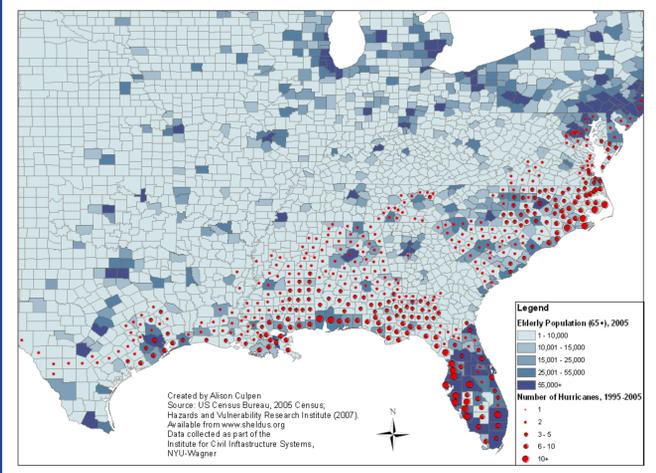


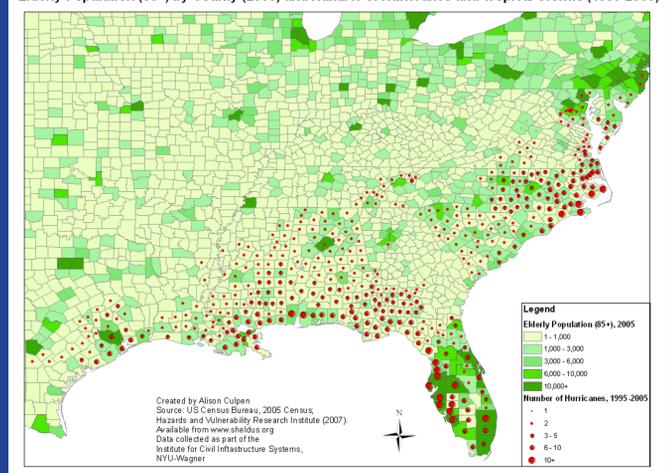
# Infrastructure Needs of Vulnerable Populations in Catastrophes

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Elderly Population (65+) by County (2005) and Number of Hurricanes and Tropical Storms (1995-2005)



Elderly Population (85+) by County (2005) and Number of Hurricanes and Tropical Storms (1995-2005)



## Elderly Demographics (age 65+)

- 36.8 million or 12% population (2005), projected to grow to 21% in 2050(1)
- 10.1% poverty rate, median income \$26,036 (2005)(1)

## Transportation Characteristics of the Elderly

- 92% (roughly) of trips by the elderly (65+) were in private vehicles (2)
- 12% of older Americans are members of households without a car, compared to 5% of the non-elderly (3)
- 9% of the U.S. drivers are elderly (4)

## Transportation of Elderly in Disasters

- 25% of adults 75 years old and older indicate needing assistance to evacuate from their home in the event of a natural disaster such as a hurricane, earthquake, or wildfire (5)
- Evacuation of seniors requires extra planning including:
  - Planning of pick-up routes;
  - Wheelchair equipped vehicles;
  - Extra time; and
  - Special challenges such as vision and hearing loss, and its effect on the ability to communicate (6)

## Current Research: Evaluate co-location at a broad geographic scale (by county) of natural hazards, the elderly, and transportation infrastructure necessary for elderly to respond to emergencies

- 3.9 million elderly living in CA (highest in nation) (7);
- 3 million in FL (almost as many over 65 as under 18) (7)

## High Concentrations of Elderly and Natural Disasters (8)

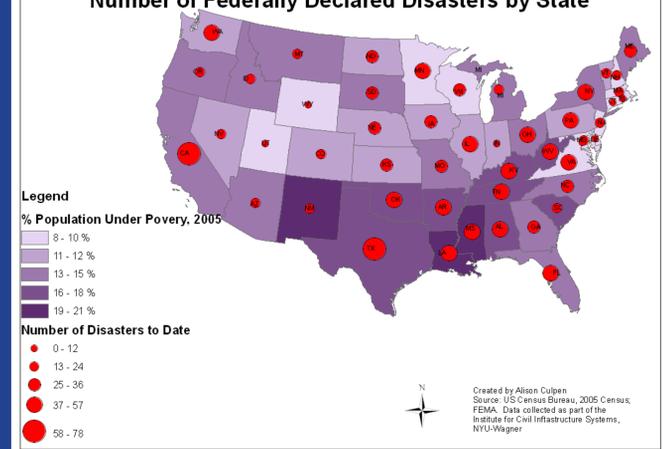
- Although the elderly population is located in all of the 3,000+ U.S. counties, half of the elderly population is highly concentrated in only 170 counties or about 5% of those counties
- The distribution of Hurricane/tropical storm events indicates that these events are geographically concentrated
- The prevalence of hurricanes and tropical storms registered by FEMA from 1995 to 2005 indicates that 471 counties (or about 15% of all counties) had at least one event, and
- These counties are concentrated in 17 states and DC
- Counties in only 4 states – Florida, North Carolina, Alabama, and Louisiana – have had ten or more events from 1995-2005

