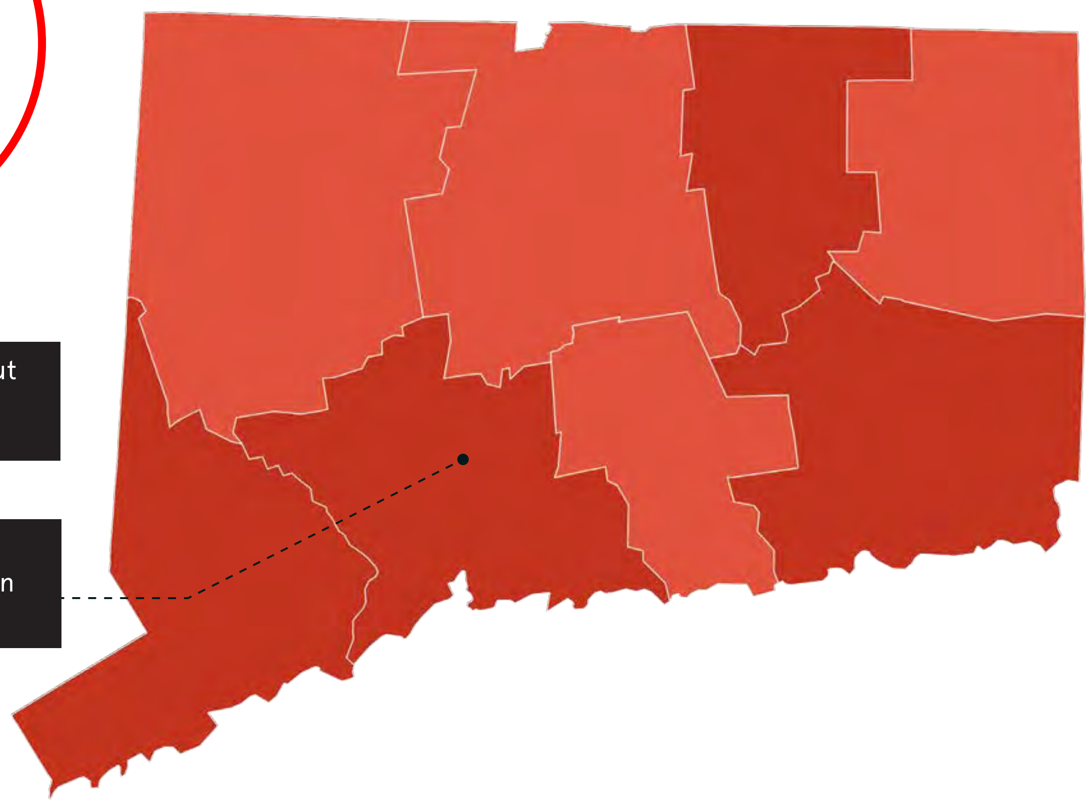
CONNECTICUT

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

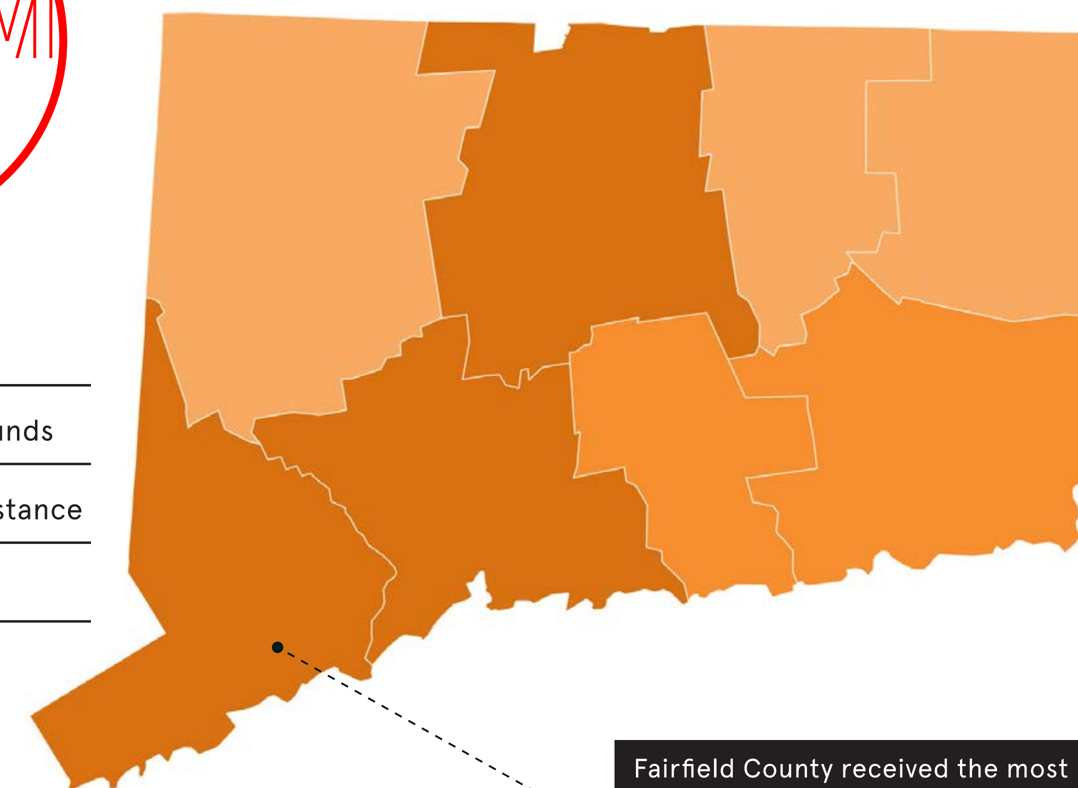
$532M
