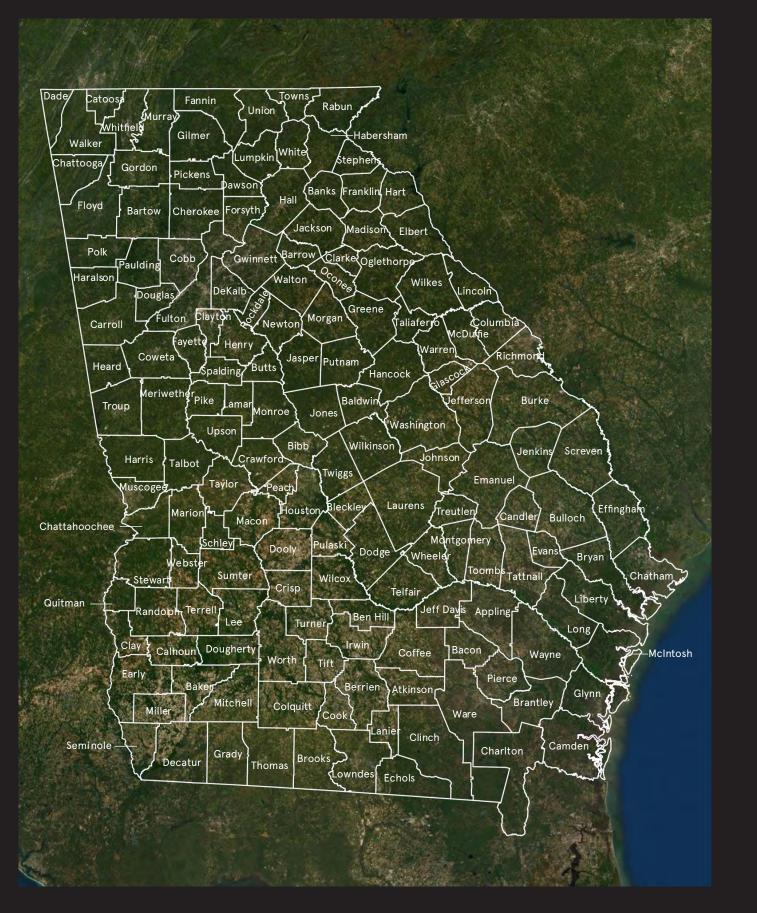
# 



GEORGIA STATIST	ICS SUMMARY (2
11	CLIMATE DISAST
ALL	COUNTIES HAVE
PICKENS	COUNTY WITH 1
8	COUNTIES WITH
103	SUPERFUND SIT
221	WASTEWATER D
C+	ASCE INFRASTR
CHATHAM, CLAYTON	HIGHEST NEED
\$675 MILLION	FEMA + HUD PO
10.5 MILLION	POPULATION TO
\$64	PER CAPITA SPE
\$9.5 BILLION	OF CLIMATE INF A SMALL INSUR

#### (2011 - 2021)

#### TER DECLARATIONS

#### 'E HAD CLIMATE DISASTERS IN TEN YEARS

#### THE HIGHEST DISASTER OCCURENCES

#### H FIVE OR MORE DISASTERS

#### ES

DISCHARGE SITES

RUCTURE REPORT CARD GRADE

FOR INVESTMENT

#### OST-DISASTER FUNDING

OTAL

#### ENDING ON CLIMATE DISASTERS

# FRASTRUCTURE COULD BE SUPPORTED THROUGH

# **DISASTER OCCURRENCES 2011-2021**

FEDERALLY DECLARED MAJOR DISASTERS BY COUNTY

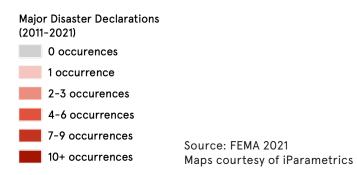
### **FEDERAL ASSISTANCE 2011-2021** POST-DISASTER PUBLIC ASSISTANCE AND HAZARD MITIGATION FUNDS **OBLIGATED BY COUNTY FOR CLIMATE DISASTERS**

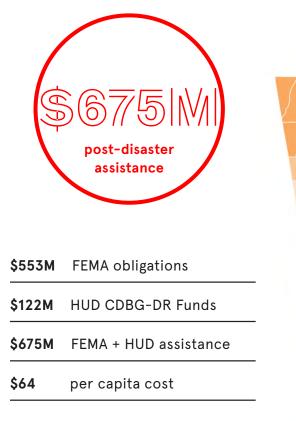


Every county in Georgia has had a recent disaster declaration.

