# 

	Dawes					Keya	Paha	~	Boyd	~		ىلىرىم	2		
Sioux		Sheridan		Cherry		Brown	Rock	Holt			Knox Pierce		Dixon Dakota	3	
Scotts Bluff	Box Butte		Grant	Hooker	Thomas	Blaine	Loup	Garfield	Wheeler	Antelope	Madison	Wayne	Thursto	on Z 	
Banner	Morrill	Garden	Arthur	McPherson	Logan	tothe .		Valley	Greeley	Boone	Platte	Colfax	Dodge	Washington	
Kimball	Cheyenne	Deuel	Keith	Line	coln	Custer		Sherman	Howard	Nance Merrick	Polk	Butler	Saunders	Douglas	holy
and an	- 410		Perkins		1000 - CON	Dawson		Buffalo	Hall	Hamilton	York	Seward	Lancaster	Ca Otoe	
			Chase	Hayes	Frontier	Gosper	Phelps	Kearney	Adams	Clay	Fillmore	Saline			Nemaha 2
		and a state	Dundy	Hitchcock	Red Willow	Furnas	Harlan	Franklin	Webster	Nuckolls	Thayer	Jefferson	Gage	Pawnee	Richardson

### NEBRASKA STATISTICS SUMMARY (2011 – 2021)

14	CLIMATE DISAST
10TH HIGHEST	PER CAPITA SPEN
THURSTON	COUNTY WITH T
9	COUNTIES WITH
25	SUPERFUND SITE
DOUGLAS, GARDEN, THURSTON	HIGHEST COMPC
\$749 MILLION	FEMA + HUD POS
1.9 MILLION	POPULATION TO
\$390	PER CAPITA SPEN
\$2.2 BILLION	OF CLIMATE INFF A SMALL INSURA