post-disaster assistance

$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

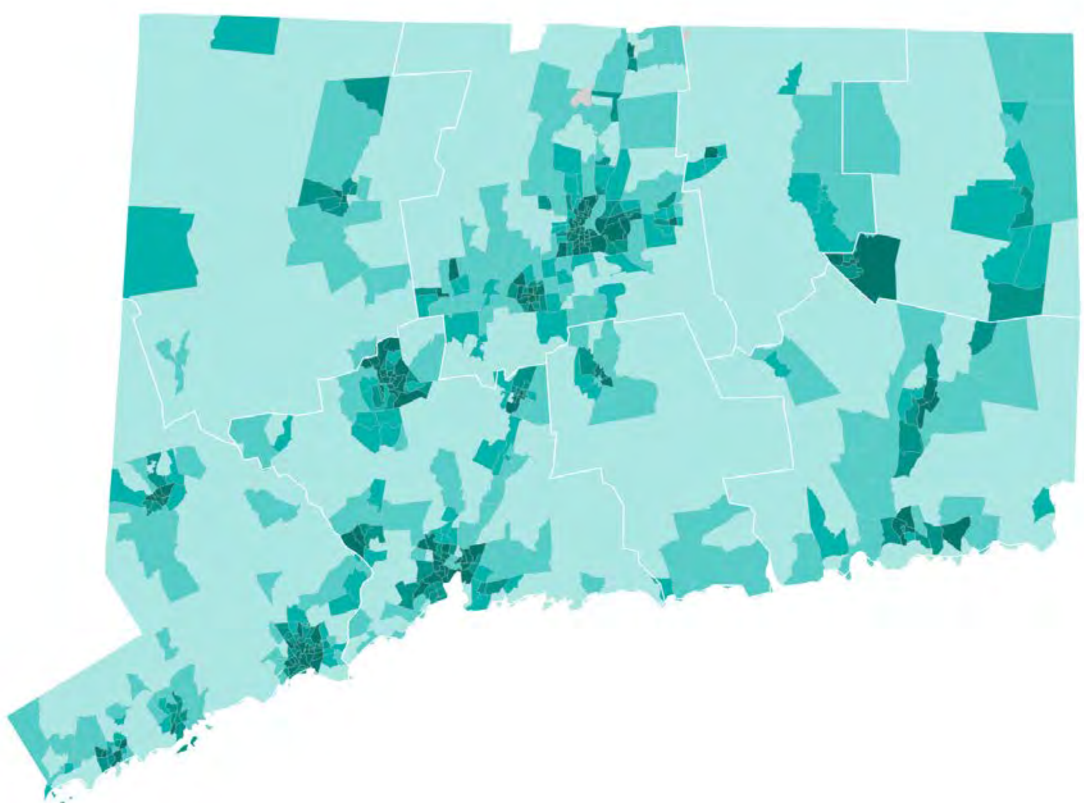
Federal Share Obligated (2011–2021)

