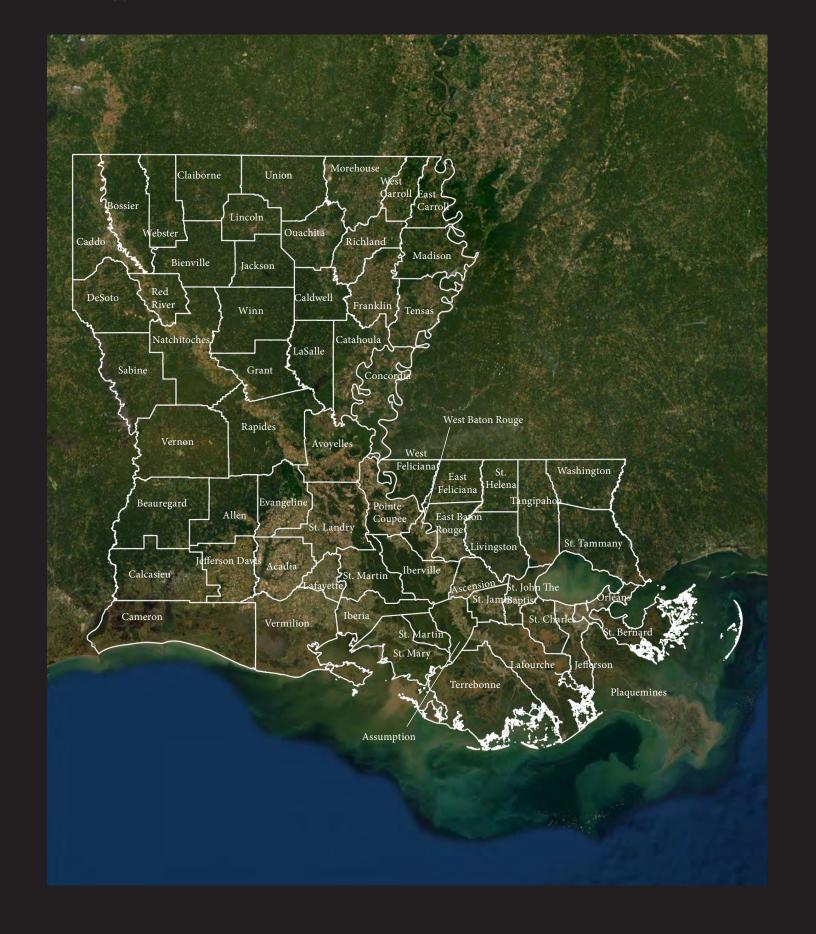
# 



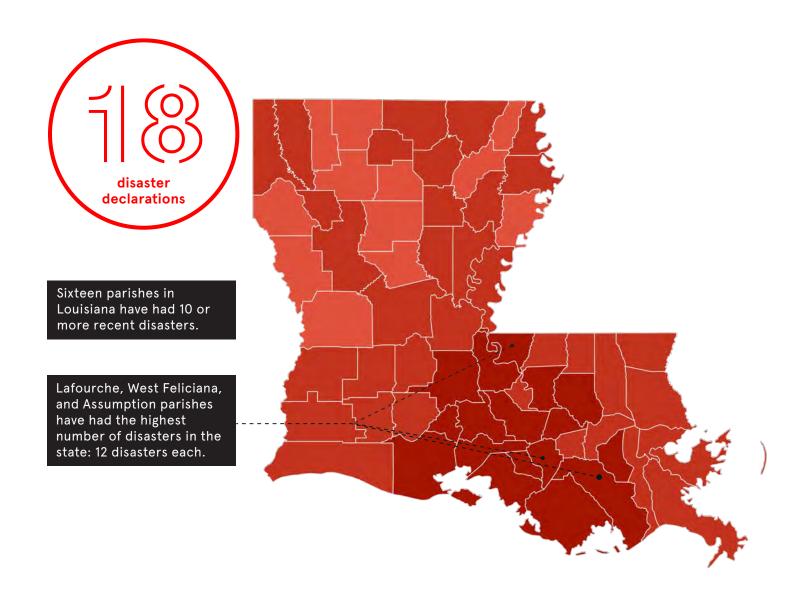
#### LOUISIANA STATISTICS SUMMARY (2011 - 2021) 18 **CLIMATE DISASTER DECLARATIONS 6TH HIGHEST** NUMBER OF DISASTERS IN THE COUNTRY **HIGHEST** PER CAPITA SPENDING ON CLIMATE DISASTERS IN THE NATION LAFOURCHE, WEST FELICIANA, PARISHES WITH THE HIGHEST DISASTER OCCURENCES **ASSUMPTION** ALL PARISHES HAVE 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 OF CLIMATE INFRASTRUCTURE COULD BE SUPPORTED THROUGH

