impact by ZIP Code. The Washington Post, 15 Aug. 2022, www.washingtonpost.com/climate-environment/interactive/2022/extreme-heat-risk-map-us/.
3. Davis, Maggie. "Heat-Related Deaths up 56% between 2018 and 2021, Provisional Data Shows." ValuePenguin, ValuePenguin, 6 June 2022, www.valuepenguin.com/heat-related-deaths-study#Key.
4. "Blistering Heatwave Suspected in 14 Oregon Deaths." The Guardian, Guardian News and Media, 2 Aug. 2022, https://www.theguardian.com/us-news/2022/aug/01/heatwave-suspected-14-oregon-deaths#:~:text=About%20800%20people%20died%20in,(46.7C)%20in%20Portland.
5. "Climate Change Indicators: Heat Waves." EPA, Environmental Protection Agency, www.epa.gov/climate-indicators/climate-change-indicators-heat-waves.
6. Hausfather, Zeke. State of the Climate: 2022 on Track for a Summer of Extreme Heat. Carbon Brief, 26 July 2022, https://www.carbonbrief.org/state-of-the-climate-2022-on-track-for-a-summer-of-extreme-heat/.
7. Extreme Heat. Centers for Disease Control and Prevention, 17 June 2022, https://www.cdc.gov/disasters/extremeheat/index.html.
8. "Cities Are Often 10-15 °C Hotter than Their Rural Surroundings." EU Science Hub, 25 July 2022, https://joint-research-centre.ec.europa.eu/jrc-news/cities-are-often-10-15-degc-hotter-their-rural-surroundings-2022-07-25_en.
9. Hsu, Angel, et al. "Disproportionate Exposure to Urban Heat Island Intensity across Major US Cities." Nature News, Nature Publishing Group, 25 May 2021, https://www.nature.com/articles/s41467-021-22799-5.
10. The Economic and Social Consequences for the United States. Atlantic Council Adrienne Arsht Rockefeller Foundation Resilience Center, Aug. 2021, https://www.atlanticcouncil.org/wp-content/uploads/2021/08/Extreme-Heat-Report-2021.pdf.https://www.nature.com/articles/s41467-021-22799-5
11. Davis, Maggie. "Heat-Related Deaths up 56% between 2018 and 2021, Provisional Data Shows." ValuePenguin, ValuePenguin, 6 June 2022, https://www.valuepenguin.com/heat-related-deaths-study#Key.
12. Williams, Ashley R. "California Becomes First US State to Begin Ranking Extreme Heat Wave Events." USA Today, Gannett Satellite Information Network, 13 Sept. 2022, https://www.usatoday.com/story/news/nation/2022/09/12/california-becomes-first-state-start-ranking-extreme-heat-waves/8061975001/.
13. How Does a Health-Based Heat Wave Categorizing and Naming System Work? Adrienne Arsht-Rockefeller Foundation Resilience Center, 10 Aug. 2022, https://onebillionresilient.org/2022/06/23/a-health-based-heatwave-categorizing-and-naming-system/
14. "Categorizing and Naming Heat Waves." Adrienne Arsht-Rockefeller Foundation Resilience Center, 13 Oct. 2022, https://onebillionresilient.org/project/categorizing-and-naming-heat-waves/. https://onebillionresilient.org/project/extreme-heat-resilience-alliance/
15. Extreme Heat Resilience Alliance. Adrienne Arsht-Rockefeller Foundation Resilience Center, 24 Aug. 2022, https://onebillionresilient.org/project/extreme-heat-resilience-alliance/.

ENDNOTES (DROUGHT)

1. "Wildfire Management." National Integrated Drought Information System, NOAA, 2022, https://www.drought.gov/sectors/wildfire-management#:~:text=Drought%20can%20be%20a%20contributing,probability%20of%20large%2Dscale%20wildfires.
2. Hogan, Michael. "Shipping Disruption Continues as Rhine Water Levels Fall Again in Germany." Reuters, Thomson Reuters, 12 Aug. 2022, https://www.reuters.com/markets/commodities/shipping-disruption-continues-rhine-water-levels-fall-again-germany-2022-08-12/.
3. "Energy." National Integrated Drought Information System, NOAA, 2022, https://www.drought.gov/sectors/energy#:~:text=Low%20water%20levels%20in%20reservoirs,be%20generated%20by%20hydroelectric%20dams.&text=High%20temperatures%20that%20often%20accompany,which%20can%20impact%20energy%20infrastructure.
4. Zurich, ETH. Drought Increases CO2 Concentration in the Air. ScienceDaily, 29 Aug. 2018, https://www.sciencedaily.com/releases/2018/08/180829133214.htm#:~:text=Summary%3A,next%20generation%20of%20climate%20models.
5. Wuebbles, Donald J, et al. "Climate Science Special Report: Droughts, Floods, and Wildfire." GlobalChange.gov, U.S. Global Change Research Program, 2017, https://science2017.globalchange.gov/chapter/8/.
6. Droughts and Climate Change. U.S. Geological Survey, https://www.usgs.gov/science/science-explorer/climate/droughts-and-climate-change#:~:text=Drought%20is%20a%20serious%20environmental,now%20and%20into%20the%20future.
7. Drought and Climate Change. Center for Climate and Energy Solutions, 23 Aug. 2022, https://www.c2es.org/content/drought-and-climate-change/#:~:text=How%20climate%20change%20contributes%20to,the%20timing%20of%20water%20availability.
8. Disaster Assistance - Emergency Disaster Designation and Declaration Process. USDA Farm Service Agency, https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/emergency_disaster_designation_declaration_process-factsheet.pdf.

COST OF INACTION

WE ARE ALREADY PAYING

The costs of not being prepared for future storm surge and rain events are massive and increasing. Smart investments in preparedness can prevent these escalating losses and provide additional benefits for the economy by creating hundreds of thousands of jobs and increasing opportunities for new economic development. By planning ahead, the efficiency and effectiveness of infrastructure projects increase, as they cost less to build in a non-disaster environment. Moreover, a longer-term planning approach with a funding guarantee by the government incentivizes private co-financing and innovation, as payback and benefits can be measured on a longer horizon.

For this report, APTIM forecasted future costs to taxpayers for flooding and found that from 1980 to 2021, damage costs of over $164 billion resulted from the 35 most costly *flooding* events in the U.S.[1] On average, the cost of these disasters per year was $3.9 billion. Despite the randomness of the occurrences of costly flooding disasters over the period, it was ultimately determined that the frequency of events increased linearly. To project future costs, past events were combined with scenario projections of increasing costs ranging from 15 to 25 percent over a 50-year period to yield a forecast for flood damage costs from billion-dollar scale events from 2022 through 2031. **The forecasted costs of flooding for the next 10 years totaled nearly $72B, which represents roughly the state spending of AK, DE, NH, MT, SD, VT, and WY combined.**

The methodology used to determine the forecast included a return period analysis of the damage costs by event, a linear regression analysis of the event frequency, and a projection of cost based on the cost per year and the number of events per year. A Monte Carlo simulation of 10,000 scenarios with various numbers of annual events and magnitudes of damage costs was computed and verified the likelihood of the forecasted damage costs yielded from the projections.

The returns on investing in flood adaptation measures, however, are higher than the costs. The National Institute of Building Sciences estimates every $1 spent on flood mitigation saves society an average of $6[2] – a figure that covers only return on investment for physical mitigation, not the money saved by avoiding economic disruption or devastating social impacts from future climate events. Spending dollars on resilient infrastructure will pay off.

HOW MUCH IS ENOUGH?

The losses from recent disasters are greater than the investments obligated to recovery. To build resilience, investments need to have significant returns with multi-purpose benefits.

The losses from major disasters over the past five years have exceeded $759 billion (2017-2021).[3] The amount of federal disaster recovery funds obligated or provided during this similar period (2017-2022) were $103 billion, less than 14 percent of the losses or need for repair and replacement.[4] To avoid such losses in the future, mitigation and resilience projects with return on investment ratios higher than 7:1 would be required.

Recent flooding disasters since 2017 have resulted in annualized costs over $152 billion.[5] Assuming projects

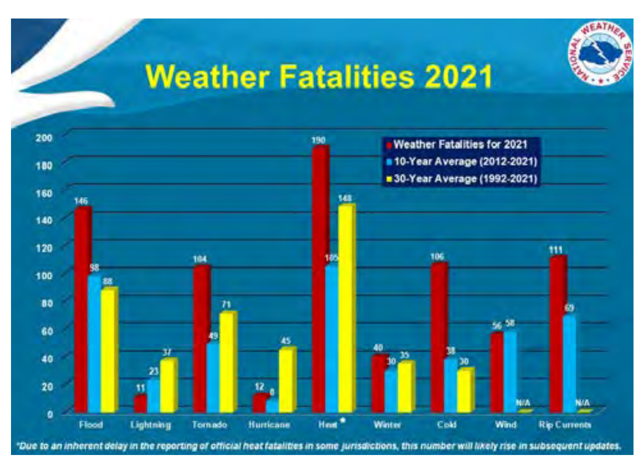


IMAGE: NATIONAL WEATHER SERVICE | NOAA

were required to provide a minimum ROI of seven, federal, state, and local climate mitigation investments of at least $22 billion annually would be necessary to offset losses from flooding alone. Current investments are falling far short of this requirement. The Infrastructure Investment and Jobs Act is anticipated to provide $10 billion annually billion annually for five years towards climate, transportation and flood resilience programs).[6] Sustained annual investments orders of magnitude greater (2x) would be required to avoid projected future losses.

THERE ARE HIGH COSTS TO INACTION

In addition to the immediate costs associated with damage from climate disasters, there are the costs of lost economic opportunity; it takes years to rebuild businesses, tourism, and other economic engines following an event – all during which it is individual community members who bear the burden. These climate events and their consequences will only get worse and require more investment.

Credit rating agencies are paying increased attention to these risks. The credit rating firm Moody's warned as early as 2017 that climate change would have an increasingly negative impact on the creditworthiness of U.S. state and local issuers—particularly those without sufficient adaptation and mitigation strategies—making it more expensive to borrow later.[7] States are enduring millions of dollars of non-recuperated costs in the aftermath of hurricanes, flash floods, storm surge, and wildfires.

INSURANCE

As the number of billion dollar climate events continues to rise each year, the insurance industry is experiencing severe losses. Insurance companies are responding to the increased frequency of environmental disasters by raising rates or choosing to no longer cover areas that are deemed too high risk. As updated risk maps are released, property values could decline and insurance premiums may rise, reshaping where people choose to live and to own businesses.

After Hurricane Ida swept through Louisiana in August 2021, the state's already vulnerable insurance industry hit a breaking point. Insurance companies raised their rates, stopped selling new policies, or declared bankruptcy and left the state.[8] Likewise, the barrage of fires across California in recent years has completely destabilized the insurance industry. The actuary and consulting firm Milliman estimates that the 2017 and 2018 fire seasons alone "wiped out about twice the combined underwriting profits for the past 26 years, leaving the insurance industry with an aggregate underwriting loss of over $10 billion for the California homeowners line of business since 1991."[9] In 2019, to bring stability back to the market, California enacted a year-long moratorium on insurance companies dropping policyholders;[10] however, this was a stop-gap effort for a challenge that needs longer-term solutions.

Flood is the most common disaster, yet only 20 percent of Americans have flood insurance.[11] Those who do have flood insurance are most likely in the NFIP program that uses FEMA's flood risk maps; however, those maps are not up to date and designations within the map examine past likelihood of vulnerability to extreme weather, not future projections. Today, 36 percent of the flood claims to the National Flood Insurance Program are for properties outside the designated 100-year flood zone – leaving many communities susceptible to flood risk without even knowing it.[12] Further, federal disasters account for less than half of flooding incidents[13] – leaving many climate disasters to be handled solely by the state and local governments.

This problem extends beyond the states who have experienced the brunt of severe weather events. In a survey of 27 state insurance regulators, the consulting firm Deloitte found that only four states said their insurers were prepared to respond to the impacts of climate change.[14] As updated risk maps are released, property values could decline and insurance premiums may rise, reshaping where people choose to live and to own businesses. Unless we address this problem head-on now, more insurance companies will become insolvent, and claims will be paid by other policyholders (through guaranteed associations) or taxpayers.

ENDNOTES

1. National Centers for Environment Information, 2022. www.ncei.noaa.gov/
2. Natural Hazard Mitigation Saves: 2019 Report. National Institute of Building Sciences, 1 Dec. 2019, https://www.nibs.org/projects/natural-hazard-mitigation-saves-2019-report.
3. Billion- Dollar Weather and Climate Disasters. NCEI, 2022, Summary Stats | Billion-Dollar Weather and Climate Disasters | National Centers for Environmental Information (NCEI) (noaa.gov)
4. Data Visualizations. FEMA, May 2022, https://www.fema.gov/about/reports-and-data/data-visualizations
5. Billion- Dollar Weather and Climate Disasters. NCEI, 2022, Summary Stats | Billion-Dollar Weather and Climate Disasters | National Centers for Environmental Information (NCEI) (noaa.gov)
6. Flavelle, Christopher. "Moody's Warns Cities to Address Climate Risks or Face Downgrades." Bloomberg.com, Bloomberg, 29 Nov. 2017, https://www.bloomberg.com/news/articles/2017-11-29/moody-s-warns-cities-to-address-climate-risks-or-face-downgrades.
7. Wilson, Sabrina. "Louisiana's Insurance Crisis Worsens a Year after Hurricane Ida." KPLCTV, https://www.kplctv.com/2022/09/14/louisianas-insurance-crisis-worsens-year-after-hurricane-ida/.
8. Evans, David, et al. "Wildfire Catastrophe Models Could Spark the Changes California Needs." Milliman, Milliman, 28 Oct. 2019, https://www.milliman.com/en/insight/Wildfire-catastrophe-models-could-spark-the-changes-California-needs.
9. Flavelle, Christopher, and Brad Plumer. California Bans Insurers from Dropping Policies Made Riskier by Climate Change. The New York Times, 5 Dec. 2019, https://www.nytimes.com/2019/12/05/climate/california-fire-insurance-climate.html.https://www.nytimes.com/2021/10/08/realestate/homeowners-flood-insurance.html#:~:text=Because%20insurance%20isn't%20required,to%20the%20Insurance%20Information%20Institute.
10. Kaysen, Ronda. Should You Get Flood Insurance for Your Home? The New York Times, 8 Oct. 2021, https://www.nytimes.com/2021/10/08/realestate/homeowners-flood-insurance.html#:~:text=Because%20insurance%20isn't%20required,to%20the%20Insurance%20Information%20Institute.https://www.fema.gov/fact-sheet/reyalite-ak-fe-sou-asirans-inondasyon
11. Kaysen, Ronda. 2021.
12. Myths and Facts about Flood Insurance. FEMA, https://www.fema.gov/fact-sheet/reyalite-ak-fe-sou-asirans-inondasyon.
13. Insurance Companies Prepare for Risk from Climate Change. Deloitte , 19 Nov. 2019, https://www2.deloitte.com/us/en/pages/financial-services/articles/insurance-companies-climate-change-risk.html.

IMAGE: GNANGARRA, GLOBAL_CLIMATE_STRIKE_PERTH_200919

MAPPING THE IMPACT

DATA VISUALIZATION TOOLS

It is evident the U.S. is already paying a steep price for this challenge. Rebuild by Design partnered with APTIM and iParametrics to create the following visual tools to demonstrate how climate events have affected each state. The set of six maps depicts which areas have been hit the hardest by recent climate events, where recovery funds are focused, where those individuals with high social vulnerabilities live, and which areas have the least energy reliability.

The U.S. needs to change the way it is making funding decisions. Where we make priority investments is equally important to what we invest in. Returns on investments (ROI) in the form of social benefits to communities needs to be part of grant evaluations. The U.S. need to utilize new decision-making frameworks that are forward-looking. The final map in the set includes an example of a new decision-making framework that takes into account current vulnerabilities and future climate risks. This is one example of how physical and social vulnerability indicators could inform where investments in adaptation infrastructure can yield high returns in social benefits to the most impacted communities. Our team recognizes, however, that there are other decision-making frameworks to explore, and further research is needed to understand which indicators should be included in any state-specific model. Given the ever-present constraints on funding availability, the intent of presenting these maps together is to prompt investments that address multiple known vulnerabilities simultaneously within projects, furthering comprehensive climate adaptation planning.

The following data are designed as a tool to help communities understand their risks to make better-informed choices with higher returns on investment, though each state should determine their own framework for investment.

There are always many ways to present these data. For the purposes of this report, we chose to analyze the years 2011-2021. The following six maps and two tables are presented in this format with the following considerations and limitations:

GEOGRAPHIC MAP

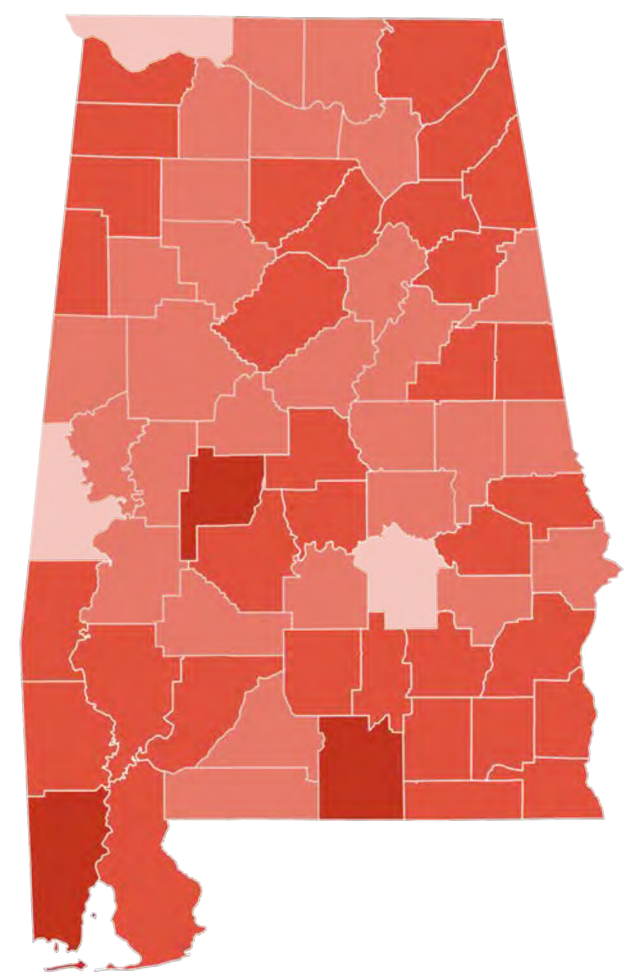
The map provides topographic and geographic context for each state and its surrounding areas, indicating whether the state encompasses coastal, riverine, lake, alpine, or desert land.

GEOGRAPHIC MAP. SOURCE: ESRI WORLD IMAGERY BASEMAP

DISASTER DECLARATIONS (RED)

This map shows federally declared climate disasters by county from 2011-2021 – providing a snapshot of the magnitude of climate disasters across the country in recent history. This report only identifies federally declared disasters, as there is no entity that collects and publishes state disaster declarations. It should be noted that the declarations shown in this report do not reflect every climate event that has occurred between 2011-2021; the report instead only shows those which have met the cost threshold for a federal disaster declaration. Therefore, the findings overall underestimate the number of occurrences and the suffering that some communities have experienced.

According to the Stafford Act, as amended in May 2021, a "major disaster" includes "any natural catastrophe (including any hurricane, tornado, storm, high water, winddriven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought), or, regardless of cause, any fire, flood, or explosion, in any part of the United States, which in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance under this Act to supplement the efforts and available resources of States, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby."[1]



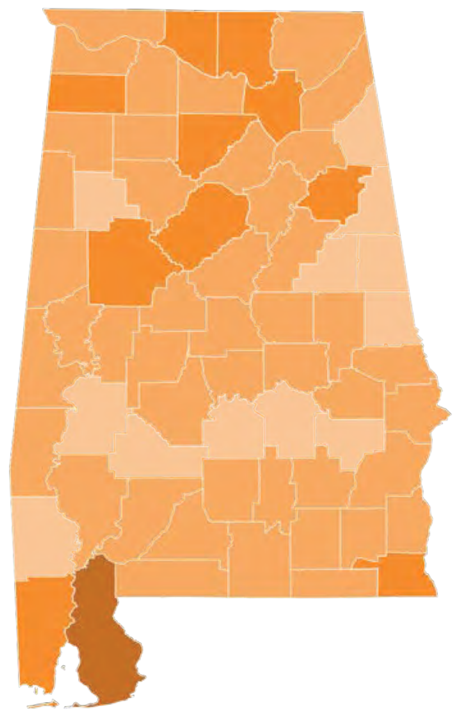
DISASTER DECLARATIONS. SOURCE: FEMA 2021 | MAPS COURTESY OF IPARAMETRICS.

Importantly, extreme heat waves do not fit the criteria for federal disaster declarations despite being the leading cause of deaths among climate hazards. Likewise, sea level rise is not included in this definition despite the threat it poses to numerous communities, including damage to property, loss of land, and displacement.

It should be noted that while most disaster declarations are due to climate events, there are a few instances of disasters due to other natural hazards, such as earthquakes and volcanic eruptions. Though these events are not increasing in magnitude or frequency due to climate change, the severity of their impact may be connected. As climate impacts degrade household and critical infrastructure, communities may become more vulnerable to other natural hazards. Retrofitting infrastructure after these events often requires the same measures as floods, tornadoes, fires, etc., so these events were included in the report to demonstrate the need to prioritize multi hazard adaptation approaches.

FEDERAL ASSISTANCE (ORANGE)

The map shows the amount of federal dollars allocated to counties through FEMA's Public Assistance and Hazard Mitigation Grant Programs between 2011-2021 which allocates funding to individual counties and statewide. The map does not show where "statewide" allocations were spent within the state, but rather only shows county allocations. However, these statewide allocation amounts are included in the Disaster Declaration table at the end of each chapter and included in the "FEMA Total" provided next to the map. The adjacent table adds HUD's Community Development Block Grant Disaster Recovery funds – which are only available to states after a disaster – to the FEMA Total for an estimate of federal post-disaster spending in each state.



FEDERAL ASSITANCE. SOURCE: FEMA 2021 | MAPS COURTESY OF IPARAMETRICS.

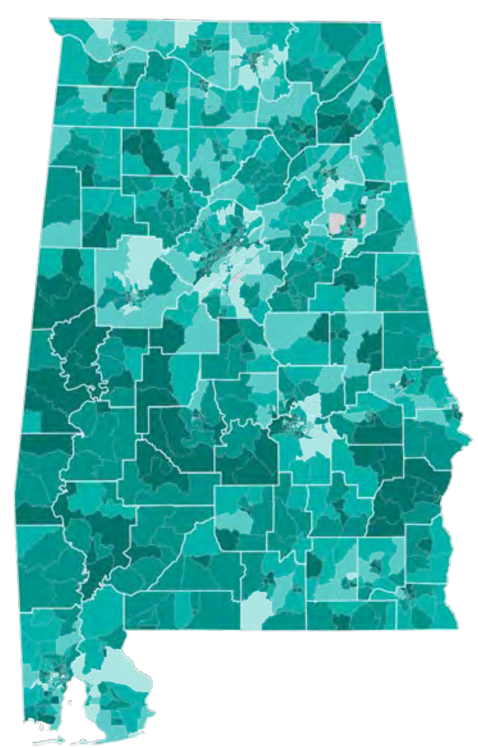
The Disaster Declaration tables provided at the end of each chapter show all federal Disaster Declarations declared between 2011-2021 and the corresponding FEMA obligations associated with those events. **However, in some instances, FEMA continues to obligate funds for years following a declaration. Some states have received funds for events that took place between 2011-2021 after 2021, so the total sum of funds associated with that event are not captured**. All FEMA funds allocated to counties between 2011-2021 are shown in the federal assistance map; however, they do not show up in the Disaster Declaration table if their corresponding event took place prior to 2011. For example, counties in the State of Illinois are still receiving funds from a 1960s storm. The funds obligated to those counties are included in the map, but that event is not included in the Disaster Declaration table at the end of the chapter.

There are additional sources of federal funding made available to governments or individuals in response to disasters, such as the U.S. Army Corp of Engineers (USACE) projects, Small Business Administration (SBA) loans, and private insurance payouts, which are not included in this report because they are harder to uniformly track and/or must be paid back. Therefore, our findings underestimate the total support available to states and individuals post-disaster.

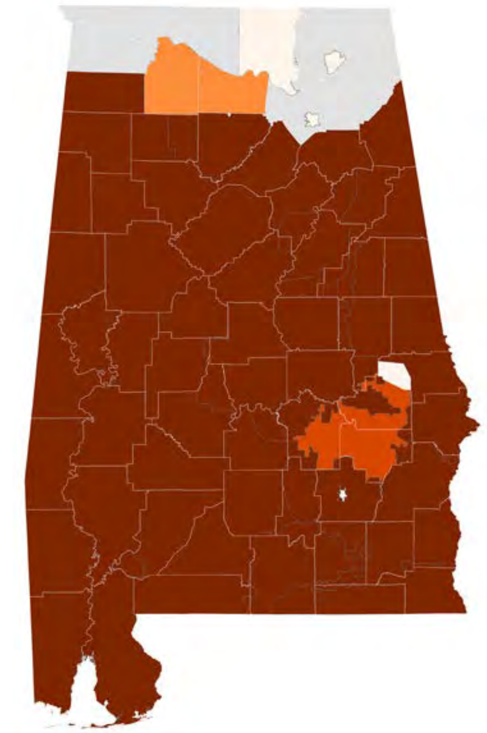
Since disaster aid is allocated to repair physical damage to property, events such as extreme heat, which largely creates physical damage to persons and not property, rarely qualify for federal disaster recovery aid. Additionally, there is only a shallow understanding of the economic impact of social and health-related costs and environmental degradation after a disaster.

SOCIAL VULNERABILITY INDEX (GREEN)

Social vulnerability refers to the potential negative effects on communities caused by external stresses on human well-being. Such stresses include natural or human-caused disasters or disease outbreaks. The factors that determine social vulnerability are directly tied to social determinants of health or the social, economic, and physical factors – such as race, socioeconomic status, and environmental conditions – that influence health. Socially vulnerable populations fare the worst during a disaster and often take longer to recover.[2] The Center for Disease Control/Agency for Toxic Substance and Disease Registry Social Vulnerability Index (CDC/ATSDR SVI) uses 15 U.S. census variables to help local officials identify communities that may need support before, during, or after disasters. The map presents the SVI on a census block level, indicating where the most socially vulnerable populations within each county live. The 15 indicators are grouped into four themes: Socioeconomic Status



SOURCE: CDC/ATSDR 2018 SOCIAL VULNERABILITY INDEX
MAPS COURTESY OF IPARAMETRICS



SOURCE: US ENERGY INFORMATION ADMINISTRATION | MAPS COURTESY OF APTIM

(below poverty, unemployed, income, no high school diploma); Household Composition & Disability (aged 65 or older, aged 17 or younger, older than age 5 with a disability, single-parent households); Minority Status & Language (minority, speak English "less than well"); and Housing Type & Transportation (multi-unit structures, mobile homes, crowding, no vehicle, group quarters).

Social Vulnerability Index data are not being used to make post-disaster assistance funding decisions. HUD only requires Low and Moderate Income for a portion of their funding. FEMA does not consider it in their allocations. To learn more about how vulnerable populations fare during climate events, turn to p. 10.

ENERGY RELIABILITY (BROWN)

Climate events often lead to energy disruptions for hours, days, or weeks. This map shows the annual average interruption time (in minutes) across the different energy utility providers within a state. Regions (or utility territories) in the darkest shade, on average, experience longer energy outages. These data are aggregated by utility territory, not county, meaning more than one provider can serve a county or group of counties.

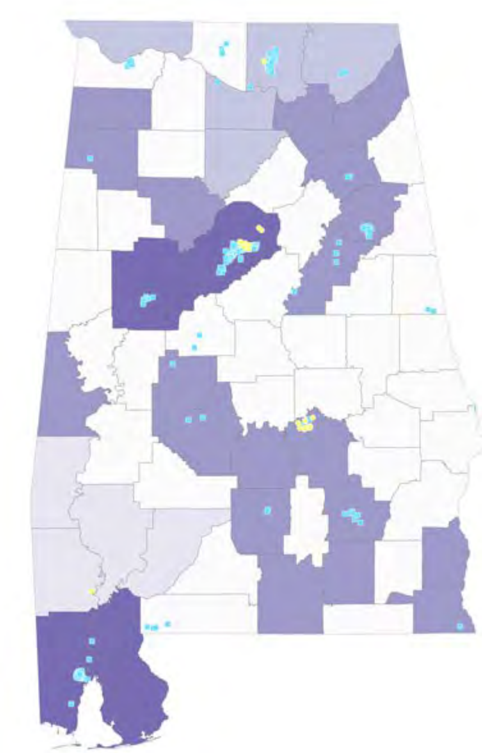
Viewing the Energy Reliability Map next to the SVI Map, one can begin to infer which regions have the most socially vulnerable residents and are served by the least reliable energy providers. Energy reliability is increasingly becoming related to climate disasters and weather events. Inclusion of these maps is to support evaluation of need for concurrent flood and energy resilience projects. To read more about how energy reliability is calculated, see Appendix A.

COMPOUNDING RISKS (PURPLE)

This map overlays multiple physical and social vulnerability indicators to identify areas where new climate infrastructure would have the greatest return on investment.

This map overlays social inputs – population density, increase in population, and health risks – with physical risk inputs – high risk of climate hazards and sea level rise – to get a more detailed picture of the populations who are most vulnerable to climate events to inform future choices of where new climate infrastructure may have the greatest return on investment through the creation of social benefits.

While other composite maps such as FEMA's National Hazard Risk Index demonstrate climate impact and



SOURCES: NOAA, FEMA, 2020 US CENSUS, GHDX, US EPA | MAP COURTESY OF APTIM some demographic information, these maps have added additional criteria, such as population density, population increase, poverty rates, and health risks, to focus on the compounding effects. For instance, if a climate event happens in an area where there is already high social vulnerability, that community is likely to suffer more.

This approach provides an example of how to begin creating new frameworks for allocating funding, moving away from funding based on damage estimates from the previous storm. These assumptions should be ground-checked by each state as data do not always give us the full picture. For instance, in some cases, the areas highlighted for "highest compounding risks" may already have numerous funding sources while others, such as rural communities, may not. In other areas, the location where investments need to be directed may be adjacent to the county with the highest need. For example, an adaptation intervention to protect a downstream riverine community may need to be built upstream in a less vulnerable area to stop flooding at its source.

Analyzed Risks Include:

+ **Climate:** sea level rise, multiple climate hazards
+ **Social:** population density, population increase, and poverty
+ **Health:** cardiovascular disease, neoplasms, and other health indicators

COMPOUNDING RISK (TABLE)

Though 10 data sources went into the data for the purple map, the chart shows a simplified view into how the areas of most need were chosen. An array of physical and social challenges were analyzed and then each county was given a score of 0 to 6, with 6 showing areas with the highest potential for returns on investment in the form of social benefits to the county. In order to qualify for a high need of investment, counties needed to have high climate risk. Read more about this approach in Appendix B.

DISASTER OCCURRENCES AND FEMA INVESTMENTS BY COUNTY (TABLE)

The chart provides the raw county-level disaster data used to inform the first two maps. Our team found that sifting through disaster declaration data is often difficult or not available. By making these data public and easily accessible, it is our intent that other organizations, academics, governments, and other decision-makers will continue to make use of and build on this collection.

ENDNOTES

1 Federal Emergency Management Agency, "Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended," 42 U.S.C. 5121 et seq., and Related Authorities, 2021. [online], www.fema.gov/sites/default/files/documents/fema_stafford_act_2021_vol1.pdf

2 Flanagan, B., Gregory, E., Hallisey, E., Heitgerd, J. & Lewis, B. "A Social Vulnerability Index for Disaster Management. Journal of Homeland Security and Emergency Management," 8(1), 2011. https://doi.org/10.2202/1547-7355.1792

NATIONWIDE STATISTICS SUMMARY (2011 - 2021)

CALIFORNIA
has had the highest number of disasters in the country: 25

NEVADA
has had the lowest number of disasters in the country: 3

11.5 median number of disaster declarations across the country

90%

OF COUNTIES IN THE US HAVE HAD A RECENT DISASTER DECLARATION

Five counties in Louisiana and Kentucky have had up to... **12** climate disasters

463
counties have high social vulnerability and low energy reliabilty

47/50 states could raise over $1 billion through an insurance surcharge

FEMA & HUD HAVE SPENT

$91B

IN POST-DISASTER ASSISTANCE

Louisiana has the highest per capita cost of federally declared disasters in the country:

$1,736

Arizona has the lowest per capita cost of declared disasters in the country: **$3**

NEW YORK, TEXAS & FLORIDA
have received the highest total post-disaster federal funding

$97 median per capita cost of federally declared disasters across all states

$287B

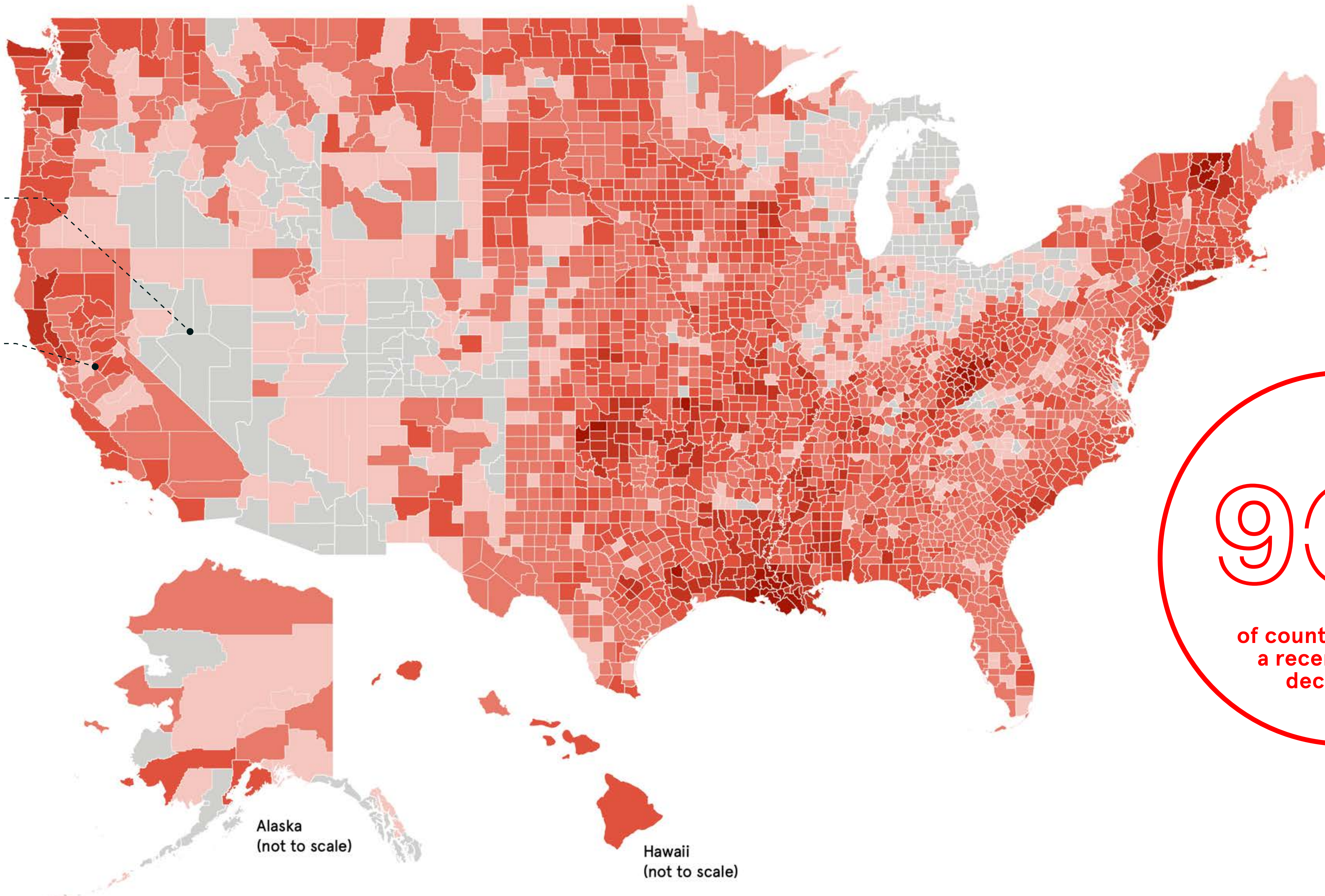
OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

Nevada has had the lowest number of recent disaster declarations in the country: 3 disasters.

California has had the highest number of disaster declarations in the country: 25 disasters.



90% of counties have had a recent disaster declaration

Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

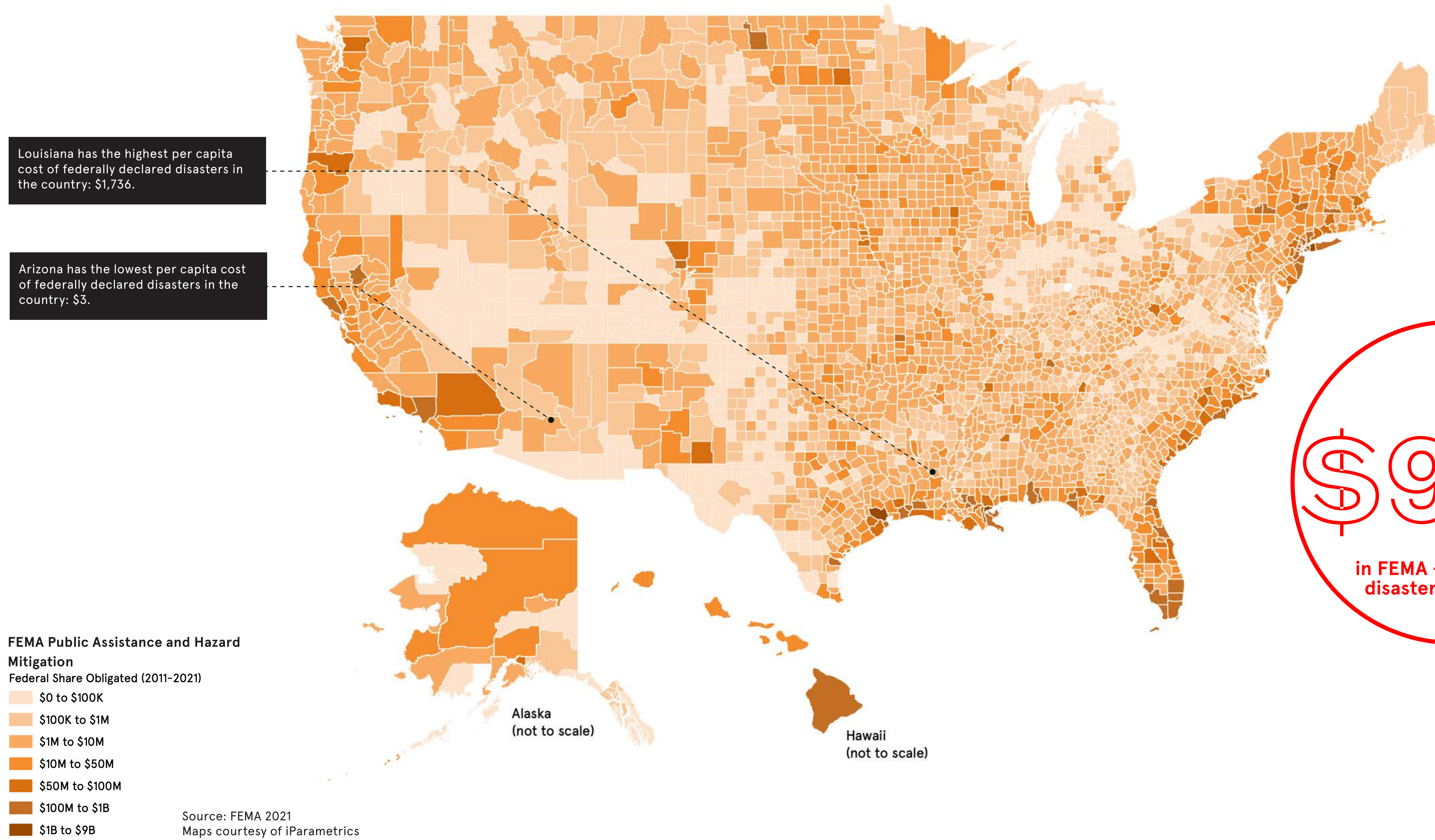
Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

Louisiana has the highest per capita cost of federally declared disasters in the country: $1,736.

Arizona has the lowest per capita cost of federally declared disasters in the country: $3.



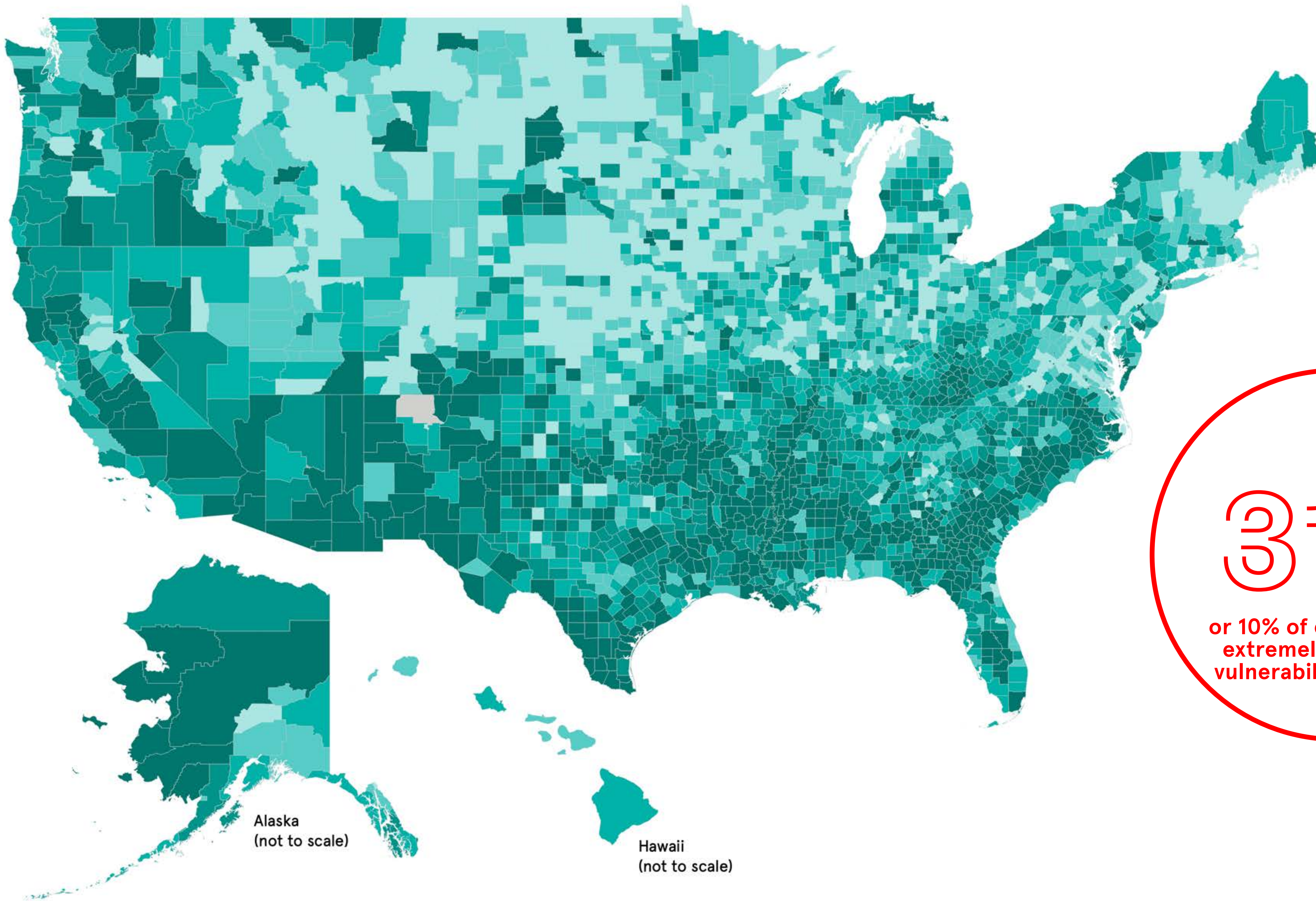
Source: FEMA 2021
Maps courtesy of iParametrics

$91B

in FEMA + HUD post-disaster assistance

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



315

or 10% of counties have extremely high social vulnerability (SVI > 0.9)

Social Vulnerability Index

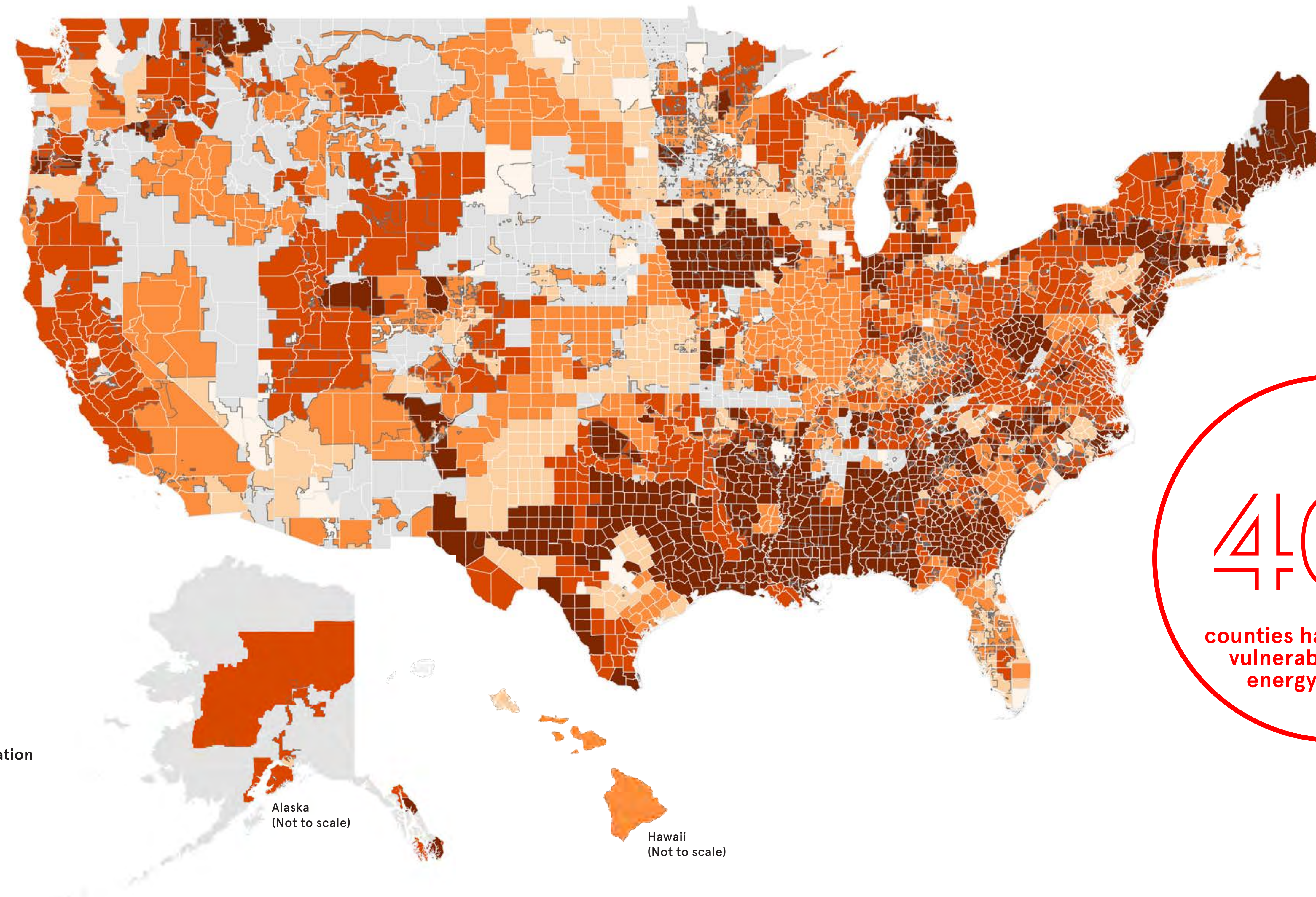
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



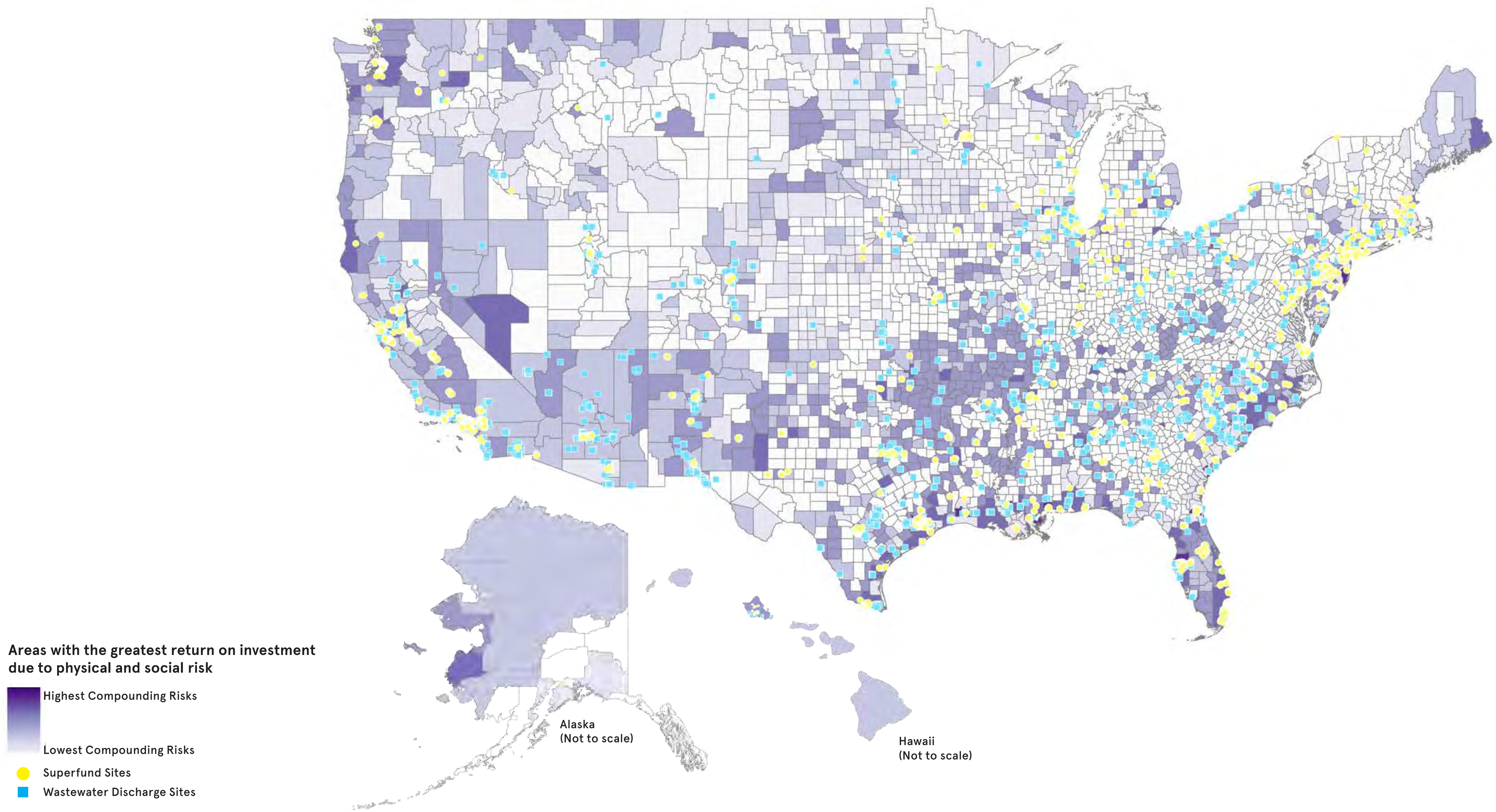
463 counties have high social vulnerabilty and low energy reliability

Aggregated Annual Electric Outage Duration Including major events - SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISK: A FRAMEWORK FOR FUTURE INVESTMENTS



Sources: Sea Level Rise and Coastal Flood Impacts, NOAA; Map | National Risk Index, FEMA); 2020 US Census; IHME, Global Health Data Exchange), density of critical infrastructure, and proximity to environment justice sites. Further information regarding the map's methodology can be found in the appendix of this report | Map courtesy of APTIM.

ALABAMA

ALABAMA STATISTICS SUMMARY (2011 – 2021)	
17	CLIMATE DISASTER DECLARATIONS
7TH HIGHEST	NUMBER OF DISASTER DECLARATIONS IN THE NATION
PERRY	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
17	COUNTIES HAVE HAD FIVE OR MORE DISASTERS
26	SUPERFUND SITES
232	WASTEWATER DISCHARGE SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
BALDWIN, JEFFERSON, MOBILE, TUSCALOOSA	HIGHEST COMPOUNDING RISKS
$1.3 BILLION	FEMA + HUD POST-DISASTER FUNDING
4.9 MILLION	POPULATION TOTAL
$275	PER CAPITA SPENDING ON CLIMATE DISASTERS
$4.1 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

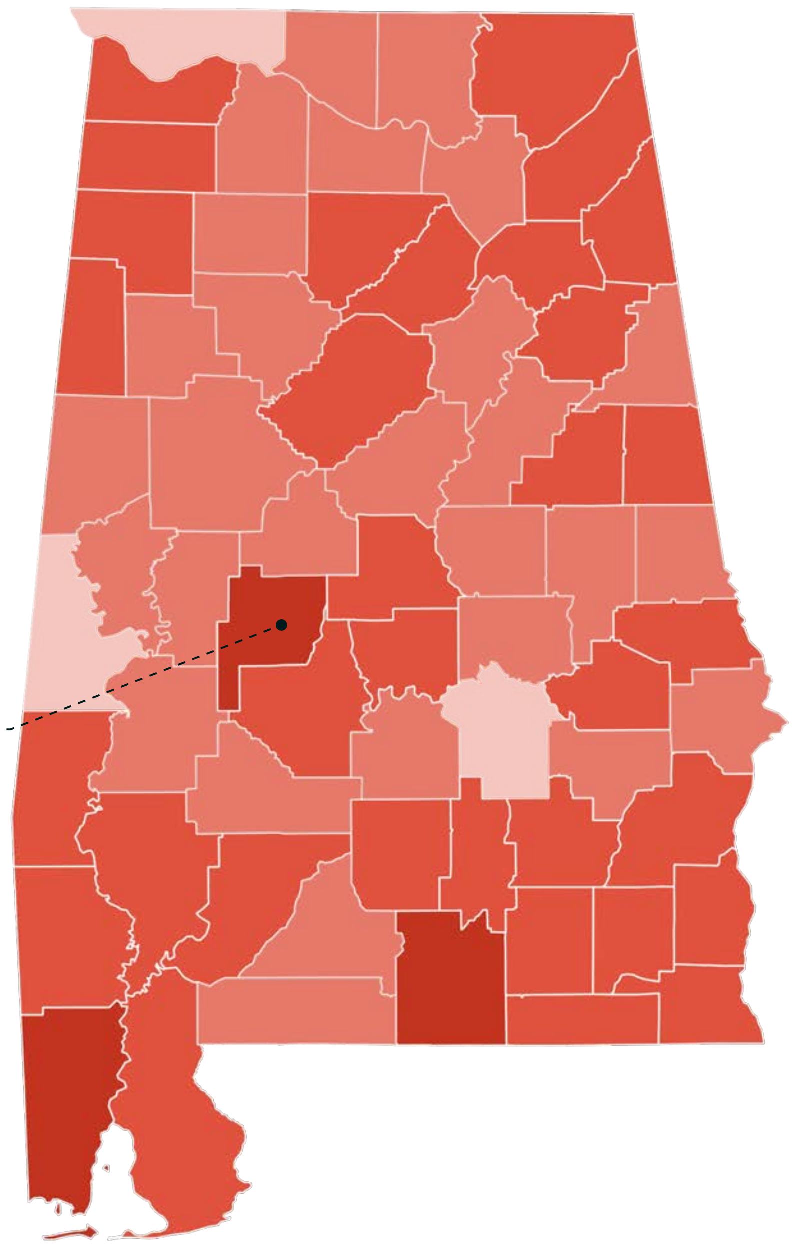
DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

17
disaster declarations

Every county in Alabama has had a recent disaster declaration.
Seventeen counties have had 5 or more.

Perry County has had the highest number of recent disasters in Alabama: 8 disasters.



Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

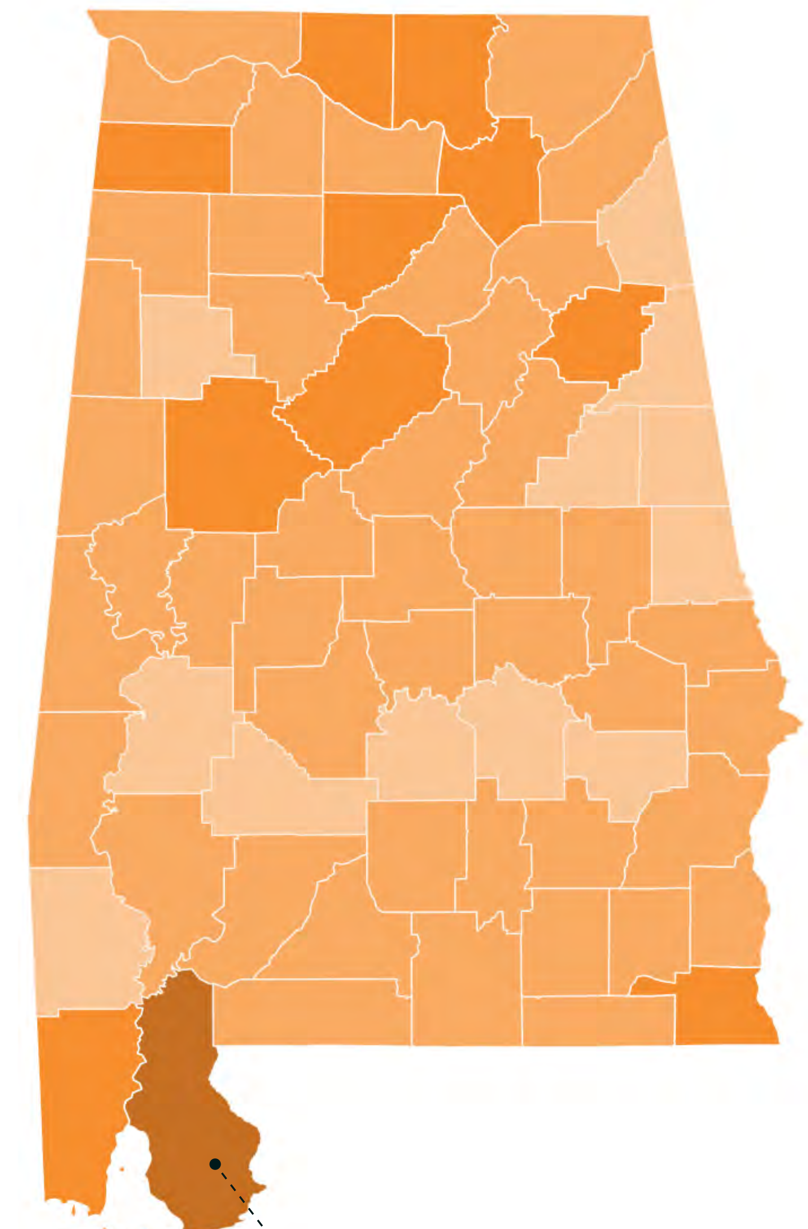
FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$1.3B
post-disaster assstance

$670M	FEMA obligations
$677M	HUD CDBG-DR Funds
$1.3B	FEMA + HUD assistance
$275	per capita cost

Every county received a disaster declaration in 2011 due to severe storms, tornadoes, straight-line winds, and flooding, which cost over $271 million.



Baldwin County has received the most post-disaster assistance in Alabama: over $128 million.

FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011-2021)

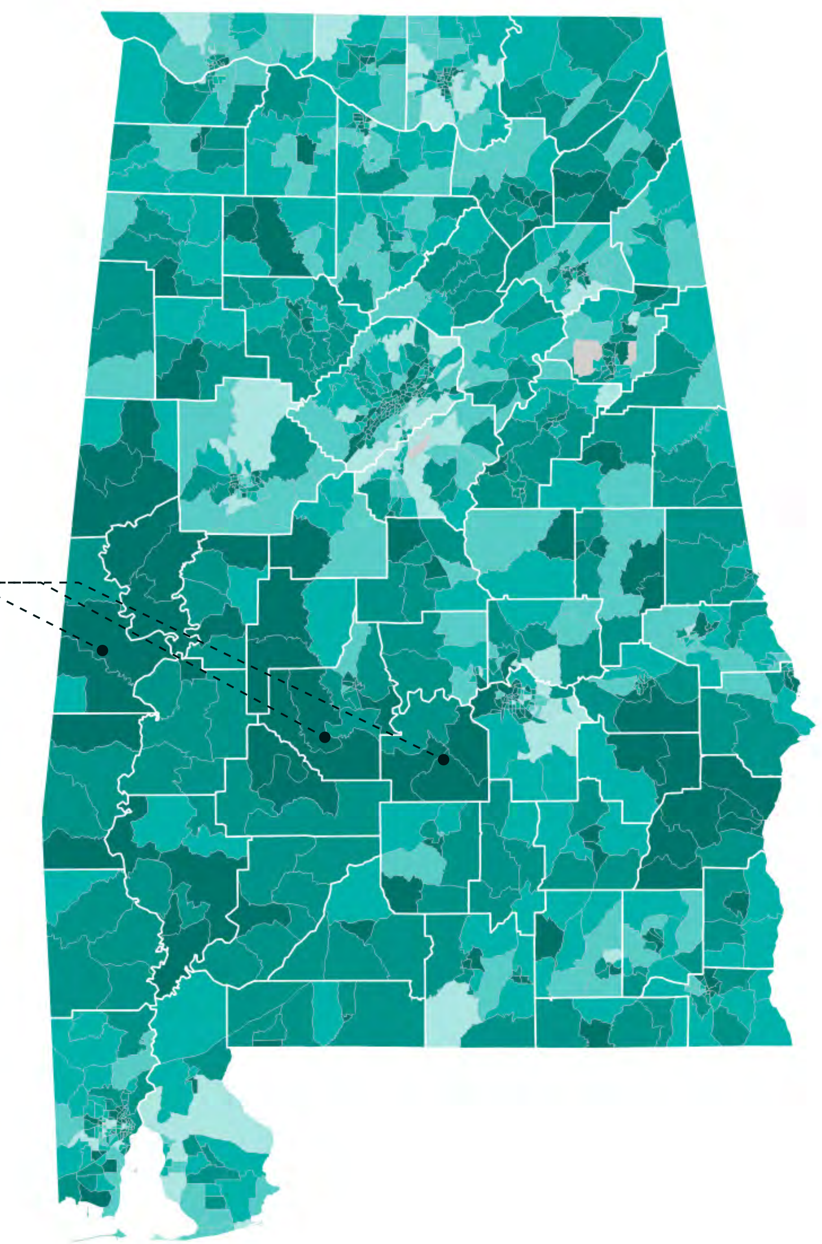
- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Sumter, Lowndes, and Dallas counties have high poverty rates and high diversity of climate hazards.



Social Vulnerability Index

CDC (2018)

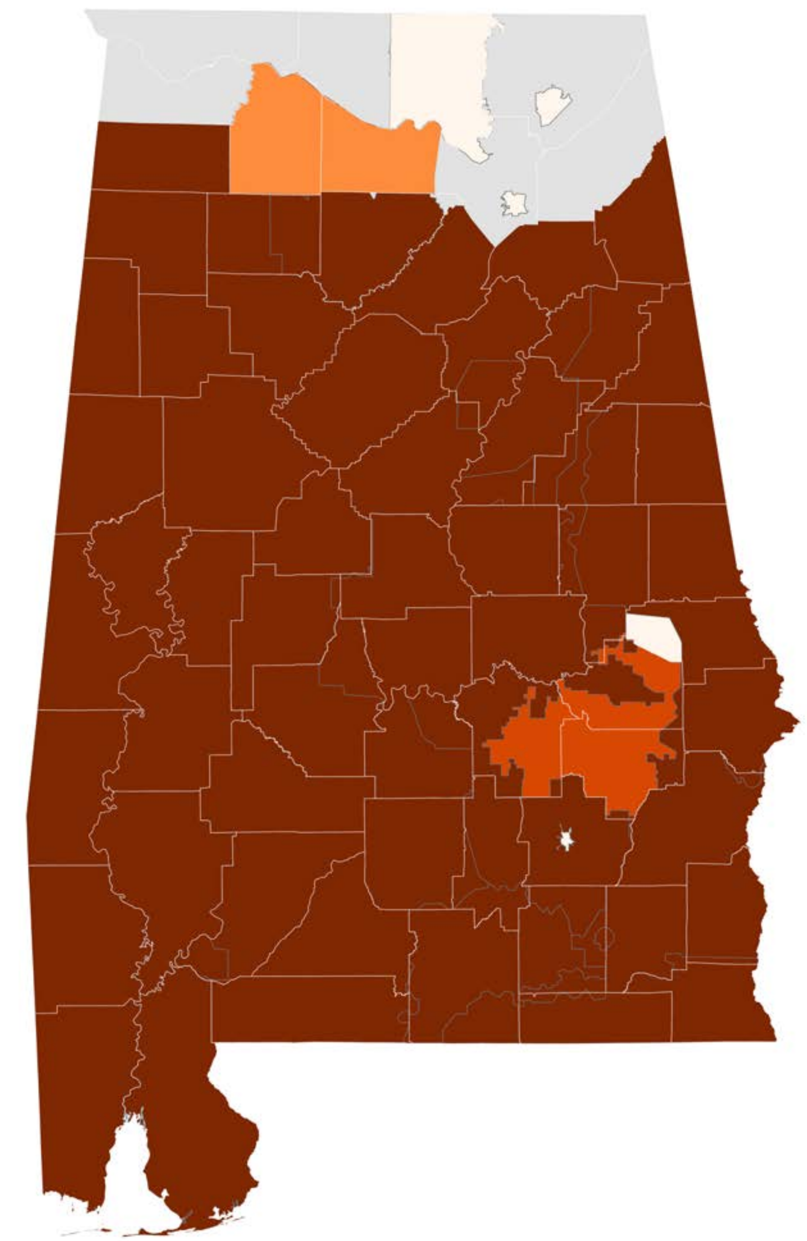
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Twenty-four counties in Alabama have high social vulnerability and low energy reliability.



Aggregated Annual Electric Outage Duration Including major events – SAIDI_W_MED

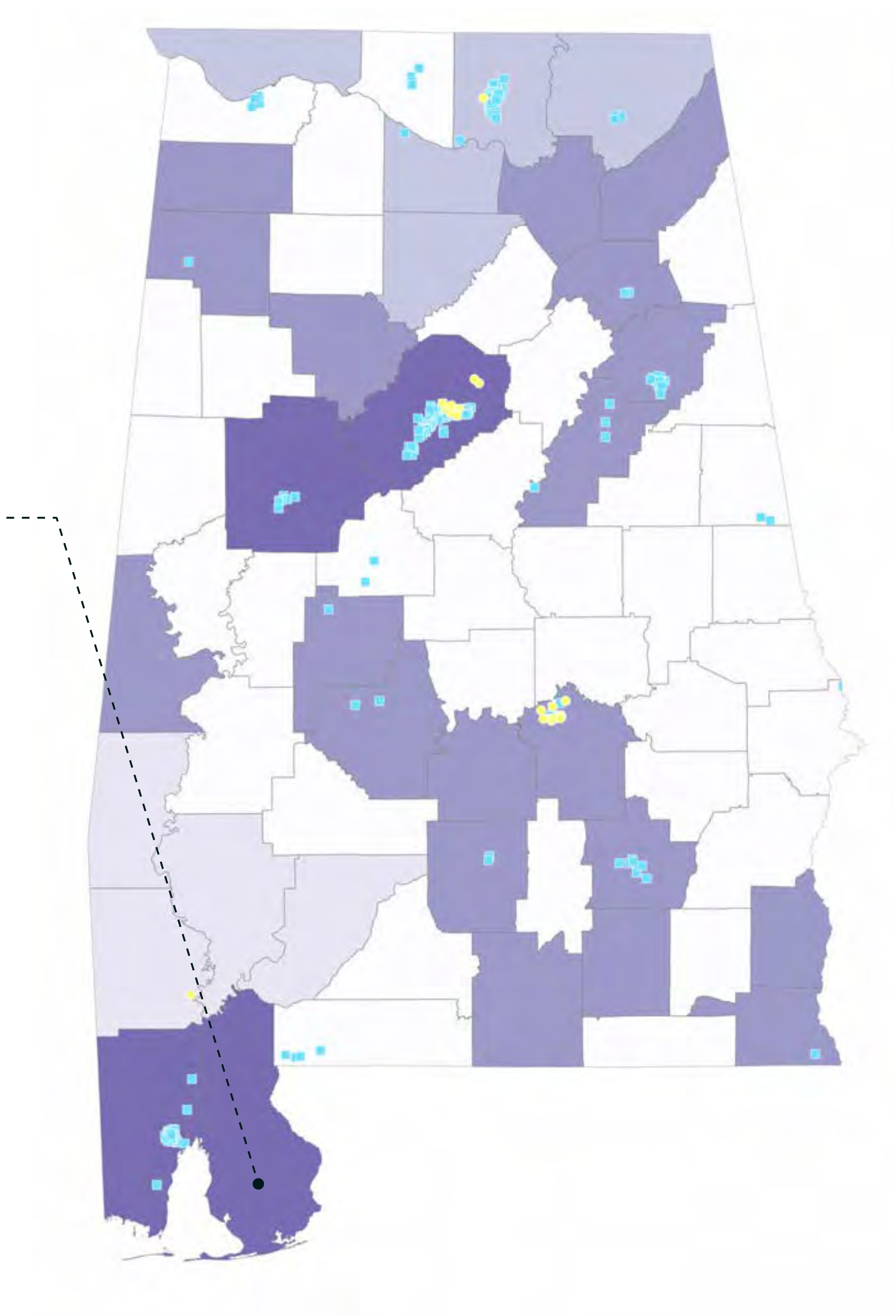
- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Baldwin, Jefferson, Mobile, and Tuscaloosa counties have high risk of climate disasters and other compounding risks.

Despite having had 5 recent disasters, Baldwin County has had a 27% increase in population over the past 10 years.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

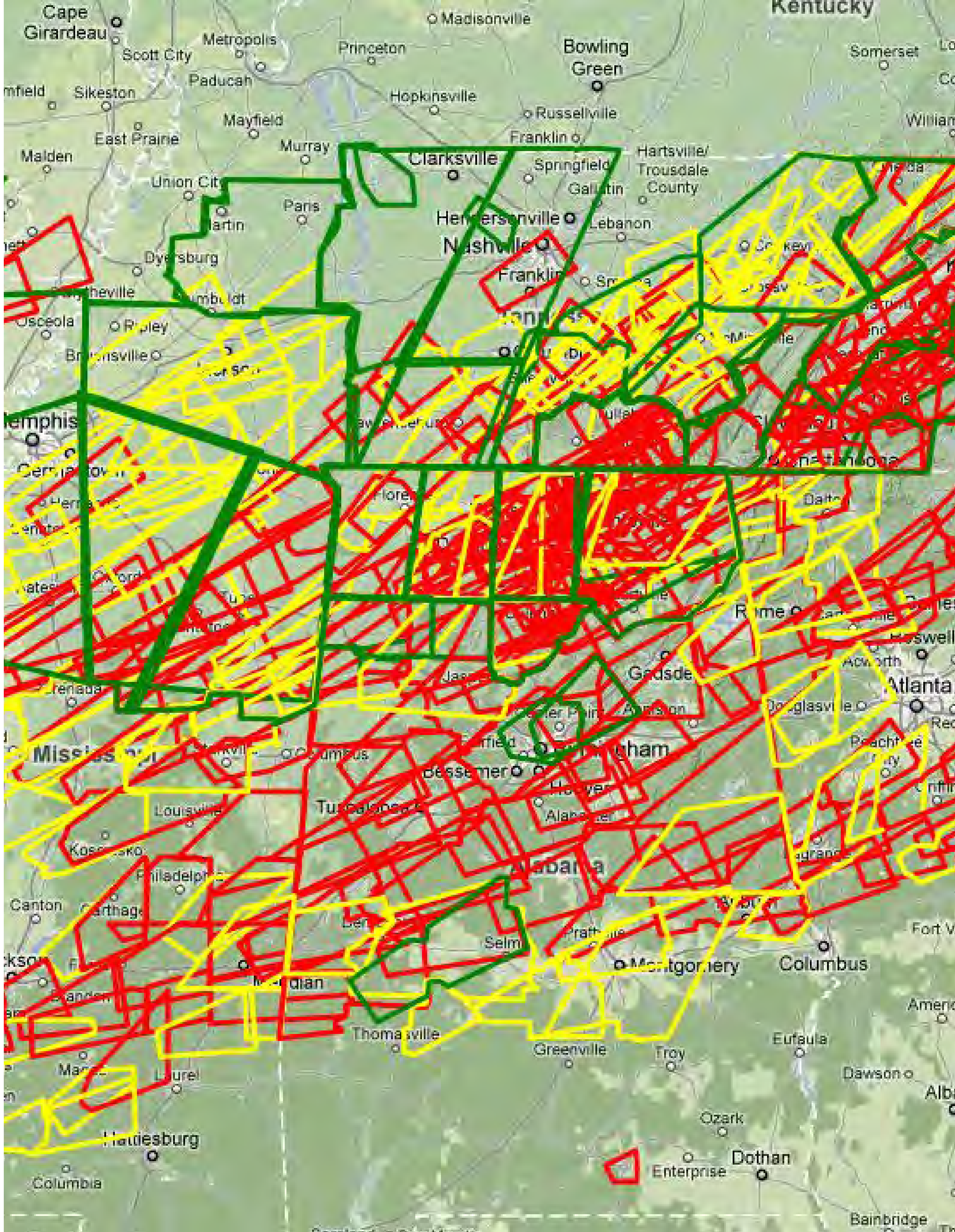
Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Autauga							0
Baldwin					1		4
Barbour							0
Bibb							0
Blount							0
Bullock							0
Butler					1		3
Calhoun					1		3
Chambers							0
Cherokee							0
Chilton							0
Choctaw							1
Clarke							1
Clay							0
Cleburne							0
Coffee					1		3
Colbert							0
Conecuh							0
Coosa							0
Covington					1		3
Crenshaw							0
Cullman					1		2
Dale							0
Dallas					1		3
DeKalb					3		3
Elmore							0
Escambia							0
Etowah					1		3
Fayette							0
Franklin					1		3
Geneva							0
Greene							0
Hale							0
Henry					1		3
Houston					1		3
Jackson					2		2
Jefferson					2		4
Lamar							0
Lauderdale					2		2
Lawrence							0
Lee							0
Limestone							0
Lowndes					1		3
Macon							0
Madison					1		2
Marengo							0
Marion					1		3
Marshall					2		3
Mobile					4		4

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Monroe							1
Montgomery					1		3
Morgan					1		2
Perry					1		3
Pickens							0
Pike					1		3
Randolph							0
Russell							0
Shelby							0
St. Clair							0
Sumter					1		3
Talladega					1		3
Tallapoosa							0
Tuscaloosa					1		4
Walker					1		3
Washington							1
Wilcox							0
Winston							0

IMAGE RIGHT: COMPOSITE MAP OF ALL TORNADO (RED), SEVERE THUNDERSTORM (YELLOW), AND FLOOD WARNINGS (GREEN) ISSUED THROUGHOUT THE MAJOR TORNADO OUTBREAK ON APRIL 27, 2011 | NATIONAL WEATHER SERVICE IN KANSAS CITY/PLEASANT HILL, MISSOURI



ALABAMA

TOTAL: 17 DISASTERS
FEMA PA + HM: $671 M
HUD CDBG-DR: $676 M
FEMA + HUD ASSISTANCE: $1.3 B

			2011		2012				2014		2016		2017		2018				2019				2020										2021			
			1971: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4052: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4082: HURRICANE ISAAC		4176: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4251: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4349: HURRICANE NATE		4362: SEVERE STORMS AND TORNADOES		4406: HURRICANE MICHAEL		4419: SEVERE STORMS, STRAIGHT-LINE WINDS, AND TORNADOES		4426: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING		4546: SEVERE STORMS AND FLOODING		4554: SEVERE STORMS, STRAIGHT-LINE WINDS, AND TORNADOES		4555: SEVERE THUNDERSTORMS		4563: HURRICANE SALLY		4573: HURRICANE ZETA		4596: SEVERE STORMS, STRAIGHT-LINE WINDS, AND TORNADOES		4632: SEVERE STORMS AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	17	$154,713,281	$64,495,901	$4,747,762			$674,061	$46,230	$3,264,574	$1,196,489	$2,186,264	$296,706	$1,360,599	$217,944	$2,738,914	$27,552	$7,141,523	$84,423	$641,684	$19,189	$511,109	$79,065	$638,329	$29,089	$2,776,614	$31,181	$1,256,855	$30,235	$52,267,106	$592,009	$5,759,864	$0	$1,602,007	$0		
Autauga County	4	$703,865	$34,141	$169,157							$215,980	$137,175	$5,262	$0																	$142,151	$0				
Baldwin County	5	$128,380,766	$0	$712,775			$2,655,912	$0	$10,124,189	$1,491,957			$1,065,041	$1,662,635															$110,668,258	$0						
Barbour County	4	$1,766,995	$0	$0							$699,119	$0													$66,413	$0			$1,001,463	$0						
Bibb County	2	$1,243,593	$622,951	$503,539																													$117,102	$0		
Blount County	6	$4,287,791	$246,351	$484,583					$1,620,148	$264,704	$723,138	$0									$83,070	$0	$241,090	$0			$624,707	$0								
Bullock County	3	$322,444	$0	$12,000					$132,924	$0	$177,520	$0																								
Butler County	6	$1,052,965	$98,806	$84,295					$140,950	$31,975	$251,065	$8,000											$209,679	$0					$113,698	$0	$114,497	$0				
Calhoun County	4	$43,136,134	$7,395,899	$955,991											$34,072,439	$366,448															$292,161	$0	$53,197	$0		
Chambers County	3	$964,287	$16,198	$121,610							$679,724	$0											$146,755	$0												
Cherokee County	4	$712,533	$168,710	$240,815							$108,182	$81,433									$113,393	$0									$0	$0				
Chilton County	4	$1,559,101	$0	$1,292,270	$0	$0																			$0	$0					$266,831	$0				
Choctaw County	4	$1,159,864	$305,814	$744,194									$0	$22,500									$87,356	$0							$0	$0				
Clarke County	4	$1,501,605	$10,540	$578,642									$12,403	$0															$177,913	$0	$722,107	$0				
Clay County	4	$403,076	$17,206	$188,384							$33,628	$0																			$144,494	$0	$19,365	$0		
Cleburne County	2	$107,185	$0	$63,494							$43,691	$0																								
Coffee County	4	$7,630,825	$0	$434,871							$3,583,465	$3,101,155													$65,311	$0			$446,023	$0						
Colbert County	4	$4,144,984	$1,382,798	$1,574,184							$156,536	$0									$839,049	$53,721	$138,697	$0												
Conecuh County	3	$1,041,527	$0	$104,225							$526,890	$0																	$410,411	$0						
Coosa County	3	$1,614,355	$16,839	$0																					$1,526,930	$0					$70,586	$0				
Covington County	7	$7,233,416	$4,260	$556,311			$789,569	$176,522	$481,456	$27,263	$4,022,256	$0											$0	$0	$190,318	$0			$985,461	$0						
Crenshaw County	6	$4,034,813	$0	$0					$253,666	$10,240	$2,561,893	$0											$684,226	$0	$244,856	$0			$279,932	$0						
Cullman County	5	$18,049,212	$9,881,901	$2,456,632							$3,578,514	$581,166			$867,612	$0							$244,812	$0			$438,575	$0								
Dale County	5	$1,316,286	$0	$85,663					$71,236	$0	$1,041,603	$0					$27,805	$0							$89,979	$0										
Dallas County	5	$2,113,886	$20,752	$339,057			$308,789	$0					$3,236	$0									$266,774	$0							$1,175,277	$0				
DeKalb County	5	$7,511,658	$3,167,730	$2,037,767					$773,511	$0	$501,167	$0									$220,736	$0					$810,747	$0								
Elmore County	3	$2,241,387	$528,800	$743,158							$777,462	$56,100																			$135,868	$0				
Escambia County	3	$3,101,727	$0	$120,405							$508,237	$70,259																	$2,402,826	$0						
Etowah County	4	$4,203,799	$175,681	$667,909					$638,888	$750,192					$971,186	$0											$999,943	$0								
Fayette County	3	$746,253	$368,441	$269,583							$64,171	$0											$44,058	$0												
Franklin County	4	$22,361,586	$19,018,060	$1,958,416					$130,519	$0	$307,077	$13,050									$934,464	$0														
Geneva County	6	$4,260,544	$0	$220,750			$464,370	$33,532	$1,275,874	$33,039	$718,474	$0					$555,975	$346,415											$612,116	$0						
Greene County	3	$1,382,678	$86,805	$699,085																	$179,103	$0	$417,684	$0												
Hale County	3	$1,055,026	$843,148	$200,163																											$0	$0	$11,715	$0		
Henry County	4	$1,157,137	$0	$0							$397,952	$0					$567,735	$0							$191,451	$0										
Houston County	5	$12,806,578	$0	$89,908					$911,267	$0	$1,127,765	$264,990					$8,968,559	$0											$1,444,089	$0						
Jackson County	4	$5,869,968	$503,123	$3,309,083							$244,341	$87,684									$1,209,418	$304,515					$211,804	$0								
Jefferson County	5	$48,892,923	$33,004,556	$7,939,761	$0	$146,221			$6,092,040	$1,693,475																							$16,870	$0	$0	$0
Lamar County	5	$2,563,773	$1,108,163	$478,533					$231,963	$0	$284,181	$18,764									$119,575	$18,755	$303,839	$0												
Lauderdale County	1	$2,509,869	$2,021,701	$488,168																																
Lawrence County	2	$4,445,284	$741,860	$3,475,335							$228,088	$0																								
Lee County	4	$4,775,642	$0	$41,506					$637,111	$0	$498,903	$46,595							$3,033,910	$517,618																
Limestone County	3	$10,696,600	$4,632,178	$929,205					$4,356,010	$410,461													$368,747	$0												
Lowndes County	3	$271,145	$0	$0							$261,434	$0																			$9,711	$0				
Macon County	4	$7,910,732	$0	$414,746							$5,462,987	$180,380	$2,650	$0									$1,849,968	$0												
Madison County	2	$12,799,568	$10,337,866	$1,367,658																	$1,094,045	$0														
Marengo County	2	$451,609	$341,260	$92,195																											$18,155	$0				
Marion County	4	$8,804,190	$6,845,785	$675,748							$491,070	$38,348									$239,256	$0	$513,983	$0												
Marshall County	3	$10,843,559	$8,169,866	$1,682,692							$498,576	$0															$492,425	$0								
Mobile County	7	$31,598,588	$0	$2,149,435			$1,397,674	$0	$1,220,793	$1,393,275			$3,991,441	$0			$287,834	$27,855											$9,785,786	$0	$11,344,496	$0				
Monroe County	5	$1,036,444	$10,143	$624,424			$105,741	$23,737			$182,712	$0																	$49,645	$0	$40,042	$0				
Montgomery County	1	$79,123	$0	$79,123																																
Morgan County	2	$2,213,477	$953,330	$959,236																	$300,911	$0														
Perry County	8	$2,602,193	$155,833	$32,380	$0	$0	$91,591	$13,853	$210,398	$57,416	$359,822	$55,865											$741,188	$0							$228,444	$0	$655,403	$0		
Pickens County	3	$889,328	$23,985	$555,430			$153,120	$58,739	$60,669	$37,386																										
Pike County	4	$5,599,930	$0	$58,033							$2,479,507	$180,380													$2,427,710	$0			$454,301	$0						
Randolph County	4	$684,420	$0	$154,177																			$458,319	$0							$40,537	$0	$31,387	$0		
Russell County	2	$1,137,303	$0	$93,443							$772,532	$271,328																								
St. Clair County	3	$5,266,839	$2,064,433	$2,514,412							$179,967	$178,697			$329,330	$0																				
Shelby County	3	$1,564,548	$74,243	$406,133																													$1,084,172	$0	$0	$0
Sumter County	1	$1,760,464	$399,942	$1,360,522																																
Talladega County	2	$1,836,348	$266,123	$1,258,323																											$311,902	$0				
Tallapoosa County	2	$1,424,142	$400,848	$346,172																					$677,123	$0										
Tuscaloosa County	5	$33,943,551	$17,569,178	$12,278,484					$2,269,995	$708,582					$5,041	$0			$13,689	$0			$1,098,582	$0												
Walker County	3	$4,796,282	$2,255,283	$2,019,989							$299,472	$0															$221,539	$0								
Washington County	4	$694,650	$17,036	$584,175					$15,864	$0			$12,634	$0																	$64,941	$0				
Wilcox County	3	$325,865	$0	$17,278																			$118,763	$0							$189,824	$0				
Winston County	3	$2,202,151	$238,929	$1,013,622							$564,761	$162,825									$176,115	$45,900														
Total FEMA Allocation		$670,513,672	$201,043,395	$70,857,018	$0	$146,221	$6,640,827	$352,613	$34,914,043	$8,106,454	$37,800,127	$5,830,900	$6,453,268	$1,903,079	$38,984,523	$394,000	$17,549,430	$458,693	$3,689,283	$536,807	$6,020,243	$501,956	$8,572,849	$29,089	$8,256,704	$31,181	$5,056,595	$30,235	$181,099,028	$592,009	$21,071,887	$0	$3,591,218	$0	$0	$0

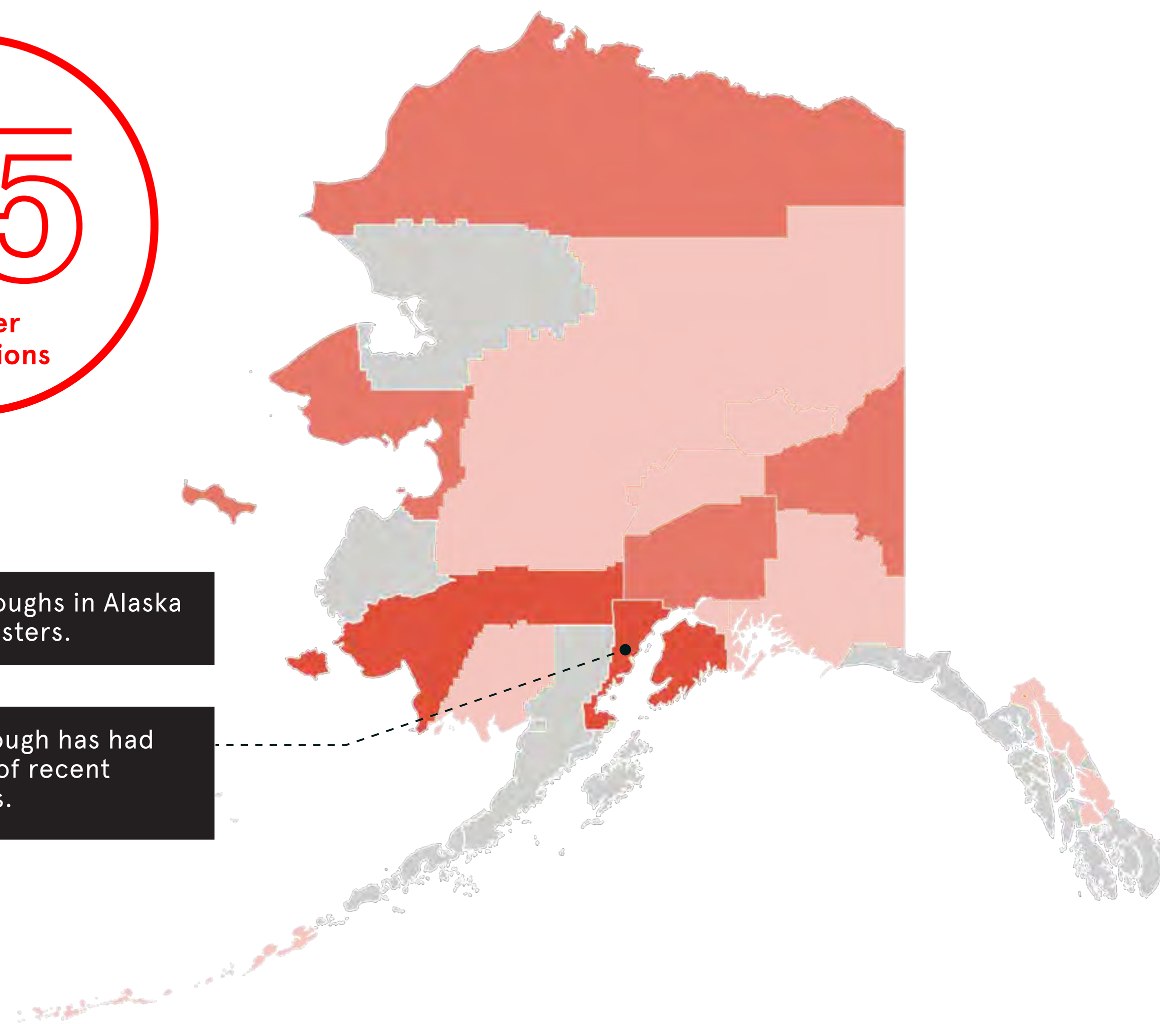
ALASKA

ALASKA STATISTICS SUMMARY (2011 - 2021)	
15	CLIMATE DISASTER DECLARATIONS
8TH	HIGHEST PER CAPITA SPENDING ON CLIMATE DISASTERS IN THE NATION
KENAI PENINSULA BOROUGH	BOROUGH WITH THE HIGHEST DISASTER OCCURENCES
17	BOROUGHS WITH FIVE OR MORE DISASTERS
5	SUPERFUND SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
KUSILVAK	HIGHEST COMPOUNDING RISKS
$294 MILLION	FEMA + HUD POST-DISASTER FUNDING
ANCHORAGE MUNICIPALITY	BOROUGH WITH THE HIGEST FEDERAL SPENDING ON CLIMATE DISASTERS
733 THOUSAND	POPULATION TOTAL
$401	PER CAPITA SPENDING ON CLIMATE DISASTERS
$600 MILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

15
disaster declarations



Sixty percent of boroughs in Alaska have had recent disasters.

Kenai Peninsula Borough has had the highest number of recent disasters: 6 disasters.

Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

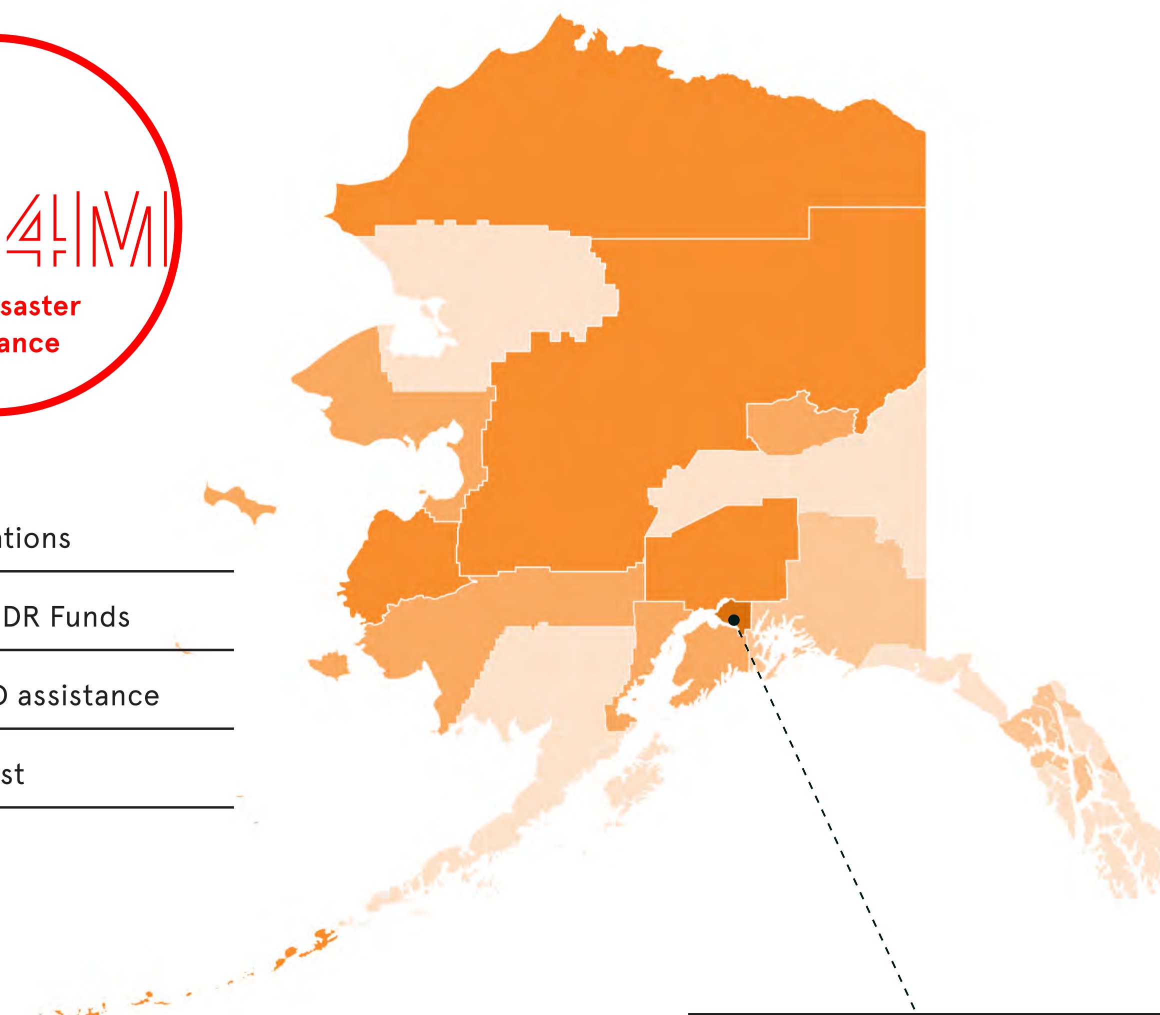
$294M
post-disaster assistance

$256M FEMA obligations

$38M HUD CDBG-DR Funds

$294M FEMA + HUD assistance

$401 per capita cost



Anchorage Municipality has received the most post-disaster federal funding in the state: over $75 million.

Alaska has the 8th highest per capita disaster spending in the nation.

The most expensive disaster in recent history is the 2019 earthquake, which totaled over $121 million.

FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011-2021)

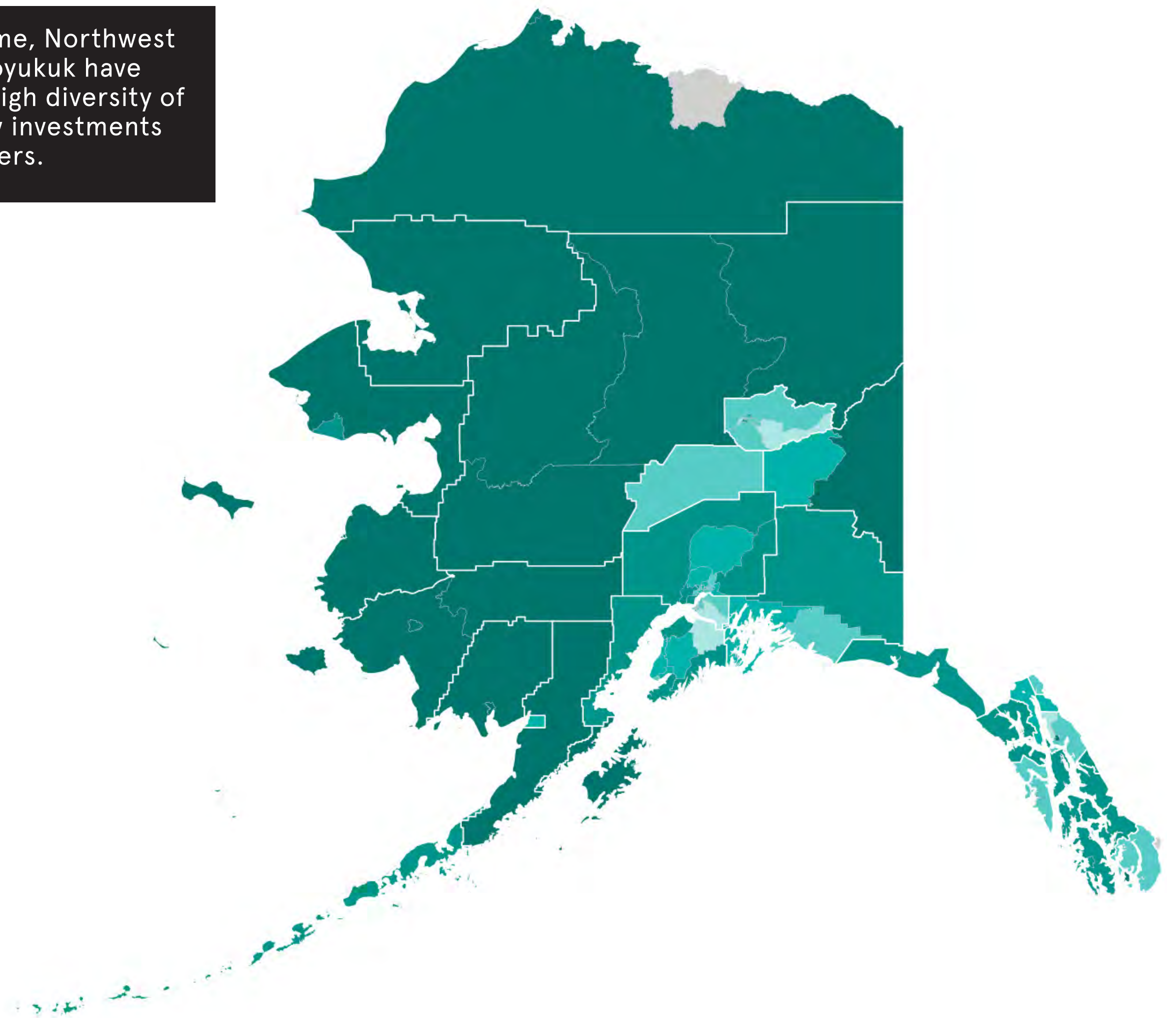
- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Kusilvak, Bethel, Nome, Northwest Arctic, and Yukon-Koyukuk have high poverty rates, high diversity of hazard risks, and low investments from previous disasters.



Social Vulnerability Index

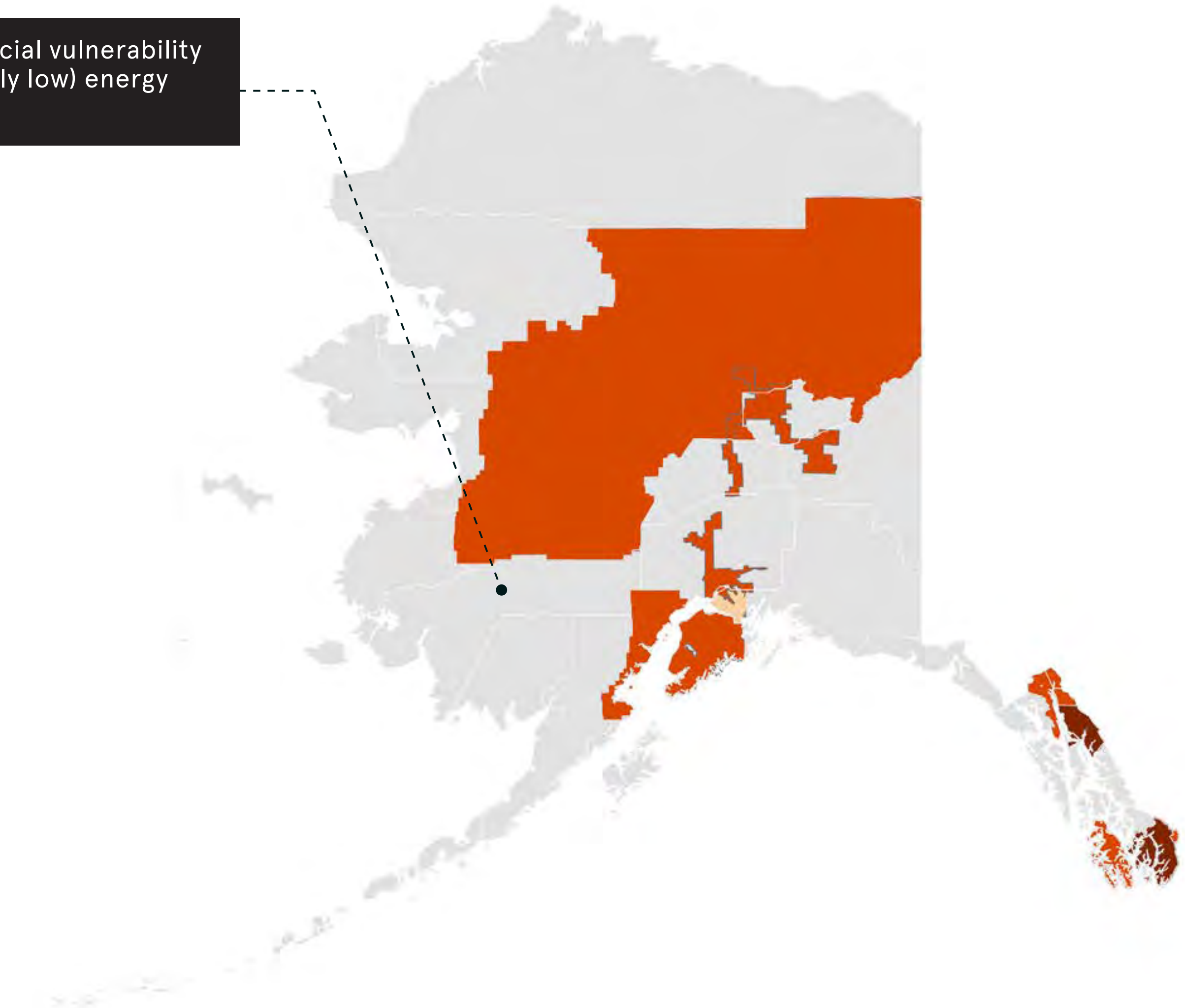
CDC (2018)
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Bethel has high social vulnerability and low (or partially low) energy reliability.



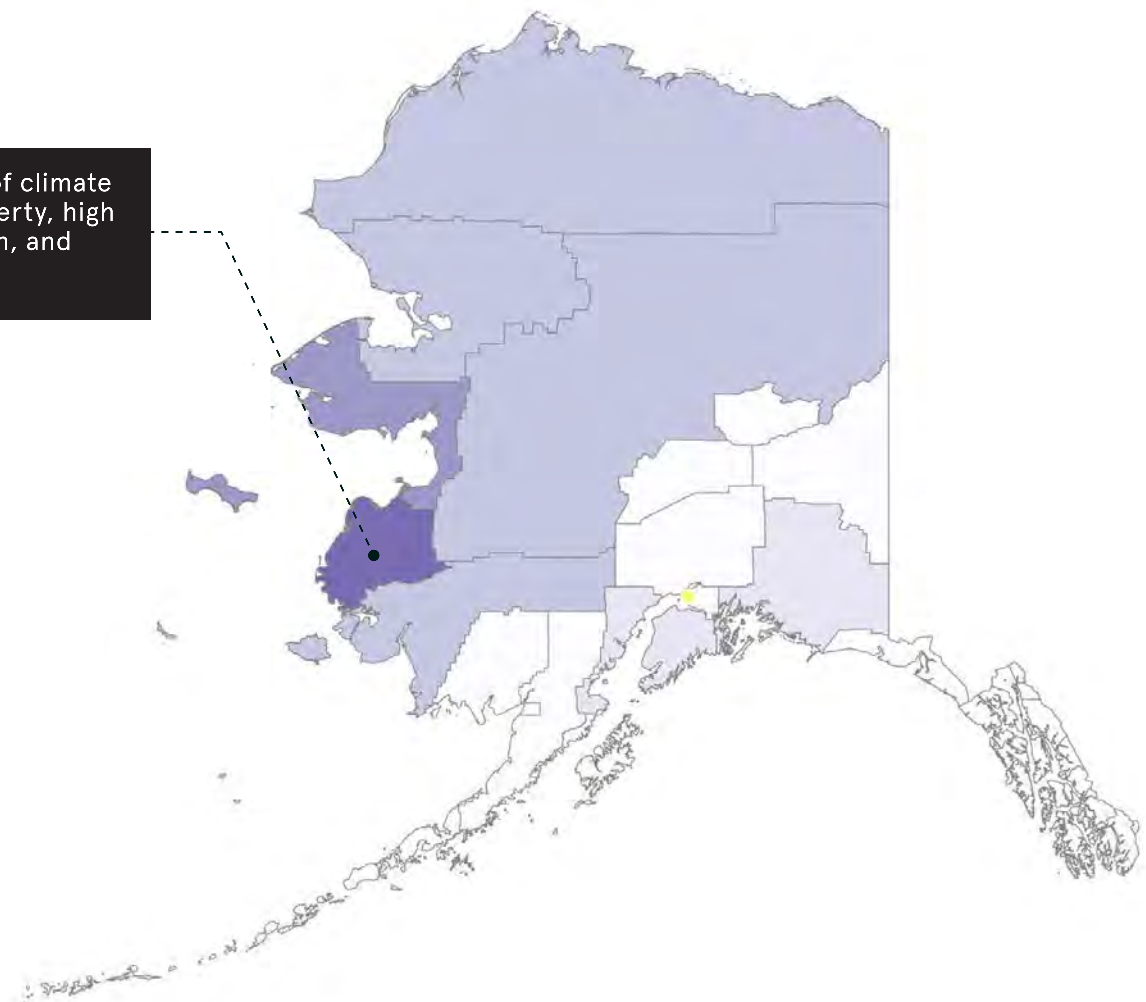
Aggregated Annual Electric Outage Duration
Including major events - SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Kusilvak has high risk of climate disasters and high poverty, high increases in population, and high health risks.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

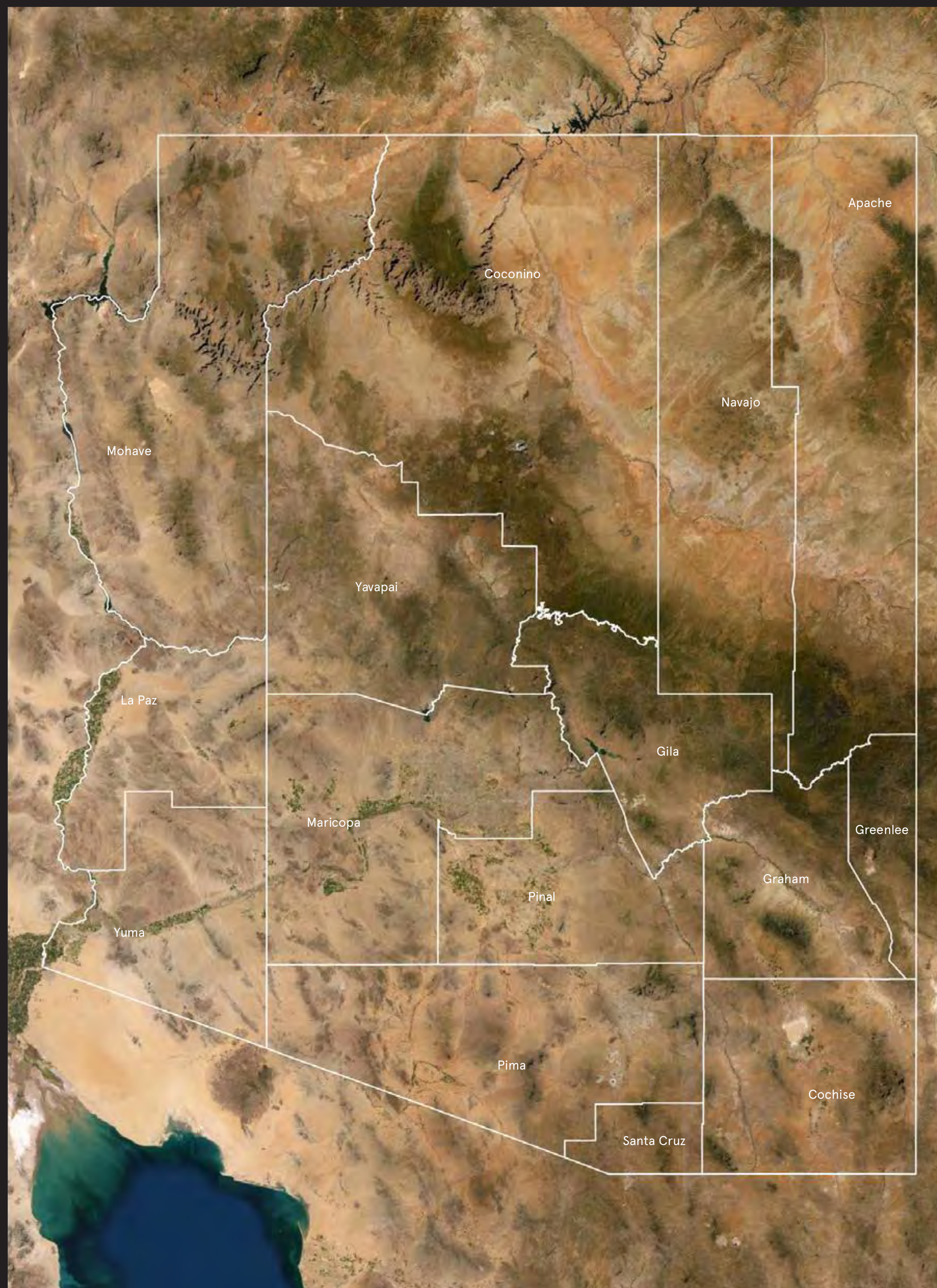
County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Aleutians East							0
Aleutians West							0
Anchorage							0
Bethel					2		2
Bristol Bay							0
Denali							0
Dillingham							0
Fairbanks North Star							0
Haines							0
Hoonah-Angoon							0
Juneau							0
Kenai Peninsula					2		1
Ketchikan Gateway							0
Kodiak Island							0
Kusilvak					1		4
Lake and Peninsula							0
Matanuska-Susitna							0
Nome					2		3
North Slope					1		2
Northwest Arctic					2		2
Petersburg							0
Prince of Wales-Hyder							0
Sitka							0
Skagway							0
Southeast Fairbanks							0
Valdez-Cordova					1		1
Wrangell							0
Yakutat							0
Yukon-Koyukuk					1		2

ALASKA

TOTAL: 15 DISASTERS
FEMA PA + HM: $256 M
CDBG-DR HUD: $38 M
FEMA + HUD ASSISTANCE: $294 M

			2011				2012				2013		2014				2015		2016		2017		2018				2019		2021	
			1992: ICE JAM AND FLOODING		4050: SEVERE WINTER STORMS AND FLOODING		4054: SEVERE STORM		4094: SEVERE STORM, STRAIGHT-LINE WINDS, FLOODING, AND LANDSLIDES		4122: FLOODING		4161: FLOODING		4162: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4244: SEVERE STORM		4257: SEVERE STORM		4351: SEVERE STORM		4369: SEVERE STORM		4391: FLOODING		4413: EARTHQUAKE		4585: SEVERE STORM, FLOODING, LANDSLIDES, AND MUDSLIDES	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	15	$89,818,320	$833,047.39	$15,224.00	$974,605.44	$10,635.00	$206,002.33	$9,980.00	$20,388,811.94	$1,469,754.00	$17,864,502.28	$190,225.00	$410,929.13	$12,255.00	$13,245,995.90	$217,140.00	$130,767.00	$83,357.59	$412,436.00	$90,575.00	$449,781.00	$366,228.25	$1,200,234.50	$74,075.00			$29,623,676.96	$1,403,074.00	$135,007.17	$0.00
Aleutians East Borough	0	$0																												
Aleutians West Census Area	1	$11,051,697																	$11,051,697.02	$0.00										
Anchorage Municipality	1	$74,786,519													$8,070,882.50	$0.00											$65,096,545.92	$1,619,090.25		
Bethel Census Area	4	$1,436,650	$923,299.41	$0.00	$114,214.21	$217,021.00					$0.00	$0.00			$0.00	$182,115.00														
Bristol Bay Borough	0	$0																												
Denali Borough	1	$0							$0.00	$0.00																				
Dillingham Census Area	1	$20,651			$20,650.65	$0.00																								
Fairbanks North Star Borough	1	$1,688,502													$1,688,501.63	$0.00														
Haines Borough	1	$158,625																											$158,625.00	$0.00
Hoonah-Angoon Census Area	0	$26,203																											$26,203.23	$0.00
Juneau City and Borough	1	$0																											$0.00	$0.00
Kenai Peninsula Borough	6	$7,360,389					$1,134,815.29	$0.00	$1,989,287.80	$0.00			$804,896.61	$0.00									$2,965,182.52	$0.00			$266,833.23	$199,374.00		
Ketchikan Gateway Borough	0	$0																												
Kodiak Island Borough	0	$0																												
Kusilvak Census Area	0	$12,962,310			$176,256.58	$0.00					$5,374,681.82	$0.00			$7,411,371.30	$0.00														
Lake and Peninsula Borough	0	$0																												
Matanuska-Susitna Borough	3	$25,041,430							$2,123,054.84	$0.00															$0.00	$0.00	$22,400,197.25	$518,177.50		
Nome Census Area	2	$4,586,980			$3,435,901.43	$0.00									$1,151,078.42	$0.00														
North Slope Borough	3	$13,478,569			$0.00	$0.00											$3,915,189.31	$0.00			$9,563,379.25	$0.00								
Northwest Arctic Borough	0	$0																												
Petersburg Borough	1	$0																											$0.00	$0.00
Prince of Wales-Hyder Census Area	0	$0																												
Sitka City and Borough	0	$0																												
Skagway Municipality	1	$49,439																											$49,438.70	$0.00
Southeast Fairbanks Census Area	2	$0							$0.00	$0.00	$0.00	$0.00																		
Valdez-Cordova Census Area	1	$143,705							$0.00	$0.00	$143,705.02	$0.00																		
Wrangell City and Borough	0	$0																												
Yakutat City and Borough	0	$0																												
Yukon-Koyukuk Census Area	1	$13,188,095									$9,297,410.06	$3,890,685.00																		
Total FEMA Allocation		$255,798,082	$1,756,346.80	$15,224.00	$4,721,628.31	$227,656.00	$1,340,817.62	$9,980.00	$24,501,154.58	$1,469,754.00	$32,680,299.18	$4,080,910.00	$1,215,825.74	$12,255.00	$31,567,829.75	$399,255.00	$4,045,956.31	$83,357.59	$11,464,133.02	$90,575.00	$10,013,160.25	$366,228.25	$4,165,417.02	$74,075.00	$0.00	$0.00	$117,387,253.36	$3,739,715.75	$369,274.10	$0.00

ARIZONA



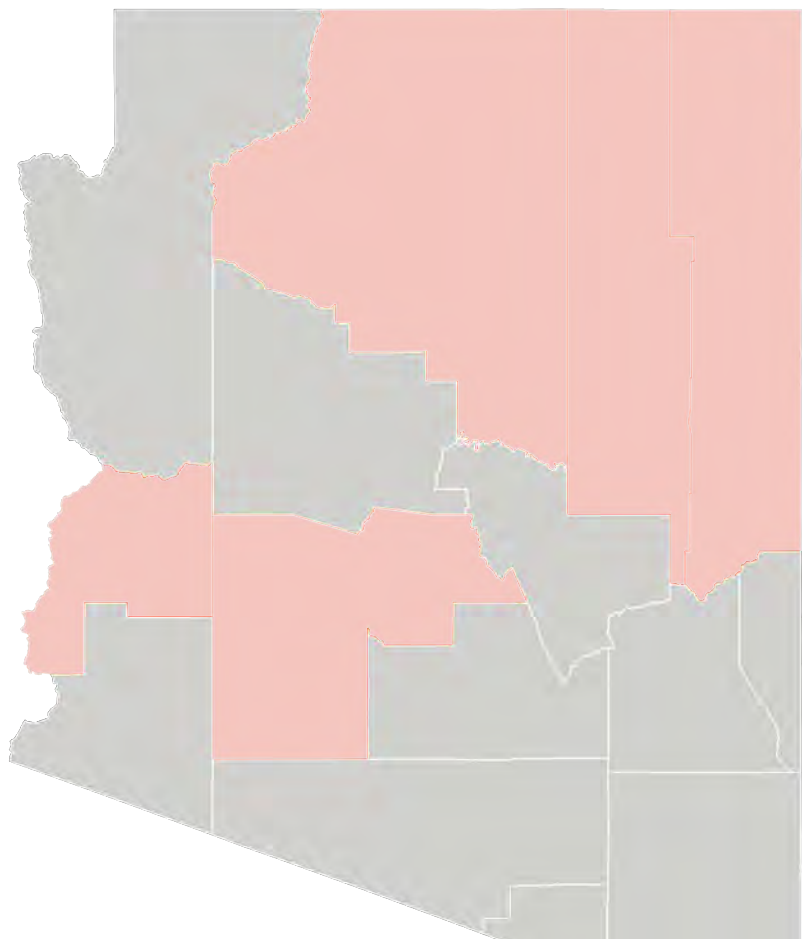
ARIZONA STATISTICS SUMMARY (2011 – 2021)	
5	CLIMATE DISASTER DECLARATIONS
7TH LOWEST	NUMBER OF DISASTER DECLARATIONS
LOWEST	PER CAPITA SPENDING ON CLIMATE DISASTERS IN THE NATION
APACHE, COCONINO, LA PAZ, MARICOPA, AND NAVAJO	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
71	SUPERFUND SITES
332	WASTEWATER DISCHARGE SITES
C	ASCE INFRASTRUCTURE REPORT CARD GRADE
APACHE AND MOHAVE	HIGHEST COMPOUNDING RISKS
$12.6 MILLION	FEMA + HUD POST-DISASTER FUNDING
7.2 MILLION	POPULATION TOTAL
$2	PER CAPITA SPENDING ON CLIMATE DISASTERS
$5.1 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011-2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

5

disaster declarations



Five counties have experienced a disaster in Arizona: Apache, Coconino, La Paz, Maricopa, and Navajo.

Though Arizona appears to have low federal disaster occurrences, Arizona has also experienced multiple heat waves and 3,000 heat-realted deaths between 2010-2020.

Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurences
- 7-9 occurences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

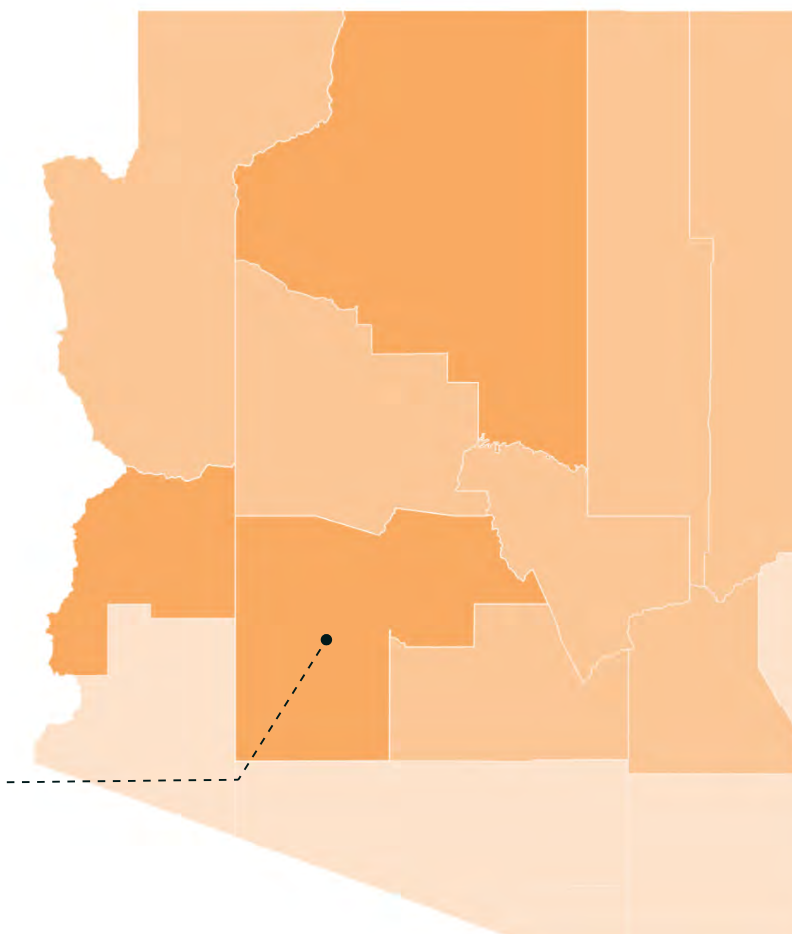
FEDERAL ASSISTANCE 2011-2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$12.6M

post-disaster assistance

$12.6	FEMA obligations
$0	HUD CDBG-DR Funds
$12.6	FEMA + HUD assistance
$2	per capita cost



Maricopa County has received the most post-disaster assistance in the state: nearly $4 million.

FEMA Public Assistance and Hazard Mitigation

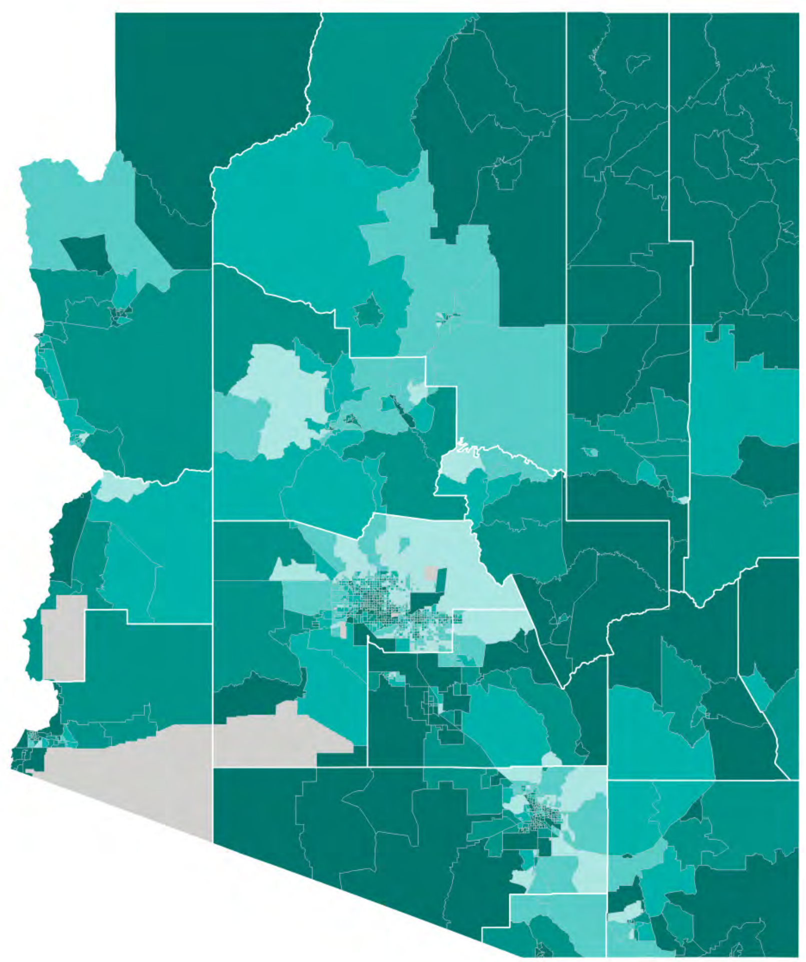
Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

CDC (2018)

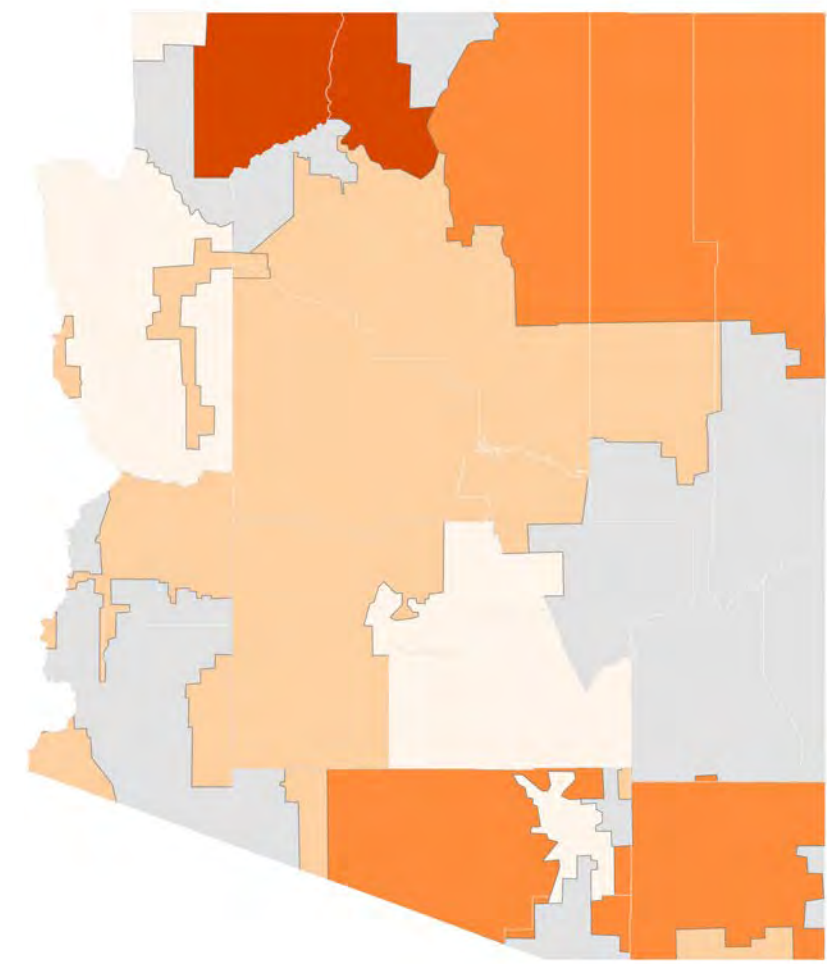
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Four counties in Arizona have high social vulnerability and low energy reliability: Gila, Graham, Pima, and Pinal.



Aggregated Annual Electric Outage Duration

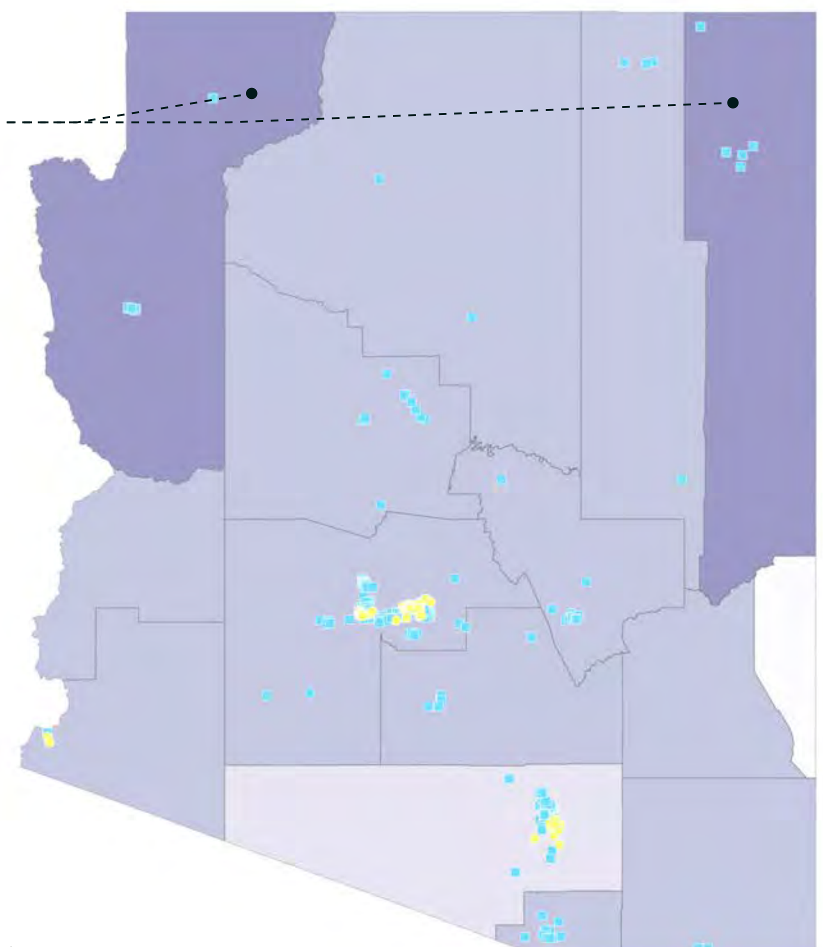
Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Apache and Mohave Counties have high risk of climate disasters, high poverty, and high health risks.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

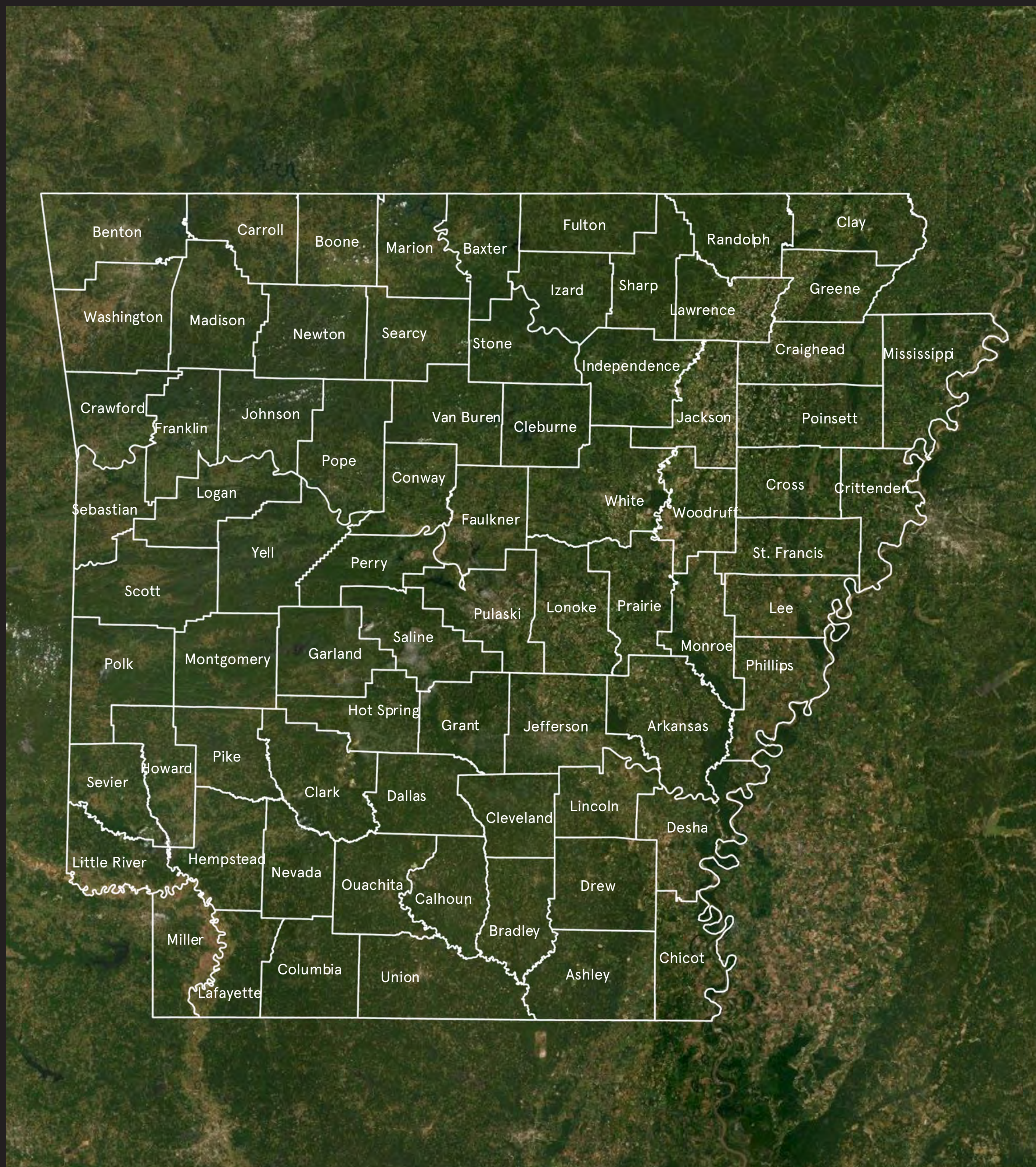
U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Apache					5		3
Cochise					4		2
Coconino					3		2
Gila					4		2
Graham					1		2
Greenlee							0
La Paz					1		2
Maricopa					6		2
Mohave					3		3
Navajo					6		2
Pima					6		1
Pinal					4		2
Santa Cruz					5		2
Yavapai					4		2
Yuma					2		2

ARIZONA

TOTAL: 6 DISASTERS FEMA PA + HM: $12.6 M HUD CDBG-DR: none FEMA + HUD ASSISTANCE: $12.6 M			2013		2014		2018				2019		2021	
			4104: SEVERE FREEZE		4203: SEVERE STORMS AND FLOODING		4389: SEVERE STORMS, FLOODING, AND LANDSLIDES		4409: SEVERE STORMS AND FLOODING		4436: SNOWSTORM AND FLOODING		4620: SEVERE STORMS AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	5	$7,980,216	$1,602,599	$0	$996,426	$50,316	$515,561	$0	$4,260,174	$0	$555,140	$0		
Apache County	1	$0											$0	$0
Cochise County	0	$0												
Coconino County	1	$0											$0	$0
Gila County	0	$0												
Graham County	0	$0												
Greenlee County	0	$0												
La Paz County	1	$631,863			$631,863	$0								
Maricopa County	1	$3,954,670			$3,954,670	$0								
Mohave County	0	$0												
Navajo County	1	$0											$0	$0
Pima County	0	$0												
Pinal County	0	$0												
Santa Cruz County	0	$0												
Yavapai County	0	$0												
Yuma County	0	$0												
Total FEMA Allocation		$12,566,750	$1,602,599	$0	$5,582,960	$50,316	$515,561	$0	$4,260,174	$0	$555,140	$0	$0	$0

ARKANSAS

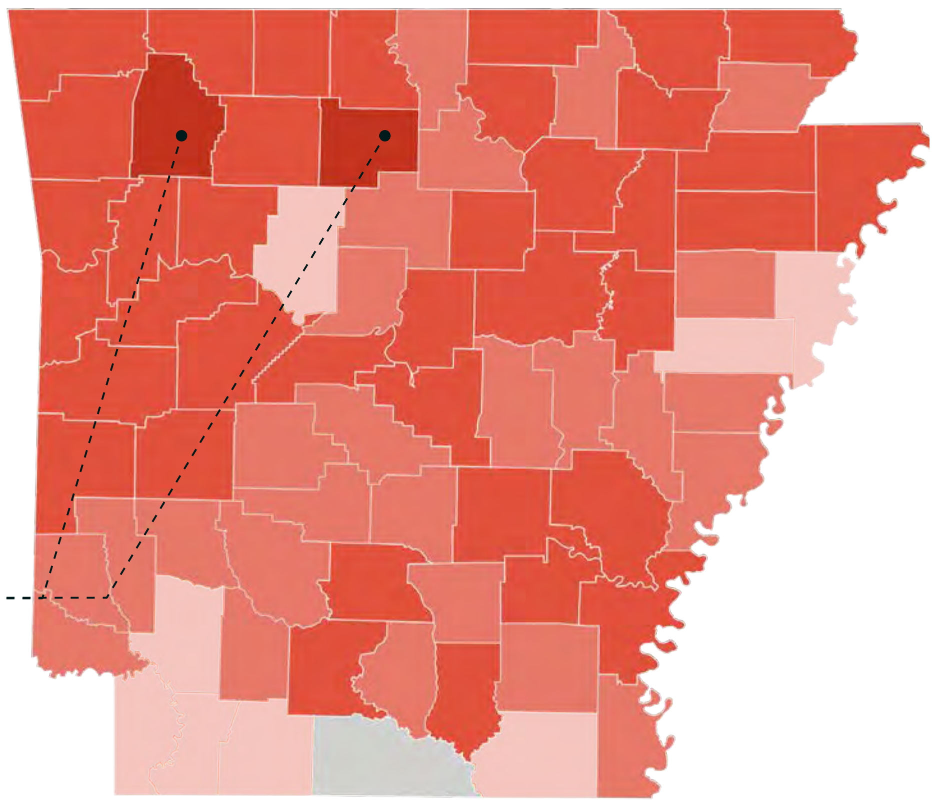


ARKANSAS STATISTICS SUMMARY (2011 – 2021)	
16	CLIMATE DISASTER DECLARATIONS
MADISON, SEARCY	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
18	COUNTIES WITH FIVE OR MORE DISASTERS
6	SUPERFUND SITES
107	WASTEWATER DISCHARGE SITES
WASHINGTON, CRAIGHEAD	HIGHEST COMPOUNDING RISKS
$244 MILLION	FEMA + HUD POST-DISASTER FUNDING
3 MILLION	POPULATION TOTAL
$81	PER CAPITA SPENDING ON CLIMATE DISASTERS
$2.4 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

16
disaster declarations



Eighteen counties in Arkansas have had 5 or more recent disasters.

Madison and Searcy counties have had the highest number of recent disasters: each has had 7 disasters.

Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$244M
post-disaster assistance

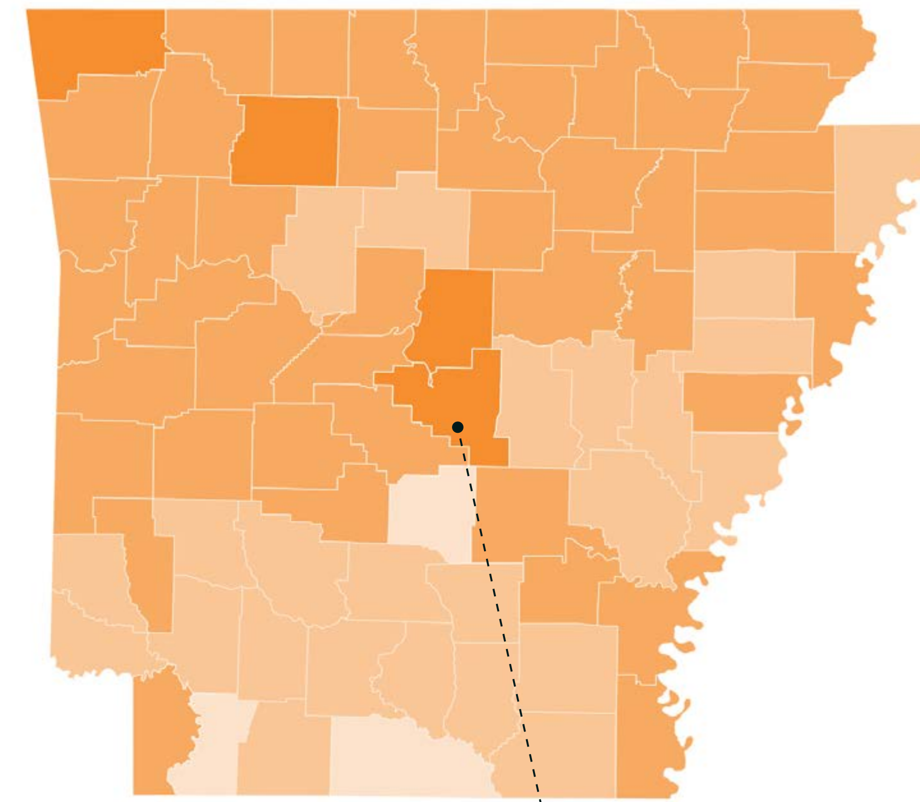
$235M FEMA obligations

$8.9M HUD CDBG-DR Funds

$244M FEMA + HUD assistance

$81 per capita cost

The most expensive recent disaster occurred in 2011 due to severe storms, tornadoes, and flooding, costing over $49 million.



Pulaski has received the most post-disaster assistance in the state: over $30 million.

FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011-2021)

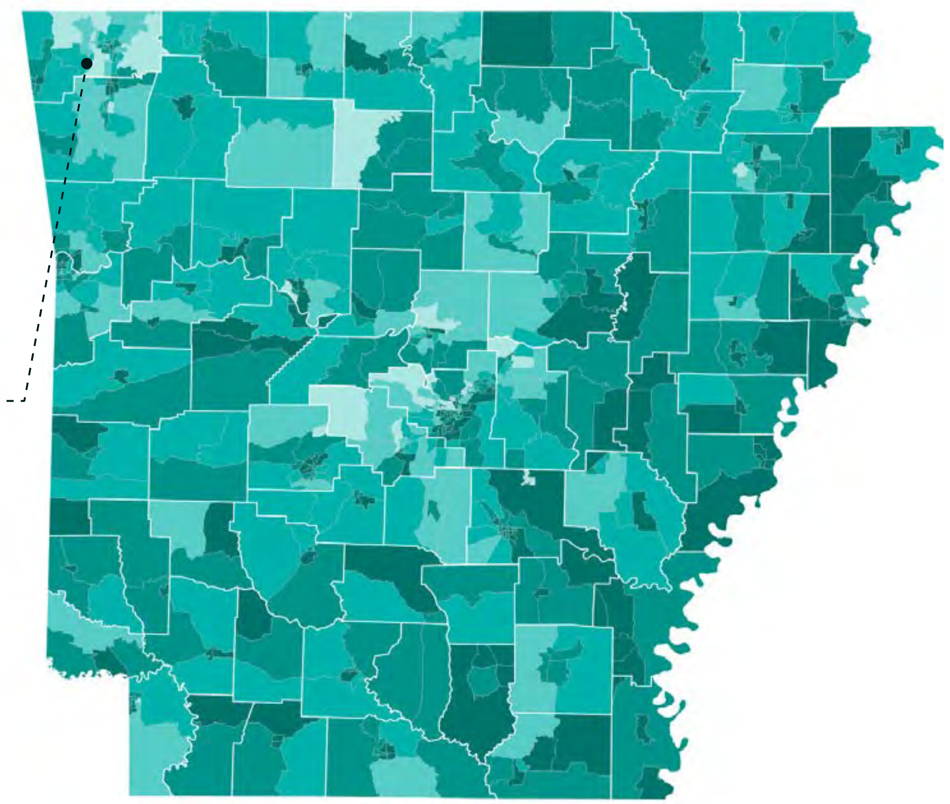
- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Only 2 counties in Arkansas do not have high poverty. One of them, Benton, has received the second most federal funding in the state.



Social Vulnerability Index

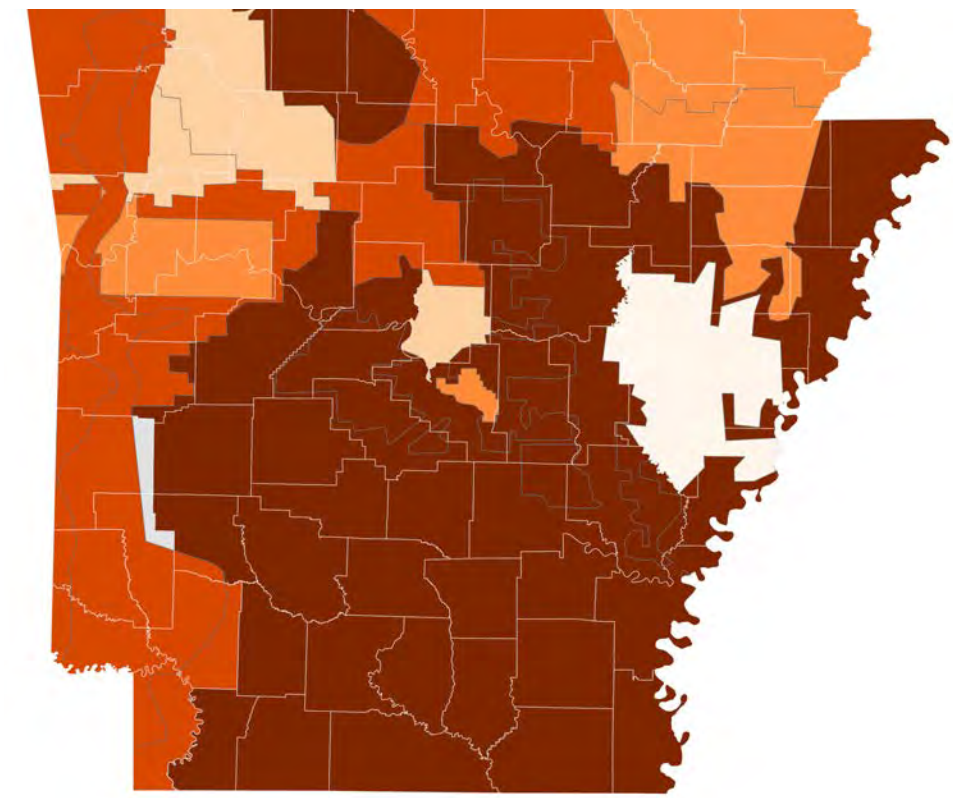
CDC (2018)
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Thirty-two counties in Arkansas have high social vulnerability and low (or patially low) energy reliability.



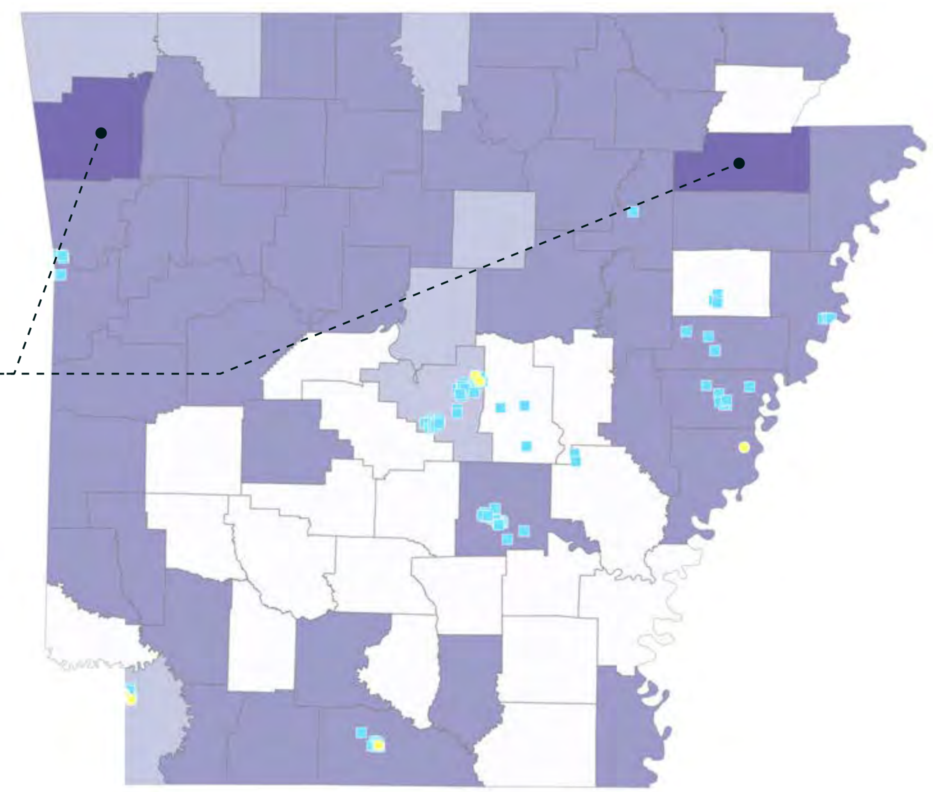
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Washington County and Craighead County have high climate risks, high poverty, high icreases in population, and high health risks.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Arkansas							0
Ashley							0
Baxter					5		2
Benton					2		2
Boone					2		3
Bradley					1		3
Calhoun							0
Carroll					5		2
Chicot					1		3
Clark							0
Clay					1		3
Cleburne					3		2
Craighead					1		4
Cleveland							0
Columbia					1		3
Conway					1		3
Crawford					2		3
Crittenden					1		3
Cross							0
Dallas							0
Desha							0
Drew							0
Faulkner					1		2
Franklin					2		3
Fulton					1		3
Garland					6		3
Grant							0
Greene							0
Hempstead					2		3
Hot Spring							0
Howard					1		3
Independence					2		3
Izard					1		3
Jackson					2		3
Jefferson					3		3
Johnson					1		3
Lafayette					2		3
Lawrence					1		3
Lee					1		3
Lincoln							0
Little River							0
Logan					3		3
Lonoke							0
Madison					2		3
Marion					4		3
Miller					2		2
Mississippi					2		3
Monroe					1		3
Montgomery							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Nevada							0
Newton					1		3
Ouachita					1		3
Perry							0
Phillips					2		3
Pike							0
Poinsett					3		3
Polk					2		3
Pope					2		3
Prairie							0
Pulaski					6		2
Randolph					1		3
Saline							0
Scott					1		3
Searcy					2		3
Sebastian					3		3
Sevier					1		3
Sharp					4		3
St. Francis					2		3
Stone					4		3
Union					1		3
Van Buren					3		3
Washington					5		4
White					2		3
Woodruff					3		3
Yell					4		3

IMAGE RIGHT: EMERGENCY RESPONDERS DURING MAY 2017 FLOODING IN RANDOLPH COUNTY, ARKANSAS. | NASA GODDARD PHOTO AND VIDEO

ARKANSAS

TOTAL: 16 DISASTERS
FEMA PA + HM: $235 M
HUD CDBG-DR: $8.94 M
FEMA + HUD ASSISTANCE: $244 M

County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	2011 – 1975: SEVERE STORMS, TORNADOES, AND ASSOCIATED FLOODING		2011 – 4000: SEVERE STORMS, TORNADOES, AND FLOODING		2013 – 4100: SEVERE WINTER STORM		2013 – 4124: SEVERE STORMS, TORNADOES, AND FLOODING		2013 – 4143: SEVERE STORMS AND FLOODING		2014 – 4160: SEVERE WINTER STORM		2014 – 4174: SEVERE STORMS, TORNADOES, AND FLOODING		2015 – 4226: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		2016 – 4254: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		2016 – 4270: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		2017 – 4318: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		2019 – 4441: SEVERE STORMS AND FLOODING		2019 – 4460: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING		2020 – 4544: SEVERE STORMS, TORNADOES, AND STRAIGHT-LINE WINDS		2020 – 4556: SEVERE STORMS AND STRAIGHT-LINE WINDS		2021 – 4633: SEVERE STORMS AND TORNADOES	
			PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	16	$38,555,620	$8,522,090	$317,222	$1,347,182	$23,036	$1,727,751	$63,921	$173,983	$34,441	$321,201	$18,788	$3,286,294	$29,109	$916,555	$79,450	$1,667,191	$213,009	$688,090	$130,464	$314,587	$19,986	$3,912,457	$230,618	$6,021,721	$484,030	$538,103	$143,361	$883,825	$80,124	$6,231,805	$135,226		
Arkansas County	4	$475,140	$61,145	$0																	$214,938	$0			$0	$0					$199,056	$0		
Ashley County	1	$236,061																			$236,061	$0												
Baxter County	2	$1,340,376	$176,592	$0																			$263,785	$900,000										
Benton County	4	$16,220,587	$4,192,237	$832,217							$3,477,877	$33,750							$2,186,771	$0			$5,497,734	$0										
Boone County	4	$3,252,116	$1,568,001	$0							$484,444	$0							$379,752	$0			$819,919	$0										
Bradley County	4	$372,190	$122,403	$0															$63,489	$0	$114,680	$0									$45,368	$26,250		
Calhoun County	3	$660,026	$353,548	$0															$190,445	$0	$116,034	$0												
Carroll County	4	$2,794,041	$818,529	$0							$404,411	$0							$412,008	$0			$1,140,343	$18,750										
Chicot County	3	$1,650,232	$1,171,221	$0																	$479,011	$0			$0	$0								
Clark County	3	$133,274	$0	$0			$0	$26,250									$107,024	$0																
Clay County	4	$1,123,295	$127,292	$0											$109,967	$0			$77,396	$628,125			$180,515	$0										
Cleburne County	4	$4,845,891	$1,329,101	$0					$1,085,401	$0					$721,677	$0							$1,709,712	$0										
Cleveland County	3	$446,646	$315,876	$0																	$130,770	$0									$0	$0		
Columbia County	1	$379,664																			$379,664	$0												
Conway County	3	$1,115,705	$124,512	$30,000																			$329,279	$0	$605,665	$26,250								
Craighead County	4	$2,268,805	$325,389	$0																			$173,375	$0					$1,743,791	$26,250			$0	$0
Crawford County	6	$6,160,594	$1,288,737	$701,250	$13,317	$0							$175,974	$0			$1,154,462	$987,294	$260,006	$0					$1,579,553	$0								
Crittenden County	1	$734,483	$734,483	$0																														
Cross County	3	$334,043	$95,352	$0					$127,659	$0													$111,032	$0										
Dallas County	4	$211,427	$183,031	$0													$28,396	$0	$0	$0											$0	$0		
Desha County	4	$1,478,617	$0	$0																	$114,189	$0			$854,354	$483,824					$0	$26,250		
Drew County	2	$106,234																	$42,964	$0											$63,270	$0		
Faulkner County	5	$13,211,045	$1,220,763	$0											$3,760,633	$1,609,362			$0	$0			$968,831	$2,544,856	$1,514,199	$1,592,401								
Franklin County	6	$2,301,521	$149,620	$0	$633,854	$0							$114,231	$0			$635,716	$0	$186,150	$0					$581,951	$0								
Fulton County	4	$1,606,549	$1,013,956	$0									$483,980	$0	$108,612	$0							$0	$0										
Garland County	3	$1,716,292	$781,871	$0			$662,066	$19,000									$253,355	$0																
Grant County	2	$1,944					$1,944	$0																							$0	$0		
Greene County	2	$2,523,192	$2,246,149	$0															$277,043	$0														
Hempstead County	1	$136,454															$136,454	$0																
Hot Spring County	2	$891,174	$85,162	$582,082			$201,429	$22,500																										
Howard County	2	$1,269,023	$175,149	$639,264													$454,610	$0																
Independence County	6	$2,331,052	$712,694	$0					$220,606	$37,500					$784,915	$0	$85,915	$0	$243,857	$0			$245,565	$0										
Izard County	5	$1,669,684	$754,313	$0											$239,679	$0	$287,426	$0	$187,737	$0			$170,529	$30,000										
Jackson County	5	$1,117,226	$601,208	$0											$298,701	$0			$0	$0			$217,317	$0									$0	$0
Jefferson County	5	$3,496,592	$0	$0													$136,240	$0	$0	$0					$2,013,515	$859,116					$487,722	$0		
Johnson County	5	$798,188	$103,631	$0	$668,706	$0							$0	$25,851			$0	$0							$0	$0								
Lafayette County	1	$54,621															$54,621	$0																
Lawrence County	4	$1,046,005	$333,062	$0											$149,103	$37,500			$88,808	$0			$437,532	$0										
Lee County	2	$2,484,707	$2,484,707	$0															$0	$0														
Lincoln County	4	$1,254,138	$899,058	$0																	$80,603	$0			$0	$0					$274,476	$0		
Little River County	2	$379,791															$319,427	$0	$60,364	$0														
Logan County	4	$2,553,969											$81,291	$0			$347,939	$0	$384,642	$665,487					$1,048,360	$26,250								
Lonoke County	2	$698,648	$315,923	$0			$157,725	$225,000																										
Madison County	7	$5,127,859	$1,498,909	$0							$503,525	$0	$0	$0			$578,586	$0	$548,000	$0			$1,314,122	$0			$684,717	$0						
Marion County	6	$4,500,388	$290,237	$0							$790,779	$1,081,928	$15,490	$0			$21,494	$0	$853,982	$0			$1,446,478	$0										
Miller County	1	$286,497															$286,497	$0																
Mississippi County	4	$941,326	$288,921	$0															$329,457	$0			$322,949	$0									$0	$0
Monroe County	2	$256,538	$256,538	$0																											$0	$0		
Montgomery County	5	$1,242,241	$269,098	$0					$289,418	$26,250							$167,538	$0	$199,766	$0			$290,171	$0										
Nevada County	2	$309,663	$84,350	$0													$225,313	$0																
Newton County	6	$10,428,589	$1,093,199	$0							$2,222,625	$0	$12,081	$0			$2,591,058	$0					$1,654,906	$0			$2,854,720	$0						
Ouachita County	5	$468,846															$49,589	$0	$25,977	$0	$43,950	$0	$125,601	$0							$223,729	$0		
Perry County	6	$2,047,755	$119,758	$0			$15,404	$0									$187,927	$0	$35,780	$0			$104,015	$0	$1,584,871	$0								
Phillips County	3	$688,963	$468,655	$0																	$94,441	$0									$125,867	$0		
Pike County	3	$600,207	$319,876	$0													$120,867	$0	$159,465	$0														
Poinsett County	4	$1,076,873	$96,628	$0					$398,470	$0													$581,775	$0									$0	$0
Polk County	5	$1,803,910	$68,926	$0					$879,972	$0			$332,879	$0			$223,778	$0	$298,356	$0														
Pope County	1	$0																							$0	$0								
Prairie County	3	$806,400	$549,152	$0																	$99,847	$0	$157,401	$0										
Pulaski County	5	$30,279,638	$2,254,400	$0			$3,257,146	$0							$0	$0							$0	$26,250	$24,741,842	$0								
Randolph County	4	$3,649,213	$1,087,051	$0											$622,875	$0			$223,092	$0			$1,716,195	$0										
St. Francis County	1	$280,625	$280,625	$0																														
Saline County	3	$4,247,189	$446,983	$0			$2,269,936	$1,053,563															$476,707	$0										
Scott County	4	$3,420,216							$2,192,616	$450,000			$143,416	$0			$601,322	$0	$32,862	$0														
Searcy County	7	$3,492,980	$747,632	$703,312					$421,245	$0			$3,125	$0			$338,858	$0	$317,485	$0			$236,002	$0	$725,322	$0								
Sebastian County	4	$7,433,058											$788,242	$710,083			$0	$0	$70,479	$0					$5,864,254	$0								
Sevier County	2	$252,840															$252,840	$0	$0	$0														
Sharp County	3	$3,838,145	$1,978,062	$0									$35,567	$30,000	$1,794,517	$0																		
Stone County	3	$1,794,400	$769,520	$0					$650,698	$0									$374,182	$0														
Union County	0	$0																																
Van Buren County	3	$701,738	$471,472	$0					$114,923	$0			$115,343	$0																				
Washington County	4	$9,236,232	$2,027,145	$886,186															$1,800,710	$0			$2,523,305	$0			$1,961,386	$37,500						
White County	4	$5,788,469	$589,424	$4,133,666					$41,426	$0					$58,434	$0			$156,609	$562,500			$246,410	$0										
Woodruff County	5	$1,038,826	$371,607	$0					$114,064	$431,250									$28,481	$0			$93,425	$0									$0	$0
Yell County	5	$2,163,720	$170,290	$0													$109,504	$675,000	$179,223	$0			$0	$0	$1,029,702	$0								
Total FEMA Allocation		$234,640,224	$49,985,261	$8,825,199	$2,663,060	$23,036	$8,293,401	$1,410,234	$6,710,480	$979,441	$8,204,862	$1,134,466	$5,587,913	$795,043	$9,565,668	$1,726,312	$11,423,947	$1,875,303	$11,363,428	$1,986,576	$2,418,773	$19,986	$27,467,386	$3,750,474	$48,165,309	$3,471,871	$6,038,927	$180,861	$2,627,615	$106,374	$7,651,294	$187,726	$0	$0

CALIFORNIA

CALIFORNIA STATISTICS SUMMARY (2011 - 2021)	
25	CLIMATE DISASTER DECLARATIONS
HIGHEST	NUMBER OF DISASTERS IN THE COUNTRY
NAPA	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
15	COUNTIES WITH FIVE OR MORE DISASTERS
BUTTE	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
1966	SUPERFUND SITES
2557	WASTEWATER DISCHARGE SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
ALAMEDA, CONTRA COSTA, DEL NORTE, SACRAMENTO, SAN JOAQUIN, YUBA	HIGHEST COMPOUNDING RISKS
$6.2 BILLION	FEMA + HUD POST-DISASTER FUNDING
39.3 MILLION	POPULATION TOTAL
$157	PER CAPITA SPENDING ON CLIMATE DISASTERS
$32.9 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

25

disaster declarations

Fifty-eight counties in California have had recent disasters.

Napa County has had the highest number of recent disasters in the state: 9 disasters.

Number of Disaster Events

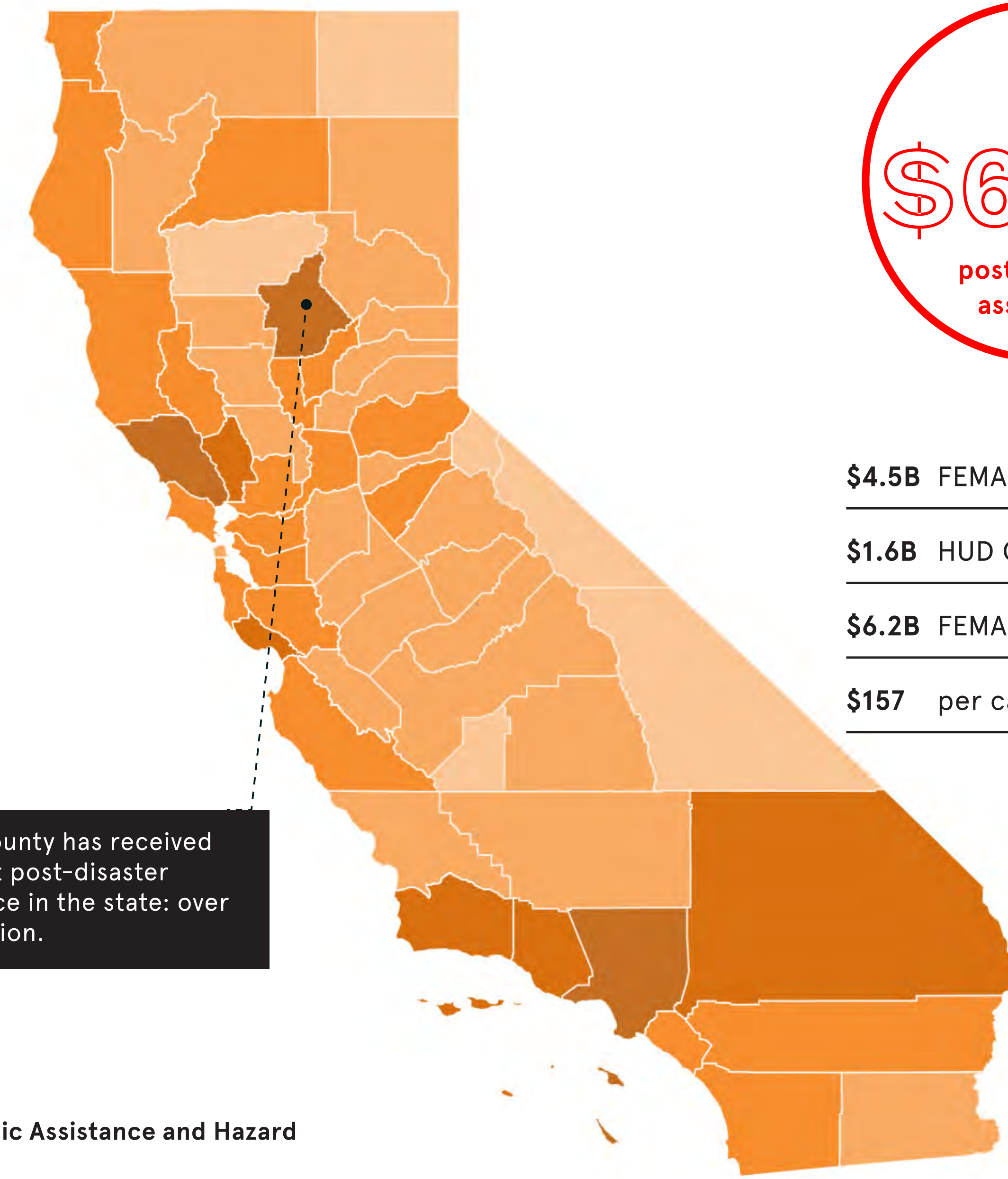
Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS



$6.2B

post-disaster assistance

$4.5B	FEMA obligations
$1.6B	HUD CDBG-DR Funds
$6.2B	FEMA + HUD assistance
$157	per capita cost

Butte County has received the most post-disaster assistance in the state: over $183 million.

FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011–2021)

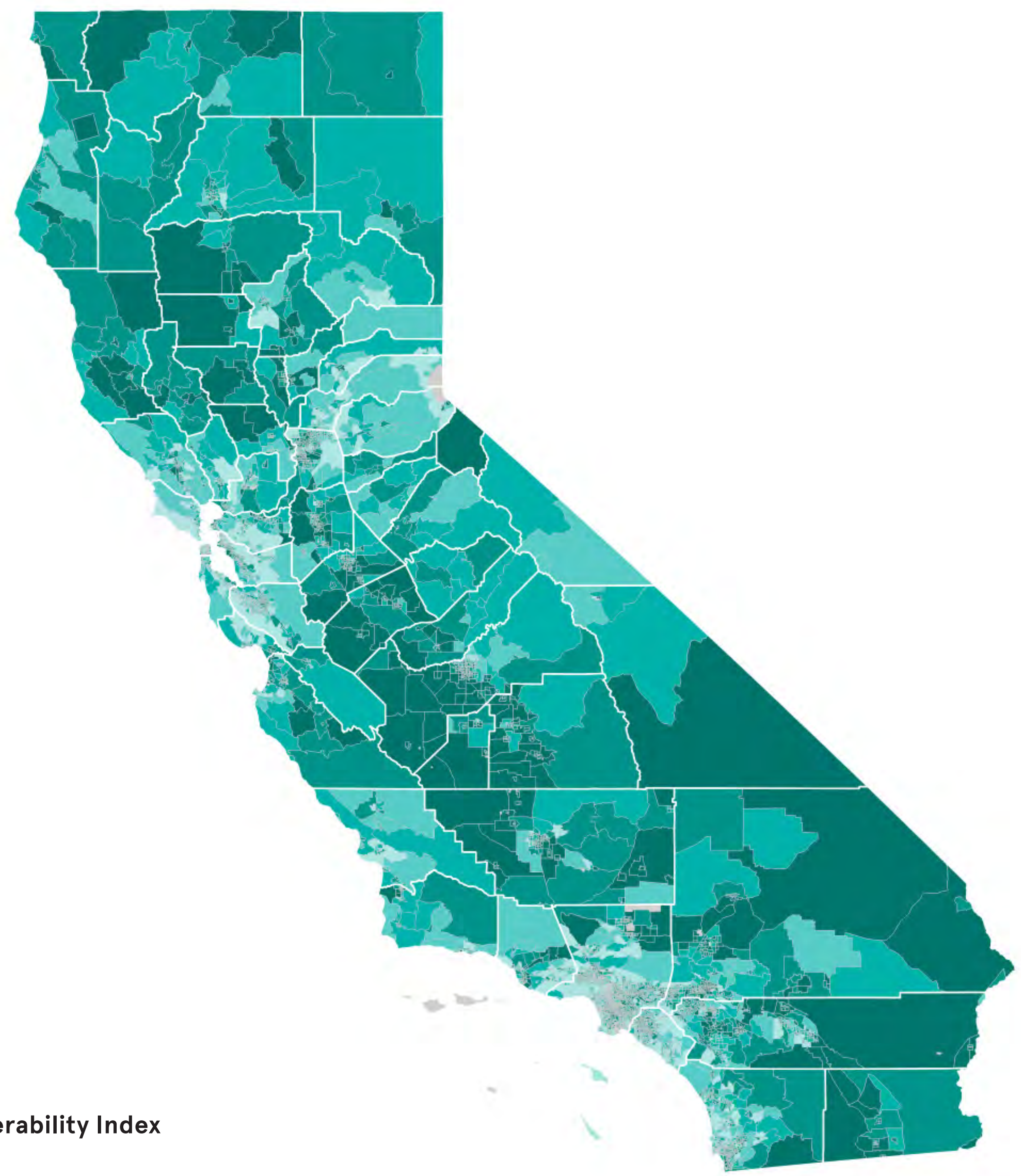
- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

In 2018, California received $2 billion in post-disaster FEMA assistance across three wildfire disasters.

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

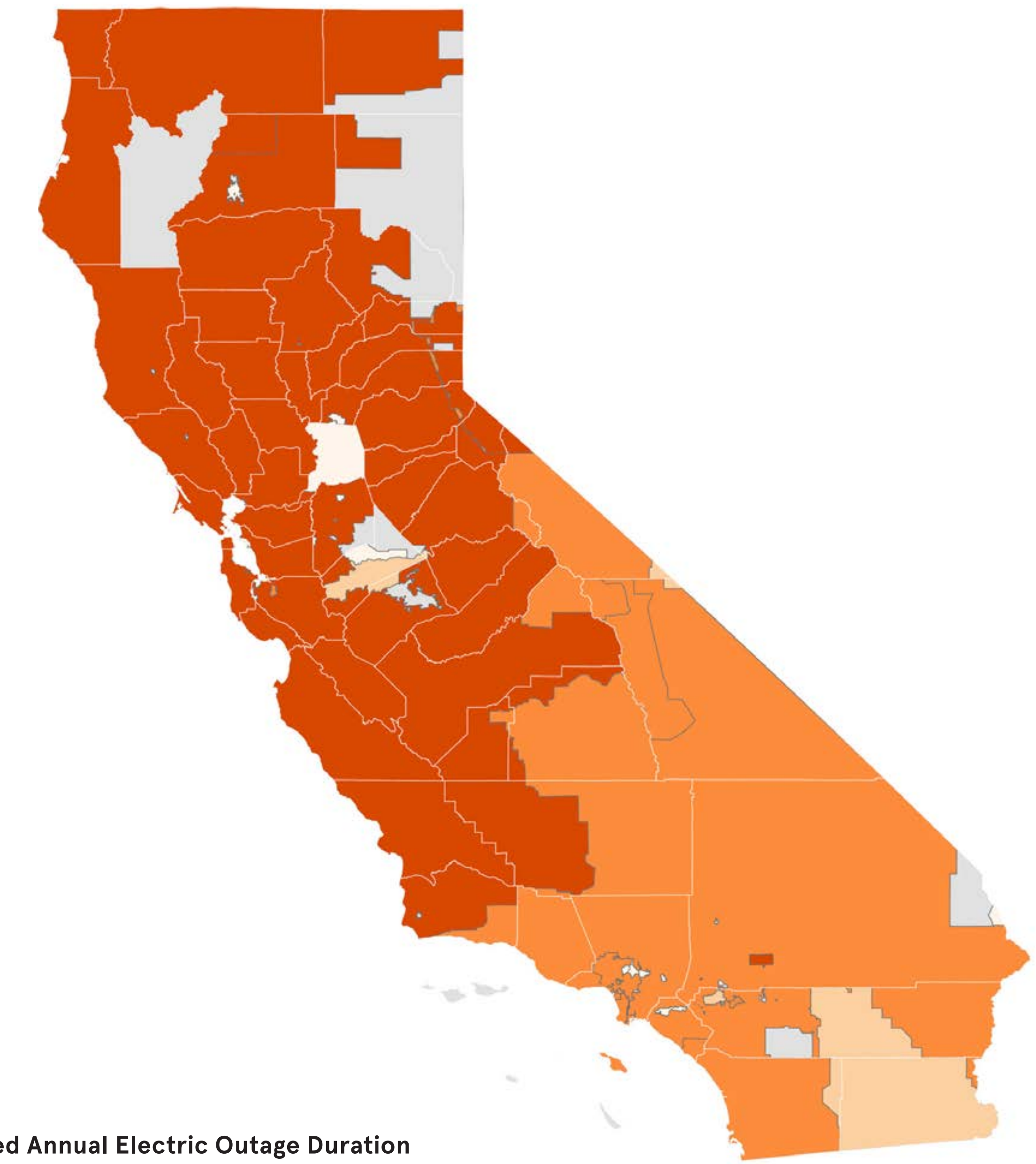
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration

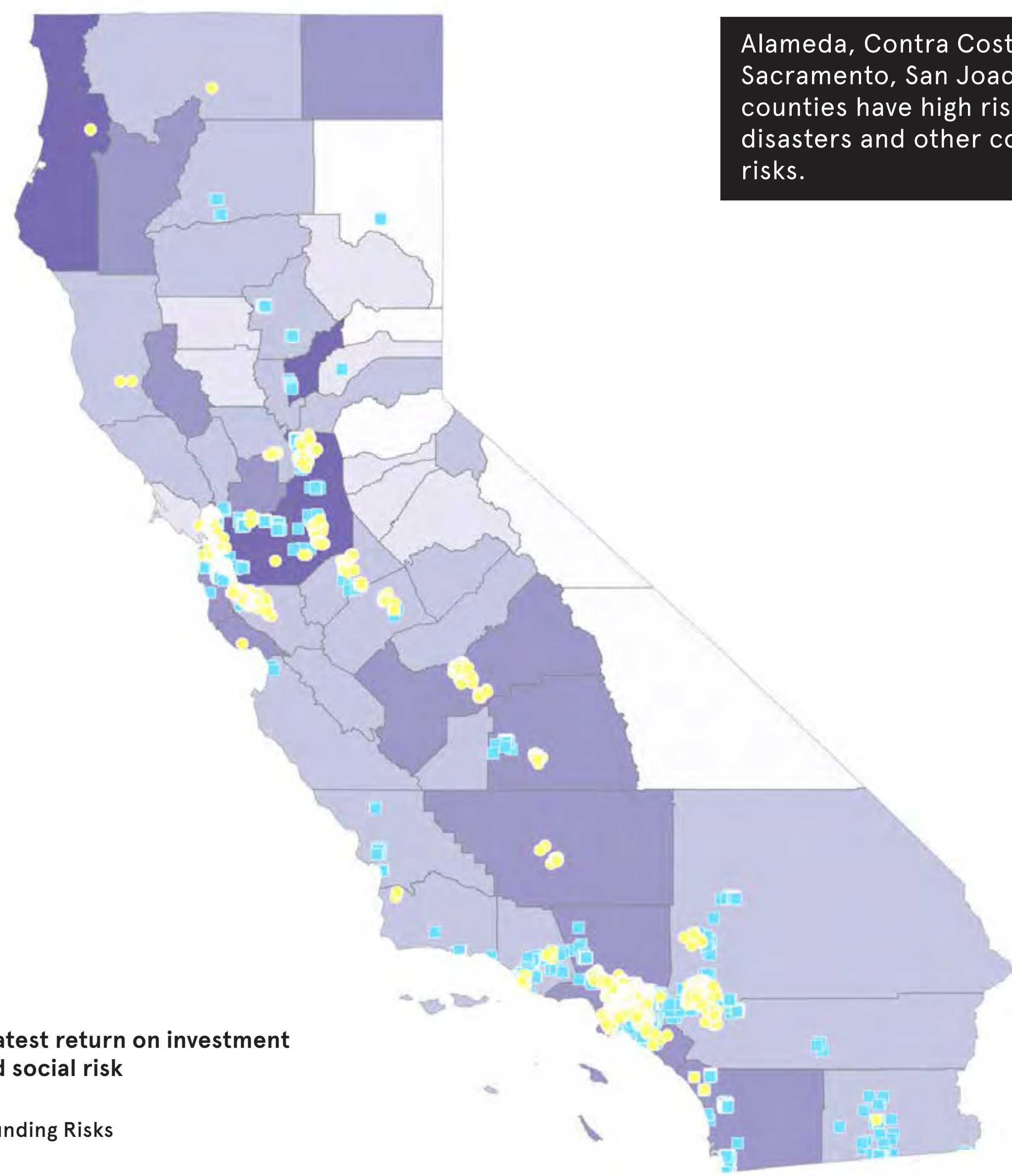
Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Alameda, Contra Costa, Del Norte, Sacramento, San Joaquin, and Yuba counties have high risk of climate disasters and other compounding risks.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Alameda					2		4
Alpine					1		2
Amador					1		1
Butte					4		2
Calaveras					3		1
Colusa					1		1
Contra Costa					2		4
Del Norte					1		4
El Dorado							0
Fresno					5		3
Glenn					1		1
Humboldt					2		4
Imperial					3		2
Inyo							0
Kern					3		3
Kings					2		2
Lake					3		3
Lassen							0
Los Angeles					6		3
Madera					4		2
Marin							1
Mariposa					2		2
Mendocino					5		2
Merced					4		2
Modoc					2		3
Mono							0
Monterey					4		2
Napa					2		2
Nevada					2		1
Orange					2		3
Placer					1		2
Plumas					3		1
Riverside					4		2
Sacramento					3		4
San Benito					1		2
San Bernardino					3		2
San Diego					3		3
San Francisco					1		3
San Joaquin					2		4
San Luis Obispo					1		2
San Mateo					1		3
Santa Barbara					3		2
Santa Clara					1		2
Santa Cruz					2		3
Shasta					5		2
Sierra							0
Siskiyou					3		2
Solano					2		3
Sonoma					4		2

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Stanislaus					2		2
Sutter					1		2
Tehama					1		2
Trinity					2		3
Tulare					4		3
Tuolumne					3		1
Ventura					3		2
Yolo					1		2
Yuba					1		4

THE SHELL FIRE RAGES ON LATE SUNDAY NIGHT, JULY 27, 2021, HAVING BURNED NEARLY 2,000 ACRES. | RUSS ALLISON LOAR

"The magnitude of the challenge is self-evident, the extreme droughts, the record-breaking heat that we experienced just 24 or so months ago, record-breaking wildfires ... require us to do more and to manage these existential threats more aggressively. We're doing everything in our power, not just rhetorical."

– Governor Newsom

CALIFORNIA

TOTAL: 25 DISASTERS
FEMA PA + HM: $ 4.5 B
HUD CDBG-DR: $ 1.6 B
FEMA + HUD ASSISTANCE: $6.2 B

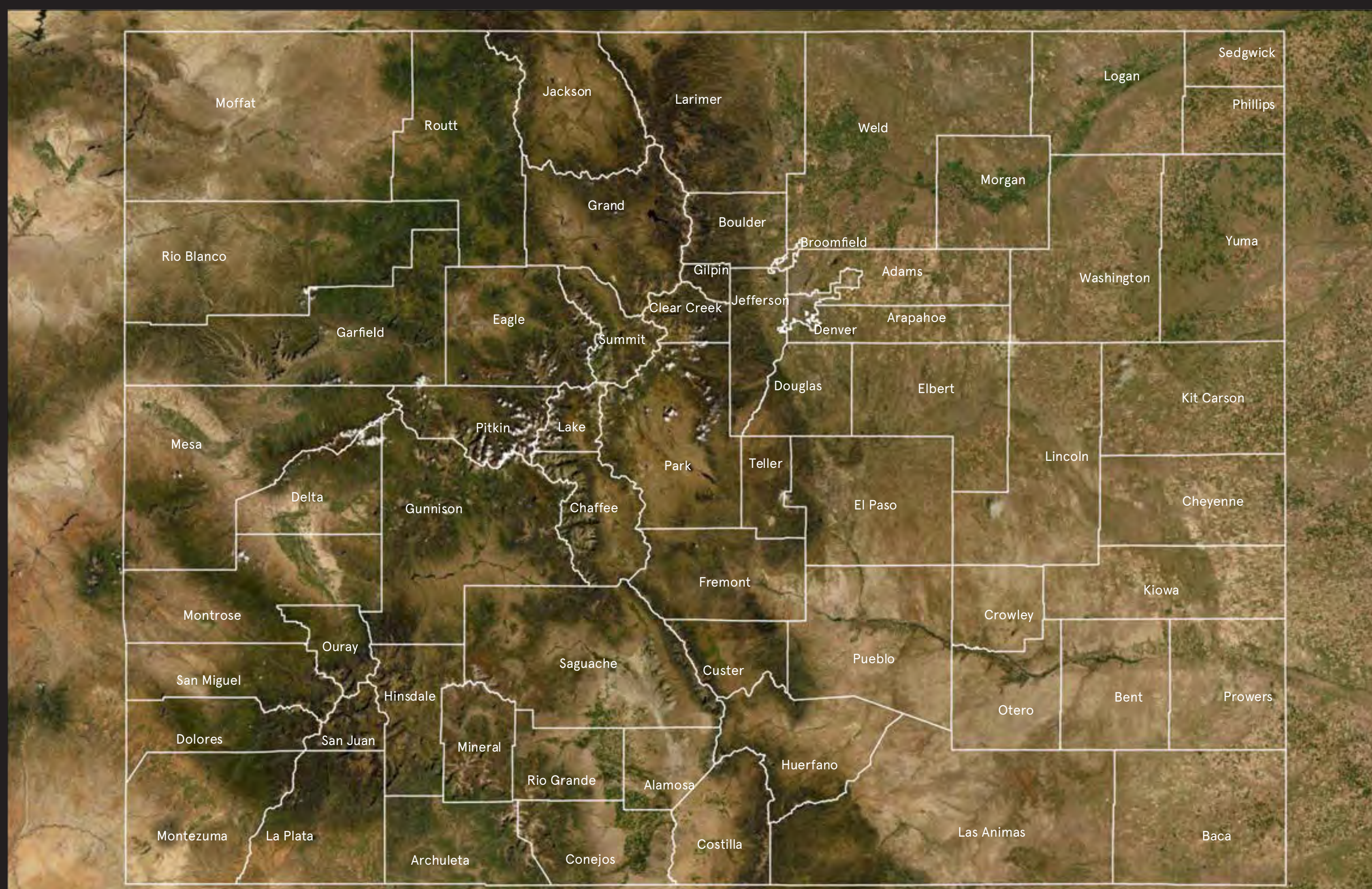
			2011				2013				2014		2015			
			1952: SEVERE WINTER STORMS, FLOODING, AND DEBRIS AND MUD FLOWS		1968: TSUNAMI WAVES		4142: WILDFIRE		4158: RIM FIRE		4193: EARTHQUAKE		4206: SEVERE STORMS, FLOODING, AND MUDSLIDES		4240: VALLEY FIRE AND BUTTE FIRE	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	25	$3,397,710,976	$8,686,951	$1,667,616	$1,284,364	$1,172,334	$444,517	$0	$20,313,601	$273,204	$5,535,216	$310,972	$1,068,005	$0	$209,373,270	$1,884,146
Alameda County	3	$17,941,389							$2,929,011	$0						
Alpine County	1	$458,117														
Amador County	3	$3,210,712														
Butte County	6	$183,345,251														
Calaveras County	5	$21,592,448													$13,642,173	$3,411,750
Colusa County	3	$2,306,197														
Contra Costa County	3	$24,374,863														
Del Norte County	4	$21,133,115			$18,646,214	$686,966										
El Dorado County	5	$15,160,710														
Fresno County	1	$2,436,863														
Glenn County	2	$2,260,743														
Humboldt County	3	$22,066,055														
Imperial County	0	$36,505														
Inyo County	3	$304,067	$304,067	$0												
Kern County	2	$8,110,387	$4,100,690	$0												
Kings County	2	$84,569	$84,569	$0												
Lake County	8	$23,935,714													$12,256,828	$897,881
Lassen County	4	$1,988,639														
Los Angeles County	4	$93,695,636														
Madera County	1	$1,463,196	$350,914	$0												
Marin County	4	$11,314,293														
Mariposa County	3	$1,259,142	$103,994	$0												
Mendocino County	7	$24,200,612														
Merced County	2	$1,325,424														
Modoc County	3	$232,758														
Mono County	3	$391,746														
Monterey County	5	$27,448,218			$3,107,906	$0										
Napa County	9	$46,941,315									$20,730,200	$2,247,438				
Nevada County	5	$3,379,843														
Orange County	3	$18,287,244	$8,912,552	$0												
Placer County	2	$4,110,232														
Plumas County	4	$2,011,890														
Riverside County	3	$28,699,813	$4,106,705	$133,200												
Sacramento County	3	$13,347,528														
San Benito County	2	$1,216,536														
San Bernardino County	2	$45,802,859	$43,112,365	$217,028												
San Diego County	4	$14,189,170	$7,800,776	$736,983												
San Francisco County	0	$0														
San Joaquin County	1	$4,423,391														
San Luis Obispo County	4	$7,940,038	$621,522	$2,395,019												
San Mateo County	3	$11,326,679														
Santa Barbara County	5	$65,357,839	$1,207,247	$931,373												
Santa Clara County	3	$32,342,737							$335,353	$2,720,383						
Santa Cruz County	5	$65,900,583			$14,665,229	$601,692										
Shasta County	5	$29,166,087														
Sierra County	3	$4,236,110														
Siskiyou County	3	$1,336,614														
Solano County	5	$10,797,401									$3,344,995	$120,882				
Sonoma County	6	$97,869,536														
Stanislaus County	2	$2,902,424														
Sutter County	2	$9,208,304														
Tehama County	3	$748,113														
Trinity County	7	$4,448,776														
Tulare County	2	$1,510,392	$1,497,218	$0												
Tuolumne County	6	$9,168,127							$1,156,987	$892,467						

	2017											
	4301: SEVERE WINTER STORMS, FLOODING, AND MUDSLIDES		4302: SEVERE WINTER STORM		4305: SEVERE WINTER STORMS, FLOODING, AND MUDSLIDES		4308: SEVERE WINTER STORMS, FLOODING, AND MUDSLIDES		4312: FLOODING		4344: WILDFIRES	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$16,585,550	$1,389,288	$3,345,510	$0	$3,796,780	$495,692	$600,492,556	$6,635,187	$269,935	$0	$416,028,795	$21,317,309
Alameda County	$2,752,582	$3,062,355			$264,901	$0	$6,647,458	$2,285,083				
Alpine County	$241,192	$0					$216,925	$0				
Amador County	$1,119,012	$0					$1,858,303	$0				
Butte County	$6,302,647	$0					$3,268,948	$0			$106,139	$0
Calaveras County	$1,634,280	$0			$11,144	$6,626	$1,170,911	$0				
Colusa County	$272,363	$0					$1,076,677	$0				
Contra Costa County	$3,608,183	$0			$451,791	$0	$16,369,184	$3,945,705				
Del Norte County							$1,704,751	$0				
El Dorado County	$6,793,300	$0			$840,071	$0	$6,848,395	$0				
Fresno County												
Glenn County							$168,870	$0				
Humboldt County	$7,973,332	$1,974,171					$7,206,106	$0				
Imperial County					$36,505	$0						
Inyo County	$0	$0			$0	$0						
Kern County					$4,009,697	$0						
Kings County							$0	$0				
Lake County	$1,868,024	$0					$3,503,225	$99,774			$314,835	$86,125
Lassen County	$459,692	$0					$1,290,665	$0				
Los Angeles County	$962,413	$0			$11,220,114	$712,936						
Madera County												
Marin County	$3,701,206	$2,982,753					$2,708,858	$0				
Mariposa County							$1,155,148	$0				
Mendocino County	$4,474,676	$0			$5,440,648	$286,443					$5,711,765	$6,008,591
Merced County	$616,093	$0					$709,330	$0				
Modoc County					$10,484	$0	$86,708	$0				
Mono County	$64,968	$0			$28,827	$0	$297,951	$0				
Monterey County	$12,144,855	$0					$11,442,337	$0				
Napa County	$3,955,989	$474,035			$970,869	$0	$2,616,699	$0			$7,268,977	$2,912,999
Nevada County	$1,744,146	$0					$834,491	$0			$137,302	$498,167
Orange County					$3,417,567	$30,000					$2,689,082	$3,238,043
Placer County	$4,078,725	$0			$31,507	$0						
Plumas County	$853,091	$0					$989,817	$0				
Riverside County					$3,356,628	$0						
Sacramento County	$4,072,664	$973,888			$4,084,714	$0	$4,115,780	$100,482				
San Benito County	$508,402	$0					$708,134	$0				
San Bernardino County												
San Diego County					$5,244,045	$0						
San Francisco County												
San Joaquin County							$3,954,475	$468,917				
San Luis Obispo County	$1,275,992	$0			$439,596	$0	$967,574	$2,240,335				
San Mateo County					$2,982,312	$381,474	$5,269,333	$1,125,767				
Santa Barbara County					$644,977	$1,127,835	$3,077,948	$3,922,882				
Santa Clara County	$13,423,881	$0					$11,244,170	$3,000,000				
Santa Cruz County	$3,617,472	$838,388			$11,590,950	$41,438	$27,297,925	$0				
Shasta County	$4,268,736	$0					$2,643,163	$0				
Sierra County	$1,277,981	$0					$2,620,630	$0				
Siskiyou County	$471,575	$0					$566,342	$0				
Solano County	$3,841,915	$0					$1,102,689	$0			$794,522	$197,032
Sonoma County	$2,889,042	$2,407,018					$2,889,794	$2,849,656			$58,372,563	$18,225,521
Stanislaus County							$2,533,063	$0				
Sutter County	$1,415,377	$2,624,163					$5,168,764	$0				
Tehama County							$264,383	$0				
Trinity County	$35,390	$0			$1,215,994	$0	$1,193,086	$0				
Tulare County												
Tuolumne County	$4,236,608	$0			$741,467	$0	$1,270,759	$0				

	2018						2019									
	4353: WILDFIRES, FLOODING, MUDFLOWS, AND DEBRIS FLOWS		4382: WILDFIRES AND HIGH WINDS		4407: WILDFIRES		4422: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4423: SEVERE STORMS AND FLOODING		4425: SEVERE STORMS AND FLOODING		4431: SEVERE WINTER STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4434: SEVERE WINTER STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$269,715,536	$752,202	$314,655,848	$1,171,510	$1,043,935,632	$21,111,412	$540,891	$0	$2,087,711	$0	$173,370	$0	$6,673,995	$344,489	$1,639,547	$324,359
Alameda County																
Alpine County																
Amador County															$233,397	$0
Butte County					$158,859,407	$6,034,778									$1,756,391	$0
Calaveras County													$1,318,199	$397,365		
Colusa County													$87,103	$0	$870,054	$0
Contra Costa County																
Del Norte County															$4,874	$0
El Dorado County															$0	$317,250
Fresno County																
Glenn County															$2,091,873	$0
Humboldt County															$4,696,357	$112,500
Imperial County																
Inyo County																
Kern County																
Kings County																
Lake County			$2,305,129	$0											$1,865,504	$158,468
Lassen County																
Los Angeles County	$0	$2,222,817			$51,523,775	$20,650,738										
Madera County																
Marin County													$1,598,222	$0	$323,254	$0
Mariposa County													$0	$0	$0	$0
Mendocino County													$0	$0	$2,121,729	$0
Merced County																
Modoc County													$135,566	$0		
Mono County																
Monterey County															$347,453	$0
Napa County													$0	$0	$512,055	$0
Nevada County																
Orange County																
Placer County																
Plumas County																
Riverside County													$21,103,280	$0		
Sacramento County																
San Benito County																
San Bernardino County																
San Diego County	$0	$0														
San Francisco County																
San Joaquin County																
San Luis Obispo County																
San Mateo County																
Santa Barbara County	$52,413,167	$253,204											$1,367,567	$411,639		
Santa Clara County																
Santa Cruz County																
Shasta County			$17,208,844	$860,700									$3,655,537	$0		
Sierra County																
Siskiyou County																
Solano County																
Sonoma County															$7,248,226	$888,119
Stanislaus County																
Sutter County																
Tehama County															$483,730	$0
Trinity County													$869,493	$0	$180,108	$0
Tulare County																
Tuolumne County															$579,104	$0

	2020				2021			
	4558: WILDFIRES		4569: WILDFIRES		4610: WILDFIRES		4619: WILDFIRES	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$261,259,360	$170,974	$133,062,736	$67,278	$7,737,043	$0	$9,916,286	$0
Alameda County								
Alpine County								
Amador County								
Butte County	$7,016,942	$0						
Calaveras County								
Colusa County								
Contra Costa County								
Del Norte County			$90,310	$0				
El Dorado County							$361,695	$0
Fresno County			$2,436,863	$0				
Glenn County								
Humboldt County	$103,589	$0						
Imperial County								
Inyo County								
Kern County								
Kings County								
Lake County	$579,921	$0					$0	$0
Lassen County	$238,282	$0			$0	$0		
Los Angeles County			$6,402,844	$0				
Madera County			$1,112,282	$0				
Marin County								
Mariposa County								
Mendocino County	$86,143	$0	$70,616	$0				
Merced County								
Modoc County								
Mono County								
Monterey County	$405,667	$0						
Napa County	$2,314,798	$0	$2,937,255	$0				
Nevada County	$165,737	$0			$0	$0		
Orange County								
Placer County					$0	$0		
Plumas County	$108,038	$0			$60,943	$0		
Riverside County								
Sacramento County								
San Benito County								
San Bernardino County			$2,473,466	$0				
San Diego County			$407,366	$0				
San Francisco County								
San Joaquin County								
San Luis Obispo County								
San Mateo County	$1,567,794	$0						
Santa Barbara County								
Santa Clara County	$1,618,950	$0						
Santa Cruz County	$7,247,488	$0						
Shasta County			$529,107	$0				
Sierra County	$337,499	$0						
Siskiyou County			$298,697	$0				
Solano County	$1,395,366	$0						
Sonoma County	$1,350,715	$0	$748,884	$0				
Stanislaus County	$369,361	$0						
Sutter County								
Tehama County					$0	$0		
Trinity County	$946,479	$0			$8,227	$0		
Tulare County	$13,174	$0						
Tuolumne County	$290,735	$0						

COLORADO

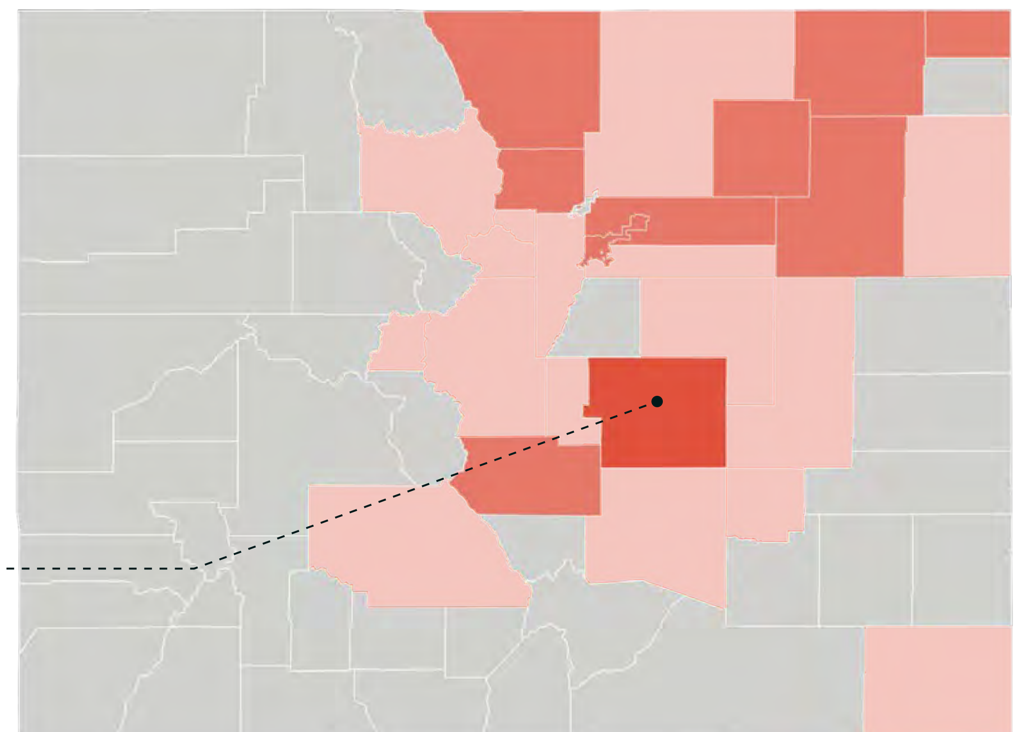


COLORADO STATISTICS SUMMARY (2011 - 2021)	
7	CLIMATE DISASTER DECLARATIONS
EL PASO	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
38	COUNTIES WITH FIVE OR MORE DISASTERS
96	SUPERFUND SITES
204	WASTEWATER DISCHARGE SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
ARAPAHOE, DENVER	HIGHEST COMPOUNDING RISKS
$799 MILLION	FEMA + HUD POST-DISASTER FUNDING
BOULDER	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
5.7 MILLION	POPULATION TOTAL
$141	PER CAPITA SPENDING ON CLIMATE DISASTERS
$5.9 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

7
disaster declarations



Twenty-six counties in Colorado have had a recent disaster.