#### FER DECLARATIONS

#### NDING ON CLIMATE DISASTERS IN THE COUNTRY

#### THE HIGHEST DISASTER OCCURENCES

#### FIVE OR MORE DISASTERS

ES

OUNDING RISKS

#### ST-DISASTER FUNDING

DTAL

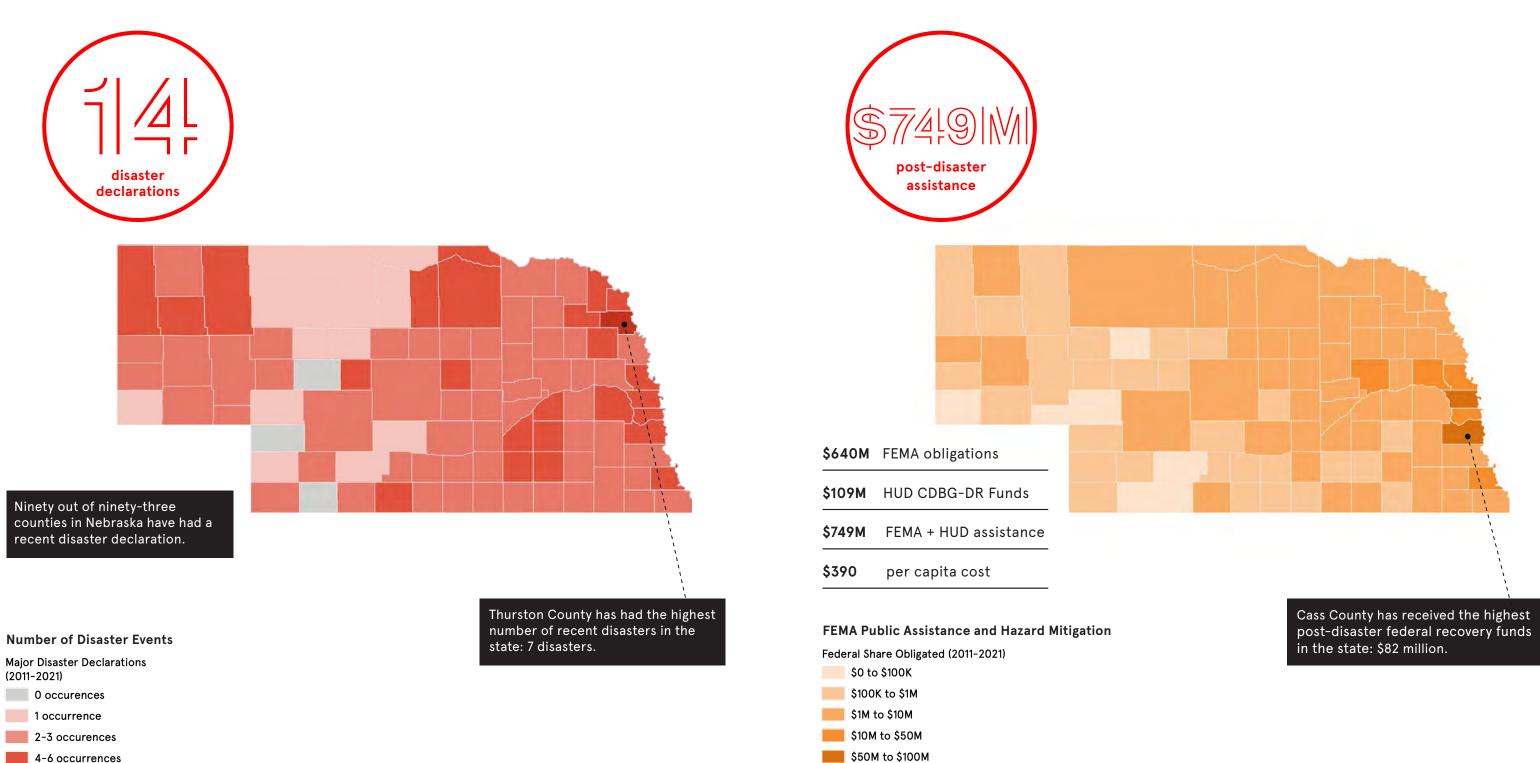
#### NDING ON CLIMATE DISASTERS

#### RASTRUCTURE COULD BE SUPPORTED THROUGH ANCE SURCHARGE

# **DISASTER OCCURRENCES 2011-2021**

FEDERALLY DECLARED CLIMATE DISASTERS BY COUNTY

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



\$100M to \$1B

\$1B to \$9B

Source: FEMA 2021

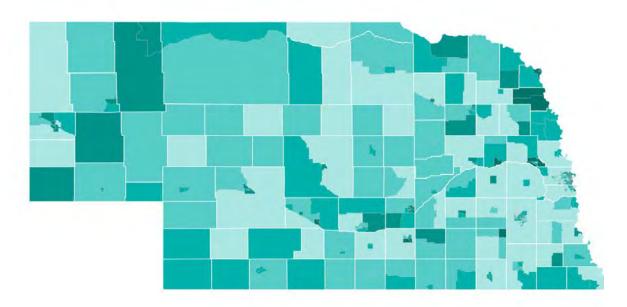
Maps courtesy of iParametrics

