



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							

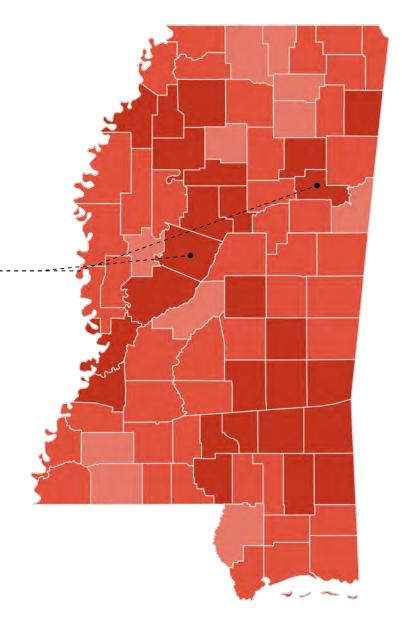
DISASTER OCCURRENCES 2011-2021

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY



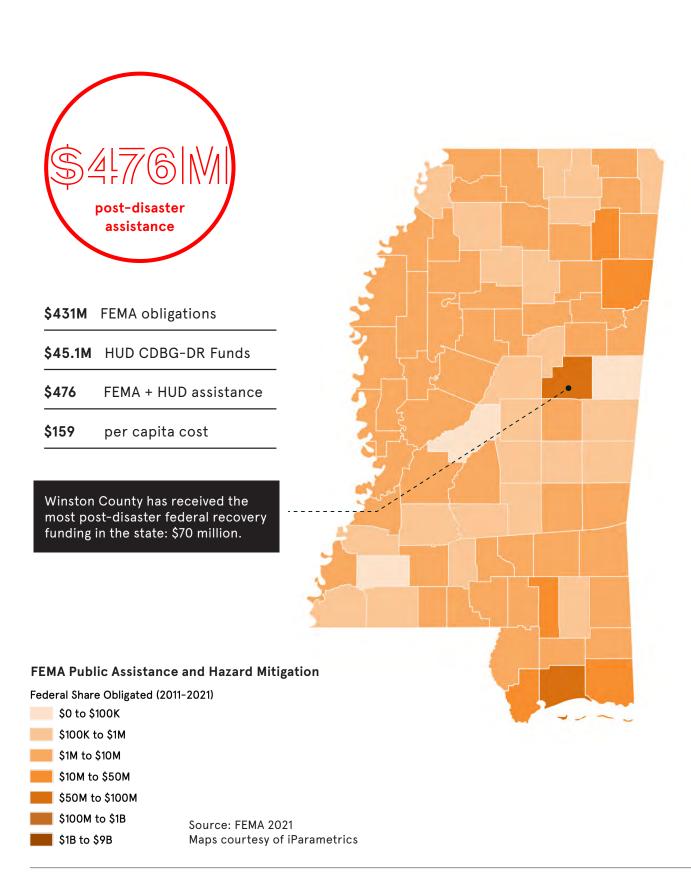
Sixty-five percent of counties in Mississippi have had five or more disasters.