El Paso County has had the highest number of recent disasters: 4 disasters.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurences
- 7–9 occurences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

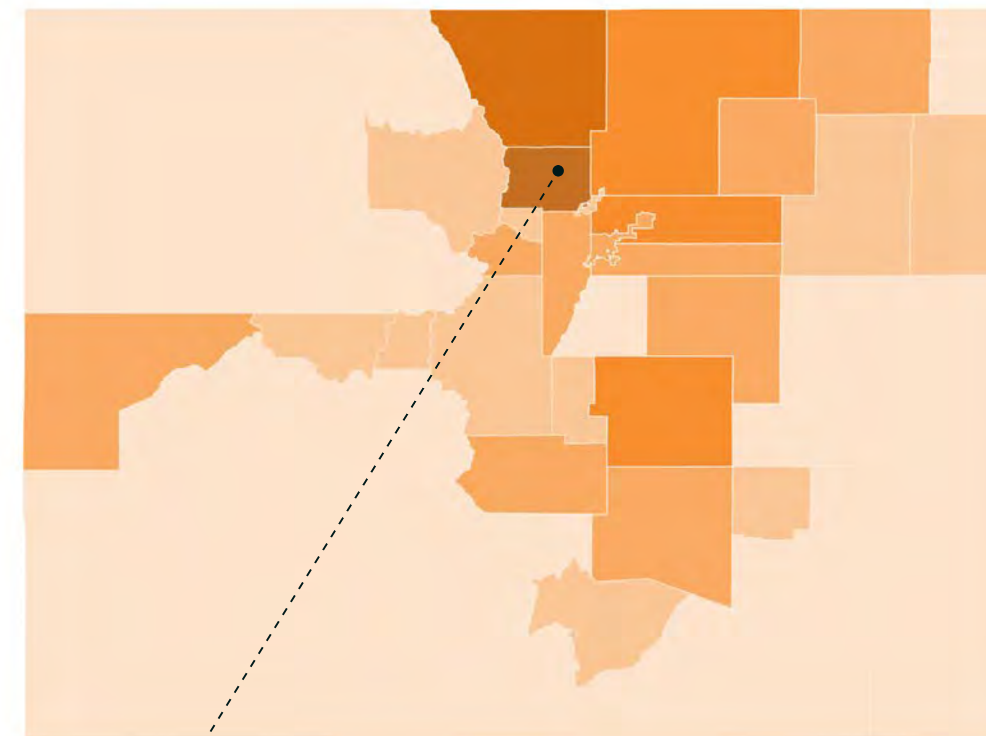
$799M
post-disaster assistance

$471M FEMA obligations

$327M HUD CDBG-DR Funds

$799M FEMA + HUD assistance

$141 per capita cost



Boulder County has recieved the most post-disaster FEMA funds, largely due to the 2013 floods (the most expensive disaster in recent history).

FEMA Public Assistance and Hazard Mitigation

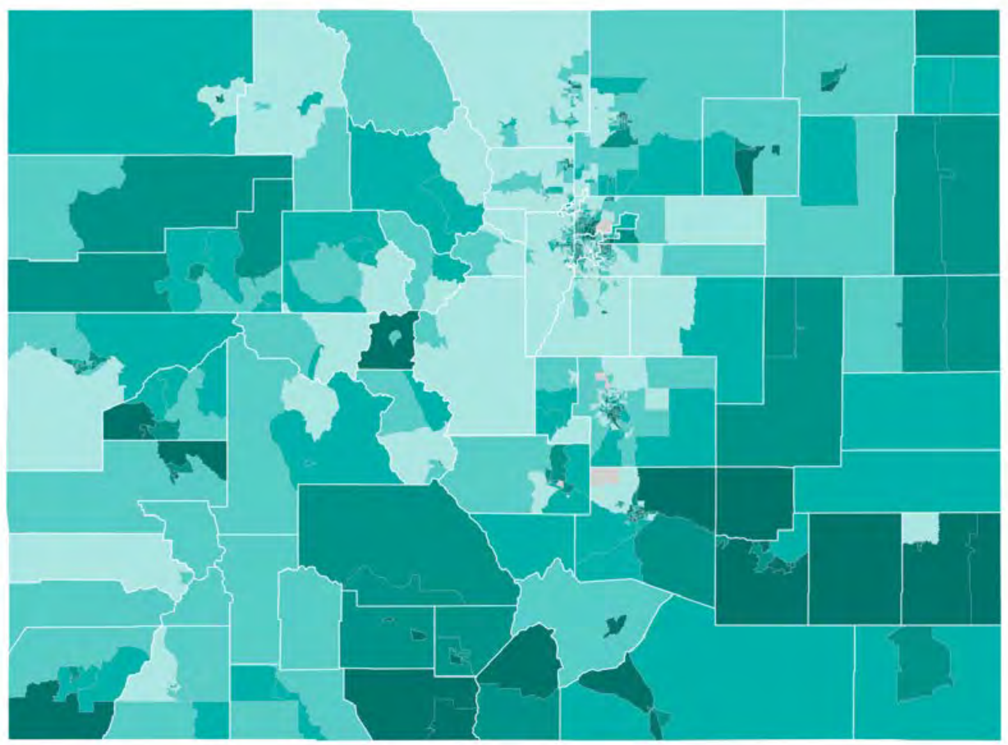
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



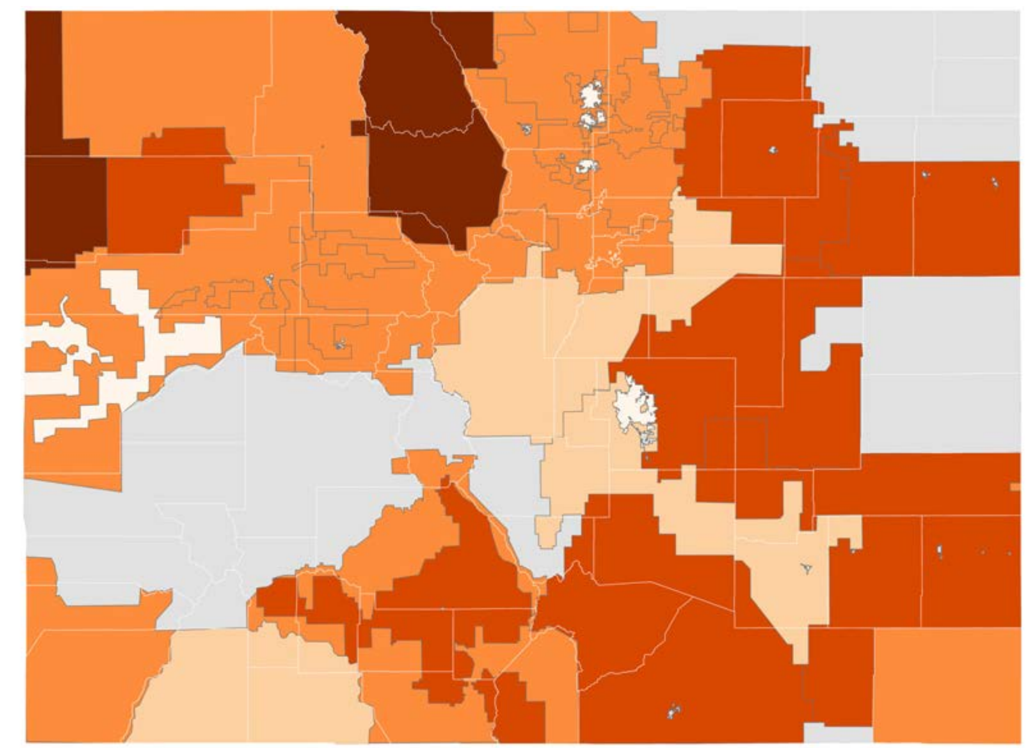
Social Vulnerability Index

CDC (2018)
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

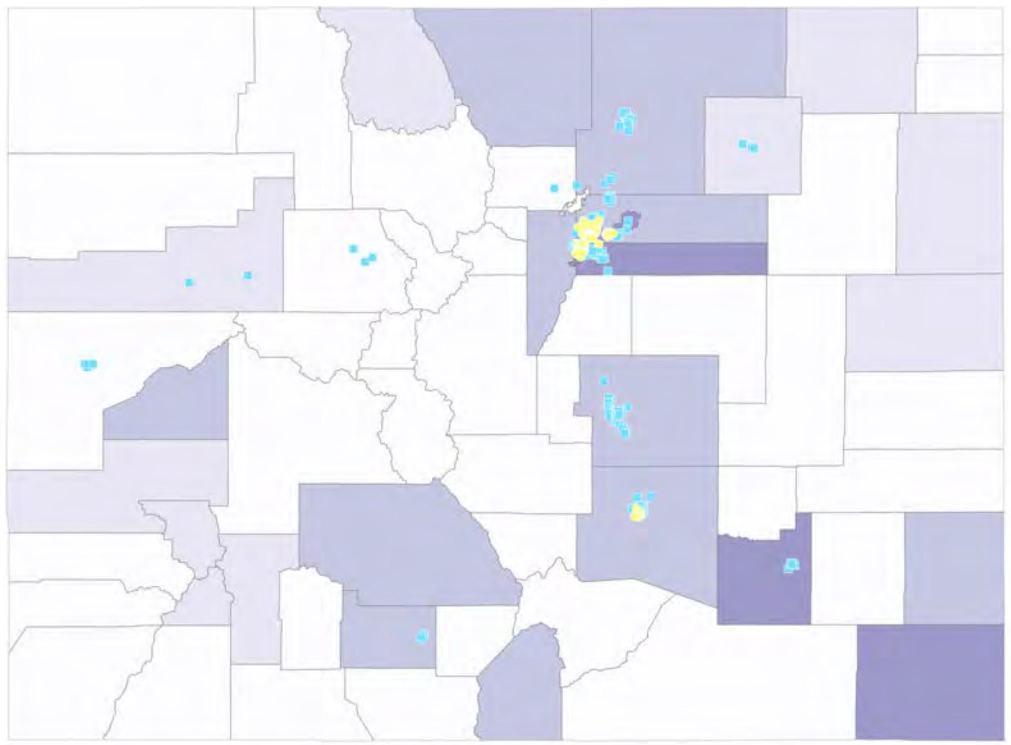
- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Arapahoe County and Denver County have high risk of climate disasters, high density, and high increases in population.

Baca County and Otero County have high risk of climate disasters, high poverty, and high health risks.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adams					2		2
Alamosa							0
Arapahoe					2		3
Archuleta							0
Baca					1		3
Bent							0
Boulder							0
Broomfield							0
Chaffee							0
Cheyenne							0
Clear Creek							0
Conejos							0
Costilla					1		2
Crowley							0
Custer							0
Delta					1		2
Denver					4		3
Dolores							0
Douglas							0
Eagle							0
El Paso					4		2
Elbert							0
Fremont							0
Garfield					1		1
Gilpin							0
Grand							0
Gunnison							0
Hinsdale					1		1
Huerfano							0
Jackson					1		1
Jefferson					1		2
Kiowa							0
Kit Carson					1		1
La Plata							0
Lake							0
Larimer					4		2
Las Animas							0
Lincoln							0
Logan					1		1
Mesa							0
Mineral							0
Moffat							0
Montezuma							0
Montrose					1		1
Morgan					1		1
Otero					2		3
Ouray					1		1
Park							0
Phillips							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Pitkin							0
Prowers					2		2
Pueblo					4		2
Rio Blanco							0
Rio Grande					1		2
Routt							0
Saguache					1		2
San Juan					1		1
San Miguel							0
Sedgwick							0
Summit							0
Teller							0
Washington							0
Weld					2		2
Yuma					2		1

IMAGE RIGHT: FRONT PORCH OF HOME BURNED BY THE MARSHALL FIRE. DECEMBER 31, 2021 | B. MURPHY

COLORADO

TOTAL: 7 DISASTERS FEMA PA+ HM: $471 M HUD CDBG-DR: $327 M FEMA + HUD ASSISTANCE: $799 M			2012		2013						2015		2021			
			4067: HIGH PARK AND WALDO CANYON WILDFIRES		4133: ROYAL GORGE FIRE		4134: BLACK FOREST WILDFIRE		4145: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4229: SEVERE STORMS, TORNADOES, FLOODING, LANDSLIDES, AND MUDSLIDES		4581: WILDFIRES		4634: WILDFIRES AND STRAIGHT-LINE WINDS	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	7	$65,022,613	$1,826,943	$0	$55,001	$0	$163,805	$0	$32,912,250	$5,313,125	$2,344,902	$96,220	$22,310,366	$0		
Adams County	2	$10,933,651							$4,990,320	$255,092	$5,688,238	$0				
Alamosa County	0	$0														
Arapahoe County	1	$2,461,032							$2,461,032	$0						
Archuleta County	0	$0														
Baca County	1	$7,191									$7,191	$0				
Bent County	0	$0														
Boulder County	3	$204,351,469							$181,996,982	$20,257,262	$2,097,225	$0			$0	$0
Broomfield County	0	$342,482							$342,482	$0						
Chaffee County	0	$0														
Cheyenne County	0	$0														
Clear Creek County	1	$1,054,897							$958,438	$96,459						
Conejos County	0	$0														
Costilla County	0	$0														
Crowley County	1	$285,714							$285,714	$0						
Custer County	0	$0														
Delta County	0	$0														
Denver County	2	$7,904,273							$2,349,774	$5,523,753	$30,746	$0				
Dolores County	0	$0														
Douglas County	0	$0														
Eagle County	0	$0														
Elbert County	1	$978,029									$978,029	$0				
El Paso County	4	$45,393,883	$1,646,851	$234,533			$6,453,937	$430,052	$7,431,960	$17,738,574	$9,644,098	$1,813,878				
Fremont County	3	$1,655,117			$118,357	$0			$760,107	$0	$776,652	$0				
Garfield County	0	$0														
Gilpin County	1	$665,623							$594,197	$71,426						
Grand County	1	$703,942											$703,942	$0		
Gunnison County	0	$0														
Hinsdale County	0	$0														
Huerfano County	0	$0														
Jackson County	0	$0														
Jefferson County	1	$7,712,112							$7,599,116	$112,996						
Kiowa County	0	$0														
Kit Carson County	0	$0														
Lake County	1	$110,912							$110,912	$0						
La Plata County	0	$0														
Larimer County	3	$90,018,043	$471,317	$0					$83,196,240	$1,768,878	$217,599	$0	$4,364,009	$0		
Las Animas County	0	$0														
Lincoln County	1	$70,300							$70,300	$0						
Logan County	2	$1,964,091							$590,043	$47,547	$1,326,501	$0				
Mesa County	0	$0														
Mineral County	0	$0														
Moffat County	0	$0														
Montezuma County	0	$0														
Montrose County	0	$0														
Morgan County	2	$3,545,731							$2,874,034	$0	$671,697	$0				
Otero County	0	$0														
Ouray County	0	$0														
Park County	1	$390,259									$390,259	$0				
Phillips County	0	$0														
Pitkin County	0	$0														
Prowers County	0	$0														
Pueblo County	1	$1,274,422									$1,274,422	$0				
Rio Blanco County	0	$0														
Rio Grande County	0	$0														
Routt County	0	$0														
Saguache County	1	$86,615									$86,615	$0				
San Juan County	0	$0														
San Miguel County	0	$0														
Sedgwick County	2	$20,618							$20,618	$0	$0	$0				
Summit County	0	$0														
Teller County	1	$101,681	$101,681	$0												
Washington County	2	$300,395							$277,783	$10,335	$12,278	$0				
Weld County	1	$23,648,739							$20,581,676	$2,889,017	$178,046	$0				
Yuma County	1	$294,170									$294,170	$0				
Total FEMA Allocation		$471,298,004	$4,046,793	$234,533	$173,358	$0	$6,617,742	$430,052	$350,403,979	$54,084,463	$26,018,668	$1,910,098	$27,378,317	$0	$0	$0

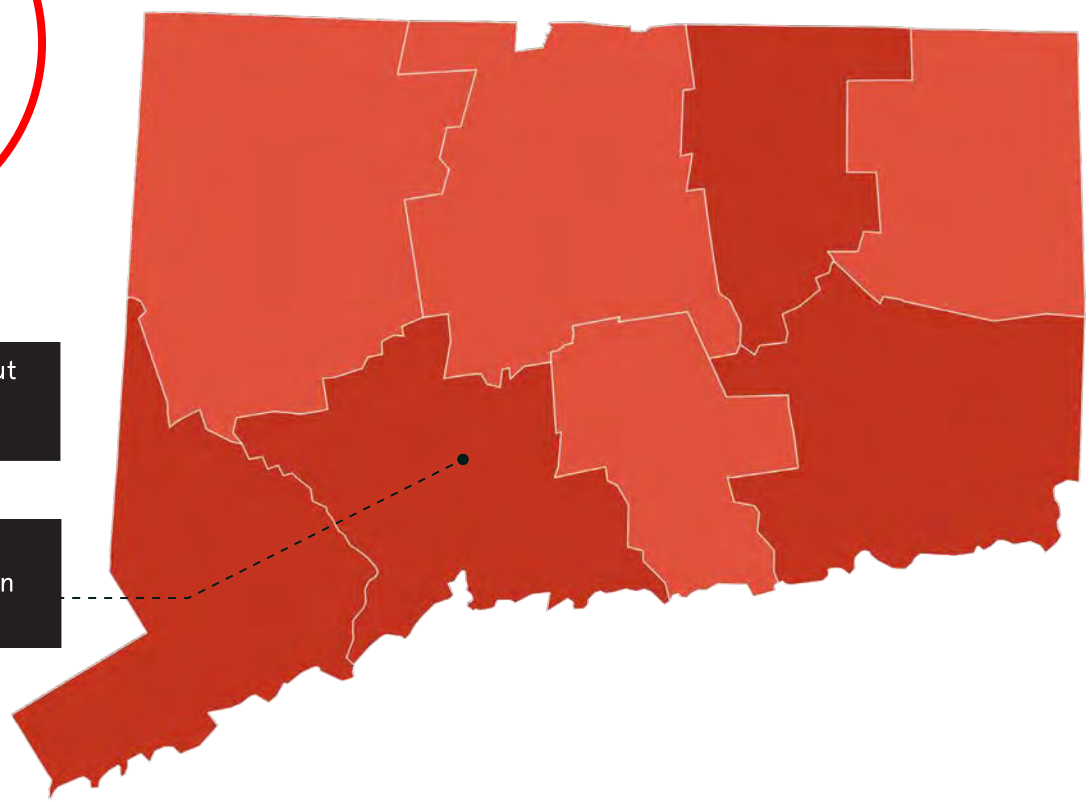
CONNECTICUT

CONNECTICUT STATISTICS SUMMARY (2011 - 2021)	
10	CLIMATE DISASTER DECLARATIONS
NEW HAVEN	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
ALL	COUNTIES HAVE HAD FIVE OR MORE DISASTERS
44	SUPERFUND SITES
52	WASTEWATER DISCHARGE SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
HARTFORD, NEW HAVEN	HIGHEST COMPOUNDING RISKS
$532 MILLION	FEMA + HUD POST-DISASTER FUNDING
FAIRFIELD	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
3.6 MILLION	POPULATION TOTAL
$149	PER CAPITA SPENDING ON CLIMATE DISASTERS
$3.7 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

10
disaster declarations



Every county in Connecticut has had at least 5 recent disasters.

New Haven County has had the most recent disasters in Connecticut: 9 disasters.

Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

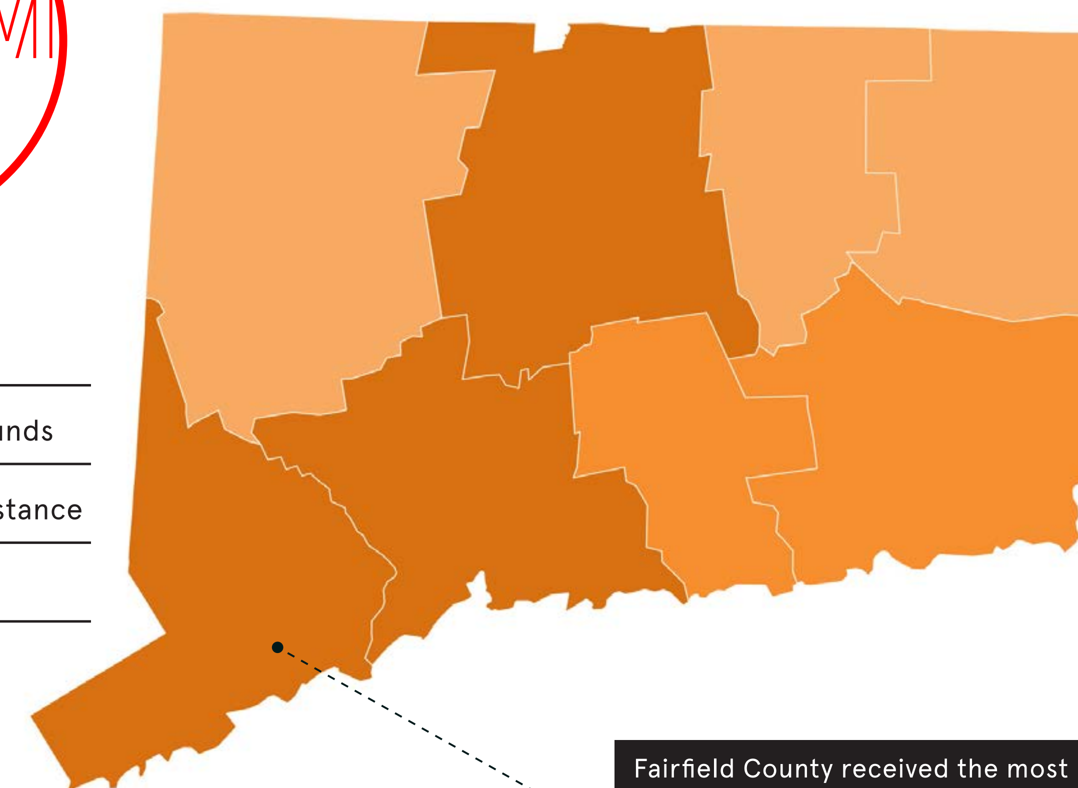
$532M
post-disaster assistance

$318M FEMA obligations

$214M HUD CDBG-DR Funds

$532M FEMA + HUD assistance

$149 per capita cost



Fairfield County received the most post-disaster assistance in the state: over $70 million.

The most expensive recent disaster in the state was Hurricane Sandy in 2012, which totaled over $70 million in FEMA assistance.

FEMA Public Assistance and Hazard Mitigation

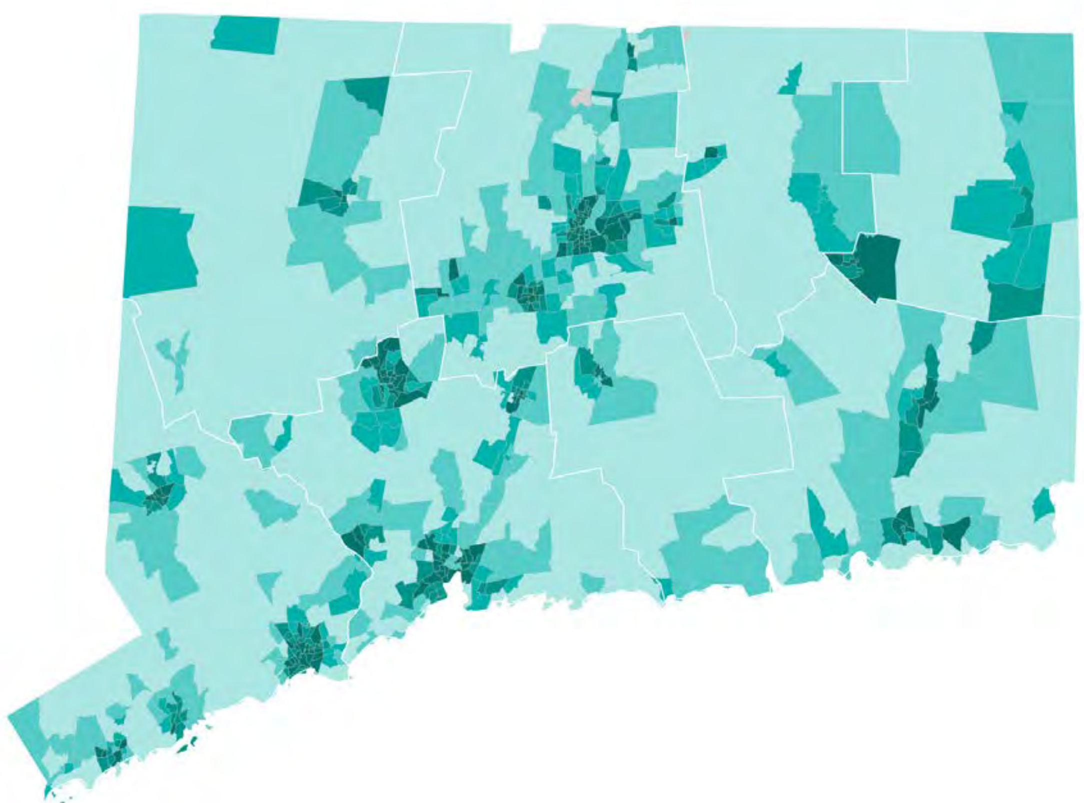
Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

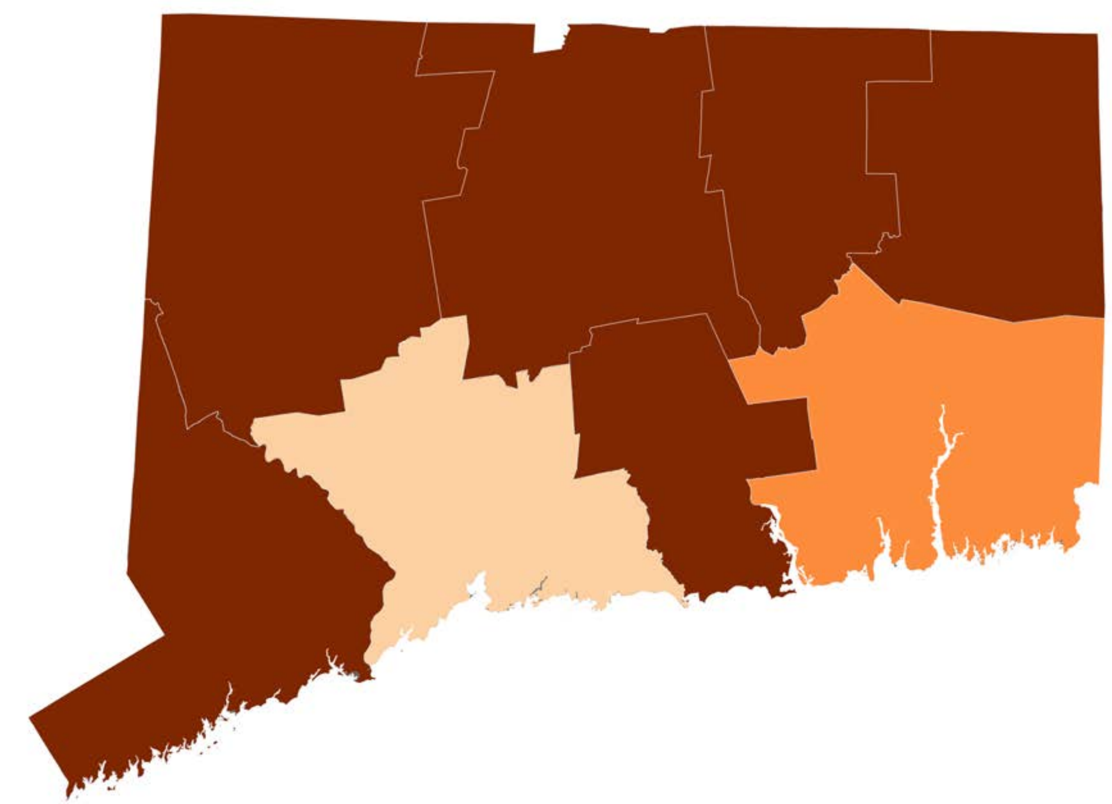
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration

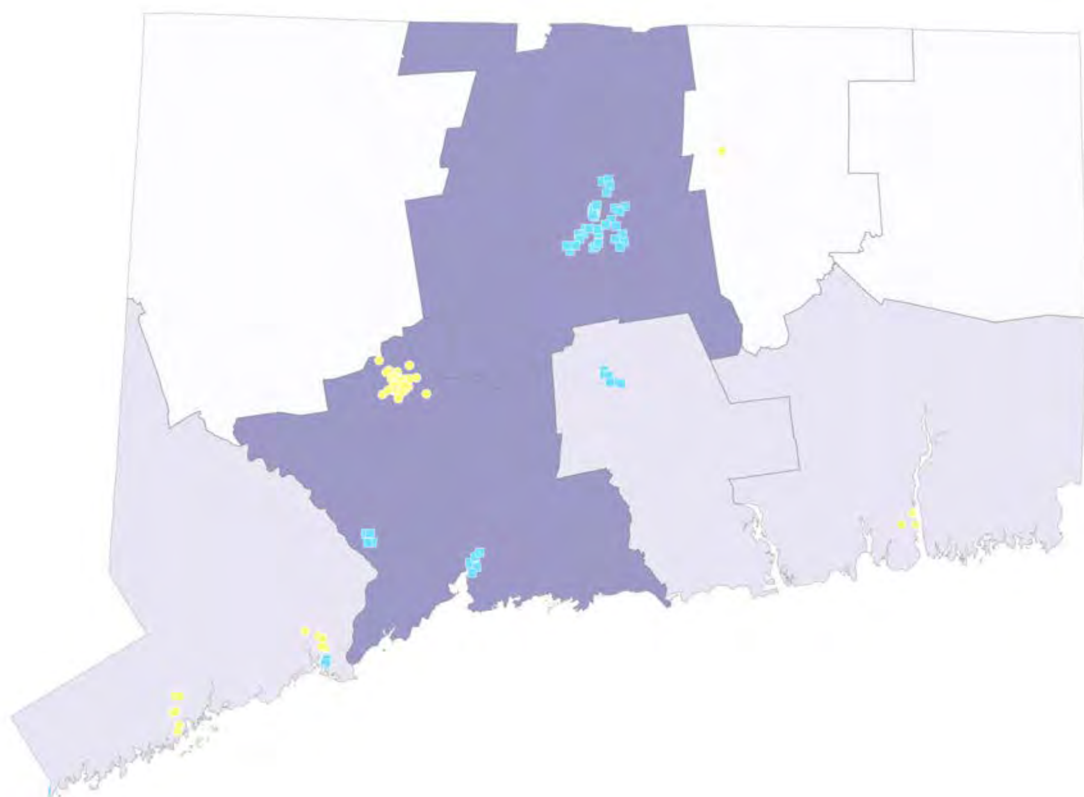
Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Hartford and New Haven counties have high risk of disasters, high densities, and will experience sea level rise.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Fairfield							1
Hartford					2		3
Litchfield							0
Middlesex							1
New Haven					1		3
New London							1
Tolland							0
Windham							0

CONNECTICUT

TOTAL: 10 DISASTERS
FEMA PA + HM: $318 M
HUD CDBG-DR: $214 M
FEMA + HUD ASSISTANCE: $532 M

			2011						2012		2013		2015		2018				2021			
			1958: SNOWSTORM		4023: TROPICAL STORM IRENE		4046: SEVERE STORM		4087: HURRICANE SANDY		4106: SEVERE WINTER STORM AND SNOWSTORM		4213: SEVERE WINTER STORM AND SNOWSTORM		4385: SEVERE STORMS, TORNADOES, AND STRAIGHT-LINE WINDS		4410: SEVERE STORMS AND FLOODING		4580: TROPICAL STORM ISAIAS		4629: REMNANTS OF HURRICANE IDA	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	10	$45,793,316	$3,877,210	$149,973	$4,131,098	$581,919	$12,123,188	$1,426,753	$8,181,412	$584,125	$7,381,488	$2,310	$2,682,965	$80,933	$3,289,490	$85,633	$526,219	$0	$688,601	$0		
Fairfield County	8	$77,127,276	$2,349,133	$0	$10,755,004	$122,812	$8,138,656	$7,852,117	$28,926,181	$4,030,293	$3,849,921	$0			$6,606,576	$0			$4,496,582	$0	$0	$0
Hartford County	5	$75,114,844	$2,460,746	$2,018,448	$3,179,288	$1,594,268	$53,386,115	$0	$9,229	$1,378,608	$6,271,139	$0							$4,817,002	$0		
Litchfield County	6	$9,035,509	$726,980	$0	$2,279,358	$192,596	$2,590,730	$27,693	$522,873	$0	$1,111,109	$0			$10,334	$0			$1,573,836	$0		
Middlesex County	6	$13,045,924			$3,186,349	$0	$1,835,486	$0	$4,218,100	$0	$1,345,627	$0	$2,456	$0			$843,518	$0	$1,614,388	$0		
New Haven County	9	$68,236,077	$2,592,890	$0	$13,084,622	$4,593,254	$4,934,946	$289,829	$12,065,770	$4,074,300	$8,058,215	$2,978,499	$3,109,904	$0	$8,932,311	$0			$3,521,538	$0	$0	$0
New London County	8	$18,003,720	$998,705	$0	$5,402,858	$308,060			$6,527,710	$0	$1,810,630	$0	$1,856,742	$0			$501,076	$0	$597,939	$0	$0	$0
Tolland County	7	$9,672,626	$738,464	$0	$593,088	$0	$5,429,546	$0	$426,657	$0	$758,860	$0	$1,124,061	$0					$601,950	$0		
Windham County	6	$2,360,436			$622,490	$0	$122,595	$14,861	$172,050	$0	$512,404	$0	$727,189	$0					$188,847	$0		
Total FEMA Allocation		$318,389,728	$13,744,126	$2,168,421	$43,234,156	$7,392,910	$88,561,263	$9,611,253	$61,049,982	$10,067,326	$31,099,393	$2,980,809	$9,503,318	$80,933	$18,838,711	$85,633	$1,870,814	$0	$18,100,681	$0	$0	$0

IMAGE: REBUILD BY DESIGN SITE VISIT IN BRIDGEPORT | CAMERON BLAYLOCK

DELAWARE

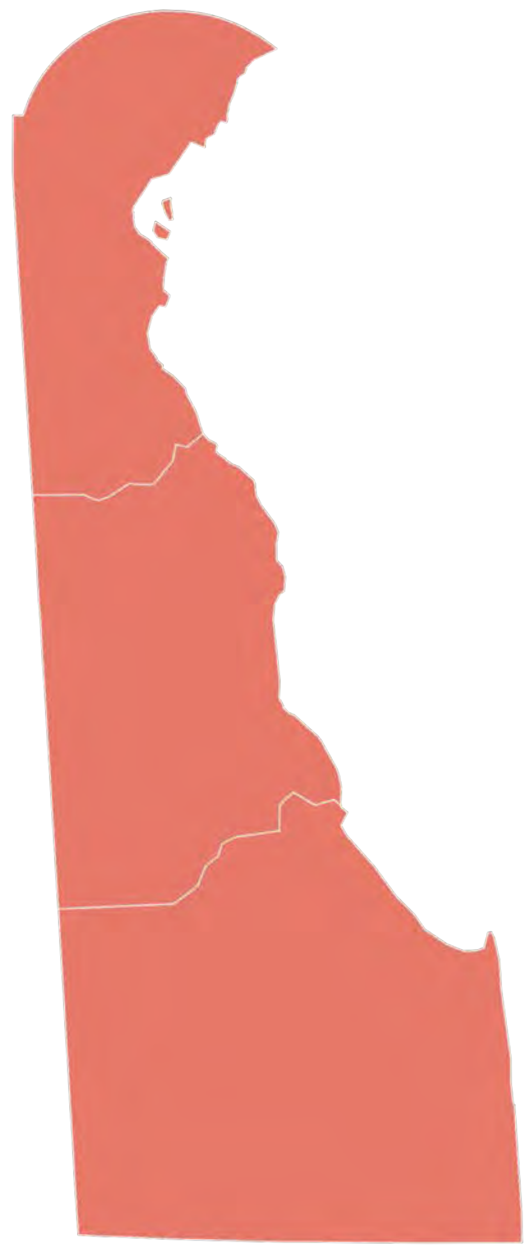
DELAWARE STATISTICS SUMMARY (2011 - 2021)	
5	CLIMATE DISASTER DECLARATIONS
3	DISASTERS IN EACH COUNTY
56	SUPERFUND SITES
19	WASTEWATER DISCHARGE SITES
NEW CASTLE, SUSSEX	HIGHEST COMPOUNDING RISKS
$13.6 MILLION	FEMA + HUD POST-DISASTER FUNDING
NEW CASTLE	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
968 THOUSAND	POPULATION TOTAL
$14	PER CAPITA SPENDING ON CLIMATE DISASTERS
$1.2 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

5
disaster
declarations

All three counties in Delaware have had 3 recent disaster declarations.



Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$13.6M
post-disaster
assistance

$13.6M	FEMA obligations
$0	HUD CDBG-DR Funds
$13.6M	FEMA + HUD assistance
$14	per capita cost

New Castle County has received the highest post-disaster assistance in the state: $2.3 million.

FEMA Public Assistance and Hazard Mitigation

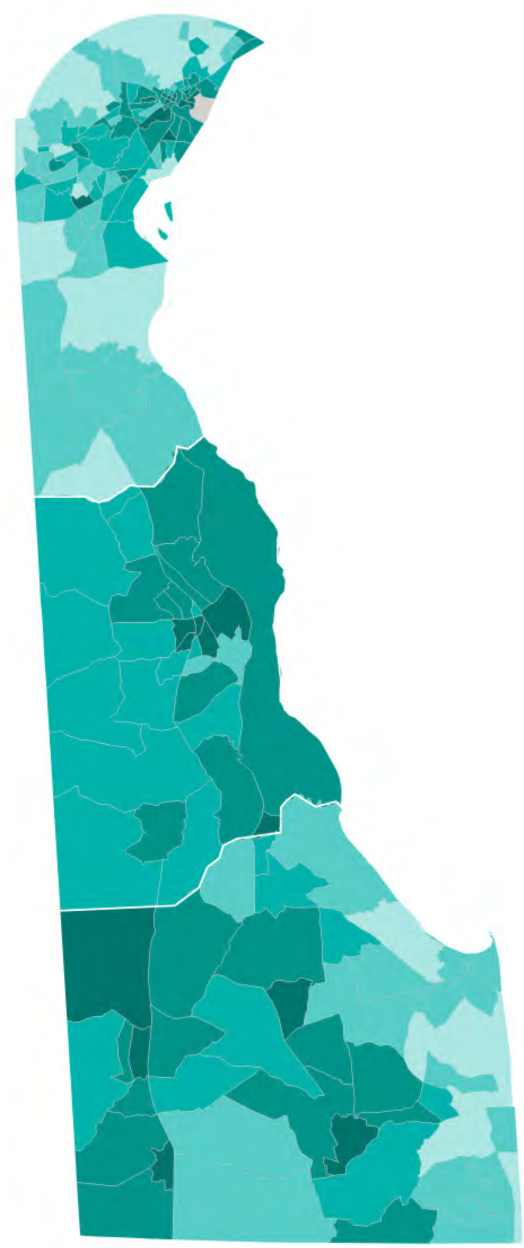
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

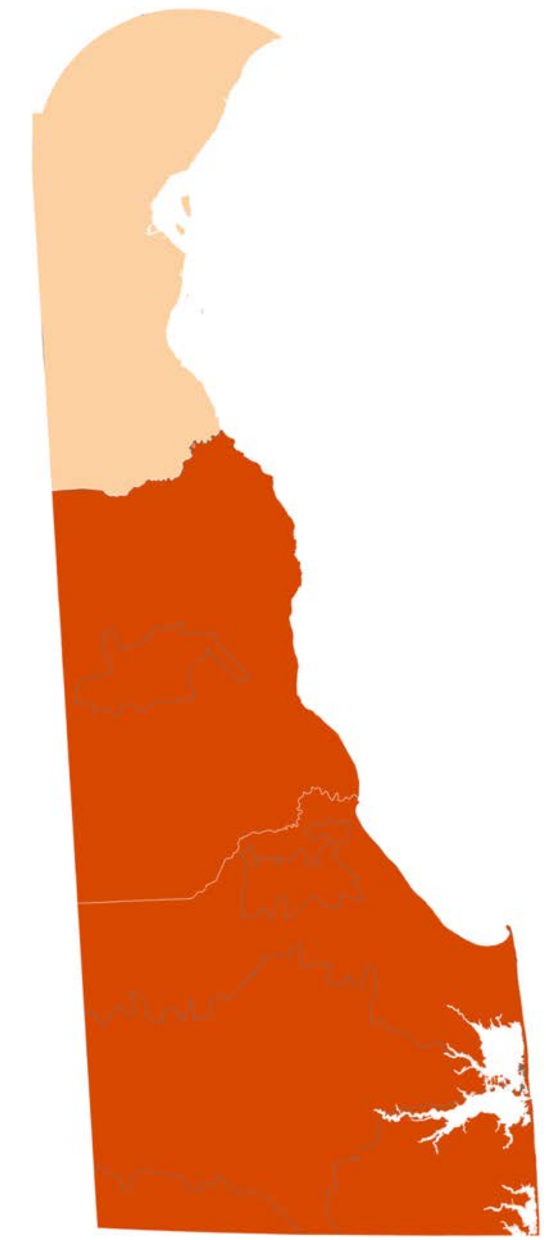
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration

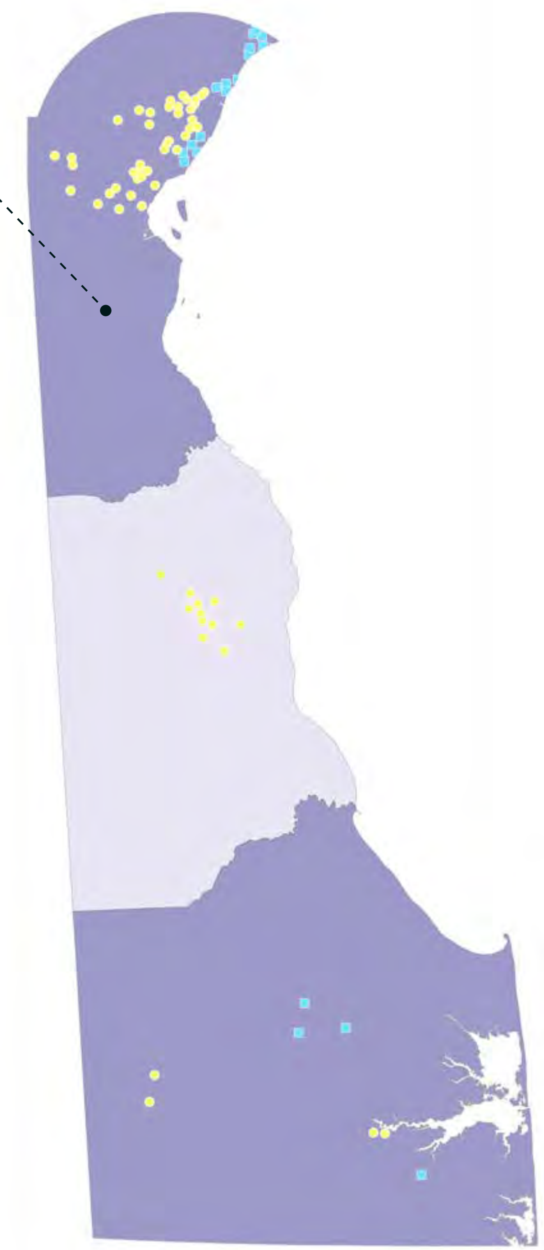
Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

New Castle and Susses counties have high risk of climate disasters and high population density.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Kent							1
New Castle					2		3
Sussex					2		3

DELAWARE

TOTAL: 5 DISASTERS **FEMA PA + HM: $13.6 M** **HUD CDBG-DR: none** **FEMA + HUD ASSISTANCE: $13.6 M**			2011		2012		2016		2020		2021	
			4037: HURRICANE IRENE		4090: HURRICANE SANDY		4265: SEVERE WINTER STORM AND SNOWSTORM		4566: TROPICAL STORM ISAIAS		4627: REMNANTS OF HURRICANE IDA	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	5	$8,045,088	$1,417,060	$16,475	$5,013,870	$6,118	$560,192	$11,491	$1,019,881	$0		
Kent County	3	$1,421,766	$328,431	$23,700	$298,145	$41,207			$730,284	$0		
New Castle County	3	$2,251,790	$5,169	$197,061	$866,530	$171,711			$1,011,318	$0	$0	$0
Sussex County	3	$1,837,426	$286,086	$0	$436,532	$72,289	$1,042,519	$0				
Total FEMA Allocation		$13,556,069	$2,036,746	$237,236	$6,615,077	$291,325	$1,602,712	$11,491	$2,761,482	$0	$0	$0

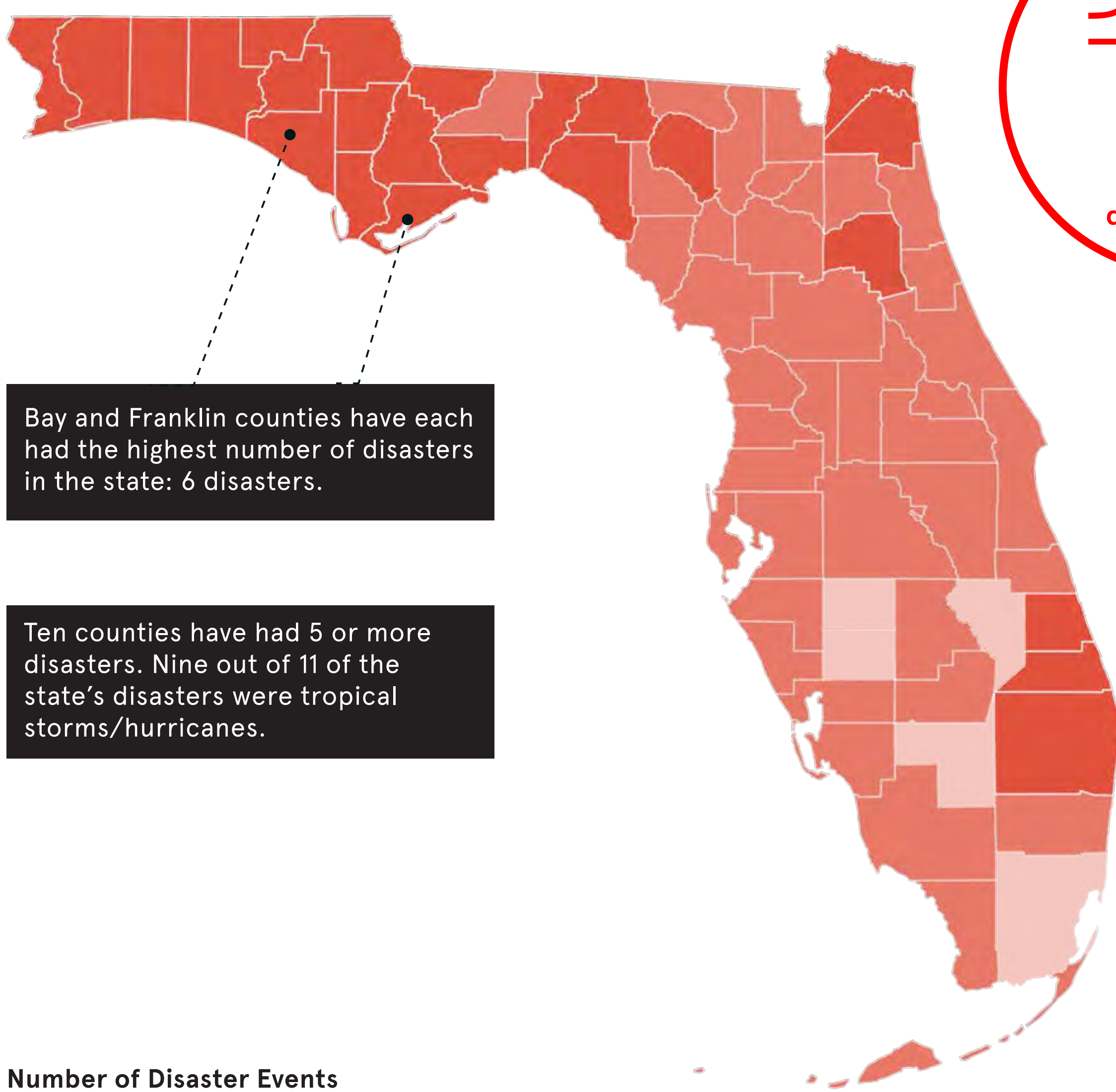
FLORIDA

FLORIDA STATISTICS SUMMARY (2011 – 2021)	
11	CLIMATE DISASTER DECLARATIONS
9TH HIGHEST	PER CAPITA SPENDING ON CLIMATE DISASTERS IN THE NATION
ALL	COUNTIES HAVE HAD CLIMATE DISASTERS IN 10 YEARS
BAY, FRANKLIN	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
10	COUNTIES WITH FIVE OR MORE DISASTERS
921	SUPERFUND SITES
232	WASTEWATER DISCHARGE SITES
C	ASCE INFRASTRUCTURE REPORT CARD GRADE
DUVAL, PASCO	HIGHEST COMPOUNDING RISKS
$8.3 BILLION	FEMA + HUD POST-DISASTER FUNDING
21 MILLION	POPULATION TOTAL
$390	PER CAPITA SPENDING ON CLIMATE DISASTERS
$23.5 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

11
disaster declarations



Bay and Franklin counties have each had the highest number of disasters in the state: 6 disasters.

Ten counties have had 5 or more disasters. Nine out of 11 of the state's disasters were tropical storms/hurricanes.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

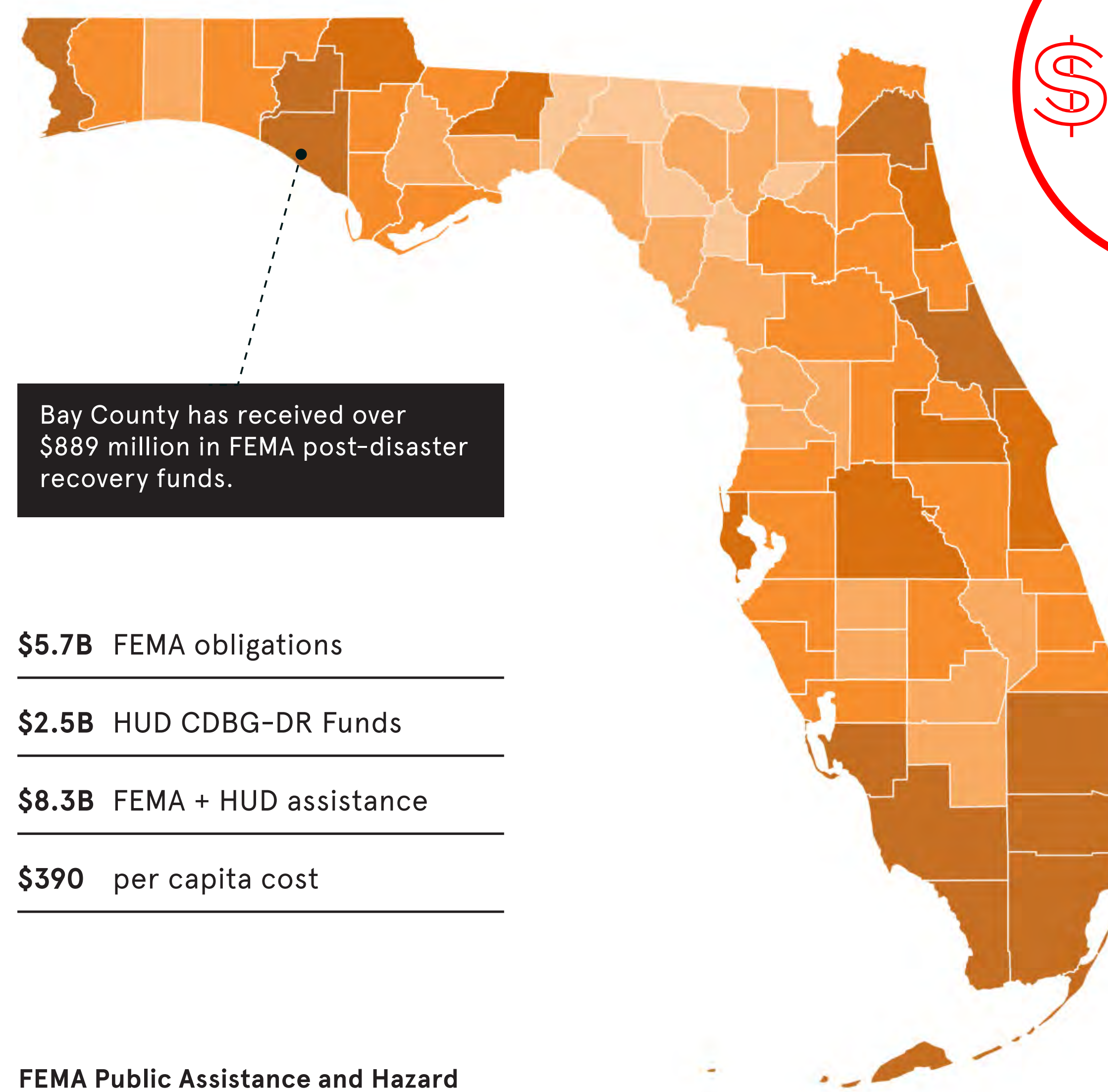
- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$8.3B
post-disaster assistance



Bay County has received over $889 million in FEMA post-disaster recovery funds.

$5.7B	FEMA obligations
$2.5B	HUD CDBG-DR Funds
$8.3B	FEMA + HUD assistance
$390	per capita cost

FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011–2021)

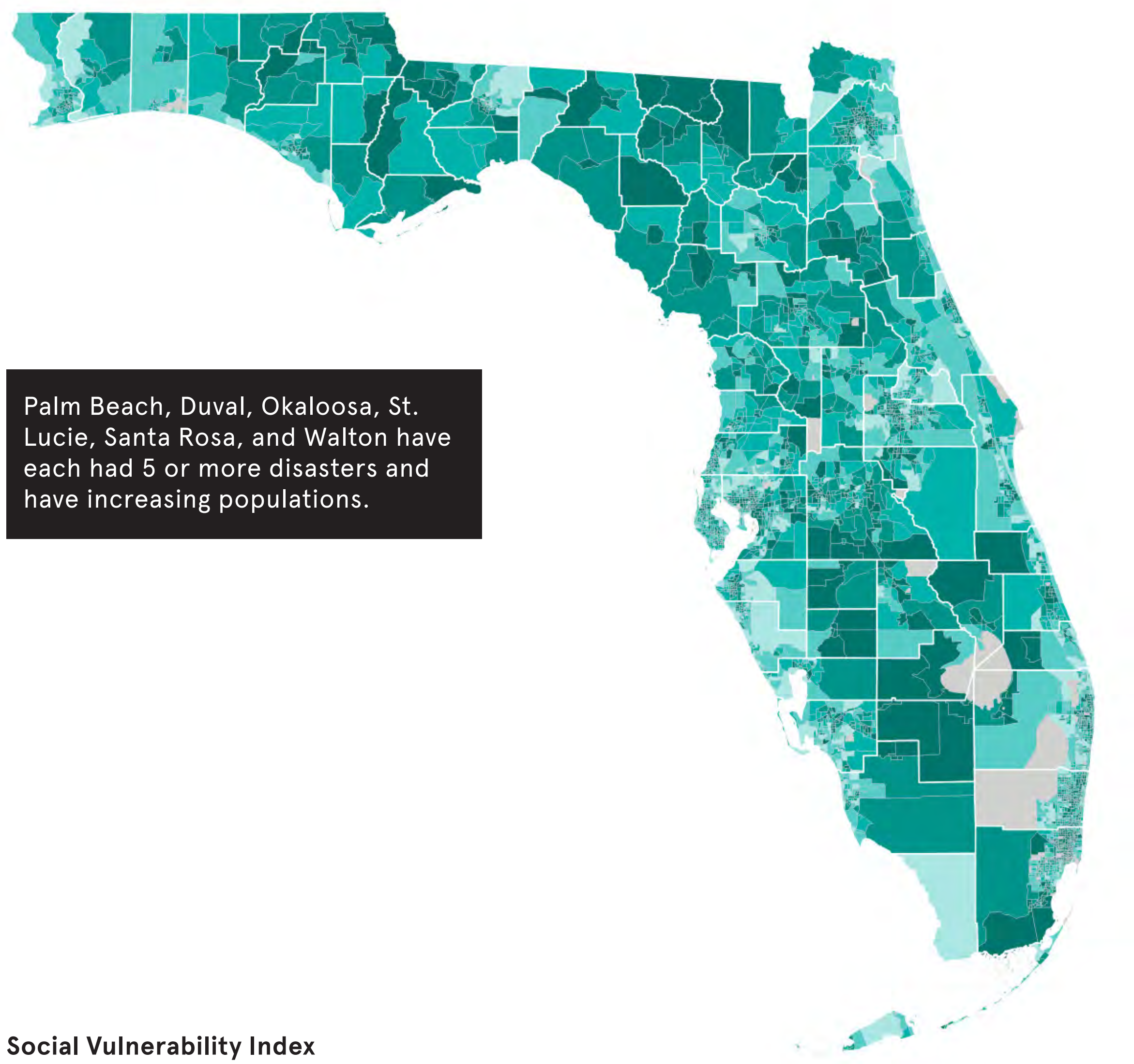
- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Forty-five counties in Florida have already received high federal funding and are susceptible to sea level rise.

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Palm Beach, Duval, Okaloosa, St. Lucie, Santa Rosa, and Walton have each had 5 or more disasters and have increasing populations.

Social Vulnerability Index

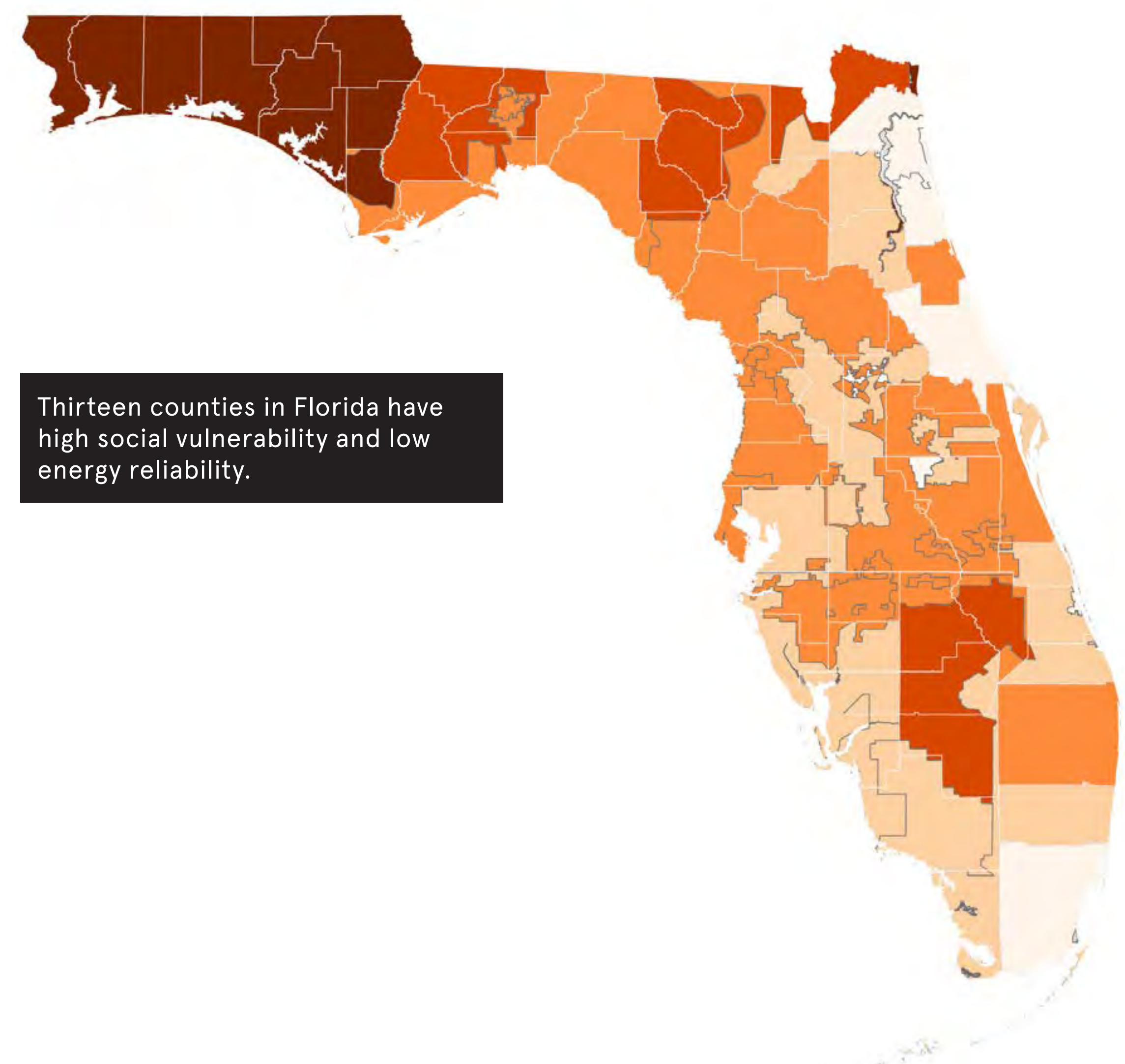
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Thirteen counties in Florida have high social vulnerability and low energy reliability.

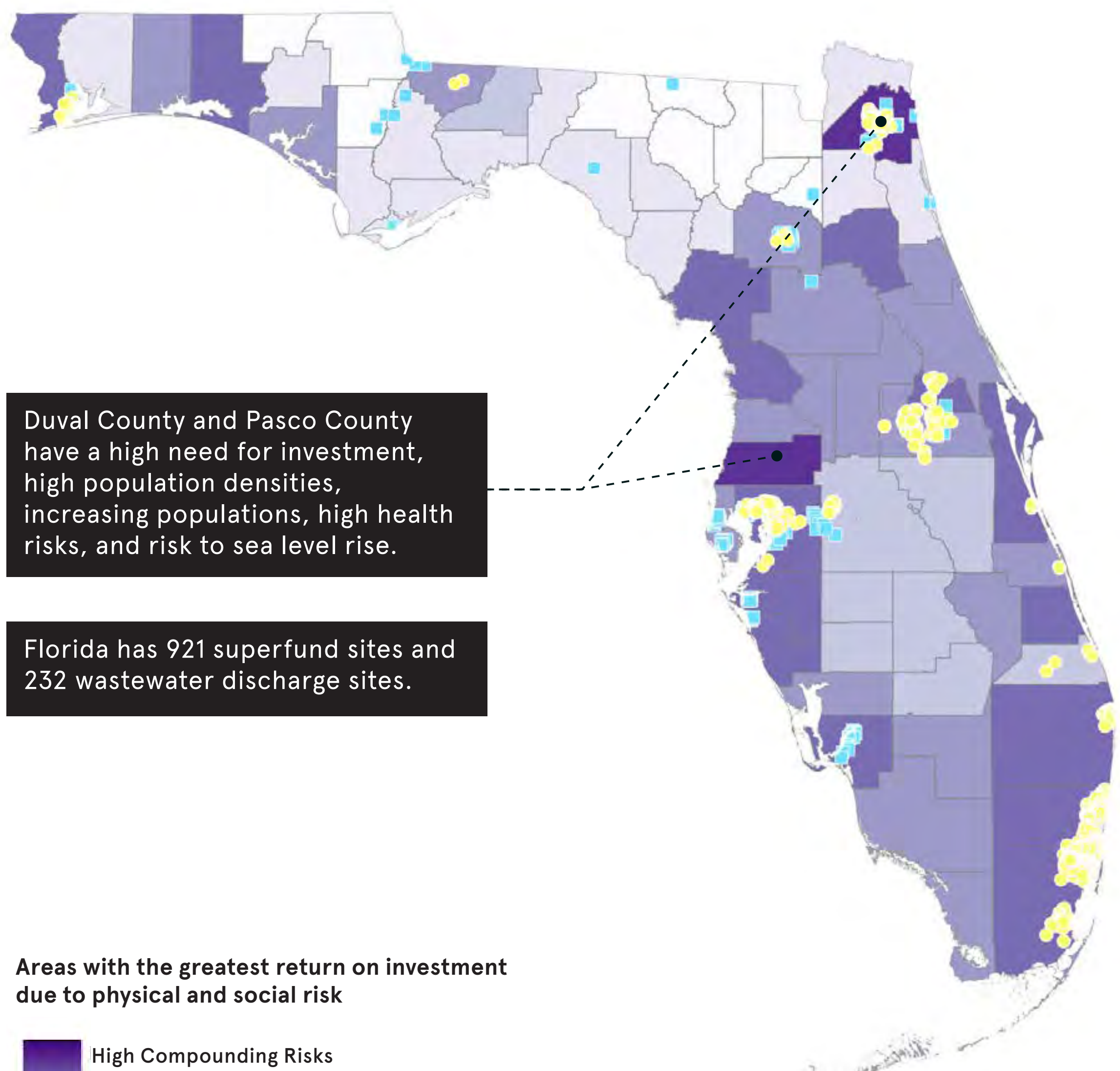
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Duval County and Pasco County have a high need for investment, high population densities, increasing populations, high health risks, and risk to sea level rise.

Florida has 921 superfund sites and 232 wastewater discharge sites.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Alachua					3		3
Baker							0
Bay					4		3
Bradford							0
Brevard					7		4
Broward					6		4
Calhoun							0
Charlotte					5		3
Citrus					5		4
Clay							1
Collier					8		3
Columbia							0
DeSoto					3		2
Dixie							1
Duval					3		5
Escambia					3		4
Flagler					3		3
Franklin							1
Gadsden					1		3
Gilchrist							1
Glades					2		2
Gulf							1
Hamilton							0
Hardee					1		2
Hendry					4		3
Hernando					2		3
Highlands					8		2
Hillsborough					4		4
Holmes							0
Indian River					5		3
Jackson							0
Jefferson							1
Lafayette							1
Lake					5		3
Lee					7		4
Leon					1		2
Levy					1		4
Liberty							1
Madison							0
Manatee					4		4
Marion					5		3
Martin					3		2
Miami-Dade					8		4
Monroe					1		3
Nassau							1
Okaloosa					2		3
Okeechobee					3		3
Orange					6		3
Osceola					6		2

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Palm Beach					8		4
Pasco					4		5
Pinellas					5		3
Polk					8		2
Putnam					2		4
Santa Rosa							1
Sarasota					4		4
Seminole					4		4
St. Johns							1
St. Lucie					5		4
Sumter					3		3
Suwannee							0
Taylor							1
Union							0
Volusia					7		3
Wakulla							1
Walton					2		4
Washington							1

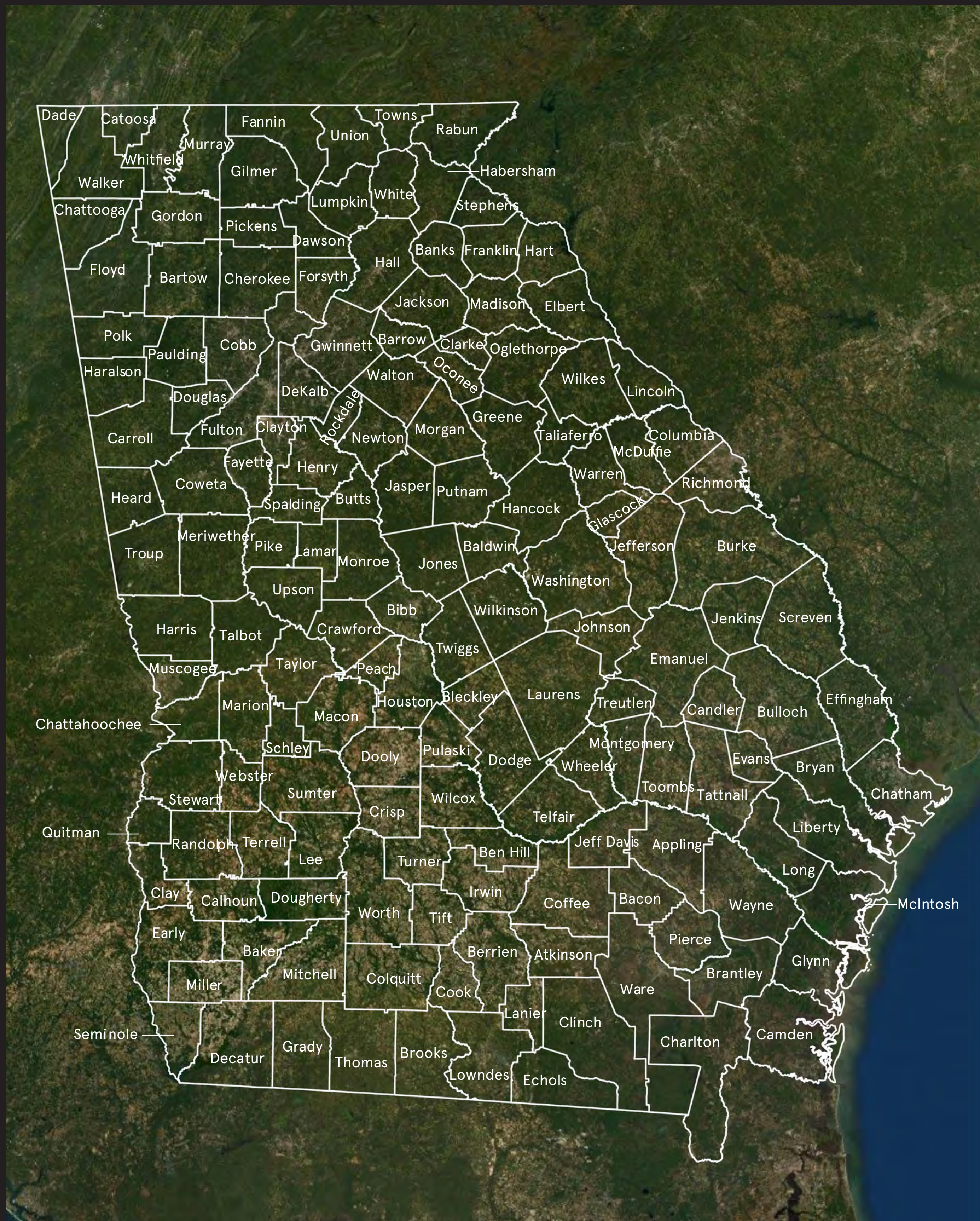
IMAGE RIGHT: AIR AND MARINE OPERATIONS AIR CREWS RESPOND TO AFFECTED AREAS ALONG FLORIDA'S COAST AFTER HURRICANE IAN MADE LANDFALL, SEPTEMBER 30, 2022. | OZZY TREVINO

FLORIDA

TOTAL: 11 DISASTERS
FEMA PA + HM: $5.7 B
HUD CDBG-DR: $2.5 B
FEMA + HUD ASSISTANCE: $8.3 B

			2012				2013		2014		2016				2017				2018		2019		2020	
			4068: TROPICAL STORM DEBBY		4084: HURRICANE ISAAC		4138: SEVERE STORMS AND FLOODING		4177: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4280: HURRICANE HERMINE		4283: HURRICANE MATTHEW		4337: HURRICANE IRMA		4341: HURRICANE IRMA - SEMINOLE TRIBE OF FLORIDA		4399: HURRICANE MICHAEL		4468: HURRICANE DORIAN		4564: HURRICANE SALLY	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	11	$1,613,187,298	$10,354,122	$1,786,189	$3,929,202	$360,388	$1,478,806	$314,926	$5,699,994	$1,501,403	$18,976,293	$776,246	$106,115,383	$2,500,857	$549,190,254	$18,728,659	$10,614	$0	$840,133,105	$8,013,426	$14,078,123	$1,010,657	$27,185,166	$1,043,484
Alachua County	2	$14,035,574									$283,564	$0			$11,431,531	$2,320,479								
Baker County	3	$2,263,978	$889,646	$117,593							$9,248	$0			$1,247,491	$0								
Bay County	6	$889,018,807			$117,670	$889,399	$4,834,492	$1,845,177	$4,031,472	$0					$71,990	$0			$841,568,818	$32,647,581			$3,012,207	$0
Bradford County	3	$1,752,792	$281,867	$120,230									$136,370	$0	$1,214,325	$0								
Brevard County	3	$93,032,695											$27,844,564	$928,996	$48,154,248	$8,481,435					$5,871,069	$1,752,383		
Broward County	3	$231,765,398											$5,369,489	$176,938	$187,083,290	$33,693,603					$5,126,867	$315,212		
Calhoun County	4	$43,542,235							$9,107,494	$583,951					$58,519	$0			$31,910,778	$802,946			$1,078,547	$0
Charlotte County	2	$41,349,461	$2,399,270	$0											$36,785,818	$2,164,373								
Citrus County	3	$7,072,785	$262,850	$803,044							$874,553	$1,750,335			$3,382,003	$0								
Clay County	3	$17,081,520	$1,306,067	$531,739									$2,375,337	$562,500	$10,277,239	$2,028,638								
Collier County	3	$147,461,790	$2,625,999	$0	$452,886	$109,040									$127,000,256	$17,273,609								
Columbia County	3	$6,251,363	$3,167,948	$1,202,303							$143,547	$0			$909,790	$827,774								
DeSoto County	1	$5,580,839													$5,270,915	$309,924								
Dixie County	3	$2,959,362	$163,137	$11,250							$2,379,660	$0			$405,315	$0								
Duval County	4	$173,383,166	$1,665,101	$309,600									$48,704,808	$1,633,863	$88,127,983	$25,787,822					$6,793,037	$360,952		
Escambia County	4	$139,925,088			$2,893,651	$1,294,363			$74,796,681	$21,285,557					$0	$0			$974,903	$0			$38,679,933	$0
Flagler County	3	$40,306,646											$20,603,544	$3,649,961	$9,050,648	$4,076,302					$2,926,192	$0		
Franklin County	6	$14,289,955	$1,518,329	$618,157	$4,032	$26,025					$741,550	$975,000			$51,938	$0			$9,244,680	$956,259			$153,986	$0
10 counties	4	$21,672,295									$17,418	$8,741			$491,808	$0			$19,363,332	$1,748,335			$42,662	$0
Gilchrist County	3	$595,991	$0	$0							$0	$17,578			$245,539	$332,875								
Glades County	2	$1,250,986			$0	$0									$1,250,986	$0								
Gulf County	5	$37,286,738	$184,059	$1,786,932	$21,133	$0									$115,095	$0			$34,186,914	$359,197			$633,408	$0
Hamilton County	3	$955,944	$302,951	$0											$652,993	$0			$0	$0				
Hardee County	1	$8,391,827													$8,029,898	$361,930								
Hendry County	1	$6,872,436													$6,612,377	$260,059								
Hernando County	3	$6,385,456	$734,886	$286,914							$732,159	$131,316			$3,621,502	$878,678								
Highlands County	2	$16,306,347	$0	$0											$16,148,847	$157,500								
Hillsborough County	3	$34,091,740	$0	$0							$0	$0			$30,813,359	$3,278,381								
Holmes County	5	$23,837,468					$16,243,629	$4,994,348	$687,298	$76,131					$25,238	$0			$1,222,886	$117,393			$470,546	$0
Indian River County	3	$31,735,150											$12,174,224	$1,175,340	$12,258,250	$29,794					$6,097,542	$0		
Jackson County	4	$67,661,270							$21,379,761	$3,483,971					$52,812	$0			$34,456,916	$8,127,850			$159,961	$0
Jefferson County	5	$839,661	$273,237	$0							$108,178	$0			$199,783	$0			$229,488	$0			$28,975	$0
Lafayette County	3	$243,942	$79,772	$0							$47,278	$0			$116,892	$0								
Lake County	2	$21,470,086											$471,820	$375,626	$18,743,822	$1,878,818								
Lee County	2	$114,047,862	$1,732,698	$0											$103,431,349	$8,883,815								
Leon County	3	$78,297,800									$20,721,190	$907,535			$5,037,339	$0			$48,286,560	$3,345,177				
Levy County	3	$2,048,365	$102,485	$0							$854,644	$275,229			$762,795	$53,213								
Liberty County	5	$3,249,000	$180,243	$0							$11,696	$0			$44,802	$0			$2,138,866	$771,388			$102,005	$0
Madison County	4	$816,313	$72,364	$91,989							$265,871	$0			$265,680	$0			$120,409	$0				
Manatee County	3	$29,292,947	$779,683	$0							$3,243,181	$0			$24,667,728	$602,354								
Marion County	2	$36,491,978									$203,328	$0			$32,600,818	$3,687,833								
Martin County	4	$44,739,955			$3,604,102	$86,416							$14,364,535	$1,047,750	$15,966,690	$0					$9,310,973	$359,489		
Miami-Dade County	1	$467,705,479													$425,689,084	$42,016,395								
Monroe County	2	$192,549,091			$821,121	$60,153									$157,877,086	$33,790,730								
Nassau County	4	$21,669,028	$394,828	$0									$11,069,504	$103,324	$10,056,273	$0					$45,098	$0		
Okaloosa County	5	$8,482,691			$35,299	$0			$4,846,178	$336,484					$23,245	$0			$946,665	$0			$2,294,821	$0
Okeechobee County	1	$3,022,965													$3,022,965	$0								
Orange County	2	$70,715,218											$2,324,810	$0	$53,934,818	$14,455,591								
Osceola County	3	$18,522,158											$707,657	$392,441	$14,435,194	$890,261					$736,980	$1,359,626		
Palm Beach County	4	$166,901,183			$4,515,681	$0							$11,143,940	$1,819,182	$126,377,479	$18,095,100					$4,051,658	$898,144		
Pasco County	3	$21,123,165	$1,833,364	$1,517,929							$1,152,002	$2,212,225			$11,575,393	$2,832,253								
Pinellas County	3	$66,369,403	$1,028,062	$0							$4,479,027	$103,857			$50,214,733	$10,543,724								
Polk County	2	$76,996,848	$0	$0											$69,389,169	$7,607,678								
Putnam County	4	$14,811,029	$1,563,520	$24,559									$1,867,237	$1,930,244	$8,989,009	$344,547					$91,912	$0		
St. Johns County	3	$98,809,436											$58,900,337	$6,350,584	$32,051,810	$170,805					$1,283,401	$52,500		
St. Lucie County	4	$29,771,794			$465,084	$497,054							$7,999,832	$856,198	$15,049,517	$2,758,433					$1,018,752	$1,126,923		
Santa Rosa County	5	$34,308,027	$1,764,117	$5,061,506	$601,119	$121,523			$4,506,996	$5,980,899					$3,947	$2,748,288							$13,519,632	$0
Sarasota County	3	$34,862,141	$8,445,941	$198,974							$4,055,608	$0			$18,145,057	$4,016,561								
Seminole County	3	$40,311,535											$3,366,571	$855,415	$32,190,058	$2,413,066					$1,377,475	$108,951		
Sumter County	2	$3,941,452									$0	$0			$3,941,452	$0								
Suwannee County	4	$4,540,690	$2,959,703	$149,295							$272,857	$0			$949,556	$176,021			$33,258	$0				
Taylor County	4	$3,265,118	$156,253	$0							$2,254,942	$178,580			$356,378	$0			$175,787	$143,178				
Union County	3	$472,365	$181,817	$35,446							$7,143	$0			$215,657	$32,301								
Volusia County	3	$114,549,445											$53,837,132	$3,732,135	$48,739,398	$6,166,258					$1,764,739	$309,782		
Wakulla County	4	$4,550,105	$625,006	$170,788							$328,303	$0			$102,768	$0			$2,978,672	$344,568				
Walton County	5	$10,391,522					$5,577,965	$381,572	$1,786,026	$586,837					$68,774	$0			$1,196,628	$0			$793,720	$0
Washington County	5	$158,157,034					$12,778,583	$0	$693,186	$8,250					$33,315	$0			$139,465,767	$3,636,571			$1,541,362	$0
Total FEMA Allocation		$5,739,641,231	$48,029,325	$14,824,437	$17,460,982	$3,444,361	$40,913,476	$7,536,022	$127,535,086	$33,843,482	$62,163,242	$7,336,642	$389,377,092	$28,091,354	$2,445,302,091	$285,155,877	$10,614	$0	$2,008,634,429	$61,013,868	$60,573,818	$7,654,619	$89,696,931	$1,043,484

GEORGIA



GEORGIA STATISTICS SUMMARY (2011 - 2021)

11	CLIMATE DISASTER DECLARATIONS
ALL	COUNTIES HAVE HAD CLIMATE DISASTERS IN TEN YEARS
PICKENS	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
8	COUNTIES WITH FIVE OR MORE DISASTERS
103	SUPERFUND SITES
221	WASTEWATER DISCHARGE SITES
C+	ASCE INFRASTRUCTURE REPORT CARD GRADE
CHATHAM, CLAYTON	HIGHEST NEED FOR INVESTMENT
$675 MILLION	FEMA + HUD POST-DISASTER FUNDING
10.5 MILLION	POPULATION TOTAL
$64	PER CAPITA SPENDING ON CLIMATE DISASTERS
$9.5 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

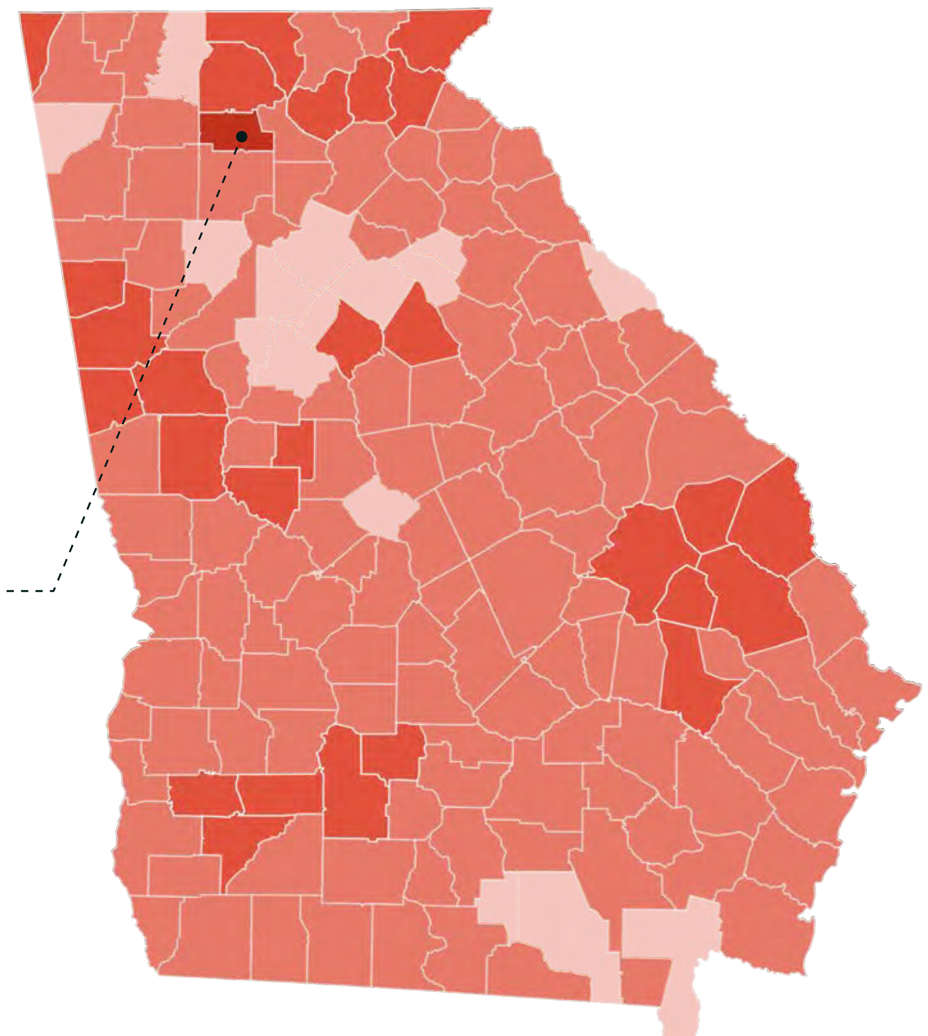
DISASTER OCCURRENCES 2011-2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

11
disaster declarations

Every county in Georgia has had a recent disaster declaration.

Pickens County has had the highest number of recent disasters in the state: 7 disasters.



Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurences
- 7-9 occurences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

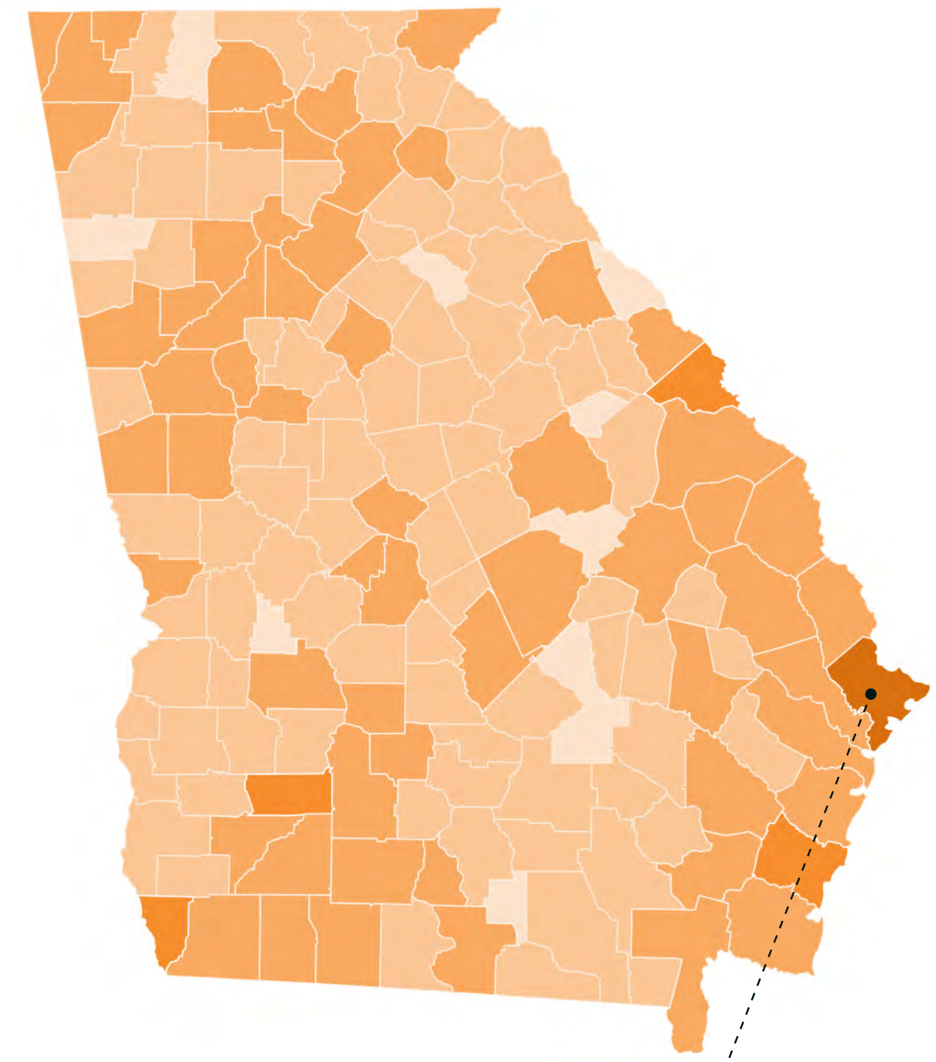
FEDERAL ASSISTANCE 2011-2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$675M
post-disaster assistance

$553M	FEMA obligations
$122M	HUD CDBG-DR Funds
$675M	FEMA + HUD assistance
$64	per capita cost

The most expensive disaster in recent history was Hurricane Irma in 2017, which totaled over $133 million in FEMA post-disaster assistance.



Chatham County has recieved the most post-disaster assistance in the state: $56 million.

FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011-2021)

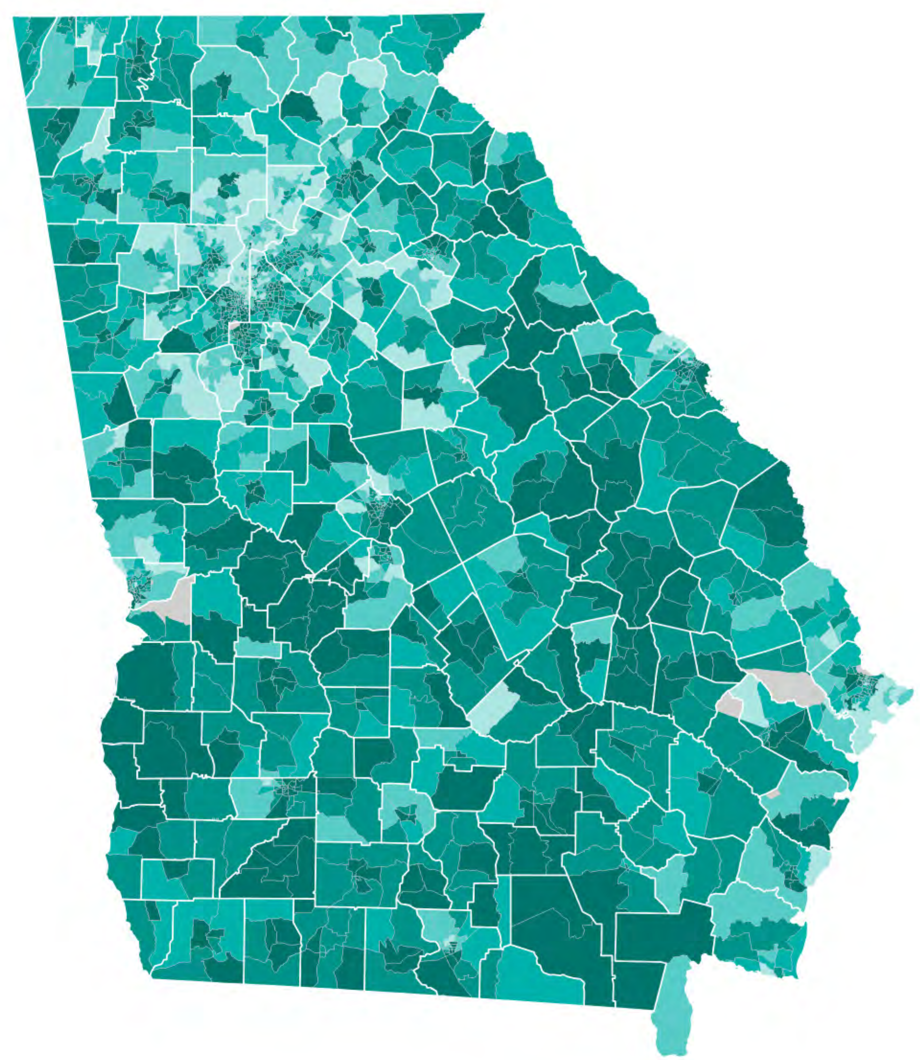
- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Clayton, Clarke, Bibb, Richmond, Muscogee, Dougherty, Screven, Burke, Decatur, Colquitt, Polk, Floyd, Glynn, Charlton, McIntosh, Wayne, and Brantley counties have high poverty, high diversity of hazard risks, and low federal investments from previous disasters.



Social Vulnerability Index

CDC (2018)

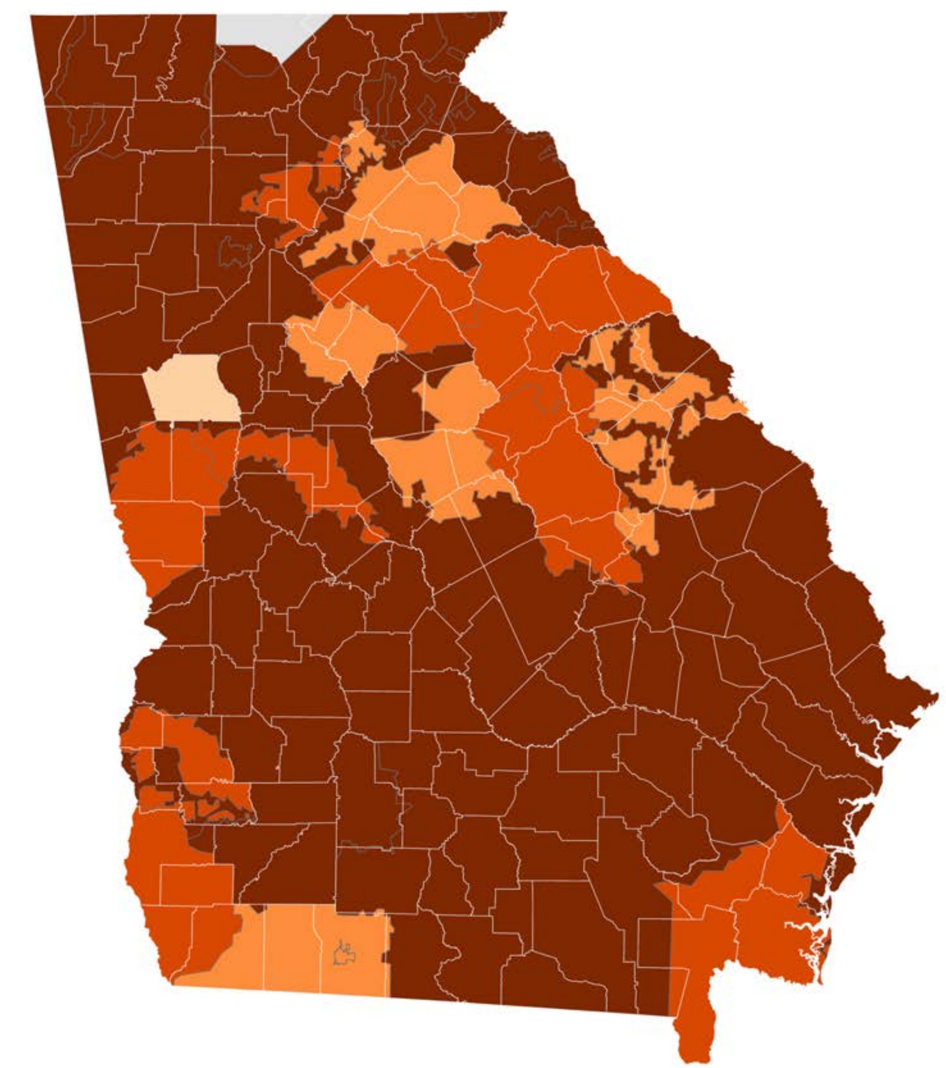
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Eighty-two counties in Georgia have high social vulnerability and low energy reliability.



Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

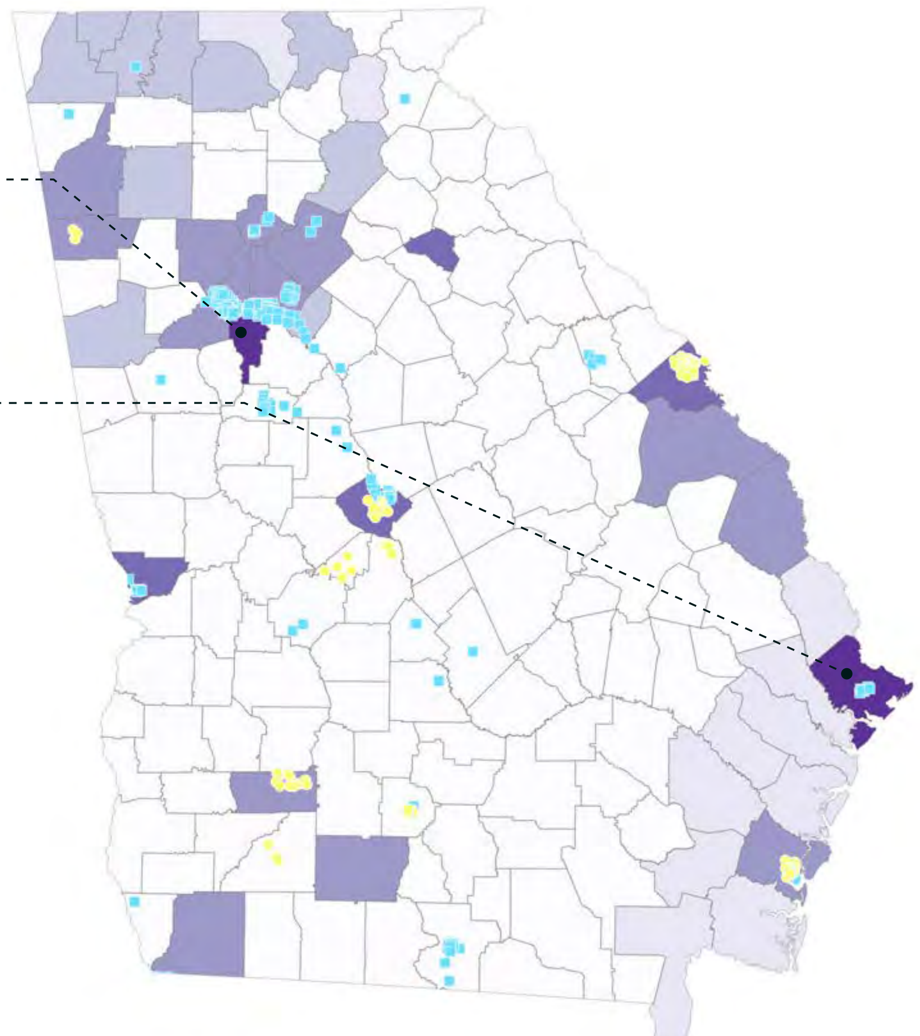
- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Clayton County has high risk of climate disasters, high poverty, high population density, high population growth, and high health risk.

Chatham County has high risk of climate disasters, high population density, high population growth, high health risk, and risk of sea level rise.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Appling							0
Atkinson							0
Bacon							0
Baker							0
Baldwin							0
Banks							0
Barrow							0
Bartow					1		2
Ben Hill							0
Berrien							0
Bibb					4		4
Bleckley							0
Brantley							1
Brooks							0
Bryan							1
Bulloch							0
Burke					1		3
Butts							0
Calhoun							0
Camden							1
Candler							0
Carroll					1		2
Catoosa					1		2
Charlton							1
Chatham					3		5
Chattahoochee							0
Chattooga							0
Cherokee							0
Clarke					1		4
Clay							0
Clayton					3		5
Clinch							0
Cobb					2		3
Coffee							0
Colquitt					1		3
Columbia							0
Cook							0
Coweta							0
Crawford							0
Crisp							0
Dade							0
Dawson							0
Decatur					1		3
DeKalb					4		3
Dodge							0
Dooly							0
Dougherty					4		3
Douglas							0
Early							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Echols							0
Effingham							1
Elbert							0
Emanuel							0
Evans							0
Fannin					2		1
Fayette							0
Floyd					1		3
Forsyth							0
Franklin							0
Fulton					2		3
Gilmer					1		2
Glascock							0
Glynn					1		3
Gordon							0
Grady							0
Greene							0
Gwinnett					4		3
Habersham							0
Hall					2		2
Hancock							0
Haralson							0
Harris							0
Hart							0
Heard							0
Henry							0
Houston							0
Irwin							0
Jackson							0
Jasper							0
Jeff Davis							0
Jefferson							0
Jenkins							0
Johnson							0
Jones							0
Lamar							0
Lanier							0
Laurens							0
Lee							0
Liberty							1
Lincoln							0
Long							1
Lowndes							0
Lumpkin							0
Macon							0
Madison							0
Marion							0
McDuffie							0
McIntosh							1
Meriwether							0
Miller							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Mitchell							0
Monroe							0
Montgomery							0
Morgan							0
Murray					1		2
Muscogee					1		4
Newton							0
Oconee							0
Oglethorpe							0
Paulding							0
Peach							0
Pickens							0
Pierce							0
Pike							0
Polk					1		3
Pulaski							0
Putnam							0
Quitman							0
Rabun							0
Randolph							0
Richmond					5		4
Rockdale					1		2
Schley							0
Screven					1		3
Seminole							0
Spalding							0
Stephens							0
Stewart							0
Sumter							0
Talbot							0
Taliaferro							0
Tattnall							0
Taylor							0
Telfair							0
Terrell							0
Thomas							0
Tift							0
Toombs							0
Towns							0
Treutlen							0
Troup							0
Turner							0
Twiggs							0
Union					2		2
Upson							0
Walker					1		2
Walton							0
Ware							0
Warren							0
Washington							0
Wayne							1

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Webster							0
Wheeler							0
White					1		1
Whitfield					3		2
Wilcox							0
Wilkes							0
Wilkinson							0
Worth							0

IMAGE RIGHT: SNOW IN FAIRMOUNT, GA | THOMSON

GEORGIA

TOTAL: 11 DISASTERS
FEMA PA + HM: $553 M
HUD CDBG-DR: $122 M
FEMA + HUD ASSISTANCE: $675 M

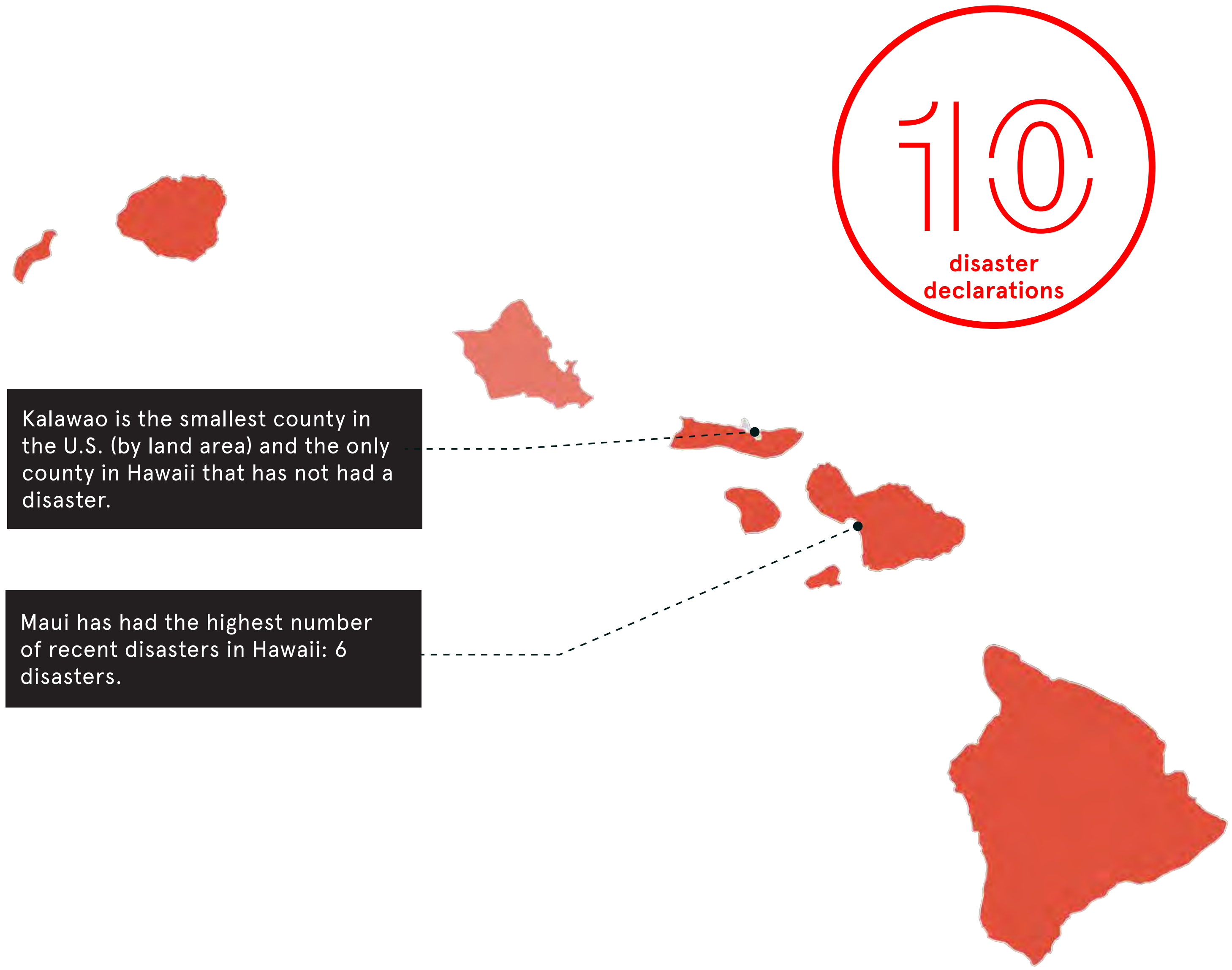
			2011		2014		2015		2016				2017						2018		2021			
			1973: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND ASSOCIATED FLOODING		4165: SEVERE WINTER STORM		4215: SEVERE WINTER STORM		4259: SEVERE STORMS AND FLOODING		4284: HURRICANE MATTHEW		4294: SEVERE STORMS, TORNADOES, AND STRAIGHT-LINE WINDS		4297: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4338: HURRICANE IRMA		4400: HURRICANE MICHAEL		4579: TROPICAL STORM ZETA		4600: SEVERE STORMS AND TORNADOES	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	11	$224,684,550	$7,539,620.43	$250,858.00	$16,008,370.79	$5,919,911.26	$6,122,297.85	$1,685,447.25	$160,236.48	$752,099.00	$21,041,057.28	$3,831,637.25	$2,114,636.63	$529,126.00	$7,325,482.35	$1,156,046.50	$52,718,268.96	$9,811,276.25	$75,751,196.56	$1,954,940.25	$7,399,625.96	$0.00	$2,612,434.60	$0.00
Appling County	3	$839,948													$428,467	$0	$389,890	$0	$21,591	$0				
Atkinson County	2	$129,113															$71,825	$0	$52,197	$5,091				
Bacon County	2	$300,483															$269,419	$0	$7,064	$24,000				
Baker County	5	$2,284,798							$41,845	$0			$24,961	$0	$45,160	$0	$43,750	$0	$2,129,083	$0				
Baldwin County	2	$640,827			$211,816	$12,759											$416,252	$0						
Banks County	3	$1,177,362					$51,247	$34,289									$1,057,680	$0			$34,146	$0		
Barrow County	2	$266,502					$117,525	$0									$148,977	$0						
Bartow County	2	$503,323	$474,823	$0													$0	$28,500						
Ben Hill County	2	$739,615															$320,280	$0	$419,335	$0				
Berrien County	3	$201,880													$51,185	$0	$129,885	$0	$20,810	$0				
Bibb County	1	$2,425,064															$2,425,064	$0						
Bleckley County	2	$179,412															$89,685	$0	$89,727	$0				
Brantley County	3	$1,992,986									$562,306	$0			$758,022	$0	$672,658	$0						
Brooks County	3	$623,906													$151,014	$0	$372,461	$0	$100,431	$0				
Bryan County	2	$1,711,303									$1,295,133	$0					$416,170	$0						
Bulloch County	5	$3,940,943			$176,071	$0					$2,111,762	$27,000			$514,633	$0	$1,084,500	$0	$26,978	$0				
Burke County	3	$1,417,362			$1,309,538	$0											$18,374	$0	$89,450	$0				
Butts County	2	$226,193			$74,108	$0											$152,085	$0						
Calhoun County	4	$266,943											$87,908	$0	$51,733	$0	$0	$13,500	$113,802	$0				
Camden County	2	$3,161,356									$734,788	$38,248					$2,388,320	$0						
Candler County	4	$497,841			$24,412	$0					$222,478	$0					$205,645	$0	$45,306	$0				
Carroll County	4	$2,252,604			$358,830	$0			$1,615,007	$0							$128,122	$0			$150,644	$0		
Catoosa County	2	$5,020,058	$4,950,230	$42,828													$0	$27,000						
Charlton County	1	$622,570															$622,570	$0						
Chatham County	2	$56,391,947									$48,442,567	$527,610					$6,422,825	$948,538	$50,407	$0				
Chattahoochee County	3	$96,634							$57,704	$0							$16,430	$0	$0	$22,500				
Chattooga County	1	$28,500															$0	$28,500						
Cherokee County	3	$315,533	$5,976	$10,297													$80,597	$30,000			$188,663	$0		
Clarke County	1	$430,240															$430,240	$0						
Clay County	3	$256,168													$91,701	$0	$22,632	$0	$141,835	$0				
Clayton County	1	$422,304															$386,304	$36,000						
Clinch County	1	$139,183															$139,183	$0						
Cobb County	1	$94,251															$26,751	$67,500						
Coffee County	2	$552,432															$501,650	$0	$50,782	$0				
Colquitt County	3	$1,573,326													$472,268	$0	$411,199	$0	$689,859	$0				
Columbia County	2	$8,632,095			$8,351,041	$39,110											$241,944	$0						
Cook County	3	$1,008,643													$534,122	$0	$419,005	$0	$55,516	$0				
Coweta County	4	$6,880,579	$15,016	$58,143	$258,471	$31,955											$258,135	$0					$6,258,859	$0
Crawford County	3	$131,970							$117,225	$0							$14,745	$0	$0	$0				
Crisp County	3	$4,102,090													$219,740	$0	$439,981	$0	$3,442,369	$0				
Dade County	4	$4,729,005	$2,119,669	$21,000	$5,525	$992,637			$542,246	$1,047,929							$0	$0						
Dawson County	3	$1,022,799					$858,889	$25,424									$67,677	$0			$70,809	$0		
Decatur County	3	$7,531,782							$232,220	$0							$204,689	$19,800	$7,075,072	$0				
DeKalb County	1	$2,775,461															$2,657,775	$117,686						
Dodge County	2	$1,235,775															$312,601	$0	$923,174	$0				
Dooly County	2	$82,383															$35,950	$0	$46,432	$0				
Dougherty County	4	$41,432,080											$11,699,641	$0	$10,015,060	$2,495,481	$721,434	$0	$16,500,463	$0				
Douglas County	3	$2,499,343							$1,382,431	$1,043,093							$13,432	$0			$60,387	$0		
Early County	3	$750,653											$36,912	$0			$56,669	$24,000	$633,072	$0				
Echols County	3	$291,769													$169,183	$0	$111,254	$0	$11,332	$0				
Effingham County	2	$1,767,348									$1,490,320	$0					$277,027	$0						
Elbert County	2	$109,485					$31,761	$0									$49,223	$28,500						
Emanuel County	4	$988,776			$118,190	$0					$0	$27,000					$485,639	$0	$357,948	$0				
Evans County	3	$600,255									$367,135	$27,000					$202,351	$0	$3,769	$0				
Fannin County	5	$622,201			$20,906	$30,191			$139,224	$13,262							$0	$24,000			$81,332	$0	$313,287	$0
Fayette County	3	$2,495,349			$251,921	$0			$1,518,772	$461,366							$263,290	$0						
Floyd County	2	$995,698	$918,353	$51,845													$0	$25,500						
Forsyth County	3	$681,053					$215,391	$0									$287,157	$28,500			$150,006	$0		
Franklin County	3	$331,242					$184,933	$0									$91,723	$0			$54,586	$0		
Fulton County	2	$2,849,185			$866,397	$56,646											$1,605,477	$320,666						
Gilmer County	5	$1,266,401			$12,051	$0			$806,016	$0							$33,299	$0			$112,201	$0	$302,835	$0
Glascock County	3	$73,273			$34,548	$0											$19,225	$0	$0	$19,500				
Glynn County	2	$25,440,177									$10,979,176	$381,071					$14,079,929	$0						
Gordon County	3	$472,473	$49,635	$17,635													$36,471	$28,500					$340,232	$0
Grady County	2	$1,003,574															$178,162	$30,563	$794,850	$0				
Greene County	3	$195,705	$5,025	$9,673					$40,119	$29,068							$111,820	$0						
Gwinnett County	1	$2,153,619															$2,153,619	$0						
Habersham County	5	$970,370	$0	$0	$11,667	$46,658	$198,790	$0									$655,516	$0			$57,739	$0		
Hall County	3	$2,461,843					$1,015,881	$0									$924,702	$19,500			$501,759	$0		
Hancock County	3	$267,431			$120,459	$0											$81,908	$0	$65,065	$0				
Haralson County	4	$605,375			$97,988	$0			$213,424	$0							$205,882	$0			$88,082	$0		
Harris County	3	$196,902	$7,489	$18,000					$75,706	$0							$70,207	$25,500						
Hart County	2	$236,919					$92,419	$0									$144,501	$0						
Heard County	5	$460,924	$3,523	$0	$13,244	$0											$0	$31,500			$26,341	$0	$386,316	$0
Henry County	1	$255,893															$255,893	$0						
Houston County	2	$1,194,491															$844,434	$0	$348,190	$1,868				
Irwin County	2	$101,496															$59,000	$0	$42,496	$0				
Jackson County	2	$515,850					$251,492	$0									$264,358	$0						
Jasper County	3	$331,407	$20,316	$0	$70,728	$0											$240,362	$0						
Jeff Davis County	3	$53,916							$53,916	$0							$0	$0	$0	$0				
Jefferson County	3	$547,104			$304,900	$0											$143,387	$0	$98,817	$0				
Jenkins County	4	$1,030,782			$848,212	$0					$20,755	$38,350					$50,513	$0	$72,952	$0				
Johnson County	3	$96,166			$50,435	$0											$34,029	$0	$11,701	$0				
Jones County	3	$300,058			$221,423	$0											$78,636	$0	$0	$0				
Lamar County	4	$905,996	$459,037	$58,760	$126,163	$0			$126,432	$0							$135,605	$0						
Lanier County	1	$48,608															$48,608	$0						
Laurens County	2	$1,354,621															$591,248	$0	$763,373	$0				
Lee County	2	$789,030															$87,987	$0	$701,043	$0				
Liberty County	2	$4,672,111									$3,723,106	$27,000					$922,004	$0						
Lincoln County	1	$11,323															$11,323	$0						
Long County	2	$333,424									$225,760	$0					$85,164	$22,500						
Lowndes County	2	$1,617,386													$178,944	$0	$1,406,942	$31,500						
Lumpkin County	5	$1,532,023	$15,880	$0			$320,346	$0									$1,001,422	$0			$39,616	$0	$154,759	$0
McDuffie County	2	$474,219			$261,321	$28,058											$163,840	$21,000						
McIntosh County	2	$5,096,980									$2,501,036	$0					$2,595,944	$0						
Macon County	3	$545,343							$382,026	$0							$87,355	$0	$75,962	$0				
Madison County	3	$442,518			$269,645	$0	$85,897	$0									$86,976	$0						
Marion County	3	$376,858							$317,151	$16,500							$21,353	$0	$21,854	$0				
Meriwether County	4	$1,477,920	$243,178	$20,409	$45,230	$0			$1,151,125	$0							$17,978	$0						
Miller County	2	$631,189															$25,244	$0	$605,945	$0				
Mitchell County	3	$1,607,513											$150,909	$0			$94,841	$13,500	$1,348,263	$0				
Monroe County	3	$469,562	$136,627	$39,130	$141,523	$24,134											$107,149	$21,000						
Montgomery County	3	$114,289							$57,073	$0							$29,792	$0	$7,455	$19,969				
Morgan County	4	$647,287	$174,031	$202,011	$8,438	$0			$120,576	$0							$121,231	$21,000						
Murray County	1	$0															$0	$0						
Muscogee County	2	$2,450,838							$2,046,188	$0							$404,649	$0						
Newton County	4	$4,957,561	$152,401	$21,000	$44,822	$0			$3,920,333	$0							$819,005	$0						
Oconee County	1	$50,800															$50,800	$0						
Oglethorpe County	3	$141,316					$9,710	$0	$82,828	$0							$48,778	$0						
Paulding County	2	$146,980															$0	$42,000			$104,980	$0		
Peach County	2	$1,175,842															$1,004,210	$0	$171,631	$0				
Pickens County	7	$2,223,727	$117,317	$29,381	$31,617	$0	$1,056,996	$0	$449,533	$24,988							$134,732	$0			$70,422	$0	$308,736	$0
Pierce County	2	$648,878									$124,949	$0					$523,929	$0						
Pike County	2	$64,112			$6,570	$57,542											$0	$0						
Polk County	2	$40,640	$40,640	$0													$0	$0						
Pulaski County	2	$212,824															$0	$0	$212,824	$0				
Putnam County	3	$263,629													$88,743	$0	$90,215	$25,500	$59,170	$0				
Quitman County	2	$120,398															$16,088	$0	$87,809	$16,500				
Rabun County	4	$1,352,022	$1,114,397	$0													$117,532	$0			$0	$0	$120,093	$0
Randolph County	3	$775,393													$283,284	$0	$103,900	$0	$388,210	$0				
Richmond County	2	$14,465,607			$13,835,058	$91,493											$489,556	$49,500						
Rockdale County	1	$239,597															$239,597	$0						
Schley County	2	$24,940															$24,940	$0	$0	$0				
Screven County	4	$1,243,521			$527,154	$0					$645,868	$27,000					$21,697	$0	$21,802	$0				
Seminole County	2	$22,188,735															$109,911	$0	$22,059,323	$19,500				
Spalding County	3	$1,875,453	$898,974	$37,268	$254,214	$63,615											$592,882	$28,500						
Stephens County	3	$379,674					$96,389	$0									$244,579	$0			$38,707	$0		
Stewart County	3	$411,140							$241,808	$0							$37,017	$0	$132,315	$0				
Sumter County	2	$1,130,990															$119,246	$0	$1,011,745	$0				
Talbot County	2	$121,707							$96,606	$0							$25,101	$0						
Taliaferro County	3	$108,097			$6,756	$0			$78,993	$17,735							$4,613	$0						
Tattnall County	4	$1,264,636									$593,499	$24,000			$305,950	$0	$341,187	$0	$0	$0				
Taylor County	2	$296,024							$223,655	$0							$72,369	$0						
Telfair County	2	$241,263															$174,697	$0	$66,566	$0				
Terrell County	2	$346,963															$29,871	$0	$317,092	$0				
Thomas County	3	$2,836,928													$456,269	$0	$428,108	$0	$1,952,550	$0				
Tift County	2	$734,511															$282,065	$33,000	$419,446	$0				
Toombs County	3	$582,189									$6,478	$0					$500,840	$0	$74,871	$0				
Towns County	3	$100,382							$73,926	$26,456							$0	$0			$0	$0		
Treutlen County	2	$142,541															$74,486	$0	$68,056	$0				
Troup County	3	$2,733,132	$79,015	$30,669					$2,519,409	$26,250							$77,789	$0						
Turner County	4	$1,587,444											$116,214	$0	$809,399	$0	$111,276	$0	$526,555	$24,000				
Twiggs County	3	$189,736			$33,127	$0											$102,006	$0	$54,604	$0				
Union County	3	$142,004							$119,534	$0							$22,470	$0			$0	$0		
Upson County	5	$640,691	$0	$11,723	$96,705	$51,928			$257,806	$6,865					$44,132	$40,500	$131,033	$0						
Walker County	3	$1,039,054	$745,586	$22,262	$190,965	$32,843											$47,398	$0						
Walton County	1	$364,840															$364,840	$0						
Ware County	3	$510,940									$139,028	$0			$103,994	$0	$267,918	$0						
Warren County	2	$113,456			$49,363	$0											$64,094	$0						
Washington County	3	$1,175,305			$813,979	$0											$286,661	$0	$74,665	$0				
Wayne County	2	$1,259,025									$575,669	$0					$656,356	$27,000						
Webster County	3	$120,114							$67,420	$0							$21,800	$0	$30,894	$0				
Wheeler County	2	$21,457															$21,457	$0	$0	$0				
White County	6	$524,775	$1,475	$58,998	$12,322	$0	$62,403	$28,949									$171,231	$0			$101,970	$0	$87,426	$0
Whitfield County	2	$122,500			$52,157	$70,343											$0	$0						
Wilcox County	3	$126,151													$53,472	$0	$4,676	$0	$68,003	$0				
Wilkes County	3	$1,825,388			$17,464	$711,230	$71,136	$0	$297,660	$0							$727,898	$0						
Wilkinson County	2	$179,763															$69,966	$0	$109,797	$0				
Worth County	4	$2,427,786											$342,781	$0	$705,444	$0	$443,278	$19,500	$916,783	$0				
Total FEMA Allocation		$552,798,243	$20,288,231	$1,011,890	$46,645,843	$8,261,053	$10,843,503	$1,774,110	$19,626,173	$3,465,609	$95,802,870	$4,975,917	$14,573,963	$529,126	$23,857,381	$3,692,028	$120,423,482	$12,070,528	$142,631,675	$2,107,868	$9,332,016	$0	$10,884,978	$0

HAWAII

HAWAII STATISTICS SUMMARY (2011 – 2021)	
10	CLIMATE DISASTER DECLARATIONS
MAUI	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
30	SUPERFUND SITES
65	WASTEWATER DISCHARGE SITES
D+	ASCE INFRASTRUCTURE REPORT CARD GRADE
HONOLULU	HIGHEST COMPOUNDING RISKS
$325 MILLION	FEMA + HUD POST-DISASTER FUNDING
HAWAII	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
1.4 MILLION	POPULATION TOTAL
$229	PER CAPITA SPENDING ON CLIMATE DISASTERS
$1.1 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY



Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$201M	FEMA obligations
$124M	HUD CDBG-DR Funds
$325M	FEMA + HUD assistance
$229	per capita cost

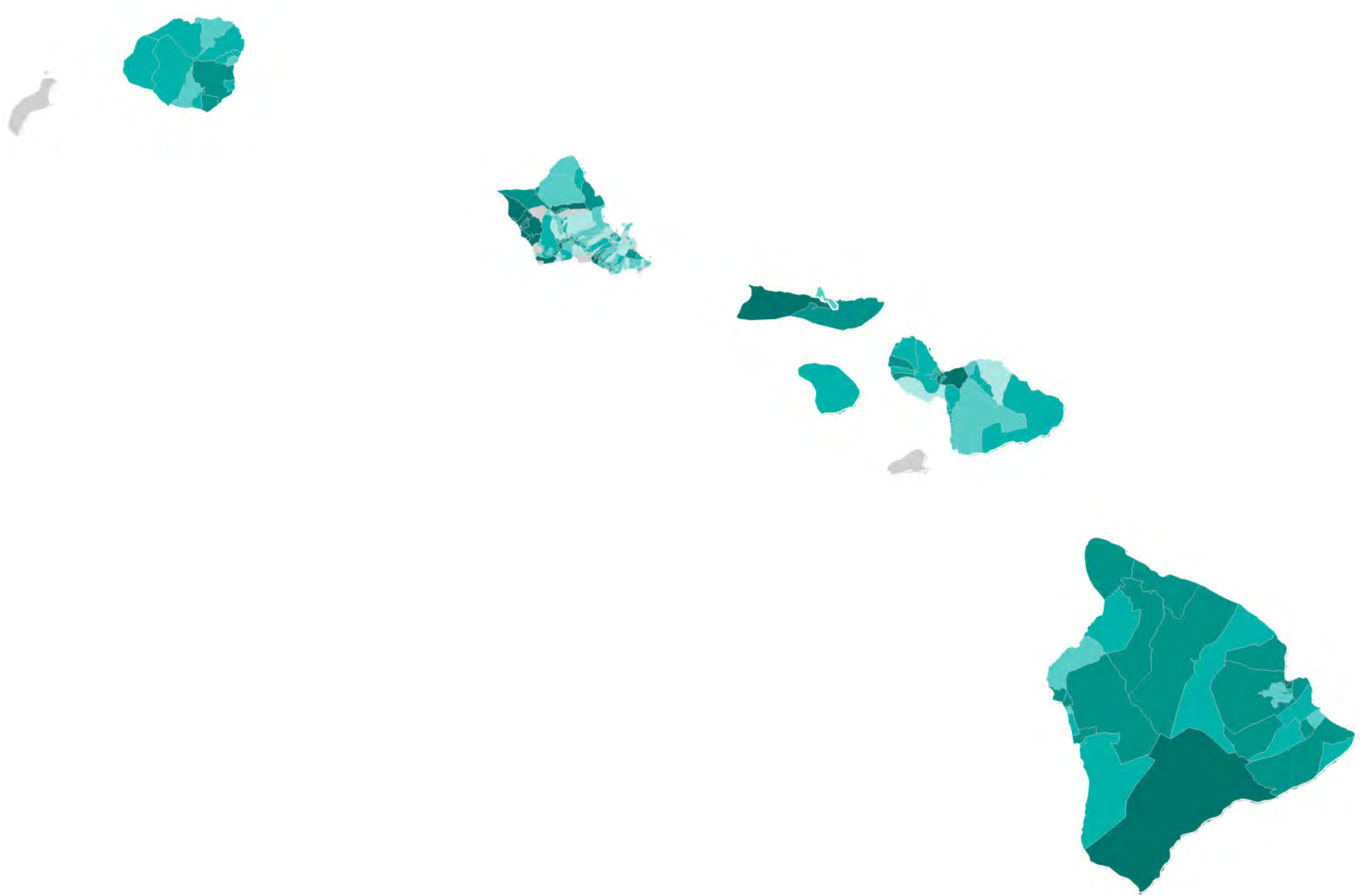
FEMA Public Assistance and Hazard Mitigation
Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



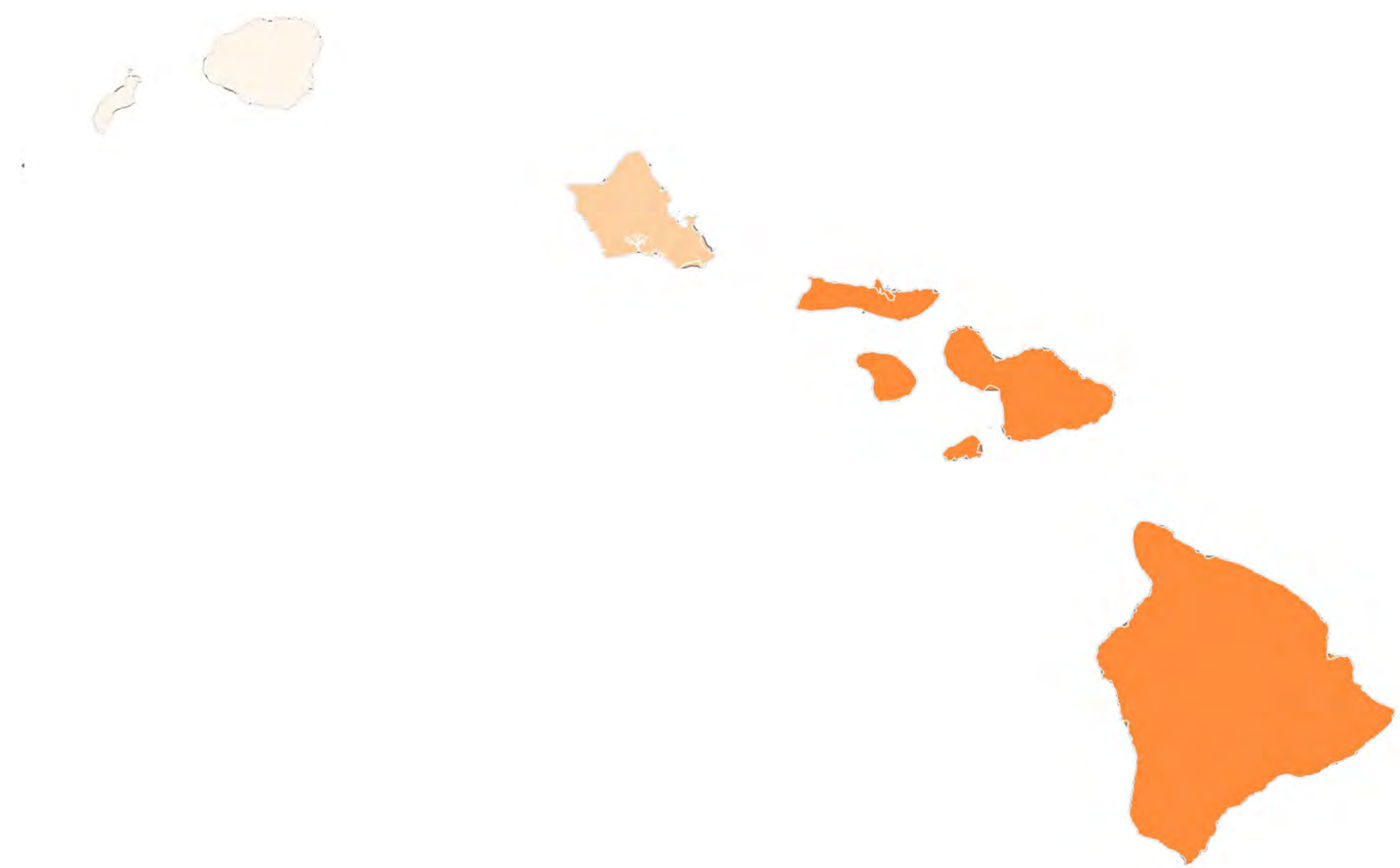
Social Vulnerability Index

CDC (2018)
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration
Including major events - SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

The state of Hawaii has 65 wastewater discharge areas and 30 superfund sites, almost entirely in Honolulu.

According to FEMA's National Risk Map, Hawaii is not at high risk for volcanic activity.

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Hawaii					3		2
Honolulu					2		3
Kalawao							0
Kauai					2		2
Maui					1		2

HAWAII

TOTAL: 10 DISASTERS
FEMA PA + HM: $201 M
HUD CDBG-DR: $124 M
FEMA + HUD ASSISTANCE: $325 M

			2011		2012		2014				2016		2018						2020		2021	
			1967: TSUNAMI WAVES		4062: SEVERE STORMS, FLOODING, AND LANDSLIDES		4194: TROPICAL STORM ISELLE		4201: PU'U O'O VOLCANIC ERUPTION AND LAVA FLOW		4282: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4365: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4366: KILAUEA VOLCANIC ERUPTION AND EARTHQUAKES		4395: HURRICANE LANE		4549: SEVERE STORMS AND FLOODING		4604: SEVERE STORMS, FLOODING, AND LANDSLIDES	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	10	$40,312,378	$5,772,417	$40,801	$1,010,633	$69,024	$1,583,270	$0	$4,436,813	$0	$631,208	$30,218	$1,951,586	$405,038	$20,467,889	$965,678	$2,341,670	$416,778	$164,983	$0	$24,373	$0
Hawaii County	5	$131,419,853	$370,906	$0			$2,846,155	$0	$6,895,135	$0					$104,093,068	$4,099,836	$13,114,753	$0				
Honolulu County	2	$6,451,709	$308,178	$776,719									$4,473,823	$892,989								
Kalawao County	0	$0																				
Kauai County	4	$12,075,564			$1,375,746	$26,500							$8,524,304	$293,625			$1,153,846	$0	$701,543	$0		
Maui County	6	$10,714,981	$203,919	$33,980	$814,194	$0	$1,716,958	$0			$3,391,325	$112,500					$1,043,297	$0			$3,398,808	$0
Total FEMA Allocation		$200,974,485	$6,655,419	$851,500	$3,200,573	$95,524	$6,146,383	$0	$11,331,947	$0	$4,022,533	$142,718	$14,949,713	$1,591,652	$124,560,957	$5,065,514	$17,653,567	$416,778	$866,526	$0	$3,423,181	$0

IDAHO

IDAHO STATISTICS SUMMARY (2011 – 2021)

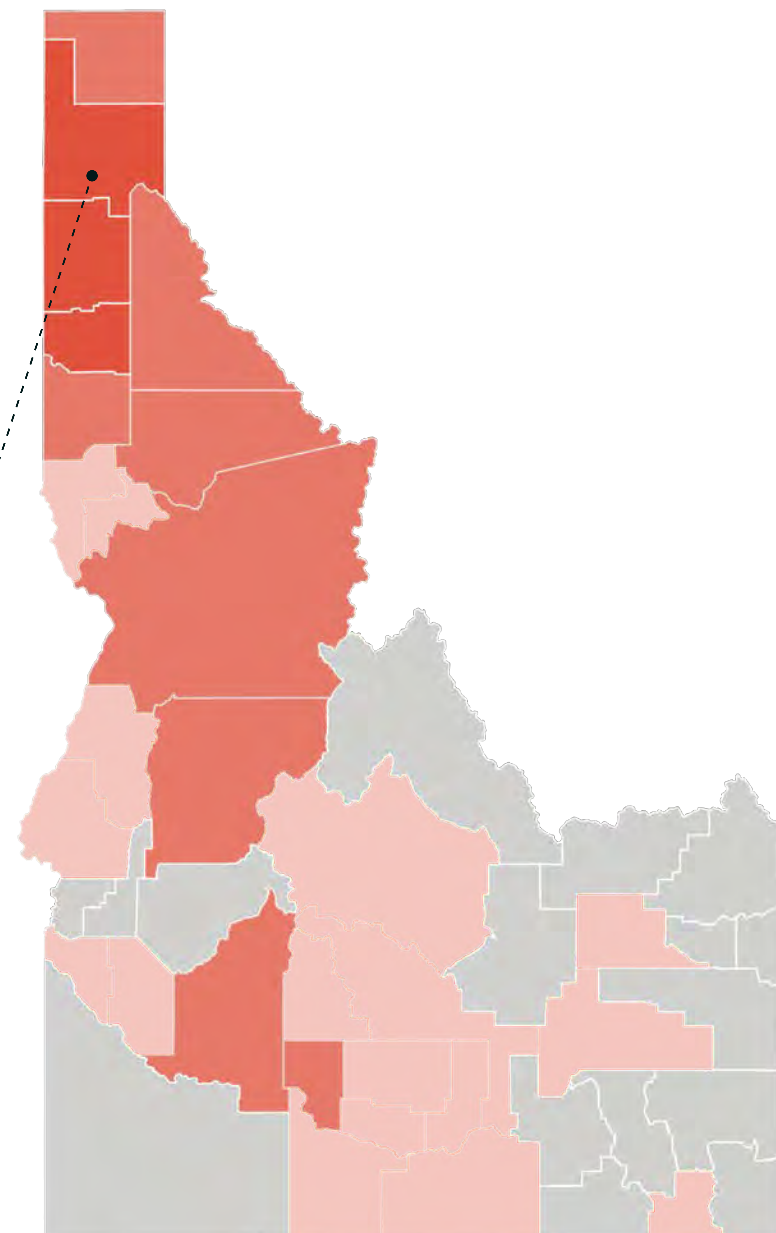
9	CLIMATE DISASTER DECLARATIONS
BONNER	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
1	SUPERFUND SITE
38	WASTEWATER DISCHARGE SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
MADISON, SHOSHONE	HIGHEST COMPOUNDING RISKS
$56.5 MILLION	FEMA + HUD POST-DISASTER FUNDING
IDAHO	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
1.8 MILLION	POPULATION TOTAL
$32	PER CAPITA SPENDING ON CLIMATE DISASTERS
$1.3 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

9
disaster declarations

Bonner County has had the highest number of recent disasters in the state: 5 disaster declarations.



Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurences
- 7–9 occurences
- 10+ occurences

Source: FEMA 2021
Maps courtesy of iParametrics

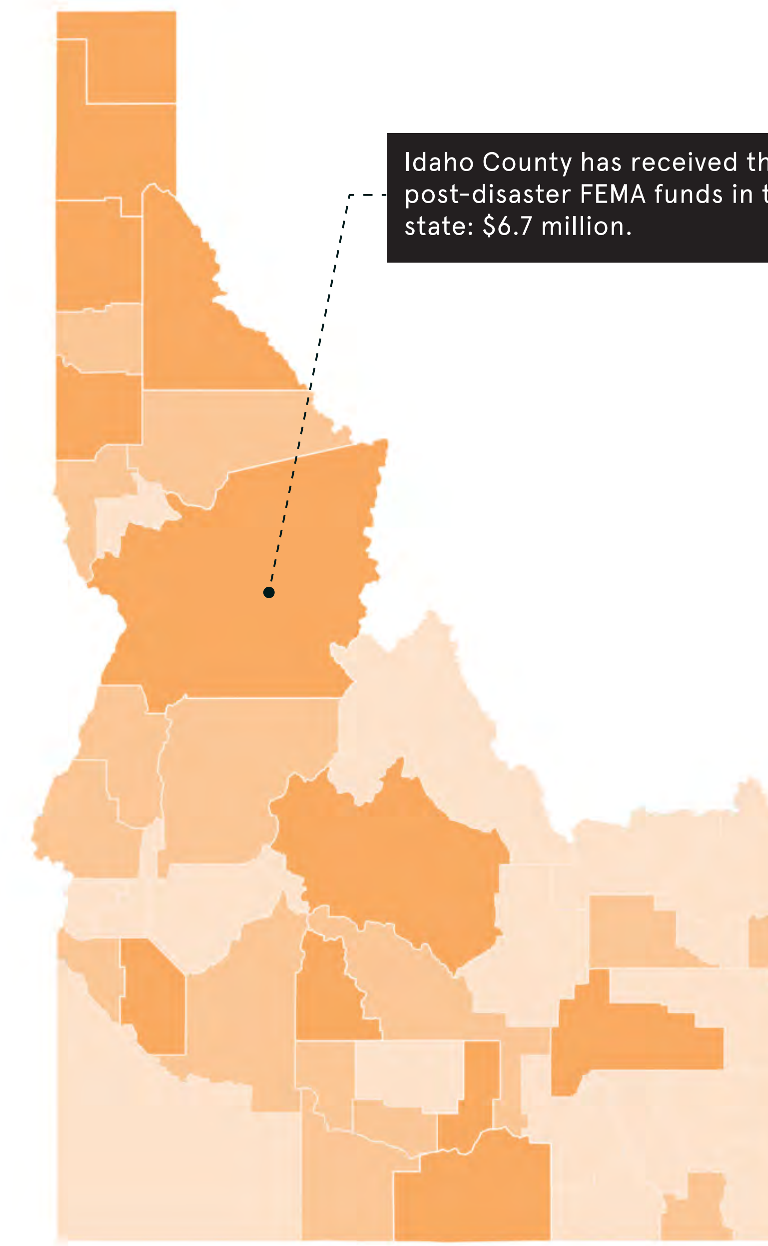
FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$56.5M
post-disaster assistance

$56.5M	FEMA obligations
$0B	HUD CDBG-DR Funds
$56.5M	FEMA + HUD assistance
$32	per capita cost

Idaho County has received the most post-disaster FEMA funds in the state: $6.7 million.



FEMA Public Assistance and Hazard Mitigation

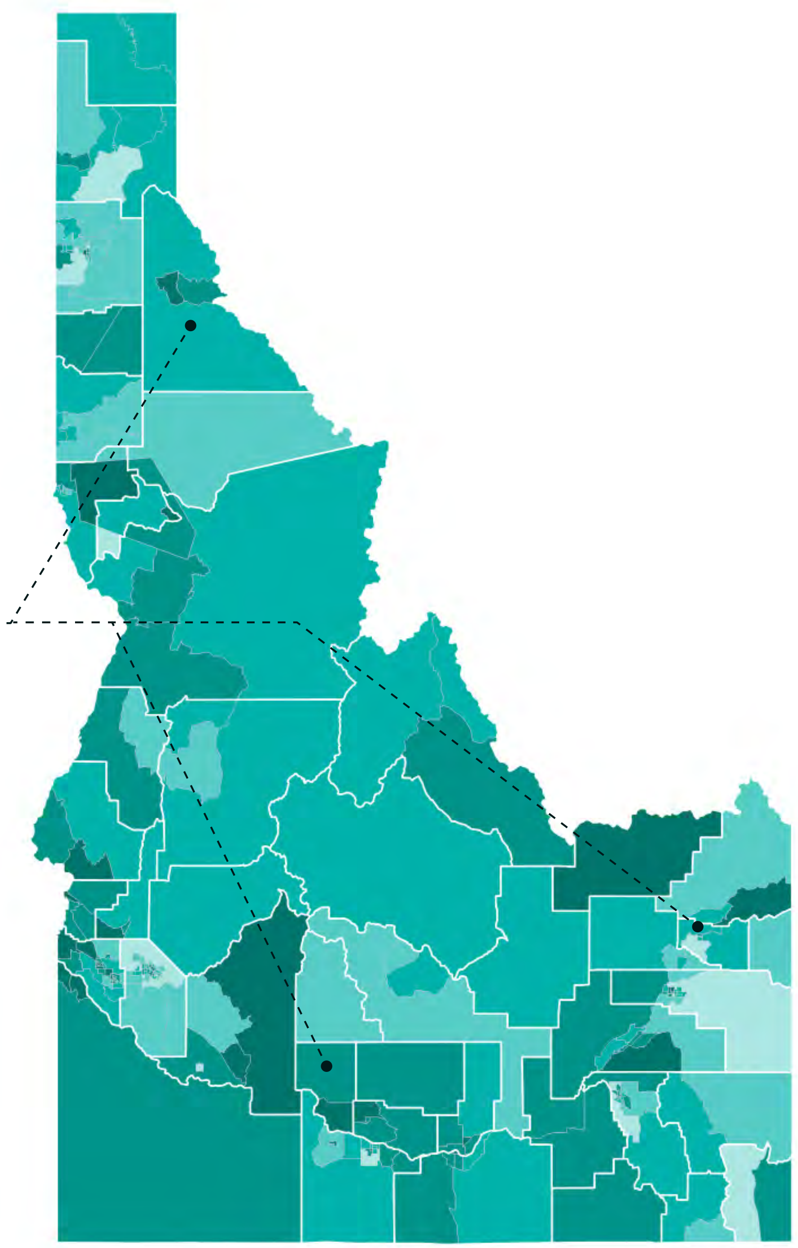
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Madison, Shoshone, and Gooding counties have high poverty, high diversity of hazard risks, and low investments from previous disasters.

Social Vulnerability Index

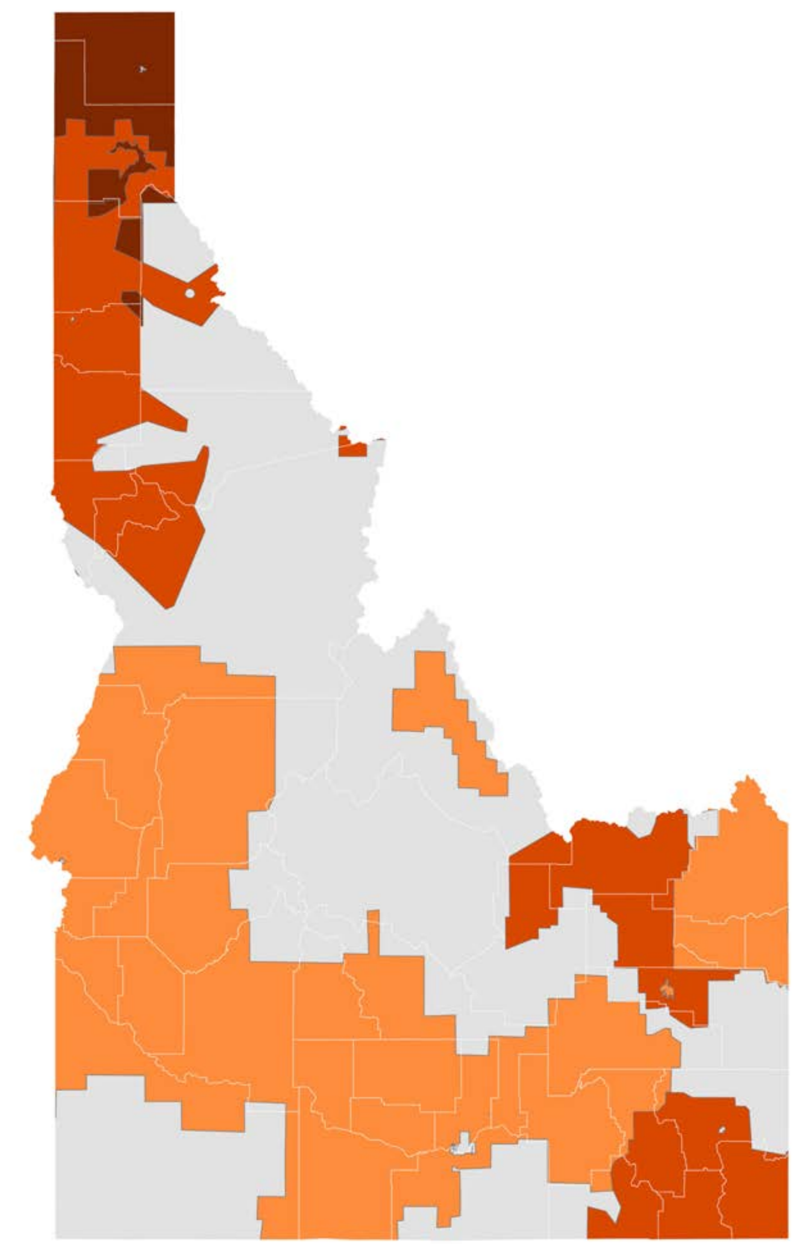
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration Including major events – SAIDI_W_MED

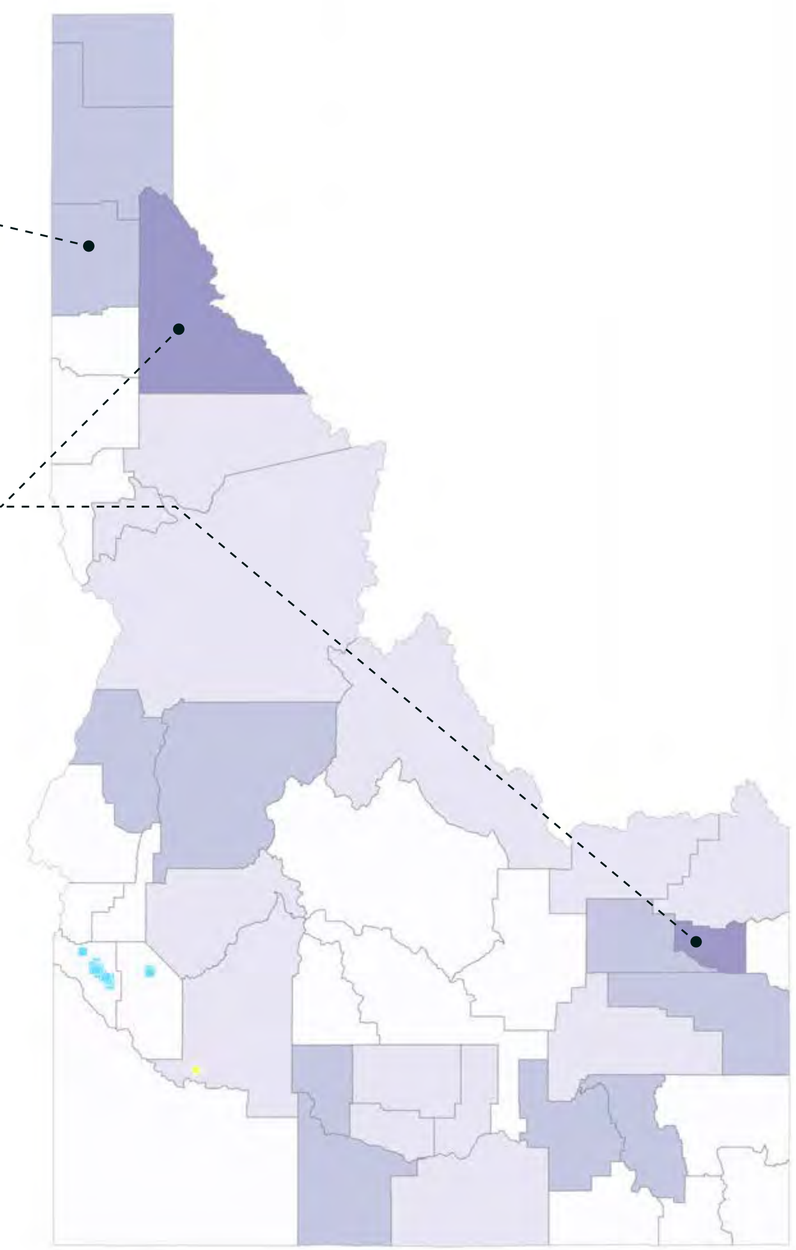
- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Bonner County has had the highest number of disasters in the state and has had over 15% population increase in ten years.

Madison and Shoshone counties have a high risk of climate disasters and other compounding risks.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Ada							0
Adams					1		2
Bannock					1		2
Bear Lake							0
Benewah							0
Bingham					2		1
Blaine							0
Boise					1		1
Bonner					1		2
Bonneville					1		2
Boundary					1		2
Butte							0
Camas							0
Canyon							0
Caribou							0
Cassia					2		1
Clark					3		1
Clearwater					1		1
Custer							0
Elmore					1		1
Franklin							0
Fremont					1		1
Gem							0
Gooding					2		2
Idaho					1		1
Jefferson					1		2
Jerome					2		1
Kootenai					1		2
Latah							0
Lemhi					1		1
Lewis					1		1
Lincoln					1		1
Madison					1		3
Minidoka					2		1
Nez Perce							0
Oneida							0
Owyhee							0
Payette							0
Power					1		2
Shoshone					1		3
Teton							0
Twin Falls					1		2
Valley					2		2
Washington							0

IDAHO

TOTAL: 9 DISASTERS FEMA PA + HM: $56.5 M HUD CDBG-DR: none FEMA + HUD ASSISTANCE: $56.5 M			2011		2015		2016		2017								2019		2021	
			1987: FLOODING, LANDSLIDES, AND MUDSLIDES		4246: SEVERE STORM AND STRAIGHT-LINE WIND		4252: SEVERE WINTER STORMS		4310: SEVERE WINTER STORMS AND FLOODING		4313: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4333: FLOODING, LANDSLIDES, AND MUDSLIDES		4342: FLOODING		4443: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4589: STRAIGHT-LINE WINDS	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	9	$23,787,265	$133,330.91	$12,486.00	$1,653,447.96	$18,930.00	$20,206,958.15	$20,877.35	$257,004.13	$52,127.00	$637,544.60	$79,067.00	$104,357.00	$22,918.00	$136,945.77	$20,166.00	$195,684.77	$65,337.26	$170,082.65	$0.00
Ada County	1	$3,500,247													$3,370,344	$129,903				
Adams County	1	$184,033															$159,375	$24,659		
Bannock County	0	$0																		
Bear Lake County	0	$0																		
Benewah County	4	$795,446			$82,749	$86,358	$264,617	$0			$266,759	$0							$94,964	$0
Bingham County	1	$338,414							$338,414	$0										
Blaine County	1	$647,473											$422,473	$225,000						
Boise County	0	$0																		
Bonner County	5	$1,657,008	$1,014,051	$0	$0	$0	$0	$0			$625,746	$0							$17,212	$0
Bonneville County	0	$0																		
Boundary County	2	$2,328,005			$522,240	$0	$225,737	$0			$1,580,029	$0								
Butte County	0	$0																		
Camas County	1	$1,076,798											$1,076,798	$0						
Canyon County	1	$157,907													$157,907	$0				
Caribou County	0	$0																		
Cassia County	1	$3,043,587							$3,043,587	$0										
Clark County	0	$0																		
Clearwater County	2	$652,557	$85,974	$0							$515,137	$51,446								
Custer County	1	$1,021,734											$904,567	$117,167						
Elmore County	2	$959,726							$402,542	$0			$524,377	$32,807						
Franklin County	1	$402,167							$348,868	$53,299										
Fremont County	0	$0																		
Gem County	0	$0																		
Gooding County	2	$494,072							$471,882	$0			$22,190	$0						
Idaho County	3	$6,655,612	$1,178,275	$0							$2,997,608	$0					$2,479,729	$0		
Jefferson County	1	$348,307							$348,307	$0										
Jerome County	1	$176,873							$176,873	$0										
Kootenai County	4	$2,967,566			$210,197	$25,560	$0	$48,592			$2,170,140	$0							$513,078	$0
Latah County	2	$874,159									$395,642	$295,200					$183,317	$0		
Lemhi County	0	$0																		
Lewis County	1	$57,000															$0	$57,000		
Lincoln County	1	$94,560							$94,560	$0										
Madison County	0	$0																		
Minidoka County	1	$1,493,090							$946,058	$547,032										
Nez Perce County	1	$335,552	$200,144	$0	$18,052	$0	$23,640	$0									$21,226	$0	$72,491	$0
Oneida County	0	$0																		
Owyhee County	0	$0																		
Payette County	0	$0																		
Power County	0	$0																		
Shoshone County	3	$986,224	$315,123	$0							$344,250	$0							$326,850	$0
Teton County	0	$0																		
Twin Falls County	1	$818,233							$818,233	$0										
Valley County	2	$449,082									$316,332	$0					$0	$132,750		
Washington County	1	$240,790							$240,790	$0										
Total FEMA Allocation		$56,543,487	$2,926,897	$12,486	$2,486,685	$130,848	$20,720,951	$69,469	$7,487,117	$652,458	$9,849,187	$425,713	$3,054,763	$397,892	$3,665,196	$150,069	$3,039,331	$279,746	$1,194,677	$0

ILLINOIS

ILLINOIS STATISTICS SUMMARY (2011 – 2021)	
5	CLIMATE DISASTER DECLARATIONS
5TH LOWEST	NUMBER OF CLIMATE DISASTERS IN THE NATION
COOK	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
183	SUPERFUND SITES
1153	WASTEWATER DISCHARGE SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
WINNEBAGO	HIGHEST COMPOUNDING RISKS
$311 MILLION	FEMA + HUD POST-DISASTER FUNDING
COOK	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
12.7 MILLION	POPULATION TOTAL
$24	PER CAPITA SPENDING ON CLIMATE DISASTERS
$11 MILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

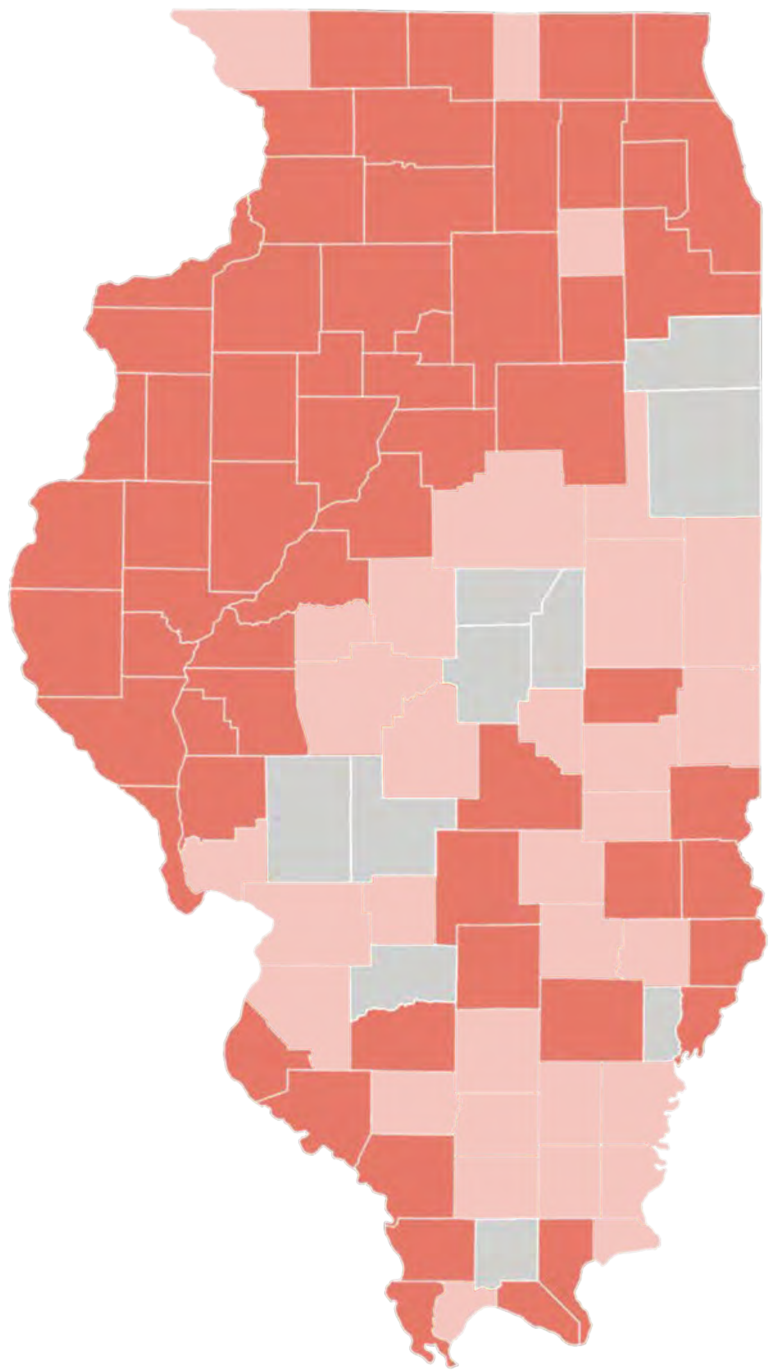
DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

5
disaster
declarations

Twenty-three counties in Illinois have had 3 disaster declarations.

Illinois has the 5th lowest number of disaster declarations in the country.



Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$311M
post-disaster
assistance

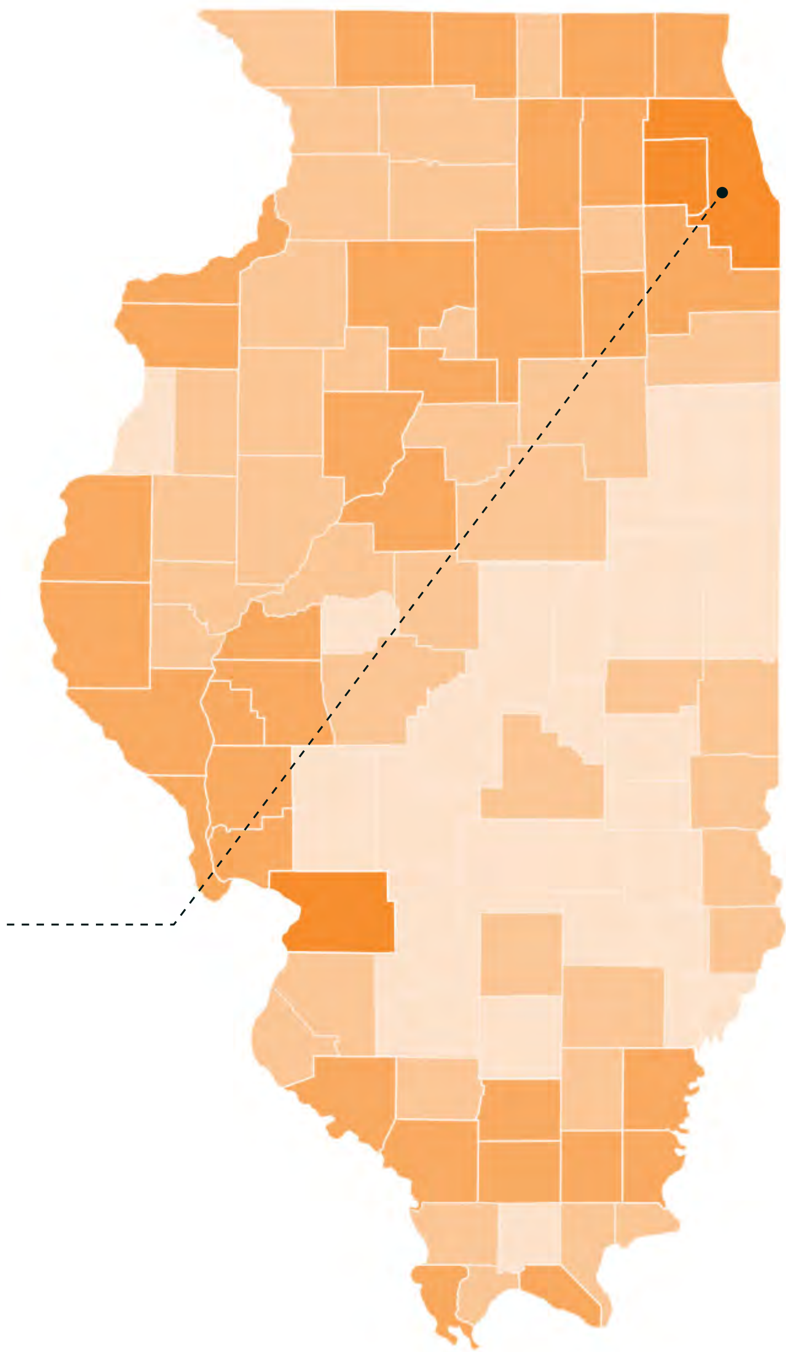
$123M FEMA obligations

$188M HUD CDBG-DR Funds

$311M FEMA + HUD assistance

$25 per capita cost

Cook County has received $24 million in federal disaster recovery funds.



FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011-2021)

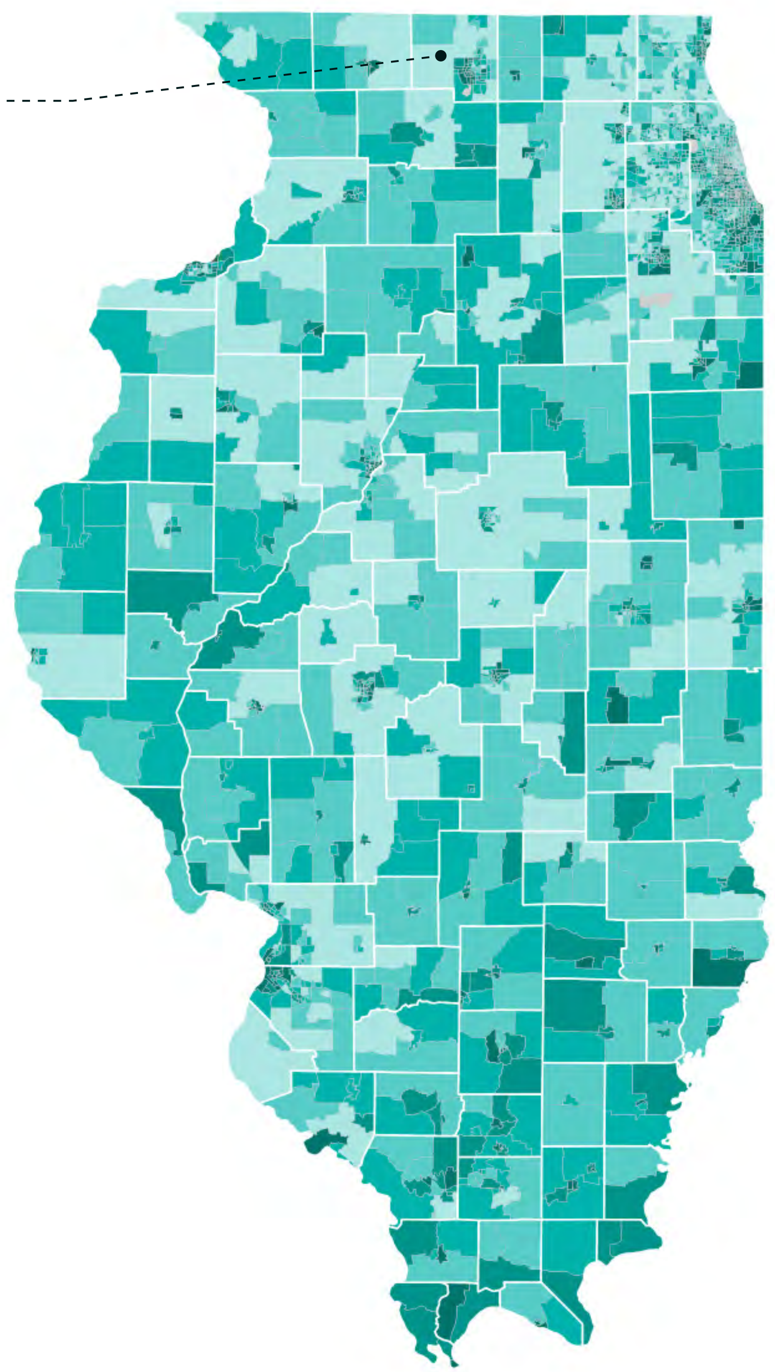
- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Winnebago County has high poverty, high diversity of hazard risks, and low investments from previous disasters.



Social Vulnerability Index

CDC (2018)

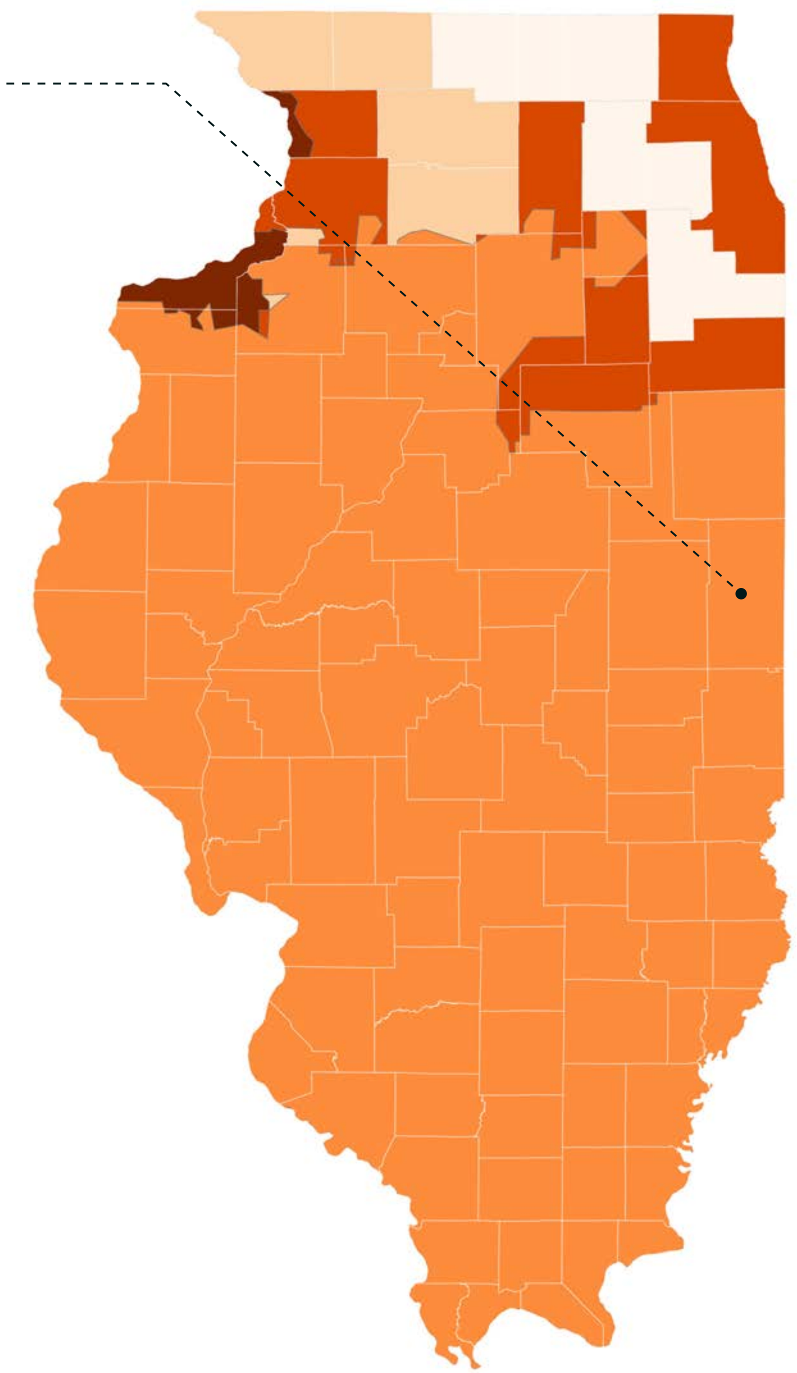
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Parts of Vermillion County have high social vulnerability and low energy reliability.



Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

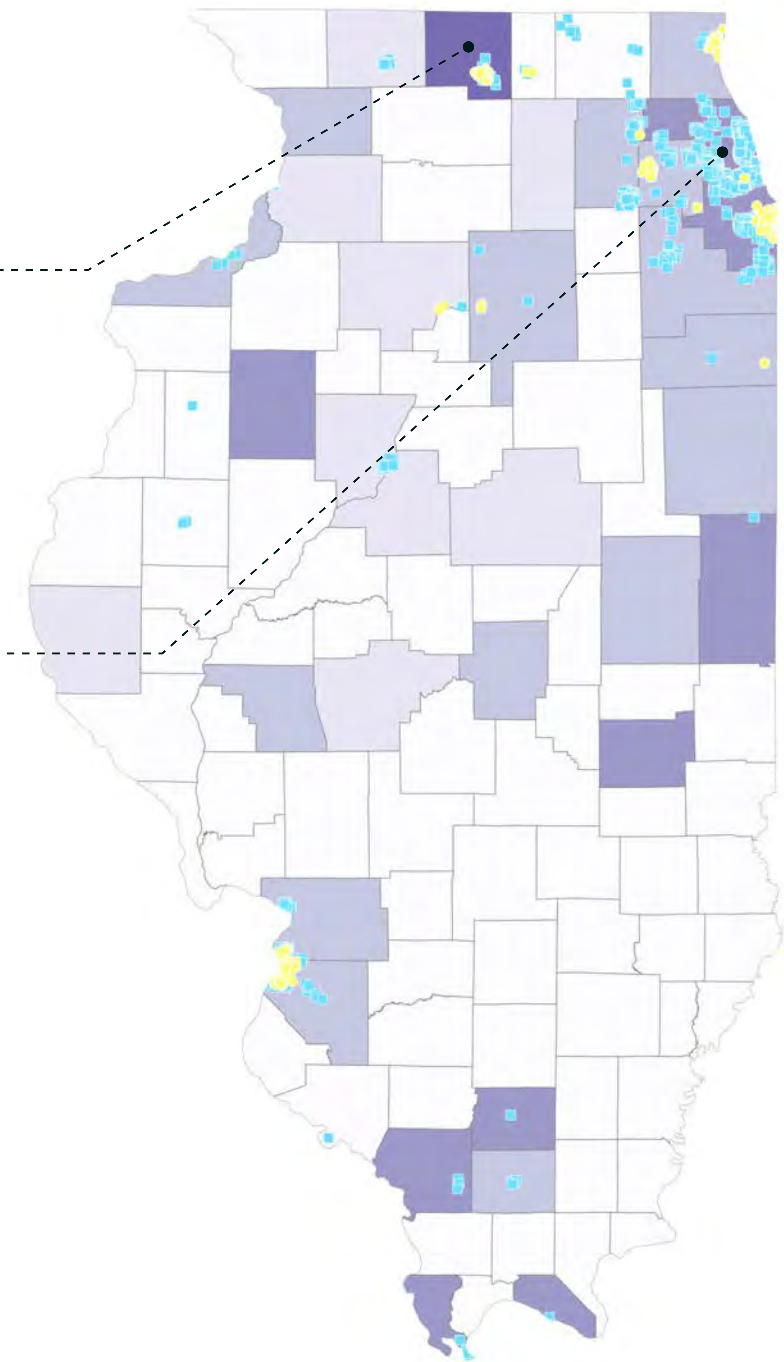
Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Winnebago County has a high risk of climate disasters, high population density, high poverty, and high health risks.

Illinois has 1,153 wastewater discharge sites and 183 superfund sites.

Cook County has the highest concentration of wastewater discharge sites.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adams					1		1
Alexander					3		3
Bond							0
Boone							0
Brown							0
Bureau					1		1
Calhoun							0
Carroll					1		2
Cass							0
Champaign					3		2
Christian							0
Clark							0
Clay							0
Clinton							0
Coles					1		3
Cook					8		3
Crawford							0
Cumberland							0
De Witt							0
DeKalb					1		1
Douglas							0
DuPage					1		2
Edgar							0
Edwards							0
Effingham							0
Fayette							0
Ford							0
Franklin					1		3
Fulton							0
Gallatin							0
Greene							0
Grundy							0
Hamilton							0
Hancock							0
Hardin							0
Henderson							0
Henry							0
Iroquois					1		2
Jackson					2		3
Jasper							0
Jefferson							0
Jersey							0
Jo Daviess							0
Johnson							0
Kane					2		2
Kankakee					1		2
Kendall							0
Knox					2		3
Lake					1		2

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
LaSalle					1		2
Lawrence							0
Lee							0
Livingston							0
Logan							0
Macon					4		2
Macoupin							0
Madison					2		2
Marion							0
Marshall							0
Mason							0
Massac					2		3
McDonough							0
McHenry							0
McLean					1		1
Menard							0
Mercer							0
Monroe							0
Montgomery							0
Morgan					1		2
Moultrie							0
Ogle							0
Peoria					4		1
Perry							0
Piatt							0
Pike							0
Pope							0
Pulaski							0
Putnam							0
Randolph							0
Richland							0
Rock Island					3		2
Saline							0
Sangamon					2		1
Schuyler							0
Scott							0
Shelby							0
St. Clair					6		2
Stark							0
Stephenson					2		1
Tazewell					1		1
Union							0
Vermilion					2		3
Wabash							0
Warren							0
Washington							0
Wayne							0
White							0
Whiteside					1		1
Will					1		2
Williamson					1		2

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Winnebago					7		4
Woodford							0

ILLINOIS

TOTAL: 5 DISASTERS FEMA PA + HM: $123 M HUD CDBG-DR: $188 M FEMA + HUD ASSISTANCE: $311 M			2011				2013				2019	
			1960: SEVERE WINTER STORM AND SNOWSTORM		1991: SEVERE STORMS AND FLOODING		4116: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4157: SEVERE STORMS, STRAIGHT-LINE WINDS, AND TORNADOES		4461: SEVERE STORMS AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	5	$46,604,452	$10,679,127	$288,587	$5,805,062	$534,100	$7,577,134	$1,441,613			$19,755,777	$523,052
Adams County	3	$4,365,163	$464,810	$0			$2,331,261	$0			$1,569,092	$0
Alexander County	2	$3,296,634			$1,948,607	$0					$1,348,027	$0
Bond County	1	$0	$0	$0								
Boone County	1	$250,934	$250,934	$0								
Brown County	2	$103,662	$49,311	$0			$54,351	$0				
Bureau County	3	$2,006,086	$268,314	$0			$1,415,886	$0			$321,886	$0
Calhoun County	3	$1,889,896	$49,770	$0			$1,026,593	$0			$813,532	$0
Carroll County	3	$229,293	$129,866	$0			$74,901	$0			$24,527	$0
Cass County	3	$1,316,768	$82,185	$0			$452,015	$0			$735,730	$46,839
Champaign County	1	$0							$0	$0		
Christian County	1	$1,980	$1,980	$0								
Clark County	2	$155,879	$75,099	$0			$80,780	$0				
Clay County	1	$25,318	$25,318	$0								
Clinton County	0	$0										
Coles County	1	$14,504	$14,504	$0								
Cook County	2	$24,144,757	$16,235,155	$0			$0	$7,909,602				
Crawford County	2	$122,658	$22,789	$0			$72,558	$27,311				
Cumberland County	1	$54,586	$0	$54,586								
De Witt County	0	$0										
DeKalb County	2	$410,795	$410,795	$0			$0	$0				
Douglas County	3	$352,288	$0	$352,288			$0	$0	$0	$0		
DuPage County	2	$11,272,069	$3,050,825	$0			$1,960,779	$6,260,464				
Edgar County	1	$23,439	$23,439	$0								
Edwards County	0	$0										
Effingham County	1	$25,572	$25,572	$0								
Fayette County	2	$0	$0	$0					$0	$0		
Ford County	1	$79,362	$79,362	$0								
Franklin County	1	$444,965			$444,965	$0						
Fulton County	3	$908,733	$190,101	$0			$670,001	$0			$48,630	$0
Gallatin County	1	$578,525			$578,525	$0						
Greene County	2	$1,929,022					$94,388	$0			$1,834,634	$0
Grundy County	3	$1,883,724	$201,218	$0			$1,192,072	$490,433	$0	$0		
Hamilton County	1	$123,297			$123,297	$0						
Hancock County	3	$1,180,082	$142,327	$0			$212,383	$0			$825,372	$0
Hardin County	1	$160,869			$160,869	$0						
Henderson County	3	$501,568	$82,313	$0			$67,661	$0			$351,593	$0
Henry County	3	$668,163	$239,377	$0			$0	$0			$428,787	$0
Iroquois County	0	$0										
Jackson County	2	$1,595,866			$788,703	$0					$807,163	$0
Jasper County	2	$6,260	$6,260	$0					$0	$0		
Jefferson County	1	$0			$0	$0						
Jersey County	1	$1,209,467									$1,209,467	$0
Jo Daviess County	1	$200,632	$200,632	$0								
Johnson County	0	$0										
Kane County	2	$1,825,320	$1,825,320	$0			$0	$0				
Kankakee County	0	$0										
Kendall County	1	$535,584					$535,584	$0				
Knox County	3	$786,245	$342,866	$0			$191,065	$0			$209,700	$42,613
Lake County	2	$5,548,949	$2,727,346	$0			$1,310,660	$1,510,942				
LaSalle County	3	$2,882,619	$452,755	$147,002			$2,282,863	$0	$0	$0		
Lawrence County	2	$299,344			$176,744	$0	$70,880	$51,720				
Lee County	2	$504,387	$206,043	$0							$298,344	$0
Livingston County	2	$295,350	$140,760	$0			$154,590	$0				
Logan County	1	$89,019	$89,019	$0								
Macon County	0	$0										
Macoupin County	0	$0										
Madison County	1	$12,954,127									$12,954,127	$0
Marion County	2	$337,922	$39,798	$0	$298,124	$0						
Marshall County	2	$1,095,996	$92,021	$0			$1,003,975	$0				
Mason County	2	$152,041	$64,432	$67,595			$20,014	$0				
Massac County	2	$516,623			$382,146	$134,477			$0	$0		
McDonough County	2	$814,023	$181,823	$0			$632,200	$0				
McHenry County	2	$2,814,983	$1,579,863	$0			$452,682	$782,439				
McLean County	1	$529,224	$529,224	$0								
Menard County	1	$76,812	$76,812	$0								
Mercer County	3	$3,429,226	$120,303	$0			$944,672	$24,998			$2,339,253	$0
Monroe County	2	$669,390					$113,742	$0			$555,648	$0
Montgomery County	0	$0										
Morgan County	3	$1,196,712	$116,722	$0			$261,743	$0			$818,247	$0
Moultrie County	1	$33,459	$0	$33,459								
Ogle County	2	$553,886	$340,667	$0			$213,219	$0				
Peoria County	2	$5,211,920	$610,836	$0			$2,238,415	$2,362,669				
Perry County	1	$87,373			$87,373	$0						
Piatt County	0	$0										
Pike County	3	$1,990,789	$215,052	$0			$127,433	$0			$1,648,304	$0
Pope County	2	$157,992			$157,992	$0			$0	$0		
Pulaski County	1	$841,810			$841,810	$0						
Putnam County	2	$206,689	$35,959	$0			$170,730	$0				
Randolph County	2	$1,013,151			$102,837	$0					$910,313	$0
Richland County	1	$0	$0	$0								
Rock Island County	3	$4,967,942	$397,086	$0			$570,115	$62,504			$3,938,238	$0
Saline County	1	$705,817			$492,269	$213,548						
Sangamon County	1	$623,019	$623,019	$0								
Schuyler County	3	$778,103	$54,969	$0			$441,728	$0			$281,406	$0
Scott County	3	$1,370,681	$72,077	$0			$265,896	$0			$1,032,708	$0
Shelby County	2	$313,722	$3,525	$0			$310,197	$0				
St. Clair County	1	$890,649									$890,649	$0
Stark County	2	$546,006	$45,182	$0			$461,586	$39,238				
Stephenson County	2	$878,542	$198,774	$0							$679,768	$0
Tazewell County	3	$3,225,290	$376,575	$0			$786,471	$2,062,244	$0	$0		
Union County	2	$305,987			$203,617	$0					$102,371	$0
Vermilion County	1	$0							$0	$0		
Wabash County	2	$30,108			$30,108	$0			$0	$0		
Warren County	2	$337,914	$101,522	$0			$236,392	$0				
Washington County	3	$17,303	$17,303	$0	$0	$0			$0	$0		
Wayne County	2	$68,545			$68,545	$0			$0	$0		
White County	1	$828,596			$828,596	$0						
Whiteside County	3	$565,395	$229,319	$0			$0	$66,218			$269,858	$0
Will County	3	$3,543,965	$2,232,434	$0			$1,311,531	$0	$0	$0		
Williamson County	1	$418,367			$418,367	$0						
Winnebago County	2	$3,982,017	$975,010	$54,750			$0	$2,952,257				
Woodford County	3	$383,454	$143,861	$0			$239,593	$0	$0	$0		
Total FEMA Allocation		$122,754,001	$48,259,661	$998,267	$13,938,557	$882,125	$32,630,739	$26,044,652	$0	$0	$57,003,152	$612,503

INDIANA

INDIANA STATISTICS SUMMARY (2011 – 2021)

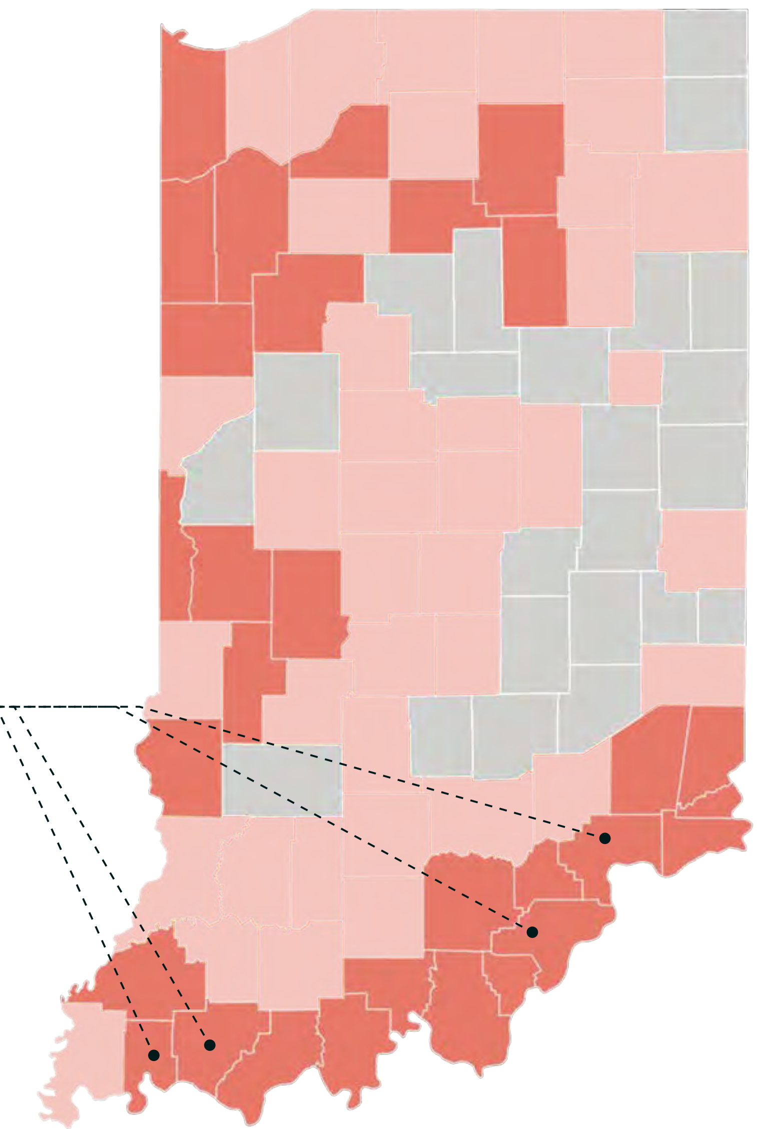
4	CLIMATE DISASTER DECLARATIONS
2ND LOWEST	NUMBER OF DISASTERS IN THE COUNTRY
2ND LOWEST	PER CAPITA SPENDING ON CLIMATE DISASTERS IN THE NATION
CLARK, VANDERBURGH, JEFFERSON, WARRICK	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
224	SUPERFUND SITES
224	WASTEWATER DISCHARGE SITES
MARION, ST. JOSEPH	HIGHEST COMPOUNDING RISKS
$46.5 MILLION	FEMA + HUD POST-DISASTER FUNDING
4TH LOWEST	FEDERAL SPENDING ON CLIMATE DISASTERS IN THE COUNTRY
CLARK	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
67 MILLION	POPULATION TOTAL
$7	PER CAPITA SPENDING ON CLIMATE DISASTERS
$5 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

Sixty-nine counties in Indiana have experienced a recent disaster.