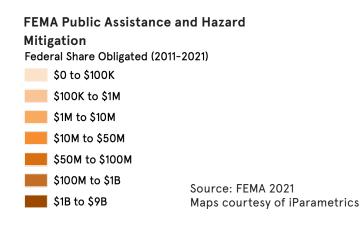
Pickens County has had the highest number of recent disasters in the state: 7 disasters.

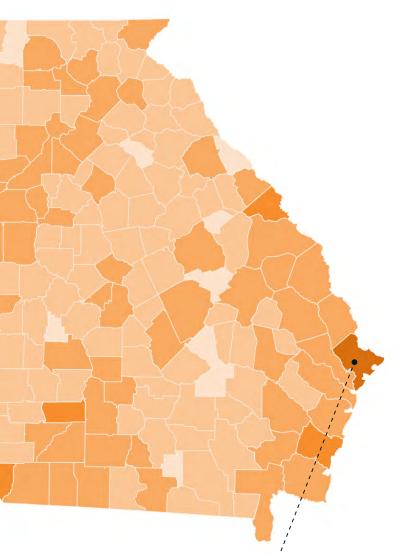






The most expensive disaster in recent history was Hurricane Irma in 2017, which totaled over \$133 million in FEMA post-disaster assistance.





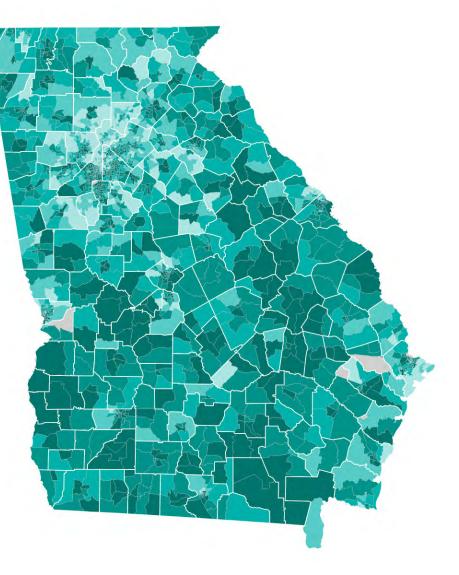
Chatham County has recieved the most post-disaster assistance in the state: \$56 million.

# **SOCIAL VULNERABILITY INDEX 2011-2021**

#### **AREAS OF GREATEST SOCIAL VULNERABILITY**

# **ENERGY RELIABILITY 2011-2021** COUNTIES AT GREATEST RISK OF POWER OUTAGES

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.

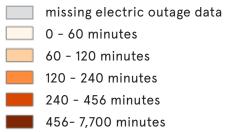


#### **Social Vulnerability Index**

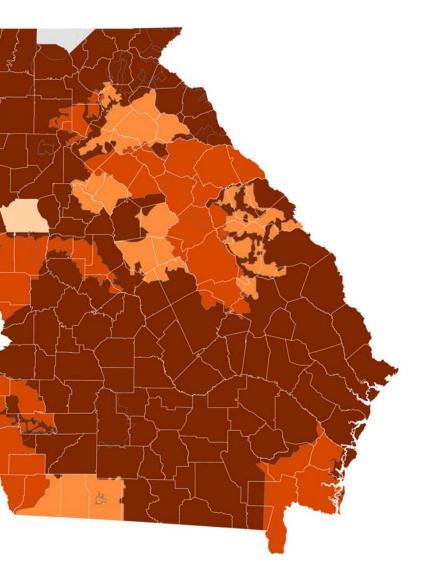
CDC (2018)	
No Value	
0.0 - 0.2	
0.2 - 0.4	
0.4 - 0.6	
0.6 - 0.8	Source: CDC/ATSDR 2018 Social Vulnerability Index
0.8 - 1.0	Maps courtesy of iParametrics