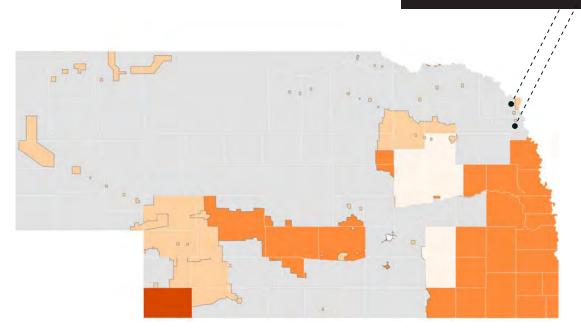
7-9 occurrences Source: FEMA 2021 Maps courtesy of iParametrics 10+ occurrences

# **SOCIAL VULNERABILITY INDEX 2011-2021**

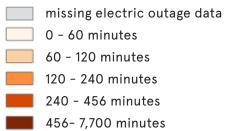
AREAS OF GREATEST SOCIAL VULNERABILITY

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





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



Administration Maps courtesy of APTIM

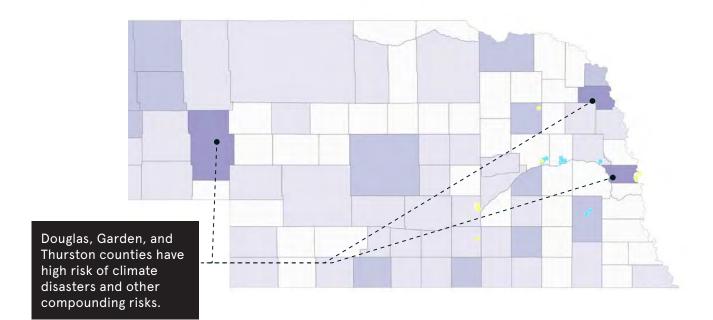
#### Social Vulnerability Index

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
0.8 - 1.0	Vulnerability Index Maps courtesy of iParametrics