Clark, Vanderburgh, Jefferson, and Warrick counties have had the highest number of disasters in the state: 3 disasters each.



Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

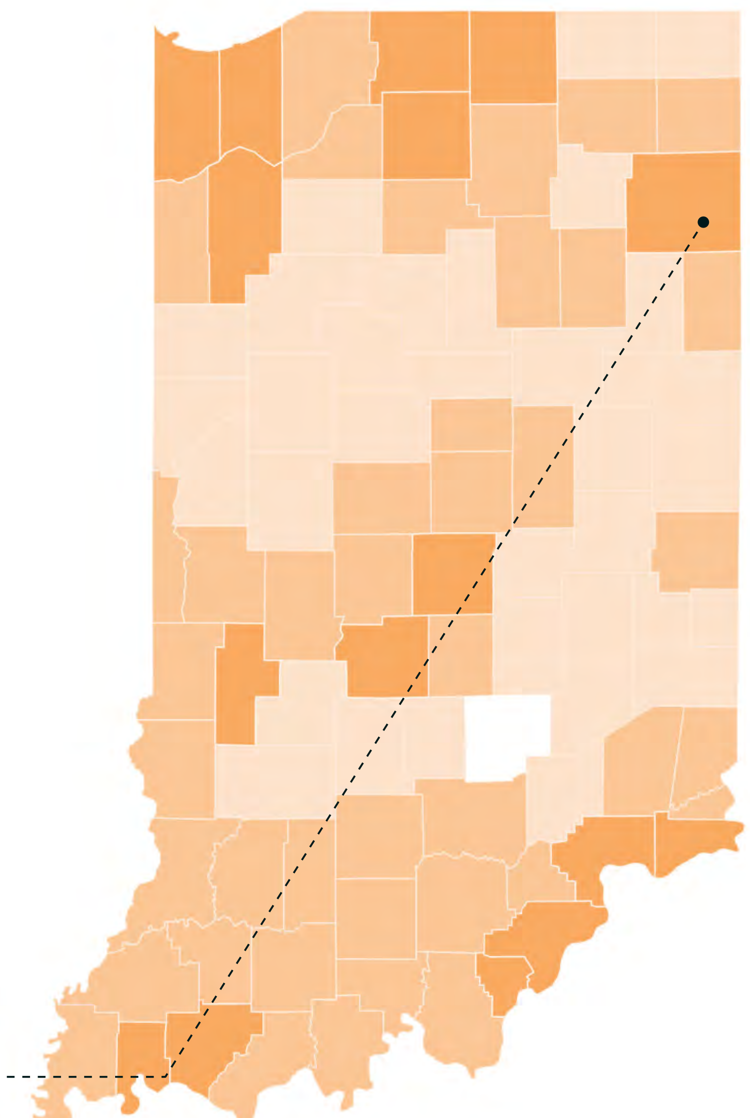
FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$46.5M	FEMA obligations
$0	HUD CDBG-DR Funds
$46.5M	FEMA + HUD assistance
$7	per capita cost

Indiana has the second lowest per capita spending on climate disasters in the country.

Clark County has received the most post-disaster FEMA assistance in the state: $3.5 million.



FEMA Public Assistance and Hazard Mitigation

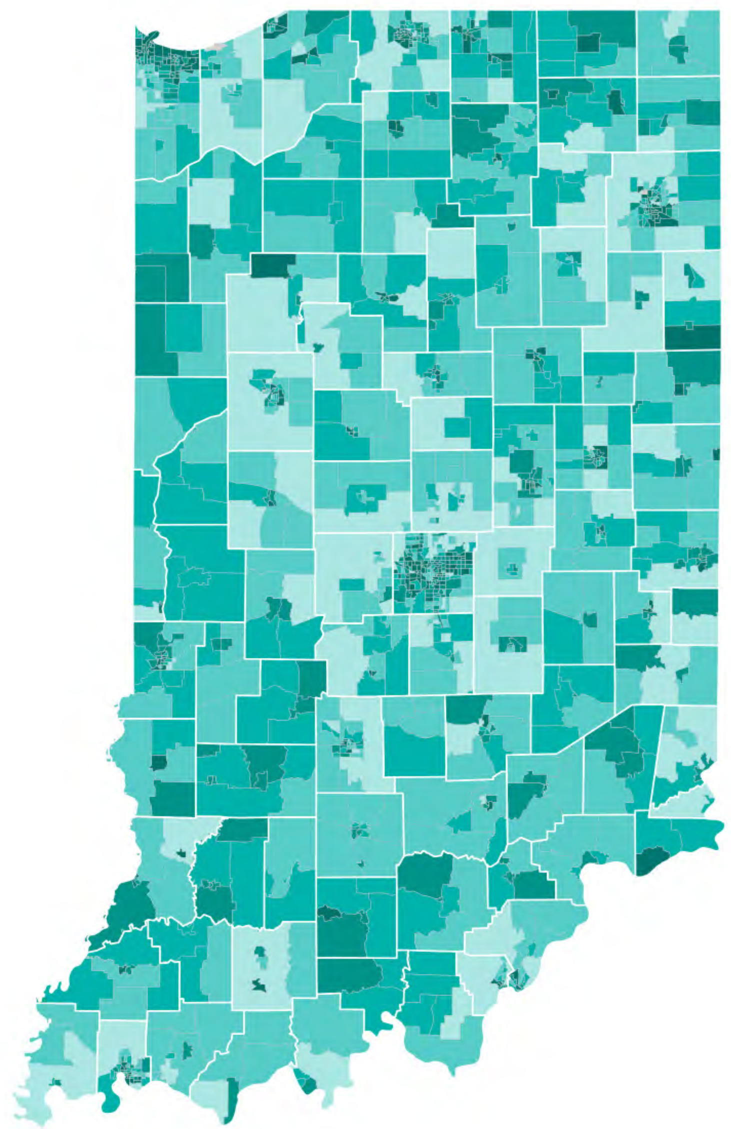
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

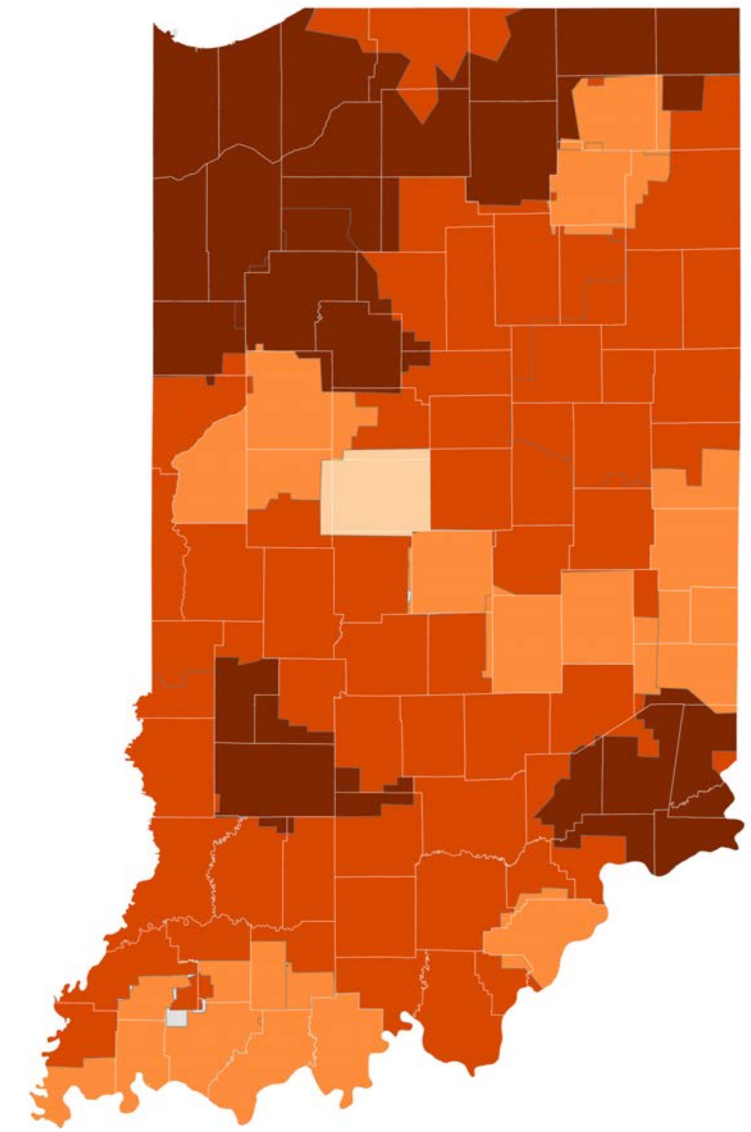
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



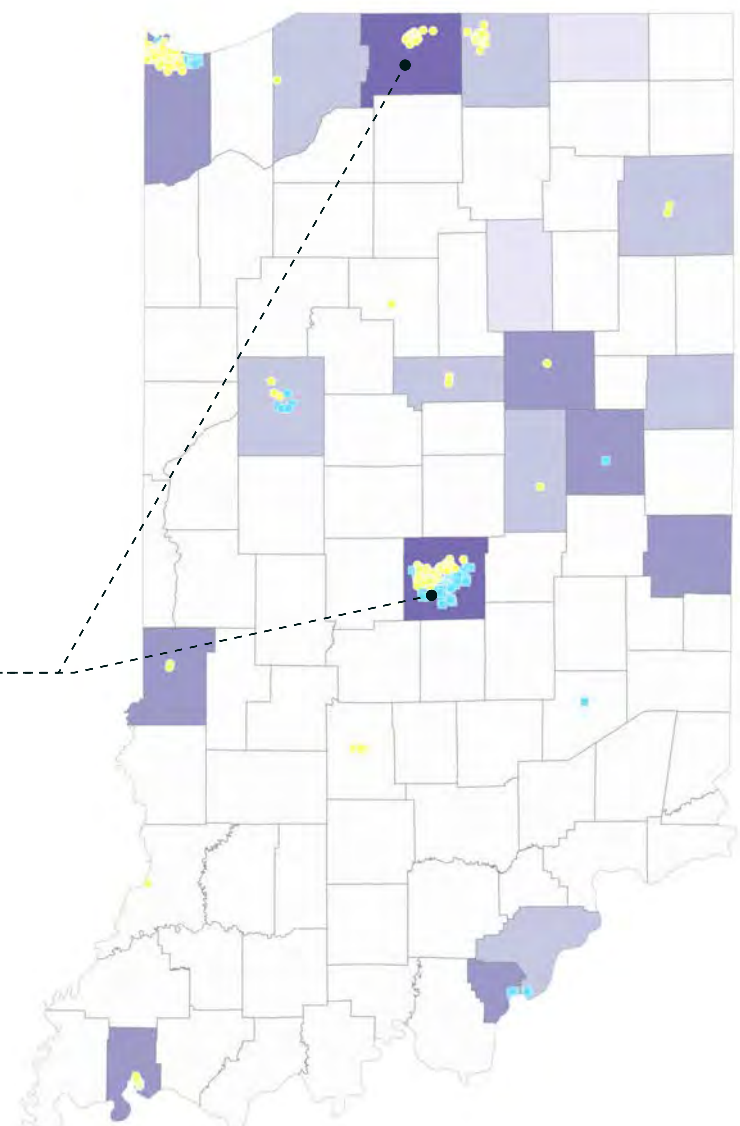
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



St. Joseph and Marion counties have a high risk of climate disasters, high population densities, high poverty, and high health risks.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adams							0
Allen					2		2
Bartholomew							0
Benton							0
Blackford							0
Boone							0
Brown							0
Carroll							0
Cass							0
Clark					1		2
Clay							0
Clinton							0
Crawford							0
Daviess							0
Dearborn							0
Decatur							0
DeKalb							0
Delaware					2		3
Dubois							0
Elkhart					4		2
Fayette							0
Floyd					1		3
Fountain							0
Franklin							0
Fulton							0
Gibson							0
Grant					2		3
Greene							0
Hamilton							0
Hancock							0
Harrison							0
Hendricks							0
Henry							0
Howard					2		2
Huntington							0
Jackson							0
Jasper							0
Jay					1		2
Jefferson							0
Jennings							0
Johnson							0
Knox							0
Kosciusko							0
LaGrange					3		1
Lake					5		3
LaPorte					1		2
Lawrence							0
Madison					1		2
Marion					6		4

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Marshall							0
Martin							0
Miami							0
Monroe							0
Montgomery							0
Morgan							0
Newton							0
Noble							0
Ohio							0
Orange							0
Owen							0
Parke							0
Perry							0
Pike							0
Porter							0
Posey							0
Pulaski							0
Putnam							0
Randolph							0
Ripley							0
Rush							0
Scott							0
Shelby							0
Spencer							0
St. Joseph					2		4
Starke							0
Steuben							0
Sullivan							0
Switzerland							0
Tippecanoe					1		2
Tipton							0
Union							0
Vanderburgh					5		3
Vermillion							0
Vigo					1		3
Wabash					1		1
Warren							0
Warrick							0
Washington							0
Wayne					3		3
Wells							0
White							0
Whitley							0

IMAGE RIGHT: A PARTIALLY COLLAPSED BRICK BUILDING IN DOWNTOWN MOORESVILLE, INDIANA AFTER A TORNADO.| NWS INDIANAPOLIS

INDIANA

TOTAL: 4 DISASTERS FEMA PA + HM: $46 M HUD CDBG-DR: none FEMA + HUD ASSISTANCE: $46 M			2011		2012		2014		2018	
			1997: SEVERE STORMS, STRAIGHT-LINE WINDS, AND TORNADOES		4058: SEVERE STORMS, STRAIGHT-LINE WINDS, AND TORNADOES		4173: SEVERE WINTER STORM AND SNOWSTORM		4363: SEVERE STORMS AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	4	$10,408,271	$2,716,746.79	$194,355.00	$3,131,176.93	$63,155.68	$2,061,259.69	$95,203.18	$1,704,310.60	$442,063.00
Adams County	0	$0								
Allen County	1	$1,075,020					$700,342	$374,677		
Bartholomew County	0	$0								
Benton County	2	$53,606	$15,081	$0					$38,525	$0
Blackford County	1	$34,193					$34,193	$0		
Boone County	1	$184,582					$184,582	$0		
Brown County	0	$0								
Carroll County	1	$0							$0	$0
Cass County	0	$0								
Clark County	3	$3,506,353	$1,159,359	$0	$1,450,416	$0			$654,098	$242,480
Clay County	2	$1,532,236	$442,851	$1,048,920			$40,466	$0		
Clinton County	1	$35,449					$35,449	$0		
Crawford County	2	$101,202	$21,596	$0					$79,607	$0
Daviess County	1	$112,303	$112,303	$0						
Dearborn County	2	$670,500	$327,375	$0					$343,125	$0
Decatur County	0	$0								
DeKalb County	0	$0								
Delaware County	0	$0								
Dubois County	1	$131,352	$131,352	$0						
Elkhart County	1	$1,129,649							$770,411	$359,238
Fayette County	0	$0								
Floyd County	2	$1,157,584	$873,195	$0					$284,389	$0
Fountain County	0	$0								
Franklin County	1	$87,609	$87,609	$0						
Fulton County	2	$338,956					$38,109	$0	$300,847	$0
Gibson County	2	$412,209	$152,956	$0					$259,253	$0
Grant County	0	$0								
Greene County	0	$0								
Hamilton County	1	$864,678					$864,678	$0		
Hancock County	0	$0								
Harrison County	2	$329,986	$296,420	$0					$33,566	$0
Hendricks County	1	$356,186					$356,186	$0		
Henry County	0	$0								
Howard County	0	$0								
Huntington County	1	$94,706					$94,706	$0		
Jackson County	1	$713,128	$713,128	$0						
Jasper County	2	$2,986,278					$55,835	$0	$2,930,443	$0
Jay County	0	$0								
Jefferson County	3	$1,751,366	$572,072	$0	$66,834	$0			$1,112,460	$0
Jennings County	1	$76,844	$76,844	$0						
Johnson County	1	$252,717					$252,717	$0		
Knox County	1	$207,006	$207,006	$0						
Kosciusko County	2	$185,231					$185,231	$0	$0	$0
LaGrange County	1	$66,075					$66,075	$0		
Lake County	2	$765,993					$765,993	$0	$0	$0
LaPorte County	1	$537,515							$537,515	$0
Lawrence County	1	$249,473	$249,473	$0						
Madison County	1	$272,784					$272,784	$0		
Marion County	1	$2,049,517					$2,049,517	$0		
Marshall County	1	$603,430							$343,480	$259,950
Martin County	1	$39,078	$39,078	$0						
Miami County	0	$0								
Monroe County	1	$47,644	$47,644	$0						
Montgomery County	1	$79,033					$79,033	$0		
Morgan County	1	$564,461					$564,461	$0		
Newton County	2	$174,537					$48,466	$0	$126,072	$0
Noble County	1	$106,461					$106,461	$0		
Ohio County	2	$743,403	$342,727	$0					$400,676	$0
Orange County	1	$187,450	$168,730	$18,720						
Owen County	1	$0					$0	$0		
Parke County	2	$111,163	$73,888	$0			$37,274	$0		
Perry County	2	$644,003	$294,193	$0					$349,810	$0
Pike County	1	$116,143	$116,143	$0						
Porter County	1	$1,039,559							$1,039,559	$0
Posey County	1	$218,027	$218,027	$0						
Pulaski County	1	$19,911							$19,911	$0
Putnam County	2	$212,833	$141,365	$0			$71,468	$0		
Randolph County	0	$0								
Ripley County	2	$117,218	$50,730	$0	$66,488	$0				
Rush County	0	$0								
Scott County	2	$206,690	$192,634	$0	$14,057	$0				
Shelby County	0	$0								
Spencer County	2	$158,580	$41,367	$0					$117,213	$0
St. Joseph County	1	$1,220,372							$670,841	$549,532
Starke County	2	$373,945	$35,943	$0					$338,002	$0
Steuben County	0	$0								
Sullivan County	2	$283,709	$224,852	$0			$58,858	$0		
Switzerland County	2	$1,200,205	$746,401	$0					$453,805	$0
Tippecanoe County	0	$0								
Tipton County	1	$300,729					$47,138	$253,591		
Union County	0	$0								
Vanderburgh County	3	$2,318,315	$1,430,300	$226,558			$80,504	$0	$580,952	$0
Vermillion County	2	$271,839	$54,329	$0					$217,511	$0
Vigo County	1	$169,015					$169,015	$0		
Wabash County	2	$174,017					$88,317	$0	$85,701	$0
Warren County	1	$74,346							$74,346	$0
Warrick County	3	$1,099,980	$650,885	$0	$0	$9,138			$439,957	$0
Washington County	2	$258,207	$90,304	$0	$167,903	$0				
Wayne County	1	$455,766	$455,766	$0						
Wells County	0	$0								
White County	2	$74,074					$74,074	$0	$0	$0
Whitley County	1	$88,624					$88,624	$0		
Total FEMA Allocation		$46,483,325	$13,570,672	$1,488,553	$4,896,875	$72,294	$9,571,817	$723,472	$14,306,381	$1,853,262

IOWA

IOWA STATISTICS SUMMARY (2011 – 2021)	
21	CLIMATE DISASTER DECLARATIONS
4TH HIGHEST	NUMBER OF DISASTER DECLARATIONS IN THE NATION
ALL	COUNTIES HAVE HAD DISASTERS IN TEN YEARS
WINNESHIEK	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
19	COUNTIES WITH FIVE OR MORE DISASTERS
23	SUPERFUND SITES
6	WASTEWATER DISCHARGE SITES
C	ASCE INFRASTRUCTURE REPORT CARD GRADE
JOHNSON, LEE, DECATUR, POLK	HIGHEST COMPOUNDING RISKS
$717 MILLION	FEMA + HUD POST-DISASTER FUNDING
POTTAWATTAMIE	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
3.1 MILLION	POPULATION TOTAL
$228	PER CAPITA SPENDING ON CLIMATE DISASTERS
$2.8 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

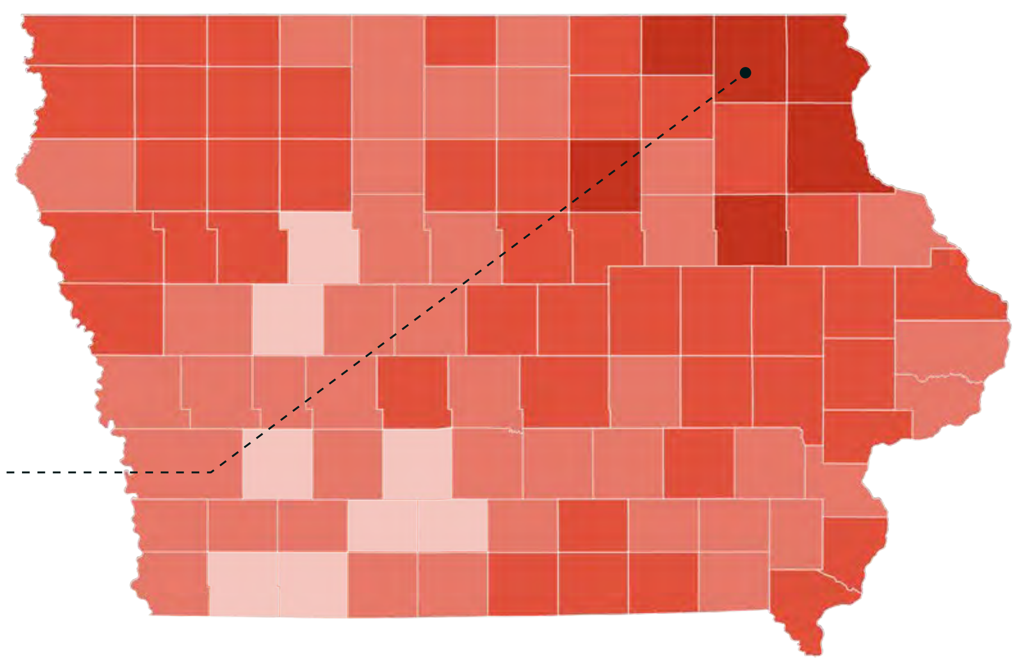
FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

21
disaster declarations

Every county in Iowa has had a climate disaster.

Iowa has the 4th highest number of climate disasters in the nation.

Winneshiek County has had the highest number of recent disasters in the state: 8 disasters.



Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$717M
post-disaster assistance

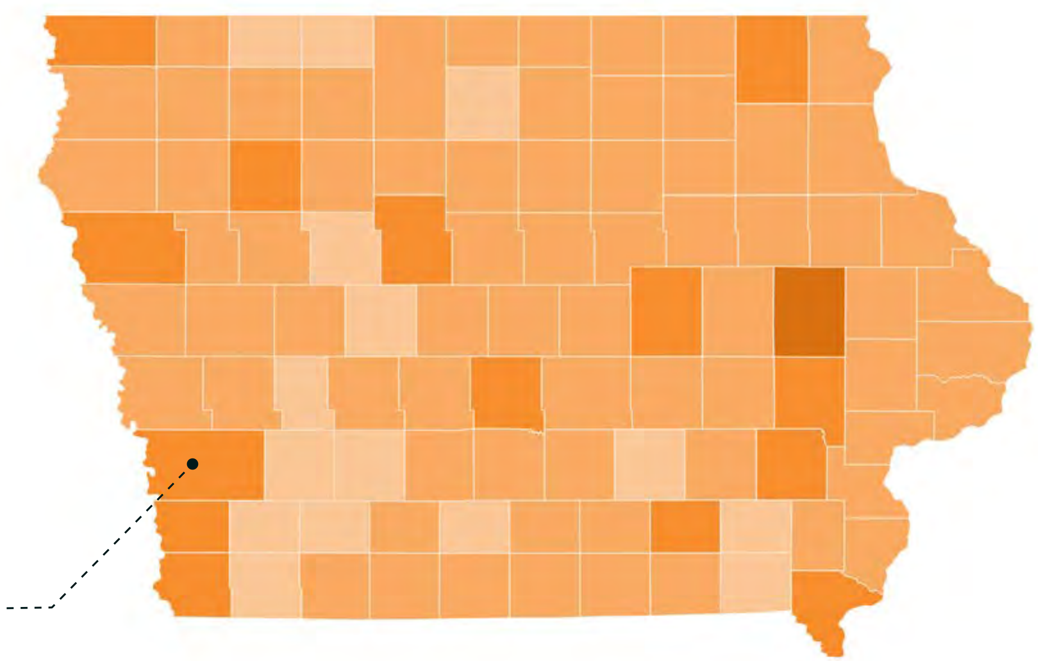
$466M FEMA obligations

$251M HUD CDBG-DR Funds

$717M FEMA + HUD assistance

$228 per capita cost

Pottawattamie County has received the most post-disaster FEMA funds in the state: $42 million.



FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

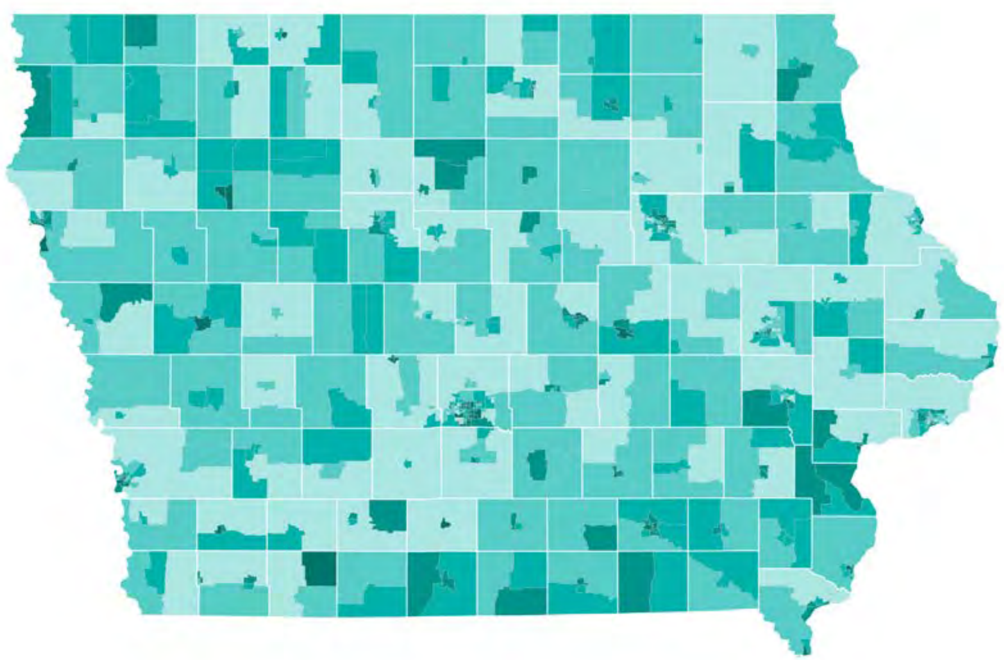
Iowa is still receiving federal funds from the 1977 Storm.

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Ringgold, Lee, Decatur, Johnson, and Wayne counties have high poverty rates, high diversity of hazard risks, and low investments from previous disasters.



Social Vulnerability Index

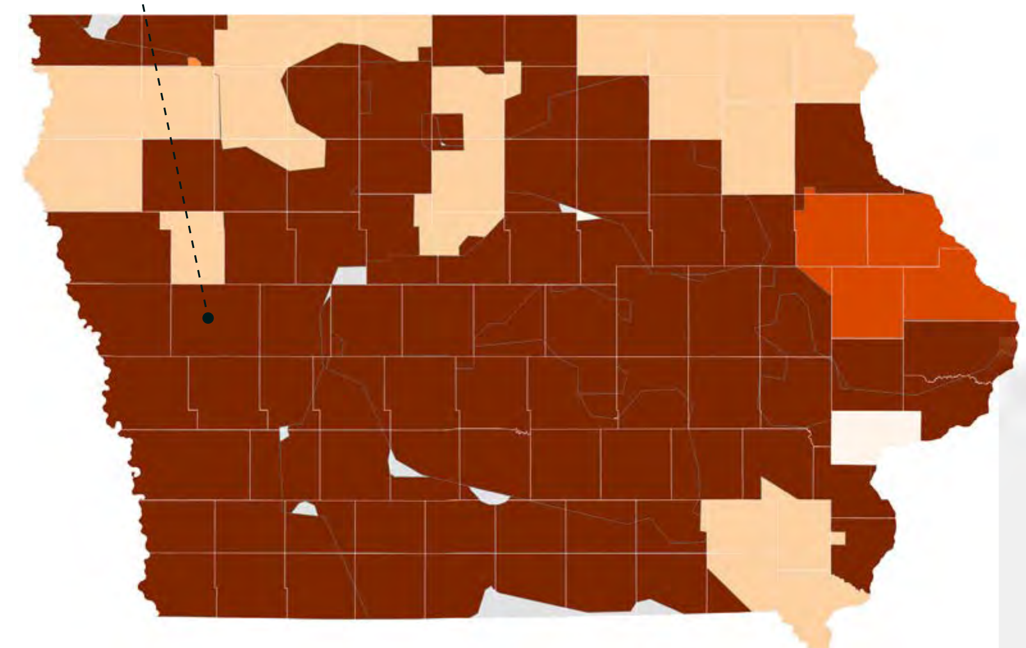
CDC (2018)
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Crawford County has high social vulnerability and low energy reliability.



Aggregated Annual Electric Outage Duration

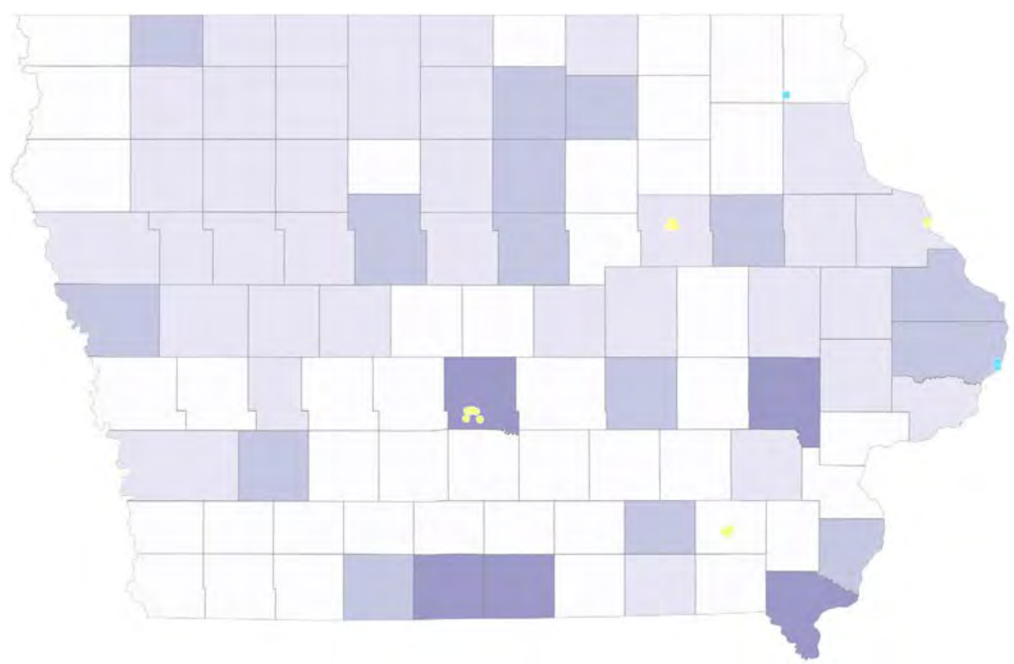
Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Decatur, Johnson, Lee, Polk, and Wayne counties have high risk of climate disasters and other compounding risks.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adair							0
Adams							0
Allamakee							0
Appanoose							0
Audubon					1		1
Benton							0
Black Hawk					2		1
Boone							0
Bremer							0
Buchanan					1		2
Buena Vista					2		1
Butler							0
Calhoun					3		1
Carroll					4		1
Cass					1		2
Cedar					1		1
Cerro Gordo					3		2
Cherokee					1		1
Chickasaw							0
Clarke							0
Clay					1		1
Clayton					1		1
Clinton					2		2
Crawford					4		1
Dallas							0
Davis					1		1
Decatur					1		3
Delaware					1		1
Des Moines					3		2
Dickinson					1		1
Dubuque					1		1
Emmet					1		1
Fayette							0
Floyd					1		2
Franklin					2		2
Fremont							0
Greene					1		1
Grundy							0
Guthrie							0
Hamilton					1		1
Hancock					1		1
Hardin					1		2
Harrison							0
Henry							0
Howard							0
Humboldt							0
Ida					1		1
Iowa							0
Jackson					1		2

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Jasper							0
Jefferson							0
Johnson					2		3
Jones					1		1
Keokuk							0
Kossuth					3		1
Lee					2		3
Linn					1		1
Louisa							0
Lucas							0
Lyon							0
Madison							0
Mahaska							0
Marion							0
Marshall					3		1
Mills							0
Mitchell					1		1
Monona					1		2
Monroe							0
Montgomery							0
Muscatine							0
O'Brien					3		1
Osceola					2		2
Page							0
Palo Alto					2		1
Plymouth							0
Pocahontas					2		1
Polk					2		3
Pottawattamie					3		1
Poweshiek					3		2
Ringgold					2		2
Sac					3		1
Scott					1		1
Shelby							0
Sioux							0
Story							0
Tama					2		1
Taylor							0
Union							0
Van Buren							0
Wapello					2		2
Warren							0
Washington					1		1
Wayne					1		3
Webster					5		2
Winnebago					2		1
Winneshiek							0
Woodbury					3		1
Worth							0
Wright					2		1

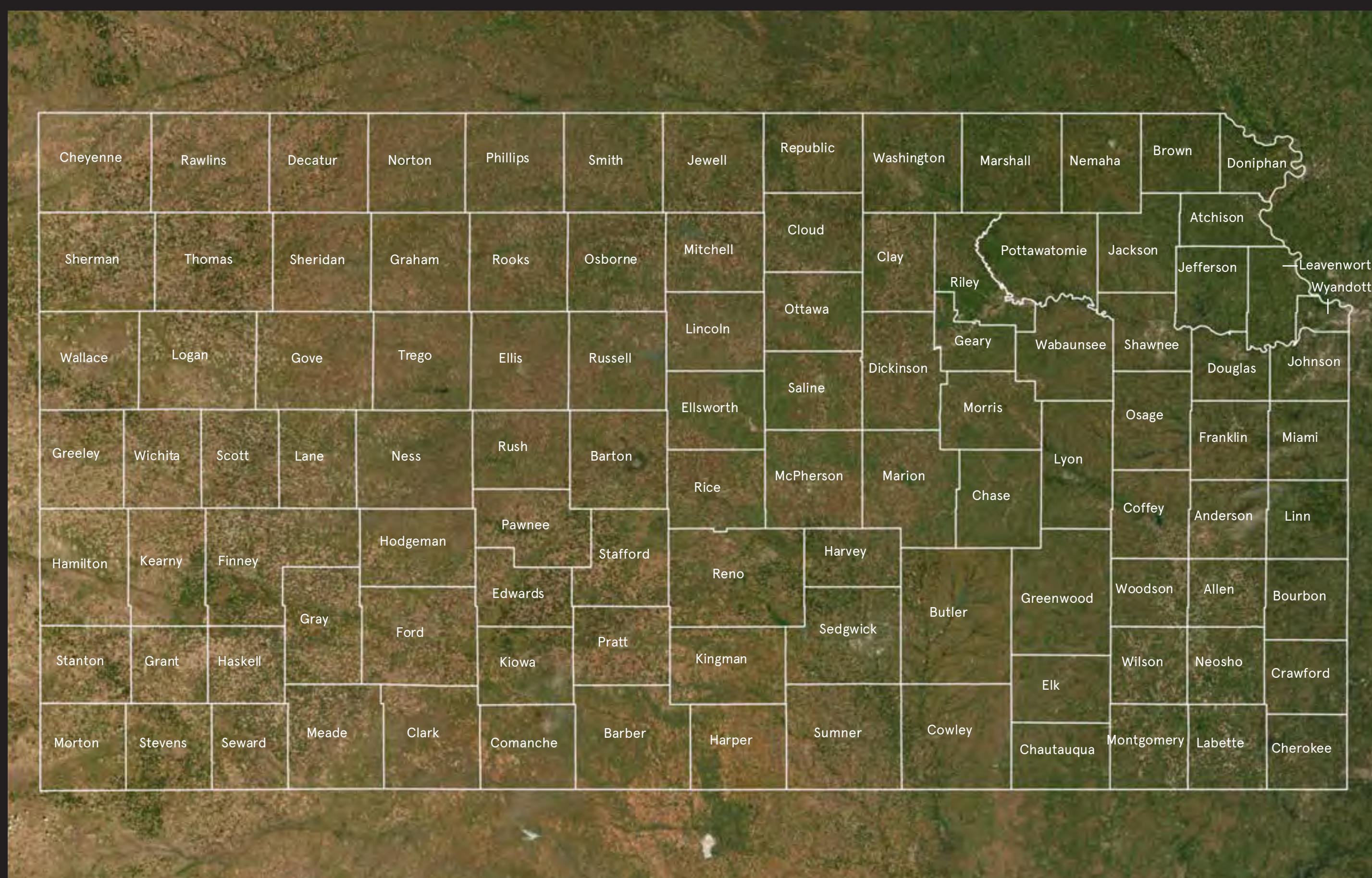
IMAGE RIGHT: FLOODED MISSISSIPPI RIVER AT RIVERSIDE PARK IN MUSCATINE, IOWA. THE FLOODED RIVER IN THIS JUNE 2013 PHOTO HAS CLOSED THE PARK, AND CAUSED BUSINESS US 61 AND IOWA HIGHWAY 92 TO BE DETOURED TO HIGHER GROUND. | ROGER DESCHER

IOWA

TOTAL: 21 DISASTERS
FEMA PA + HM: $466 M
HUD CDBG-DR: $251 M
FEMA + HUD ASSISTANCE: $717 M

			2011								2013								2014						2015		2016				2017		2018				2019				2020			
			1977: SEVERE STORMS, TORNADOES, AND STRAIGHT-LINE WINDS		1998: FLOODING		4016: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4018: SEVERE STORMS AND FLOODING		4114: SEVERE WINTER STORM		4119: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4126: SEVERE STORMS, TORNADOES, AND FLOODING		4135: SEVERE STORMS, TORNADOES, AND FLOODING		4181: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4184: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4187: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4234: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4281: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4289: SEVERE STORMS AND FLOODING		4334: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4386: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4392: SEVERE STORM AND TORNADOES		4421: SEVERE STORMS AND FLOODING		4430: SEVERE STORMS AND FLOODING		4557: SEVERE STORMS		4561: SEVERE STORMS AND STRAIGHT-LINE WINDS	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	21	$98,972,615	$2,089,789	$31,980	$17,411,034	$369,975	$2,570,040	$39,446	$389,541	$145,845	$11,173,937	$1,131,241	$872,110	$328,926	$2,181,703	$461,320	$544,702	$73,890	$2,081,295	$60,497	$3,284,028	$176,084	$1,444,759	$352,180	$1,289,885	$73,009	$258,365	$756,369	$1,454,785	$156,673	$900,587	$115,023	$1,098,703	$400,708	$481,758	$641,494	$32,264,831	$900,730	$556,701	$0	$9,827,362	$405,106	$176,204	$0
Adair County	2	$102,182																															$4,768	$0			$97,413	$0						
Adams County	2	$492,461																	$137,718	$0																	$354,743	$0						
Allamakee County	7	$3,170,105															$1,008,937	$0			$248,202	$0			$127,708	$0	$1,011,953	$0	$423,177	$0	$44,477	$0					$305,651	$0						
Appanoose County	4	$574,219											$165,047	$0	$65,979	$0									$343,193	$0											$0	$0						
Audubon County	3	$837,309															$267,629	$0					$319,737	$0													$249,943	$0						
Benton County	5	$3,685,428					$2,103,913	$60,030							$255,106	$0	$26,976	$30,112											$242,121	$7,064											$960,106	$0		
Black Hawk County	2	$3,411,570																					$477,929	$0					$1,688,873	$1,244,768														
Boone County	2	$1,535,953																																			$311,543	$0			$1,224,410	$0		
Bremer County	3	$2,856,127																											$277,929	$0	$1,415,330	$610,419					$534,862	$17,588						
Buchanan County	7	$1,839,799													$255,330	$0	$170,174	$0			$52,214	$45,203							$117,759	$0	$127,055	$0	$243,933	$0			$828,131	$0						
Buena Vista County	5	$8,624,141	$7,419	$0											$1,061,048	$0					$432,381	$0											$216,053	$0			$6,874,238	$33,001						
Butler County	7	$3,451,630													$171,905	$27,486	$284,821	$0			$165,304	$0	$150,442	$0	$5,233	$0			$1,223,621	$1,002,008							$420,811	$0						
Calhoun County	1	$0																																			$0	$0						
Carroll County	1	$217,511																																			$217,511	$0						
Cass County	1	$204,442																																			$204,442	$0						
Cedar County	4	$1,400,449											$149,618	$0			$397,417	$0					$438,385	$0																	$383,941	$31,089		
Cerro Gordo County	2	$815,483																											$296,495	$0			$518,988	$0										
Cherokee County	5	$8,682,212	$0	$0											$2,915,715	$1,363,407					$615,742	$0											$209,503	$0			$3,534,852	$42,993						
Chickasaw County	6	$2,442,962													$81,891	$0					$89,150	$0					$218,868	$0	$1,523,122	$0	$423,071	$0	$106,861	$0										
Clarke County	1	$82,002																	$82,002	$0																								
Clay County	5	$2,273,967					$77,882	$0							$62,654	$0					$976,849	$0											$535,543	$0			$621,038	$0						
Clayton County	7	$2,308,004													$163,687	$0	$269,806	$0							$0	$0	$149,640	$0	$35,491	$0	$1,181,496	$15,272					$492,612	$0						
Clinton County	3	$3,363,220											$154,338	$0																							$1,724,028	$954,443			$530,412	$0		
Crawford County	3	$1,847,977													$318,984	$0							$548,473	$0													$980,521	$0						
Dallas County	4	$2,096,297																							$695,806	$0							$317,716	$0			$334,847	$0			$708,367	$39,561		
Davis County	4	$1,595,462											$185,786	$0	$43,253	$0									$1,132,688	$0											$233,736	$0						
Decatur County	3	$685,027											$237,737	$0					$437,945	$0																	$9,346	$0						
Delaware County	4	$564,217													$108,569	$0	$192,832	$0											$174,553	$0			$88,264	$0										
Des Moines County	6	$5,072,229											$412,553	$21,000	$624,235	$0							$702,227	$0	$318,217	$14,159			$148,087	$0							$2,831,750	$0						
Dickinson County	5	$815,728					$196,762	$0			$60,126	$0									$187,306	$0											$141,816	$0			$229,719	$0						
Dubuque County	2	$3,750,108							$3,434,077	$0																					$316,031	$0												
Emmet County	3	$440,076																			$140,634	$0											$46,806	$0			$230,586	$22,050						
Fayette County	6	$2,882,310													$228,750	$0					$592,512	$24,859					$188,145	$0	$136,343	$0	$1,319,445	$0					$392,257	$0						
Floyd County	5	$1,865,570													$537,137	$0											$50,634	$0	$734,420	$0			$504,740	$0			$38,640	$0						
Franklin County	4	$1,177,725													$132,908	$0					$91,716	$0							$53,076	$0							$900,025	$0						
Fremont County	2	$29,679,729			$5,754,100	$0																															$18,725,954	$5,199,675						
Greene County	3	$800,167													$232,395	$0																					$530,263	$0			$37,508	$0		
Grundy County	4	$1,809,501													$472,514	$0	$509,215	$0					$612,377	$0																	$215,395	$0		
Guthrie County	3	$1,254,631																							$233,342	$0											$871,685	$51,604			$98,000	$0		
Hamilton County	3	$2,018,262																					$218,981	$0									$251,716	$0			$1,547,565	$0						
Hancock County	3	$610,528																			$192,260	$0											$125,381	$0			$292,888	$0						
Hardin County	4	$2,795,453													$122,179	$0							$183,039	$0													$2,092,158	$0			$398,077	$0		
Harrison County	2	$8,626,697			$786,847	$0																															$7,839,850	$0						
Henry County	2	$1,190,128													$274,889	$0																					$915,239	$0						
Howard County	7	$1,302,015													$34,462	$0	$42,000	$0							$136,233	$0	$833,472	$0	$85,128	$0			$71,544	$0			$99,175	$0						
Humboldt County	3	$2,728,556																			$143,705	$0											$175,308	$0			$2,409,544	$0						
Ida County	5	$1,194,538	$0	$0											$141,304	$0					$80,847	$0	$0	$0													$972,386	$0						
Iowa County	5	$1,274,687											$64,295	$0	$304,840	$0							$245,382	$0													$427,622	$0			$93,087	$139,460		
Jackson County	4	$975,813							$309,091	$0													$239,147	$0													$288,621	$0			$138,954	$0		
Jasper County	4	$2,153,391													$332,980	$0							$223,197	$0													$675,822	$0			$921,392	$0		
Jefferson County	2	$149,215											$149,215	$0											$0	$0																		
Johnson County	4	$7,305,194											$720,554	$0	$2,852,775	$0							$1,692,084	$1,041,907																	$720,063	$277,812		
Jones County	5	$2,294,116													$43,690	$0	$199,677	$0					$1,235,925	$0													$0	$0			$790,990	$23,834		
Keokuk County	4	$775,791											$176,704	$0	$36,791	$0							$154,273	$0													$408,022	$0						
Kossuth County	3	$2,924,144																			$125,529	$0											$524,042	$0			$2,274,573	$0						
Lee County	6	$4,567,974											$1,066,746	$0	$123,658	$0							$338,418	$0	$139,254	$0									$88,259	$0	$2,811,640	$0						
Linn County	4	$28,418,216													$605,363	$0							$4,023,123	$0					$7,797,371	$0											$15,959,392	$32,966		
Louisa County	2	$1,174,187													$389,053	$0																					$785,134	$0						
Lucas County	3	$600,251											$192,890	$0											$124,046	$0											$283,314	$0						
Lyon County	5	$7,934,268									$490,859	$0			$201,105	$0					$4,569,157	$1,223,303											$573,245	$0			$876,600	$0						
Madison County	1	$170,381																																			$170,381	$0						
Mahaska County	3	$401,734													$136,907	$0							$145,311	$0													$119,516	$0						
Marion County	3	$316,353											$67,405	$0											$248,949	$0									$0	$0								
Marshall County	5	$4,164,485					$316,426	$0							$430,584	$0																			$2,470,475	$0	$39,976	$0			$907,024	$0		
Mills County	3	$39,329,566			$1,230,045	$0													$101,585	$0																	$17,168,149	$20,829,787						
Mitchell County	6	$2,306,632													$1,569,415	$0									$328,483	$0	$201,515	$0	$77,234	$0	$0	$0					$129,985	$0						
Monona County	4	$4,976,797	$531,289	$0	$1,168,476	$0									$409,668	$0																					$2,867,364	$0						
Monroe County	4	$1,184,024											$95,710	$0	$61,880	$0									$842,432	$0											$184,003	$0						
Montgomery County	2	$454,401																	$372,856	$0																	$81,545	$0						
Muscatine County	4	$2,216,157											$707,629	$0									$293,271	$0													$708,311	$406,169			$100,777	$0		
O'Brien County	4	$1,984,787									$257,209	$0			$111,598	$0																	$1,354,075	$0			$261,905	$0						
Osceola County	4	$1,218,765									$291,562	$0									$131,392	$0											$540,172	$0			$255,639	$0						
Page County	1	$362,719																																			$362,719	$0						
Palo Alto County	4	$2,698,686													$68,585	$0					$361,329	$0											$1,087,382	$0			$1,181,390	$0						
Plymouth County	3	$1,870,161													$625,722	$0					$137,116	$0															$1,107,323	$0						
Pocahontas County	4	$599,444	$14,778	$0																	$154,135	$0											$187,647	$0			$242,883	$0						
Polk County	3	$12,263,293																															$3,893,661	$1,335,456			$1,221,422	$64,168			$5,748,587	$0		
Pottawattamie County	3	$41,601,524			$16,659,317	$2,907,087													$1,709,903	$0																	$18,355,399	$1,969,818						
Poweshiek County	3	$2,171,873													$313,232	$0							$172,843	$0																	$1,375,255	$310,542		
Ringgold County	3	$1,324,097											$524,556	$0					$465,559	$0																	$333,981	$0						
Sac County	4	$342,348	$58,839	$0											$0	$0					$119,861	$0															$163,648	$0						
Scott County	2	$4,123,074																																			$3,520,461	$0			$602,613	$0		
Shelby County	2	$598,219																					$215,791	$0													$382,428	$0						
Sioux County	5	$4,383,672									$206,372	$0			$239,276	$0					$2,093,139	$197,757											$852,765	$13,272			$781,091	$0						
Story County	4	$2,881,949					$67,549	$0							$343,862	$0																	$418,393	$0							$2,030,958	$21,188		
Tama County	5	$2,888,450					$411,019	$0							$388,268	$0							$189,685	$0													$388,963	$0	$52,562	$0	$1,457,953	$0		
Taylor County	1	$107,283																	$107,283	$0																								
Union County	1	$1,306,610																																			$1,291,070	$15,540						
Van Buren County	2	$151,852											$98,346	$0																					$53,505	$0								
Wapello County	3	$1,962,925											$1,032,922	$0	$16,916	$0																					$913,087	$0						
Warren County	3	$785,411											$66,736	$0											$456,703	$0							$261,972	$0										
Washington County	2	$115,043																					$74,141	$0																	$40,902	$0		
Wayne County	4	$1,158,038											$453,562	$0					$36,021	$0					$254,776	$0											$413,679	$0						
Webster County	3	$7,394,724													$64,540	$0																	$841,987	$0			$6,488,196	$0						
Winnebago County	4	$346,725													$70,645	$0					$135,894	$0											$140,186	$0			$0	$0						
Winneshiek County	8	$5,803,276															$637,645	$0			$357,613	$0			$372,387	$0	$2,485,827	$271,341	$163,903	$882,168	$40,177	$29,154	$263,416	$0			$299,646	$0						
Woodbury County	4	$20,065,774			$3,263,450	$0															$2,182,872	$0											$311,070	$0			$14,308,382	$0						
Worth County	2	$166,615													$166,615	$0																					$0	$0						
Wright County	6	$930,595													$129,553	$0					$145,298	$0			$29,205	$0			$129,714	$0			$208,761	$0			$288,064	$0						
Total FEMA Allocation		$465,822,432	$2,702,114	$31,980	$46,273,269	$3,277,062	$5,743,592	$99,476	$4,132,709	$145,845	$12,480,066	$1,131,241	$7,594,458	$349,926	$20,524,116	$1,852,213	$4,551,831	$104,002	$5,532,168	$60,497	$17,806,184	$1,667,206	$14,338,941	$1,394,087	$7,078,538	$87,168	$5,398,419	$1,027,710	$16,783,201	$3,292,682	$5,767,668	$769,867	$16,116,418	$1,749,436	$3,093,996	$641,494	$174,376,741	$30,507,564	$609,263	$0	$45,271,525	$1,281,558	$176,204	$0

KANSAS



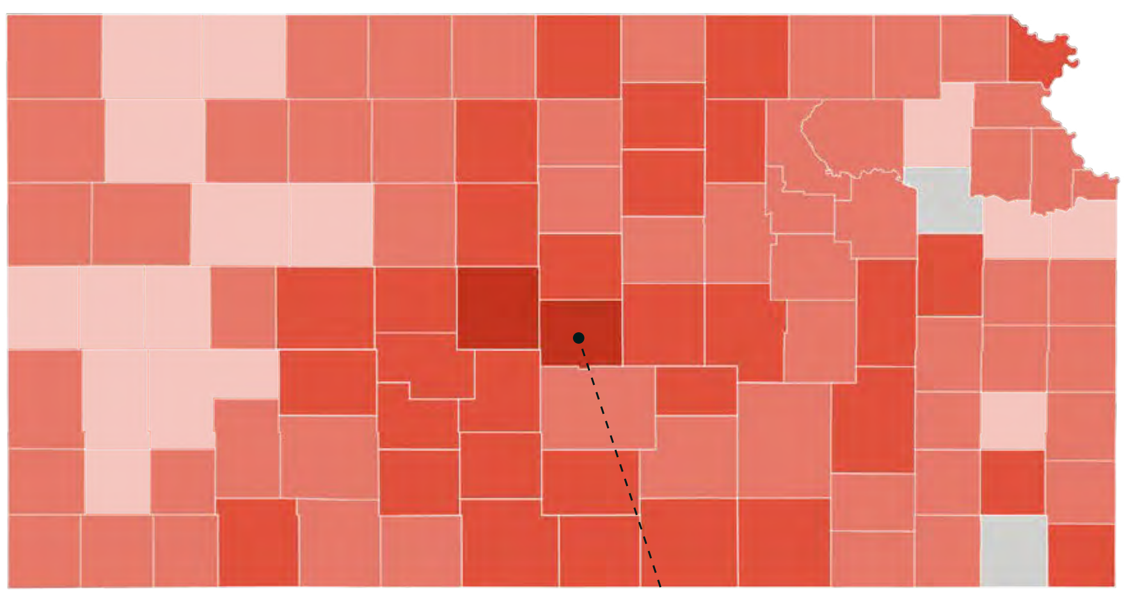
KANSAS STATISTICS SUMMARY (2011 – 2021)	
13	CLIMATE DISASTER DECLARATIONS
RICE	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
19	COUNTIES WITH FIVE OR MORE DISASTERS
6	SUPERFUND SITES
63	WASTEWATER DISCHARGE SITES
C	ASCE INFRASTRUCTURE REPORT CARD GRADE
WYANDOTTE	HIGHEST COMPOUNDING RISKS
$175 MILLION	FEMA + HUD POST-DISASTER FUNDING
WYANDOTTE	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
2.9 MILLION	POPULATION TOTAL
$60	PER CAPITA SPENDING ON CLIMATE DISASTERS
$3 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

13
disaster declarations

All but two counties in Kansas have had a disaster declaration in recent years.



Rice County has had the highest number of recent disasters in the state: 8 disasters.

Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

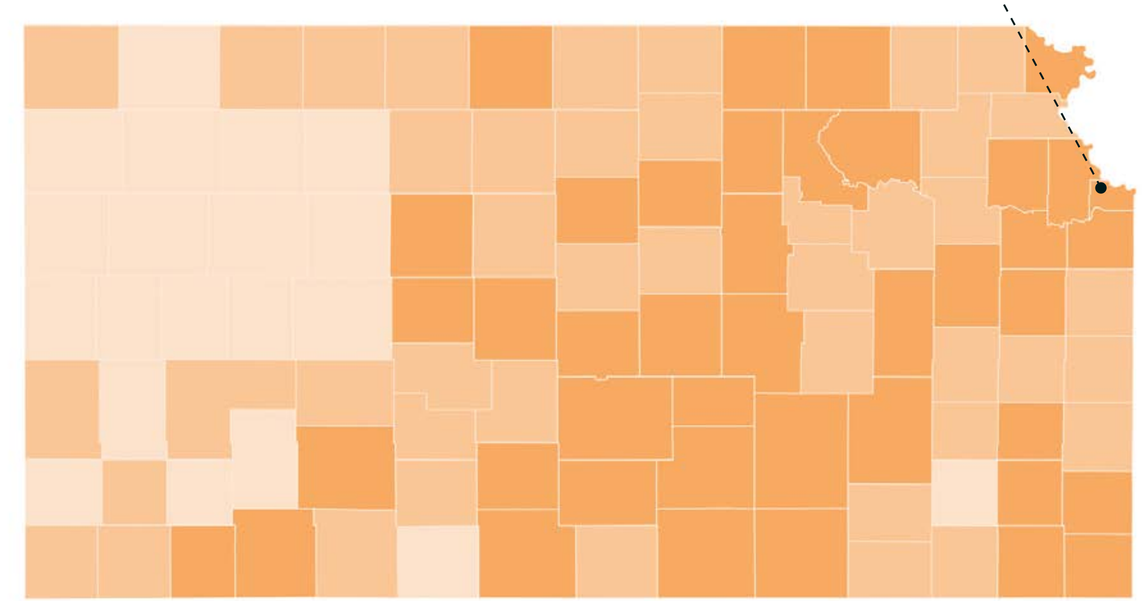
Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$175M
post-disaster assistance

Wyandotte County has received the most post-disaster FEMA funds in the state: $4.9 million.



FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

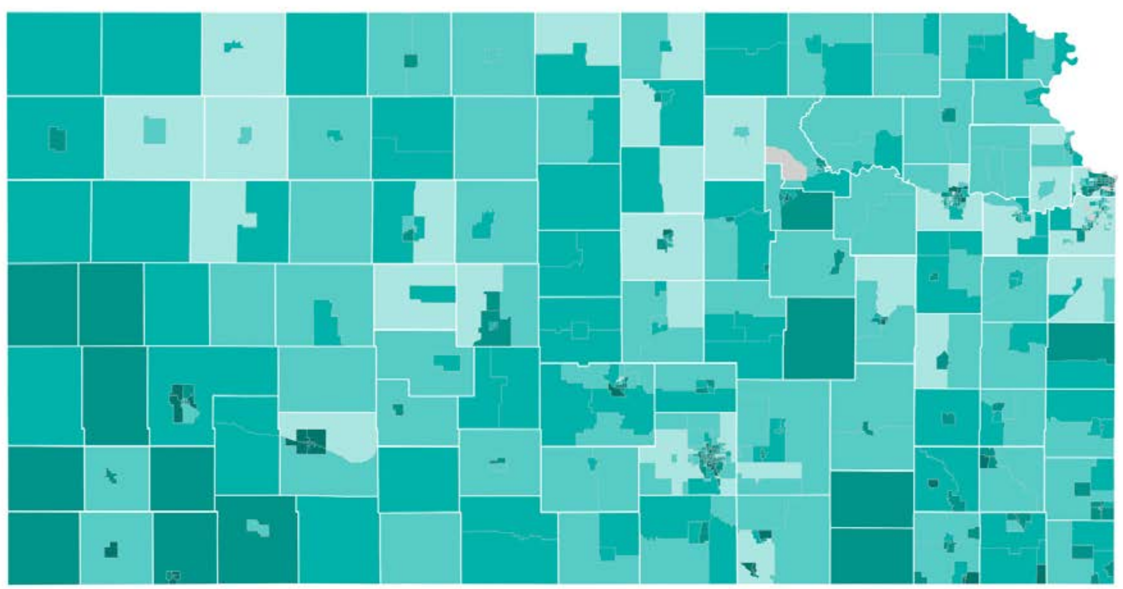
Source: FEMA 2021
Maps courtesy of iParametrics

$175M	FEMA obligations
$0	HUD CDBG-DR Funds
$175M	FEMA + HUD assistance
$60	per capita cost

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Wyandotte, Cherokee, Neosho, Labette, Montgomery, and Crawford counties have high poverty, high diversity of hazard risks, and low investments from previous disasters.



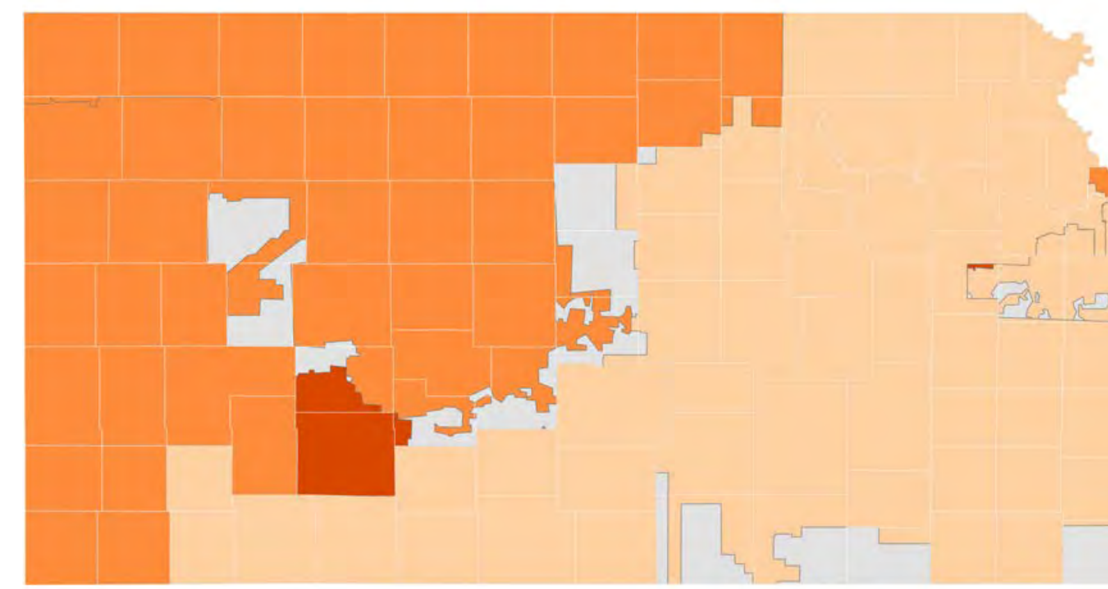
Social Vulnerability Index

CDC (2018)
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration

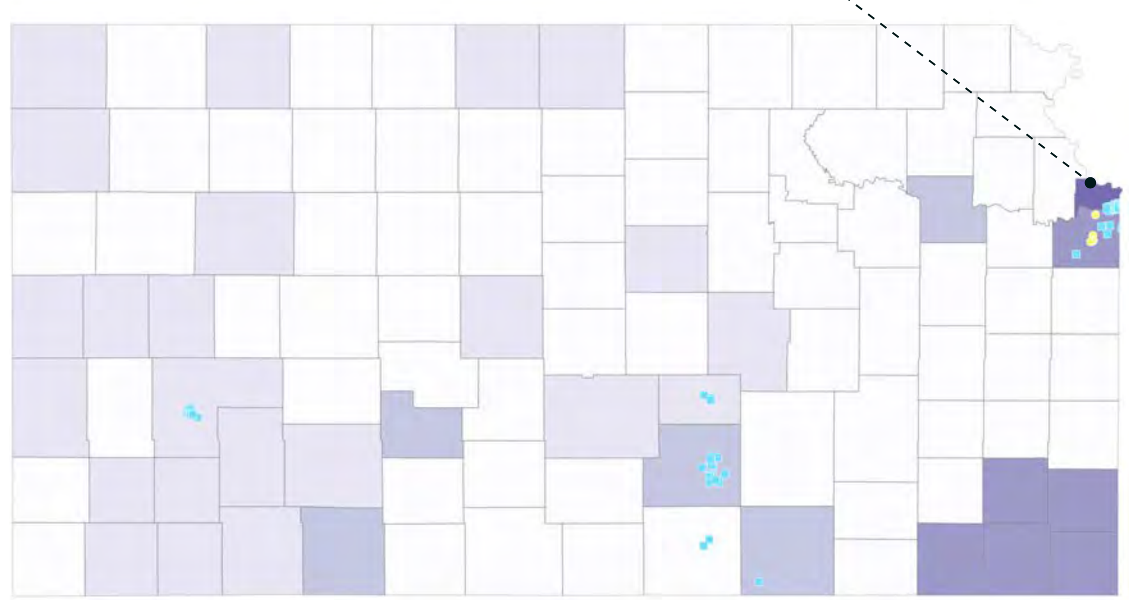
Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Wyandotte County has high risk of climate disasters, high population density, high poverty, and high health risks.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Allen							0
Anderson							0
Atchison							0
Barber							0
Barton					5		1
Bourbon							0
Brown							0
Butler							0
Chase							0
Chautauqua							0
Cherokee					2		3
Cheyenne					1		1
Clark					1		2
Clay							0
Cloud							0
Coffey							0
Comanche							0
Cowley					2		2
Crawford					3		3
Decatur					3		1
Dickinson							0
Doniphan							0
Douglas							0
Edwards					1		2
Elk							0
Ellis							0
Ellsworth							0
Finney					3		1
Ford					1		1
Franklin							0
Geary							0
Gove					1		1
Graham							0
Grant					2		1
Gray					1		1
Greeley					2		1
Greenwood							0
Hamilton					2		1
Harper							0
Harvey					2		1
Haskell					2		1
Hodgeman							0
Jackson							0
Jefferson							0
Jewell					1		1
Johnson					2		3
Kearny							0
Kingman							0
Kiowa							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Labette					1		3
Lane							0
Leavenworth							0
Lincoln							0
Linn							0
Logan							0
Lyon							0
Marion					1		1
Marshall							0
McPherson							0
Meade					1		1
Miami							0
Mitchell							0
Montgomery					5		3
Morris							0
Morton							0
Nemaha							0
Neosho					1		3
Ness							0
Norton							0
Osage							0
Osborne							0
Ottawa							0
Pawnee							0
Phillips							0
Pottawatomie							0
Pratt							0
Rawlins							0
Reno					4		1
Republic							0
Rice							0
Riley							0
Rooks							0
Rush							0
Russell							0
Saline					4		1
Scott					2		1
Sedgwick					4		2
Seward					2		1
Shawnee					2		2
Sheridan							0
Sherman					1		1
Smith					1		1
Stafford							0
Stanton							0
Stevens					1		1
Sumner							0
Thomas							0
Trego							0
Wabaunsee							0
Wallace							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Washington							0
Wichita					2		1
Wilson							0
Woodson							0
Wyandotte					6		4

KANSAS

TOTAL: 13 DISASTERS
FEMA PA + HM: $175 M
HUD CDBG-DR: none
FEMA + HUD ASSISTANCE: $175 M

			2011				2012		2013				2015		2016		2017						2018		2019			
			4010: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING		4035: FLOODING		4063: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4112: SNOWSTORM		4150: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING		4230: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4287: SEVERE STORMS AND FLOODING		4304: SEVERE WINTER STORM		4319: SEVERE WINTER STORM, SNOWSTORM, STRAIGHT-LINE WINDS, AND FLOODING		4347: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4403: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4417: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4449: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, FLOODING, LANDSLIDES, AND MUDSLIDES	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	13	$84,490,172	$1,962,583.16	$30,883.00	$720,836.29	$23,894.00	$2,864,040.92	$33,862.00	$302,718.94	$9,254.00	$1,935,373.48	$70,737.00	$1,356,101.52	$75,877.48	$1,732,277.81	$61,295.18	$5,055,429.48	$60,781.40	$62,335,464.45	$496,001.00	$411,327.97	$70,250.00	$728,952.89	$62,000.00	$408,879.65	$168,000.11	$3,454,476.72	$58,873.47
Allen County	1	$26,455																									$26,454.87	$0.00
Anderson County	2	$732,155																							$196,761.50	$0.00	$535,393.63	$0.00
Atchison County	3	$919,290			$453,753.20	$0.00							$353,293.63	$0.00													$112,243.56	$0.00
Barber County	5	$1,478,890							$26,703.93	$0.00	$0.00	$0.00											$157,781.85	$0.00	$87,795.55	$0.00	$412,370.85	$794,238.00
Barton County	7	$1,754,579	$0.00	$0.00					$86,854.18	$0.00	$265,313.89	$0.00	$82,042.14	$0.00			$244,632.64	$0.00							$182,607.66	$0.00	$893,128.09	$0.00
Bourbon County	2	$568,023									$191,762.80	$20,192.00															$356,067.81	$0.00
Brown County	2	$318,761											$176,287.71	$0.00													$142,472.88	$0.00
Butler County	3	$3,340,468									$686,480.00	$0.00	$471,173.45	$0.00													$2,182,814.66	$0.00
Chase County	3	$338,650									$50,708.24	$0.00	$105,021.81	$0.00													$182,920.34	$0.00
Chautauqua County	2	$224,966											$80,747.52	$0.00													$144,218.85	$0.00
Cherokee County	4	$1,636,426									$50,809.89	$341,130.00	$0.00	$748,774.20					$185,663.04	$99,174.15							$210,874.41	$0.00
Cheyenne County	3	$186,128											$46,416.89	$77,992.50	$43,509.67	$0.00			$18,208.64	$0.00								
Clark County	3	$65,807									$0.00	$0.00					$65,807.11	$0.00									$0.00	$0.00
Clay County	5	$1,462,283	$537,181.67	$0.00							$147,695.36	$464,031.00	$211,272.63	$0.00									$48,086.94	$0.00			$54,015.06	$0.00
Cloud County	4	$375,912	$153,537.04	$0.00							$219,338.08	$0.00	$0.00	$0.00													$3,037.09	$0.00
Coffey County	3	$210,106									$23,646.30	$0.00	$165,597.93	$0.00													$20,862.00	$0.00
Comanche County	3	$74,608									$9,823.16	$0.00					$55,709.22	$0.00									$9,075.27	$0.00
Cowley County	5	$3,865,263					$7,821.38	$0.00			$416,444.39	$0.00	$630,722.49	$0.00	$245,840.71	$0.00									$157,273.41	$0.00	$1,877,363.99	$529,797.00
Crawford County	3	$2,151,934									$126,505.56	$33,370.00							$23,602.19	$1,962,142.96							$6,313.51	$0.00
Decatur County	1	$122,245																	$122,245.12	$0.00								
Dickinson County	3	$1,256,806							$41,772.36	$0.00	$478,344.97	$0.00															$339,206.42	$397,482.00
Doniphan County	4	$1,245,731			$531,772.45	$0.00							$256,950.04	$0.00											$122,241.93	$0.00	$334,766.66	$0.00
Douglas County	1	$703,984																									$593,670.30	$110,313.24
Edwards County	5	$591,020					$12,279.65	$0.00			$146,867.34	$0.00	$136,847.80	$0.00			$255,236.74	$0.00									$39,788.90	$0.00
Elk County	3	$397,135									$365,434.32	$0.00	$17,302.87	$0.00													$14,397.90	$0.00
Ellis County	2	$505,942							$106,940.19	$0.00					$399,001.95	$0.00												
Ellsworth County	5	$344,762					$0.00	$0.00			$89,191.87	$53,250.00	$45,502.50	$0.00			$11,122.69	$0.00									$145,695.09	$0.00
Finney County	1	$593,228																	$593,227.68	$0.00								
Ford County	3	$681,197									$86,960.44	$0.00					$594,236.68	$0.00									$0.00	$0.00
Franklin County	3	$1,052,105							$85,477.11	$0.00			$390,406.93	$0.00													$576,220.81	$0.00
Geary County	2	$363,067									$236,729.13	$0.00															$126,338.12	$0.00
Gove County	1	$16,446																	$16,445.94	$0.00								
Graham County	2	$99,495													$99,495.45	$0.00			$0.00	$0.00								
Grant County	1	$167,441																	$167,440.60	$0.00								
Gray County	2	$17,380											$17,380.33	$0.00													$0.00	$0.00
Greeley County	1	$32,782																	$32,782.16	$0.00								
Greenwood County	5	$2,683,106									$257,452.21	$0.00	$503,026.79	$0.00	$461,525.96	$0.00									$386,489.17	$0.00	$1,074,611.45	$0.00
Hamilton County	3	$115,550	$0.00	$0.00							$46,698.08	$0.00							$68,852.14	$0.00								
Harper County	5	$758,725					$66,452.11	$0.00	$18,722.36	$0.00	$14,778.09	$0.00	$386,503.47	$0.00													$272,269.27	$0.00
Harvey County	5	$2,312,273							$76,800.17	$0.00	$630,836.96	$0.00	$230,710.71	$0.00											$111,648.82	$0.00	$1,151,807.94	$110,468.54
Haskell County	2	$20,177											$375.00	$0.00					$19,802.44	$0.00								
Hodgeman County	6	$215,063					$9,348.98	$0.00	$27,816.20	$0.00	$8,696.93	$0.00	$75,984.95	$0.00			$46,813.63	$0.00									$0.00	$46,402.00
Jackson County	1	$624,362											$624,361.64	$0.00														
Jefferson County	2	$2,382,035											$548,519.33	$63,081.00													$626,354.60	$1,144,080.00
Jewell County	4	$209,556	$38,963.49	$7,238.00			$34,443.93	$0.00					$125,323.34	$0.00			$3,587.54	$0.00										
Johnson County	1	$3,558,411			$20,002.83	$0.00															$3,538,408.12	$0.00						
Kearny County	1	$69,592																	$69,591.84	$0.00								
Kingman County	6	$1,783,785							$49,678.53	$0.00	$88,184.33	$0.00			$413,292.03	$0.00							$202,482.40	$0.00	$697,030.56	$0.00	$333,117.49	$0.00
Kiowa County	4	$231,618					$0.00	$0.00			$41,104.06	$0.00					$152,095.77	$0.00					$38,417.92	$0.00				
Labette County	0	$0																										
Lane County	2	$45,756									$21,300.13	$0.00							$24,455.88	$0.00								
Leavenworth County	2	$644,541			$507,100.39	$0.00																					$137,440.97	$0.00
Lincoln County	2	$561,403	$561,402.65	$0.00																							$0.00	$0.00
Linn County	2	$606,371									$42,927.25	$0.00															$563,444.21	$0.00
Logan County	2	$48,560	$0.00	$0.00															$48,559.51	$0.00								
Lyon County	4	$2,330,573	$880,970.06	$181,831.00							$124,823.24	$0.00	$66,074.98	$0.00													$1,076,873.55	$0.00
Marion County	5	$343,081	$0.00	$0.00					$40,661.61	$0.00	$186,750.74	$0.00	$46,079.67	$0.00													$69,589.44	$0.00
Marshall County	3	$1,131,997											$431,630.13	$0.00									$425,145.99	$0.00			$275,221.24	$0.00
McPherson County	4	$1,161,722							$50,941.55	$130,772.00	$426,073.75	$0.00	$26,562.71	$0.00											$18,881.25	$0.00	$508,490.45	$0.00
Meade County	4	$4,793,710									$49,082.10	$0.00	$36,661.84	$0.00			$4,580,059.01	$27,371.00									$100,536.36	$0.00
Miami County	2	$264,188											$192,263.64	$0.00													$71,924.22	$0.00
Mitchell County	2	$375,144	$285,960.45	$0.00			$44,365.72	$0.00									$44,817.41	$0.00										
Montgomery County	2	$354,810									$344,649.19	$0.00															$10,160.49	$0.00
Morris County	3	$627,398									$112,476.87	$0.00	$146,476.75	$0.00													$368,444.42	$0.00
Morton County	2	$133,689	$0.00	$0.00															$133,689.39	$0.00								
Nemaha County	2	$435,553											$270,115.72	$0.00													$165,436.93	$0.00
Neosho County	4	$256,948											$128,611.21	$0.00					$50,467.73	$0.00					$70,973.20	$0.00	$6,896.11	$0.00
Ness County	4	$44,566							$30,148.28	$0.00	$14,417.95	$0.00					$0.00	$0.00									$0.00	$0.00
Norton County	2	$109,764													$109,763.93	$0.00			$0.00	$0.00								
Osage County	4	$1,152,912	$35,889.44	$0.00					$84,626.45	$0.00			$442,124.59	$0.00													$590,271.19	$0.00
Osborne County	4	$352,316	$169,779.59	$0.00			$0.00	$0.00	$22,250.39	$0.00																	$160,285.80	$0.00
Ottawa County	4	$1,352,515	$412,974.00	$0.00							$473,109.25	$0.00													$131,007.31	$0.00	$335,423.98	$0.00
Pawnee County	5	$547,182							$46,144.79	$0.00	$0.00	$0.00	$72,471.21	$0.00			$210,621.32	$0.00									$217,944.24	$0.00
Phillips County	3	$127,482							$28,699.09	$0.00					$98,782.89	$0.00											$0.00	$0.00
Pottawatomie County	3	$1,027,323	$295,356.42	$0.00									$425,404.82	$0.00													$306,561.59	$0.00
Pratt County	6	$718,291							$46,984.95	$0.00	$0.00	$0.00					$80,942.03	$0.00					$414,149.44	$0.00	$172,839.21	$3,375.00	$0.00	$0.00
Rawlins County	1	$14,534																	$14,533.96	$0.00								
Reno County	3	$2,908,376									$966,323.19	$0.00													$270,027.03	$0.00	$1,672,025.71	$0.00
Republic County	3	$413,250	$157,191.09	$0.00							$56,782.15	$0.00	$199,276.80	$0.00														
Rice County	8	$2,536,985					$75,698.22	$14,251.00	$33,342.31	$0.00	$298,851.91	$201,759.00	$50,792.80	$0.00			$61,728.78	$0.00					$34,795.00	$0.00	$316,612.41	$0.00	$1,449,153.69	$0.00
Riley County	3	$3,076,511	$395,014.00	$0.00																			$2,304,769.03	$328,077.40			$48,650.50	$0.00
Rooks County	3	$218,963	$34,170.75	$0.00					$22,742.22	$0.00					$162,050.26	$0.00												
Rush County	5	$1,257,385	$55,067.57	$0.00			$0.00	$0.00	$24,145.44	$0.00							$0.00	$0.00									$1,178,172.46	$0.00
Russell County	6	$264,433	$33,375.94	$0.00			$0.00	$0.00	$6,779.58	$0.00					$71,664.73	$0.00	$64,952.67	$0.00									$87,659.80	$0.00
Saline County	2	$991,275									$106,295.47	$334,304.00															$550,675.80	$0.00
Scott County	1	$53,158																	$53,157.90	$0.00								
Sedgwick County	2	$3,500,307					$1,719,809.96	$678,221.00							$1,102,276.28	$0.00												
Seward County	2	$949,579															$877,200.64	$0.00	$72,378.10	$0.00								
Shawnee County	0	$0																										
Sheridan County	2	$17,023															$0.00	$0.00	$17,023.23	$0.00								
Sherman County	2	$59,849	$59,849.16	$0.00															$0.00	$0.00								
Smith County	3	$1,003,078	$666,353.91	$0.00					$21,267.72	$0.00																	$315,456.12	$0.00
Stafford County	5	$559,991	$0.00	$373,735.00			$48,771.95	$0.00	$38,574.61	$0.00							$98,909.89	$0.00									$0.00	$0.00
Stanton County	2	$77,159	$0.00	$0.00															$77,158.53	$0.00								
Stevens County	2	$133,824											$23,012.06	$0.00					$110,812.03	$0.00								
Sumner County	6	$2,244,313					$0.00	$0.00			$128,346.98	$0.00	$297,614.36	$0.00	$796,770.48	$0.00									$178,305.72	$14,790.00	$828,485.14	$0.00
Thomas County	1	$9,089																	$9,089.17	$0.00								
Trego County	1	$0															$0.00	$0.00										
Wabaunsee County	2	$450,574											$265,250.77	$0.00													$185,322.95	$0.00
Wallace County	2	$0																	$0.00	$0.00							$0.00	$0.00
Washington County	4	$1,775,505	$548,108.47	$0.00							$79,340.68	$0.00	$806,711.94	$0.00													$341,344.40	$0.00
Wichita County	1	$28,538																	$28,538.42	$0.00								
Wilson County	2	$85,768									$85,768.36	$0.00															$0.00	$0.00
Woodson County	3	$214,230									$2,702.43	$0.00			$61,892.96	$0.00											$149,634.52	$0.00
Wyandotte County	3	$4,895,374			$667,126.96	$0.00															$2,091,131.25	$0.00					$2,137,115.40	$0.00
Total FEMA Allocation		$174,662,761	$7,283,728.86	$593,687.00	$2,900,592.12	$23,894.00	$4,883,032.82	$726,334.00	$1,320,792.96	$140,026.00	$10,135,201.52	$1,518,773.00	$10,965,009.42	$965,725.18	$5,798,145.11	$61,295.18	$12,503,903.25	$88,152.40	$64,293,190.09	$2,557,318.11	$6,040,867.34	$70,250.00	$4,354,581.46	$390,077.40	$3,509,374.38	$186,165.11	$30,160,990.22	$3,191,654.25

KENTUCKY

KENTUCKY STATISTICS SUMMARY (2011 – 2021)	
16	CLIMATE DISASTER DECLARATIONS
LAWRENCE, MAGOFFIN	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES IN THE STATE AND THE NATION (12 OCCURENCES)
19	COUNTIES WITH FIVE OR MORE DISASTERS
8	COUNTIES WITH TEN OR MORE DISASTERS
61	WASTEWATER DISCHARGE SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
WARREN	HIGHEST COMPOUNDING RISKS
$470 MILLION	FEMA + HUD POST-DISASTER FUNDING
4.5 MILLION	POPULATION TOTAL
$105	PER CAPITA SPENDING ON CLIMATE DISASTERS
$3.3 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

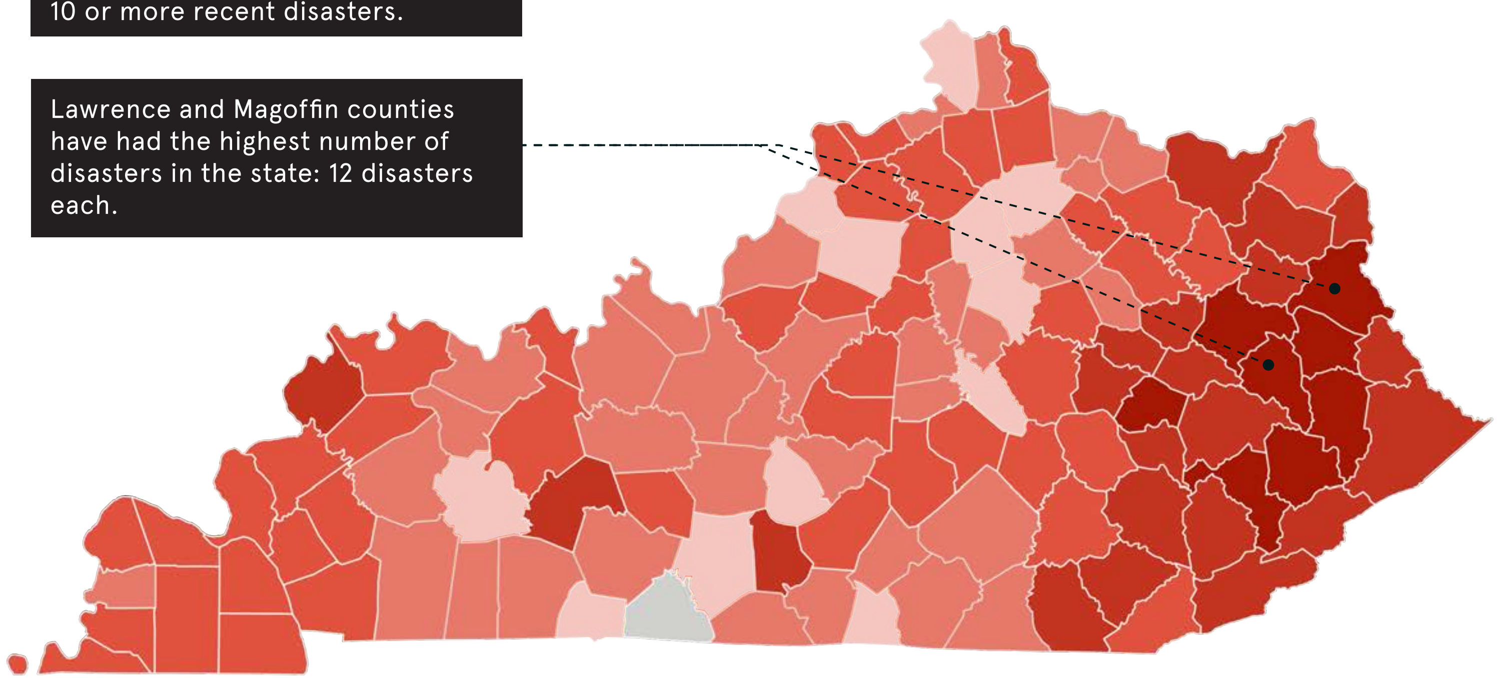
DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

16
disaster declarations

Eight counties in Kentucky have had 10 or more recent disasters.

Lawrence and Magoffin counties have had the highest number of disasters in the state: 12 disasters each.



Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$470M
post-disaster assistance

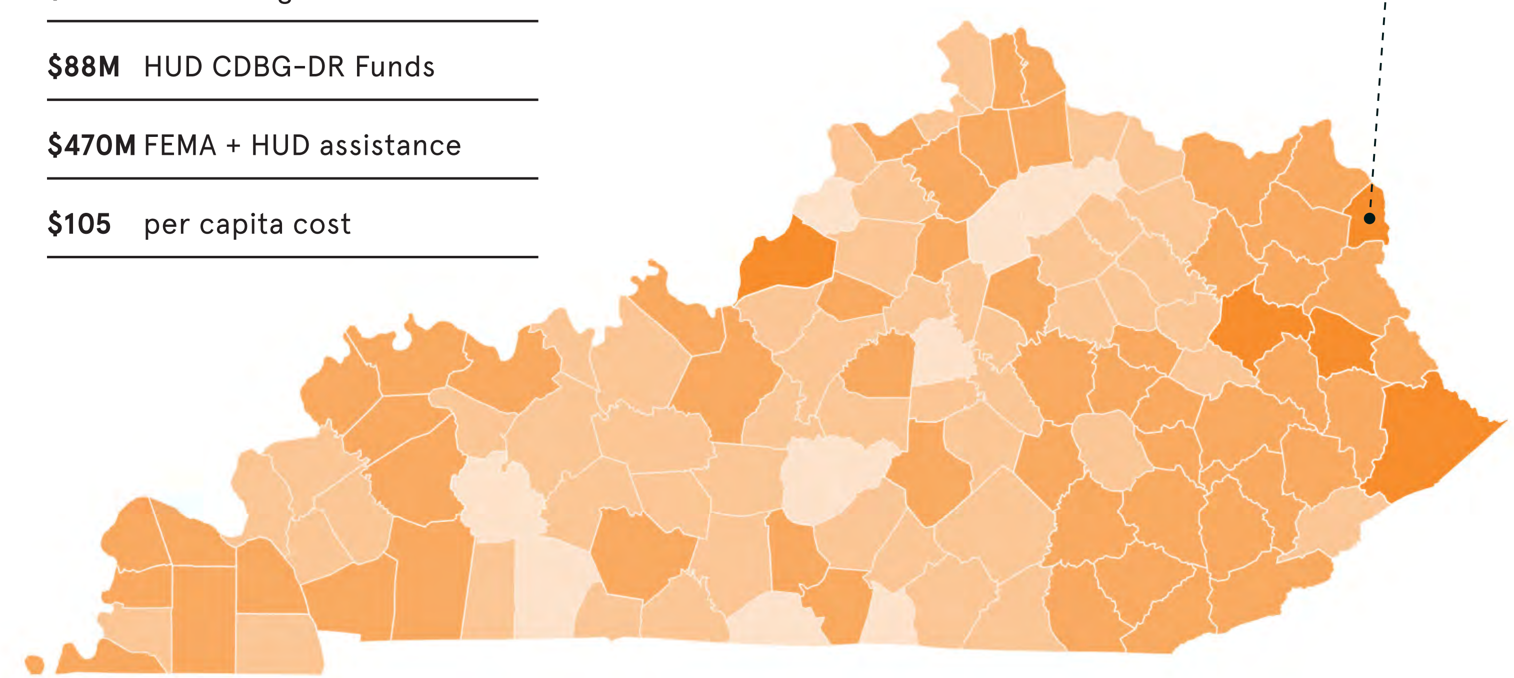
Boyd County has received the most post-disaster FEMA funds in the state: $12.4 million.

$382M FEMA obligations

$88M HUD CDBG-DR Funds

$470M FEMA + HUD assistance

$105 per capita cost



FEMA Public Assistance and Hazard Mitigation
Federal Share Obligated (2011-2021)

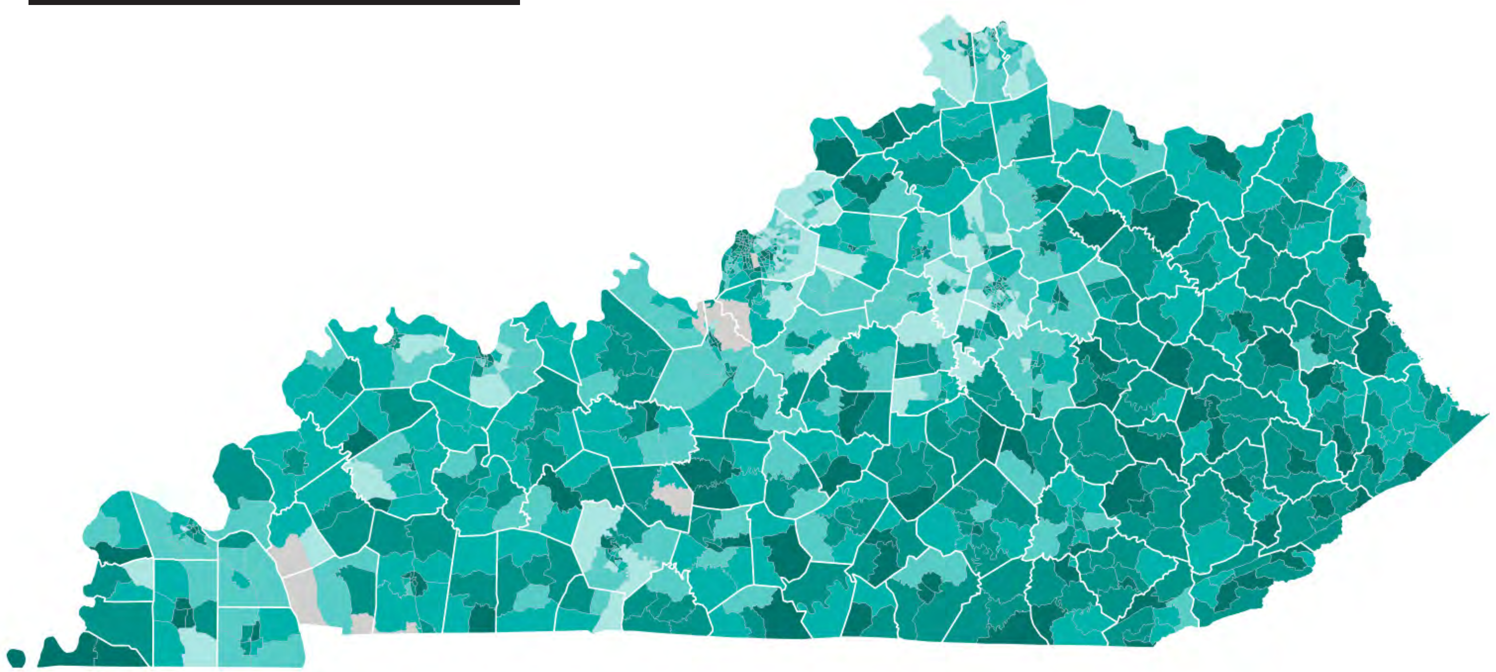
- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Warren, Davies, Fayette, McCracken, Calloway, Graves, Hopkins, Christian, Barren, and Powell counties have high poverty, high diversity of disasters, and low investments from previous disasters.



Social Vulnerability Index

CDC (2018)

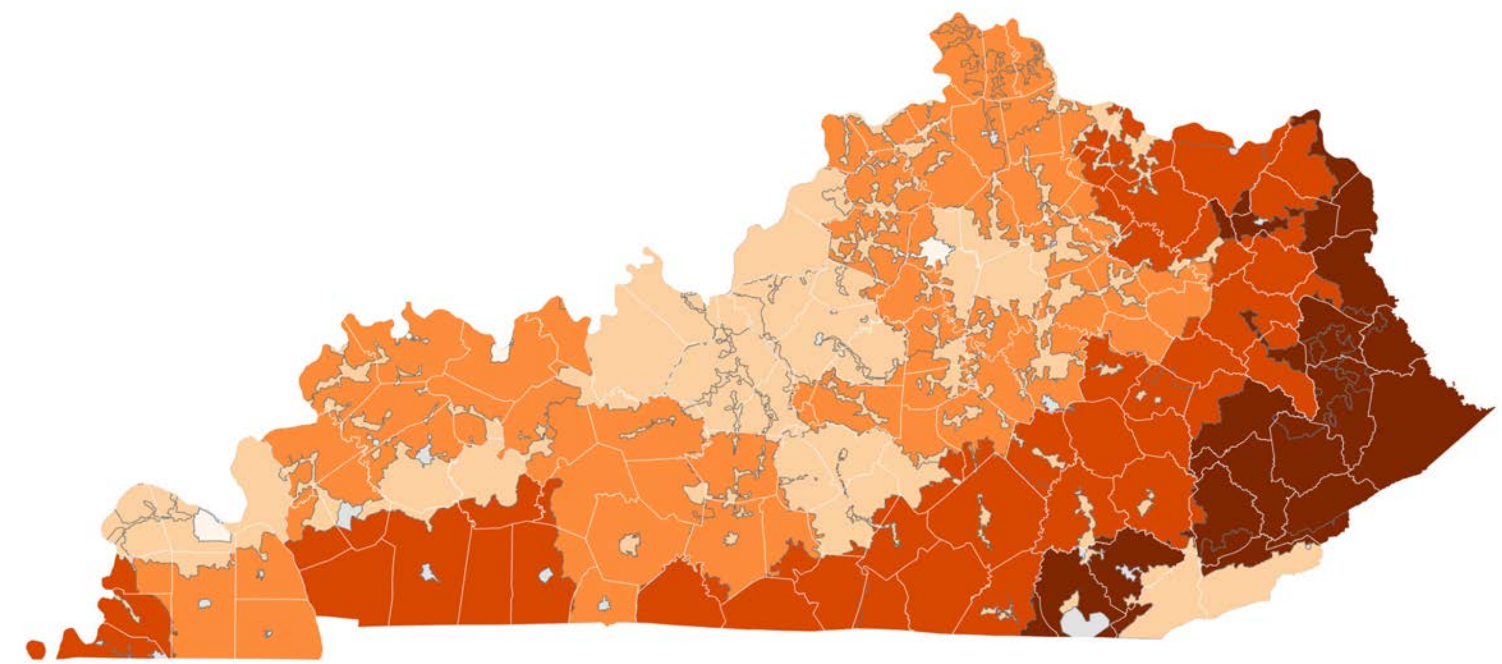
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Eighteen counties in Kentucky have high social vulnerability and low energy reliability.



Aggregated Annual Electric Outage Duration

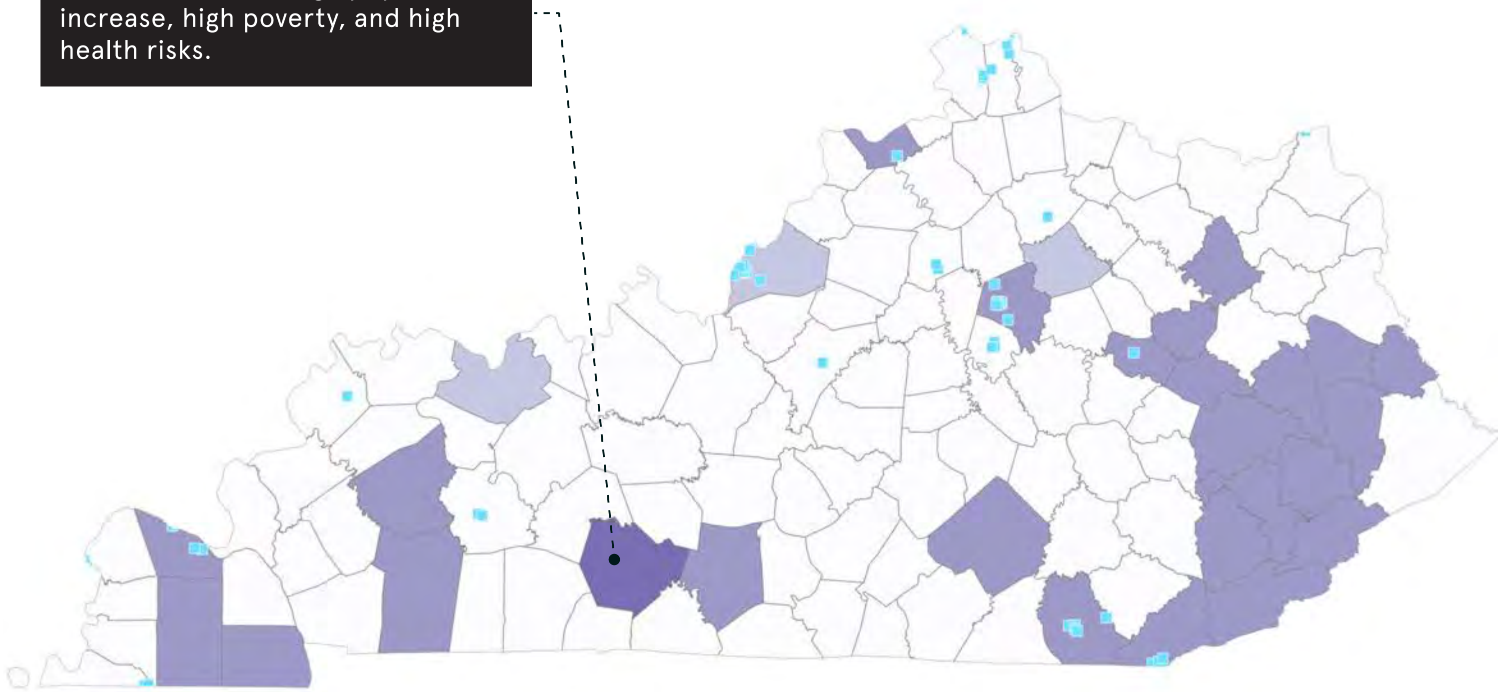
Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Warren County has a high risk of climate disasters, high population increase, high poverty, and high health risks.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adair							0
Allen							0
Anderson							0
Ballard							0
Barren					1		3
Bath							0
Bell					3		3
Boone							0
Bourbon					1		2
Boyd							0
Boyle							0
Bracken							0
Breathitt					1		3
Breckinridge							0
Bullitt							0
Butler							0
Caldwell							0
Calloway					1		3
Campbell							0
Carlisle							0
Carroll					1		3
Carter							0
Casey							0
Christian					1		3
Clark							0
Clay							0
Clinton							0
Crittenden							0
Cumberland							0
Daviess					2		2
Edmonson							0
Elliott							0
Estill							0
Fayette					2		3
Fleming							0
Floyd					1		3
Franklin							0
Fulton							0
Gallatin							0
Garrard							0
Grant							0
Graves					2		3
Grayson							0
Green							0
Greenup							0
Hancock							0
Hardin							0
Harlan					1		3
Harrison							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Hart							0
Henderson							0
Henry							0
Hickman							0
Hopkins					2		3
Jackson							0
Jefferson					8		2
Jessamine							0
Johnson					1		3
Kenton							0
Knott					1		3
Knox							0
Larue							0
Laurel							0
Lawrence							0
Lee							0
Leslie					1		3
Letcher					1		3
Lewis							0
Lincoln							0
Livingston							0
Logan							0
Lyon							0
Madison							0
Magoffin					1		3
Marion							0
Marshall							0
Martin					1		3
Mason							0
McCracken					4		3
McCreary							0
McLean							0
Meade							0
Menifee					1		3
Mercer							0
Metcalfe							0
Monroe							0
Montgomery							0
Morgan							0
Muhlenberg							0
Nelson							0
Nicholas							0
Ohio							0
Oldham							0
Owen							0
Owsley							0
Pendleton							0
Perry					1		3
Pike							0
Powell					1		3
Pulaski					1		3

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Robertson							0
Rockcastle							0
Rowan					1		3
Russell							0
Scott							0
Shelby							0
Simpson							0
Spencer							0
Taylor							0
Todd							0
Trigg							0
Trimble							0
Union							0
Warren					2		4
Washington							0
Wayne							0
Webster							0
Whitley					1		3
Wolfe					1		3
Woodford							0

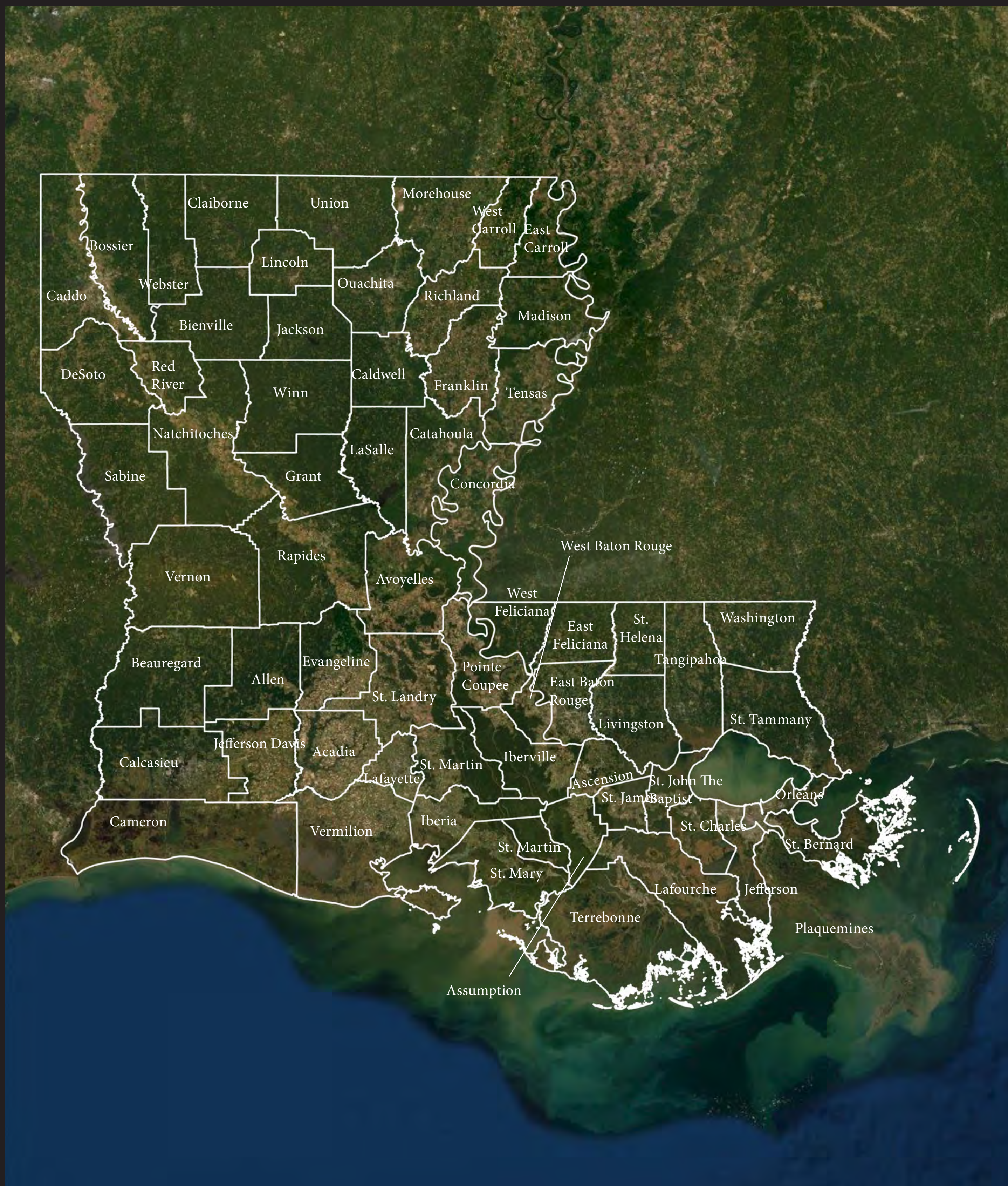
KENTUCKY

TOTAL: 16 DISASTERS
FEMA PA + HM: $382 M
HUD CDBG-DR: $88 M
FEMA + HUD ASSISTANCE: $470 M

			2011				2012		2014		2015					
			1976: SEVERE STORMS, TORNADOES, AND FLOODING		4008: SEVERE STORMS, TORNADOES, AND FLOODING		4057: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS AND FLOODING		4196: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4216: SEVERE WINTER STORMS, SNOWSTORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4217: SEVERE WINTER STORMS, SNOWSTORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4218: SEVERE WINTER STORMS, SNOWSTORMS, FLOODING, LANDSLIDES, AND MUDSLIDES	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	12	$189,123,296	$11,175,204	$733,689	$806,450	$73,197	$7,888,912	$249,218	$2,070,639	$54,633	$1,452,590	$45,370	$2,848,302	$168,093	$10,543,472	$201,689
Adair County	4	$17,952					$375	$0			$17,577	$0				
Allen County	0	$0														
Anderson County	4	$275,387	$207,644	$0							$18,656	$0			$49,087	$0
Ballard County	5	$1,245,993	$500,378	$0			$1,851	$0			$12,302	$0				
Barren County	1	$0														
Bath County	5	$742,075	$114,350	$0			$0	$0					$500,516	$0	$14,652	$0
Bell County	6	$2,868,162			$753,566	$0									$16,851	$0
Boone County	1	$696,713	$696,713	$0												
Bourbon County	2	$390,877											$345,825	$0	$45,051	$0
Boyd County	8	$12,353,257	$748,320	$0							$144,681	$0			$750,968	$0
Boyle County	2	$175,676									$114,719	$0				
Bracken County	2	$157,973	$121,091	$0												
Breathitt County	9	$4,540,898	$909,902	$0	$237,384	$0							$614,550	$0	$538,755	$0
Breckinridge County	2	$119,965	$119,965	$0												
Bullitt County	4	$583,360											$92,165	$0	$151,149	$0
Butler County	7	$681,595	$0	$0							$23,047	$0			$27,800	$0
Caldwell County	5	$173,924	$61,589	$0							$70,595	$0				
Calloway County	4	$639,234	$281,360	$0											$68,205	$0
Campbell County	4	$1,640,770	$228,952	$258,750			$0	$0								
Carlisle County	3	$1,938,978	$628,865	$34,535												
Carroll County	5	$4,719,828	$66,969	$0			$0	$0								
Carter County	8	$6,724,092	$450,961	$0									$155,923	$0	$31,091	$0
Casey County	4	$768,719													$214,313	$0
Christian County	3	$981,907	$357,013	$445,661												
Clark County	4	$628,230									$102,684	$0	$294,035	$0		
Clay County	9	$5,231,231	$155,747	$0											$665,878	$0
Clinton County	1	$0														
Crittenden County	4	$744,765	$67,313	$0												
Cumberland County	3	$1,058,758														
Daviess County	3	$1,521,018	$240,206	$0											$87,573	$0
Edmonson County	5	$460,847	$24,146	$0							$19,852	$0				
Elliott County	7	$5,101,475	$407,859	$0							$0	$0	$616,798	$0	$102,351	$0
Estill County	9	$1,628,291	$233,347	$0							$51,463	$0	$47,112	$0	$327,473	$0
Fayette County	1	$0														
Fleming County	4	$222,050	$123,536	$0											$35,207	$0
Floyd County	10	$6,692,589	$233,345	$0					$1,562,583	$645,387	$88,700	$0	$447,917	$0	$390,149	$98,356
Franklin County	5	$1,104,362	$173,187	$370,238							$129,827	$0	$199,367	$0	$103,710	$111,905
Fulton County	5	$1,232,491	$779,304	$104,432											$32,701	$0
Gallatin County	3	$547,082	$411,666	$0											$22,689	$0
Garrard County	1	$0														
Grant County	5	$2,343,683	$388,961	$0			$20,958	$0							$40,396	$0
Graves County	4	$1,249,643	$0	$0												
Grayson County	3	$100,680	$100,680	$0			$0	$0								
Green County	1	$10,791	$10,791	$0												
Greenup County	6	$1,894,173	$323,741	$0											$244,369	$193,200
Hancock County	4	$309,324	$65,641	$0											$33,426	$0
Hardin County	2	$718,376	$0	$0												
Harlan County	8	$6,445,334	$0	$0							$120,185	$0			$0	$0
Harrison County	1	$67,727													$67,727	$0
Hart County	3	$139,764													$73,651	$66,113
Henderson County	4	$3,839,772	$864,277	$0												
Henry County	4	$511,221	$278,196	$0												
Hickman County	5	$464,313	$178,162	$20,670												
Hopkins County	3	$314,156	$176,195	$0												
Jackson County	6	$814,029									$18,469	$0			$10,241	$0
Jefferson County	3	$7,042,043	$0	$3,033,456									$750,169	$485,431		
Jessamine County	2	$80,179									$80,179	$0				
Johnson County	11	$11,487,509	$186,333	$0			$354,331	$274,450	$478,425	$70,129			$462,160	$0	$149,029	$1,933,706
Kenton County	3	$804,003	$311,461	$0			$130,000	$0								
Knott County	10	$2,076,975	$276,703	$0	$168,636	$0			$225,514	$0	$52,954	$0			$207,690	$0
Knox County	7	$2,744,544			$37,365	$0					$22,649	$0			$0	$0
Larue County	2	$26,391					$11,683	$0							$14,708	$0
Laurel County	4	$598,332					$573,506	$24,826								
Lawrence County	12	$2,817,442	$282,455	$225,774			$96,816	$0			$8,766	$0	$354,353	$0	$270,110	$0
Lee County	10	$2,740,399	$290,603	$0	$252,120	$0					$35,696	$0	$1,324,107	$0	$3,009	$0
Leslie County	7	$8,241,866													$1,468,014	$0
Letcher County	7	$925,498									$189,531	$0			$227,951	$0
Lewis County	7	$1,090,374	$305,806	$0							$29,104	$0	$438,053	$0	$40,764	$0
Lincoln County	5	$206,764									$43,986	$0	$30,536	$0		
Livingston County	4	$885,044	$486,090	$0												
Logan County	2	$40,908	$40,908	$0												
Lyon County	4	$270,300	$185,973	$0							$28,938	$24,738				
Madison County	4	$946,255											$65,878	$237,830		
Magoffin County	12	$4,801,163	$85,048	$0	$133,436	$66,767	$581,493	$0			$44,276	$0	$211,675	$0	$200,907	$0
Marion County	5	$137,962	$89,316	$0												
Marshall County	6	$1,311,108	$352,399	$0							$0	$0			$55,409	$0
Martin County	7	$1,186,901	$154,883	$0			$163,536	$0							$105,418	$0
Mason County	3	$179,868	$126,975	$0											$52,894	$0
McCracken County	5	$3,454,649	$887,437	$74,867							$71,953	$0				
McCreary County	3	$335,246														
McLean County	2	$389,756	$219,275	$85,985												
Meade County	2	$64,460	$64,460	$0												
Menifee County	8	$349,466	$64,051	$0			$115,689	$0			$16,021	$0			$26,212	$0
Mercer County	2	$4,023	$0	$0												
Metcalfe County	8	$2,699,063									$2,345	$0	$568,623	$0	$234,830	$19,605
Monroe County	2	$27,280	$8,574	$0												
Montgomery County	3	$49,074					$0	$0								
Morgan County	10	$10,705,810	$224,418	$0			$4,905,491	$1,186,472			$122,393	$0	$194,888	$0	$0	$0
Muhlenberg County	1	$0														
Nelson County	2	$0	$0	$0												
Nicholas County	6	$457,992	$319,425	$0									$48,964	$0	$24,254	$0
Ohio County	6	$341,628					$0	$0							$10,156	$0
Oldham County	1	$24,104	$24,104	$0												
Owen County	5	$1,064,371	$13,676	$0									$101,165	$0	$19,756	$0
Owsley County	9	$1,577,316	$232,990	$0									$29,466	$0	$113,677	$0
Pendleton County	5	$1,413,674	$351,001	$0			$170,920	$67,682			$18,040	$11,353				
Perry County	10	$5,596,605	$654,264	$0	$191,711	$0					$258,785	$0			$845,816	$58,797
Pike County	9	$8,858,122	$0	$0					$829,100	$185,876	$244,658	$264,000	$406,775	$2,001,225	$1,200,446	$360,586
Powell County	7	$1,162,986									$246,791	$0			$0	$0
Pulaski County	2	$219,334														
Robertson County	3	$33,502	$11,996	$0											$6,141	$0
Rockcastle County	6	$2,385,451									$105,193	$0			$17,503	$0
Rowan County	6	$651,161	$0	$0			$0	$0					$168,595	$0	$42,173	$0
Russell County	2	$585,765					$0	$467,955								
Scott County	1	$0											$0	$0		
Shelby County	1	$0														
Simpson County	1	$18,010									$18,010	$0				
Spencer County	6	$2,914,966	$116,417	$0									$96,741	$0	$35,078	$0
Taylor County	3	$40,309									$40,309	$0				
Todd County	3	$99,725	$33,929	$0												
Trigg County	5	$419,443	$99,265	$0											$90,666	$0
Trimble County	4	$665,240	$105,600	$0			$11,461	$0								
Union County	7	$1,943,444	$679,753	$675							$46,103	$0				
Warren County	2	$0														
Washington County	6	$1,070,050	$276,567	$0							$28,990	$101,165			$29,503	$0
Wayne County	3	$281,921									$53,628	$31,480				
Webster County	5	$1,033,736	$692,996	$22,267											$0	$0
Whitley County	7	$2,807,237											$126,544	$0	$174,502	$0
Wolfe County	9	$810,043	$36,213	$0			$39,828	$0			$62,546	$0	$171,067	$0		
Woodford County	3	$99,807									$50,188	$1,125			$48,493	$0
Total FEMA Allocation		$382,253,399	$30,196,940	$5,410,999	$2,580,668	$139,964	$15,066,850	$2,270,602	$5,166,261	$956,025	$4,307,379	$479,231	$11,712,271	$2,892,579	$20,404,042	$3,043,957

	2015		2016		2018				2019		2020		2021					
	4216: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, FLOODING, LANDSLIDES, AND MUDSLIDES		4278: SEVERE STORM, TORNADOES, FLOODING, LANDSLIDES, AND MUDSLIDES		4358: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4361: SEVERE STORMS, TORNADOES, FLOODING, LANDSLIDES, AND MUDSLIDES		4428: SEVERE STORMS, STRAIGHT-LINE WINDS, FLOODING, LANDSLIDES, AND MUDSLIDES		4540: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4592: SEVERE WINTER STORMS, LANDSLIDES, AND MUDSLIDES		4595: SEVERE, STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4630: SEVERE STORMS, STRAIGHT-LINE WINDS, FLOODING, AND TORNADOES	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$5,298,559	$156,281	$1,853,946	$43,924	$22,689,517	$34,025	$6,067,480	$45,352	$41,991,792	$1,343,771	$39,388,900	$170,777	$26,258,795	$0	$5,468,720	$0		
Adair County			$0	$0					$0	$0								
Allen County																		
Anderson County															$0	$0		
Ballard County									$672,691	$0					$58,770	$0		
Barren County																	$0	
Bath County													$112,557	$0				
Bell County					$626,561	$0			$340,054	$0	$1,131,131	$0			$0	$0		
Boone County																		
Bourbon County																		
Boyd County							$539,641	$127,725	$1,821,997	$0	$3,370,633	$0	$3,295,531	$0	$1,553,762	$0		
Boyle County													$60,957	$0				
Bracken County	$36,882	$0																
Breathitt County	$438,126	$0			$930,738	$0			$693,839	$0			$0	$0	$177,605	$0		
Breckinridge County																	$0	
Bullitt County							$340,046	$0									$0	
Butler County			$45,756	$18,750			$0	$18,750	$188,847	$191,250	$167,395	$0						
Caldwell County			$41,740	$0			$0	$0									$0	
Calloway County			$73,513	$0											$216,157	$0		
Campbell County							$406,407	$0	$746,661	$0								
Carlisle County							$396,877	$0	$878,701	$0								
Carroll County	$393,732	$0					$3,348,691	$0	$910,436	$0								
Carter County	$202,186	$0					$378,286	$0	$685,579	$0			$4,050,783	$0	$769,284	$0		
Casey County									$0	$0			$0	$0	$554,406	$0		
Christian County			$179,233	$0													$0	
Clark County													$65,433	$0	$166,078	$0		
Clay County	$316,112	$0	$6,092	$0	$376,912	$0			$796,315	$0	$953,618	$0	$65,218	$0	$1,895,340	$0		
Clinton County													$0	$0				
Crittenden County			$509,659	$0			$127,802	$0	$39,992	$0								
Cumberland County	$32,578	$149,205							$876,976	$0					$0	$0		
Daviess County			$380,566	$812,672														
Edmonson County			$0	$0					$416,849	$0					$0	$0		
Elliott County	$0	$0							$376,879	$0			$3,484,704	$0	$112,884	$0		
Estill County	$55,764	$0			$147,361	$0			$670,016	$0			$32,135	$0	$63,621	$0		
Fayette County															$0	$0		
Fleming County	$63,307	$0											$0	$0				
Floyd County	$34,271	$0			$718,323	$386,678			$1,528,447	$0			$44,656	$0	$513,777	$0		
Franklin County															$16,127	$0		
Fulton County							$0	$0	$316,053	$0							$0	
Gallatin County							$112,727	$0										
Garrard County													$0	$0				
Grant County							$775,971	$0	$1,117,397	$0								
Graves County							$1,182,524	$0							$67,119	$0	$0	
Grayson County																	$0	
Green County																		
Greenup County							$180,493	$0	$0	$100,000			$718,878	$0	$133,493	$0		
Hancock County							$114,684	$40,635	$54,938	$0								
Hardin County							$718,376	$0										
Harlan County					$805,556	$155,588			$3,384,723	$0	$1,546,427	$0	$63,499	$0	$369,356	$0		
Harrison County																		
Hart County			$0	$0													$0	
Henderson County							$1,982,274	$20,246	$287,170	$0	$685,806	$0						
Henry County	$78,470	$0					$86,878	$0	$67,677	$0								
Hickman County							$46,181	$0	$175,227	$0	$44,072	$0					$0	
Hopkins County			$137,961	$0													$0	
Jackson County	$0	$0							$779,373	$0			$0	$0	$5,945	$0		
Jefferson County							$2,165,786	$607,200										
Jessamine County															$0	$0		
Johnson County	$413,622	$125,744			$568,354	$0			$1,306,229	$172,125	$0	$0	$3,003,104	$0	$1,989,768	$0		
Kenton County							$338,505	$24,038										
Knott County	$160,236	$0			$261,833	$0			$53,595	$0	$390,420	$0			$279,395	$0		
Knox County					$388,953	$0			$1,188,107	$0	$1,107,469	$0			$0	$0		
Larue County																		
Laurel County									$0	$0			$0	$0	$0	$0		
Lawrence County	$38,745	$0			$199,918	$0	$133,041	$0	$214,347	$0	$902,185	$0	$90,933	$0	$0	$0		
Lee County	$0	$0			$171,167	$0			$506,455	$0			$0	$0	$157,242	$0		
Leslie County	$941,256	$0			$920,915	$0			$2,049,641	$0	$2,138,569	$0	$6,053	$0	$717,419	$0		
Letcher County	$212,684	$0			$295,332	$0			$0	$0	$0	$0			$0	$0		
Lewis County	$75,014	$0									$193,846	$0	$7,787	$0				
Lincoln County	$21,621	$0											$110,621	$0	$0	$0		
Livingston County			$150,779	$0			$49,407	$0	$198,767	$0								
Logan County																	$0	
Lyon County			$30,650	$0													$0	
Madison County									$346,296	$0			$293,280	$0	$2,971	$0		
Magoffin County	$202,819	$62,526			$219,421	$48,750			$2,090,476	$0	$853,572	$0	$0	$0	$0	$0		
Marion County									$48,645	$0			$0	$0	$0	$0	$0	
Marshall County			$815,819	$0					$87,480	$0							$0	
Martin County					$296,977	$0			$302,920	$0			$25,019	$0	$138,148	$0		
Mason County															$0	$0		
McCracken County							$1,150,693	$0	$692,152	$0	$577,547	$0						
McCreary County									$234,197	$0	$94,646	$0	$6,404	$0				
McLean County							$84,496	$0										
Meade County																	$0	
Menifee County	$82,841	$0									$0	$0	$44,652	$0	$0	$0		
Mercer County													$4,023	$0				
Metcalfe County			$159,685	$0	$241,264	$0	$330,366	$0	$671,098	$0	$471,246	$0						
Monroe County											$18,706	$0						
Montgomery County	$33,136	$15,938											$0	$0				
Morgan County	$97,628	$0							$568,148	$119,363	$525,359	$0	$2,529,282	$0	$232,369	$0		
Muhlenberg County																	$0	
Nelson County													$0	$0				
Nicholas County	$55,358	$0							$0	$0			$9,990	$0				
Ohio County			$41,306	$0			$235,573	$0							$54,593	$0	$0	
Oldham County																		
Owen County							$766,851	$84,411	$78,512	$0								
Owsley County	$184,246	$0			$112,808	$0			$415,351	$0	$96,646	$0	$11,118	$0	$381,015	$0		
Pendleton County							$182,467	$0	$561,724	$50,488								
Perry County	$156,277	$72,328			$613,447	$0			$913,385	$155,850	$586,084	$75,000	$406,885	$0	$607,977	$0		
Pike County					$1,001,227	$0			$1,781,897	$0	$229,593	$0			$352,739	$0		
Powell County					$7,675	$0			$315,514	$376,875	$0	$0	$96,298	$0	$119,833	$0		
Pulaski County													$219,334	$0	$0	$0		
Robertson County	$15,364	$0																
Rockcastle County	$126,225	$25,789							$1,636,796	$0			$39,318	$0	$434,628	$0		
Rowan County	$63,866	$376,527											$0	$0				
Russell County									$117,810	$0								
Scott County																		
Shelby County																	$0	
Simpson County																		
Spencer County	$278,258	$426,081					$1,923,210	$39,181									$0	
Taylor County													$0	$0			$0	
Todd County			$65,796	$0													$0	
Trigg County			$160,094	$0			$0	$0	$69,418	$0								
Trimble County	$519,334	$0					$28,845	$0										
Union County			$53,039	$0			$214,734	$0	$454,572	$279,101	$77,701	$0			$137,767	$0		
Warren County															$0	$0	$0	
Washington County	$54,823	$0					$0	$0	$579,001	$0								
Wayne County									$169,591	$0			$27,222	$0				
Webster County			$86,256	$44,689			$95,521	$0	$58,721	$33,287								
Whitley County					$546,274	$0			$808,253	$0	$1,119,506	$0	$0	$0	$32,157	$0		
Wolfe County	$17,343	$0			$139,698	$0			$335,308	$0			$0	$0	$8,039	$0		
Woodford County															$0	$0		
Total FEMA Allocation	$10,700,682	$1,410,419	$4,791,890	$920,035	$32,280,230	$625,040	$24,504,832	$1,007,537	$78,673,032	$2,822,109	$56,671,077	$245,777	$45,184,467	$0	$17,788,504	$0	$0	

LOUISIANA

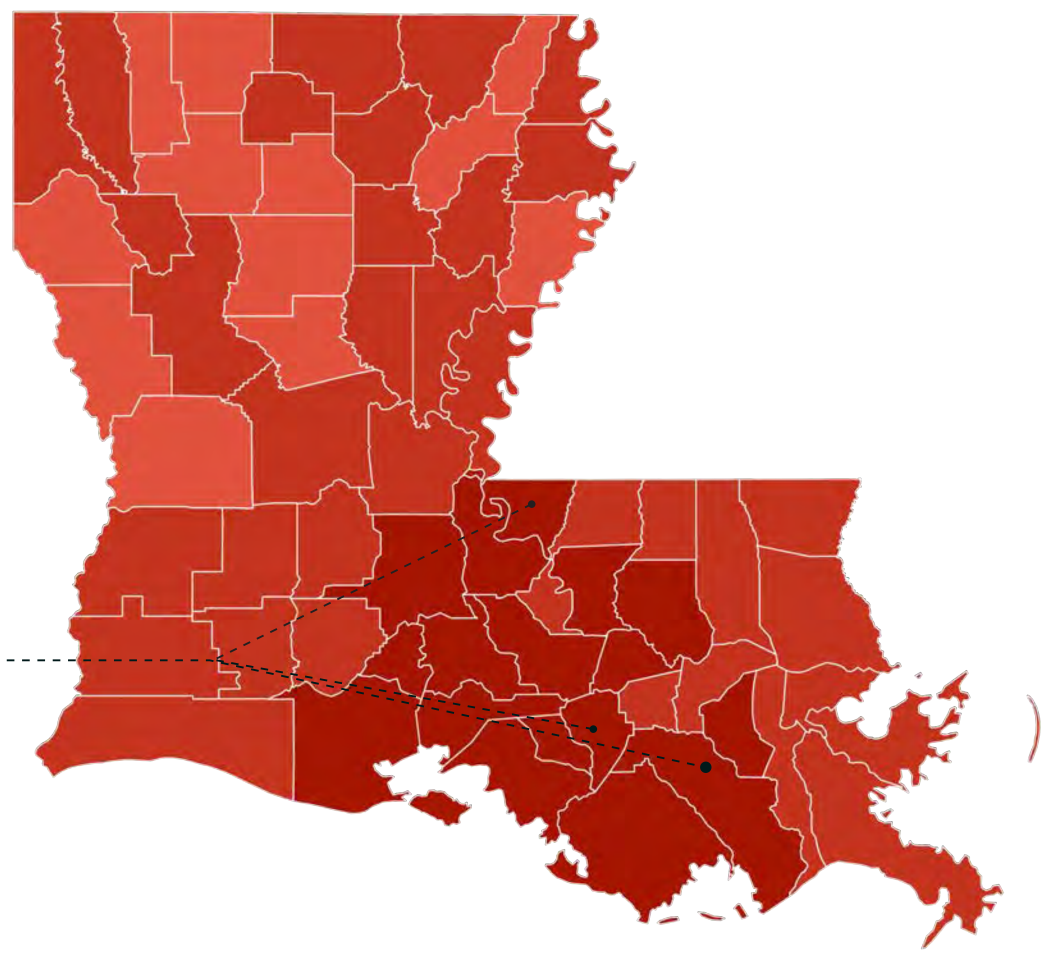


LOUISIANA STATISTICS SUMMARY (2011 – 2021)	
18	CLIMATE DISASTER DECLARATIONS
6TH HIGHEST	NUMBER OF DISASTERS IN THE COUNTRY
HIGHEST	PER CAPITA SPENDING ON CLIMATE DISASTERS IN THE NATION
LAFOURCHE, WEST FELICIANA, ASSUMPTION	PARISHES WITH THE HIGHEST DISASTER OCCURENCES
ALL	PARISHES HAVE HAD FIVE OR MORE DISASTERS
61	SUPERFUND SITES
121	WASTEWATER DISCHARGE SITES
D+	ASCE INFRASTRUCTURE REPORT CARD GRADE
ORLEANS	HIGHEST COMPOUNDING RISKS
$8.1 BILLION	FEMA + HUD POST-DISASTER FUNDING
4.7 MILLION	POPULATION TOTAL
$1,736	PER CAPITA SPENDING ON CLIMATE DISASTERS
$5.2 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY PARISH

18
disaster declarations



Sixteen parishes in Louisiana have had 10 or more recent disasters.

Lafourche, West Feliciana, and Assumption parishes have had the highest number of disasters in the state: 12 disasters each.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

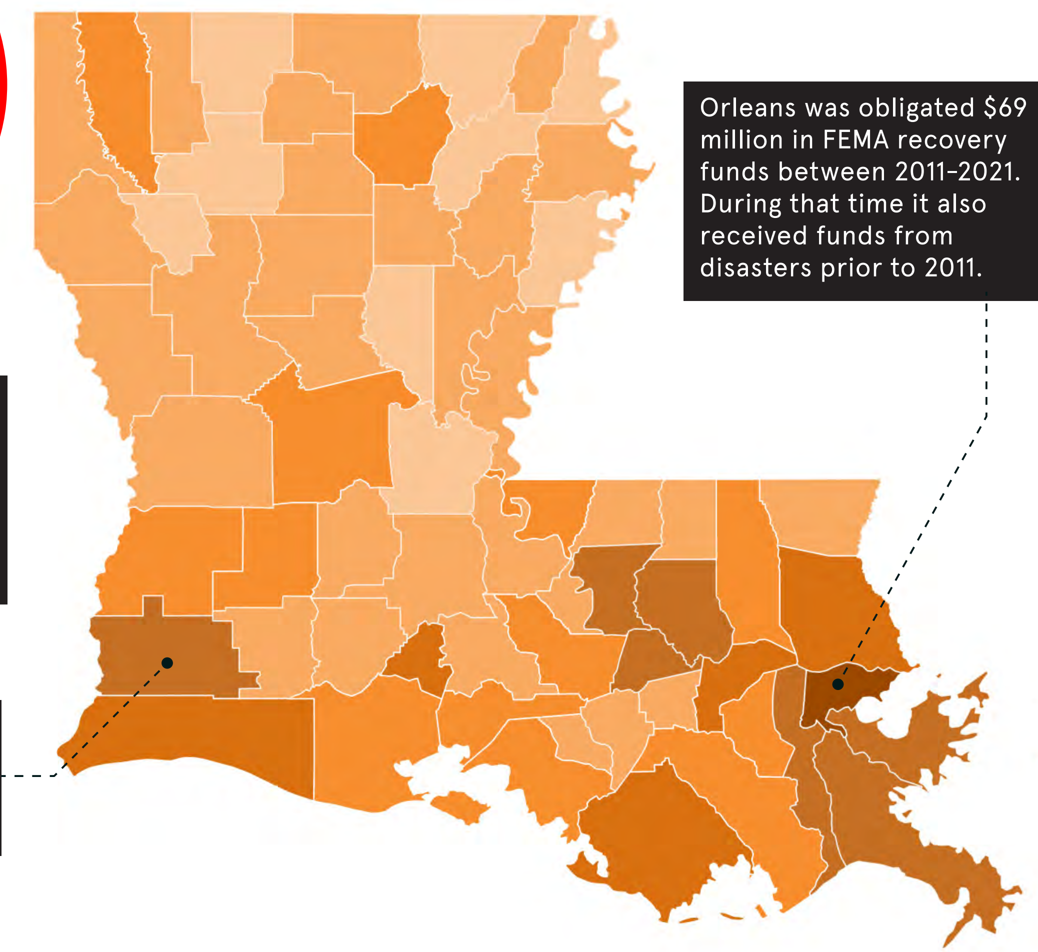
- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurences
- 7–9 occurences
- 10+ occurences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY PARISH FOR CLIMATE DISASTERS

$8.1B
post-disaster assistance



The most expensive event in recent history was Hurricane Laura in 2020, which totaled over $860 million in FEMA post-disaster assistance.

Calcasieu was obligated the highest post-disaster FEMA funding in the state: $424 million.

Orleans was obligated $69 million in FEMA recovery funds between 2011–2021. During that time it also received funds from disasters prior to 2011.

FEMA Public Assistance and Hazard Mitigation
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

$2.5B FEMA obligations

$5.6B HUD CDBG-DR Funds

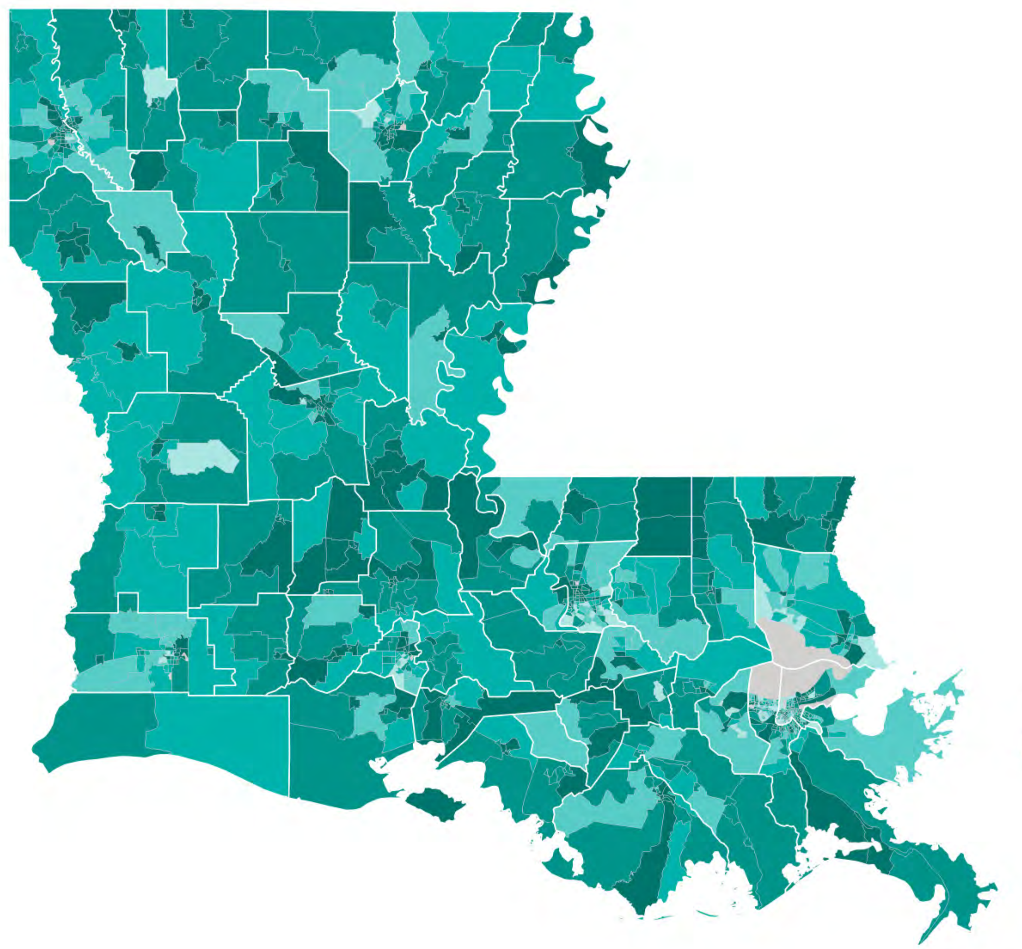
$8.1B FEMA + HUD assistance

$1736 per capita cost

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Bossier, Livingston, Orleans, Calcasieu, St. Tammany, West Baton Rouge, Ascension, St. Bernard have each had over 5 disasters and have high population increases.



Social Vulnerability Index

CDC (2018)

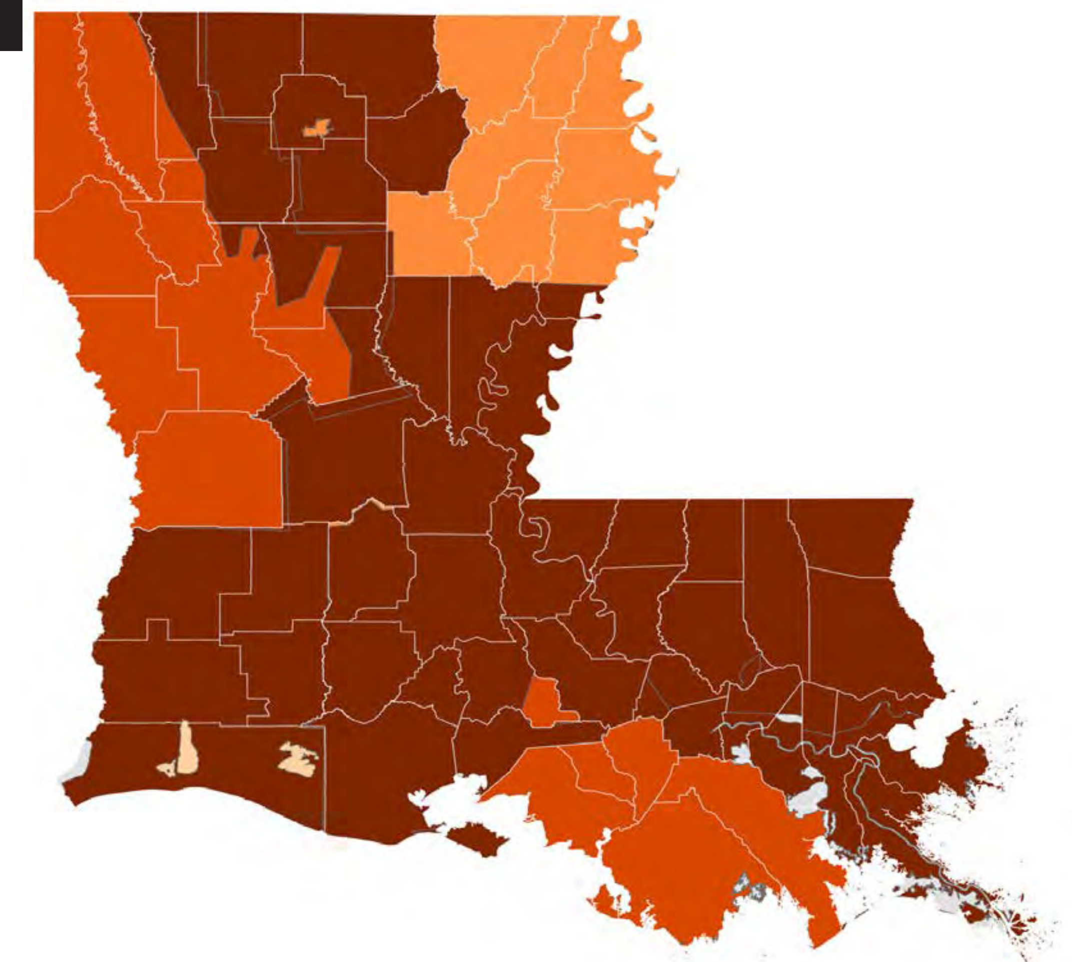
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

PARISHES AT GREATEST RISK OF POWER OUTAGES

Thirty-seven parishes in Louisiana have high social vulnerability and low energy reliability.



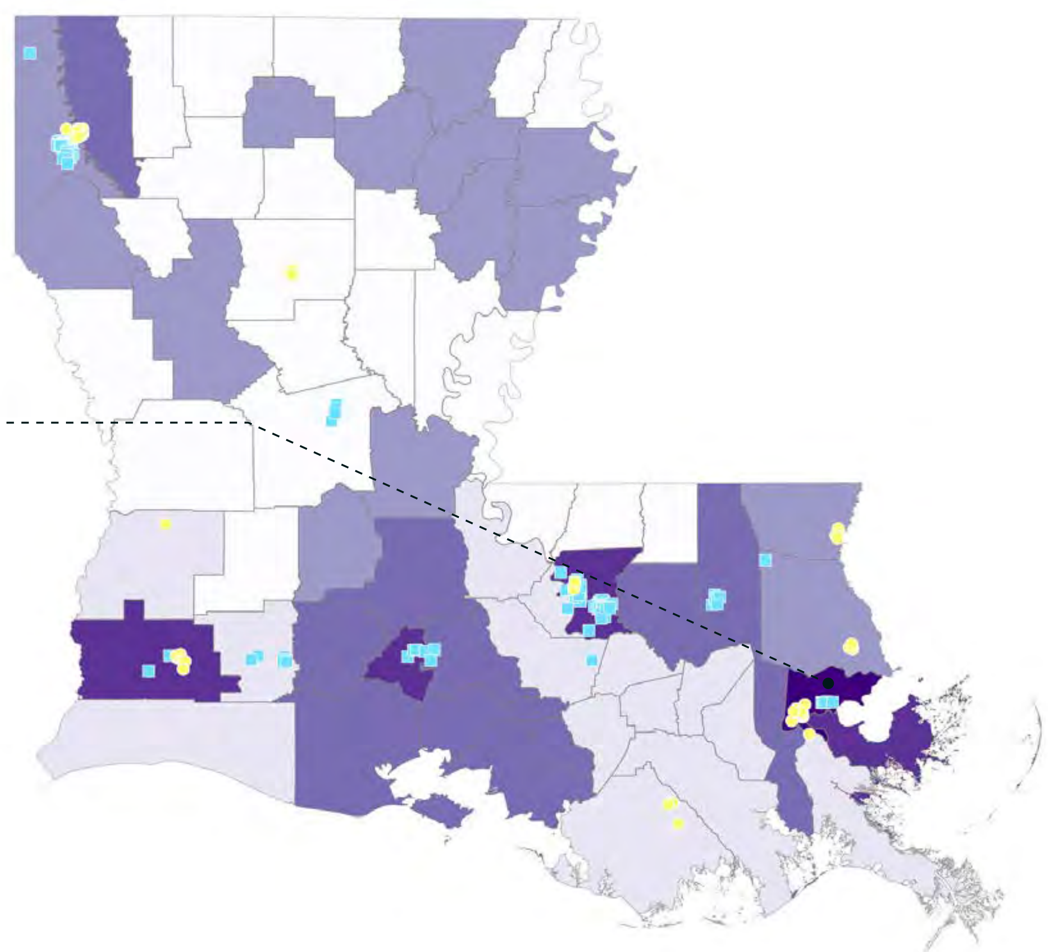
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Orleans has high risk of climate disasters, high population density, high population increase, high poverty, high health risks, and risk of sea level rise.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

Parish Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Acadia					1		4
Allen							0
Ascension							1
Assumption							1
Avoyelles					2		3
Beauregard							1
Bienville							0
Bossier					2		4
Caddo					5		3
Calcasieu					2		5
Caldwell							0
Cameron							1
Catahoula							0
Claiborne							0
Concordia							0
De Soto					1		3
East Baton Rouge					4		5
East Carroll							0
East Feliciana							0
Evangeline					1		3
Franklin					1		3
Grant							0
Iberia					1		4
Iberville							1
Jackson							0
Jefferson					3		4
Jefferson Davis							1
La Salle							0
Lafayette					1		5
Lafourche							1
Lincoln					3		3
Livingston					1		4
Madison					3		3
Morehouse					2		3
Natchitoches					1		3
Orleans					4		6
Ouachita					3		3
Plaquemines							1
Pointe Coupee							1
Rapides							0
Red River							0
Richland					1		3
Sabine							0
St. Bernard					1		5
St. Charles							1
St. Helena							0
St. James							1
St. John the Baptist							1
St. Landry					4		4
St. Martin					1		4

Parish Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
St. Mary					1		4
St. Tammany					1		3
Tangipahoa					1		4
Tensas					1		3
Terrebonne							1
Union							0
Vermilion					1		4
Vernon							0
Washington					1		3
Webster							0
West Baton Rouge							1
West Carroll							0
West Feliciana							0
Winn							0

IMAGE RIGHT: SPC. DAVID WILLIAMS AND SPC. TAMEISHA MCKAY, ALABAMA NATIONAL GUARD'S 214TH MILITARY POLICE COMPANY, GUARD A DESTROYED WALGREENS AGAINST LOOTERS IN THE AFTERMATH OF HURRICANE IDA, LAROSE, LA. SEP. 9, 2021 | THE NATIONAL GUARD

LOUISIANA

TOTAL: 18 DISASTERS
FEMA PA + HM: $2.5 B
HUD CDBG-DR: $5.6B
FEMA + HUD ASSISTANCE: $8.1 B

County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	2011 — 4015: FLOODING		2011 — 4041: TROPICAL STORM LEE		2012 — 4080: HURRICANE ISAAC		2013 — 4102: SEVERE STORMS AND FLOODING		2015 — 4228: SEVERE STORMS AND FLOODING		2016 — 4263: SEVERE STORMS AND FLOODING		2016 — 4277: SEVERE STORMS AND FLOODING		2017 — 4300: SEVERE STORMS, TORNADOES, AND STRAIGHT-LINE WINDS		2017 — 4345: TROPICAL STORM HARVEY		2019 — 4439: SEVERE STORMS AND TORNADOES		2019 — 4458: HURRICANE BARRY		2019 — 4462: FLOODING		2020 — 4559: HURRICANE LAURA		2020 — 4570: HURRICANE DELTA		2021 — 4577: HURRICANE ZETA		2021 — 4590: SEVERE WINTER STORMS		2021 — 4606: SEVERE STORMS, TORNADOES, AND FLOODING		2021 — 4611: HURRICANE IDA	
			PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	18	$832,370,927	$1,835,633	$99,078	$486,460	$10,404	$109,793,036	$5,852,421	$594,188	$930	$1,013,247	$0	$19,738,351	$118,594	$247,646,188	$13,105,156			$3,239,272	$13,753	$19,579,682	$0	$22,286,392	$0	$5,194,235	$0	$321,971,429	$0	$34,239,889	$0	$5,001,700	$0	$9,460,194	$0	$90,998	$0	$10,999,698	$0
Acadia Parish	9	$7,110,859					$6,977	$0	$3,914,829	$0					$1,054,429	$0			$5,125	$0							$1,638,434	$0	$491,064	$0	$0	$0	$0	$0			$0	$0
Allen Parish	9	$17,119,855					$7,694	$0					$62,693	$223,500					$131,069	$0			$118,494	$0			$16,522,129	$0	$43,025	$0	$0	$0	$11,250	$0			$0	$0
Ascension Parish	11	$98,675,203	$0	$0			$1,646,366	$370,586					$869,146	$239,250	$87,520,444	$7,139,729							$611,172	$0			$126,619	$0	$130,346	$0	$11,747	$0	$3,274	$0	$6,525	$0	$0	$0
Assumption Parish	12	$1,008,407	$0	$0			$102,790	$370,752							$145,077	$70,125			$25,208	$0			$123,214	$0	$69,367	$0	$3,621	$0	$3,150	$0	$0	$0	$0	$0	$0	$0	$95,104	$0
Avoyelles Parish	8	$590,701	$0	$0			$74,126	$0					$44,868	$34,500	$227,019	$210,187											$0	$0	$0	$0			$0	$0			$0	$0
Beauregard Parish	8	$10,641,261					$0	$0					$577,016	$0					$188,986	$0							$9,867,724	$0	$7,535	$0	$0	$0	$0	$0			$0	$0
Bienville Parish	5	$242,032											$137,435	$0													$89,823	$0	$0	$0			$14,774	$0			$0	$0
Bossier Parish	7	$33,116,482					$18,285	$0			$2,553,846	$1,006,945	$28,412,787	$652,302													$188,520	$0	$0	$0			$283,797	$0			$0	$0
Caddo Parish	7	$2,767,916					$0	$0			$590,912	$0	$1,098,893	$972,675													$62,372	$0	$0	$0			$43,064	$0			$0	$0
Calcasieu Parish	8	$424,564,291											$1,501,592	$643,692					$2,270,234	$670,326							$416,982,934	$0	$1,671,848	$0	$0	$0	$150,887	$0	$667,727	$0	$5,050	$0
Caldwell Parish	7	$1,838,629					$59,425	$0					$493,672	$315,053											$879,278	$0	$52,124	$0	$28,241	$0			$10,837	$0			$0	$0
Cameron Parish	9	$34,691,537					$1,878	$0							$425,976	$187,500			$274,959	$0			$26,340	$0			$33,774,884	$0	$0	$0	$0	$0	$0	$0			$0	$0
Catahoula Parish	9	$1,629,863	$0	$0			$6,613	$0	$105,222	$0			$207,600	$40,121											$882,180	$0	$210,509	$0	$146,800	$0			$30,818	$0			$0	$0
Claiborne Parish	6	$470,022					$0	$0					$399,985	$0													$66,169	$0	$0	$0			$3,869	$0			$0	$0
Concordia Parish	8	$1,375,840	$56,386	$0			$13,937	$0	$82,896	$0															$1,105,856	$0	$5,745	$0	$4,191	$0			$106,829	$0			$0	$0
De Soto Parish	6	$1,203,338											$1,119,775	$0					$20,972	$0							$62,590	$0	$0	$0			$0	$0			$0	$0
East Baton Rouge Parish	10	$239,364,932	$0	$0			$6,767,270	$1,031,989							$185,713,002	$39,998,669							$2,908,802	$0			$703,674	$0	$1,762,624	$0	$0	$0	$220,540	$0	$17,520	$0	$240,844	$0
East Carroll Parish	9	$780,543	$497,126	$0			$0	$0	$14,504	$0			$20,798	$0											$248,114	$0	$0	$0	$0	$0			$0	$0			$0	$0
East Feliciana Parish	9	$7,682,089			$22,788	$0	$238,587	$0							$7,252,861	$105,750							$7,075	$0			$0	$0	$11,769	$0	$0	$0	$0	$0			$43,259	$0
Evangeline Parish	8	$1,075,726					$68,919	$0	$208,849	$0					$255,772	$0											$542,185	$0	$0	$0	$0	$0	$0	$0			$0	$0
Franklin Parish	8	$349,912					$30,046	$0	$147,085	$0			$172,781	$0											$0	$0	$0	$0	$0	$0			$0	$0			$0	$0
Grant Parish	6	$1,233,287									$32,007	$0	$167,465	$32,501													$738,833	$0	$262,481	$0			$0	$0			$0	$0
Iberia Parish	10	$8,623,034	$0	$0			$155,367	$0							$1,027,166	$231,000			$16,879	$0			$1,047,216	$0			$5,129,765	$0	$1,006,317	$0	$0	$0	$9,323	$0			$0	$0
Iberville Parish	11	$3,000,140	$0	$0			$1,108,723	$0							$1,044,601	$289,583							$269,999	$0	$76,577	$0	$168,686	$0	$0	$0	$0	$0	$7,500	$0	$0	$0	$34,471	$0
Jackson Parish	6	$2,905,715					$1,017	$0					$1,287,227	$0													$1,617,471	$0	$0	$0			$0	$0			$0	$0
Jefferson Davis Parish	9	$8,451,241					$0	$0	$281,301	$0					$787,200	$240,000			$21,425	$0							$6,942,551	$0	$178,763	$0	$0	$0	$0	$0			$0	$0
Jefferson Parish	8	$78,811,510			$1,824,309	$0	$30,536,761	$8,573,541															$770,025	$0			$1,045,801	$0	$136,211	$0	$1,945,782	$0	$0	$0			$33,979,080	$0
Lafayette Parish	10	$39,102,260					$488,602	$0							$13,714,131	$4,802,648			$25,221	$0			$2,074,653	$0			$4,211,664	$0	$13,517,528	$0	$0	$0	$166,478	$0	$0	$0	$101,336	$0
Lafourche Parish	12	$15,101,926	$0	$738,285	$919,215	$0	$5,875,951	$0					$0	$0					$419,106	$0			$2,877,660	$0			$356,568	$0	$2,192,269	$0	$1,323,000	$0	$0	$0	$0	$0	$399,872	$0
LaSalle Parish	7	$958,186	$0	$0			$10,855	$0					$71,889	$0													$854,065	$0	$3,658	$0			$17,719	$0			$0	$0
Lincoln Parish	7	$6,514,923					$20,716	$0					$786,469	$93,070							$3,223,479	$0					$2,299,979	$0	$0	$0			$91,209	$0			$0	$0
Livingston Parish	11	$188,250,359					$2,245,357	$4,804,169	$261,477	$0			$476,348	$383,460	$161,420,851	$17,715,745	$0	$0					$428,990	$0			$98,683	$0	$182,938	$0	$0	$0	$130,661	$0			$101,680	$0
Madison Parish	8	$642,266	$53,402	$0			$0	$0	$118,213	$0			$470,651	$0													$0	$0	$0	$0			$0	$0			$0	$0
Morehouse Parish	7	$871,264					$145,232	$0					$399,398	$0							$0	$0					$326,634	$0	$0	$0			$0	$0			$0	$0
Natchitoches Parish	8	$7,941,986					$6,432	$0			$2,644,085	$0	$2,673,562	$67,775					$92,494	$0							$2,283,818	$0	$0	$0			$173,821	$0			$0	$0
Orleans Parish	8	$68,823,627					$30,583,110	$5,934,434									$0	$516,700					$3,831,105	$0			$601,225	$0	$24,360	$0	$2,431,475	$0	$14,152	$0			$24,887,065	$0
Ouachita Parish	7	$17,817,125					$461,591	$0					$12,577,432	$596,129											$1,067,874	$0	$3,016,458	$0	$9,815	$0			$87,826	$0			$0	$0
Plaquemines Parish	9	$83,024,861			$898,274	$0	$66,325,412	$12,118,481											$489,891	$0			$1,342,412	$0			$329,996	$0	$129,079	$0	$1,391,317	$0	$0	$0			$0	$0
Pointe Coupee Parish	10	$1,058,394	$21,167	$0			$325,614	$0							$240,726	$95,813							$92,858	$0	$81,655	$0	$84,960	$0	$81,226	$0	$0	$0	$10,613	$0			$23,763	$0
Rapides Parish	9	$10,623,775					$342,911	$0			$177,274	$0	$143,512	$114,288					$25,879	$0					$5,006	$0	$8,876,569	$0	$938,335	$0			$0	$0			$0	$0
Red River Parish	7	$469,220									$168,585	$0	$291,544	$0					$0	$0							$9,092	$0	$0	$0			$0	$0			$0	$0
Richland Parish	6	$956,949					$3,191	$0					$853,826	$0													$0	$0	$78,717	$0			$21,216	$0			$0	$0
Sabine Parish	6	$2,859,966											$1,712,096	$0					$432,678	$0							$604,938	$0	$0	$0			$110,254	$0			$0	$0
St. Bernard Parish	8	$7,209,101			$232,098	$0	$3,566,899	$0															$204,411	$0			$305,252	$0	$26,877	$0	$2,873,564	$0	$0	$0			$0	$0
St. Charles Parish	11	$23,533,875	$0	$0	$495,255	$0	$4,636,039	$6,209,500							$445,325	$538,486			$362,200	$0			$38,934	$0			$182,253	$0	$40,568	$0	$664,753	$0	$0	$0			$9,920,563	$0
St. Helena Parish	9	$1,042,052					$180,700	$0					$96,939	$91,988	$531,126	$0							$28,288	$0			$0	$0	$20,750	$0	$0	$0	$0	$0			$92,261	$0
St. James Parish	8	$3,655,956	$20,690	$0			$881,339	$250,502							$401,897	$0											$66,878	$0	$0	$0	$0	$0	$0	$0			$2,034,650	$0
St. John the Baptist Parish	8	$60,805,291					$49,434,136	$3,175,124							$180,775	$301,560							$156,845	$0			$109,964	$0	$0	$0	$0	$0	$0	$0			$7,446,887	$0
St. Landry Parish	10	$4,236,069	$0	$0			$202,239	$0	$93,519	$0					$2,548,102	$0							$207,087	$0			$507,014	$0	$518,891	$0	$0	$0	$107,825	$0			$51,392	$0
St. Martin Parish	10	$2,776,555	$0	$0			$109,098	$0							$1,122,999	$0							$389,000	$0	$157,510	$0	$236,197	$0	$761,751	$0	$0	$0	$0	$0			$0	$0
St. Mary Parish	10	$10,127,321	$394,832	$0			$784,084	$563,996											$47,894	$0			$3,032,557	$0	$4,826,305	$0	$260,179	$0	$167,973	$0	$0	$0	$11,023	$0			$38,478	$0
St. Tammany Parish	8	$34,090,165					$7,447,946	$4,451,828					$19,933,313	$887,453	$58,062	$705,000											$39,553	$0	$0	$0	$549,338	$0	$0	$0			$17,673	$0
Tangipahoa Parish	9	$17,854,466					$1,832,332	$1,415,409					$1,080,587	$1,394,623	$6,718,439	$3,855,864							$281,293	$0			$126,611	$0	$0	$0	$39,555	$0	$25,364	$0			$1,084,390	$0
Tensas Parish	6	$81,528	$5,255	$0			$0	$0																			$0	$0	$0	$0			$76,274	$0			$0	$0
Terrebonne Parish	10	$16,648,791	$2,644,098	$0	$687,983	$839,208	$2,668,736	$1,514,067															$5,235,379	$0	$0	$0	$1,923,660	$0	$515,627	$0	$332,261	$0	$0	$0			$287,772	$0
Union Parish	7	$3,574,348					$4,526	$0					$3,455,844	$38,849							$39,846	$0					$35,282	$0	$0	$0			$0	$0			$0	$0
Vermilion Parish	10	$13,171,998					$302,115	$0	$104,487	$0					$2,173,988	$230,014			$129,558	$0			$707,430	$0			$8,343,553	$0	$929,146	$0	$0	$0	$0	$0			$251,708	$0
Vernon Parish	6	$3,573,126											$1,207,760	$1,516,909					$23,582	$0							$814,531	$0	$10,345	$0			$0	$0			$0	$0
Washington Parish	8	$5,147,601					$561,560	$1,239,998					$1,386,326	$1,517,007	$214,200	$5,100											$0	$0	$0	$0	$0	$0	$0	$0			$223,410	$0
Webster Parish	5	$5,641,058											$5,404,330	$0													$233,070	$0	$0	$0			$3,658	$0			$0	$0
West Baton Rouge Parish	8	$1,102,094	$0	$0			$210,302	$0							$466,134	$179,175											$66,136	$0	$150,665	$0	$0	$0	$3,005	$0			$26,677	$0
West Carroll Parish	6	$736,957					$0	$0					$736,957	$0													$0	$0	$0	$0			$0	$0			$0	$0
West Feliciana Parish	12	$8,551,108	$24,539	$0	$4,546	$0	$112,011	$0			$71,789	$0			$4,740,586	$331,023							$54,540	$0	$2,969,452	$0	$27,224	$0	$199,528	$0	$0	$0	$3,545	$0			$12,326	$0
Winn Parish	5	$5,469,944											$1,040,140	$0													$4,400,317	$0	$26,002	$0			$0	$0			$3,485	$0
Total FEMA Allocation		$2,495,741,785	$5,553,128	$837,363	$5,570,929	$849,612	$330,406,851	$57,876,796	$5,926,569	$930	$7,251,744	$1,006,945	$111,111,008	$9,973,738	$728,077,077	$90,338,126	$0	$516,700	$8,242,630	$684,079	$22,843,008	$0	$49,152,174	$0	$17,563,409	$0	$860,146,914	$0	$60,650,301	$0	$16,564,490	$0	$11,411,598	$0	$782,770	$0	$92,402,895	$0

MAINE

MAINE STATISTICS SUMMARY (2011 – 2021)	
6	CLIMATE DISASTER DECLARATIONS
YORK	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
1	COUNTY WITH FIVE OR MORE DISASTERS
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
WASHINGTON	HIGHEST NEED FOR INVESTMENT
$24 MILLION	FEMA + HUD POST-DISASTER FUNDING
YORK	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
1.3 MILLION	POPULATION TOTAL
$18	PER CAPITA SPENDING ON CLIMATE DISASTERS
$1 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

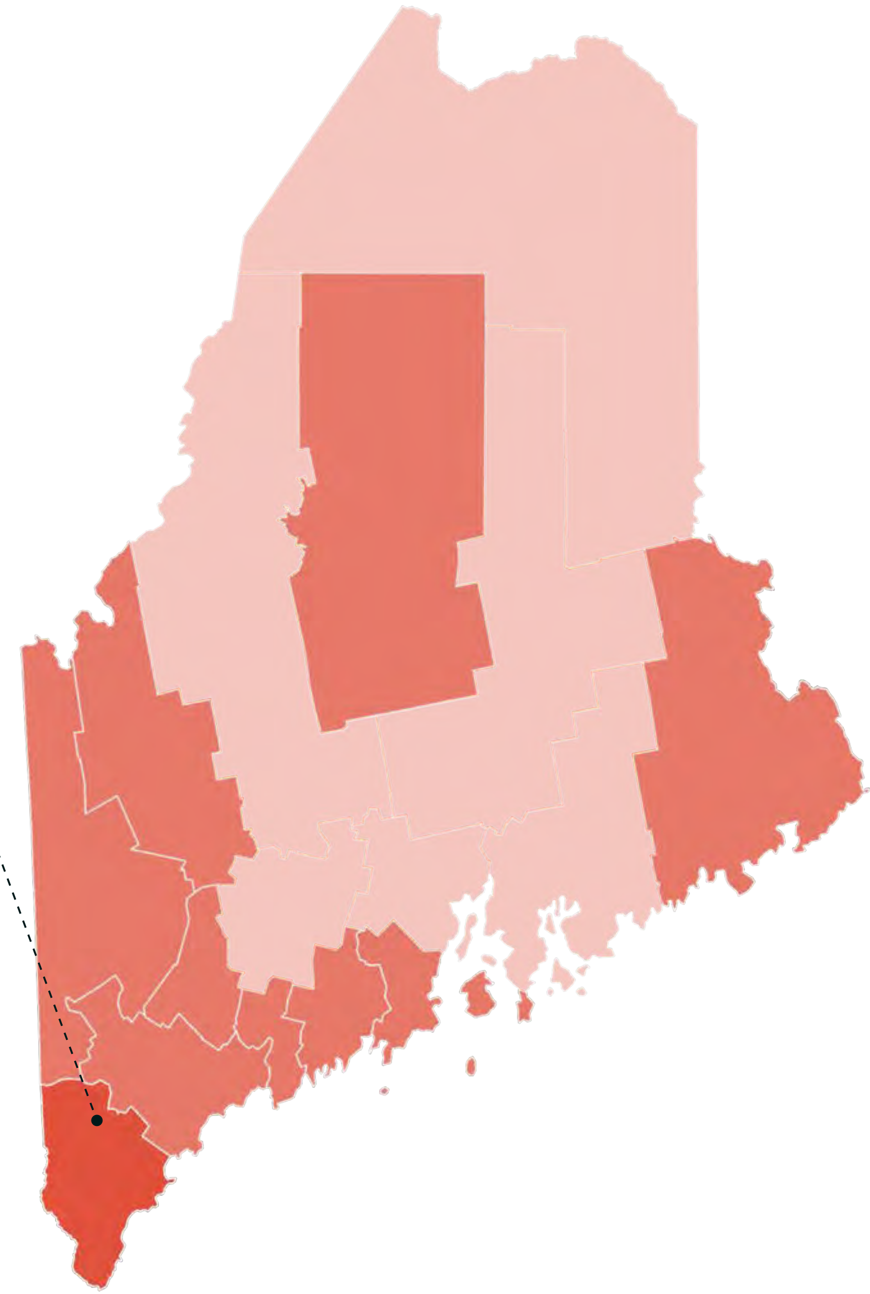
DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

6
disaster
declarations

Every county in Maine has had at least one recent disaster declaration.

York County has had the highest number of disaster declarations in the state: 5 disasters.



Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

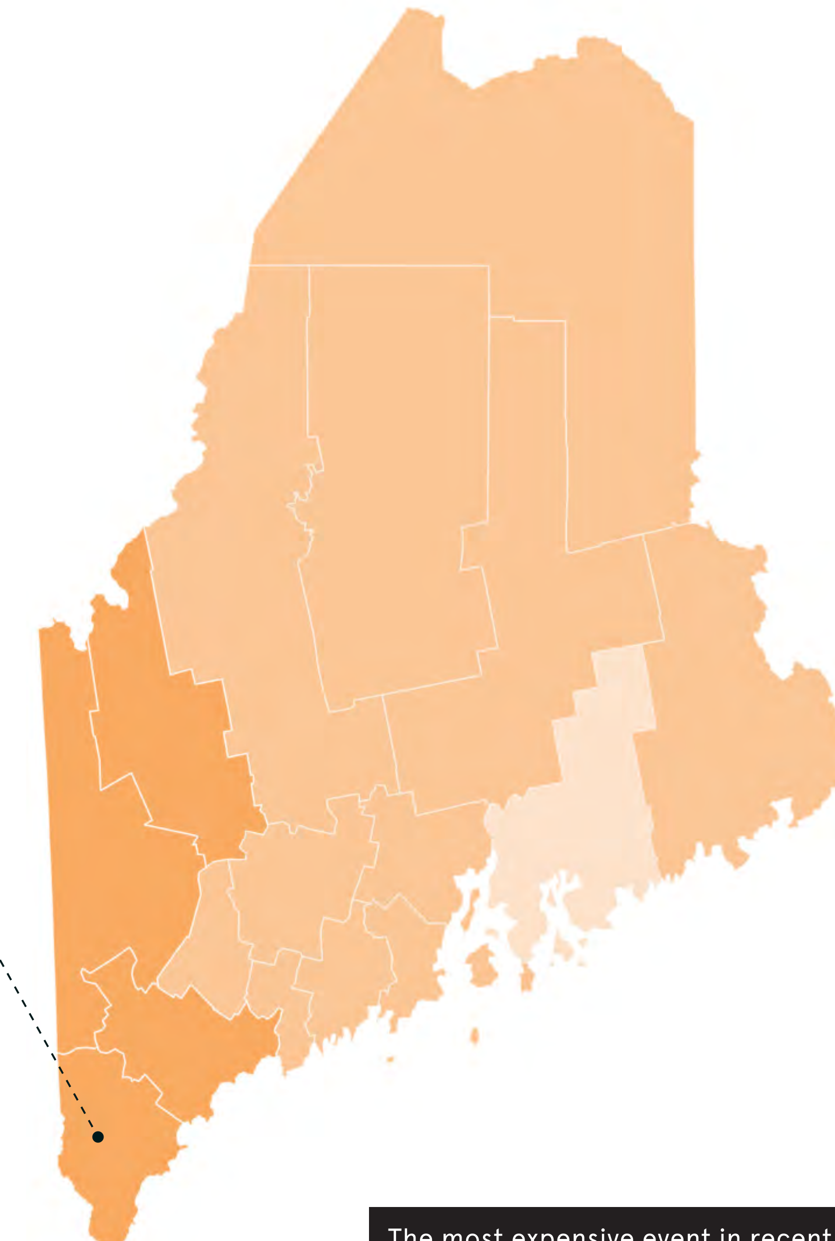
FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS 2011 – 2021

$24M
post-disaster
assistance

$24M	FEMA obligations
$0B	HUD CDBG-DR Funds
$24M	FEMA + HUD assistance
$18	per capita cost

York County has received the most post-disaster FEMA funding in the state: $9 million.



FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

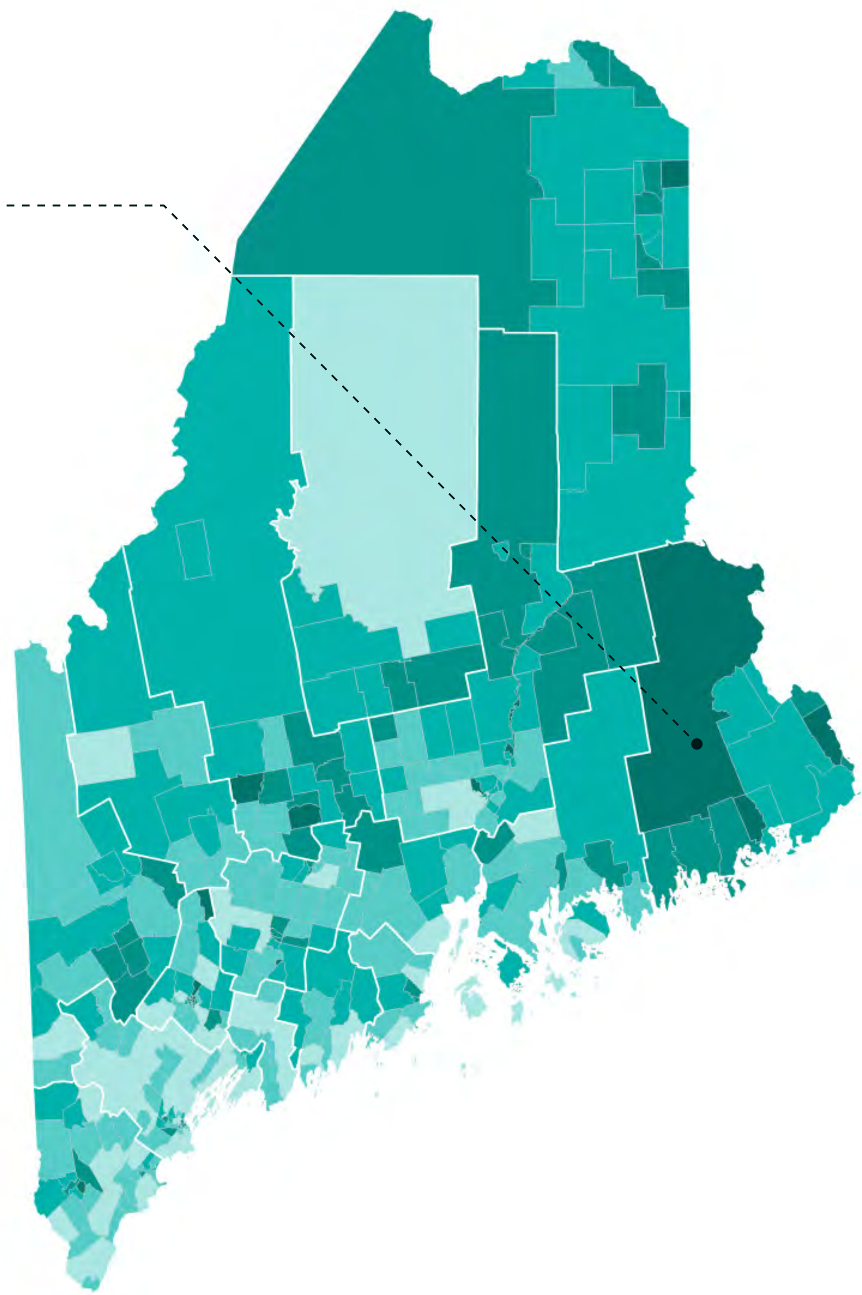
The most expensive event in recent history was Hurricane Laura in 2020, which totaled over $860 million in FEMA post-disaster assistance.

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Washington County has the highest percent of Native American residents in the state.



Social Vulnerability Index

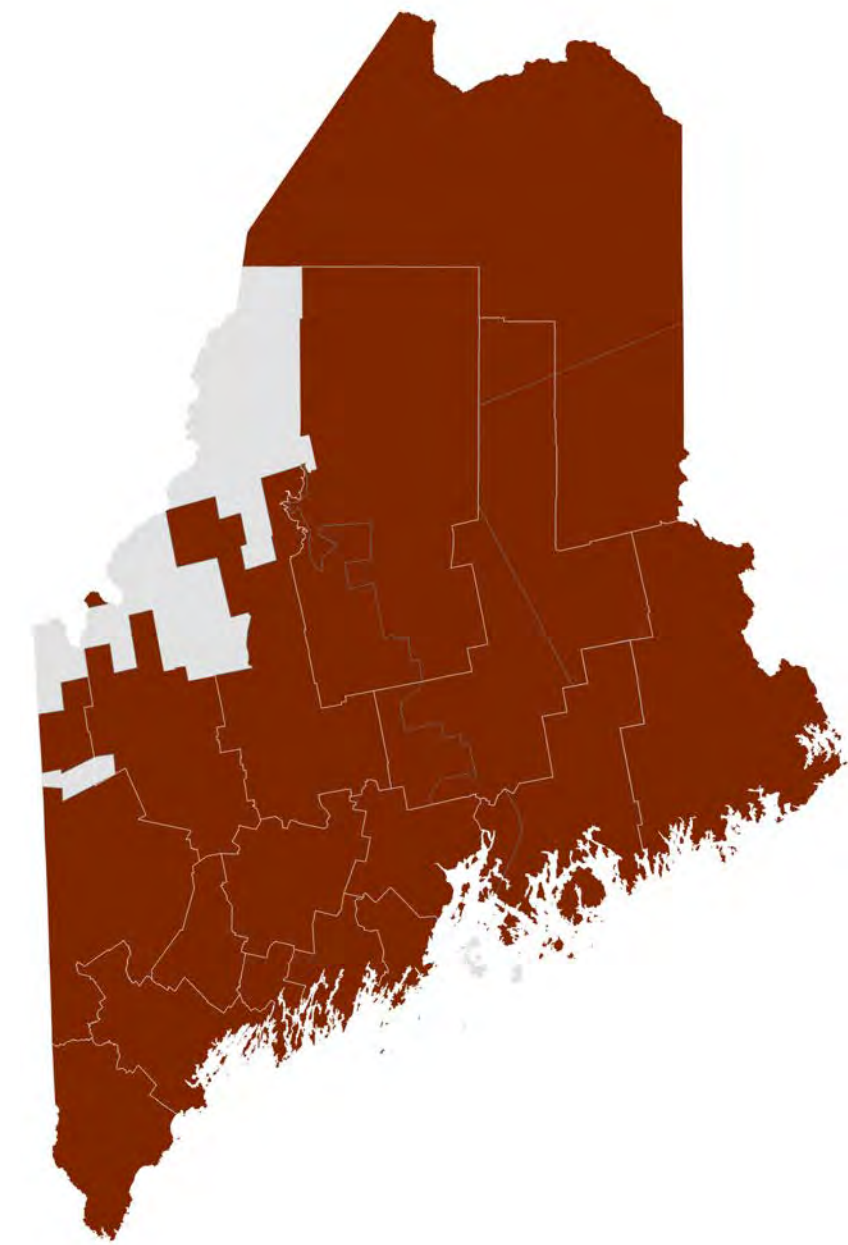
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration

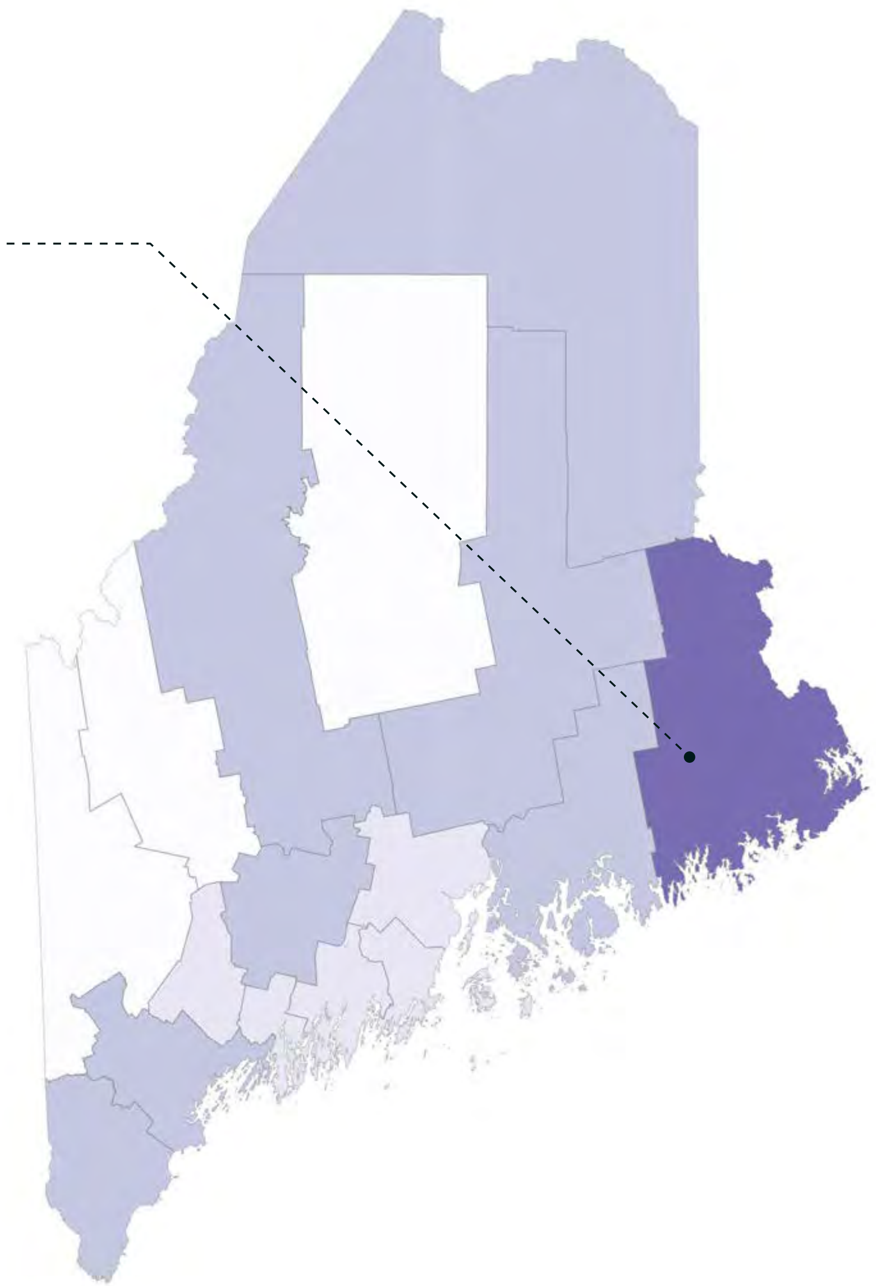
Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Washington County has high risk of climate disasters, high poverty, high health risks, and risk of sea level rise.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Androscoggin					1		1
Aroostook					1		2
Cumberland					1		2
Franklin							0
Hancock					1		2
Kennebec					1		2
Knox							1
Lincoln							1
Oxford							0
Penobscot					1		2
Piscataquis							0
Sagadahoc							1
Somerset					1		2
Waldo							1
Washington					1		4
York					1		2

MAINE

TOTAL: 6 DISASTERS FEMA PA + HM: $24 M HUD CDBG-DR: none FEMA + HUD ASSISTANCE: $24 M			2011				2013		2015		2018			
			1953: SEVERE STORMS AND FLOODING		4032: TROPICAL STORM IRENE		4108: SEVERE WINTER STORM, SNOWSTORM, AND FLOODING		4208: SEVERE WINTER STORM, SNOWSTORM, AND FLOODING		4354: SEVERE STORM AND FLOODING		4367: SEVERE STORM AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	6	$3,176,754	$228,589	$702	$194,029	$3,180	$242,816	$8,634	$182,505	$19,223	$2,100,660	$8,513	$124,185	$63,718
Androscoggin County	2	$837,391					$342,358	$99,909	$395,125	$0				
Aroostook County	1	$620,268	$620,268	$0										
Cumberland County	3	$3,495,988					$1,094,100	$70,241	$1,021,858	$0	$1,309,789	$0		
Franklin County	2	$1,571,764			$671,428	$297,416					$602,920	$0		
Hancock County	1	$36,143									$36,143	$0		
Kennebec County	1	$691,051									$691,051	$0		
Knox County	2	$417,161					$253,086	$0			$164,075	$0		
Lincoln County	2	$345,231			$35,626	$0					$309,605	$0		
Oxford County	2	$1,680,217			$758,693	$0					$921,524	$0		
Penobscot County	1	$457,603									$457,603	$0		
Piscataquis County	2	$227,830	$103,867	$89,292							$34,670	$0		
Sagadahoc County	3	$454,708					$85,577	$0	$78,661	$0	$290,470	$0		
Somerset County	1	$161,563									$161,563	$0		
Waldo County	1	$64,225									$64,225	$0		
Washington County	2	$719,619	$647,731	$0			$71,888	$0						
York County	5	$8,997,545			$336,111	$0	$1,025,132	$0	$965,413	$0	$1,284,175	$0	$5,190,444	$196,269
Total FEMA Allocation		$23,955,061	$1,600,456	$89,994	$1,995,887	$300,596	$3,114,957	$178,784	$2,643,562	$19,223	$8,428,474	$8,513	$5,314,629	$259,987

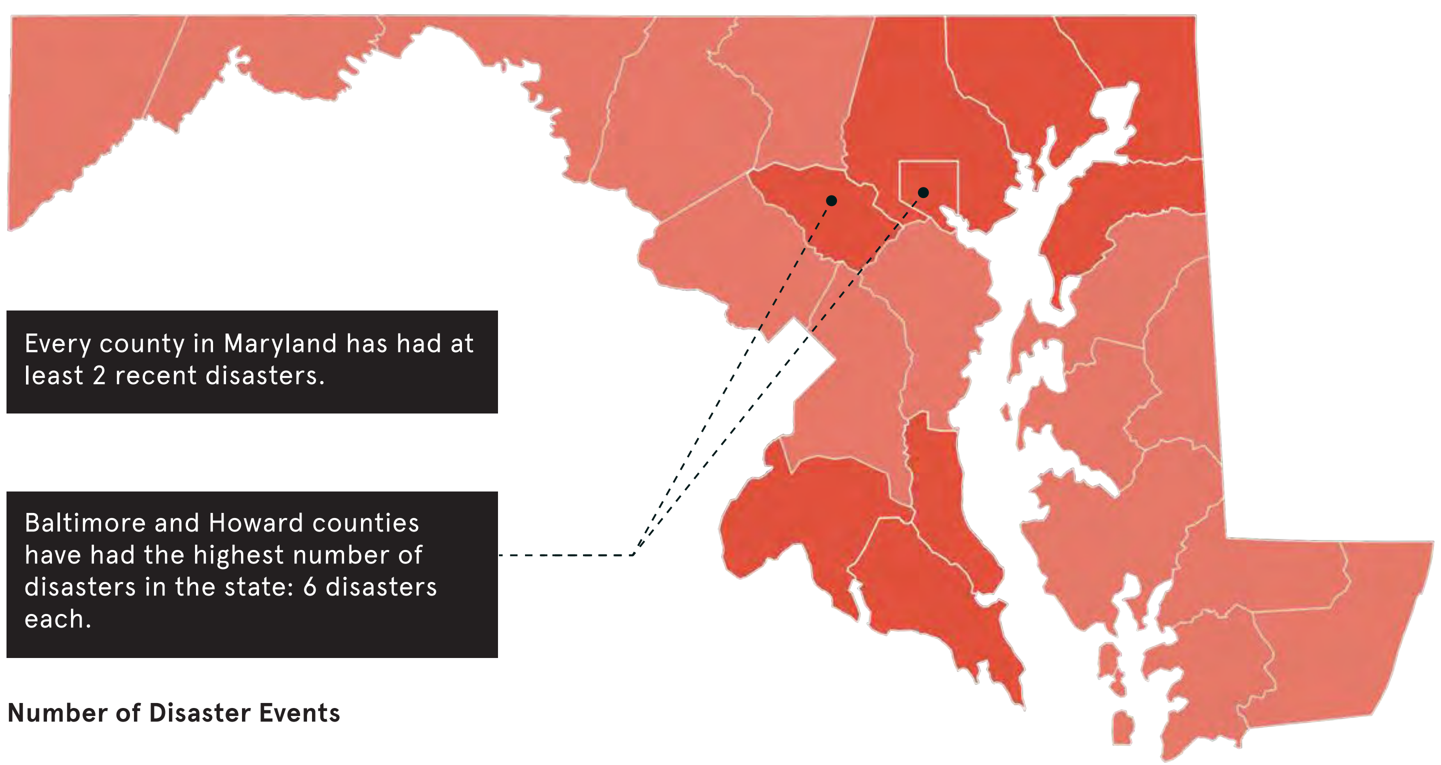
MARYLAND

MARYLAND STATISTICS SUMMARY (2011 – 2021)	
10	CLIMATE DISASTER DECLARATIONS
BALTIMORE, HOWARD	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
5	COUNTIES WITH FIVE OR MORE DISASTERS
86	SUPERFUND SITES
78	WASTEWATER DISCHARGE SITES
C	ASCE INFRASTRUCTURE REPORT CARD GRADE
BALTIMORE CITY	HIGHEST COMPOUNDING RISKS
$237 MILLION	FEMA + HUD POST-DISASTER FUNDING
HOWARD	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
6 MILLION	POPULATION TOTAL
$39	PER CAPITA SPENDING ON CLIMATE DISASTERS
$5.2 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

10
disaster declarations



Every county in Maryland has had at least 2 recent disasters.