- $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

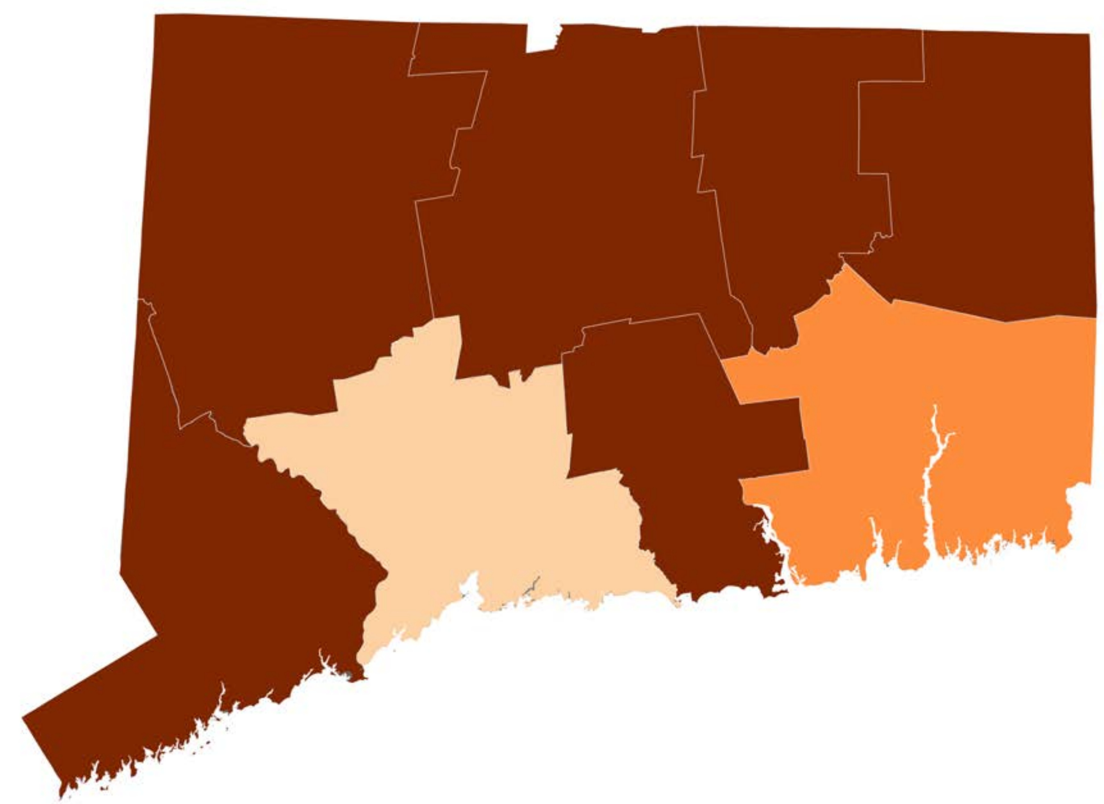
CDC (2018)