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

Source: U.S. Energy Information

# COMPOUNDING RISKS: A FRAMEWORK FOR FUTURE INVESTMENT



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



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

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

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







#### NEBRASKA

TOTAL: 14 DI FEMA PA + H			20	)11		20	13		2	014			20	15		20 <sup>-</sup>	17			201	8			20	19	2021
HUD CDBG-D	DR: \$108			4014: SEVERE S TORNADOES, STR	RAIGHT LINE	4156: SEVERE ST STORMS, TORI	NADOES AND	4179: SEVERE ST TORNADOES, STRAI	AIGHT-LINE TORNADOE	VERE STORMS, S, STRAIGHT-LINE	4185: SEVER TORNADOES, S	TRAIGHT-LINE		STRAIGHT-LINE	4321: SEVERE WI		4325: SEVERE S TORNADOES, AND	STRAIGHT-	4375: SEVERE WI		4387: SEVER TORNADOES, S	TRAIGHT-LINE	4420: SEVERE WIN STRAIGHT-LINE	WINDS, AND	4446: SEVERE STORMS AND	4616: SEVERE STORMS AND
i	# of Climate Disasters 2011-	- Total FEMA	4013: FLOODING	WINDS, AND FI	LOODING	FLOO	DING	WINDS, AND FLO	DODING WINDS,	AND FLOODING	WINDS, AND	FLOODING	WINDS, AND	FLOODING	AND STRAIGHT-	LINE WINDS		DS	AND STRAIGHT-	LINE WINDS	WINDS, AND	FLOODING	FLOOD	NG	FLOODING	STRAIGHT-LINE WINDS
County Name	<b>2021</b>	4 \$235,944,413	PA Obligations         HM Obligations           \$40,565,182.10         \$147,211.55	PA Obligations         H           5         \$2,510,235.48	M Obligations \$4,947.00	\$1,384,230.30	\$5,965.00	\$8,650,027.57	A Obligations         PA Obligation           \$44,096.83         \$6,105,555		PA Obligations \$3,420,787.43		\$2,737,144.17	\$82,978.07	\$2,711,986.67		PA Obligations HI \$12,831,811.01	M Obligations \$65,572.17	_		PA Obligations \$234,218.20		\$141,463,919.43	\$3,451,484.64		PA Obligations         HM Obligation           0         \$959,254.81         \$0
dams County Intelope County	3	3 \$3,310,024 2 \$5,124,059				\$175,340.06	\$0.00						\$569,808.78	\$1,017,849.00					\$0.00	\$0.00			\$1,547,026.35 \$3,366,059.01	\$0.00 \$1,758,000.00		
arthur County	2	2 \$62,197 2 \$253,011											\$0.00	\$13,275.00			\$0.00	\$0.00					\$48,922.21 \$253,011.16	\$0.00 \$0.00		
Blaine County	3	3 \$106,726 2 \$1,457,100													\$0.00	\$0.00			\$0.00 \$0.00	\$0.00 \$0.00			\$106,726.32	\$0.00 \$0.00		
Soone County Sox Butte County	4	4 \$400,991											\$33,881.03	\$0.00			\$18,750.00	\$0.00					\$1,457,099.68 \$327,104.04	\$0.00		\$21,256.36 \$0
Boyd County Brown County	4	4 \$7,546,095 1 \$3,434,788	\$0.00 \$0.00																\$0.00	\$0.00	\$105,803.54	\$0.00	\$7,440,291.58 \$3,434,787.63	\$0.00 \$0.00		
Buffalo County Burt County	2	2 \$2,001,870 3 \$1,841,386	\$176,492.60 \$0.00	\$0.00	\$0.00						\$75,676.84	\$0.00											\$2,001,870.00 \$1,589,216.77	\$0.00 \$0.00		
Butler County Cass County	3	3 \$1,437,506	\$3,776,049.15 \$0.00								\$0.00 \$99.350.27			\$0.00			\$54,299.69 \$95,969.77	\$0.00 \$0.00					\$1,383,206.69 \$77,594,995.36	\$0.00 \$0.00		\$0.00 \$0
edar County	3	3 \$2,096,459	φ0,170,0 <del>4</del> 9.10 φ0.00						\$667,438	3.32 \$0.00			ØJJ 1,823.24	ş0.00			\$30,303.11	\$0.00			\$211,962.54	\$0.00	\$1,217,058.19	\$0.00		
hase County herry County	1	1         \$251,922           1         \$1,880,787		\$251,921.97	\$0.00																		\$1,880,786.98	\$0.00		
heyenne County lay County	2	2 \$10,097 5 \$805,053						\$239,661.81	\$0.00				\$309,755.38	\$0.00					\$10,097.27 \$0.00	\$0.00 \$0.00			\$0.00 \$245,495.88	\$0.00 \$0.00		\$10,140.21