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

#### Aggregated Annual Electric Outage Duration Including major events - SAIDI\_W\_MED



Administration Maps courtesy of APTIM



Source: U.S. Energy Information

# 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



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					I		0
Calhoun							+
							0
Camden							1
Candler					1		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					4		0
					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		1					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	· · <b>,</b>						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
Pickens Pierce							0
Pike							0
Polk Dulashi					1		3
Pulaski							0
Putnam							0
Quitman							0
Rabun							0
Randolph							0
Richmond			1		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



2.75%

AND 2000

3.93

310

MAPPING THE IMPAC	Т
-------------------	---



#### GEORGIA

IA PA + HM: \$553 M O CDBG-DR: \$122 M IA + HUD ASSISTANO # of Climate Disasters	CE: \$675 M	SEVERE STORMS, DOES, STRAIGHT-LINE S, AND ASSOCIATED FLOODING	4165: SEVERE WINTER	STORM 4215: SEVER	4259: SEVERE STORMS AND RE WINTER STORM FLOODING		94: SEVERE STORMS, NADOES, AND STRAIGH LINE WINDS	4297: SEVERE STORMS, T- TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING	4338: HURRI	CANE IRMA	4400: HURRICANE	MICHAEL 4579: TRC	4 DPICAL STORM ZETA	600: SEVERE STORMS AND TORNADOES
ty Name 2011-2021	Total FEMA Obligations PA Obligations   11 \$224,684,550 \$7,533   3 \$839,948 \$839,948		PA Obligations HM Ob   00 \$16,008,370.79 \$5,5	-		S PA Obligations HM Obligations PA O   00 \$21,041,057.28 \$3,831,637.25 \$2	ligationsHM Obligation114,636.63\$529,120		PA Obligations \$52,718,268.96 \$389,890	-	5 \$75,751,196.56	Obligations PA Obligation   \$1,954,940.25 \$7,399,62   \$0 \$		Obligations HM Obligation   \$2,612,434.60 \$0
on County County County	2 \$129,113 2 \$300,483 5 \$2,284,798				\$41,845	50 S0	\$24,961	\$0 \$45,160 \$0	\$71,825 \$269,419 \$43,750	\$0 \$0 \$0	\$7,064	\$5,091 \$24,000 \$0		
rin County County	2 \$640,827 3 \$1,177,362		\$211,816	\$12,759					\$416,252 \$1,057,680	\$C \$C	0		4,146 \$0	
w County		474,823 \$	50 0	\$117,5	\$25 \$0				\$148,977 \$0	\$0 \$28,500	0	\$0		
ill County n County County	2 \$739,615 3 \$201,880 1 \$2,425,064							\$51,185 \$0	\$320,280 \$129,885 \$2,425,064	\$C \$C \$C	\$20,810	\$0		
ley County ley County	2 \$179,412 3 \$1,992,986					\$562,306 \$0		\$758,022 \$0	\$89,685 \$672,658	\$C	)	\$0		
s County County ch County	3 \$623,906   2 \$1,711,303   5 \$3,940,943		\$176,071	\$0		\$1,295,133 \$0 \$2,111,762 \$27,000		\$151,014 \$0 \$514,633 \$0	\$372,461 \$416,170 \$1,084,500	\$0 \$0 \$0	)	\$0		
County	3 \$1,417,362 2 \$226,193		\$1,309,538 \$74,108	\$0 \$0		φ2,111,702 φ27,000		φυ 14,000	\$18,374 \$152,085	\$C \$C \$C	\$89,450	\$0		
