
Estimating Distribution of Evacuees from the New Orleans Area As a Result of Hurricane Katrina

Dan Prives
dprives@gmail.com
Charity Industry Observer

This article presents a simple mathematical model for estimating the number of relocated evacuees from the Gulf region. I am offering it to the community in the event that it could be helpful to local support efforts. I know of no similar estimate that is readily available (i.e. on the Internet). If anyone knows of such resources, I'd appreciate knowing about them. I don't want to duplicate efforts.

The model estimates the number of relocated evacuees as proportional to the population of a census metropolitan statistical area (MSA) and inversely proportional to the square of the distance of the central city of the MSA to New Orleans.

The technique I used was to take Baton Rouge as a base and index the rest of the 250 largest MSAs to Baton Rouge (except of course New Orleans and Gulfport and Pascagoula, MS), by population and squared distance from New Orleans. The 250 largest MSAs are roughly those with populations of 150,000 or more. These MSAs include about 77% of the total US population.

Population is from the 2000 census, mileage from Google maps, except Anchorage & Honolulu were estimated.

The indexes were then multiplied by each other per the formula and then applied to a preliminary estimated of number of relocated evacuees in Baton Rouge. I then used an iterative process, adjusting the number in Baton Rouge until the calculated total equaled an estimated total displaced of 500,000.

Since it is a multiplicative model, the estimate can be easily adjusted to reflect different estimates of the total number of displaced persons.

Table 1 is a summary by state, and Table 2 is the listing of all 250 MSAs.

I was surprised to find that the model projects some impact in every MSA, even Anchorage and Honolulu. It confirms that Texas would be the state most affected after Louisiana, but it indicates that there could be significant impact (over 10,000 expected) in Alabama, Florida, Georgia, and Mississippi -- but also in Illinois and New York. Florida would expect the third most impact after Texas.

Between 5,000 and 10,000 would be expected in California, Michigan, Missouri, North Carolina, Ohio, Pennsylvania, and South Carolina.

Dan Prives has been working in finance and administrative positions in nonprofit organizations since 1990. He is a frequent contributor to e-mail lists in the areas of charity management and public policy toward nonprofit organizations.

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Within Louisiana, the focus has been on Baton Rouge, but I wonder the extent to which people are paying attention to the impact of the displaced on Lafayette & Houma.

This is just a mathematical model and doesn't take into account historical and familial patterns of migration. If anyone is familiar with any statistical series that could be used to proxy these factors, I would be interested in knowing about them.

It is also just an estimate. The ordinary statistical expectation is that there would be considerable local variations between these estimates and the actual numbers of displaced persons.

Table 1. Projected evacuees by state

State	Estimate
Alaska	10
Alabama	33,580
Arkansas	4,240
Arizona	1,820
California	7,590
Colorado	1,620
Connecticut	1,590
DC	2,970
Delaware	530
Florida	39,750
Georgia	23,750
Hawaii	10
Iowa	1,100
Idaho	80
Illinois	11,760
Indiana	4,320
Kansas	730

State	Estimate
Kentucky	2,880
Louisiana	175,530
Massachusetts	2,150
Maryland	2,940
Maine	170
Michigan	6,100
Minnesota	1,850
Missouri	8,350
Mississippi	13,480
North Carolina	6,860
North Dakota	70
Nebraska	790
New Hampshire	210
New Jersey	3,480
New Mexico	620
Nevada	430
New York	10,160

State	Estimate
Ohio	9,040
Oklahoma	3,240
Oregon	340
Pennsylvania	6,440
Rhode Island	670
South Carolina	5,070
South Dakota	110
Tennessee	16,470
Texas	78,970
Utah	450
Virginia	3,280
Vermont	70
Washington	530
Wisconsin	2,440
West Virginia	870
Total estimated	499,510