A SMALL INSURANCE SURCHARGE

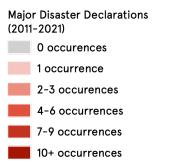
\$5.2 BILLION

## **DISASTER OCCURRENCES 2011-2021**

#### FEDERALLY DECLARED MAJOR DISASTERS BY PARISH



#### **Number of Disaster Events**

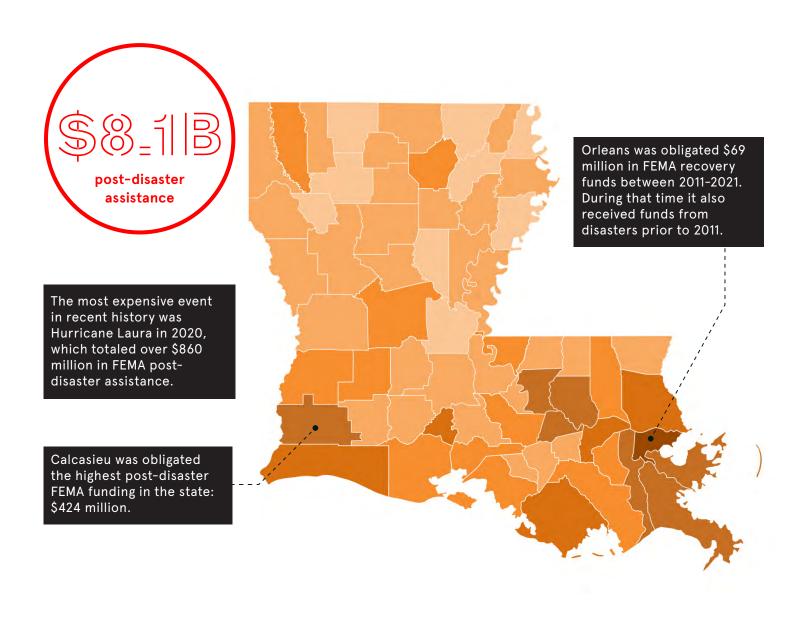


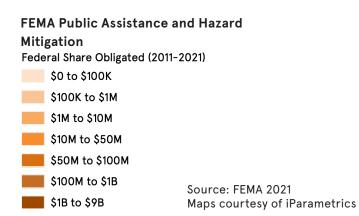
Source: FEMA 2021

Maps courtesy of iParametrics

## **FEDERAL ASSISTANCE 2011–2021**

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





**\$2.5B** FEMA obligations

**\$5.6B** HUD CDBG-DR Funds

**\$8.1B** FEMA + HUD assistance

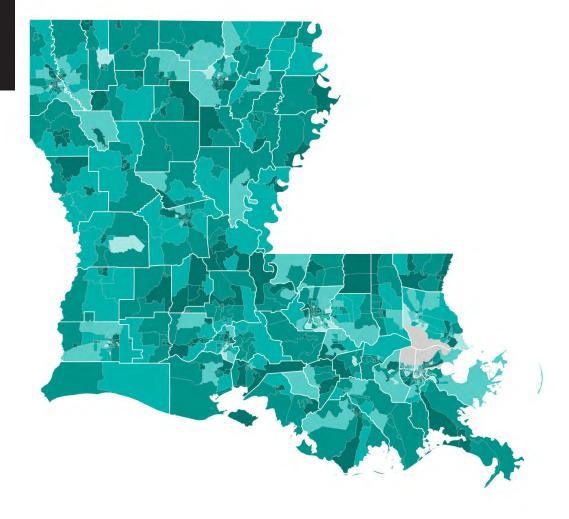
\$1736 per capita cost

MAPPING THE IMPACT

## **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



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

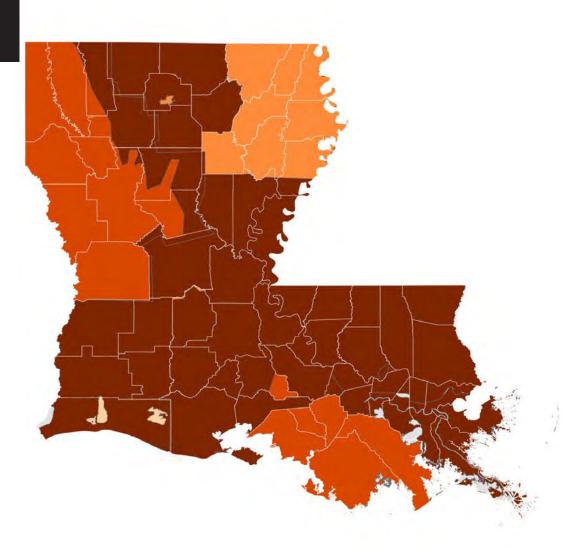
Vulnerability Index

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

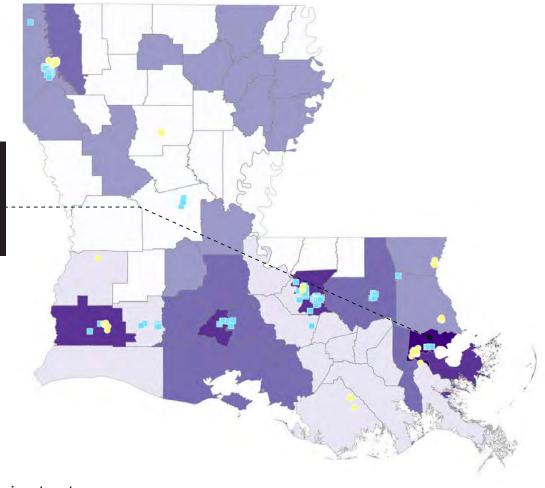
456-7,700 minutes

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



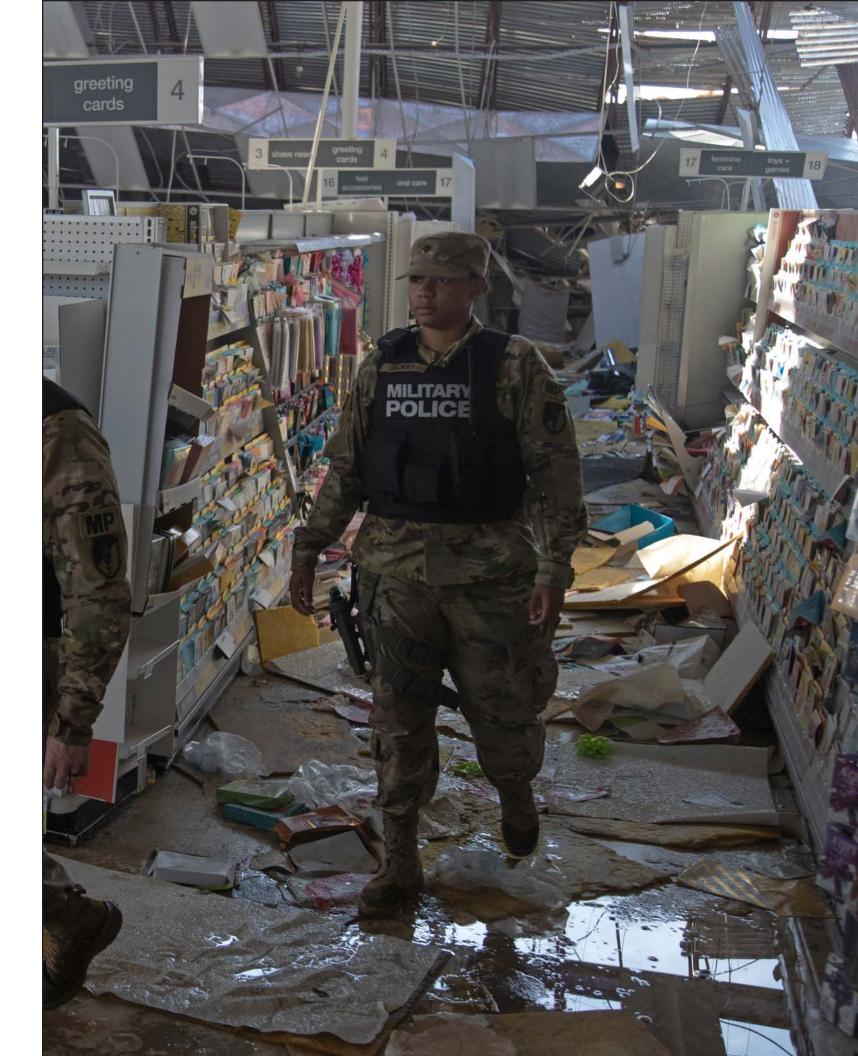
Wastewater Discharge Sites

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. MAPPING THE IMPACT

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
	<u> </u>						•

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



#### LOUISIANA

TOTAL: 18 DISA				2011	2012	2	2013	20	15		201	16		2	017			2019			20	20		20	21	
HUD CDBG-DR: FEMA + HUD AS	\$5.6B SSISTANO		4015: FLOODING	4041: TROPICAL STORM LEE	4080: HURRICAN		4102: SEVERE STORMS AND FLOODING	4228: SEVERE FLOO	STORMS AND	4263: SEVERE STO	ORMS AND	4277: SEVERE STOR FLOODING	RMS AND TO	4300: SEVERE STORMS, ORNADOES, AND STRAIGHT LINE WINDS	- 4345: TROPICAI	L STORM HARVEY	4439: SEVERE STORMS AND TORNADOES	4458: HURRICANE BAR	RRY 4462: FLOODING	4559: HURRIC	ANE LAURA	4570: HURRICANE DELTA	4577: HURRICANE ZETA	4590: SEVERE WINTER STORMS	4606: SEVERE STORMS, TORNADOES, AND FLOODING	4611: HURRICANE IDA