un County en County	4 \$266,943 2 \$3,161,356					\$734,788 \$38,248	\$87,908	\$0 \$51,733 \$0	\$0 \$2,388,320	\$13,500 \$0	)	\$0		
er County Il County sa County	4 \$497,841 4 \$2,252,604 2 \$5,020,058 \$4,	950,230 \$42,82	\$24,412 \$358,830	\$0 \$0	\$1,615,007	\$222,478 \$0 \$0			\$205,645 \$128,122 \$0	\$0 \$0 \$27,000	0	\$0 \$150	0,644 \$0	
ton County am County	1 \$622,570   2 \$56,391,947	φτ <u>ε</u> ,σε				\$48,442,567 \$527,610			\$622,570 \$6,422,825	\$948,538	0	\$0		
ahoochee County ooga County	3 \$96,634 1 \$28,500				\$57,704	0 <mark>0</mark>			\$16,430 \$0	\$0 \$28,500	)	\$22,500		
skee County e County County	3 \$315,533 1 \$430,240 3 \$256,168	\$5,976 \$10,29	37					\$91,701 \$0	\$80,597 \$430,240 \$22,632	\$30,000 \$0 \$0		\$188	8,663 \$0	
on County	1 \$422,304 1 \$139,183								\$386,304 \$139,183	\$36,000 \$0	)			
County e County	1 \$94,251 2 \$552,432								\$26,751 \$501,650	\$67,500 \$0	\$50,782	\$0		
itt County nbia County County	3 \$1,573,326   2 \$8,632,095   3 \$1,008,643		\$8,351,041	\$39,110				\$472,268 \$0 \$534,122 \$0	\$411,199 \$241,944 \$419,005	\$C \$C \$C	)	\$0 \$0		
ta County		\$15,016 \$58,14	43 \$258,471	\$31,955	\$117,225	50			\$258,135 \$14,745	\$C \$C	0	\$0		\$6,258,859
County County		119,669 \$21,00	00 \$5,525	\$992,637	\$542,246 \$1,047,9	29		\$219,740 \$0	\$439,981 \$0	\$0 \$0	0	\$0		
on County ur County b County	3 \$1,022,799   3 \$7,531,782   1 \$2,775,461			\$858,8		0			\$67,677 \$204,689 \$2,657,775	\$0 \$19,800 \$117,686	\$7,075,072	\$70 \$0	0,809 \$0	
e County County	2 \$1,235,775 2 \$82,383								\$312,601 \$35,950	\$C \$C	0 \$923,174 0 \$46,432	\$0 \$0		
herty County las County	4 \$41,432,080 3 \$2,499,343 3 \$750,653				\$1,382,431 \$1,043,0		\$36.912	\$0 \$10,015,060 \$2,495,481	\$721,434 \$13,432 \$56,669	\$0 \$0 \$24,000	0		0,387 \$0	
County Is County Jham County	3 \$750,653   3 \$291,769   2 \$1,767,348					\$1,490,320 \$0	\$36,912	\$0 \$169,183 \$0	\$56,669 \$111,254 \$277,027	\$24,000 \$0 \$0	\$11,332	\$0 \$0		
t County uel County	2 \$109,485 4 \$988,776		\$118,190	\$31,7	61 \$0	\$0 \$27,000			\$49,223 \$485,639	\$28,500 \$0	2) 2) \$357,948	\$0		
	3 \$600,255   5 \$622,201   3 \$2,495,349		\$20,906	\$30,191 \$0	\$139,224 \$139,224 \$1,518,772 \$461,3				\$202,351 \$0 \$263,290		)	<b>\$0</b> \$81	1,332 \$0	\$313,287
te County County th County	\$2,100,010	918,353 \$51,84	\$251,921 \$5	\$0 \$215,3					\$263,290 \$0 \$287,157	\$0 \$25,500 \$28,500	0	\$150	0,006 \$0	
din County n County	3 \$331,242 2 \$2,849,185		\$866,397	\$184,9 \$56,646	33 \$0				\$91,723 \$1,605,477	\$0 \$320,666	<b>)</b> 6	\$54	4,586 \$0	
cock County	5 \$1,266,401 3 \$73,273		\$12,051 \$34,548	\$0 \$0	\$806,016				\$33,299 \$19,225	\$C \$C	\$0	\$112 \$19,500	2,201 \$0	\$302,835
a County on County / County	2 \$25,440,177 3 \$472,473 2 \$1,003,574	\$49,635 \$17,63	35			\$10,979,176 \$381,071			\$14,079,929 \$36,471 \$178,162	\$0 \$28,500 \$30,563	0	\$0		\$340,232