- 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

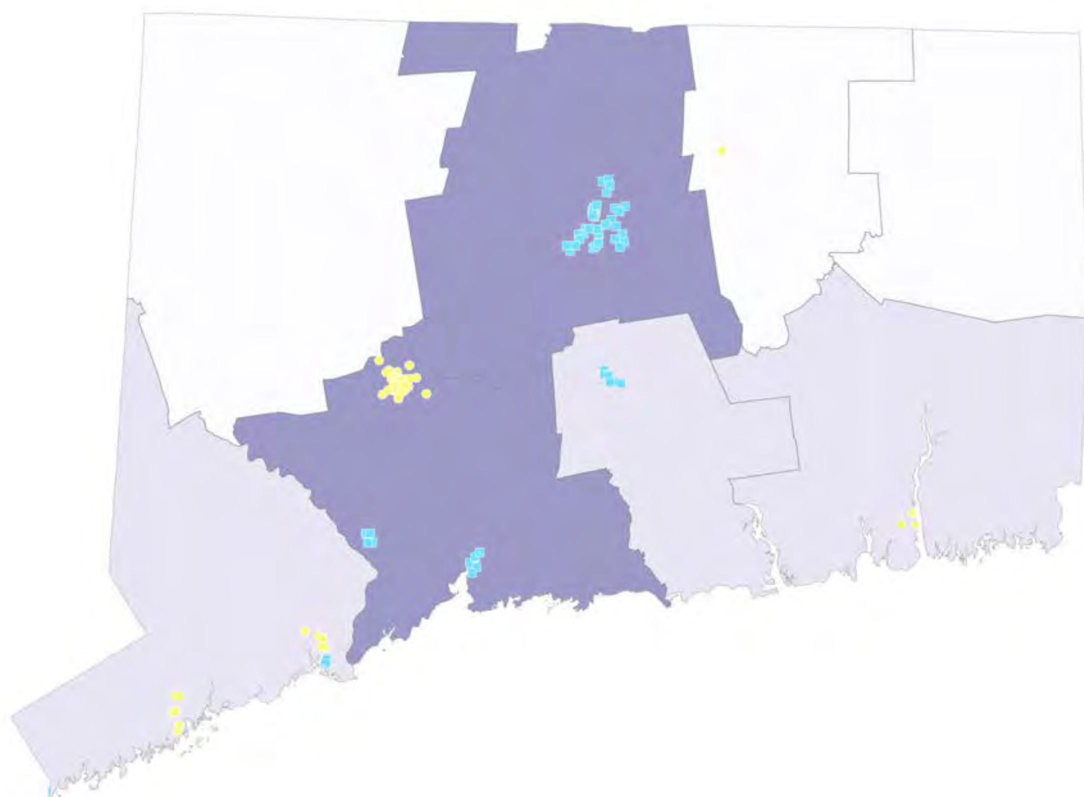
Including major events - SAIDI_W_MED

- 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

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
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
Kentucky	12
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
Delaware	9
Idaho	9
Massachusetts	9
Pennsylvania	9
South Carolina	8
Colorado	7
Utah	7
Maine	6
Michigan	6
Ohio	6
Arizona	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

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. Together, these maps depict 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.

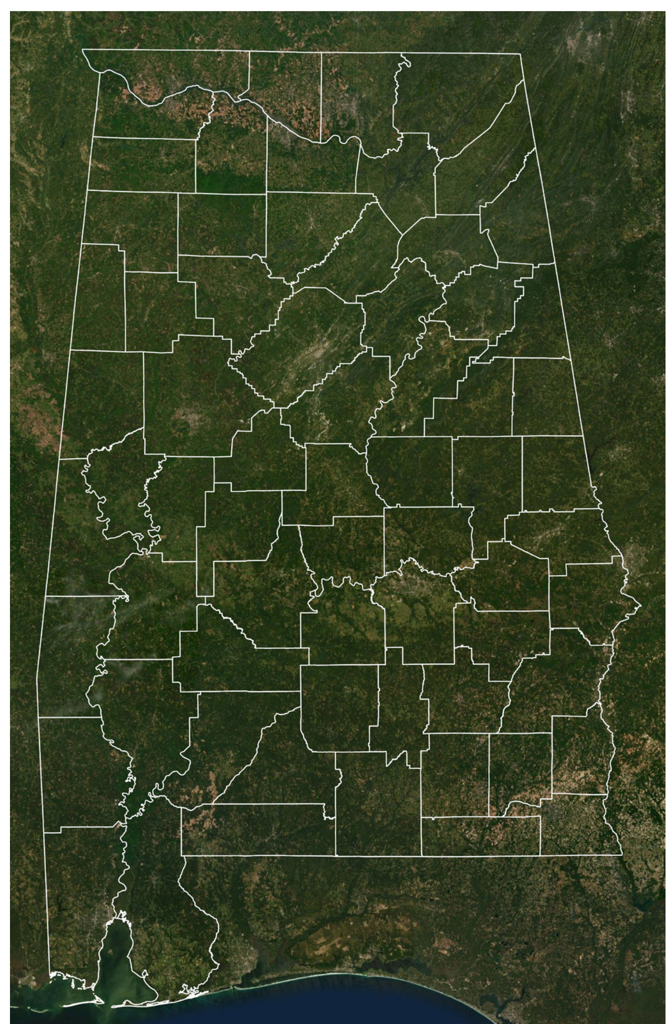
The U.S. needs to change the way we are making funding decisions. Where we make priority investments is equally important to what we invest in. Returns on investments (ROI) in the form of social benefits to communities needs to be part of grant evaluations. The U.S. needs to utilize new decision-making frameworks that are forward-looking. The final map in the set of maps 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 is 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 this 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.