	# of Climate Disasters 2011-2021	Total FEMA	PA Obligations HM Obl	gations PA Obligations HM Obligations	PA Obligations HM	// Obligations PA	A Obligations HM Obligations	PA Obligations	HM Obligations	PA Obligations HN	M Obligations	PA Obligations HM	Obligations PA	Obligations HM Obligation	ns PA Obligations	HM Obligations	PA Obligations HM Obligations	PA Obligations HM Oblig	pations PA Obligations HM Oblig	igations PA Obligations	HM Obligations	PA Obligations HM Obligation	ns PA Obligations HM Obligation	s PA Obligations HM Obligations	PA Obligations HM Obligations	PA Obligations HM Obligations
Statewide		8 \$832,370,927			4 \$109,793,036	\$5,852,421	\$594,188 \$930	0 \$1,013,247	\$0			\$247,646,188	\$13,105,156		\$3,239,272	2 \$13,753		\$22,286,392	\$0 \$5,194,235	\$0 \$321,971,429	\$0	\$34,239,889	\$0 \$5,001,700	\$0 \$9,460,194 \$0		\$10,999,698 \$0
Acadia Parish Allen Parish	9	9 \$7,110,859 9 \$17,119,855			\$6,977 \$7,694	\$0 \$0	\$3,914,829 \$0	0		\$62,693	\$223,500	\$1,054,429	\$0		\$5,125 \$131,069			\$118,494	\$0	\$1,638,434 \$16,522,129	\$0 \$0		\$0 \$0 \$0 \$0	\$0		\$0 \$0 \$0 \$0
Ascension Parish	11	1 \$98,675,203	\$0	\$0	\$1,646,366	\$370,586				\$869,146	\$239,250		\$7,139,729					\$611,172	\$0	\$126,619	\$0	\$ 100 je 10	\$0 \$11,747	\$0 \$3,274 \$0	\$6,525 \$0	\$0 \$0
Assumption Parish  Avoyelles Parish	12	2 \$1,008,407 8 \$590,701	\$0 \$0	\$0 \$0	\$102,790 \$74,126	\$370,752 \$0				\$44,868	\$34,500	\$145,077 \$227,019	\$70,125 \$210,187		\$25,208	B  \$0		\$123,214	\$0 \$69,367	\$0 \$3,621 \$0	\$0 \$0	\$3,150 \$0	\$0   \$0   \$0	\$0 \$0 \$0 \$0 \$0	\$0  \$0	\$95,104 \$0 \$0 \$0
Beauregard Parish	8	8 \$10,641,261			\$0	\$0				\$577,016	\$0				\$188,986	6 \$0				\$9,867,724	\$0	\$7,535	\$0 \$0	\$0 \$0 \$0		\$0 \$0
Bienville Parish Bossier Parish		5 \$242,032 7 \$33,116,482			\$18,285	\$0		\$2,553,846	\$1,006,945	\$137,435 \$28,412,787	\$0 \$652,302									\$89,823 \$188,520	\$0 \$0	\$0 \$0	\$0 \$0	\$14,774 \$0 \$283,797 \$0		\$0 \$0 \$0 \$0
Caddo Parish	7	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 Caldwell Parish		8 \$424,564,291 7 \$1,838,629			\$59,425	\$0				\$1,501,592 \$493,672	\$643,692 \$315,053				\$2,270,234	4 \$670,326			\$879,278	\$416,982,934 \$0 \$52,124	\$0 \$0	\$1,671,848 \$28,241	\$0 \$0 \$0	\$0 \$150,887 \$0 \$10,837 \$0	\$667,727 \$0	\$5,050 \$0 \$0 \$0