e County nett County		\$5,025 \$9,67	73		\$40,119 \$29,00	58			\$111,820 \$2,153,619	\$C \$C	0			
county	5 \$970,370   3 \$2,461,843   2 2007,101	\$0 \$		\$46,658 \$198,7 \$1,015,8					\$655,516 \$924,702	\$0 \$19,500	)		7,739 \$0 1,759 \$0	
ock County son County s County	3 \$267,431   4 \$605,375   3 \$196,902	\$7,489 \$18,00	\$120,459 \$97,988	\$0 \$0	\$213,424 \$75,706	50 50			\$81,908 \$205,882 \$70,207	\$0 \$0 \$25,500	0	\$0 \$88	8,082 \$0	
County	2 \$236,919		60 <b>\$13,24</b> 4	\$92,4 \$0					\$144,501 \$0	\$0	<u>ס</u>	\$26	6,341 \$0	\$386,316
r County ton County	1 \$255,893 2 \$1,194,491								\$255,893 \$844,434	\$0 \$0	\$348,190	\$1,868		
County on County or County	2 \$101,496 2 \$515,850 3 \$331,407	\$20,316 \$	\$0 \$70,728	\$251,4	92 \$0				\$59,000 \$264,358 \$240,362	\$C \$C \$C	0	\$0		
Davis County rson County	3 \$53,916 3 \$547,104		\$304,900	\$0	\$53,916	0			\$0 \$143,387	\$C \$C		\$0 \$0		
ns County son County	4 \$1,030,782 3 \$96,166		\$848,212 \$50,435	\$0 \$0		\$20,755 \$38,350			\$50,513 \$34,029	\$0 \$0	\$11,701	\$0 \$0		
s County r County r County	3 \$300,058 4 \$905,996 \$ 1 \$48,608	459,037 \$58,76	\$221,423 50 \$126,163	\$0	\$126,432	50 · · · · · · · · · · · · · · · · · · ·			\$78,636 \$135,605 \$48,608	\$C \$C \$C		φU		
ounty	2 \$1,354,621 2 \$789,030								\$591,248 \$87,987	\$C \$C		\$0 \$0		
ty County In County County	2 \$4,672,111 1 \$11,323 2 \$333,424					\$3,723,106 \$27,000 \$225,760 \$0			\$922,004 \$11,323 \$85,164	\$0 \$0 \$22,500	0			
des County	2 \$1,617,386	\$15,880 \$	0	\$320,3	146 \$0	\$223,700 \$0		\$178,944 \$0		\$22,500 \$31,500 \$0	0	\$3	9,616 \$0	\$154,759
osh County	2 \$474,219 2 \$5,096,980		\$261,321	\$28,058		\$2,501,036 \$0			\$163,840 \$2,595,944	\$21,000 \$0	0			
n County on County n County	3 \$545,343   3 \$442,518   3 \$376,858		\$269,645	\$0 \$85,8	97 \$0 \$317,151 \$16,5	00			\$87,355 \$86,976 \$21,353	\$C \$C \$C	0	\$0 \$0		
rether County County		243,178 \$20,40	09 \$45,230	\$0		00 00			\$17,978 \$25,244	\$C \$C \$C	0	\$0		
ell County De County		136,627 \$39,13	30 \$141,523	\$24,134			\$150,909	\$0	\$94,841 \$107,149	\$13,500 \$21,000	D	\$0		
jomery County an County y County	3 \$114,289 4 \$647,287 \$ 1 \$0	174,031 \$202,01	11 \$8,438	\$0		00 00			\$29,792 \$121,231 \$0	\$0 \$21,000 \$0	0	\$19,969		
ogee County on County	2 \$2,450,838	152,401 \$21,00	00 \$44,822	\$0		50 50			\$0 \$404,649 \$819,005	\$C \$C				
ee County horpe County	1 \$50,800 3 \$141,316			\$9,7		50			\$50,800 \$48,778	\$0 \$0				
	2 \$146,980 2 \$1,175,842 7 \$2,223,722 \$	117,317 \$29,38	31 \$31,617	\$0 \$1,056,9	996 \$0 \$449,533 \$24,9	38			\$0 \$1,004,210 \$134,732	\$42,000 \$0 \$0	5 \$171,631	\$0	4,980 <b>\$0</b> 0,422 <b>\$0</b>	\$308,736
a County County	2 \$648,878 2 \$64,112		\$6,570	\$57,542		\$124,949 \$0			\$523,929 \$0	\$C \$C	) )			