olfax County uming County	2	2 \$2,091,926 4 \$1,557,377							\$69,650	0.20 \$0.00							\$0.00	\$0.00			\$123,651.03 \$168,375.24	\$0.00 \$0.00	\$1,968,275.11 \$1,319,351.34	\$0.00 \$0.00		
uster County	3	3 \$7,999,594													\$0.00	\$0.00			\$62,703.65	\$0.00			\$7,936,890.49	\$0.00		
akota County awes County	3	4 \$9,643,531 3 \$1,008,419	\$5,110,188.49 \$14,650.00			\$370,543.79	\$0.00		\$462,595	5.18 \$0.00			\$190,736.35	\$0.00							\$428,301.95	\$0.00	\$3,627,795.58 \$447,139.07	\$0.00 \$0.00		
awson County euel County	1	1 \$483,394 2 \$0																	\$0.00	\$0.00			\$483,394.25 \$0.00	\$0.00 \$0.00		
ixon County odge County	5	5 \$2,582,218 3 \$30,700,230	\$0.00 \$0.00	\$315,502.86	\$0.00	\$9,232.10	\$21,118.00		\$478,379	9.87 \$0.00							\$478,821.19	\$0.00			\$817,128.30	\$0.00	\$1,256,359.27 \$26,867,706.53	\$0.00 \$3,038,199.19		
ouglas County	4	4 \$59,356,149	\$5,587,274.84 \$0.00	)													\$308,676.13	\$0.00					\$51,360,286.60			\$0.00 \$0
undy County illmore County	2 E	2 \$173,599 6 \$865,052		\$19,512.43	\$0.00			\$0.00	\$769,415.00				\$154,086.69 \$37,929.36				\$0.00	\$0.00	\$0.00	\$0.00			\$57,707.71	\$0.00		\$0.00
ranklin County rontier County	2	2 \$357,287 1 \$62,158							\$177,673	3.95 \$0.00													\$179,613.49 \$46,412.79	\$0.00 \$15,745.38		
urnas County Bage County	4	4 \$1,905,370 3 \$2,417,306		\$8,183.74	\$0.00				\$71,246	5.41 \$1,283,034.00			\$701,733.41	\$0.00	\$0.00	\$2,150.00	\$154,647.26	\$37,493.00					\$540,755.35 \$1,523,432.16	\$0.00 \$0.00		
arden County	2	2 \$569,406	\$12,327.21 \$0.00	· · · · · · · · · · · · · · · · · · ·									¢. e 1,. ee	<b>,</b> ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				Ç01,100.00					\$557,078.40	\$0.00		
arfield County iosper County	3	3 \$7,162,457 3 \$285,415													\$15,456.63 \$0.00	\$0.00 \$0.00			\$0.00 \$0.00	\$0.00 \$0.00			\$7,147,000.10 \$285,414.87	\$0.00 \$0.00		
rant County reeley County	2	2 \$169,351 3 \$3,105,068				\$31,316.20	\$0.00												\$0.00	\$0.00			\$169,350.66 \$3,073,751.43	\$0.00 \$0.00		\$0.00 \$0
all County amilton County	3	3 \$1,462,108 5 \$134,067		\$0.00	\$7,129.00						\$0.00	\$0.00	\$80,553.66	\$0.00					\$0.00 \$0.00	\$0.00 \$0.00			\$443,589.66	\$1,005,652.50		\$12,866.25 \$0 \$46,384.67 \$0
arlan County	3	3 \$499,647							\$19,696	\$.82 \$0.00											\$0.00	\$0.00	\$479,950.33	\$0.00		
ayes County itchcock County	C	3 \$320,266 0 \$0		\$63,673.18	\$0.00								\$13,735.04	\$0.00									\$242,858.06	\$0.00		
olt County ooker County	1	4 \$5,978,217 1 \$0									\$0.00	\$0.00			\$0.00	\$0.00			\$0.00	\$0.00			\$5,978,216.76 \$0.00	\$0.00 \$0.00		
oward County efferson County	3	3 \$1,602,958 3 \$729,433				\$25,905.90	\$0.00						\$306,740.94	\$0.00			\$15,435.60	\$0.00	\$0.00	\$46,084.00			\$1,468,938.46 \$35,691.05	\$62,029.76 \$371,565.77		
ohnson County earney County	2	2 \$2,132,748 2 \$186,336							\$71,02	7.42 \$0.00			\$343,446.68	\$0.00									\$1,789,301.49 \$115,308.87	\$0.00 \$0.00		
eith County	1	1 \$0							¢11,021	.42 \$0.00									\$0.00	\$0.00						
eya Paha County imball County	1	1         \$4,046,130           1         \$21,282																					\$4,046,130.42 \$21,282.47	\$0.00 \$0.00		
nox County ancaster County	3	3         \$5,444,188           2         \$4,852,166	\$101,475.46 \$33,083.00										\$2,569,966.85	\$0.00					\$0.00	\$0.00			\$5,309,629.86 \$1,317,249.19	\$0.00 \$964,950.00		
incoln County ogan County	3	3 \$925,332 4 \$396,159	\$383,912.89 \$0.00	\$48,584.40	\$0.00								\$335,927.97	\$0.00					\$0.00	\$0.00	\$35,695.21	\$0.00	\$205,491.33 \$311,879.10	\$0.00 \$0.00		