Baltimore and Howard counties have had the highest number of disasters in the state: 6 disasters each.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

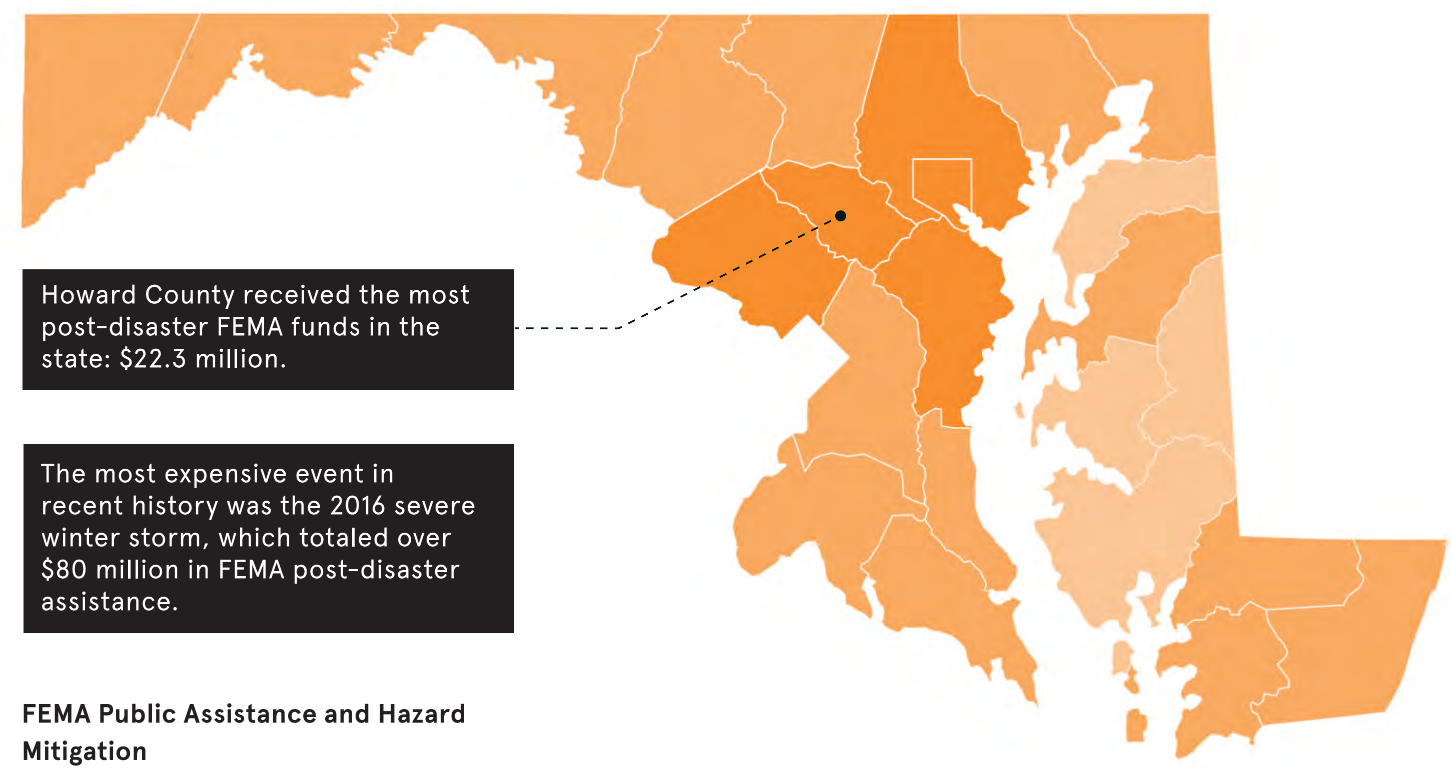
Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$237M
post-disaster assistance

$208M	FEMA obligations
$29M	HUD CDBG-DR Funds
$237M	FEMA + HUD assistance
$39	per capita cost



Howard County received the most post-disaster FEMA funds in the state: $22.3 million.

The most expensive event in recent history was the 2016 severe winter storm, which totaled over $80 million in FEMA post-disaster assistance.

FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011–2021)

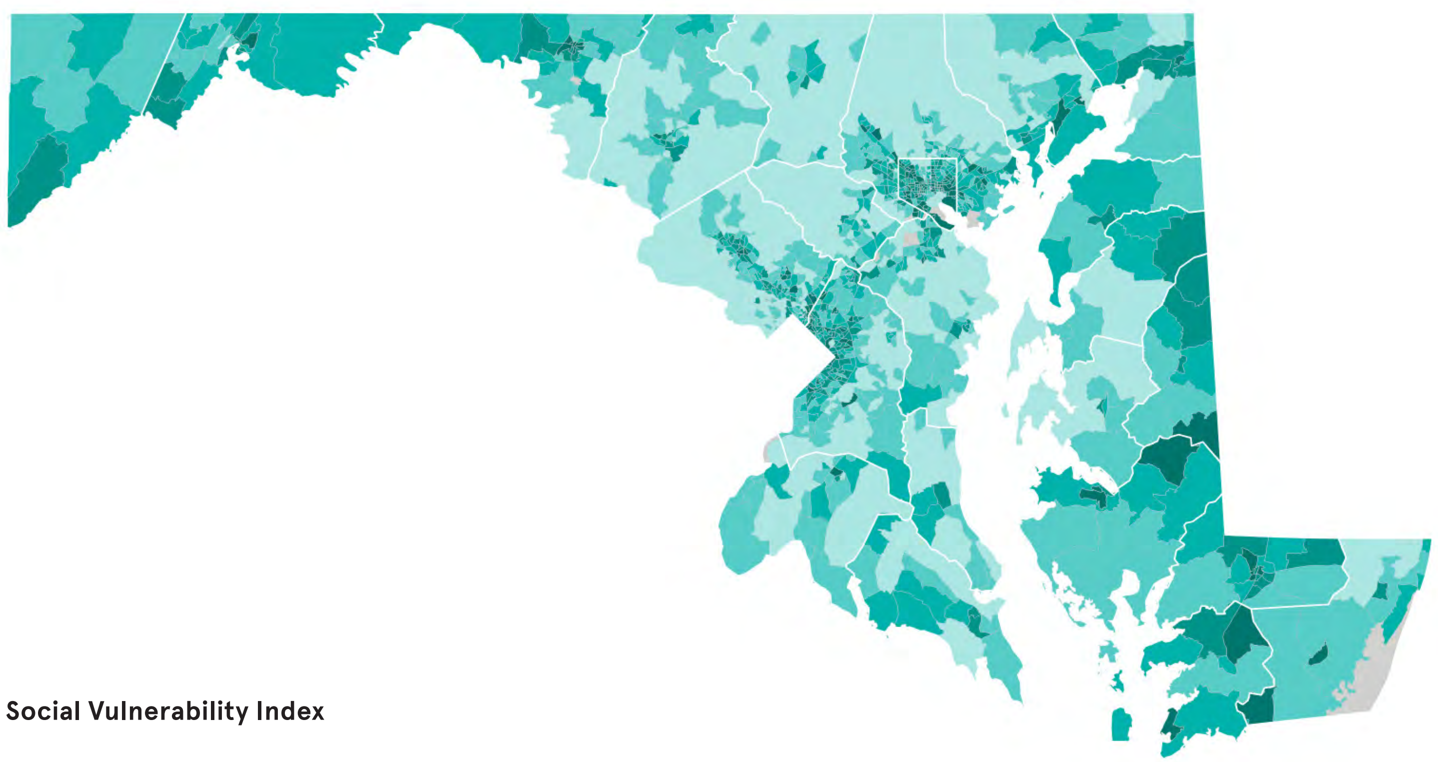
- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Baltimore City, Somerset, Dorchester, and Wicomico counties have high poverty, high diversity of disasters, and low investments from previous disasters.



Social Vulnerability Index

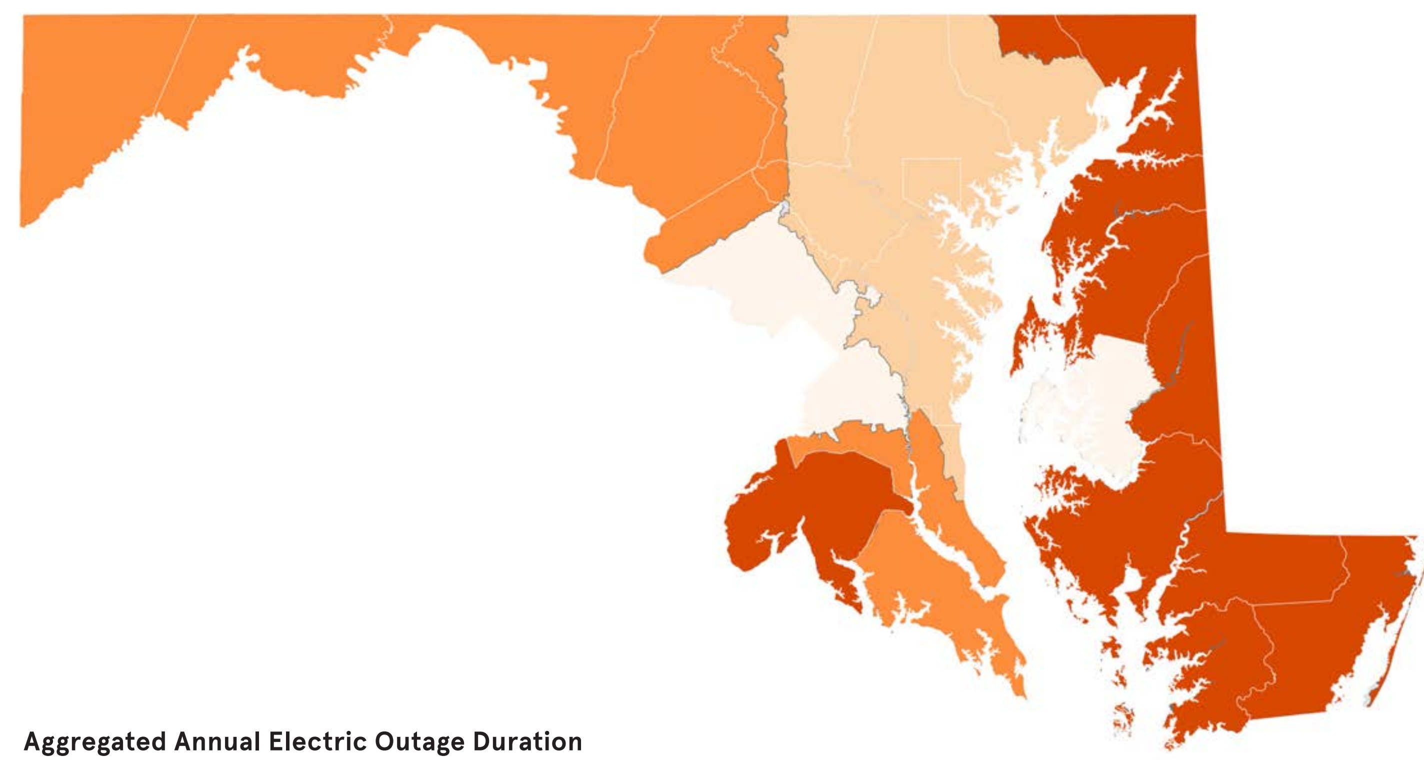
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



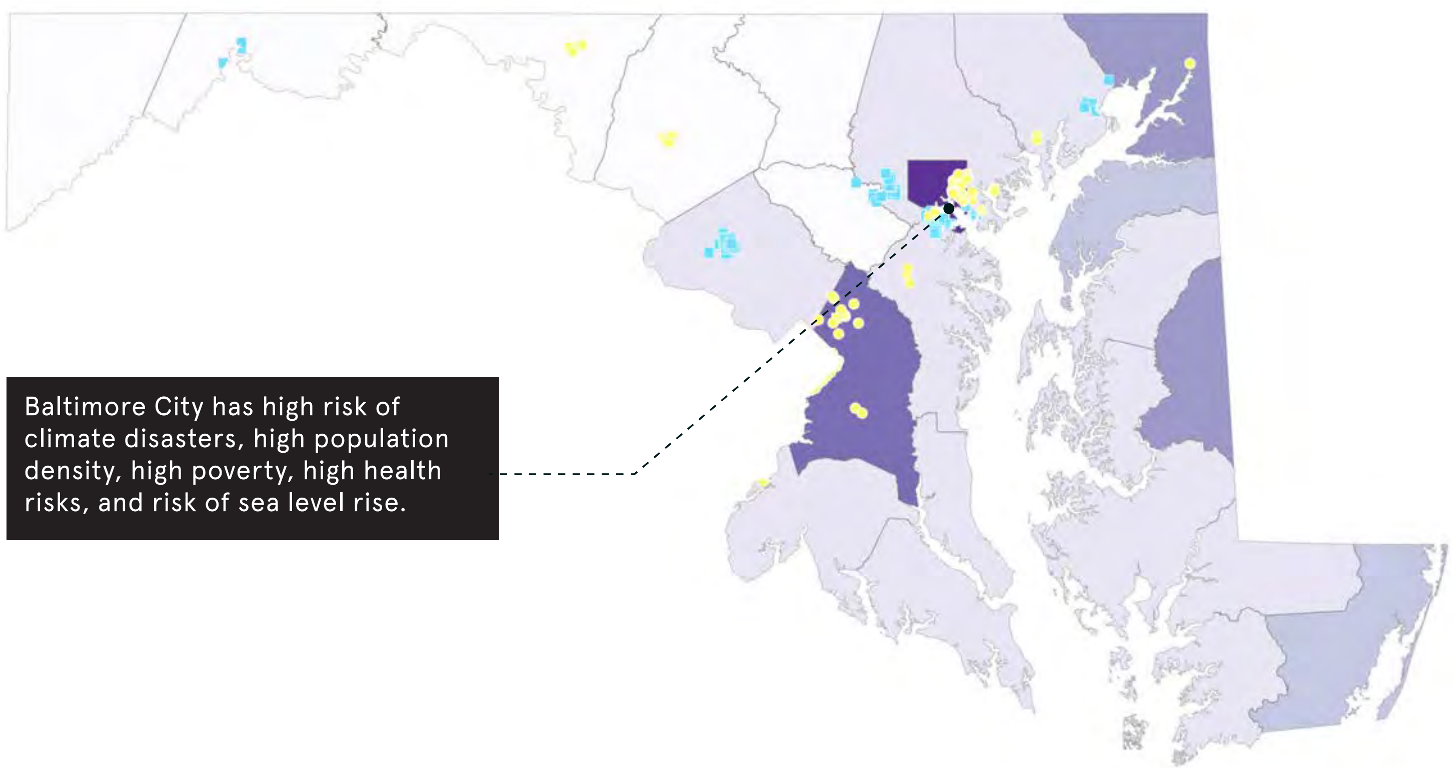
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Baltimore City has high risk of climate disasters, high population density, high poverty, high health risks, and risk of sea level rise.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Allegany							0
Anne Arundel							1
Baltimore City					7		5
Baltimore County							1
Calvert							1
Caroline					1		3
Carroll							1
Cecil					1		3
Charles							1
Dorchester							1
Frederick							0
Garrett							0
Harford							1
Howard							0
Kent					1		2
Montgomery							1
Prince George's					3		4
Queen Anne's							1
Somerset							1
St. Mary's							1
Talbot							1
Washington							0
Wicomico							1
Worcester					1		2

MARYLAND

TOTAL: 10 DISASTERS FEMA PA + HM: $208 M HUD CDBG-DR: $29 M FEMA + HUD ASSISTANCE: $237M			2011				2012				2014		2016				2018				2021	
			4034: HURRICANE IRENE		4038: REMNANTS OF TROPICAL STORM LEE		4075: SEVERE STORMS AND STRAIGHT-LINE WINDS		4091: HURRICANE SANDY		4170: SNOWSTORM		4261: SEVERE WINTER STORM AND SNOWSTORM		4279: SEVERE STORM AND FLOODING		4374: SEVERE STORMS AND FLOODING		4376: SEVERE STORM AND FLOODING		4583: TROPICAL STORM ISAIAS	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	10	$61,994,899	$7,887,996	$23,169	$536,644	$34,841	$870,376	$93,047	$10,175,448	$291,280	$4,598,645	$146,705	$27,771,478	$4,139,470	$1,079,961	$51,063	$1,018,229	$83,177	$2,076,062	$443,835	$673,473	$0
Allegany County	2	$1,372,494							$148,745	$113,569			$360,179	$750,000								
Anne Arundel County	3	$8,198,373			$1,556,819	$1,078,240			$777,597	$0			$2,426,303	$2,359,413								
Baltimore County	6	$19,022,539	$1,698,372	$0	$1,646,735	$22,500			$830,547	$384,707	$2,613,161	$0	$4,811,266	$1,955,400					$5,059,849	$0		
Calvert County	5	$4,380,251	$1,884,119	$0			$61,897	$0	$291,145	$417,799			$535,890	$797,636							$391,765	$0
Caroline County	3	$813,402	$431,195	$0					$275,290	$0			$106,917	$0								
Carroll County	3	$3,014,580							$509,238	$89,550	$702,096	$0	$1,339,423	$374,273								
Cecil County	4	$975,670	$255,247	$0	$212,157	$17,280			$129,095	$0			$361,891	$0								
Charles County	5	$6,964,613	$612,446	$0	$1,095,215	$0	$1,670,168	$194,463	$121,981	$1,987,433			$1,282,907	$0								
Dorchester County	3	$680,583	$234,684	$0					$271,788	$47,159											$126,952	$0
Frederick County	3	$7,152,310							$953,608	$64,108			$1,662,723	$0			$4,445,451	$26,419				
Garrett County	2	$1,619,188							$1,316,058	$39,840			$221,290	$42,000								
Harford County	4	$7,455,426	$1,097,477	$2,202,000	$766,340	$66,000			$1,281,855	$4,406			$1,830,348	$207,000								
Howard County	6	$22,270,523			$1,515,491	$0			$692,463	$33,600	$715,738	$128,955	$1,757,903	$60,000	$6,382,583	$1,041,101			$9,942,690	$0		
Kent County	4	$508,341	$203,709	$0			$66,023	$0	$90,862	$0			$147,747	$0								
Montgomery County	3	$20,706,753					$7,401,940	$0	$2,449,879	$0			$10,854,934	$0								
Prince George's County	3	$8,215,067			$3,689,559	$0	$1,401	$0	$1,458,865	$0			$3,065,241	$0								
Queen Anne's County	3	$1,374,316	$362,168	$0					$347,597	$232,513			$355,575	$76,463								
St. Mary's County	4	$4,244,597	$2,702,250	$0			$0	$69,039	$310,773	$0											$1,162,534	$0
Somerset County	2	$3,982,658	$174,818	$0					$3,290,386	$517,454												
Talbot County	2	$338,644	$131,851	$0					$206,793	$0												
Washington County	3	$3,302,894							$247,734	$0			$737,135	$0			$2,318,025	$0				
Wicomico County	2	$849,807	$310,175	$0					$513,232	$26,400												
Worcester County	3	$1,782,198	$330,918	$74,198					$1,051,128	$63,132			$174,080	$88,742								
Baltimore City	5	$16,730,773	$1,551,419	$0			$1,968,702	$612,910	$3,007,340	$0	$48,935	$0	$9,464,466	$77,000								
Total FEMA Allocation		$207,950,899	$19,868,844	$2,299,367	$11,018,961	$1,218,861	$12,040,508	$969,459	$30,749,449	$4,312,950	$8,678,576	$275,660	$69,267,698	$10,927,397	$7,462,544	$1,092,164	$7,781,705	$109,596	$17,078,601	$443,835	$2,354,724	$0

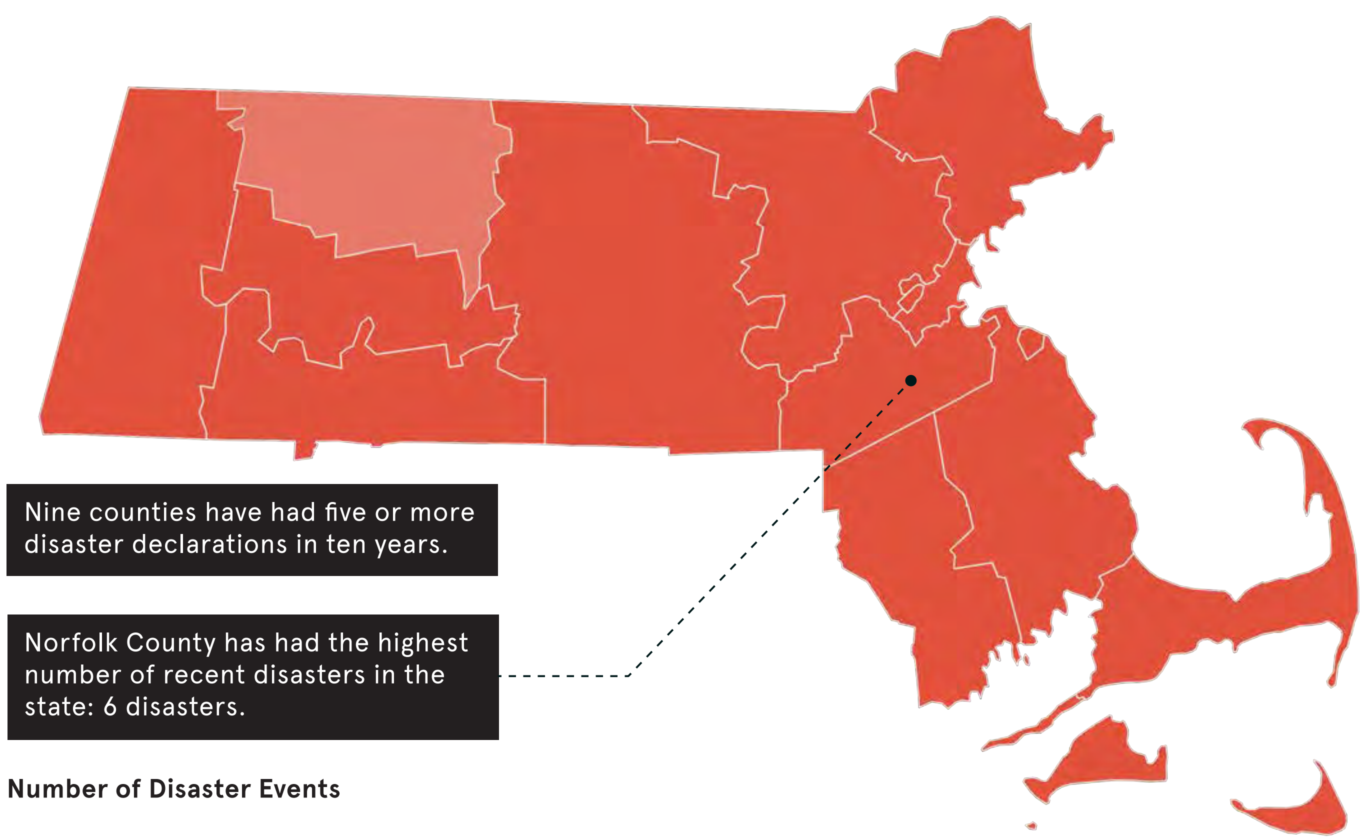
MASSACHUSETTS

MASSACHUSETTS STATISTICS SUMMARY (2011 – 2021)	
9	CLIMATE DISASTER DECLARATIONS
NORFOLK	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
9	COUNTIES WITH FIVE OR MORE DISASTERS
73	SUPERFUND SITES
75	WASTEWATER DISCHARGE SITES
SUFFOLK	HIGHEST COMPOUNDING RISKS
$501 MILLION	FEMA + HUD POST-DISASTER FUNDING
SUFFOLK	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
6.9 MILLION	POPULATION TOTAL
$73	PER CAPITA SPENDING ON CLIMATE DISASTERS
$6.7 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

9
disaster declarations



Nine counties have had five or more disaster declarations in ten years.

Norfolk County has had the highest number of recent disasters in the state: 6 disasters.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

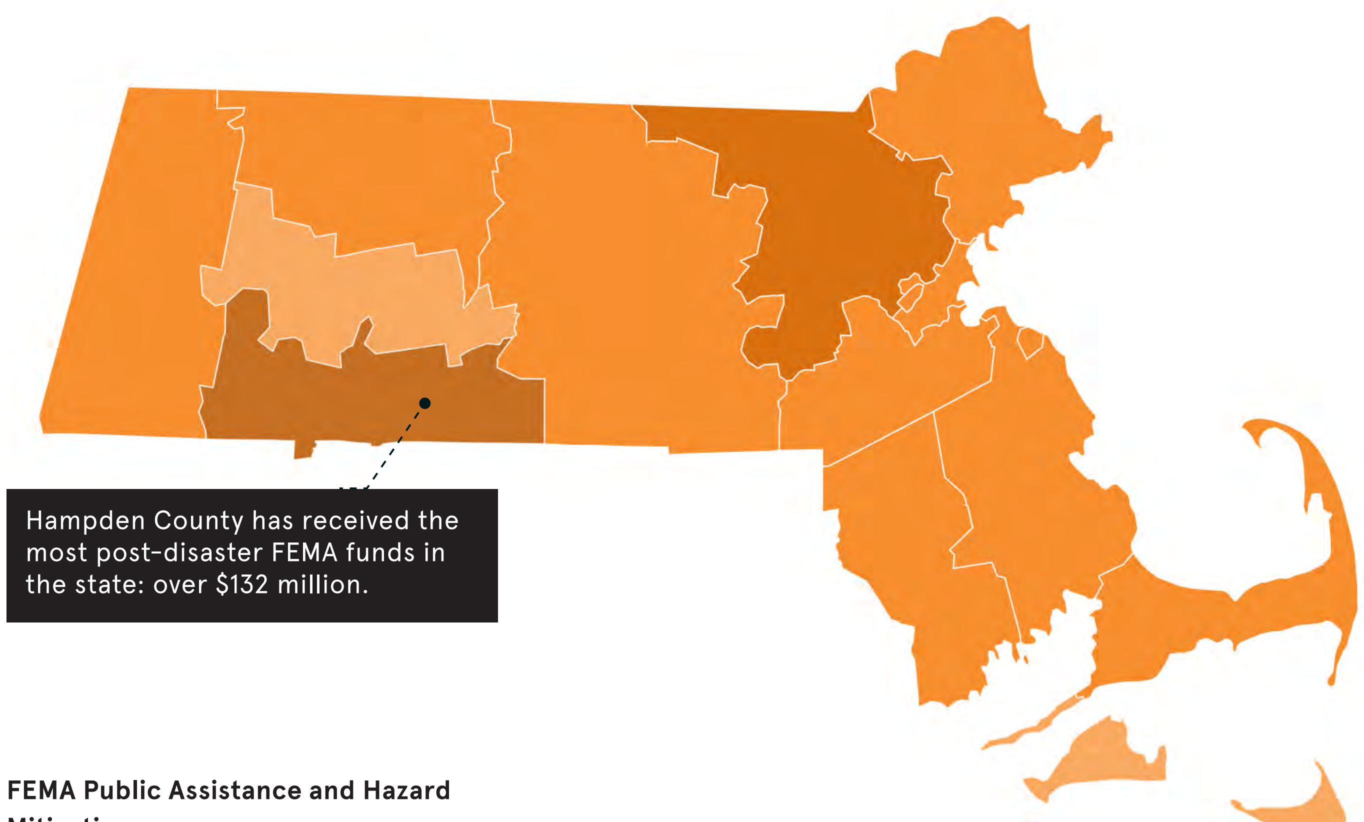
$501M
post-disaster assistance

$455M FEMA obligations

$46M HUD CDBG-DR Funds

$501M FEMA + HUD assistance

$73 per capita cost



Hampden County has received the most post-disaster FEMA funds in the state: over $132 million.

FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011–2021)

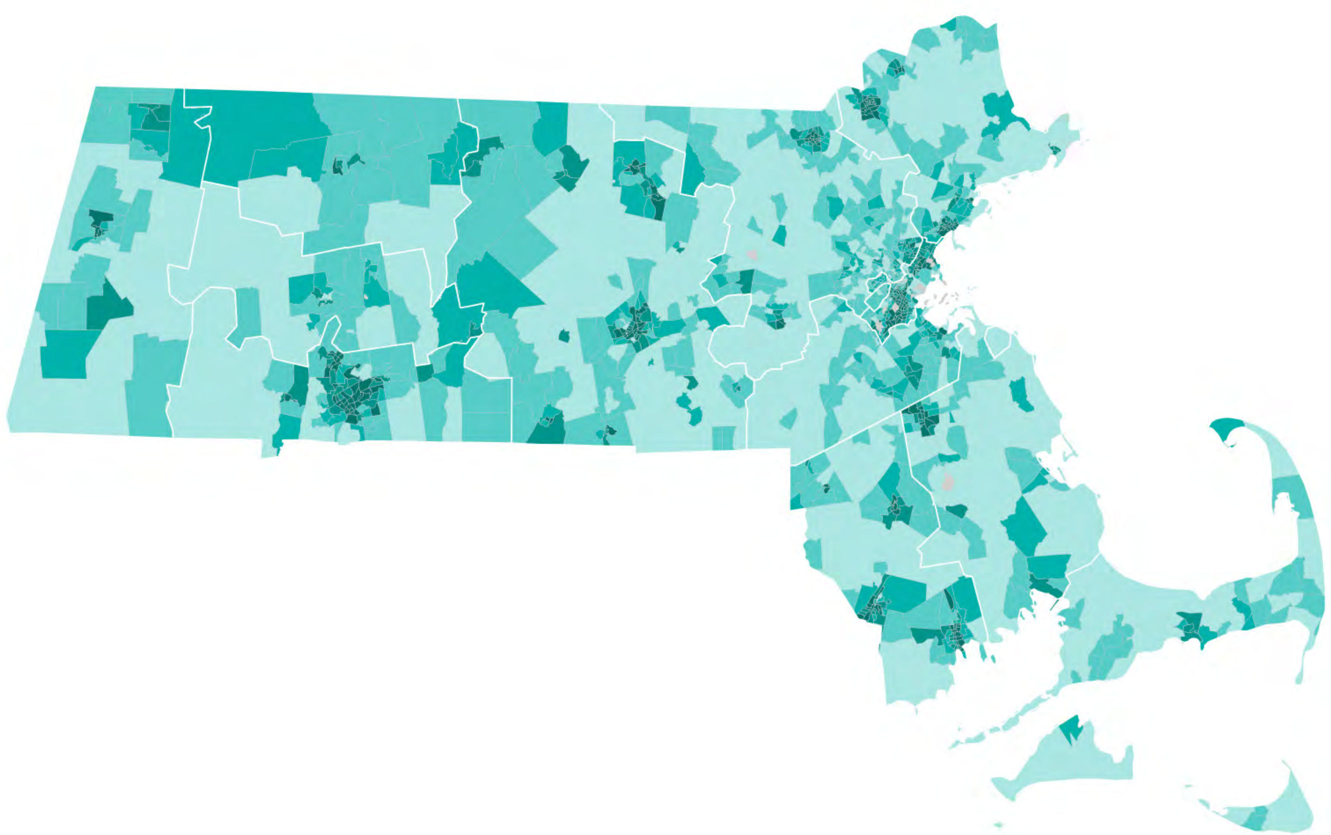
- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

The most expensive disaster in recent history was the 2015 severe winter storm, which totaled over $94 million in FEMA post-disaster assistance.

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

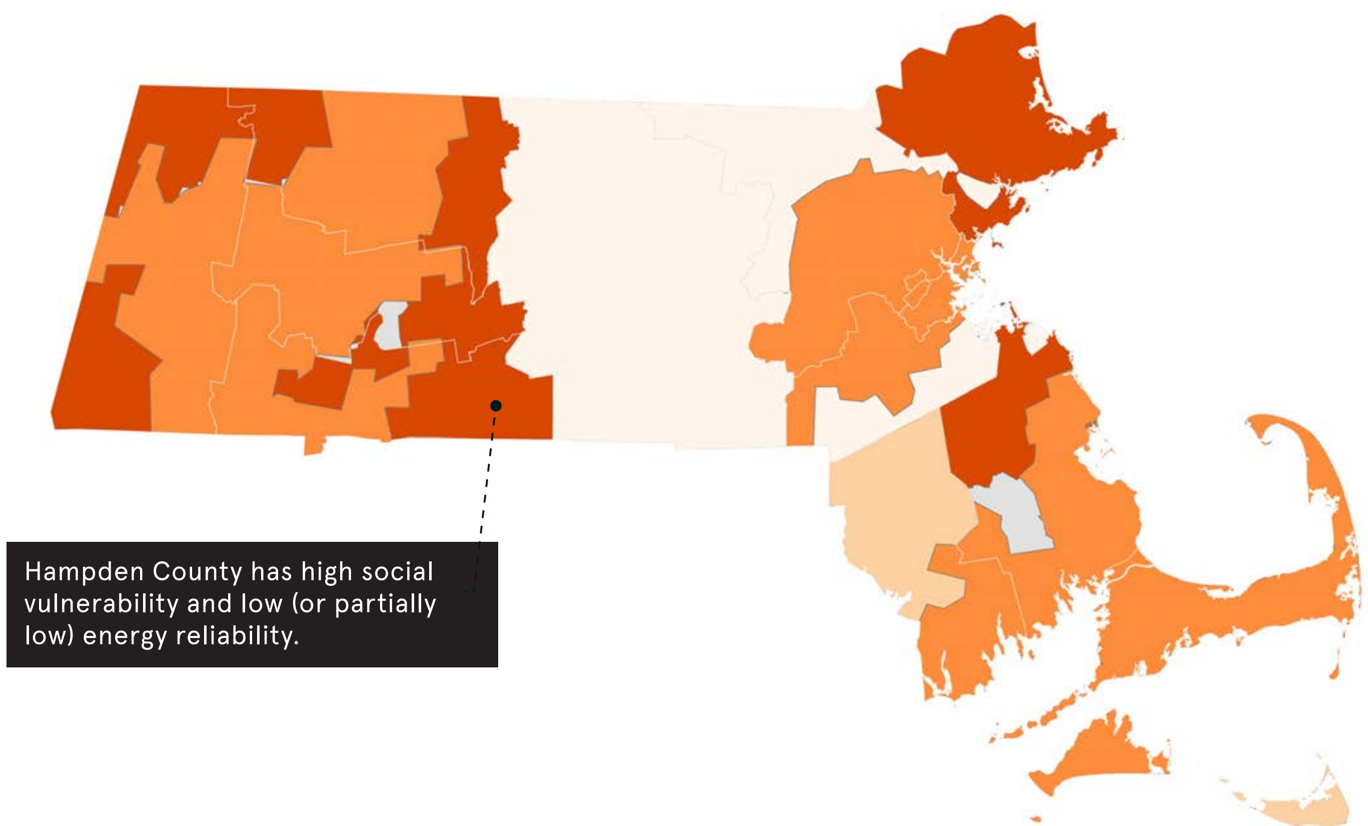
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



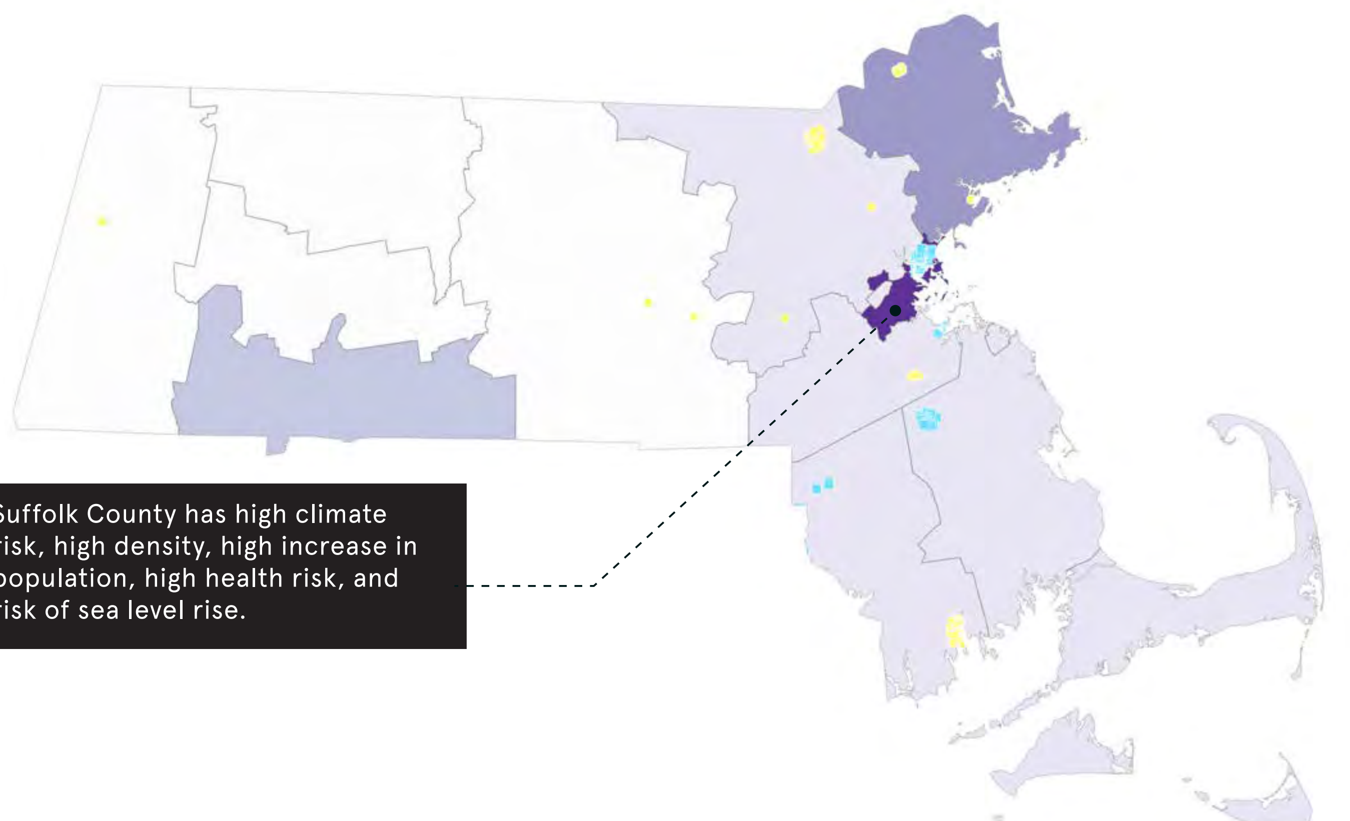
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Suffolk County has high climate risk, high density, high increase in population, high health risk, and risk of sea level rise.

Areas with the greatest return on investment due to physical and social risk (2011-2021)

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Barnstable							1
Berkshire							0
Bristol							1
Dukes							1
Essex					1		3
Franklin							0
Hampden					1		2
Hampshire							0
Middlesex							1
Nantucket							1
Norfolk							1
Plymouth							1
Suffolk					4		5
Worcester							0

MASSACHUSETTS

TOTAL: 9 DISASTERS
FEMA PA + HM: $455 M
HUD CDBG-DR: $46 M
FEMA + HUD ASSISTANCE: $501 M

			2011						2012				2013		2015		2018			
			1959: SEVERE WINTER STORM AND SNOWSTORM		1994: SEVERE STORMS AND TORNADOES		4028: TROPICAL STORM IRENE		4051: SEVERE STORM AND SNOWSTORM		4097: HURRICANE SANDY		4110: SEVERE WINTER STORM, SNOWSTORM, AND FLOODING		4214: SEVERE WINTER STORM, SNOWSTORM, AND FLOODING		4372: SEVERE WINTER STORM AND FLOODING		4379: SEVERE WINTER STORM AND SNOWSTORM	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	9	$76,028,941	$6,826,376	$185,050	$3,100,544	$381,326	$1,118,484	$268,039	$2,136,228	$526,955	$2,940,549	$101,895	$14,895,839	$527,596	$24,897,769	$1,020,838	$2,875,238	$477,566	$13,332,243	$416,405
Barnstable County	5	$10,325,685					$1,263,147	$0			$976,327	$66,280	$4,659,170	$0	$2,311,402	$76,911	$972,448	$0		
Berkshire County	4	$11,739,317	$687,685	$0			$8,857,683	$0	$404,016	$0			$526,958	$1,262,976						
Bristol County	5	$17,879,772					$2,017,456	$0			$1,315,591	$0	$3,316,031	$240,389	$3,684,959	$5,095,961	$2,199,457	$0	$9,928	$0
Dukes County	4	$1,157,581					$49,249	$392,884			$535,632	$0	$31,588	$0	$148,228	$0				
Essex County	5	$35,816,159	$3,440,957	$379,929					$5,323	$295,973			$12,462,524	$169,548	$7,908,863	$327,749	$6,152,181	$0	$4,382,889	$290,224
Franklin County	3	$11,726,513					$10,277,444	$0	$686,221	$132,957			$383,993	$245,899						
Hampden County	5	$132,048,236	$1,635,829	$0	$71,827,605	$92,625	$1,798,390	$86,029	$53,443,634	$934,575			$1,921,725	$307,824						
Hampshire County	4	$5,990,414	$636,071	$18,522			$882,099	$0	$3,038,952	$616,990			$797,780	$0						
Middlesex County	5	$49,223,322	$6,737,511	$390,560					$4,514,832	$66,818			$10,002,947	$301,367	$15,680,312	$673,544			$10,855,431	$0
Nantucket County	4	$1,079,970									$30,698	$0	$36,003	$0	$851,808	$34,859	$126,602	$0		
Norfolk County	6	$30,536,390	$3,097,205	$0			$2,169,093	$0					$4,855,562	$294,131	$8,513,295	$1,392,624	$6,166,602	$0	$4,047,879	$0
Plymouth County	5	$27,554,932					$2,074,590	$0			$1,235,082	$0	$5,256,828	$0	$6,685,655	$488,713	$11,425,688	$388,376		
Suffolk County	5	$23,581,480	$2,784,768	$0							$3,918,036	$0	$3,861,484	$0	$9,055,604	$0			$3,961,587	$0
Worcester County	5	$20,056,367			$311,153	$75,866			$6,777,396	$1,059,763			$3,804,080	$204,657	$4,968,487	$219,358			$2,587,835	$47,772
Total FEMA Allocation		$454,745,082	$25,846,401	$974,061	$75,239,302	$549,817	$30,507,636	$746,952	$71,006,603	$3,634,031	$10,951,915	$168,175	$66,812,512	$3,554,386	$84,706,383	$9,330,557	$29,918,216	$865,942	$39,177,793	$754,400

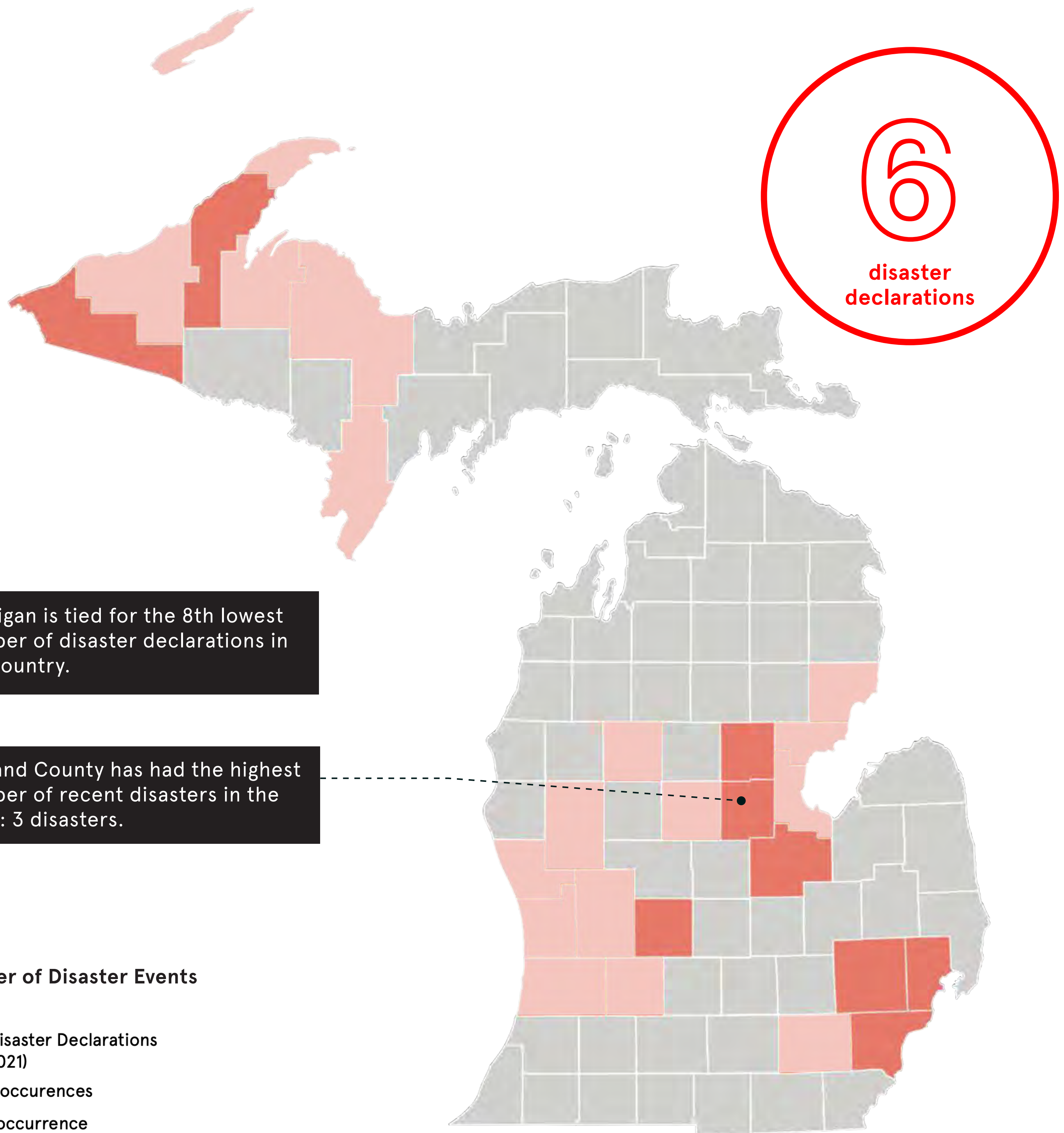
MICHIGAN

MICHIGAN STATISTICS SUMMARY (2011 – 2021)

6	CLIMATE DISASTER DECLARATIONS
MIDLAND	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
30%	OF COUNTIES HAVE RECEIVED A DISASTER DECLARATION
141	SUPERFUND SITES
253	WASTEWATER DISCHARGE SITES
D+	ASCE INFRASTRUCTURE REPORT CARD GRADE
GENESEE, INGHAM, WAYNE	HIGHEST COMPOUNDING RISKS
$235 MILLION	FEMA + HUD POST-DISASTER FUNDING
HOUGHTON	COUNTY WITH THE HIGHEST FEDERAL SPENDING ON CLIMATE DISASTERS
10 MILLION	POPULATION TOTAL
$23	PER CAPITA SPENDING ON CLIMATE DISASTERS
$8.9 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY



Michigan is tied for the 8th lowest number of disaster declarations in the country.

Midland County has had the highest number of recent disasters in the state: 3 disasters.

Number of Disaster Events

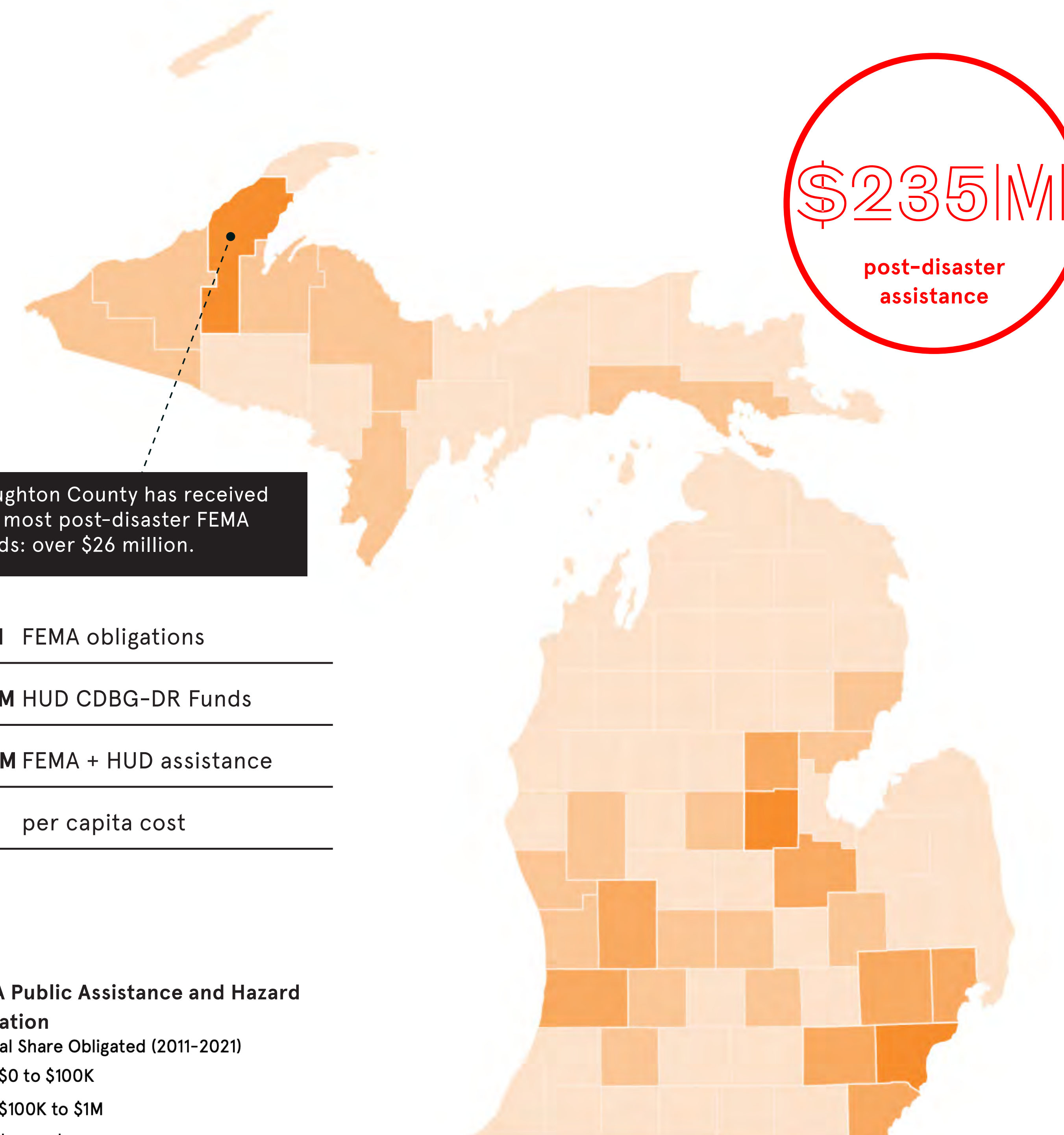
Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS



Houghton County has received the most post-disaster FEMA funds: over $26 million.

$88M	FEMA obligations
$146M	HUD CDBG-DR Funds
$235M	FEMA + HUD assistance
$23	per capita cost

FEMA Public Assistance and Hazard Mitigation

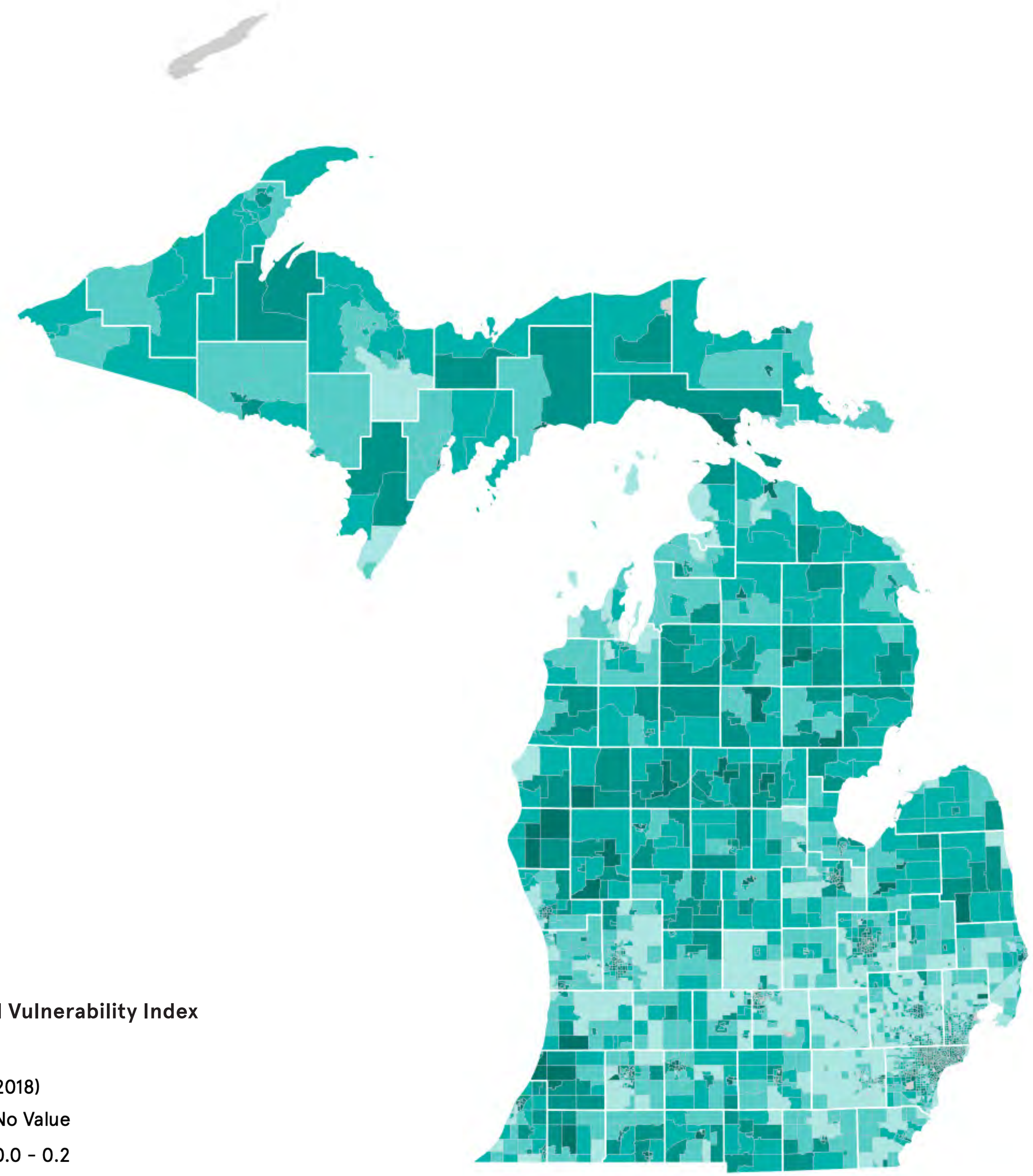
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

CDC (2018)

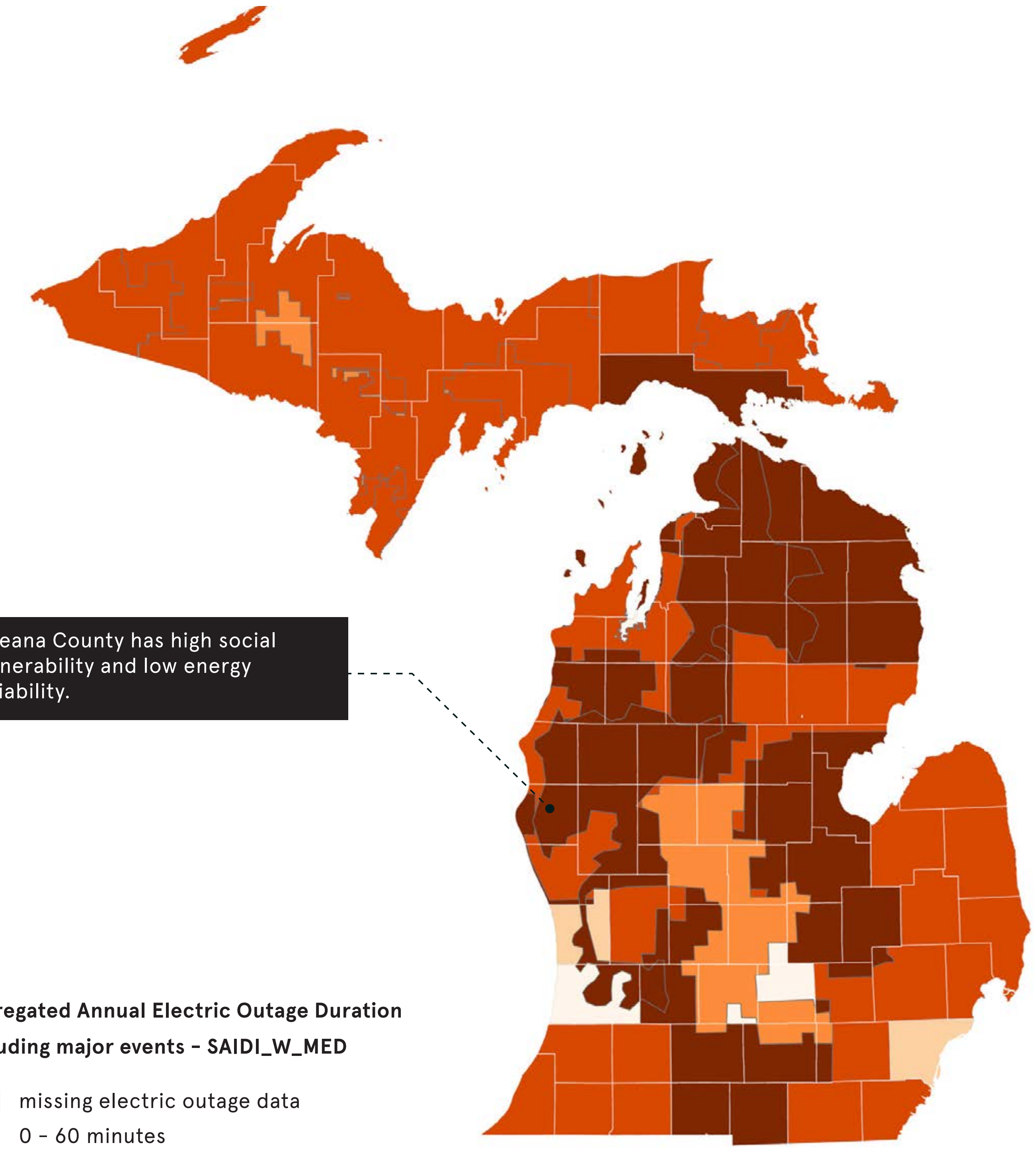
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Oceana County has high social vulnerability and low energy reliability.

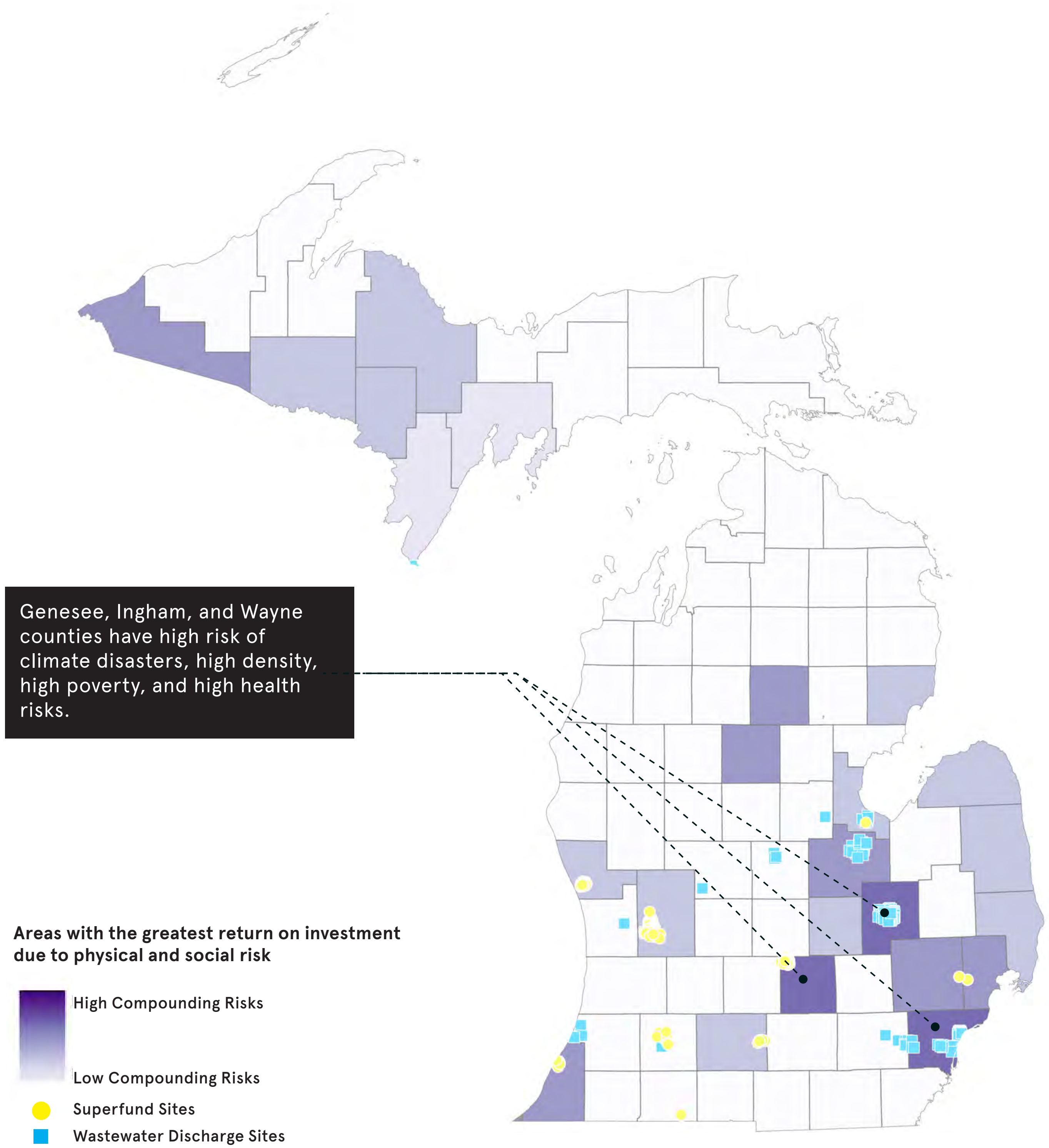


Aggregated Annual Electric Outage Duration
Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

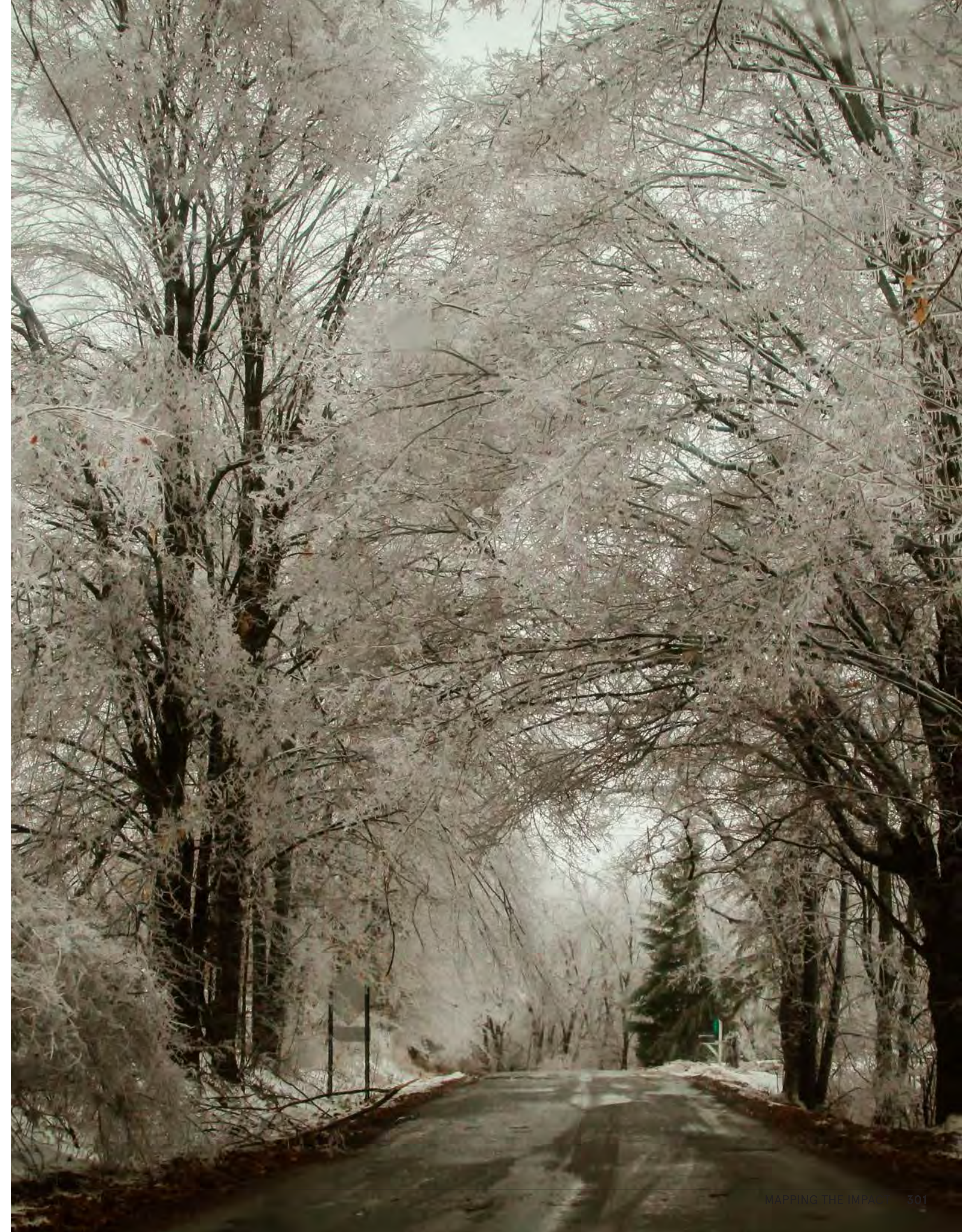


U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Alcona							2
Alger							0
Allegan							0
Alpena							1
Antrim							0
Arenac							2
Baraga							1
Barry							0
Bay					2		2
Benzie							0
Berrien					2		3
Branch							1
Calhoun					1		2
Cass							0
Charlevoix							0
Cheboygan							0
Chippewa							1
Clare					2		3
Clinton							0
Crawford							1
Delta					1		1
Dickinson					1		2
Eaton							0
Emmet							0
Genesee					4		4
Gladwin							1
Gogebic					1		3
Grand Traverse							0
Gratiot							1
Hillsdale							2
Houghton							1
Huron					1		2
Ingham					3		4
Ionia							0
Iosco					1		2
Iron					1		2
Isabella							2
Jackson							1
Kalamazoo							0
Kalkaska							1
Kent					3		2
Keweenaw							0
Lake							2
Lapeer							1
Leelanau							0
Lenawee							1
Livingston							0
Luce							1
Mackinac							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Macomb					6		3
Manistee							0
Marquette					2		2
Mason							0
Mecosta							0
Menominee					1		1
Midland							0
Missaukee							0
Monroe							0
Montcalm							0
Montmorency							0
Muskegon					2		2
Newaygo							0
Oakland					5		3
Oceana							0
Ogemaw							0
Ontonagon							0
Osceola							0
Oscoda							0
Otsego							0
Ottawa							0
Presque Isle							0
Roscommon					1		3
Saginaw					4		3
Sanilac					1		2
Schoolcraft							0
Shiawassee					1		2
St. Clair					2		2
St. Joseph							0
Tuscola							0
Van Buren							0
Washtenaw							0
Wayne					7		4
Wexford							0

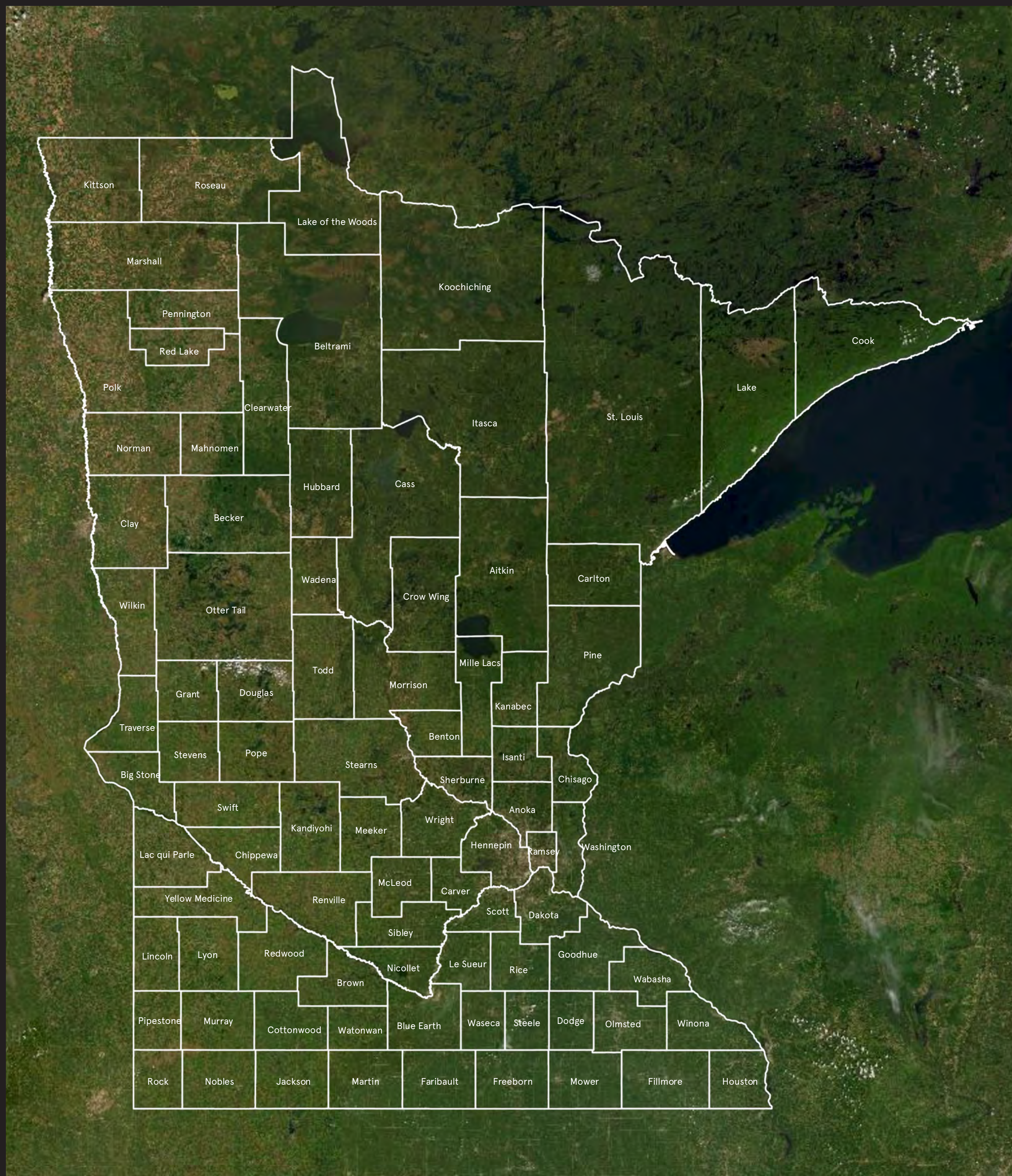
IMAGE RIGHT: DECEMBER 2013 ICE STORM WHICH LEFT HOUSEHOLDS WITHOUT POWER FOR DAYS. LANSING, MICHIGAN. | LADYDRAGONFLY



MICHIGAN

TOTAL: 6 DISASTERS FEMA PA + HM: $88 M HUD CDBG-DR: $146 M FEMA + HUD ASSISTANCE: $234 M			2013		2014		2017		2018		2020		2021	
			4121: FLOODING		4195: SEVERE STORMS AND FLOODING		4326: SEVERE STORMS AND FLOODING		4381: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4547: SEVERE STORMS AND FLOODING		4607: SEVERE STORMS, FLOODING, AND TORNADOES	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	6	$12,727,118	$175,011	$20,431	$194,951	$3,551,492			$7,078,112	$408,744	$1,298,377	$0		
Alcona County	0	$0												
Alger County	0	$0												
Allegan County	1	$228,326	$228,326	$0										
Alpena County	0	$0												
Antrim County	0	$0												
Arenac County	1	$582,512									$582,512	$0		
Baraga County	1	$334,941	$334,941	$0										
Barry County	1	$238,779	$238,779	$0										
Bay County	1	$0					$0	$0						
Benzie County	0	$0												
Berrien County	0	$0												
Branch County	0	$0												
Calhoun County	0	$0												
Cass County	0	$0												
Charlevoix County	0	$0												
Cheboygan County	0	$0												
Chippewa County	0	$0												
Clare County	0	$0												
Clinton County	0	$0												
Crawford County	0	$0												
Delta County	0	$0												
Dickinson County	0	$0												
Eaton County	0	$0												
Emmet County	0	$0												
Genesee County	0	$0												
Gladwin County	2	$2,034,058					$0	$0			$1,991,457	$42,601		
Gogebic County	2	$498,107	$347,030	$0					$151,076	$0				
Grand Traverse County	0	$0												
Gratiot County	0	$0												
Hillsdale County	0	$0												
Houghton County	2	$26,184,062	$366,916	$0					$25,606,471	$210,675				
Huron County	0	$0												
Ingham County	0	$0												
Ionia County	2	$380,808	$380,808	$0									$0	$0
Iosco County	1	$145,082									$102,246	$42,836		
Iron County	0	$0												
Isabella County	1	$405,248					$0	$405,248						
Jackson County	0	$0												
Kalamazoo County	0	$0												
Kalkaska County	0	$0												
Kent County	1	$1,605,557	$1,343,623	$261,934										
Keweenaw County	1	$46,127	$46,127	$0										
Lake County	0	$0												
Lapeer County	0	$0												
Leelanau County	0	$0												
Lenawee County	0	$0												
Livingston County	0	$0												
Luce County	0	$0												
Mackinac County	0	$0												
Macomb County	2	$2,063,849			$1,858,341	$205,508							$0	$0
Manistee County	0	$0												
Marquette County	1	$193,991	$193,991	$0										
Mason County	0	$0												
Mecosta County	0	$0												
Menominee County	1	$137,861							$137,861	$0				
Midland County	3	$17,293,204	$198,644	$0			$0	$275,588			$16,818,972	$0		
Missaukee County	0	$0												
Monroe County	0	$0												
Montcalm County	0	$0												
Montmorency County	0	$0												
Muskegon County	1	$238,779	$238,779	$0										
Newaygo County	1	$148,649	$148,649	$0										
Oakland County	2	$5,887,781			$5,740,119	$147,662							$0	$0
Oceana County	0	$0												
Ogemaw County	0	$0												
Ontonagon County	1	$47,232	$47,232	$0										
Osceola County	1	$53,043	$53,043	$0										
Oscoda County	0	$0												
Otsego County	0	$0												
Ottawa County	1	$266,242	$266,242	$0										
Presque Isle County	0	$0												
Roscommon County	0	$0												
Saginaw County	2	$1,268,623	$241,809	$0							$1,026,814	$0		
St. Clair County	0	$0												
St. Joseph County	0	$0												
Sanilac County	0	$0												
Schoolcraft County	0	$0												
Shiawassee County	0	$0												
Tuscola County	0	$0												
Van Buren County	0	$0												
Washtenaw County	1	$0											$0	$0
Wayne County	2	$15,847,875			$7,423,205	$8,424,670							$0	$0
Wexford County	0	$0												
Total FEMA Allocation		$88,857,850	$4,849,948	$282,365	$15,216,615	$12,329,332	$0	$680,836	$32,973,520	$619,419	$21,820,378	$85,437	$0	$0

MINNESOTA



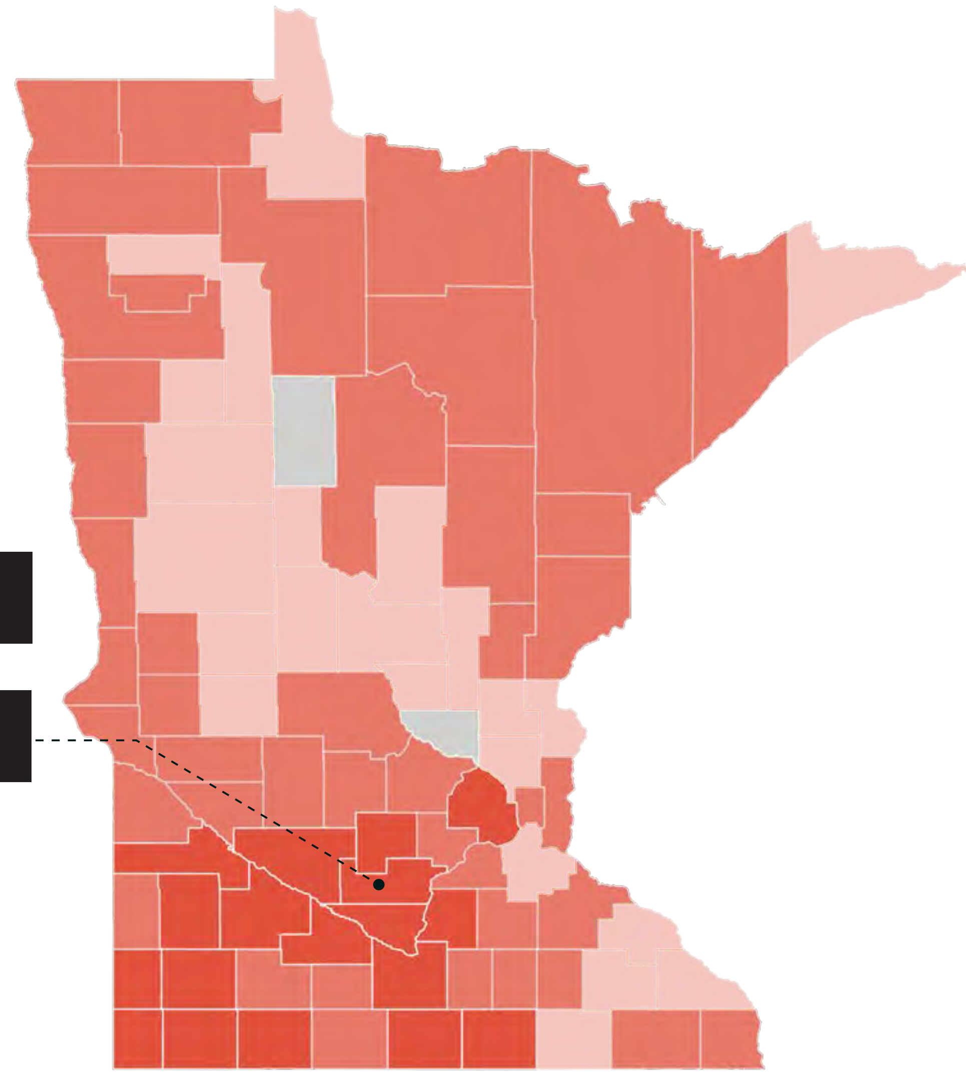
MINNESOTA STATISTICS SUMMARY (2011 - 2021)	
11	CLIMATE DISASTER DECLARATIONS
SIBLEY	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
6	COUNTIES WITH FIVE OR MORE DISASTERS
138	SUPERFUND SITES
27	WASTEWATER DISCHARGE SITES
C	ASCE INFRASTRUCTURE REPORT CARD GRADE
DAKOTA, HENNEPIN, MAHNOMEN	HIGHEST COMPOUNDING RISKS
$276 MILLION	FEMA + HUD POST-DISASTER FUNDING
ST. LOUIS	COUNTY WITH THE HIGEST FEDERAL SPENDING ON CLIMATE DISASTERS
5.6 MILLION	POPULATION TOTAL
$49	PER CAPITA SPENDING ON CLIMATE DISASTERS
$5.2 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011-2021

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

11

disaster declarations



Six counties in Minnesota have had 5 or more recent disasters.

Sibley County has had six disaster declarations.

Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

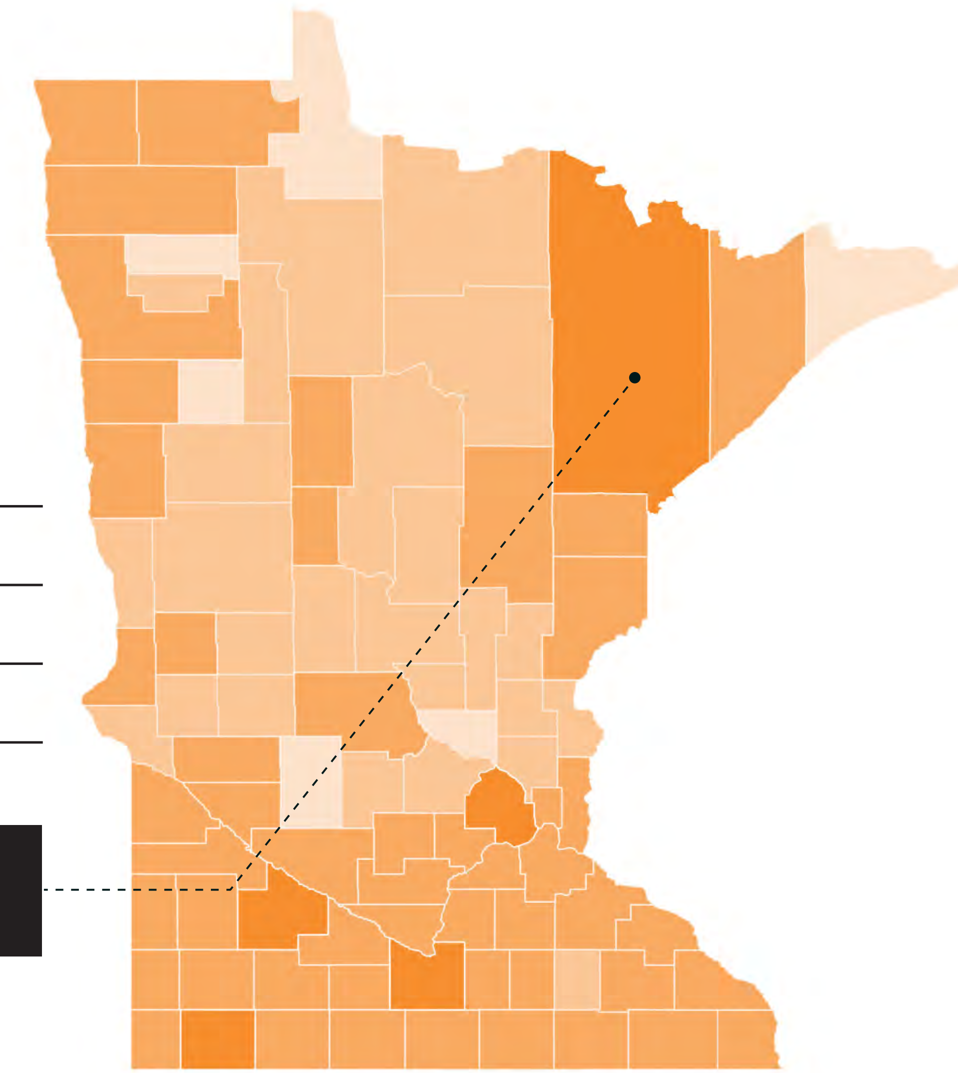
FEDERAL ASSISTANCE 2011-2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$276M

post-disaster assistance

$276	FEMA obligations
$0	HUD CDBG-DR Funds
$276	FEMA + HUD assistance
$49	per capita cost



St. Louis has received the most post-disaster FEMA funds in the state: over $24.7 million.

FEMA Public Assistance and Hazard Mitigation

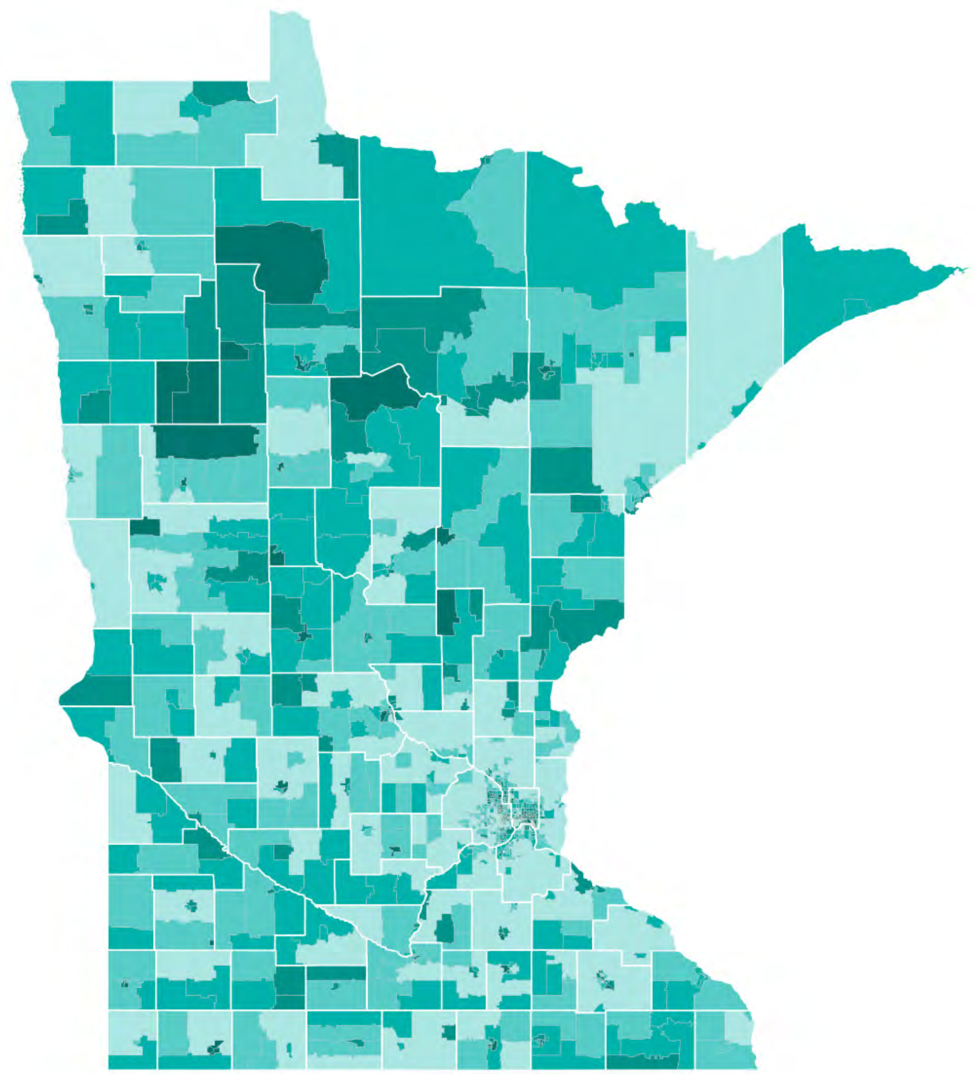
Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

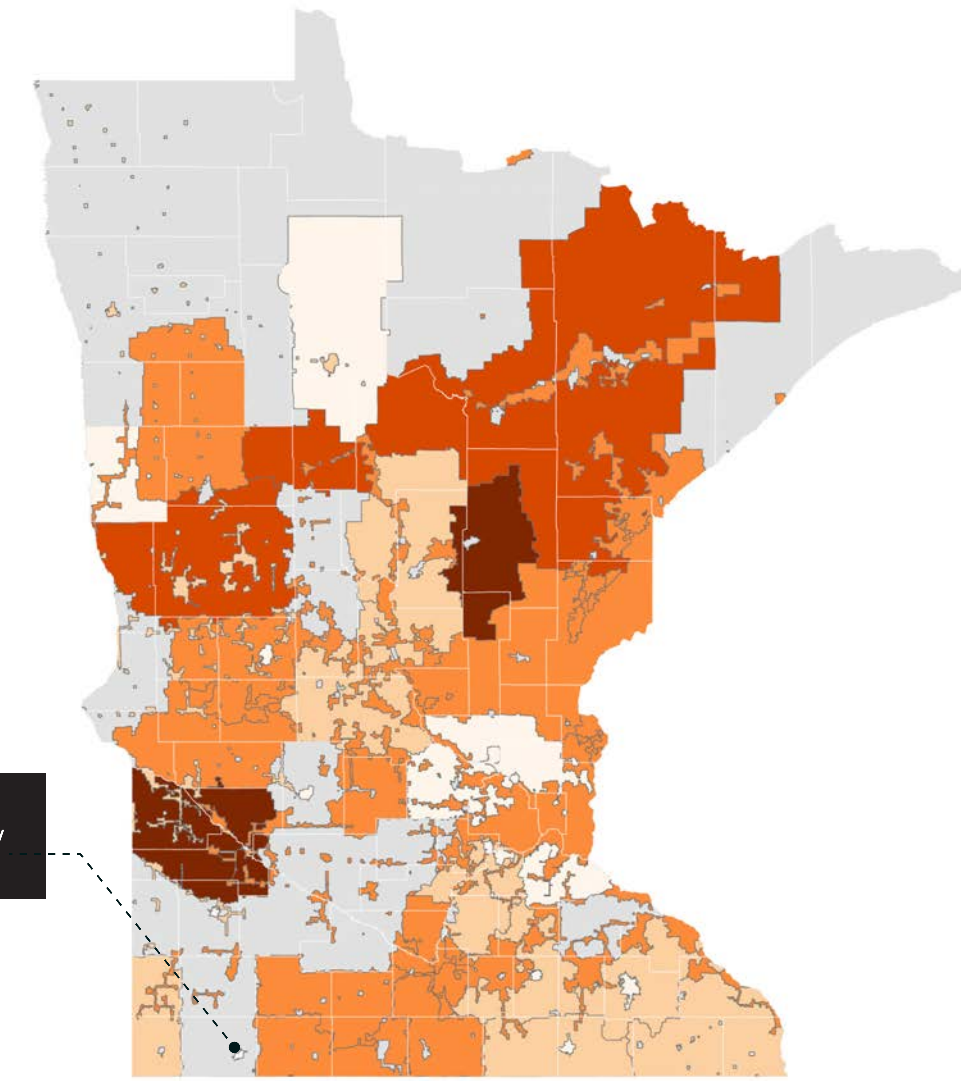
CDC (2018)
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Parts of Nobles County have high social vulnerability and low energy reliability.

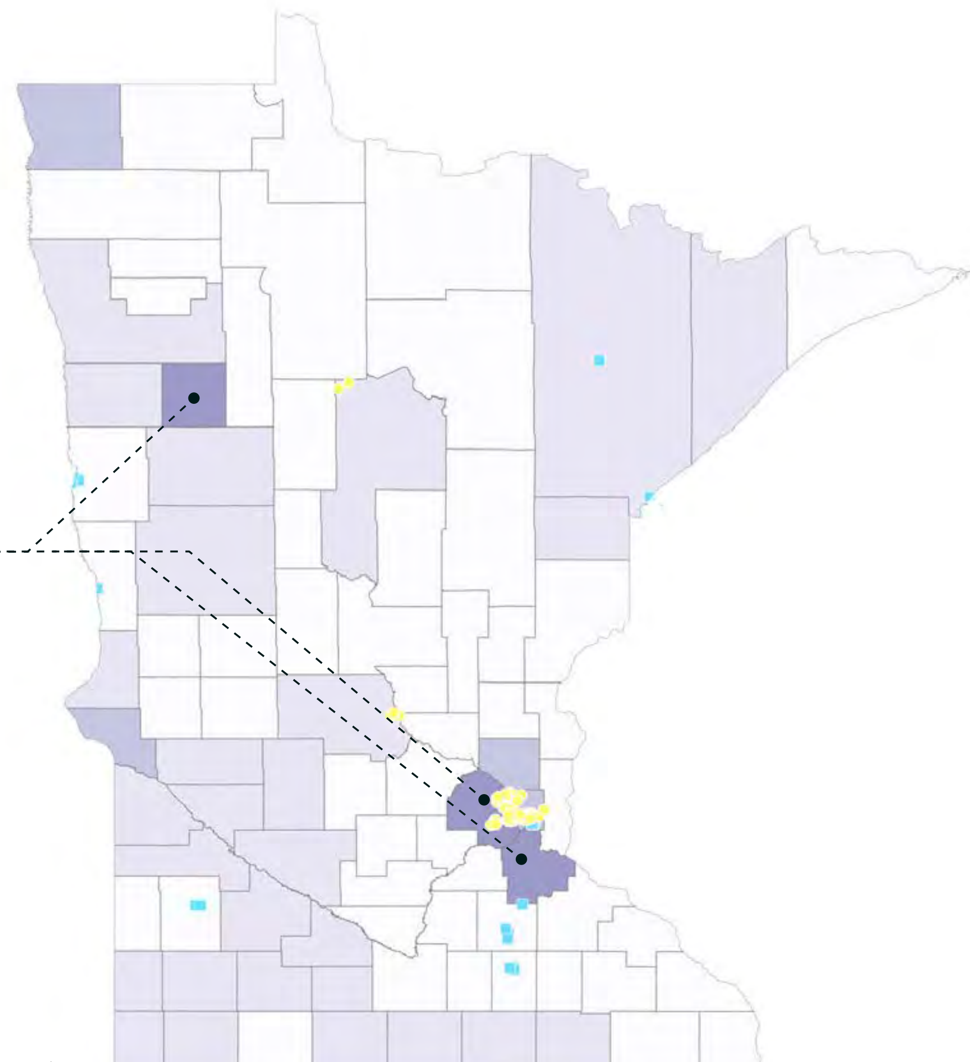


Aggregated Annual Electric Outage Duration
Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Dakota, Hennepin, and Mahnomen counties have high risk of climate disasters and other compounding risks.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Aitkin							0
Anoka					1		2
Becker					1		1
Beltrami							0
Benton							0
Big Stone					1		2
Blue Earth							0
Brown					2		1
Carlton					1		1
Carver							0
Cass					1		1
Chippewa					2		1
Chisago							0
Clay							0
Clearwater							0
Cook							0
Cottonwood					3		1
Crow Wing							0
Dakota					1		3
Dodge							0
Douglas							0
Faribault					1		1
Fillmore							0
Freeborn					2		1
Goodhue							0
Grant							0
Hennepin					4		3
Houston							0
Hubbard							0
Isanti							0
Itasca							0
Jackson							0
Kanabec							0
Kandiyohi					2		1
Kittson					1		2
Koochiching							0
Lac qui Parle					1		1
Lake					1		1
Lake of the Woods							0
Le Sueur							0
Lincoln							0
Lyon							0
Mahnomen					1		3
Marshall							0
Martin					3		1
McLeod							0
Meeker							0
Mille Lacs							0
Morrison							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Mower					2		1
Murray					3		1
Nicollet							0
Nobles					3		1
Norman					1		1
Olmsted							0
Otter Tail					1		1
Pennington							0
Pine							0
Pipestone					1		1
Polk					1		1
Pope							0
Ramsey					5		2
Red Lake							0
Redwood					2		1
Renville					2		1
Rice							0
Rock					1		1
Roseau							0
Scott							0
Sherburne							0
Sibley							0
St. Louis					2		1
Stearns					1		1
Steele							0
Stevens							0
Swift					2		1
Todd							0
Traverse					1		1
Wabasha							0
Wadena							0
Waseca							0
Washington							0
Watonwan					2		1
Wilkin							0
Winona							0
Wright							0
Yellow Medicine					1		1

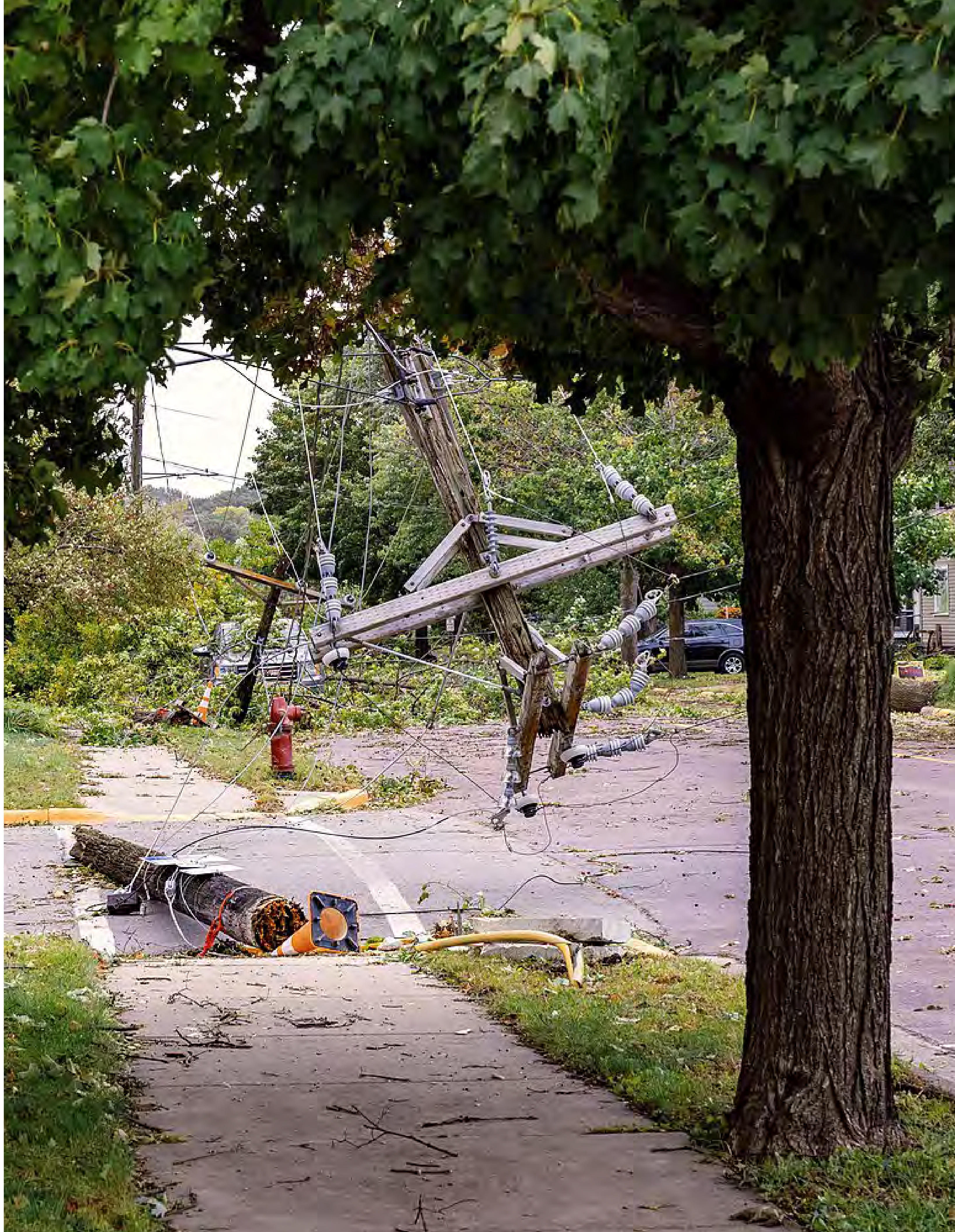


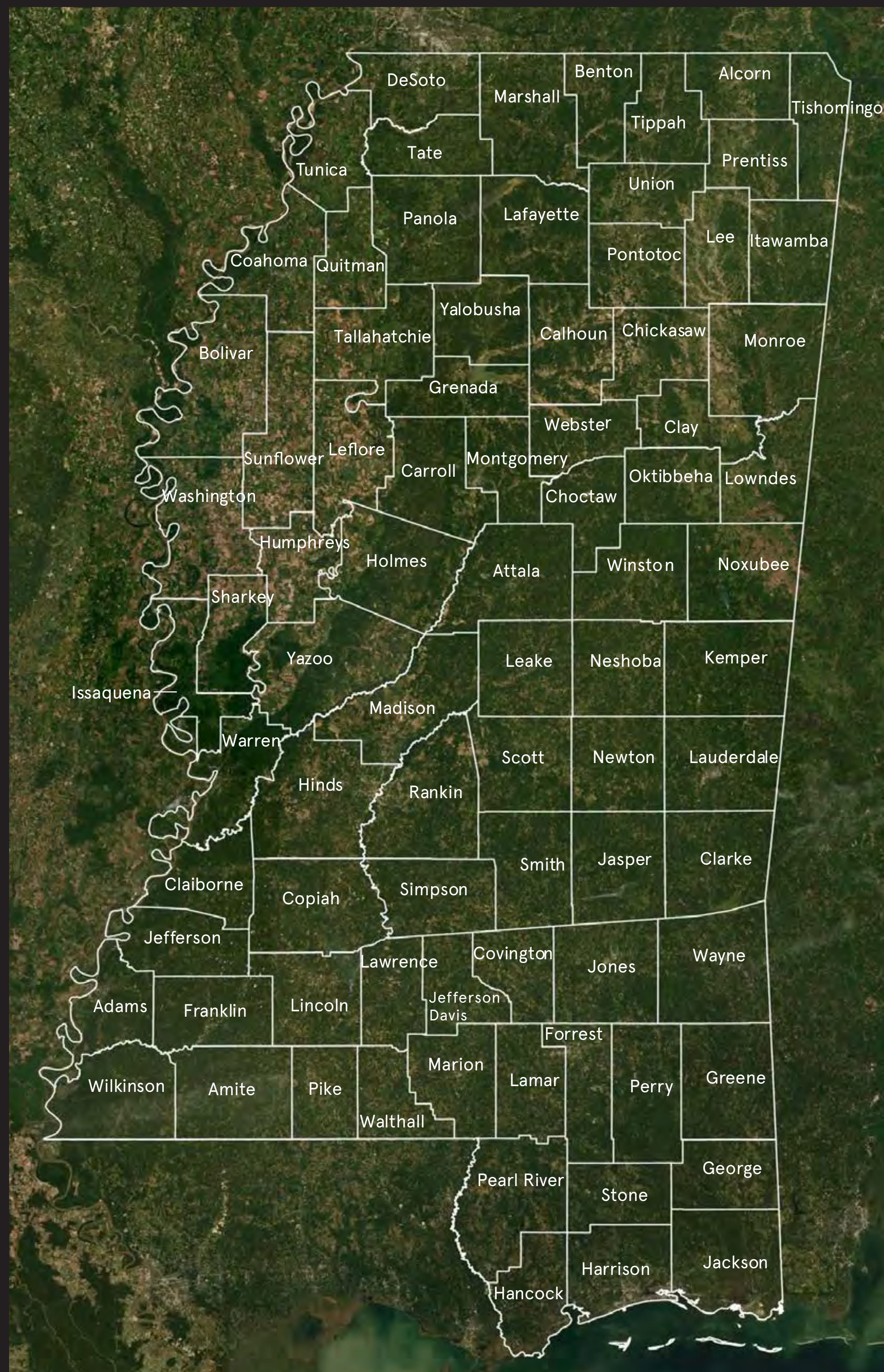
IMAGE RIGHT: ELECTRICAL LINE DOWN AND POWER OUTAGE - WATERVILLE, MINNESOTA STORM AND TORNADO DAMAGE | TONY WEBSTER

MINNESOTA

TOTAL: 11 DISASTERS
FEMA PA + HM: $276 M
HUD CDBG-DR: none
FEMA + HUD ASSISTANCE: $276M

			2011						2012		2013				2014		2016		2018		2019			
			1982: SEVERE STORMS AND FLOODING		1990: SEVERE STORMS AND TORNADOES		4009: SEVERE STORMS, FLOODING, AND TORNADOES		4069: SEVERE STORMS AND FLOODING		4113: SEVERE WINTER STORM		4131: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4182: SEVERE STORMS, STRAIGHT-LINE WINDS, FLOODING, LANDSLIDES, AND MUDSLIDES		4290: SEVERE STORMS AND FLOODING		4390: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4414: SEVERE STORMS AND FLOODING		4442: SEVERE WINTER STORM, STRAIGHT-LINE WINDS, AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	11	$74,501,536	$2,518,003	$151,562	$168,229	$67,839	$8,296,606	$105,445	$12,728,207	$323,453	$2,295,739	$58,885	$1,297,725	$98,799	$8,070,430	$300,885	$705,962	$69,056	$8,879,869	$419,285	$556,912	$147,948	$27,071,429	$169,267
Aitkin County	2	$2,146,664							$1,755,761	$0									$390,902	$0				
Anoka County	1	$106,645			$106,645	$0																		
Becker County	1	$225,066	$225,066	$0																				
Beltrami County	3	$824,504	$499,754	$0											$80,356	$0			$244,394	$0				
Benton County	1	$294,274											$294,274	$0										
Big Stone County	3	$913,375	$294,322	$0									$55,693	$0									$563,361	$0
Blue Earth County	5	$7,695,338	$165,943	$13,862											$1,482,412	$0	$1,383,343	$284,432	$320,973	$344,643			$3,382,105	$317,625
Brown County	4	$7,649,944	$713,043	$0											$1,040,889	$787,699			$836,676	$0			$1,953,556	$2,318,081
Carlton County	2	$6,485,356							$4,985,599	$173,164									$1,326,593	$0				
Carver County	2	$2,127,980	$344,634	$0											$1,586,909	$196,437								
Cass County	2	$538,415							$301,109	$0									$237,306	$0				
Chippewa County	3	$2,734,534	$498,949	$0											$251,924	$0							$1,942,795	$40,867
Chisago County	1	$118,213					$118,213	$0																
Clay County	2	$4,961,265	$4,373,898	$0																			$570,365	$17,002
Clearwater County	1	$102,242																	$102,242	$0				
Cook County	1	$49,071							$49,071	$0														
Cottonwood County	3	$1,540,472									$494,457	$0							$491,844	$0			$496,337	$57,835
Crow Wing County	1	$407,490							$407,490	$0														
Dakota County	1	$1,451,828							$1,451,828	$0														
Dodge County	2	$222,516													$222,516	$0							$0	$0
Douglas County	1	$304,120											$304,120	$0										
Faribault County	4	$1,770,150											$156,730	$0	$190,298	$0			$885,629	$0			$537,493	$0
Fillmore County	3	$2,469,312											$1,275,564	$0			$646,161	$0					$547,587	$0
Freeborn County	4	$5,187,490											$917,614	$0	$859,826	$0	$968,266	$0					$2,441,783	$0
Goodhue County	3	$1,858,828							$1,307,189	$0							$181,689	$0					$369,950	$0
Grant County	3	$1,339,104	$632,848	$0									$496	$0									$705,760	$0
Hennepin County	4	$14,134,692			$3,273,737	$15,412							$4,216,801	$0	$6,628,742	$0	$0	$0						
Houston County	3	$4,349,859											$3,102,792	$24,485			$888,960	$0					$333,622	$0
Hubbard County	0	$0																						
Isanti County	1	$156,958					$156,958	$0																
Itasca County	2	$352,728							$299,163	$0									$53,565	$0				
Jackson County	4	$2,090,309									$134,275	$23,692			$242,398	$0			$993,459	$0			$642,431	$54,055
Kanabec County	2	$612,822					$45,084	$0											$567,737	$0				
Kandiyohi County	2	$3,726					$0	$0	$3,726	$0														
Kittson County	2	$1,121,528	$458,094	$0																			$473,159	$190,275
Koochiching County	2	$927,728													$790,237	$0			$137,491	$0				
Lac qui Parle County	3	$1,455,042	$287,848	$0											$38,361	$104,842							$1,023,991	$0
Lake County	2	$1,060,979							$856,276	$0									$204,703	$0				
Lake of the Woods County	1	$45,623													$45,623	$0								
Le Sueur County	4	$2,309,865	$333,391	$0											$636,155	$140,227	$268,295	$0					$931,797	$0
Lincoln County	2	$936,050					$403,374	$0															$532,676	$0
Lyon County	5	$2,533,232	$103,657	$0			$448,208	$0							$110,222	$0			$1,090,525	$0			$780,619	$0
McLeod County	5	$2,364,064	$162,937	$0			$68,185	$0					$153,197	$0	$351,733	$0							$1,628,012	$0
Mahnomen County	1	$74,367																					$74,367	$0
Marshall County	3	$2,216,794	$811,348	$0											$62,535	$0							$1,342,910	$0
Martin County	3	$1,276,473													$253,761	$0			$414,886	$0			$607,826	$0
Meeker County	2	$131,838					$51,745	$22,500	$57,594	$0														
Mille Lacs County	1	$29,937					$29,937	$0																
Morrison County	1	$186,771											$186,771	$0										
Mower County	1	$916,922																					$713,985	$202,937
Murray County	4	$2,936,776									$143,158	$0			$299,642	$0			$1,936,250	$0			$557,726	$0
Nicollet County	4	$2,289,759	$55,559	$0											$826,584	$0			$440,423	$0			$967,193	$0
Nobles County	4	$12,122,778									$7,342,527	$18,402			$399,070	$2,840,011			$616,564	$0			$906,204	$0
Norman County	2	$3,136,749	$1,066,343	$0																			$850,193	$1,220,213
Olmsted County	1	$818,230																					$818,230	$0
Otter Tail County	1	$503,319	$503,319	$0																				
Pennington County	1	$54,319																					$54,319	$0
Pine County	3	$3,860,413					$187,052	$0	$442,309	$2,932,359									$298,693	$0				
Pipestone County	4	$1,388,028					$87,877	$0							$487,192	$0			$127,947	$0			$685,013	$0
Polk County	3	$1,674,298	$948,481	$0															$29,536	$0			$696,281	$0
Pope County	1	$142,897											$142,897	$0										
Ramsey County	3	$5,602,190	$973,314	$0											$2,151,344	$0							$2,102,532	$375,000
Red Lake County	2	$113,694	$57,908	$0																			$55,787	$0
Redwood County	5	$11,784,934	$292,710	$0			$490,707	$0							$522,092	$0			$2,661,449	$0			$7,342,464	$475,512
Renville County	5	$3,670,086	$583,654	$0			$315,248	$24,613							$745,005	$0			$500,106	$0			$1,501,461	$0
Rice County	3	$1,905,910							$431,709	$0					$1,054,472	$0	$419,728	$0						
Rock County	4	$4,616,392									$697,865	$0			$1,774,541	$0			$374,227	$0			$1,769,760	$0
Roseau County	3	$1,572,468	$899,048	$17,730											$165,846	$0							$489,844	$0
St. Louis County	3	$24,700,328							$16,186,063	$538,599									$563,930	$0	$6,424,454	$987,282		
Scott County	3	$4,933,972	$295,818	$0											$4,268,287	$0							$369,866	$0
Sherburne County	0	$0																						
Sibley County	6	$4,139,976	$419,232	$0					$123,776	$20,343			$93,620	$0	$2,303,862	$0			$190,282	$0			$988,863	$0
Stearns County	2	$1,024,052					$396,345	$0					$627,707	$0										
Steele County	3	$993,390													$395,597	$0	$365,342	$0					$232,451	$0
Stevens County	3	$602,474	$136,954	$0									$141,477	$0									$324,042	$0
Swift County	3	$1,444,920	$82,236	$0									$630,453	$0									$732,232	$0
Todd County	1	$337,704													$337,704	$0								
Traverse County	3	$1,187,386	$488,300	$13,572									$79,222	$0									$606,292	$0
Wabasha County	1	$499,668																					$475,432	$24,236
Wadena County	1	$106,017													$106,017	$0								
Waseca County	3	$2,267,609													$267,419	$0	$1,251,508	$0					$748,683	$0
Washington County	2	$1,332,075	$368,885	$0																			$861,518	$101,672
Watonwan County	3	$1,863,179													$53,441	$0			$357,839	$0			$1,451,899	$0
Wilkin County	3	$545,584	$228,572	$0									$35,743	$0									$281,270	$0
Winona County	1	$585,836																					$585,836	$0
Wright County	2	$539,244	$199,481	$0											$339,763	$0								
Yellow Medicine County	4	$3,093,727	$225,843	$0			$0	$0							$451,438	$0							$2,416,447	$0
Total FEMA Allocation		$275,704,418	$20,249,390	$196,726	$3,548,610	$83,251	$11,095,538	$152,558	$41,386,871	$3,987,918	$11,108,021	$100,979	$13,712,895	$123,284	$39,894,642	$4,370,101	$7,079,254	$353,488	$25,276,041	$763,928	$6,981,367	$1,135,230	$78,539,750	$5,564,576

MISSISSIPPI

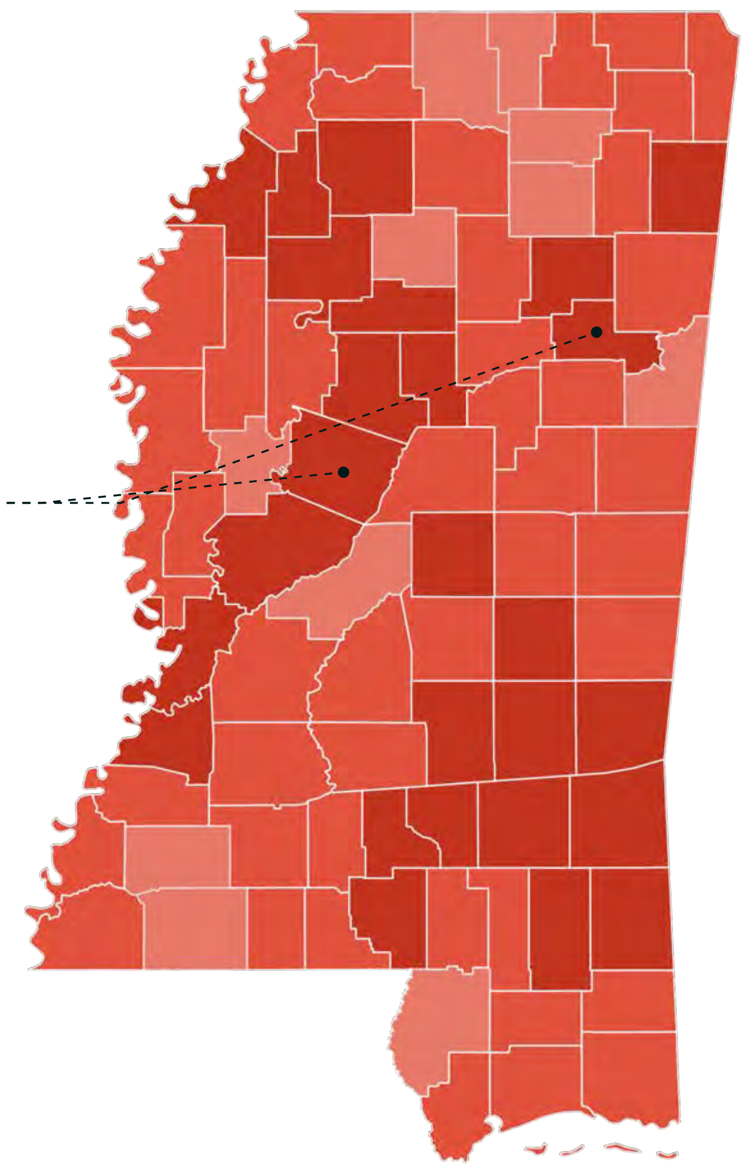


MISSISSIPPI STATISTICS SUMMARY (2011 – 2021)	
22	CLIMATE DISASTER DECLARATIONS
2ND	HIGHEST NUMBER OF DISASTERS IN THE COUNTRY
EVERY	COUNTY HAS HAD A RECENT DISASTER
CLAY, HOLMES	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
54	COUNTIES WITH FIVE OR MORE DISASTERS
44	SUPERFUND SITES
D+	ASCE INFRASTRUCTURE REPORT CARD GRADE
HARRISON	HIGHEST COMPOUNDING RISKS
$476M	FEMA + HUD POST-DISASTER FUNDING
3 MILLION	POPULATION TOTAL
$159	PER CAPITA SPENDING ON CLIMATE DISASTERS
$2.4 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

22
disaster declarations



Sixty-five percent of counties in Mississippi have had five or more disasters.

Clay and Holmes counties in Mississippi have each had 9 reecent disasters.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

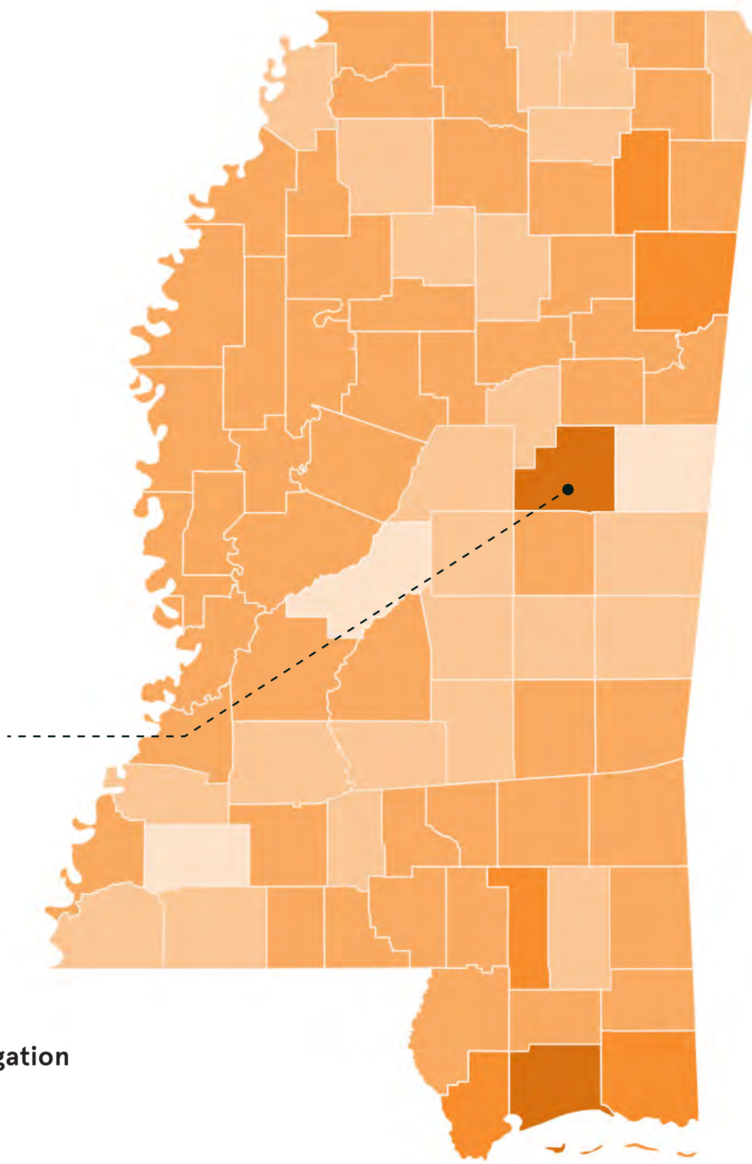
- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$476M
post-disaster assistance



$431M	FEMA obligations
$45.1M	HUD CDBG-DR Funds
$476	FEMA + HUD assistance
$159	per capita cost

Winston County has received the most post-disaster federal recovery funding in the state: $70 million.

FEMA Public Assistance and Hazard Mitigation

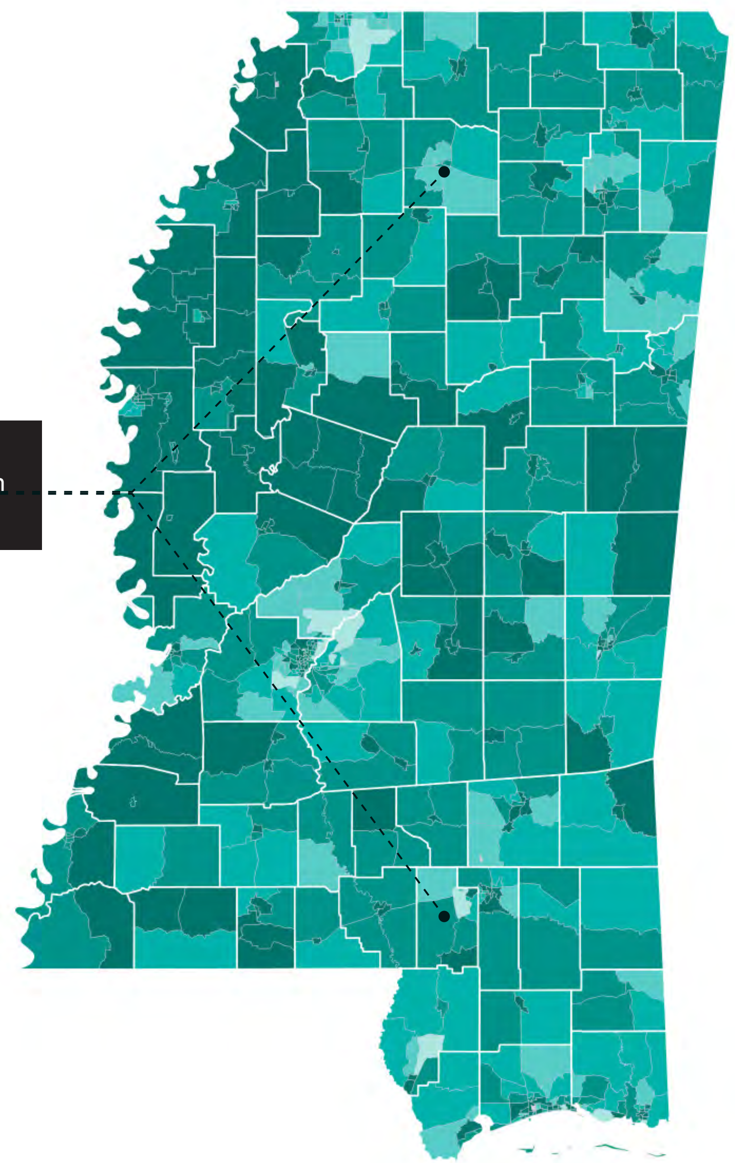
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



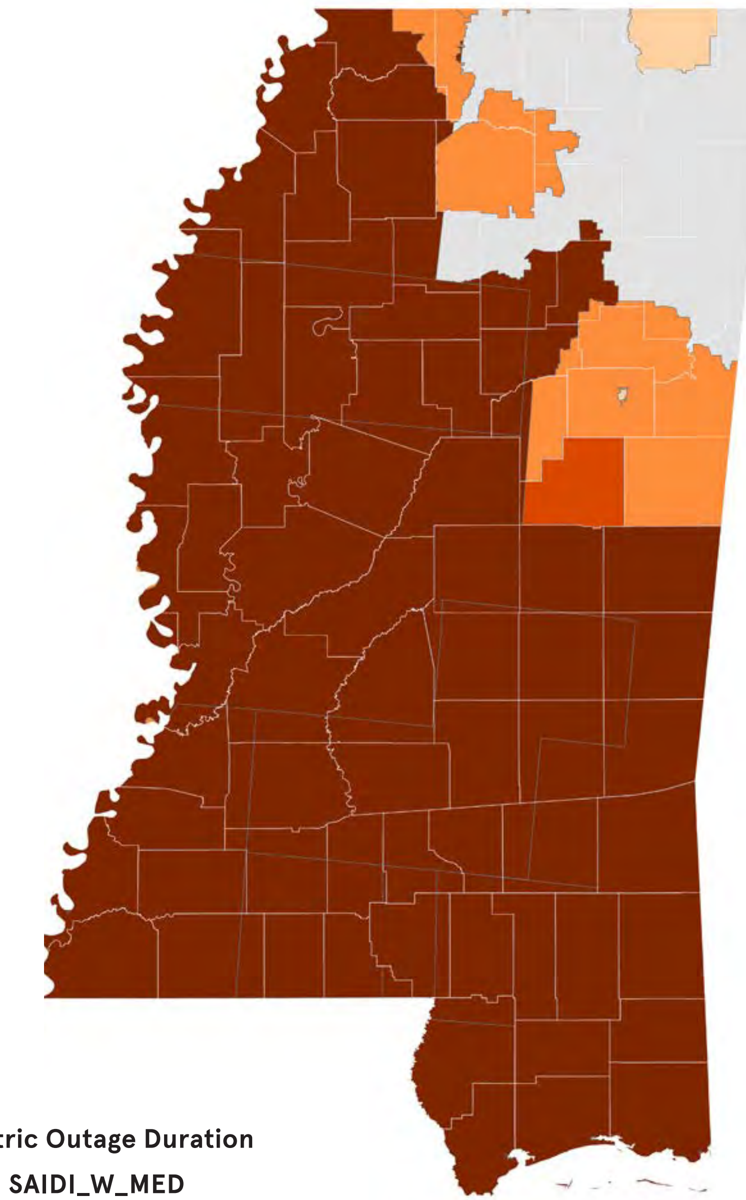
Lamar and Lafayette counties have had five disasters and have had high increases in popuation.

CDC (2018)
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



A majority of the state is serviced by an energy utility company with longer than average energy outage periods.

Twenty-four counties in Mississippi have high social vulnerabilty and low energy reliability.

Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

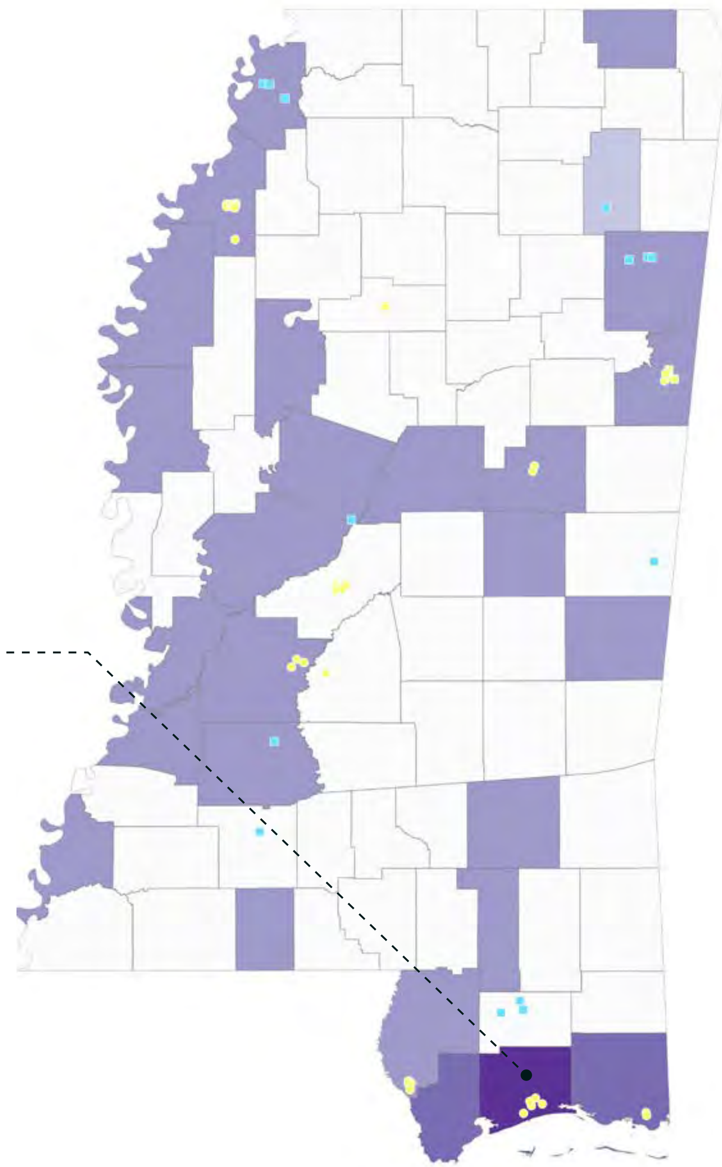
- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Every county in Mississippi has a high health risk.

Harrison County has high risk of climate disasters, high population increase, high poverty rates, and high health risks.



Areas with the greatest return on investment due to physical and social risk (2011-2021)

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adams					1		3
Alcorn					1		3
Amite							0
Attala					1		3
Benton							0
Bolivar					2		3
Calhoun							0
Carroll							0
Chickasaw							0
Choctaw							0
Claiborne					1		3
Clarke							0
Clay							0
Coahoma					2		3
Copiah					2		3
Covington							0
DeSoto							0
Forrest					2		3
Franklin							0
George							0
Greene							0
Grenada							0
Hancock					1		4
Harrison					4		5
Hinds					7		3
Holmes					1		3
Humphreys							0
Issaquena							0
Itawamba							0
Jackson					1		4
Jasper							0
Jefferson							0
Jefferson Davis							0
Jones					2		3
Kemper							0
Lafayette							0
Lamar							0
Lauderdale					3		3
Lawrence							0
Leake							0
Lee					1		2
Leflore					3		3
Lincoln							0
Lowndes					1		3
Madison							0
Marion							0
Marshall							0
Monroe					2		3
Montgomery							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Neshoba					1		3
Newton							0
Noxubee							0
Oktibbeha							0
Panola							0
Pearl River					1		3
Perry							0
Pike					2		3
Pontotoc							0
Prentiss							0
Quitman							0
Rankin							0
Scott							0
Sharkey							0
Simpson							0
Smith							0
Stone							0
Sunflower							0
Tallahatchie							0
Tate							0
Tippah							0
Tishomingo							0
Tunica					1		3
Union							0
Walthall							0
Warren					2		3
Washington					3		3
Wayne							0
Webster							0
Wilkinson							0
Winston					1		3
Yalobusha							0
Yazoo					1		3

IMAGE RIGHT: JANUARY 21, 2017. PETAL, MISSISSIPPI TORNADO DAMAGE | NATIONAL WEATHER SERVICE OFFICE IN JACKSON, MISSISSIPPI

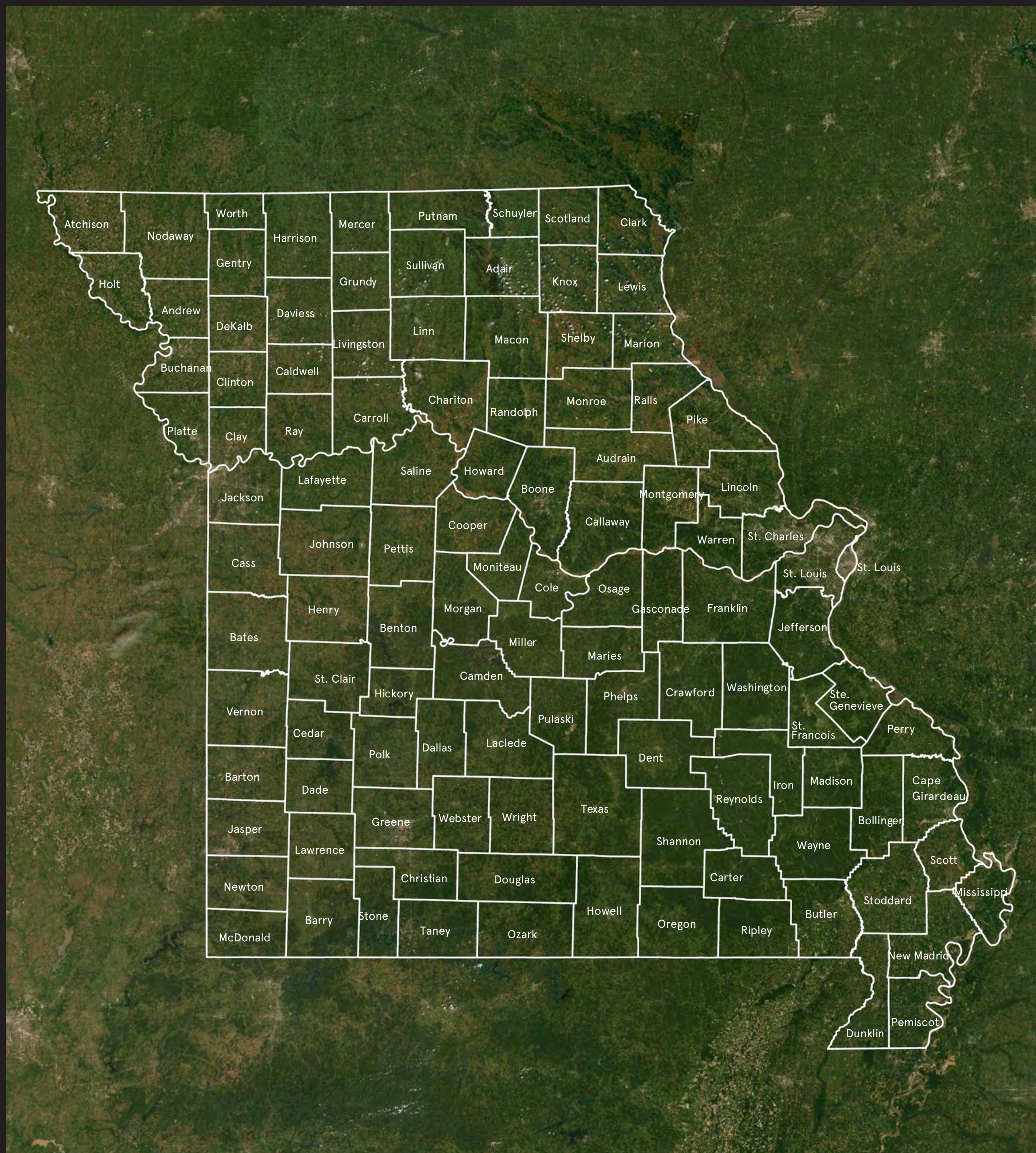
MISSISSIPPI

TOTAL: 22 DISASTERS
FEMA PA + HM: $431 M
HUD CDBG-DR: $45.1 M
FEMA + HUD ASSISTANCE: $476 M

			2011				2012		2013		2014		2015		2016				2017			
			1972: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND ASSOCIATED FLOODING		1983: FLOODING		4081: HURRICANE ISAAC		4101: SEVERE STORMS, TORNADOES, AND FLOODING		4175: SEVERE STORMS, TORNADOES, AND FLOODING		4205: SEVERE STORMS AND TORNADOES		4248: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4268: SEVERE STORMS AND FLOODING		4295: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4314: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	22	$109,877,869	$6,993,818	$157,841	$4,115,298	$83,758	$12,033,008	$40,536	$962,433	$12,363	$8,966,561	$680,512	$1,384,642	$0	$2,416,821	$63,086	$689,224	$127,070	$2,071,824	$88,099	$3,390,314	$112,256
Adams County	5	$1,661,207			$393,399	$0	$112,849	$74,969													$106,368	$0
Alcorn County	4	$6,177,717	$141,975	$0																		
Amite County	3	$149,989					$149,989	$0														
Attala County	5	$163,106	$0	$0			$0	$0														
Benton County	3	$779,511	$195,583	$0											$583,928	$0						
Bolivar County	5	$912,590			$146,022	$0											$676,703	$23,733				
Calhoun County	5	$353,660	$82,861	$0																	$99,712	$0
Carroll County	7	$1,939,110	$60,023	$0			$0	$32,322													$42,940	$0
Chickasaw County	7	$1,812,910	$672,585	$27,774											$110,706	$0						
Choctaw County	6	$549,526	$397,859	$0																		
Claiborne County	8	$2,735,037			$46,303	$0	$170,095	$0									$263,162	$0			$1,370,156	$0
Clarke County	7	$1,243,692	$99,664	$83,300			$221,129	$0									$180,869	$0				
Clay County	9	$895,582	$351,388	$0											$90,841	$0						
Coahoma County	7	$2,217,116	$0	$0	$120,375	$0									$51,163	$0	$1,368,722	$0				
Copiah County	4	$230,936					$108,725	$0														
Covington County	8	$5,750,950					$117,304	$0									$288,680	$0				
DeSoto County	4	$239,861	$130,994	$0	$0	$0																
Forrest County	6	$9,728,494					$102,677	$0	$1,852,250	$0							$722,698	$0	$6,476,840	$0		
Franklin County	3	$39,553					$34,272	$0														
George County	6	$8,293,216					$459,227	$0									$0	$0				
Greene County	8	$2,353,271	$669,660	$103,476			$154,041	$0	$0	$0							$288,333	$0				
Grenada County	7	$1,107,628	$0	$0			$0	$0														
Hancock County	4	$13,939,525					$3,157,985	$435,857														
Harrison County	4	$46,405,498					$8,017,534	$3,561,736														
Hinds County	5	$3,509,981	$890,043	$0			$184,909	$1,931,985														
Holmes County	9	$7,060,952	$193,880	$0			$9,000	$0									$155,122	$0			$5,963,131	$0
Humphreys County	3	$1,468,497			$131,816	$0																
Issaquena County	5	$3,292,237			$60,284	$0											$14,190	$0				
Itawamba County	7	$1,463,138	$44,083	$0							$857,615	$0			$304,427	$0						
Jackson County	4	$23,295,206					$8,661,285	$0														
Jasper County	7	$2,124,308	$31,570	$0			$0	$0														
Jefferson County	5	$340,710			$163,519	$0	$29,210	$0													$143,923	$0
Jefferson Davis County	8	$4,218,310					$9,370	$0	$0	$0							$43,126	$0				
Jones County	7	$5,309,084					$40,442	$0			$501,104	$0					$378,662	$0				
Kemper County	5	$294,249	$120,807	$0			$0	$31,415														
Lafayette County	5	$1,865,780	$1,006,379	$112,425																		
Lamar County	5	$2,442,949					$419,977	$0	$1,027,009	$0							$98,210	$272,520	$625,232	$0		
Lauderdale County	4	$319,720					$27,782	$0											$0	$0		
Lawrence County	6	$652,065					$94,023	$0									$61,424	$0				
Leake County	7	$590,294					$0	$0			$51,143	$0					$171,684	$0				
Lee County	5	$12,223,106	$94,536	$0							$8,059,949	$103,225										
Leflore County	5	$2,265,465	$0	$0													$219,073	$0				
Lincoln County	4	$785,362					$667,909	$0									$60,456	$0				
Lowndes County	3	$3,986,386									$1,445,270	$42,744										
Madison County	3	$51,758					$0	$0			$51,758	$0										
Marion County	8	$2,799,195					$289,532	$0	$43,721	$0			$1,600,667	$0			$162,319	$0				
Marshall County	3	$1,586,526	$309,795	$0											$1,276,731	$0						
Monroe County	5	$8,790,192	$4,554,276	$1,705,885											$227,604	$0						
Montgomery County	7	$2,750,812	$188,506	$0			$0	$0			$0	$0									$2,443,464	$0
Neshoba County	5	$918,892	$255,707	$0			$4,165	$0														
Newton County	7	$542,457	$140,899	$0			$149,951	$0			$125,133	$0										
Noxubee County	6	$84,095	$4,822	$0			$0	$0														
Oktibbeha County	4	$552,748																				
Panola County	7	$899,486	$269,408	$0											$60,881	$0	$201,182	$0				
Pearl River County	3	$1,359,407					$890,311	$407,275									$61,821	$0				
Perry County	7	$300,091					$16,926	$0	$0	$0							$29,222	$0	$25,983	$0		
Pike County	4	$1,852,761					$346,992	$0														
Pontotoc County	3	$281,904																				
Prentiss County	6	$1,106,854	$0	$0											$66,151	$0						
Quitman County	8	$1,509,411	$78,792	$24,257											$157,989	$0	$816,938	$0				
Rankin County	4	$906,150					$0	$0			$512,236	$42,464										
Scott County	5	$184,397	$12,927	$87,477			$10,072	$0														
Sharkey County	4	$1,792,780			$91,589	$0																
Simpson County	6	$51,306					$0	$0			$0	$0										
Smith County	7	$261,749	$7,486	$0			$0	$0														
Stone County	4	$1,393,560					$153,386	$0														
Sunflower County	6	$3,015,311	$0	$0													$90,887	$0				
Tallahatchie County	7	$1,929,402													$180,248	$0	$373,265	$44,068				
Tate County	4	$248,982	$47,419	$0													$129,699	$0				
Tippah County	4	$469,466	$68,540	$0											$171,664	$0						
Tishomingo County	4	$558,273	$203,004	$0																		
Tunica County	5	$453,839	$43,850	$0	$262,519	$0											$111,001	$0				
Union County	3	$519,479	$42,403	$0																		
Walthall County	5	$1,077,005					$137,915	$0									$123,090	$0				
Warren County	8	$4,509,643			$721,839	$53,997	$63,719	$0			$0	$0										
Washington County	5	$3,766,592			$734,407	$818,411											$485,986	$0				
Wayne County	8	$6,553,378					$155,957	$0	$575,700	$470,199	$846,788	$0					$930,446	$0				
Webster County	6	$5,842,241	$5,296,182	$0																	$34,135	$0
Wilkinson County	5	$726,910			$297,977	$0	$197,977	$0														
Winston County	5	$69,529,169	$27,908	$0			$0	$0			$69,405,864	$0										
Yalobusha County	3	$126,538																				
Yazoo County	8	$4,121,786			$180,028	$0	$0	$0													$3,242,111	$0
Total FEMA Allocation		$430,489,894	$23,729,628	$2,302,435	$7,465,375	$956,166	$37,399,647	$6,516,095	$4,461,112	$482,562	$90,823,420	$868,945	$2,985,308	$0	$5,699,154	$63,086	$9,196,195	$467,391	$9,199,879	$88,099	$16,836,255	$112,256

	2017		2019								2020										2021			
	4350: HURRICANE NATE		4415: SEVERE STORMS, FLOODING, AND TORNADO		4429: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING		4450: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4470: SEVERE STORM, STRAIGHT-LINE WINDS, AND FLOODING		4478: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4536: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4538: SEVERE STORMS, FLOODING, AND MUDSLIDES		4551: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4576: HURRICANE ZETA		4598: SEVERE WINTER STORMS		4626: HURRICANE IDA	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$2,744,307	$137,521	$363,417	$28,219	$1,698,991	$184,028	$1,372,594	$0	$3,363,698	$0	$3,398,909	$0	$15,094,417	$0	$863,867	$0	$2,195,651	$0	$22,170,515	$0	$10,960,606	$0	$911,665	$0
Adams County																					$973,623	$0	$0	$0
Alcorn County					$330,226	$0			$5,705,515	$0													$0	$0
Amite County																	$0	$0					$0	$0
Attala County															$83,290	$0					$79,816	$0	$0	$0
Benton County																							$0	$0
Bolivar County											$36,602	$0	$29,529	$0									$0	$0
Calhoun County					$143,830	$0							$27,257	$0									$0	$0
Carroll County					$896,751	$0							$29,018	$0	$878,056	$0							$0	$0
Chickasaw County					$477,575	$19,979			$108,031	$0	$396,260	$0	$0	$0									$0	$0
Choctaw County									$5,413	$0	$132,957	$0	$0	$0							$13,297	$0	$0	$0
Claiborne County															$786,519	$0	$45,520	$0			$40,925	$0	$12,356	$0
Clarke County			$366,102	$0			$243,920	$0					$48,707	$0									$0	$0
Clay County					$58,011	$0	$30,960	$0			$108,014	$0	$39,434	$0	$153,200	$0					$63,734	$0	$0	$0
Coahoma County					$348,885	$0							$327,970	$0									$0	$0
Copiah County															$96,647	$0					$25,564	$0	$0	$0
Covington County			$386,534	$0					$836,744	$0			$3,815,244	$0			$280,980	$0			$25,464	$0	$0	$0
DeSoto County											$108,867	$0											$0	$0
Forrest County			$532,230	$0																			$41,800	$0
Franklin County																					$5,281	$0	$0	$0
George County	$65,925	$0															$148,246	$0	$7,584,784	$0			$35,034	$0
Greene County	$32,390	$0	$0	$0															$1,105,371	$0			$0	$0
Grenada County					$725,310	$124,339							$34,442	$0	$124,403	$20,060					$79,073	$0	$0	$0
Hancock County	$702,311	$0																	$9,512,907	$0			$130,464	$0
Harrison County	$1,705,695	$94,275																	$32,644,255	$0			$382,004	$0
Hinds County															$117,408	$0					$385,636	$0	$0	$0
Holmes County							$230,442	$0					$15,021	$0	$494,356	$0					$0	$0	$0	$0
Humphreys County					$1,336,681	$0																	$0	$0
Issaquena County					$3,190,472	$0									$27,292	$0							$0	$0
Itawamba County					$98,877	$0	$158,136	$0	$0	$0													$0	$0
Jackson County	$5,584,195	$0																	$9,032,451	$0			$17,275	$0
Jasper County			$274,160	$0					$0	$0			$1,818,578	$0							$0	$0	$0	$0
Jefferson County																					$4,057	$0	$0	$0
Jefferson Davis County									$51,543	$31,841			$2,895,089	$0			$1,179,520	$0			$7,821	$0	$0	$0
Jones County			$725,798	$0									$2,983,705	$0			$679,372	$0					$0	$0
Kemper County							$12,250	$0													$129,777	$0	$0	$0
Lafayette County					$610,754	$26,560							$86,569	$0							$23,093	$0	$0	$0
Lamar County																							$0	$0
Lauderdale County																					$291,938	$0	$0	$0
Lawrence County													$482,961	$0			$13,657	$0			$0	$0	$0	$0
Leake County									$66,826	$0			$293,385	$0							$7,256	$0	$0	$0
Lee County					$1,037,599	$0			$2,927,796	$0													$0	$0
Leflore County					$591,423	$0									$1,454,970	$0							$0	$0
Lincoln County																					$56,997	$0	$0	$0
Lowndes County					$2,498,373	$0																	$0	$0
Madison County																							$0	$0
Marion County			$0	$0					$0	$0					$702,955	$0							$0	$0
Marshall County																							$0	$0
Monroe County					$0	$0	$2,302,427	$0															$0	$0
Montgomery County					$118,843	$0							$0	$0									$0	$0
Neshoba County									$9,700	$0											$649,319	$0	$0	$0
Newton County			$5,827	$0					$0	$0											$120,648	$0	$0	$0
Noxubee County			$79,273	$0									$0	$0							$0	$0	$0	$0
Oktibbeha County							$281,329	$0	$57,082	$0	$214,338	$0											$0	$0
Panola County					$163,709	$0					$43,133	$0	$161,173	$0									$0	$0
Pearl River County																							$0	$0
Perry County			$133,927	$0															$94,033	$0			$0	$0
Pike County																	$1,499,301	$0			$3,072	$0	$3,396	$0
Pontotoc County					$281,904	$0			$0	$0													$0	$0
Prentiss County					$474,587	$0			$408,121	$0	$157,994	$0											$0	$0
Quitman County					$285,734	$0					$10,985	$0	$110,444	$0							$24,273	$0	$0	$0
Rankin County																					$351,450	$0	$0	$0
Scott County									$0	$0											$73,922	$0	$0	$0
Sharkey County					$1,675,383	$0									$25,807	$0							$0	$0
Simpson County									$6,621	$0							$0	$0			$44,685	$0	$0	$0
Smith County									$0	$0			$47,454	$0			$60,274	$0			$146,535	$0	$0	$0
Stone County	$6,419	$0																	$1,223,655	$0			$10,100	$0
Sunflower County					$2,919,922	$0					$4,501	$0	$0	$0									$0	$0
Tallahatchie County					$724,375	$392,438					$151,122	$0	$22,319	$0							$41,567	$0	$0	$0
Tate County													$71,865	$0									$0	$0
Tippah County									$229,261	$0													$0	$0
Tishomingo County					$289,507	$40,679					$25,084	$0											$0	$0
Tunica County													$36,469	$0									$0	$0
Union County					$477,076	$0																	$0	$0
Walthall County													$733,789	$0							$58,347	$0	$23,865	$0
Warren County					$1,080,468	$0	$244,851	$0							$1,754,273	$0					$590,496	$0	$0	$0
Washington County					$1,669,926	$0					$57,862	$0											$0	$0
Wayne County			$2,913,963	$0													$60,074	$0	$586,509	$0			$13,743	$0
Webster County					$431,104	$0							$0	$0							$80,820	$0	$0	$0
Wilkinson County															$116,171	$0					$90,720	$0	$24,065	$0
Winston County																					$95,398	$0	$0	$0
Yalobusha County					$126,538	$0							$0	$0									$0	$0
Yazoo County					$133,769	$0	$304,723	$0							$157,906	$0					$103,249	$0	$0	$0
Total FEMA Allocation	$10,841,242	$231,796	$5,781,229	$28,219	$24,896,603	$788,021	$5,181,632	$0	$13,776,353	$31,841	$4,846,629	$0	$29,204,838	$0	$7,837,121	$20,060	$6,162,594	$0	$83,954,481	$0	$15,648,460	$0	$1,605,766	$0

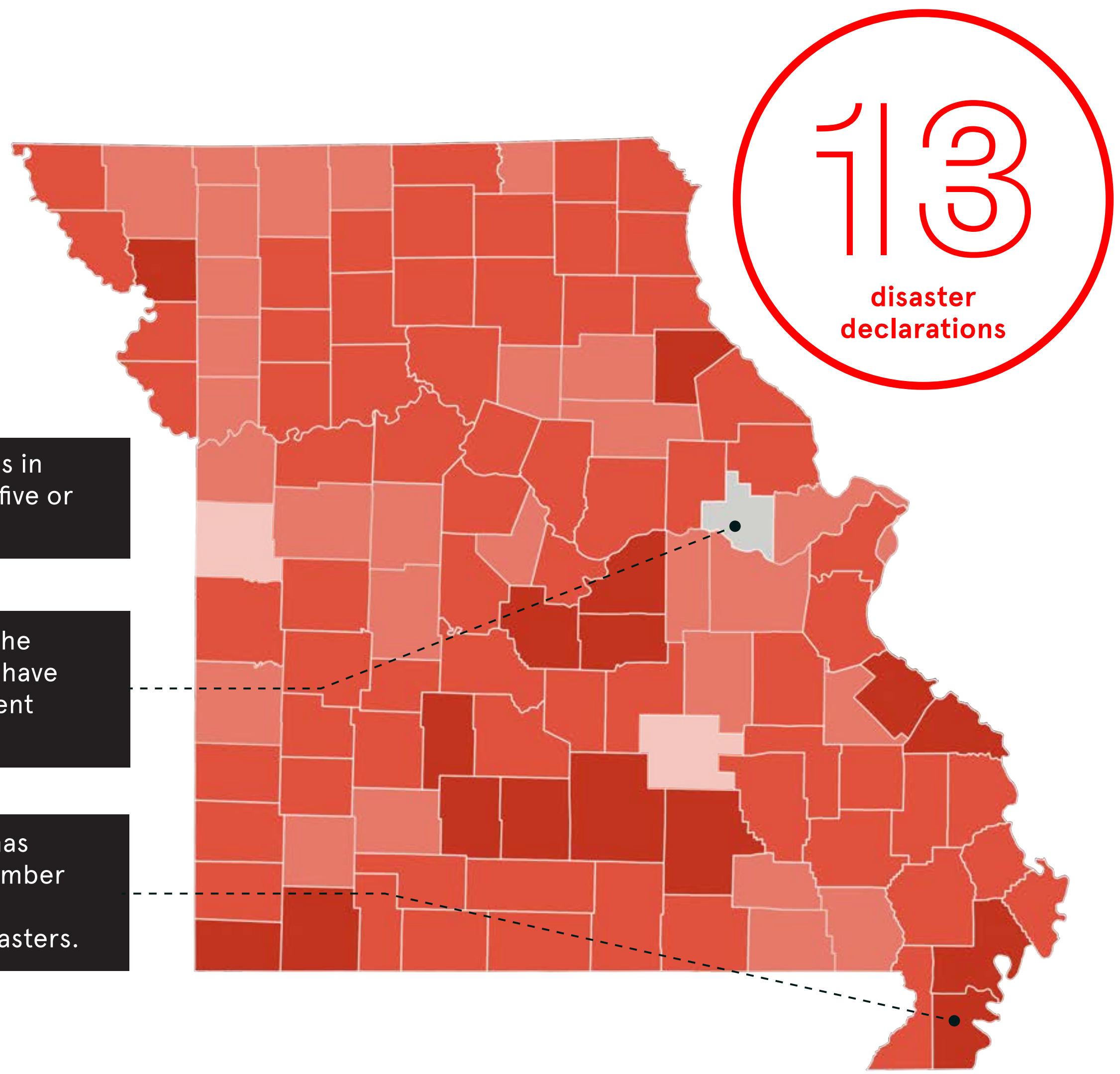
MISSOURI



MISSOURI STATISTICS SUMMARY (2011 - 2021)	
14	CLIMATE DISASTER DECLARATIONS
PEMISCOT	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
57	COUNTIES WITH FIVE OR MORE DISASTERS
21	SUPERFUND SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
ST. LOUIS CITY	HIGHEST COMPOUNDING RISKS
$992 MILLION	FEMA + HUD POST DISASTER FUNDING
6.1 MILLION	POPULATION TOTAL
$162	PER CAPITA SPENDING ON CLIMATE DISASTERS
$5.3 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011-2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY



Half of the counties in Missouri have had five or more disasters.

Warren County is the only county to not have experienced a recent disaster

Pemiscot County has had the highest number of recent disaster declarations: 8 disasters.

Number of Disaster Events

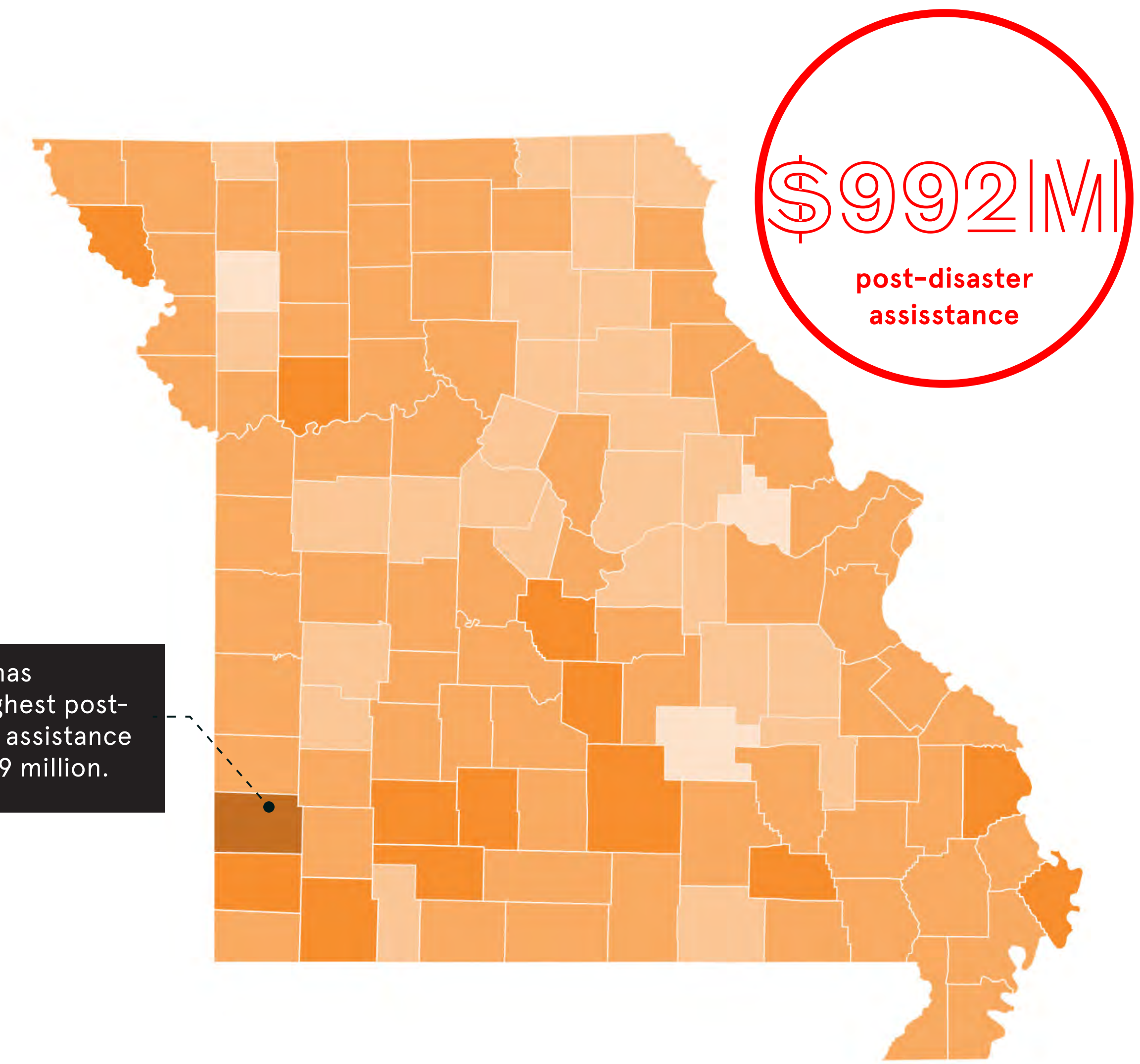
Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011-2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS



Jasper County has received the highest post-disaster federal assistance in the state: $149 million.

FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011-2021)

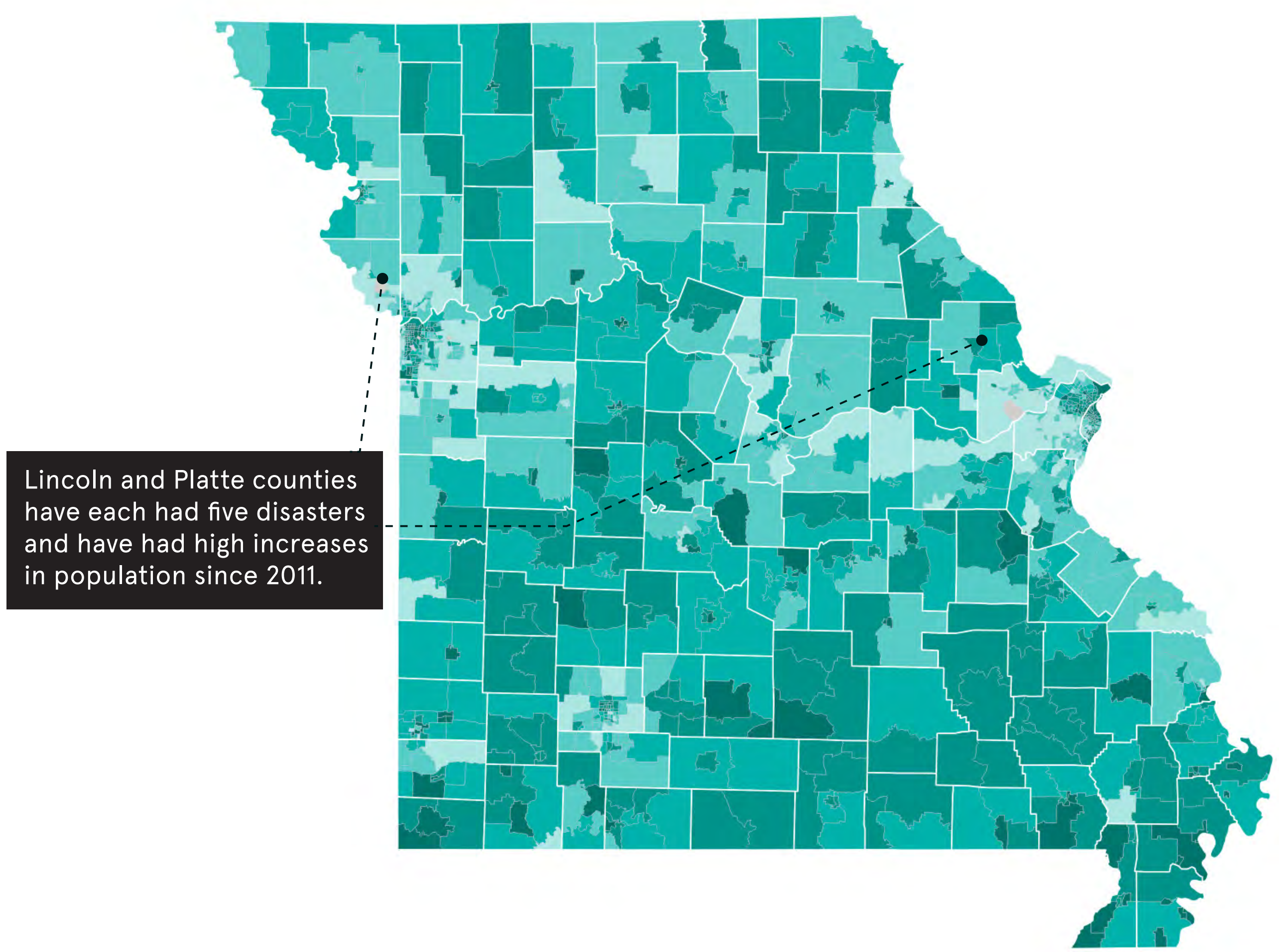
- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

$672M	FEMA obligations
$319M	HUD CDBG-DR Funds
$992M	FEMA + HUD assistance
$162	per capita cost

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

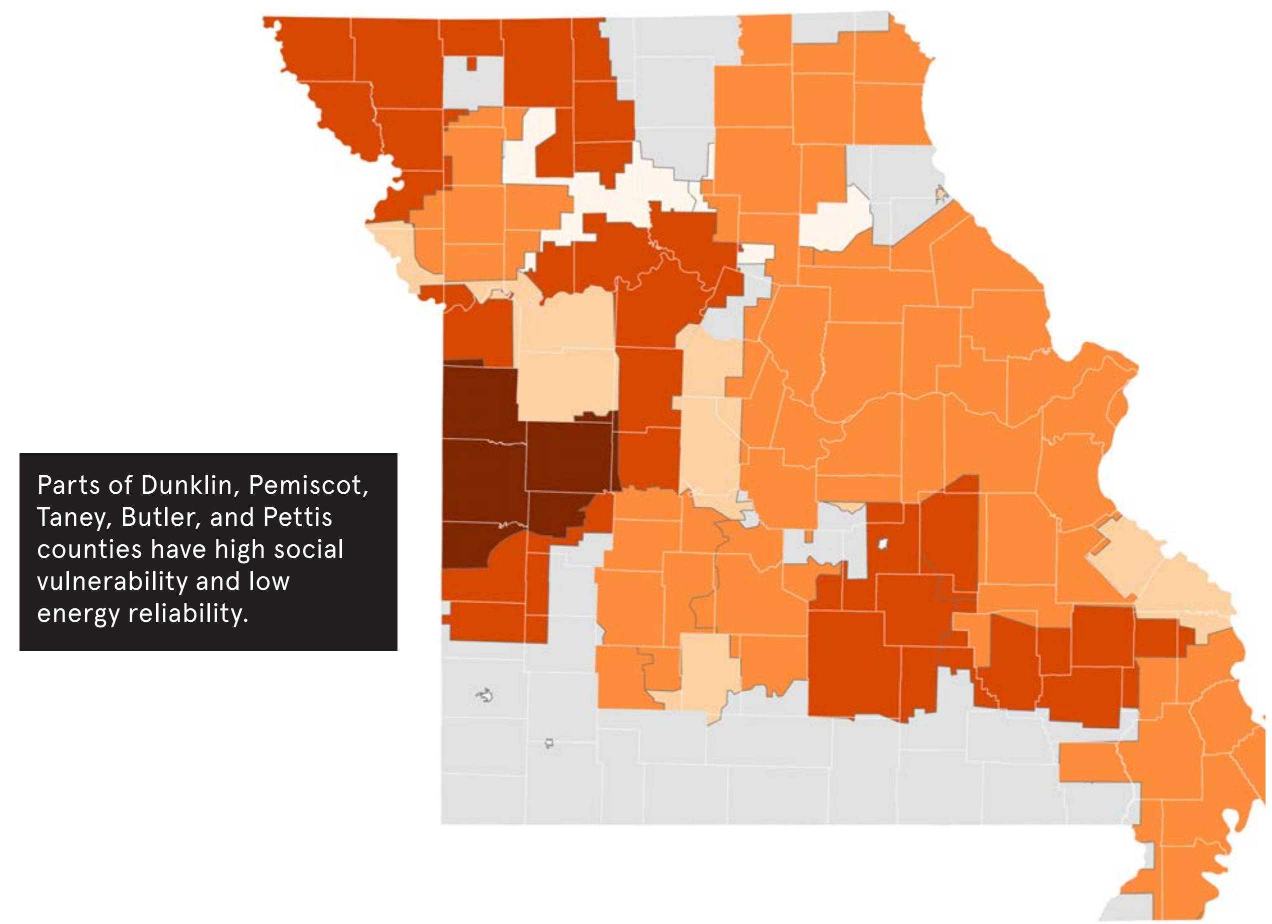
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



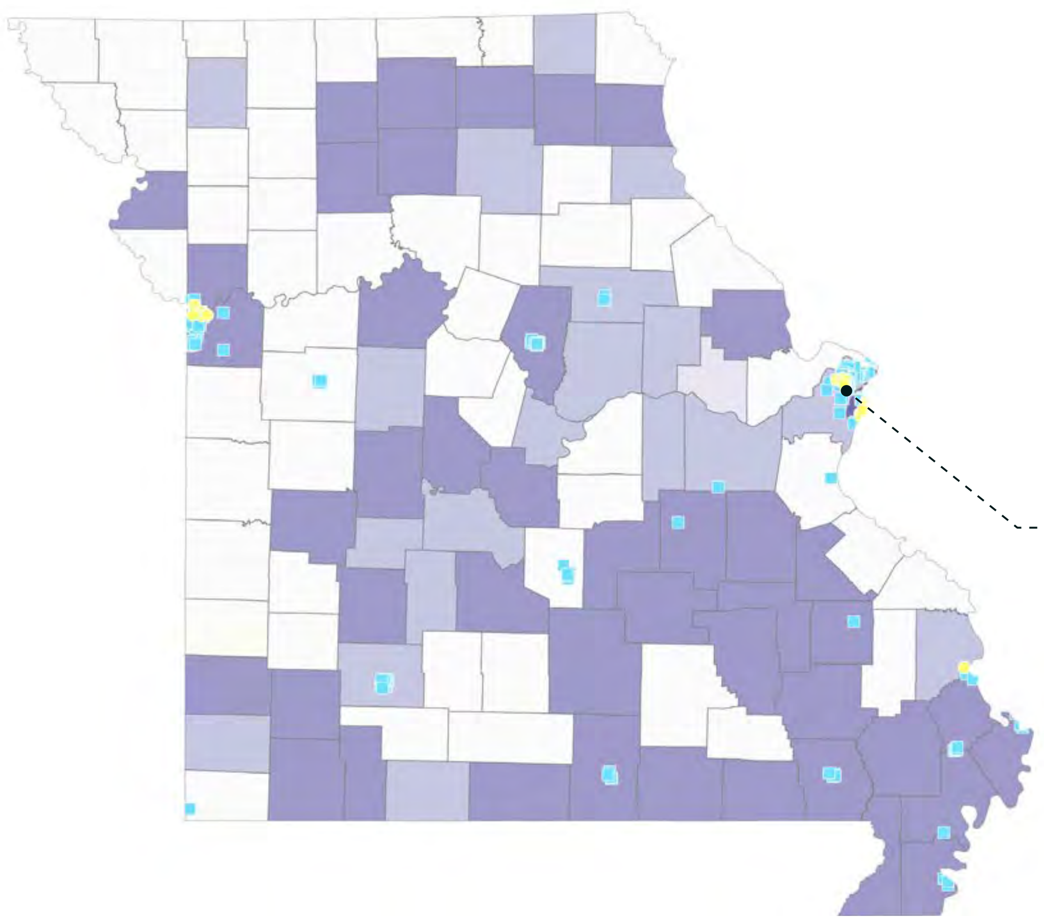
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



St. Louis City has high risk of climate disasters, high population density, and high health risk.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adair					1		3
Andrew							0
Atchison							0
Audrain					2		2
Barry					5		3
Barton							0
Bates							0
Benton					1		3
Bollinger							0
Boone					2		3
Buchanan					1		3
Butler					5		3
Caldwell							0
Callaway					1		2
Camden					4		2
Cape Girardeau					2		2
Carroll							0
Carter							0
Cass							0
Cedar							0
Chariton							0
Christian							0
Clark							0
Clay					1		3
Clinton							0
Cole					1		2
Cooper							0
Crawford					2		3
Dade							0
Dallas					1		2
Daviess							0
DeKalb							0
Dent					1		3
Douglas							0
Dunklin					4		3
Franklin					1		2
Gasconade					1		2
Gentry					1		2
Greene					5		2
Grundy					2		3
Harrison							0
Henry							0
Hickory					3		2
Holt							0
Howard							0
Howell					3		3
Iron					1		3
Jackson					8		3
Jasper					4		3

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Jefferson							0
Johnson							0
Knox					1		3
Laclede					2		3
Lafayette							0
Lawrence					2		3
Lewis					1		3
Lincoln					1		3
Linn					1		3
Livingston					1		3
Macon					2		2
Madison					2		3
Maries							0
Marion					2		2
McDonald							0
Mercer							0
Miller					2		3
Mississippi					1		3
Moniteau							0
Monroe							0
Montgomery					1		2
Morgan					2		3
New Madrid					3		3
Newton					2		2
Nodaway							0
Oregon					1		3
Osage							0
Ozark					1		3
Pemiscot					4		3
Perry							0
Pettis					2		2
Phelps					1		3
Pike							0
Platte							0
Polk					1		3
Pulaski							0
Putnam							0
Ralls							0
Randolph							0
Ray							0
Reynolds					1		3
Ripley					2		3
Saline					2		3
Schuyler							0
Scotland					1		2
Scott					3		3
Shannon							0
Shelby							0
St. Charles							0
St. Clair					1		3
St. Francois					1		3

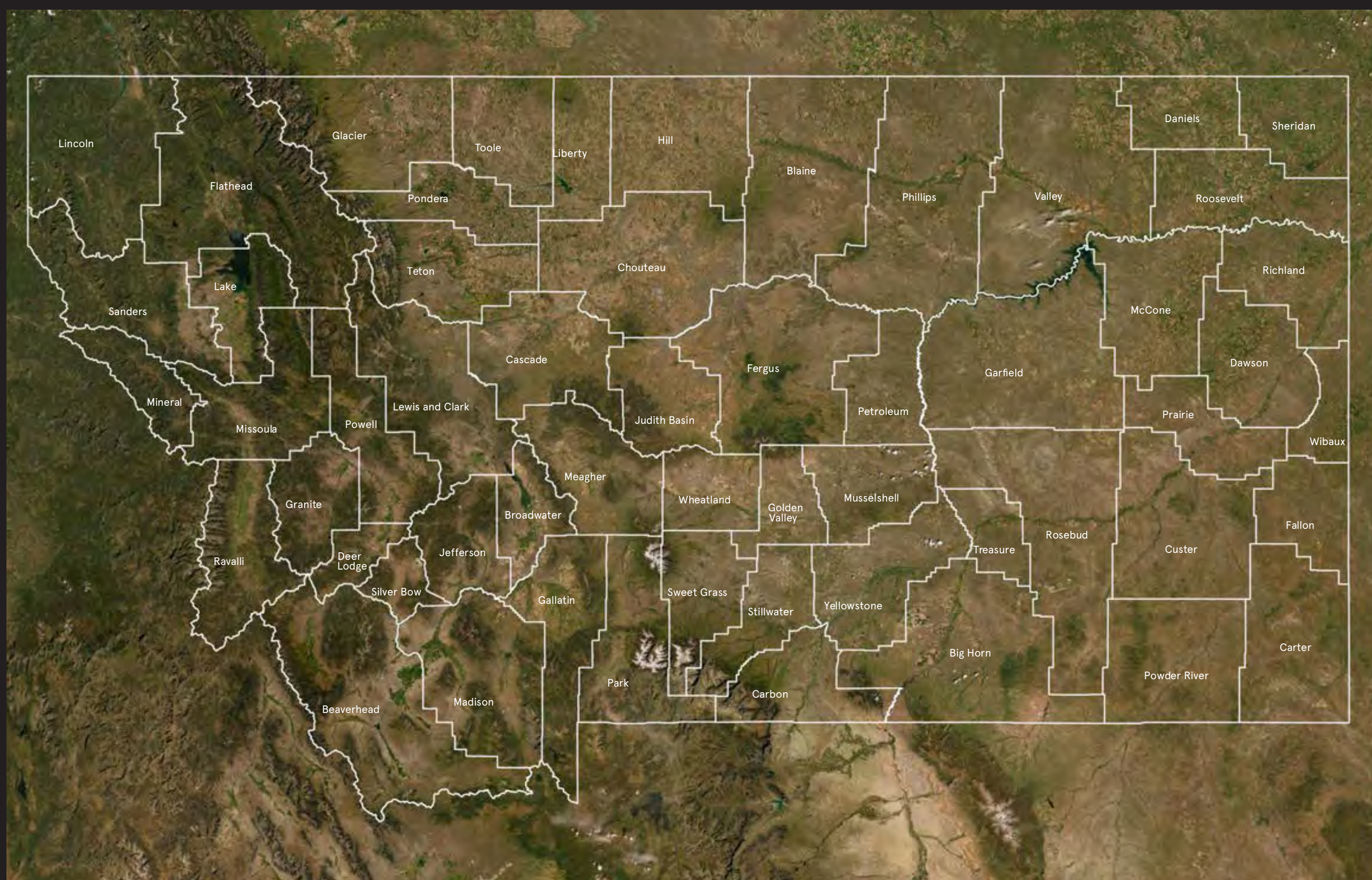
County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
St. Louis City					7		4
St. Louis County					7		2
Ste. Genevieve							0
Stoddard					2		3
Stone					3		3
Sullivan					2		3
Taney					5		2
Texas					2		3
Vernon							0
Warren					1		1
Washington					1		3
Wayne					2		3
Webster							0
Worth							0
Wright							0

MISSOURI

TOTAL: 13 DISASTERS
FEMA PA + HM: $672 M
HUD CDBG-DR: $319 M
FEMA + HUD ASSISTANCE: $992 M

			2011						2013				2014		2015		2016		2017		2019				2020		2021	
			1961: SEVERE WINTER STORM AND SNOWSTORM		1980: SEVERE STORMS, TORNADOES, AND FLOODING		4012: FLOODING		4130: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING		4144: SEVERE STORMS, STRAIGHT-LINE WINDS AND FLOODING		4200: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4238: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4250: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4317: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS AND FLOODING		4435: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4451: SEVERE STORMS, TORNADOES, AND FLOODING		4552: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4612: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	13	$82,616,148	$2,984,402	$4,513	$15,745,234	$2,078,133	$6,396,714	$1,011,466	$1,571,704	$18,458	$1,630,793	$39,696	$325,598	$49,304	$3,431,033	$853,317	$5,223,172	$416,120	$14,772,453	$768,651	$4,411,008	$366,235	$13,561,461	$742,710	$5,463,706	$65,437	$684,830	$0
Adair County	4	$2,147,204	$55,471	$0									$282,328	$0	$1,099,218	$0							$710,188	$0				
Andrew County	7	$2,110,374	$30,651	$0			$458,097	$1,364,746					$20,422	$0	$68,719	$0					$14,812	$0	$59,178	$93,750			$0	$0
Atchison County	5	$9,190,417					$3,895,403	$0					$93,846	$0	$434,460	$0					$3,474,781	$707,154	$584,773	$0				
Audrain County	3	$387,047	$64,004	$0											$318,062	$0											$4,982	$0
Barry County	7	$10,335,568			$581,219	$3,575,297					$391,973	$0			$588,917	$0	$2,201,026	$1,184,250	$1,020,249	$492,499			$300,138	$0			$0	$0
Barton County	5	$2,873,030	$94,794	$0					$210,120	$0							$0	$0	$157,615	$1,389,180			$1,021,320	$0				
Bates County	4	$1,919,296	$251,934	$0											$373,526	$0							$1,293,837	$0	$0	$0		
Benton County	3	$1,181,226	$65,768	$0											$544,983	$0							$570,476	$0				
Bollinger County	5	$3,933,403			$358,406	$0											$133,073	$0	$170,118	$1,055,250			$146,556	$2,070,000				
Boone County	4	$1,153,040	$552,022	$0															$190,982	$0			$410,036	$0			$0	$0
Buchanan County	6	$8,450,027	$89,569	$0			$2,790,527	$1,344,209							$457,590	$0					$2,139,674	$0	$1,628,459	$0			$0	$0
Butler County	3	$5,370,033			$1,135,876	$3,252,448													$981,709	$0					$0	$0		
Caldwell County	4	$1,931,178	$172,692	$0											$614,208	$0							$1,141,765	$0			$2,513	$0
Callaway County	4	$481,106	$126,105	$0					$80,001	$0													$255,893	$19,107			$0	$0
Camden County	6	$8,351,029	$155,803	$0							$1,306,841	$0			$2,084,611	$0	$388,383	$0	$197,896	$1,110,000			$3,107,496	$0				
Cape Girardeau County	6	$10,920,252			$681,370	$3,545,203			$19,943	$0							$174,560	$2,936,958	$165,150	$66,418	$252,542	$0	$1,830,851	$1,247,256				
Carroll County	5	$3,640,339	$92,356	$0			$384,245	$0													$460,790	$0	$2,642,618	$0			$60,329	$0
Carter County	3	$11,731,581			$321,610	$0													$10,405,073	$749,474					$255,424	$0		
Cass County	1	$1,969,545	$342,881	$1,626,664																								
Cedar County	5	$905,922	$42,080	$0							$89,981	$0					$195,774	$0	$308,537	$0			$269,550	$0				
Chariton County	6	$2,150,994	$87,076	$0					$103,121	$0					$396,342	$0					$30,785	$0	$1,483,733	$0			$49,937	$0
Christian County	4	$8,933,549			$145,601	$5,215,189									$1,334,656	$1,816,875			$421,228	$0							$0	$0
Clark County	4	$939,509	$22,016	$0					$60,129	$0					$86,193	$0							$771,171	$0				
Clay County	2	$1,294,493													$1,197,385	$97,108							$0	$0				
Clinton County	3	$682,011	$55,247	$0											$626,764	$0											$0	$0
Cole County	5	$3,274,774	$321,164	$0											$222,614	$0	$0	$0	$350,185	$0			$2,107,061	$273,750				
Cooper County	4	$533,596	$92,277	$0			$396,621	$0															$44,698	$0			$0	$0
Crawford County	3	$588,584													$127,356	$0	$133,255	$0	$327,973	$0								
Dade County	6	$3,259,001	$35,399	$0							$589,579	$0			$193,562	$0	$370,026	$0	$374,383	$0			$623,551	$1,072,500				
Dallas County	7	$1,064,559	$44,904	$0							$127,587	$0			$299,392	$0	$239,835	$0	$80,429	$0			$62,413	$210,000	$0	$0		
Daviess County	4	$2,950,733											$298,164	$0	$584,955	$0							$2,044,935	$0			$22,678	$0
DeKalb County	2	$40,159	$17,423	$0											$22,737	$0												
Dent County	1	$86,862																	$86,862	$0								
Douglas County	6	$2,059,616			$245,324	$0									$301,147	$0	$412,913	$0	$917,299	$133,179			$49,754	$0	$0	$0		
Dunklin County	6	$4,123,942			$316,494	$0											$80,624	$29,997	$279,873	$0			$489,292	$2,875,500	$52,162	$0		
Franklin County	2	$3,916,134															$1,994,565	$0	$505,750	$1,415,819								
Gasconade County	3	$391,604															$160,885	$0	$94,359	$0			$136,360	$0				
Gentry County	3	$1,309,437											$178,563	$0	$585,510	$0							$545,365	$0				
Greene County	3	$11,083,108			$493,977	$7,230,035											$395,909	$16,437	$0	$0			$0	$2,946,750				
Grundy County	4	$2,002,321	$156,584	$0									$526,688	$0									$1,319,049	$0			$0	$0
Harrison County	3	$3,110,461											$553,562	$0	$767,326	$0							$1,789,573	$0				
Henry County	4	$1,000,906	$149,477	$0											$258,857	$0							$550,507	$36,538	$5,527	$0		
Hickory County	5	$1,641,454	$29,314	$0											$255,965	$0	$0	$0					$6,175	$1,350,000	$0	$0		
Holt County	6	$23,079,995					$2,424,514	$0					$350,990	$0	$87,612	$0					$13,316,605	$0	$6,827,880	$0			$72,395	$0
Howard County	5	$904,689	$38,414	$0			$124,187	$0	$116,677	$0													$625,412	$0			$0	$0
Howell County	5	$6,053,769			$409,864	$342,830											$63,937	$430,500	$2,766,604	$129,664			$118,447	$1,625,554	$144,393	$21,976		
Iron County	5	$720,988			$304,840	$0			$89,341	$0							$100,790	$0	$226,016	$0								
Jackson County	2	$2,443,237	$204,548	$0											$1,235,874	$41,786							$735,590	$225,440				
Jasper County	4	$149,319,063	$19,158	$0	$115,491,282	$30,896,557											$207,952	$2,625,000	$40,128	$2,835			$36,150	$0				
Jefferson County	4	$8,366,793													$1,452,767	$0	$2,556,642	$1,277,967	$1,136,254	$1,943,163			$0	$0				
Johnson County	2	$678,498	$306,332	$0											$372,166	$0												
Knox County	5	$579,911	$11,003	$0					$39,978	$0			$38,673	$0	$465,193	$0							$25,064	$0				
Laclede County	6	$8,000,813	$121,853	$0							$1,478,684	$0			$468,912	$1,468,125	$0	$1,208,625					$170,716	$1,750,500	$1,333,398	$0		
Lafayette County	4	$1,693,181	$158,143	$0			$76,071	$0							$921,690	$0							$537,278	$0				
Lawrence County	3	$3,080,571			$0	$2,035,081											$484,078	$0	$561,412	$0								
Lewis County	5	$1,861,190	$55,027	$0					$64,160	$0			$83,788	$0	$905,318	$0							$752,897	$0				
Lincoln County	5	$6,890,618							$69,927	$1,809,123					$2,408,672	$900,409	$478,858	$66,519					$999,270	$96,671			$61,168	$0
Linn County	4	$1,462,379	$138,513	$0									$629,503	$0	$694,364	$0							$0	$0				
Livingston County	5	$1,463,564	$97,200	$0									$99,832	$0	$622,581	$0							$552,814	$0			$91,137	$0
McDonald County	7	$9,267,931	$29,472	$0	$288,381	$5,510,932					$185,683	$0			$101,638	$0	$368,388	$0	$1,323,278	$910,719			$549,441	$0				
Macon County	4	$970,719	$167,094	$0									$181,427	$0	$113,872	$0							$508,327	$0				
Madison County	4	$682,004	$51,443	$0	$266,117	$0													$364,444	$0								
Maries County	7	$1,130,050	$24,945	$0					$17,066	$0	$226,928	$0			$165,189	$0	$0	$0	$615,022	$0			$80,900	$0				
Marion County	4	$4,580,908	$138,983	$0					$158,191	$0					$723,185	$0							$3,544,799	$15,750				
Mercer County	2	$963,092											$379,612	$0									$583,480	$0				
Miller County	7	$11,136,738	$98,380	$0	$467,080	$2,309,431			$166,363	$0	$1,967,508	$0			$3,381,576	$0			$282,363	$0			$1,440,286	$1,023,750				
Mississippi County	5	$12,404,873			$8,633,004	$2,238,735											$61,106	$0	$196,034	$0	$133,353	$0	$1,142,642	$0				
Moniteau County	3	$394,837	$53,960	$138,819											$202,058	$0											$0	$0
Monroe County	3	$102,758	$44,809	$0											$41,449	$0							$0	$16,500				
Montgomery County	5	$580,608	$60,381	$0					$51,746	$0					$384,267	$0							$65,321	$0			$18,892	$0
Morgan County	4	$1,835,538	$60,857	$0											$273,122	$1,350,000	$0	$0	$151,559	$0								
New Madrid County	7	$3,804,278			$1,782,833	$0									$150,856	$0	$23,693	$0	$0	$0	$4,941	$0	$374,583	$1,339,497	$127,875	$0		
Newton County	5	$10,985,510	$467,307	$0	$198,816	$6,614,782											$577,521	$0	$729,566	$0			$597,519	$1,800,000				
Nodaway County	3	$3,143,455											$587,758	$1,149,170	$881,855	$0							$524,672	$0				
Oregon County	4	$692,668			$150,922	$0									$2,601	$0			$495,145	$0					$0	$44,000		
Osage County	7	$761,735	$30,525	$0					$365,966	$0	$78,611	$0			$234,691	$0	$0	$0	$51,943	$0			$0	$0				
Ozark County	6	$6,167,948			$381,153	$0					$373,115	$0			$167,612	$1,867,069	$548,499	$0	$2,543,274	$0			$287,226	$0				
Pemiscot County	8	$2,657,322			$802,960	$0									$336,300	$0	$33,725	$0	$0	$0	$196,014	$0	$1,288,323	$0	$0	$0		
Perry County	7	$6,382,786			$705,787	$0			$146,868	$0					$327,281	$0	$670,716	$0	$419,776	$2,438,739	$686,933	$0	$986,687	$0				
Pettis County	3	$349,429	$66,438	$0	$98,641	$66,600									$117,751	$0												
Phelps County	5	$4,388,907			$0	$618,558					$1,221,948	$0			$592,134	$0	$1,124,160	$0	$611,797	$220,309								
Pike County	6	$3,032,796	$170,159	$0					$78,013	$0					$1,408,242	$0			$140,610	$0	$89,514	$628,587	$501,546	$16,125				
Platte County	5	$7,995,578	$26,633	$0			$1,993,805	$0							$4,447,745	$406,387					$1,121,008	$0	$0	$0				
Polk County	5	$2,630,949	$79,735	$0	$63,440	$1,060,544									$266,056	$0	$0	$0							$0	$1,161,174		
Pulaski County	6	$28,928,424	$80,532	$0	$0	$2,048,359					$4,927,500	$209,805					$542,934	$0	$17,526,609	$261,792			$30,425	$3,300,468				
Putnam County	5	$3,159,468	$61,683	$0					$228,605	$0			$332,698	$0	$1,376,112	$0							$1,160,370	$0				
Ralls County	7	$1,284,622	$35,049	$0					$151,069	$0			$88,640	$0	$355,923	$0			$271,505	$15,450			$366,986	$0			$0	$0
Randolph County	2	$131,549	$108,066	$0																			$23,483	$0				
Ray County	6	$10,446,021	$162,705	$0			$1,646,464	$0							$1,770,771	$0					$1,045,352	$2,867,178	$2,953,551	$0			$0	$0
Reynolds County	4	$3,013,603			$815,960	$0											$432,362	$0	$1,765,281	$0								
Ripley County	3	$4,675,590			$703,441	$2,618,544													$1,002,182	$302,410					$49,013	$0		
St. Charles County	3	$6,810,566							$2,640,751	$0							$1,171,303	$0					$2,640,688	$357,824				
St. Clair County	4	$115,484	$26,407	$0											$31,897	$0	$20,300	$0					$36,880	$0				
Ste. Genevieve County	7	$3,527,554			$458,684	$0			$142,406	$0					$846,051	$0	$314,370	$0	$1,168,577	$76,078	$125,814	$34,017	$361,557	$0				
St. Francois County	2	$2,048,037			$73,145	$1,974,892											$0	$0										
St. Louis County	4	$8,989,550			$2,307,304	$0			$1,618,719	$0							$2,273,087	$0	$2,402,014	$388,425								
Saline County	5	$3,050,643	$104,468	$0			$1,152,595	$0							$266,922	$0							$1,526,658	$0			$0	$0
Schuyler County	3	$297,195	$0	$0											$279,819	$0							$17,375	$0				
Scotland County	4	$348,799	$12,065	$0					$42,507	$0					$186,415	$0							$107,812	$0				
Scott County	5	$2,455,111			$704,141	$0											$235,424	$0	$130,415	$0	$131,508	$1,030,785	$222,838	$0				
Shannon County	7	$6,548,012			$1,069,802	$0					$49,229	$0			$463,190	$22,391	$290,378	$0	$3,634,264	$1,018,758			$0	$0	$0	$0		
Shelby County	5	$727,865	$39,418	$0					$102,204	$0			$68,112	$0	$185,478	$0							$332,653	$0				
Stoddard County	5	$1,506,089			$1,369,162	$0			$41,475	$0							$62,047	$0					$33,405	$0	$0	$0		
Stone County	4	$896,686			$54,534	$0									$127,714	$0	$182,647	$0	$531,791	$0								
Sullivan County	5	$2,192,155	$128,750	$0					$269,115	$0			$435,884	$0	$800,584	$0							$557,822	$0				
Taney County	6	$6,105,676			$927,274	$2,371,825					$206,122	$0			$280,230	$0	$546,708	$0	$1,161,401	$433,619			$178,496	$0				
Texas County	7	$10,700,998			$352,089	$941,250			$218,453	$0	$1,218,222	$798,981			$1,218,239	$50,454	$763,681	$0	$3,722,519	$71,081			$1,252,280	$93,750				
Vernon County	2	$1,353,933	$195,976	$0																			$1,157,957	$0				
Warren County	0	$0																										
Washington County	4	$806,872			$350,555	$0									$162,270	$0	$88,802	$0	$205,245	$0								
Wayne County	5	$4,015,399			$639,381	$2,381,595													$957,177	$0			$37,246	$0	$0	$0		
Webster County	7	$9,041,427			$173,462	$223,091			$169,187	$0	$1,302,799	$690,321			$733,919	$0	$1,969,221	$0	$764,207	$844,694			$1,227,214	$943,311				
Worth County	3	$261,428	$0	$0									$112,383	$0	$149,045	$0												
Wright County	7	$1,156,899			$101,686	$0					$94,852	$0			$315,518	$0	$0	$0	$256,246	$60,941			$327,656	$0	$0	$0		
St. Louis city	2	$5,553,446															$4,607,638	$0					$945,809	$0				
Total FEMA Allocation		$671,827,350	$9,807,841	$1,769,996	$160,170,851	$89,149,911	$21,739,244	$3,720,421	$9,033,805	$1,827,581	$17,467,954	$1,738,803	$5,668,468	$1,198,474	$50,780,812	$8,873,921	$32,904,966	$10,192,373	$79,962,784	$16,299,147	$27,635,433	$5,633,956	$80,914,661	$25,543,001	$7,431,498	$1,292,587	$1,068,863	$0

MONTANA

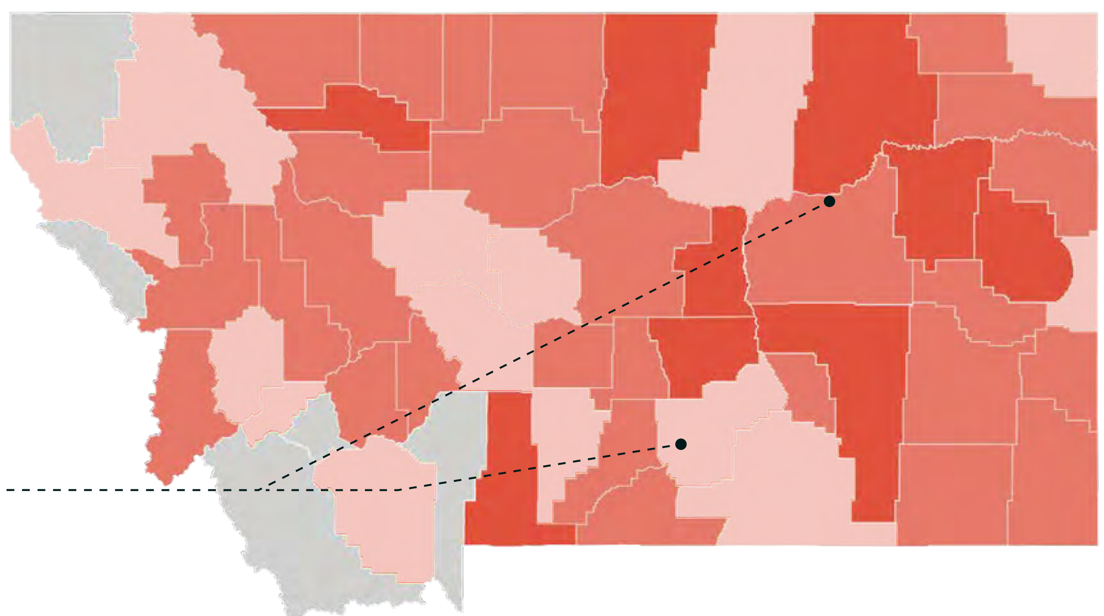


MONTANA STATISTICS SUMMARY (2011 – 2021)	
12	CLIMATE DISASTER DECLARATIONS
MUSSELSHELL, VALLEY	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
3	COUNTIES WITH FIVE OR MORE DISASTERS
1	SUPERFUND SITE
C	ASCE INFRASTRUCTURE REPORT CARD GRADE
BIG HORN, GLACIER, HILL, LINCOLN, RICHLAND, SILVER BOW	HIGHEST COMPOUNDING RISKS
$67 MILLION	FEMA + HUD POST-DISASTER FUNDING
1 MILLION	POPULATION TOTAL
$63	PER CAPITA SPENDING ON CLIMATE DISASTERS
$1 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

12
disaster declarations



Fifty-two out of 56 counties in Montana have had a disaster between 2011 and 2021.