County ki County	2 \$212,824	\$40,640 \$	0						\$0 \$0	\$0 \$0	\$212,824	\$0		
m County an County n County	3 \$263,629   2 \$120,398   4 \$1,352,022 \$1	114,397 \$	0					\$88,743 \$0	\$90,215 \$16,088 \$117,532	\$25,500 \$0 \$0	\$87,809	\$0 \$16,500	\$0 \$0	\$120,093
olph County nond County	3 \$775,393 2 \$14,465,607	φ	\$13,835,058	\$91,493				\$283,284 \$0	\$103,900 \$489,556	\$0 \$49,500	\$388,210 0	\$0		
lale County y County	1 \$239,597 2 \$24,940								\$239,597 \$24,940	\$0 \$0	\$0	\$0		
en County nole County ing County	4 \$1,243,521 2 \$22,188,735 3 \$1,875,453 \$	398,974 \$37,26	\$527,154 58 \$254,214	\$0 \$63,615		\$645,868 \$27,000			\$21,697 \$109,911 \$592,882	\$0 \$0 \$28,500	\$22,059,323	\$0 \$19,500		
ens County rt County	3 \$1,875,453 \$   3 \$379,674   3 \$411,140	φ37,20		\$96,3		<b>0</b>			\$592,882 \$244,579 \$37,017	\$28,500 \$0 \$0	0	\$38	8,707 \$0	
er County County	2 \$1,130,990 2 \$121,707					50			\$119,246 \$25,101	\$C \$C	0	\$0		
erro County Il County County	3 \$108,097 4 \$1,264,636 2 \$296,024		\$6,756	\$0	\$78,993 \$17,7 \$223,655	35 \$593,499 \$0		\$305,950 \$0	\$4,613 \$341,187 \$72,369	\$0 \$0 \$0	0 \$0	\$0		
County	2 \$290,024 2 \$241,263 2 \$346,963								\$174,697 \$29,871	\$C \$C	0 \$66,566 0 \$317,092	\$0 \$0		
as County punty	3 \$2,836,928 2 \$734,511							\$456,269 \$0	\$428,108 \$282,065	\$0 \$33,000	\$419,446	\$0 \$0		
bs County s County en County	3 \$582,189   3 \$100,382   2 \$142,541				\$73,926 \$26,4	\$6,478 \$0 56			\$500,840 \$0 \$74,486	\$0 \$0 \$0		\$0 \$0	\$0 \$0	
county County r County		\$79,015 \$30,66	<u>39</u>		\$2,519,409 \$26,2	50	\$116,214	\$0 \$809,399 \$0	\$74,486 \$77,789 \$111,276	\$C \$C	0	\$0 \$24,000		
s County County	3 \$189,736   3 \$142,004		\$33,127	\$0	¢110,001	\$0			\$102,006 \$22,470	\$C \$C	0 \$54,604	\$0	\$0 \$0	
r County		\$0 \$11,72 745,586 \$22,26		\$51,928 \$32,843	\$257,806 \$6,80	35		\$44,132 \$40,500	\$131,033 \$47,398 \$364,840	\$0 \$0 \$0	0			
n County County n County	1 \$364,840   3 \$510,940   2 \$113,456		\$49,363	\$0		\$139,028 \$0		\$103,994 \$0	\$364,840 \$267,918 \$64,094	\$C \$C \$C	0			
ington County e County	3 \$1,175,305 2 \$1,259,025		\$49,565	\$0 \$0		\$575,669 \$0			\$286,661 \$656,356	\$0 \$0 \$27,000	\$74,665	\$0		
ter County ler County	3 \$120,114 2 \$21,457	¢1 47E	00			00 			\$21,800 \$21,457	\$0 \$0	0 \$0	\$0 \$0	1.070	C07.400
e County ield County ox County	6 \$524,775   2 \$122,500   3 \$126,151	\$1,475 \$58,99	\$12,322 \$52,157	\$0 \$62,4 \$70,343	03 \$28,949			\$53,472 \$0	\$171,231 \$0 \$4,676	\$0 \$0 \$0	0	\$10 <sup>-</sup> \$0	1,970 \$0	\$87,426
es County	3 \$126,151   3 \$1,825,388   2 \$179,763		\$17,464	\$711,230 \$71,1	36 \$0 \$297,660	50		\$0	\$4,676 \$727,898 \$69,966	\$C \$C \$C	0	\$0		
nson County	= \$173,703						\$342,781	\$0 \$705,444 \$0		\$19,500		\$0		