Cameron Parish	9	9 \$34,691,537			\$1,878	\$0					40.0,000	\$425,976	\$187,500		\$274,959	9 \$0		\$26,340	\$0	\$33,774,884	\$0	\$0	\$0 \$0	\$0 \$0 \$0		\$0 \$0
Catahoula Parish Claiborne Parish	9	9 \$1,629,863 6 \$470,022	\$0	\$0	\$6,613 \$0	\$0 \$0	\$105,222 \$0	0		\$207,600 \$399,985	\$40,121 \$0								\$882,180	\$0 \$210,509 \$66,169	\$0 \$0	\$146,800 \$0	\$0 \$0	\$30,818 \$0 \$3,869 \$0		\$0 \$0 \$0 \$0
Concordia Parish	8	8 \$1,375,840	\$56,386	\$0	\$13,937	\$0	\$82,896 \$0	0		\$000,000	Ç								\$1,105,856	\$0 \$5,745	\$0	\$4,191	\$0	\$106,829 \$0		\$0 \$0
De Soto Parish East Baton Rouge Parish	10	6 \$1,203,338 0 \$239,364,932	\$0	90	\$6,767,270	\$1,031,989				\$1,119,775	\$0	\$185,713,002	\$30,009,660		\$20,972	2 \$0		\$2,908,802	\$0	\$62,590 \$703,674	\$0	\$0 \$1.762.624	\$0	\$0 \$0 \$0 \$220,540 \$0	\$17,520 \$0	\$0 \$0 \$240.844 \$0
East Carroll Parish	9	9 \$780,543	\$0 \$497,126	\$0	\$0,767,270	\$0	\$14,504 \$0	0		\$20,798	\$0	\$100,710,002	900,000					92,500,002	\$248,114	\$0 \$0	\$0	\$0	\$0	\$0 \$0	\$17,020 \$0	\$0 \$0
East Feliciana Parish	9	9 \$7,682,089 8 \$1,075,726		\$22,788	0 \$238,587	\$0	0000 040	•				\$7,252,861	\$105,750					\$7,075	\$0	\$0	\$0	\$11,769	\$0 \$0	\$0 \$0 \$0		\$43,259 \$0
Evangeline Parish Franklin Parish	8	8 \$349,912			\$68,919 \$30,046	\$0 \$0	\$208,849 \$0 \$147,085 \$0	0		\$172,781	\$0	\$255,772	\$0						\$0	\$542,185 \$0 \$0	\$0	\$0	\$0 \$0	\$0 \$0 \$0 \$0 \$0		\$0 \$0 \$0 \$0
Grant Parish	6	6 \$1,233,287						\$32,007	\$0	\$167,465	\$32,501									\$738,833	\$0	\$262,481	\$0	\$0 \$0		\$0 \$0
Iberia Parish Iberville Parish	11	0 \$8,623,034 1 \$3,000,140	\$0 \$0	\$0	\$155,367 \$1,108,723	\$0 \$0						\$1,027,166 \$1,044,601	\$231,000 \$289,583		\$16,879	9 \$0		\$1,047,216 \$269,999	\$0 \$0 \$76,577	\$5,129,765 \$0 \$168,686	\$0 \$0	\$1,006,317 \$0	\$0 \$0 \$0 \$0	\$0 \$9,323 \$0 \$0 \$7,500 \$0	\$0 \$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  Jefferson Parish	2	9 \$8,451,241 8 \$78,811,510		\$1,824,309 \$	\$0 0 \$30,536,761	\$0 \$8,573,541	\$281,301 \$0	0				\$787,200	\$240,000		\$21,425	5 \$0		\$770,025	\$0	\$6,942,551 \$1,045,801	\$0 \$0	\$178,763 \$136,211	\$0 \$0 \$0 \$1.945.782	\$0 \$0 \$0 \$0 \$0 \$0		\$0 \$0 \$33,979,080 \$0