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



FEDERAL ASSISTANCE 2011–2021

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



MAPPING THE IMPACT

Number of Disaster Events

Major Disaster Declarations

0 occurences

1 occurrence

2-3 occurences

4-6 occurrences

7-9 occurrences

10+ occurrences

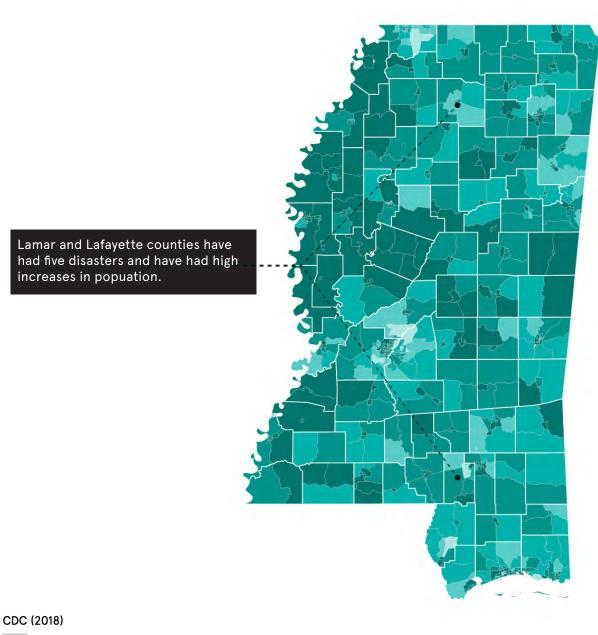
Source: FEMA 2021

Maps courtesy of iParametrics

(2011-2021)

SOCIAL VULNERABILITY INDEX 2011-2021

AREAS OF GREATEST SOCIAL VULNERABILITY





0.0 - 0.2

0.2 - 0.4

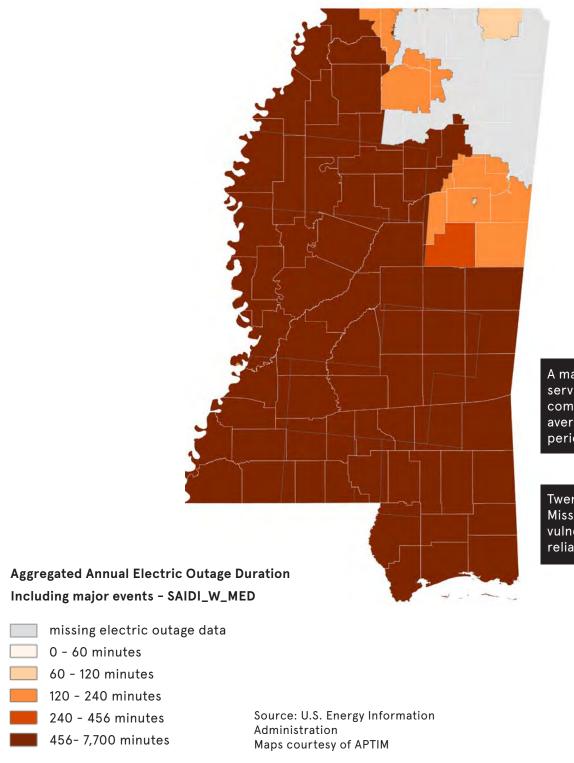
0.4 - 0.6

0.6 - 0.8

Source: CDC/ATSDR 2018 Social Vulnerability Index 0.8 - 1.0 Maps courtesy of iParametrics

ENERGY RELIABILITY 2011-2021

COUNTIES AT GREATEST RISK OF POWER OUTAGES



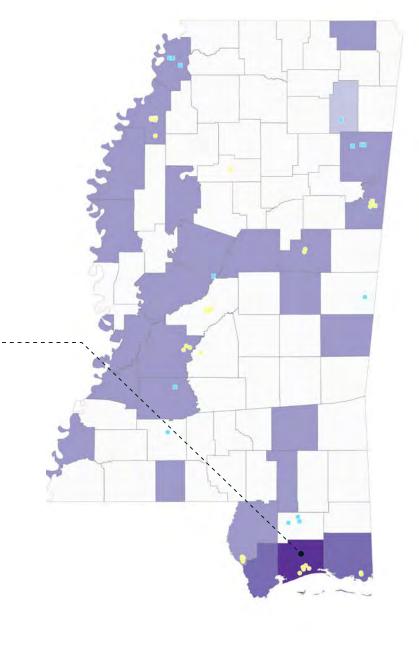
A majority of the state is serviced by an energy utility company with longer than average energy outage periods.