### **DISASTER OCCURRENCES 2011-2021**

### FEMA AND HUD COST PER CAPITA 2011-2021

	TOTAL DISASTERS		TOTAL DISASTERS
California	25	Virginia	11
Mississippi	22	Florida	11
Oklahoma	22	Georgia	11
Iowa	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

	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	ldaho	\$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		

# 

#### 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 betterinformed 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.

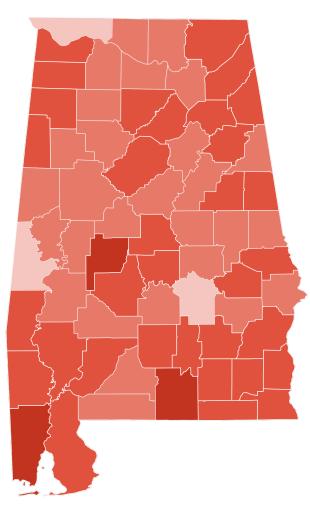


GEOGRAPHIC MAP. SOURCE: ESRI WORLD IMAGERY BASEMAP

#### **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

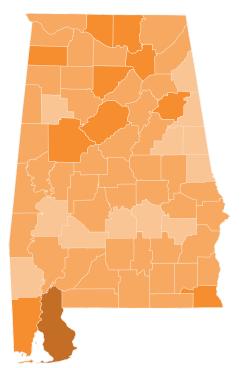
explosion, in any part of the United States, which in the determination of the President causes damage of sufficient severity 2 and magnitude to warrant major disaster assistance under this Act to supplement the efforts and available resources of States, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby."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.

#### 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.

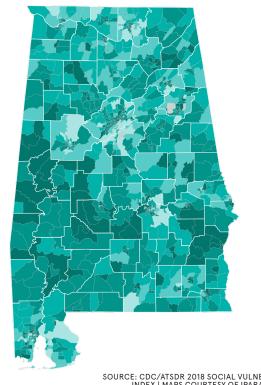
Since disaster aid is allocated to repair physical damage to property, events such as extreme heat, which creates physical damage to persons and not property, rarely qualify for federal disaster recovery aid. Additionally, there is only a shallow understanding of the economic impact of social and health-related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

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

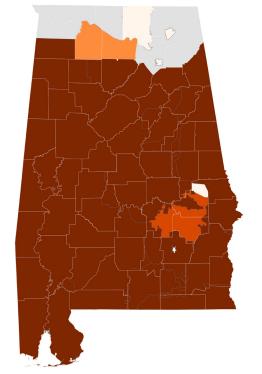
Social vulnerability refers to the potential negative effects on communities caused by external stresses on human well-being. Such stresses include natural or human-caused disasters or disease outbreaks.

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.<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







This approach provides an example of how to begin to create new frameworks for allocating funding, SOURCE: US ENERGY INFORMATION ADMINISTRATION | MAPS COURTESY OF APTIM 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,

#### **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.

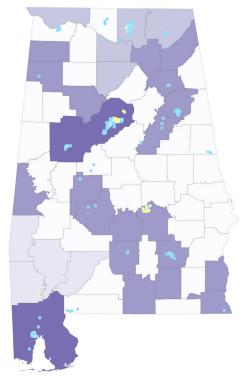
Viewing the Energy Reliability Map next to the SVI Map, one can begin to infer which regions have the most socially vulnerable residents and are served by the least reliable energy providers. Energy reliability is increasingly becoming related to climate disasters and weather events. Inclusion of these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



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.

# 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

- 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

MAPPING THE IMPACT

#### REBUILD BY DESIGN



## 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