## Counties Where Elderly Prone to More Disasters and the Location of Selected Critical Infrastructure

State	County	Hurricane Frequency (1995-2005)	Total Elderly Population (2005)	Elderly - Percent of Population	Number of Bridges	Average Daily Traffic Over Bridges (# vehicles)
Florida	Hillsborough County	15	129,929	11	744	22,275,970
Florida	DeSoto County	14	6,196	17	56	1,267,594
Florida	Lee County	14	123,668	23	351	3,872,973
Florida	Manatee County	14	68,897	22	237	3,779,677
Florida	Charlotte County	13	53,104	34	179	1,942,662
Florida	Pinellas County	13	193,067	21	94	558,099
Florida	Sarasota County	13	108,147	30	303	4,506,933
Florida	Citrus County	12	41,163	31	40	198,869
Florida	Levy County	12	6,659	18	75	124,702
Florida	Palm Beach County	12	271,278	21	756	20,261,823
North Carolina	Carteret County	12	10,978	18	72	439,365
North Carolina	Hyde County	12	879	16	76	111,332
Alabama	Baldwin County	11	26,429	16	330	2,217,497
Alabama	Mobile County	11	48,855	12	727	9,665,173
Florida	Hernando County	11	42,231	27	81	670,070
Florida	Pasco County	11	92,950	22	135	2,038,596
Florida	Polk County	11	95,300	18	425	6,336,325
North Carolina	Dare County	11	4,679	14	43	310,125
North Carolina	Onslow County	11	11,275	7	163	1,370,240
North Carolina	Pamlico County	11	2,548	20	51	99,250

Source: Table constructed using U.S. Census data and Hazards and Vulnerability Research Institute (2007) and USDOT FHWA Bridge data. The Spatial Hazard Events and Losses Database for the United States, Version 5.1; "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges", USDOT FHWA, Report No. FHWA-PD-96-001, Office of Engineering Bridge Division, December 2005

## Percent of Population Under Poverty (2005) and Number of Federally Declared Disasters by State



## Co-location of Elderly, Number of Disasters, and Transportation Infrastructure

- Selected counties with high number of elderly and high hurricane frequency but also
- High number of bridges and high level of average daily traffic

## Elderly are Victims of Transportation, Electricity and Communication Outages

- Although most elderly drive, many need evacuation assistance
- Transportation services for elderly in times of disaster are inadequate
- During Hurricane Katrina, deaths occurred among the elderly in hospitals in which electricity failed
- The duration of electricity outages, in particular those that are weather-related appears to be increasing (9)

## This Research Identifies Important Co-location Issues:

- Concentrated elderly populations
- Concentrated natural disasters
- Concentrated infrastructure (and special needs of elderly)

## Other Areas to Explore for Future Research:

- Vulnerable populations (poor)
- Infrastructure services (other than transportation)

## ENDNOTES

- 1 Census Facts for Features: "Older Americans Month: May 2007" [http://www.census.gov/Press-Release/www/releases/archives/facts\\_for\\_features\\_special\\_editions/009715.html](http://www.census.gov/Press-Release/www/releases/archives/facts_for_features_special_editions/009715.html)
- 2 Sandra Rosenbloom, "Sustainability and automobile among the elderly: An international assessment," Transportation, November 2001, 28, 4, Research Library, pages 380-381.
- 3 Genevieve Giuliano, table 3-4 and page 18. Based on an analysis of the 1995 National Personal Transportation Survey (NPTS).
- 4 Lois R. Shea, "NH Considers Crackdown on Elderly Drivers: Some Fight De-licensing Proposal; Others Favor Changes," Boston Globe, August 6, 2000, C1.
- 5 AARP "We Can Do Better" Older Persons and Evacuation: Who Needs Help? A Survey of Americans Age 50 or Older, Washington, DC, 2006, <http://assets.aarp.org/rgcenter/ii/better.pdf>, pages 14 and 15.
- 6 US General Accountability Office (GAO) Disaster Preparedness: Preliminary Observations on the Evacuation of Vulnerable Populations due to Hurricanes and Other Disasters, May 18, 2006, <http://www.gao.gov/new.items/d06790t.pdf>, page 4.
- 7 Census Facts for Features: "Older Americans Month: May 2007" [http://www.census.gov/Press-Release/www/releases/archives/facts\\_for\\_features\\_special\\_editions/009715.html](http://www.census.gov/Press-Release/www/releases/archives/facts_for_features_special_editions/009715.html)
- 8 R. Zimmerman, C.E. Restrepo, B. Nagorsky, and A.M. Culpen "Vulnerability of the Elderly During Natural Hazard Events," University of Colorado (Boulder), Hazards and Disasters Researchers Meeting; Vulnerable Populations in Disaster: Preparedness, Response, and Recovery Session, Boulder, CO, July 12, 2007.
- 9 J.S. Simonoff, C.E. Restrepo, and R. Zimmerman (2007) "Risk Management and Risk Analysis-Based Decision Tools for Attacks on Electric Power," Risk Analysis, Vol. 27 (3), pp. 547-570.

## ICIS BACKGROUND

- Initial \$5 million from NSF for a multi-university, interdisciplinary center for research and education on infrastructure services
- Additional infrastructure and environment research funded by U.S. EPA
- For more information, see: [www.nyu.edu/icis](http://www.nyu.edu/icis)

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