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

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.



due to physical and social risk (2011-2021) High Compounding Risks

Areas with the greatest return on investment

Low Compounding Risks

MAPPING THE IMPACT

Superfund Sites Wastewater Discharge Sites

Diabetes, urogenital, blood, and endocrine diseases (Source: US Data | GHDx (healthdata.org)); FEMA Natural Hazard risk (Source:

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)); 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					2		0
DeSoto							0
Forrest					2		3
					2		
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

AL: 22 DISASTERS A PA + HM: \$431 M CDBG-DR: \$45.1 M		20 1972: SEVERE STORMS,	11	2012	2013	2014	2015		2016		2017				019				2020			2	2021
A + HUD ASSISTANCE:	\$476 M	TORNADOES, STRAIGHT-LINE WINDS, AND ASSOCIATED FLOODING	1983: FLOODING	4081: HURRICANE ISAA	4101: SEVERE STORMS, TORNADOES, AND FLOODIN	4175: SEVERE STORMS, G TORNADOES, AND FLOODING	4205: SEVERE STORMS AND TORNADOES	4248: SEVERE STORMS, TORNADOES, STRAIGHT-LIN 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	4350: HURRICANE	4415: SEVERE STORMS, NATE FLOODING, AND TORNADO	4429: SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, AND FLOODING	4450: SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING	4470: SEVERE STO STRAIGHT-LINE WIND FLOODING		AIGHT-LINE TORNADOES, STRAIGHT-LI	INE 4538: SEVERE STORMS,	4551: SEVERE STORMS, TORNADOES, STRAIGHT-LINI WINDS, AND FLOODING	E 4576: HURRICANE ZET/	'A 4598: SEVERE WINTER STORM	RMS 4626: HURRICAN
# of Climate		PA Obligations HM Obligations	PA Obligations HM Obligation	s PA Obligations HM Obliga	ions PA Obligations HM Obligation	ons PA Obligations HM Obligations	s PA Obligations HM Obligations	s PA Obligations HM Obligati	ons PA Obligations HM Obligations			-	Obligations PA Obligations HM Obligations	s PA Obligations HM Obligation	s PA Obligations HM Obligations	s PA Obligations HM O	bligations PA Obligations H	M Obligations PA Obligations HM Obliga	tions PA Obligations HM Obligation	ns PA Obligations HM Obligation	ons PA Obligations HM Obliga	ations PA Obligations HM Obligation	ons PA Obligations HN
de 22 County 5	\$109,877,869 \$1,661,207	\$6,993,818 \$157,841	\$4,115,298 \$83,79 \$393,399	\$60 \$112,849 \$	0,536 \$962,433 \$12, 4,969	,363 \$8,966,561 \$680,51	2 \$1,384,642 \$	\$0 \$2,416,821 \$63	,086 \$689,224 \$127,07	70 \$2,071,824 \$88,09	\$3,390,314 \$112,256 \$106,368 \$0	\$2,744,307	\$137,521 \$363,417 \$28,21	9 \$1,698,991 \$184,0	28 \$1,372,594 \$	\$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 \$973,623	\$0 \$911,665 \$0 \$0