oup County	3	3 \$1,110,724		¢ 10,00 m 10	<b>\$0.00</b>										\$0.00	\$0.00			\$0.00	\$0.00	\$00,000.2 I	\$0.00	\$1,110,723.89	\$0.00		
cPherson County adison County	3	0 \$0 3 \$6,558,671																	\$0.00	\$0.00			\$6,515,445.03	\$0.00		\$43,225.57 \$0
lerrick County lorrill County	3	2 \$4,112,382 3 \$1,069,295											\$497,343.26	\$0.00			\$105,647.54	\$17,140.59	\$0.00	\$0.00			\$140,373.46 \$449,163.23	\$3,972,008.58 \$0.00		
ance County emaha County	2	2 \$7,755,949 4 \$14,326,883	\$758,990.52 \$0.00	)							\$64,698.38	\$40,845.00	\$0.00	\$0.00					\$0.00	\$32,636.00			\$7,723,313.01 \$13,060,094.16	\$0.00 \$402,254.60		
uckolls County toe County	3	3 \$997,055 3 \$3,881,812	\$747,530.20 \$262,702.00										\$372,518.55 \$840,286.32	\$0.00					\$0.00	\$0.00			\$624,536.82 \$1,859,363.31	\$0.00 \$139,307.25		
awnee County	3	3 \$1,170,491	φτητ,000.20 φ262,702.00								\$20,689.42	\$0.00											\$1,859,363.31 \$888,210.72	\$139,307.25 \$0.00		
Perkins County Phelps County	3	0 \$0 3 \$494,771		\$0.00	\$0.00				\$28,547	7.21 \$0.00													\$466,223.68	\$0.00		
Pierce County Platte County	2	2 \$4,970,675 3 \$21,540,944															\$214,931.07	\$0.00	\$0.00 \$0.00	\$0.00 \$0.00			\$4,432,279.10 \$19,886,501.75			
Polk County Red Willow County	4	4 \$271,164 2 \$0		\$141,761.48 \$0.00	\$0.00 \$0.00						\$0.00	\$0.00			\$0.00	\$0.00	\$0.00	\$0.00					\$129,402.02	\$0.00		
ichardson County	3	3 \$1,135,268	\$195,458.99 \$0.00		φ <b>0.0</b> 0								\$340,552.85	\$0.00									\$599,256.11	\$0.00		
Rock County Saline County	3	4 \$4,196,685 3 \$2,352,541						\$0.00	\$0.00		\$0.00	\$0.00	\$1,054,153.72	\$0.00	\$0.00	\$0.00			\$0.00	\$0.00			\$4,141,185.39 \$437,244.19	\$55,500.00 \$861,143.25		
arpy County aunders County	4		\$2,013,525.65 \$1,828,131.00					\$691,422.71	\$0.00				\$205,829.61	\$0.00			\$819,479.36 \$0.00	\$0.00 \$0.00					\$6,496,045.40 \$6,205,025.19	\$1,525,254.00 \$0.00		\$36,624.08 \$0 \$0.00 \$0
cotts Bluff County	2	2 \$1,391,960 3 \$752,646						\$151,483.65	\$0.00				\$211,724.59										\$478,131.99 \$389,437.57	\$0.00 \$0.00		
heridan County	4	4 \$508,631				\$17,094.75			ψυ.υυ				ψ <b>2</b> 11,724.39				\$0.00	\$0.00					\$491,536.44	\$0.00		\$0.00 \$0
herman County ioux County	3	3 \$658,941 4 \$527,439				\$11,684.22 \$85,465.94							\$135,787.96	\$0.00			\$0.00	\$0.00	\$0.00	\$0.00			\$647,256.29 \$306,185.54	\$0.00 \$0.00		
tanton County hayer County	2	2 \$4,471,108 2 \$2,340,320							\$3,646,144	4.99 \$0.00			\$2,142,634.46	\$0.00									\$824,962.81 \$54,844.56	\$0.00 \$142,840.65		
nomas County	1	1 \$13,484 7 \$4,687,349				\$3.275.25	\$0.00		\$210.70 <sup>7</sup>	1.85 \$0.00	\$0.00	\$0.00					\$0.00	\$0.00			\$13,483.88 \$467,629.26	\$0.00 \$0.00		\$0.00		
hurston County alley County	4	4 \$1,541,049				\$3,275.25	\$0.00		\$210,70	\$0.00	\$0.00	\$0.00			\$0.00	\$0.00		\$0.00	\$0.00	\$0.00	\$467,629.26	\$0.00	\$1,541,048.81	\$0.00		
ashington County ayne County	4 6	4 \$12,523,566 6 \$2,475,274	\$2,942,123.49 \$5,564,205.00			\$556,425.07	\$0.00		\$88,369	9.91 \$0.00	\$156,392.96	\$0.00	\$70,964.95	\$47,570.82			\$0.00	\$0.00			\$100,960.64	\$0.00	\$3,457,932.67 \$1,610,982.97	\$402,912.00 \$0.00		\$0.00 \$0
Vebster County Vheeler County	2	2 \$172,069 2 \$931,835																	\$0.00 \$0.00	\$0.00 \$0.00			\$172,069.38 \$931,835.04	\$0.00 \$0.00		
	-	5 \$555,079		\$3,092.91					\$0.00					\$33,042.75					÷0.00	<b>Q</b> 0.00			\$335,911.18	\$0.00		\$0.00