Table 2: Projected evacuees by MSA

Metropolitan Statistical Area	ST	2000 census	Miles to N.O.	Estimate
Anchorage, AK	AK	319,605	6,000	10
Birmingham-Hoover, AL	AL	1,052,238	343	8,350
Mobile, AL	AL	399,843	144	18,120
Montgomery, AL	AL	346,528	309	3,380
Huntsville, AL	AL	342,376	441	1,630
Tuscaloosa, AL	AL	192,034	291	2,100
Little Rock-North Little Rock, AR	AR	610,518	444	2,880
Fayetteville-Springdale-Rogers, AR-MO	AR	347,045	710	640
Fort Smith, AR-OK	AR	273,170	599	720
Phoenix-Mesa-Scottsdale, AZ	AZ	3,251,876	1,522	1,310
Tucson, AZ	AZ	843,746	1,411	400
Prescott, AZ	AZ	167,517	1,577	60
Lake Havasu City-Kingman, AZ	AZ	155,032	1,703	50
Los Angeles-Long Beach-Santa Ana, CA	CA	12,365,627	1,894	3,220
San Francisco-Oakland-Fremont, CA	CA	4,123,740	2,274	740
Riverside-San Bernardino-Ontario, CA	CA	3,254,821	1,845	890
San Diego-Carlsbad-San Marcos, CA	CA	2,813,833	1,817	800
Sacramento--Arden-Arcade--Roseville, CA	CA	1,796,857	2,286	320
San Jose-Sunnyvale-Santa Clara, CA	CA	1,735,819	2,234	320
Fresno, CA	CA	799,407	2,074	170
Oxnard-Thousand Oaks-Ventura, CA	CA	753,197	1,958	180
Bakersfield, CA	CA	661,645	2,067	150
Stockton, CA	CA	563,598	2,232	110
Santa Rosa-Petaluma, CA	CA	458,614	2,306	80
Modesto, CA	CA	446,997	2,166	90
Salinas, CA	CA	401,762	2,171	80
Santa Barbara-Santa Maria-Goleta, CA	CA	399,347	1,993	90
Vallejo-Fairfield, CA	CA	394,542	2,278	70
Visalia-Porterville, CA	CA	368,021	2,015	80
Santa Cruz-Watsonville, CA	CA	255,602	2,257	50
San Luis Obispo-Paso Robles, CA	CA	246,681	2,097	50
Merced, CA	CA	210,554	2,128	40
Chico, CA	CA	203,171	2,366	30
Redding, CA	CA	163,256	2,447	30
Denver-Aurora, CO	CO	2,179,240	1,396	1,050
Colorado Springs, CO	CO	537,484	1,384	260
Boulder, CO	CO	269,814	1,415	130
Fort Collins-Loveland, CO	CO	251,494	1,450	110
Greeley, CO	CO	180,926	1,538	70
Hartford-West Hartford-East Hartford, CT	CT	1,148,618	1,426	530
Bridgeport-Stamford-Norwalk, CT	CT	882,567	1,347	450
New Haven-Milford, CT	CT	824,008	1,387	400
Norwich-New London, CT	CT	259,088	1,440	120
Torrington, CT	CT	182,193	1,415	90
Washington-Arlington-Alexandria, DC-VA-MD-WV	DC	3,727,565	1,082	2,970
Wilmington, DE-MD-NJ	DE	650,501	1,192	430