county 4 ounty 3	\$6,177,717 \$149,989	\$141,975 \$0		\$149,989	\$0									\$330,226	\$0	\$5,705,515	\$0			\$0	\$0		\$0 \$0
ounty 5 County 3	\$163,106 \$779,511	\$0 \$0 \$195,583 \$0		\$0	\$0			\$583,928	so.										\$83,290	\$0		\$79,816	\$0 \$0 \$0
County 5	\$912,590		\$146,022	60				\$	\$676,703 \$23,73	33					-		\$36,602	\$0 \$29,529	\$0				\$0
County 5 County 7	\$353,660 \$1,939,110	\$82,861 \$0 \$60,023 \$0		\$0 \$	2,322						\$99,712 \$0 \$42,940 \$0			\$143,830 \$896,751	\$0 \$0			\$27,257 \$29,018	\$0 \$0 \$878,056	\$0			\$0 \$0
aw County 7 V County 6	\$1,812,910 \$549,526	\$672,585 \$27,774 \$397,859 \$0						\$110,706	\$0					\$477,575 \$19,9	79	\$108,031 \$5,413	\$0 \$396,260 \$0 \$132,957	\$0 \$0 \$0 \$0	\$0 \$0			\$13,297	\$0 \$0
e County 8	\$2,735,037 \$1,243,692	\$99.664 \$83.300	\$46,303	\$0 \$170,095 \$221,129	\$0 \$0				\$263,162 \$ \$180,869 \$	50	\$1,370,156 \$0		\$366.102 \$	0	\$243,920	80		\$48.707	\$786,519	\$0 \$45,520	\$0	\$40,925	\$0 \$12,356 \$0
unty 9	\$895,582	, , , , , , , , , , , , , , , , , , ,		Q221,120				\$90,841	\$0				\$555,15 <u>2</u>	\$50,011	\$0 \$30,960 \$	60	\$108,014	\$0 \$39,434	\$0 \$153,200	\$0		\$63,734	\$0 \$0
a County 7 County 4	\$2,217,116 \$230,936	\$0 \$0	\$120,375	\$108,725	\$0			\$51,163	\$0 \$1,368,722 \$	50				\$348,885	\$0			\$327,970	\$96,647	\$0		\$25,564	\$0 \$0
county 8 County 4	\$5,750,950 \$239,861	\$130,994 \$0	\$0	\$117,304 \$0	\$0				\$288,680	50			\$386,534 \$	0		\$836,744	\$0 \$108,867	\$3,815,244 \$0	\$0	\$280,980	\$0	\$25,464	\$0 \$0 \$0
County 6 County 3	\$9,728,494 \$39,553			\$102,677 \$34,272	\$0 \$1,852,250 \$0	\$0			\$722,698	\$6,476,840)		\$532,230	0								\$5,281	\$41,800 \$0 \$0
County 6	\$8,293,216			\$459,227	\$0				\$0 \$	50		\$65,925	\$0							\$148,246	\$0 \$7,584,784	\$0	\$35,034
County 8	\$2,353,271 \$1,107,628	\$669,660 \$103,476 \$0 \$0		\$154,041 \$0	\$0 \$0	50			\$288,333	50		\$32,390	\$0 \$0 \$	0 \$725,310 \$124,3	39			\$34,442	\$0 \$124,403 \$20,	060	\$1,105,371	\$0 \$79,073	\$0 \$0
County 4	\$13,939,525 \$46,405,498			\$3,157,985 \$4 \$8,017,534 \$3,5								\$702,311 \$1,705,695	\$0 \$94,275								\$9,512,907 \$32,644,255	\$0 \$0	\$130,464 \$382,004