Lafayette Parish	10	0 \$39,102,260		\$1,521,500 ¢	\$488,602	\$0						\$13,714,131	\$4,802,648		\$25,22	1 \$0		\$2,074,653	\$0	\$4,211,664	\$0		\$0 \$0	\$0 \$166,478 \$0	\$0 \$0	\$101,336 \$0
Lafourche Parish  LaSalle Parish	12	2 \$15,101,926 7 \$958,186	\$0	\$738,285 \$919,215 \$ \$0	\$5,875,951 \$10,855	\$0 \$0				\$0 \$71,889	\$0 \$0				\$419,100	6 \$0		\$2,877,660	\$0	\$356,568 \$854,065	\$0 \$0		\$0 \$1,323,000	\$0 \$0 \$0 \$17,719 \$0	\$0 \$0	\$399,872 \$0 \$0 \$0
Lincoln Parish	-	7 \$6,514,923	Ç	40	\$20,716	\$0				\$786,469	\$93,070						\$3,223,479 \$0			\$2,299,979	\$0	\$0	\$0	\$91,209 \$0		\$0 \$0
Livingston Parish  Madison Parish	11	1 \$188,250,359 8 \$642,266	\$53,402	\$0	\$2,245,357 \$0	\$4,804,169	\$261,477 \$0 \$118,213 \$0	0		\$476,348 \$470,651	\$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 \$0 \$0
Morehouse Parish	,	7 \$871,264	\$33,402	φυ	\$145,232	\$0	φ110,213 φt	o .		\$399,398	\$0						\$0 \$0			\$326,634	\$0	\$0	\$0	\$0 \$0		\$0 \$0
Natchitoches Parish Orleans Parish	3	8 \$7,941,986 8 \$68,823,627			\$6,432 \$30,583,110	\$0 \$5.934.434		\$2,644,085	\$0	\$2,673,562	\$67,775			\$0 \$516,7	\$92,494	4 \$0		\$3,831,105	60	\$2,283,818 \$601,225	\$0	\$0 \$24,360	\$0 \$0 \$2.431.475	\$173,821 \$0 \$0 \$14,152 \$0		\$0 \$0 \$24,887,065 \$0
Ouachita Parish	-	7 \$17,817,125			\$461,591	\$5,934,434				\$12,577,432	\$596,129			\$0 \$510,i	00			\$3,631,105	\$1,067,874	\$0 \$3,016,458	\$0	\$9,815	\$0 \$2,431,475	\$87,826 \$0		\$24,007,005 \$0
Plaquemines Parish	9	9 \$83,024,861		\$898,274		\$12,118,481									\$489,89	1 \$0		\$1,342,412	\$0	\$329,996	\$0	\$129,079	\$0 \$1,391,317	\$0 \$0 \$0		\$0 \$0