Metropolitan Statistical Area	ST	2000 census	Miles to N.O.	Estimate
Seaford, DE	DE	156,638	1,205	100
Miami-Fort Lauderdale-Miami Beach, FL	FL	5,007,564	895	5,830
Tampa-St. Petersburg-Clearwater, FL	FL	2,395,997	656	5,190
Orlando, FL	FL	1,644,561	638	3,770
Jacksonville, FL	FL	1,122,750	546	3,520
Sarasota-Bradenton-Venice, FL	FL	589,959	708	1,100
Lakeland-Winter Haven, FL	FL	483,924	654	1,060
Palm Bay-Melbourne-Titusville, FL	FL	476,230	678	960
Deltona-Daytona Beach-Ormond Beach, FL	FL	443,343	633	1,040
Cape Coral-Fort Myers, FL	FL	440,888	774	680
Pensacola-Ferry Pass-Brent, FL	FL	412,153	201	9,460
Tallahassee, FL	FL	320,304	385	2,000
Port St. Lucie-Fort Pierce, FL	FL	319,426	780	490
Ocala, FL	FL	258,916	563	770
Naples-Marco Island, FL	FL	251,377	814	360
Gainesville, FL	FL	232,392	531	770
Fort Walton Beach-Crestview-Destin, FL	FL	170,498	240	2,750
Atlanta-Sandy Springs-Marietta, GA	GA	4,247,981	469	18,040
Augusta-Richmond County, GA-SC	GA	499,684	611	1,250
Savannah, GA	GA	293,000	681	600
Columbus, GA-AL	GA	281,768	396	1,680
Macon, GA	GA	222,368	492	840
Athens-Clarke County, GA	GA	166,079	538	550
Albany, GA	GA	157,833	428	790
Honolulu, HI	HI	876,156	8,000	10
Des Moines, IA	IA	481,394	1,099	370
Davenport-Moline-Rock Island, IA-IL	IA	376,019	943	390
Cedar Rapids, IA	IA	237,230	1,023	210
Waterloo-Cedar Falls, IA	IA	163,706	1,075	130
Boise City-Nampa, ID	ID	464,840	2,349	80
Chicago-Naperville-Joliet, IL-IN-WI	IL	9,098,316	923	9,970
Peoria, IL	IL	366,899	844	480
Rockford, IL	IL	320,204	971	310
Champaign-Urbana, IL	IL	210,275	798	310
Springfield, IL	IL	201,437	774	320
Ottawa-Streator, IL	IL	153,098	915	170
Bloomington-Normal, IL	IL	150,433	838	200
Indianapolis, IN	IN	1,525,104	818	2,130
Fort Wayne, IN	IN	390,156	940	410
Evansville, IN-KY	IN	342,815	680	700
South Bend-Mishawaka, IN-MI	IN	316,663	1,078	260
Elkhart-Goshen, IN	IN	182,791	1,098	140
Lafayette, IN	IN	178,541	983	170
Bloomington, IN	IN	175,506	784	270
Terre Haute, IN	IN	170,943	807	240
Wichita, KS	KS	571,166	971	570
Topeka, KS	KS	224,551	1,145	160

Metropolitan Statistical Area	ST	2000 census	Miles to N.O.	Estimate
Louisville, KY-IN	KY	1,161,975	705	2,190
Lexington-Fayette, KY	KY	408,326	743	690
New Orleans-Metairie-Kenner, LA	LA	1,316,510	-	-
Baton Rouge, LA	LA	705,973	80	103,000
Shreveport-Bossier City, LA	LA	375,965	341	3,000
Lafayette, LA	LA	239,086	135	12,300
Houma-Bayou Cane-Thibodaux, LA	LA	194,477	60	51,270
Lake Charles, LA	LA	193,568	206	4,190
Monroe, LA	LA	170,053	299	1,770
Boston-Cambridge-Quincy, MA-NH	MA	4,391,344	1,523	1,770
Springfield, MA	MA	680,014	1,451	300
Barnstable Town, MA	MA	222,230	1,610	80
Baltimore-Towson, MD	MD	2,552,994	1,120	1,900
Bethesda-Frederick-Gaithersburg, MD	MD	1,068,618	1,082	850
Hagerstown-Martinsburg, MD-WV	MD	222,771	1,065	190
Portland-South Portland, ME	ME	487,568	1,625	170
Detroit-Warren-Livonia, MI	MI	4,452,557	1,066	3,660
Grand Rapids-Wyoming, MI	MI	740,482	1,174	500
Lansing-East Lansing, MI	MI	447,728	1,064	370
Flint, MI	MI	436,141	1,108	330
Ann Arbor, MI	MI	322,895	1,056	270
Kalamazoo-Portage, MI	MI	314,866	1,129	230
Holland-Grand Haven, MI	MI	238,314	1,040	210
Saginaw-Saginaw Township North, MI	MI	210,039	1,140	150
Muskegon-Norton Shores, MI	MI	170,200	1,168	120
Niles-Benton Harbor, MI	MI	162,453	1,082	130
Jackson, MI	MI	158,422	1,056	130
Minneapolis-St. Paul-Bloomington, MN-WI	MN	2,968,806	1,340	1,550
Duluth, MN-WI	MN	275,486	1,433	130
St. Cloud, MN	MN	167,392	1,405	80
Rochester, MN	MN	163,618	1,309	90
St. Louis, MO-IL	MO	2,698,687	676	5,510
Kansas City, MO-KS	MO	1,836,038	931	1,980
Springfield, MO	MO	368,374	735	630
Joplin, MO	MO	157,322	793	230
Jackson, MS	MS	497,197	185	13,480
Gulfport-Biloxi, MS	MS	246,190	-	-
Pascagoula, MS	MS	150,564	-	-
Charlotte-Gastonia-Concord, NC-SC	NC	1,330,448	712	2,440
Raleigh-Cary, NC	NC	797,071	898	920
Greensboro-High Point, NC	NC	643,430	802	930
Durham, NC	NC	426,493	871	520
Asheville, NC	NC	369,171	694	710
Hickory-Morganton-Lenoir, NC	NC	341,851	726	600
Fayetteville, NC	NC	336,609	860	430
Greenville, NC	NC	152,772	975	150
Jacksonville, NC	NC	150,355	928	160