unty 5	\$3,509,981 \$7,060,952	\$890,043 \$0 \$193,880 \$0		\$184,909 \$1,9 \$9,000					\$155,122 \$	50	\$5,963,131 \$0				\$230,442 \$	60		\$15.021	\$117,408 \$0 \$494,356	\$0 \$0		\$385,636 \$0	\$0 \$0 \$0 \$0
eys County 3 na County 5	\$1,468,497 \$3,292,237		\$131,816 \$60,284	50						20				\$1,336,681 \$3,190,472	\$0			\$10,021		20			\$0
a County 7	\$3,292,237 \$1,463,138	\$44,083 \$0	\$60,284	50		\$857,615	0	\$304,427	\$14,190 \$	50				\$3,190,472 \$98,877	\$0 \$0 \$158,136 \$	\$0 \$0	\$0		\$27,292	\$0			\$0 \$0
County 4 punty 7	\$23,295,206 \$2,124,308	\$31,570 \$0		\$8,661,285 \$0	\$0 \$0							\$5,584,195	\$0 \$274,160 \$	0		\$0	\$0	\$1,818,578	\$0		\$9,032,451	\$0	\$17,275 \$0 \$0
County 5 Davis County 8	\$340,710 \$4,218,310		\$163,519	\$29,210	\$0 \$0 \$0	\$0			\$43,126		\$143,923 \$0					\$51,543	\$31.841	\$2,895,089	90	\$1,179,520	\$0		\$0 \$0 \$0 \$0
nty 7	\$5,309,084			\$40,442	\$0	\$501,104	0		\$378,662				\$725,798	0		\$01,040	901,041	\$2,983,705	\$0	\$679,372			\$0
County 5	\$294,249 \$1,865,780	\$120,807 \$0 \$1,006,379 \$112,425		\$0 \$	1,415									\$610,754 \$26,5	\$12,250 60	50		\$86,569	\$0			\$129,777 \$23,093	\$0 \$0 \$0 \$0
unty 5 le County 4	\$2,442,949 \$319,720			\$419,977 \$27,782	\$0 \$1,027,009 \$0	\$0			\$98,210 \$272,52	20 \$625,232 \$ \$0 \$												\$291,938	\$0 \$0
e County 6	\$652,065			\$94,023 \$0	\$0	054.440			\$61,424 \$ \$171,684 \$	50						000.000	•	\$482,961 \$293,385	\$0	\$13,657	\$0	\$0 \$7,256	\$0 \$0
ounty 7 nty 5	\$590,294 \$12,223,106	\$94,536		\$0	\$0	\$51,143 \$1 \$8,059,949 \$103,22	5			50				\$1,037,599	\$0	\$66,826 \$2,927,796	\$0	\$293,385	\$0			\$7,256	\$0 \$0
County 5	\$2,265,465 \$785,362	\$0 \$0		\$667,909	\$0				\$219,073 \$60,456	50				\$591,423	\$0				\$1,454,970	\$0		\$56,997	\$0 \$0
s County 3	\$3,986,386 \$51,758			\$0		\$1,445,270 \$42,74 \$51,758 \$(\$2,498,373	\$0								\$0
ounty 8	\$2,799,195				\$0 \$43,721	\$0	\$1,600,667	50	\$162,319	60			\$0 \$	0		\$0	\$0		\$702,955	\$0			\$0
County 3 County 5	\$8,790,192	\$309,795 \$0 \$4,554,276 \$1,705,885						\$1,276,731 \$227,604	\$0 \$0						\$0 \$2,302,427 \$	60							\$0 \$0
nery County 7 County 5	\$2,750,812 \$918,892	\$188,506 \$0 \$255,707 \$0		\$0 \$4,165	\$0 \$0	\$0 \$6	0				\$2,443,464 \$0			\$118,843	\$0	\$9,700	\$0	\$0	\$0			\$649,319	\$0 \$0
County 7 County 6	\$542,457 \$84,095	\$140,899 \$0 \$4,822 \$0		\$149,951 \$0	\$0 \$0	\$125,133	0						\$5,827 \$ \$79,273 \$	0		\$0	\$0	20	\$0			\$120,648 \$0	\$0 \$0 \$0
a County 4	\$552,748			\$U	40								\$13,213		\$281,329	\$0 \$57,082	\$0 \$214,338	\$0	•			φυ	\$0