Musselshell and Valley counties have had the highest number of recent disasters in the state: 5 disasters each.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

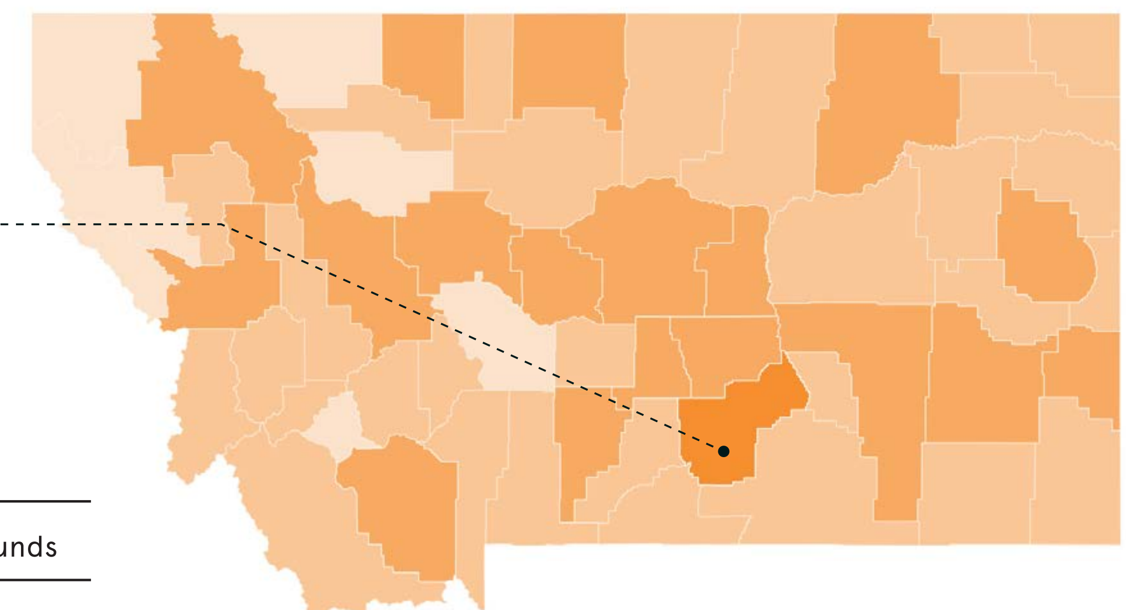
Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$67M
post-disaster assistance

Yellowstone County has received over $10 million in federal disaster recovery funds from 2011 severe storms and flooding.



$67M	FEMA obligations
$0	HUD CDBG-DR Funds
$67M	FEMA + HUD assistance
$63	per capita cost

FEMA Public Assistance and Hazard Mitigation

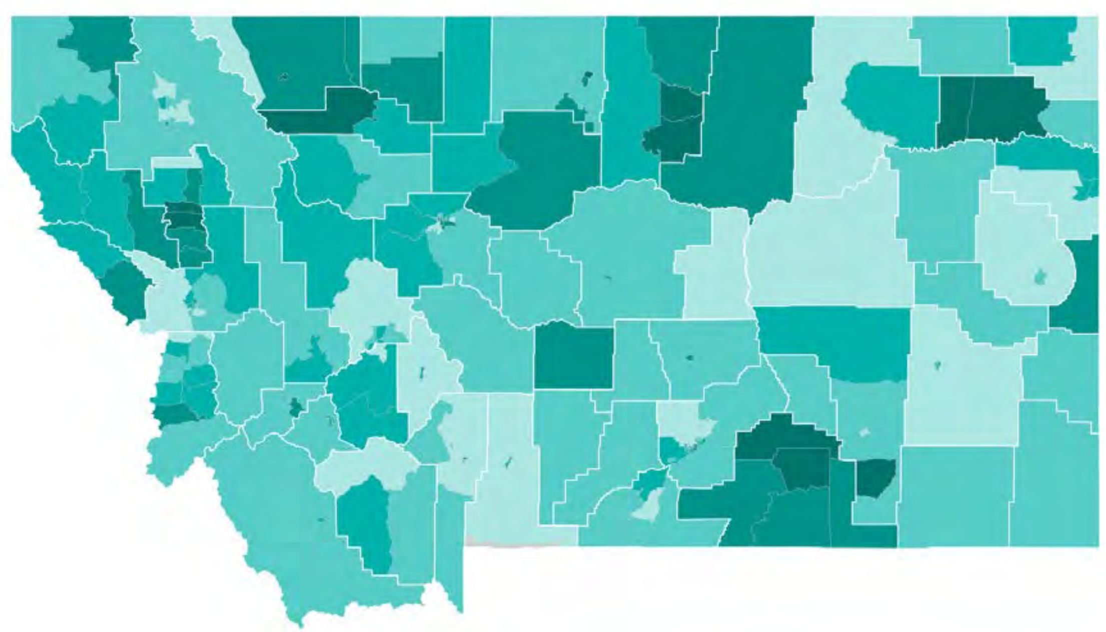
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

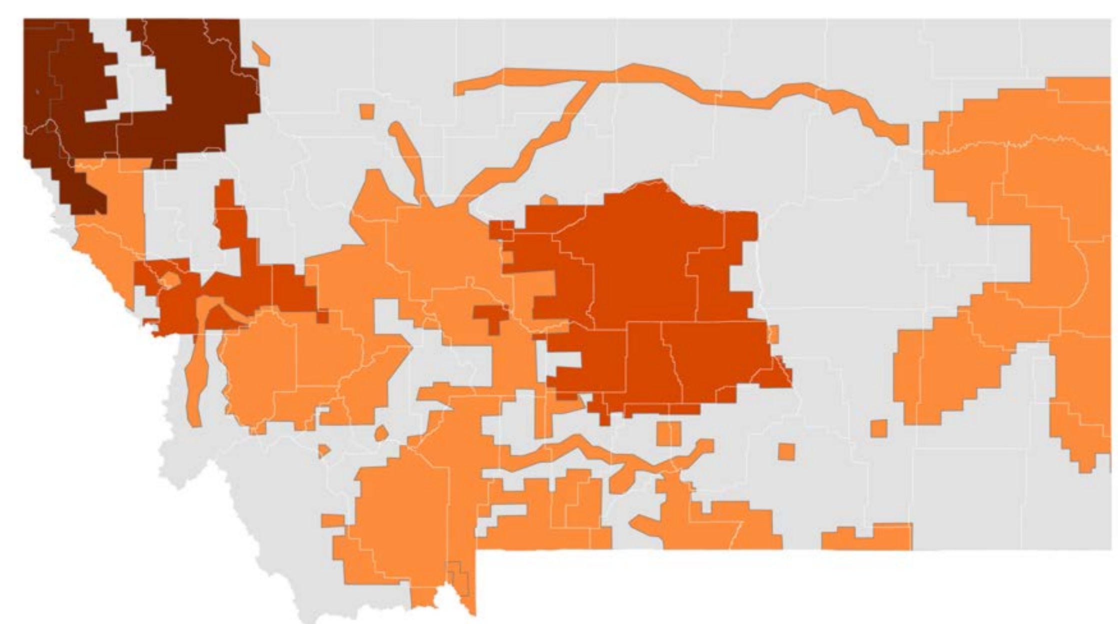
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



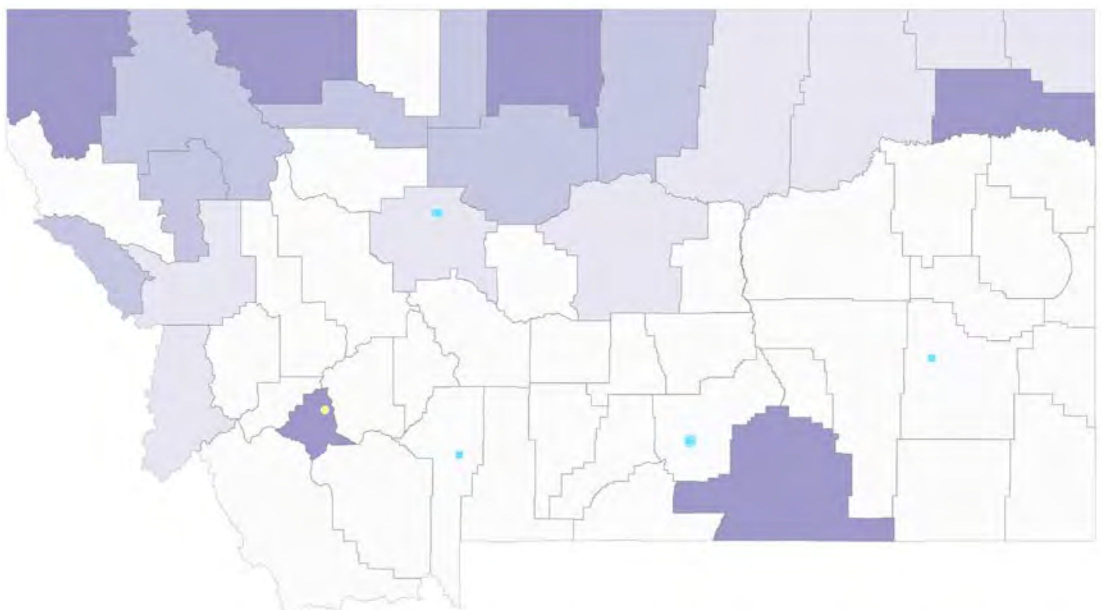
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Big Horn, Glacier, Hill, Lincoln, Richland, and Silver Bow counties have high risk of climate disasters and other compounding risks.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Beaverhead							0
Big Horn					2		3
Blaine					1		2
Broadwater							0
Carbon							0
Carter							0
Cascade					2		1
Chouteau					1		2
Custer							0
Daniels					1		1
Dawson							0
Deer Lodge							0
Fallon							0
Fergus					2		1
Flathead					1		2
Gallatin							0
Garfield							0
Glacier					2		3
Golden Valley							0
Granite							0
Hill					1		3
Jefferson							0
Judith Basin							0
Lake					2		2
Lewis and Clark							0
Liberty					1		2
Lincoln					2		3
Madison							0
McCone							0
Meagher							0
Mineral					1		2
Missoula					1		1
Musselshell							0
Park							0
Petroleum							0
Phillips					1		1
Pondera					1		2
Powder River							0
Powell							0
Prairie							0
Ravalli					2		1
Richland							0
Roosevelt					2		3
Rosebud							0
Sanders							0
Sheridan					1		1
Silver Bow					1		3
Stillwater							0
Sweet Grass							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Teton							0
Toole							0
Treasure							0
Valley					1		1
Wheatland							0
Wibaux							0
Yellowstone							0

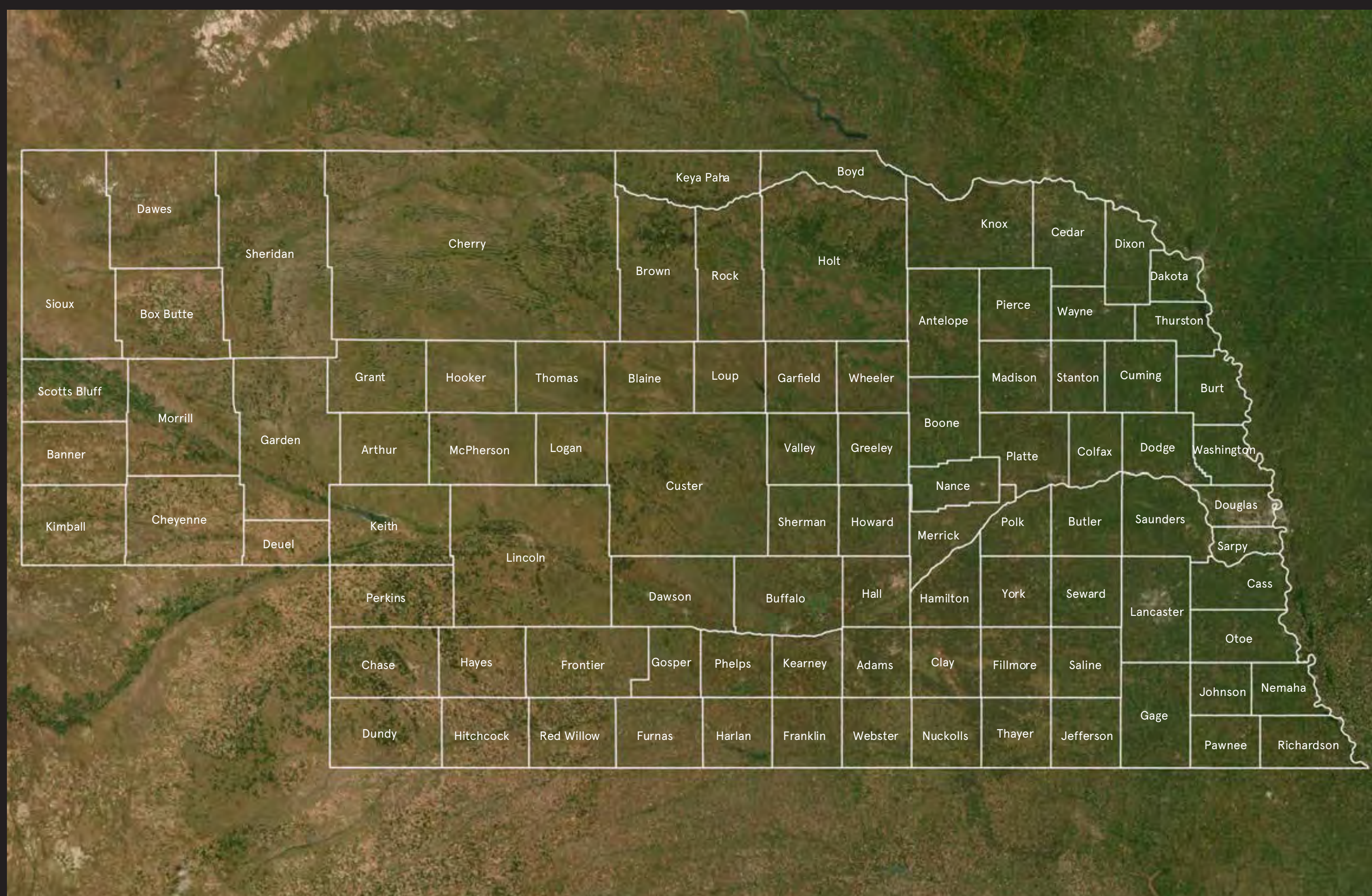
IMAGE RIGHT: LIGHTNING NEAR BUTTE, MONTANA | JAMES ST.JOHN

MONTANA

TOTAL: 12 DISASTERS
FEMA PA + HM: $67 M
HUD CDBG-DR: none
FEMA + HUD ASSISTANCE: $67 M

			2011		2012		2013		2014				2016				2018				2019		2021			
			1996: SEVERE STORMS AND FLOODING		4074: WILDFIRE		4127: FLOODING		4172: ICE JAMS AND FLOODING		4198: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4271: SEVERE WINTER STORM AND STRAIGHT-LINE WINDS		4275: TORNADO		4388: FLOODING		4405: FLOODING		4437: FLOODING		4608: STRAIGHT-LINE WINDS		4623: RICHARD SPRING FIRE	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	12	$8,213,969	$5,123,121.66	$415,321.51	$291,103.81	$14,281.00	$481,717.03	$16,400.27	$207,463.12	$7,243.76	$81,183.07	$446.86	$1,207,565.55	$4,265.67	$7,661.96	$5,312.19	$112,080.35	$26,013.00	$108,238.54	$17,589.00	$86,960.44	$0.00				
Beaverhead County	0	$0																								
Big Horn County	1	$935,501	$913,131.79	$22,369.00																						
Blaine County	4	$692,109	$293,162.00	$25,000.00			$259,907.15	$0.00			$0.00	$0.00					$114,040.23	$0.00								
Broadwater County	2	$870,754	$21,902.31	$713,996.28					$84,141.79	$50,714.00																
Carbon County	2	$753,283	$698,779.83	$0.00															$39,503.42	$15,000.00						
Carter County	2	$437,250	$226,058.62	$35,250.00							$175,941.06	$0.00														
Cascade County	1	$1,214,739	$1,214,739.28	$0.00																						
Chouteau County	2	$229,151	$229,150.51	$0.00			$0.00	$0.00																		
Custer County	3	$1,619,593	$1,384,138.50	$15,389.00			$136,012.88	$3,695.00											$80,357.89	$0.00						
Daniels County	2	$303,418	$196,237.74	$7,462.00																	$99,718.73	$0.00				
Dawson County	4	$1,482,190	$1,415,368.96	$0.00			$66,821.47	$0.00	$0.00	$0.00													$0.00	$0.00		
Deer Lodge County	1	$301,361	$301,361.06	$0.00																						
Fallon County	2	$3,554,433	$510,066.49	$0.00											$3,037,453.49	$6,913.00										
Fergus County	2	$4,523,052	$3,943,883.18	$70,000.00			$414,641.00	$94,528.00																		
Flathead County	1	$1,301,168	$331,488.67	$969,679.00																						
Gallatin County	0	$0																								
Garfield County	3	$196,580	$181,894.79	$0.00			$14,684.83	$0.00															$0.00	$0.00		
Glacier County	2	$89,893	$0.00	$28,249.00									$61,644.13	$0.00												
Golden Valley County	3	$1,060,253	$656,097.00	$0.00					$170,956.29	$0.00									$233,199.65	$0.00						
Granite County	1	$184,168	$53,272.33	$130,895.98																						
Hill County	3	$1,182,147	$386,090.12	$16,650.00			$441,553.26	$0.00									$337,853.73	$0.00								
Jefferson County	2	$343,706	$301,403.32	$0.00					$42,302.67	$0.00																
Judith Basin County	1	$1,302,059	$1,302,059.33	$0.00																						
Lake County	2	$430,179							$255,562.82	$0.00											$174,615.99	$0.00				
Lewis and Clark County	2	$2,880,334	$243,971.91	$2,523,317.61															$113,044.29	$0.00						
Liberty County	3	$551,370	$82,097.70	$0.00									$0.00	$0.00			$469,272.34	$0.00								
Lincoln County	0	$0																								
McCone County	4	$380,961	$163,293.41	$0.00			$25,684.32	$0.00													$191,983.30	$0.00	$0.00	$0.00		
Madison County	1	$1,326,574	$124,694.96	$1,201,878.99																						
Meagher County	1	$65,254	$65,253.59	$0.00																						
Mineral County	0	$0																								
Missoula County	2	$487,968	$0.00	$119,190.00															$368,778.42	$0.00						
Musselshell County	5	$3,227,655	$2,430,437.15	$110,346.00			$78,127.06	$0.00	$232,031.86	$0.00	$203,285.21	$102,383.33							$71,044.14	$0.00						
Park County	4	$658,308	$248,052.98	$0.00					$167,317.81	$0.00									$105,972.73	$0.00	$136,964.14	$0.00				
Petroleum County	4	$2,460,844	$1,143,668.74	$0.00			$576,916.06	$0.00			$655,697.56	$0.00					$84,561.86	$0.00								
Phillips County	1	$228,233	$228,232.54	$0.00																						
Pondera County	4	$683,793	$32,416.33	$181,283.00					$92,869.04	$0.00			$261,414.33	$0.00			$115,810.33	$0.00								
Powder River County	3	$306,816	$122,758.22	$0.00	$34,012.07	$0.00															$150,045.74	$0.00				
Powell County	2	$517,992	$388,070.43	$27,315.00															$102,606.22	$0.00						
Prairie County	2	$411,533	$376,105.10	$0.00					$35,428.09	$0.00																
Ravalli County	2	$346,119	$11,091.37	$0.00					$335,027.60	$0.00																
Richland County	3	$341,149	$298,217.11	$42,932.00					$0.00	$0.00													$0.00	$0.00		
Roosevelt County	2	$461,000	$460,999.54	$0.00																			$0.00	$0.00		
Rosebud County	5	$1,402,729	$350,884.30	$19,207.00	$971,910.96	$0.00	$60,726.88	$0.00	$0.00	$0.00															$0.00	$0.00
Sanders County	1	$67,028							$67,028.22	$0.00																
Sheridan County	1	$194,834	$194,834.18	$0.00																						
Silver Bow County	0	$0																								
Stillwater County	3	$720,779	$386,125.85	$0.00					$126,461.45	$0.00											$208,192.08	$0.00				
Sweet Grass County	1	$1,572,662	$1,570,889.38	$1,773.00																						
Teton County	2	$38,155	$38,155.37	$0.00									$0.00	$0.00												
Toole County	3	$1,384,425	$462,973.38	$65,820.00									$159,809.89	$153,975.63			$541,845.75	$0.00								
Treasure County	3	$549,809	$39,623.22	$0.00															$510,185.62	$0.00	$0.00	$0.00				
Valley County	5	$3,257,658	$2,273,081.91	$0.00			$217,660.70	$0.00			$492,902.71	$7,884.00					$148,915.17	$0.00			$0.00	$117,214.00				
Wheatland County	2	$367,104	$202,259.96	$55,500.00					$109,344.44	$0.00																
Wibaux County	1	$117,036	$45,766.13	$71,270.00																						
Yellowstone County	1	$10,596,410	$10,596,409.82	$0.00																						
Total FEMA Allocation		$66,825,490	$42,263,772.07	$6,870,094.37	$1,297,026.84	$14,281.00	$2,774,452.64	$114,623.27	$1,925,935.20	$57,957.76	$1,609,009.61	$110,714.19	$1,690,433.90	$158,241.30	$3,045,115.45	$12,225.19	$1,924,379.76	$26,013.00	$1,732,930.92	$32,589.00	$1,048,480.42	$117,214.00	$0.00	$0.00	$0.00	$0.00

NEBRASKA



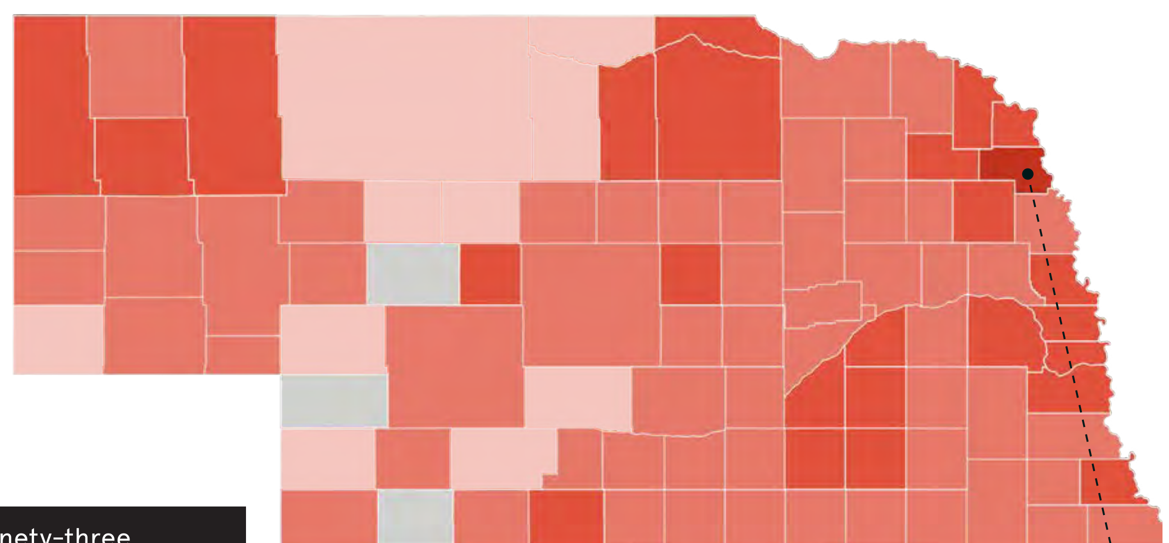
NEBRASKA STATISTICS SUMMARY (2011 – 2021)	
14	CLIMATE DISASTER DECLARATIONS
10TH HIGHEST	PER CAPITA SPENDING ON CLIMATE DISASTERS IN THE COUNTRY
THURSTON	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
9	COUNTIES WITH FIVE OR MORE DISASTERS
25	SUPERFUND SITES
DOUGLAS, GARDEN, THURSTON	HIGHEST COMPOUNDING RISKS
$749 MILLION	FEMA + HUD POST-DISASTER FUNDING
1.9 MILLION	POPULATION TOTAL
$390	PER CAPITA SPENDING ON CLIMATE DISASTERS
$2.2 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

14

disaster declarations



Ninety out of ninety-three counties in Nebraska have had a recent disaster declaration.

Thurston County has had the highest number of recent disasters in the state: 7 disasters.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

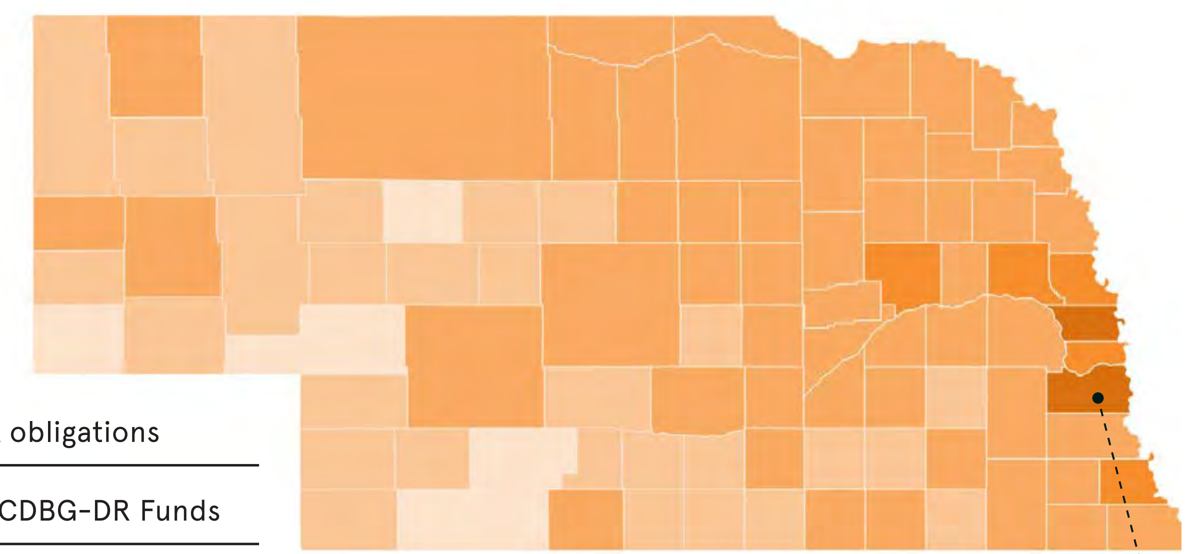
Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$749M

post-disaster assistance



$640M	FEMA obligations
$109M	HUD CDBG-DR Funds
$749M	FEMA + HUD assistance
$390	per capita cost

Cass County has received the highest post-disaster federal recovery funds in the state: $82 million.

FEMA Public Assistance and Hazard Mitigation

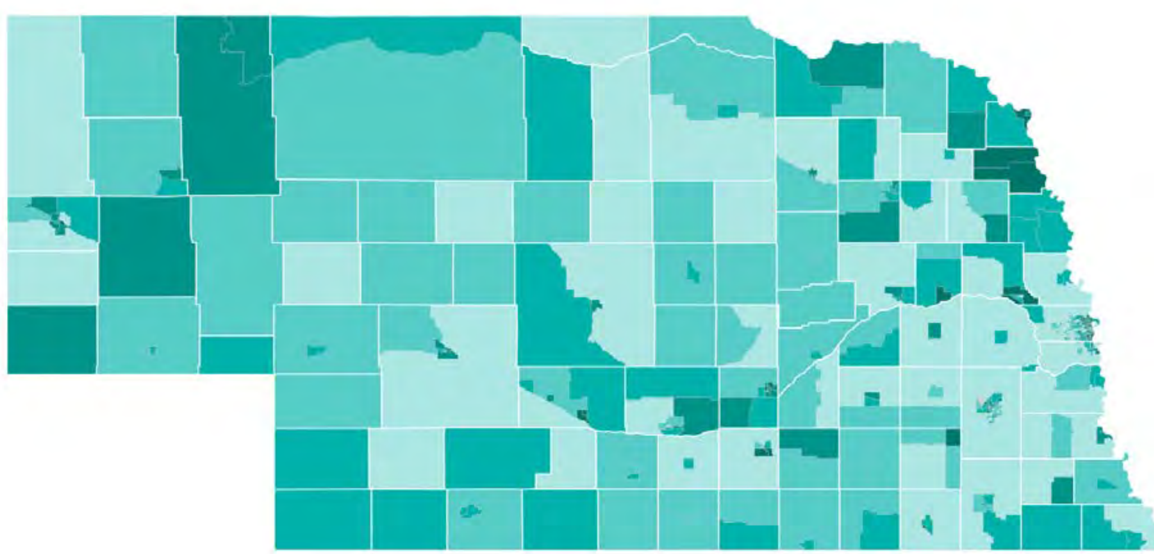
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

CDC (2018)

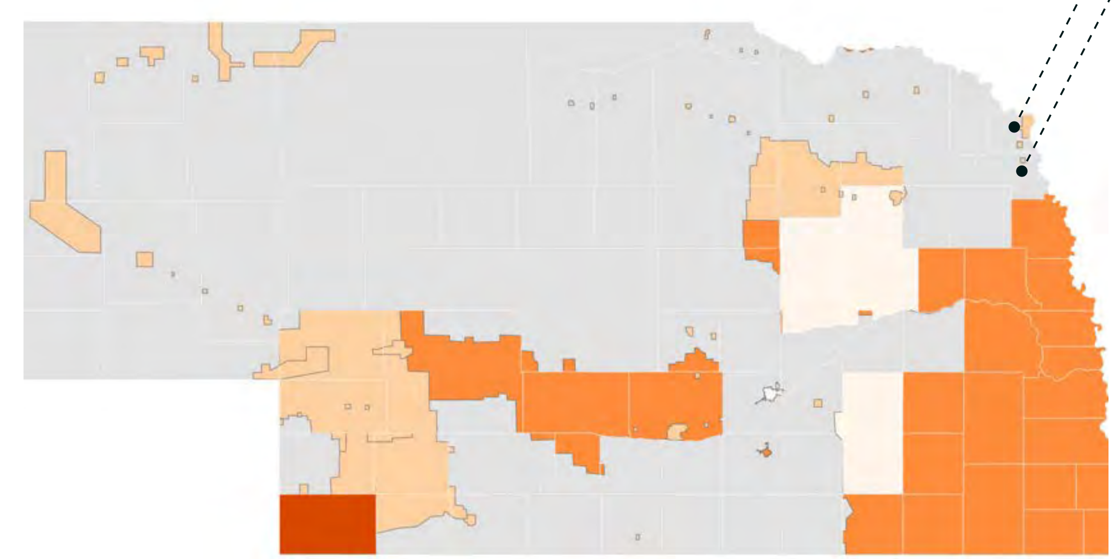
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Though most data for Dakota and Thurston counties is unavailable, parts of both counties have high social vulnerability and low energy reliability.



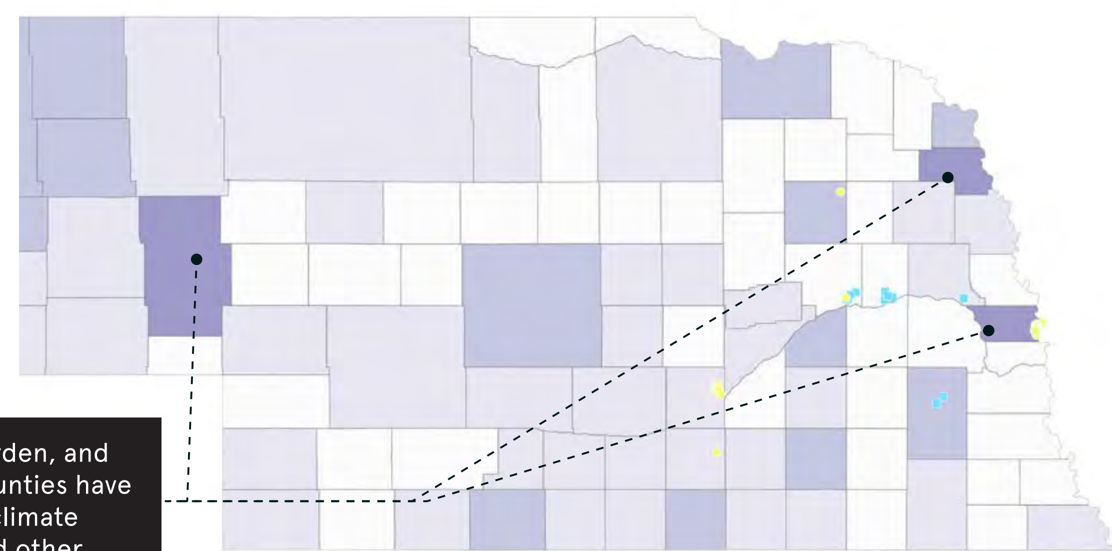
Aggregated Annual Electric Outage Duration

Including major events - SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Douglas, Garden, and Thurston counties have high risk of climate disasters and other compounding risks.

Areas with the greatest return on investment due to physical and social risk (2011-2021)

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adams					1		1
Antelope							0
Arthur							0
Banner					1		1
Blaine							0
Boone							0
Box Butte					1		2
Boyd							0
Brown					1		1
Buffalo					1		1
Burt					1		1
Butler							0
Cass							0
Cedar							0
Chase					2		1
Cherry					1		1
Cheyenne					1		1
Clay					1		1
Colfax							0
Cuming					1		1
Custer					1		2
Dakota					1		2
Dawes					1		2
Dawson					3		1
Deuel							0
Dixon							0
Dodge					2		1
Douglas					4		3
Dundy					1		1
Fillmore					1		2
Franklin					2		1
Frontier							0
Furnas					4		2
Gage					2		1
Garden					1		3
Garfield							0
Gosper					2		1
Grant							0
Greeley					1		1
Hall					6		1
Hamilton							0
Harlan					2		1
Hayes							0
Hitchcock							0
Holt					1		1
Hooker					1		1
Howard							0
Jefferson							0
Johnson							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Kearney					1		1
Keith					1		1
Keya Paha							0
Kimball					1		1
Knox					3		2
Lancaster					3		2
Lincoln					2		1
Logan							0
Loup							0
Madison					2		2
McPherson							0
Merrick					1		1
Morrill					1		1
Nance					1		1
Nemaha							0
Nuckolls					1		1
Otoe							0
Pawnee							0
Perkins							0
Phelps					2		1
Pierce							0
Platte							0
Polk					1		2
Red Willow					1		1
Richardson					1		1
Rock							0
Saline							0
Sarpy							2
Saunders							0
Scotts Bluff					2		2
Seward							0
Sheridan					1		1
Sherman					1		1
Sioux					1		2
Stanton							0
Thayer					3		1
Thomas							0
Thurston					3		3
Valley					1		1
Washington							0
Wayne							0
Webster					4		2
Wheeler							0
York					2		1

IMAGE RIGHT: HALLAM, NEBRASKA AFTER A TORNADO | NOAA

NEBRASKA

TOTAL: 14 DISASTERS FEMA PA + HM: $640 M HUD CDBG-DR: $108 M FEMA + HUD ASSISTANCE: $749 M			2011				2013		2014						2015		2017				2018				2019				2021	
			4013: FLOODING		4014: SEVERE STORMS, TORNADOES, STRAIGHT LINE WINDS, AND FLOODING		4156: SEVERE STORMS, WINTER STORMS, TORNADOES AND FLOODING		4179: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4183: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4185: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4225: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4321: SEVERE WINTER STORM AND STRAIGHT-LINE WINDS		4325: SEVERE STORMS, TORNADOES, AND STRAIGHT-LINE WINDS		4375: SEVERE WINTER STORM AND STRAIGHT-LINE WINDS		4387: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4420: SEVERE WINTER STORM, STRAIGHT-LINE WINDS, AND FLOODING		4446: SEVERE STORMS AND FLOODING		4616: SEVERE STORMS AND STRAIGHT-LINE WINDS	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	14	$235,944,413	$40,565,182.10	$147,211.55	$2,510,235.48	$4,947.00	$1,384,230.30	$5,965.00	$8,650,027.57	$44,096.83	$6,105,555.12	$21,171.00	$3,420,787.43	$10,670.00	$2,737,144.17	$82,978.07	$2,711,986.67	$15,113.36	$12,831,811.01	$65,572.17	$7,355,271.36	$51,477.00	$234,218.20	$25,851.00	$141,463,919.43	$3,451,484.64	$1,088,251.32	$0.00	$959,254.81	$0.00
Adams County	3	$3,310,024					$175,340.06	$0.00							$569,808.78	$1,017,849.00									$1,547,026.35	$0.00				
Antelope County	2	$5,124,059																			$0.00	$0.00			$3,366,059.01	$1,758,000.00				
Arthur County	2	$62,197													$0.00	$13,275.00									$48,922.21	$0.00				
Banner County	2	$253,011																	$0.00	$0.00					$253,011.16	$0.00				
Blaine County	3	$106,726															$0.00	$0.00			$0.00	$0.00			$106,726.32	$0.00				
Boone County	2	$1,457,100																			$0.00	$0.00			$1,457,099.68	$0.00				
Box Butte County	4	$400,991													$33,881.03	$0.00			$18,750.00	$0.00					$327,104.04	$0.00			$21,256.36	$0.00
Boyd County	4	$7,546,095	$0.00	$0.00																	$0.00	$0.00	$105,803.54	$0.00	$7,440,291.58	$0.00				
Brown County	1	$3,434,788																							$3,434,787.63	$0.00				
Buffalo County	2	$2,001,870			$0.00	$0.00																			$2,001,870.00	$0.00				
Burt County	3	$1,841,386	$176,492.60	$0.00									$75,676.84	$0.00											$1,589,216.77	$0.00				
Butler County	3	$1,437,506											$0.00	$0.00					$54,299.69	$0.00					$1,383,206.69	$0.00				
Cass County	6	$81,918,290	$3,776,049.15	$0.00									$99,350.27	$0.00	$351,925.24	$0.00			$95,969.77	$0.00					$77,594,995.36	$0.00			$0.00	$0.00
Cedar County	3	$2,096,459									$667,438.32	$0.00											$211,962.54	$0.00	$1,217,058.19	$0.00				
Chase County	1	$251,922			$251,921.97	$0.00																								
Cherry County	1	$1,880,787																							$1,880,786.98	$0.00				
Cheyenne County	2	$10,097																			$10,097.27	$0.00			$0.00	$0.00				
Clay County	5	$805,053							$239,661.81	$0.00					$309,755.38	$0.00					$0.00	$0.00			$245,495.88	$0.00			$10,140.21	$0.00
Colfax County	2	$2,091,926																					$123,651.03	$0.00	$1,968,275.11	$0.00				
Cuming County	4	$1,557,377									$69,650.20	$0.00							$0.00	$0.00			$168,375.24	$0.00	$1,319,351.34	$0.00				
Custer County	3	$7,999,594															$0.00	$0.00			$62,703.65	$0.00			$7,936,890.49	$0.00				
Dakota County	4	$9,643,531	$5,110,188.49	$14,650.00							$462,595.18	$0.00											$428,301.95	$0.00	$3,627,795.58	$0.00				
Dawes County	3	$1,008,419					$370,543.79	$0.00							$190,736.35	$0.00									$447,139.07	$0.00				
Dawson County	1	$483,394																							$483,394.25	$0.00				
Deuel County	2	$0																			$0.00	$0.00			$0.00	$0.00				
Dixon County	5	$2,582,218	$0.00	$0.00			$9,232.10	$21,118.00			$478,379.87	$0.00											$817,128.30	$0.00	$1,256,359.27	$0.00				
Dodge County	3	$30,700,230			$315,502.86	$0.00													$478,821.19	$0.00					$26,867,706.53	$3,038,199.19				
Douglas County	4	$59,356,149	$5,587,274.84	$0.00															$308,676.13	$0.00					$51,360,286.60	$2,099,911.50			$0.00	$0.00
Dundy County	2	$173,599			$19,512.43	$0.00									$154,086.69	$0.00														
Fillmore County	6	$865,052							$0.00	$769,415.00					$37,929.36	$0.00			$0.00	$0.00	$0.00	$0.00			$57,707.71	$0.00			$0.00	$0.00
Franklin County	2	$357,287									$177,673.95	$0.00													$179,613.49	$0.00				
Frontier County	1	$62,158																							$46,412.79	$15,745.38				
Furnas County	4	$1,905,370			$8,183.74	$0.00					$71,246.41	$1,283,034.00					$0.00	$2,150.00							$540,755.35	$0.00				
Gage County	3	$2,417,306													$701,733.41	$0.00			$154,647.26	$37,493.00					$1,523,432.16	$0.00				
Garden County	2	$569,406	$12,327.21	$0.00																					$557,078.40	$0.00				
Garfield County	3	$7,162,457															$15,456.63	$0.00			$0.00	$0.00			$7,147,000.10	$0.00				
Gosper County	3	$285,415															$0.00	$0.00			$0.00	$0.00			$285,414.87	$0.00				
Grant County	2	$169,351																							$169,350.66	$0.00			$0.00	$0.00
Greeley County	3	$3,105,068					$31,316.20	$0.00													$0.00	$0.00			$3,073,751.43	$0.00				
Hall County	3	$1,462,108																			$0.00	$0.00			$443,589.66	$1,005,652.50			$12,866.25	$0.00
Hamilton County	5	$134,067			$0.00	$7,129.00							$0.00	$0.00	$80,553.66	$0.00					$0.00	$0.00							$46,384.67	$0.00
Harlan County	3	$499,647									$19,696.82	$0.00											$0.00	$0.00	$479,950.33	$0.00				
Hayes County	3	$320,266			$63,673.18	$0.00									$13,735.04	$0.00									$242,858.06	$0.00				
Hitchcock County	0	$0																												
Holt County	4	$5,978,217											$0.00	$0.00			$0.00	$0.00			$0.00	$0.00			$5,978,216.76	$0.00				
Hooker County	1	$0																							$0.00	$0.00				
Howard County	3	$1,602,958					$25,905.90	$0.00													$0.00	$46,084.00			$1,468,938.46	$62,029.76				
Jefferson County	3	$729,433													$306,740.94	$0.00			$15,435.60	$0.00					$35,691.05	$371,565.77				
Johnson County	2	$2,132,748													$343,446.68	$0.00									$1,789,301.49	$0.00				
Kearney County	2	$186,336									$71,027.42	$0.00													$115,308.87	$0.00				
Keith County	1	$0																			$0.00	$0.00								
Keya Paha County	1	$4,046,130																							$4,046,130.42	$0.00				
Kimball County	1	$21,282																							$21,282.47	$0.00				
Knox County	3	$5,444,188	$101,475.46	$33,083.00																	$0.00	$0.00			$5,309,629.86	$0.00				
Lancaster County	2	$4,852,166													$2,569,966.85	$0.00									$1,317,249.19	$964,950.00				
Lincoln County	3	$925,332	$383,912.89	$0.00											$335,927.97	$0.00									$205,491.33	$0.00				
Logan County	4	$396,159			$48,584.40	$0.00															$0.00	$0.00	$35,695.21	$0.00	$311,879.10	$0.00				
Loup County	3	$1,110,724															$0.00	$0.00			$0.00	$0.00			$1,110,723.89	$0.00				
McPherson County	0	$0																												
Madison County	3	$6,558,671																			$0.00	$0.00			$6,515,445.03	$0.00			$43,225.57	$0.00
Merrick County	2	$4,112,382																			$0.00	$0.00			$140,373.46	$3,972,008.58				
Morrill County	3	$1,069,295													$497,343.26	$0.00			$105,647.54	$17,140.59					$449,163.23	$0.00				
Nance County	2	$7,755,949																			$0.00	$32,636.00			$7,723,313.01	$0.00				
Nemaha County	4	$14,326,883	$758,990.52	$0.00									$64,698.38	$40,845.00	$0.00	$0.00									$13,060,094.16	$402,254.60				
Nuckolls County	3	$997,055													$372,518.55	$0.00					$0.00	$0.00			$624,536.82	$0.00				
Otoe County	3	$3,881,812	$747,530.20	$262,702.00											$840,286.32	$32,622.75									$1,859,363.31	$139,307.25				
Pawnee County	3	$1,170,491											$20,689.42	$0.00	$261,590.83	$0.00									$888,210.72	$0.00				
Perkins County	0	$0																												
Phelps County	3	$494,771			$0.00	$0.00					$28,547.21	$0.00													$466,223.68	$0.00				
Pierce County	2	$4,970,675																			$0.00	$0.00			$4,432,279.10	$538,395.82				
Platte County	3	$21,540,944																	$214,931.07	$0.00	$0.00	$0.00			$19,886,501.75	$1,439,511.19				
Polk County	4	$271,164			$141,761.48	$0.00							$0.00	$0.00					$0.00	$0.00					$129,402.02	$0.00				
Red Willow County	2	$0			$0.00	$0.00											$0.00	$0.00												
Richardson County	3	$1,135,268	$195,458.99	$0.00											$340,552.85	$0.00									$599,256.11	$0.00				
Rock County	4	$4,196,685											$0.00	$0.00			$0.00	$0.00			$0.00	$0.00			$4,141,185.39	$55,500.00				
Saline County	3	$2,352,541							$0.00	$0.00					$1,054,153.72	$0.00									$437,244.19	$861,143.25				
Sarpy County	4	$12,719,059	$2,013,525.65	$1,828,131.00															$819,479.36	$0.00					$6,496,045.40	$1,525,254.00			$36,624.08	$0.00
Saunders County	5	$7,102,278							$691,422.71	$0.00					$205,829.61	$0.00			$0.00	$0.00					$6,205,025.19	$0.00			$0.00	$0.00
Scotts Bluff County	2	$1,391,960	$279,018.28	$634,810.00																					$478,131.99	$0.00				
Seward County	3	$752,646							$151,483.65	$0.00					$211,724.59	$0.00									$389,437.57	$0.00				
Sheridan County	4	$508,631					$17,094.75	$0.00											$0.00	$0.00					$491,536.44	$0.00			$0.00	$0.00
Sherman County	3	$658,941					$11,684.22	$0.00													$0.00	$0.00			$647,256.29	$0.00				
Sioux County	4	$527,439					$85,465.94	$0.00							$135,787.96	$0.00			$0.00	$0.00					$306,185.54	$0.00				
Stanton County	2	$4,471,108									$3,646,144.99	$0.00													$824,962.81	$0.00				
Thayer County	2	$2,340,320													$2,142,634.46	$0.00									$54,844.56	$142,840.65				
Thomas County	1	$13,484																					$13,483.88	$0.00						
Thurston County	7	$4,687,349	$158,781.17	$14,245.00			$3,275.25	$0.00			$210,701.85	$0.00	$0.00	$0.00					$0.00	$0.00			$467,629.26	$0.00	$3,832,716.90	$0.00				
Valley County	4	$1,541,049											$0.00	$0.00			$0.00	$0.00			$0.00	$0.00			$1,541,048.81	$0.00				
Washington County	4	$12,523,566	$2,942,123.49	$5,564,205.00									$156,392.96	$0.00											$3,457,932.67	$402,912.00			$0.00	$0.00
Wayne County	6	$2,475,274					$556,425.07	$0.00			$88,369.91	$0.00			$70,964.95	$47,570.82			$0.00	$0.00			$100,960.64	$0.00	$1,610,982.97	$0.00				
Webster County	2	$172,069																			$0.00	$0.00			$172,069.38	$0.00				
Wheeler County	2	$931,835																			$0.00	$0.00			$931,835.04	$0.00				
York County	5	$555,079			$3,092.91	$0.00			$88,747.94	$0.00					$94,284.43	$33,042.75									$335,911.18	$0.00			$0.00	$0.00
Total FEMA Allocation		$640,426,518	$62,808,331.04	$8,499,037.55	$3,362,468.45	$12,076.00	$2,670,513.58	$27,083.00	$9,821,343.68	$813,511.83	$12,097,027.25	$1,304,205.00	$3,837,595.30	$51,515.00	$14,965,043.08	$1,227,338.39	$2,727,443.30	$17,263.36	$15,098,468.62	$120,205.76	$7,428,072.28	$130,197.00	$2,707,209.79	$25,851.00	$466,210,048.14	$22,246,666.08	$1,088,251.32	$0.00	$1,129,751.95	$0.00

TORNADO TOUCHING GROUND, 2014 | NOAA WEATHER IN FOCUS PHOTO CONTEST 2015

NEVADA

NEVADA STATISTICS SUMMARY (2011 – 2021)	
3	CLIMATE DISASTER DECLARATIONS
LOWEST	NUMBER OF CLIMATE DISASTERS IN THE COUNTRY
3RD LOWEST	PER CAPITA SPENDING ON CLIMATE DISASTERS
DOUGLAS, STOREY, WASHOE, CARSON CITY	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
8	COUNTIES HAVE HAD DISASTER DECLARATIONS
C	ASCE INFRASTRUCTURE REPORT CARD GRADE
NYE	HIGHEST COMPOUNDING RISKS
$34 MILLIOM	FEMA + HUD POST-DISASTER FUNDING
3 MILLION	POPULATION TOTAL
$11	PER CAPITA SPENDING ON CLIMATE DISASTERS
$2.6	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011-2021

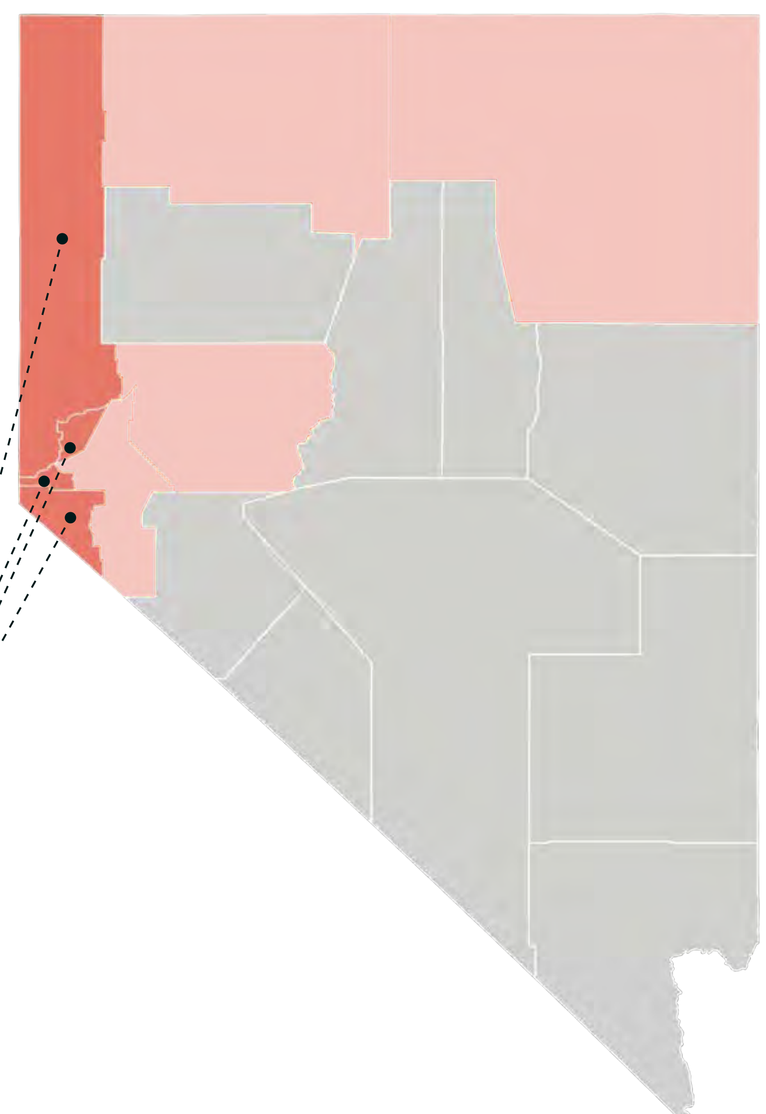
FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

3
disaster declarations

Though Nevada appears to have low federal disaster occurrences, between 2018 and 2021, 571 people in Nevada died where heat was among the causes of death.

Eight out of 17 counties in Nevada have had disaster declarations.

Douglas, Storey, Washoe, and Carson City counties have each had two disaster declarations.



Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

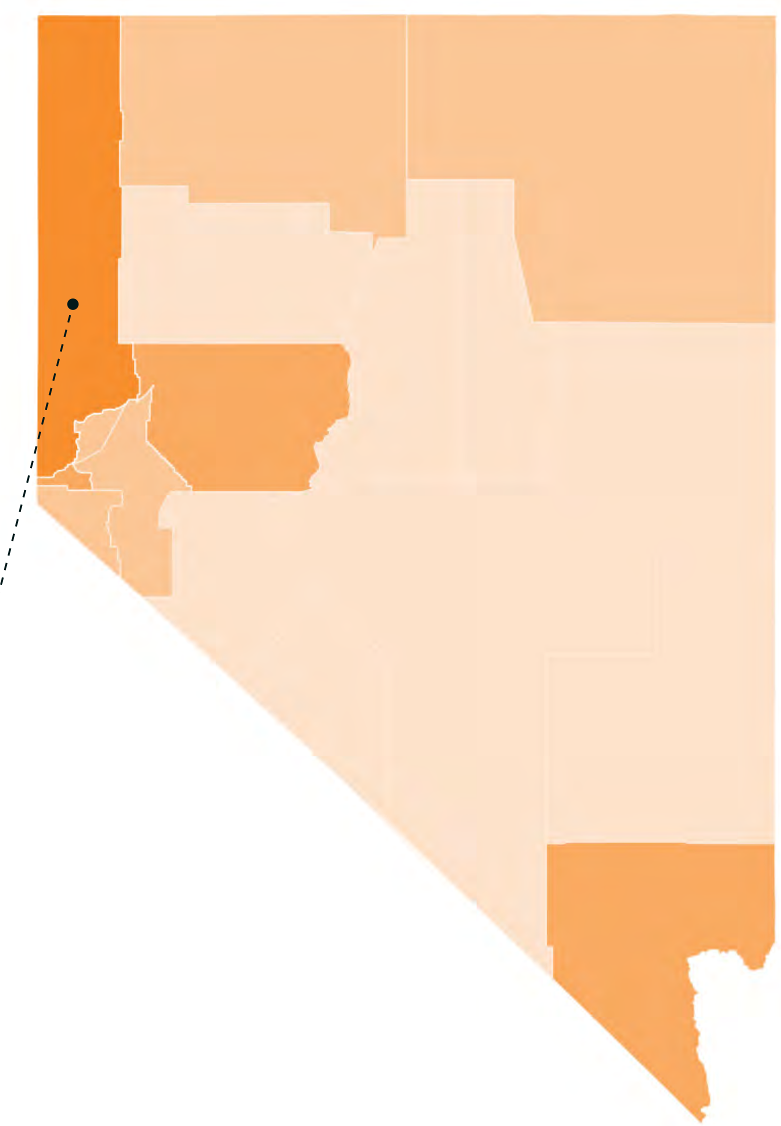
FEDERAL ASSISTANCE 2011-2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$34M
post-disaster assistance

$34M	FEMA obligations
$0	HUD CDBG-DR Funds
$34M	FEMA + HUD assistance
$11	per capita cost

Washoe County has received the most post-disaster federal recovery funds in the state: over $10 million.



FEMA Public Assistance and Hazard Mitigation

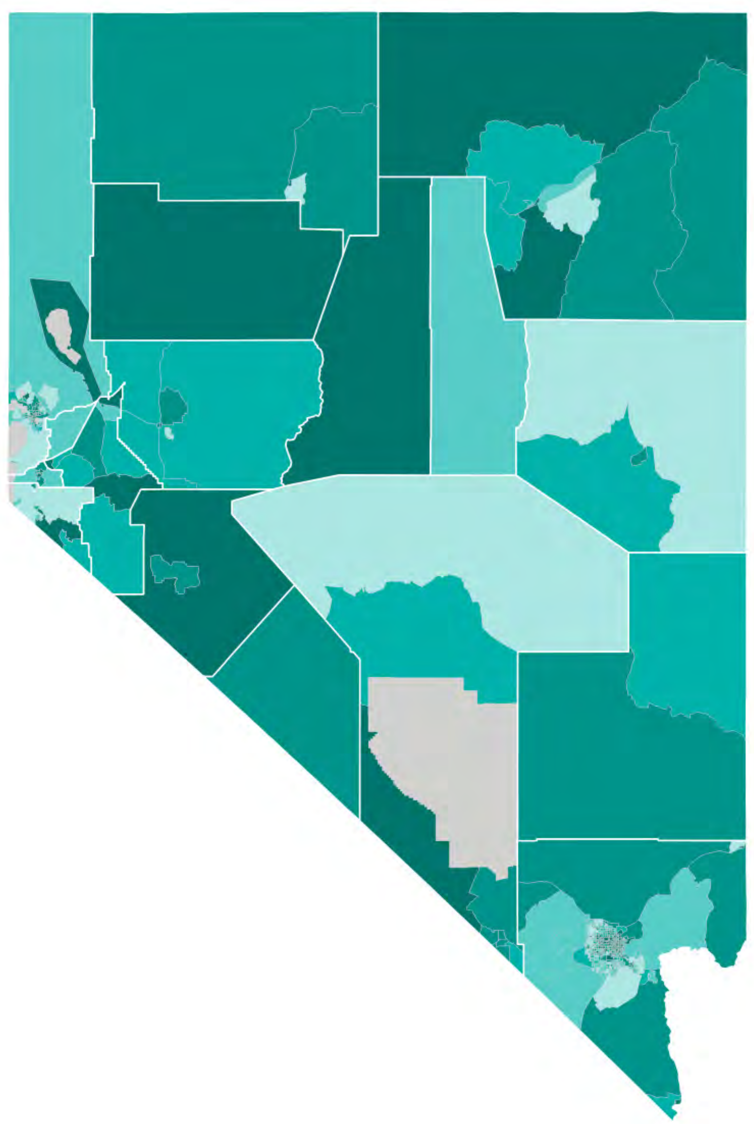
Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

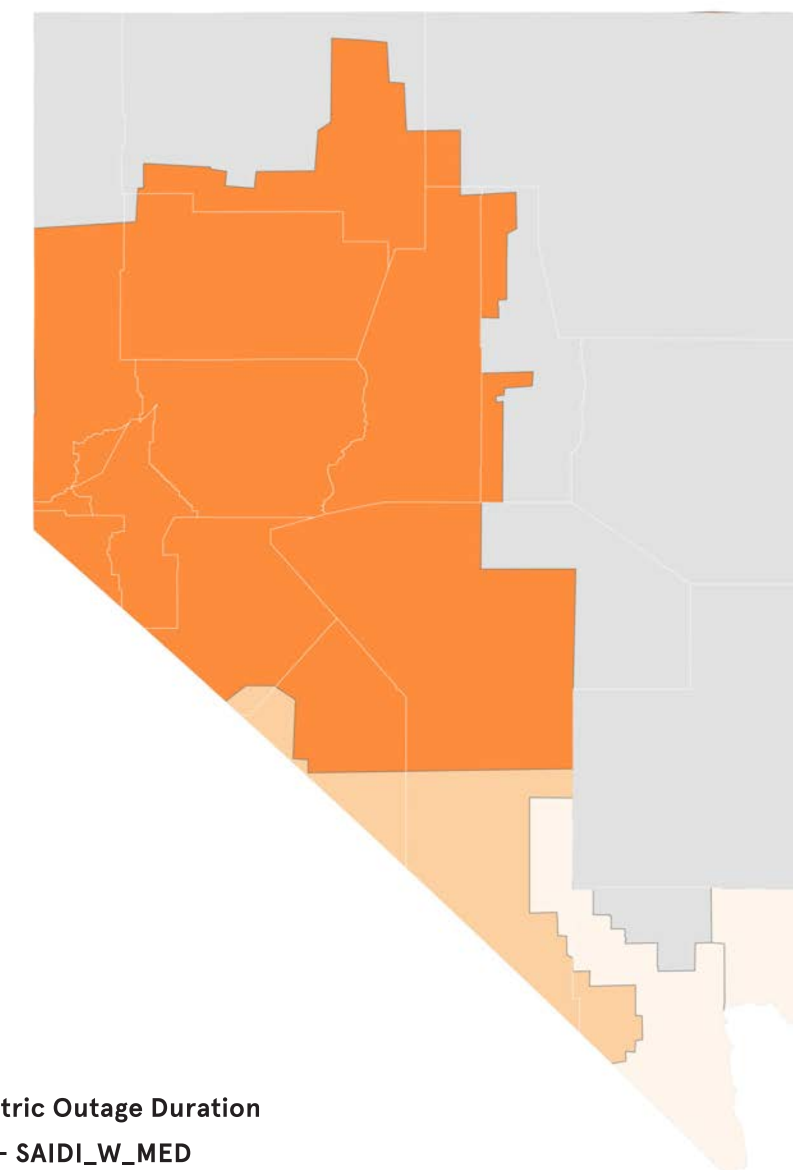
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



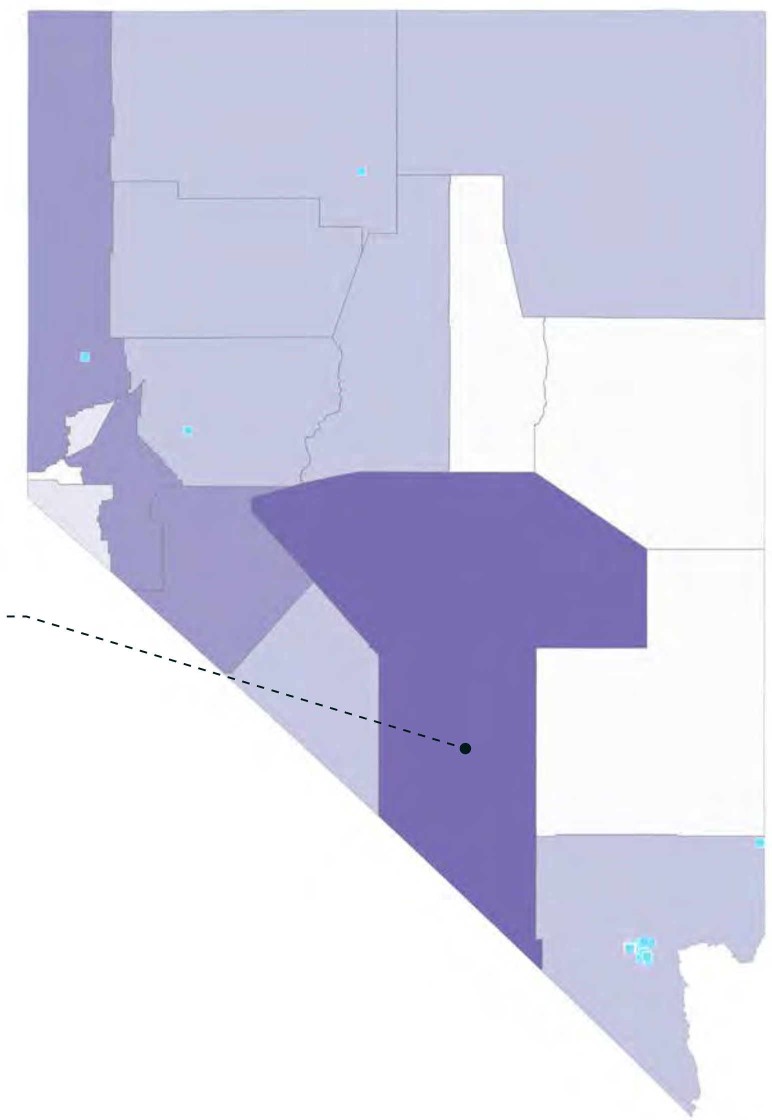
Aggregated Annual Electric Outage Duration

Including major events - SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Nye County has high risk of climate disasters, high increase in population, high health risk, and high poverty rates.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Carson City							0
Churchill					1		2
Clark					5		2
Douglas					2		1
Elko					1		2
Esmeralda					1		2
Eureka							0
Humboldt					1		2
Lander					1		2
Lincoln							0
Lyon					1		3
Mineral					1		3
Nye					2		4
Pershing					1		2
Storey					1		1
Washoe					3		3
White Pine							0

NEVADA

TOTAL: 3 DISASTERS FEMA PA + HM: $34 M HUD CDBG-DR: none FEMA + HUD ASSISTANCE: $34 M			2014		2017			
			4202: SEVERE STORMS AND FLOODING		4303: SEVERE WINTER STORMS, FLOODING, AND MUDSLIDES		4307: SEVERE WINTER STORMS, FLOODING, AND MUDSLIDES	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	3	$9,286,220	$165,556.25	$16,875.57	$4,941,595.66	$106,438.00	$3,924,244.78	$131,510.00
Churchill County	1	$4,759,096					$4,759,095.60	$0.00
Clark County	0	$2,939,837	$2,383,437.23	$556,400.25				
Douglas County	2	$615,090			$438,473.34	$0.00	$176,616.48	$0.00
Elko County	1	$541,182					$541,182.32	$0.00
Esmeralda County	0	$0						
Eureka County	0	$0						
Humboldt County	1	$871,067					$871,067.12	$0.00
Lander County	0	$0						
Lincoln County	0	$0						
Lyon County	1	$278,396			$278,395.83	$0.00		
Mineral County	0	$0						
Nye County	0	$0						
Pershing County	0	$0						
Storey County	2	$736,649			$663,160.22	$0.00	$0.00	$73,489.00
Washoe County	2	$10,680,111			$5,116,721.10	$1,443,473.25	$3,084,935.79	$1,034,981.25
White Pine County	0	$0						
Carson City	2	$2,932,207			$759,793.18	$638,111.30	$729,496.07	$804,806.25
Total FEMA Allocation		$33,639,856	$2,548,993.48	$573,275.82	$12,198,139.33	$2,188,022.55	$14,086,638.16	$2,044,786.50

IMAGE: VALLEY OF FIRE NEVADA | SVEN RUEDIGER

NEW HAMPSHIRE

NEW HAMPSHIRE STATISTICS SUMMARY (2011 – 2021)	
16	CLIMATE DISASTER DECLARATIONS
GRAFTON	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
7	COUNTIES WITH FIVE OR MORE DISASTERS
3	SUPERFUND SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
COOS, ROCKINGHAM, STRAFFORD	HIGHEST COMPOUNDING RISKS
$74 MILLION	FEMA + HUD POST-DISASTER FUNDING
1.4 MILLION	POPULATION TOTAL
$55	PER CAPITA SPENDING ON CLIMATE DISASTERS
$1.1 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

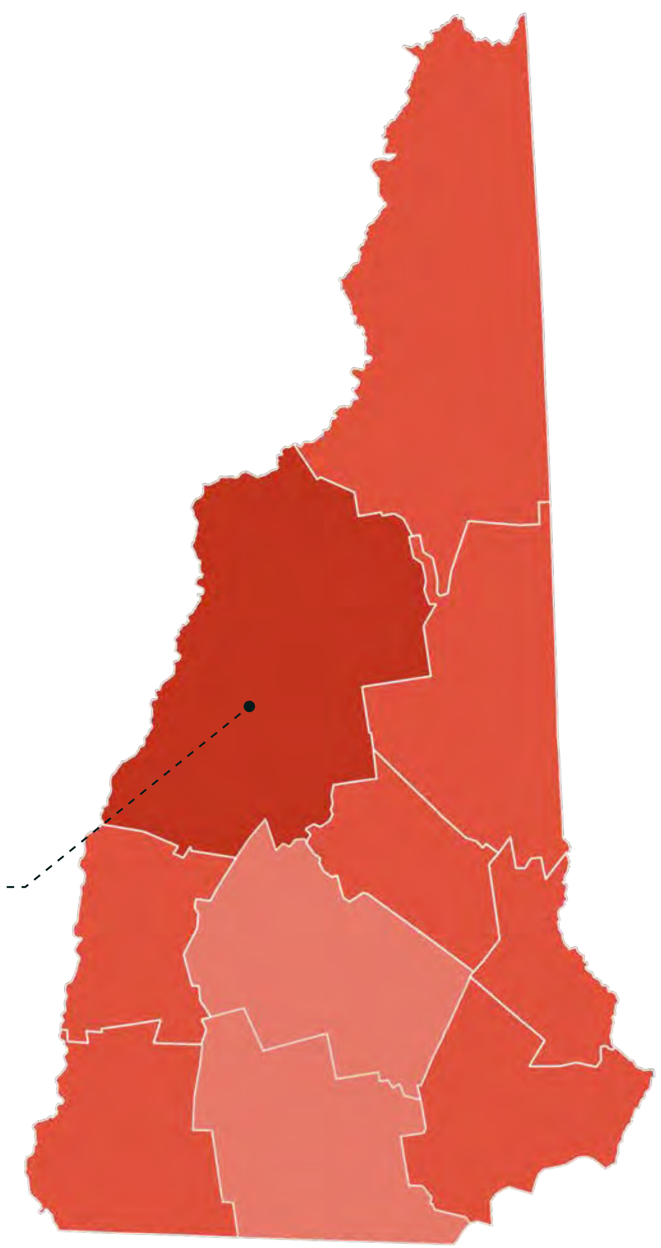
DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

16
disaster declarations

Every county in New Hampshire has had a disaster declaration. Seven out of the 10 counties have had more than 5.

Grafton County has had the highest number of recent disaster declarations in the state: 7 disasters.



Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

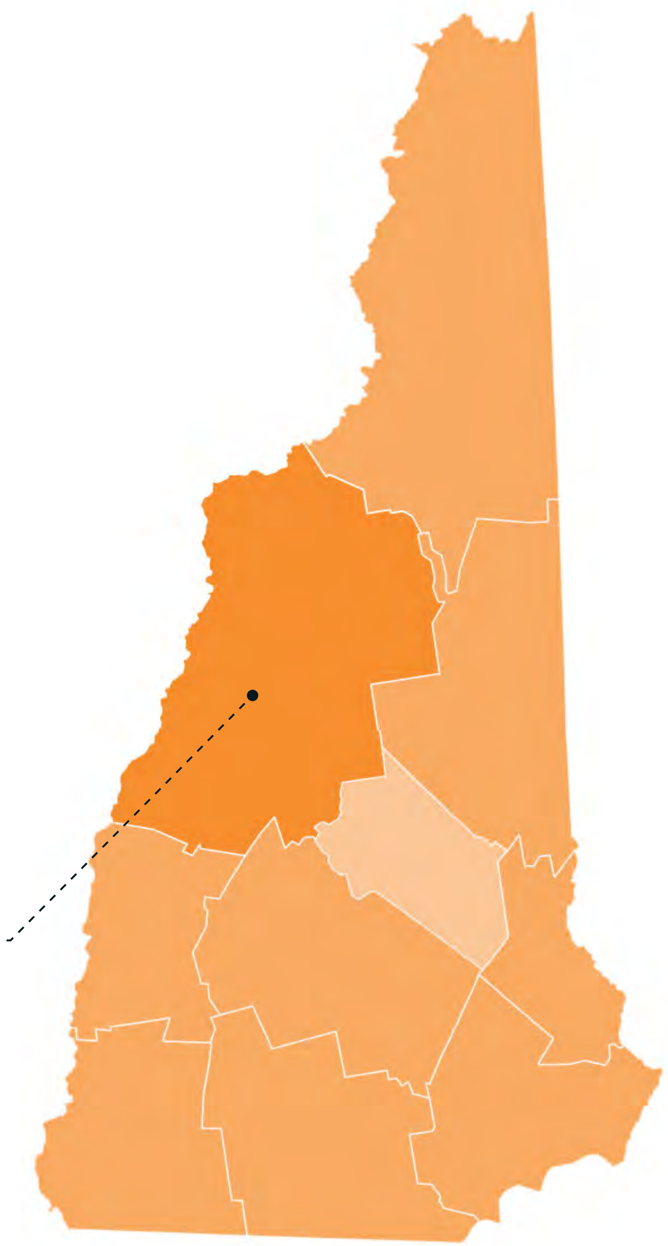
FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$74M
post-disaster assistance

$74M	FEMA obligations
$0	HUD CDBG-DR Funds
$74M	FEMA + HUD assistance
$55	per capita cost

Grafton County has received the most post-disaster federal recovery funds in the state: over $30 million.



FEMA Public Assistance and Hazard Mitigation

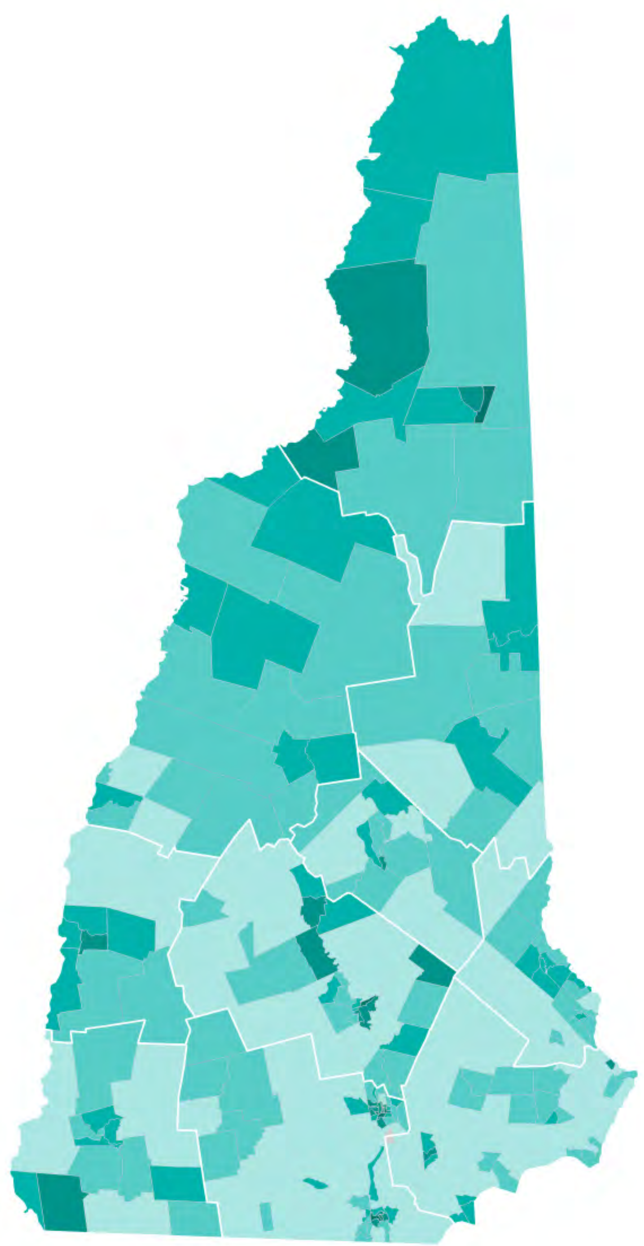
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerabil

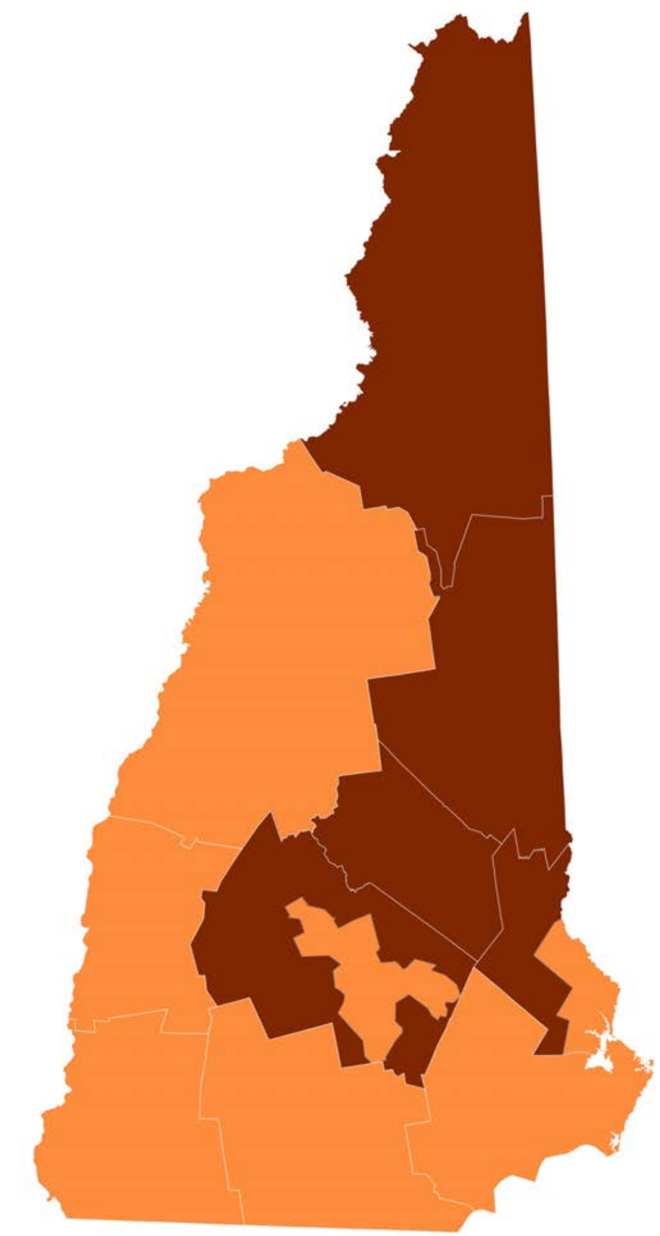
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration

Including major events - SAIDI_W_MED

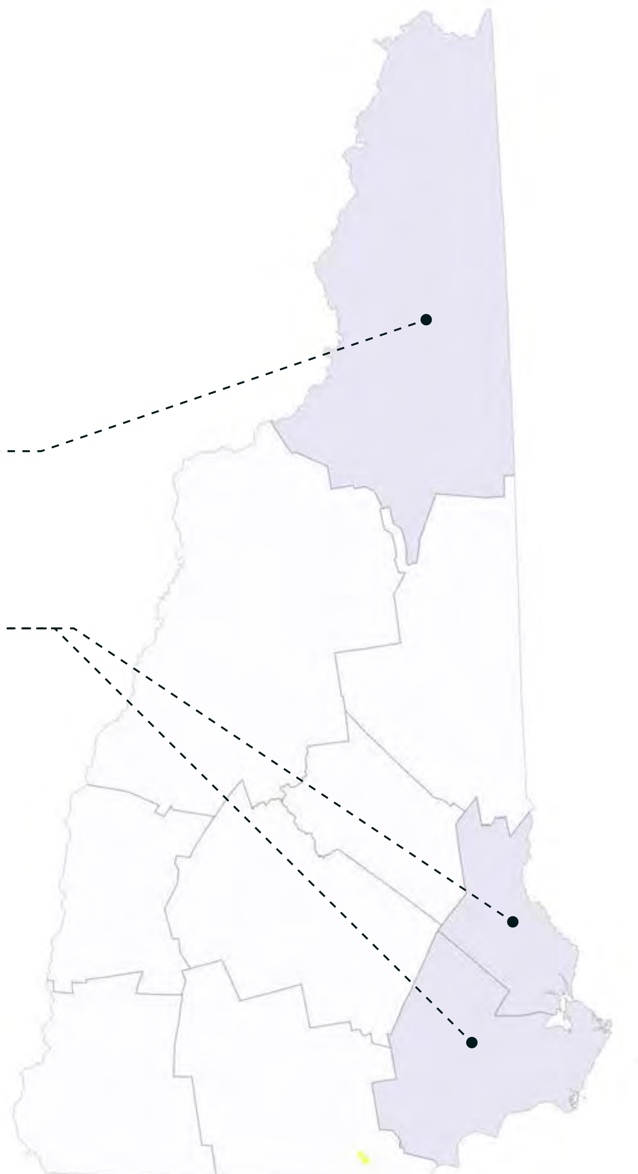
- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Coos County has a high risk of severe cold waves.

Rockingham County and Strafford County have a high risk of sea level rise.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Belknap							0
Carroll							0
Cheshire							0
Coos					1		1
Grafton							0
Hillsborough							0
Merrimack							0
Rockingham							1
Strafford							1
Sullivan							0

NEW HAMPSHIRE

TOTAL: 16 DISASTERS
FEMA PA + HM: $74 M
HUD CDBG-DR: none
FEMA + HUD ASSISTANCE: $74 M

County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	2011 — 4006: SEVERE STORMS AND FLOODING		2011 — 4026: TROPICAL STORM IRENE		2011 — 4049: SEVERE STORM AND SNOWSTORM	
			PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	16	$16,227,768	$807,178.40	$7,428.69	$2,388,998.88	$305,341.00	$260,976.72	$14,911.00
Belknap County	5	$698,400			$179,431.54	$0.00		
Carroll County	6	$3,113,835			$2,124,387.02	$350,371.00		
Cheshire County	5	$4,056,415						
Coos County	5	$2,640,853	$286,250.37	$0.00	$1,002,626.91	$0.00		
Grafton County	7	$30,551,166	$125,407.19	$141,118.50	$11,072,277.54	$858,169.00	$210,156.26	$0.00
Hillsborough County	3	$5,095,790					$2,186,364.99	$0.00
Merrimack County	3	$1,760,615			$514,431.20	$0.00		
Rockingham County	6	$6,205,560					$680,047.67	$169,080.00
Strafford County	4	$1,724,511			$255,661.59	$0.00		
Sullivan County	6	$1,788,860			$601,906.28	$284,828.00		
Total FEMA Allocation		$73,863,772	$1,218,835.96	$148,547.19	$18,139,720.96	$1,798,709.00	$3,337,545.64	$183,991.00

County Name	2012 — 4065: SEVERE STORM AND FLOODING		2012 — 4095: HURRICANE SANDY		2013 — 4105: SEVERE WINTER STORM AND SNOWSTORM		2013 — 4139: SEVERE STORMS, TORNADOES, AND FLOODING	
	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$734,505.10	$17,190.00	$467,952.75	$9,553.00	$1,608,122.74	$44,631.72	$233,217.49	$38,187.46
Belknap County			$15,756.14	$0.00	$214,377.40	$0.00		
Carroll County			$14,017.98	$0.00	$123,157.85	$0.00		
Cheshire County	$2,304,687.26	$302,015.00			$199,585.77	$297,372.00	$952,754.66	$0.00
Coos County			$46,365.46	$0.00				
Grafton County			$1,451,111.14	$0.00			$4,046,305.71	$221,961.00
Hillsborough County					$1,413,564.19	$0.00		
Merrimack County					$573,805.12	$409,639.00		
Rockingham County			$109,175.57	$55,385.00	$1,535,170.04	$0.00		
Strafford County					$379,667.51	$203,644.00		
Sullivan County			$9,226.88	$0.00	$106,020.87	$0.00	$665,797.02	$0.00
Total FEMA Allocation	$3,039,192.36	$319,205.00	$2,113,605.92	$64,938.00	$6,153,471.49	$955,286.72	$5,898,074.88	$260,148.46

County Name	2015 — 4209: SEVERE WINTER STORM AND SNOWSTORM		2017 — 4316: SEVERE WINTER STORM		2017 — 4329: SEVERE STORMS AND FLOODING		2018 — 4355: SEVERE STORM AND FLOODING	
	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$997,527.74	$31,819.60	$89,498.41	$12,326.00	$3,162,715.56	$57,431.00	$2,277,743.15	$8,099.00
Belknap County			$35,451.27	$0.00			$253,383.27	$0.00
Carroll County			$97,728.49	$6,000.00			$298,809.42	$0.00
Cheshire County								
Coos County					$101,680.71	$0.00	$1,203,929.62	$0.00
Grafton County			$1,454,120.36	$6,000.00	$3,741,867.95	$14,166.95	$5,138,988.95	$472,090.50
Hillsborough County	$1,296,715.22	$6,000.00						
Merrimack County							$262,739.35	$0.00
Rockingham County	$2,109,093.72	$6,000.00						
Strafford County	$514,070.35	$12,000.00						
Sullivan County							$121,081.17	$0.00
Total FEMA Allocation	$4,917,407.03	$55,819.60	$1,676,798.53	$24,326.00	$7,006,264.22	$71,597.95	$9,556,674.93	$480,189.50

County Name	2018 — 4370: SEVERE STORM AND FLOODING		2018 — 4371: SEVERE WINTER STORM AND SNOWSTORM		2019 — 4457: SEVERE STORM AND FLOODING		2021 — 4622: SEVERE STORM AND FLOODING		2021 — 4624: SEVERE STORM AND FLOODING	
	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$348,600.87	$0.00	$833,846.28	$2,725.00	$1,456,431.25	$10,809.00				
Belknap County										
Carroll County			$99,362.77	$0.00						
Cheshire County							$0.00	$0.00	$0.00	$0.00
Coos County										
Grafton County					$1,597,425.28	$0.00				
Hillsborough County			$193,145.56	$0.00						
Merrimack County										
Rockingham County	$360,907.60	$0.00	$1,180,700.15	$0.00						
Strafford County			$359,467.72	$0.00						
Sullivan County									$0.00	$0.00
Total FEMA Allocation	$709,508.47	$0.00	$2,666,522.48	$2,725.00	$3,053,856.53	$10,809.00	$0.00	$0.00	$0.00	$0.00

NEW JERSEY

NEW JERSEY STATISTICS SUMMARY (2011 - 2021)	
13	CLIMATE DISASTER DECLARATIONS
3RD HIGHEST	PER CAPITA SPENDING ON CLIMATE DISASTERS IN THE COUNTRY
ATLANTIC, BERGEN, BURLINGTON, CAPE MAY, CUMBERLAND, ESSEX, MORRIS	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
ALL 20	COUNTIES WITH FIVE OR MORE DISASTERS
946	SUPERFUND SITES
D+	ASCE INFRASTRUCTURE REPORT CARD GRADE
OCEAN COUNTY	HIGHEST COMPOUNDING RISKS
$7.2 BILLION	FEMA + HUD POST-DISASTER FUNDING
8.9 MILLION	POPULATION TOTAL
$815	PER CAPITA SPENDING ON CLIMATE DISASTERS
$9.1 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

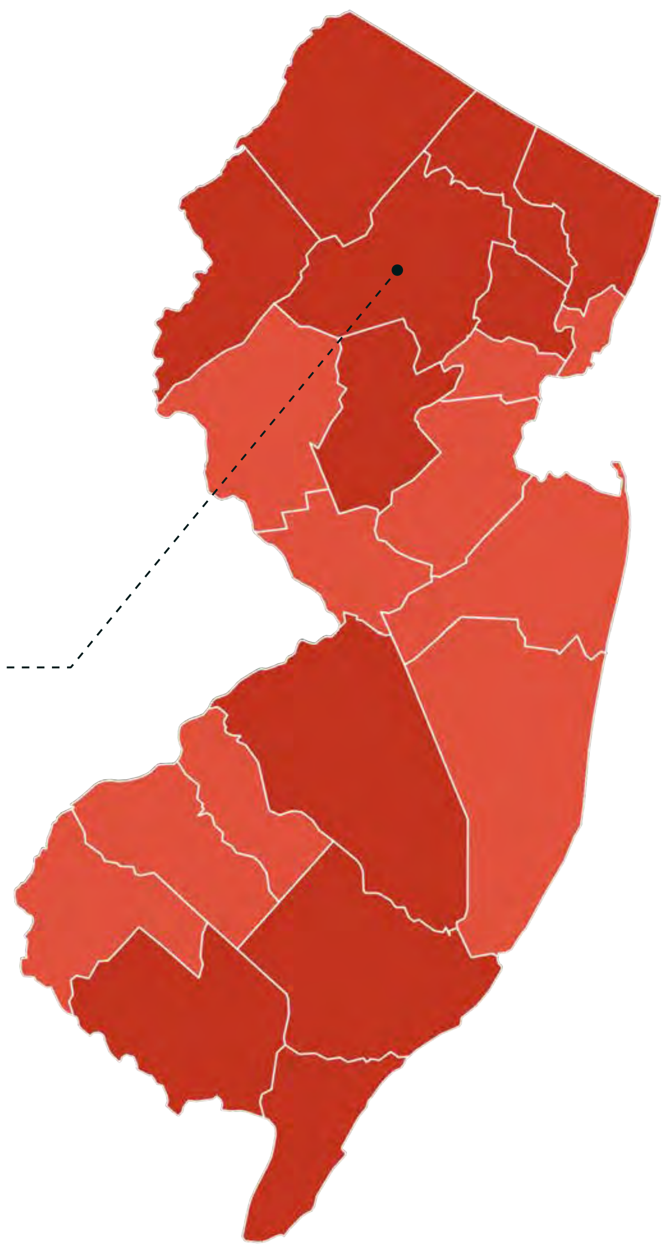
FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

13
disaster
declarations

Every county in New Jersey has had at least 5 recent disasters.

Morris County has had 9 recent climate disasters.

Atlantic, Bergen, Burlington, Cape May, Cumberland, and Essex counties have each had 8 disasters.



Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurences
- 7–9 occurences
- 10+ occurences

Source: FEMA 2021
Maps courtesy of iParametrics

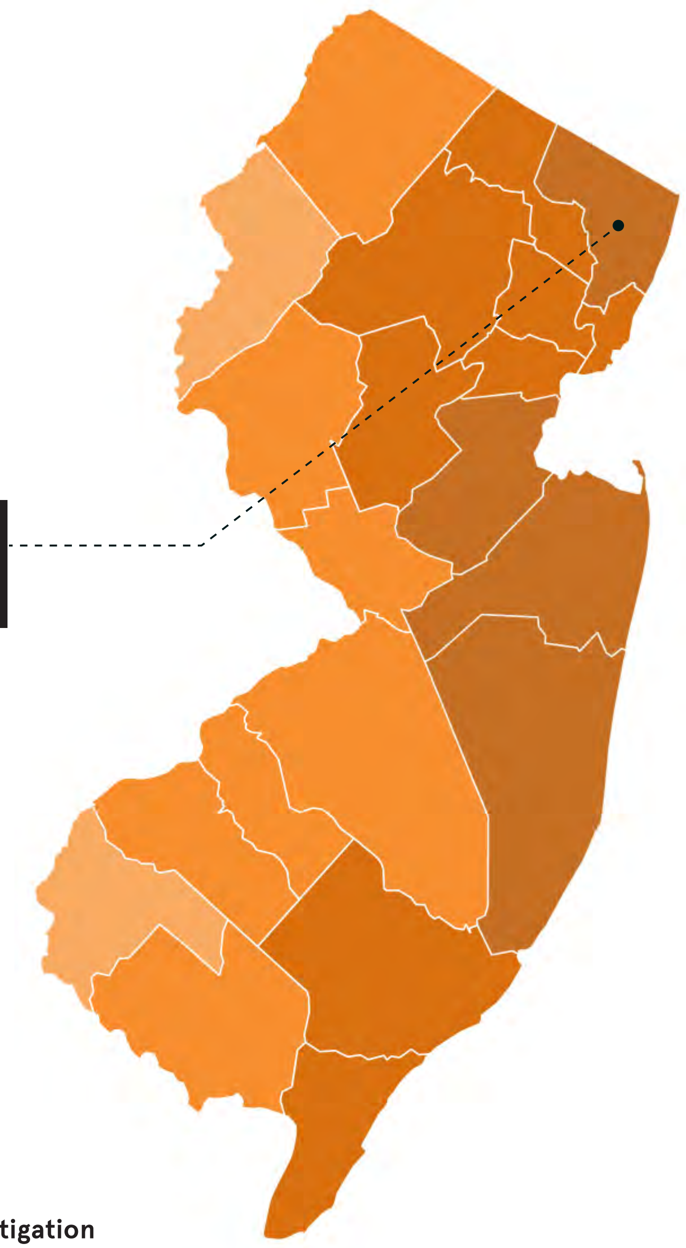
FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$7.2B
post-disaster
assistance

Bergen County received the most post-disaster federal assistance in the state: over $110M.

$2.8B	FEMA obligations
$4.4B	HUD CDBG-DR Funds
$7.2B	FEMA + HUD assistance
$815	per capita cost



FEMA Public Assistance and Hazard Mitigation

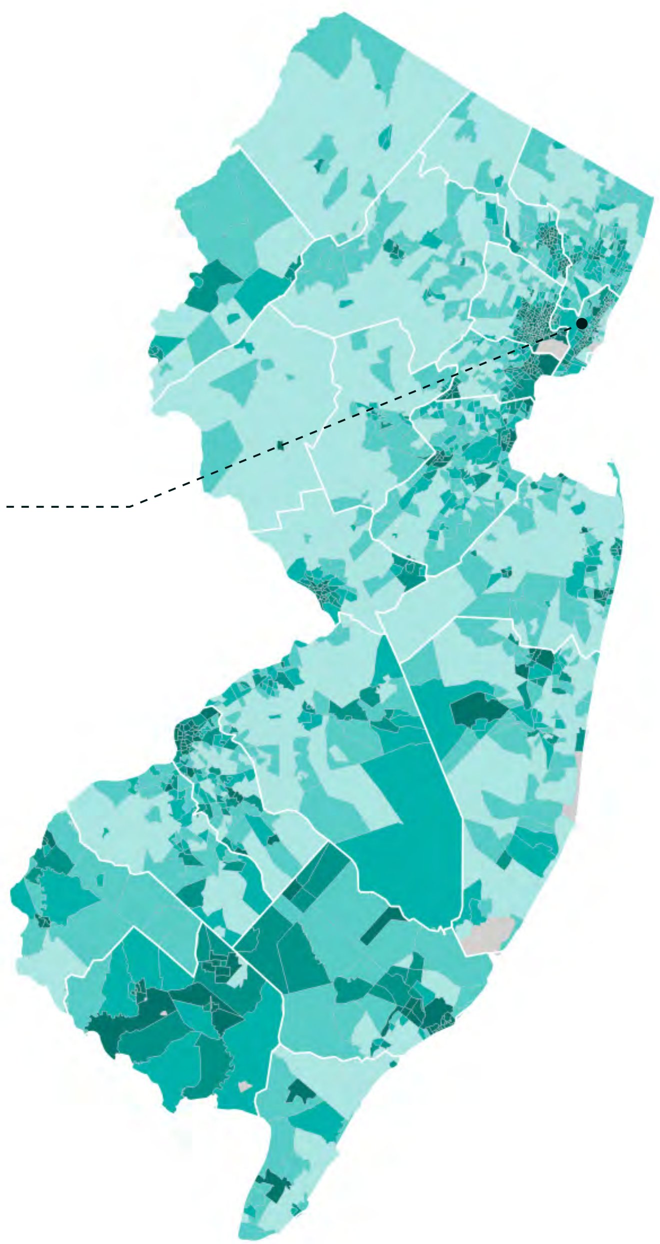
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $500M
- $500M to $1.25B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Hudson County has had the highest population increase in the state since 2011 and 5 disasters during that time.

Four counties have had more than 5 disasters and an increase in population by more than 10 percent since 2011.

Social Vulnerability Index

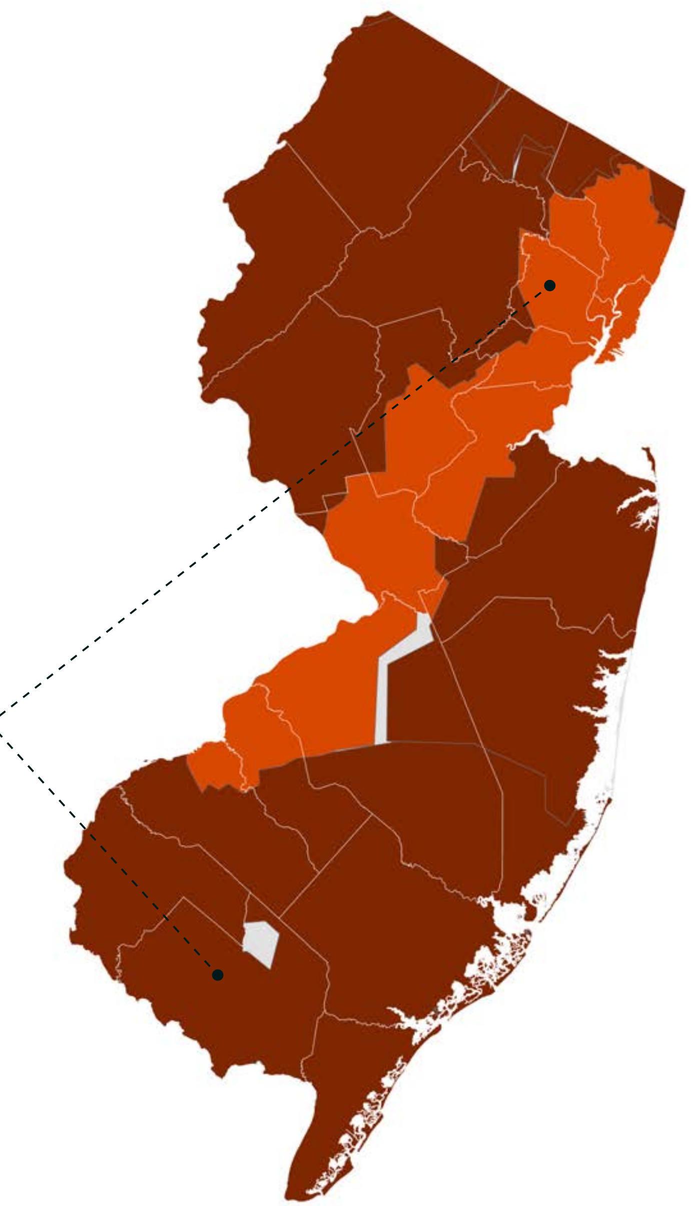
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



The majority of counties in New Jersey rely on utility companies with longer than average energy outage periods.

Cumberland County and Essex County have high social vulnerability and low energy reliability.

Aggregated Annual Electric Outage Duration

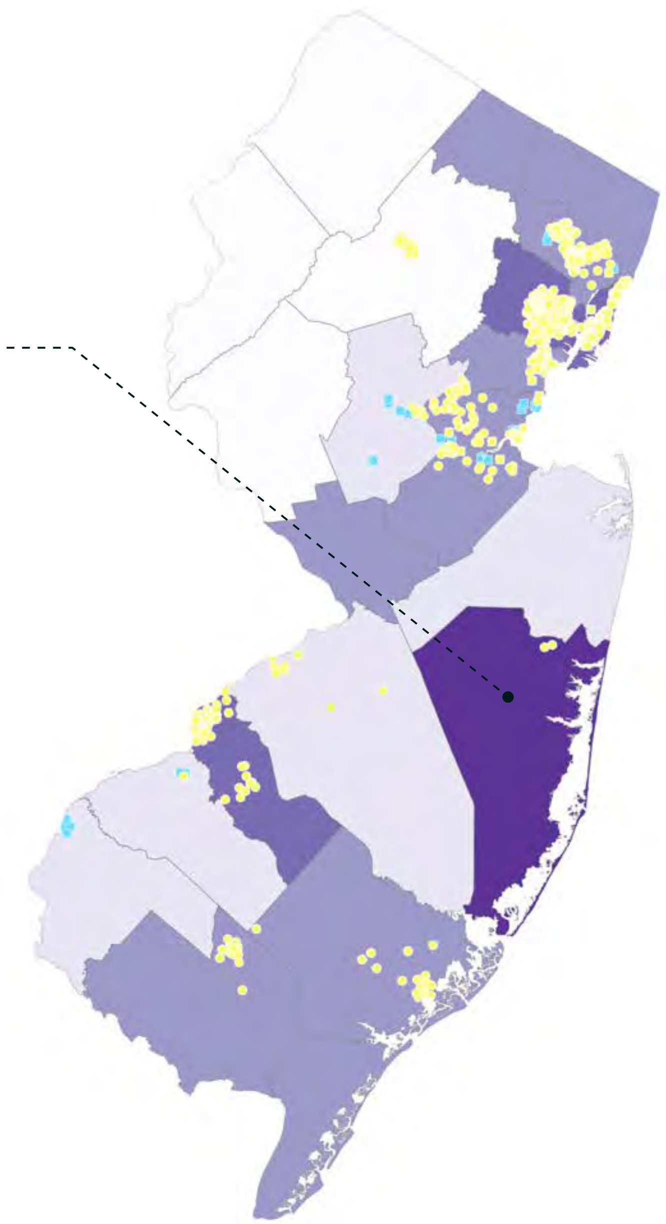
Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Ocean County has high risk of climate disasters, high density, high population change, and high risk of sea level rise.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Atlantic					7		3
Bergen					1		3
Burlington							1
Camden					3		4
Cape May					2		3
Cumberland					2		3
Essex					5		4
Gloucester							1
Hudson					6		4
Hunterdon							0
Mercer					3		3
Middlesex					1		3
Monmouth							1
Morris							0
Ocean					6		5
Passaic					5		3
Salem							1
Somerset							1
Sussex							0
Union					3		3
Warren							0

NEW JERSEY

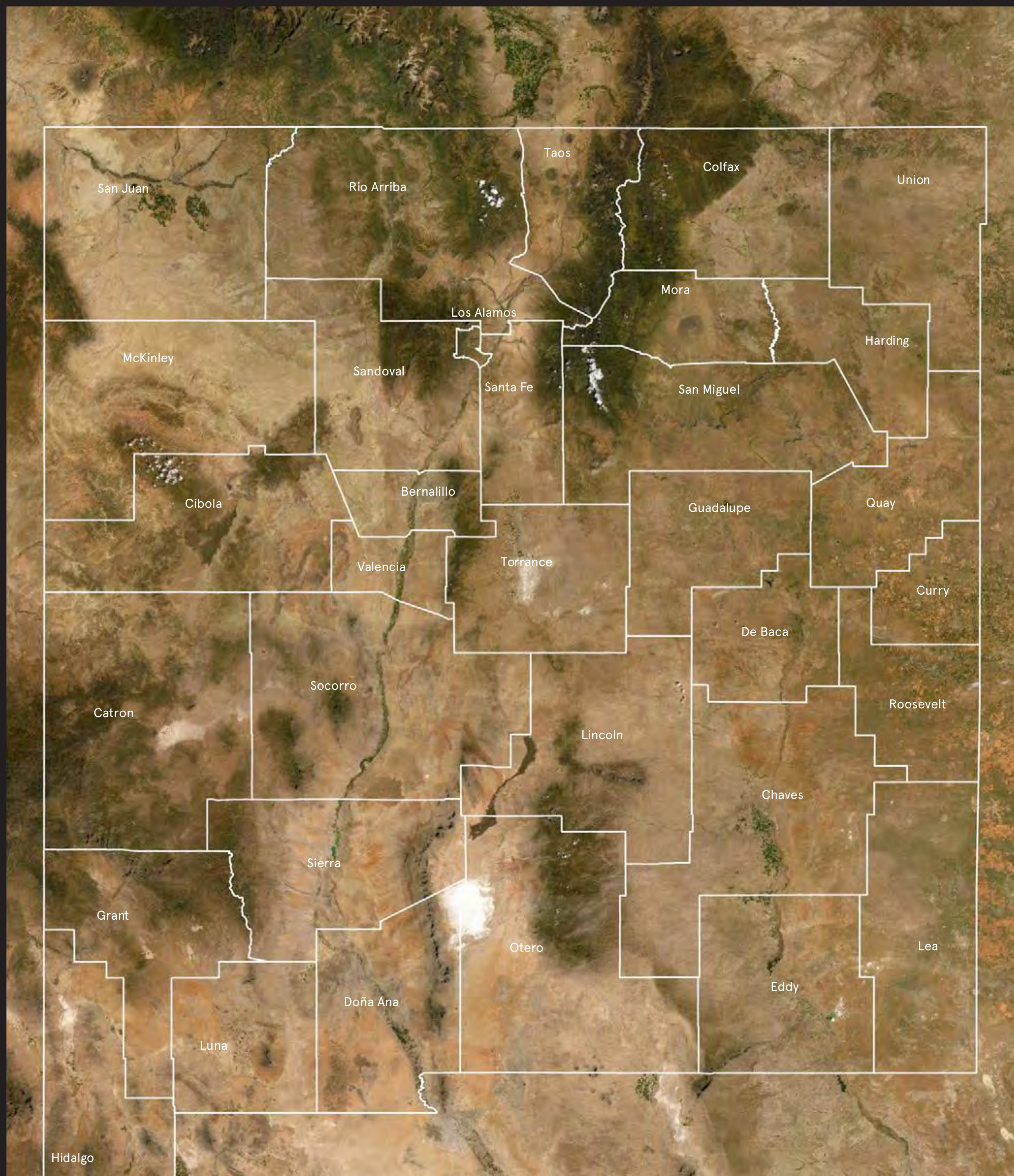
TOTAL: 13 DISASTERS
FEMA PA + HM: $2.8 B
HUD CDBG-DR: $4.4 B
FEMA + HUD ASSISTANCE: $7.2B

County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	2011					
			1954: SEVERE WINTER STORM AND SNOWSTORM		4021: HURRICANE IRENE		4033: SEVERE STORMS AND FLOODING	
			PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	13	$1,165,079,099	$18,726,825	$388,929	$18,445,345	$1,751,443	$667,746	$239,397
Atlantic County	8	$52,251,817	$1,043,400	$0	$1,889,674	$0		
Bergen County	8	$110,260,606	$3,434,189	$0	$8,453,448	$2,934,152		
Burlington County	8	$20,280,312	$1,452,101	$0	$3,786,275	$0		
Camden County	5	$10,592,711			$1,071,733	$0		
Cape May County	8	$50,591,579	$3,171,115	$4,984,384	$1,183,171	$0		
Cumberland County	8	$32,873,447	$483,165	$0	$1,451,980	$0	$4,105,431	$0
Essex County	8	$56,276,181	$2,833,171	$0	$6,026,174	$2,627,587		
Gloucester County	6	$11,375,621			$2,546,093	$0	$1,064,496	$0
Hudson County	5	$97,170,927	$1,681,886	$0	$2,238,772	$0		
Hunterdon County	6	$14,196,791			$2,177,773	$0		
Mercer County	6	$26,645,584	$1,293,898	$0	$4,866,392	$0		
Middlesex County	6	$299,803,367	$2,797,569	$0	$9,999,591	$1,558,218		
Monmouth County	6	$320,531,921	$4,926,979	$0	$9,351,231	$0		
Morris County	9	$68,053,073	$1,901,139	$0	$14,308,541	$10,648,643		
Ocean County	6	$283,965,799	$3,659,015	$0	$2,438,380	$0		
Passaic County	7	$52,272,156	$1,287,628	$1,992,639	$8,950,113	$10,024,038		
Salem County	6	$5,265,708			$2,591,925	$0	$1,199,622	$0
Somerset County	7	$61,169,698	$1,310,985	$0	$5,823,495	$2,535,235		
Sussex County	7	$12,318,611			$3,477,090	$0		
Union County	6	$51,879,697	$2,010,225	$0	$8,034,941	$2,850,142		
Warren County	7	$7,871,630			$1,396,610	$0		
Total FEMA Allocation		$2,810,726,335	$52,013,289	$7,365,952	$120,508,747	$34,929,458	$7,037,295	$239,397

County Name	2011				2012			
	4039: REMNANTS OF TROPICAL STORM LEE		4048: SEVERE STORM		4070: SEVERE STORMS AND STRAIGHT-LINE WINDS		4086: HURRICANE SANDY	
	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$643,637	$20,631	$1,084,955	$192,482	$729,575	$38,483	$1,042,379,145	$35,737,539
Atlantic County					$3,409,682	$0	$37,183,792	$3,683,162
Bergen County			$6,337,045	$98,000			$67,444,883	$7,959,218
Burlington County							$5,048,255	$1,253,801
Camden County							$2,075,818	$984,932
Cape May County			$844,901	$0			$24,454,575	$4,003,552
Cumberland County					$4,555,083	$0	$4,528,335	$16,724,401
Essex County			$5,226,054	$0			$23,768,079	$3,361,221
Gloucester County					$2,791	$0	$888,063	$983,776
Hudson County							$86,671,159	$4,031,734
Hunterdon County	$445,474	$0	$526,892	$0			$8,012,201	$2,073,749
Mercer County	$229,622	$1,200,000					$11,483,291	$5,667,183
Middlesex County			$1,742,646	$0			$154,386,910	$125,117,595
Monmouth County							$283,625,128	$13,684,779
Morris County			$4,004,647	$0			$18,634,954	$4,022,283
Ocean County							$248,203,630	$20,867,519
Passaic County	$1,469,808	$0	$1,263,112	$0			$6,380,063	$15,180,272
Salem County					$99,729	$0	$614,644	$653,000
Somerset County			$1,076,906	$588,000			$11,272,743	$33,847,136
Sussex County	$873,111	$0	$846,770	$0			$3,399,441	$1,961,621
Union County			$2,980,139	$1,266,428			$27,035,669	$4,898,856
Warren County	$345,966	$0	$477,648	$0			$1,808,644	$2,278,184
Total FEMA Allocation	$4,007,618	$1,220,631	$26,411,716	$2,144,910	$8,796,860	$38,483	$2,069,299,419	$308,975,513

County Name	2015		2016		2018		2020		2021			
	4231: SEVERE STORM		4264: SEVERE WINTER STORM AND SNOWSTORM		4368: SEVERE WINTER STORM AND SNOWSTORM		4574: TROPICAL STORM ISAIAS		4597: SEVERE WINTER STORM AND SNOWSTORM		4614: REMNANTS OF HURRICANE IDA	
	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$1,178,787	$140,448	$32,673,010	$540,175	$5,729,905	$582,359	$1,002,865	$0	$1,214,979	$0	$970,439	$0
Atlantic County	$513,315	$138,395	$510,615	$2,876,326			$1,003,456	$0			$0	$0
Bergen County			$3,975,985	$250,000	$4,931,238	$272,662	$3,247,509	$0			$922,278	$0
Burlington County	$2,240,446	$339,000	$2,910,068	$0	$2,819,618	$0	$430,747	$0			$0	$0
Camden County	$3,639,938	$367,502	$2,452,788	$0							$0	$0
Cape May County			$6,068,986	$3,835,100			$1,154,939	$0	$890,858	$0	$0	$0
Cumberland County			$330,915	$0			$694,137	$0			$0	$0
Essex County			$4,401,703	$0	$4,929,908	$0	$3,016,316	$0			$85,969	$0
Gloucester County	$4,894,008	$922,129					$74,265	$0			$0	$0
Hudson County			$2,480,168	$0							$67,207	$0
Hunterdon County			$960,702	$0							$0	$0
Mercer County			$1,905,198	$0							$0	$0
Middlesex County			$4,170,068	$0							$30,771	$0
Monmouth County			$4,666,390	$250,000			$4,027,414	$0			$0	$0
Morris County			$2,851,307	$0	$7,212,169	$0	$2,572,553	$0	$1,828,182	$0	$68,654	$0
Ocean County			$4,957,336	$3,835,101					$4,818	$0	$0	$0
Passaic County					$1,939,367	$3,767,877					$17,237	$0
Salem County							$106,788	$0			$0	$0
Somerset County			$2,047,991	$0	$2,636,179	$0					$31,029	$0
Sussex County							$503,167	$0	$1,257,412	$0	$0	$0
Union County			$2,803,298	$0							$0	$0
Warren County			$926,190	$0					$638,389	$0	$0	$0
Total FEMA Allocation	$12,466,495	$1,907,474	$81,092,719	$11,586,702	$30,198,384	$4,622,898	$17,834,156	$0	$5,834,637	$0	$2,193,584	$0

NEW MEXICO

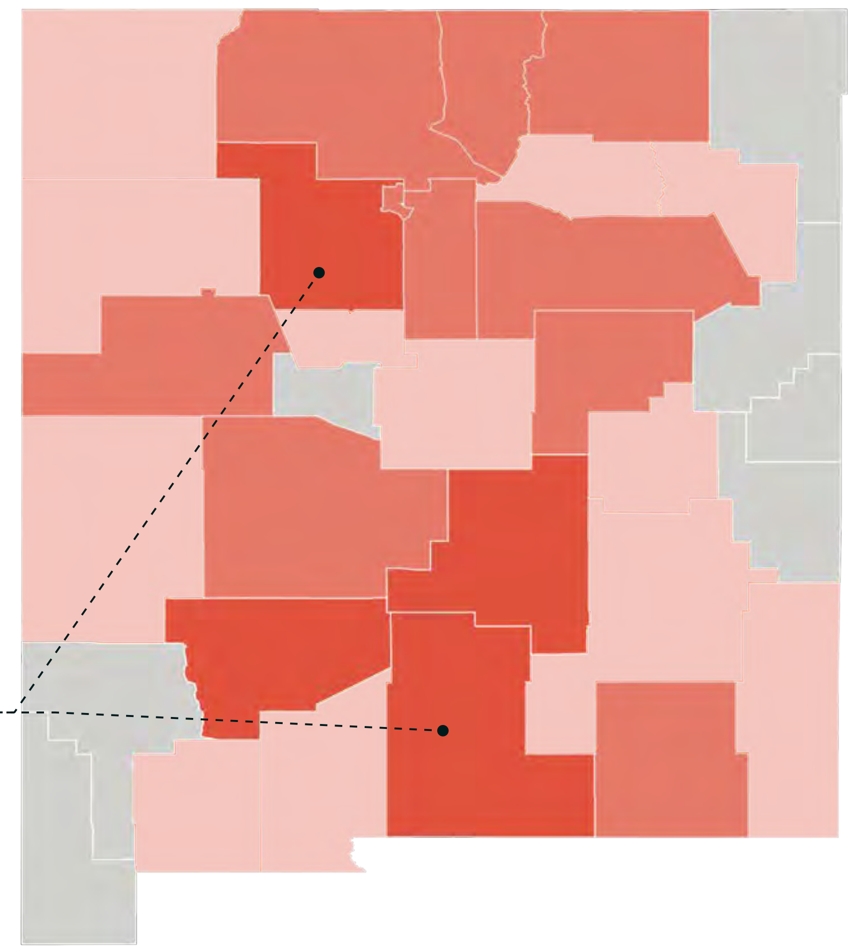


NEW MEXICO STATISTICS SUMMARY (2011 – 2021)	
10	CLIMATE DISASTER DECLARATIONS
LINCOLN, SANDOVAL	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
2	COUNTIES WITH FIVE OR MORE DISASTERS
122	SUPERFUND SITES
LEA	HIGHEST COMPOUNDING RISKS
$203 MILLION	FEMA + HUD POST-DISASTER FUNDING
2 MILLION	POPULATION TOTAL
$97	PER CAPITA SPENDING ON CLIMATE DISASTERS
$1.5 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

10
disaster
declarations



Lincoln County and Sandoval County have had the highest number of recent disasters in the state: 5 disasters each.

Nine out of 10 of the disasters in New Mexico have been due to flooding.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

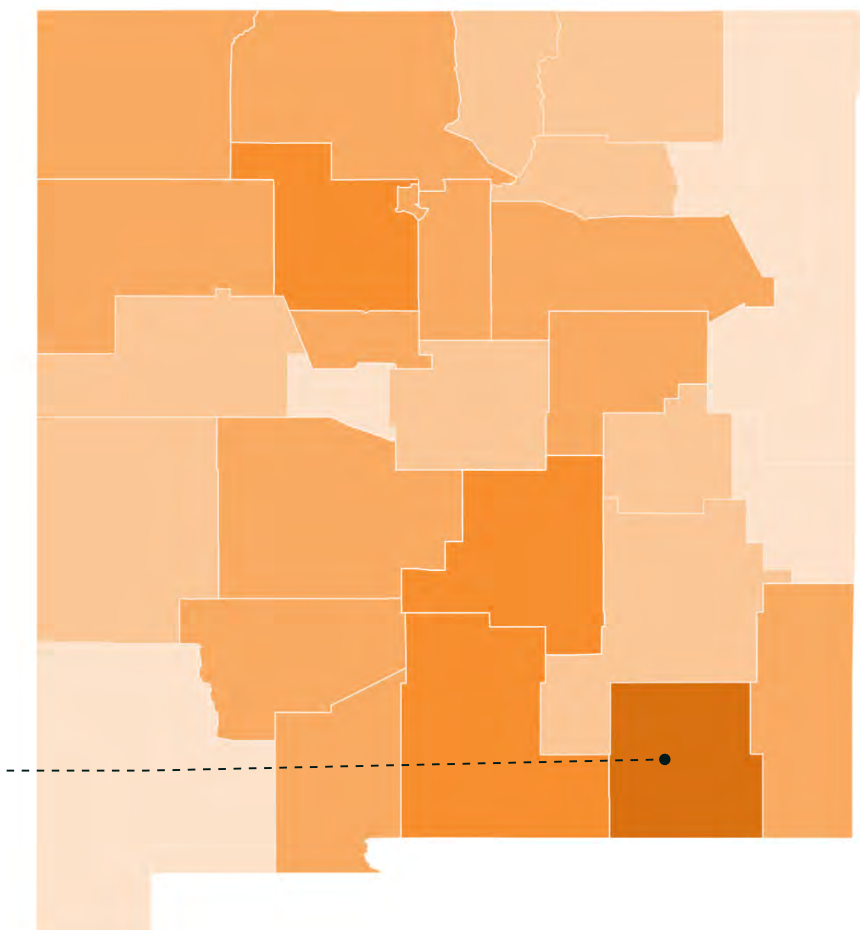
Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$203M
post-disaster
assistance

$203M	FEMA obligations
$0	HUD CDBG-DR Funds
$203M	FEMA + HUD assistance
$97	per capita cost



Eddy County has received the most post-disaster federal recovery funds in the state: over $65 million.

FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011–2021)

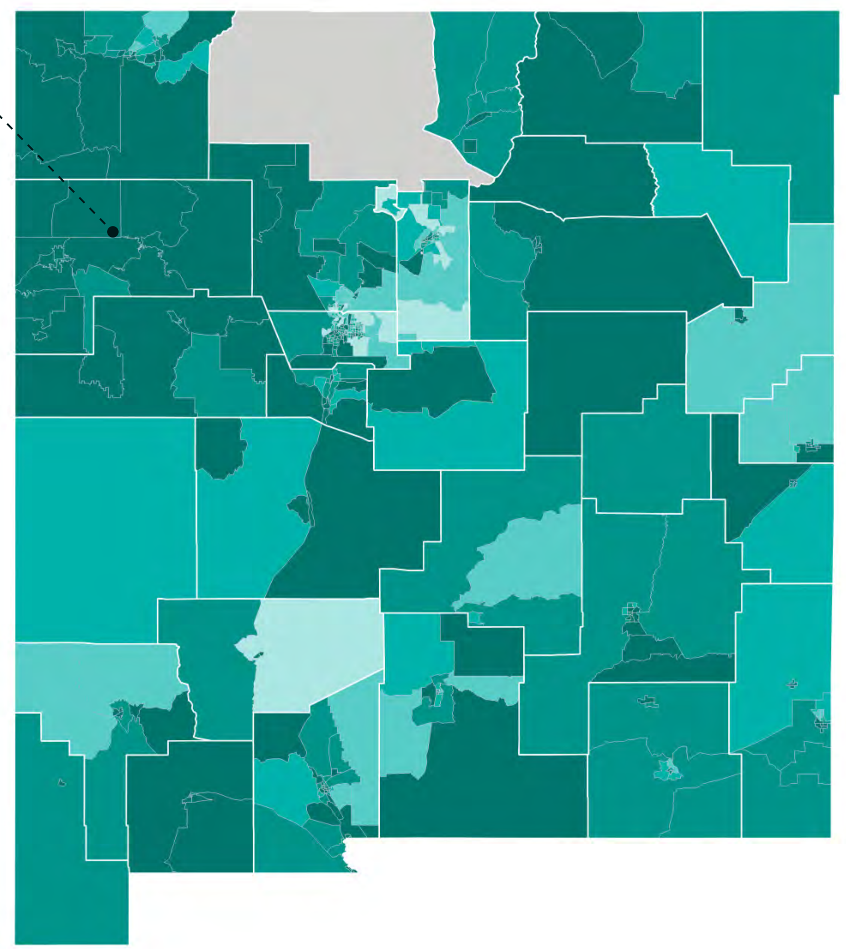
- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Sandoval County has had 5 recent disasters and a high increase in population since 2011.



Social Vulnerability Index

CDC (2018)

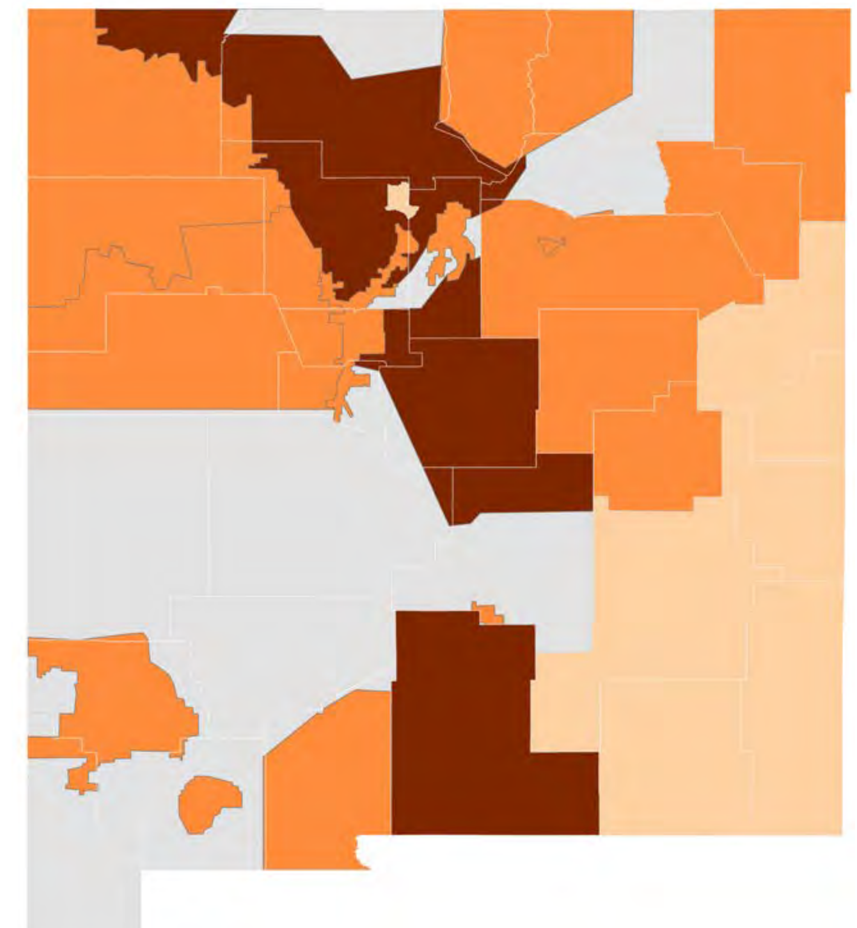
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Twelve counties in New Mexico have populations with high social vulnerability and low energy reliabilty.



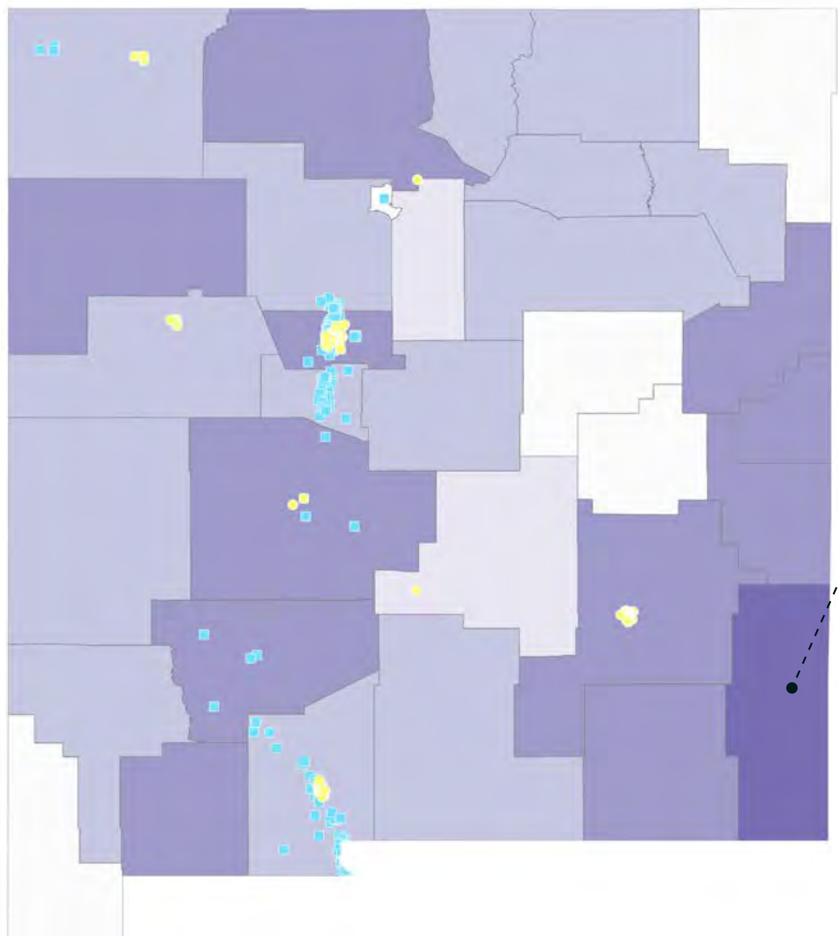
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Lea County has high risk of climate disasters, high percentage of population change, high poverty, and high health risks.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Bernalillo					1		3
Catron					1		2
Chaves					4		3
Cibola					3		2
Colfax					4		2
Curry					2		3
De Baca							0
DoÃ±a Ana					1		2
Eddy					1		3
Grant					2		2
Guadalupe							0
Harding					1		2
Hidalgo							0
Lea					2		4
Lincoln					2		1
Los Alamos							0
Luna					1		3
McKinley					5		3
Mora					3		2
Otero					4		2
Quay					1		3
Rio Arriba					4		3
Roosevelt					2		3
San Juan					2		2
San Miguel					3		2
Sandoval					1		2
Santa Fe					3		1
Sierra					4		3
Socorro					2		3
Taos					3		2
Torrance					1		2
Union							0
Valencia					2		2

NEW MEXICO

TOTAL: 10 DISASTERS
FEMA PA + HM: $203 M
HUD CDBG-DR: none
FEMA + HUD ASSISTANCE: $203 M

			2011				2012		2013								2014				2017	
			1962: SEVERE WINTER STORM AND EXTREME COLD TEMPERATURES		4047: FLOODING		4079: FLOODING		4147: SEVERE STORMS AND FLOODING		4148: SEVERE STORMS AND FLOODING		4151: SEVERE STORMS AND FLOODING		4152: SEVERE STORMS, FLOODING, AND MUDSLIDES		4197: SEVERE STORMS AND FLOODING		4199: SEVERE STORMS AND FLOODING		4352: SEVERE STORMS AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	10	$68,784,144	$749,407	$0	$12,461,988	$310,113	$4,464,245	$404,603	$72,569	$0	$2,426,430	$43,302	$4,347,341	$0	$19,114,473	$498,905	$3,813,540	$63,539	$3,544,182	$1,345,878	$15,123,630	$0
Bernalillo County	1	$1,887,537									$1,887,537	$0										
Catron County	1	$735,376													$701,664	$33,713						
Chaves County	1	$369,694													$268,211	$101,483						
Cibola County	2	$224,865			$116,843	$0									$108,022	$0						
Colfax County	3	$109,493									$18,809	$0			$0	$0			$53,631	$37,053		
Curry County	0	$0																				
De Baca County	1	$137,482													$137,482	$0						
Doña Ana County	1	$1,281,550													$1,281,550	$0						
Eddy County	2	$65,676,855													$960,944	$0			$64,715,911	$0		
Grant County	0	$0																				
Guadalupe County	2	$1,836,334													$1,148,371	$0	$687,963	$0				
Harding County	1	$68,337													$68,337	$0						
Hidalgo County	0	$0																				
Lea County	1	$2,654,081																	$2,654,081	$0		
Lincoln County	5	$3,573,335	$628,223	$0			$2,788,692	$41,262							$96,263	$0	$6,689	$0	$12,206	$0		
Los Alamos County	3	$5,098,548			$791,428	$0	$962,946	$0							$3,344,174	$0						
Luna County	1	$20,027									$20,027	$0										
McKinley County	1	$811,629													$811,629	$0						
Mora County	1	$123,545													$123,545	$0						
Otero County	4	$17,558,313	$134,837	$0			$15,607,906	$0							$712,120	$23,133	$282,853	$0	$759,965	$37,500		
Quay County	0	$0																				
Rio Arriba County	3	$5,071,712	$78,866	$0			$4,184,022	$0							$365,691	$0	$443,132	$0				
Roosevelt County	0	$0																				
Sandoval County	5	$12,193,546			$0	$30,383	$0	$7,188,818			$559,987	$0			$3,269,259	$1,145,099	$0	$0				
San Juan County	1	$2,424,702													$2,424,702	$0						
San Miguel County	3	$2,160,349													$1,164,953	$0	$867,911	$0	$0	$127,485		
Santa Fe County	2	$6,110,174													$2,992,781	$26,867			$840,526	$2,250,000		
Sierra County	4	$3,254,303	$0	$0							$58,779	$0			$2,392,694	$0			$757,829	$45,000		
Socorro County	3	$789,851	$49,495	$0							$569,134	$0			$171,222	$0						
Taos County	2	$208,941	$161,011	$0											$14,181	$33,750						
Torrance County	1	$150,019													$128,572	$21,446						
Union County	0	$0																				
Valencia County	0	$0																				
Total FEMA Allocation		$203,314,737	$1,801,838	$0	$13,370,259	$340,496	$28,007,810	$7,634,683	$72,569	$0	$5,540,702	$43,302	$4,347,341	$0	$41,800,839	$1,884,396	$6,102,087	$63,539	$73,338,331	$3,842,916	$15,123,630	$0

NEW YORK

NEW YORK STATISTICS SUMMARY (2011 – 2021)	
16	CLIMATE DISASTER DECLARATIONS
HIGHEST	TOTAL FEMA + HUD INVESTMENT IN THE COUNTRY
EVERY	COUNTY HAS HAD A DISASTER OCCURENCE
2ND HIGHEST	PER CAPITA SPENDING ON CLIMATE DISASTERS IN THE COUNTRY
HERKIMER, SUFFOLK	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
16	COUNTIES WITH FIVE OR MORE DISASTERS
868	SUPERFUND SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
THE BRONX, KINGS	HIGHEST COMPOUNDING RISKS
$26.3 BILLION	FEMA + HUD POST-DISASTER FUNDING
19.5 MILLION	POPULATION TOTAL
$1,348	PER CAPITA SPENDING ON CLIMATE DISASTERS
$19.3 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

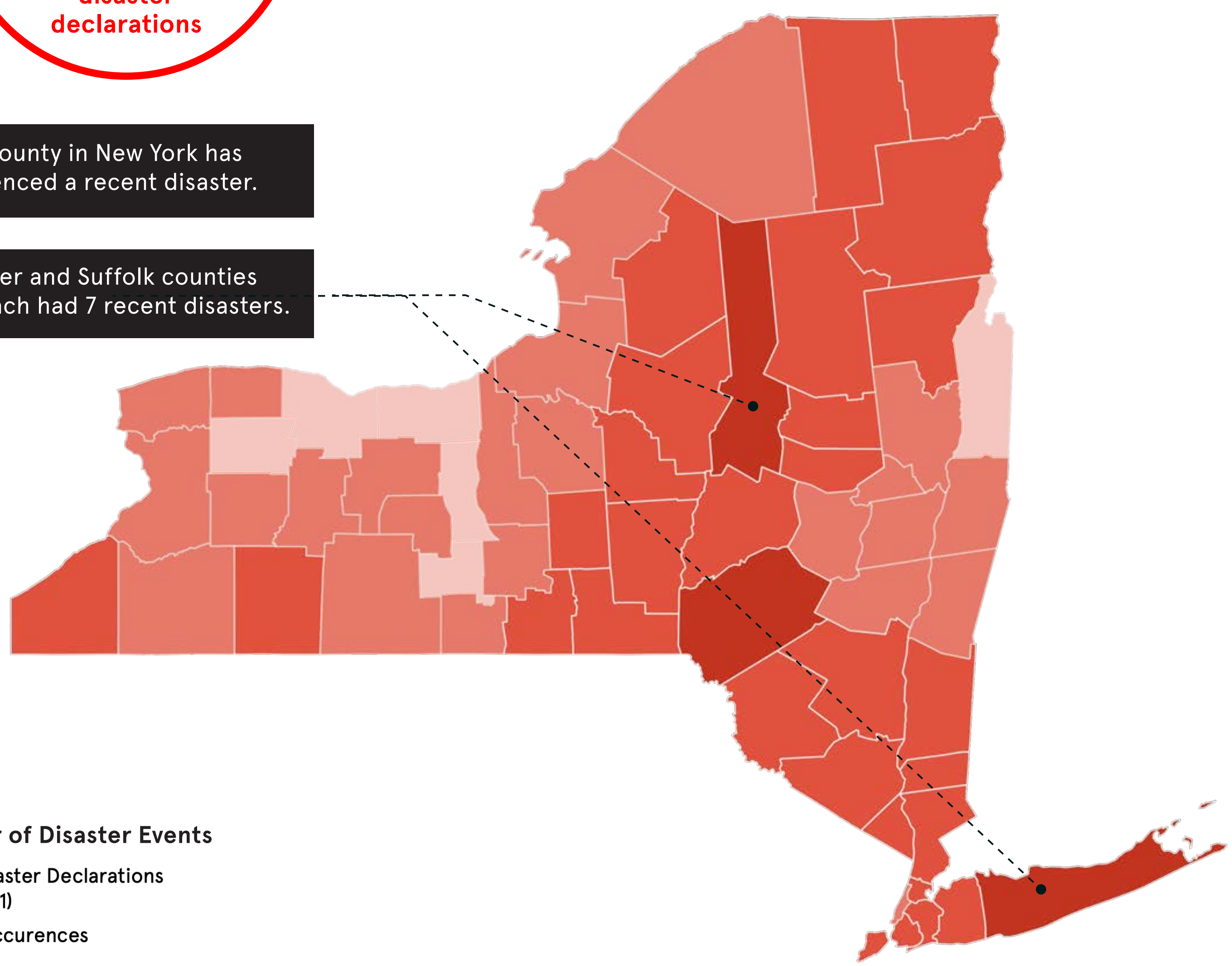
FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

16

disaster declarations

Every county in New York has experienced a recent disaster.

Herkimer and Suffolk counties have each had 7 recent disasters.



Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$26.3B

post-disaster assistance

$17.1B FEMA obligations

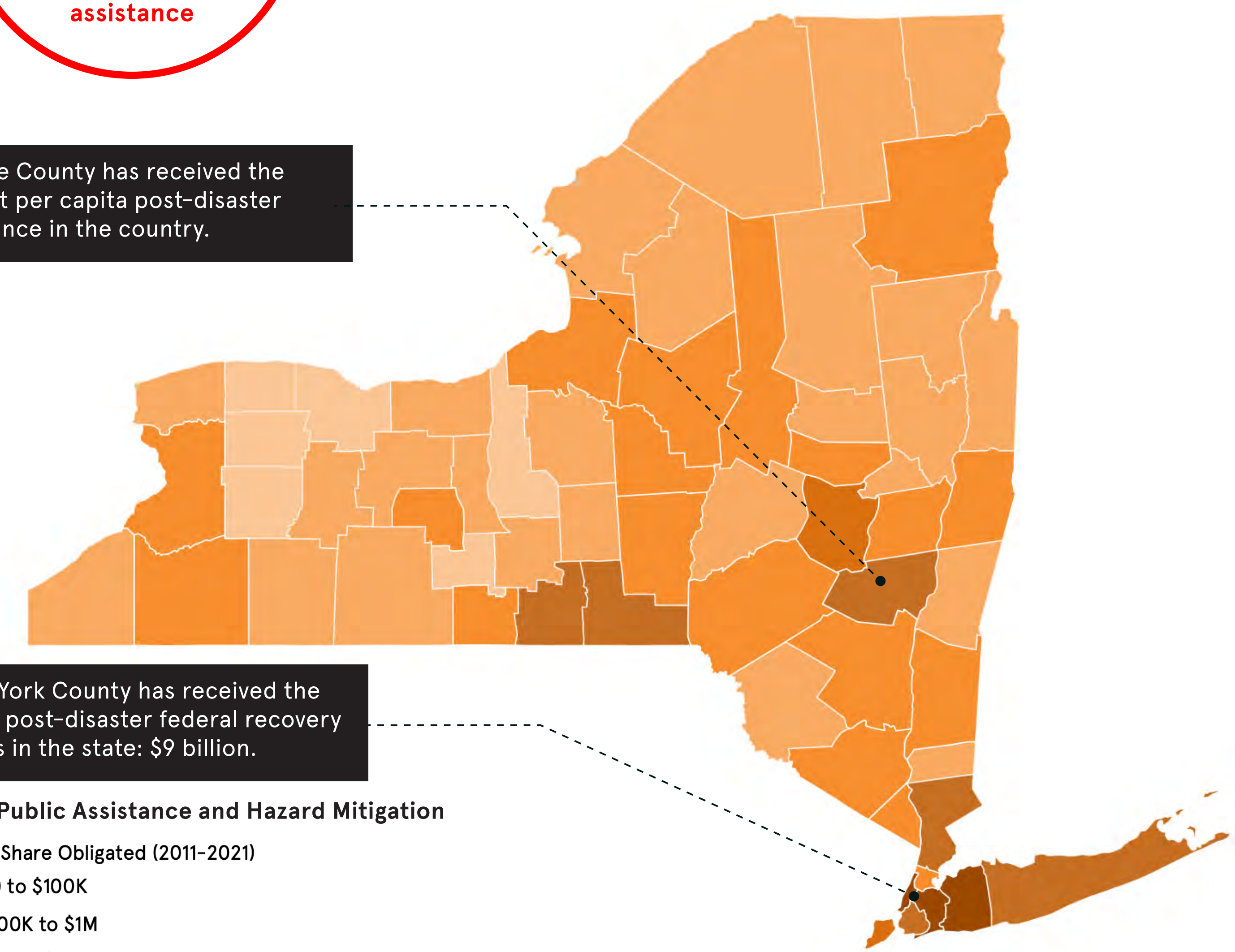
$9.2B HUD CDBG-DR Funds

$26.3B FEMA + HUD assistance

$1,348 per capita cost

Greene County has received the highest per capita post-disaster assistance in the country.

New York County has received the most post-disaster federal recovery funds in the state: $9 billion.



FEMA Public Assistance and Hazard Mitigation

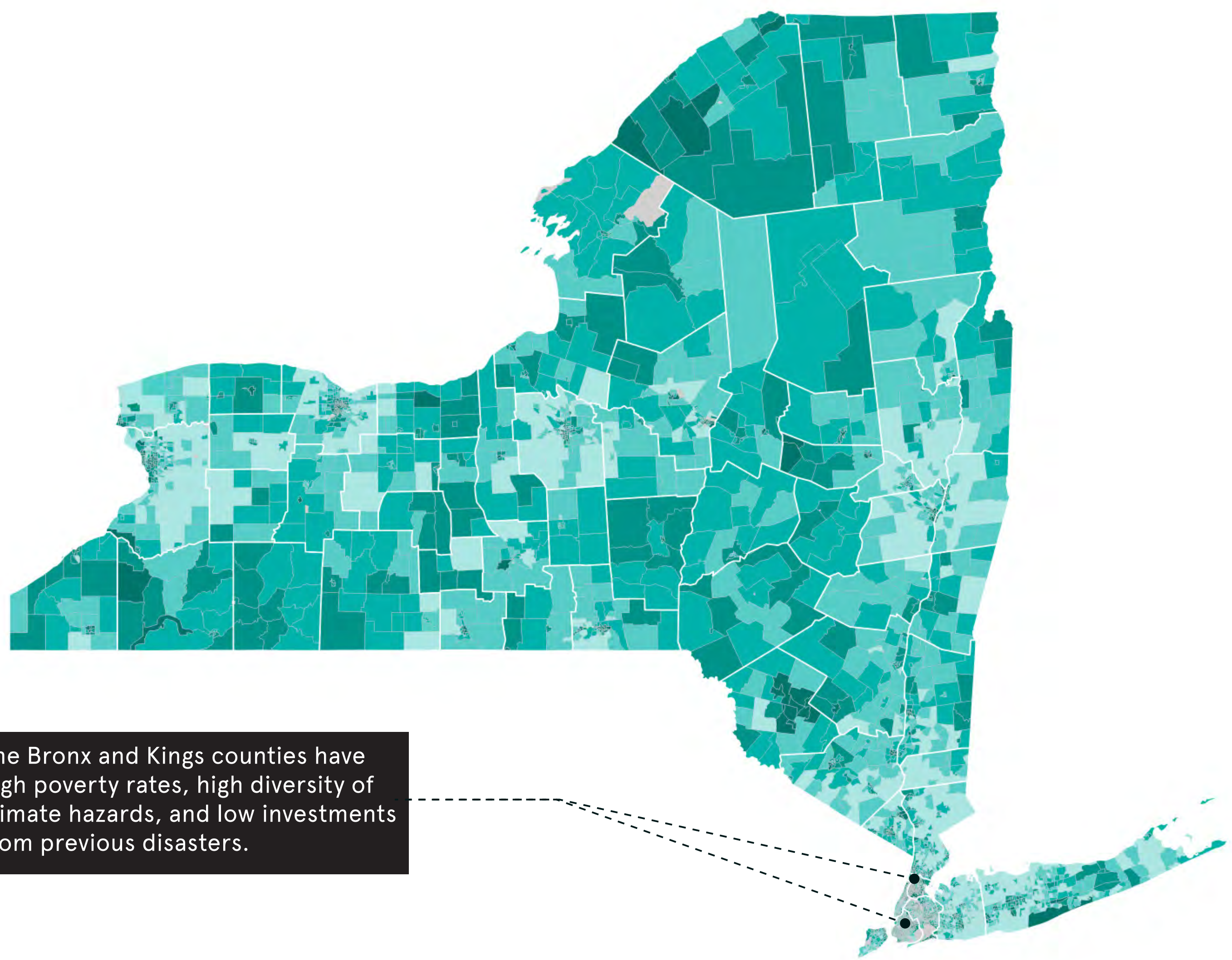
Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



The Bronx and Kings counties have high poverty rates, high diversity of climate hazards, and low investments from previous disasters.

Social Vulnerability Index

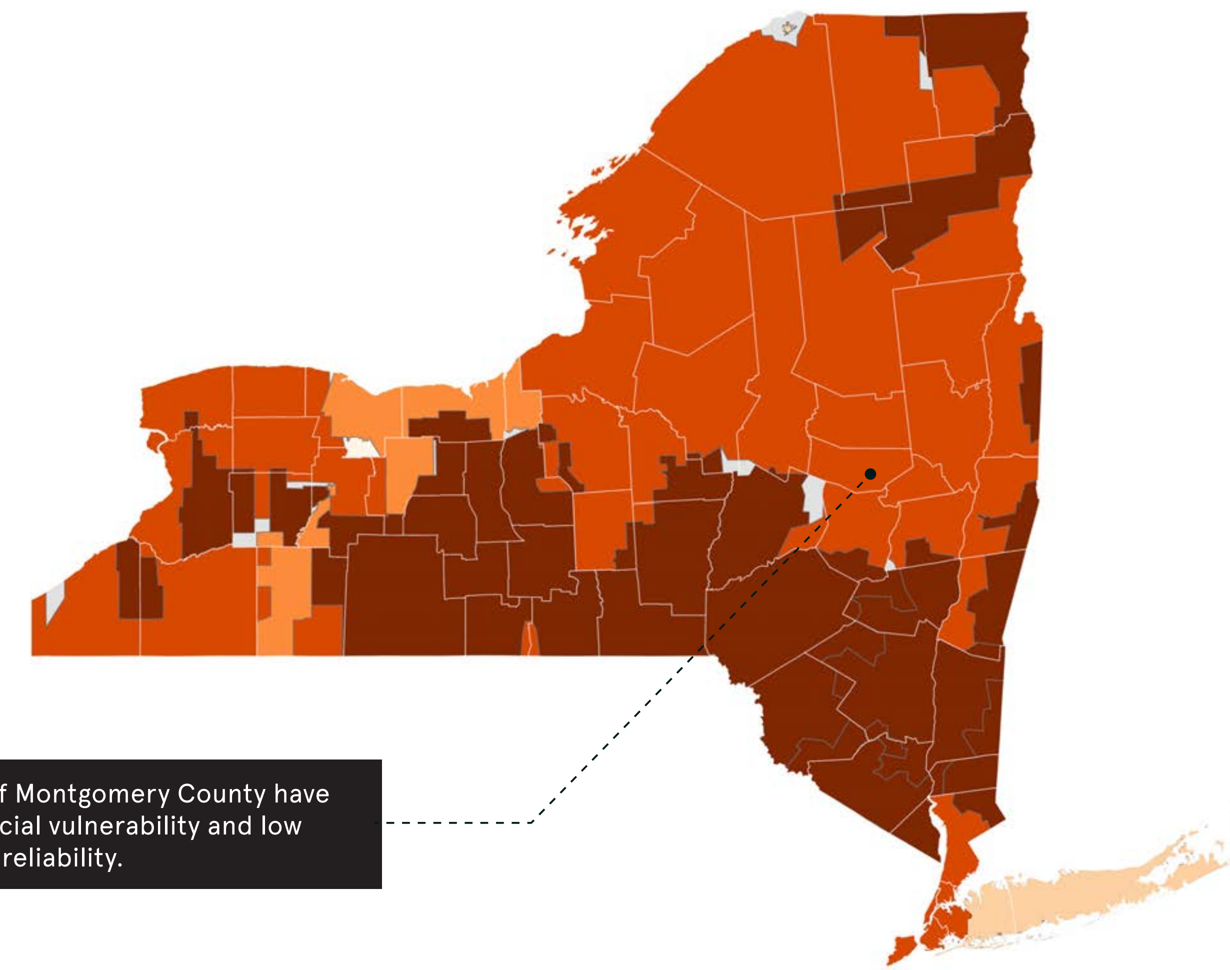
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Parts of Montgomery County have high social vulnerability and low energy reliability.

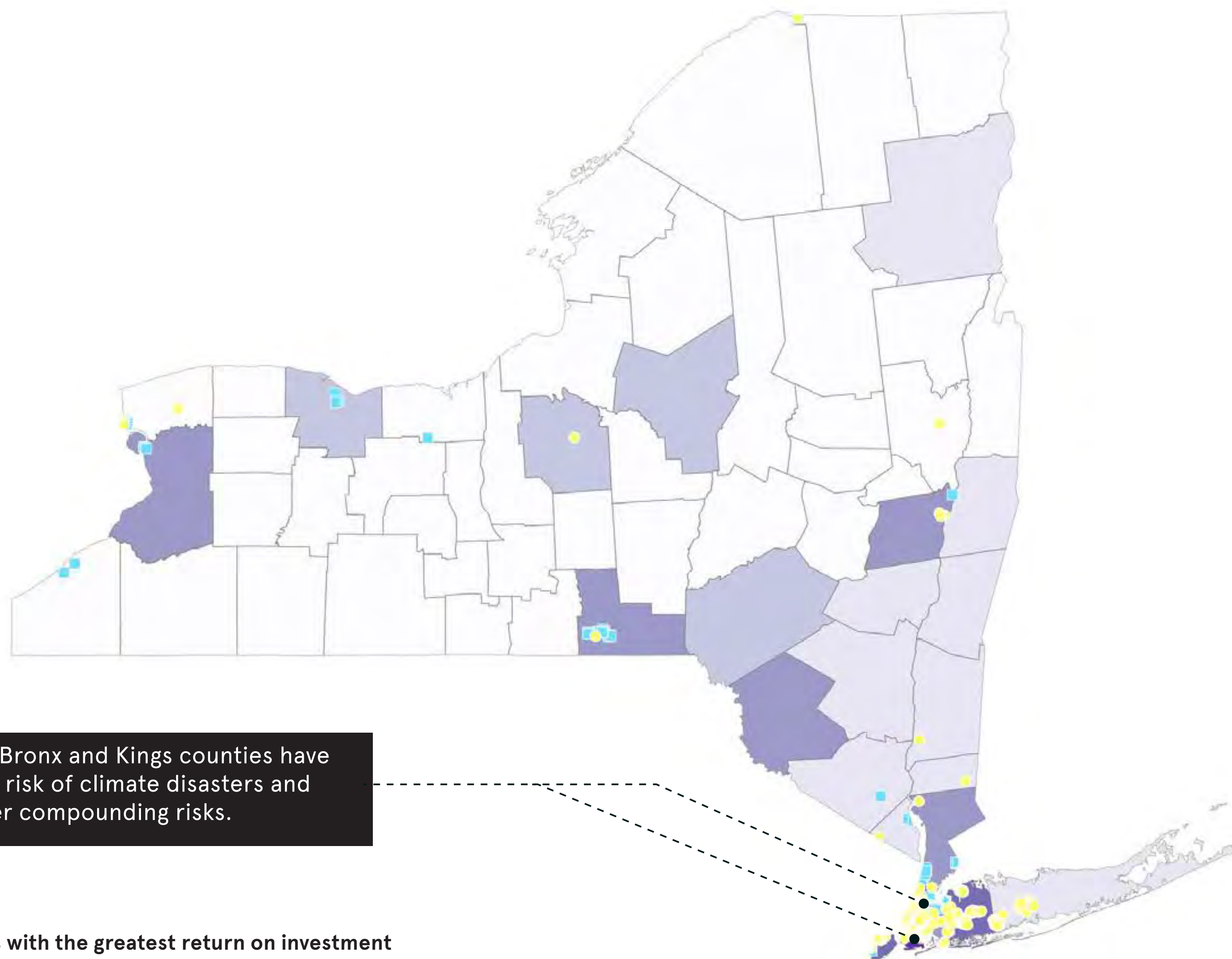
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



The Bronx and Kings counties have high risk of climate disasters and other compounding risks.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Albany					1		3
Allegany							0
Bronx					1		5
Broome					2		3
Cattaraugus							0
Cayuga							0
Chautauqua							0
Chemung							0
Chenango							0
Clinton							0
Columbia							1
Cortland							0
Delaware					1		2
Dutchess							1
Erie					1		3
Essex					1		1
Franklin							0
Fulton							0
Genesee							0
Greene							1
Hamilton							0
Herkimer							0
Jefferson							0
Kings					9		5
Lewis							0
Livingston							0
Madison							0
Monroe					1		2
Montgomery							0
Nassau					1		4
New York					9		3
Niagara							0
Oneida					2		2
Onondaga					2		2
Ontario							0
Orange							1
Orleans							0
Oswego							0
Otsego							0
Putnam							1
Queens					8		3
Rensselaer							1
Richmond					3		4
Rockland							1
Saratoga							0
Schenectady							0
Schoharie							0
Schuyler							0
Seneca							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
St. Lawrence							0
Steuben							0
Suffolk							1
Sullivan					1		3
Tioga							0
Tompkins							0
Ulster							1
Warren							0
Washington							0
Wayne							0
Westchester					1		3
Wyoming							0
Yates							0

IMAGE RIGHT: SAILORS ASSIST WITH HURRICANE SANDY CLEAN-UP | U.S. NAVY

NEW YORK

TOTAL: 16 DISASTERS
FEMA PA + HM: $17.1B
HUD CDBG-DR: $9.2B
FEMA + HUD ASSISTANCE: $26.3B

			2011							
			1957: SEVERE WINTER STORM AND SNOWSTORM		1993: SEVERE STORMS, FLOODING, TORNADOES, AND STRAIGHT-LINE WINDS		4020: HURRICANE IRENE		4031: REMNANTS OF TROPICAL STORM LEE	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	16	$3,081,003,424	$16,838,245.11	$344,763.00	$2,112,278.68	$257,411.00	$179,876,483.84	$4,331,769.00	$67,310,063.45	$2,378,524.00
Albany County	2	$10,170,304					$8,470,690.80	$0.00		
Allegany County	4	$5,273,661			$3,234,080.39	$0.00				
Bronx County	4	$15,292,744	$52,914.37	$0.00			$371,327.17	$0.00		
Broome County	5	$116,763,314			$1,692,066.35	$203,379.00			$105,594,592.07	$77,912.16
Cattaraugus County	2	$10,474,413								
Cayuga County	2	$95,964								
Chautauqua County	4	$2,280,657								
Chemung County	3	$11,405,382			$438,533.01	$0.00			$6,841,866.95	$0.00
Chenango County	6	$10,445,165			$2,152,720.63	$0.00			$4,203,918.36	$302,743.00
Clinton County	4	$8,369,943			$2,748,851.04	$0.00	$4,042,291.96	$233,091.00		
Columbia County	3	$2,953,496	$444,893.17	$0.00			$1,894,744.41	$46,120.50		
Cortland County	4	$1,411,210								
Delaware County	7	$28,498,006			$421,077.42	$0.00	$9,747,497.11	$7,205,403.00	$4,427,314.37	$3,264,005.00
Dutchess County	4	$7,107,707	$1,060,631.78	$0.00			$4,202,395.41	$166,591.00		
Erie County	2	$22,307,942								
Essex County	5	$24,266,442			$2,244,844.70	$0.00	$15,777,797.04	$4,091,395.00		
Franklin County	4	$7,429,081			$5,247,340.36	$0.00	$403,934.93	$750,261.00		
Fulton County	4	$1,289,501					$240,415.83	$0.00	$0.00	$0.00
Genesee County	1	$415,404								
Greene County	3	$552,300,768					$30,329,974.48	$2,968,236.00		
Hamilton County	4	$3,564,968			$334,167.17	$0.00	$30,204.61	$0.00		
Herkimer County	7	$36,256,782			$1,217,753.24	$0.00	$307,656.66	$5,829,938.79	$240,966.54	$0.00
Jefferson County	3	$2,842,499								
Kings County	4	$190,788,711	$155,578.24	$0.00			$3,595,257.28	$0.00		
Lewis County	5	$1,345,288			$632,568.11	$0.00				
Livingston County	2	$3,002,268			$873,263.69	$0.00				
Madison County	4	$5,795,137			$761,673.78	$0.00				
Monroe County	1	$810,813								
Montgomery County	5	$9,581,890					$3,402,391.93	$1,799,361.00	$408,002.37	$543,162.73
Nassau County	5	$1,784,981,983	$5,553,730.69	$0.00			$25,522,018.33	$831,861.33		
New York County	3	$8,950,902,274	$14,438,702.72	$0.00			$57,507,438.47	$0.00		
Niagara County	3	$3,718,979			$513,376.62	$0.00				
Oneida County	6	$17,886,606			$1,510,132.31	$0.00			$1,405,119.60	$1,400,946.59
Onondaga County	2	$2,401,940			$2,401,940.34	$0.00				
Ontario County	2	$3,529,396			$2,205,862.33	$0.00				
Orange County	4	$37,845,737					$25,270,610.75	$341,560.74	$8,174,439.71	$0.00
Orleans County	3	$307,744								
Oswego County	2	$11,170,592								
Otsego County	6	$9,728,574					$1,070,566.28	$0.00	$4,362,695.95	$0.00
Putnam County	4	$6,792,035					$4,295,013.14	$101,702.00		
Queens County	5	$1,095,831,127	$18,569.04	$0.00			$3,347,384.69	$0.00		
Rensselaer County	3	$11,162,968	$558,595.88	$0.00			$9,834,277.25	$0.00		
Richmond County	5	$69,390,714	$328,549.85	$0.00			$634,847.10	$654,463.00		
Rockland County	5	$41,395,570	$1,401,722.76	$1,055,582.09			$10,018,041.89	$0.00		
St. Lawrence County	2	$991,512								
Saratoga County	3	$4,369,615					$1,694,865.86	$0.00		
Schenectady County	3	$5,773,608					$4,479,007.34	$0.00	$0.00	$879,569.00
Schoharie County	3	$92,526,900					$87,020,954.56	$3,980,437.58	$1,084,496.50	$146,815.49
Schuyler County	1	$451,277								
Seneca County	1	$3,703,188								
Steuben County	3	$4,065,504			$1,833,855.94	$0.00				
Suffolk County	7	$527,771,613	$3,639,901.75	$0.00			$21,571,669.71	$218,738.00		
Sullivan County	4	$4,641,800					$3,066,367.19	$0.00		
Tioga County	6	$94,897,000			$1,517,627.17	$0.00			$88,686,264.06	$832,103.00
Tompkins County	2	$1,852,960							$1,417,512.69	$0.00
Ulster County	6	$32,938,590			$248,817.99	$0.00	$21,323,154.89	$5,522,884.16	$211,922.22	$0.00
Warren County	4	$5,623,496			$584,500.41	$0.00	$2,782,215.62	$0.00		
Washington County	1	$1,216,841					$1,216,841.42	$0.00		
Wayne County	1	$1,110,715								
Westchester County	4	$125,598,300					$12,714,792.85	$180,000.00		
Wyoming County	2	$304,202			$71,179.17	$0.00				
Yates County	3	$6,344,132			$685,672.02	$0.00				
Total FEMA Allocation		$17,134,770,375	$44,492,035.36	$1,400,345.09	$35,684,182.87	$460,790.00	$556,063,130.80	$39,253,813.10	$294,369,174.84	$9,825,780.97

	2012		2013				2014			
	4085: HURRICANE SANDY		4111: SEVERE WINTER STORM AND SNOWSTORM		4129: SEVERE STORMS AND FLOODING		4180: SEVERE STORMS AND FLOODING		4204: SEVERE WINTER STORM, SNOWSTORM, AND FLOODING	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$2,633,611,095.34	$91,750,583.94	$14,584,443.45	$163,456.00	$28,288,126.78	$421,889.00	$3,457,491.63	$0.00	$9,314,204.20	$0.00
Albany County										
Allegany County					$242,912.23	$0.00	$1,327,751.63	$468,917.00		
Bronx County	$8,493,502.41	$6,375,000.00								
Broome County					$1,208,838.86	$0.00				
Cattaraugus County							$10,316,084.35	$0.00	$158,328.80	$0.00
Cayuga County										
Chautauqua County					$349,992.94	$0.00	$818,114.52	$0.00	$370,524.28	$0.00
Chemung County										
Chenango County					$1,028,934.53	$0.00				
Clinton County					$927,822.32	$0.00				
Columbia County										
Cortland County					$749,423.32	$0.00				
Delaware County					$186,937.33	$0.00	$347,950.85	$0.00		
Dutchess County										
Erie County									$20,424,536.30	$0.00
Essex County					$904,069.06	$0.00				
Franklin County					$767,123.54	$0.00				
Fulton County										
Genesee County									$415,404.39	$0.00
Greene County	$494,960.18	$518,123,545.00								
Hamilton County										
Herkimer County					$17,910,560.23	$0.00	$810,156.69	$0.00		
Jefferson County									$327,590.40	$0.00
Kings County	$175,897,939.47	$11,139,936.00								
Lewis County							$261,158.48	$0.00	$122,430.89	$26,562.54
Livingston County							$2,129,004.01	$0.00		
Madison County					$3,717,632.71	$0.00				
Monroe County										
Montgomery County					$2,986,849.62	$0.00				
Nassau County	$1,597,171,673.73	$150,430,841.00								
New York County	$8,799,402,203.30	$79,306,365.38								
Niagara County					$372,351.75	$0.00				
Oneida County					$5,065,933.88	$0.00				
Onondaga County										
Ontario County							$1,323,533.89	$0.00		
Orange County	$3,867,265.30	$191,860.48								
Orleans County									$0.00	$0.00
Oswego County										
Otsego County					$530,046.76	$0.00	$716,813.80	$0.00		
Putnam County	$2,071,081.94	$0.00								
Queens County	$1,057,939,053.76	$34,526,119.52								
Rensselaer County										
Richmond County	$5,412,576.67	$62,360,277.59								
Rockland County	$23,670,333.24	$4,798,713.00								
St. Lawrence County									$183,901.19	$0.00
Saratoga County										
Schenectady County										
Schoharie County										
Schuyler County										
Seneca County										
Steuben County							$2,231,647.93	$0.00		
Suffolk County	$197,534,965.78	$285,468,150.75	$9,711,155.99	$0.00						
Sullivan County	$1,072,419.82	$0.00								
Tioga County										
Tompkins County										
Ulster County	$4,699,345.31	$0.00								
Warren County					$497,689.96	$0.00				
Washington County										
Wayne County										
Westchester County	$102,596,301.84	$9,417,719.41								
Wyoming County									$233,023.29	$0.00
Yates County							$5,658,459.55	$0.00		
Total FEMA Allocation	$14,613,934,718.0	$1,253,889,112.07	$24,295,599.44	$163,456.00	$65,735,245.82	$421,889.00	$29,398,167.33	$468,917.00	$31,549,943.74	$26,562.54

	2017				2018		2019		2020		2021			
	4322: SEVERE WINTER STORM AND SNOWSTORM		4348: FLOODING		4397: SEVERE STORMS AND FLOODING		4472: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4567: TROPICAL STORM ISAIAS		4615: REMNANTS OF HURRICANE IDA		4625: REMNANTS OF TROPICAL STORM FRED	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$10,316,747.35	$0.00	$6,385,770.97	$0.00	$3,544,900.26	$0.00	$4,614,901.78	$0.00	$1,044,574.12	$0.00	$55,700.60	$0.00		
Albany County	$1,399,613.40	$300,000.00												
Allegany County													$0.00	$0.00
Bronx County											$0.00	$0.00		
Broome County	$1,176,320.20	$0.00			$4,648,159.48	$2,162,046.00								
Cattaraugus County														
Cayuga County			$95,963.88	$0.00									$0.00	$0.00
Chautauqua County							$682,024.91	$60,000.00						
Chemung County					$4,124,981.93	$0.00								
Chenango County	$385,781.83	$0.00			$1,756,975.50	$0.00	$614,091.63	$0.00						
Clinton County	$417,886.94	$0.00												
Columbia County	$567,738.04	$0.00												
Cortland County	$280,370.56	$0.00					$381,415.87	$0.00					$0.00	$0.00
Delaware County	$529,008.62	$0.00			$2,368,812.11	$0.00								
Dutchess County	$1,678,088.68	$0.00									$0.00	$0.00		
Erie County							$1,883,405.90	$0.00						
Essex County	$225,461.40	$0.00					$1,022,874.72	$0.00						
Franklin County	$260,421.31	$0.00												
Fulton County	$279,952.72	$0.00					$769,132.45	$0.00						
Genesee County														
Greene County	$384,052.05	$0.00												
Hamilton County	$61,503.53	$0.00					$3,139,092.57	$0.00						
Herkimer County	$347,195.34	$0.00					$9,592,554.45	$0.00						
Jefferson County			$2,430,253.36	$0.00			$84,655.30	$0.00						
Kings County											$0.00	$0.00		
Lewis County							$302,567.79	$0.00					$0.00	$0.00
Livingston County														
Madison County	$396,479.89	$0.00					$859,350.24	$60,000.00						
Monroe County			$810,813.05	$0.00										
Montgomery County	$230,494.07	$0.00					$151,628.21	$60,000.00						
Nassau County									$5,097,041.20	$0.00	$374,816.48	$0.00		
New York County									$247,563.90	$0.00	$0.00	$0.00		
Niagara County			$2,772,500.37	$60,750.00										
Oneida County	$2,724,829.10	$106,514.00					$5,673,130.43	$0.00					$0.00	$0.00
Onondaga County													$0.00	$0.00
Ontario County														
Orange County											$0.00	$0.00		
Orleans County	$129,003.84	$0.00	$178,740.59	$0.00										
Oswego County			$10,715,355.44	$0.00			$455,236.83	$0.00						
Otsego County	$438,076.19	$0.00					$2,610,374.96	$0.00						
Putnam County									$308,552.50	$0.00	$15,685.31	$0.00		
Queens County									$0.00	$0.00	$0.00	$0.00		
Rensselaer County	$770,095.14	$0.00												
Richmond County									$0.00	$0.00	$0.00	$0.00		
Rockland County									$437,723.59	$0.00	$13,453.13	$0.00		
St. Lawrence County			$807,610.44	$0.00										
Saratoga County	$837,329.91	$0.00					$1,837,419.07	$0.00						
Schenectady County	$415,031.49	$0.00												
Schoharie County	$294,195.86	$0.00												
Schuyler County					$451,277.26	$0.00								
Seneca County					$3,703,188.27	$0.00								
Steuben County													$0.00	$0.00
Suffolk County	$315,430.90	$0.00							$9,218,839.58	$0.00	$92,760.20	$0.00		
Sullivan County	$503,012.96	$0.00									$0.00	$0.00		
Tioga County	$160,819.68	$0.00			$2,742,297.50	$0.00	$957,888.78	$0.00					$0.00	$0.00
Tompkins County	$435,447.46	$0.00												
Ulster County	$932,465.15	$0.00									$0.00	$0.00		
Warren County							$1,759,089.64	$0.00						
Washington County														
Wayne County			$1,110,714.95	$0.00										
Westchester County									$689,486.17	$0.00	$0.00	$0.00		
Wyoming County														
Yates County													$0.00	$0.00
Total FEMA Allocation	$26,892,853.61	$406,514.00	$25,307,723.05	$60,750.00	$23,340,592.31	$2,162,046.00	$37,390,835.53	$180,000.00	$17,043,781.06	$0.00	$552,415.72	$0.00	$0.00	$0.00

HURRICANE SANDY NEW YORK BLACKOUT 2012 | DAVID SHANKBONE

NORTH CAROLINA

NORTH CAROLINA STATISTICS SUMMARY (2011 – 2021)	
15	CLIMATE DISASTER DECLARATIONS
7TH HIGHEST	TOTAL FEDERAL DISASTER RELIEF
ASHE, BEAUFORT, BRUNSWICK, CRAVEN, HYDE, ONSLOW, PENDER, PITT, SAMPSON	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
25	COUNTIES WITH FIVE OR MORE DISASTERS
74	SUPERFUND SITES
BEAUFORT, BLADEN, COLUMBUS, DUPLIN, GUILFORD, HARNETT, JONES, NEW HANOVER, ROBESON, SAMPSON, WASHINGTON	HIGHEST COMPOUNDING RISKS
$2.5 BILLION	FEMA + HUD POST-DISASTER FUNDING
10 MILLION	POPULATION TOTAL
$243	PER CAPITA SPENDING ON CLIMATE DISASTERS
$7 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

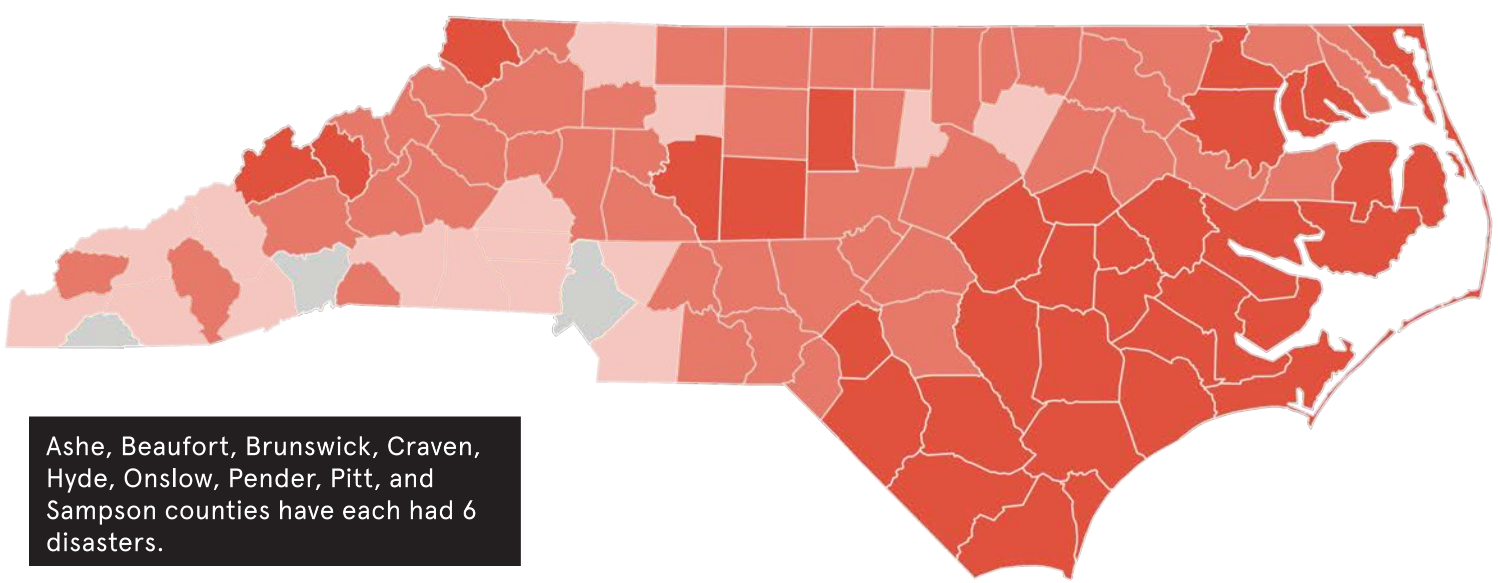
DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

15
disaster declarations

Ninety-seven out of 100 counties have had a disaster between 2011-2021.

Eight out of 15 disasters were due to tropical storms or hurricanes.



Ashe, Beaufort, Brunswick, Craven, Hyde, Onslow, Pender, Pitt, and Sampson counties have each had 6 disasters.

Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurences
- 10+ occurrences

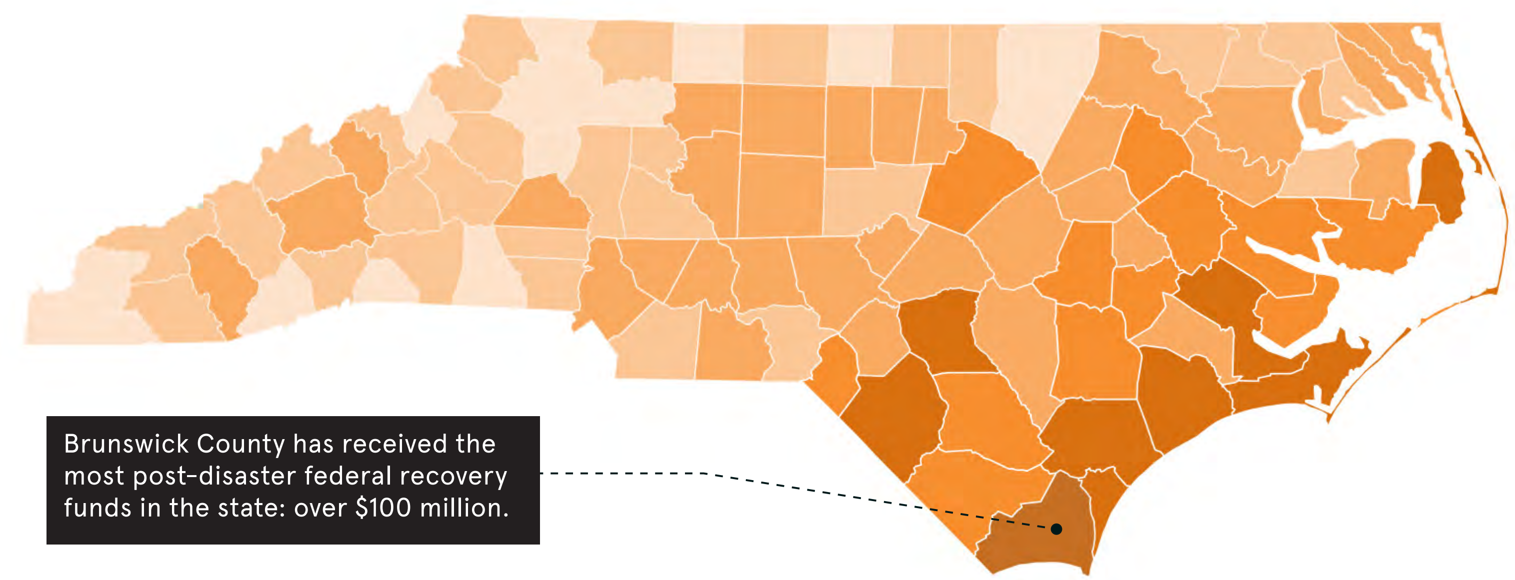
Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$2.5B
post-disaster assistance

$1.5B	FEMA obligations
$989	HUD CDBG-DR Funds
$2.5B	FEMA + HUD assistance
$243	per capita cost



Brunswick County has received the most post-disaster federal recovery funds in the state: over $100 million.

FEMA Public Assistance and Hazard Mitigation

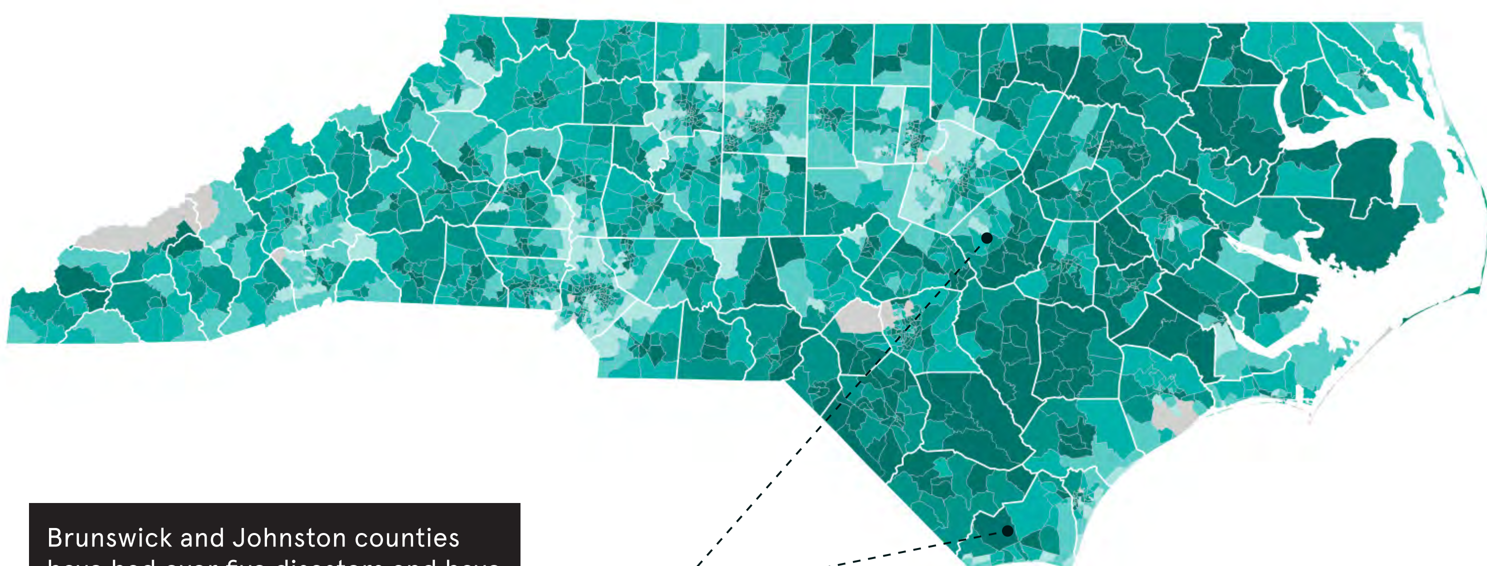
Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Brunswick and Johnston counties have had over five disasters and have had population increases over 30%.

Fourty-two counties in North Carolina have high poverty rates, high diversity of disasters, and low investments from previous storms.

Social Vulnerability Index

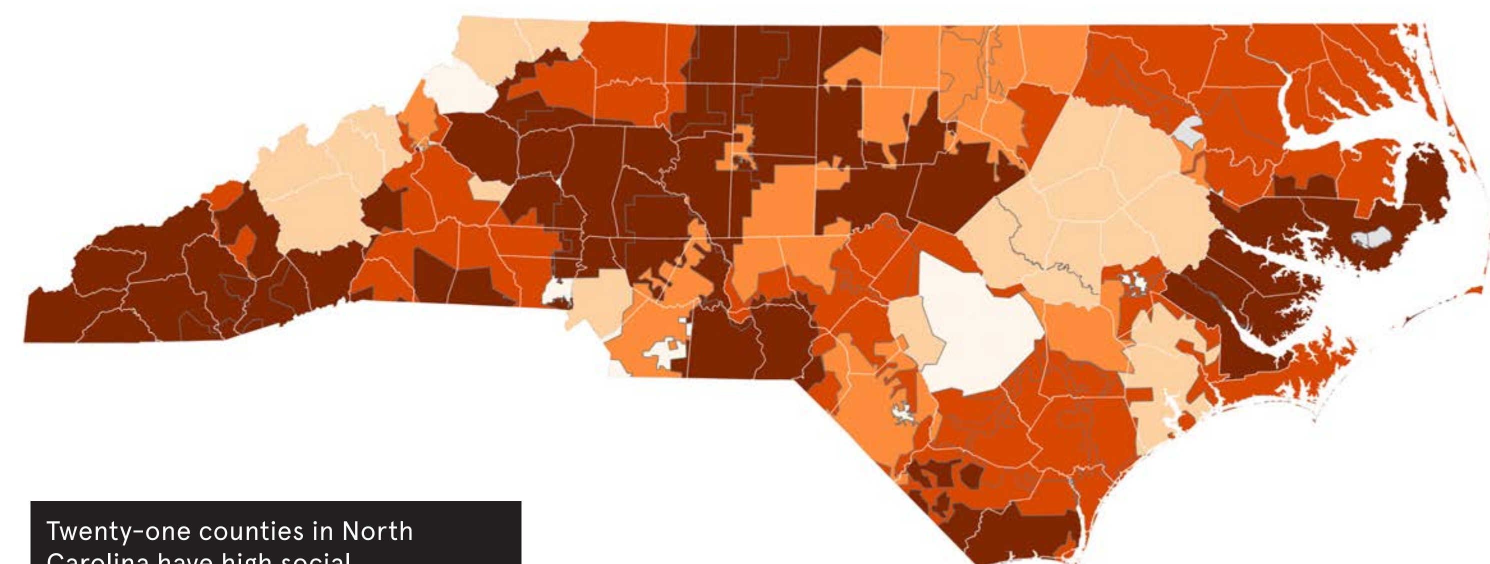
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Twenty-one counties in North Carolina have high social vulnerability and low energy reliability.