Metropolitan Statistical Area	ST	2000 census	Miles to N.O.	Estimate
Fargo, ND-MN	ND	174,367	1,573	70
Omaha-Council Bluffs, NE-IA	NE	767,041	1,100	590
Lincoln, NE	NE	266,787	1,107	200
Manchester-Nashua, NH	NH	380,841	1,565	150
Lebanon, NH-VT	NH	167,387	1,574	60
Edison, NJ	NJ	2,173,869	1,282	1,240
Newark-Union, NJ-PA	NJ	2,098,843	1,303	1,150
Camden, NJ	NJ	1,186,999	1,220	740
Trenton-Ewing, NJ	NJ	350,761	1,252	210
Atlantic City, NJ	NJ	252,552	1,321	140
Albuquerque, NM	NM	729,649	1,177	490
Las Cruces, NM	NM	174,682	1,138	130
Las Vegas-Paradise, NV	NV	1,375,765	1,833	380
Reno-Sparks, NV	NV	342,885	2,436	50
New York-Wayne-White Plains, NY-NJ	NY	11,296,377	1,308	6,160
Nassau-Suffolk, NY	NY	2,753,913	1,355	1,400
Buffalo-Niagara Falls, NY	NY	1,170,111	1,255	690
Rochester, NY	NY	1,037,831	1,322	550
Albany-Schenectady-Troy, NY	NY	825,875	1,426	380
Syracuse, NY	NY	650,154	1,398	310
Poughkeepsie-Newburgh-Middletown, NY	NY	621,517	1,368	310
Utica-Rome, NY	NY	299,896	1,446	130
Binghamton, NY	NY	252,320	1,315	140
Kingston, NY	NY	177,749	1,374	90
Cleveland-Elyria-Mentor, OH	OH	2,148,143	1,057	1,790
Cincinnati-Middletown, OH-KY-IN	OH	2,009,632	812	2,850
Columbus, OH	OH	1,612,694	915	1,800
Dayton, OH	OH	848,153	858	1,070
Akron, OH	OH	694,960	1,044	590
Toledo, OH	OH	659,188	1,007	600
Canton-Massillon, OH	OH	406,934	1,053	340
Oklahoma City, OK	OK	1,095,421	722	1,960
Tulsa, OK	OK	859,532	794	1,280
Portland-Vancouver-Beaverton, OR-WA	OR	1,927,881	2,776	230
Salem, OR	OR	347,214	2,690	40
Eugene-Springfield, OR	OR	322,959	2,884	40
Medford, OR	OR	181,269	2,592	30
Philadelphia, PA	PA	3,849,647	1,219	2,420
Pittsburgh, PA	PA	2,431,087	1,096	1,890
Allentown-Bethlehem-Easton, PA-NJ	PA	740,395	1,216	470
Scranton--Wilkes-Barre, PA	PA	560,625	1,254	330
Harrisburg-Carlisle, PA	PA	509,074	1,137	370
Lancaster, PA	PA	470,658	1,174	320
Reading, PA	PA	373,638	1,195	240
Erie, PA	PA	280,843	1,166	190
Johnstown, PA	PA	152,598	1,172	110
Pottsville, PA	PA	150,336	1,189	100