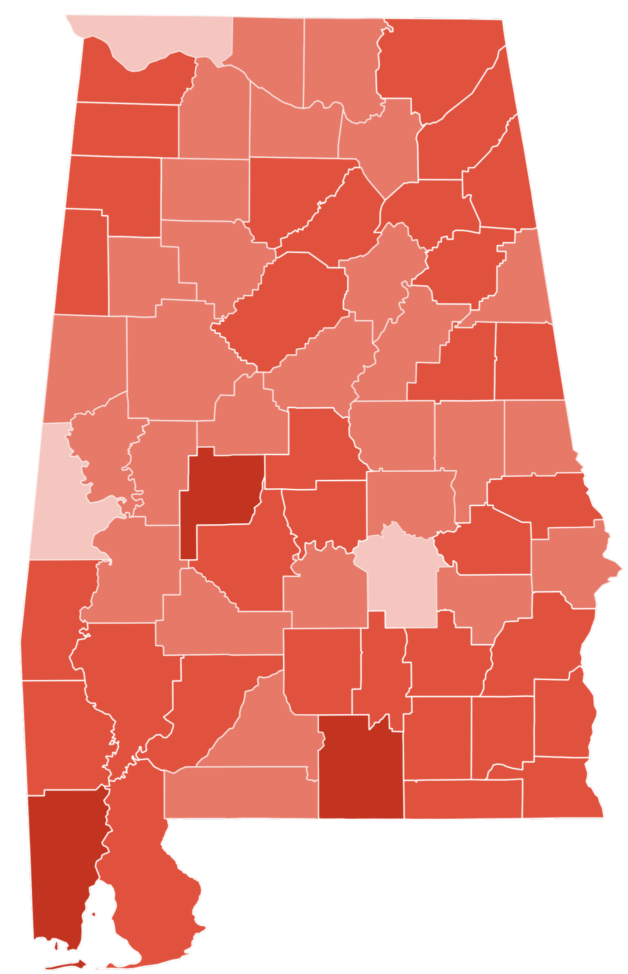


GEOGRAPHIC MAP. SOURCE: ESRI WORLD IMAGERY BASEMAP

DISASTER DECLARATIONS (RED):

Federally declared climate disasters by county 2011-2021. The map provides 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 2 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]



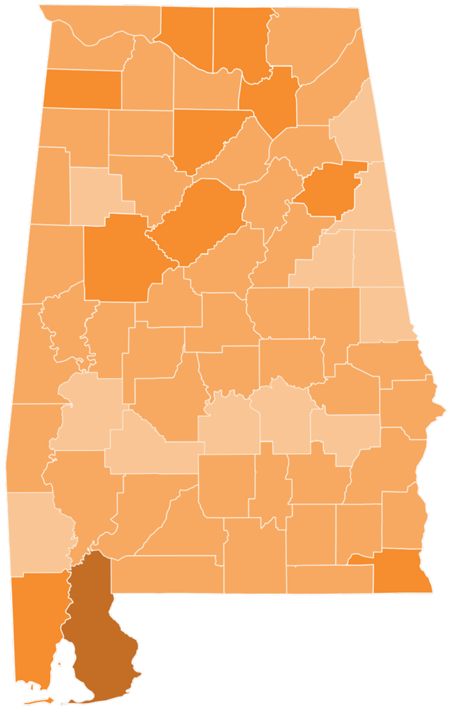
DISASTER DECLARATIONS. SOURCE: FEMA 2021 | MAPS COURTESY OF IPARAMETRICS.

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.

FEDERAL ASSISTANCES (ORANGE):

Public Assistance and Hazard Mitigation funding obligated by county for climate disasters 2011-2021
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 allocations are in the Disaster Declaration table and included in the "FEMA Total." 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.

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



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

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 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.

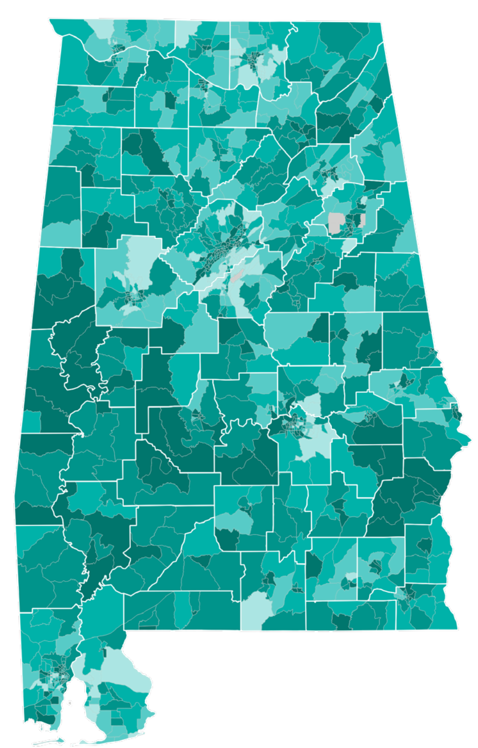
SOCIAL VULNERABILITY INDEX (GREEN):

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.