Pointe Coupee Parish Rapides Parish	10	0 \$1,058,394 9 \$10,623,775	\$21,167	\$0	\$325,614 \$342,911	\$0		\$177,274	\$0	\$143,512	\$114,288	\$240,726	\$95,813		\$25,879	9 \$0		\$92,858	\$0 \$81,655 \$5,006	\$0 \$84,960 \$0 \$8,876,569	\$0	\$81,226 \$938,335	\$0 \$0 \$0	\$0 \$10,613 \$0 \$0 \$0		\$23,763 \$0 \$0 \$0
Red River Parish	1	7 \$469,220						\$168,585	\$0	\$291,544	\$0				\$0	0 \$0				\$9,092	\$0	\$0	\$0	\$0 \$0		\$0 \$0
Richland Parish Sabine Parish		6 \$956,949 6 \$2,859,966			\$3,191	\$0				\$853,826 \$1,712,096	\$0 \$0				\$432,678	8 \$0				\$0 \$604,938	\$0 \$0	\$78,717 \$0	\$0 \$0	\$21,216 \$0 \$110,254 \$0		\$0 \$0 \$0 \$0
St. Bernard Parish	8	8 \$7,209,101		1-1-111	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 St. Helena Parish		1 \$23,533,875 9 \$1,042,052	\$0	\$0 \$495,255 \$	\$4,636,039 \$180,700	\$6,209,500 \$0				\$96,939	\$91,988	\$445,325 \$531,126	\$538,486 <b>\$</b> 0		\$362,200	\$0		\$38,934 \$28,288	\$0 \$0	\$182,253 \$0	\$0 \$0	\$40,568 \$20,750	\$0 \$664,753 \$0 \$0	\$0 \$0 \$0 \$0 \$0 \$0		\$9,920,563 \$0 \$92,261 \$0
St. James Parish	8	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 St. Landry Parish	h 8	8 \$60,805,291 0 \$4,236,069	\$0	\$0	\$49,434,136 \$202,239	\$3,175,124 \$0	\$93,519 \$0	0				\$180,775 \$2,548,102	\$301,560 \$0					\$156,845 \$207,087	\$0 \$0	\$109,964 \$507,014	\$0 \$0	\$0 \$518,891	\$0 \$0 \$0 \$0	\$0		\$7,446,887 \$0 \$51,392 \$0
St. Martin Parish	10	0 \$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 St. Tammany Parish	10	0 \$10,127,321 8 \$34,090,165	\$394,832	\$0	\$784,084 \$7,447,946	\$563,996 \$4,451,828				\$19,933,313	\$887,453	\$58,062	\$705,000		\$47,894	4 \$0		\$3,032,557	\$0 \$4,826,305	\$0 \$260,179 \$39,553	\$0	\$167,973	\$0 \$0 \$0 \$549,338	\$0 \$11,023 \$0 \$0 \$0 \$0		\$38,478 \$0 \$17,673 \$0
Tangipahoa Parish	9	9 \$17,854,466				\$4,451,828						\$6,718,439						\$281,293	\$0	\$126,611	\$0	\$0		\$0 \$0 \$0 \$0 \$25,364 \$0		\$17,673 \$0 \$1,084,390 \$0
Tensas Parish	10	6 \$81,528	\$5,255	\$0	\$0	\$1 514 007												es 225 270	80	\$0	\$0	\$0	\$0	\$76,274 \$0		\$0 \$0 \$387,772