ounty 7 or County 3	\$899,486 \$1,359,407	\$269,408 \$0		\$890,311 \$4	7,275			\$60,881	\$0 \$201,182 \$ \$61,821 \$	50				\$163,709	\$0		\$43,133	\$0 \$161,173	\$0				\$0 \$0
unty 7	\$300,091 \$1,852,761			\$16,926 \$346,992	\$0 \$0	\$0			\$29,222	\$0 \$25,983 \$			\$133,927	0						\$1,499,301	\$94,033 \$0	\$0 \$3,072	\$0 \$0 \$3,396
County 3	\$281,904 \$1,106,854	60						\$66,151	00					\$281,904 \$474,587	\$0 en	\$0 \$408,121	\$0 \$0 \$157.994	60					\$0
County 6 County 8	\$1,509,411	\$0 \$0 \$78,792 \$24,257						\$157,989	\$0 \$816,938 \$	50				\$474,587 \$285,734	\$0	\$400,121	11 111	\$0 \$0 \$110,444	\$0			\$24,273	\$0 \$0
ounty 4 nty 5	\$906,150 \$184,397	\$12,927 \$87,477		\$0 \$10,072	\$0 \$0	\$512,236 \$42,46	4									\$0	\$0					\$351,450 \$73,922	\$0 \$0 \$0 \$0
County 4 County 6	\$1,792,780 \$51,306		\$91,589	\$0	\$0	\$0 \$(0							\$1,675,383	\$0	\$6.621	\$0		\$25,807	\$0 \$0	\$0	\$44,685	\$0 \$0
inty 7	\$261,749	\$7,486 \$0		\$0 \$0	\$0	70						40.11	80			\$6,621 \$0	\$0	\$47,454	\$0	\$60,274	\$0	\$146,535	\$0 \$0
County 4	\$1,393,560 \$3,015,311	\$0 \$0		\$153,386	\$ 0				\$90,887	50		\$6,419	\$0	\$2,919,922 \$724,375 \$392,4	\$0		\$4,501	\$0 \$0	\$0		\$1,223,655	\$0	\$10,100 \$0
ty 7	\$1,929,402 \$248,982	\$47,419						\$180,248	\$0 \$373,265 \$44,06 \$129,699 \$	50				\$724,375 \$392,4	38		\$151,122	\$0 \$22,319 \$71,865	\$0 \$0			\$41,567	\$0 \$0 \$0
unty 4	\$469,466	\$68,540 \$0 \$203,004 \$0						\$171,664	\$0					\$289,507 \$40,6	70	\$229,261	\$0						\$0
to County 4 unty 5	\$558,273 \$453,839	\$43,850 \$0	\$262,519	50					\$111,001	50					15		\$25,084	\$36,469	\$0				\$0 \$0
ounty 3	\$519,479 \$1,077,005			\$137,915					\$123,090 \$	50				\$477,076	\$0			\$733,789				\$58,347	\$0 \$0 \$23,865
unty 8 n County 5	\$4,509,643 \$3,766,592		\$721,839 \$53,99 \$734,407 \$818,4	\$63,719		\$0 \$i	0		\$485,986						\$0 \$244,851 \$		\$57.862	\$0	\$1,754,273	\$0		\$590,496	
inty 8	\$6,553,378				\$0 \$575,700 \$470,	.199 \$846,788 \$6	0		\$930,446				\$2,913,963	0			300,100			\$60,074	\$0 \$586,509	\$0	\$13,743
ounty 6 County 5	\$726,910			\$197,977	\$0						\$34,135 \$0			\$431,104	5 0			\$0	\$0 \$116,171	\$0		\$90,720	\$0 \$0 \$0 \$24,065
County 5 na County 3	\$69,529,169 \$126,538	\$27,908 \$0		\$0	\$0	\$69,405,864	0							\$126,538	\$0			\$0	\$0			\$95,398	\$0 \$0 \$0
	\$4,121,786			\$0 \$0							\$3,242,111 \$0		\$231,796 \$5,781,229 \$28,21	\$133,769		60			\$157,906			\$103,249	\$0 \$0