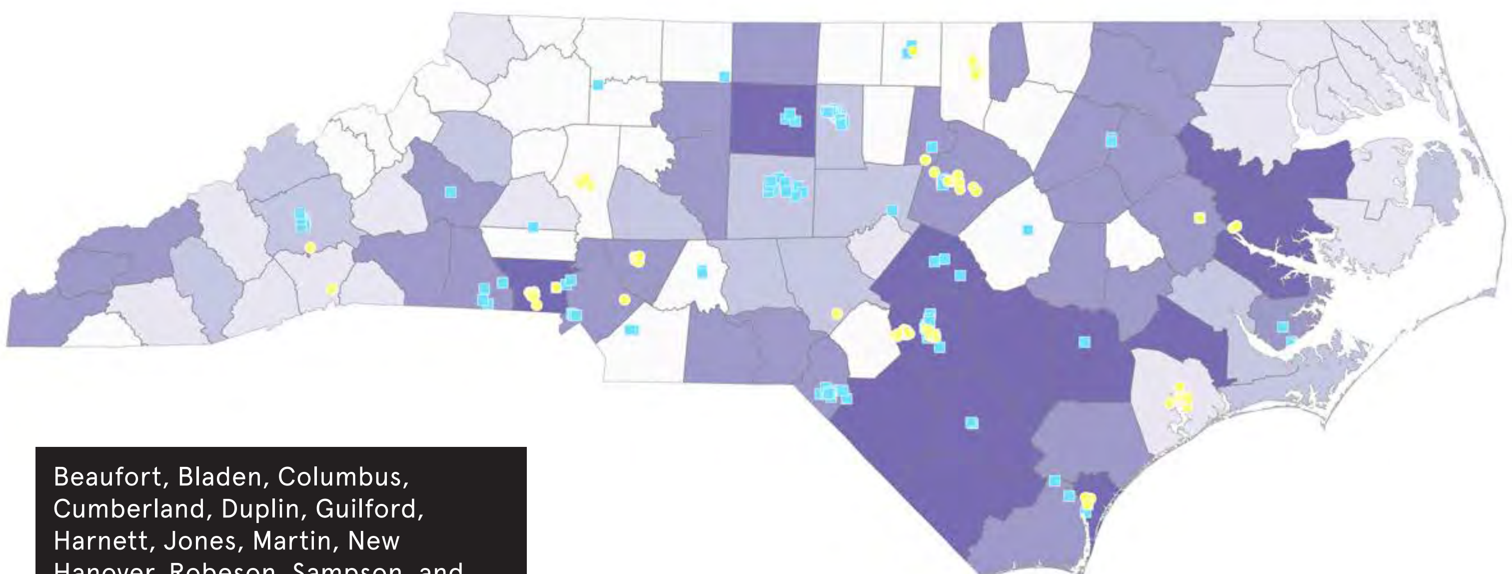
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Beaufort, Bladen, Columbus, Cumberland, Duplin, Guilford, Harnett, Jones, Martin, New Hanover, Robeson, Sampson, and Washington counties have high risk of climate disasters and other compounding risks.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

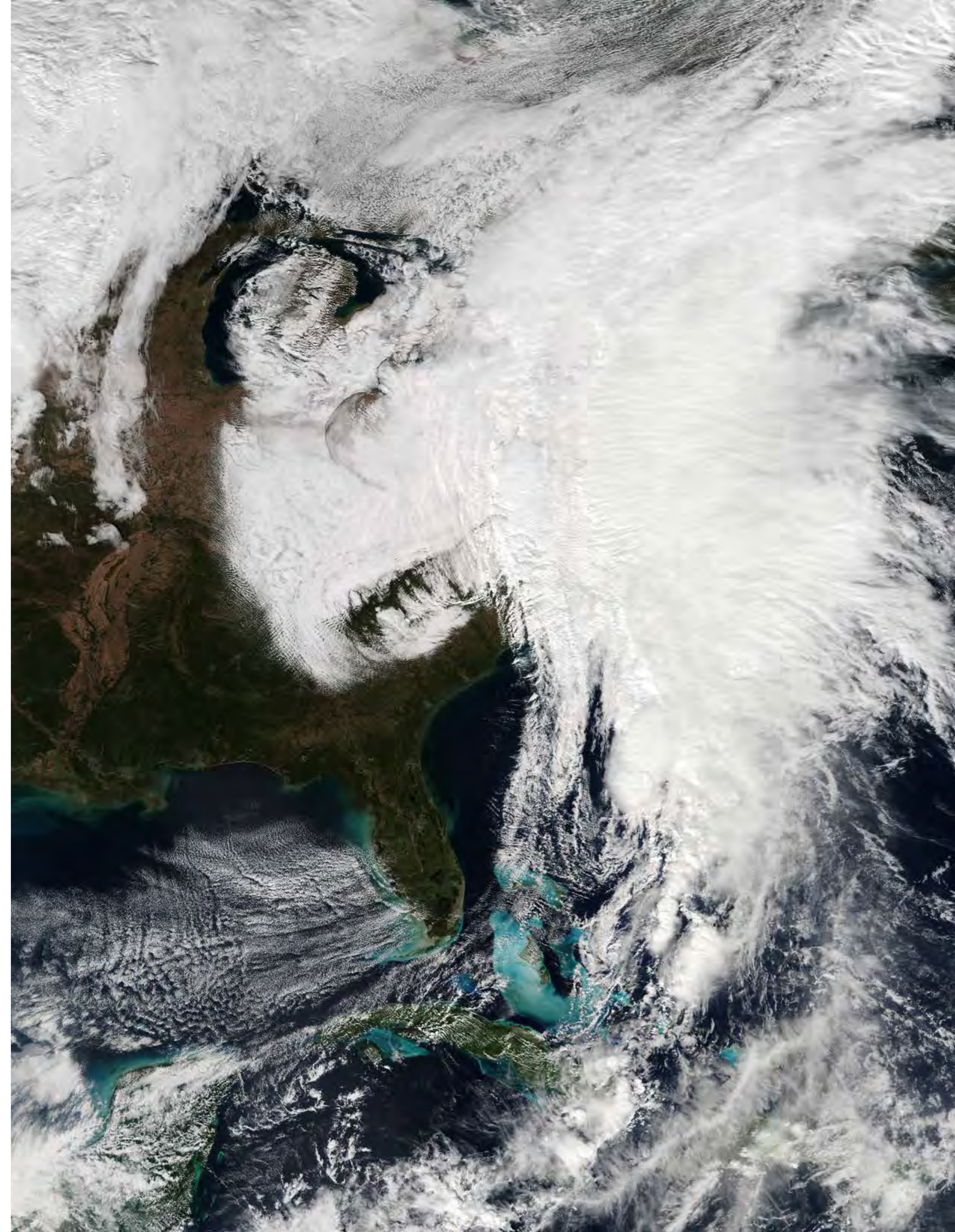
Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Alamance					2		2
Alexander							0
Alleghany							0
Anson					1		3
Ashe					1		1
Avery							0
Beaufort					3		4
Bertie							1
Bladen					3		4
Brunswick					6		3
Buncombe					5		2
Burke					3		3
Cabarrus					1		3
Caldwell					2		2
Camden							1
Carteret					2		2
Caswell							0
Catawba					2		1
Chatham					1		2
Cherokee					1		3
Chowan							1
Clay							0
Cleveland					2		3
Columbus					3		4
Craven					4		2
Cumberland					3		4
Currituck							1
Dare					2		2
Davidson					1		3
Davie							0
Duplin					5		4
Durham					2		3
Edgecombe					6		3
Forsyth					1		3
Franklin							0
Gaston					3		4
Gates							1
Graham					1		3
Granville							0
Greene							0
Guilford					3		4
Halifax					4		3
Harnett					1		4
Haywood					2		1
Henderson					4		1
Hertford							1
Hoke							0
Hyde							1
Iredell							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Jackson					3		2
Johnston							0
Jones					1		4
Lee					1		1
Lenoir					6		3
Lincoln							0
Macon					4		1
Madison					1		2
Martin					2		4
McDowell					1		1
Mecklenburg					3		3
Mitchell							0
Montgomery					1		2
Moore					4		2
Nash					4		3
New Hanover					5		4
Northampton					2		3
Onslow							1
Orange							0
Pamlico					1		3
Pasquotank							1
Pender					1		3
Perquimans							1
Person							0
Pitt					4		3
Polk					1		1
Randolph					2		2
Richmond					1		3
Robeson					7		4
Rockingham					1		3
Rowan					1		2
Rutherford					2		3
Sampson					4		4
Scotland					2		3
Stanly							0
Stokes							0
Surry							0
Swain					2		3
Transylvania					4		1
Tyrrell							1
Union							0
Vance					3		3
Wake					1		3
Warren							0
Washington					1		4
Watauga							0
Wayne					4		3
Wilkes							0
Wilson					2		3
Yadkin							0
Yancey							0

IMAGE RIGHT: OCTOBER 2017 STORM SYSTEM OVER NORTH CAROLINA | NOAA

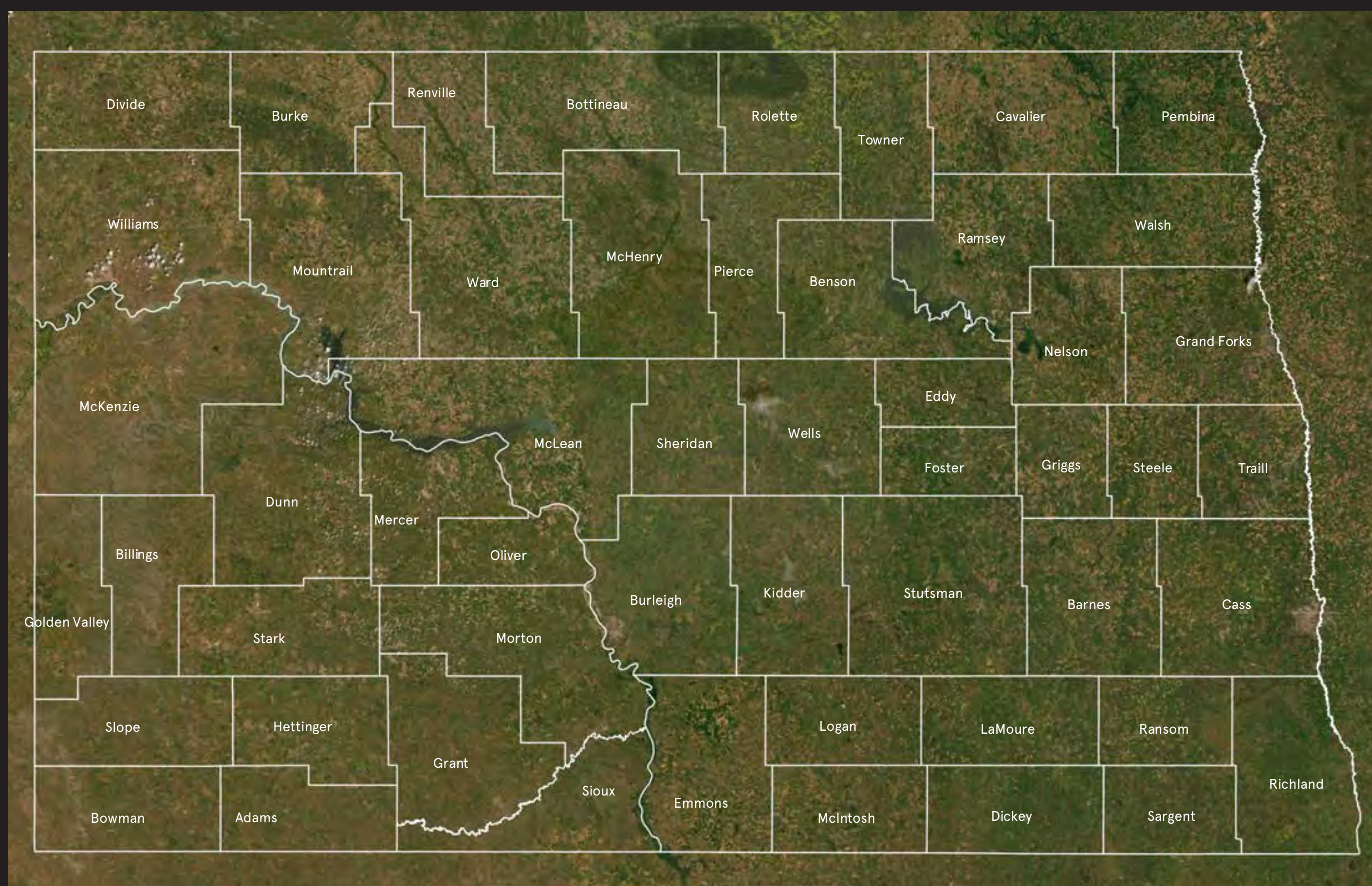


NORTH CAROLINA

TOTAL: 15 DISASTERS
FEMA PA + HM: $1.5 B
HUD CDBG-DR: $989 M
FEMA + HUD ASSISTANCE: $2.5 B

County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	2011 – 1969: SEVERE STORMS, TORNADOES, AND FLOODING		2011 – 4019: HURRICANE IRENE		2013 – 4103: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		2013 – 4146: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		2013 – 4153: SEVERE STORMS, FLOODING, LANDSLIDES, MUDSLIDES		2014 – 4167: SEVERE WINTER STORM		2016 – 4285: HURRICANE MATTHEW		2018 – 4364: TORNADO AND SEVERE STORMS		2018 – 4393: HURRICANE FLORENCE		2019 – 4412: TROPICAL STORM MICHAEL		2019 – 4465: HURRICANE DORIAN		2020 – 4543: SEVERE STORMS, TORNADOES, AND FLOODING		2020 – 4568: HURRICANE ISAIAS		2020 – 4588: TROPICAL STORM ETA		2021 – 4617: REMNANTS OF TROPICAL STORM FRED	
			PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	15	$575,020,720	$6,676,155.90	$233,431.00	$25,060,605.79	$1,334,042.87	$4,212,154.14	$0.00	$5,840,771.95	$152,083.00	$3,591,026.28	$99,322.58	$29,866,908.90	$736,487.08	$129,286,200.08	$5,596,799.53			$298,600,826.45	$4,467,028.42	$12,875,797.15	$265,675.10	$15,960,048.24	$285,736.00	$11,317,759.19	$79,789.00	$6,948,763.51	$311,436.00	$9,909,520.84	$102,176.00	$1,210,175.18	$0.00
Alamance County	4	$3,198,932	$0.00	$0.00									$2,941,184.98	$0.00					$188,894.69	$0.00	$68,852.56	$0.00										
Alexander County	2	$92,824																							$0.00	$0.00			$92,823.71	$0.00		
Alleghany County	3	$6,537							$0.00	$0.00									$6,536.57	$0.00									$0.00	$0.00		
Anson County	2	$1,133,208													$454,890.82	$0.00			$678,317.10	$0.00												
Ashe County	6	$107,076							$47,559.15	$0.00	$0.00	$0.00							$55,517.02	$0.00					$4,000.00	$0.00			$0.00	$0.00	$0.00	$0.00
Avery County	3	$21,374							$21,373.96	$0.00	$0.00	$0.00																			$0.00	$0.00
Beaufort County	6	$9,181,079			$3,416,606.73	$111,797.00									$757,423.29	$0.00			$2,273,163.80	$1,808,147.25			$623,171.69	$0.00			$190,769.56	$0.00	$0.00	$0.00		
Bertie County	5	$6,179,720	$40,324.33	$0.00	$156,036.30	$0.00									$1,104,868.66	$4,473,310.50			$64,704.45	$179,418.75							$161,056.53	$0.00				
Bladen County	5	$10,729,843	$55,450.68	$0.00	$0.00	$33,750.00									$1,438,681.15	$912,901.75			$6,490,512.00	$1,769,899.50			$28,647.64	$0.00								
Brunswick County	6	$105,193,487			$2,792,564.45	$0.00									$19,240,378.69	$0.00			$51,156,454.09	$2,285,525.25	$6,871,470.19	$0.00	$14,392,389.71	$0.00			$8,454,704.54	$0.00				
Buncombe County	2	$2,337,725							$2,337,725.43	$0.00																					$0.00	$0.00
Burke County	2	$274,780							$89,642.78	$0.00																			$185,136.82	$0.00		
Cabarrus County	1	$246,869																	$246,869.41	$0.00												
Caldwell County	2	$365,834							$165,458.14	$0.00									$88,566.71	$0.00									$16,433.61	$0.00	$95,375.77	$0.00
Camden County	3	$1,016,300			$14,229.16	$0.00									$65,680.68	$930,040.00							$6,350.48	$0.00								
Carteret County	5	$90,647,758			$7,734,283.76	$254,938.00									$437,876.04	$0.00			$79,536,037.21	$1,266,410.25			$1,318,507.31	$0.00			$99,705.14	$0.00				
Caswell County	2	$84,700											$0.00	$41,312.00							$43,387.61	$0.00										
Catawba County	1	$4,497,962									$4,497,962.37	$0.00																				
Chatham County	3	$494,016													$154,243.91	$0.00			$319,953.41	$0.00	$19,818.36	$0.00										
Cherokee County	1	$0																							$0.00	$0.00						
Chowan County	4	$1,279,805			$319,897.37	$0.00									$503,159.01	$108,696.58							$262,530.04	$0.00			$85,521.53	$0.00				
Clay County	0	$0																														
Cleveland County	1	$0																							$0.00	$0.00						
Columbus County	5	$16,005,832			$80,504.93	$0.00									$2,825,341.59	$7,167,642.75			$3,887,513.22	$1,681,401.75			$363,427.27	$0.00			$0.00	$0.00				
Craven County	6	$77,210,867	$65,976.29	$60,000.00	$4,938,288.86	$715,883.00									$678,361.04	$0.00			$63,670,527.58	$4,653,225.45			$1,312,237.23	$518,707.50			$597,660.49	$0.00				
Cumberland County	3	$56,664,674	$3,019,214.57	$0.00											$22,849,010.73	$3,645,371.25			$26,254,075.79	$897,001.25												
Currituck County	4	$1,547,453	$1,658.29	$0.00	$395,017.07	$267,345.00									$169,799.32	$0.00							$713,633.16	$0.00								
Dare County	5	$53,574,847			$6,010,846.61	$1,702,420.50									$15,423,681.29	$0.00			$4,533,271.76	$3,273,441.00	$423,038.32	$0.00	$22,208,147.48	$0.00								
Davidson County	4	$2,479,118											$1,415,262.56	$0.00					$338,805.37	$0.00	$725,049.93	$0.00							$0.00	$0.00		
Davie County	3	$532,129											$106,898.96	$0.00							$97,505.93	$0.00							$327,724.24	$0.00		
Duplin County	5	$11,919,954			$268,361.89	$0.00									$1,407,612.75	$972,031.00			$6,177,390.25	$2,940,959.25			$153,598.42	$0.00					$0.00	$0.00		
Durham County	1	$1,196,709																	$0.00	$1,196,709.00												
Edgecombe County	3	$25,420,417			$1,637,044.76	$0.00									$8,250,758.34	$15,532,613.75													$0.00	$0.00		
Forsyth County	1	$1,945,524																			$1,945,523.68	$0.00										
Franklin County	1	$49,061													$49,061.34	$0.00																
Gaston County	1	$243,350																							$243,350.18	$0.00						
Gates County	2	$166,912			$31,933.62	$0.00									$134,978.44	$0.00																
Graham County	2	$0																							$0.00	$0.00					$0.00	$0.00
Granville County	3	$535,171											$87,287.83	$0.00					$352,573.82	$0.00	$95,309.34	$0.00										
Greene County	5	$2,771,530	$170,859.33	$29,201.00	$300,594.44	$0.00									$652,320.19	$1,333,485.69			$253,419.96	$0.00			$31,649.56	$0.00								
Guilford County	3	$7,856,943											$5,646,299.76	$47,561.00			$0.00	$0.00	$1,812,247.73	$350,835.00												
Halifax County	3	$2,012,404	$90,348.32	$0.00	$1,486,240.09	$119,837.00									$217,989.15	$97,989.00																
Harnett County	3	$3,770,188	$194,443.86	$0.00											$2,194,647.58	$0.00			$1,381,096.29	$0.00												
Haywood County	1	$187,777																													$187,777.38	$0.00
Henderson County	0	$0																														
Hertford County	5	$745,873	$8,854.30	$0.00	$239,466.85	$0.00									$285,782.34	$0.00											$211,769.96	$0.00	$0.00	$0.00		
Hoke County	4	$1,454,699	$5,950.84	$0.00											$945,546.95	$0.00			$403,093.23	$89,775.00			$10,333.38	$0.00								
Hyde County	6	$12,147,918			$2,013,010.61	$576,318.22									$3,275,124.58	$0.00			$190,202.90	$1,142,996.63	$0.00	$0.00	$4,950,265.53	$0.00			$0.00	$0.00				
Iredell County	2	$447,223																			$55,584.37	$0.00							$391,638.78	$0.00		
Jackson County	2	$1,288,566							$1,288,565.73	$0.00																					$0.00	$0.00
Johnston County	4	$9,723,480	$251,340.31	$0.00	$84,789.34	$0.00									$5,464,176.02	$2,796,421.91			$1,126,752.41	$0.00												
Jones County	5	$9,339,220			$107,327.35	$53,502.00									$80,095.62	$564,509.00			$3,340,266.74	$5,091,027.75			$73,663.12	$0.00			$28,828.45	$0.00				
Lee County	3	$5,267,642	$1,519,917.57	$0.00											$1,497,785.17	$0.00			$2,249,939.59	$0.00												
Lenoir County	5	$19,895,782			$3,470,653.89	$0.00									$4,597,233.97	$5,958,173.25			$5,318,673.32	$0.00			$256,758.96	$20,624.31			$273,664.06	$0.00				
Lincoln County	1	$338,717									$338,717.30	$0.00																				
McDowell County	2	$701,863																	$524,552.72	$121,768.50	$55,541.84	$0.00										
Macon County	1	$0							$0.00	$0.00																						
Madison County	4	$451,479							$124,752.64	$0.00									$0.00	$326,726.00					$0.00	$0.00					$0.00	$0.00
Martin County	2	$1,522,667			$1,304,605.53	$0.00									$218,061.10	$0.00																
Mecklenburg County	0	$0																														
Mitchell County	3	$56,289							$56,289.41	$0.00															$0.00	$0.00					$0.00	$0.00
Montgomery County	3	$2,056,256													$181,759.48	$0.00			$1,874,496.54	$0.00	$0.00	$0.00										
Moore County	2	$6,621,879													$809,574.82	$581,801.00			$3,262,263.00	$1,968,240.00												
Nash County	2	$5,907,605			$4,383,707.90	$52,500.00									$1,083,712.61	$387,684.00																
New Hanover County	5	$77,479,288			$1,613,558.51	$0.00									$3,752,068.45	$0.00			$61,392,786.32	$2,416,377.00			$1,885,085.55	$0.00			$6,419,412.12	$0.00				
Northampton County	2	$261,643			$211,755.62	$0.00									$49,887.52	$0.00																
Onslow County	6	$62,308,198	$218,409.73	$0.00	$1,756,647.22	$0.00									$6,487,394.09	$0.00			$47,113,875.25	$2,572,731.75			$3,529,278.50	$0.00			$629,861.56	$0.00				
Orange County	3	$3,694,222											$966,574.35	$906,241.25					$1,153,424.18	$534,981.00	$133,001.25	$0.00										
Pamlico County	5	$14,425,258			$2,284,590.01	$6,320,748.66									$70,870.80	$0.00			$5,062,661.50	$479,440.80			$178,638.39	$0.00			$28,307.97	$0.00				
Pasquotank County	3	$1,861,573			$475,629.97	$0.00									$343,446.96	$734,818.50							$307,677.87	$0.00								
Pender County	6	$77,665,187			$5,619,886.28	$0.00									$9,528,462.16	$3,449,819.00			$44,852,376.48	$11,712,168.00			$2,372,549.91	$0.00	$0.00	$0.00	$129,924.99	$0.00				
Perquimans County	4	$257,355			$104,557.88	$0.00									$114,846.11	$0.00							$37,951.04	$0.00	$0.00	$0.00						
Person County	3	$105,591											$45,781.49	$0.00					$0.00	$0.00	$59,809.85	$0.00										
Pitt County	6	$15,272,180	$144,864.25	$58,125.00	$5,595,695.13	$383,509.43									$2,806,244.34	$950,392.00			$1,585,044.22	$2,844,021.75			$373,273.72	$0.00			$531,009.93	$0.00				
Polk County	3	$22,291							$22,291.35	$0.00									$0.00	$0.00					$0.00	$0.00						
Randolph County	4	$1,500,927											$941,688.71	$0.00					$298,344.51	$181,081.50	$70,693.46	$0.00			$9,118.49	$0.00						
Richmond County	2	$572,857													$125,896.24	$0.00			$446,961.21	$0.00												
Robeson County	5	$62,433,509	$379,041.47	$0.00											$26,506,647.03	$14,849,856.00			$12,160,511.94	$8,394,345.75			$143,106.76	$0.00					$0.00	$0.00		
Rockingham County	2	$336,353															$0.00	$0.00			$336,353.34	$0.00										
Rowan County	2	$929,336																	$929,335.53	$0.00									$0.00	$0.00		
Rutherford County	1	$466,609							$33,994.99	$0.00	$2,350.41	$0.00													$430,263.74	$0.00						
Sampson County	6	$6,203,711	$53,162.88	$0.00	$108,191.78	$0.00									$1,635,686.57	$472,170.50			$2,307,256.89	$1,505,734.50			$121,507.70	$0.00					$0.00	$0.00		
Scotland County	2	$12,918,524													$1,244,147.73	$0.00			$11,674,376.74	$0.00												
Stanly County	2	$1,027,860																	$830,370.64	$0.00					$197,489.36	$0.00						
Stokes County	3	$60,478																			$60,477.60	$0.00			$0.00	$0.00			$0.00	$0.00		
Surry County	1	$122,009																			$122,009.08	$0.00										
Swain County	1	$76,486																							$76,486.03	$0.00						
Transylvania County	1	$4,031																													$4,030.94	$0.00
Tyrrell County	5	$2,005,397	$0.00	$0.00	$746,638.34	$59,969.00									$139,466.97	$203,348.00			$19,889.91	$0.00			$836,084.76	$0.00								
Union County	1	$805,956																	$805,956.48	$0.00												
Vance County	2	$94,540			$31,038.63	$0.00															$63,501.16	$0.00										
Wake County	2	$11,408,277	$5,727,069.61	$868,966.00											$4,812,241.70	$0.00																
Warren County	2	$11,083			$11,082.72	$0.00									$0.00	$0.00																
Washington County	3	$675,397			$340,901.51	$70,896.71									$148,246.14	$0.00							$115,352.58	$0.00								
Watauga County	3	$573,530							$379,743.84	$0.00	$0.00	$184,587.00																			$9,198.95	$0.00
Wayne County	5	$19,157,413			$757,080.15	$0.00									$6,570,527.95	$6,624,184.50			$4,555,877.55	$475,854.00			$173,888.78	$0.00	$0.00	$0.00						
Wilkes County	2	$22,230									$22,230.00	$0.00																	$0.00	$0.00		
Wilson County	5	$5,976,492	$442,838.47	$0.00	$1,640,542.22	$0.00									$2,754,072.75	$592,945.00			$538,780.86	$0.00									$7,312.50	$0.00		
Yadkin County	3	$11,071																			$4,271.46	$0.00			$6,800.00	$0.00			$0.00	$0.00		
Yancey County	4	$713,177							$14,367.61	$0.00									$681,394.37	$0.00					$0.00	$0.00					$17,414.69	$0.00
Total FEMA Allocation		$1,537,628,606	$19,065,881.00	$1,249,723.00	$87,544,413.27	$12,057,457.39	$4,212,154.14	$0.00	$10,422,536.98	$152,083.00	$8,452,286.36	$283,909.58	$42,017,887.54	$1,731,601.33	$293,825,970.26	$78,937,004.46	$0.00	$0.00	$763,066,739.71	$66,627,272.05	$24,126,996.48	$265,675.10	$72,739,754.78	$825,067.81	$12,285,266.99	$79,789.00	$24,790,960.34	$311,436.00	$10,930,590.50	$102,176.00	$1,523,972.91	$0.00

NORTH DAKOTA



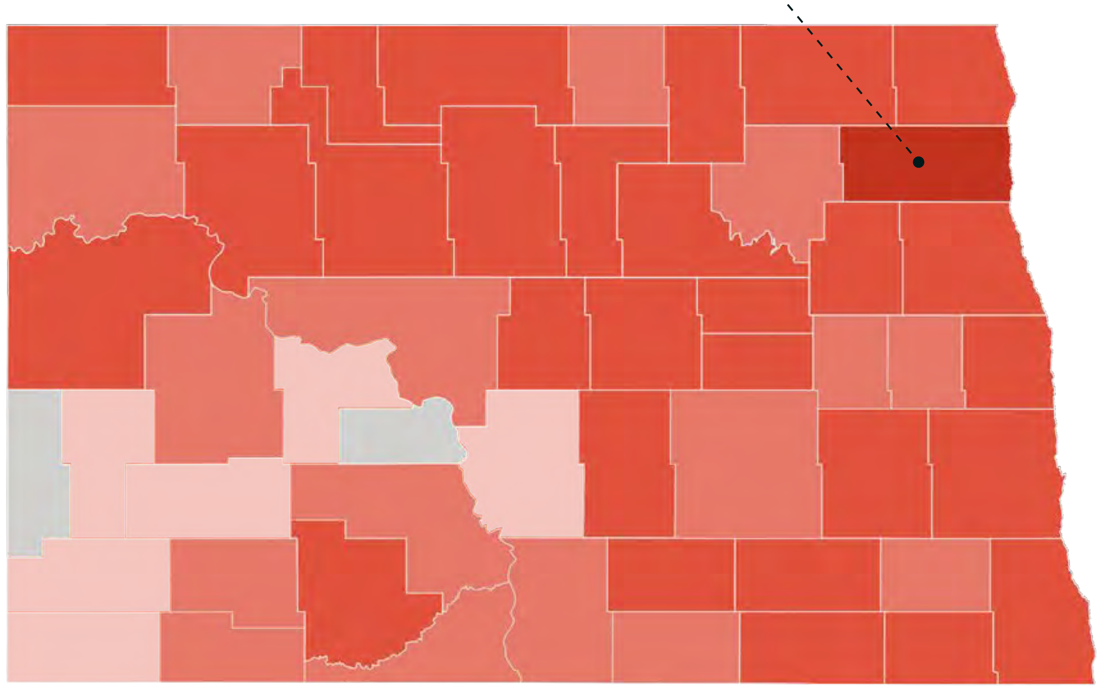
NORTH DAKOTA STATISTICS SUMMARY (2011 – 2021)	
13	CLIMATE DISASTER DECLARATIONS
4TH HIGHEST	PER CAPITA SPENDING ON CLIMATE DISASTERS IN THE COUNTRY
WALSH	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
14	COUNTIES WITH FIVE OR MORE DISASTERS
C	ASCE INFRASTRUCTURE REPORT CARD GRADE
BENSON, ROLETTE, SIOUX	HIGHEST COMPOUNDING RISKS
$561 MILLION	FEMA + HUD POST-DISASTER FUNDING
760 THOUSAND	POPULATION TOTAL
$738	PER CAPITA SPENDING ON CLIMATE DISASTERS
$1.2 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY 2011 – 2021

13
disaster declarations

Walsh County has had the highest number of recent disasters in the state: 7 disasters.



Fifty-one out of 53 counties have received a federal disaster declaration between 2011-2021.

The most frequent and expensive disasters in North Dakota were due to flooding.

Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

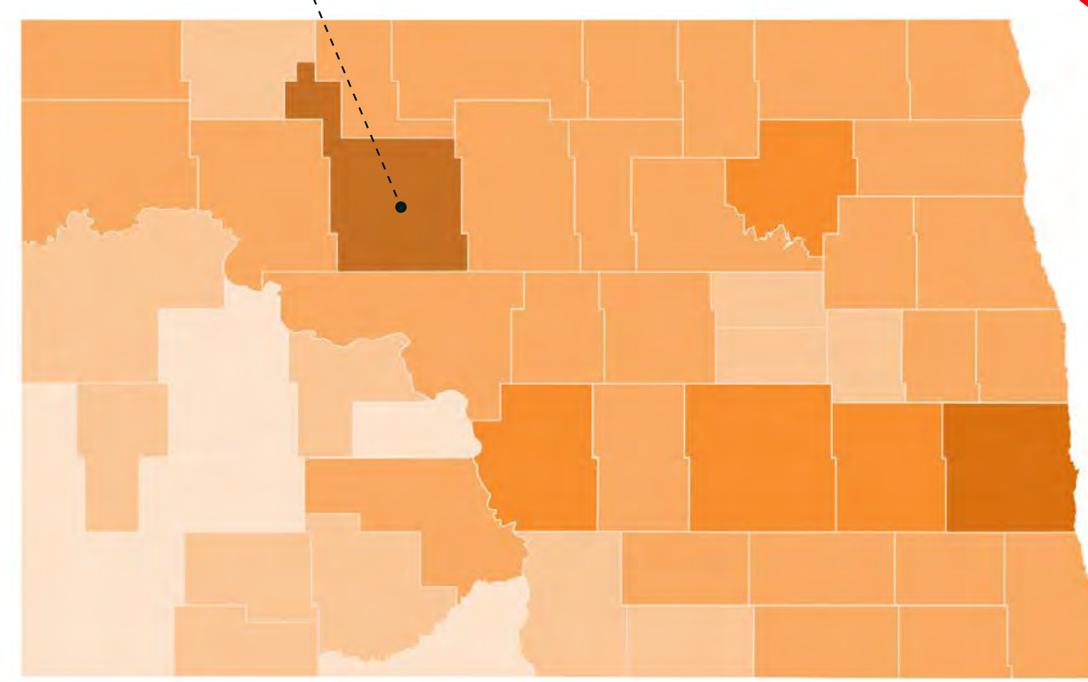
Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS 2011 – 2021

$561M
post-disaster assistance

Ward County has received the highest post-disaster federal recovery funds in the state: over $111 million.



FEMA Public Assistance and Hazard Mitigation

Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

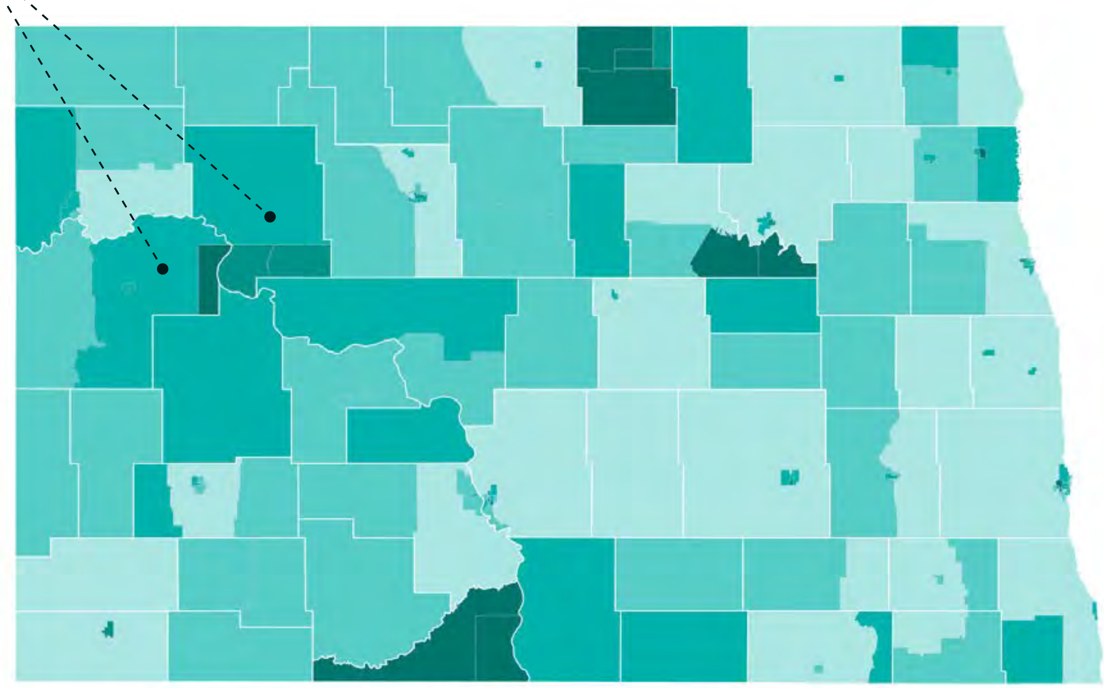
Source: FEMA 2021
Maps courtesy of iParametrics

$366M	FEMA obligations
$195M	HUD CDBG-DR Funds
$561M	FEMA + HUD assistance
$738	per capita cost

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Mountrail and McKenzie counties have had more than 5 disasters and an increase in population by more than 10% since 2011.



Social Vulnerability Index

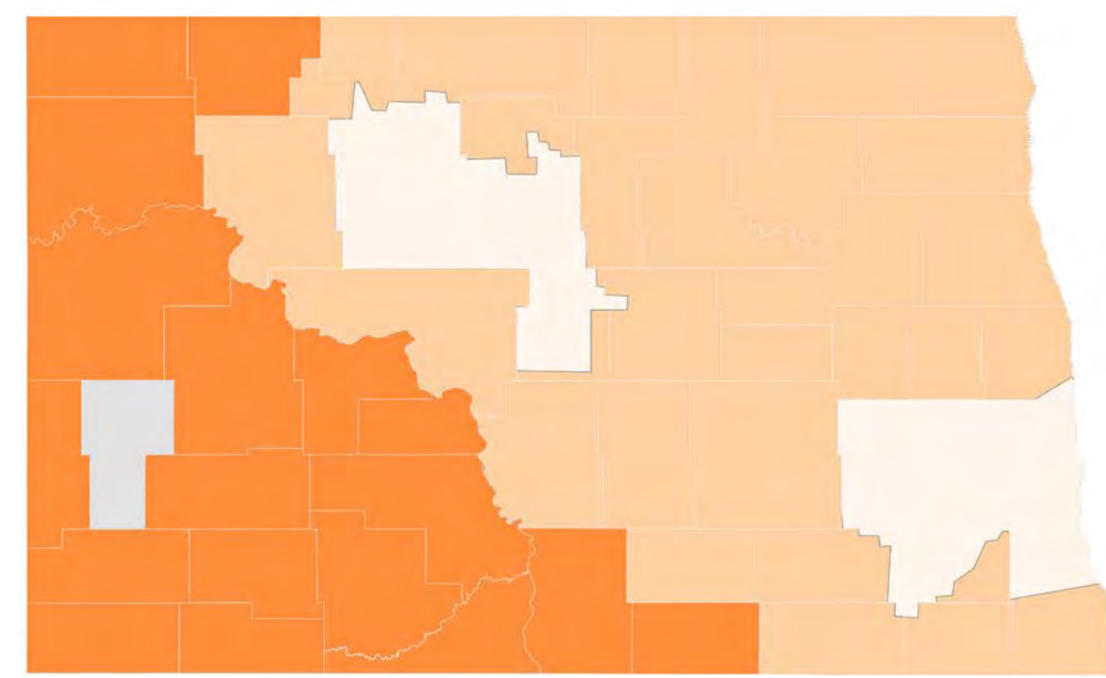
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration

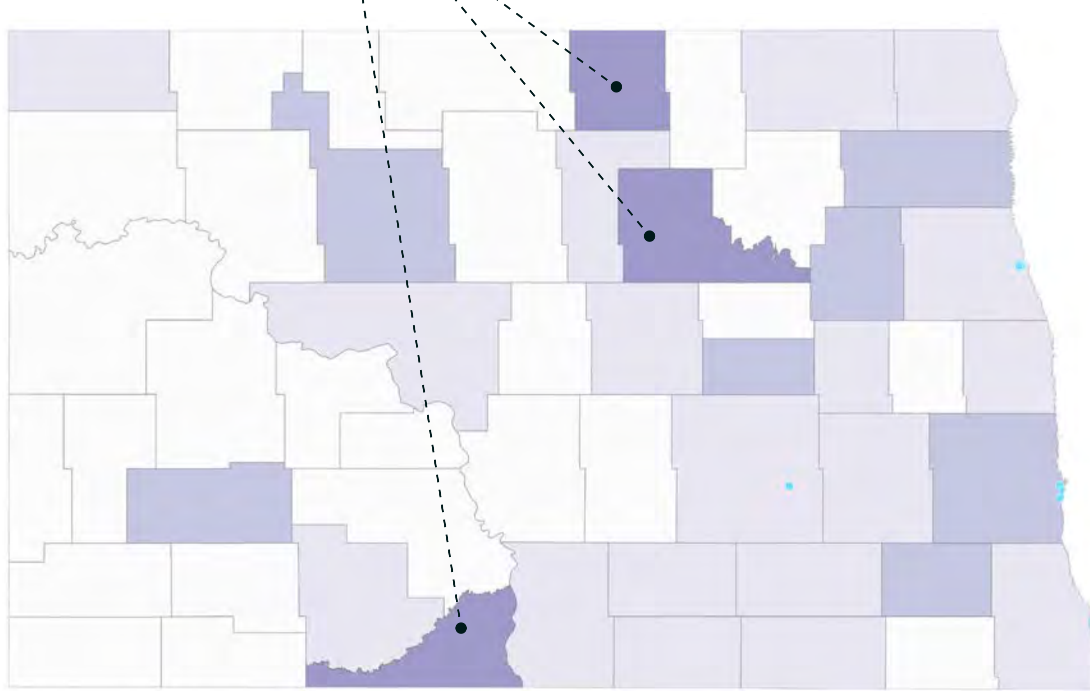
Including major events - SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Benson, Rolette, and Sioux counties have high risk of climate disasters and other compounding risks.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adams							0
Barnes					1		1
Benson					3		3
Billings							0
Bottineau							0
Bowman							0
Burke							0
Burleigh							0
Cass					1		2
Cavalier					1		1
Dickey					2		1
Divide					1		1
Dunn							0
Eddy							0
Emmons					1		1
Foster					1		2
Golden Valley							0
Grand Forks					1		1
Grant					1		1
Griggs					1		1
Hettinger							0
Kidder							0
LaMoure					1		1
Logan					1		1
McHenry							0
McIntosh					2		1
McKenzie							0
McLean					1		1
Mercer							0
Morton							0
Mountrail							0
Nelson					1		2
Oliver							0
Pembina					1		1
Pierce					1		1
Ramsey							0
Ransom					1		2
Renville							0
Richland					1		1
Rolette					2		3
Sargent							0
Sheridan							0
Sioux					2		3
Slope							0
Stark					1		2
Steele							0
Stutsman					2		1
Towner							0
Traill					1		1
Walsh					2		2
Ward					1		2
Wells					1		1
Williams							0

NORTH DAKOTA

TOTAL: 13 DISASTERS
FEMA PA + HM: $366 M
HUD CDBG-DR: $195 M
FEMA + HUD ASSISTANCE: $561 M

			2011				2013								2014		2017		2019		2020						2021	
			1981: FLOODING		1986: SEVERE WINTER STORM		4118: FLOODING		4123: SEVERE STORMS AND FLOODING		4128: SEVERE STORMS AND FLOODING		4154: SEVERE WINTER STORM		4190: SEVERE STORMS AND FLOODING		4323: FLOODING		4444: FLOODING		4475: FLOODING		4553: FLOODING		4565: SEVERE STORMS AND FLOODING		4613: SEVERE STORM, STRAIGHT-LINE WINDS, AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	13	$57,819,086	$37,037,744	$3,350,566	$5,864,779	$16,871	$631,912	$249,154	$239,921	$0	$818,921	$46,212	$4,219,742	$44,473	$234,179	$15,803	$485,631	$199,019	$849,979	$1,165,384	$616,673	$0	$1,039,335	$0	$649,266	$0	$43,522	$0
Adams County	2	$81,327											$50,484	$0					$30,843	$0								
Barnes County	4	$9,642,831	$6,947,702	$993,584															$217,200	$0	$753,571	$0	$730,775	$0				
Benson County	6	$5,070,885	$1,983,741	$1,880,396			$157,135	$0			$215,421	$0			$348,606	$0	$335,271	$0							$150,316	$0		
Billings County	1	$182,037	$182,037	$0																								
Bottineau County	6	$3,319,204	$2,114,091	$0	$0	$0	$87,107	$0			$19,953	$0			$202,875	$0	$895,178	$0										
Bowman County	1	$0											$0	$0														
Burke County	3	$465,172	$453,382	$0	$0	$0																					$11,790	$0
Burleigh County	1	$23,503,620	$23,503,620	$0																								
Cass County	4	$51,024,428	$9,813,161	$35,493,510			$3,117,775	$2,336											$1,942,737	$0			$654,910	$0				
Cavalier County	4	$2,742,398	$519,950	$0			$538,978	$0			$310,354	$0					$1,373,115	$0										
Dickey County	4	$2,975,812	$2,248,972	$49,500															$459,178	$0	$124,635	$0	$93,526	$0				
Divide County	4	$2,124,384	$2,085,827	$0	$0	$0									$38,557	$0											$0	$0
Dunn County	2	$32,377			$0	$0					$32,377	$0																
Eddy County	4	$921,730	$746,813	$0			$12,411	$35,587							$104,616	$0					$22,304	$0						
Emmons County	3	$228,261																	$114,351	$0	$58,950	$0					$54,961	$0
Foster County	4	$744,625	$505,050	$21,000			$91,159	$0													$94,656	$0	$32,760	$0				
Golden Valley County	0	$0																										
Grand Forks County	5	$5,409,067	$667,665	$390,769															$607,383	$0	$1,180,542	$207,992	$1,324,534	$0	$1,030,183	$0		
Grant County	4	$427,558	$121,499	$0									$107,129	$0					$11,388	$0							$187,543	$0
Griggs County	2	$786,126	$651,749	$26,434																	$107,943	$0						
Hettinger County	2	$258,497											$0	$228,663					$11,286	$18,548								
Kidder County	5	$3,172,521	$1,216,155	$29,606							$112,520	$0									$1,203,638	$0	$591,843	$0			$18,758	$0
LaMoure County	5	$2,854,428	$998,527	$497,551															$719,827	$28,082	$337,816	$70,648	$163,236	$0			$38,741	$0
Logan County	4	$2,210,135	$1,672,328	$0															$124,229	$0	$137,976	$0	$275,602	$0				
McHenry County	5	$6,647,742	$4,933,746	$0			$267,901	$0			$902,786	$0			$158,392	$0	$384,916	$0										
McIntosh County	2	$770,091	$701,432	$0																			$68,659	$0				
McKenzie County	6	$871,926	$55,434	$36,432	$0	$0					$336,728	$0							$443,333	$0					$0	$0	$0	$0
McLean County	2	$1,441,225	$1,176,349	$42,419							$200,914	$21,543																
Mercer County	1	$260,230	$260,230	$0																								
Morton County	3	$7,748,534	$7,514,554	$33,750									$11,821	$0					$188,408	$0								
Mountrail County	6	$1,990,596	$1,406,594	$46,048	$0	$0					$394,678	$0			$73,346	$0					$69,929	$0			$0	$0		
Nelson County	5	$1,792,404	$881,205	$18,092							$399,836	$0									$178,122	$0	$198,555	$0	$116,595	$0		
Oliver County	0	$0																										
Pembina County	6	$5,921,314	$1,006,055	$1,264,977			$158,391	$77,975			$2,549,631	$0					$254,877	$0	$220,441	$0			$388,967	$0				
Pierce County	4	$2,868,152	$1,639,853	$0							$639,683	$0			$464,111	$0	$124,504	$0										
Ramsey County	3	$10,082,108	$8,859,594	$685,799			$40,205	$0			$469,592	$26,918																
Ransom County	3	$1,780,639	$1,460,631	$0															$155,374	$0			$164,635	$0				
Renville County	5	$1,083,959	$847,695	$0	$0	$0	$31,974	$13,488							$75,161	$16,054	$99,588	$0										
Richland County	4	$2,976,796	$1,801,339	$264,761			$370,245	$0											$504,014	$0			$36,437	$0				
Rolette County	3	$862,912	$556,640	$0			$39,938	$0									$246,216	$20,118										
Sargent County	4	$1,116,350	$696,365	$32,709															$128,275	$0	$181,119	$0	$77,881	$0				
Sheridan County	4	$920,406	$680,837	$0							$145,639	$0									$27,038	$0	$66,893	$0				
Sioux County	3	$44,065	$6,616	$0									$0	$0													$37,449	$0
Slope County	1	$0											$0	$0														
Stark County	1	$25,573									$25,573	$0																
Steele County	3	$930,646	$722,087	$0															$142,975	$0			$65,584	$0				
Stutsman County	3	$12,674,515	$6,061,575	$176,429																	$5,120,966	$0	$1,315,545	$0				
Towner County	4	$2,577,455	$1,635,860	$53,550			$130,217	$0			$236,574	$15,959					$505,295	$0										
Traill County	5	$1,937,495	$434,723	$179,131			$110,165	$21,591											$197,009	$0	$244,071	$0	$750,806	$0				
Walsh County	7	$5,895,931	$1,200,846	$0			$937,675	$267,351			$304,839	$0					$713,962	$36,365	$1,218,293	$67,650	$195,819	$0	$953,132	$0				
Ward County	4	$111,532,824	$83,430,820	$25,751,601	$0	$0					$1,697,339	$0			$653,064	$0												
Wells County	6	$3,795,189	$2,003,229	$231,123			$374,364	$0			$313,581	$0									$684,715	$100,005	$64,413	$0	$23,760	$0		
Williams County	3	$1,035,538	$911,440	$0	$70,144	$0																					$53,954	$0
Total FEMA Allocation		$365,581,124	$224,355,762	$71,549,737	$5,934,923	$16,871	$7,097,551	$667,482	$239,921	$0	$10,126,940	$110,632	$4,389,176	$273,136	$2,352,906	$31,857	$5,418,553	$255,501	$8,286,522	$1,279,664	$11,340,483	$378,644	$9,058,026	$0	$1,970,119	$0	$446,718	$0

OHIO

OHIO STATISTICS SUMMARY (2011 - 2021)	
6	CLIMATE DISASTER DECLARATIONS
ADAMS, ATHENS, BELMONT, GALLIA, HOCKING, JACKSON, LAWRENCE, MEIGS, MONROE, MORGAN, MUSKINGUM, NOBLE, PERRY, PIKE, VINTON, WASHINGTON	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
61	SUPERFUND SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
CUYAHOGA, FRANKLIN, LUCAS, MAHONING	HIGHEST COMPOUNDING RISKS
$225 MILLION	FEMA + HUD POST-DISASTER FUNDING
11.6 MILLION	POPULATION TOTAL
$19.26	PER CAPITA SPENDING ON CLIMATE DISASTERS
$7.9 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

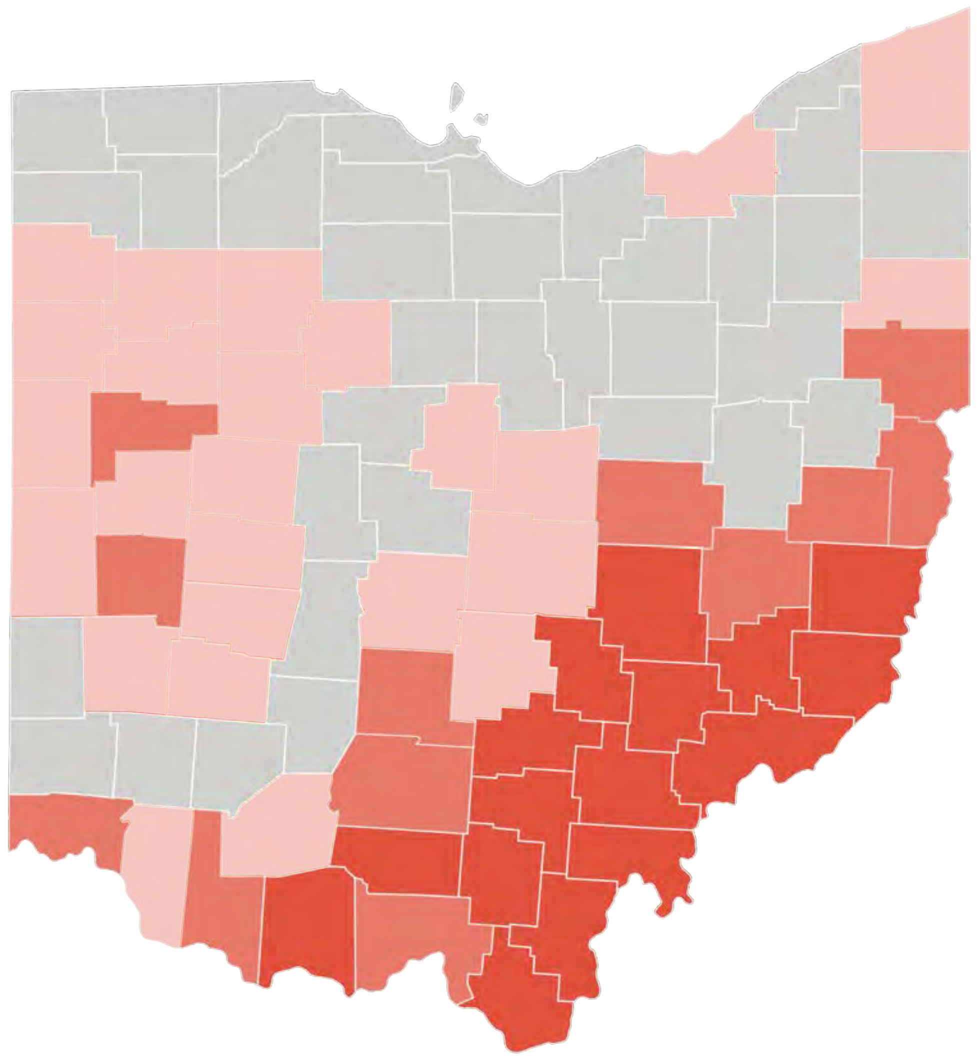
DISASTER OCCURRENCES 2011-2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

6
disaster declarations

Fifty-three out of 88 counties have had a disaster declaration in Ohio.

Sixteen counties in Ohio have had four disasters.



Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011-2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$225M
post-disaster assistance

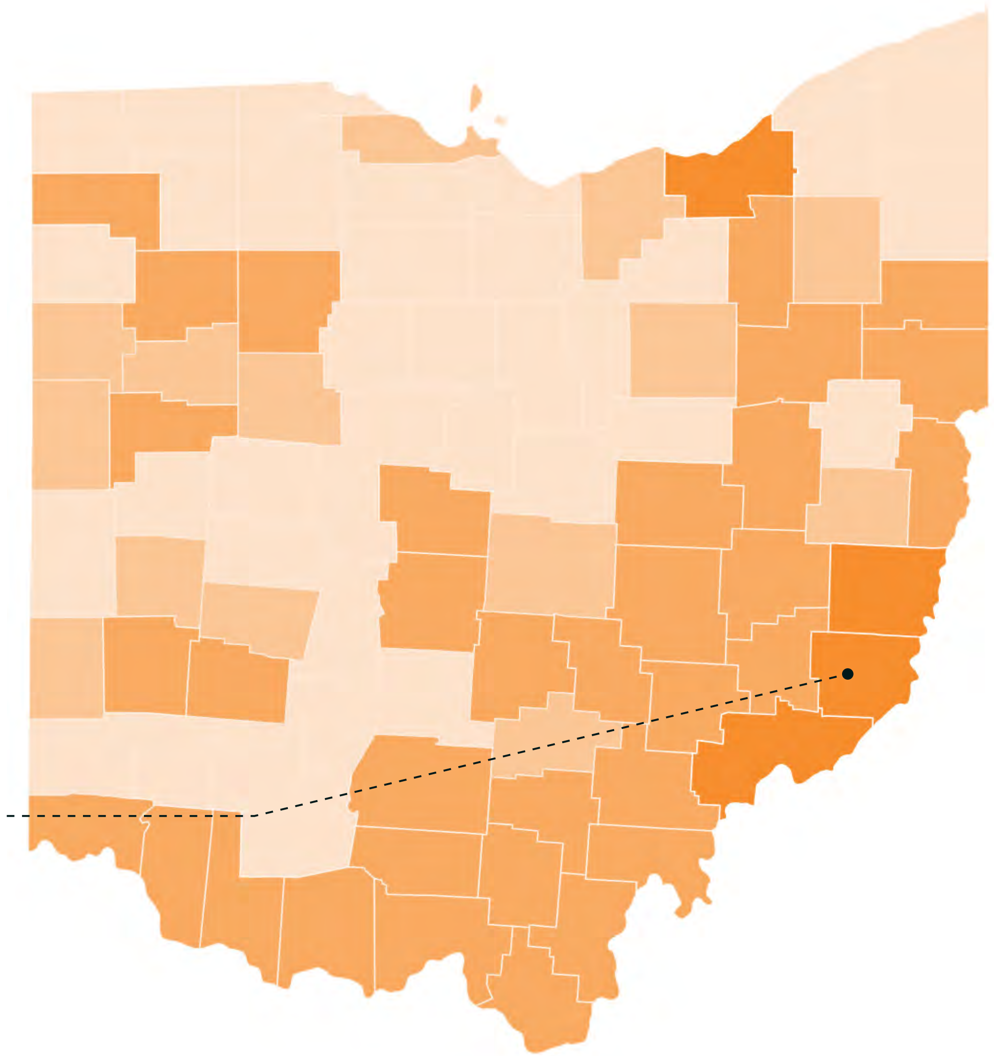
$213M FEMA obligations

$12.3M HUD CDBG-DR Funds

$225M FEMA + HUD assistance

$19.26 per capita cost

Monroe County has received the most post-disaster federal assistance in the state: $27 million.



Public Assistance and Hazard Mitigation

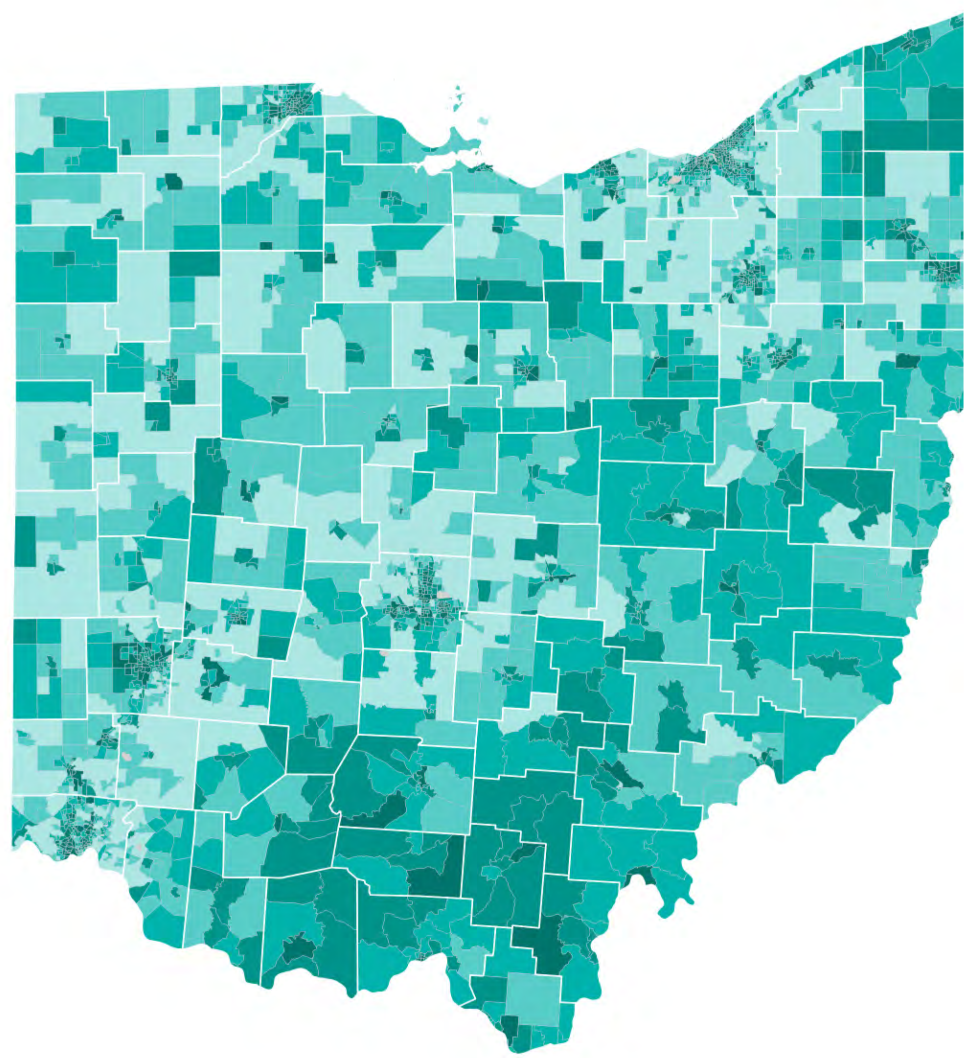
Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



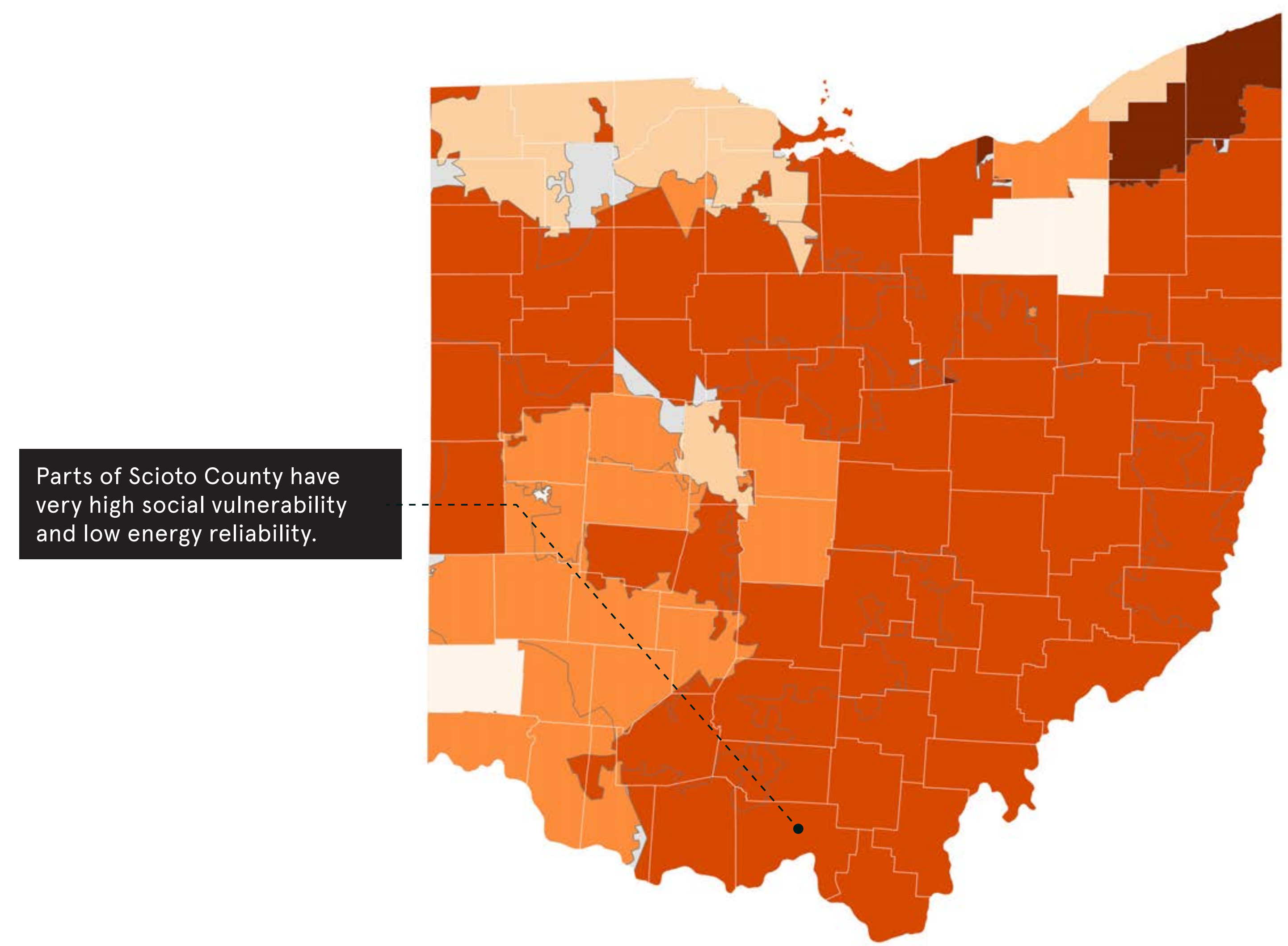
Social Vulnerability Index

CDC (2018)
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration

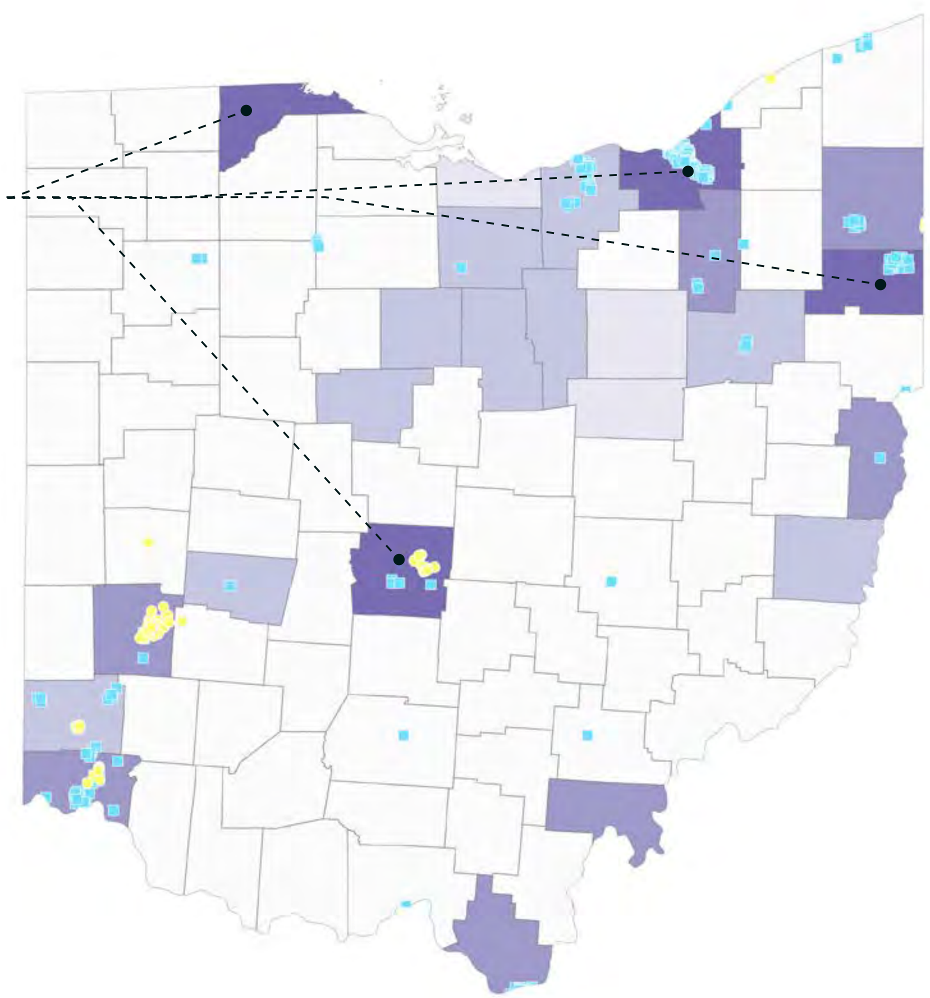
Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Cuyahoga, Franklin, Lucas, and Mahoning counties have high risk of climate disasters and other compounding risks.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adams							0
Allen							0
Ashland					1		2
Ashtabula							0
Athens							0
Auglaize							0
Belmont					1		2
Brown							0
Butler					1		2
Carroll							0
Champaign							0
Clark					1		2
Clermont							0
Clinton							0
Columbiana							0
Coshocton							0
Crawford					1		2
Cuyahoga					7		4
Darke							0
Defiance							0
Delaware							0
Erie					1		1
Fairfield							0
Fayette							0
Franklin					6		4
Fulton							0
Gallia							0
Geauga							0
Greene							0
Guernsey							0
Hamilton					6		3
Hancock							0
Hardin							0
Harrison							0
Henry							0
Highland							0
Hocking							0
Holmes					1		1
Huron					1		2
Jackson							0
Jefferson					1		3
Knox							0
Lake							0
Lawrence					1		3
Licking							0
Logan							0
Lorain					2		2
Lucas					4		4
Madison							0

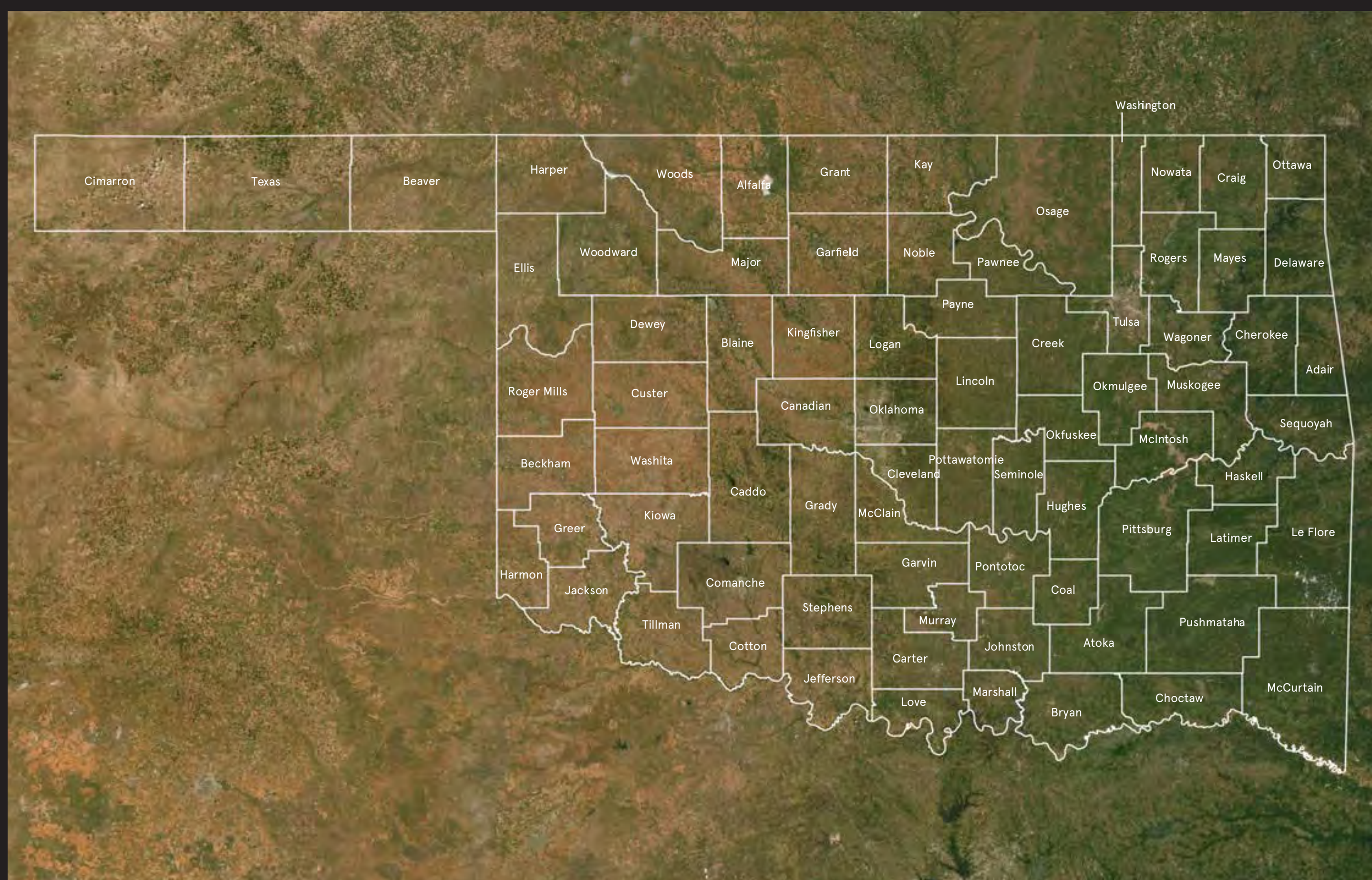
County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Mahoning					3		4
Marion					1		2
Medina							0
Meigs					1		3
Mercer							0
Miami							0
Monroe							0
Montgomery					5		3
Morgan							0
Morrow							0
Muskingum							0
Noble							0
Ottawa							0
Paulding							0
Perry							0
Pickaway							0
Pike							0
Portage							0
Preble							0
Putnam							0
Richland					1		2
Ross							0
Sandusky							0
Scioto							0
Seneca							0
Shelby							0
Stark					3		2
Summit					3		3
Trumbull					3		3
Tuscarawas							0
Union							0
Van Wert							0
Vinton							0
Warren							0
Washington							0
Wayne					1		1
Williams							0
Wood							0
Wyandot							0

IMAGE RIGHT: WINTER STORM LANDON | DAN KECK

OHIO

TOTAL: 6 DISASTERS FEMA PA + HM: $213 M HUD CDBG-DR: $12.3 M FEMA + HUD ASSISTANCE: $225 M			2011		2012		2013		2018		2019			
			4002: SEVERE STORMS AND FLOODING		4077: SEVERE STORMS AND STRAIGHT-LINE WINDS		4098: SEVERE STORMS AND FLOODING DUE TO THE REMNANTS OF HURRICANE SANDY		4360: SEVERE STORMS, LANDSLIDES, AND MUDSLIDES		4424: SEVERE STORMS, FLOODING, AND LANDSLIDES		4447: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, FLOODING, LANDSLIDES, AND MUDSLIDE	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	6	$21,231,167	$744,292	$801,274	$7,407,750	$186,916	$5,379,812	$209,278	$1,423,104	$1,106,289	$1,211,333	$308,962	$2,049,495	$402,661
Adams County	4	$8,047,900	$2,221,076	$0	$0	$0			$5,336,545	$0	$490,280	$0		
Allen County	1	$240,210			$240,210	$0								
Ashland County	0	$0												
Ashtabula County	1	$60,390					$60,390	$0						
Athens County	4	$9,257,126	$1,709,907	$0	$354,901	$0			$5,407,915	$135,398	$1,649,005	$0		
Auglaize County	2	$180,216			$180,216	$0							$0	$0
Belmont County	4	$19,829,320	$857,628	$42,420	$96,400	$0			$16,693,336	$0	$2,139,536	$0		
Brown County	3	$4,040,774	$2,125,851	$21,676					$999,222	$0	$894,026	$0		
Butler County	0	$0												
Carroll County	0	$0												
Champaign County	1	$71,033			$71,033	$0								
Clark County	1	$538,153			$419,321	$118,832								
Clermont County	1	$2,182,321	$2,182,321	$0										
Clinton County	0	$0												
Columbiana County	2	$2,339,134							$607,201	$1,681,169			$50,764	$0
Coshocton County	2	$1,160,396			$81,951	$0			$1,078,445	$0				
Crawford County	0	$0												
Cuyahoga County	1	$12,606,710					$12,163,029	$443,681						
Darke County	1	$0											$0	$0
Defiance County	0	$0												
Delaware County	0	$0												
Erie County	0	$0												
Fairfield County	1	$1,622,470			$374,319	$1,248,151								
Fayette County	0	$0												
Franklin County	1	$2,118,627			$2,118,627	$0								
Fulton County	0	$0												
Gallia County	4	$9,021,410	$3,912,203	$0	$285,687	$0			$794,151	$0	$4,029,368	$0		
Geauga County	0	$0												
Greene County	1	$2,515,952											$2,515,952	$0
Guernsey County	3	$2,182,006	$396,888	$0	$470,892	$0					$1,314,226	$0		
Hamilton County	2	$6,874,956	$2,771,573	$131,160					$2,957,976	$1,014,247				
Hancock County	1	$955,894			$288,385	$667,509								
Hardin County	1	$134,445			$134,445	$0								
Harrison County	2	$572,391			$19,801	$11,444			$541,145	$0				
Henry County	0	$0												
Highland County	1	$26,569			$26,569	$0								
Hocking County	4	$891,157	$301,565	$0	$100,882	$0					$488,710	$0	$0	$0
Holmes County	0	$0												
Huron County	0	$0												
Jackson County	4	$3,250,416	$419,524	$0	$309,782	$206,250			$1,829,832	$0	$485,028	$0		
Jefferson County	3	$6,864,519	$859,231	$18,750					$3,114,528	$57,960	$2,814,050	$0		
Knox County	1	$94,683			$79,683	$15,000								
Lake County	0	$0												
Lawrence County	4	$8,725,369	$6,826,858	$22,561	$26,900	$0			$1,349,584	$0	$499,465	$0		
Licking County	1	$623,768			$623,768	$0								
Logan County	1	$86,032			$86,032	$0								
Lorain County	0	$0												
Lucas County	0	$0												
Madison County	0	$0												
Mahoning County	1	$1,139,475											$0	$1,139,475
Marion County	0	$0												
Medina County	0	$0												
Meigs County	4	$3,785,816	$1,216,194	$0	$187,935	$0			$1,663,584	$0	$718,103	$0		
Mercer County	1	$304,450											$304,450	$0
Miami County	2	$652,291			$505,291	$0							$0	$147,000
Monroe County	4	$27,131,026	$1,201,305	$0	$74,304	$0			$6,416,992	$0	$19,438,425	$0		
Montgomery County	1	$7,195,334											$7,160,861	$34,473
Morgan County	4	$4,881,546	$267,925	$695,028	$50,737	$0			$1,537,568	$0	$2,330,287	$0		
Morrow County	1	$9,270			$9,270	$0								
Muskingum County	4	$1,407,624			$376,228	$0			$381,618	$0	$649,778	$0	$0	$0
Noble County	4	$4,904,268	$265,943	$0	$82,549	$0			$1,763,408	$0	$2,792,368	$0		
Ottawa County	0	$0												
Paulding County	1	$48,693			$48,693	$0								
Perry County	4	$3,157,148			$176,751	$0			$334,788	$0	$2,645,608	$0	$0	$0
Pickaway County	2	$35,349			$35,349	$0							$0	$0
Pike County	4	$3,617,757	$991,987	$0	$94,925	$0			$946,471	$0	$1,584,374	$0		
Portage County	0	$0												
Preble County	0	$0												
Putnam County	1	$1,182,419			$495,059	$687,360								
Richland County	0	$0												
Ross County	2	$1,236,478	$226,502	$0							$1,009,976	$0		
Sandusky County	0	$0												
Scioto County	3	$7,556,250	$2,749,148	$0					$1,119,832	$0	$3,687,270	$0		
Seneca County	0	$0												
Shelby County	1	$37,393			$37,393	$0								
Stark County	0	$0												
Summit County	0	$0												
Trumbull County	0	$0												
Tuscarawas County	0	$0												
Union County	0	$0												
Van Wert County	1	$123,820			$116,320	$7,500								
Vinton County	4	$3,386,177	$80,646	$0	$33,403	$0			$2,251,314	$0	$1,020,814	$0		
Warren County	0	$0												
Washington County	4	$12,338,393	$636,047	$8,156	$411,787	$0			$7,278,056	$0	$3,780,094	$224,252		
Wayne County	0	$0												
Williams County	0	$0												
Wood County	0	$0												
Wyandot County	1	$62,110			$62,110	$0								
Total FEMA Allocation		$212,538,602	$32,964,612	$1,741,025	$16,595,663	$3,148,962	$17,603,231	$652,959	$65,826,616	$3,995,064	$55,672,126	$533,214	$12,081,522	$1,723,609

OKLAHOMA

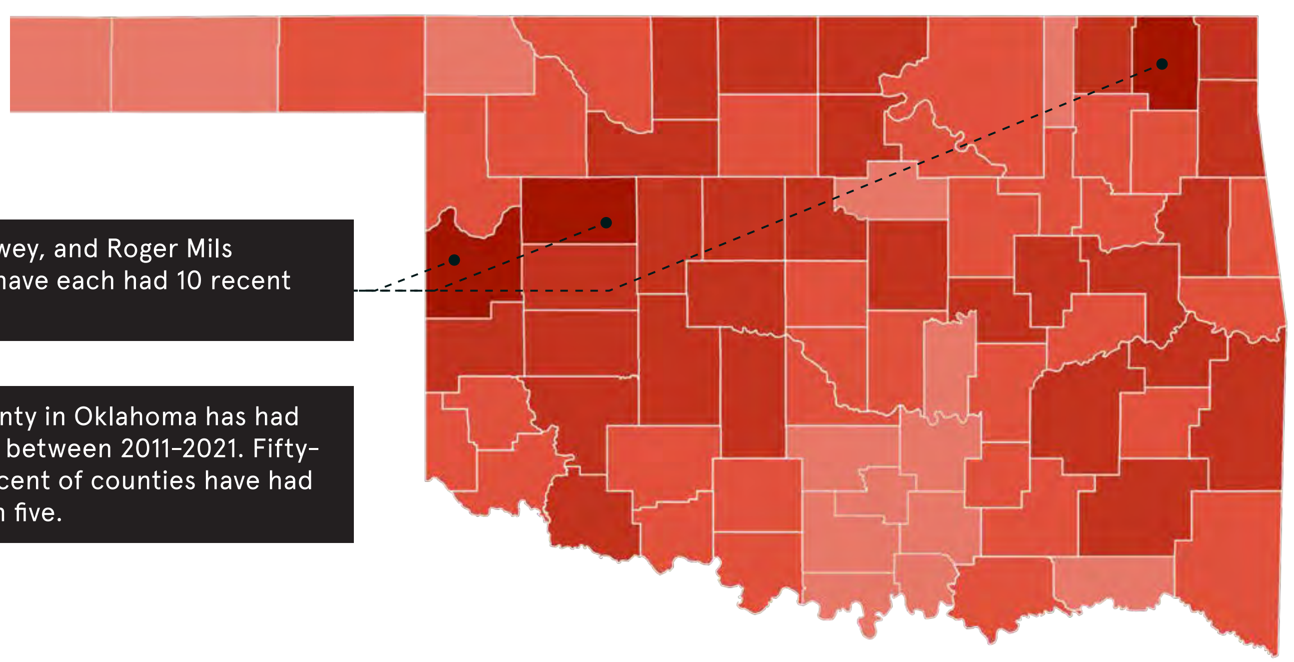


OKLAHOMA STATISTICS SUMMARY (2011 - 2021)	
22	CLIMATE DISASTER DECLARATIONS
2ND HIGHEST	NUMBER OF DISASTERS IN THE COUNTRY
CRAIG, DEWEY, ROGER MILLS	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
41	COUNTIES WITH FIVE OR MORE DISASTERS
7	SUPERFUND SITES
CLEVELAND, OKLAHOMA, TULSA	HIGHEST COMPOUNDING RISKS
$849 MILLION	FEMA + HUD POST-DISASTER FUNDING
3.9 MILLION	POPULATION TOTAL
$215	PER CAPITA SPENDING ON CLIMATE DISASTERS
$3.6 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

22
disaster declarations



Craig, Dewey, and Roger Mils counties have each had 10 recent disasters.

Every county in Oklahoma has had a disaster between 2011–2021. Fifty-three percent of counties have had more than five.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

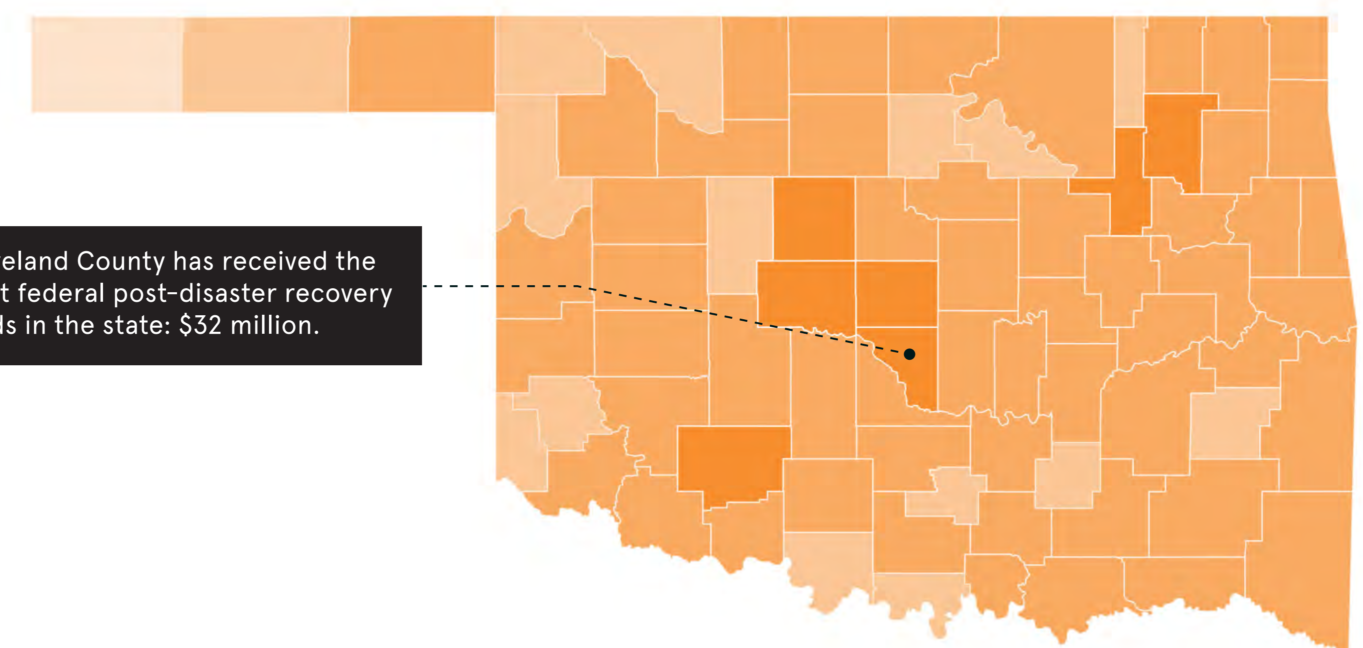
- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEMA ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$849M
post-disaster assistance



Cleveland County has received the most federal post-disaster recovery funds in the state: $32 million.

Public Assistance and Hazard Mitigation

Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

$667M FEMA obligations

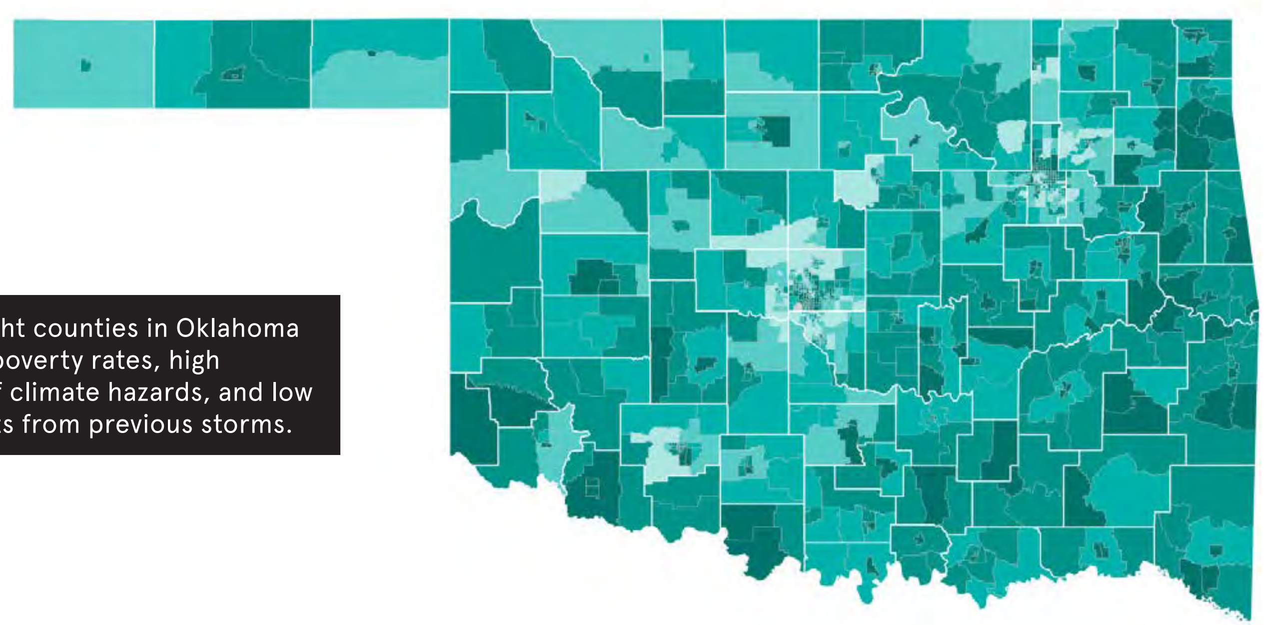
$182M HUD CDBG-DR Funds

$849M FEMA + HUD assistance

$215 per capita cost

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Twenty-eight counties in Oklahoma have high poverty rates, high diversity of climate hazards, and low investments from previous storms.

Social Vulnerability Index

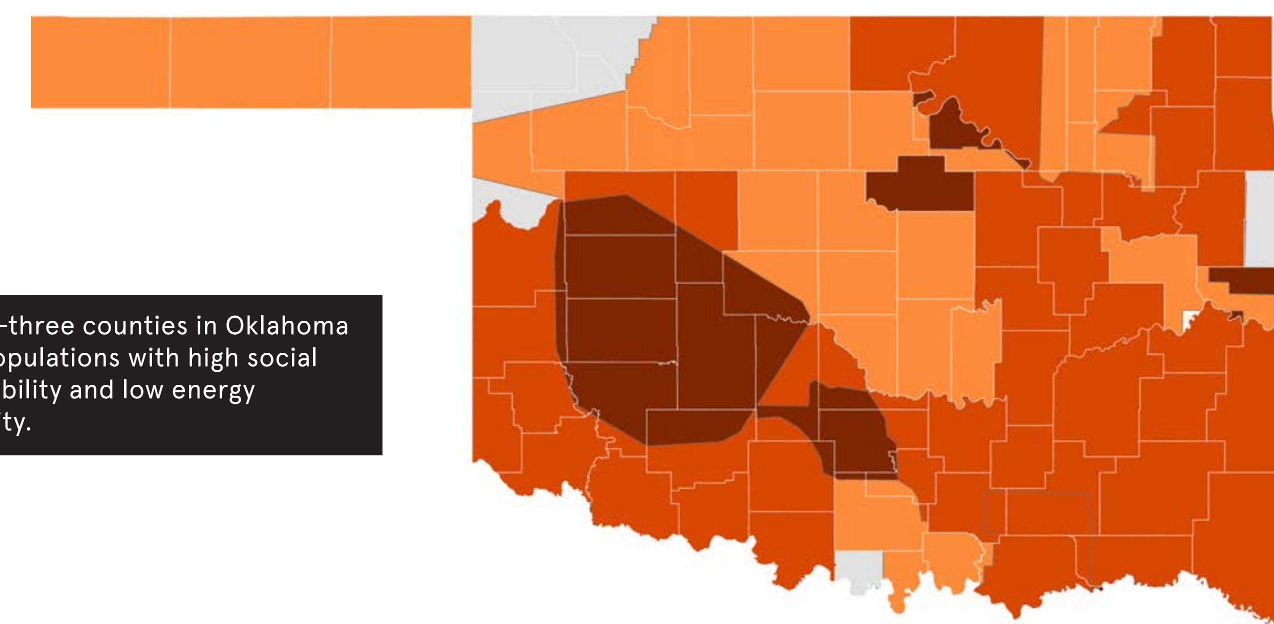
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Twenty-three counties in Oklahoma have populations with high social vulnerability and low energy reliability.

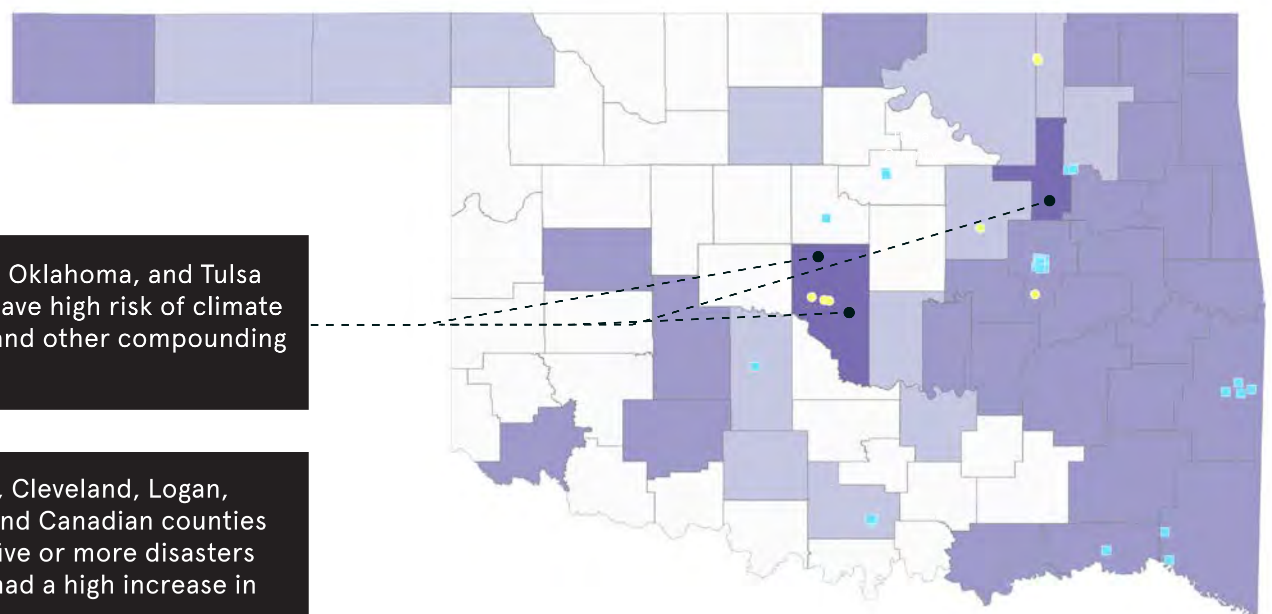
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Cleveland, Oklahoma, and Tulsa counties have high risk of climate disasters and other compounding risks.

Oklahoma, Cleveland, Logan, McClain, and Canadian counties have had five or more disasters and have had a high increase in poulation.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adair					6		3
Alfalfa							0
Atoka							0
Beaver					2		2
Beckham							0
Blaine							0
Bryan					2		3
Caddo					2		3
Canadian							0
Carter					2		2
Cherokee					6		3
Choctaw					3		3
Cimarron					2		3
Cleveland					1		4
Coal							0
Comanche					2		3
Cotton							0
Craig					3		3
Creek					3		2
Custer					1		3
Delaware					5		3
Dewey							0
Ellis							0
Garfield					3		2
Garvin							0
Grady					1		2
Grant							0
Greer							0
Harmon							0
Harper					2		2
Haskell					4		3
Hughes					1		3
Jackson					1		3
Jefferson							0
Johnston							0
Kay					3		3
Kingfisher							0
Kiowa							0
Latimer					1		3
Le Flore					4		3
Lincoln							0
Logan							0
Love							0
Major							0
Marshall							0
Mayes					3		3
McClain							0
McCurtain					1		3
McIntosh					5		3

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Muskogee					6		3
Noble							0
Nowata					1		3
Okfuskee					2		3
Oklahoma					8		4
Okmulgee					2		3
Osage					3		2
Ottawa					7		3
Pawnee							0
Payne							0
Pittsburg					4		3
Pontotoc					2		2
Pottawatomie					3		2
Pushmataha					2		3
Roger Mills							0
Rogers					2		2
Seminole					2		3
Sequoyah					3		3
Stephens					1		2
Texas					2		2
Tillman							0
Tulsa					6		4
Wagoner					2		3
Washington					3		2
Washita							0
Woods							0
Woodward							0

IMAGE RIGHT: WEBBERS FALLS, OKLAHOMA, INUNDATED BY A SWOLLEN ARKANSAS RIVER ON MAY 31, 2019 | STEVE PILTZ, NATIONAL WEATHER SERVICE TULSA, OKLAHOMA

OKLAHOMA

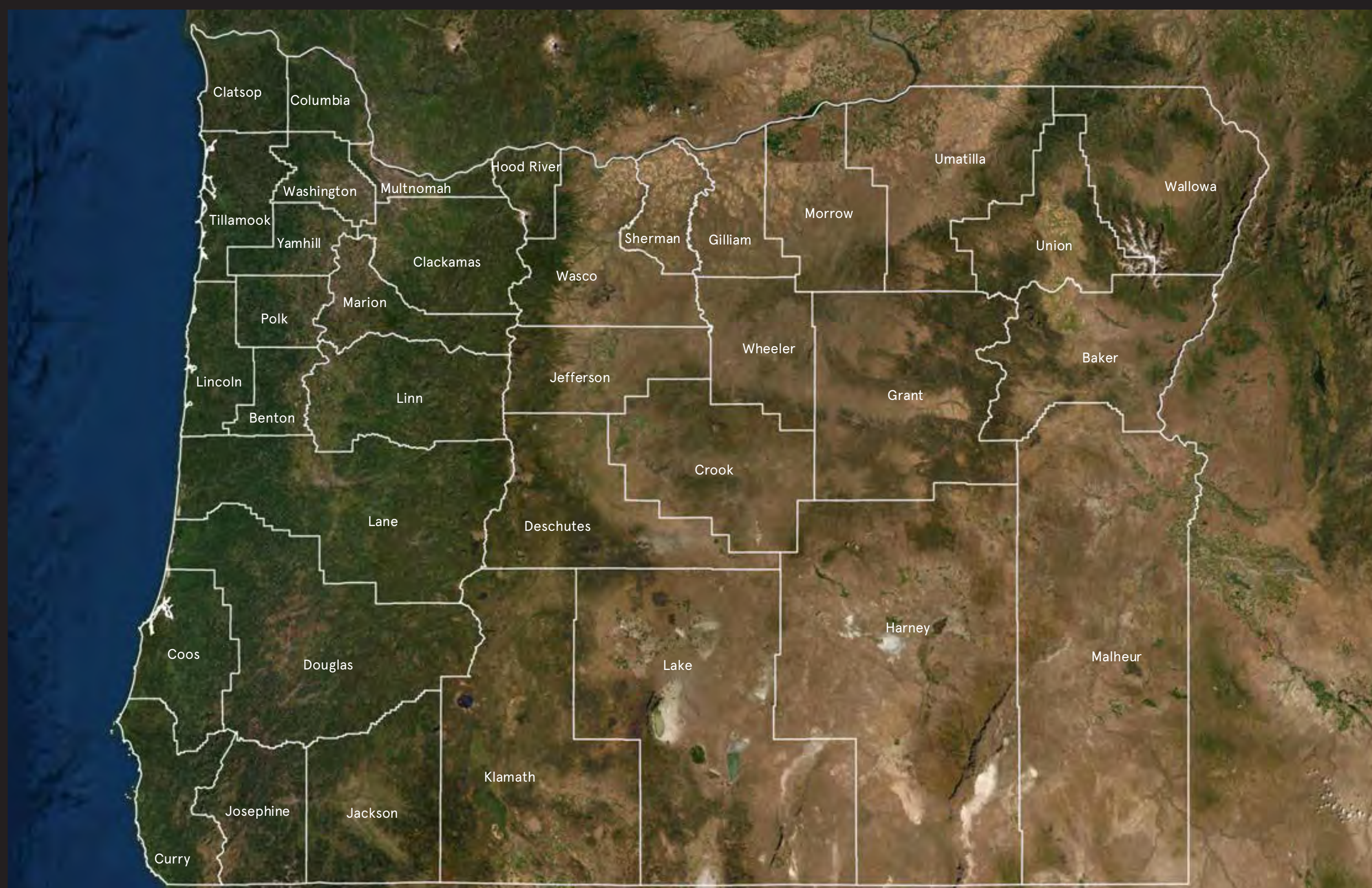
TOTAL: 22 DISASTERS
FEMA PA + HM: $667 M
HUD CDBG-DR: $182 M
FEMA + HUD ASSISTANCE: $849 M

			2011								2012			
			1970: SEVERE STORMS, TORNADOES, AND STRAIGHT-LINE WINDS		1985: SEVERE WINTER STORM AND SNOWSTORM		1988: SEVERE STORMS AND FLOODING		1989: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4064: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4078: FREEDOM AND NOBLE WILDFIRES	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	22	$382,478,313.98	$2,237,147.97	$143,501.87	$1,135,361.60	$21,956.66	$231,032.67	$81,187.68	$5,150,300.61	$135,810.81	$1,392,709.83	$31,791.00		
Adair County	6	$2,343,800					$335,630	$0						
Alfalfa County	9	$1,368,715									$0	$0		
Atoka County	5	$3,761,059	$2,634,157	$0										
Beaver County	5	$1,203,956												
Beckham County	8	$2,939,930												
Blaine County	8	$588,167							$87,304	$0				
Bryan County	4	$1,458,984												
Caddo County	9	$1,611,244							$0	$0				
Canadian County	8	$31,719,126							$422,983	$1,389,044				
Carter County	2	$1,915,111												
Cherokee County	7	$743,130					$156,339	$0						
Choctaw County	3	$1,021,044												
Cimarron County	2	$0												
Cleveland County	5	$32,698,400											$0	$0
Coal County	6	$581,818												
Comanche County	5	$6,098,021												
Cotton County	5	$3,521,958												
Craig County	10	$2,197,127			$89,768	$0			$201,798	$0	$92,642	$179,818		
Creek County	5	$1,420,167			$90,124	$0							$0	$0
Custer County	8	$8,399,754												
Delaware County	8	$2,007,481					$161,521	$0	$81,530	$0				
Dewey County	10	$7,418,604												
Ellis County	6	$478,626												
Garfield County	5	$2,121,307												
Garvin County	3	$963,393												
Grady County	8	$3,638,096							$68,770	$0				
Grant County	8	$3,061,263									$521,074	$0		
Greer County	5	$184,079												
Harmon County	4	$143,772												
Harper County	3	$443,045												
Haskell County	7	$2,582,879					$636,040	$0						
Hughes County	4	$2,755,361												
Jackson County	6	$2,657,055												
Jefferson County	4	$671,738			$19,880	$0			$27,179	$0				
Johnston County	3	$1,369,344												
Kay County	8	$6,310,372									$863,529	$0		
Kingfisher County	8	$1,617,617							$17,212	$0				
Kiowa County	7	$1,651,231												
Latimer County	4	$301,677												
Le Flore County	8	$2,274,265					$244,897	$0	$39,682	$0				
Lincoln County	7	$2,789,212												
Logan County	8	$6,393,873			$46,032	$0			$384,955	$0				
Love County	3	$269,007												
McClain County	5	$4,531,350							$677,166	$0				
McCurtain County	4	$1,392,468												
McIntosh County	5	$2,594,595					$1,067,367	$0						
Major County	9	$2,115,922							$9,693	$0				
Marshall County	2	$1,013,390												
Mayes County	6	$1,342,833			$111,782	$0								
Murray County	3	$783,872												
Muskogee County	7	$9,542,761					$354,893	$0						
Noble County	7	$341,391												
Nowata County	8	$2,129,916			$53,206	$0			$52,943	$0	$48,208	$0		
Okfuskee County	7	$4,930,438												
Oklahoma County	5	$29,747,179												
Okmulgee County	9	$4,538,458			$70,117	$0	$207,234	$0						
Osage County	6	$2,255,928			$60,939	$0			$0	$0				
Ottawa County	9	$3,049,871			$88,997	$99,624			$0	$0				
Pawnee County	4	$426,370			$36,402	$0								
Payne County	3	$1,605,292												
Pittsburg County	9	$3,822,044					$166,563	$0						
Pontotoc County	3	$1,215,949												
Pottawatomie County	6	$2,745,809			$106,688	$0								
Pushmataha County	8	$2,499,053	$0	$0										
Roger Mills County	10	$1,813,760												
Rogers County	5	$3,149,614			$275,891	$0								
Seminole County	3	$751,141												
Sequoyah County	6	$6,832,276					$364,079	$0						
Stephens County	6	$2,618,318			$191,756	$0								
Texas County	3	$330,643												
Tillman County	7	$2,805,264												
Tulsa County	4	$16,246,360			$998,531	$19,658								
Wagoner County	4	$1,219,372			$25,768	$0								
Washington County	3	$175,542			$89,140	$0								
Washita County	9	$5,744,120												
Woods County	6	$895,865												
Woodward County	5	$1,266,247												
Total FEMA Allocation		$666,646,532	$4,871,305	$143,502	$3,490,382	$141,239	$3,925,597	$81,188	$7,221,516	$1,524,855	$2,918,163	$211,609	$0	$0

	2013				2014		2015				2016				2017	
	4109: SEVERE WINTER STORM AND SNOWSTORM		4117: SEVERE STORMS, TORNADOES, AND FLOODING		4164: SEVERE WINTER STORM		4222: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4247: SEVERE WINTER STORMS AND FLOODING		4256: SEVERE WINTER STORMS AND FLOODING		4274: SEVERE STORMS AND FLOODING		4299: SEVERE WINTER STORM	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$54,416,008.77	$601,423.50	$15,409,207.74	$862,373.23	$2,182,195.68	$27,730.00	$10,962,663.58	$1,094,802.09	$16,629,632.41	$214,840.13	$35,473,020.44	$407,246.00	$190,402.33	$99,908.25	$119,245,415.37	$613,098.00
Adair County							$87,183	$0			$270,591	$1,286,534				
Alfalfa County	$13,604	$0							$84,032	$0	$0	$0				
Atoka County			$62,520	$0			$897,190	$0								
Beaver County	$281,025	$0													$726,497	$0
Beckham County	$41,158	$0					$229,478	$291,418	$80,487	$112,887	$27,162	$196,851			$0	$0
Blaine County	$87,201	$0							$143,989	$0	$125,850	$0			$21,024	$0
Bryan County							$925,926	$0	$355,349	$0						
Caddo County							$460,781	$0	$252,324	$0	$298,710	$0	$341,836	$0		
Canadian County			$1,332,061	$0			$800,718	$30,000	$5,004,376	$25,266	$135,005	$0				
Carter County							$1,907,065	$0								
Cherokee County							$0	$0			$64,590	$0				
Choctaw County					$526,133	$0	$494,910	$0								
Cimarron County																
Cleveland County			$23,725,072	$954,920			$1,911,319	$0								
Coal County			$99,406	$0			$198,831	$0			$123,615	$0				
Comanche County							$4,624,331	$0			$10,875	$0	$1,008,576	$0		
Cotton County							$2,316,060	$0			$0	$0	$264,473	$0		
Craig County			$75,138	$5,864			$169,274	$35,914			$166,895	$0				
Creek County							$458,315	$0								
Custer County	$600,248	$51,975					$1,723,441	$0	$169,622	$47,998	$3,942,382	$59,699				
Delaware County							$175,452	$160,428			$109,306	$148,683				
Dewey County	$907,317	$0					$470,349	$0	$1,385,203	$0	$983,289	$0			$336,013	$0
Ellis County	$103,415	$0							$0	$0					$278,071	$0
Garfield County	$79,359	$0							$1,024,206	$0						
Garvin County							$571,782	$0					$391,611	$0		
Grady County							$1,851,170	$0	$197,990	$0	$33,476	$138,925	$288,157	$0		
Grant County	$15,986	$0					$36,546	$0	$24,489	$0	$0	$0				
Greer County							$80,618	$0	$72,750	$0	$12,598	$0				
Harmon County							$124,969	$0			$0	$0				
Harper County															$308,900	$22,500
Haskell County			$143,876	$0			$1,141,941	$0			$277,463	$0				
Hughes County			$310,929	$0			$1,960,473	$0			$483,958	$0				
Jackson County							$1,886,975	$0			$222,445	$0	$69,427	$0		
Jefferson County							$624,679	$0								
Johnston County							$1,341,203	$0								
Kay County	$32,181	$47,690					$749,110	$0			$0	$1,501,496				
Kingfisher County	$9,466	$0					$54,175	$0	$82,975	$0	$41,649	$0				
Kiowa County							$973,846	$0	$0	$54,702	$0	$0				
Latimer County			$115,998	$0			$70,969	$0			$0	$0				
Le Flore County			$0	$483,289	$8,714	$0	$987,579	$21,519								
Lincoln County			$472,620	$844,264			$0	$958,437								
Logan County							$412,518	$3,099,510	$248,634	$0						
Love County							$227,840	$0								
McClain County			$286,913	$296,803			$2,451,865	$153,123								
McCurtain County					$162,096	$0	$573,612	$0			$656,760	$0				
McIntosh County			$336,862	$0			$901,284	$0			$286,382	$0				
Major County	$39,606	$0					$144,884	$1,120,756	$60,614	$18,000	$214,085	$0			$126,342	$130,029
Marshall County							$985,599	$27,790								
Mayes County							$211,874	$0			$231,130	$0				
Murray County							$764,508	$0								
Muskogee County							$879,462	$0			$376,496	$0				
Noble County	$0	$22,261					$28,308	$0			$0	$0				
Nowata County			$146,201	$0			$98,429	$0								
Okfuskee County			$600,652	$1,717,120			$909,512	$0			$32,279	$0				
Oklahoma County			$10,558,814	$974,005			$1,651,072	$1,036,696	$3,475,367	$0						
Okmulgee County			$246,628	$0			$1,323,863	$1,577,852			$409,003	$0				
Osage County											$0	$0				
Ottawa County			$12,851	$39,700			$138,673	$230,033			$74,017	$192,000				
Pawnee County																
Payne County																
Pittsburg County			$119,911	$0			$2,094,445	$0			$335,031	$0				
Pontotoc County							$972,306	$0								
Pottawatomie County			$721,926	$0			$1,364,583	$0								
Pushmataha County			$92,404	$0	$1,097,815	$0	$449,823	$0			$643,761	$0				
Roger Mills County	$277,211	$0					$572,017	$0	$237,819	$0	$189,813	$72,563			$0	$83,550
Rogers County							$0	$1,148,821								
Seminole County			$162,778	$0			$588,363	$0								
Sequoyah County							$1,530,092	$1,500			$727,696	$0				
Stephens County							$509,458	$36,071					$1,387,867	$0		
Texas County															$253,026	$0
Tillman County							$1,786,230	$0			$118,763	$0	$281,745	$0		
Tulsa County							$171,871	$248,063								
Wagoner County							$547,608	$0								
Washington County																
Washita County	$0	$15,713					$1,158,690	$0	$70,707	$26,011	$2,923,441	$158,108				
Woods County	$327,626	$0							$9,120	$0	$0	$0			$33,588	$0
Woodward County	$424,654	$0													$552,784	$0
Total FEMA Allocation	$57,656,065	$739,062	$55,032,768	$6,178,338	$3,976,955	$27,730	$64,718,108	$11,272,732	$29,609,684	$499,704	$50,021,535	$4,162,104	$4,224,095	$99,908	$121,881,660	$849,177

	2017				2018		2019						2020		2021	
	4315: SEVERE STORMS, TORNADOES, AND FLOODING		4324: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4373: WILDFIRES		4438: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING		4453: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4456: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING		4575: SEVERE WINTER STORM		4587: SEVERE WINTER STORMS	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$80,077,965.00	$698,629.25	$1,559,053.36	$274,633.25	$4,773,232.66	$97,760.48	$9,607,888.00	$482,398.04	$887,520.20	$160,083.48	$256,752.01	$0.00	$13,855,568.71	$112,704.52	$593,773.63	$49,583.17
Adair County	$183,521	$0					$180,342	$0							$0	$0
Alfalfa County			$0	$0			$1,240,368	$0	$10,517	$0			$0	$0	$20,195	$0
Atoka County									$143,046	$0					$24,146	$0
Beaver County	$0	$0					$158,919	$37,515							$0	$0
Beckham County			$288,073	$0			$1,672,416	$0							$0	$0
Blaine County							$23,528	$0					$99,272	$0	$0	$0
Bryan County									$156,019	$0					$21,690	$0
Caddo County	$0	$0					$47,344	$0					$210,249	$0	$0	$0
Canadian County							$2,634,379	$0					$19,800,936	$0	$144,356	$0
Carter County															$8,047	$0
Cherokee County	$409,701	$0	$0	$0			$0	$112,500							$0	$0
Choctaw County															$0	$0
Cimarron County	$0	$0													$0	$0
Cleveland County													$6,048,381	$0	$58,707	$0
Coal County			$81,372	$0					$66,743	$0					$11,850	$0
Comanche County													$349,575	$0	$104,664	$0
Cotton County			$941,424	$0											$0	$0
Craig County	$470,662	$0					$696,792	$0	$12,565	$0					$0	$0
Creek County							$871,728	$0							$0	$0
Custer County					$0	$0	$1,749,367	$0					$50,148	$0	$4,875	$0
Delaware County	$818,635	$0	$20,177	$0			$331,750	$0							$0	$0
Dewey County	$1,446,726	$0			$431,330	$0	$1,448,152	$0					$10,225	$0	$0	$0
Ellis County							$97,140	$0					$0	$0	$0	$0
Garfield County							$904,727	$37,500					$75,515	$0	$0	$0
Garvin County															$0	$0
Grady County							$228,471	$0					$826,880	$0	$4,256	$0
Grant County							$2,400,183	$0					$11,686	$0	$51,299	$0
Greer County							$18,113	$0							$0	$0
Harmon County					$18,803	$0									$0	$0
Harper County							$111,646	$0							$0	$0
Haskell County	$383,559	$0					$0	$0							$0	$0
Hughes County															$0	$0
Jackson County							$412,529	$0					$65,679	$0	$0	$0
Jefferson County															$0	$0
Johnston County			$28,142	$0											$0	$0
Kay County							$3,023,465	$90,000	$0	$0			$0	$0	$2,901	$0
Kingfisher County							$1,280,181	$0					$131,958	$0	$0	$0
Kiowa County	$20,488	$0					$583,103	$0					$19,092	$0	$0	$0
Latimer County															$114,711	$0
Le Flore County			$274,527	$0			$214,057	$0							$0	$0
Lincoln County	$86,561	$0					$405,935	$0	$5,658	$0			$15,737	$0	$0	$0
Logan County	$86,870	$0					$1,126,234	$0					$989,120	$0	$0	$0
Love County									$41,168	$0					$0	$0
McClain County													$665,479	$0	$0	$0
McCurtain County															$0	$0
McIntosh County															$2,698	$0
Major County									$234,394	$0			$17,521	$0	$0	$0
Marshall County															$0	$0
Mayes County	$40,050	$56,339					$691,659	$0							$0	$0
Murray County			$19,364	$0											$0	$0
Muskogee County	$325,505	$0	$364,238	$0			$5,022,264	$2,144,903							$75,000	$0
Noble County							$177,247	$0	$0	$0			$113,575	$0	$0	$0
Nowata County							$1,690,766	$14,175	$25,988	$0					$0	$0
Okfuskee County			$409,587	$0			$1,073,968	$0	$187,322	$0					$0	$0
Oklahoma County													$11,824,422	$0	$226,803	$0
Okmulgee County			$124,835	$0			$575,363	$0	$0	$0					$3,564	$0
Osage County							$1,311,166	$0	$883,822	$0					$0	$0
Ottawa County	$214,083	$21,303					$1,120,662	$580,959	$232,877	$0					$4,093	$0
Pawnee County	$180,915	$0					$209,053	$0					$0	$0	$0	$0
Payne County							$1,204,560	$0					$400,732	$0	$0	$0
Pittsburg County	$411,289	$0	$121,752	$0			$415,014	$0	$154,024	$0					$4,014	$0
Pontotoc County			$243,643	$0											$0	$0
Pottawatomie County							$171,618	$0					$380,994	$0	$0	$0
Pushmataha County							$61,031	$0	$154,219	$0					$0	$0
Roger Mills County			$0	$0	$89,261	$0	$254,027	$37,500					$0	$0	$0	$0
Rogers County	$300,048	$0					$1,424,855	$0							$0	$0
Seminole County															$0	$0
Sequoyah County	$299,274	$3,261,972					$640,685	$0							$6,977	$0
Stephens County									$284,737	$0			$131,667	$76,763	$0	$0
Texas County	$77,616	$0													$0	$0
Tillman County							$174,969	$0	$443,557	$0			$0	$0	$0	$0
Tulsa County	$69,354	$855,799					$13,355,475	$206,306							$321,302	$0
Wagoner County							$533,496	$112,500							$0	$0
Washington County							$86,401	$0							$0	$0
Washita County	$19,456	$90,932	$70,958	$0			$1,210,105	$0					$0	$0	$0	$0
Woods County							$525,532	$0							$0	$0
Woodward County					$0	$0	$288,809	$0							$0	$0
Total FEMA Allocation	$85,922,280	$4,984,975	$4,547,145	$274,633	$5,312,627	$97,760	$63,687,480	$3,856,256	$3,924,175	$160,083	$256,752	$0	$56,094,412	$189,467	$1,809,922	$49,583

OREGON

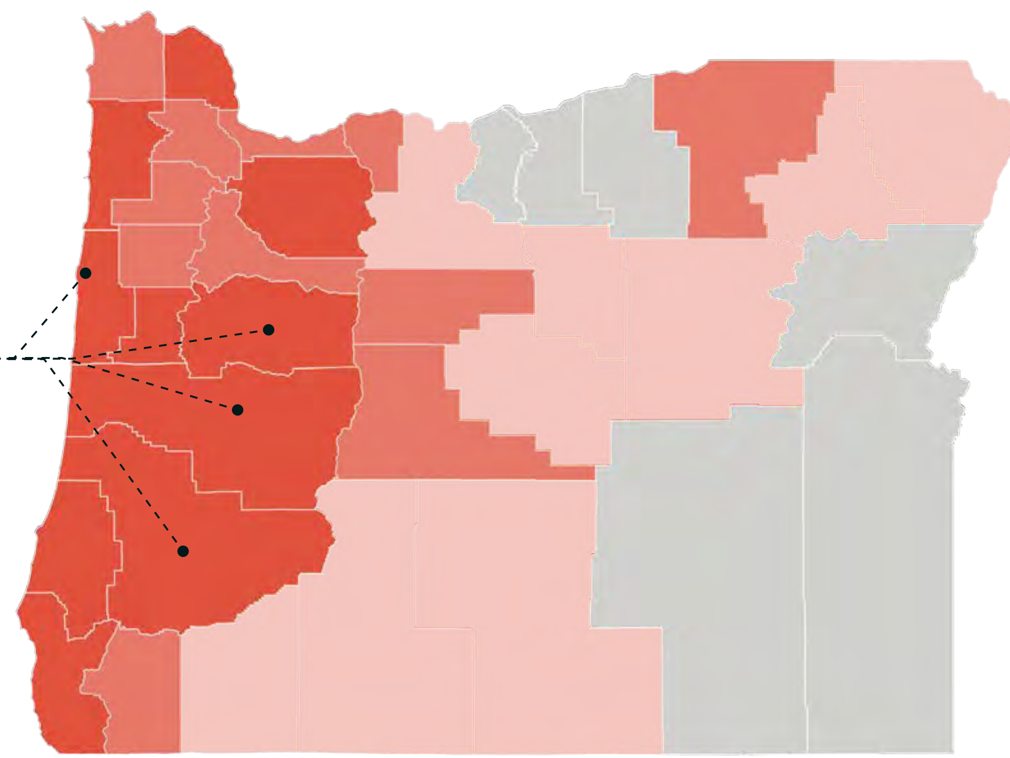


OREGON STATISTICS SUMMARY (2011 – 2021)	
12	CLIMATE DISASTER DECLARATIONS
LINN, LINCOLN, LANE, DOUGLAS	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
6	COUNTIES WITH FIVE OR MORE DISASTERS
6	SUPERFUND SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
MULTNOMAH	HIGHEST COMPOUNDING RISKS
$879 MILLION	FEMA + HUD POST-DISASTER FUNDING
4.2 MILLION	POPULATION TOTAL
$210	PER CAPITA SPENDING ON CLIMATE DISASTERS
$3.2 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

12
disaster declarations



Linn, Lincoln, Lane, and Douglas counties have each had six disaster declarations.

Thirty out of 36 counties in Oregon have had a recent disaster declaration.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

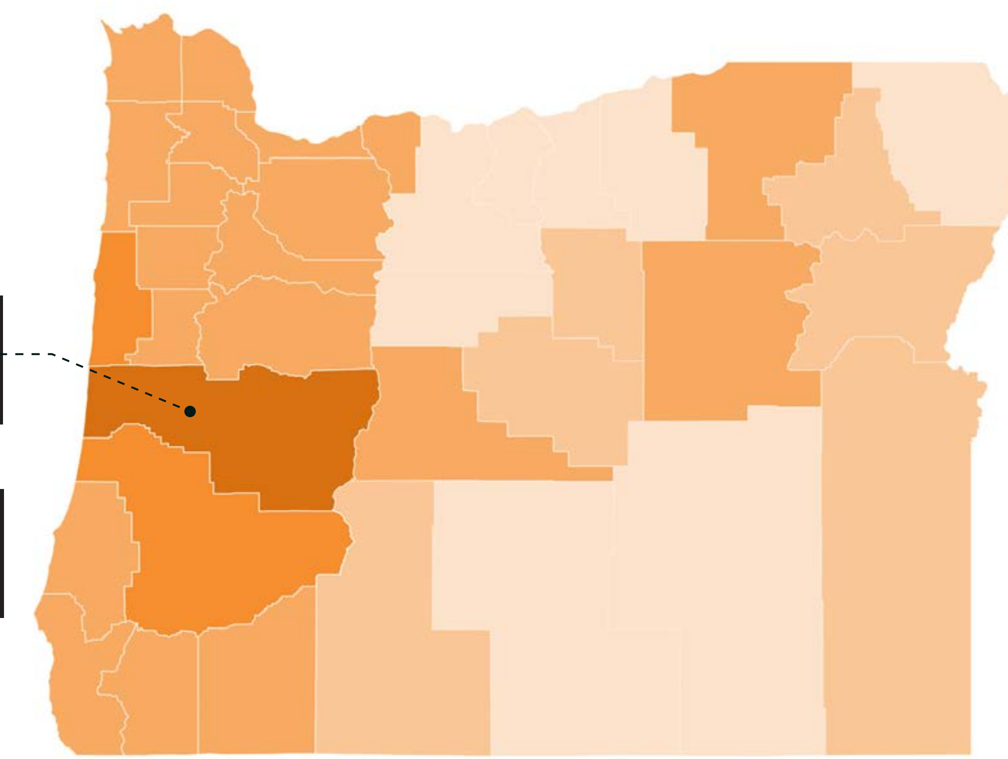
- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$879M
post-disaster assistance



Lane County has received the most post-disaster federal funding in the state: $66 million.

The costliest event in Oregon was due to fire and straightline winds in 2020.

Public Assistance and Hazard Mitigation

Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

$457M FEMA obligations

$422M HUD CDBG-DR Funds

$879M FEMA + HUD assistance

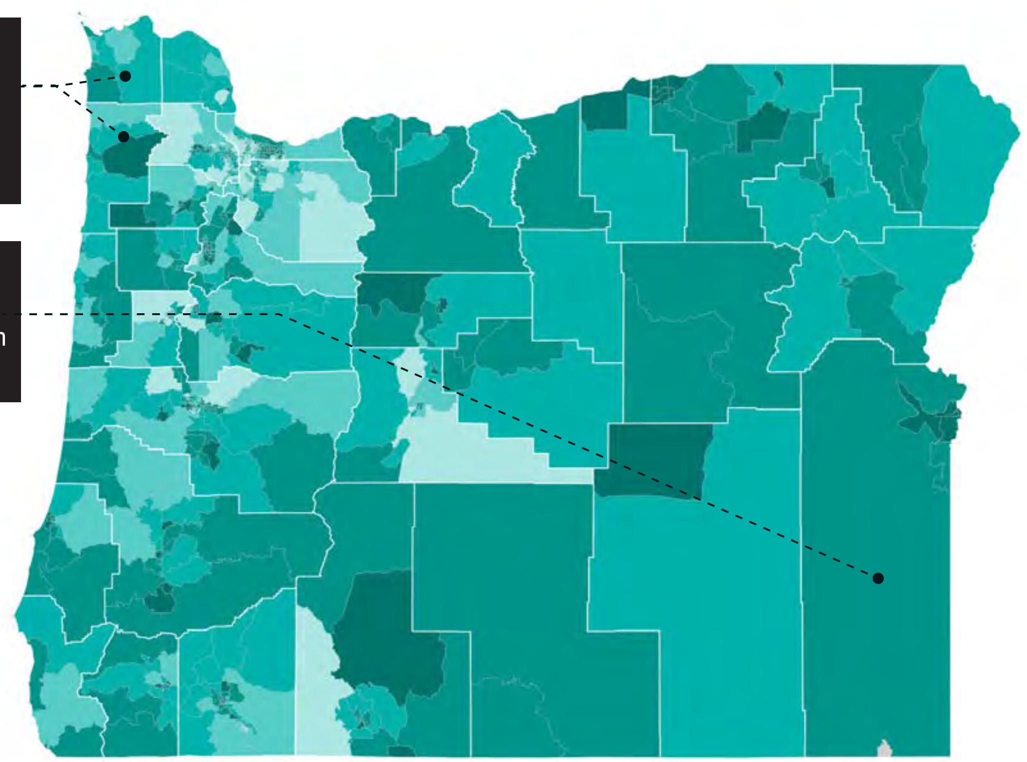
$210 per capita cost

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Clatsop and Tillamook counties have already received high post-disaster support and will see future impacts due to sea level rise.

Malheur County has high poverty, a high diversity of climate risks, and has had low investments from previous disasters.



Social Vulnerability Index

CDC (2018)

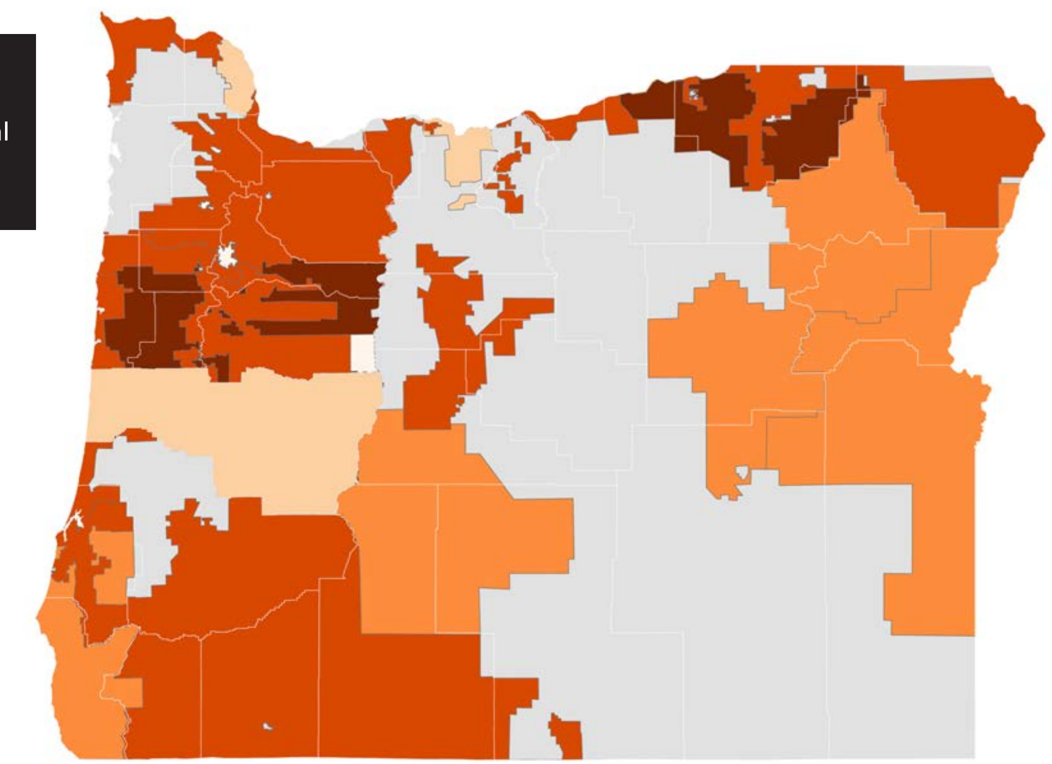
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Jefferson, Klamath, Marion, Umatilla, and Wasco counties have populations with high social vulnerability and low energy reliability.



Aggregated Annual Electric Outage Duration

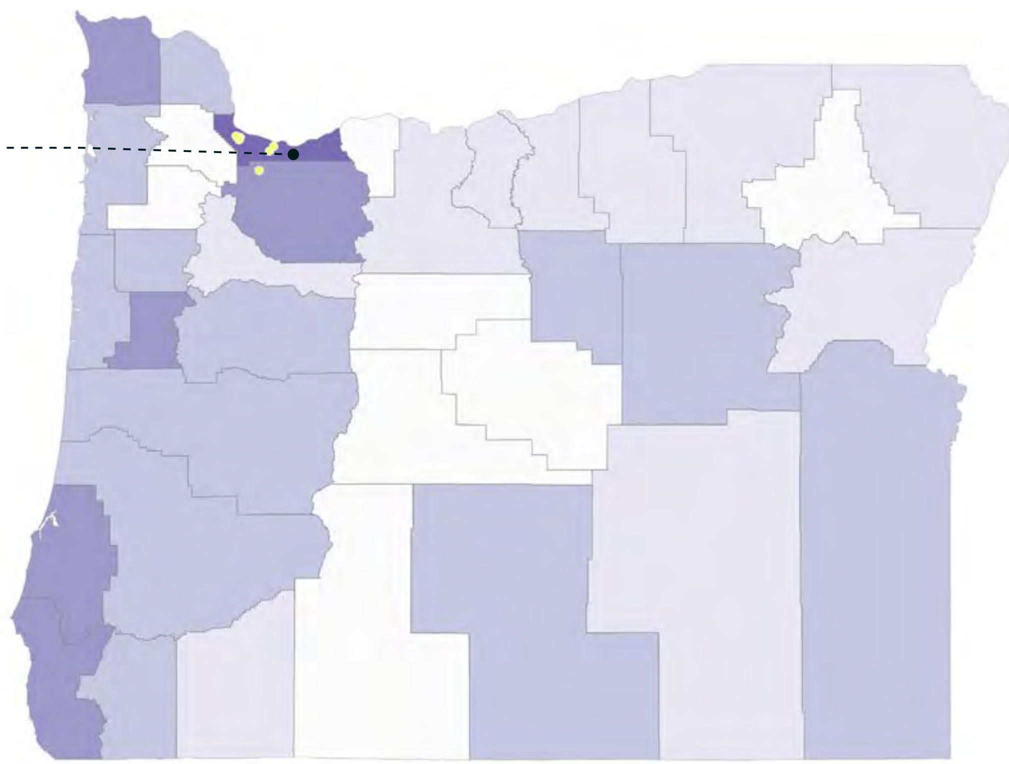
Including major events - SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Multnomah County has high risk of climate disasters, high population density, and high population change.



County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Baker					1		1
Benton					1		3
Clackamas					1		3
Clatsop					3		3
Columbia					1		2
Coos					4		3
Crook							0
Curry					3		3
Deschutes							0
Douglas					2		2
Gilliam					1		1
Grant					1		2
Harney					1		1
Hood River							0
Jackson					2		1
Jefferson							0
Josephine					2		2
Klamath							0
Lake					1		2
Lane					3		2
Lincoln					4		2
Linn					1		2
Malheur					3		2
Marion					1		1
Morrow					1		1
Multnomah					2		4
Polk					1		2
Sherman					1		1
Tillamook					3		2
Umatilla					3		1
Union							0
Wallowa					1		1
Wasco					2		1
Washington							0
Wheeler					1		2
Yamhill							0

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

OREGON

TOTAL: 12 DISASTERS
FEMA PA + HM: $457 M
HUD CDBG-DR: $422 M
FEMA + HUD ASSISTANCE: $879 M

			2011				2012		2014		2016		2017				2019				2020				2021	
			1956: SEVERE WINTER STORM, FLOODING, MUDSLIDES, LANDSLIDES, AND DEBRIS FLOWS		1964: TSUNAMI WAVE SURGE		4055: SEVERE WINTER STORM, FLOODING, LANDSLIDES, AND MUDSLIDES		4169: SEVERE WINTER STORM		4258: SEVERE WINTER STORMS, STRAIGHT-LINE WINDS, FLOODING, LANDSLIDES, AND MUDSLIDES		4296: SEVERE WINTER STORM AND FLOODING		4328: SEVERE WINTER STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4432: SEVERE WINTER STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4452: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4519: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4562: WILDFIRES AND STRAIGHT-LINE WINDS		4599: OR WINTER STORM 02-13-2021	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	12	$300,303,342	$211,475	$46,014	$195,953	$56,486	$1,899,881	$333,911	$790,085	$45,813	$4,478,343	$519,693	$436,094	$127,695	$94,921	$73,510	$1,347,879	$239,764	$618,913	$176,866	$410,308	$0	$287,697,665	$0	$502,074	$0
Baker County	0	$0																								
Benton County	4	$2,614,418					$1,404,332	$782,238	$101,789	$0													$66,559	$259,500	$0	$0
Clackamas County	4	$6,466,391	$1,752,802	$641,167							$2,225,728	$0											$755,547	$0	$1,091,147	$0
Clatsop County	2	$1,115,194	$230,926	$0							$884,268	$0														
Columbia County	4	$3,378,615					$222,135	$300,298			$1,840,501	$225,000			$790,681	$0							$0	$0		
Coos County	5	$1,912,975			$133,638	$0	$154,723	$134,217			$996,459	$92,655					$281,282	$0					$120,000	$0		
Crook County	1	$193,411	$151,741	$41,670																						
Curry County	5	$9,808,937			$5,092,839	$474,652	$391,312	$192,707			$1,190,296	$749,165					$734,327	$0	$983,639	$0						
Deschutes County	2	$2,023,284													$1,853,349	$0	$101,940	$0					$67,995	$0		
Douglas County	6	$15,985,626	$107,608	$0			$586,245	$0			$3,046,044	$0					$10,769,166	$245,880	$190,987	$0			$927,947	$111,750		
Gilliam County	0	$0																								
Grant County	1	$1,215,260																	$1,215,260	$0						
Harney County	0	$0																								
Hood River County	2	$704,155					$562,840	$0							$141,315	$0										
Jackson County	1	$4,076,871																					$4,076,871	$0		
Jefferson County	2	$0															$0	$0					$0	$0		
Josephine County	3	$1,682,311											$1,450,955	$0	$54,108	$84,428							$92,819	$0		
Klamath County	1	$115,763																					$115,763	$0		
Lake County	1	$28,466																					$28,466	$0		
Lane County	6	$66,167,918					$1,040,761	$77,903	$5,169,277	$762,063	$1,877,394	$126,773	$11,512,070	$249,516			$15,350,161	$481,467					$28,178,892	$1,341,641		
Lincoln County	6	$10,875,227	$770,524	$0	$189,394	$680,478	$5,063,171	$630,361	$132,702	$64,470	$1,784,726	$1,020,807					$36,261	$0					$400,817	$101,517		
Linn County	6	$5,530,967					$1,065,832	$168,781	$170,720	$0	$1,349,532	$187,317							$270,829	$0			$2,186,473	$0	$131,483	$0
Malheur County	0	$0																								
Marion County	3	$4,350,637					$1,809,424	$202,370															$2,216,075	$0	$122,768	$0
Morrow County	0	$0																								
Multnomah County	2	$3,225,534									$3,225,534	$0											$0	$0		
Polk County	3	$2,218,099					$801,381	$108,049			$1,256,276	$0													$52,393	$0
Sherman County	0	$0																								
Tillamook County	4	$5,896,416	$765,064	$0			$85,183	$0			$4,217,371	$275,963											$552,835	$0		
Umatilla County	2	$3,315,758																	$1,045,435	$300,000	$1,970,323	$0				
Union County	1	$371,203																			$371,203	$0				
Wallowa County	1	$0																			$0	$0				
Wasco County	1	$0																					$0	$0		
Washington County	2	$1,614,407									$472,875	$0											$1,141,531	$0		
Wheeler County	1	$300,468																	$300,468	$0						
Yamhill County	3	$1,074,440									$867,605	$0											$19,604	$0	$187,232	$0
Total FEMA Allocation		$456,566,092	$3,990,138	$728,851	$5,611,823	$1,211,616	$15,087,219	$2,930,835	$6,364,573	$872,346	$29,712,952	$3,197,373	$13,399,119	$377,211	$2,934,374	$157,938	$28,621,016	$967,111	$4,625,531	$476,866	$2,751,834	$0	$328,645,860	$1,814,408	$2,087,098	$0

PENNSYLVANIA

PENNSYLVANIA STATISTICS SUMMARY (2011 - 2021)	
9	CLIMATE DISASTER DECLARATIONS
NORTHAMPTON, SULLIVAN	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
6	COUNTIES WITH FIVE OR MORE DISASTERS
224	SUPERFUND SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
PHILADELPHIA	HIGHEST COMPOUNDING RISKS
$630 MILLION	FEMA + HUD POST-DISASTER FUNDING
12.8 MILLION	POPULATION TOTAL
$49	PER CAPITA SPENDING ON CLIMATE DISASTERS
$10.4 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

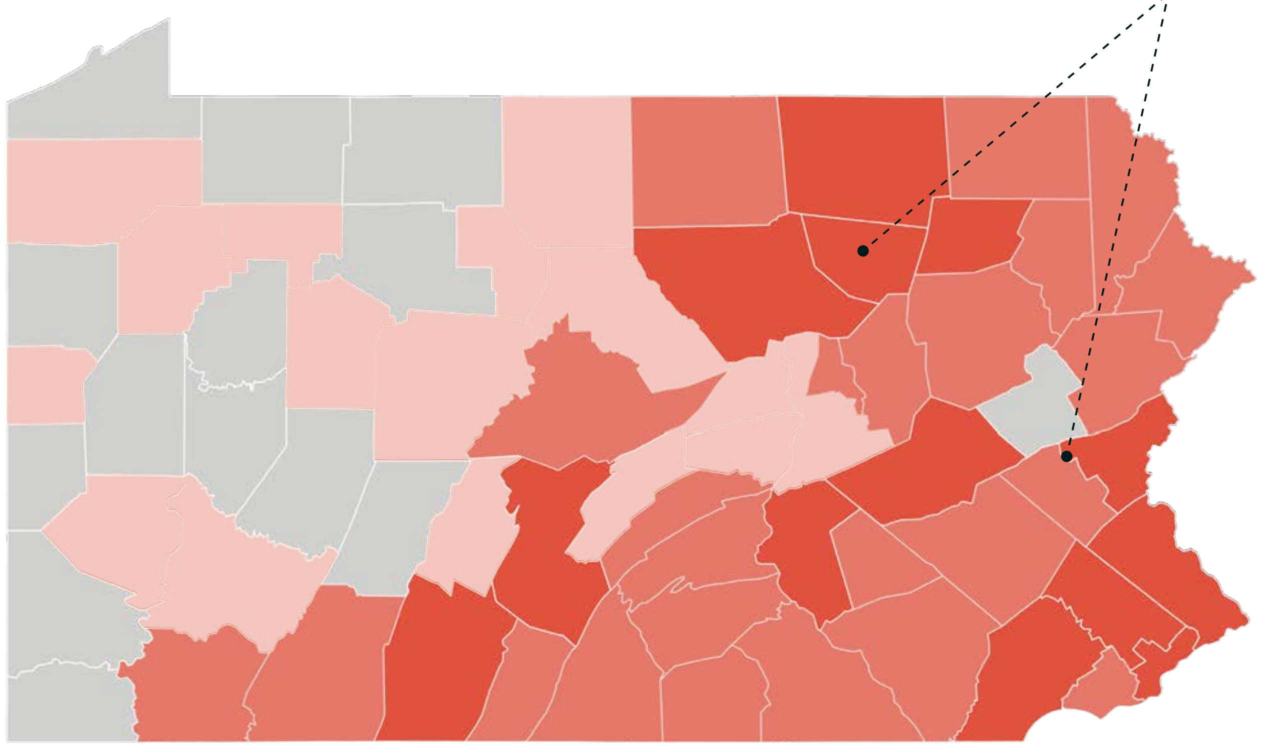
DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

9
disaster
declarations

Fifty-three out of 67 counties in Pennsylvania have had a recent disaster.

Northampton and Sullivan counties have each had six recent disasters.



Number of Disaster Events

Major Disaster Declarations
(2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

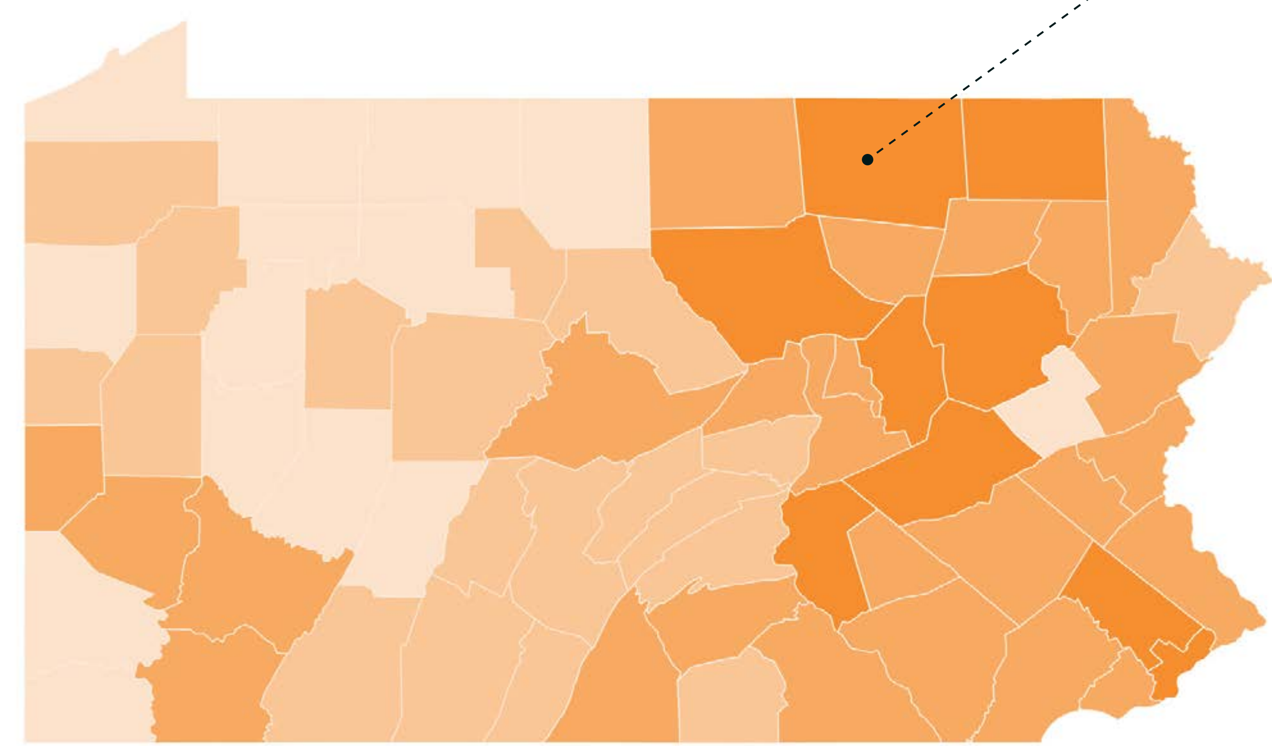
Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$630M
post-disaster
assistance

Bradford County has received the highest post-disaster federal funding in the state: $30 million.



Public Assistance and Hazard Mitigation

Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

$411M FEMA obligations

$218M HUD CDBG-DR Funds

$630M FEMA + HUD assistance

$49.20 per capita cost

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Social Vulnerability Index

CDC (2018)

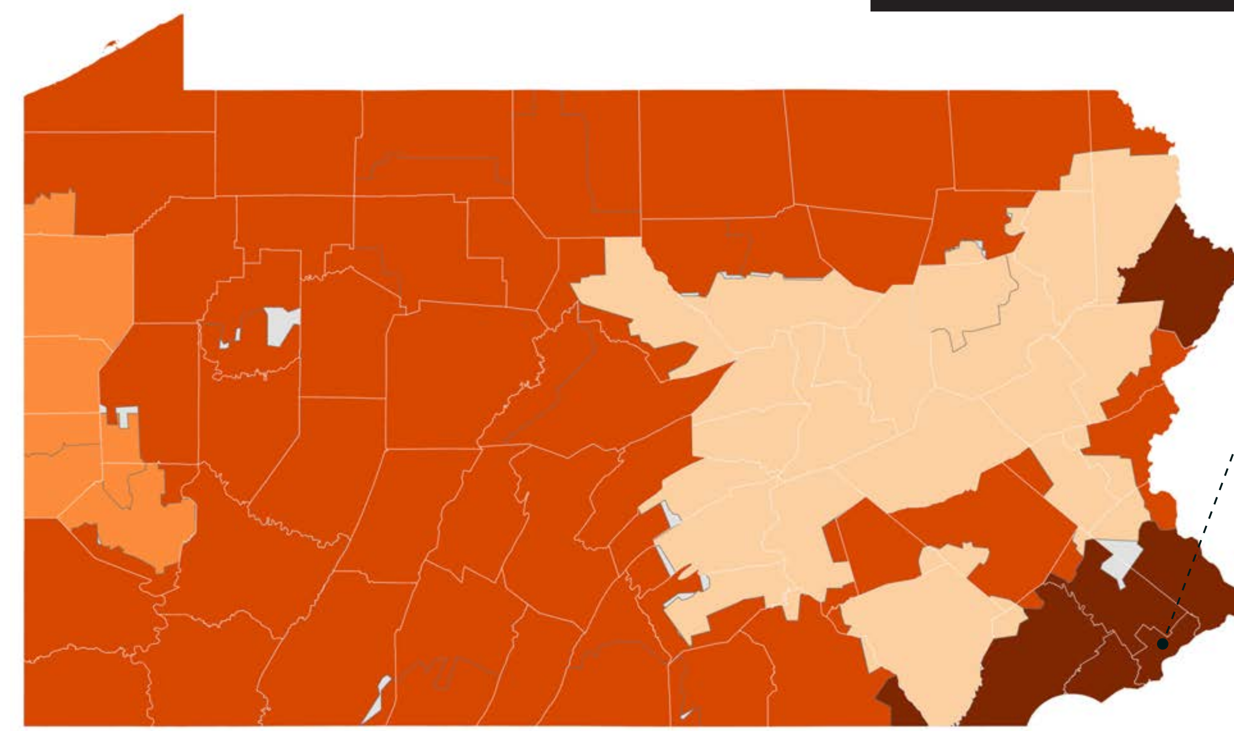
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Philadelphia County has high social vulnerability and low energy reliability.



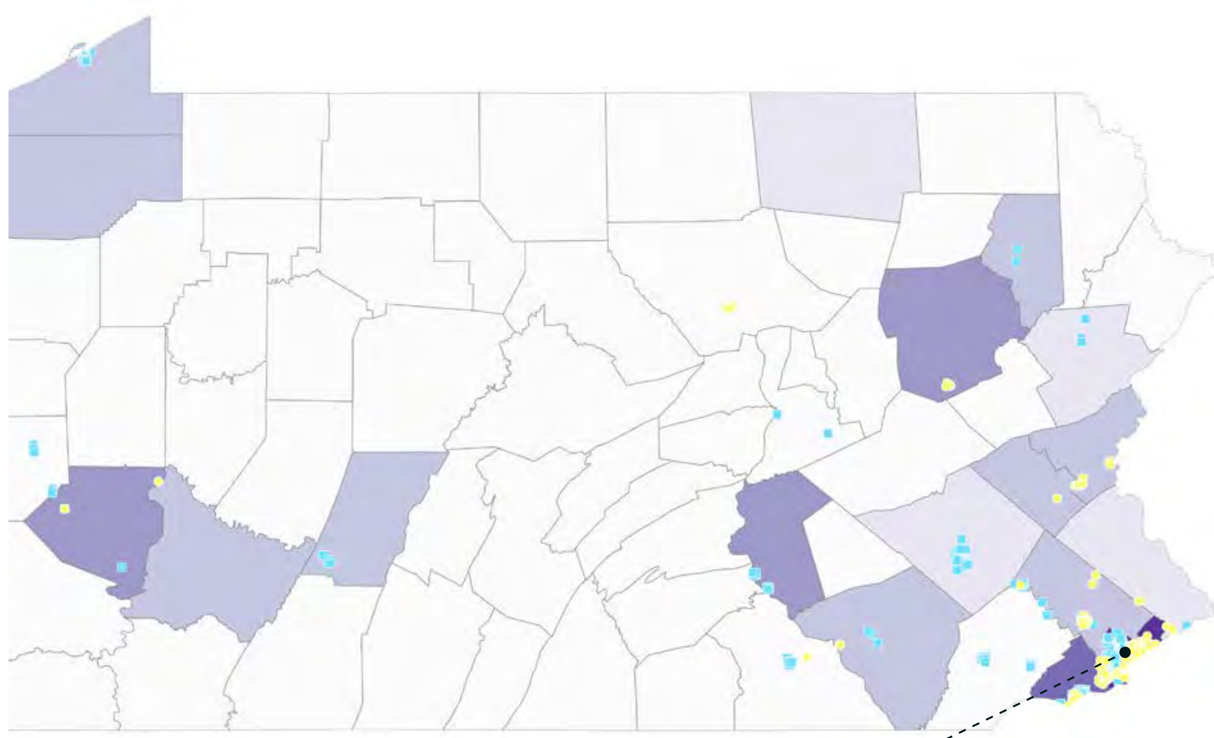
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Philadelphia County has high risk of climate hazards, high population density, high health risks, high poverty, and risk of sea level rise.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adams							0
Allegheny					3		3
Armstrong							0
Beaver							0
Bedford							0
Berks					5		1
Blair							0
Bradford					1		1
Bucks							1
Butler							0
Cambria					1		2
Cameron							0
Carbon							0
Centre							0
Chester							0
Clarion							0
Clearfield							0
Clinton							0
Columbia							0
Crawford					2		2
Cumberland							0
Dauphin					1		3
Delaware					3		4
Elk							0
Erie					1		2
Fayette							0
Forest							0
Franklin							0
Fulton							0
Greene							0
Huntingdon							0
Indiana							0
Jefferson							0
Juniata							0
Lackawanna					1		2
Lancaster					1		2
Lawrence							0
Lebanon							0
Lehigh					3		2
Luzerne					2		3
Lycoming							0
McKean							0
Mercer							0
Mifflin							0
Monroe					1		1
Montgomery					1		2
Montour							0
Northampton					1		2
Northumberland							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Perry							0
Philadelphia					8		5
Pike							0
Potter							0
Schuylkill							0
Snyder							0
Somerset							0
Sullivan							0
Susquehanna							0
Tioga							0
Union							0
Venango							0
Warren							0
Washington							0
Wayne							0
Westmoreland					2		2
Wyoming							0
York							0

IMAGE RIGHT: MORE THAN 650 MEMBERS OF BOTH THE PENNSYLVANIA AIR AND ARMY NATIONAL GUARD WERE PLACED ON STATE ACTIVE DUTY TO SUPPORT PENNSYLVANIA EMERGENCY MANAGEMENT AGENCY-DIRECTED MISSIONS THROUGHOUT THE STATE DURING WINTER STORM STELLA. | PENNSYLVANIA NATIONAL GUARD

PENNSYLVANIA

TOTAL: 9 DISASTERS
FEMA PA + HM: $411 M
HUD CDBG-DR: $218 M
FEMA + HUD ASSISTANCE: $630 M

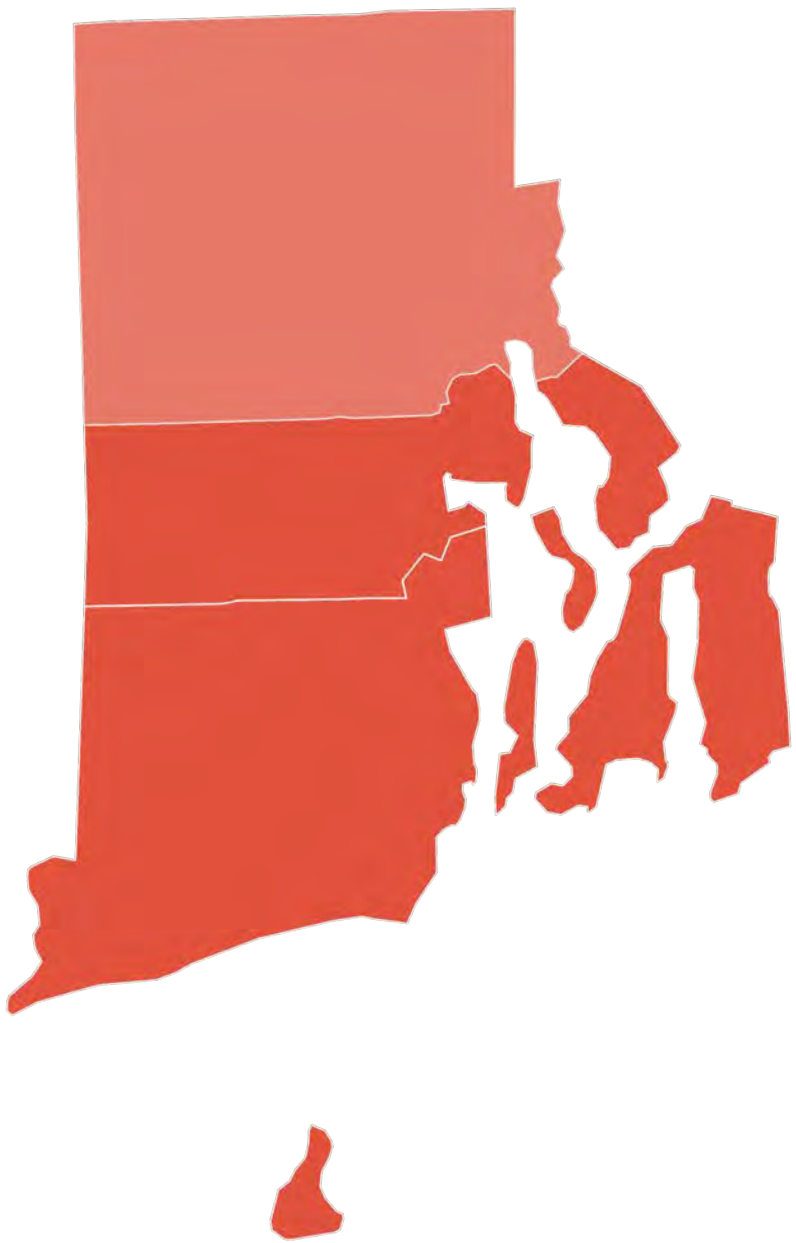
			2011						2013				2016				2018		2021	
			4003: SEVERE STORMS AND FLOODING		4025: HURRICANE IRENE		4030: TROPICAL STORM LEE		4099: HURRICANE SANDY		4149: SEVERE STORMS, TORNADOES, AND FLOODING		4267: SEVERE WINTER STORM AND SNOWSTORM		4292: SEVERE STORMS AND FLOODING		4408: SEVERE STORMS AND FLOODING		4618: REMNANTS OF HURRICANE IDA	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	9	$137,432,781	$1,413,797	$51,670	$12,881,126	$548,537	$44,749,110	$2,961,218	$2,929,242	$92,328	$3,445,698	$89,489	$12,237,338	$508,087	$18,499,708	$205,159	$35,528,047	$1,292,226		
Adams County	2	$882,697					$355,794	$0					$526,903	$0						
Allegheny County	1	$3,399,684									$3,194,523	$205,161								
Armstrong County	0	$0																		
Beaver County	0	$0																		
Bedford County	4	$569,917					$238,264	$0	$89,538	$0			$242,115	$0					$0	$0
Berks County	2	$3,423,899					$1,852,273	$0					$1,571,626	$0						
Blair County	1	$328,289											$294,000	$34,290						
Bradford County	4	$29,487,619	$4,205,675	$0			$8,975,159	$480,719							$1,985,532	$0	$12,612,439	$1,228,096		
Bucks County	5	$7,345,687			$1,116,242	$6,619	$1,228,372	$0	$2,331,978	$0			$2,662,476	$0					$0	$0
Butler County	0	$0																		
Cambria County	0	$0																		
Cameron County	1	$11,874							$11,874	$0										
Carbon County	0	$0																		
Centre County	2	$3,030,790									$551,113	$0			$2,479,676	$0				
Chester County	4	$4,638,502			$1,296,021	$76,515	$315,100	$245,926					$2,704,939	$0					$0	$0
Clarion County	0	$0																		
Clearfield County	1	$474,468									$474,468	$0								
Clinton County	1	$231,010									$231,010	$0								
Columbia County	2	$18,025,141					$5,670,498	$5,048,267									$3,692,539	$3,613,837		
Crawford County	1	$543,145									$543,145	$0								
Cumberland County	2	$995,068					$0	$0					$995,068	$0						
Dauphin County	4	$23,307,725					$16,451,669	$4,512,120	$179,117	$241,825			$1,922,994	$0					$0	$0
Delaware County	3	$1,627,632			$1,145,730	$0	$0	$481,902											$0	$0
Elk County	0	$0																		
Erie County	0	$0																		
Fayette County	2	$3,938,339									$1,147,411	$65,974	$546,836	$2,178,118						
Forest County	1	$0							$0	$0										
Franklin County	2	$800,377							$145,533	$0			$654,844	$0						
Fulton County	3	$166,893							$15,206	$36,000			$115,687	$0					$0	$0
Greene County	0	$0																		
Huntingdon County	4	$449,275					$268,213	$25,114	$0	$0	$155,948	$0							$0	$0
Indiana County	0	$0																		
Jefferson County	1	$512,012									$512,012	$0								
Juniata County	3	$569,317					$450,348	$0	$20,330	$0			$98,640	$0						
Lackawanna County	2	$3,710,095					$699,145	$39,750									$2,971,200	$0		
Lancaster County	2	$7,256,297					$5,318,297	$0					$1,938,000	$0						
Lawrence County	1	$421,331									$421,331	$0								
Lebanon County	2	$4,453,209					$2,275,332	$1,650,322					$527,555	$0						
Lehigh County	2	$2,410,423			$606,739	$0							$1,803,684	$0						
Luzerne County	3	$21,861,319			$1,340,095	$877,139	$13,372,177	$6,271,907											$0	$0
Lycoming County	4	$12,320,498	$296,037	$0			$4,762,026	$2,532,578							$2,424,137	$0	$1,595,545	$710,175		
McKean County	0	$0																		
Mercer County	0	$0																		
Mifflin County	1	$288,285					$288,285	$0												
Monroe County	3	$978,341			$513,426	$0	$0	$0	$464,915	$0										
Montgomery County	5	$19,713,873			$2,710,701	$3,358,514	$2,696,526	$4,722,247	$2,306,032	$332,291			$3,587,563	$0					$0	$0
Montour County	2	$9,555,019					$8,060,384	$28,506									$690,757	$775,373		
Northampton County	6	$4,975,162			$1,360,256	$0	$487,677	$0	$1,097,600	$0			$1,504,906	$0			$524,723	$0	$0	$0
Northumberland County	1	$8,568,531					$8,454,661	$113,870												
Perry County	2	$332,583					$116,712	$0					$215,871	$0						
Philadelphia County	5	$9,675,428			$1,230,813	$0	$0	$0	$2,233,707	$0			$6,210,908	$0					$0	$0
Pike County	2	$385,338			$250,731	$0			$134,608	$0										
Potter County	1	$54,507							$54,507	$0										
Schuylkill County	4	$13,681,658					$3,779,799	$27,126					$683,040	$105,252			$9,086,440	$0	$0	$0
Snyder County	1	$346,331					$188,352	$157,979												
Somerset County	2	$955,038							$564,560	$38,700			$351,778	$0						
Sullivan County	6	$8,171,992	$300,366	$0	$105,354	$50,860	$3,912,598	$23,325	$82,976	$0					$1,604,118	$0	$2,092,396	$0		
Susquehanna County	3	$15,916,011			$237,981	$67,502	$3,283,384	$110,962									$11,111,558	$1,104,624		
Tioga County	3	$3,488,083	$2,841,303	$0			$418,736	$0									$228,044	$0		
Union County	1	$610,038					$435,138	$174,900												
Venango County	1	$269,841									$269,841	$0								
Warren County	0	$0																		
Washington County	0	$0																		
Wayne County	3	$1,496,490			$70,943	$0	$237,074	$38,717			$1,149,756	$0								
Westmoreland County	1	$1,076,534											$1,076,534	$0						
Wyoming County	5	$8,620,153	$332,429	$0	$772,699	$0	$4,036,755	$2,653,648	$5,122	$0							$819,500	$0		
York County	3	$7,244,828					$4,646,771	$54,865					$2,145,890	$397,302					$0	$0
Total FEMA Allocation		$411,029,377	$9,389,606	$51,670	$25,638,857	$4,985,686	$148,024,629	$32,355,968	$12,666,844	$741,144	$12,096,257	$360,624	$44,619,195	$3,223,049	$26,993,171	$205,159	$80,953,188	$8,724,330	$0	$0

RHODE ISLAND

RHODE ISLAND STATISTICS SUMMARY (2011 – 2021)	
4	CLIMATE DISASTER DECLARATIONS
EVERY	COUNTY HAS HAD A DISASTER OCCURENCE
12	SUPERFUND SITES
C-	ASCE INFRASTRUCTURE REPORT CARD GRADE
PROVIDENCE	HIGHEST COMPOUNDING RISKS
$56.3 MILLION	FEMA + HUD POST-DISASTER FUNDING
1 MILLION	POPULATION TOTAL
$53	PER CAPITA SPENDING ON CLIMATE DISASTERS
$1.1 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY



4
disaster declarations

All 5 counties in Rhode Island have had recent disasters.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurences
- 7–9 occurences
- 10+ occurences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$56.3M
post-disaster assistance

Providence County has received the highest post-disaster federal funding in the state: $11 million.

$36.4M	FEMA obligations
$19.9M	HUD CDBG-DR Funds
$56.3M	FEMA + HUD assistance
$53	per capita cost

Public Assistance and Hazard Mitigation

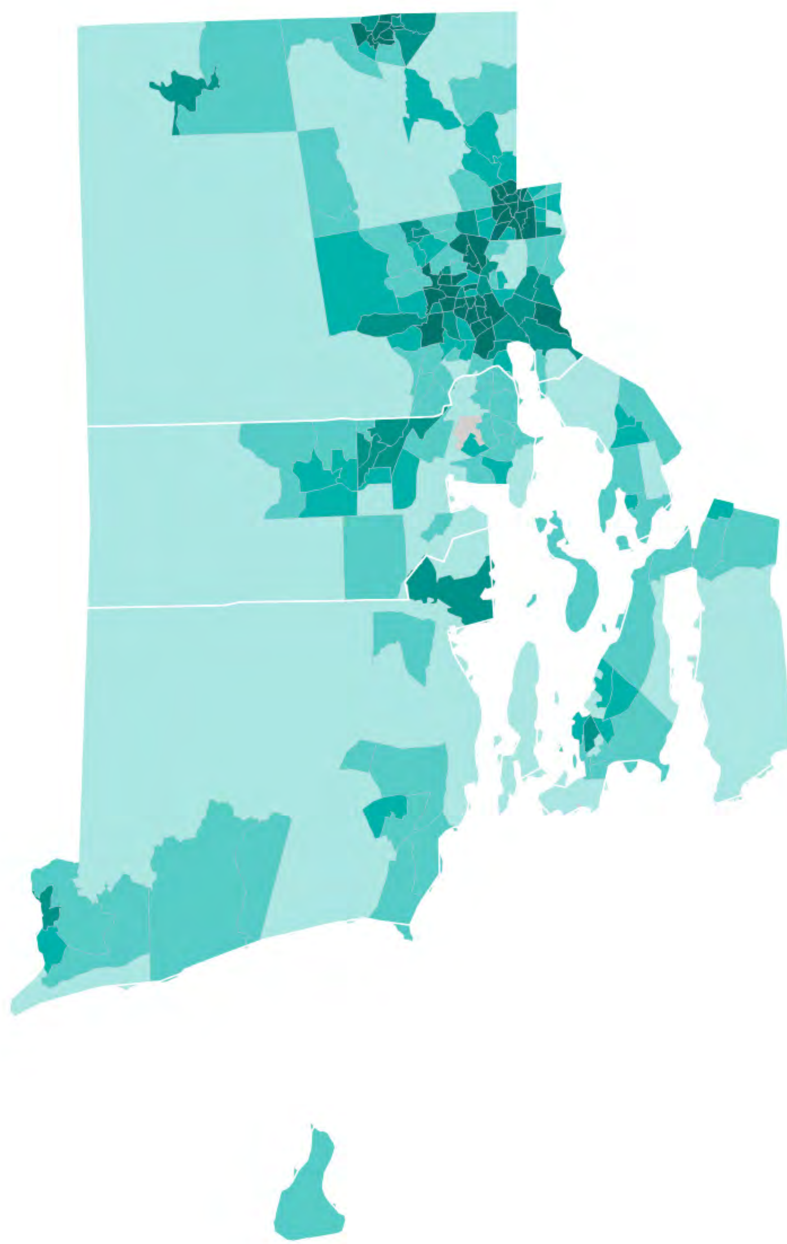
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

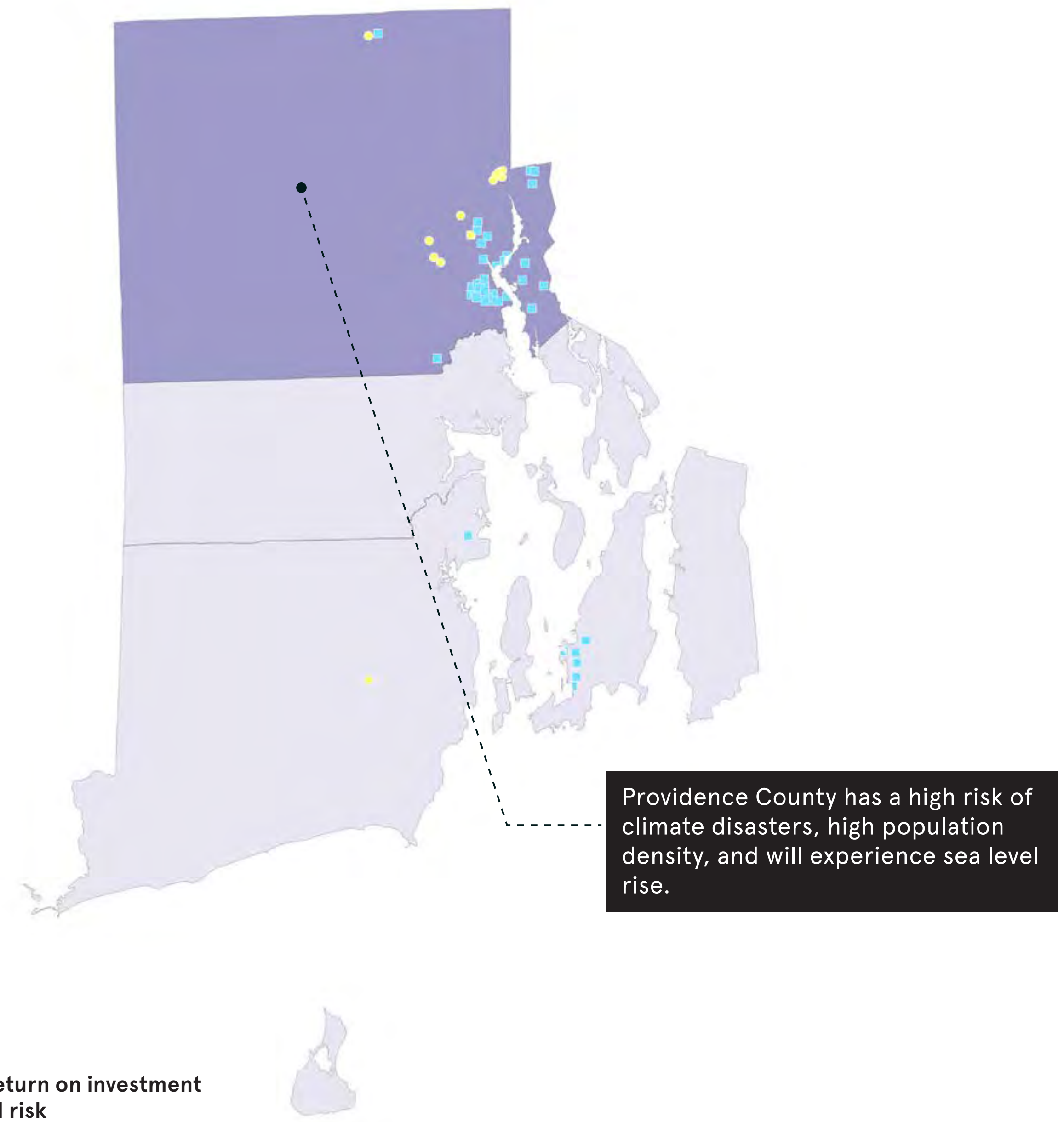
Rhode Island has longer than average energy outage periods.

Aggregated Annual Electric Outage Duration
Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Bristol							1
Kent							1
Newport							1
Providence					2		3
Washington							1

RHODE ISLAND

TOTAL: 4 DISASTERS FEMA PA + HM: $36.4 M HUD CDBG-DR: $19.9 M FEMA + HUD ASSISTANCE: $56M			2011 4027: TROPICAL STORM IRENE		2012 4089: HURRICANE SANDY		2013 4107: SEVERE WINTER STORM AND SNOWSTORM		2015 4212: SEVERE WINTER STORM AND SNOWSTORM	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	4	$10,010,221	$1,142,656	$78,676	$2,528,678	$74,614	$2,790,068	$52,350	$3,336,693	$6,487
Bristol County	4	$1,947,907	$644,337	$0	$373,694	$0	$301,250	$363,721	$178,629	$86,277
Kent County	4	$3,136,530	$1,135,274	$13,300	$491,228	$35,216	$742,714	$0	$689,346	$29,453
Newport County	4	$2,515,919	$497,717	$33,830	$1,171,792	$0	$350,707	$0	$461,874	$0
Providence County	3	$11,107,408	$4,216,795	$39,738			$2,802,582	$254,037	$3,450,681	$343,575
Washington County	4	$7,707,288	$704,515	$746,681	$4,168,912	$504,939	$927,724	$35,250	$619,267	$0
Total FEMA Allocation		$36,425,274	$8,341,293	$912,226	$8,734,303	$614,769	$7,915,044	$705,358	$8,736,490	$465,792

FEMA / STATE DISASTER RECOVERY CENTER IS SET UP AT THE WAKEFIELD MALL TO PROVIDE HELP TO THOSE AFFECTED BY FLOODS TO APPLY FOR IDENTIFICATION CARDS ENABLING THEM TO RE-ENTER THEIR COMMUNITY TO CHECK THEIR HOMES FOR DAMAGE. | MICHAEL RIEGER/FEMA

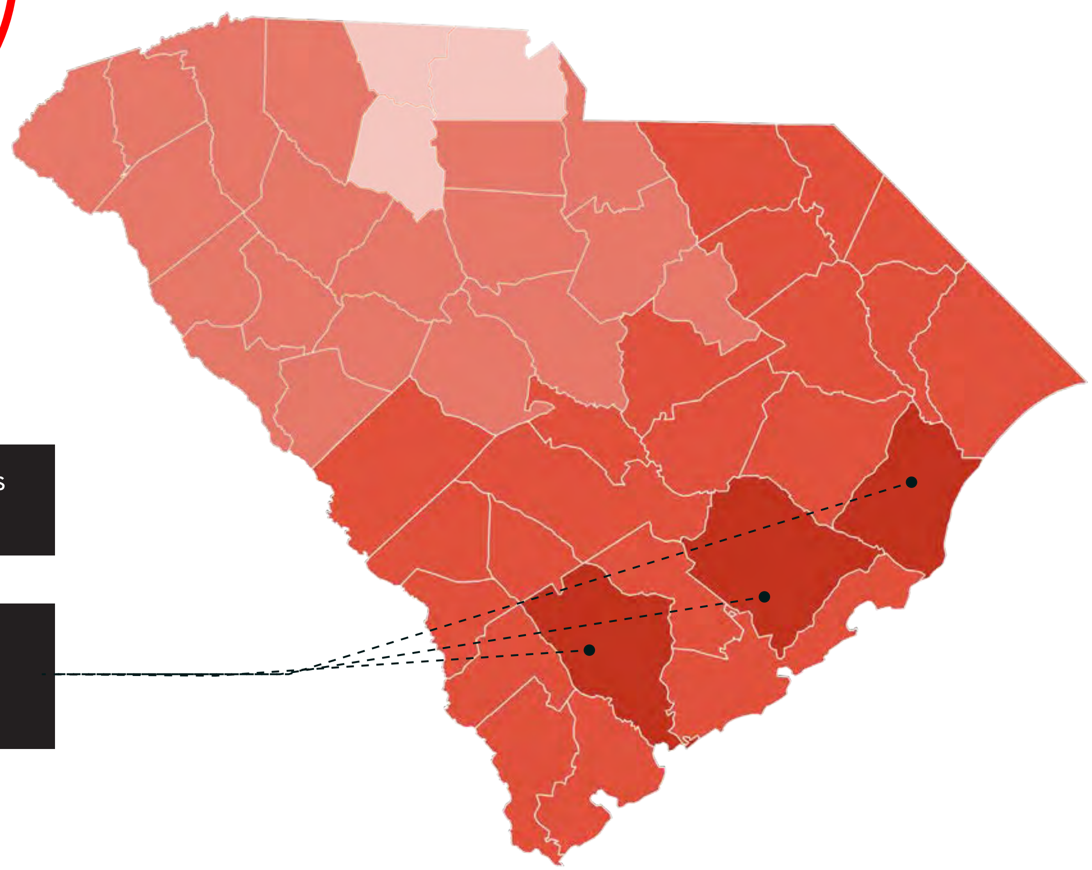
SOUTH CAROLINA

SOUTH CAROLINA STATISTICS SUMMARY (2011 - 2021)	
8	CLIMATE DISASTER DECLARATIONS
EVERY	COUNTY HAS HAD A DISASTER OCCURENCE
BERKELEY, COLLETON, GEORGETOWN	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
20	COUNTIES WITH FIVE OR MORE DISASTERS
138	WASTEWATER DISCHARGE SITES
53	SUPERFUND SITES
D+	ASCE INFRASTRUCTURE REPORT CARD GRADE
DILLON, FLORENCE, HORRY	HIGHEST COMPOUNDING RISKS
$1.5 BILLION	FEMA + HUD POST-DISASTER FUNDING
5 MILLION	POPULATION TOTAL
$289	PER CAPITA SPENDING ON CLIMATE DISASTERS
$4.4 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

8
disaster declarations



Every county in South Carolina has had a recent disaster declaration.

Berkeley, Colleton, and Georgetown counties have each had seven disasters.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

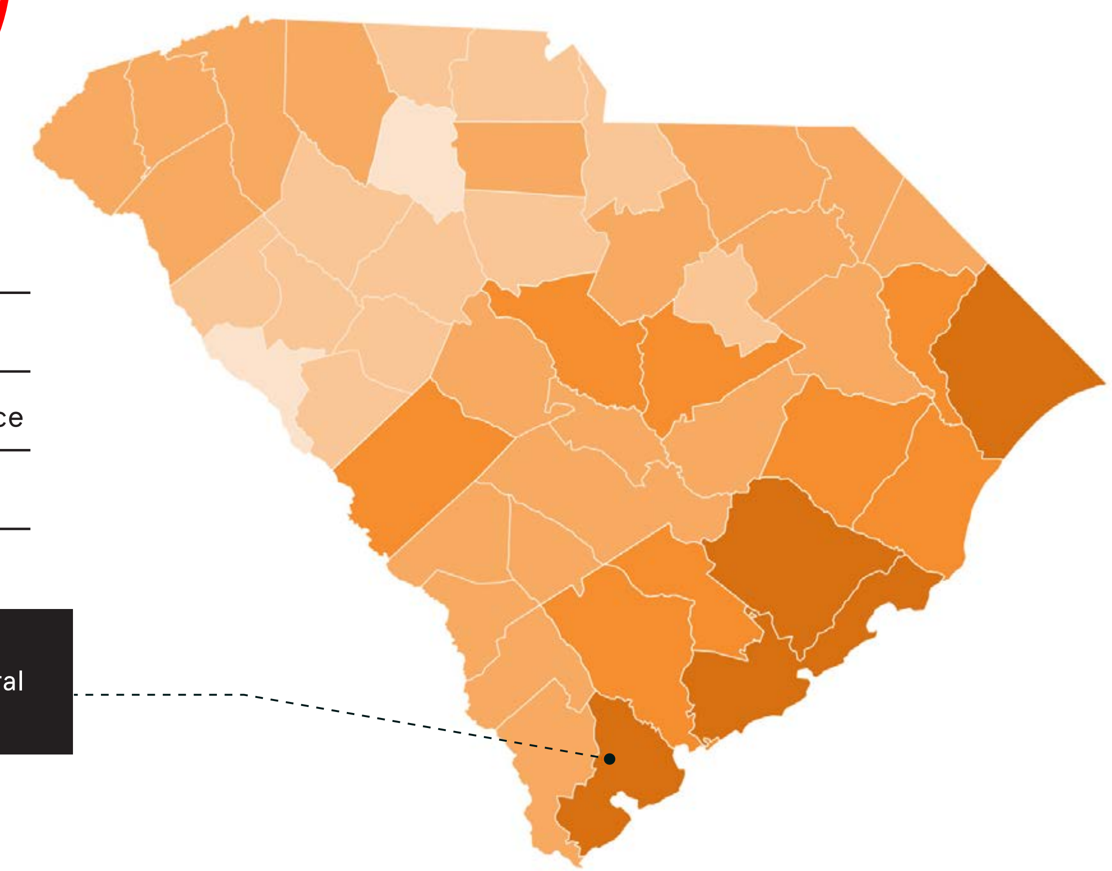
$1.5B
post-disaster assistance

$883M FEMA obligations

$589M HUD CDBG-DR Funds

$1.5B FEMA + HUD assistance

$289 per capita cost



Beaufort County has received the highest post-disaster federal funding: over $77 million.

Public Assistance and Hazard Mitigation

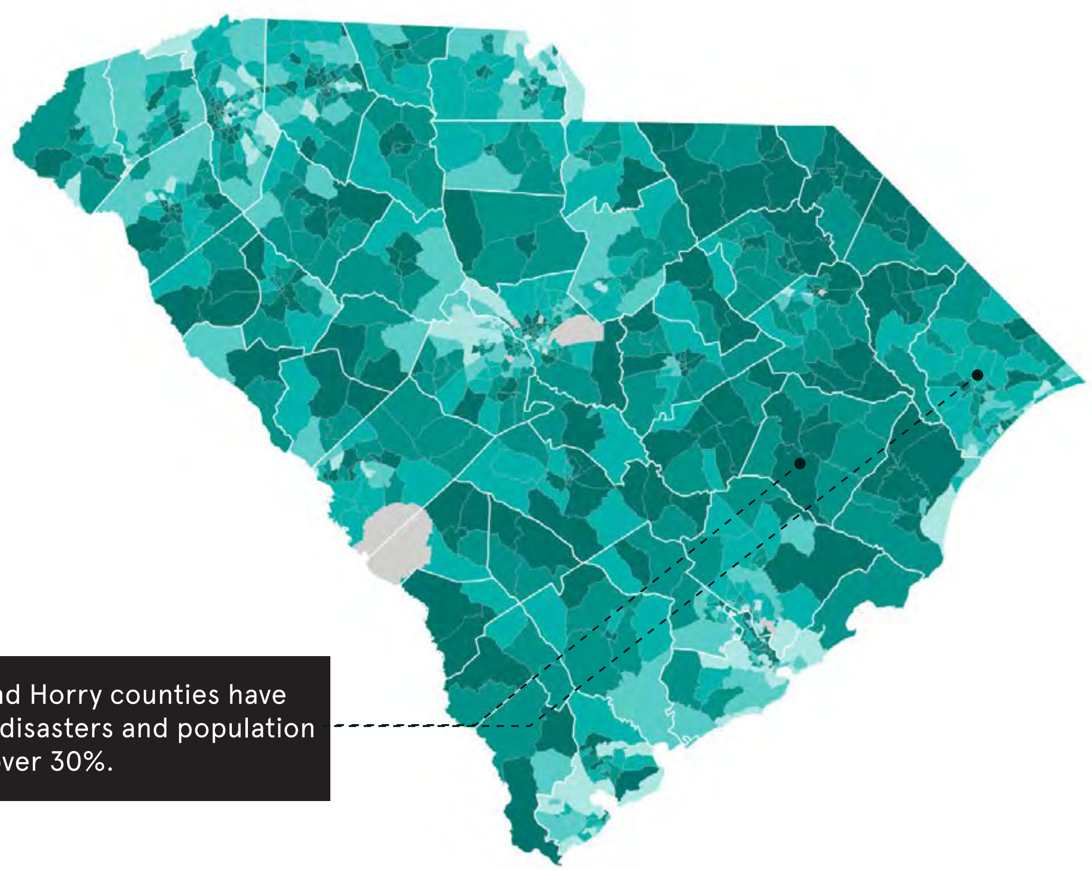
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

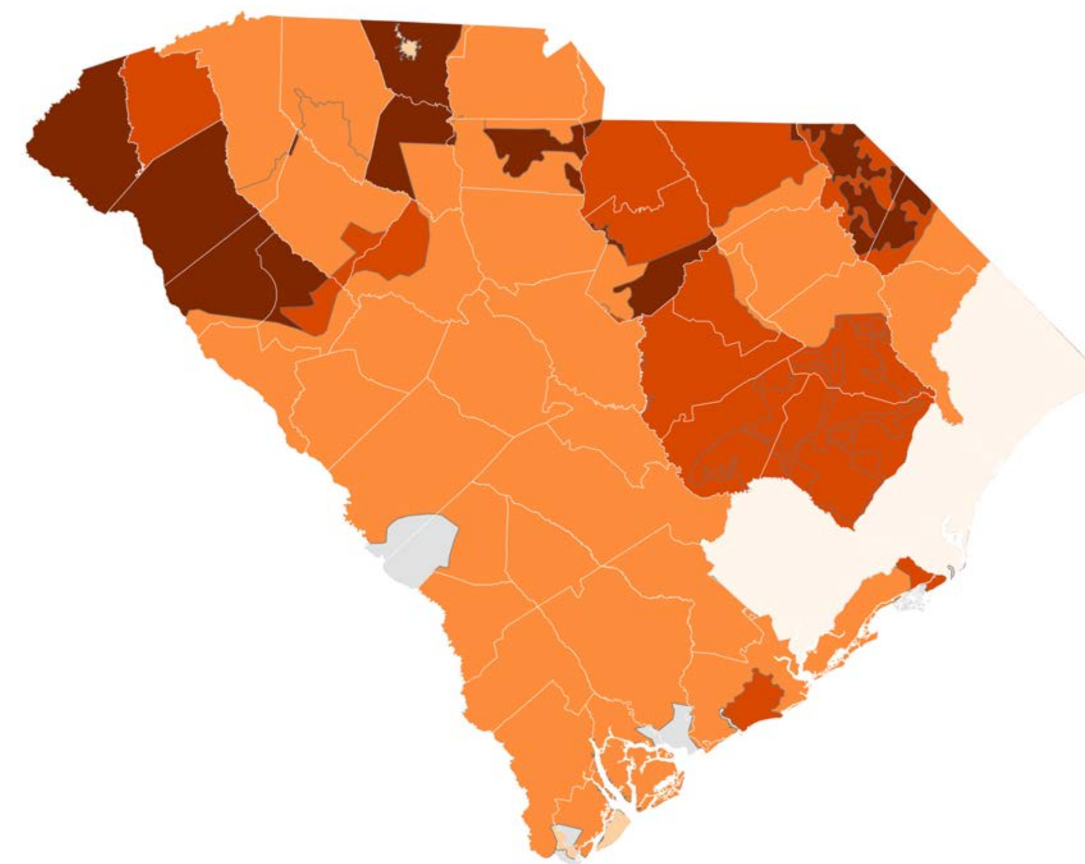
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

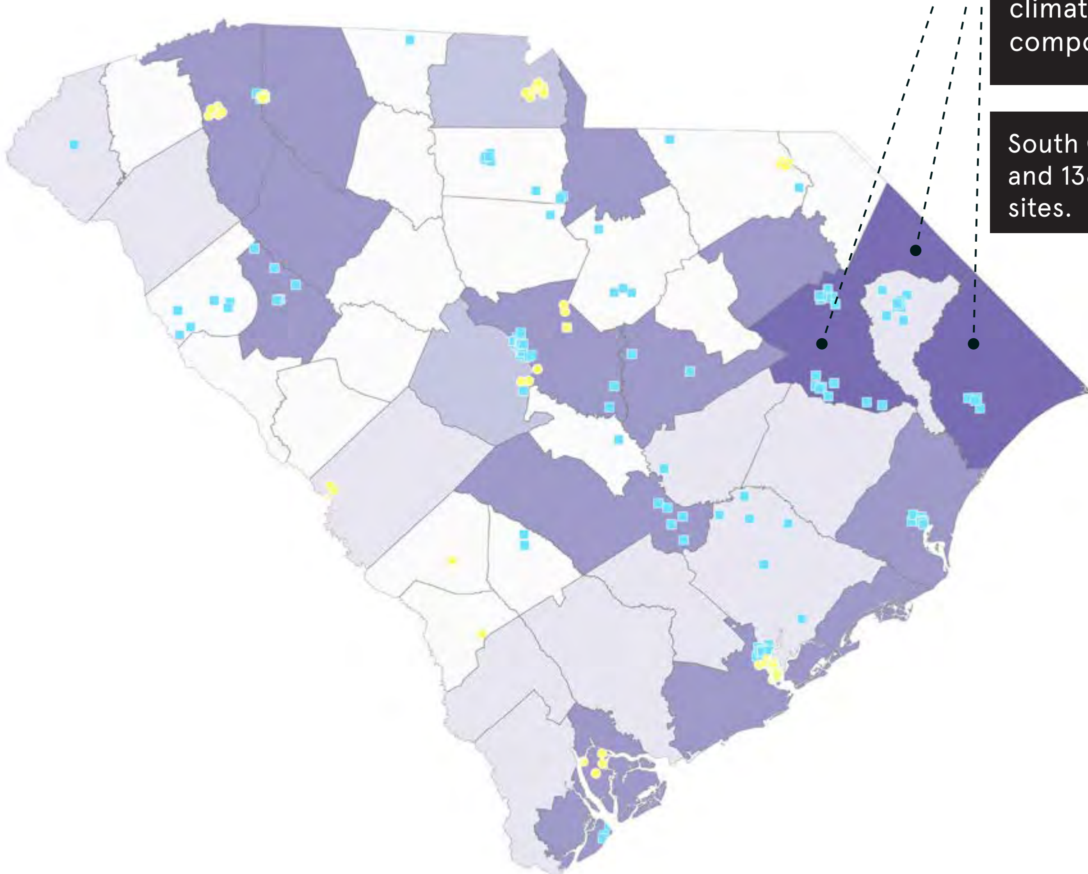
- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Dillon, Horry, and Florence counties have high risk of climate disasters and other compounding risks.