# **DISASTER OCCURRENCES 2011-2021**

	TOTAL DISASTERS
California	25
Mississippi	22
Oklahoma	22
lowa	21
Tennessee	20
Louisiana	18
Alabama	17
Texas	17
Vermont	17
West Virginia	17
Arkansas	16
Kentucky	16
New Hampshire	16
New York	16
Washington	16
Alaska	15
North Carolina	15
Nebraska	14
Missouri	13
Kansas	13
New Jersey	13
North Dakota	13
South Dakota	13
Montana	12
Oregon	12

	TOTAL DISASTERS
Virginia	11
Florida	11
Georgia	11
Minnesota	11
Connecticut	10
Hawaii	10
Maryland	10
New Mexico	10
Wisconsin	10
Idaho	9
Massachusetts	9
Pennsylvania	9
South Carolina	8
Colorado	7
Utah	7
Maine	6
Michigan	6
Ohio	6
Arizona	6
Delaware	5
Illinois	5
Indiana	4
Rhode Island	4
Wyoming	4
Nevada	3

# FEMA AND HUD COST PER CAPITA 2011-2021

	PER CAPITA		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

# 

#### 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 betterinformed 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.

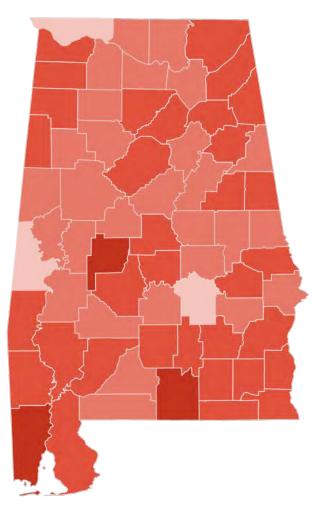


GEOGRAPHIC MAP. SOURCE: ESRI WORLD IMAGERY BASEMAP

#### **DISASTER DECLARATIONS (RED)**

This map shows federally declared climate disasters of sufficient severity and magnitude to warrant major by county from 2011-2021 – providing a snapshot of disaster assistance under this Act to supplement the magnitude of climate disasters across the country the efforts and available resources of States, local in recent history. This report only identifies federally governments, and disaster relief organizations in declared disasters, as there is no entity that collects alleviating the damage, loss, hardship, or suffering and publishes state disaster declarations. It should caused thereby."1 be noted that the declarations shown in this report do not reflect every climate event that has occurred Importantly, extreme heat waves do not fit the criteria between 2011-2021; the report instead only shows for federal disaster declarations despite being the those which have met the cost threshold for a federal leading cause of deaths among climate hazards. disaster declaration. Therefore, the findings overall Likewise, sea level rise is not included in this definition underestimate the number of occurrences and the despite the threat it poses to numerous communities, suffering that some communities have experienced. including damage to property, loss of land, and displacement.

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,



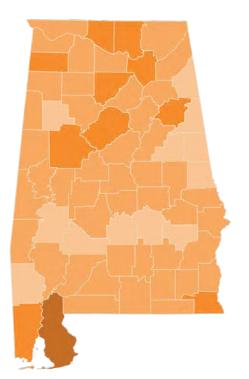
DISASTER DECLARATIONS. SOURCE: FEMA 2021 | MAPS COURTESY OF IPARAMETRICS.

or explosion, in any part of the United States, which in the determination of the President causes damage

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

#### FEDERAL ASSISTANCE (ORANGE)

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



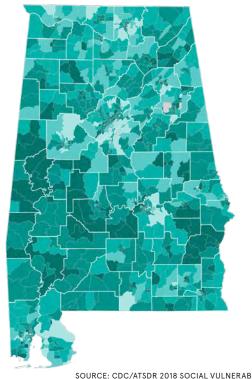
FEDERAL ASSITANCE. SOURCE: FEMA 2021 | MAPS COURTESY OF IPARAMETRICS.

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

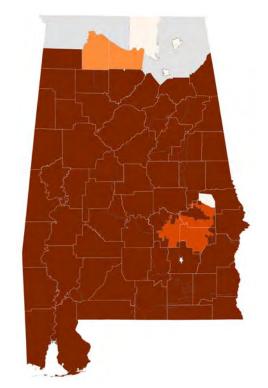
There are additional sources of federal funding made available to governments or individuals in response to disasters, such as the U.S. Army Corp of Engineers (USACE) projects, Small Business Administration (SBA) loans, and private insurance payouts, which are not included in this report because they are harder to uniformly track and/or must be paid back. Therefore, our findings underestimate the total support available to states and individuals post-disaster. Since disaster aid is allocated to repair physical damage to property, events such as extreme heat, which largely creates physical damage to persons and not property, rarely qualify for federal disaster recovery aid. Additionally, there is only a shallow understanding of the economic impact of social and health-related costs and environmental degradation after a disaster.

#### SOCIAL VULNERABILITY INDEX (GREEN)

Social vulnerability refers to the potential negative effects on communities caused by external stresses on human well-being. Such stresses include natural or human-caused disasters or disease outbreaks. The factors that determine social vulnerability are directly tied to social determinants of health or the social, economic, and physical factors - such as race, socioeconomic status, and environmental conditions - that influence health. Socially vulnerable populations fare the worst during a disaster and often take longer to recover.<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



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).
(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.

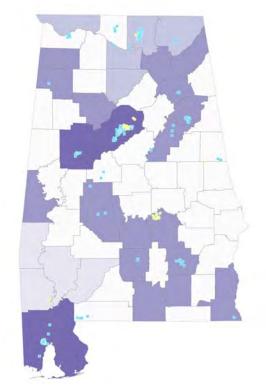
#### **ENERGY RELIABILITY (BROWN)**

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.



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

some demographic information, these maps have added additional criteria, such as population density, population increase, poverty rates, and health risks, to focus on the compounding effects. For instance, if a climate event happens in an area where there is already high social vulnerability, that community is likely to suffer more.

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

#### **Analyzed Risks Include:**

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

#### 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

#### 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.

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