Terrebonne Parish Union Parish	7	0 \$16,648,791 7 \$3,574,348	\$2,644,098	\$0 \$687,983 \$839,20	8 \$2,668,736 \$4,526	\$1,514,067 \$0				\$3,455,844	\$38,849						\$39,846 \$0	\$5,235,379	\$0 \$0	\$0 \$1,923,660 \$35,282	\$0 \$0		\$0 \$332,261 \$0	\$0 \$0 \$0 \$0 \$0		\$287,772 \$0 \$0 \$0
Vermilion Parish	10	0 \$13,171,998			\$302,115	\$0	\$104,487 \$0	0			•	\$2,173,988	\$230,014		\$129,558			\$707,430	\$0	\$8,343,553	\$0		\$0 \$0	\$0 \$0 \$0		\$251,708 \$0
Vernon Parish Washington Parish	8	6 \$3,573,126 8 \$5,147,601			\$561,560	\$1,239,998				\$1,207,760 \$1,386,326		\$214,200	\$5,100		\$23,582	2 \$0				\$814,531 \$0	\$0 \$0	\$10,345 \$0	\$0 \$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 West Carroll Parish	£	8 \$1,102,094 6 \$736,957	\$0	\$0	\$210,302 \$0	\$0 \$0				\$736,957	\$0	\$466,134	\$179,175							\$66,136 \$0	\$0 \$0	\$150,665 \$0	\$0 \$0 \$0	\$0 \$3,005 \$0 \$0 \$0		\$26,677 \$0 \$0 \$0
West Feliciana Parish	12	2 \$8,551,108	\$24,539	\$0 \$4,546 \$	0 \$112,011	\$0		\$71,789	\$0		00	\$4,740,586	\$331,023					\$54,540	\$0 \$2,969,452	\$0 \$27,224		\$199,528	\$0 \$0	\$0 \$3,545 \$0		\$12,326 \$0
Winn Parish Total FEMA Allocation		5 \$5,469,944 \$2,495,741,785	\$5,553,128	\$837,363 \$5,570,929 \$849,61	2 \$330,406,851	\$57.876.796	\$5,926,569	0 \$7.251.744	\$1,006,045	\$1,040,140 \$111 111 008	\$0 \$9.973.738		\$90 338 126	<u>\$0</u> \$516	00 - \$8.242.626	0 \$684.070	\$22.843.008	\$49 152 174	\$0 \$17.563.409	\$4,400,317 \$0 \$860,146,914	\$0 \$0		\$0 \$0 \$16,564,490	\$0 \$0 \$0 \$11,411,598 \$0	\$782,770 \$0	\$3,485 \$0 \$92,402,895 \$0
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#### **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	Delaware	9
Arkansas	16	Idaho	9
New Hampshire	16	Massachusetts	9
New York	16	Pennsylvania	9
Washington	16	South Carolina	8
Alaska	15	Colorado	7
North Carolina	15	Utah	7
Nebraska	14	Maine	6
Missouri	13	Michigan	6
Kansas	13	Ohio	6
New Jersey	13	Arizona	5
North Dakota	13	Illinois	5
South Dakota	13	Indiana	4
Kentucky	12	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
Iowa	\$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