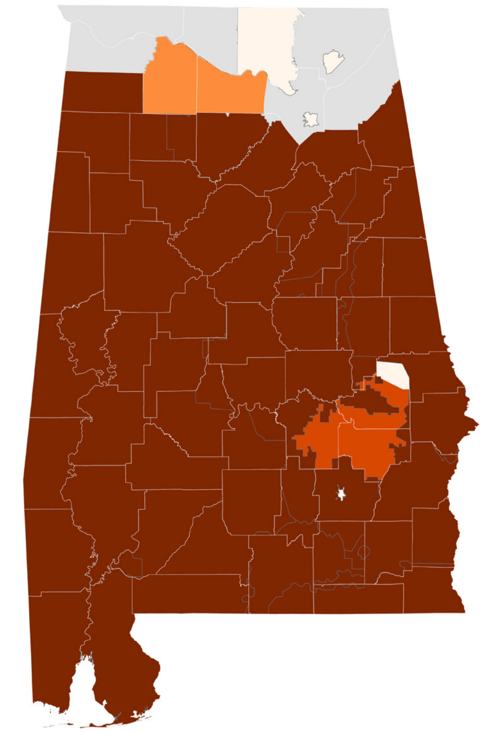
The factors that determine social vulnerability are directly tied to social determinants of health or the social, economic, and physical factors – such as race, socioeconomic status, and environmental conditions – that influence health. Socially vulnerable populations fare the worst during a disaster 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 (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 is 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 page XX



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



SOURCE: US ENERGY INFORMATION ADMINISTRATION | MAPS COURTESY OF APTIM

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. This data is 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.

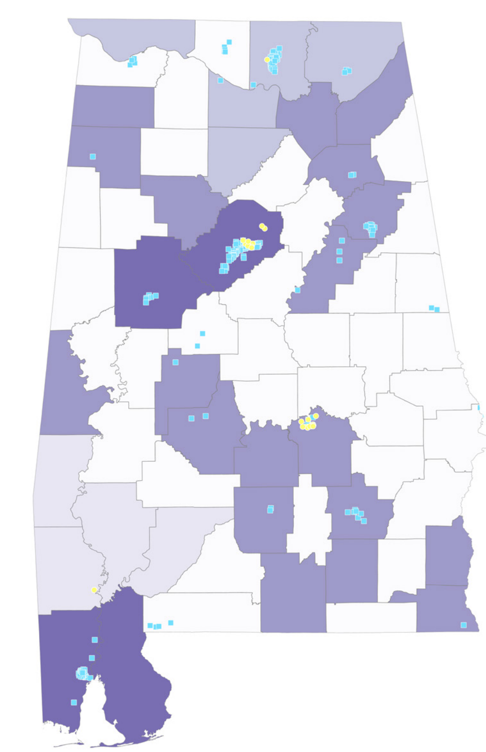
COMPOUNDING RISKS (PURPLE):

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.

While other composite maps such as FEMA's National Hazard Risk Index demonstrate climate impact and some demographic information, these maps have added additional criteria, such as population density, population increase, high poverty rates, and health risks. We did this 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 to create 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 does not always give us the full picture. For instance, in some cases, the areas highlighted for "greatest need" may already have numerous funding sources while others, such as rural communities, may not. In other areas,



SOURCES: NOAA, FEMA, 2020 US CENSUS, GHDX | MAP COURTESY OF APTIM 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

Storm water discharge indicator and Superfund proximity: U.S. Environmental Protection Agency EJSCREEN Indexes—2020 Public Release.

RANKING OF NEEDS:

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 combined and then ranked on a scale 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

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 this 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.

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

2 Flanagan, B., Gregory, E., Hallisey, E., Heitgerd, J. & Lewis, B. (2011). A Social Vulnerability Index for Disaster Management. Journal of Homeland Security and Emergency Management, 8(1), 0000102202154773551792. https://doi.org/10.2202/1547-7355.1792

THANK YOU

FUNDERS

Siegel Family Endowment
Rockefeller Brothers Foundation
Tiger Global Philanthropic Ventures

CONTRIBUTORS

Research:

Eleni Myrivili
Hannah Crane
Georgetown Climate Center
Rosa Lander
Sam Harowitz

Graphic Design:

Austin Pena
Haerim Park
Gabrielle Napolitano
Geethanjali MR
Vishal Amler
Xenia Adjoubei

Editing:

Rose Weiner
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:

Jeff Stevens
Ariel Seigel
Paul Pelletier
Mark Homrich

REBUILD BY DESIGN · institute for public knowledge new york university · iParametrics · APTIM