South Carolina has 53 superfund and 138 wastewater discharge sites.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

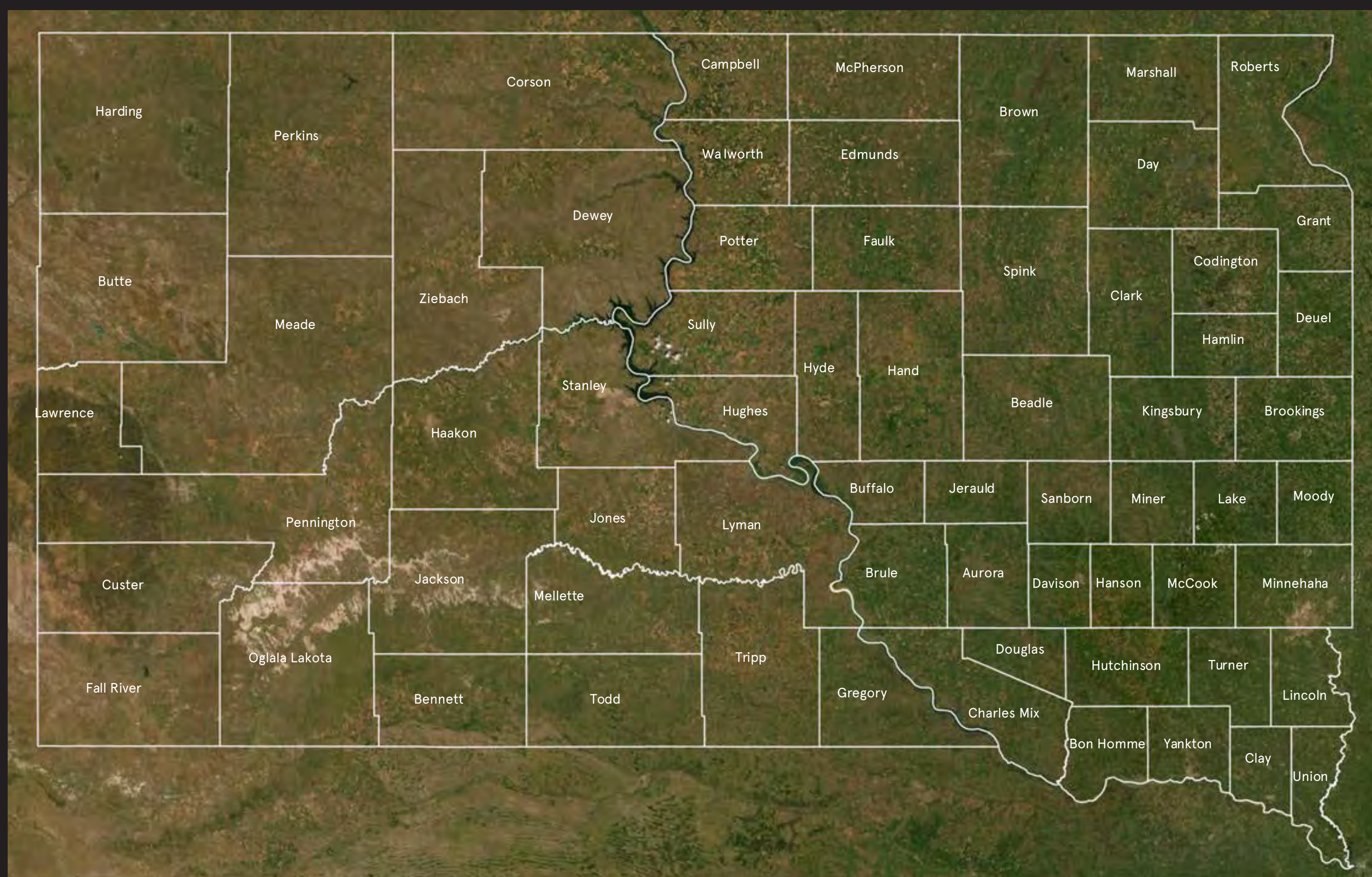
County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Abbeville							0
Aiken					1		1
Allendale							0
Anderson					2		1
Bamberg							0
Barnwell							0
Beaufort					4		3
Berkeley							1
Calhoun							0
Charleston					2		3
Cherokee							0
Chester							0
Chesterfield							0
Clarendon							1
Colleton							1
Darlington					1		3
Dillon					2		4
Dorchester							1
Edgefield							0
Fairfield							0
Florence					3		4
Georgetown					1		3
Greenville					2		3
Greenwood					2		3
Hampton							1
Horry					6		4
Jasper							1
Kershaw							0
Lancaster					1		3
Laurens					2		3
Lee							0
Lexington					2		2
Marion							1
Marlboro							0
McCormick							0
Newberry							0
Oconee					1		1
Orangeburg					1		3
Pickens							0
Richland					2		3
Saluda							0
Spartanburg					2		3
Sumter					1		3
Union							0
Williamsburg							1
York					1		2

SOUTH CAROLINA

TOTAL: 8 DISASTERS
FEMA PA + HM: $883 M
HUD CDBG-DR: $589 M
FEMA + HUD ASSISTANCE: $ 1.5 B

			2014		2015		2016		2017		2018		2019		2020			
			4166: SEVERE WINTER STORM		4241: SEVERE STORMS AND FLOODING		4286: HURRICANE MATTHEW		4346: HURRICANE IRMA		4394: HURRICANE FLORENCE		4464: HURRICANE DORIAN		4479: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4542: SEVERE STORMS, TORNADOES, AND STRAIGHT-LINE WINDS	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	8	$349,994,540	$133,118,049	$3,992,043	$39,940,745	$3,373,901	$76,019,795	$2,599,845	$12,725,226	$650,525	$54,281,366	$989,970	$12,217,352	$141,016	$1,961,456	$36,131	$7,900,506	$46,616
Abbeville County	2	$387,471			$340,473	$0			$46,997	$0								
Aiken County	4	$43,012,779	$31,936,911	$9,536,562	$392,096	$22,500	$203,332	$307,475	$94,030	$183,061							$336,813	$0
Allendale County	5	$1,247,185	$1,021,828	$89,764	$0	$0	$124,089	$0	$11,505	$0			$0	$0				
Anderson County	3	$4,217,135			$391,423	$0			$2,170,314	$0					$730,245	$0	$925,154	$0
Bamberg County	5	$4,959,034	$3,071,337	$116,565	$117,336	$0	$1,567,606	$0	$12,307	$0					$73,882	$0		
Barnwell County	5	$3,662,255	$2,912,540	$46,238			$100,772	$466,198	$21,630	$0					$58,021	$0	$56,855	$0
Beaufort County	4	$77,475,685			$827,774	$0	$71,849,878	$0	$3,973,489	$0			$824,544	$0				
Berkeley County	7	$57,866,880	$7,420,858	$162,867	$12,368,295	$0	$17,881,679	$458,571	$1,726,568	$0	$9,396,680	$0	$8,000,514	$0			$450,849	$0
Calhoun County	5	$1,017,344	$739,743	$0	$161,338	$0	$82,143	$0	$7,858	$0	$26,263	$0						
Charleston County	5	$71,510,708			$4,932,900	$18,176,262	$20,115,788	$1,576,435	$8,583,609	$1,182,557	$1,704,731	$118,125	$15,120,301	$0				
Cherokee County	1	$0							$0	$0								
Chester County	2	$358,269							$0	$231,454					$126,815	$0		
Chesterfield County	5	$4,325,778	$79,105	$0	$58,221	$0	$571,367	$91,658	$0	$0	$3,290,339	$235,088						
Clarendon County	5	$3,215,135	$624,807	$63,397	$2,121,094	$93,644	$212,421	$0	$12,539	$0	$87,234	$0						
Colleton County	7	$12,528,276	$3,879,920	$51,828	$1,198,235	$0	$4,799,053	$31,521	$780,282	$0	$189,008	$0	$896,844	$0			$701,584	$0
Darlington County	4	$6,395,386	$433,136	$0	$181,271	$0	$3,664,257	$613,433	$4,428	$0	$1,479,485	$0	$19,376	$0				
Dillon County	6	$4,655,982	$268,294	$153,647	$40,466	$0	$1,170,367	$0	$62,165	$0	$1,311,609	$1,585,396	$64,038	$0				
Dorchester County	6	$13,738,598	$3,381,873	$4,777,693	$2,216,184	$0	$1,394,491	$318,367	$115,198	$0	$375,923	$0	$1,158,869	$0				
Edgefield County	2	$208,344	$143,856	$51,425					$13,064	$0								
Fairfield County	2	$391,144			$391,144	$0			$0	$0								
Florence County	5	$8,957,336	$1,119,757	$334,731	$606,986	$119,883	$3,670,662	$288,900	$37,634	$19,500	$541,394	$2,217,890						
Georgetown County	7	$12,810,974	$3,776,769	$186,302	$1,627,972	$0	$2,638,121	$1,003,631	$704,577	$0	$1,708,841	$195,750	$969,011	$0			$0	$0
Greenville County	3	$1,452,179			$0	$0			$81,938	$0					$1,370,241	$0		
Greenwood County	2	$247,597			$247,597	$0			$0	$0								
Hampton County	5	$2,920,578	$353,790	$53,225			$1,500,350	$83,250	$114,457	$0					$370,415	$0	$445,090	$0
Horry County	6	$72,871,232	$3,331,692	$0	$2,865,308	$650,701	$28,465,604	$8,290,913	$82,889	$464,135	$21,625,082	$5,130,105	$1,964,803	$0				
Jasper County	4	$4,259,419					$2,407,121	$0	$847,476	$0	$194,345	$0	$351,280	$0			$459,197	$0
Kershaw County	3	$1,465,636			$801,578	$0	$160,992	$267,186	$20,226	$215,655								
Lancaster County	3	$115,515			$23,574	$0			$0	$0	$91,942	$0						
Laurens County	2	$305,462			$305,462	$0			$0	$0								
Lee County	3	$519,390			$295,681	$0	$223,709	$0	$0	$0								
Lexington County	3	$9,683,640	$2,417,606	$12,687	$6,806,413	$440,618			$6,316	$0								
McCormick County	2	$9,399			$9,399	$0			$0	$0								
Marion County	6	$11,780,866	$2,335,253	$1,184,689	$103,887	$0	$1,132,661	$156,000	$0	$0	$5,163,498	$1,626,518	$78,359	$0				
Marlboro County	5	$2,926,294	$84,856	$0	$0	$0	$1,036,035	$0	$0	$0	$1,805,403	$0					$0	$0
Newberry County	3	$545,380			$539,156	$0			$6,223	$0					$0	$0		
Oconee County	3	$1,691,838							$479,965	$0					$484,572	$0	$727,302	$0
Orangeburg County	6	$6,277,552	$1,738,446	$293,152	$852,049	$0	$2,280,078	$743,933	$17,689	$0	$121,757	$0					$230,449	$0
Pickens County	3	$1,192,664					$80,963	$442,505	$106,145	$0	$9,321	$0			$396,424	$0	$157,307	$0
Richland County	3	$46,176,954	$32,677	$0	$23,298,143	$15,428,736	$539,747	$6,378,818	$91,457	$0							$407,377	$0
Saluda County	3	$131,972	$12,327	$0	$110,144	$0			$9,501	$0								
Spartanburg County	3	$2,105,051			$699,507	$0			$0	$0					$1,405,544	$0		
Sumter County	5	$11,198,333	$3,774,096	$0	$2,799,938	$2,948,047	$997,210	$0	$95,840	$426,151	$157,050	$0						
Union County	1	$0							$0	$0								
Williamsburg County	6	$22,332,858	$8,200,179	$598,562	$10,922,419	$0	$1,723,468	$54,925	$220,391	$0	$544,725	$0	$30,691	$37,500				
York County	1	$0							$0	$0								
Total FEMA Allocation		$883,146,047	$216,209,703	$21,705,375	$118,594,210	$41,254,292	$246,613,757	$24,173,564	$33,283,932	$3,373,037	$104,105,995	$12,098,840	$41,695,982	$178,516	$6,977,615	$36,131	$12,798,481	$46,616

SOUTH DAKOTA



SOUTH DAKOTA SUMMARY (2011 – 2021)	
13	CLIMATE DISASTER DECLARATIONS
BUTTE, JACKSON, UNION	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
15	COUNTIES WITH FIVE OR MORE DISASTERS
53	SUPERFUND SITES
BENNETT, CORSON, DEWEY, MELLETTE, OGLALA LAKOTA, TODD, WALWORTH, ZIEBACH	HIGHEST COMPOUNDING RISKS
$237 MILLION	FEMA + HUD POST-DISASTER FUNDING
876 THOUSAND	POPULATION TOTAL
$269	PER CAPITA SPENDING ON CLIMATE DISASTERS
$1.1 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

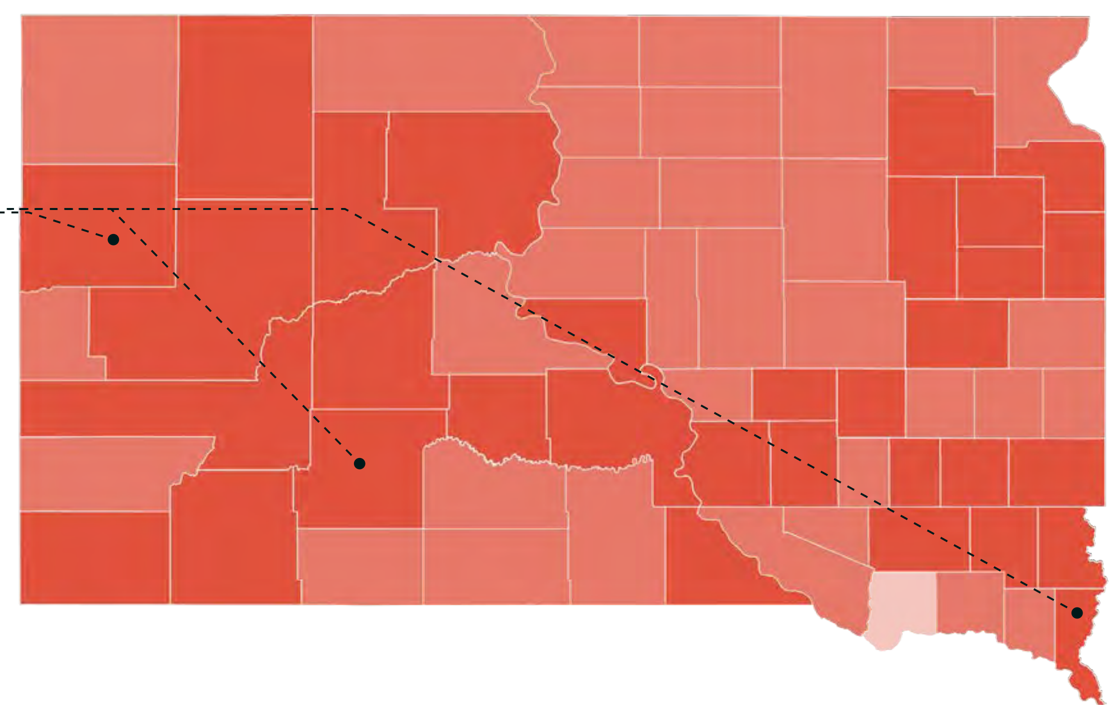
DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

13
disaster
declarations

Butte, Jackson, and Union counties have each had six disaster declarations.

Every county in South Dakota has had a recent disaster declaration.



Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

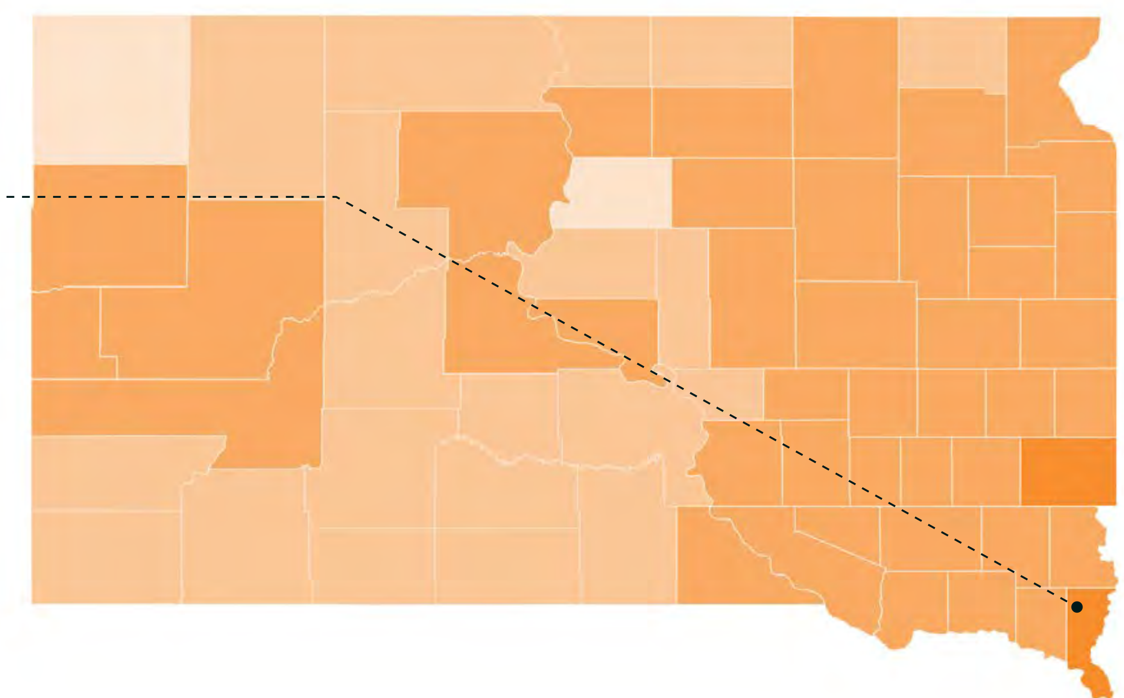
FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$237M
post-disaster
assistance

$237M	FEMA obligations
$0	HUD CDBG-DR Funds
$237M	FEMA + HUD assistance
$269	per capita cost

Union County has received the most post-disaster federal funding in the state: over $17 million.



Public Assistance and Hazard Mitigation

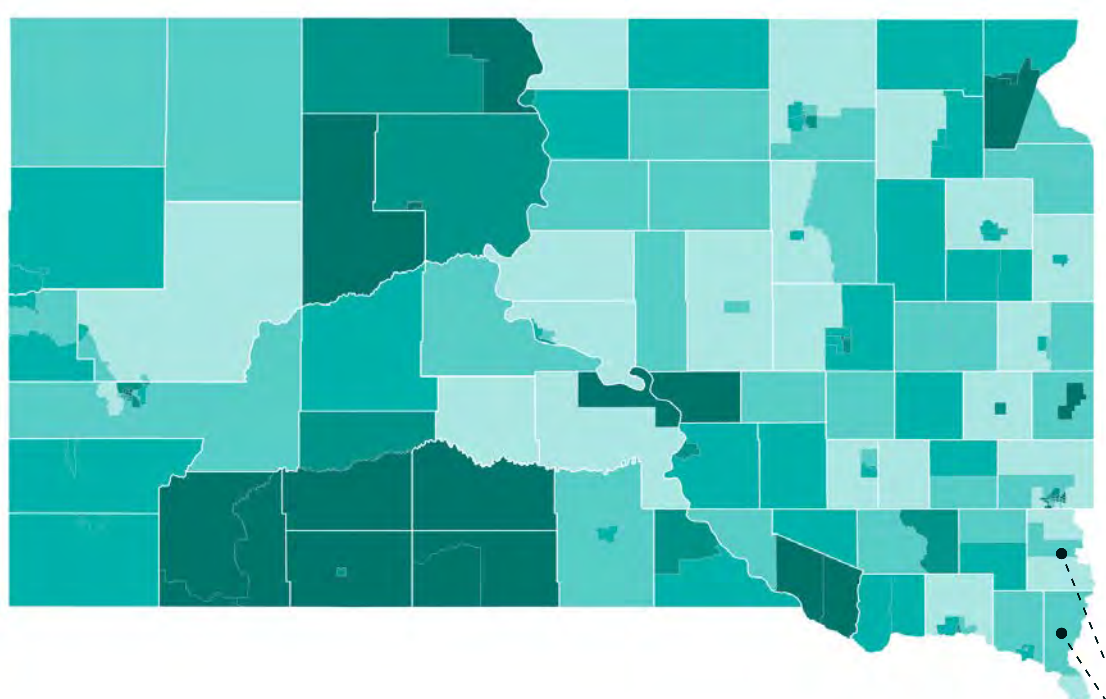
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Union County and Lincoln County have each had five or more disasters and also have high increases in population.

Social Vulnerability Index

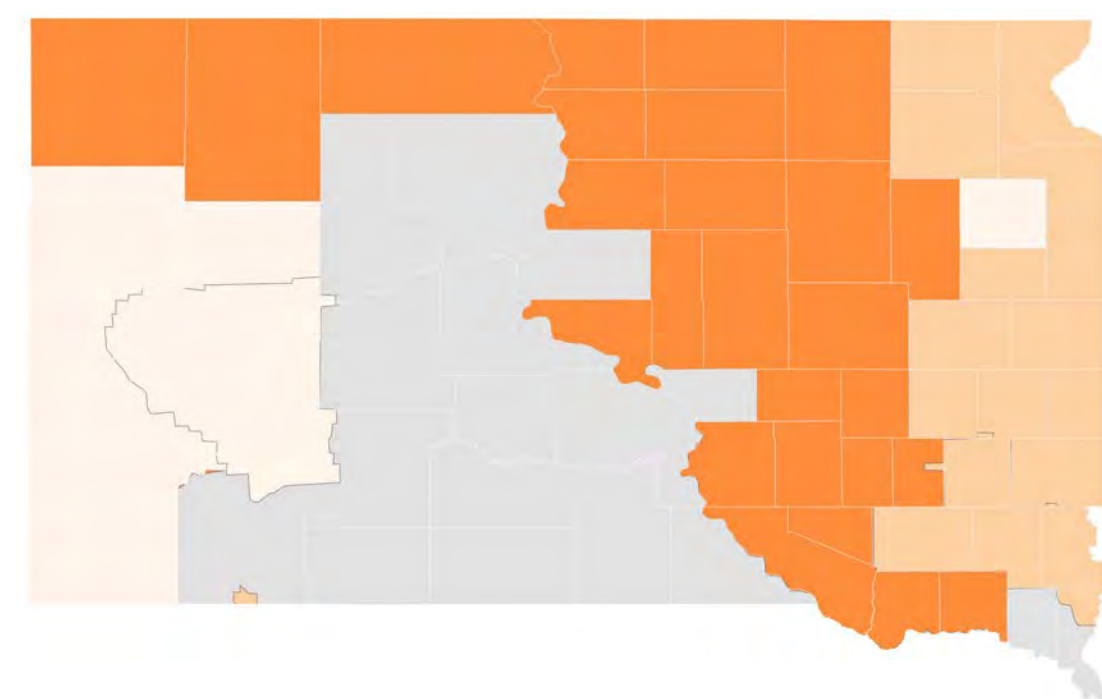
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



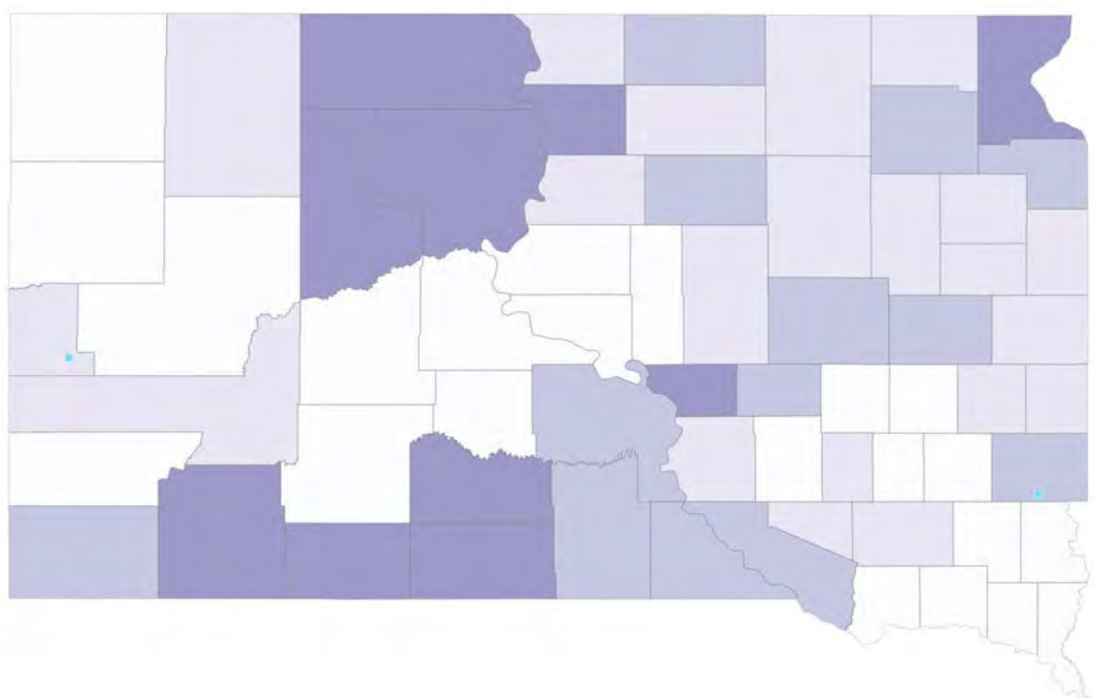
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Ten counties in South Dakota have high risk of climate disasters, high poverty rates, and high mortality.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Aurora							0
Beadle					1		2
Bennett					2		3
Bon Homme							0
Brookings					1		1
Brown					2		1
Brule					1		1
Buffalo					3		3
Butte							0
Campbell					1		1
Charles Mix					1		2
Clark					1		1
Clay							0
Codington					1		1
Corson					2		3
Custer							0
Davison					1		1
Day					2		2
Deuel					1		1
Dewey					2		3
Douglas					1		1
Edmunds					1		1
Fall River					1		2
Faulk					1		2
Grant					1		2
Gregory					1		2
Haakon							0
Hamlin					1		1
Hand					1		1
Hanson							0
Harding							0
Hughes							0
Hutchinson					2		1
Hyde							0
Jackson							0
Jerauld					1		2
Jones							0
Kingsbury					1		2
Lake					1		1
Lawrence					2		1
Lincoln							0
Lyman					1		2
Marshall					1		1
McCook							0
McPherson					1		2
Meade							0
Mellette					1		3
Miner							0
Minnehaha					3		2

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Moody					1		1
Oglala Lakota					7		3
Pennington					2		1
Perkins					1		1
Potter					1		1
Roberts					2		3
Sanborn							0
Spink					1		1
Stanley							0
Sully							0
Todd					6		3
Tripp					1		2
Turner							0
Union							0
Walworth					2		3
Yankton							0
Ziebach					1		3

IMAGE RIGHT: EVACUATED RESIDENTS OF DAKOTA DUNES ARE LINING UP AT THE INCIDENT COMMAND POST INFORMATION TRAILER TO APPLY FOR IDENTIFICATION CARDS ENABLING THEM TO RE-ENTER THEIR COMMUNITY TO CHECK THEIR HOMES FOR DAMAGE FROM FLOODING. | FEMA/ NATIONAL ARCHIVES AT COLLEGE PARK

SOUTH DAKOTA

TOTAL: 13 DISASTERS
FEMA PA + HM: $237 M
HUD CDBG-DR: none
FEMA + HUD ASSISTANCE: $237 M

			2011		2013								2014		2015		2017		2019									
			1984: FLOODING		4115: SEVERE WINTER STORM AND SNOWSTORM		4125: SEVERE STORMS, TORNADO, AND FLOODING		4137: SEVERE STORMS, TORNADOES, AND FLOODING		4155: SEVERE WINTER STORM, SNOWSTORM, AND FLOODING		4186: SEVERE STORMS, TORNADOES, AND FLOODING		4233: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4298: SEVERE WINTER STORM		4440: SEVERE WINTER STORM, SNOWSTORM, AND FLOODING		4448: SEVERE WINTER STORM, SNOWSTORM, AND FLOODING		4463: SEVERE STORMS AND FLOODING		4467: SEVERE STORMS, TORNADOES, AND FLOODING		4469: SEVERE STORMS, TORNADOES, AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	13	$95,854,614	$11,539,001	$4,255,152	$1,939,050	$54,808	$59,437	$8,359	$377,404	$8,305	$38,108,746	$110,343	$4,089,013	$70,536	$1,723,919	$22,013	$9,674,083	$143,887	$17,389,375	$356,200	$1,179,421	$0	$2,753,222	$41,765	$333,729	$11,906	$1,419,612	$185,328
Aurora County	4	$2,975,437	$134,107	$223,758															$1,607,962	$77,175			$11,225	$0			$897,310	$23,899
Beadle County	3	$3,303,510	$1,613,359	$134,627					$79,968	$0									$1,161,437	$314,119								
Bennett County	3	$900,097					$0	$0											$192,954	$702,354			$4,789	$0				
Bon Homme County	1	$2,766,875																	$2,726,725	$0							$10,289	$29,861
Brookings County	3	$1,252,582	$290,959	$0															$671,141	$74,813							$215,670	$0
Brown County	2	$3,274,718	$1,702,034	$226,201															$1,346,483	$0								
Brule County	5	$1,853,432	$329,207	$0											$20,902	$9,949			$62,550	$0			$1,274,254	$0			$156,569	$0
Buffalo County	3	$33,000	$33,000	$0											$0	$0			$0	$0								
Butte County	6	$1,230,607	$202,886	$0							$281,980	$525,670	$117,367	$0			$0	$0					$102,703	$0	$0	$0		
Campbell County	2	$68,286																	$52,932	$0			$15,355	$0				
Charles Mix County	3	$4,020,116	$359,226	$0															$1,549,765	$269,993							$1,395,731	$445,402
Clark County	4	$1,583,011	$874,118	$0													$0	$40,177	$550,906	$0							$117,811	$0
Clay County	3	$1,201,718	$52,585	$0									$148,217	$0					$1,000,917	$0								
Codington County	5	$2,252,313	$456,887	$126,578					$342,013	$157,051							$50,610	$0	$706,823	$0							$412,351	$0
Corson County	3	$314,278					$124,596	$0			$0	$61,934	$127,748	$0														
Custer County	2	$134,006									$52,624	$14,033											$67,349	$0				
Davison County	2	$2,197,856																	$493,524	$153,600							$1,550,733	$0
Day County	4	$4,104,589	$1,815,430	$144,131													$0	$0	$206,201	$1,906,519							$15,042	$17,266
Deuel County	5	$1,105,845	$125,087	$0					$143,401	$0							$0	$19,426	$743,715	$0			$74,217	$0				
Dewey County	4	$462,661									$0	$314,828	$147,833	$0			$0	$0	$0	$0								
Douglas County	3	$1,150,232			$0	$279,585													$590,163	$185,063							$95,422	$0
Edmunds County	3	$1,104,574	$764,779	$0													$59,592	$36,867	$243,336	$0								
Fall River County	5	$460,655									$169,519	$0			$166,095	$0	$0	$0	$125,041	$0			$0	$0				
Faulk County	3	$769,783	$277,066	$194,041													$0	$0	$298,676	$0								
Grant County	4	$933,751	$101,163	$603,347					$56,633	$0							$0	$0	$172,608	$0								
Gregory County	5	$1,867,092	$42,417	$18,532															$478,577	$6,000			$148,102	$0	$529,945	$0	$643,519	$0
Haakon County	4	$451,679									$0	$0			$112,623	$0	$0	$0					$339,056	$0				
Hamlin County	5	$2,406,675	$988,572	$0					$99,213	$0							$0	$0	$929,791	$294,584			$4,514	$90,000				
Hand County	2	$1,428,341	$607,768	$10,125															$810,447	$0								
Hanson County	5	$1,872,596	$155,266	$0									$15,643	$0					$756,950	$0			$34,915	$0			$909,823	$0
Harding County	2	$0									$0	$0					$0	$0										
Hughes County	4	$7,095,489	$5,855,629	$0					$0	$0					$887,430	$154,651			$197,779	$0								
Hutchinson County	4	$3,469,939	$115,586	$0	$15,591	$136,512													$1,994,822	$13,771							$1,193,657	$0
Hyde County	2	$352,330	$171,889	$0															$167,316	$13,125								
Jackson County	6	$603,205	$30,117	$0							$0	$1,738			$13,034	$0	$0	$0	$428,810	$0			$129,506	$0				
Jerauld County	4	$1,286,839	$116,161	$13,926									$792,000	$58,747	$4,498	$0			$301,507	$0								
Jones County	4	$250,367													$0	$0	$0	$0	$83,685	$0			$166,682	$0				
Kingsbury County	5	$1,743,937	$515,623	$0					$37,222	$0									$955,326	$0					$192,442	$0	$43,324	$0
Lake County	3	$7,004,526	$212,527	$78,928															$587,149	$1,055,882							$5,070,041	$0
Lawrence County	3	$2,438,390					$435,954	$0			$1,131,937	$432,996													$437,503	$0		
Lincoln County	5	$4,525,049			$43,644	$0	$402,105	$0					$1,770,605	$0					$1,587,956	$720,740							$0	$0
Lyman County	4	$712,573	$171,662	$134,820											$7,801	$0			$34,743	$23,449			$340,098	$0				
McCook County	4	$1,328,604			$1,576	$0									$0	$0			$912,097	$0							$414,931	$0
McPherson County	2	$197,693															$22,415	$90,215	$85,064	$0								
Marshall County	3	$789,546	$280,909	$0													$30,658	$0	$477,979	$0								
Meade County	4	$1,886,880									$658,762	$0					$0	$18,364					$405,532	$0	$804,222	$0		
Mellette County	2	$168,292																	$149,494	$13,125			$5,672	$0				
Miner County	3	$911,619	$266,613	$0															$363,821	$0							$281,186	$0
Minnehaha County	4	$15,816,740			$6,216,747	$0							$1,929,284	$0					$2,468,453	$2,549,983							$2,634,282	$17,990
Moody County	3	$1,302,598	$194,043	$128,404															$383,730	$0							$596,421	$0
Oglala Lakota County	4	$119,752			$3,351	$0					$51,429	$0			$24,846	$0			$40,127	$0								
Pennington County	4	$3,746,536									$3,309,754	$0					$0	$0	$0	$0			$436,781	$0				
Perkins County	5	$901,194	$218,942	$0							$258,847	$0	$195,932	$0			$0	$0	$227,473	$0								
Potter County	2	$77,716	$45,437	$10,125															$22,154	$0								
Roberts County	3	$854,102	$178,842	$343,591													$0	$11,795	$319,875	$0								
Sanborn County	4	$1,856,367	$516,800	$0															$1,073,390	$0			$135,427	$0			$130,750	$0
Spink County	3	$2,554,266	$905,541	$96,181					$23,368	$0									$1,529,176	$0								
Stanley County	3	$6,567,354	$6,450,069	$0											$117,285	$0	$0	$0										
Sully County	3	$414,749	$58,799	$126,953													$0	$0	$215,872	$13,125								
Todd County	2	$489,880																	$482,548	$0			$7,332	$0				
Tripp County	3	$767,110																	$707,135	$0			$59,975	$0	$0	$0		
Turner County	5	$2,290,997			$11,075	$0							$156,749	$0					$1,876,824	$9,638			$135,044	$48,150			$53,517	$0
Union County	6	$17,577,668	$13,033,614	$0			$193,594	$0					$1,450,631	$0					$1,658,600	$757,151			$146,277	$0			$337,801	$0
Walworth County	2	$327,567																	$136,160	$103,500			$87,907	$0				
Yankton County	3	$2,956,070	$321,584	$0															$2,159,256	$440,949							$34,280	$0
Ziebach County	5	$160,330									$0	$22,500	$137,830	$0			$0	$0	$0	$0			$0	$0				
Total FEMA Allocation		$236,881,204	$52,125,303	$6,869,420	$8,231,035	$470,905	$1,215,685	$8,359	$1,159,221	$165,356	$44,023,598	$1,484,042	$11,078,851	$129,283	$3,078,434	$186,613	$9,837,358	$360,731	$56,497,320	$10,054,854	$1,179,421	$0	$6,885,936	$179,915	$2,297,842	$11,906	$18,630,070	$719,745

TENNESSEE

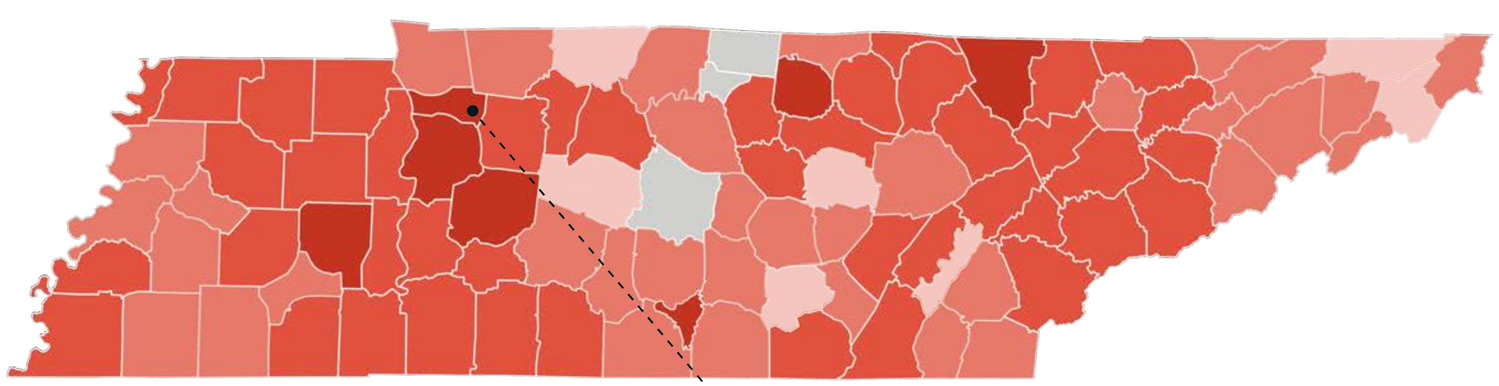
TENNESSEE STATISTICS SUMMARY (2011 – 2021)	
20	CLIMATE DISASTER DECLARATIONS
5TH HIGHEST	NUMBER OF DISASTERS IN THE COUNTRY
HOUSTON	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
35	COUNTIES WITH FIVE OR MORE DISASTERS
89	SUPERFUND SITES
DAVIDSON, KNOX, PUTNAM, SHELBY	HIGHEST COMPOUNDING RISKS
$657 MILLION	FEMA + HUD POST-DISASTER FUNDING
6.8 MILLION	POPULATION TOTAL
$97	PER CAPITA SPENDING ON CLIMATE DISASTERS
$5.2 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

20
disaster
declarations

Ninety-seven percent of counties in Tennessee have had a recent disaster declaration.



Houston County has had the highest number of recent disaster declarations in the state: 9 recent disasters.

Number of Disaster Events

Major Disaster Declarations
(2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

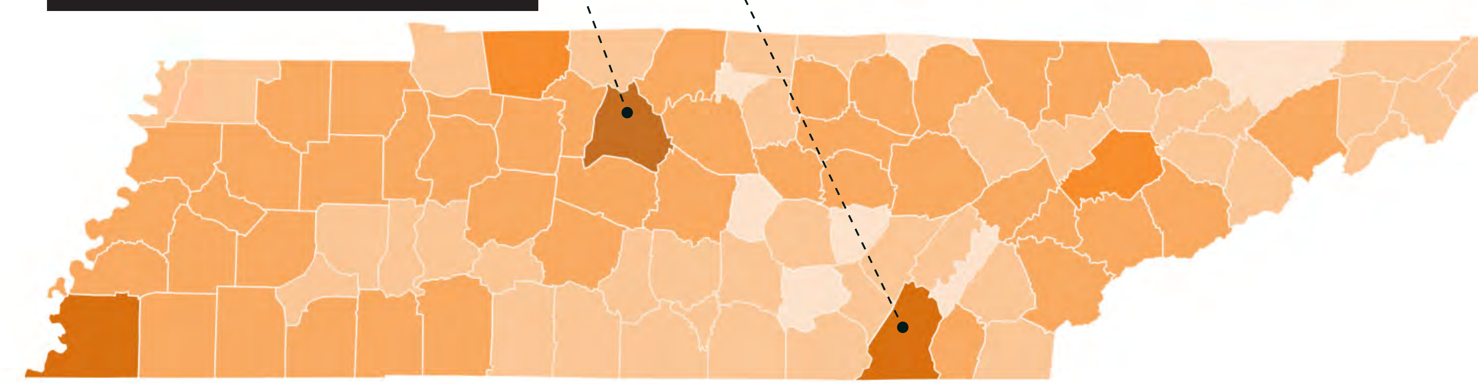
FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$657M
post-disaster
assistance

Hamilton County received the most post-disaster federal funding in the state between 2011–2021: over $63 million.

Davidson County spent the most post-disaster federal funding between 2011–2021.



Public Assistance and Hazard Mitigation

Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

$457M FEMA obligations

$200M HUD CDBG-DR Funds

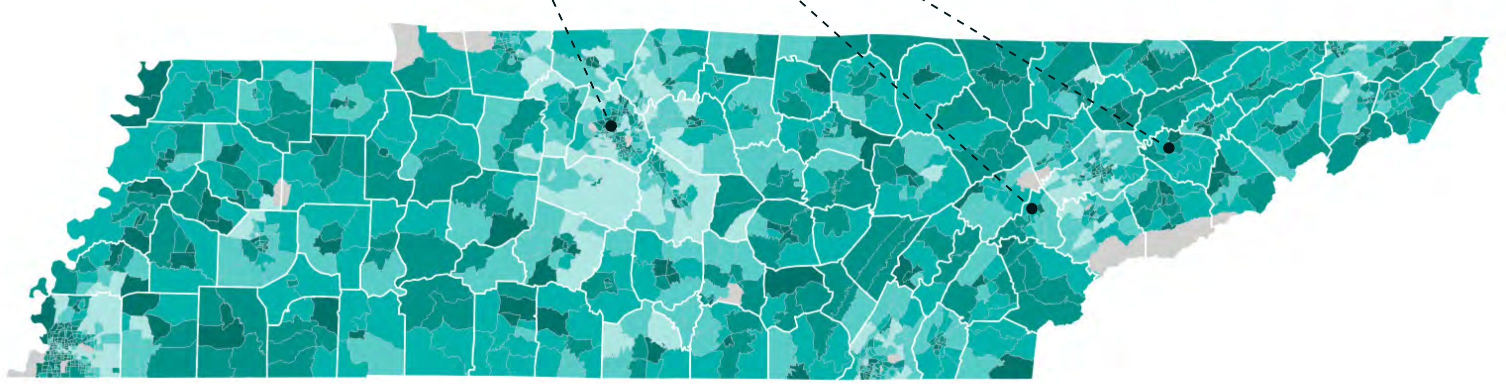
$657M FEMA + HUD assistance

$97 per capita cost

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Knox, Loudon, and Davidson counties have had five or more recent disasters and high increases in population.



Social Vulnerability Index

CDC (2018)

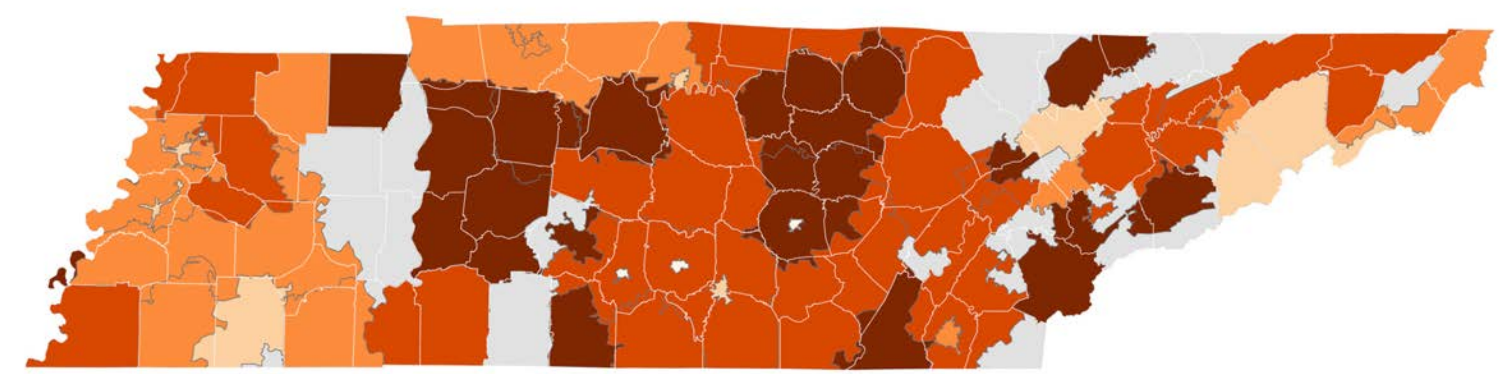
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Six counties in Tennessee have populations with high social vulnerability and low energy reliability.



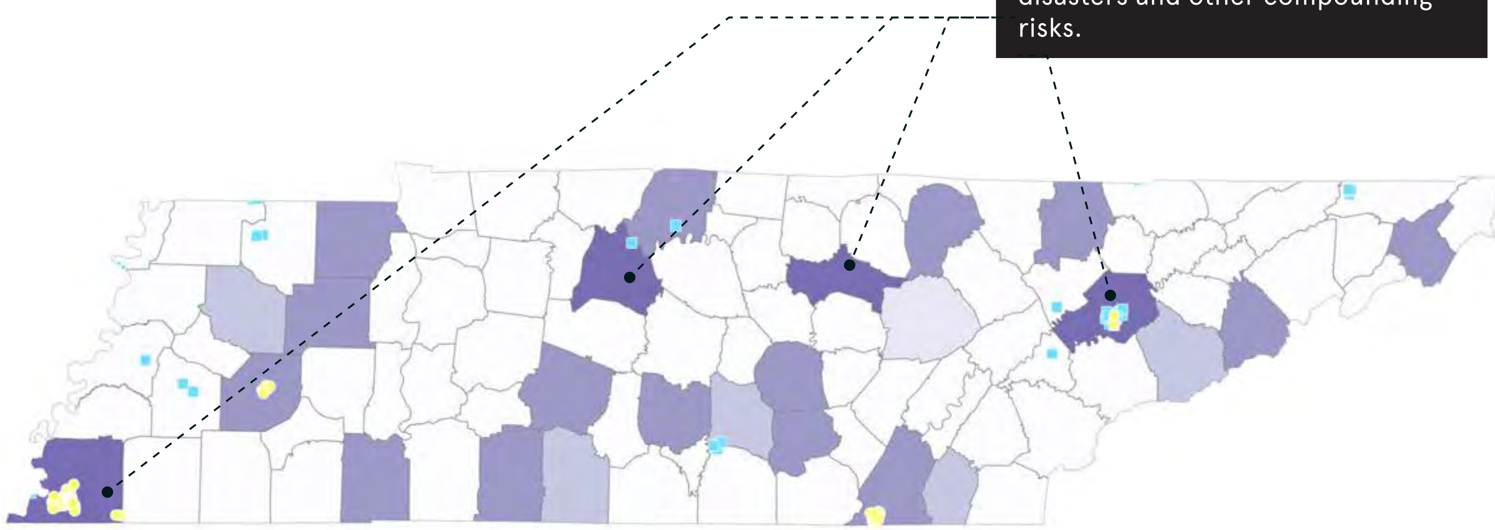
Aggregated Annual Electric Outage Duration
Including major events - SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Knox, Davidson, Putnam, and Shelby counties have high risk of climate disasters and other compounding risks.



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Anderson							0
Bedford					1		3
Benton							0
Bledsoe							0
Blount							0
Bradley					1		2
Campbell					1		3
Cannon							0
Carroll					1		3
Carter					1		3
Cheatham							0
Chester							0
Claiborne							0
Clay							0
Cocke					1		3
Coffee					1		2
Crockett							0
Cumberland					2		1
Davidson					5		4
Decatur							0
DeKalb							0
Dickson							0
Dyer							0
Fayette							0
Fentress					1		3
Franklin							0
Gibson					2		2
Giles					1		2
Grainger							0
Greene							0
Grundy					1		3
Hamblen							0
Hamilton					3		3
Hancock							0
Hardeman							0
Hardin					1		3
Hawkins							0
Haywood							0
Henderson							0
Henry					1		3
Hickman							0
Houston							0
Humphreys							0
Jackson							0
Jefferson							0
Johnson							0
Knox					2		4
Lake							0
Lauderdale							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Lawrence					1		3
Lewis							0
Lincoln							0
Loudon							0
Macon							0
Madison					2		3
Marion							0
Marshall							0
Maury					1		3
McMinn							0
McNairy							0
Meigs							0
Monroe							0
Montgomery							0
Moore							0
Morgan							0
Obion							0
Overton							0
Perry							0
Pickett							0
Polk							0
Putnam					1		4
Rhea							0
Roane							0
Robertson							0
Rutherford							0
Scott							0
Sequatchie							0
Sevier					2		2
Shelby					5		4
Smith							0
Stewart							0
Sullivan							0
Sumner					1		3
Tipton							0
Trousdale							0
Unicoi							0
Union							0
Van Buren							0
Warren					1		3
Washington							0
Wayne							0
Weakley							0
White							0
Williamson							0
Wilson							0

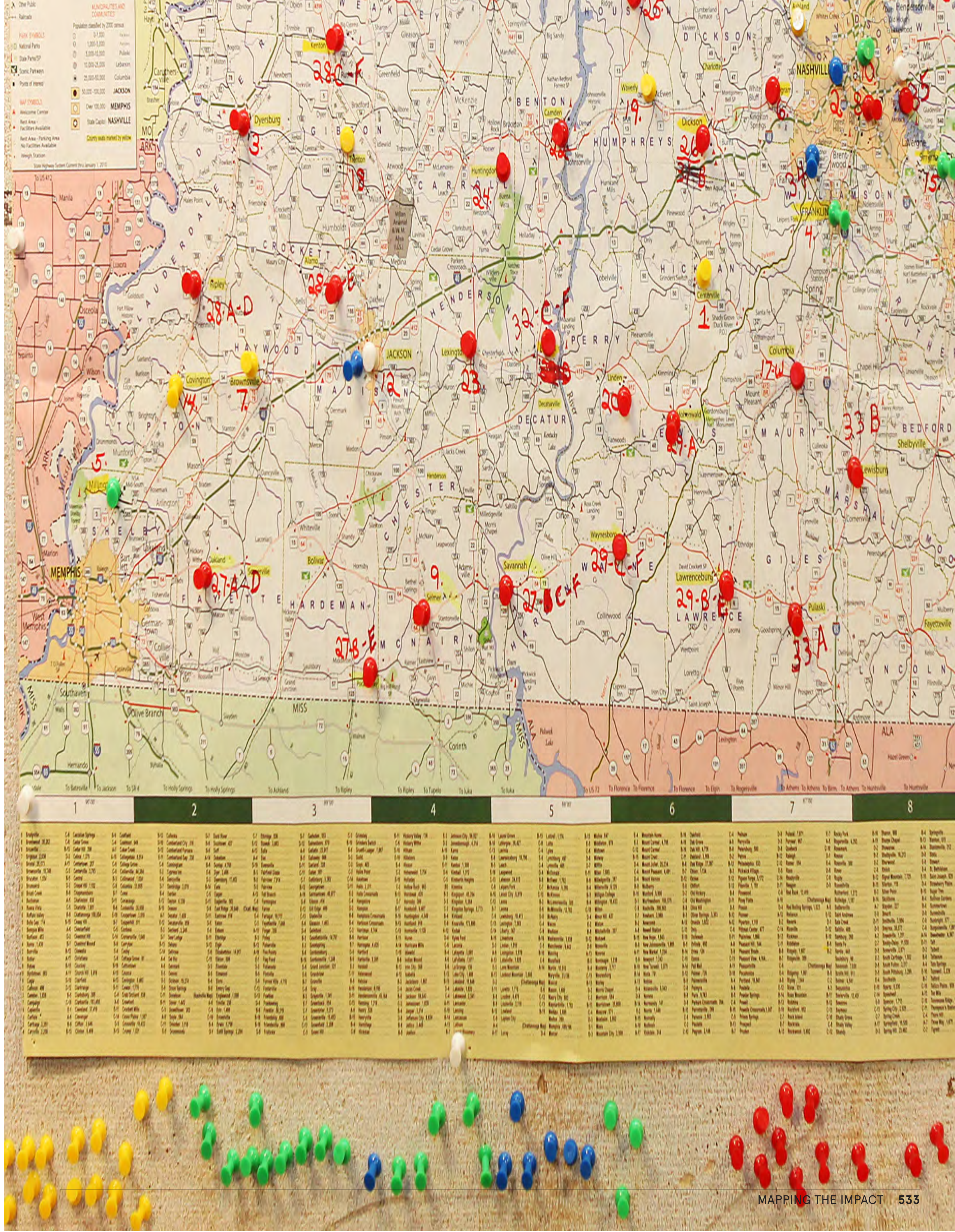


IMAGE RIGHT: FEMA LOGISTICS SPECIALISTS USE A TENNESSEE MAP AND PUSHPINS TO CREATE A VISUAL REFERENCE OF THE LOCATION OF DISASTER RECOVERY CENTERS AS WELL AS THE OPEN-CLOSED STATUS OF EACH CENTER | DAVID FINE

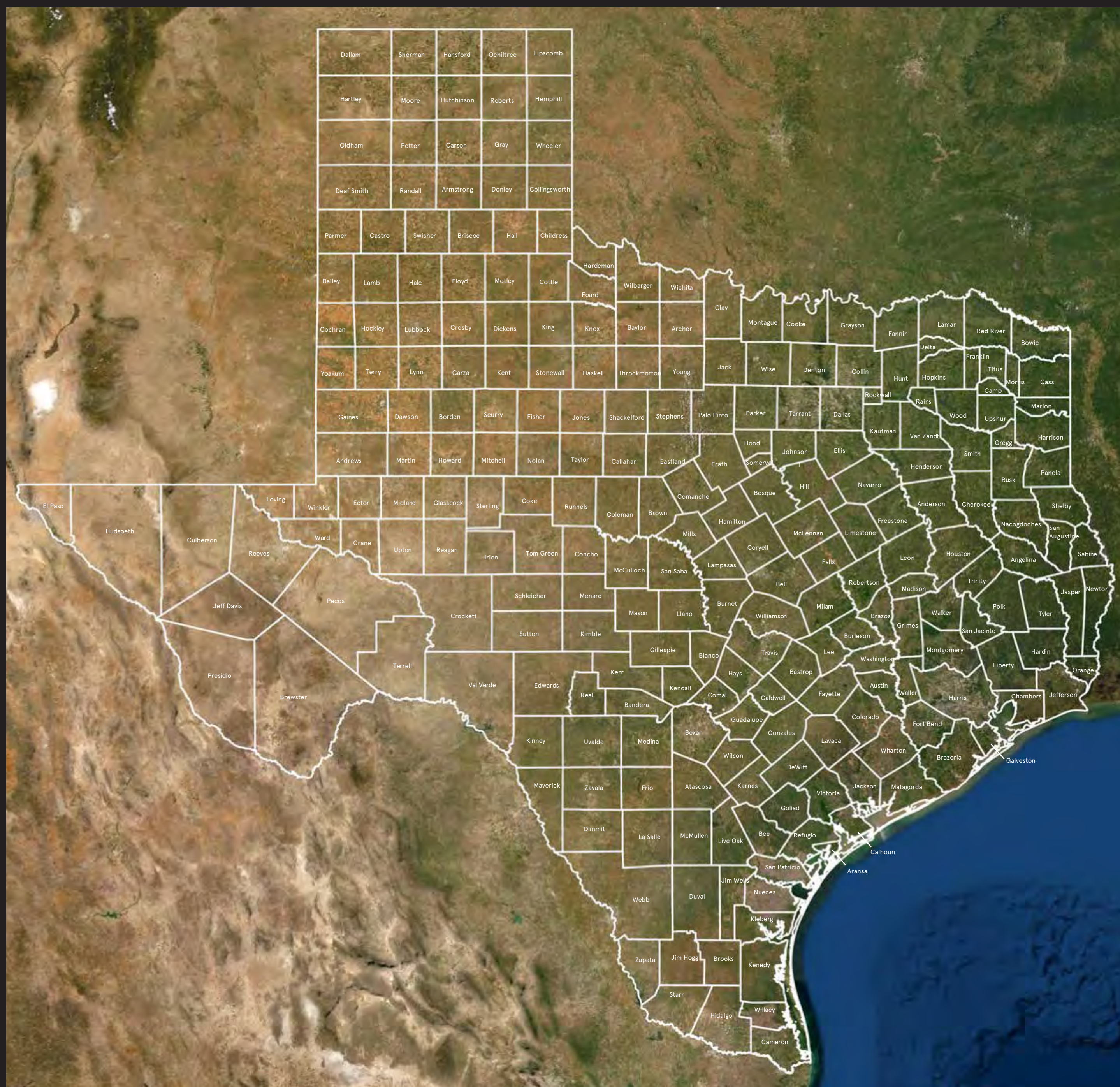
TENNESSEE

TOTAL: 20 DISASTERS
FEMA PA + HM: $457 M
HUD CDBG-DR: $200 M
FEMA + HUD ASSISTANCE: $657 M

			2011										2012		2014				2015	
			1965: SEVERE STORMS, TORNADOES, AND FLOODING		1974: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND ASSOCIATED FLOODING		1978: SEVERE STORMS, FLOODING, TORNADOES, AND STRAIGHT-LINE WINDS		1979: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING		4005: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING		4060: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS AND FLOODING		4171: SEVERE WINTER STORM		4189: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4211: SEVERE WINTER STORM AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	21	$164,349,010	$2,158,904	$56,084	$5,668,011	$160,558	$2,075,176	$55,333	$2,064,270	$80,475	$533,902	$44,529			$638,127	$54,899	$936,081	$39,033	$11,836,539	$503,036
Anderson County	4	$903,136									$86,958	$0					$339,817	$0	$158,152	$0
Bedford County	3	$976,547																	$791,282	$0
Benton County	5	$829,777			$336,097	$0			$90,621	$0										
Bledsoe County	4	$980,408			$438,551	$0											$181,790	$0	$73,411	$0
Blount County	4	$7,217,452			$324,419	$0													$684,658	$0
Bradley County	3	$6,107,844			$4,453,387	$0							$0	$0						
Campbell County	5	$957,201			$136,455	$0													$106,024	$0
Cannon County	2	$62,603																		
Carroll County	6	$1,526,338			$369,090	$0			$333,652	$0					$28,265	$0	$507,690	$0		
Carter County	1	$333,310																		
Cheatham County	4	$138,002													$0	$0				
Chester County	2	$228,601			$218,976	$0	$9,625	$0												
Claiborne County	6	$1,544,775									$1,270,939	$0	$0	$0			$58,244	$0	$7,821	$0
Clay County	3	$151,753																	$6,281	$0
Cocke County	3	$691,429			$391,929	$0													$18,510	$0
Coffee County	3	$576,276																	$153,336	$0
Crockett County	2	$1,099,895			$93,103	$940,296			$66,496	$0										
Cumberland County	3	$6,513,577											$0	$0					$6,423,743	$0
Davidson County	6	$35,756,504					$140,468	$0											$449,514	$205,996
Decatur County	6	$642,699					$2,718	$0									$0	$0		
DeKalb County	4	$84,374											$0	$0					$28,586	$0
Dickson County	6	$2,040,565					$592,956	$0							$777,285	$0				
Dyer County	3	$885,961							$637,377	$0										
Fayette County	3	$1,005,854			$706,030	$0									$87,146	$0				
Fentress County	6	$2,427,277	$53,465	$0	$5,477	$0													$2,011,848	$0
Franklin County	2	$241,119	$33,400	$0	$207,719	$0														
Gibson County	5	$5,342,779			$194,859	$3,984,125			$522,491	$0							$157,306	$0		
Giles County	4	$664,542			$76,895	$0											$137,759	$0	$132,087	$0
Grainger County	5	$156,034	$35,664	$0							$42,105	$0							$6,877	$0
Greene County	3	$2,771,207			$2,037,616	$0													$80,410	$0
Grundy County	1	$10,797																	$10,797	$0
Hamblen County	2	$270,359																	$135,606	$0
Hamilton County	5	$63,292,244	$271,177	$0	$20,528,388	$0							$0	$0						
Hancock County	2	$15,320																	$15,320	$0
Hardeman County	3	$1,226,583			$223,688	$0													$164,996	$674,625
Hardin County	5	$2,160,416			$724,450	$0													$123,539	$0
Hawkins County	2	$99,925																	$37,326	$0
Haywood County	2	$219,746													$202,019	$0	$17,727	$0		
Henderson County	8	$298,012			$6,153	$0	$6,193	$0	$15,990	$0	$5,879	$0								
Henry County	5	$1,455,624			$519,090	$0			$464,364	$0							$115,039	$0		
Hickman County	7	$905,908			$158,397	$0									$45,756	$0	$325,902	$0		
Houston County	9	$1,001,149	$117,474	$0	$394,554	$0			$82,202	$0					$23,767	$125,638	$21,083	$0		
Humphreys County	7	$5,454,959	$79,728	$0	$622,014	$1,396,099	$23,848	$0												
Jackson County	7	$1,341,933	$884,706	$0	$57,919	$25,974							$0	$0						
Jefferson County	5	$485,092	$32,677	$0	$36,425	$0													$102,464	$0
Johnson County	2	$398,324			$77,257	$0														
Knox County	5	$12,588,897			$3,071,909	$0					$4,565,817	$0							$1,661,833	$84,000
Lake County	6	$573,120			$0	$0	$0	$0	$393,690	$0										
Lauderdale County	2	$668,389							$374,960	$0										
Lawrence County	5	$824,609			$159,526	$0											$194,017	$0	$141,692	$0
Lewis County	4	$358,340			$63,617	$0											$189,220	$0		
Lincoln County	3	$675,737			$102,536	$0			$0	$0										
Loudon County	5	$1,918,463			$174,120	$0					$361,207	$0							$1,065,592	$0
McMinn County	3	$266,535			$266,535	$0							$0	$0					$0	$0
McNairy County	6	$1,925,697			$276,150	$0											$134,945	$0	$111,593	$0
Macon County	0	$14,365																		
Madison County	6	$9,308,772			$1,218,366	$0			$1,061,479	$0					$405,876	$0	$621,362	$0		
Marion County	6	$872,266			$0	$0					$73,538	$0					$208,221	$0	$131,573	$0
Marshall County	3	$205,818			$59,104	$0													$107,720	$0
Maury County	3	$1,185,600															$242,018	$0		
Meigs County	1	$31,545																	$31,545	$0
Monroe County	4	$1,167,710			$163,703	$0							$0	$0					$823,595	$0
Montgomery County	3	$4,542,354			$651,476	$0			$690,539	$0										
Moore County	7	$445,633	$17,755	$0	$13,962	$0											$27,833	$0	$68,526	$0
Morgan County	4	$491,120	$22,417	$0															$405,614	$0
Obion County	5	$737,546							$96,406	$0									$124,991	$0
Overton County	5	$1,402,413											$0	$0					$611,720	$0
Perry County	5	$409,830			$58,437	$0											$109,556	$0		
Pickett County	4	$49,827	$9,181	$0	$22,639	$0													$12,165	$0
Polk County	3	$266,339			$42,264	$0							$0	$0						
Putnam County	4	$7,010,485																	$1,527,676	$0
Rhea County	4	$822,700			$369,700	$0													$106,836	$0
Roane County	4	$4,418,417															$637,151	$0	$1,149,929	$0
Robertson County	1	$0																		
Rutherford County	0	$126,390																		
Scott County	7	$2,741,189	$1,478,409	$0	$139,993	$0													$394,209	$0
Sequatchie County	3	$166,870			$54,485	$0											$48,746	$0		
Sevier County	4	$4,403,677																	$390,586	$0
Shelby County	6	$48,679,756			$3,181,810	$0	$3,865,156	$0	$8,784,344	$0					$4,972,557	$116,336				
Smith County	6	$249,016			$31,711	$0														
Stewart County	2	$174,939							$149,648	$0										
Sullivan County	1	$461,610			$399,475	$40,411														
Sumner County	2	$325,697					$325,697	$0												
Tipton County	4	$3,543,773							$2,393,176	$0					$343,851	$0	$143,904	$0		
Trousdale County	0	$0																		
Unicoi County	2	$232,141																		
Union County	2	$487,312	$419,506	$0																
Van Buren County	2	$66,619																	$53,842	$0
Warren County	2	$872,363																	$521,982	$0
Washington County	2	$8,742,388			$593,773	$0														
Wayne County	5	$576,013			$158,471	$0													$200,901	$0
Weakley County	5	$1,399,631			$128,788	$0			$211,814	$894,913							$89,557	$0		
White County	1	$1,337,836																	$1,306,457	$0
Williamson County	1	$233,073																		
Wilson County	3	$3,197,890																		
Total FEMA Allocation		$457,043,955	$5,614,462	$56,084	$50,409,497	$6,547,463	$7,041,838	$55,333	$18,433,517	$975,388	$6,940,346	$44,529	$0	$0	$7,524,648	$296,873	$5,444,968	$39,033	$34,509,703	$1,467,657

	2016		2017		2019				2020								2021					
	4293: WILDFIRES		4320: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4427: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4471: SEVERE STORM AND STRAIGHT-LINE WINDS		4476: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4514: COVID-19 PANDEMIC		4541: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4550: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4594: SEVERE WINTER STORMS		4601: SEVERE STORMS, TORNADOES, AND FLOODING		4609: SEVERE STORM AND FLOODING	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$1,120,451	$21,370	$3,630,891	$232,211	$3,805,144	$506,791	$6,604,329	$0	$15,171,600	$0	$93,876,582	$0	$1,178,782	$0	$5,504,458	$0	$3,521,687	$0	$1,364,257	$0	$905,500	$0
Anderson County					$295,051	$0					$23,158	$0										
Bedford County					$95,352	$45,000					$0	$0					$44,912	$0				
Benton County							$167,376	$0	$124,050	$0	$0	$0			$111,633	$0						
Bledsoe County					$286,656	$0					$0	$0										
Blount County			$1,357,067	$0	$175,792	$7,500					$4,668,016	$0										
Bradley County											$8,963	$0	$1,645,494	$0								
Campbell County					$352,376	$0					$0	$0	$0	$0					$362,346	$0		
Cannon County											$0	$0					$62,603	$0	$0	$0		
Carroll County									$174,978	$0	$0	$0			$112,663	$0						
Carter County					$325,306	$0					$8,004	$0										
Cheatham County					$91,598	$0					$0	$0							$46,404	$0		
Chester County											$0	$0										
Claiborne County					$207,771	$0					$0	$0							$0	$0		
Clay County					$64,816	$0					$0	$0							$80,657	$0		
Cocke County					$280,990	$0					$0	$0										
Coffee County					$199,068	$0					$3,978	$0					$219,894	$0				
Crockett County											$0	$0										
Cumberland County			$76,175	$0							$13,659	$0										
Davidson County									$13,236,557	$0	$20,129,430	$0			$912,020	$0			$682,519	$0		
Decatur County					$175,683	$0	$354,723	$0			$0	$0			$94,997	$0			$14,579	$0		
DeKalb County					$55,789	$0					$0	$0					$0	$0				
Dickson County					$162,759	$0					$0	$0			$503,375	$0					$4,190	$0
Dyer County					$226,332	$0					$0	$0			$22,252	$0						
Fayette County			$182,073	$0							$30,605	$0										
Fentress County					$173,629	$0					$0	$0					$177,794	$0	$5,064	$0		
Franklin County											$0	$0										
Gibson County					$143,716	$0					$6,260	$0			$334,022	$0						
Giles County					$173,789	$107,625					$36,387	$0										
Grainger County					$71,387	$0					$0	$0							$0	$0		
Greene County					$653,181	$0					$0	$0										
Grundy County											$0	$0										
Hamblen County					$134,753	$0					$0	$0										
Hamilton County					$692,194	$0					$997,887	$0	$40,802,599	$0								
Hancock County					$0	$0					$0	$0										
Hardeman County											$0	$0							$163,275	$0		
Hardin County					$546,592	$0	$736,213	$0			$0	$0			$29,623	$0						
Hawkins County					$62,600	$0					$0	$0										
Haywood County											$0	$0										
Henderson County							$81,137	$0			$0	$0			$39,528	$0			$143,133	$0		
Henry County											$47,031	$0			$310,101	$0						
Hickman County					$199,058	$0					$28,890	$0			$49,933	$0			$91,302	$0	$6,670	$0
Houston County					$46,986	$0	$109,533	$0			$0	$0			$24,389	$0					$55,523	$0
Humphreys County					$132,971	$0	$330,584	$0			$0	$0			$0	$0					$2,869,715	$0
Jackson County			$52,676	$0	$101,738	$0					$0	$0					$120,984	$0	$97,935	$0		
Jefferson County			$0	$0	$296,156	$0					$17,371	$0										
Johnson County					$301,917	$0					$19,149	$0										
Knox County			$167,666	$0	$2,781,669	$0					$256,004	$0										
Lake County					$179,430	$0					$0	$0			$0	$0						
Lauderdale County					$289,952	$0					$3,477	$0										
Lawrence County					$224,882	$0					$0	$0			$104,492	$0						
Lewis County					$68,491	$0					$0	$0			$37,013	$0						
Lincoln County					$573,202	$0					$0	$0										
Loudon County			$140,505	$0	$17,075	$0					$159,964	$0										
McMinn County											$0	$0										
McNairy County					$622,912	$0	$511,926	$0			$0	$0							$268,171	$0		
Macon County											$14,365	$0										
Madison County											$5,544,640	$0			$293,986	$0			$163,062	$0		
Marion County					$138,575	$0					$7,023	$0	$313,335	$0					$0	$0		
Marshall County					$38,994	$0					$0	$0										
Maury County											$87,498	$0			$690,871	$0			$165,213	$0		
Meigs County											$0	$0										
Monroe County											$0	$0	$180,412	$0								
Montgomery County							$3,162,606	$0			$37,733	$0										
Moore County					$199,820	$0					$0	$0					$89,228	$0	$28,508	$0		
Morgan County			$0	$0	$63,089	$0					$0	$0										
Obion County					$278,001	$93,750					$54,016	$0			$90,382	$0						
Overton County					$209,764	$0					$0	$0					$572,980	$0	$7,949	$0		
Perry County					$119,131	$0	$115,057	$0			$0	$0			$7,649	$0						
Pickett County											$0	$0					$5,842	$0				
Polk County											$0	$0	$224,075	$0								
Putnam County			$1,013,842	$0					$3,624,103	$0	$367,982	$0					$476,882	$0				
Rhea County			$77,115	$0	$269,049	$0					$0	$0										
Roane County			$981,584	$0	$1,649,753	$0					$0	$0										
Robertson County					$0	$0					$0	$0										
Rutherford County											$126,390	$0										
Scott County					$76,847	$0					$16,544	$0	$51,618	$0			$58,097	$0	$525,472	$0		
Sequatchie County					$63,639	$0					$0	$0										
Sevier County	$2,354,004	$0	$42,361	$101,250	$1,486,886	$0					$28,589	$0										
Shelby County			$24,215,073	$0							$2,228,651	$0					$1,315,829	$0				
Smith County			$23,007	$0	$143,445	$0			$40,159	$0	$0	$0					$0	$0	$10,694	$0		
Stewart County											$25,291	$0										
Sullivan County											$21,724	$0										
Sumner County											$0	$0										
Tipton County					$627,972	$0					$34,870	$0										
Trousdale County											$0	$0										
Unicoi County					$0	$0					$0	$0	$232,141	$0								
Union County					$67,806	$0					$0	$0										
Van Buren County					$12,777	$0					$0	$0										
Warren County					$350,381	$0					$0	$0										
Washington County											$8,106,770	$0	$41,845	$0								
Wayne County					$130,893	$0	$0	$0			$0	$0							$85,749	$0		
Weakley County											$14,147	$0			$60,413	$0						
White County											$31,379	$0										
Williamson County											$21,495	$0							$211,578	$0		
Wilson County									$3,110,440	$0	$0	$0							$87,450	$0		
Total FEMA Allocation	$3,474,455	$21,370	$31,960,035	$333,461	$21,215,586	$760,666	$12,173,484	$0	$35,481,887	$0	$137,103,923	$0	$44,670,301	$0	$9,333,801	$0	$6,666,733	$0	$4,605,317	$0	$3,841,597	$0

TEXAS

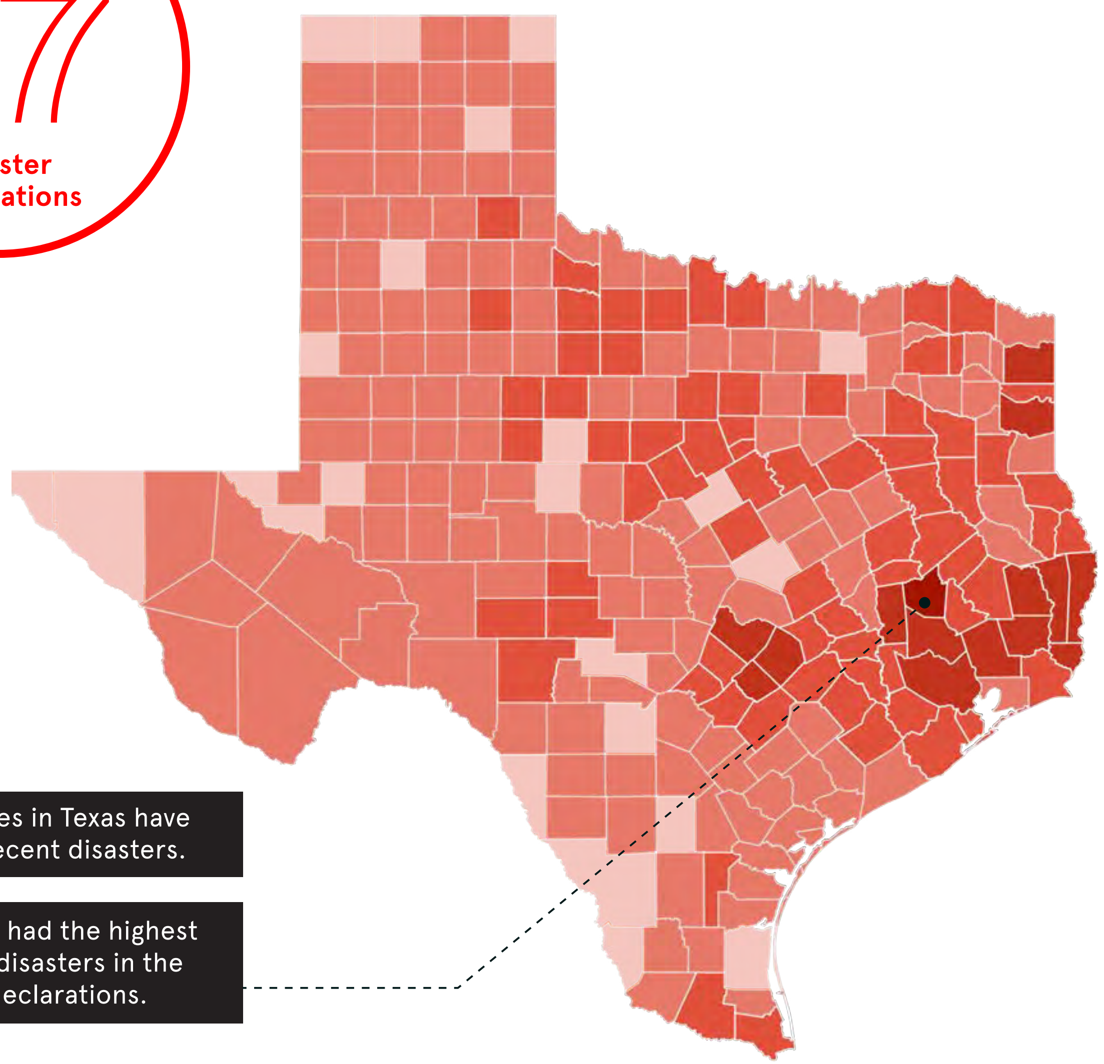


TEXAS STATISTICS SUMMARY (2011 - 2021)	
17	CLIMATE DISASTER DECLARATIONS
2ND HIGHEST	FEDERAL FUNDING IN THE COUNTRY
6TH HIGHEST	PER CAPITA SPENDING ON CLIMATE DISASTERS
7TH HIGHEST	NUMBER OF DISASTERS IN THE COUNTRY
WALKER	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
49	COUNTIES WITH FIVE OR MORE DISASTERS
26	SUPERFUND SITES
C	ASCE INFRASTRUCTURE REPORT CARD GRADE
HARRIS	HIGHEST COMPOUNDING RISKS
$14.8 BILLION	FEMA + HUD POST-DISASTER FUNDING
28.6 MILLION	POPULATION TOTAL
$518	PER CAPITA SPENDING ON CLIMATE DISASTERS
$26.6 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

17
disaster declarations



Twenty-five counties in Texas have had five or more recent disasters.

Walker County has had the highest number of recent disasters in the state: 10 disaster declarations.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

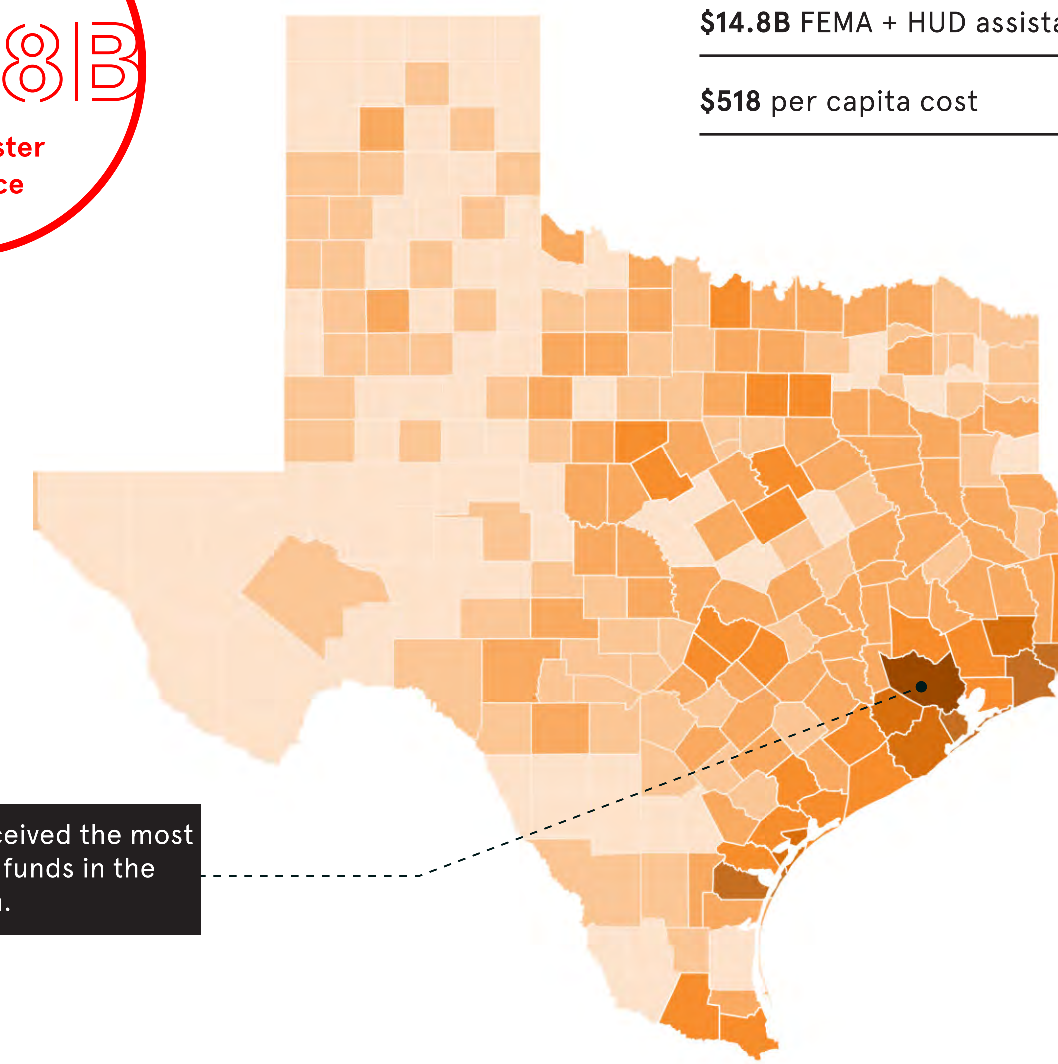
$14.8B
post-disaster assistance

$3.8B FEMA obligations

$10.9B HUD CDBG-DR Funds

$14.8B FEMA + HUD assistance

$518 per capita cost



Harris County has received the most post-disaster federal funds in the state: over $1.4 billion.

Public Assistance and Hazard Mitigation

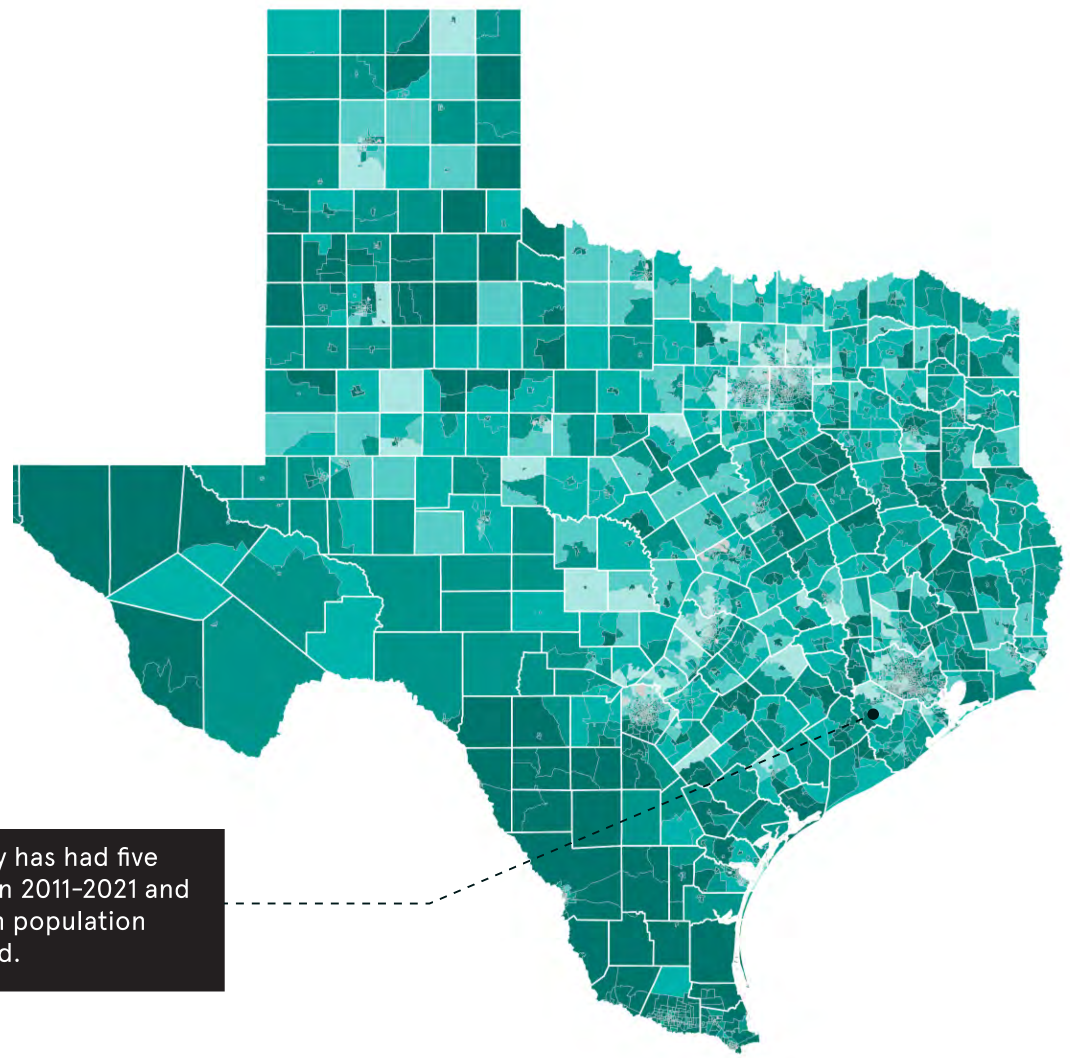
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Fort Bend County has had five disasters between 2011–2021 and a 40% increase in population during that period.

Social Vulnerability Index

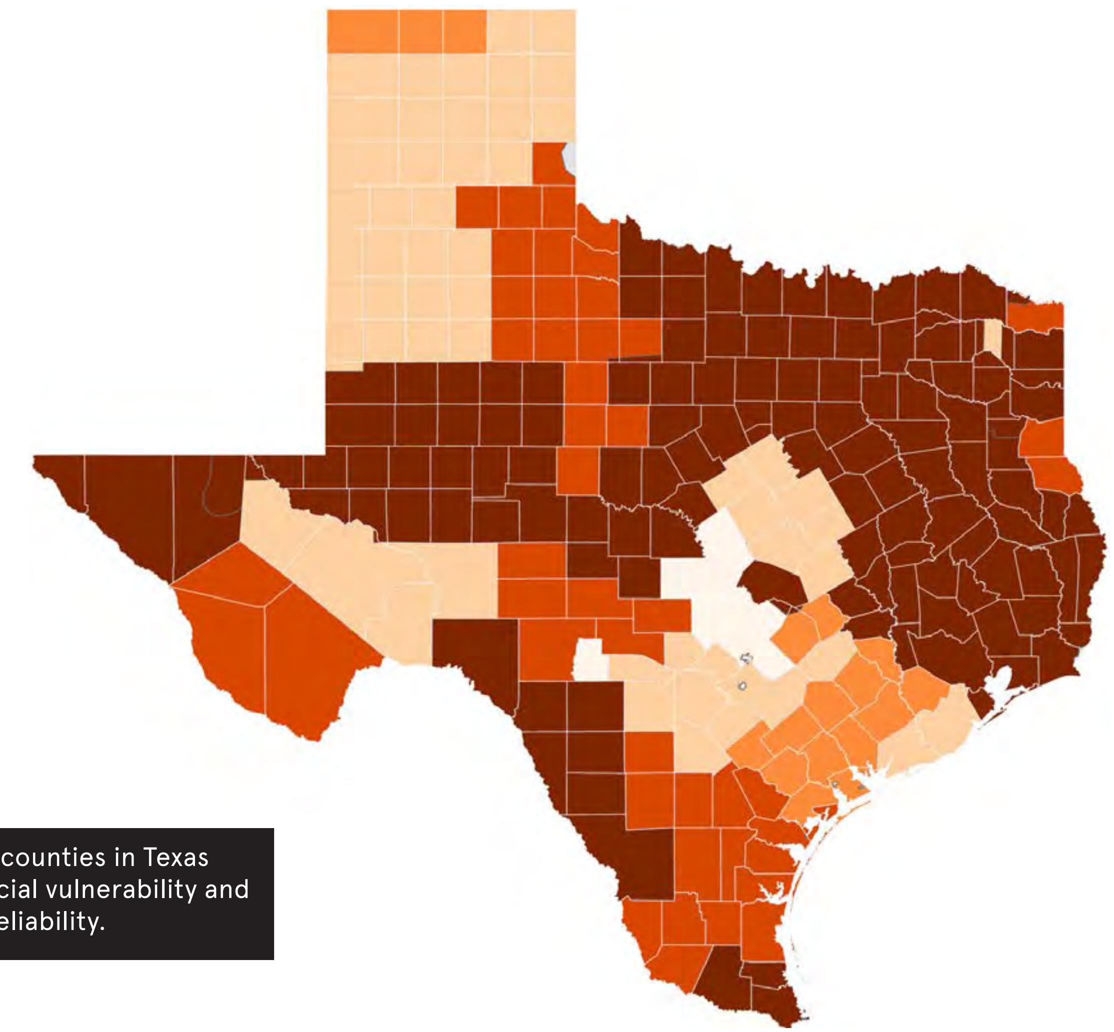
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



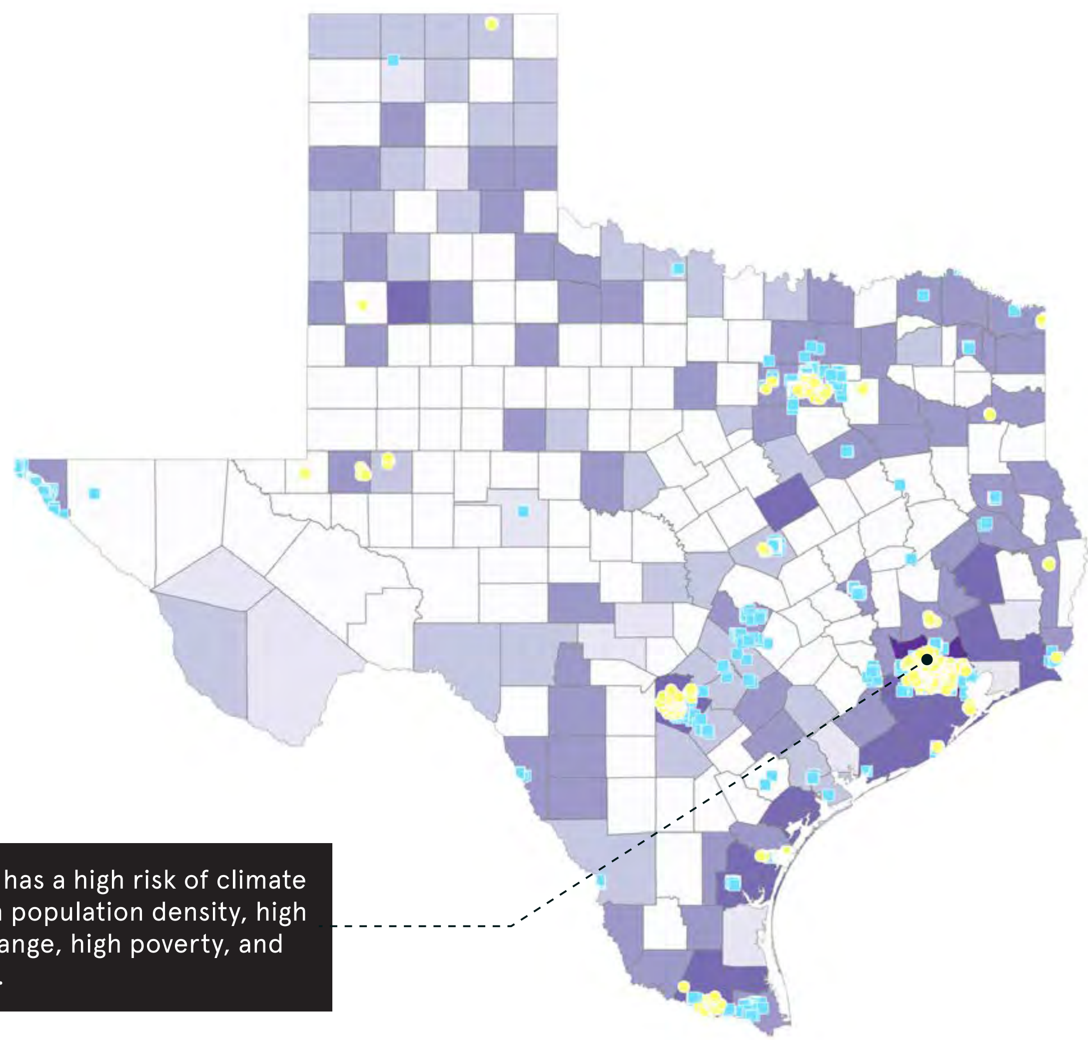
Eighty-eight counties in Texas have high social vulnerability and low energy reliability.

Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Harris County has a high risk of climate disasters, high population density, high population change, high poverty, and high mortality.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Anderson							0
Andrews							0
Angelina					3		3
Aransas					2		4
Archer							0
Armstrong					1		1
Atascosa					1		2
Austin							0
Bailey					3		2
Bandera							0
Bastrop							0
Baylor					1		3
Bee							0
Bell					2		2
Bexar					6		4
Blanco							0
Borden							0
Bosque							0
Bowie					3		3
Brazoria					2		4
Brazos					1		3
Brewster					1		1
Briscoe					1		2
Brooks					2		3
Brown					1		2
Burleson							0
Burnet					1		2
Caldwell					1		2
Calhoun					1		2
Callahan							0
Cameron					8		3
Camp							0
Carson							0
Cass					2		3
Castro					1		2
Chambers							1
Cherokee							0
Childress							0
Clay					1		2
Cochran					1		3
Coke							0
Coleman					1		3
Collin					2		3
Collingsworth					1		3
Colorado							0
Comal					1		2
Comanche							0
Concho							0
Cooke					1		2

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Coryell							0
Cottle					3		3
Crane							0
Crockett							0
Crosby					3		3
Culberson							0
Dallam					2		2
Dallas					8		3
Dawson							0
Deaf Smith					4		3
Delta							0
Denton					2		3
DeWitt					1		3
Dickens							0
Dimmit					2		3
Donley					1		3
Duval							0
Eastland							0
Ector					2		3
Edwards					1		2
El Paso					8		3
Ellis							0
Erath							0
Falls							0
Fannin							0
Fayette							0
Fisher							0
Floyd							0
Foard					1		3
Fort Bend					1		4
Franklin							0
Freestone							0
Frio							0
Gaines							0
Galveston					3		4
Garza							0
Gillespie					3		1
Glasscock							0
Goliad							0
Gonzales					1		3
Gray					2		2
Grayson					4		3
Gregg					4		3
Grimes							0
Guadalupe					1		2
Hale					4		2
Hall					1		3
Hamilton							0
Hansford					2		2
Hardeman							0
Hardin							1

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Harris					8		5
Harrison					1		3
Hartley							0
Haskell							0
Hays					1		2
Hemphill					1		2
Henderson					1		3
Hidalgo					1		4
Hill					1		2
Hockley							0
Hood					1		2
Hopkins					1		2
Houston							0
Howard							0
Hudspeth							0
Hunt					2		3
Hutchinson					2		2
Irion							0
Jack							0
Jackson							1
Jasper					2		3
Jeff Davis					1		1
Jefferson					5		4
Jim Hogg							0
Jim Wells					2		3
Johnson					1		3
Jones							0
Karnes							0
Kaufman							0
Kendall							0
Kenedy							1
Kent							0
Kerr					4		1
Kimble					1		3
King							0
Kinney							0
Kleberg					1		4
Knox					1		3
La Salle							0
Lamar					2		3
Lamb					3		3
Lampasas							0
Lavaca					1		2
Lee							0
Leon							0
Liberty					1		4
Limestone							0
Lipscomb							0
Live Oak							0
Llano					4		2
Loving							0

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Lubbock					7		4
Lynn							0
Madison							0
Marion							0
Martin							0
Mason							0
Matagorda					2		4
Maverick					3		3
McCulloch							0
McLennan					2		4
McMullen							0
Medina							0
Menard							0
Midland					2		2
Milam							0
Mills							0
Mitchell							0
Montague							0
Montgomery					3		3
Moore					5		1
Morris					1		3
Motley							0
Nacogdoches					2		3
Navarro					2		3
Newton							0
Nolan					2		3
Nueces					4		4
Ochiltree					2		2
Oldham							0
Orange					2		3
Palo Pinto					1		3
Panola							0
Parker							0
Parmer					1		2
Pecos							0
Polk					2		4
Potter					7		3
Presidio					4		2
Rains							0
Randall					3		2
Reagan							0
Real					2		3
Red River					1		3
Reeves							0
Refugio					1		4
Roberts							0
Robertson							0
Rockwall							0
Runnels							0
Rusk							0
Sabine					1		3

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
San Augustine							0
San Jacinto					2		3
San Patricio					2		3
San Saba							0
Schleicher							0
Scurry							0
Shackelford							0
Shelby					1		3
Sherman					2		2
Smith					2		3
Somervell							0
Starr					7		3
Stephens							0
Sterling							0
Stonewall					1		3
Sutton							0
Swisher							0
Tarrant					6		3
Taylor					2		2
Terrell							0
Terry					1		3
Throckmorton							0
Titus					1		3
Tom Green					2		1
Travis					5		3
Trinity					1		3
Tyler							0
Upshur							0
Upton							0
Uvalde					2		3
Val Verde					3		2
Van Zandt					1		3
Victoria					2		2
Walker							0
Waller					1		3
Ward							0
Washington							0
Webb					4		2
Wharton					2		3
Wheeler					1		2
Wichita					1		2
Wilbarger					1		2
Willacy					3		4
Williamson							0
Wilson					1		2
Winkler							0
Wise							0
Wood							0
Yoakum							0
Young							0
Zapata					2		3
Zavala					2		3

TEXAS

TOTAL: 17 DISASTERS
FEMA PA + HM: $3.8 B
HUD CDBG-DR: $10.9 B
FEMA + HUD ASSISTANCE: $14.8 B

			2011				2013				2015				2016								2017		2018		2019						2020		2021	
			1999: WILDFIRES		4029: WILDFIRES		4136: EXPLOSION		4159: SEVERE STORMS AND FLOODING		4223: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS AND FLOODING		4245: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4255: SEVERE WINTER STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4266: SEVERE STORMS, TORNADOES, AND FLOODING		4269: SEVERE STORMS AND FLOODING		4272: SEVERE STORMS AND FLOODING		4332: HURRICANE HARVEY		4377: SEVERE STORMS AND FLOODING		4416: SEVERE STORMS AND FLOODING		4454: SEVERE STORMS AND FLOODING		4466: TROPICAL STORM IMELDA		4572: HURRICANE LAURA		4586: SEVERE WINTER STORMS	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	17	$1,056,367,219	$48,502,179	$734,285	$29,908,775	$593,814	$3,553,575	$140,106	$716,629	$0	$31,869,172	$2,267,280	$9,231,996	$397,269	$7,464,721	$192,391	$5,271,487	$326,342	$6,460,631	$821,454	$10,554,290	$708,599	$839,219,137	$22,083,670			$9,859,567	$818,492					$22,147,920	$0	$2,523,437	$0
Anderson County	4	$1,300,662	$34,689	$0	$129,702	$0													$1,136,271	$0															$0	$0
Andrews County	2	$134,032	$134,032	$0																															$0	$0
Angelina County	3	$1,706,308									$1,164,568	$63,375					$434,346	$44,019																	$0	$0
Aransas County	2	$77,116,597																					$75,054,919	$2,002,069											$59,609	$0
Archer County	4	$1,122,655	$80,895	$0							$664,716	$0															$241,369	$132,300							$3,375	$0
Armstrong County	2	$19,578	$19,578	$0																															$0	$0
Atascosa County	2	$304,204									$0	$267,905																							$36,299	$0
Austin County	5	$3,902,621									$871,725	$0							$1,116,526	$0	$299,954	$0	$1,593,514	$0											$20,901	$0
Bailey County	3	$469,504	$3,901	$0											$465,603	$0																			$0	$0
Bandera County	2	$230,034																			$230,034	$0													$0	$0
Bastrop County	8	$33,893,211	$0	$3,101,895	$15,184,726	$188,389					$1,568,800	$1,827,009	$461,555	$2,439,934					$545,366	$0	$2,475,973	$2,478,577	$3,597,538	$0											$23,451	$0
Baylor County	4	$984,413	$10,865	$0							$100,601	$0															$715,447	$157,500							$0	$0
Bee County	2	$1,155,521																					$959,119	$183,753											$12,649	$0
Bell County	1	$53,770																																	$53,770	$0
Bexar County	2	$775,605											$39,178	$0									$0	$0											$736,427	$0
Blanco County	3	$668,235	$0	$0							$668,235	$0																							$0	$0
Borden County	2	$0													$0	$0																			$0	$0
Bosque County	6	$1,097,467			$107,064	$0					$237,915	$0	$309,763	$0					$76,094	$0	$366,631	$0													$0	$0
Bowie County	3	$856,637			$75,441	$0					$781,196	$0																							$0	$0
Brazoria County	5	$50,601,689									$343,918	$0	$0	$0							$2,491,593	$0	$27,107,019	$20,534,969											$124,190	$0
Brazos County	2	$988,521																			$910,569	$0													$77,952	$0
Brewster County	2	$16,187	$16,187	$0																															$0	$0
Briscoe County	3	$51,475	$26,755	$0	$24,720	$0																													$0	$0
Brooks County	2	$79,594	$79,594	$0																															$0	$0
Brown County	5	$6,668,179	$62,158	$0							$839,625	$0									$4,790,486	$0					$975,910	$0							$0	$0
Burleson County	4	$1,120,482									$432,300	$0									$522,084	$0	$166,098	$0											$0	$0
Burnet County	3	$1,320,718	$0	$0																							$846,087	$458,386							$16,245	$0
Caldwell County	7	$2,720,993			$88,523	$0			$300,849	$0	$196,049	$0	$295,323	$0							$369,832	$85,097	$1,380,816	$0											$4,505	$0
Calhoun County	2	$19,940,932																					$18,728,424	$1,189,779											$22,729	$0
Callahan County	6	$5,376,286	$77,274	$0							$669,627	$1,344,207							$0	$0	$2,204,222	$0					$1,073,531	$0							$7,425	$0
Cameron County	4	$527,075											$0	$0											$0	$237,774			$0	$264,417					$24,884	$0
Camp County	2	$12,308			$12,308	$0																													$0	$0
Carson County	2	$34,948	$34,948	$0																															$0	$0
Cass County	7	$819,117	$64,090	$0	$45,815	$0					$192,213	$67,200			$34,798	$57,788	$262,177	$0	$95,036	$0															$0	$0
Castro County	3	$324,887	$8,164	$0											$316,723	$0																			$0	$0
Chambers County	3	$4,221,538																					$4,194,897	$0							$0	$0			$26,641	$0
Cherokee County	4	$1,364,734			$134,700	$0					$902,268	$0							$322,806	$0															$4,960	$0
Childress County	3	$33,502	$14,044	$0											$19,458	$0																			$0	$0
Clay County	4	$315,345	$82,651	$0	$40,177	$0					$192,517	$0																							$0	$0
Cochran County	3	$68,040	$13,808	$0											$54,233	$0																			$0	$0
Coke County	2	$0	$0	$0																															$0	$0
Coleman County	3	$1,388,737	$34,992	$0																	$1,311,869	$0													$41,876	$0
Collin County	1	$376,753									$34,806	$0																							$341,947	$0
Collingsworth County	3	$135,968									$135,968	$0			$0	$0																			$0	$0
Colorado County	5	$4,174,812			$115,093	$0					$505,829	$0							$1,054,001	$0			$2,499,889	$0											$0	$0
Comal County	4	$1,386,228									$253,415	$0	$783,095	$0									$338,901	$0											$10,816	$0
Comanche County	4	$10,893,513									$4,448,156	$0									$6,361,096	$0					$84,261	$0							$0	$0
Concho County	2	$6,141	$6,141	$0																															$0	$0
Cooke County	2	$4,957,807									$4,917,949	$0																							$39,858	$0
Coryell County	6	$2,448,579	$101,819	$0	$168,859	$0					$273,390	$0							$630,451	$0							$1,274,060	$0							$0	$0
Cottle County	3	$88,959	$88,959	$0											$0	$0																			$0	$0
Crane County	2	$18,682	$18,682	$0																															$0	$0
Crockett County	3	$62,634	$62,634	$0	$0	$0																													$0	$0
Crosby County	3	$15,783	$7,621	$0											$0	$0																			$8,162	$0
Culberson County	2	$51,654	$51,654	$0																															$0	$0
Dallam County	1	$0																																	$0	$0
Dallas County	4	$13,701,346									$6,766,625	$154,738			$5,507,501	$831,000							$0	$0											$441,483	$0
Dawson County	2	$12,892	$12,892	$0																															$0	$0
Deaf Smith County	3	$362,415	$52,436	$0											$309,979	$0																			$0	$0
Delta County	3	$489,551									$259,014	$0			$227,015	$0																			$3,522	$0
Denton County	2	$5,515,481									$4,886,788	$64,766																							$563,927	$0
DeWitt County	3	$1,558,135									$58,312	$0											$1,499,823	$0											$0	$0
Dickens County	4	$193,325	$102,961	$0							$72,414	$0			$0	$0																			$17,949	$0
Dimmit County	2	$0																									$0	$0							$0	$0
Donley County	3	$53,930	$53,930	$0											$0	$0																			$0	$0
Duval County	3	$366,235	$21,848	$0							$344,386	$0																							$0	$0
Eastland County	4	$9,936,341	$45,322	$0							$2,475,007	$2,813,942									$4,348,541	$236,629													$16,901	$0
Ector County	1	$0																																	$0	$0
Edwards County	4	$1,273,301			$0	$0					$90,302	$0															$1,182,999	$0							$0	$0
Ellis County	3	$1,373,571									$732,605	$0			$380,664	$0																			$260,302	$0
El Paso County	1	$0																																	$0	$0
Erath County	5	$3,407,737	$91,950	$0							$546,505	$0					$1,155,757	$0			$1,588,036	$0													$25,489	$0
Falls County	2	$580,237																			$580,237	$0													$0	$0
Fannin County	3	$2,016,703									$653,997	$1,008,265															$232,192	$114,750							$7,500	$0
Fayette County	6	$3,883,195			$0	$0					$262,651	$236,119							$155,257	$0	$497,876	$84,042	$2,533,924	$96,200											$17,125	$0
Fisher County	4	$390,499	$58,006	$0											$0	$0					$332,493	$0													$0	$0
Floyd County	2	$335,529													$228,640	$0					$106,889	$0													$0	$0
Foard County	4	$30,548	$17,358	$0	$13,190	$0									$0	$0																			$0	$0
Fort Bend County	5	$59,508,333									$0	$533,288							$278,190	$5,778,240	$2,890,464	$670,917	$45,453,294	$3,630,158											$273,783	$0
Franklin County	5	$747,398	$50,213	$0	$9,557	$0									$556,567	$0											$131,062	$0							$0	$0
Freestone County	2	$447,253							$426,654	$0																									$20,599	$0
Frio County	3	$12,766	$0	$0							$12,766	$0																							$0	$0
Gaines County	2	$109,286									$109,286	$0																							$0	$0
Galveston County	4	$74,260,765											$0	$0									$62,508,383	$10,850,561									$520,090	$0	$381,731	$0
Garza County	3	$210,765	$63,383	$0							$147,382	$0																							$0	$0
Gillespie County	2	$170,425									$64,544	$0																							$105,881	$0
Glasscock County	2	$11,427	$11,427	$0																															$0	$0
Goliad County	2	$292,921																					$279,605	$0											$13,316	$0
Gonzales County	4	$2,067,173	$14,580	$0							$131,499	$25,358											$1,246,469	$499,534											$149,734	$0
Gray County	1	$0																																	$0	$0
Grayson County	3	$2,994,247			$57,777	$1,028,603					$1,775,232	$108,675																							$23,960	$0
Gregg County	3	$1,591,740			$227,108	$0											$1,301,272	$0																	$63,359	$0
Grimes County	7	$1,685,303			$0	$0					$538,579	$0							$162,782	$0	$219,991	$0	$324,623	$106,875			$315,693	$0							$16,760	$0
Guadalupe County	4	$931,760									$0	$0	$113,206	$0									$661,291	$0											$157,263	$0
Hale County	1	$0																																	$0	$0
Hall County	6	$948,176	$23,653	$0	$19,986	$0					$218,479	$0			$0	$0					$686,058	$0													$0	$0
Hamilton County	1	$0																																	$0	$0
Hansford County	2	$0	$0	$0																															$0	$0
Hardeman County	3	$33,697	$0	$0											$33,697	$0																			$0	$0
Hardin County	7	$58,004,726	$75,003	$0	$10,723	$0					$218,206	$0	$0	$0							$59,863	$0	$54,920,362	$2,720,570											$0	$0
Harris County	7	$1,404,770,585									$12,032,865	$1,884,330	$0	$0					$19,997,658	$201,878	$0	$24,368	$1,143,731,017	$220,373,974							$0	$213,000			$6,311,493	$0
Harrison County	7	$1,349,926	$62,256	$0	$130,951	$0					$299,401	$0			$41,071	$0	$435,669	$0	$374,197	$0															$6,382	$0
Hartley County	3	$72,807	$53,481	$0							$19,326	$0																							$0	$0
Haskell County	4	$1,278,764	$0	$0											$0	$0											$1,278,764	$0							$0	$0
Hays County	4	$10,356,848							$1,007,153	$0	$3,667,782	$60,000	$3,337,000	$2,207,226																					$77,688	$0
Hemphill County	2	$36,565	$36,565	$0																															$0	$0
Henderson County	5	$2,529,951			$89,469	$0					$2,004,589	$0			$235,352	$0	$128,028	$0																	$72,513	$0
Hidalgo County	6	$16,996,548									$5,606,382	$5,899,898	$3,799,682	$633,041							$130,861	$598,652			$0	$253,174			$0	$0					$74,858	$0
Hill County	5	$12,056,427			$131,071	$0					$1,227,137	$19,793	$2,299,234	$0													$8,379,191	$0							$0	$0
Hockley County	3	$383,615	$17,452	$0											$359,060	$0																			$7,103	$0
Hood County	4	$631,788									$419,121	$0					$0	$0			$197,538	$0													$15,129	$0
Hopkins County	4	$4,598,696									$1,860,280	$0			$1,022,919	$0											$1,500,664	$206,915							$7,918	$0
Houston County	6	$6,573,822	$62,068	$0	$123,128	$0					$1,113,927	$0									$1,708,948	$0					$3,537,369	$0							$28,382	$0
Howard County	3	$179,657	$145,406	$0	$34,251	$0																													$0	$0
Hudspeth County	1	$0																																	$0	$0
Hunt County	2	$52,559			$52,559	$0																													$0	$0
Hutchinson County	2	$3,019	$3,019	$0																															$0	$0
Irion County	2	$22,524	$22,524	$0																															$0	$0
Jack County	3	$667,174	$0	$0							$667,174	$0																							$0	$0
Jackson County	2	$2,186,580																					$1,937,580	$249,000											$0	$0
Jasper County	8	$3,070,919	$29,985	$0							$556,243	$0	$75,807	$48,762			$403,412	$0			$465,054	$0	$1,372,067	$0									$119,589	$0	$0	$0
Jeff Davis County	2	$85,575	$85,575	$0																															$0	$0
Jefferson County	5	$157,563,188			$0	$0																	$146,271,451	$8,399,226							$0	$2,355,052	$286,963	$0	$250,496	$0
Jim Hogg County	2	$8,675	$0	$0																															$8,675	$0
Jim Wells County	4	$1,429,999									$1,155,426	$0											$135,235	$0	$0	$139,338									$0	$0
Johnson County	2	$541,089									$541,089	$0																							$0	$0
Jones County	6	$8,452,450	$0	$0							$1,359,843	$0			$265,275	$0			$1,247,101	$0							$5,564,494	$0							$15,736	$0
Karnes County	2	$128,924																					$128,924	$0											$0	$0
Kaufman County	3	$1,680,379									$959,416	$0			$656,538	$64,425																			$0	$0
Kendall County	3	$280,442			$0	$0					$280,442	$0																							$0	$0
Kenedy County	1	$0																																	$0	$0
Kent County	3	$42,962	$42,962	$0											$0	$0																			$0	$0
Kerr County	1	$106,286																																	$106,286	$0
Kimble County	4	$3,734,141	$0	$0	$23,826	$0																					$3,681,880	$0							$28,435	$0
King County	3	$22,370	$22,370	$0											$0	$0																			$0	$0
Kinney County	2	$405,610																									$405,610	$0							$0	$0
Kleberg County	3	$887,620																			$782,324	$0	$100,736	$0											$4,560	$0
Knox County	4	$236,825	$0	$0											$0	$0											$236,825	$0							$0	$0
Lamar County	4	$2,740,850	$42,359	$0							$2,197,545	$0					$486,484	$0																	$14,462	$0
Lamb County	3	$764,469	$38,700	$0											$725,769	$0																			$0	$0
Lampasas County	2	$0	$0	$0																															$0	$0
La Salle County	2	$0			$0	$0																													$0	$0
Lavaca County	2	$458,837																					$261,546	$193,050											$4,241	$0
Lee County	6	$452,733	$0	$0	$15,535	$0					$166,096	$0									$111,642	$0	$154,689	$0											$4,772	$0
Leon County	6	$1,489,646	$81,918	$0	$269,707	$0					$328,778	$0			$667,967	$0					$104,939	$0													$36,338	$0
Liberty County	7	$18,516,736									$2,508,212	$0	$322,442	$0					$924,908	$0	$658,963	$0	$9,411,411	$4,690,800							$0	$0			$0	$0
Limestone County	3	$9,383			$0	$0											$0	$0																	$9,383	$0
Lipscomb County	1	$0																																	$0	$0
Live Oak County	2	$28,195	$21,744	$0																															$6,451	$0
Llano County	2	$2,977,393																									$2,747,168	$116,011							$114,214	$0
Loving County	1	$0																																	$0	$0
Lubbock County	3	$2,849,695									$1,196,634	$465,000			$1,188,061	$0																			$0	$0
Lynn County	3	$152,783	$10,366	$0							$138,790	$0																							$3,628	$0
McCulloch County	3	$2,415,975			$0	$0																					$2,415,975	$0							$0	$0
McLennan County	3	$27,192,058					$25,359,817	$54,925			$1,002,611	$760,561																							$14,144	$0
McMullen County	1	$0																																	$0	$0
Madison County	6	$1,584,782									$414,908	$0					$60,029	$0			$120,202	$0	$193,628	$0			$696,380	$75,000							$24,635	$0
Marion County	4	$250,351	$24,548	$0	$77,062	$0											$148,741	$0																	$0	$0
Martin County	2	$4,574	$4,574	$0																															$0	$0
Mason County	3	$444,813	$37,764	$0																							$407,049	$0							$0	$0
Matagorda County	3	$12,645,285			$0	$0																	$9,911,149	$2,682,459											$51,677	$0
Maverick County	1	$14,748																																	$14,748	$0
Medina County	1	$17,513																																	$17,513	$0
Menard County	4	$399,902	$17,458	$0	$0	$0																					$382,444	$0							$0	$0
Midland County	2	$14,255	$14,255	$0																															$0	$0
Milam County	4	$3,338,861									$366,369	$173,034							$391,695	$0			$2,407,763	$0											$0	$0
Mills County	2	$0	$0	$0																															$0	$0
Mitchell County	2	$13,174	$13,174	$0																															$0	$0
Montague County	4	$13,297,067	$69,299	$0	$60,335	$0					$13,134,600	$0																							$32,833	$0
Montgomery County	7	$28,985,213			$0	$0					$0	$0							$2,086,953	$0	$5,367,093	$0	$20,864,696	$219,208							$0	$273,000			$174,264	$0
Moore County	2	$60,130	$60,130	$0																															$0	$0
Morris County	3	$21,462	$15,236	$0	$6,226	$0																													$0	$0
Motley County	3	$61,749	$61,749	$0											$0	$0																			$0	$0
Nacogdoches County	2	$1,156,024									$1,156,024	$0																							$0	$0
Navarro County	6	$5,846,093			$117,729	$0					$1,840,448	$325,170	$3,018,927	$66,268	$200,254	$34,259					$228,075	$0													$14,962	$0
Newton County	8	$34,860,297	$36,701	$25,630	$11,828	$0					$292,548	$1,748,154	$42,397	$0			$21,867,901	$4,585,322					$5,911,567	$325,012									$13,238	$0	$0	$0
Nolan County	5	$80,505	$0	$0	$0	$0									$0	$0											$80,505	$0							$0	$0
Nueces County	3	$139,115,519									$1,861,534	$62,438											$134,430,711	$2,715,811											$45,025	$0
Ochiltree County	2	$0	$0	$0																															$0	$0
Oldham County	2	$0	$0	$0																															$0	$0
Orange County	7	$137,836,537			$0	$0					$347,932	$0					$1,088,231	$0					$119,062,812	$6,339,387							$0	$487,583	$10,485,599	$0	$24,994	$0
Palo Pinto County	4	$680,440	$0	$0							$171,084	$0									$185,166	$261,306													$62,885	$0
Panola County	3	$0	$0	$0	$0	$0																													$0	$0
Parker County	5	$1,249,693									$1,204,802	$0					$18,618	$0	$0	$0	$0	$0													$26,272	$0
Parmer County	2	$967,402													$967,402	$0																			$0	$0
Pecos County	3	$59,683	$59,683	$0	$0	$0																													$0	$0
Polk County	6	$1,401,216			$0	$0					$184,248	$0									$422,249	$0	$794,719	$0			$0	$0							$0	$0
Potter County	2	$37,939	$37,939	$0																															$0	$0
Presidio County	2	$43,752	$43,752	$0																															$0	$0
Rains County	2	$121,105													$121,105	$0																			$0	$0
Randall County	2	$61,435	$61,435	$0																															$0	$0
Reagan County	2	$0	$0	$0																															$0	$0
Real County	3	$579,493									$207,350	$0															$355,661	$0							$16,482	$0
Red River County	6	$848,948	$19,751	$0	$32,157	$0					$512,205	$0			$203,955	$0	$80,880	$0																	$0	$0
Reeves County	2	$0			$0	$0																													$0	$0
Refugio County	3	$28,778,872									$33,536	$0											$28,149,968	$578,588											$16,781	$0
Roberts County	3	$34,665	$28,199	$0	$6,467	$0																													$0	$0
Robertson County	2	$310,965									$290,602	$0																							$20,363	$0
Rockwall County	2	$10,897													$0	$0																			$10,897	$0
Runnels County	1	$0																																	$0	$0
Rusk County	4	$613,098	$50,678	$0	$223,321	$0					$304,150	$0																							$34,948	$0
Sabine County	5	$1,180,193	$0	$0							$173,044	$0					$268,316	$18,224					$683,864	$0											$36,745	$0
San Augustine County	6	$509,832	$24,331	$0	$12,464	$0					$0	$0					$126,336	$0					$346,702	$0											$0	$0
San Jacinto County	6	$4,571,322									$1,328,011	$39,090							$1,103,709	$0	$336,669	$0	$1,763,843	$0							$0	$0			$0	$0
San Patricio County	2	$39,908,496																					$37,162,587	$2,709,012											$36,897	$0
San Saba County	3	$1,752,082	$0	$0																							$1,670,857	$81,225							$0	$0
Schleicher County	2	$20,336																									$20,336	$0							$0	$0
Scurry County	3	$30,160	$30,160	$0											$0	$0																			$0	$0
Shackelford County	3	$0	$0	$0											$0	$0																			$0	$0
Shelby County	4	$2,275,130			$0	$0					$1,616,379	$0					$628,470	$0																	$30,282	$0
Sherman County	1	$0																																	$0	$0
Smith County	5	$2,052,731			$195,006	$0					$115,954	$0	$1,370,101	$0					$352,269	$0															$19,401	$0
Somervell County	4	$337,491	$0	$0							$165,217	$0									$172,274	$0													$0	$0
Starr County	2	$66,485									$66,485	$0																							$0	$0
Stephens County	3	$551,032	$41,012	$0																	$510,021	$0													$0	$0
Sterling County	2	$0	$0	$0																															$0	$0
Stonewall County	3	$0	$0	$0											$0	$0																			$0	$0
Sutton County	4	$491,129	$30,269	$0	$0	$0																					$460,860	$0							$0	$0
Swisher County	2	$0	$0	$0																															$0	$0
Tarrant County	3	$4,303,764									$2,702,468	$1,430,179											$0	$0											$171,117	$0
Taylor County	1	$122,791																																	$122,791	$0
Terrell County	2	$51,957	$51,957	$0																															$0	$0
Terry County	3	$433,435	$16,167	$0											$417,269	$0																			$0	$0
Throckmorton County	5	$1,611,280	$50,954	$0							$192,005	$0									$0	$0					$1,368,321	$0							$0	$0
Titus County	3	$264,323			$33,613	$0									$230,710	$0																			$0	$0
Tom Green County	3	$139,227	$139,227	$0							$0	$0																							$0	$0
Travis County	8	$28,095,664			$0	$75,000			$5,259,269	$1,132,025	$2,278,862	$669,024	$14,420,224	$0							$26,617	$0	$499,568	$0			$3,343,315	$137,947							$253,812	$0
Trinity County	5	$702,163	$137,111	$0							$238,993	$0			$50,216	$70,994					$204,848	$0													$0	$0
Tyler County	7	$1,960,183	$121,189	$0	$17,650	$0					$367,152	$0					$376,820	$0			$286,226	$60,075	$731,071	$0											$0	$0
Upshur County	3	$363,295			$289,902	$0													$73,393	$0															$0	$0
Upton County	2	$0	$0	$0																															$0	$0
Uvalde County	3	$1,135,489									$807,421	$0															$328,068	$0							$0	$0
Val Verde County	3	$943,264	$111,166	$0																							$725,551	$0							$106,547	$0
Van Zandt County	4	$6,153,607									$3,117,954	$0			$2,229,186	$0			$793,210	$0															$13,257	$0
Victoria County	3	$26,577,553									$128,820	$41,250											$25,165,995	$1,140,176											$101,311	$0
Walker County	10	$8,099,455	$54,761	$0	$278,840	$0					$1,588,096	$0	$1,808,815	$0	$218,182	$0	$304,750	$0			$584,548	$0	$2,727,654	$0			$465,074	$0							$68,735	$0
Waller County	6	$3,579,143			$0	$0					$308,457	$0							$429,758	$0	$383,172	$0	$2,457,755	$0											$0	$0
Ward County	1	$0																																	$0	$0
Washington County	5	$7,426,189									$327,750	$0							$193,961	$0	$4,821,126	$1,584,997	$470,978	$0											$27,377	$0
Webb County	1	$67,356																																	$67,356	$0
Wharton County	4	$10,982,668									$1,812,510	$0							$489,714	$140,216			$6,901,977	$1,625,906											$12,345	$0
Wheeler County	3	$0	$0	$0											$0	$0																			$0	$0
Wichita County	3	$1,785,214	$0	$0							$1,506,965	$213,593																							$64,656	$0
Wilbarger County	3	$24,807	$24,807	$0											$0	$0																			$0	$0
Willacy County	3	$956,045											$899,045	$0															$0	$57,000					$0	$0
Williamson County	3	$1,449,543			$0	$0					$1,307,934	$54,000																							$87,610	$0
Wilson County	3	$1,119,782									$888,357	$0	$228,491	$0																					$2,935	$0
Winkler County	2	$24,719	$24,719	$0																															$0	$0
Wise County	3	$1,465,360			$67,366	$0					$1,397,994	$0																							$0	$0
Wood County	2	$10,434																	$10,434	$0															$0	$0
Yoakum County	1	$0																																	$0	$0
Young County	3	$991,570	$187,233	$0							$804,337	$0																							$0	$0
Zapata County	1	$0																																	$0	$0
Zavala County	2	$33,267									$33,267	$0																							$0	$0
Total FEMA Allocation		$3,838,222,688	$52,813,413	$3,861,810	$48,674,708	$1,885,805	$28,913,393	$195,030	$7,710,555	$1,132,025	$159,535,419	$24,627,639	$42,856,282	$5,792,500	$25,399,887	$1,250,857	$34,847,724	$4,973,906	$40,502,371	$6,941,788	$62,007,634	$6,793,258	$2,848,411,709	$316,139,746	$0	$630,286	$56,984,538	$2,298,525	$0	$321,417	$0	$3,328,635	$33,573,398	$0	$15,818,432	$0

HURRICANE HARVEY FLOODING AFTERMATH IN HOUSTON, TX | 2C2K PHOTOGRAPHY

UTAH

UTAH STATISTICS SUMMARY (2011 – 2021)	
7	CLIMATE DISASTER DECLARATIONS
3RD LOWEST	PER CAPITA SPENDING ON CLIMATE DISASTERS IN THE COUNTRY
DAVIS, SALT LAKE	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
46	SUPERFUND SITES
C+	ASCE INFRASTRUCTURE REPORT CARD GRADE
SALT LAKE	HIGHEST COMPOUNDING RISKS
$36.1 MILLION	FEMA + HUD POST-DISASTER FUNDING
3.1 MILLION	POPULATION TOTAL
$11	PER CAPITA SPENDING ON CLIMATE DISASTERS
$2.2 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

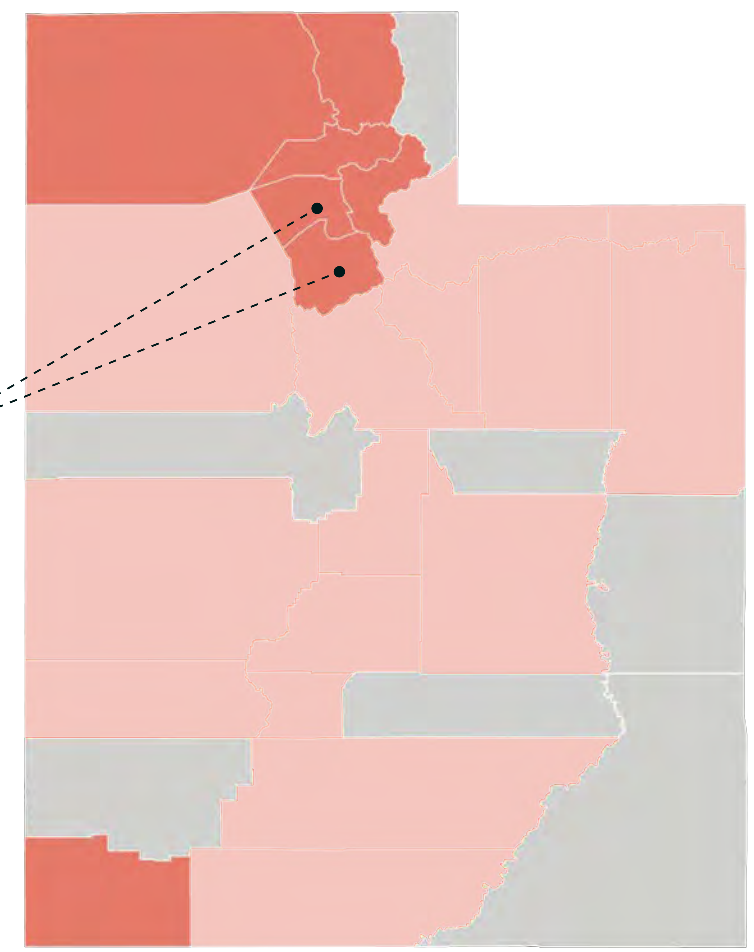
DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

7
disaster
declarations

Davis County and Salt Lake County have each had 3 disaster declarations.

Seventy-six percent of counties have had recent disaster declarations.



Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

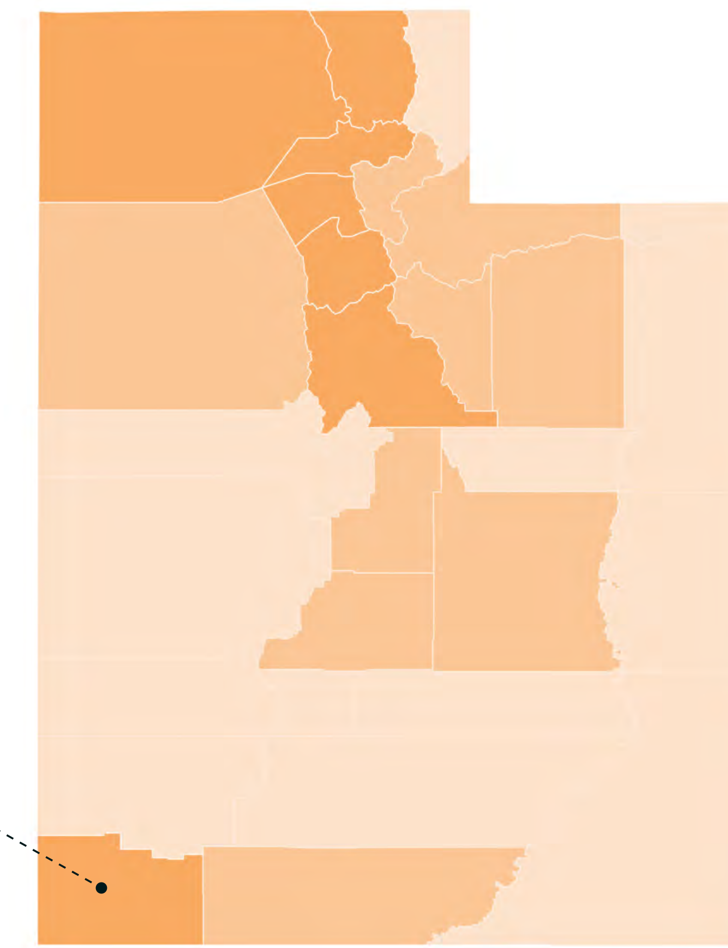
FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$36.1M
post-disaster
assistance

$36.1M	FEMA obligations
$0	HUD CDBG-DR Funds
$36.1M	FEMA + HUD assistance
$11	per capita cost

Washington County has received the most post-disaster federal assistance in Utah: $7 million due to severe storms and flooding.



Public Assistance and Hazard Mitigation

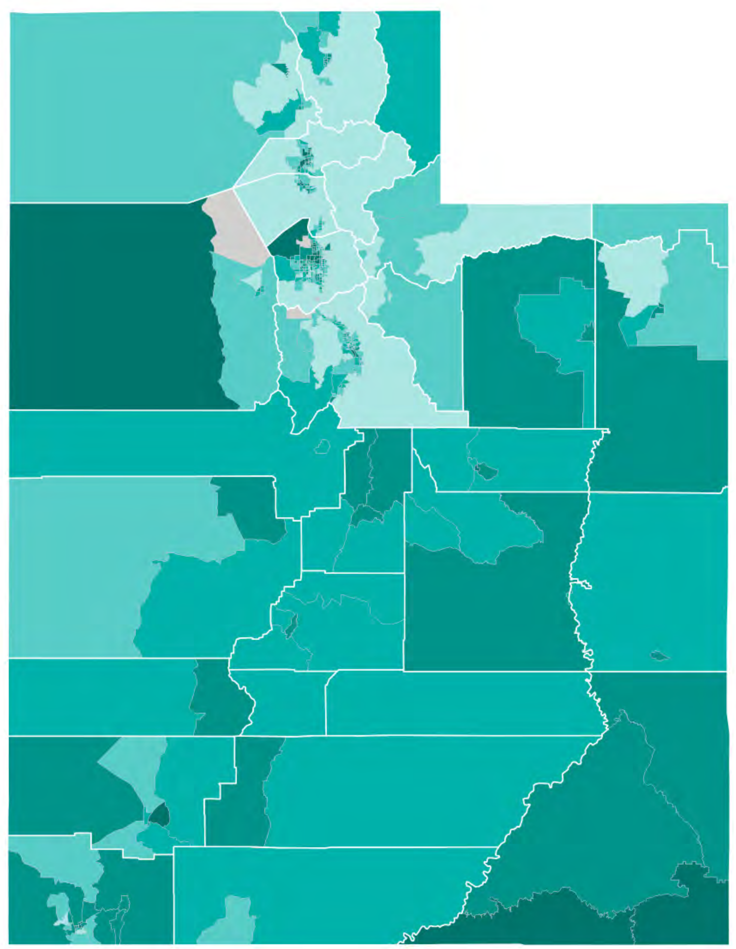
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

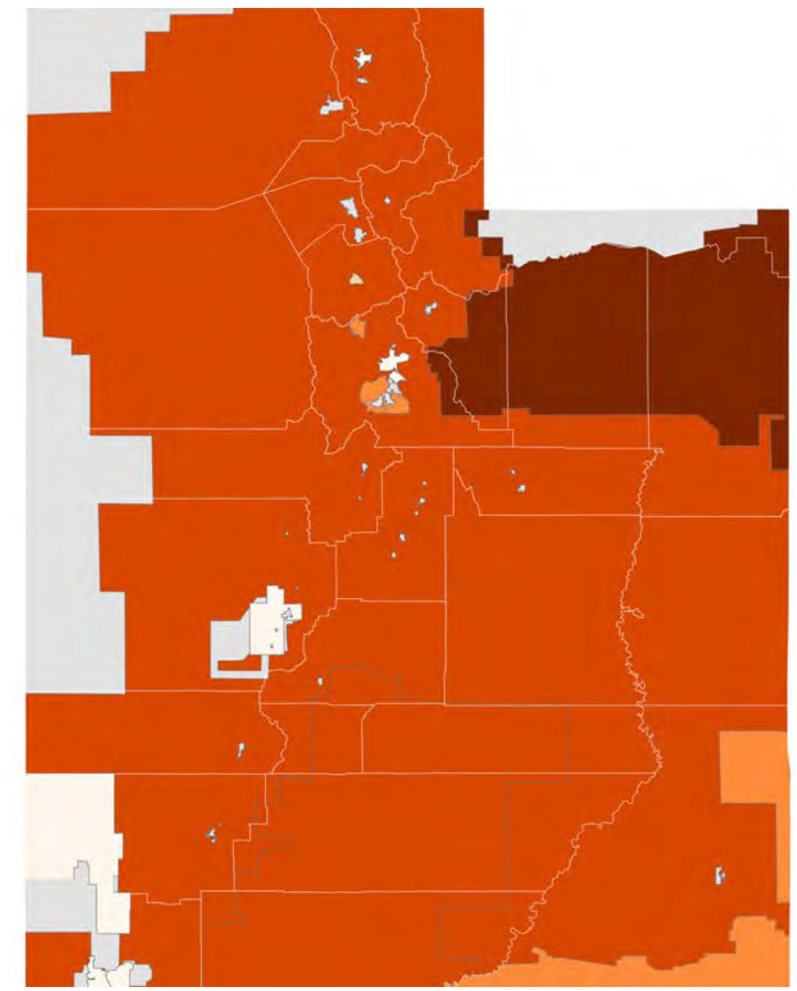
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



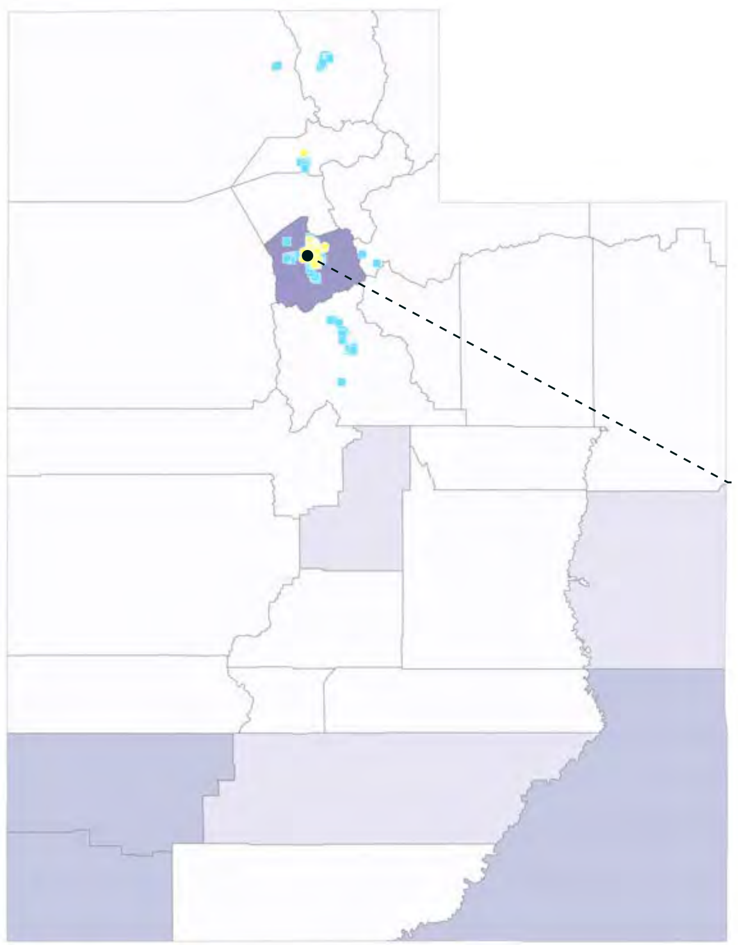
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Salt Lake County has a high risk of climate disasters, high population density, and high increase in population.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Beaver							0
Box Elder							0
Cache							0
Carbon							0
Daggett							0
Davis							0
Duchesne							0
Emery							0
Garfield					1		1
Grand					1		1
Iron					1		2
Juab							0
Kane							0
Millard							0
Morgan							0
Piute							0
Rich							0
Salt Lake					1		3
San Juan					1		2
Sanpete					1		1
Sevier							0
Summit							0
Tooele							0
Uintah							0
Utah							0
Wasatch							0
Washington					3		2
Wayne							0
Weber							0

UTAH

TOTAL: 7 DISASTERS FEMA PA + HM: $36.1 M HUD CDBG-DR: none FEMA + HUD ASSISTANCE: $36.1 M			2011				2012				2017		2020		2021	
			1955: SEVERE WINTER STORM AND FLOODING		4011: FLOODING		4053: SEVERE STORM		4088: SEVERE STORM AND FLOODING		4311: SEVERE WINTER STORMS AND FLOODING		4548: EARTHQUAKE AND AFTERSHOCKS		4578: STRAIGHT-LINE WINDS	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	7	$5,365,752	$1,125,458	$66,545	$904,502	$62,093	$372,194	$21,000	$49,020	$25,500	$153,012	$43,276	$915,116	$0	$1,628,036	$0
Beaver County	1	$70,395			$70,395	$0										
Box Elder County	2	$820,993			$92,046	$0					$728,947	$0				
Cache County	2	$3,174,745			$688,894	$0					$2,485,851	$0				
Carbon County	0	$0														
Daggett County	1	$7,661			$7,661	$0										
Davis County	3	$5,255,968			$752,951	$233,012	$2,192,490	$0					$0	$0	$2,077,516	$0
Duchesne County	1	$178,324			$178,324	$0										
Emery County	1	$109,590			$109,590	$0										
Garfield County	1	$59,331	$59,331	$0												
Grand County	0	$0														
Iron County	0	$0														
Juab County	0	$0														
Kane County	1	$244,036	$244,036	$0												
Millard County	1	$46,298			$46,298	$0										
Morgan County	2	$238,024			$157,404	$0									$80,620	$0
Piute County	1	$23,597			$23,597	$0										
Rich County	0	$0														
Salt Lake County	3	$6,893,602			$1,193,825	$973,738							$1,250,784	$0	$3,475,255	$0
San Juan County	0	$0														
Sanpete County	1	$381,062			$381,062	$0										
Sevier County	1	$109,438			$109,438	$0										
Summit County	1	$67,191			$67,191	$0										
Tooele County	1	$140,926			$140,926	$0										
Uintah County	1	$94,020			$94,020	$0										
Utah County	1	$541,629			$541,629	$0										
Wasatch County	1	$506,018			$506,018	$0										
Washington County	2	$9,477,411	$7,272,517	$600,118					$1,604,777	$0						
Wayne County	0	$0														
Weber County	2	$2,331,724			$1,672,999	$0									$658,725	$0
Total FEMA Allocation		$36,137,736	$8,701,343	$666,663	$7,738,770	$1,268,843	$2,564,684	$21,000	$1,653,797	$25,500	$3,367,810	$43,276	$2,165,900	$0	$7,920,152	$0

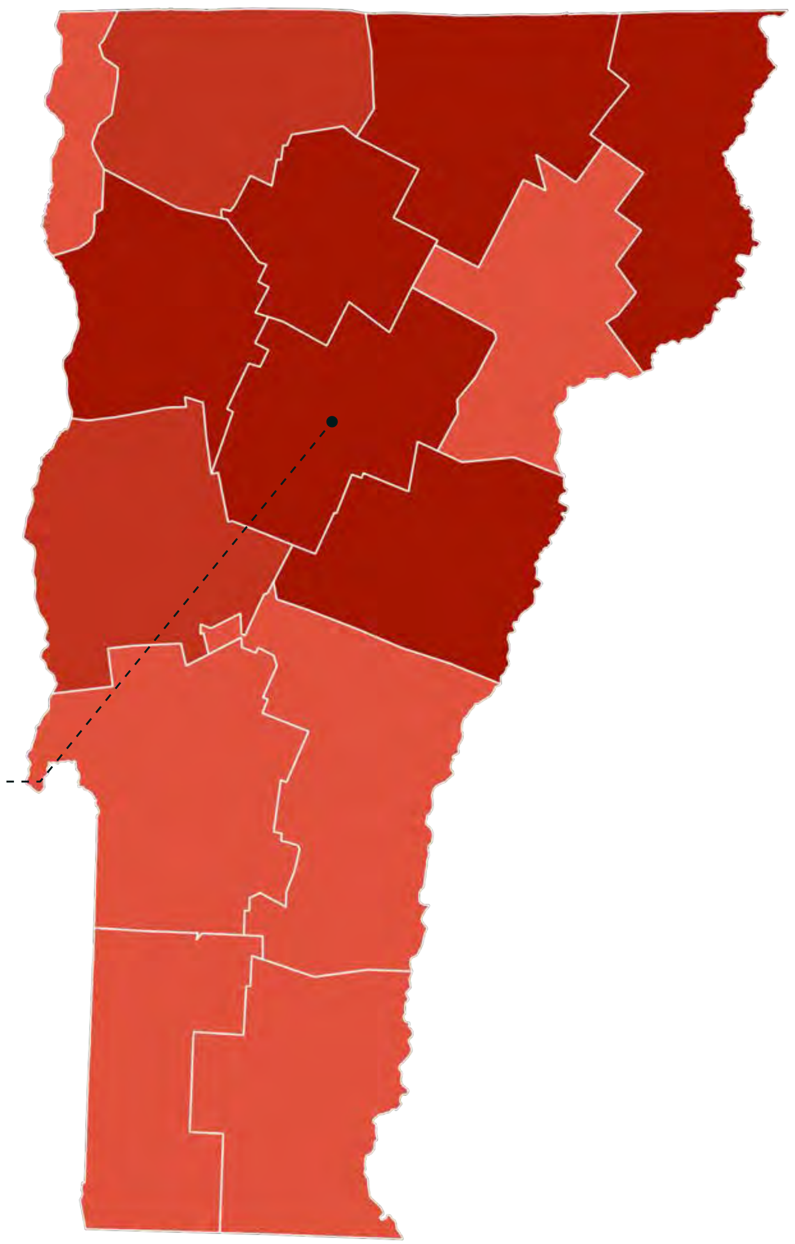
VERMONT

VERMONT STATISTICS SUMMARY (2011 – 2021)	
17	CLIMATE DISASTER DECLARATIONS
EVERY	COUNTY HAS HAD 4 OR MORE DISASTERS
5TH HIGHEST	PER CAPITA SPENDING ON CLIMATE DISASTERS IN THE COUNTRY
$593	PER CAPITA SPENDING ON CLIMATE DISASTERS
WASHINGTON	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
11	COUNTIES WITH FIVE OR MORE DISASTERS
1	SUPERFUND SITE
C	ASCE INFRASTRUCTURE REPORT CARD GRADE
$370 MILLION	FEMA + HUD POST-DISASTER FUNDING
624 THOUSAND	POPULATION TOTAL
$600 MILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011-2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

17
disaster declarations



Every county in Vermont has had four or more recent climate disasters. Six out of the 14 counties have had 10 or more.

Washington County has experienced 11 recent disaster declarations - the highest in the State.

Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011-2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

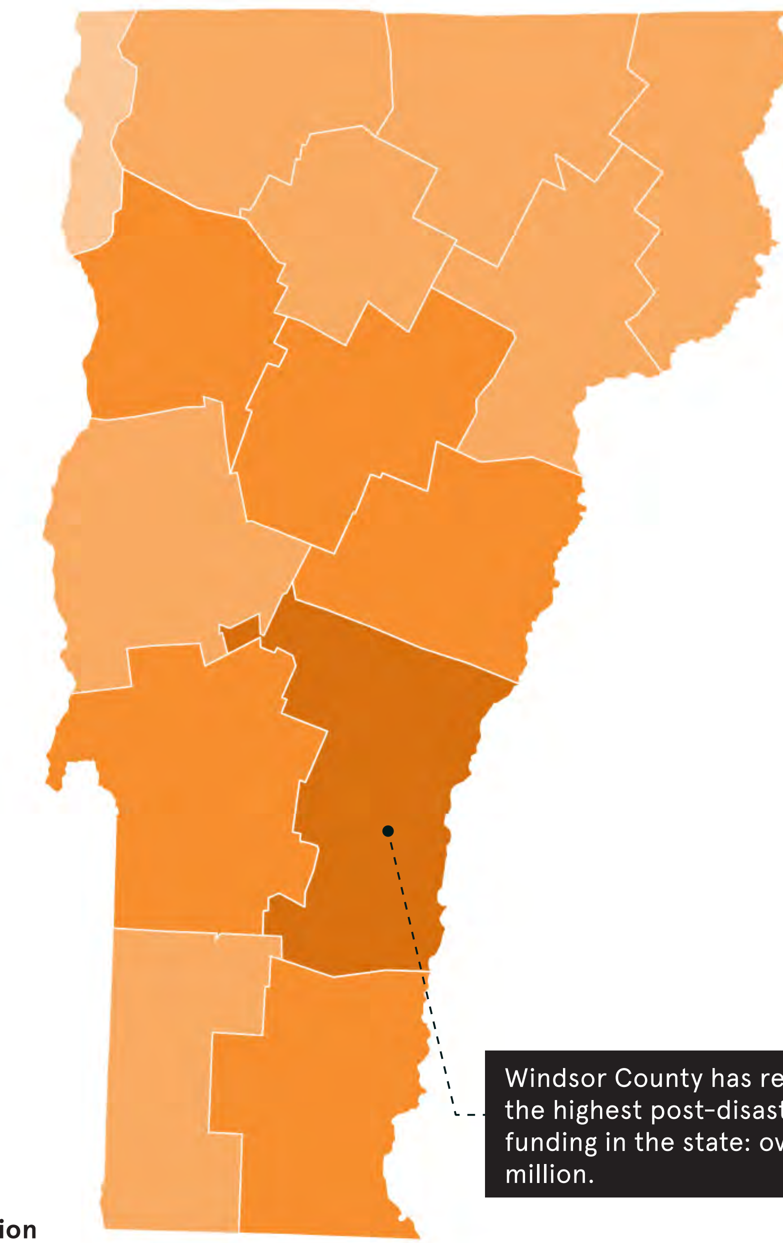
$370M
post-disaster assistance

$331M FEMA obligations

$39.5M HUD CDBG-DR Funds

$370M FEMA + HUD assistance

$593 per capita cost



Windsor County has received the highest post-disaster federal funding in the state: over $58 million.

Public Assistance and Hazard Mitigation

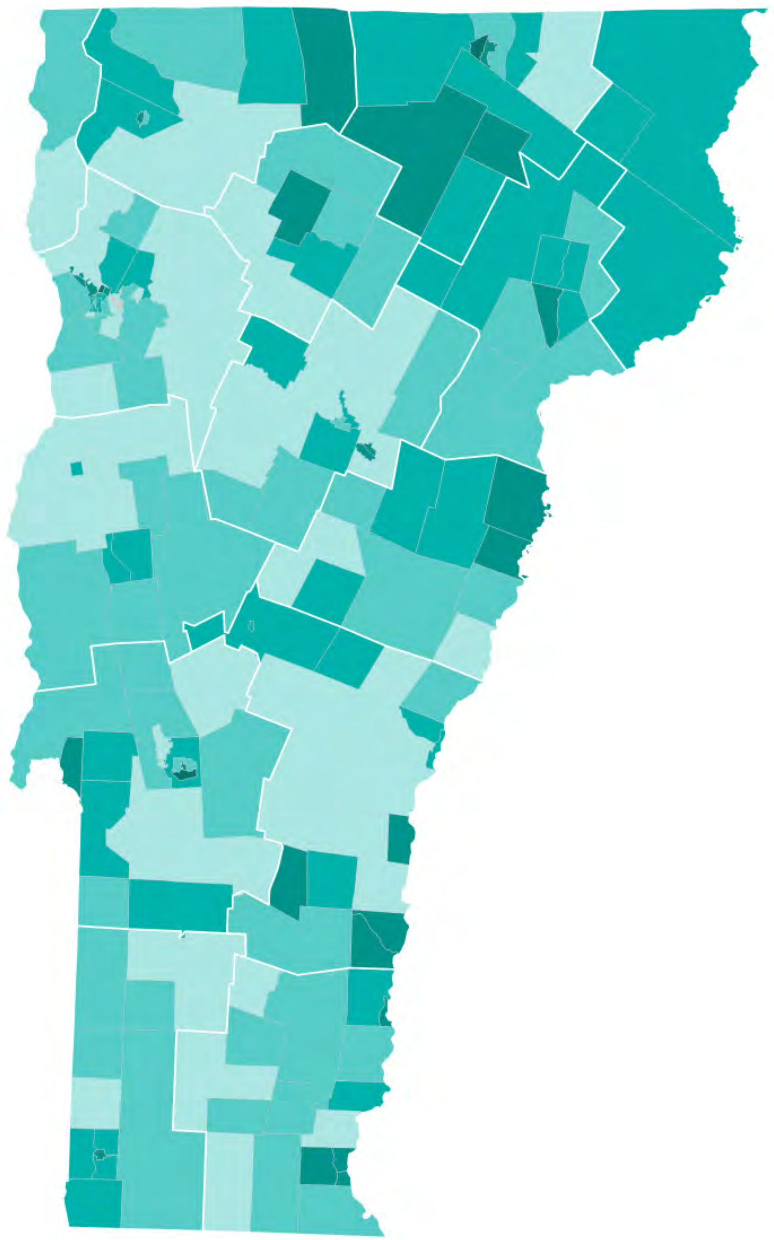
Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

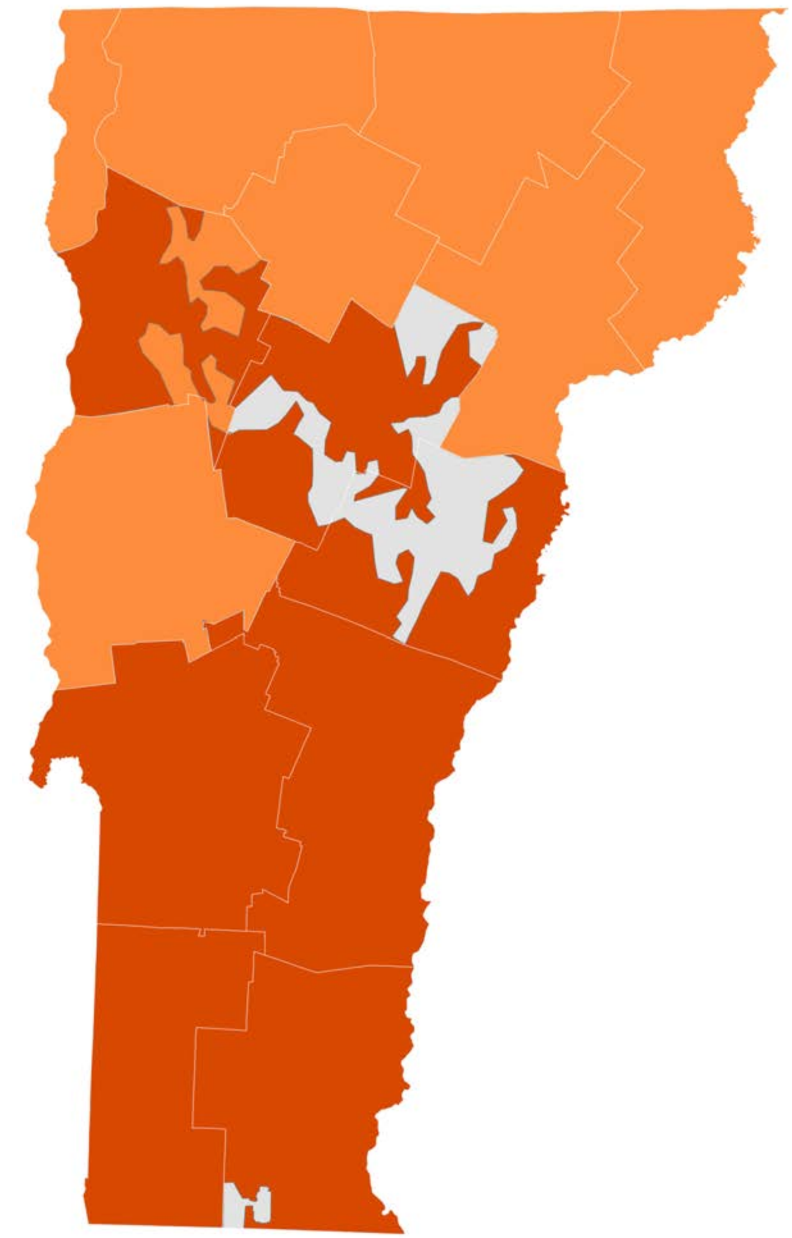
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration

Including major events - SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Despite having had 17 recent climate disasters, FEMA's disaster risk rating does not identify any counties in Vermont as having a high risk to any particular hazard.

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

FLOOD WATERS FROM TROPICAL STORM IRENE | STEPHEN FLANDERS

VERMONT

TOTAL: 17 DISASTERS
FEMA PA + HM: $331M
HUD CDBG-DR: $39.5 M
FEMA + HUD ASSISTANCE: $370 M

			2011							
			1995: SEVERE STORMS AND FLOODING		4001: SEVERE STORMS AND FLOODING		4022: TROPICAL STORM IRENE		4043: SEVERE STORMS AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	17	$127,173,118	$6,777,749	$11,338	$674,418	$19,715	$93,255,030	$4,573,057	$20,995	$316
Addison County	8	$7,833,824	$288,312	$236,548			$3,628,573	$1,638,141		
Bennington County	4	$7,597,696					$6,339,296	$1,001,021		
Caledonia County	6	$6,326,165			$3,152,698	$0	$2,242,702	$113,495		
Chittenden County	10	$11,879,816	$2,460,958	$225,772			$439,637	$1,291,054		
Essex County	10	$2,269,186	$391,202	$0	$1,396,986	$0	$52,197	$0		
Franklin County	8	$4,400,614	$290,862	$0			$300,874	$592,394	$600,020	$0
Grand Isle County	5	$642,564	$642,564	$0			$0	$0		
Lamoille County	10	$9,648,677	$909,281	$28,458			$1,536,312	$1,230,209		
Orange County	10	$11,123,688			$167,667	$0	$5,790,765	$549,046		
Orleans County	10	$6,319,426	$1,111,248	$0			$1,920,785	$657,688		
Rutland County	5	$20,115,836					$12,181,097	$3,619,559		
Washington County	11	$23,598,405	$836,627	$0	$5,154,030	$91,571	$9,115,274	$3,735,881	$220,072	$0
Windham County	4	$33,446,662					$28,690,917	$3,501,209	$105,280	$0
Windsor County	5	$58,177,312					$43,722,813	$7,781,951		
Total FEMA Allocation		$330,552,989	$13,708,804	$502,116	$10,545,799	$111,286	$209,216,271	$30,284,704	$946,367	$316

	2012		2013				2014			
	4066: SEVERE STORM, TORNADO, AND FLOODING		4120: SEVERE STORMS AND FLOODING		4140: SEVERE STORMS AND FLOODING		4163: SEVERE WINTER STORMS		4178: SEVERE STORMS AND FLOODING	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$22,133	$864	$44,018	$13,453	$1,289,572	$16,206	$5,127,881	$30,583	$605,660	$123
Addison County	$129,636	$0								
Bennington County										
Caledonia County					$229,522	$0	$48,695	$7,313	$74,660	$0
Chittenden County			$1,436,953	$0	$1,254,214	$0	$68,377	$0		
Essex County			$147,746	$0			$0	$12,864	$239,730	$0
Franklin County							$855,920	$0	$113,227	$0
Grand Isle County							$0	$0		
Lamoille County	$263,102	$0	$285,965	$127,050			$81,703	$0	$386,450	$0
Orange County					$746,862	$0			$127,598	$0
Orleans County	$602,891	$0			$118,956	$0	$159,765	$12,864	$104,766	$0
Rutland County					$198,851	$0				
Washington County					$996,628	$0			$172,431	$0
Windham County										
Windsor County					$1,348,368	$38,013				
Total FEMA Allocation	$1,017,761	$864	$1,914,683	$140,503	$6,182,973	$54,219	$6,342,341	$63,624	$1,824,523	$123

	2015				2017	
	4207: SEVERE WINTER STORM		4232: SEVERE STORM AND FLOODING		4330: SEVERE STORMS AND FLOODING	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$249,787	$8,585	$126,093	$7,540	$2,606,802	$69,054
Addison County	$146,185	$0	$795,594	$0	$651,505	$0
Bennington County					$70,865	$0
Caledonia County	$85,165	$0			$371,917	$0
Chittenden County	$236,296	$0	$484,504	$0		
Essex County	$0	$0				
Franklin County	$0	$0				
Grand Isle County						
Lamoille County	$2,202,073	$0				
Orange County	$94,472	$0			$3,012,852	$0
Orleans County	$25,156	$0				
Rutland County	$247,197	$76,787			$1,413,582	$310,684
Washington County	$480,187	$325,850			$773,641	$160,667
Windham County						
Windsor County	$182,575	$0			$3,018,473	$0
Total FEMA Allocation	$3,949,093	$411,222	$1,406,191	$7,540	$11,919,638	$540,405

	2018				2019		2020		2021	
	4356: SEVERE STORM AND FLOODING		4380: SEVERE STORM AND FLOODING		4445: SEVERE STORMS AND FLOODING		4474: SEVERE STORM AND FLOODING		4621: SEVERE STORM AND FLOODING	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$2,653,844	$79,404	$1,591,800	$47,708	$3,003,296	$13,913	$4,145,482	$18,809	$67,893	$0
Addison County	$69,643	$0					$249,686	$0		
Bennington County					$134,389	$52,125			$0	$0
Caledonia County										
Chittenden County	$141,546	$0	$1,498,243	$0			$2,342,263	$0		
Essex County	$0	$0			$28,460	$0	$0	$0		
Franklin County	$149,230	$0					$1,498,085	$0		
Grand Isle County	$0	$0	$0	$0						
Lamoille County	$451,110	$0	$40,781	$0			$2,106,183	$0		
Orange County	$22,237	$0	$0	$0	$608,981	$0	$3,208	$0		
Orleans County	$3,466	$0	$0	$0			$1,601,841	$0		
Rutland County					$1,922,985	$145,095				
Washington County	$560,601	$0	$115,963	$0	$234,543	$0	$624,439	$0		
Windham County	$1,075,220	$0							$74,037	$0
Windsor County					$2,085,119	$0				
Total FEMA Allocation	$5,126,898	$79,404	$3,246,787	$47,708	$8,017,772	$211,133	$12,571,185	$18,809	$141,930	$0

VIRGINIA

INDEPENDENT CITIES

1. Alexandria City
2. Bristol City
3. Buena Vista City
4. Charlottesville City
5. Chesapeake City
6. Colonial Heights City
7. Covington City
8. Danville City
9. Emporia City
10. Fairfax City
11. Falls Church City
12. Franklin City
13. Fredericksburg City
14. Galax City
15. Hampton City
16. Harrisonburg City
17. Hopewell City
18. Lexington City
19. Lynchburg City
20. Manassas City
21. Manassas Park City
22. Martinsville City
23. Newport News City
24. Norfolk City
25. Norton City
26. Petersburg City
27. Poquoson City
28. Portsmouth City
29. Radford City
30. Richmond City
31. Roanoke City
32. Salem City
33. Staunton City
34. Suffolk City
35. Virginia Beach City
36. Waynesboro City
37. Williamsburg City
38. Winchester City

VIRGINIA STATISTICS SUMMARY (2011 – 2021)	
11	CLIMATE DISASTER DECLARATIONS
KING AND QUEEN	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
7	COUNTIES WITH FIVE OR MORE DISASTERS
102	SUPERFUND SITES
RICHMOND CITY	HIGHEST COMPOUNDING RISKS
$417 MILLION	FEMA + HUD POST-DISASTER FUNDING
8.5 MILLION	POPULATION TOTAL
$49	PER CAPITA SPENDING ON CLIMATE DISASTERS
$6.2 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011-2021

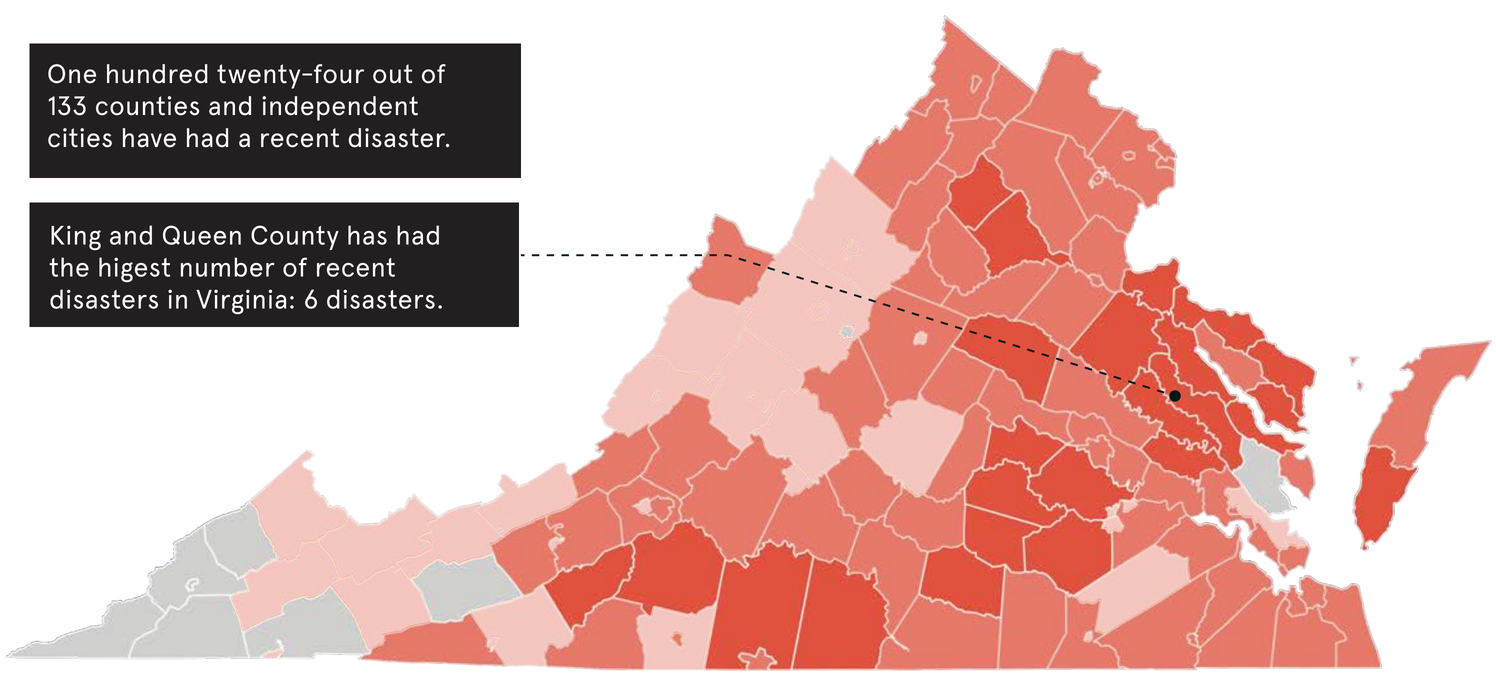
FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

11

disaster declarations

One hundred twenty-four out of 133 counties and independent cities have had a recent disaster.

King and Queen County has had the higest number of recent disasters in Virginia: 6 disasters.



Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

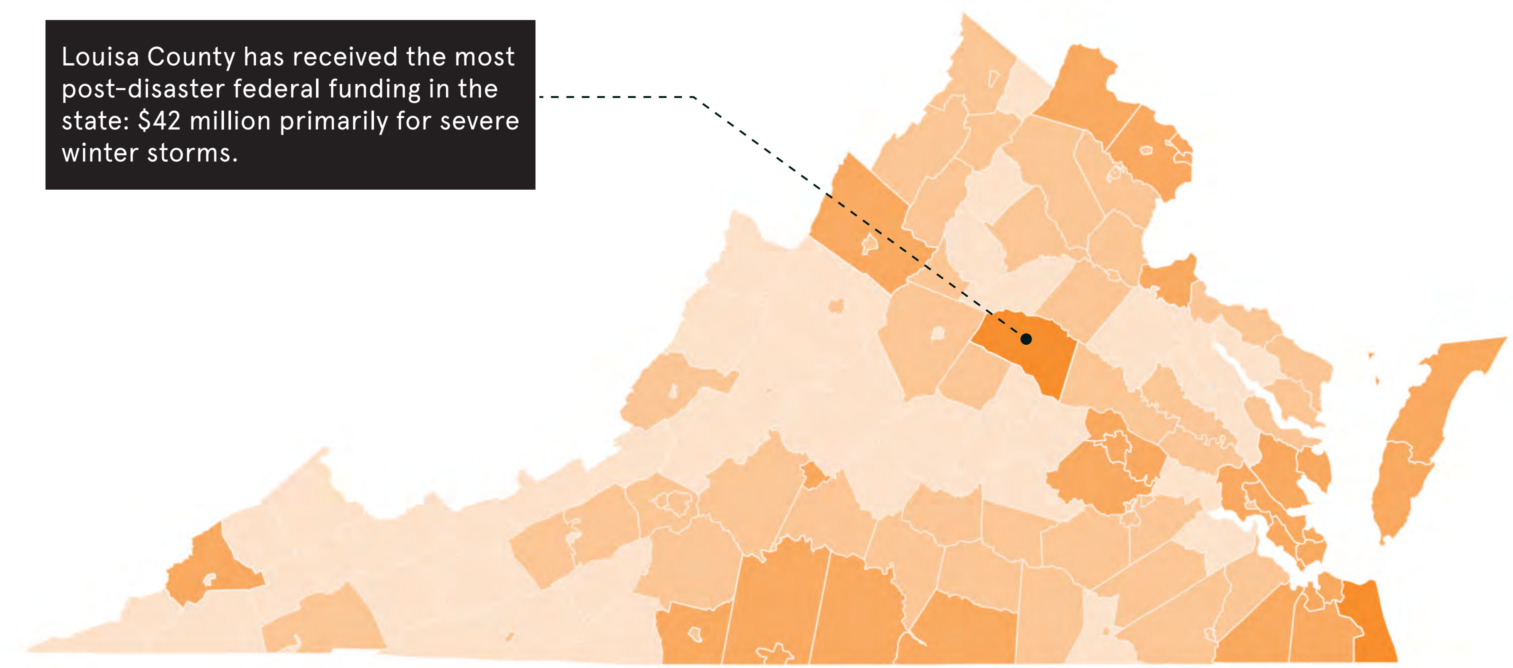
FEDERAL ASSISTANCE 2011-2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$417M

post-disaster assistance

Louisa County has received the most post-disaster federal funding in the state: $42 million primarily for severe winter storms.



Public Assistance and Hazard Mitigation

Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

$297M FEMA obligations

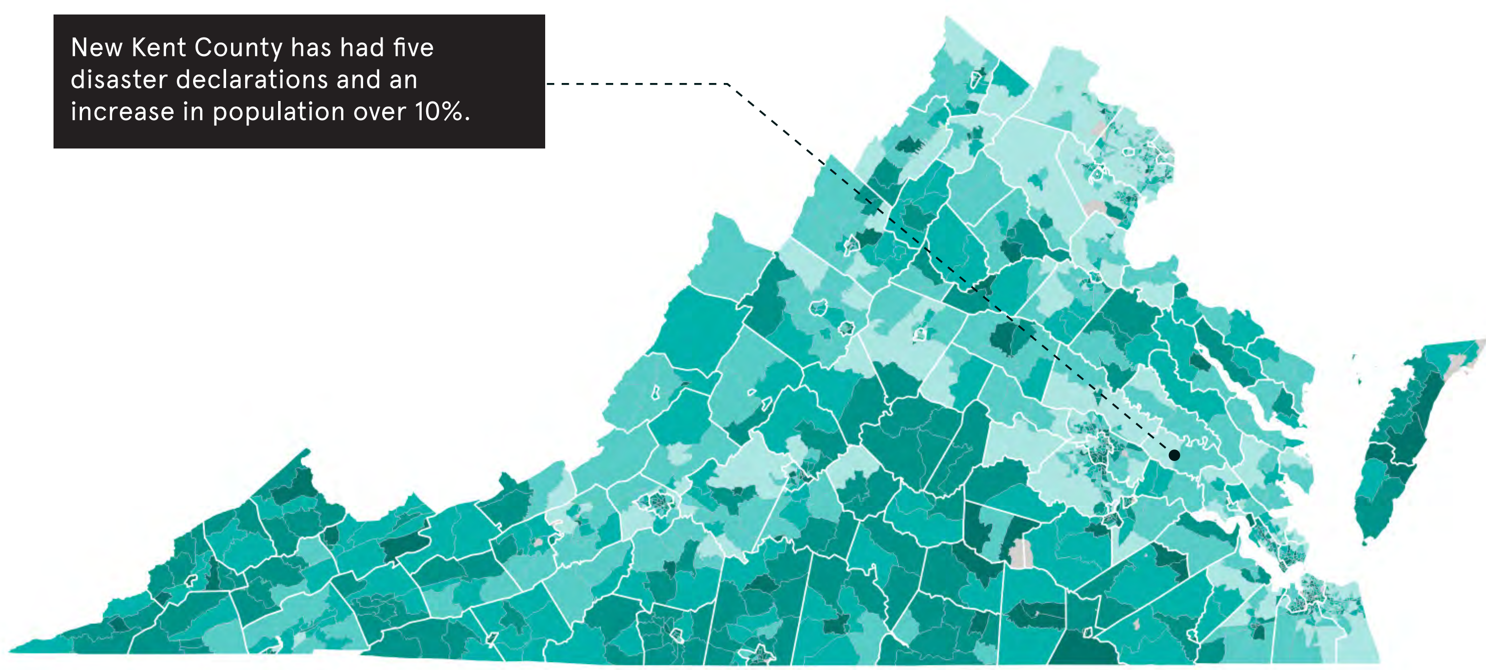
$120M HUD CDBG-DR Funds

$417M FEMA + HUD assistance

$49 per capita cost

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

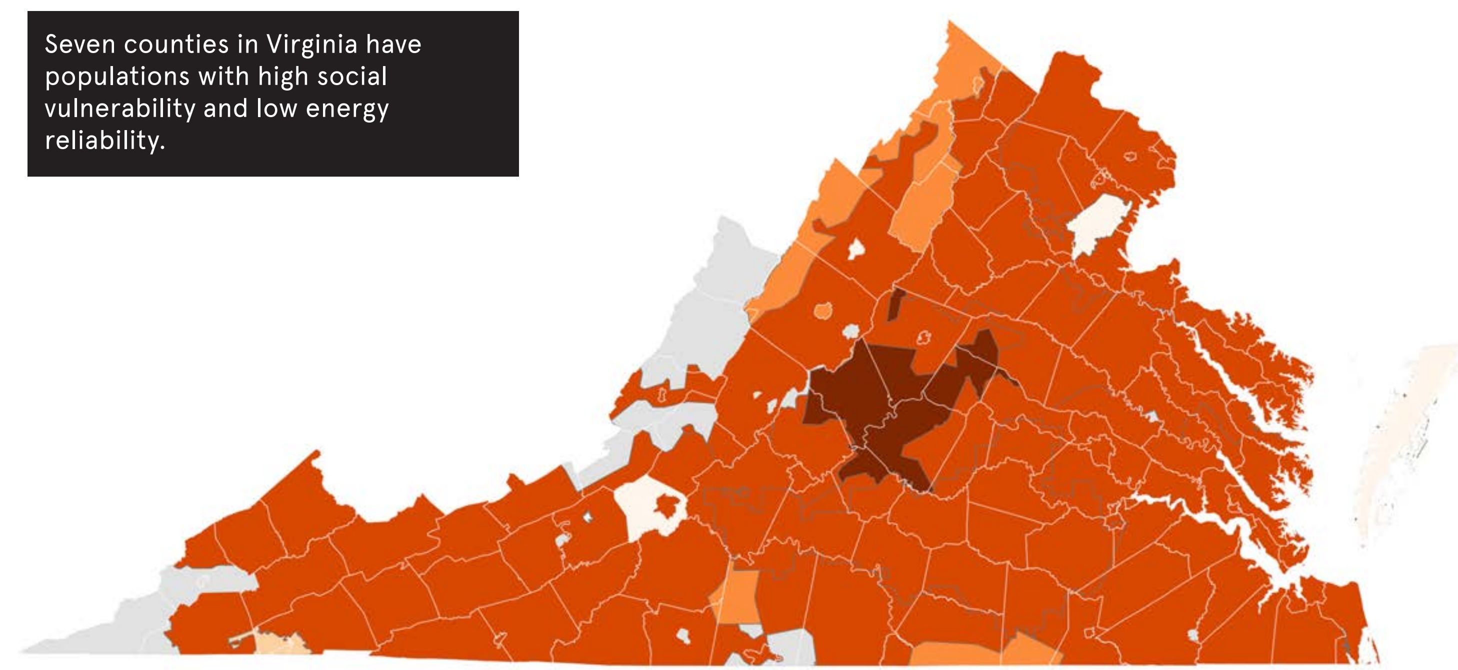
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT

Richmond City has a high risk of climate disasters, high population density, high population increase, high poverty, high health risks, and will experience sea level rise.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Accomack					1		4
Albemarle							0
Alexandria							1
Alleghany							0
Amelia							0
Amherst							0
Appomattox							0
Arlington							1
Augusta							0
Bath					1		2
Bedford County							0
Bland							0
Botetourt							0
Bristol							0
Brunswick							0
Buchanan							0
Buckingham							0
Buena Vista							0
Campbell							0
Caroline							0
Carroll							0
Charles City							1
Charlotte							0
Charlottesville							0
Chesapeake							1
Chesterfield							1
Clarke							0
Colonial Heights							1
Covington							0
Craig							0
Culpeper							0
Cumberland					1		1
Danville					2		4
Dickenson							0
Dinwiddie							0
Emporia							0
Essex							1
Fairfax City							0
Fairfax County							1
Falls Church							0
Fauquier							0
Floyd							0
Fluvanna							0
Franklin City							1
Franklin County							0
Frederick							0
Fredericksburg							0
Galax							0
Giles					1		2

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Gloucester							1
Goochland							0
Grayson							0
Greene							0
Greensville							0
Halifax							0
Hampton							1
Hanover							0
Harrisonburg							0
Henrico							1
Henry							0
Highland							0
Hopewell							1
Isle of Wight							1
James City							1
King and Queen							1
King George							1
King William							1
Lancaster							1
Lee					1		3
Lexington							0
Loudoun							0
Louisa							0
Lunenburg							0
Lynchburg							0
Madison							0
Manassas							0
Manassas Park							0
Martinsville							0
Mathews							1
Mecklenburg							0
Middlesex							1
Montgomery							0
Nelson							0
New Kent							1
Newport News							1
Norfolk							1
Northampton							1
Northumberland							1
Norton					1		3
Nottoway					1		3
Orange							0
Page							0
Patrick							0
Petersburg							1
Pittsylvania							0
Poquoson							0
Portsmouth							1
Powhatan							0
Prince Edward							0
Prince George							1

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Prince William							1
Pulaski							0
Radford							0
Rappahannock							0
Richmond City					1		6
Richmond County							1
Roanoke City					1		4
Roanoke County							0
Rockbridge							0
Rockingham							0
Russell							0
Salem							0
Scott							0
Shenandoah							0
Smyth							0
Southampton							1
Spotsylvania							0
Stafford							1
Staunton							0
Suffolk							1
Surry							1
Sussex							1
Tazewell							0
Virginia Beach							1
Warren							0
Washington							0
Waynesboro							0
Westmoreland							1
Williamsburg							1
Winchester							0
Wise							0
Wythe							0
York							1

VIRGINIA

TOTAL: 17 DISASTERS
FEMA PA + HM: $613 M
HUD CDBG-DR: $256 M
FEMA + HUD ASSISTANCE: $870 M

			2012								2013		2015										2016		2017		2018				2019		2021			
			4059: SEVERE STORMS, TORNADOES, FLOODING, MUDSLIDES, AND LANDSLIDES		4061: SEVERE STORMS, FLOODING, MUDSLIDES, AND LANSLIDES		4071: SEVERE STORMS AND STRAIGHT-LINE WINDS		4093: HURRICANE SANDY		4132: SEVERE STORMS AND FLOODING		4210: SEVERE WINTER STORM, FLOODING, LANDSLIDES, AND MUDSLIDES		4219: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4220: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4221: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4236: SEVERE STORMS, STRAIGHT-LINE WINDS, FLOODING, LANDSLIDES, AND MUDSLIDES		4273: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4331: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4359: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4378: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4455: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4603: SEVERE WINTER STORMS		4605: SEVERE STORMS AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	17	$460,372,225	$6,524,210	$0	$2,010,090	$0	$5,414,231	$0	$13,240,602	$0	$1,760,717	$0	$23,510,504	$48,459	$7,385,828	$13,333	$6,270,895	$16,610	$5,885,190	$8,225	$6,857,195	$12,867	$322,210,553	$4,049,649	$8,188,633	$149,242	$38,974,371	$233,923	$2,060,454	$43,279	$2,493,524	$81,746	$687,451	$0	$2,240,444	$
Barbour County	3	$429,403					$143,180	$0	$286,223	$0			$0	$0																						
Berkeley County	1	$198,703					$198,703	$0																												
Boone County	5	$189,431					$86,375	$0	$25,299	$0			$21,808	$0	$0	$0																			$55,949	$
Braxton County	6	$166,795					$53,276	$0	$11,249	$0			$0	$0			$0	$0			$67,493	$0	$34,778	$0												
Brooke County	2	$1,949,564															$0	$0									$1,949,564	$0								
Cabell County	7	$1,581,934					$184,163	$0					$492,544	$329,820	$0	$0			$0	$0							$208,778	$0					$340,439	$0	$26,191	$
Calhoun County	3	$41,308					$41,308	$0											$0	$0							$0	$0								
Clay County	4	$13,142,403					$126,839	$0	$13,327	$0											$0	$0	$13,002,236	$0												
Doddridge County	6	$57,502	$3,608	$0			$0	$0					$0	$0			$0	$0							$53,894	$0	$0	$0								
Fayette County	4	$3,001,409					$476,769	$0	$57,301	$47,325			$43,470	$0									$2,225,881	$150,663												
Gilmer County	4	$16,726					$16,726	$0					$0	$0			$0	$0					$0	$0												
Grant County	3	$95,258					$29,262	$0																					$2,529	$0	$63,468	$0				
Greenbrier County	3	$16,685,796					$234,863	$521,572											$0	$0			$11,785,187	$4,144,173												
Hampshire County	1	$215,877																											$215,877	$0						
Hancock County	1	$0																									$0	$0								
Hardy County	2	$196,066					$3,486	$0																					$192,580	$0						
Harrison County	5	$1,103,927	$1,260	$0			$359,062	$0					$64,504	$100,109											$20,447	$0	$558,545	$0								
Jackson County	6	$117,956					$70,480	$0					$47,477	$0			$0	$0	$0	$0	$0	$0	$0	$0												
Jefferson County	2	$111,904					$103,025	$0																					$8,879	$0						
Kanawha County	5	$48,557,317					$1,055,456	$272,309	$175,076	$2,127,372			$4,354,681	$2,480,991									$27,967,398	$10,089,301											$34,734	$
Lewis County	5	$290,153					$271,620	$0	$13,784	$0			$4,748	$0			$0	$0					$0	$0												
Lincoln County	10	$4,027,737	$166,489	$0	$27,330	$0	$142,464	$0					$28,597	$0	$0	$0					$153,933	$0	$45,727	$3,383,782			$3,847	$0					$49,298	$0	$26,270	$
Logan County	7	$1,979,824			$1,918,663	$0	$16,758	$0					$44,403	$0	$0	$0					$0	$0					$0	$0							$0	$
McDowell County	2	$139,669					$69,191	$0					$70,479	$0																						
Marion County	2	$631,778	$118,629	$0																					$513,149	$0										
Marshall County	5	$4,212,990					$29,680	$0					$0	$0			$0	$0							$4,183,310	$0	$0	$0								
Mason County	4	$245,489					$100,754	$0			$0	$0															$120,496	$0					$24,239	$0		
Mercer County	2	$26,389					$20,201	$0					$6,188	$0																						
Mineral County	1	$0																											$0	$0						
Mingo County	6	$811,601	$0	$0	$18,396	$0	$141,839	$0					$564,618	$0	$0	$0																			$86,748	$
Monongalia County	4	$38,962	$8,327	$0									$0	$0											$0	$0	$30,635	$0								
Monroe County	2	$4,078,252					$137,918	$0															$3,940,334	$0												
Morgan County	1	$185,004																											$101,184	$83,820						
Nicholas County	4	$28,733,554					$337,060	$0	$201,248	$0											$28,625	$0	$26,487,555	$1,679,066												
Ohio County	3	$1,016,860															$0	$0							$247,394	$0	$580,842	$188,625								
Pendleton County	4	$32,162					$22,884	$0	$9,278	$0																			$0	$0	$0	$0				
Pleasants County	4	$44,970					$44,970	$0									$0	$0	$0	$0							$0	$0								
Pocahontas County	3	$96,990					$44,460	$0	$17,729	$0													$34,801	$0												
Preston County	6	$927,201	$3,380	$0			$63,746	$0	$223,571	$0															$0	$406,238	$0	$230,265			$0	$0				
Putnam County	3	$283,399					$151,461	$0					$18,897	$38,250																			$74,791	$0		
Raleigh County	3	$793,422					$418,670	$0	$96,508	$0			$278,243	$0																						
Randolph County	5	$2,377,265					$77,084	$0	$204,313	$0													$0	$0	$0	$0					$2,095,868	$0				
Ritchie County	5	$55,840	$8,097	$0			$10,484	$0					$28,197	$0			$9,063	$0									$0	$0								
Roane County	7	$3,138,679	$50,045	$0			$50,181	$0			$1,523,012	$0	$0	$0					$0	$0	$0	$0	$522,696	$992,745												
Summers County	4	$379,819					$53,077	$0					$0	$0					$0	$0			$326,742	$0												
Taylor County	5	$25,808	$4,370	$0			$21,438	$0	$0	$0															$0	$0	$0	$0								
Tucker County	5	$822,915					$10,228	$442,465	$114,672	$40,197			$183,872	$0											$0	$0					$31,480	$0				
Tyler County	5	$372,637					$47,984	$0					$35,062	$0			$40,859	$0							$191,450	$0	$57,282	$0								
Upshur County	4	$1,947,774					$71,838	$0	$69,965	$0			$0	$46,350									$0	$1,759,621												
Wayne County	8	$859,670	$15,616	$0			$29,000	$0					$118,299	$287,540	$29,330	$0							$0	$0			$0	$0					$321,572	$0	$58,313	$
Webster County	5	$3,644,644					$41,478	$0	$100,734	$0			$0	$0							$355,834	$0	$3,146,598	$0												
Wetzel County	5	$1,785,823					$242,675	$0					$0	$0			$0	$0							$1,511,825	$0	$31,324	$0								
Wirt County	4	$19,844					$19,844	$0					$0	$0					$0	$0							$0	$0								
Wood County	4	$1,070,786					$399,413	$390,666					$0	$0							$280,707	$0					$0	$0								
Wyoming County	3	$389,885					$33,114	$109,356	$29,190	$0			$57,534	$160,691																						
Total FEMA Allocation		$613,719,302	$6,904,031	$0	$3,974,479	$0	$11,718,721	$1,736,368	$14,890,072	$2,214,894	$3,283,730	$0	$29,974,123	$3,492,211	$7,415,158	$13,333	$6,320,817	$16,610	$5,885,190	$8,225	$7,743,787	$12,867	$411,730,486	$26,249,000	$14,910,101	$555,480	$42,515,683	$652,813	$2,581,502	$127,099	$4,684,340	$81,746	$1,497,789	$0	$2,528,648	$

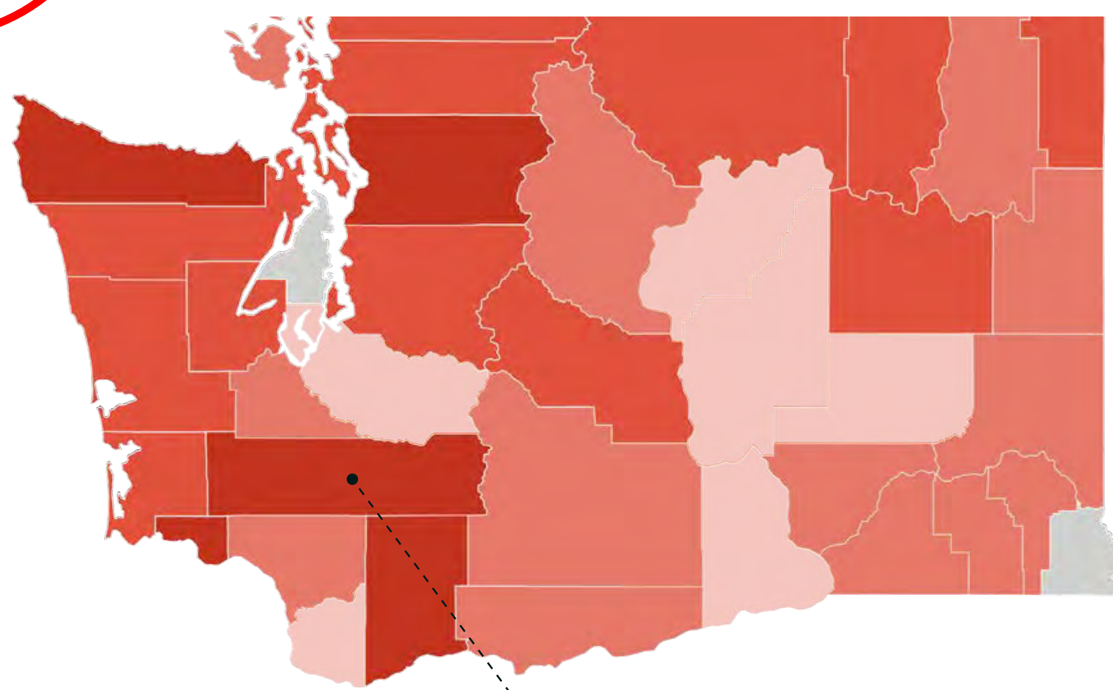
WASHINGTON

WASHINGTON STATISTICS SUMMARY (2011 - 2021)	
16	CLIMATE DISASTER DECLARATIONS
LEWIS	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
12	COUNTIES WITH FIVE OR MORE DISASTERS
143	SUPERFUND SITES
C	ASCE INFRASTRUCTURE REPORT CARD GRADE
ADAMS, CLARK, KING, PACIFIC, PIERCE	HIGHEST COMPOUNDING RISKS
$267 MILLION	FEMA + HUD POST-DISASTER FUNDING
7.5 MILLION	POPULATION TOTAL
$36	PER CAPITA SPENDING ON CLIMATE DISASTERS
$6.2 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

16
disaster declarations



Lewis County has had the highest number of recent disasters in the state: 8 disasters.

Ninety-five percent of Washington counties have had a recent disaster declaration. Twelve counties have had five or more.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

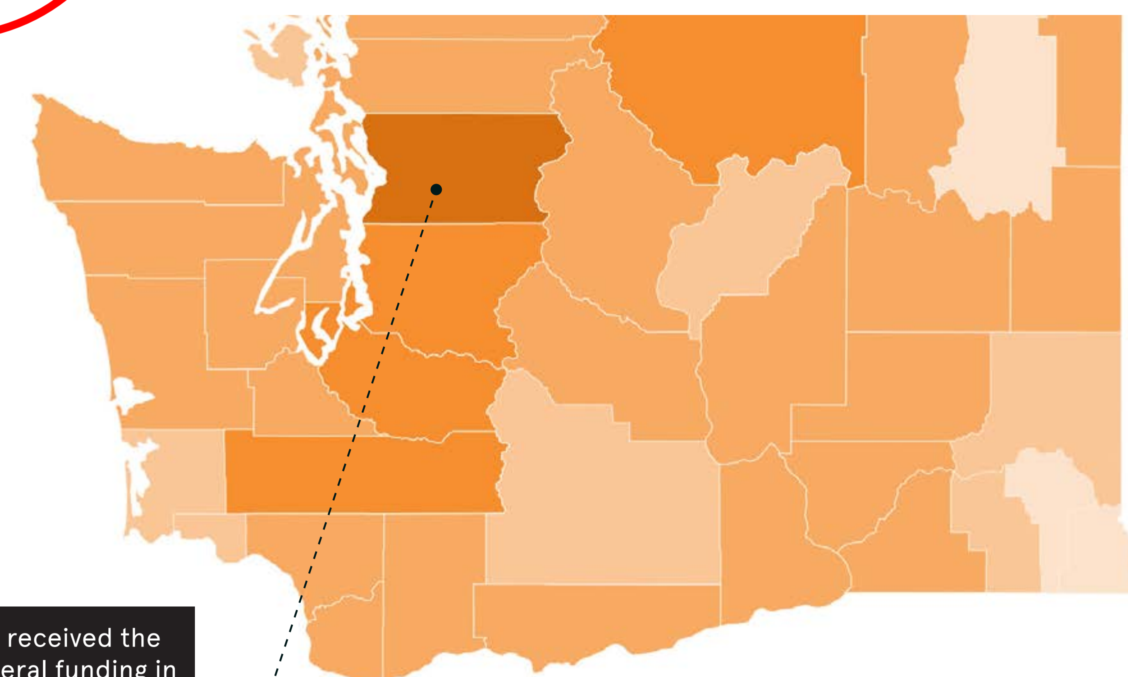
- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurences
- 7–9 occurences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$267M
post-disaster assistance



Snohomish County has received the most post-disaster federal funding in the state: over $48 million.

Public Assistance and Hazard Mitigation

Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

$248M FEMA obligations

$18.6M HUD CDBG-DR Funds

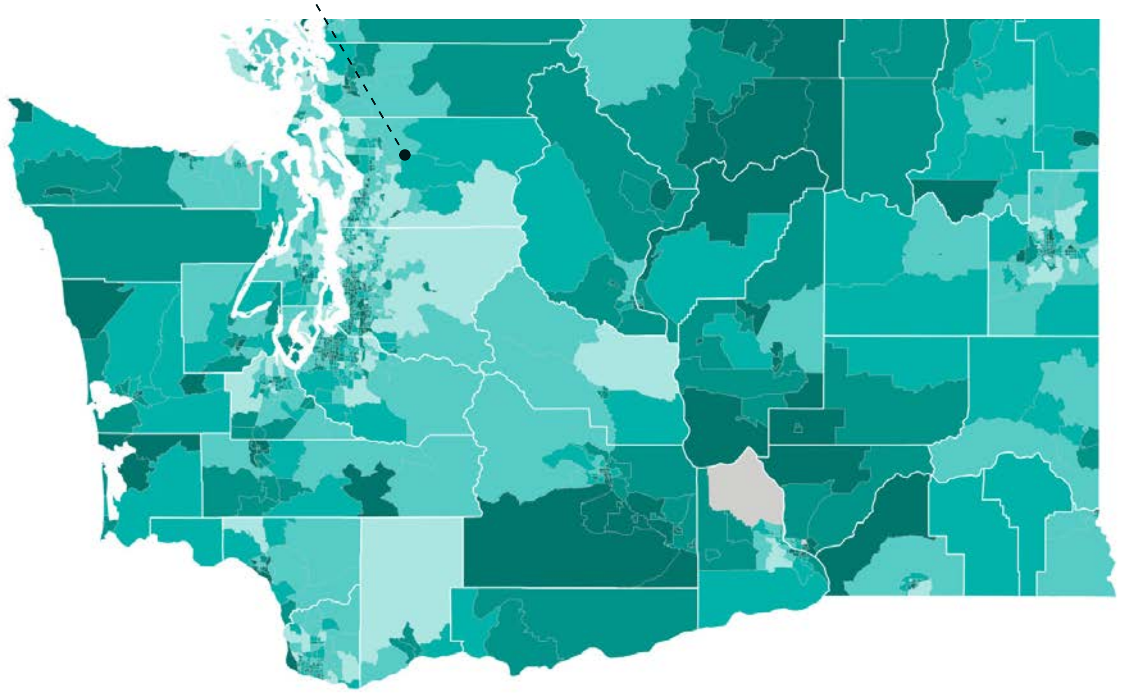
$267M FEMA + HUD assistance

$35 per capita cost

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY

Between 2011–2021, Snohomish County had a 16% increase in population and 7 disasters.