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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. 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.

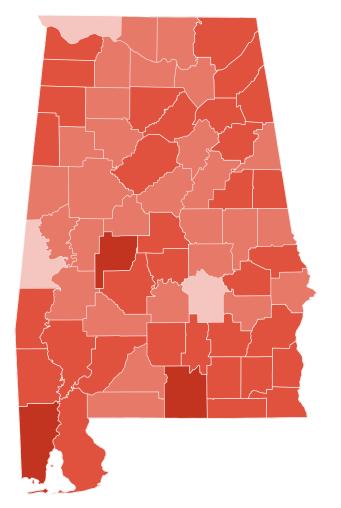


GEOGRAPHIC MAP. SOURCE: ESRI WORLD IMAGERY BASEMAP

#### **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



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

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."

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.

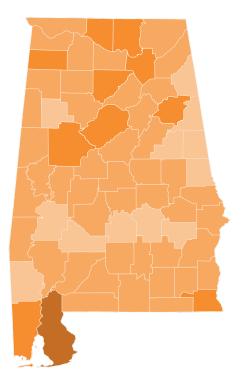
#### FEDERAL ASSISTANCES (ORANGE):

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

MAPPING THE IMPACT



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.

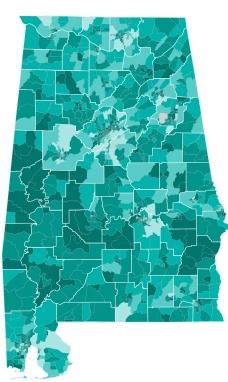
#### **SOCIAL VULNERABILITY INDEX (GREEN):**

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.

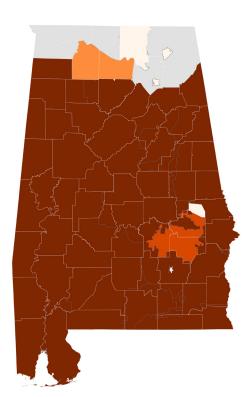
The factors that determine social vulnerability are directly tied to social determinants of health or the social, economic, and physical factors - such as race, socioeconomic status, and environmental conditions - that influence health. Socially vulnerable populations fare the worst during a disaster and often take longer to recover.<sup>2</sup> 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.

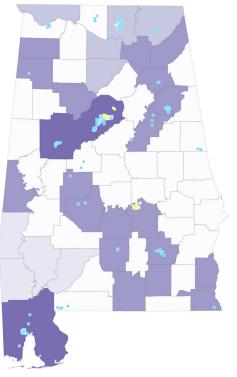
#### **COMPOUNDING RISKS (PURPLE):**

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

MAPPING THE IMPACT

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

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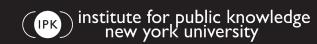
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Flanagan, B., Gregory, E., Hallisey, E., Heitgerd, J. & Lewis, B. (2011). A Social Vulnerability Index for Disaster Management. Journal of Homeland Security and Emergency Management, 8(1), 0000102202154773551792. https://doi.org/10.2202/1547-7355.1792