DISASTER OCCURRENCES 2011–2021

	TOTAL DISASTERS		TOTAL DISASTERS
California	25	Virginia	11
Mississippi	22	Florida	11
Oklahoma	22	Georgia	11
lowa	21	Minnesota	11
Tennessee	20	Connecticut	10
Louisiana	18	Hawaii	10
Alabama	17	Maryland	10
Texas	17	New Mexico	10
Vermont	17	Wisconsin	10
West Virginia	17	ldaho	9
Arkansas	16	Massachusetts	9
Kentucky	16	Pennsylvania	9
New Hampshire	16	South Carolina	8
New York	16	Colorado	7
Washington	16	Utah	7
Alaska	15	Maine	6
North Carolina	15	Michigan	6
Nebraska	14	Ohio	6
Missouri	13	Arizona	6
Kansas	13	Delaware	5
New Jersey	13	Illinois	5
North Dakota	13	Indiana	4
South Dakota	13	Rhode Island	4
Montana	12	Wyoming	4
Oregon	12	Nevada	3

FEMA AND HUD COST PER CAPITA 2011-2021

	PER CAPITA		PER CAPITA
Louisiana	\$1,736	New Mexico	\$97
New York	\$1,348	Arkansas	\$81
New Jersey	\$815	Massachusetts	\$73
North Dakota	\$738	Georgia	\$64
Vermont	\$593	Montana	\$63
Texas	\$518	Kansas	\$60
West Virginia	\$481	New Hampshire	\$55
Alaska	\$401	Rhode Island	\$53
Florida	\$390	Minnesota	\$49
Nebraska	\$390	Pennsylvania	\$49
South Carolina	\$289	Virginia	\$49
Alabama	\$275	Maryland	\$39
South Dakota	\$269	Washington	\$36
North Carolina	\$243	Wyoming	\$32
Hawaii	\$229	Idaho	\$32
lowa	\$228	Wisconsin	\$27
Oklahoma	\$215	Illinois	\$24
Oregon	\$210	Michigan	\$23
Missouri	\$162	Ohio	\$19
Mississippi	\$159	Maine	\$18
California	\$157	Delaware	\$14
Connecticut	\$149	Utah	\$11
Colorado	\$141	Nevada	\$11
Kentucky	\$105	Indiana	\$7
Tennessee	\$97	Arizona	\$2

MAPPING THE IMPACT

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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 decisionmaking 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.

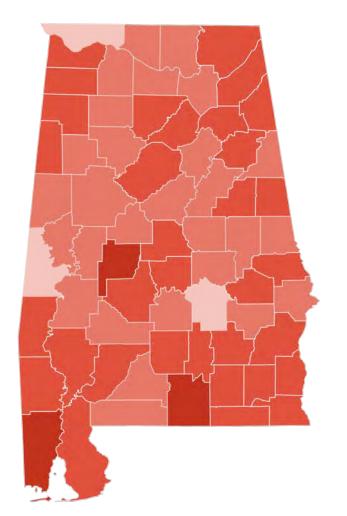


GEOGRAPHIC MAP. SOURCE: ESRI WORLD IMAGERY BASEMAP

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,



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

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

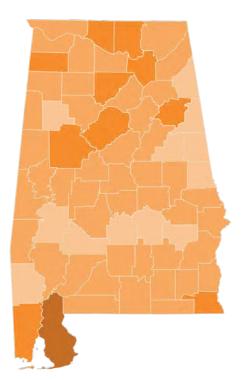
Importantly, extreme heat waves do not fit the criteria for federal disaster declarations despite being the leading cause of deaths among climate hazards. Likewise, sea level rise is not included in this definition despite the threat it poses to numerous communities, including damage to property, loss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

MAPPING THE IMPACT



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

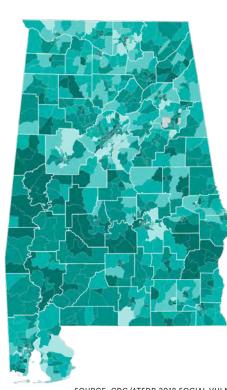
The Disaster Declaration tables provided at the end of each chapter show all federal Disaster Declarations declared between 2011-2021 and the corresponding FEMA obligations associated with those events. However, in some instances, FEMA continues to obligate funds for years following a declaration. Some 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.

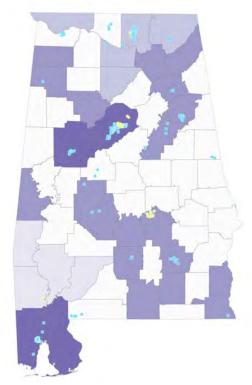
Viewing the Energy Reliability Map next to the SVI Map, one can begin to infer which regions have the most socially vulnerable residents and are served by the least reliable energy providers. Energy reliability is increasingly becoming related to climate disasters and weather events. Inclusion of these 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

MAPPING THE IMPACT

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

THANK YOU

FUNDERS

Siegel Family Endowment

with

Rockefeller Brothers Foundation
Tiger Global Philanthropic Ventures

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