Social Vulnerability Index

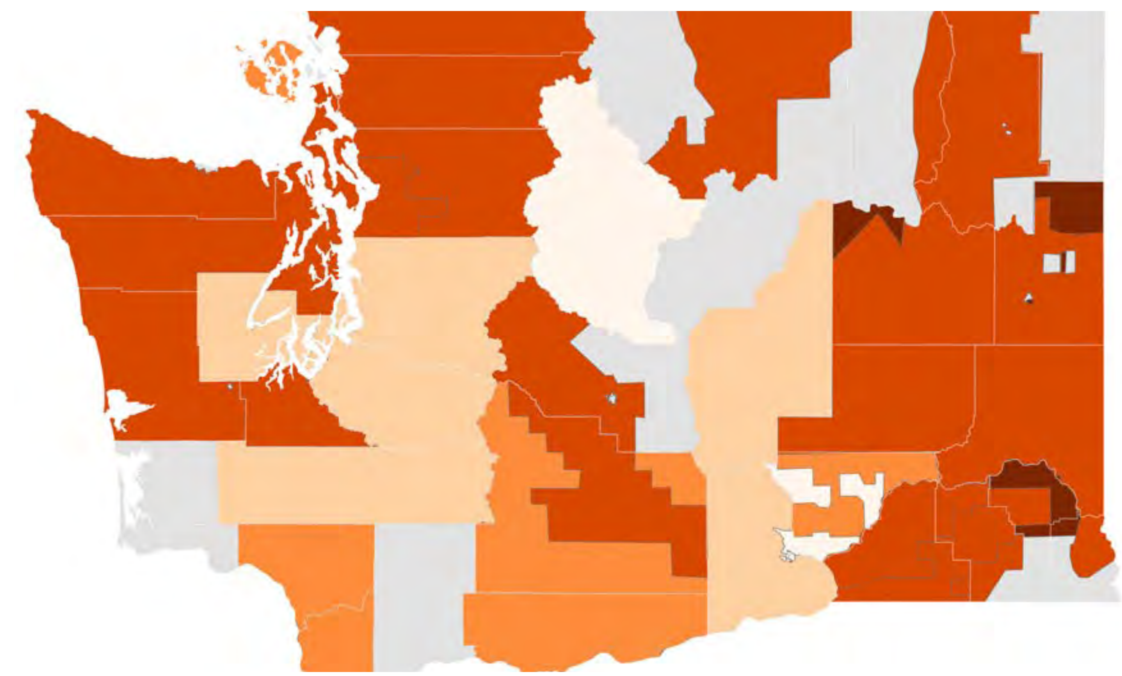
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



Five counties in Washington have populations with high social vulnerability and low energy reliability.

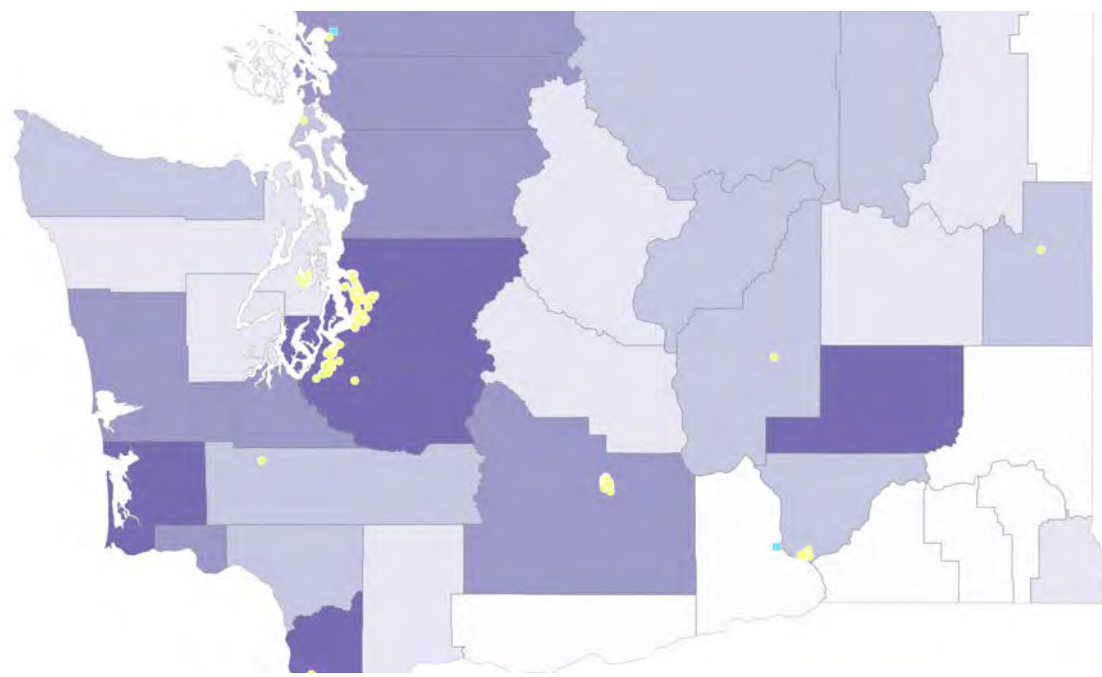
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Adams, Clark, King, Pacific, and Pierce counties have high risk of climate disasters and other compounding risks.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adams					1		4
Asotin					1		1
Benton							0
Chelan					3		1
Clallam					1		2
Clark					1		4
Columbia							0
Cowlitz					3		2
Douglas					2		2
Ferry					1		2
Franklin					1		2
Garfield							0
Grant					1		2
Grays Harbor					4		3
Island					1		2
Jefferson							1
King					3		4
Kitsap							1
Kittitas					1		1
Klickitat							0
Lewis					2		2
Lincoln					1		1
Mason							1
Okanogan					3		2
Pacific					3		4
Pend Oreille							0
Pierce					3		4
San Juan							0
Skagit					2		3
Skamania							1
Snohomish					2		3
Spokane					1		2
Stevens					1		1
Thurston					1		3
Wahkiakum					2		3
Walla Walla							0
Whatcom					2		3
Whitman							0
Yakima					6		3

WASHINGTON

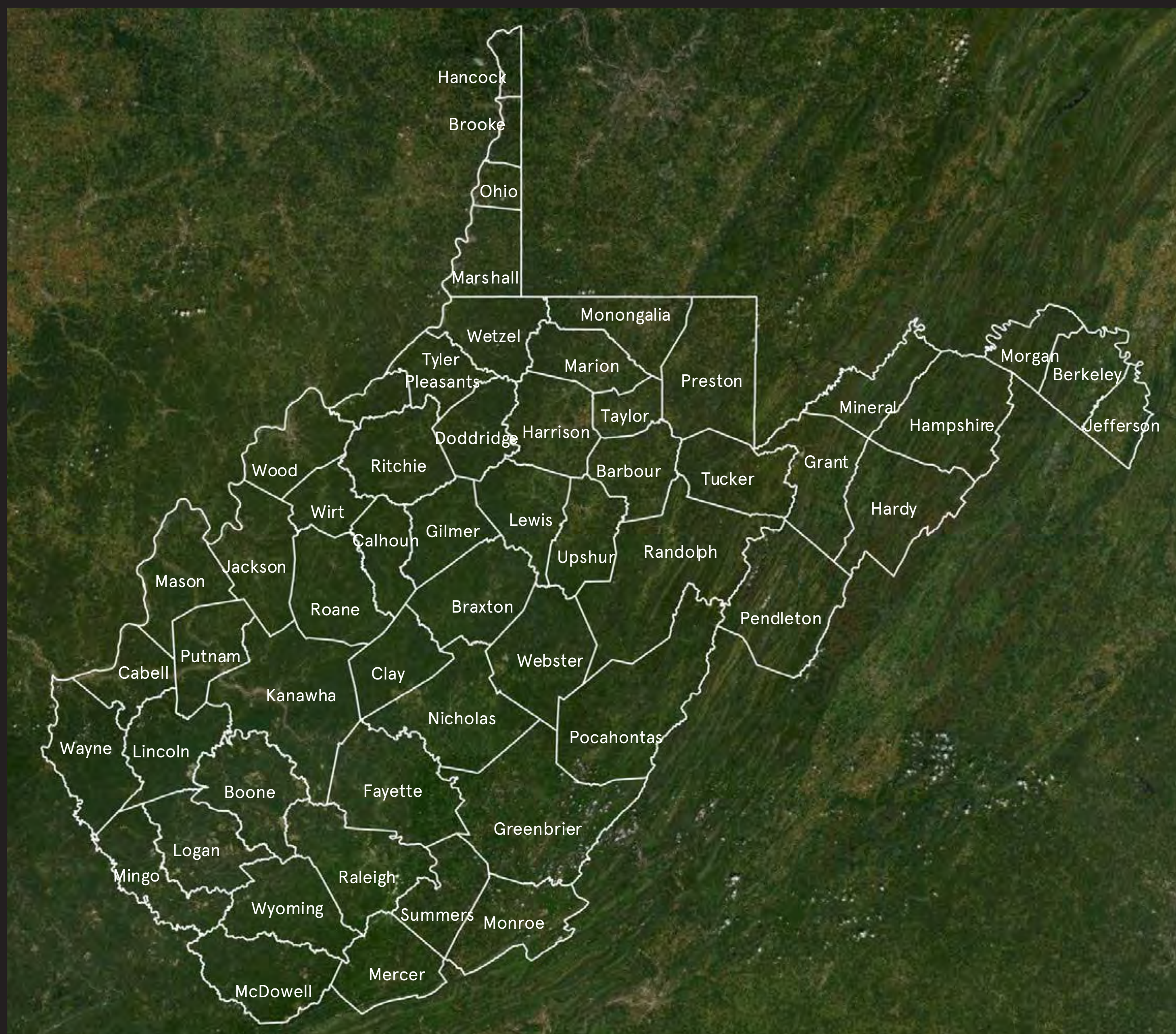
TOTAL: 16 DISASTERS
FEMA PA + HM: $248 M
HUD CDBG-DR: $18.6 M
FEMA + HUD ASSISTANCE: $267 M

			2011		2012				2014			
			1963: SEVERE WINTER STORM, FLOODING, LANDSLIDES, AND MUDSLIDES		4056: SEVERE WINTER STORM, FLOODING, LANDSLIDES, AND MUDSLIDES		4083: SEVERE STORM, STRAIGHT-LINE WINDS, AND FLOODING		4168: FLOODING AND MUDSLIDES		4188: WILDFIRES	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	16	$75,389,575	$501,758	$55,066	$2,765,494	$288,292	$1,008,244	$30,373	$8,551,194	$302,903	$9,943,457	$232,957
Adams County	1	$1,124,617										
Asotin County	0	$0										
Benton County	1	$1,756,802										
Chelan County	2	$3,382,317										
Clallam County	7	$2,832,285			$216,742	$45,207						
Clark County	1	$1,910,538										
Columbia County	3	$864,238										
Cowlitz County	2	$3,247,243										
Douglas County	1	$507,865										
Ferry County	4	$2,621,396					$1,560,859	$0				
Franklin County	2	$2,401,077										
Garfield County	2	$5,700										
Grant County	1	$2,370,008									$0	$0
Grays Harbor County	6	$2,010,459			$425,095	$95,255						
Island County	6	$376,191										
Jefferson County	6	$3,455,880										
King County	4	$26,579,596	$5,105,414	$718,181	$8,426,987	$260,648			$26,047	$381,763		
Kitsap County	0	$0										
Kittitas County	4	$1,557,651	$404,290	$0							$153,538	$210,938
Klickitat County	3	$1,755,083	$117,113	$0	$1,637,971	$0						
Lewis County	8	$10,660,159	$899,529	$0	$734,077	$0						
Lincoln County	4	$3,126,824										
Mason County	6	$1,903,787			$428,115	$0						
Okanogan County	5	$16,461,482					$179,718	$0			$9,442,994	$769,958
Pacific County	4	$179,853										
Pend Oreille County	5	$1,040,211										
Pierce County	1	$10,030,546			$7,902,462	$2,128,084						
San Juan County	2	$105,880										
Skagit County	4	$1,694,232	$412,953	$0								
Skamania County	7	$1,654,895	$0	$0	$881,394	$0						
Snohomish County	7	$48,034,537			$5,180,765	$1,800,806			$20,242,628	$3,500,061		
Spokane County	3	$7,743,382										
Stevens County	2	$20,842										
Thurston County	2	$2,522,869			$1,771,431	$0						
Wahkiakum County	7	$546,972	$88,038	$0	$21,826	$0						
Walla Walla County	2	$1,678,873										
Whatcom County	6	$5,981,991										
Whitman County	2	$603,483										
Yakima County	2	$0										
Total FEMA Allocation		$248,139,335	$7,529,094	$773,247	$30,392,359	$4,618,292	$2,748,821	$30,373	$28,819,870	$4,184,727	$19,539,989	$1,213,852

	2015				2016			
	4242: SEVERE WINDSTORM		4243: WILDFIRES AND MUDSLIDES		4249: SEVERE STORMS, STRAIGHT-LINE WINDS, FLOODING, LANDSLIDES, AND MUDSLIDES		4253: SEVERE WINTER STORM, STRAIGHT-LINE WINDS, FLOODING, LANDSLIDES, MUDSLIDES, AND A TORNADO	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$290,266	$58,158	$27,328,073	$447,308	$8,337,260	$287,326	$906,651	$82,388
Adams County								
Asotin County								
Benton County								
Chelan County			$2,638,834	$0	$743,483	$0		
Clallam County	$111,372	$257,153			$176,318	$0	$383,337	$0
Clark County							$1,910,538	$0
Columbia County								
Cowlitz County							$3,235,288	$0
Douglas County			$507,865	$0				
Ferry County			$298,753	$0				
Franklin County								
Garfield County					$0	$0		
Grant County								
Grays Harbor County	$177,140	$83,250					$213,278	$0
Island County	$14,345	$0			$154,864	$0		
Jefferson County	$270,200	$0			$1,785,293	$0	$69,841	$0
King County			$1,714,497	$419,976				
Kitsap County								
Kittitas County					$788,886	$0		
Klickitat County								
Lewis County					$295,747	$0	$3,493,660	$0
Lincoln County			$0	$0	$0	$0		
Mason County					$349,126	$0	$425,013	$0
Okanogan County			$5,826,415	$0				
Pacific County							$0	$0
Pend Oreille County			$108,247	$0	$585,199	$76,063		
Pierce County								
San Juan County								
Skagit County								
Skamania County					$0	$0	$95,029	$0
Snohomish County	$4,985,222	$0			$6,869,427	$158,799		
Spokane County					$3,769,947	$0		
Stevens County			$20,842	$0	$0	$0		
Thurston County								
Wahkiakum County					$23,003	$0	$237,815	$0
Walla Walla County								
Whatcom County	$328,814	$0	$0	$0				
Whitman County					$341,126	$0		
Yakima County			$0	$0				
Total FEMA Allocation	$6,177,358	$398,561	$38,443,525	$867,284	$24,219,678	$522,188	$10,970,449	$82,388

	2017		2018		2019		2020		2021			
	4309: SEVERE WINTER STORMS, FLOODING, LANDSLIDES, MUDSLIDES		4384: FLOODING		4418: SEVERE WINTER STORMS, STRAIGHT-LINE WINDS, FLOODING, LANDSLIDES, MUDSLIDES, TORNADO		4539: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4584: WILDFIRES AND STRAIGHT-LINE WINDS		4593: SEVERE WINTER STORM, STRAIGHT-LINE WINDS, FLOODING, LANDSLIDES, AND MUDSLIDES	
County Name	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	$4,813,080	$245,645	$386,447	$0	$3,677,315	$259,476	$998,470	$436,940	$2,425,423	$0	$729,613	$0
Adams County	$1,072,117	$52,500										
Asotin County												
Benton County	$1,756,802	$0										
Chelan County												
Clallam County					$1,383,056	$239,100					$20,000	$0
Clark County												
Columbia County	$609,162	$62,250					$192,826	$0			$0	$0
Cowlitz County											$11,955	$0
Douglas County									$0	$0		
Ferry County	$696,684	$0							$65,099	$0		
Franklin County	$2,102,681	$0							$298,396	$0		
Garfield County							$5,700	$0				
Grant County	$2,313,758	$56,250										
Grays Harbor County					$899,851	$0	$102,027	$0			$14,562	$0
Island County					$46,016	$0	$160,966	$0			$0	$0
Jefferson County					$333,047	$997,500					$0	$0
King County	$5,840,184	$2,224,534					$419,137	$1,036,500			$5,728	$0
Kitsap County												
Kittitas County									$0	$0		
Klickitat County											$0	$0
Lewis County	$3,091,519	$0					$810,922	$0			$1,334,706	$0
Lincoln County	$3,113,691	$0							$13,133	$0		
Mason County					$243,913	$0	$221,377	$0			$236,244	$0
Okanogan County									$115,513	$0	$126,885	$0
Pacific County					$38,830	$0	$24,395	$0			$116,627	$0
Pend Oreille County	$32,593	$0							$153,420	$0	$84,689	$0
Pierce County												
San Juan County							$105,880	$0				
Skagit County							$715,952	$280,538			$284,790	$0
Skamania County	$590,862	$30,750							$56,860	$0	$0	$0
Snohomish County					$3,685,260	$0	$1,606,715	$0			$4,853	$0
Spokane County	$2,332,431	$0							$1,533,988	$0	$107,016	$0
Stevens County												
Thurston County							$751,438	$0				
Wahkiakum County	$95,502	$0					$28,573	$0			$52,214	$0
Walla Walla County	$1,224,156	$0					$454,717	$0				
Whatcom County	$1,813,666	$337,457			$2,589,527	$0	$912,528	$0				
Whitman County									$262,357	$0		
Yakima County									$0	$0		
Total FEMA Allocation	$31,498,889	$3,009,385	$386,447	$0	$12,896,814	$1,496,076	$7,511,623	$1,753,978	$4,924,189	$0	$3,129,882	$0

WEST VIRGINIA



WEST VIRGINIA STATISTICS SUMMARY (2011 – 2021)	
17	CLIMATE DISASTER DECLARATIONS
7TH HIGHEST	PER CAPITA SPENDING ON CLIMATE DISASTERS IN THE COUNTRY
LINCOLN	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
22	COUNTIES WITH FIVE OR MORE DISASTERS
D	ASCE INFRASTRUCTURE REPORT CARD GRADE
BOONE, BRAXTON, FAYETTE, GREENBRIER, KANAWHA, LINCOLN, LOGAN, MCDOWELL, MERCER, NICHOLAS, ROANE, SUMMERS, WAYNE, WEBSTER, WETZEL	HIGHEST COMPOUNDING RISKS
$870 MILLION	FEMA + HUD POST-DISASTER FUNDING
1.8 MILLION	POPULATION TOTAL
$481	PER CAPITA SPENDING ON CLIMATE DISASTERS
$1.3 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

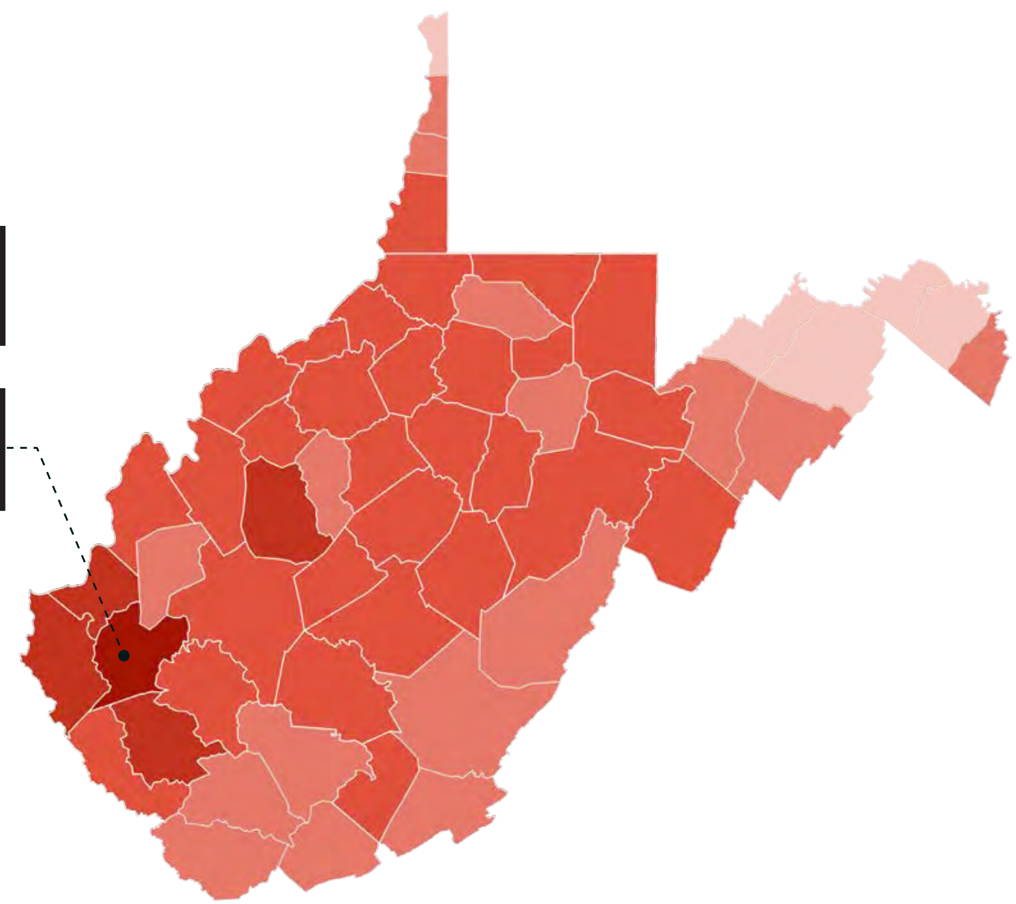
DISASTER OCCURRENCES 2011-2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

17
disaster declarations

Every county in West Virginia has had a recent climate disaster. Twenty-two counties have had at least five.

Lincoln County has had the highest number of disaster declarations in the state: 10 disasters.



Number of Disaster Events

Major Disaster Declarations (2011-2021)

- 0 occurences
- 1 occurrence
- 2-3 occurences
- 4-6 occurrences
- 7-9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011-2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

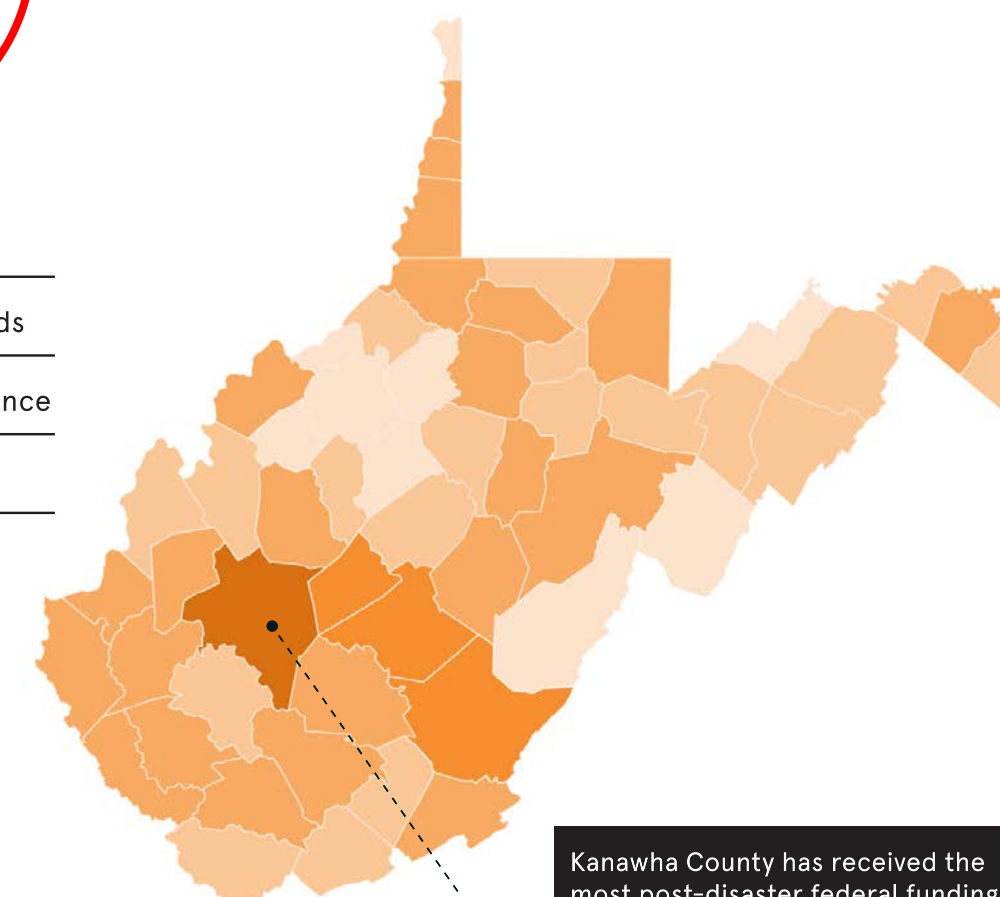
$870M
post-disaster assistance

$613M FEMA obligations

$256M HUD CDBG-DR Funds

$870M FEMA + HUD assistance

$481 per capita cost



Kanawha County has received the most post-disaster federal funding in the state: over $48 million.

Public Assistance and Hazard Mitigation

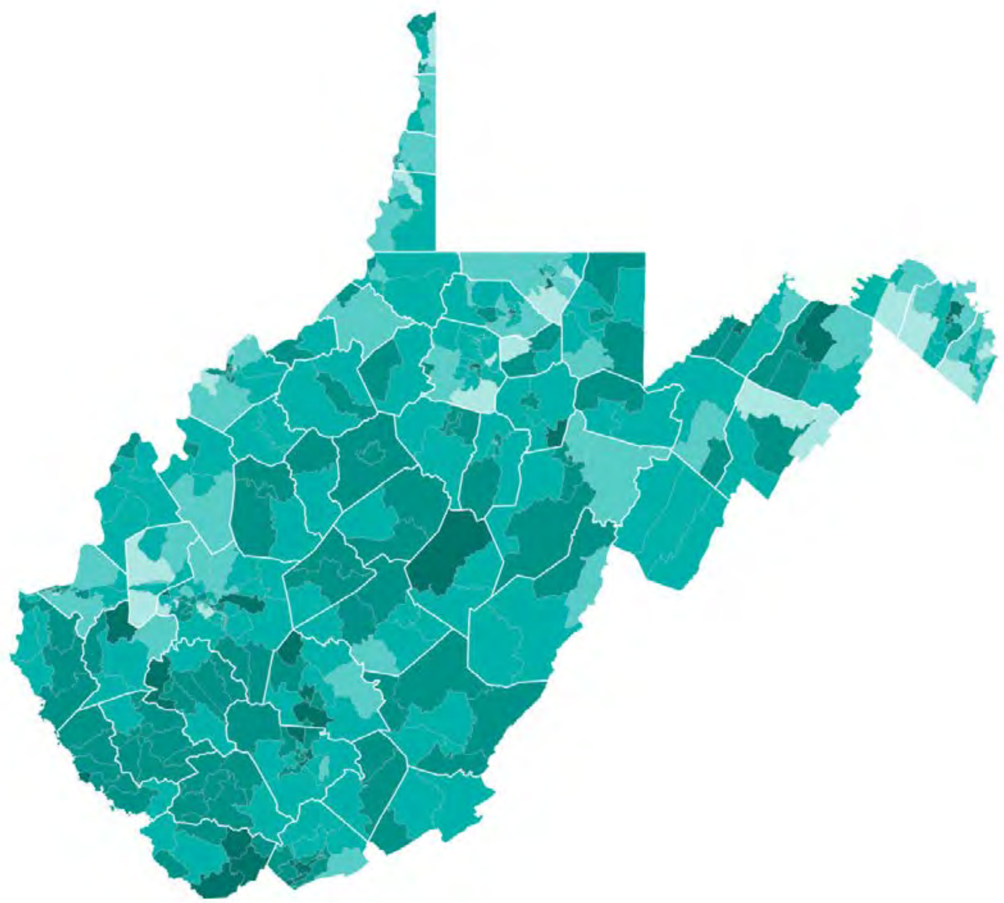
Federal Share Obligated (2011-2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

CDC (2018)

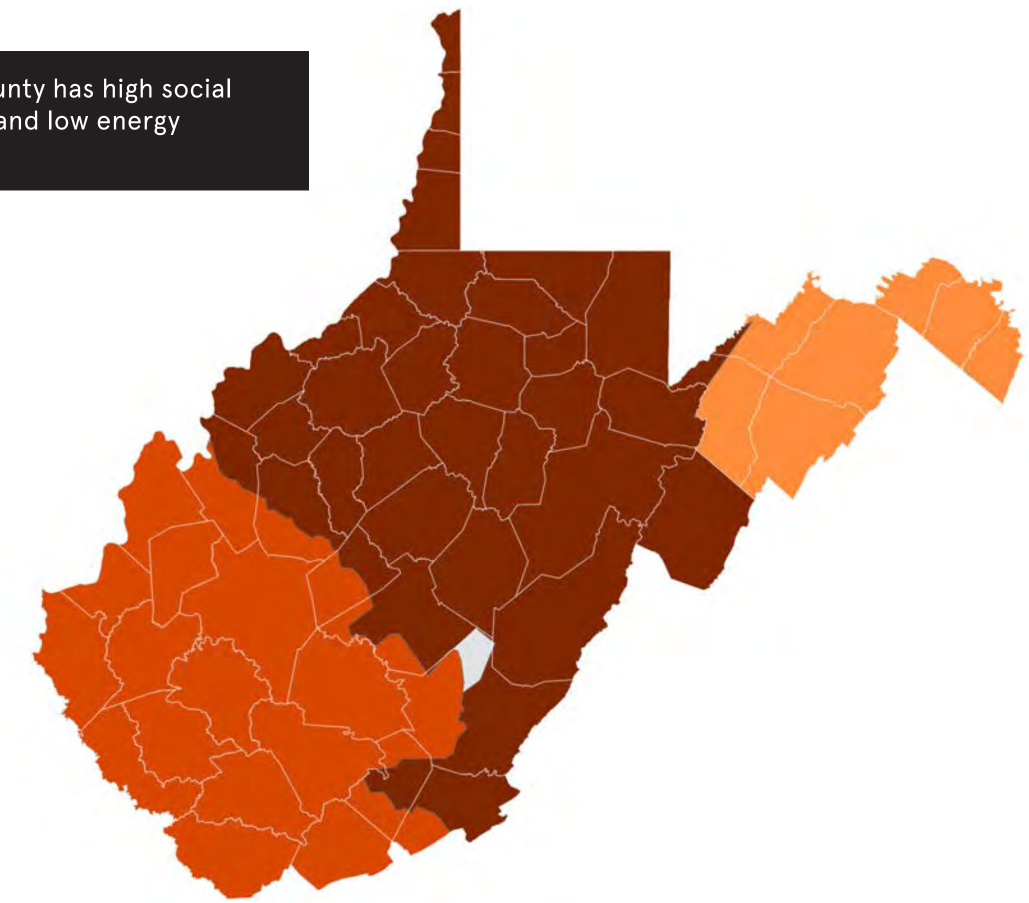
- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES

Summers County has high social vulnerability and low energy reliability.



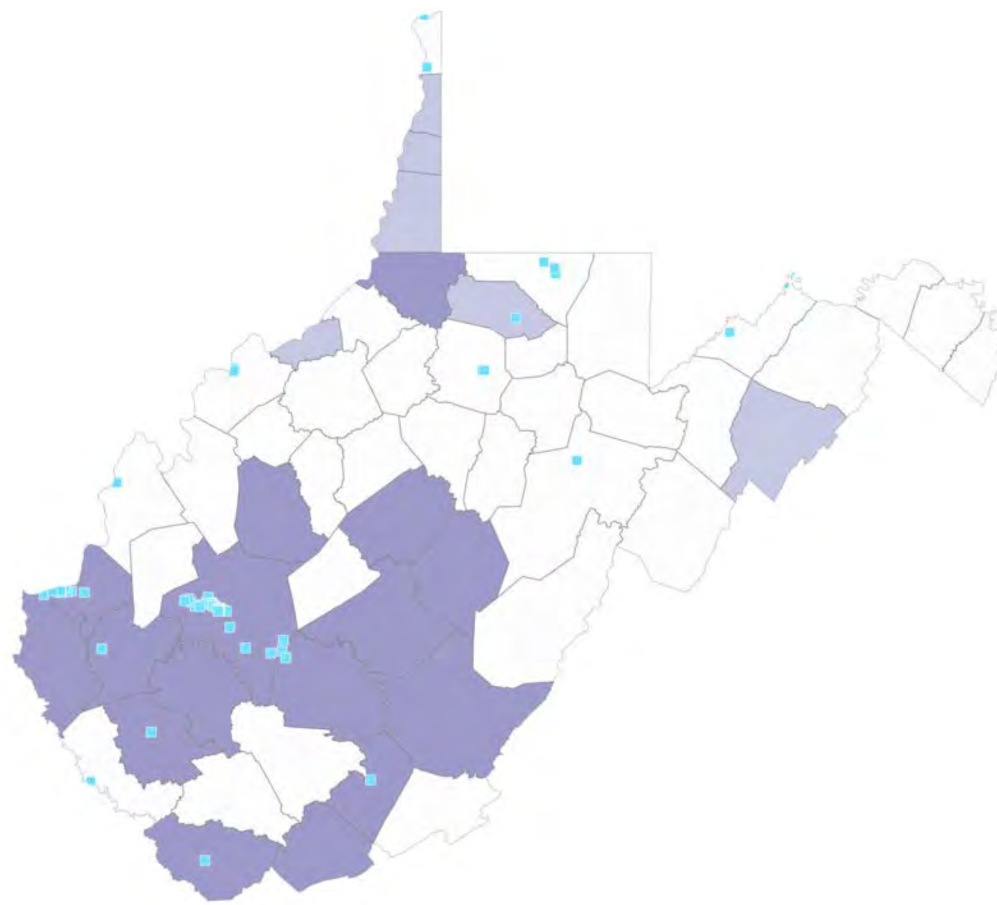
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Barbour							0
Berkeley							0
Boone					1		3
Braxton					1		3
Brooke					1		2
Cabell					1		3
Calhoun							0
Clay							0
Doddridge							0
Fayette					1		3
Gilmer							0
Grant							0
Greenbrier					1		3
Hampshire							0
Hancock							0
Hardy					1		2
Harrison							0
Jackson							0
Jefferson							0
Kanawha					1		3
Lewis							0
Lincoln					1		3
Logan					1		3
Marion					1		2
Marshall					1		2
Mason							0
McDowell					2		3
Mercer					1		3
Mineral							0
Mingo							0
Monongalia							0
Monroe							0
Morgan							0
Nicholas					1		3
Ohio					2		2
Pendleton							0
Pleasants					1		2
Pocahontas							0
Preston							0
Putnam							0
Raleigh							0
Randolph							0
Ritchie							0
Roane					1		3
Summers					1		3
Taylor							0
Tucker							0
Tyler							0
Upshur							0
Wayne					1		3
Webster					1		3
Wetzel					1		3
Wirt							0
Wood							0
Wyoming							0

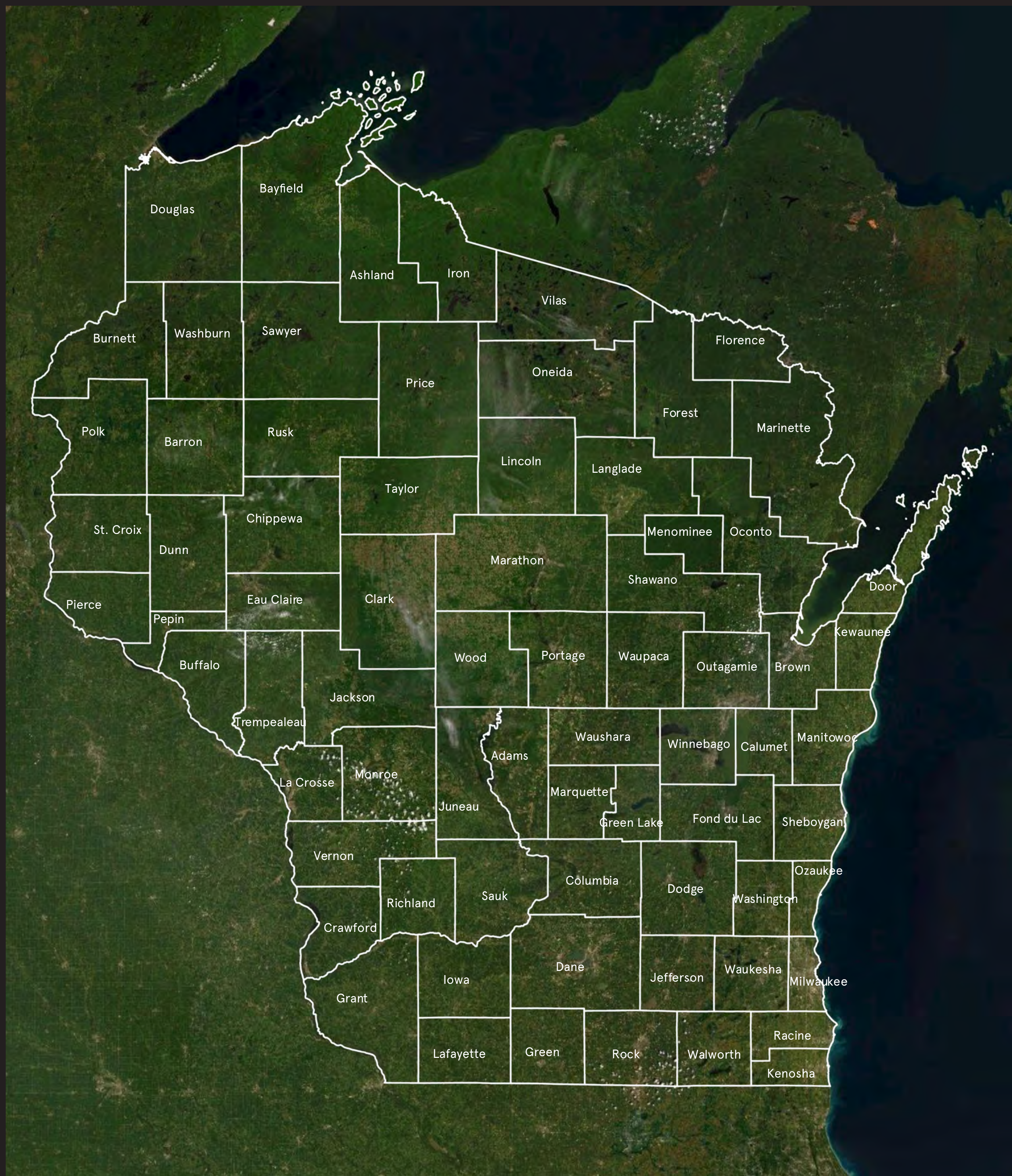
WEST VIRGINIA

TOTAL: 17 DISASTERS
FEMA PA + HM: $613 M
HUD CDBG-DR: $256 M
FEMA + HUD ASSISTANCE: $870 M

			2012								2013		2015										2016		2017		2018				2019		2021			
			4059: SEVERE STORMS, TORNADOES, FLOODING, MUDSLIDES, AND LANDSLIDES		4061: SEVERE STORMS, FLOODING, MUDSLIDES, AND LANSLIDES		4071: SEVERE STORMS AND STRAIGHT-LINE WINDS		4093: HURRICANE SANDY		4132: SEVERE STORMS AND FLOODING		4210: SEVERE WINTER STORM, FLOODING, LANDSLIDES, AND MUDSLIDES		4219: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4220: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4221: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4236: SEVERE STORMS, STRAIGHT-LINE WINDS, FLOODING, LANDSLIDES, AND MUDSLIDES		4273: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4331: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4359: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4378: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4455: SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES		4603: SEVERE WINTER STORMS		4605: SEVERE STORMS AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	17	$460,372,225	$6,524,210	$0	$2,010,090	$0	$5,414,231	$0	$13,240,602	$0	$1,760,717	$0	$23,510,504	$48,459	$7,385,828	$13,333	$6,270,895	$16,610	$5,885,190	$8,225	$6,857,195	$12,867	$322,210,553	$4,049,649	$8,188,633	$149,242	$38,974,371	$233,923	$2,060,454	$43,279	$2,493,524	$81,746	$687,451	$0	$2,240,444	$0
Barbour County	3	$429,403					$143,180	$0	$286,223	$0			$0	$0																						
Berkeley County	1	$198,703					$198,703	$0																												
Boone County	5	$189,431					$86,375	$0	$25,299	$0			$21,808	$0	$0	$0																			$55,949	$0
Braxton County	6	$166,795					$53,276	$0	$11,249	$0			$0	$0			$0	$0			$67,493	$0	$34,778	$0												
Brooke County	2	$1,949,564															$0	$0									$1,949,564	$0								
Cabell County	7	$1,581,934					$184,163	$0					$492,544	$329,820	$0	$0			$0	$0							$208,778	$0					$340,439	$0	$26,191	$0
Calhoun County	3	$41,308					$41,308	$0											$0	$0							$0	$0								
Clay County	4	$13,142,403					$126,839	$0	$13,327	$0											$0	$0	$13,002,236	$0												
Doddridge County	6	$57,502	$3,608	$0			$0	$0					$0	$0			$0	$0							$53,894	$0	$0	$0								
Fayette County	4	$3,001,409					$476,769	$0	$57,301	$47,325			$43,470	$0									$2,225,881	$150,663												
Gilmer County	4	$16,726					$16,726	$0					$0	$0			$0	$0					$0	$0												
Grant County	3	$95,258					$29,262	$0																					$2,529	$0	$63,468	$0				
Greenbrier County	3	$16,685,796					$234,863	$521,572											$0	$0			$11,785,187	$4,144,173												
Hampshire County	1	$215,877																											$215,877	$0						
Hancock County	1	$0																									$0	$0								
Hardy County	2	$196,066					$3,486	$0																					$192,580	$0						
Harrison County	5	$1,103,927	$1,260	$0			$359,062	$0					$64,504	$100,109											$20,447	$0	$558,545	$0								
Jackson County	6	$117,956					$70,480	$0					$47,477	$0			$0	$0	$0	$0	$0	$0	$0	$0												
Jefferson County	2	$111,904					$103,025	$0																					$8,879	$0						
Kanawha County	5	$48,557,317					$1,055,456	$272,309	$175,076	$2,127,372			$4,354,681	$2,480,991									$27,967,398	$10,089,301											$34,734	$0
Lewis County	5	$290,153					$271,620	$0	$13,784	$0			$4,748	$0			$0	$0					$0	$0												
Lincoln County	10	$4,027,737	$166,489	$0	$27,330	$0	$142,464	$0					$28,597	$0	$0	$0					$153,933	$0	$45,727	$3,383,782			$3,847	$0					$49,298	$0	$26,270	$0
Logan County	7	$1,979,824			$1,918,663	$0	$16,758	$0					$44,403	$0	$0	$0					$0	$0					$0	$0							$0	$0
McDowell County	2	$139,669					$69,191	$0					$70,479	$0																						
Marion County	2	$631,778	$118,629	$0																					$513,149	$0										
Marshall County	5	$4,212,990					$29,680	$0					$0	$0			$0	$0							$4,183,310	$0	$0	$0								
Mason County	4	$245,489					$100,754	$0			$0	$0															$120,496	$0					$24,239	$0		
Mercer County	2	$26,389					$20,201	$0					$6,188	$0																						
Mineral County	1	$0																											$0	$0						
Mingo County	6	$811,601	$0	$0	$18,396	$0	$141,839	$0					$564,618	$0	$0	$0																			$86,748	$0
Monongalia County	4	$38,962	$8,327	$0									$0	$0											$0	$0	$30,635	$0								
Monroe County	2	$4,078,252					$137,918	$0															$3,940,334	$0												
Morgan County	1	$185,004																											$101,184	$83,820						
Nicholas County	4	$28,733,554					$337,060	$0	$201,248	$0											$28,625	$0	$26,487,555	$1,679,066												
Ohio County	3	$1,016,860															$0	$0							$247,394	$0	$580,842	$188,625								
Pendleton County	4	$32,162					$22,884	$0	$9,278	$0																			$0	$0	$0	$0				
Pleasants County	4	$44,970					$44,970	$0									$0	$0	$0	$0							$0	$0								
Pocahontas County	3	$96,990					$44,460	$0	$17,729	$0													$34,801	$0												
Preston County	6	$927,201	$3,380	$0			$63,746	$0	$223,571	$0															$0	$406,238	$0	$230,265			$0	$0				
Putnam County	3	$283,399					$151,461	$0					$18,897	$38,250																			$74,791	$0		
Raleigh County	3	$793,422					$418,670	$0	$96,508	$0			$278,243	$0																						
Randolph County	5	$2,377,265					$77,084	$0	$204,313	$0													$0	$0	$0	$0					$2,095,868	$0				
Ritchie County	5	$55,840	$8,097	$0			$10,484	$0					$28,197	$0			$9,063	$0									$0	$0								
Roane County	7	$3,138,679	$50,045	$0			$50,181	$0			$1,523,012	$0	$0	$0					$0	$0	$0	$0	$522,696	$992,745												
Summers County	4	$379,819					$53,077	$0					$0	$0					$0	$0			$326,742	$0												
Taylor County	5	$25,808	$4,370	$0			$21,438	$0	$0	$0															$0	$0	$0	$0								
Tucker County	5	$822,915					$10,228	$442,465	$114,672	$40,197			$183,872	$0											$0	$0					$31,480	$0				
Tyler County	5	$372,637					$47,984	$0					$35,062	$0			$40,859	$0							$191,450	$0	$57,282	$0								
Upshur County	4	$1,947,774					$71,838	$0	$69,965	$0			$0	$46,350									$0	$1,759,621												
Wayne County	8	$859,670	$15,616	$0			$29,000	$0					$118,299	$287,540	$29,330	$0							$0	$0			$0	$0					$321,572	$0	$58,313	$0
Webster County	5	$3,644,644					$41,478	$0	$100,734	$0			$0	$0							$355,834	$0	$3,146,598	$0												
Wetzel County	5	$1,785,823					$242,675	$0					$0	$0			$0	$0							$1,511,825	$0	$31,324	$0								
Wirt County	4	$19,844					$19,844	$0					$0	$0					$0	$0							$0	$0								
Wood County	4	$1,070,786					$399,413	$390,666					$0	$0							$280,707	$0					$0	$0								
Wyoming County	3	$389,885					$33,114	$109,356	$29,190	$0			$57,534	$160,691																						
Total FEMA Allocation		$613,719,302	$6,904,031	$0	$3,974,479	$0	$11,718,721	$1,736,368	$14,890,072	$2,214,894	$3,283,730	$0	$29,974,123	$3,492,211	$7,415,158	$13,333	$6,320,817	$16,610	$5,885,190	$8,225	$7,743,787	$12,867	$411,730,486	$26,249,000	$14,910,101	$555,480	$42,515,683	$652,813	$2,581,502	$127,099	$4,684,340	$81,746	$1,497,789	$0	$2,528,648	$0

MEMBERS OF THE WEST VIRGINIA NATIONAL GUARD LOAD BOTTLED WATER ONTO A UH-60 BLACK HAWK HELICOPTER JULY 1, 2012
FOLLOWING STRONG STORMS THAT DEVASTATED THE STATE. | CANADIAN FORCES LCOL DAVID LESTER

WISCONSIN



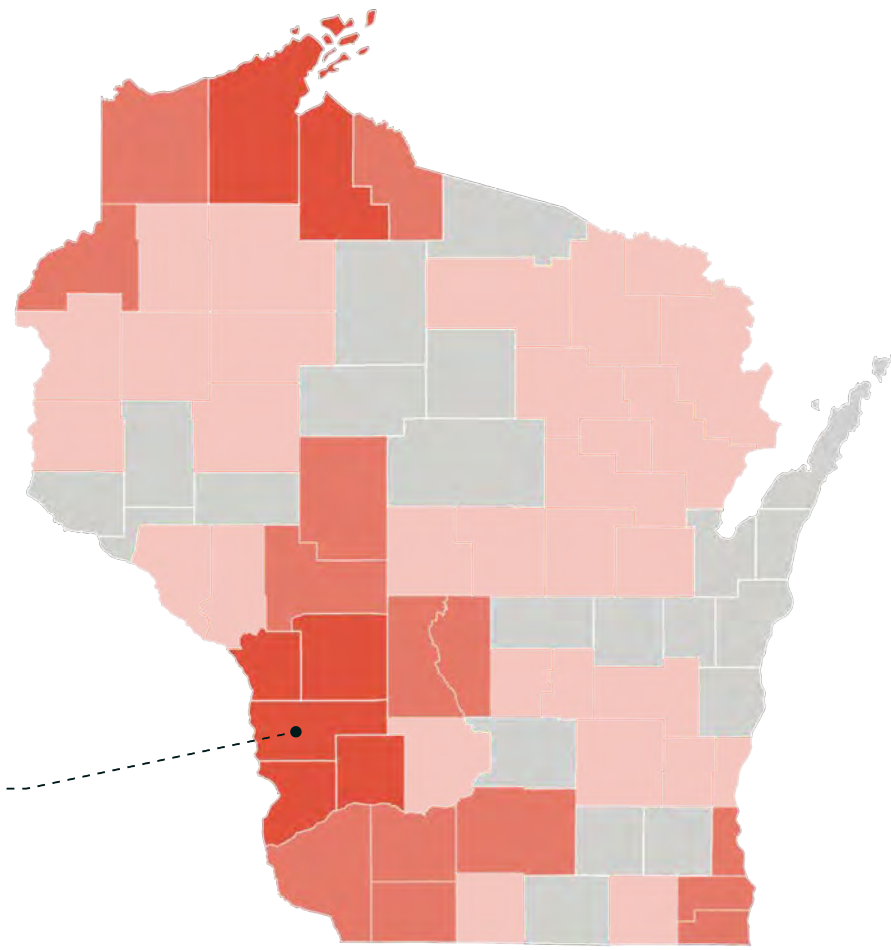
WISCONSIN STATISTICS SUMMARY (2011 - 2021)	
10	CLIMATE DISASTER DECLARATIONS
VERNON	COUNTY WITH THE HIGHEST DISASTER OCCURENCES
24	SUPERFUND SITES
C	ASCE INFRASTRUCTURE REPORT CARD GRADE
MILWAUKEE	HIGHEST COMPOUNDING RISKS
$154 MILLION	FEMA + HUD POST-DISASTER FUNDING
5.8 MILLION	POPULATION TOTAL
$27	PER CAPITA SPENDING ON CLIMATE DISASTERS
$4.2 BILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

10

disaster declarations



Seventy-one percent of counties in Wisconsin have had a recent disaster declaration.

Vernon County has had the highest number of recent disasters in the state: 5 disasters.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

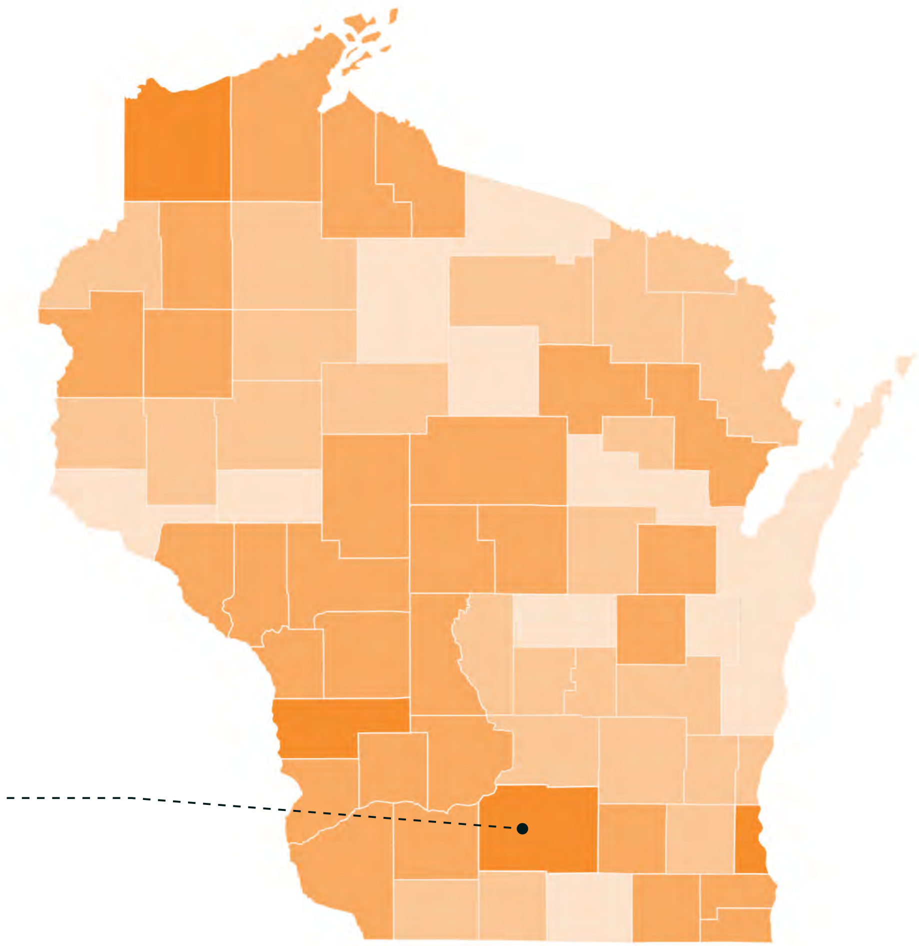
FEDERAL ASSISTANCE 2011–2021

POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$154M

post-disaster assistance

$137M	FEMA obligations
$16.3M	HUD CDBG-DR Funds
$154M	FEMA + HUD assistance
$154	per capita cost



Dane County has received the most post-disaster federal funding for recent climate disasters: over $17 million.

Public Assistance and Hazard Mitigation

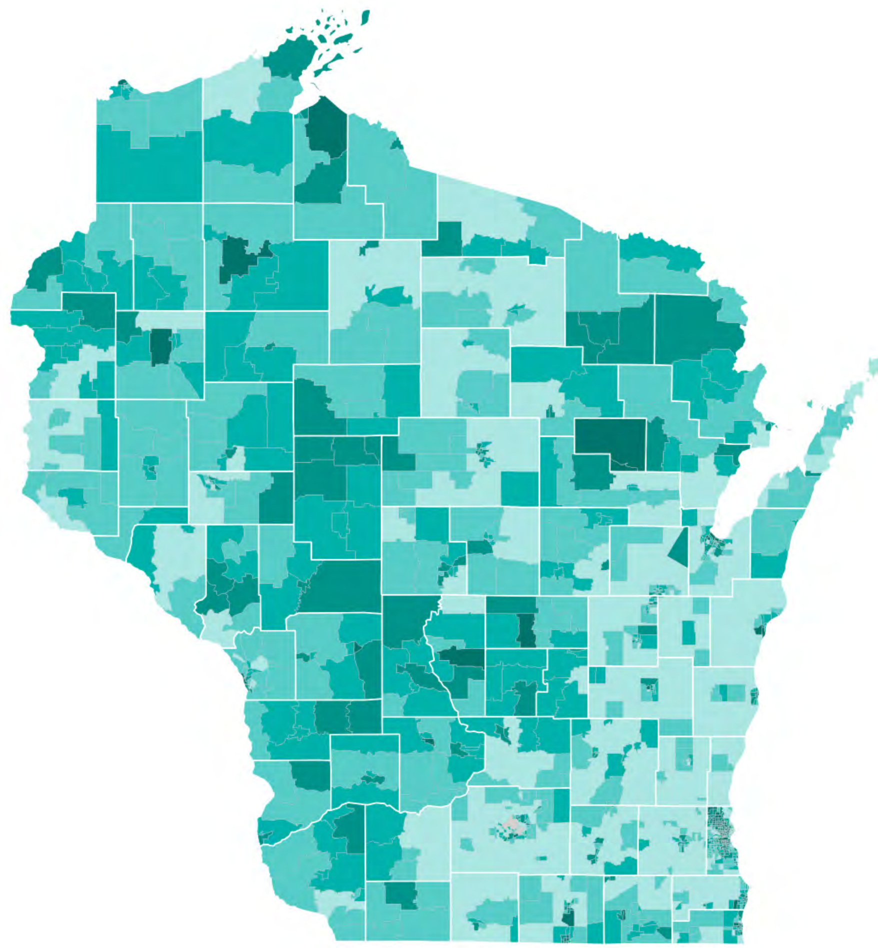
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

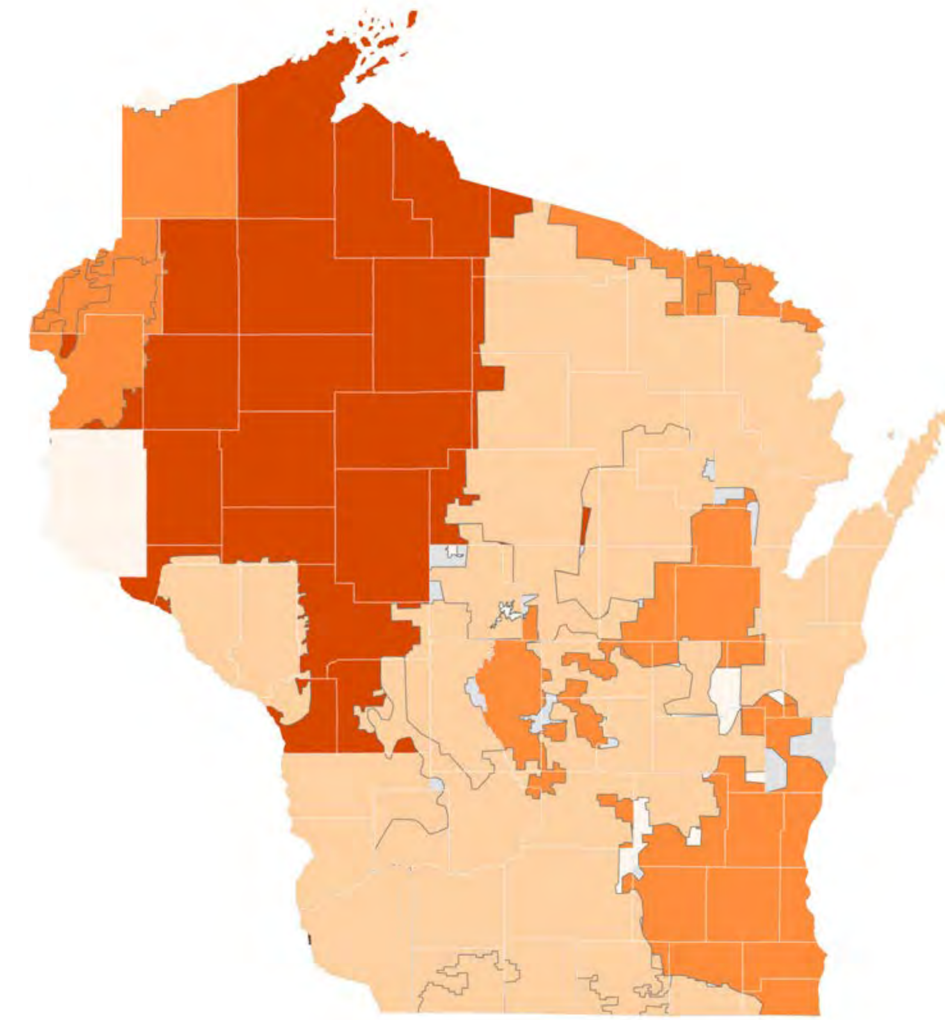
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



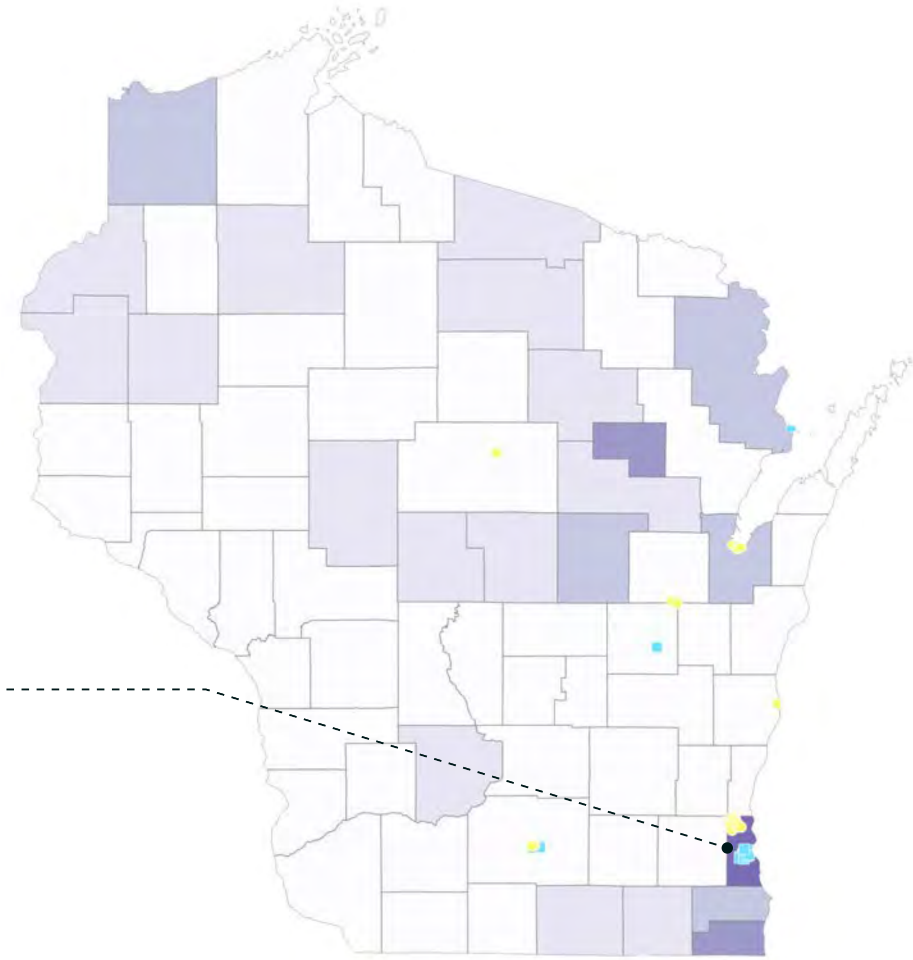
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 – 60 minutes
- 60 – 120 minutes
- 120 – 240 minutes
- 240 – 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

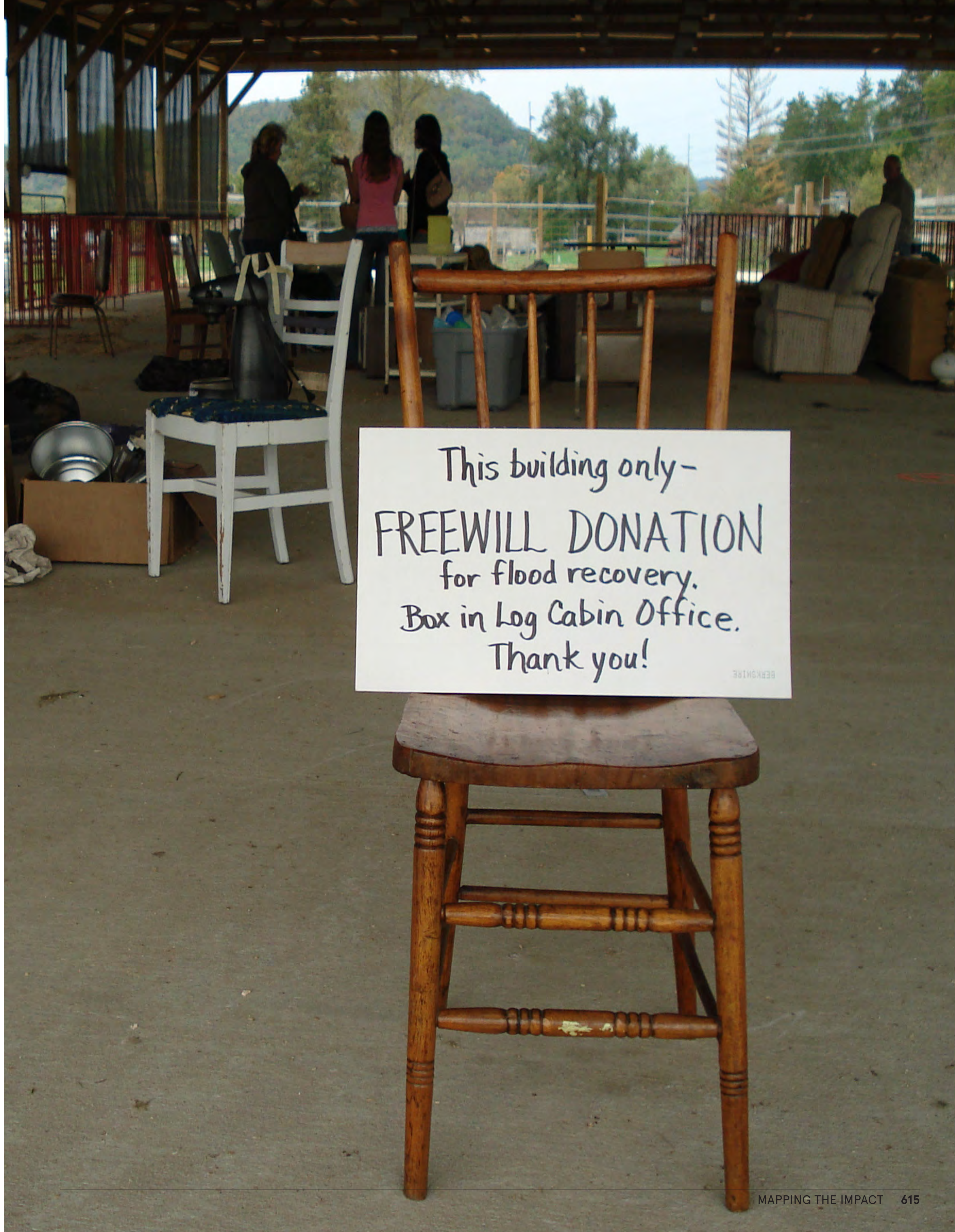
Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Adams							0
Ashland							0
Barron					1		1
Bayfield							0
Brown					1		2
Buffalo							0
Burnett					1		1
Calumet							0
Chippewa							0
Clark					1		1
Columbia							0
Crawford							0
Dane							0
Dodge							0
Door							0
Douglas					1		2
Dunn							0
Eau Claire							0
Florence							0
Fond du Lac							0
Forest							0
Grant							0
Green							0
Green Lake							0
Iowa							0
Iron							0
Jackson							0
Jefferson							0
Juneau							0
Kenosha					1		3
Kewaunee							0
La Crosse							0
Lafayette							0
Langlade					1		1
Lincoln							0
Manitowoc							0
Marathon							0
Marinette					1		2
Marquette							0
Menominee					2		3
Milwaukee					8		4
Monroe							0
Oconto							0
Oneida					1		1
Outagamie							0
Ozaukee							0
Pepin							0
Pierce							0
Polk					1		1

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Portage					1		1
Price							0
Racine					1		2
Richland							0
Rock					1		1
Rusk							0
Sauk					1		1
Sawyer					1		1
Shawano					1		1
Sheboygan							0
St. Croix							0
Taylor							0
Trempealeau							0
Vernon							0
Vilas					1		1
Walworth					1		1
Washburn							0
Washington							0
Waukesha							0
Waupaca					1		2
Waushara							0
Winnebago							0
Wood					1		1

IMAGE RIGHT: DONATION AREA AT THE GAYS MILLS APPLE FESTIVAL, WISCONSIN | SAVANNAH BREHMER/FEMA

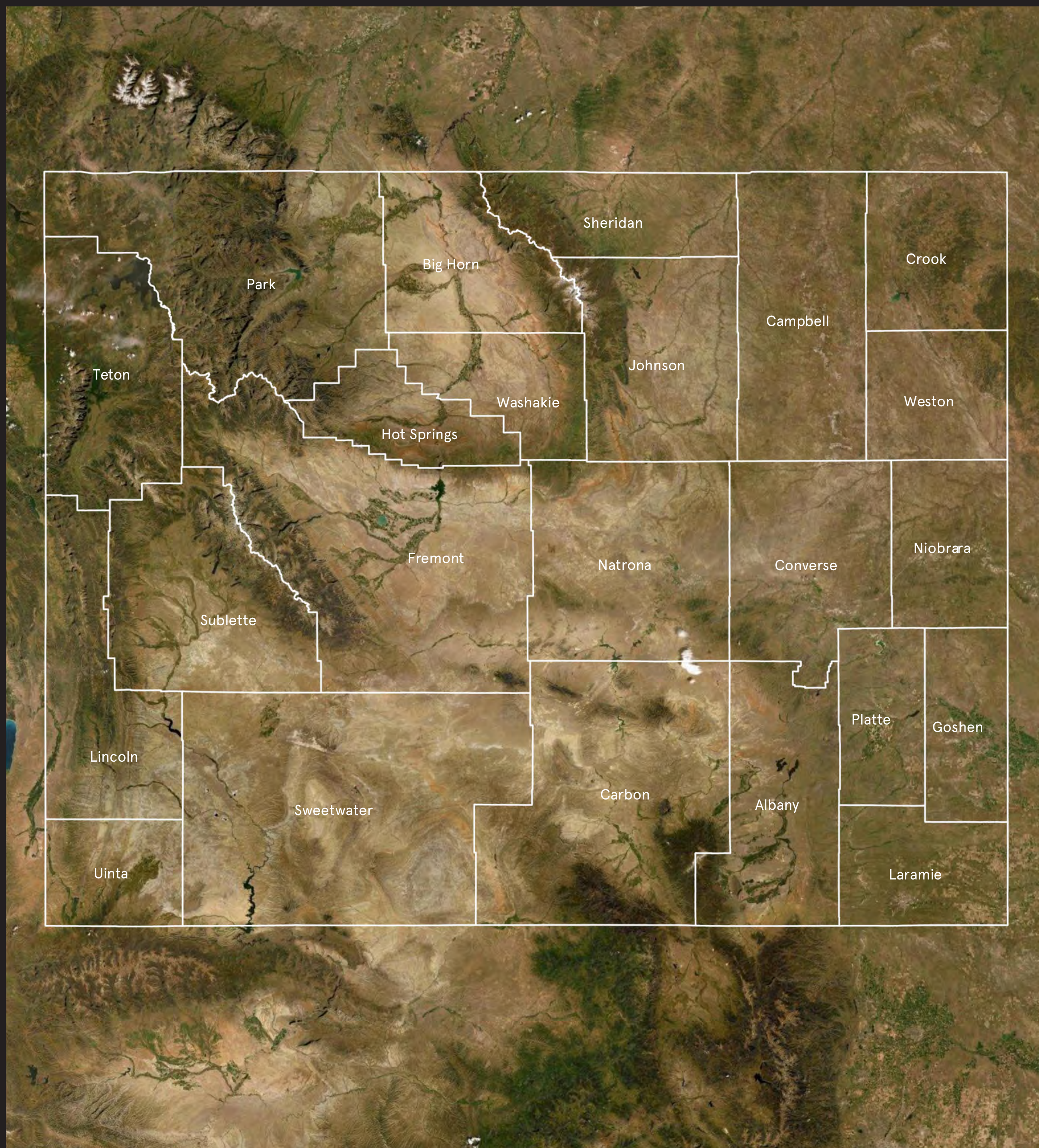


WISCONSIN

TOTAL: 10 DISASTERS
FEMA PA + HM: $137 M
HUD CDBG-DR: $16.3 M
FEMA + HUD ASSISTANCE: $154M

			2011		2012		2013		2016				2017		2018				2019		2020	
			1966: SEVERE WINTER STORM AND SNOWSTORM		4076: SEVERE STORMS AND FLOODING		4141: SEVERE STORMS, FLOODING, AND MUDSLIDES		4276: SEVERE STORMS AND FLOODING		4288: SEVERE STORMS, FLOODING, AND MUDSLIDES		4343: SEVERE STORMS, STRAIGHT-LINE WINDS, FLOODING, LANDSLIDES, AND MUD		4383: SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING		4402: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, FLOODING, AND LANDSLIDES		4459: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING		4477: SEVERE WINTER STORM AND FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	10	$16,355,375	$1,505,083	$61,394	$266,677	$63,695	$942,027	$52,383	$1,318,889	$103,129	$725,152	$85,350	$992,109	$192,958	$974,572	$218,457	$3,541,077	$625,175	$3,539,383	$429,656	$615,968	$102,242
Adams County	2	$424,954									$89,143	$0					$335,811	$0				
Ashland County	4	$2,953,565			$230,527	$0	$263,067	$0	$1,731,312	$397,854					$127,000	$203,807						
Barron County	1	$1,114,099																	$1,114,099	$0		
Bayfield County	4	$5,496,100			$658,788	$380,374	$236,421	$0	$1,512,532	$30,000					$2,677,985	$0						
Brown County	0	$0																				
Buffalo County	1	$1,002,433											$1,002,433	$0								
Burnett County	2	$619,560							$568,001	$0					$51,559	$0						
Calumet County	0	$0																				
Chippewa County	1	$364,025									$364,025	$0										
Clark County	3	$1,398,020									$1,126,261	$0			$127,536	$0			$144,223	$0		
Columbia County	0	$0																				
Crawford County	4	$4,662,565					$1,447,574	$62,453			$1,490,219	$0	$237,117	$103,654			$1,126,912	$194,636				
Dane County	2	$17,050,255	$1,358,017	$1,232,452													$14,039,088	$420,698				
Dodge County	1	$338,100	$338,100	$0																		
Door County	0	$0																				
Douglas County	3	$11,099,806			$7,332,339	$0			$841,000	$0					$2,926,467	$0						
Dunn County	0	$0																				
Eau Claire County	0	$0																				
Florence County	1	$21,998							$21,998	$0												
Fond du Lac County	1	$520,822															$520,822	$0				
Forest County	1	$114,913																	$67,663	$47,250		
Grant County	3	$3,129,041	$242,541	$280,107			$1,372,756	$0					$1,181,700	$51,938								
Green County	1	$194,081	$194,081	$0																		
Green Lake County	1	$252,008															$252,008	$0				
Iowa County	3	$1,009,772	$160,246	$0			$760,962	$0					$88,564	$0								
Iron County	3	$4,482,941							$3,929,538	$23,747					$490,064	$0	$39,592	$0				
Jackson County	2	$898,718									$740,316	$0	$158,401	$0								
Jefferson County	0	$0																				
Juneau County	2	$3,941,789									$248,415	$0					$1,873,528	$1,819,847				
Kenosha County	2	$3,477,935	$640,368	$0																	$2,713,805	$123,762
Kewaunee County	0	$0																				
La Crosse County	4	$3,967,892									$309,528	$0	$2,150,005	$0			$1,122,309	$0	$386,049	$0		
Lafayette County	2	$461,545	$146,551	$12,000									$302,994	$0								
Langlade County	1	$1,622,339																	$1,622,339	$0		
Lincoln County	0	$0																				
Manitowoc County	0	$0																				
Marathon County	0	$0																				
Marinette County	1	$192,249																	$192,249	$0		
Marquette County	1	$313,387															$294,672	$18,715				
Menominee County	1	$656,040																	$17,351	$638,690		
Milwaukee County	2	$2,609,372	$2,028,173	$0																	$581,199	$0
Monroe County	4	$7,544,106									$165,122	$0	$921,938	$0			$4,806,627	$1,343,443	$306,976	$0		
Oconto County	1	$1,231,967																	$1,141,931	$90,036		
Oneida County	1	$315,199																	$264,949	$50,250		
Outagamie County	1	$1,806,748																	$1,806,748	$0		
Ozaukee County	1	$389,269															$389,269	$0				
Pepin County	0	$0																				
Pierce County	0	$0																				
Polk County	1	$3,328,448																	$3,328,448	$0		
Portage County	1	$1,334,529																	$1,334,529	$0		
Price County	0	$0																				
Racine County	2	$1,281,668	$706,995	$0																	$529,673	$45,000
Richland County	4	$1,750,375					$117,219	$0			$477,809	$227,995	$264,530	$0			$647,288	$15,535				
Rock County	0	$0																				
Rusk County	1	$15,463																	$15,463	$0		
St. Croix County	1	$337,257					$334,157	$3,100														
Sauk County	1	$6,632,335															$1,818,725	$4,813,610				
Sawyer County	1	$905,625							$281,451	$624,174												
Shawano County	1	$38,849																	$10,760	$28,089		
Sheboygan County	0	$0																				
Taylor County	0	$0																				
Trempealeau County	1	$1,045,097											$1,045,097	$0								
Vernon County	5	$14,795,169					$460,182	$390,318			$3,387,316	$0	$646,187	$379,206			$5,791,557	$1,395,700	$337,417	$2,007,286		
Vilas County	0	$0																				
Walworth County	1	$427,991	$427,991	$0																		
Washburn County	1	$1,284,011							$1,284,011	$0												
Washington County	1	$395,573	$395,573	$0																		
Waukesha County	0	$0																				
Waupaca County	1	$743,482																	$743,482	$0		
Waushara County	0	$0																				
Winnebago County	0	$0																				
Wood County	1	$1,491,776																	$1,491,776	$0		
Total FEMA Allocation		$137,840,639	$8,143,720	$1,585,953	$8,488,330	$444,069	$5,934,364	$508,254	$11,488,733	$1,178,904	$9,123,306	$313,345	$8,991,075	$727,755	$7,375,184	$422,264	$36,599,283	$10,647,358	$17,865,836	$3,291,257	$4,440,645	$271,004

WYOMING



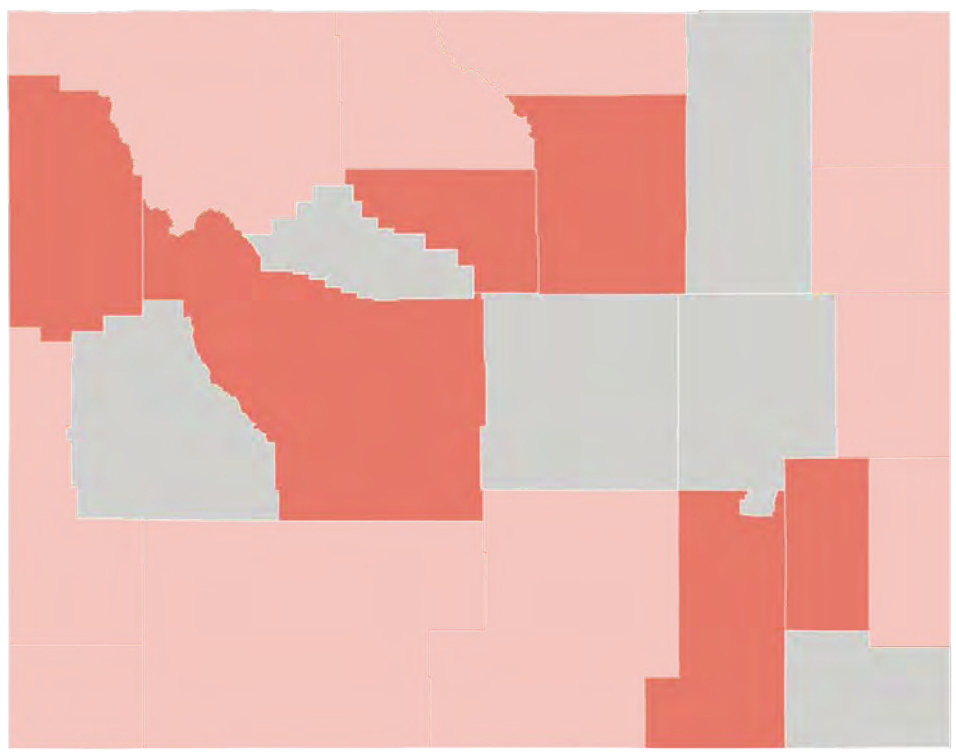
WYOMING STATISTICS SUMMARY (2011 – 2021)	
4	CLIMATE DISASTER DECLARATIONS
2ND LOWEST	NUMBER OF DISASTERS IN THE COUNTRY
ALBANY, FREMONT, JOHNSON, PLATTE, TETON, WASHAKIE	COUNTIES WITH THE HIGHEST DISASTER OCCURENCES
ALBANY	HIGHEST COMPOUNDING RISKS
$18.4 MILLION	FEMA + HUD POST-DISASTER FUNDING
581 THOUSAND	POPULATION TOTAL
$32	PER CAPITA SPENDING ON CLIMATE DISASTERS
$600 MILLION	OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH A SMALL INSURANCE SURCHARGE

DISASTER OCCURRENCES 2011–2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

4

disaster declarations



Six counties have had two recent disasters: Albany, Fremont, Johnson, Platte, Teton, and Washakie.

Number of Disaster Events

Major Disaster Declarations (2011–2021)

- 0 occurences
- 1 occurrence
- 2–3 occurences
- 4–6 occurrences
- 7–9 occurrences
- 10+ occurrences

Source: FEMA 2021
Maps courtesy of iParametrics

FEDERAL ASSISTANCE 2011–2021

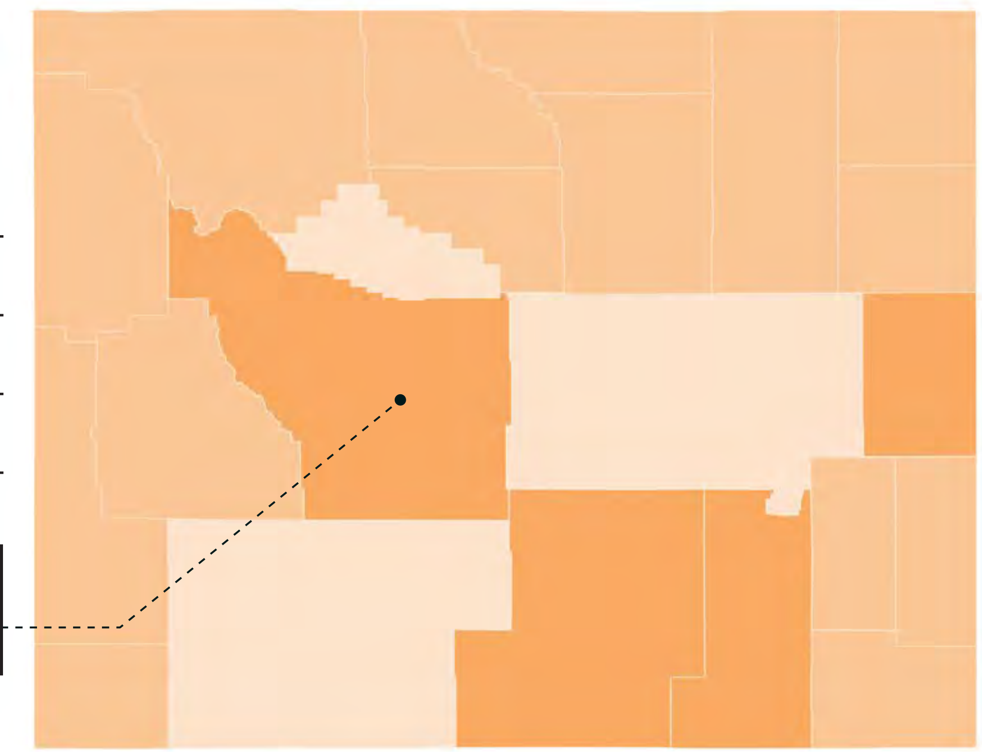
POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS OBLIGATED BY COUNTY FOR CLIMATE DISASTERS

$18.4M

post-disaster assistance

$18.4M	FEMA obligations
$0	HUD CDBG-DR Funds
$18.4M	FEMA + HUD assistance
$32	per capita cost

Fremont County has received the most post-disaster federal funding in the state: nearly $6 million.



Public Assistance and Hazard Mitigation

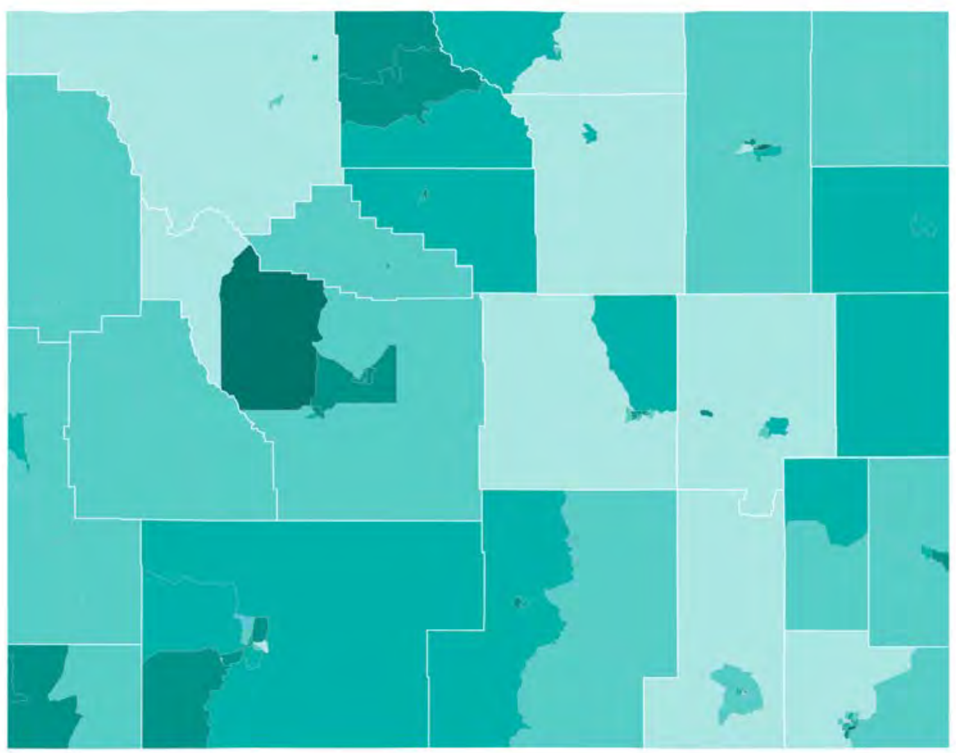
Federal Share Obligated (2011–2021)

- $0 to $100K
- $100K to $1M
- $1M to $10M
- $10M to $50M
- $50M to $100M
- $100M to $1B
- $1B to $9B

Source: FEMA 2021
Maps courtesy of iParametrics

SOCIAL VULNERABILITY INDEX 2011–2021

AREAS OF GREATEST SOCIAL VULNERABILITY



Social Vulnerability Index

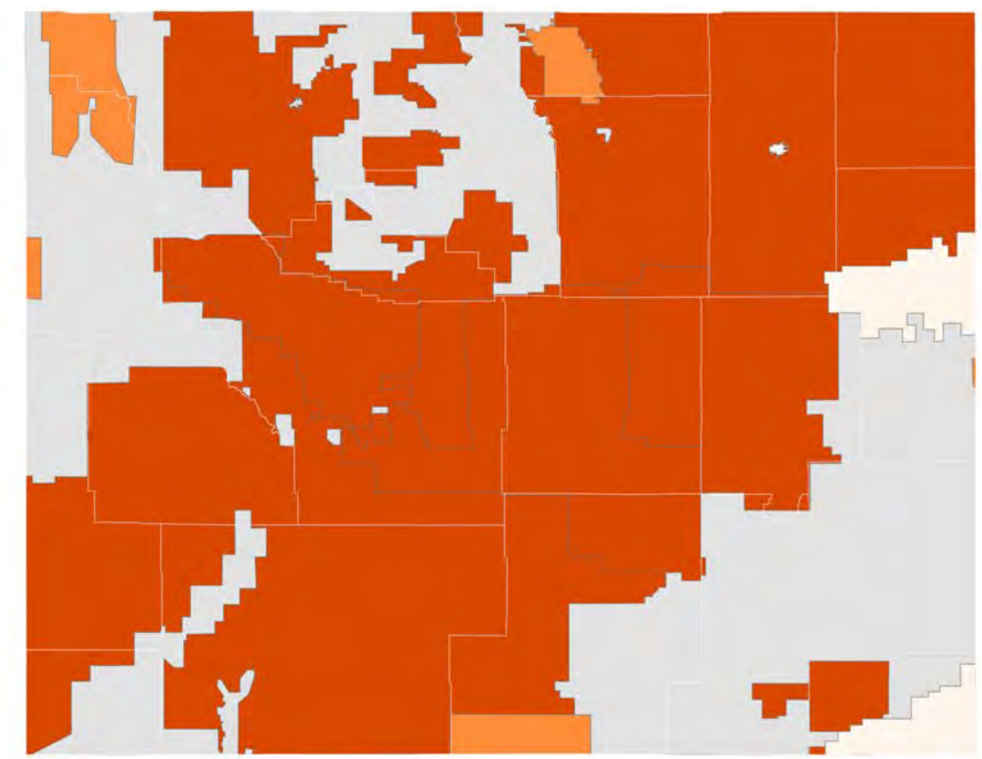
CDC (2018)

- No Value
- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0

Source: CDC/ATSDR 2018 Social Vulnerability Index
Maps courtesy of iParametrics

ENERGY RELIABILITY 2011–2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



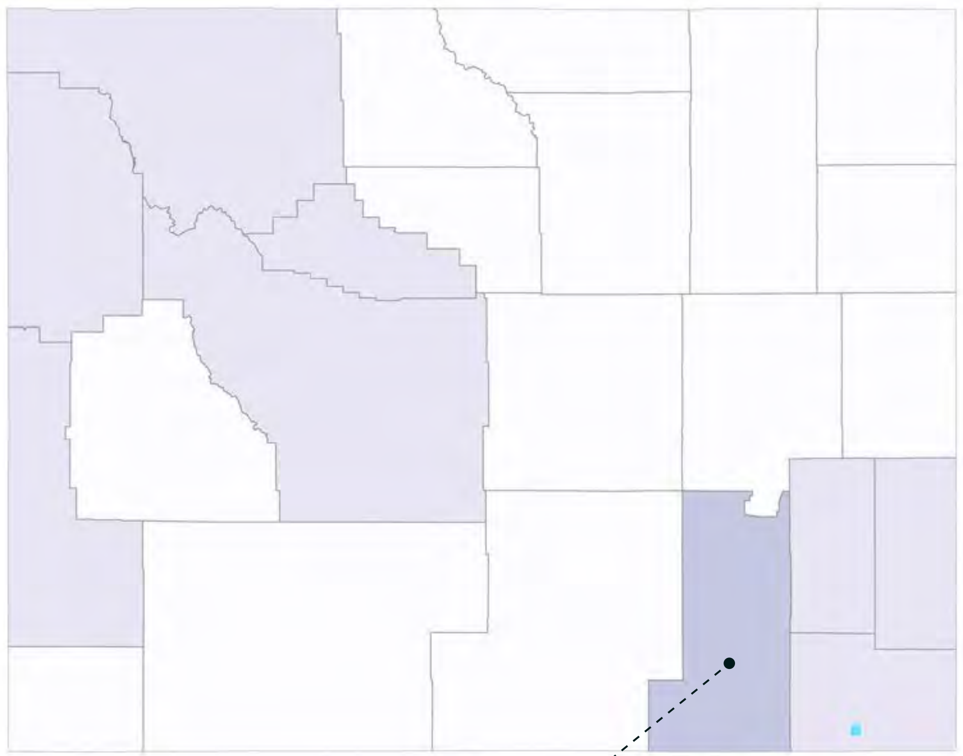
Aggregated Annual Electric Outage Duration

Including major events – SAIDI_W_MED

- missing electric outage data
- 0 - 60 minutes
- 60 - 120 minutes
- 120 - 240 minutes
- 240 - 456 minutes
- 456- 7,700 minutes

Source: U.S. Energy Information Administration
Maps courtesy of APTIM

COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



Albany County has a high risk of climate disasters and high poverty.

Areas with the greatest return on investment due to physical and social risk

High Compounding Risks

Low Compounding Risks

Superfund Sites

Wastewater Discharge Sites

U.S. counties were analyzed for social benefits using the following parameters: NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov)); Population Density (Source: 2020 Census Demographic Data Map Viewer); Population Change (Source: 2020 Census Demographic Data Map Viewer); Poverty (Source: 2020 Census Demographic Data Map Viewer); Cardiovascular Diseases (Source: US Data | GHDx (healthdata.org)); Neoplasms (Source: US Data | GHDx (healthdata.org)); Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))t | Map courtesy of APTIM.

County Name	High Population Density	High Percent of Population Change	High Poverty Rate	High Health Risk	Types of High Climate Risk	Sea Level	Total Risk Count
Albany					1		2
Big Horn							0
Campbell							0
Carbon							0
Converse							0
Crook							0
Fremont					2		1
Goshen					1		1
Hot Springs					1		1
Johnson							0
Laramie					1		1
Lincoln					1		1
Natrona							0
Niobrara							0
Park					1		1
Platte					1		1
Sheridan							0
Sublette							0
Sweetwater							0
Teton					1		1
Uinta							0
Washakie							0
Weston							0

WYOMING

TOTAL: 4 DISASTERS
FEMA PA + HM: $18.4 M
HUD CDBG-DR none
FEMA + HUD ASSISTANCE: $18.4 M

			2011		2015		2017			
			4007: SEVERE STORMS, FLOODING, AND LANDSLIDES		4227: SEVERE STORMS AND FLOODING		4306: SEVERE WINTER STORM AND STRAIGHT-LINE WINDS		4327: FLOODING	
County Name	# of Climate Disasters 2011-2021	Total FEMA Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations	PA Obligations	HM Obligations
Statewide	4	$5,549,565	$2,096,187	$12,072	$244,883	$28,245	$2,249,166	$17,417	$807,049	$94,545
Albany County	2	$814,092	$75,565	$0	$738,527	$0				
Big Horn County	1	$417,604	$412,429	$5,175						
Campbell County	0	$0								
Carbon County	1	$472,781	$472,781	$0						
Converse County	0	$0								
Crook County	1	$866,199	$866,199	$0						
Fremont County	2	$5,900,656	$104,852	$608,003					$5,187,801	$0
Goshen County	1	$199,212	$199,212	$0						
Hot Springs County	0	$0								
Johnson County	2	$399,779	$57,777	$21,375	$320,627	$0				
Laramie County	0	$0								
Lincoln County	1	$227,474	$227,474	$0						
Natrona County	0	$0								
Niobrara County	1	$1,156,283			$815,039	$341,243				
Park County	1	$467,577							$467,577	$0
Platte County	2	$379,113	$0	$0	$379,113	$0				
Sheridan County	1	$592,736	$422,378	$170,358						
Sublette County	0	$41,528	$41,528	$0						
Sweetwater County	1	$0	$0	$0						
Teton County	2	$214,582	$45,288	$0			$169,294	$0		
Uinta County	1	$216,338	$216,338	$0						
Washakie County	2	$194,321	$23,887	$0					$170,434	$0
Weston County	1	$306,684	$306,684	$0						
Total FEMA Allocation		$18,416,523	$5,568,579	$816,983	$2,498,190	$369,489	$2,418,460	$17,417	$6,632,861	$94,545

DARK STORM CLOUDS ARE ROLLING IN AT THE PAWNEE BUTTES NATIONAL GRASSLANDS | MICHAEL KIRSH

DISASTER OCCURRENCES FOR U.S. TERRITORIES 2011–2021

In addition to the 50 states, tribes and territories participate in federal programs both before and after disasters. For the years 2011-2021, the following allocations were given to the U.S. Territories and the District of Columbia.

In 2013, President Obama signed the Sandy Recovery Improvement Act of 2013, which included an amendment to the Stafford Act to provide federally recognized Indian tribal governments the option to request a disaster declaration independent of the state; however, tribal governments still have the option to request assistance under the state declaration. Since then, eight out of the twenty-one federally recognized tribal governments have received a direct disaster declaration separate from the state. However, only one tribal governement – the Confederated Tribes of the Colville Nation in Washington State – has been allocated FEMA hazard mitigation (HM) and public assistance (PA) funds ($210,000). The seven other tribes received individual assistance (IA) only.

	DISASTER COUNT	FEMA HM + PA	CDBG-DR
DISTRICT OF COLUMBIA	5	$30,061,452	--
PUERTO RICO	7	$21,558,392,837	$20,408,072,230
VIRGIN ISLANDS	2	$3,079,080,562	$1,917,330,884
GUAM	4	$14,219,977	--
SAMOA	3	$30,972,549	$24,509,000
NORTHERN MARIANA ISLAND	2	$332,296,219	$270,549,000

IMAGE RIGHT: EL MANÍ IN MAYAGÜEZ, PUERTO RICO AFTER HURRICANE MARIA (SEPTEMBER 20, 2017) | NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

SUMMARY

Recent extreme weather events add to a trend of increasing climate disasters over the past decade that touch every corner of the U.S.[1] Our analysis of federal disaster declarations revealed that 90 percent of counties in the U.S. have experienced a climate disaster between 2011-2021, which accounts for approximately 93 percent of the population (or 307,387,257 people).

Across all 50 states, those with the highest number of disaster declarations were California (25), Mississippi (22), Oklahoma (22), Iowa (21), Tennessee (20), Louisiana (18), Alabama (17), Texas (17), Vermont (17), and West Virginia (17) (see full list of states p.632). The states with the most disasters, however, are not always those that have received the most post-disaster assistance. The states that received the highest post-disaster assistance per capita are Louisiana ($1,736), New York ($1,348), New Jersey ($815), North Dakota ($738), Vermont ($593), Texas ($518), West Virginia ($81), Alaska ($401), Florida ($390), and Nebraska ($390) (see full list of states p.633).

Through FEMA (Public Assistance and Hazard Mitigation) and HUD (CDBG-DR) programs alone, the U.S. spent over $91 billion between 2011-2021 on post-disaster assistance. Still, this is an underestimation of the total cost of disasters, as it excludes Army Corps projects, Department of Agriculture support, Small Business Association loans, private insurance payouts, and state investments, among other costs.

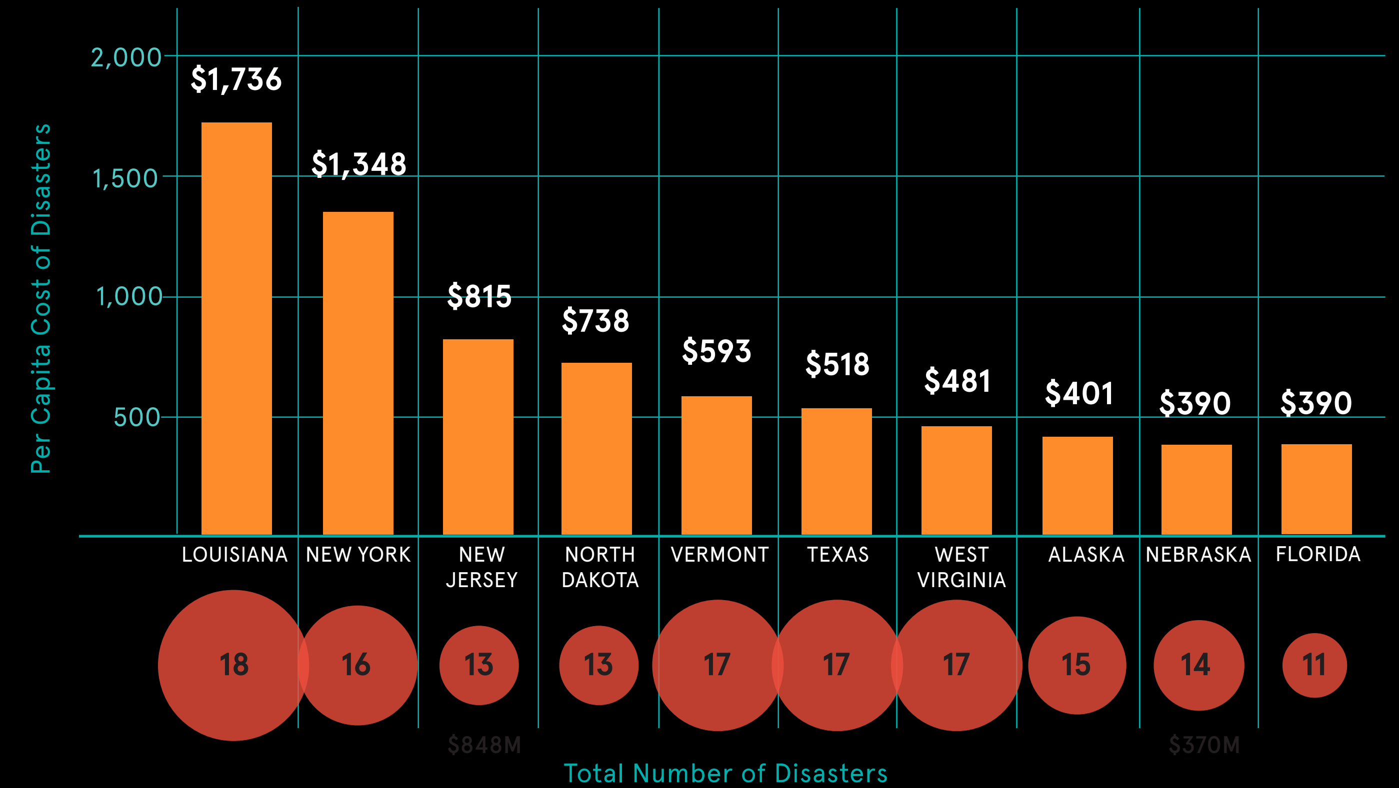
Federal Disaster Declarations and federal post-disaster assistance both provide a sense of the expanse and magnitude of the impact of climate change over the past decade; however, they provide only a snapshot of a much larger challenge.

Severe weather events destroy or apply stress to our already vulnerable energy systems. Power outages cause disruptions to livelihoods, medical care, communications, water, food, supply chains, and education.[2] These pressures can have devastating rippling effects, particularly on socially vulnerable populations. Our analysis of 2019 energy outage data, including major outage events (SAIDI_W_MED), revealed that 463 counties in the U.S. have high social vulnerability (SVI >0.8) and are serviced by energy utility providers with longer than average energy disruptions (above the national average of 456 minutes per year). In southeast Texas, counties such as Jasper, Newton, Polk, San Augustine, Jefferson, Houston, and Trinity, which have all had five or more recent disasters, also have the longest average energy outages in the country (7,699 minutes or 5.35 days in a year). These counties, home to both urban and rural communities, also have high social vulnerability scores (>0.8). More research is needed to understand the impact of climate events on energy service at a more granular scale; however, this information does suggest that investments in sustainable and resilient energy infrastructure could be utilized to create social benefits to the most vulnerable populations.

Since not enough funding is currently available to meet the increasing costs of climate change, it is essential to develop an investment strategy that does more for community resilience than solely replacing what was lost or mitigating the threat of a singular climate risk. The concept of return on investment may be expanded to mean more than direct revenue or avoided losses. As the cascading impacts or unintended consequences of a disaster are evaluated, additional returns – such as those related to the avoided costs of business disruption or of eroded property value in neighborhoods with repetitive losses – may be defined. A deeper analysis may also consider counting jobs added as a function of implementing mitigation measures, or economic growth in response to long-term sustainability planning and action.

A return on investment analysis considering such a wide realm of opportunities and stakeholder needs is a key component of capital planning and building resilience. Envisioning the investment opportunities with multi-sector returns and considering the need for higher return on investment to address the gap between need and obligated funding prompted the development of the Compounding Risks map series in this report. The map series highlights areas of opportunity where investments would address multiple objectives and contribute to a

TOP 10 STATES WITH HIGHEST PER CAPITA COST OF DISASTERS (2011-2021)



higher return. Investment in climate adaptation in the areas shown in darker purple hues would address some or all of the following objectives:

+ Addressing critical infrastructure needs in areas of highest risk;
+ Sparking redevelopment and economic activity in areas of population growth;
+ Preventing acute climate displacement in areas of high risk and denser population;
+ Supporting rural communities in extreme poverty where adaptation is unlikely;
+ Eliminating a contributing factor to emotional stress in areas of poorest health;
+ Slowing the spread of environmental contamination as climate hazards increase potential for movement.

This exercise, in repurposing social vulnerability and risk data to illuminate opportunities outside of the favored investment areas, offers a useful methodology to inspire projects that would provide multiple social and environmental benefits in addition to risk reduction. This approach can be incorporated during the evaluation of where critical infrastructure and dense populations are located and where cost saving after adaptation is feasible in areas of repetitive loss. However, this framework may need to be modified to address the specific vulnerabilities of each state. For example, some states may want to factor in other indicators, such as age, indigenous populations, immigration status, to name a few. Importantly, any framework used to identify areas with the highest compounding physical and social risks must be developed with the residents of the state.

As a caveat, communities should primarily consider making investments when the window of opportunity is open even if there is a surcharge, with the intention of addressing multiple community issues. The benefits of implementing a project at today's costs and initiating return on investment are likely to outweigh the costs of not constructing a necessary project in the foreseeable future. Identifying adaptation pathways during capital planning can assist in the decision-making process but cannot fully represent the value of temporary political will and available funding.

DISASTER OCCURRENCES 2011–2021

	TOTAL DISASTERS
California	25
Mississippi	22
Oklahoma	22
Iowa	21
Tennessee	20
Louisiana	18
Alabama	17
Texas	17
Vermont	17
West Virginia	17
Arkansas	16
Kentucky	16
New Hampshire	16
New York	16
Washington	16
Alaska	15
North Carolina	15
Nebraska	14
Missouri	13
Kansas	13
New Jersey	13
North Dakota	13
South Dakota	13
Montana	12
Oregon	12

	TOTAL DISASTERS
Virginia	11
Florida	11
Georgia	11
Minnesota	11
Connecticut	10
Hawaii	10
Maryland	10
New Mexico	10
Wisconsin	10
Idaho	9
Massachusetts	9
Pennsylvania	9
South Carolina	8
Colorado	7
Utah	7
Maine	6
Michigan	6
Ohio	6
Arizona	6
Delaware	5
Illinois	5
Indiana	4
Rhode Island	4
Wyoming	4
Nevada	3

FEMA AND HUD COST PER CAPITA 2011–2021

	PER CAPITA
Louisiana	$1,736
New York	$1,348
New Jersey	$815
North Dakota	$738
Vermont	$593
Texas	$518
West Virginia	$481
Alaska	$401
Florida	$390
Nebraska	$390
South Carolina	$289
Alabama	$275
South Dakota	$269
North Carolina	$243
Hawaii	$229
Iowa	$228
Oklahoma	$215
Oregon	$210
Missouri	$162
Mississippi	$159
California	$157
Connecticut	$149
Colorado	$141
Kentucky	$105
Tennessee	$97

	PER CAPITA
New Mexico	$97
Arkansas	$81
Massachusetts	$73
Georgia	$64
Montana	$63
Kansas	$60
New Hampshire	$55
Rhode Island	$53
Minnesota	$49
Pennsylvania	$49
Virginia	$49
Maryland	$39
Washington	$36
Wyoming	$32
Idaho	$32
Wisconsin	$27
Illinois	$24
Michigan	$23
Ohio	$19
Maine	$18
Delaware	$14
Utah	$11
Nevada	$11
Indiana	$7
Arizona	$2

ve

Endnotes

1. Smith, Adam B. 2021 U.S. Billion-Dollar Weather and Climate Disasters in Historical Context. NOAA, https://www.climate.gov/news-features/blogs/beyond-data/2021-us-billion-dollar-weather-and-climate-disasters-historical#:~:text=Damages%20from%20the%202021%20disasters,Western%20wildfires%20(%2410.9%20billion).
2. "Power Outages." Ready.gov, https://www.ready.gov/power-outages#:~:text=A%20power%20outage%20may%3A,food%20spoilage%20and%20water%20contamination.

BLUEPRINT FOR ACTION

1 BUILD A COLLABORATIVE PROGRAM

2 FINANCE THE CHALLENGE

3 REFORM COST-BENEFIT ANALYSIS

4 RECOMMENDATIONS

IMAGE LEFT: SCAPE AND TY COLE

GUIDE TO BUILDING A COLLABORATIVE PROGRAM

In order to address the worsening impacts of climate change and head off future damages, we need bold action. Governments must work alongside communities and cross-sector partners to identify infrastructure investments that will drive physical, social, and ecological co-benefits and create hundreds of thousands of middle-class jobs – before climate events strike, not after communities have suffered. Using a co-creation process with stakeholders, states can deliver new, upgraded, innovative, and climate-ready infrastructure that protects communities in the face of climate vulnerabilities; work to make existing investments more resilient; and create a new source for "local match" to leverage additional federal funding opportunities.

Investing in climate infrastructure will bring short- and long-term benefits to both the state and the community where projects are implemented by creating new jobs and seeding new local industries, improving community physical and mental health outcomes, protecting and enhancing ecosystems, and providing a framework for future investments.

Building on the successes of the Rebuild by Design Hurricane Sandy Design Competition, the National Disaster Resilience Competition, Bay Area Resilient by Design, and the great work that is already underway in many communities throughout the U.S., Rebuild by Design proposes that this fund be coupled with a two-stage Statewide Community Planning Process that leads communities through a process to identify their specific vulnerabilities to climate hazards such as flooding, heat, wind, and drought.

PROGRAM OBJECTIVES:

1. Use funding to catalyze regional strategies for planning, designing, and building to drive investments in multi-benefit infrastructure that addresses physical, environmental, and social vulnerabilities;
2. Fully engage local stakeholders to create a better understanding of the risks and impacts that increasingly frequent and intense climate events will bring to their communities;
3. Support the needs of the most physically and socially vulnerable first;
4. Create jobs and job training opportunities, revitalize local/regional economies, promote healthy communities, and increase social resilience;
5. Create a replicable process that provides insight into other challenges in the community and can be recreated to address other challenges.

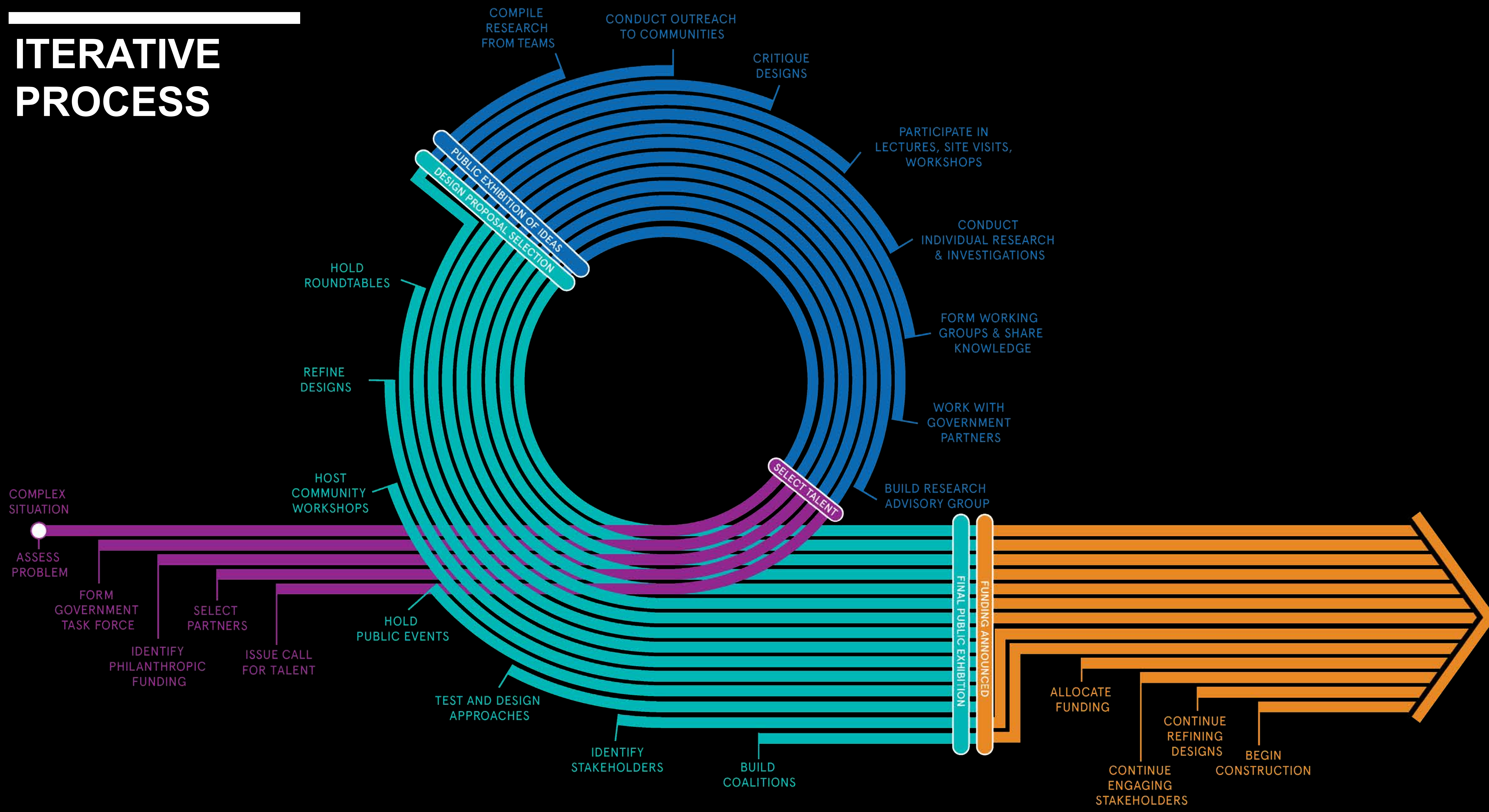
IMAGE: REBUILD BY DESIGN/CAMERON BLAYLOCK

Communities are the experts of their neighborhoods. They know exactly what happens when there is a heat wave or a flood; they understand their community's existing needs and vulnerabilities; they know who is most affected and who needs the most assistance. Adapting to climate change presents a significant opportunity to create new or rebuild existing infrastructure that is designed to support the needs of communities on sunny days and promote climate resilience on days of increased rainfall, heat waves, storm surges, or fires. This type of infrastructure is known as "multi-benefit" since it is designed to serve more than one purpose. For example, a park that is designed to store and filter water during heavy rainfall events can provide multiple other benefits to the surrounding community, such as space for recreation and exercise, shade during hot days, species habitat, improvements to mental health, carbon capture, and cooling of local temperatures.

By using a collaborative design methodology, the State can incentivize regional planning processes to design and build infrastructure with multiple benefits alongside the communities who are most affected to ensure each project addresses local physical and social vulnerabilities and embeds local knowledge and expertise with current and future needs. Additionally, the involvement of stakeholder support from the very start ensures that projects are built faster and that every dollar invested goes further by addressing the specific needs of the intended community.

States can lead a two-stage Statewide Community Planning Process: (1) stakeholder inclusion, research, risk assessment; and (2) collaborative design. These stages are further detailed in the following pages.

ITERATIVE PROCESS



STAGE ONE: RESEARCH, RISK ASSESSMENT, AND PLANNING

The goal of Stage One is to align community and government aspirations in the face of climate change, and to create a shared understanding of the interdependencies between local and regional infrastructural, ecological, and social systems that will be further affected by the increased occurrences and severity of climate events.

To incentivize planning outside political boundaries, program participants should be self-defined at the neighborhood, city, county, or regional scale, based on the systems that they share (e.g., watershed, wastewater treatment plant, coastline, mountain range) to ensure that interventions will be holistic. Program participants should be encouraged to address all of the issues that arise across an entire system. For example, addressing the challenges across a full watershed could include building infrastructure to protect a highway from flooding through a crucial hospital access corridor or creating a buy-out program that not only gives homeowners in flood zones options to leave but also identifies places for new investment. The end goal is to fund multiple exemplary infrastructure projects that demonstrate effective interventions and can be replicated in other areas of the same state or inspire communities in other states to pursue similar projects.

PROGRAM PARTICIPANTS SHOULD TAKE THE FOLLOWING STEPS:

Define their community along geographic or political boundaries such as a coastal community, a watershed, or an environmental justice area;

Identify non-government partners such as civic organizations, chambers of commerce, or universities;

Identify site-specific climate hazards using the best available data;

Identify local and regional stakeholders, including government agency staff, residents, community organizations, business leaders, experts, and landowners, to understand which assets are most valuable to protect;

Determine the areas of greatest need based on the goals of the program and participants. Use up-to-date climate projections to understand different scenario levels that will impact site-specific hazards;

Undertake a vulnerability assessment to identify socially vulnerable areas, particularly environmental justice communities and neighborhoods disproportionately impacted by climate change due to underlying inequalities relating to race, ethnicity, age, gender, ability, or income and health indicators. Identify physically vulnerable areas such as buildings, hazardous materials, hazardous or polluting sites, utilities, healthcare, telecommunications, transportation, environmental protection and remediation, parks/recreation/public access areas, water and wastewater, schools, shelters, and any other critical operations such as police/fire as well as sectors and needs that should be protected;

Hold public events to ensure all community stakeholders are a part of the identification of community assets and vulnerability processes;

Double check that all affected populations are listened to and involved in decision-making. Use the vulnerability assessment to understand which other localities share identified vulnerable systems such as a watershed, tributary, railroad track, etc., and invite them to collaborate in the program. Double check that all the stakeholders for the system have been included and if they have not, invite them to join this process;

Ground the data to ensure the vulnerability assessment matches lived experiences;

Quantify the economic impact or future averted costs on the defined system or locality for repeated losses from climate events, avoided loss, and flood insurance payments.

After identifying, prioritizing, and understanding local vulnerabilities, program participants should identify if they need to expand the co-applicants to include neighboring municipalities and/or community organizations, and include them as co-applicants where possible in order to move on to Stage Two together. Support community organizations to meaningfully participate and to ensure that there is ongoing collaboration of the local community voices.

The State should certify that the outcome of Stage One meets the ambition, and then program participants move to Stage Two. States may choose to waive the required risk assessment in Stage One for localities who can demonstrate they have undergone significant resilience planning that includes risk assessment, project identification, and stakeholder analysis. These localities can form partnerships, move to Stage Two of the Statewide Community Planning Process, and apply to the State Resilient Infrastructure Fund to support their plan that already has initial support from local government and stakeholders.

IMAGE: REBUILD BY DESIGN

STAGE TWO: COMPREHENSIVE COLLABORATIVE ADAPTATION PLAN DESIGN

Stage Two focuses on creating a comprehensive vision with specific fundable projects, policies, or initiatives that will directly address the vulnerabilities identified in Stage One. Given the complexity of adapting to climate change, significant capacity-building in the form of financial support and both local and technical expertise may be required for smaller localities to help them move through these three stages successfully. To ensure the process is inclusive, equitable, and research-driven, it must have an Expert Advisory Group that includes individuals with both lived and learned expertise. Advisors should include a diverse cross-representation of sectors such as climate science, hydrology, finance, design, engineering, community outreach and social services, history, geography, geology, data processing, and mapping. Universities located around the state can provide support to the Expert Advisory Group. This group should create the criteria for advancement from stage to stage.

The advisory group should be staffed by technical consultants, meaning firms that will be available to assist program participants and local governments. States are encouraged to procure private companies and not-for-profit organizations that already have notable experience in climate science, planning, engineering, coalition-building, modeling, and engaging comprehensively with stakeholders collaboratively.

Program participants should be highly encouraged to collaborate with the stakeholders identified in Stage One to work together to develop and design fundable project and policy proposals that address the vulnerabilities uncovered in the first stage. Program participants throughout this stage must ensure that as projects are formed, they continue to reflect stakeholder needs. Where possible, program participants should demonstrate how their projects have changed as a result of stakeholder collaboration.

In addition to risk reduction, projects should be designed to also restore and enhance ecology, increase recreational opportunities, improve public health and mental health, and build social resilience by serving multiple purposes. Proposals could include one single piece of infrastructure or an entire system of interventions. Program participants should demonstrate how their project will result in valuation of ecosystem services, GHG emissions reduction, improved social and economic equity, increased safety, and long-term monetary value such as future loss avoidance (insurance) and future cost avoidance (public and mental health).

STAGE TWO COMPREHENSIVE PLANS MAY INCLUDE, BUT ARE NOT LIMITED TO:

+ One single piece of infrastructure or an entire system of interventions;
+ Existing infrastructure that needs additional funding to add additional layers of protection. For instance, if the state has an energy-efficiency program for single-family homes, the cost differential for creating resilience upgrades at the same time – such as moving critical infrastructure to a higher floor – should be supported. Similarly, a Department of Transportation could use this fund to install porous services or green infrastructure as an addition to regularly-scheduled highway improvement projects;
+ Non-capital expenses and new and amended policies should be encouraged, such as public education and communication; updating local bylaws, ordinances, or plans; creating a land-use strategy to enable retreat from harm's way; municipal restructuring or merging; or preparing accurate future flood maps that predict future risk;

Final proposals should include a quantification of the risk reduction and co-benefits of their proposed project through a Benefit-Cost Analysis and demonstrate that their project's approach is feasible and cost-effective for the long-term (at least the intended lifetime of the specific infrastructure), and identify additional available funding through federal, state, and local programs as well as policy changes needed to fully realize their project's intended goals. The proposals should incorporate or reference other planning documents and, where appropriate, must be integrated with the local municipality's Hazard Mitigation Plan.

Program participants should demonstrate who the project will protect and how the project will result in valuation of ecosystem services, GHG emissions reduction, improved social and economic equity, increased safety, and long-term monetary value such as future loss avoidance (insurance) and future cost avoidance (public and mental health). Additionally, program participants should work with regulators early on to ensure that the proposed projects will be implementable under applicable policies and legal requirements and utilize FEMA's Community Rating System (CRS) to receive premium credit for risk reduction where applicable.

Included in the submission to the State should be an implementation plan, funding estimates, and cost-benefit analysis. The State should create a benefit-cost framework that measures projects' social, health, and ecological benefits and helps compare investment opportunities to one another (see p. 662). An analysis of existing state and federal programs to support the projects should also be included to demonstrate how the Resilient Infrastructure Fund support will be leveraged.

HOW DO WE DETERMINE WHO IS "DISADVANTAGED"?

RECOGNIZING THAT THERE IS NOT ONE DEFINITION FOR A DISADVANTAGED COMMUNITY, NEW YORK STATE'S CLIMATE LEADERSHIP COMMUNITY PROTECTION ACT ESTABLISHED THE CLIMATE JUSTICE WORKING GROUP AND CHARGED IT WITH DEVELOPING CRITERIA BY WHICH DISADVANTAGED COMMUNITIES WOULD BE IDENTIFIED, PRIMARILY FOR THE PURPOSES OF ENSURING THAT AT LEAST 35%, WITH A GOAL OF 40%, OF BENEFITS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY PROJECTS WOULD ACCRUE TO THOSE COMMUNITIES. THE WORKING GROUP, COMPOSED OF REPRESENTATIVES FROM STATE AGENCIES AND ENVIRONMENTAL JUSTICE GROUPS ACROSS THE STATE, WAS FORMED TO IDENTIFY DISADVANTAGED COMMUNITIES WHO ARE OFTEN OVERLOOKED IN CLIMATE POLICY INITIATIVES AND TO ENSURE THEY DIRECTLY BENEFIT FROM THE STATE'S HISTORIC TRANSITION TO CLEANER, GREENER SOURCES OF ENERGY, REDUCED POLLUTION AND CLEANER AIR, AND ECONOMIC OPPORTUNITIES.

THE WORKING GROUP USED THREE CATEGORIES:

- LAND USE AND FACILITIES ASSOCIATED WITH HISTORICAL DISCRIMINATION OR DISINVESTMENT,
- POTENTIAL CLIMATE CHANGE RISKS, AND
- POTENTIAL POLLUTION EXPOSURES TO DEVELOP 45 INDICATORS TO IDENTIFY 35 PERCENT OF CENSUS TRACTS IN NEW YORK AS DISADVANTAGED COMMUNITIES.

THIS COLLABORATIVE PROCESS WITH THE COMMUNITIES THAT REPRESENT AREAS OF HISTORICAL DISINVESTMENT CAN BE A MODEL FOR OTHER STATES TO IDENTIFY AND DEFINE "DISADVANTAGED COMMUNITIES" WITH A UNIQUE SET OF INDICATORS SPECIFIC TO THEIR LOCAL VULNERABILITIES.

CRITERIA FOR SUCCESSFUL PROPOSALS

Before scoring the projects, the State should check every application against predetermined criteria to ensure it addresses all climate hazards that the specific locality is vulnerable to and has followed the intention and goals established for Stage One and Two. This means the application:

Achieves quantifiable risk reduction, adopts science-based and forward-looking risk approaches, has a demonstrable impact, can be replicated elsewhere in the state or beyond, and promotes a full system approach;

Demonstrates that the municipality truly collaborated with frontline communities who will be most affected, and that those communities support the vision;

Advances qualitative and quantitative ecological, social, and public health benefits as project outcomes that would address existing and expected social and physical vulnerabilities as well as designs proposed infrastructure to provide multiple benefits and address multiple risks (such as heat, wind, etc.) when applicable;

Addresses the needs outlined in the detailed vulnerability and risk assessment created in Stage One (if a municipality can demonstrate they have already completed this step, a prior assessment can be used);

Prioritizes the needs of the most physically and socially vulnerable;

Prioritizes infrastructure that protects livelihoods (e.g., maintaining job centers) and health (e.g., keeping healthcare facilities like hospitals and nursing homes operational in disasters by ensuring critical routes around them do not flood, or establishing backup energy generation);

Prioritizes nature-based solutions where applicable, including conservation or restoration of existing natural features to enhance ecological value;

Will be included in future mandated Hazard Mitigation Plans; and

Carries applicability for FEMA's Community Rating System to lower risk and flood insurance premiums.

PROJECT SCORING AND SELECTION

A clearly defined and transparent method to select funded projects is needed in order to maintain trust with communities.

THE FOLLOWING ARE SUGGESTIONS FOR KEY STAKEHOLDERS WHO SHOULD BE INVOLVED IN SELECTING PROJECTS FOR FUNDING:

+ Utilize the Expert Advisory Group to score and recommend projects for funding. The Group's members will have been closest to the evolutions of the project throughout design.
+ Create a Statewide Investment Board that represents the varied interests around the state, including state agencies (Transportation, Environmental, Energy, etc.), private sector experts (infrastructure design/build, environmental protection, economic development, urban planning, finance), community development and advocacy, representatives from members of historically marginalized and socially vulnerable communities, and municipal and county officials.
+ Create a Committee of Executive-Level Leaders from the state's infrastructure agencies responsible for water, transportation, energy, and other critical areas. These agencies could include, for example, the Departments of State, Environmental Conservation and Natural Resources, Transportation, Storm Recovery, Emergency Management, and others.
+ Once projects are awarded funding, localities, agencies, or other entities will either be granted funding from the State Infrastructure Fund to build resilient infrastructure, or dollars will be allocated to the appropriate state agency responsible for project implementation.

A separate effort should be undertaken to measure and monitor the project's physical and social benefits, identify where changes should be made if needed, and help communities around the state learn from one another's efforts. An inclusive community collaboration and engagement process for each project through implementation must be maintained and funded as part of the construction budget.

WE ALL BENEFIT

Climate change is a collective risk that will pose challenges to all of our lives and livelihoods. Thus, everyone stands to benefit from adaptation interventions. Resilient green and gray infrastructure can have multiple benefits while fulfilling their primary purpose of reducing the risk of climate impacts. For example, the adaptation measures provided to vulnerable communities can help reduce risk to individuals and property from extreme harm or loss during climate events, which can in turn reduce the payout from insurance companies after an event. In addition, infrastructure that can better withstand shocks and stressors can also contribute to the stabilization of the supply chain by reducing the frequency and length of disruptions to production, costs, and delivery.[1]

Even in the absence of extreme weather, communities will benefit from multi-purpose resilient infrastructure:

+ **Economic:** An investment in resilient infrastructure pays off economically with investments in manufacturing, construction, trade, labor, and development, which can spur the creation of new jobs and economic growth, along with investments in long-term maintenance. Simultaneously, the creation of high quality, high paid jobs must be coupled with intentional efforts to train workers who would otherwise be unqualified.

+ **Health:** Where green infrastructure projects are implemented, communities gain from the additional benefits of cleaner air, cooling from tree coverage, green space to exercise and socialize, improved neighborhood aesthetics, and more. This means healthier environments for children to grow up in, more walkable streets for seniors and people with disabilities, and less emergency room visits for people with underlying conditions.

+ **Social:** Investments in physical infrastructure, namely public spaces and green spaces, help build social resilience within communities. These spaces, such as libraries and parks, enable communities to build social connections. In the event of a disaster, these communities fare better, as neighbors are more likely to check on each other, understand each other's needs, and rebuild together.[2]

PROJECT EXAMPLES:

IMPROVING SHORELINES AND STORMWATER MANAGEMENT SYSTEMS ● RESTORING WETLANDS AND PROTECTING MIGRATION PATHWAYS ● BUILDING BERMS, DIKES, AND LEVEES ● REMOVING DAMS ● RIGHT-SIZING CULVERTS AND ELEVATING STREETS AND RAILWAYS ● DAYLIGHTING RIVERS ● ADAPTING SEWAGE TREATMENT PLANTS, WATER SUPPLY SYSTEMS, AND OTHER UTILITIES ● BUYING OUT HOMES AND BUSINESSES FROM HARM'S WAY ● ACQUIRING LAND THAT CAN REMAIN PROTECTED ● STABILIZING SOIL FOR FARMLAND ● CREATING NEW PARKS OR ECOLOGICAL ENHANCEMENTS ● ABSORBING ENERGY FROM STORMS ● PROVIDING GRANTS OR TAX INCENTIVES FOR THE RELOCATION OF CRITICAL INFRASTRUCTURE ● INCENTIVIZING GREEN BUILDING ADAPTATION OR ELECTRICAL VEHICLE INFRASTRUCTURE ● FOREST MANAGEMENT

CASCADING BENEFITS

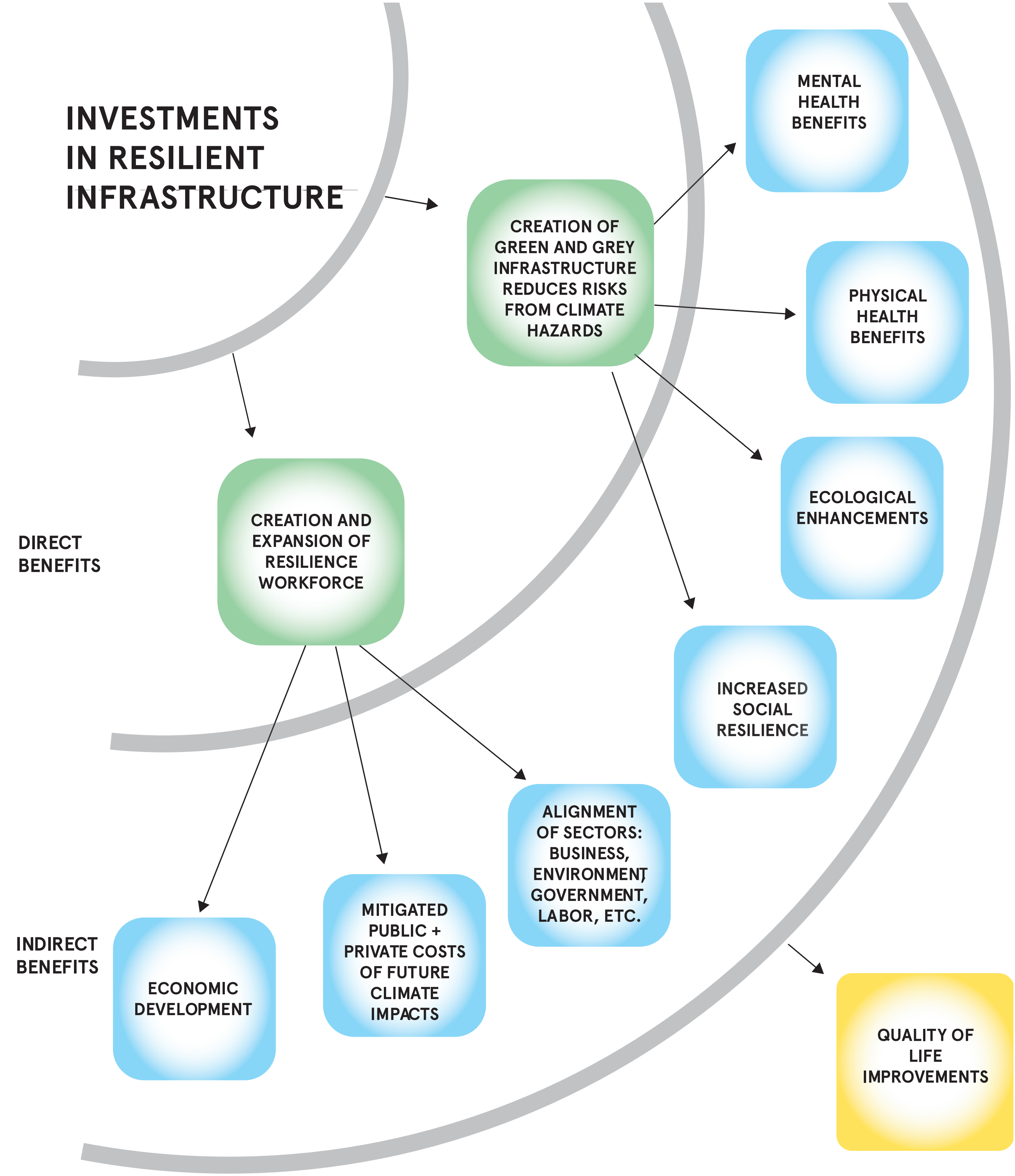


IMAGE: REBUILD BY DESIGN

ENDNOTES

1. Woetzel, Jonathan, et al. Could Climate Become the Weak Link in Your Supply Chain? McKinsey & Company, 31 Aug. 2020, www.mckinsey.com/business-functions/sustainability/our-insights/could-climate-become-the-weak-link-in-your-supply-chain.
2. Klinenberg, Eric. "Palaces for the People: How Social Infrastructure can Help Fight Inequality, Polarization, and the Decline of Civic Life," Sep. 2019.

FINANCING RESILIENT INFRASTRUCTURE

Innovative processes call for innovative finance solutions. Each state in the U.S. should create a Resilient Infrastructure Fund to serve as a catalyst to support innovative, data-driven, and community-led approaches to address climate risk throughout the United States. A Resilient Infrastructure Fund would enable investment in state-priority projects at both the regional and systems levels and in both individual and community actions by leveraging state and federal dollars to support capital projects that enhance communities' physical and social resilience and create a funding source to provide the "local-match" for federal investment.

A Resilient Infrastructure Fund can catalyze local planning and community understanding of what is needed to address the risks of future climate events and drive projects that support the well-being of communities every day, not just during extreme weather.

INVESTMENT SOURCES

The United States is always chasing the last storm. We need to get ahead of the physical and financial costs by utilizing creative and urgent financing solutions that invest in adaptation and mitigation efforts before communities suffer. Many states have capital programs and infrastructure banks to cover certain types of capital investments. However, in order to meet current and future needs, we need to invest a lot more in these programs than we currently are. Regardless of the source, funding should be held in a protected fund (such as an infrastructure bank) to ensure that the money is safe from other competing future needs. The following strategies could support the creation of State-led Resilient Infrastructure Funds:

1 Leverage a two-percent surcharge on Property and Casualty (P&C) insurance:

Learning from the pioneering work of the State of Florida in response to catastrophic hurricane events, states can revamp an existing "post-event" financing model by turning the concept into a "pre-event" approach resulting in an ability to leverage billions of dollars to fund the construction of new resiliency-focused infrastructure to address an uncertain climate. Florida, for instance, has addressed post-event losses utilizing a P&C surcharge financing mechanism to spread out the impact of catastrophic events over a period of years in the creation of three separate entities: the Florida Insurance Guaranty Association (FIGA), the Florida Hurricane Catastrophe Fund (a reinsurer of primary insurers), and the Citizens Property Insurance Corporation (a state-created primary insurer). Below we focus our discussion on FIGA.

Created in 1970 by the State Legislature, the Florida Insurance Guaranty Association (FIGA) protects Florida consumers by servicing insurance claims by or against Florida policyholders of all Florida-licensed direct writers of property or casualty insurance if they become insolvent.

This fund is a nonprofit, state-based fund that pays certain outstanding claims of insolvent insurance companies after an extreme weather event to ensure that consumers get the payouts from their insurance policies that they are entitled to. When a court enters an order of liquidation that the insurance company is insolvent, the unpaid claims of the insolvent company

IMAGE: REBUILD BY DESIGN

are then transferred to the Florida Insurance Guaranty Association, which steps in to ensure the policy holders get the payments they are entitled to after an event, just as other states' guaranty associations would. What makes Florida's model unique is that the funds for the payouts are pooled from a surcharge on all Property and Casualty insurance after an event, making every policyholder, regardless of the company holding their insurance, part of the solution. Until 2022, assessments for FIGA were capped at two percent. In 2022, recognizing the increased need to cover policies for increasing weather events, the Florida State Legislature allowed for emergency assessment of up to four percent when the insolvency results from a hurricane.[1]

While this effort was innovative for its time, according to the Insurance Information Institute, homeowners in Florida pay the highest premiums in the country: nearly three times the national average. The increase in billion-dollar climate events is pushing the insurance system beyond its capacity, and all policyholders are paying the price without reaping the benefits of a safer community ahead of the next storm. Two months before Hurricane Ian, Florida's FIGA approved a plan to borrow $150 million after five property insurers became insolvent in six months. According to an estimate from a risk-modeling firm, early estimates for the damage from Hurricane Ian will cost private U.S. insurers $63 billion in claims and will cause the largest storm-related losses in Florida's history.[2] That does not include the funding that the U.S. federal government will give in assistance.

If we were to take this same pro-consumer model and apply it state by state, a two-percent (for example) surcharge on P&C insurance (not including Medical Malpractice and Workers' Compensation) could leverage from $600 million to over $32.9 billion in states across the U.S, for a total of $287 billion across the U.S. This surcharge on certain types (lines) of property-casualty insurance could support a statewide Resilient Infrastructure Fund that gives communities the funding they need to build more resiliently and to leverage private, state, and federal budget sources. As climate adaptation and hazard mitigation interventions are implemented, the risk of loss or damage will decline, reducing the property and casualty payouts for some insurers (such as those who write policies for commercial flood and basement backup riders). This would also lower flood insurance premiums by five to 45 percent for those in the FEMA flood zones through FEMA's Community Rating System.

With just a two-percent surcharge, six states – Illinois, New York, Pennsylvania, Texas, and even California and Florida, all of whom are having difficulty in their insurance markets – can currently support over $10 billion of infrastructure spending in ten years. This will give the insurance industry a lifeline by creating new funding sources that can support physical and social infrastructure before an event, slowing down their exposure to large payouts. Forty-one states can raise between one billion and $9.9 billion, which is an enormous opportunity. A surcharge on certain types of property-casualty insurance can be equitable because community members with more resources are likely to insure more numerous, expensive, and energy-consumptive items (e.g., multiple homes, boats, cars), while community members with less resources are likely to insure less or have no insurance at all. Additionally, states could exempt lower income policyholders from the surcharge or to exempt vital community services such as affordable housing or schools. States can also decide to hold some of this allocation aside before it is leveraged for the maintenance of new climate infrastructure.

This approach may not be successful in states whose insurance industries have reached breaking points and where obtaining insurance has been a challenge due to past climate events. In some disaster-prone locations, insurance companies are raising rates, dropping policyholders, or refusing new customers, as it has become too costly to insure these properties. Under these circumstances, it may not be feasible to leverage a surcharge on certain types of Property and Casualty insurance. However, most states still have time to leverage a surcharge into meaningful infrastructure investment to ensure that everyone's insurance costs will be reduced and the insurance industry will be able to continue to operate and support communities in the future.

Further, the federal government could incentivize these funds by offering matching grants to states that implement surcharges, coupled with programs such as FEMA's Community Rating System that would bring community-wide infrastructure and policy investments, that would lower flood insurance payments community-wide, magnifying the opportunity multifold.

IMAGE: SCOT PENA, STORM SURGE

LEVEREAGING AN INSURANCE SURCHARGE FOR INFRASTRUCTURE

	TOTAL INSURED P&C* ($000)	TOTAL INSURED WITHOUT MED MAL AND WC** ($000)	TWO-PERCENT SURCHARGE WITHOUT BONDING ($000)	TWO-PERCENT SURCHARGE WITH 10-YEAR BONDING (IN BILLIONS)
Total 50 States	$695,509,700	$629,385,861	$12,587,717	$287.1
Alabama	$9,464,513	$8,948,954	$178,979	$4.1
Alaska	$1,655,434	$1,402,346	$28,047	$0.6
Arizona	$12,414,975	$11,338,136	$226,763	$5.1
Arkansas	$5,706,307	$5,396,813	$107,936	$2.4
California	$84,880,338	$72,448,508	$1,448,970	$32.9
Colorado	$14,285,006	$13,069,112	$261,382	$5.9
Connecticut	$8,992,575	$8,131,839	$162,637	$3.7
Delaware	$2,906,697	$2,664,456	$53,289	$1.2
Florida	$55,576,482	$51,794,341	$1,035,887	$23.5
Georgia	$22,954,861	$20,953,153	$419,063	$9.5
Hawaii	$2,701,615	$2,381,525	$47,631	$1.1
Idaho	$3,231,796	$2,759,183	$55,184	$1.3
Illinois	$27,060,540	$24,181,953	$483,639	$11.0
Indiana	$12,037,170	$11,100,606	$222,012	$5.0
Iowa	$6,790,563	$6,069,738	$121,395	$2.8
Kansas	$6,980,593	$6,511,683	$130,234	$3.0
Kentucky	$8,042,654	$7,361,013	$147,220	$3.3
Louisiana	$12,396,192	$11,411,646	$228,233	$5.2
Maine	$2,476,882	$2,189,416	$43,788	$1.0
Maryland	$12,684,730	$11,527,865	$230,557	$5.2
Massachusetts	$16,354,175	$14,721,756	$294,435	$6.7
Michigan	$20,817,467	$19,547,615	$390,952	$8.9
Minnesota	$12,462,639	$11,416,765	$228,335	$5.2

* Source: NAIC, Statistical Compilation of Annual Statement Information for Property/Casualty Insurance Companies in 2019.

** MED MAL = Medical Malpractice Insurance; WC = Workers Compensation Insurance

	TOTAL INSURED P&C* ($000)	TOTAL INSURED WITHOUT MED MAL AND WC** ($000)	TWO-PERCENT SURCHARGE WITHOUT BONDING ($000)	TWO-PERCENT SURCHARGE WITH 10-YEAR BONDING (IN BILLIONS)
Mississippi	$5,591,834	$5,192,253	$103,845	$2.4
Missouri	$12,677,046	$11,576,608	$231,532	$5.3
Montana	$2,603,859	$2,293,122	$45,862	$1.0
Nebraska	$5,246,314	$4,842,941	$96,859	$2.2
Nevada	$6,256,046	$5,736,060	$114,721	$2.6
New Hampshire	$2,594,294	$2,323,267	$46,465	$1.1
New Jersey	$22,875,472	$19,993,159	$399,863	$9.1
New Mexico	$3,749,295	$3,392,114	$67,842	$1.5
New York	$47,566,816	$42,538,109	$850,762	$19.3
North Carolina	$17,059,009	$15,440,215	$308,804	$7.0
North Dakota	$2,616,611	$2,600,180	$52,004	$1.2
Ohio	$17,738,127	$17,401,892	$348,038	$7.9
Oklahoma	$8,605,457	$7,844,825	$156,897	$3.6
Oregon	$7,732,347	$6,947,913	$138,958	$3.2
Pennsylvania	$26,196,056	$22,812,640	$456,253	$10.4
Rhode Island	$2,644,794	$2,382,057	$47,641	$1.1
South Carolina	$10,636,489	$9,741,622	$194,832	$4.4
South Dakota	$2,555,563	$2,371,137	$47,423	$1.1
Tennessee	$12,534,747	$11,514,225	$230,285	$5.2
Texas	$61,402,995	$58,514,883	$1,170,298	$26.6
Utah	$5,405,102	$4,898,669	$97,973	$2.2
Vermont	$1,506,858	$1,302,233	$26,045	$0.6
Virginia	$14,885,228	$13,589,738	$271,795	$6.2
Washington	$16,288,384	$13,551,966	$271,039	$6.2
West Virginia	$3,165,210	$2,795,077	$55,902	$1.3
Wisconsin	$11,213,538	$9,196,595	$183,932	$4.2
Wyoming	$1,288,005	$1,263,939	$25,279	$0.6

See Appendix C for methods of the insurance suracharge bonding analysis.

2 Develop a Statewide Ballot Measure:

Voters around the country have overwhelmingly supported funding of infrastructure measures (see table below) that address resilience and other climate-related investments. As voters experience extreme weather firsthand, they are looking for their government leaders to invest in the resilience of their communities. A campaign to pass a Resilient Infrastructure Bond Act would create a public conversation with voters on the need to prioritize flood infrastructure while also galvanizing the support needed to justify this type of infrastructure spending. In order to achieve success, a Bond Act would require a substantial investment of private funding to educate voters so they support the measure. When passed, the funds would be held in a separate account to ensure its specific purpose.

A ballot measure is a helpful first step; however, to ensure the Resilient Infrastructure Fund's longevity, it would also need to be coupled with a non-capital budget allocation to increase capacities at agencies to manage the funding and to ensure a transparent and equitable process for distribution (see p. 654).

RECENT VOTER-APPROVED BALLOT MEASURES

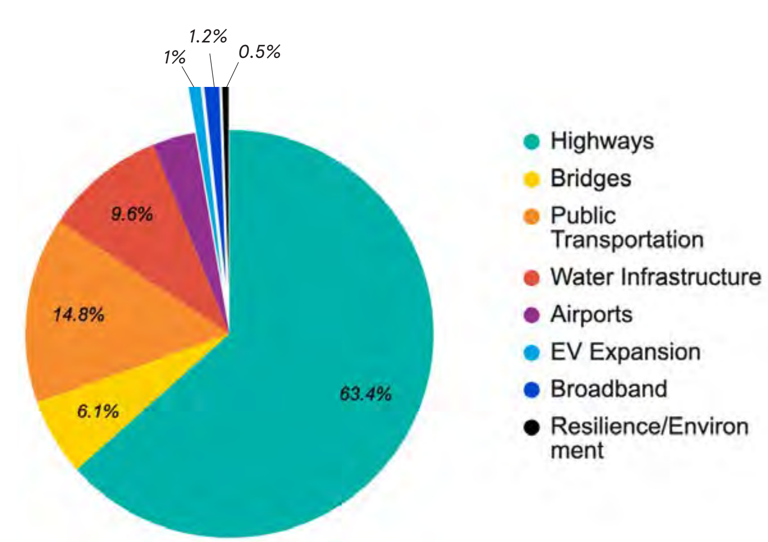
YEAR	LOCALITY	AMOUNT	PURPOSE	STATUS
2022	New York	$4.2 billion bond	Ecological and Climate Resilience	67.5%
2021	Denver, CO	$40 million per year	Raised the city's sales tax by 0.25% to address climate – both mitigation and adaptation efforts. 50% of the fund is directed toward underserved communities	62.34%
2021	Maine	$100 million bond	Municipal, regional and state infrastructure adaptation improvements that support public safety and emergency management and infrastructure resiliency	72%
2021	Virginia Beach, VA	$567.5 million bond	Design and construction of flood mitigation measures as part of a comprehensive flood protection program	72.72%
2020	Key Biscayne, FL (Miami-Dade County)	$100 million bond	$40 million for mitigating the effects of sea level rise and flooding, $23 million for protecting the beaches and shoreline, and more than $35 million to harden and place infrastructure underground to withstand hurricanes.	56.55%
2018	California	$4 billion bond	Environmental and recreational purposes	57.59%
2018	Harris County, TX	$2.5 billion bond	Flood damage reduction projects	85%
2018	San Francisco Bay Area, CA	$425 million bond	Seismic strengthening and flood protection projects for the hundred-year-old Embarcadero seawall and other critical infrastructure	82.7%
2017	Miami, FL	$400 million	Sea-Level Rise and Flood Prevention, Roadways, Parks and Cultural Facilities, Public Safety and Affordable Housing	55%
2016	San Francisco Bay Area, CA	$12 parcel tax to raise approximately $25 million annually, or $500 million over twenty years	San Francisco Bay: wetlands restoration to address clean water, pollution prevention, and habitat restoration	69%
2012	Rhode Island	$20 million	Bond for environmental and recreational purposes	69.8%

3 States use their own funding sources, coupled with federal and other sources to support climate infrastructure.

According to Trimble, a construction technology firm, states spend from $100 million to $44 billion per year on building and upgrading infrastructure.[1] States can earmark existing dollars in the capital budget over the next ten years to support a Resilient Infrastructure Fund that can support the additional dollars needed to upgrade existing projects up to risk standards and can support new projects where existing ones will not be enough. Both capital and expense dollars will be needed to build and maintain the infrastructure. Better protection from extreme climate events means less damage to the physical environment and less suffering for communities. According to data collected by Trimble, approximately 0.5 percent of the Infrastructure Bill funds allocated to states will be spent on resilience or the environment and 9.6 percent will be spent on water infrastructure. The other 89.9 percent of funds will go towards highways, bridges, public transportation, airports, EV expansion, and broadband.[2]

Funding Allocated to States through the Infrastructure Investment and Jobs Act

DATA SOURCE: TRIMBLE



States and localities using existing funding sources and programs to adapt to climate change:

California: In 2022, under the leadership of Governor Newsom, California legislators passed a suite of bills to reduce greenhouse gas emissions and reliance on fossil fuels as well as various climate adaptation programs. Totaling $54 billion, the budget includes "$6.1 billion for electric vehicles, including money to buy new battery-powered school buses; $14.8 billion for transit, rail, and port projects; more than $8 billion to clean up and stabilize the electric grid; $2.7 billion to reduce wildfire risks; and $2.8 billion in water programs to deal with drought."[3]

Connecticut: In the 2021 session, Governor Lamont requested and the Legislature adopted Substitute House Bill No. 6441, An Act Concerning Climate Change Adaptation, that: (1) authorizes all municipalities to establish a municipal stormwater authority, thereby giving them the ability to assess fees that can bring in federal matching funds; (2) expands the authority of municipal flood and erosion control boards to include flood prevention and climate resilience; and (3) expands the scope of the Connecticut Green Bank from one focused solely on green energy to one that is now charged with identifying innovative financing for climate resilience projects. The legislation also increased the amount of bonds the Green Bank may issue from $100 million to $250 million.[4]

District of Columbia: In 2014, DC launched the Stormwater Retention Credit (SRC) trading program. This system allows redevelopment projects to meet strong regulatory requirements by buying credits from other properties that voluntarily retrofit impervious surfaces with green infrastructure.[5] Private landowners who voluntarily implement green infrastructure to generate Stormwater Retention Credits can then sell their credits to the Department of Energy and Environment or to the private market. Developers needing to adhere to the stormwater regulations can buy credits, thereby paying for green infrastructure interventions in high-need areas. This program is coupled with tight regulations and guidelines on how to implement green infrastructure with the purpose of reducing harmful runoff to DC's waterways.[6]

Iowa: The Soil and Water Outcomes Fund, seeded by a $7.5M investment from the Iowa SRF and the Iowa Finance Authority, uses private capital to provide upfront financial incentive payments to farmers who implement new on-farm conservation practices that generate verifiable environmental outcomes such as carbon sequestration and water quality improvements.[7] Environmental outcomes are sold by the Soil and Water Outcomes Fund to beneficiaries, including corporations seeking to offset greenhouse gas emissions in their supply chain, and public entities, such as municipal water utilities or state Departments of Agriculture seeking to improve and safeguard water quality.[8]

Louisiana: Created by the State in response to Hurricanes Katrina and Rita, the Coastal Protection Restoration Authority (CPRA) coordinates the local, state, and federal efforts to achieve coastal protection and restoration. To accomplish these goals, CPRA was charged with developing a master plan to guide work toward a sustainable coast using the best available science and engineering and to update that plan every six years. Projects are funded through multiple funding sources from various state and federal programs, agencies, initiatives, and organizations.[9]

Rhode island: Founded in 1989, the Rhode Island Infrastructure Bank (RIIF) is a central hub for financing infrastructure improvements for municipalities, businesses, and homeowners by supporting and financing investments in the state's infrastructure through issuing bonds, originating loans, making grants, and engaging with and mobilizing sources of public and private capital. Through its activities, the Bank fosters infrastructure improvements that create jobs, promote economic development, and enhance the environment. RIIF leverages limited capital in a revolving fund to offer financing for infrastructure projects such as water and wastewater, roads and bridges, energy efficiency and renewable energy, and brownfield remediation.[10]

Massachusetts: The Climate Change Adaptation, Environmental Protection, and Community Investments bill supports $2.4 billion in capital allocations to protect environmental resources and improve recreational opportunities.[11] Funding includes over $474 million to support environmental programs ranging from air and water quality monitoring to hazardous waste cleanup and the restoration of rivers, wetlands, streams, and lakes, and authorizes $501 million to respond to and prepare for extreme weather, sea level rise, inland flooding, and other climate impacts.

Virginia: In 2020, the General Assembly passed SB 1027 to support Virginia entering into the Regional Greenhouse Gas Initiative (RGGI), a cap and trade program for the electric sector. To support community climate adaptation efforts, the enabling legislation established a Community Flood Preparedness Fund. Forty-five percent of RGGI auction proceeds go into the Fund and no less than 25 percent of those funds is dedicated to disadvantaged communities. In 2021, the auction brought in $228M; in 2022 $74.2M.[12]

Washington State: In the 2021 session, the Legislature passed and Governor Inslee signed the Climate Commitment Act, a comprehensive cap and invest program.[13] The state's Department of Ecology is currently going through rulemaking, with the program slated to launch in January 2023. Auction proceeds will go toward clean energy transition and assistance, clean transportation, and climate resiliency projects that promote climate justice, including dedicating a minimum of 35 percent of funds toward overburdened communities and a minimum of ten percent toward Tribal projects.[14]

ARE THERE NEW FUNDING TOOLS WE SHOULD EXPLORE?

States can use traditional approaches to support the building or rebuilding of infrastructure that will address an increasingly uncertain environment. However, there is a market under development for a new suite of tools that could be investigated as part of this investment:

Environmental Impact Bond (EIB) – Otherwise known as "Pay For Performance." The borrower will pay back their bond investors contingent on the performance of the adaptation measures, such as green infrastructure.

Green Bonds – Bonds that are specifically earmarked to be used for climate and environmental projects. These bonds are typically asset-linked and backed by the issuer's balance sheet, and are also referred to as climate bonds. Green bonds come with tax incentives such as tax exemption and tax credits.

Resilience Bonds – Generate risk reduction rebates from a city's catastrophe insurance premiums to pay for resilience projects. Resilience Bonds create incentives for cities to invest in resilience so as to reduce the human and financial cost of catastrophes when they strike.

Catastrophe Bonds – Or "cat bonds." Financial instruments designed to help manage the financial risks associated with extreme natural disasters. These bonds kick in after a disaster and do not raise money for resilience planning.

Resilience Districts – There has been a lot of discussion regarding leveraging the power of a location to pool resources to finance shared, community-wide infrastructure, known in shorthand as "resilience districts," which functions on the principle of "everyone pays, everyone benefits." One example is the City of Boston's Climate Resilience Fund, a form of Land Value Capture that recognizes that upgraded and new infrastructure benefits the private sector by offering a lower risk. The City asks developers to pay into a fund that will support community-wide infrastructure.

IMAGE: FLOODABLE PARK | STOSS LANDSCAPE URBANISM

ENDNOTES

1. FIGA. "2021 Annual Report." Florida Insurance Guaranty Association, 2021, https://figafacts.com/.
2. Reyes, Max. Ian Losses to Set Florida Record, Cost Insurers $63 Billion. Bloomberg, 30 Sept. 2022, www.bloomberg.com/news/articles/2022-09-30/hurricane-ian-to-cost-us-insurers-63-billion-risk-modeler-says.
3. Ramage, Matt. "Chart: Infrastructure Bill Spending by State." Constructible, Trimble, 13 Oct. 2022, https://constructible.trimble.com/construction-industry/infrastructure-bill-spending-per-state-chart.
4. Ramage, 2022.
5. Plumer, Brad. California Approves a Wave of Aggressive New Climate Measures. The New York Times, 1 Sept. 2022, www.nytimes.com/2022/09/01/climate/california-lawmakers-climate-legislation.html.
6. Public Act No. 21-115 - Connecticut General Assembly. www.cga.ct.gov/2021/ACT/PA/PDF/2021PA-00115-R00HB-06441-PA.PDF.
7. Developers as Allies: DC's Stormwater Retention Credit Trading Program: Most Center. MOST Center, https://mostcenter.umd.edu/developers-allies-dcs-stormwater-retention-credit-trading-program.
8. Stormwater Retention Credit Trading Program. DOEE, https://doee.dc.gov/src.
9. Letsinger, Eric. Evaluating Best Practices from State Revolving Funds (Srfs) to Support Market- and Nature-Based Approaches for Flood Risk Reduction and Water Quality Improvement. Environmental Defense Fund, www.edf.org/sites/default/files/documents/Evaluating%20Best%20Practices%20from%20State%20Revolving%20Funds%20vF.pdf.
10. Cost-Effective Solutions for Soil and Water Stewardship. Soil and Water Outcomes Fund, https://developers.squarespace.com/static-pages/.
11. Our Plan: Louisiana's Coastal Master Plan. Coastal Protection And Restoration Authority, https://coastal.la.gov/our-plan/.
12. Who We Are. Rhode Island Infrastructure Bank, www.riib.org/who-we-are.
13. "Governor Baker Signs Legislation Directing $2.4 Billion to Climate Change Adaptation, Environmental Protection, and Community Investments." Mass.gov, Office of Governor Charlie Baker and Lt. Karyn Polito, www.mass.gov/news/governor-baker-signs-legislation-directing-24-billion-to-climate-change-adaptation-environmental-protection-and-community-investments.
14. Lewis, Lynwood W. SB 1027 Clean Energy and Community Flood Preparedness Act; Definitions, Funds, Report. Legislative Information System, https://lis.virginia.gov/cgi-bin/legp604.exe?201%2Bsum%2BSB1027.
15. Chapter 70A.65 RCW: Greenhouse Gas Emissions-Cap and Invest Program. Washington State Legislature, https://app.leg.wa.gov/RCW/default.aspx?cite=70A.65.
16. Climate Commitment Act (CCA). Washington State Department of Ecology, https://ecology.wa.gov/Air-Climate/Climate-change/Reducing-greenhouse-gases/Climate-Commitment-Act#:~:text=Proposed%20rulemaking%20timeline%20%20%20%20Rulemaking%20,6%2C%202021%20%20%20February%209%2C%202022%20.

COST-BENEFIT REFORM

Governments have limited resources and a lot of need. New Benefit-Cost Analysis (BCA) frameworks could drive forward justice-centered resilient infrastructure projects with multiple benefits and uses by determining what projects should invest in. This approach could save money in the long run by incentivizing agencies to look holistically at benefits and could lead to better project design from the start. Projects that are able to withstand climate impacts over the entirety of their useful lives and ensure that equity and co-benefits, such as positive physical and mental health outcomes and the creation of middle class jobs, would be prioritized in the capital planning process under this approach.

A standard benefit-cost analysis (BCA) is an analytical and decision making tool that calculates the monetarily quantified benefits of a project and compares them to its costs, often over a period of time by applying a discount rate. BCAs can also be significantly influenced by the discount rate used. Choosing a discount rate is a subjective decision and reflects a decision maker's valuation of future versus present benefit accrual. Even seemingly minor changes in a discount rate, for example, from 7 percent to 3 percent, can have large consequences. A BCA calculation will result in a benefit-cost ratio (BCR), which summarizes the costs and benefits of a given project. Decision makers can then use the BCR to assess project alternatives and justify going ahead with a given project. BCAs can be an influential factor in whether a project goes ahead or not. Consequently, the various costs and benefits which are included or excluded from a BCA can have a significant effect on decision making outcomes.

At the federal level, BCAs are mandated by the Office of Management and Budget, although many agencies have their own specific stipulations for BCAs. Use of BCAs as a decision making or funding tool at the state and local levels is inconsistent.

The factors that make up a BCA are not an exact science.

Relying on monetization of costs and benefits alone creates blinders. For example, a BCA concluded that smoking saved states money, largely because their citizens died early. Such an outcome, while technically correct, shows that contextual and non-quantifiable factors need to be taken into account in order to produce outcomes rooted in values and equity. A thoughtful approach is needed to reach the goals and intention of this important tool.

Certain costs and benefits may be difficult to quantify and across projects and agencies there are no standards for valuing either the cost or the benefit. They also rarely account for equity, or "public good." For example, in the context of flood-resilient infrastructure investments, BCAs typically measure benefits as reductions in expected annual flood-related damages. Besides being a narrow measure of project benefits, this inherently puts low-income communities at a disadvantage because their assets and homes are valued less compared to affluent communities and therefore their expected damages are lower. This common approach to BCAs puts low-income communities, which are more likely to be communities of color due to a history of discriminatory practices, at the back of the line for infrastructure projects.

Any new framework needs to go much further to include direct and indirect benefits to the community in which the project is being built. Carbon sequestration benefits, for example, can vary depending on tree age and type. Other difficult-to-quantify benefits, such as those relating to mental health, are often estimated using contingent valuation surveys in which individuals are asked how much they would value a particular thing, which would be too burdensome for agencies to implement for every single capital project. Even so, the level of accuracy of the subsequent valuations are questionable, especially in the context of location-specific public infrastructure projects. Environmental benefits in particular can be difficult to estimate based on contingent valuation surveys because they are typically public and diffuse, and therefore their true value can be divorced from private individual's valuations. For these reasons, governments should create a broader framework for decision purposes and move away from an exact quantification of benefits that may be impossible to quantify.

Governments can use several methods to sidestep this issue of difficulty to quantify benefits within an overall framework. One is breakeven analysis. In this method, analysts do not quantify unquantified or unmonetized benefits but instead specify how high such benefits would have to be in order for them to justify the costs. They can then compare those hypotheticals to measures like the Value of a Statistical Life (VSL) to see if they are reasonable or not. Cost-effectiveness analysis is another alternative for unquantifiable or difficult-to-quantify benefits. In this method, a decisionmaker "starts by stating a specific goal, such as reducing the incidence of a disease in a town by 50 percent in four years, presents data on the expected cost of two or more methods of achieving this goal, and then selects the least-cost alternative."[1] A final, albeit slightly different decision making framework is Policy Pathway Analysis. Under Policy Pathway Analysis, thresholds or "trigger points" are set for taking actions that are costlier or may require greater analysis.[2] In this case, actions with unquantifiable or difficult-to-quantify benefits may be pushed off for later implementation. At a minimum, even a qualitative description of the unquantifiable benefits is necessary, as is sometimes done in the federal regulatory process.

Further, the concept of diminishing marginal utility – that low-income people will benefit more from the same amount of money than high-income people – has largely not been translated into BCAs. In a BCA context, diminishing marginal utility should dictate that benefits accruing to low-income people are valued more than benefits accruing to high-income people. Instead, equal benefits for the poor and the rich are seen as equal increases in well-being, despite it being well proven that they are not.

Recognizing these challenges, FEMA has instituted changes to its Benefit Cost Ratio requirements for the Building Resilient Infrastructure and Communities (BRIC) and Flood Mitigation Assistance (FMA) programs, starting in FY 2022. The threshold for cost-effectiveness will be lowered if a project benefits disadvantaged communities, addresses climate impacts, has difficult-to-quantify benefits, and/or has higher costs due to the use of low-carbon materials or compliance with the Federal Flood Risk Management Standard. In other words, if a project meets the aforementioned conditions, it will not have to demonstrate as high of a Benefit Cost Ratio as it would've otherwise.

IMAGE: DRAWING FROM A COMMUNITY MEETING HOSTED BY REBUILD BY DESIGN IN THE WAKE OF HURRICANE SANDY. AUTHOR UNKNOWN.

VISION FOR A NEW BCA FRAMEWORK

It is essential that agencies at every level build on FEMA's intention and take a holistic approach to BCAs. Doing so will more accurately reflect the totality of benefits from projects that decrease emissions and build resilience to climate impacts. By quantifying a wide range of benefits, governments will be able to more effectively justify ambitious climate projects if they are designed with a holistic range of benefits.

Mandating that a holistic range of benefits be included in a BCA will incentivize agencies to design multi-use, multi-benefit projects from the start. While these projects may appear more expensive at first, every dollar spent on them will go further in that they will result in a greater calculated return on investment and a higher BCR. Mandating an approach that forces agencies to analyze projects through the lens of a holistic BCA will encourage them to design projects from the outset that produce more benefits, especially for disadvantaged communities, and ultimately be more efficient.

The exact framework for project design and analysis should be based on a government's specific values and goals. Broad mandates – like environmental justice, mitigating emissions, enhancing resilience, and safeguarding public health and safety – should drive capital planning and investments, and in turn, what benefits are included in a BCA. Assigning different weights is also a strategy to advance equity. The costs and benefits of a project may have different values in different neighborhoods. Communities experience the impacts of climate change and benefit from infrastructure projects differently. The marginal utility of a project that improves air quality in an environmental justice community that is overburdened with fossil fueled power plants and last-mile warehouses has a much greater benefit than improving it in a different neighborhood filled with greenery, free from intense trucking traffic and industrial facilities. Weighting is a way to recognize that our society is inherently unequal, and that benefits will accrue differently across separate socioeconomic demographics.

A final consideration is when in the timeline of project scoping this framework should be used. Inserting a BCA early in the scoping process ensures that a project can be designed to fully maximize benefits. For instance, a department of transportation that does not have green infrastructure as a mandate, could utilize stormwater management practices that would ordinarily be outside the scope of this agency, if it were built into the project early enough. It's possible to further incentivize looking broader than a one-agency approach by leveraging a bump in capital funding, or an abbreviated inter-governmental process, or other "carrots."

CURRENT	NEW APPROACH
High discount rate	Low discount rate
No inclusion of equity	Includes equity through benefits and weighting
Considers a limited range of benefits	Includes a holistic range of benefits spanning climate, health, jobs, and more
Sole determinant of project outcomes	One tool in a broader toolbox used to determine project outcomes
Ignores unquantifiable or difficult-to-quantify factors	Accounts for unquantifiable or difficult-to-quantify factors qualitatively or through other methods
Utilized in the alternative analysis or later	Utilized at scoping to affect project design

Ultimately, the design of a BCA framework must be collaborative and flexible yet not overburden the agency or grant applicant. Multiple stakeholders should be involved in its initial design, and a yearly review to ensure it matches the locality's goals should be conducted.

BENEFITS THAT SHOULD BE INCLUDED IN A BCA FRAMEWORK:

Government agencies should look to quantify a wide range of direct and indirect benefits in their BCA such as carbon reduction, mental and physical health, middle-class job creation, and benefits that address years of disinvestment and discrimination. Doing so will force agencies to prioritize capital projects that meet multiple goals which will ensure that each dollar of investment will go further. While it would be necessary to align specific categories with local goals, the following broad categories can serve as a minimum. Additionally, projects should be designed with useful lives in mind: agencies should consider how projects will deliver benefits in future conditions, not just current ones and how the most vulnerable communities should be prioritized. The following are essential inputs to a modern and equity-focused BCA tool:

Equity

Equity must be an overarching theme across all categories of costs and benefits. Agencies should consider using equity weights, which enable BCAs to account for marginal utility, to properly value benefits flowing to disadvantaged communities. This would correct a major shortcoming of standard BCAs, provide a fair and real-world evaluation of benefits, and push agencies to prioritize communities that they may not have otherwise.

Climate Change – Adaptation and Mitigation

Agencies must consider how projects will make communities more resilient not only to current climate impacts, but also those projected to occur over the lifecycle of a given project. Considerations must be included for how projects can create benefits in the face of extreme heat and higher average temperatures, extreme and changing patterns of precipitation, more intense tropical storms, and sea level rise. For all impacts, agencies should consider benefits to both physical infrastructure and to social infrastructure. Thanks to a wide variety of publicly available modeling tools, agencies can make localized determinations about the climate resilience benefits their projects will deliver.

Agencies must also consider the climate mitigation benefits of their projects. This should encompass every stage of a project's life cycle, including raw material extraction, manufacturing, construction, use, and decommissioning. Selecting the projects that limit emissions the most across the board is essential. The benefits of low-emissions projects can be reflected using measures such as the Social Cost of Carbon, based on the latest guidance from the federal government. Agencies can assess greenhouse gas impacts using a suite of both publicly available and proprietary quantification and analysis tools.

Health and Safety

Agencies should assess how their projects will safeguard and improve the physical wellbeing of communities, such as protecting pedestrians and bicyclists from cars, reducing combined sewage overflows, mitigating climate justice impacts or enhancing ecology and green space, for example, and these should be quantified in a BCA. Using a life-expectancy approach allows for a universal goal to lower human suffering.

Jobs and Economic Development

The inclusion of job and economic development benefits is standard in most BCAs. Agencies could go above and beyond by infusing this analysis with the government's values of what types of jobs they would like to create. Such an approach could incentivize the use of union labor, local hiring, and job training. As low-income communities tend to reap higher benefits from an equal dollar amount than high-income communities, agencies should place greater value on projects that deliver economic development benefits to disadvantaged communities.

ENDNOTES

1. Independent Evaluation Group. 2010. Cost-Benefit Analysis in World Bank Projects. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/2561 License: CC BY 3.0 IGO.

2. Lyster, Rosemary, Daniel A. Farber, and Robert R.M. Verchick. "Chapter 15: Climate-induced disasters and electricity infrastructure". Research Handbook on Climate Change Adaptation Law. Cheltenham, UK: Edward Elgar Publishing, 2022. doi.org/10.4337/9781800371491.00020.

RECOMMENDATIONS

During the Covid-19 pandemic, while stay-at-home orders were in place, many were still forced to flee their homes. Fires burned over 17.25 million acres,[1] while heat waves in Washington State and western Canada killed over 1,400 people.[2] Freezing temperatures made their way from North Dakota to Mexico, leaving 246 people dead,[3] and a cold snap left four million households without power in Texas.[4] Flood waters from Hurricane Ida plunged New Orleans into darkness and left behind destruction in New York and New Jersey. Any way you look at it, everyone is affected. The buck stops with the taxpayer, and unless our policies and practices stop chasing the last storm instead of what's to come, communities will continue to suffer and all taxpayers will continue to pay.

U.S. federal disaster recovery policies were created at a time when extreme weather events were less common. When the Stafford Act was first signed into law in the 1980s, the 10-year average for billion-dollar disasters was approximately three; as of 2021, the 10-year average was 14.5.[5] In its current form, the system in place to support communities preparing for and responding to climate events is too slow, politicized, and disproportionately focused on response instead of preparation.

Waiting until after a climate event to access the large amounts of federal funding needed to build infrastructure that is ready for climate change does not incentivize smart investments, as states know they would be "bailed out" through the federal Disaster Declaration process which can free up federal funding. Smart investments must be linked to post-disaster funding sources to build the capacity to withstand increasing events.

Many communities now understand their risks better, climate infrastructure is being designed and implemented on a small scale, and governments are beginning to invest in improvements to infrastructure, building codes, and zoning rules. There is a long way to go until state and federal governments are focusing investments to meet the ever-present challenge. The United States continues to underinvest in preventing disasters, even though we are seeing communities suffer each year. The United States must transform its post-disaster policies, programs, and allocations of funding to build and rebuild the nation's infrastructure to support the prosperity of generations today and in the future.

In addition to improved planning and financing mechanisms, we need federal and state governments to reform policies, invest in climate data collection, and engage stakeholders to create the environment in which climate-smart, equitable infrastructure investments are prioritized. It is critical for the U.S. to enact the following changes to overhaul how our government responds to severe weather events.

REFORM PLANNING AND BUILD CAPACITY

+ Create a U.S. National Resilience Strategy that uses baseline climate information of future risks that the federal, state, and local governments use to ensure projects and policies are being developed to withstand projected climate impacts. This should encompass all risks, including extreme heat, wildfires, hurricanes, floods, tornadoes, drought, severe winter storms, and sea level rise;
+ Create state-level funding mechanisms such as insurance surcharges or ballot initiatives to catalyze comprehensive local adaptation planning and leverage federal funding by providing the required "match" to federal grants. Federal incentives such as a 1:1 match can catalyze new and creative state funding sources;

+ Shift the billions of taxpayer dollars that are awarded after climate events each year into pre-disaster climate infrastructure, and use updated decision-making frameworks that respond to climate risk and prioritize socially vulnerable communities;
+ Review federal programs with an eye towards making it easier for lower capacity governments and NGOs to access state and federal programs;
+ Require that every capital project be built with net zero or net negative carbon emissions standards, to ensure they do not contribute to the problem being addressed.
+ Design predictable state-led programs that institutionalize buying out properties that are most at risk to help homeowners and renters relocate out of harm's way before they lose their lives and livelihoods. Ensure that the influx of new residents will not further strain the housing market or displace existing upland communities
+ Require that states work with communities in HMGP and climate infrastructure planning so they become educated in their risks and can help identify programs and projects that will drive down risks on the community level.

AMEND OUTDATED POLICIES

+ Amend the Stafford Act to encompass all aspects of loss due to climate change, not just the cost of property damage. This includes loss of life, quality of life, health, and livelihoods due to shocks, such as extreme weather events, as well as chronic stressors, such as heat, air pollution, and sea level rise;
+ Enact flood disclosure requirements in every state, requiring property owners/sellers to disclose flood history to potential renters and buyers;
+ Take politics out of delivering needed assistance. Congress and governors have the discretion to determine post-disaster spending, which can be influenced by their ties to the locality in need. Permanently authorize the CDBG-DR program so localities can easily deliver projects faster, more effectively and with less red tape;
+ Ensure each funding program is designed to prioritize those with the greatest social and physical vulnerabilities to climate hazards.

COLLECT, DISSEMINATE, AND UTILIZE DATA

+ Identify social vulnerability indicators specific to the municipality, county, or state to fold into funding, programmatic, and policy criteria. These inputs – through research and engagement – must inform where and how money is invested;
+ Require states to publish and report annual state disaster occurrences, cost to local governments, and deaths to provide a more complete understanding of the toll of extreme weather events and the policies and programs they have enacted to address vulnerability;
+ Create a central platform to disclose projects that are funded through federal and state programs;
+ Disclose information about who each project will serve along the lines of: renters vs homeowners, race, ethnicity, socio-economic status, age, ability, gender, household composition, etc., to institutionalize feedback loops and ensure that programs are delivering on their mission and are informing future policies, programs, and projects.

THE LIST OF RECOMMENDATIONS TO IMPROVE FEDERAL AND STATE DISASTER MITIGATION AND RECOVERY PROGRAMS APPEARS DAUNTING; HOWEVER, IT IS DIMINUTIVE COMPARED TO THE SCALE OF THE CHALLENGE IN FRONT OF US SHOULD WE NOT CAPITALIZE ON THIS MOMENT TO ACT BOLDLY AND COMPREHENSIVELY. THE PUBLIC SECTOR CANNOT SOLVE FOR THIS ALONE. PHILANTHROPY AND THE PRIVATE SECTOR HAVE A ROLE TO PLAY IN SUPPORTING THE PLANNING AND IMPLEMENTATION OF CLIMATE ADAPTATION INITIATIVES, AS WELL AS DRIVING INNOVATIVE SOLUTIONS THAT CREATE MULTIPLE BENEFITS FOR COMMUNITIES. INDIVIDUALS WILL NEED TO PARTICIPATE IN PUBLIC INPUT PROCESSES TO ENSURE PLANS ARE INFORMED BY THOSE MOST IMPACTED. UNTIL WE PRIORITIZE OUR FUTURE, PEOPLE WILL CONTINUE TO SUFFER.

WE CANNOT WAIT ANY LONGER . . .

ENDNOTES

1. Sönnichsen, N. U.S. Wildfires: Acres Burned 2021. Statista, 21 June 2022, www.statista.com/statistics/203990/area-of-acres-burnt-due-to-wildland-fires-in-the-us/#:~:text=About%207.13%20million%20acres%20of,three%20million%20acres%20in%202021.
2. Popovich, Nadja, and Winston Choi-schagrin. Hidden Toll of the Northwest Heat Wave: Hundreds of Extra Deaths. The New York Times, 11 Aug. 2021, www.nytimes.com/interactive/2021/08/11/climate/deaths-pacific-northwest-heat-wave.html.
3. Svitek, Patrick. Texas Puts Final Estimate of Winter Storm Death Toll at 246. The Texas Tribune, 2 Jan. 2022, www.texastribune.org/2022/01/02/texas-winter-storm-final-death-toll-246/amp/.
4. Reuters, and Maria Caspani. Cold Snap Leaves One Dead, over 4 Million without Power in Texas. Thomson Reuters, 16 Feb. 2021, www.reuters.com/business/environment/cold-snap-leaves-8-million-texas-mexico-without-power-2021-02-16/.
5. NOAA. Billion-Dollar Weather and Climate Disasters. National Centers for Environmental Information (NCEI), www.ncei.noaa.gov/access/billions/time-series.

APPENDIX

A. METHODS: ENERGY RELIABILITY

System Average Interruption Duration Index (SAIDI) is one of the performance metrics used to measure the reliability of an electric utility's service. This metric measures the total time (in minutes) an average customer experiences a non-momentary power interruption over a one-year (calendar) period. A Major Event Day (MED) is another metric which occurs when the SAIDI exceeds a specific threshold within a given day and tends to reflect outages on the longer end of the spectrum. The data presented in this report shows a metric of SAIDI combined with MED to highlight and report electric reliability in areas (utility territories) irrespective of the root cause of the interruption. The Energy Reliability Map displays the SAIDI_W_MED metric for utility territories and highlights areas that are susceptible to electric system vulnerabilities based on reliability performances. These vulnerabilities serve as an indicator as to where investments and improvements in the distribution grid should be focused.

Electric utilities experience power interruptions due to a variety of issues. Those issues include inclement weather, vegetation management practices, utility practices, maintenance patterns, and capital investment strategy, among others, which all play a part in a utility's overall reliability performance. The U.S. Energy Information Administration produces an Annual Electric Power Industry Report which utilizes data collected from U.S. electric utilities reflecting their reliability performance against certain industry standards and performance metrics. Utilities have the flexibility to report interruptions according to duration and frequency either with major events, without major events, or both.

The annual SAIDI is the summation of the individual SAIDIs for each non-momentary interruption event over the entire year:

$$\text{SAIDI} = \frac{\sum(\text{Duration of Interruption} \times \text{No. of Sustained Customer Interruptions})}{\text{Total No. of Customers Served}}$$

For utilities that report SAIDI metrics using the Institute of Electrical and Electronics Engineers (IEEE) standards, "non-momentary" interruptions are those lasting longer than five minutes. A Major Event Day (MED) is another metric which occurs when the SAIDI exceeds a specific threshold within a given day and tends to reflect outages on the longer end of the spectrum.

Utilities have certain flexibilities when reporting with these metrics. Including MED in the SAIDI metric (SAIDI_W_MED) provides an overall picture of the electric reliability experienced by customers. Excluding MED from the SAIDI metrics (SAIDI_WO_MED) tends to separate power interruption events by their durations, which provides an indicator of the source of the power interruption (i.e., distinguishes a Major Event vs. Systematic Operation interruption).

Our methodology utilizes SAIDI_W_MED as the primary measurement indicator for the electric reliability experience of the end user (customer). Our SAIDI_W_MED metric highlights the reported electric reliability in areas (utility territories, counties, and states) irrespective of the root cause of the interruption. Our metric does not exclude interruptions categorized as MEDs.

This report endeavors to highlight areas across the national electric distribution network (utility territories) that are susceptible to electric system vulnerabilities based on historical reliability of performance. We view vulnerabilities caused by major events (longer duration outages) on par with vulnerabilities caused by systematic failures (shorter duration outages) and believe they should equally drive electric grid investment and improvement decisions. These investments should also incorporate solutions aimed at mitigating systemic vulnerabilities that stem from issues like vegetation management practices, distribution automation improvements to major event vulnerabilities with root causes embedded in grid hardening, distribution generation schemes, and Automated Metering Infrastructure (AMI) upgrades aimed at minimizing customer interruption numbers and durations.

B. METHODS: COMPOUNDING RISKS

To determine the areas with the highest compounding risks, social benefits were ranked on a scale of 0 to 6, with 6 showing the maximum level of social benefits for that county. Each county was examined to see if it would be impacted by sea level rise at the 3 feet Mean Higher High Water (MHHW). If yes, the county was assigned a 1. Next, each county was analyzed for hazard risks (on a scale of Low to Very High Risk). These included avalanches, coastal flooding, cold waves, droughts, earthquakes, hail, heat waves, hurricanes, ice storms, landslides, lightning, riverine flooding, strong winds, tornadoes, tsunami, volcanic activity, wildfires, and winter weather. If the county had any of these hazards ranked Very High or Relatively High Risk, the county was assigned a 1. Counties with a population density of 500 people or more per square mile were assigned a 1. If the county experienced a population increase in the past ten years of at least 10 percent it was assigned a 1. If the county had a poverty level of 15 percent or higher then the county was assigned a 1. Health and social benefits were then analyzed together per county. If a county had any of the following risks, it was assigned a 1: cardiovascular disease at a rate of 265 deaths per 100,000 or higher; neoplasms at 245 deaths per 100,000 or higher; or diabetes, urogenital, blood, and endocrine diseases at 80 deaths per 100,000 or higher. After all risks were examined across each risk category, they were then added up to give a total score of social benefits.

United States counties were analyzed for social benefits using the following data sources:

- NOAA Sea Level Rise (Source: Sea Level Rise and Coastal Flooding Impacts (noaa.gov))
- Population Density (Source: 2020 Census Demographic Data Map Viewer)
- Population Change (Source: 2020 Census Demographic Data Map Viewer)
- Poverty (Source: 2020 Census Demographic Data Map Viewer)
- Cardiovascular Diseases (Source: U.S. Data | GHDx (healthdata.org))
- Neoplasms (Source: U.S. Data | GHDx (healthdata.org))
- Diabetes, urogenital, blood, and endocrine diseases (Source: U.S. Data | GHDx (healthdata.org))
- FEMA Natural Hazard risk (Source: Map | National Risk Index (fema.gov))

C. METHODS: PROPERTY AND CASUALTY INSURANCE SURCHARGE

Total funds raised for a Resilient Infrastructure Fund are based on the 10-year bonding of a two-percent surcharge on all lines of property and casualty insurance, excluding medical professional liability and workers' compensation.

Each state is considered "without" surcharges on medical malpractice and workers' compensation, based on 2.0 percent surcharge levels. It should be noted that we did not assume two likely factors that could further increase the projected results: (1) continued leveraging beyond year 10 reflecting available surcharge revenue and (2) the possibility of providing the proceeds generated as loans (in some percentage) rather than grants which can further increase programmatic reach.

The analysis assumes:

+ 2.0 percent annual growth rate for aggregate insurance premiums
+ Bonds issued annually such that 1.20x coverage is reached in year 10
+ 30-year fully amortizing bonds
+ 4 percent borrowing costs
+ No cost of issuance or debt service reserves
+ Total proceeds capacity, as shown by state, is the sum of (i) indicative bond proceeds and (ii) "pay-go" availability (funds available after debt service payments).

For example, in order to arrive at the $21.6 billion available under the New York scenario assuming a two-percent surcharge (including premiums from medical malpractice and workers' compensation), it is assumed the state could bond against base year surcharge revenue of ~$950 million. The analysis assumes ten separate $1.6 billion bond issuances which would each be structured with level annual amortizing payments equal to ~$95 million. Following the tenth issuance, the aggregate annual debt service would be $950 million (to be serviced by surcharge revenue projected to grow to $1.14 billion, representing 1.20x coverage). The sum of the bond proceeds from the ten separate bond issuances would be $16.4 billion, and the excess cash flow after paying debt service ("pay-go" funds) would have amounted to $5.2 billion, indicating up to $21.6 billion in available capital for resiliency projects.

It should also be noted that several of the states (e.g., Florida, Texas, and maybe others) already have property and casualty insurance surcharge bonding provisions for post-event financing.

Insurance data source: National Association of Insurance Commissioners | Statistical Compilation of Annual Statement Information for Property/Casualty Insurance Companies in 2019

Q AND A ON THE INSURANCE SURCHARGE:

Why is a surcharge a good source of funding for resilient infrastructure?

Preparedness can prevent escalating economic, social, and infrastructural losses from climate events; however, how to fund needed improvements to infrastructure continues to be a challenge. The creation of new sources of funding, dedicated to smart investments in preparedness, will address immediate climate risk and provide additional benefits such as creating hundreds of thousands of jobs, increasing opportunities for recreation, and stimulating new economic development. By planning ahead, efficiency and effectiveness increase since it costs less to build in a non-disaster environment than a post-disaster scenario. Moreover, a longer-term planning approach – with a funding guarantee by the government – incentivizes private co-financing and innovation since payback and benefits can be measured on a longer horizon. This will mitigate flood risks and create a further opportunity to address the problem of climate change by cutting carbon, helping the state reach its goals.

How would an insurance surcharge leverage other funding sources?

FEMA programs often have a cost-share component. A Resilient Infrastructure Fund, created through a surcharge on P&C insurance, could enable the state to provide the non-federal match on behalf of communities, leveraging the initial investment for a larger payoff. Additionally, federal grant sources, such as water, transportation, and hazard mitigation, require local funding matches, and often low- to medium-sized governments do not have the extra funding available to provide a match. This will come into play with the recent Bipartisan Infrastructure Law, in which more than $50 billion has been allocated to protect against droughts, heat, floods, and wildfires, in addition to a major investment in infrastructure weatherization.[1] To draw down on these funds, localities will likely need to match a certain percent of the federal allocation.

Would the State still be eligible for federal funding if there was another disaster?

After a disaster (which is considered a singular event), any state that deems there is more damage than the state can handle can ask the federal government for funds under the Federal Disaster Relief Act (Public Law 81-875), which authorizes the President to provide supplementary federal assistance. The federal government will then examine the damage assessment submitted by the state government to determine the level of aid needed to rebuild. The federal government does not look at the actual money in the state's coffers, such as money already allocated to pre-disaster uses, so it would not be re-allocated toward disaster recovery if a major climate event were to occur.

Is a surcharge on insurance just another fee or tax?

The proposed surcharge is not just another tax. It is a fee that is 1) progressive, ensuring that those with more wealth pay more. For instance, wealthier people are likely to have more insurable property, such as multiple cars, boats, etc., that would contribute to this fund; 2) has a direct policy correlation, as property is at risk from climate hazards. Furthermore, this fee stands apart from other fees and taxes because it will save money and lives over time.

Has this been done before?

States have not yet taken advantage of this mechanism. There are other surcharges on insurance; for instance, Florida Hurricane Catastrophe Fund Assessment places an insurance surcharge in the form of an emergency assessment that can be levied to restore the capacity of the Florida Hurricane Catastrophe Fund (FHCF) if the revenue generated from premiums is insufficient. This assessment is paid by all Florida insurers. However, the Florida model does not generate funds for resilience planning, meaning it is identical in structure to the concept we are proposing, with the sole difference being that the proceeds from any transaction would be utilized to finance resiliency capital improvements prior to storm-related events.

Is this a tax on insurance companies who are already over-regulated?

This charge will be administered equally across insurance companies and is expected to be passed on to the consumer fully. This will neither advantage nor disadvantage any insurance company. Surcharges exist on a number of different bills from insurance to cell phones. Insurers can easily show that the charges are not instituted by the state government by providing a clear explanation of what it is for and what it will be used for.

ENDNOTES

1 President Biden's Bipartisan Infrastructure Law. The White House, 2 Dec. 2021, www.whitehouse.gov/bipartisan-infrastructure-law/#:~:text=The%20Bipartisan%20Infrastructure%20Law%20makes,as%20thousands%20of%20smaller%20bridges.