Metropolitan Statistical Area	ST	2000 census	Miles to N.O.	Estimate
Providence-New Bedford-Fall River, RI-MA	RI	1,582,997	1,488	670
Columbia, SC	SC	647,158	675	1,330
Greenville, SC	SC	559,940	615	1,380
Charleston-North Charleston, SC	SC	549,033	810	780
Spartanburg, SC	SC	253,791	641	580
Myrtle Beach-Conway-North Myrtle Beach, SC	SC	196,629	821	270
Florence, SC	SC	193,155	776	300
Anderson, SC	SC	165,740	592	430
Sioux Falls, SD	SD	187,093	1,278	110
Nashville-Davidson--Murfreesboro, TN	TN	1,311,789	531	4,350
Memphis, TN-MS-AR	TN	1,205,204	394	7,260
Knoxville, TN	TN	616,079	598	1,600
Chattanooga, TN-GA	TN	476,531	490	1,840
Clarksville, TN-KY	TN	232,000	582	640
Kingsport-Bristol, TN-VA	TN	230,014	709	430
Johnson City, TN	TN	181,607	703	350
Dallas-Fort Worth-Arlington, TX	TX	5,161,544	520	17,820
Houston-Baytown-Sugar Land, TX	TX	4,715,407	347	36,570
San Antonio, TX	TX	1,711,703	543	5,410
Austin-Round Rock, TX	TX	1,249,763	508	4,520
El Paso, TX	TX	679,622	1,094	530
McAllen-Edinburg-Pharr, TX	TX	569,463	707	1,070
Corpus Christi, TX	TX	403,280	556	1,220
Beaumont-Port Arthur, TX	TX	385,090	261	5,320
Brownsville-Harlingen, TX	TX	335,227	699	630
Killeen-Temple-Fort Hood, TX	TX	330,714	551	1,020
Lubbock, TX	TX	249,700	866	310
Amarillo, TX	TX	226,522	881	270
Waco, TX	TX	213,517	531	700
Longview, TX	TX	194,042	397	1,130
Laredo, TX	TX	193,117	696	370
College Station-Bryan, TX	TX	184,885	440	890
Tyler, TX	TX	174,706	432	880
Abilene, TX	TX	160,245	701	310
Salt Lake City, UT	UT	968,858	1,919	250
Ogden-Clearfield, UT	UT	442,656	1,914	110
Provo-Orem, UT	UT	376,774	1,937	90
Virginia Beach-Norfolk-Newport News, VA-NC	VA	1,576,370	1,070	1,280
Richmond, VA	VA	1,096,957	1,010	1,000
Roanoke, VA	VA	288,309	855	370
Lynchburg, VA	VA	228,616	912	250
Charlottesville, VA	VA	174,021	959	180
Blacksburg-Christiansburg-Radford, VA	VA	151,272	829	200
Burlington-South Burlington, VT	VT	198,889	1,589	70
Seattle-Tacoma-Bellevue, WA	WA	3,043,878	2,755	370
Spokane, WA	WA	417,939	2,478	60
Bremerton-Silverdale, WA	WA	231,969	2,933	30

Metropolitan Statistical Area	ST	2000 census	Miles to N.O.	Estimate
Olympia, WA	WA	207,355	2,929	20
Kennewick-Richland-Pasco, WA	WA	191,822	2,633	30
Bellingham, WA	WA	166,814	2,971	20
Milwaukee-Waukesha-West Allis, WI	WI	1,500,741	1,055	1,260
Madison, WI	WI	501,774	1,038	430
Green Bay, WI	WI	282,599	1,170	190
Appleton, WI	WI	201,602	1,151	140
Racine, WI	WI	188,831	1,041	160
Oshkosh-Neenah, WI	WI	156,763	1,131	110
Janesville, WI	WI	152,307	998	150
Charleston, WV	WV	309,635	906	350
Huntington-Ashland, WV-KY-OH	WV	288,649	869	360
Parkersburg-Marietta, WV-OH	WV	164,624	984	160
			TOTAL	499,510