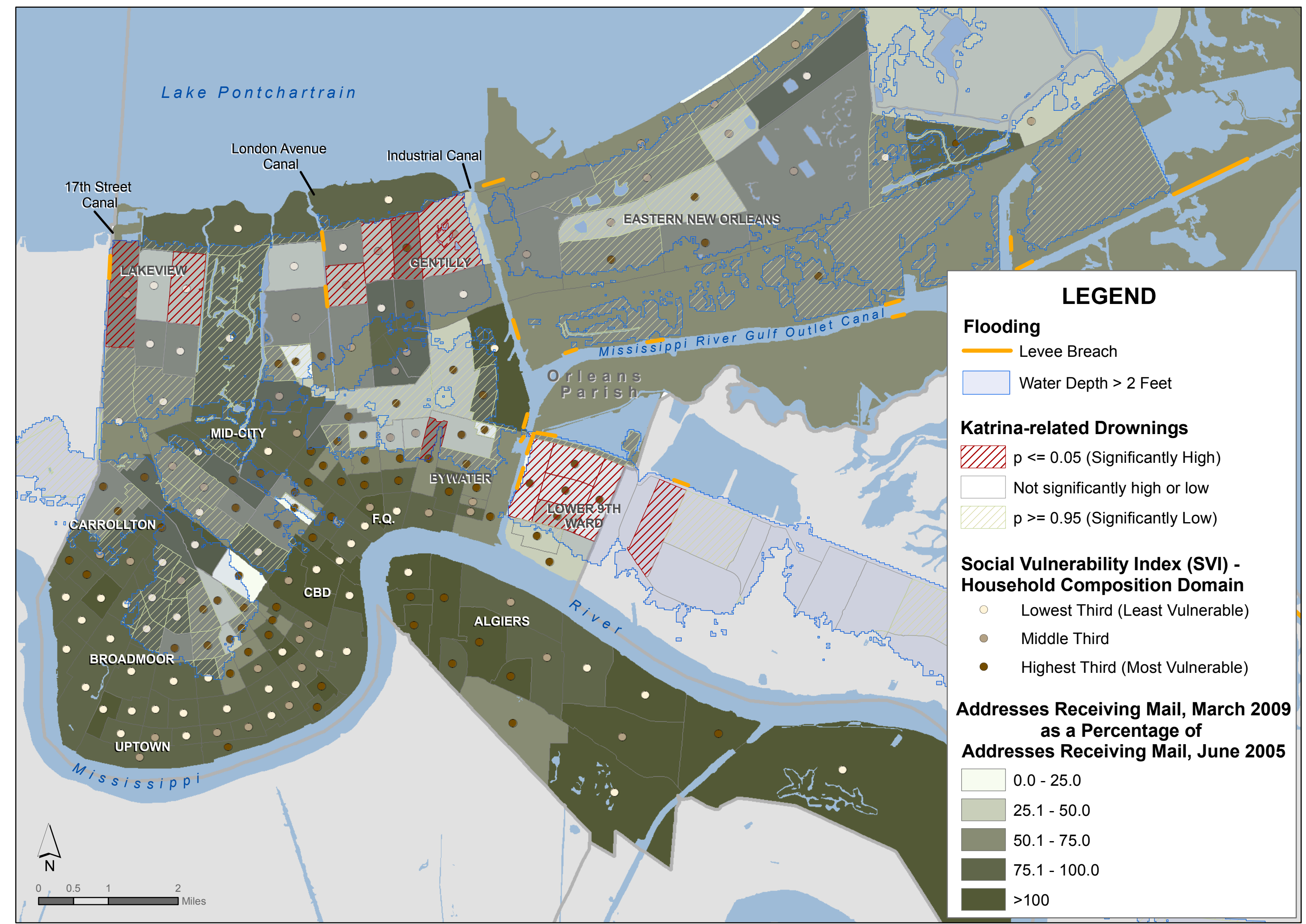


# Recovery after Katrina: Deconstructing the Map



The purpose of this poster is twofold; to explore recovery in New Orleans Parish after Hurricane Katrina and to individually visualize and examine variables that may affect and help explain geographic variation in recovery.

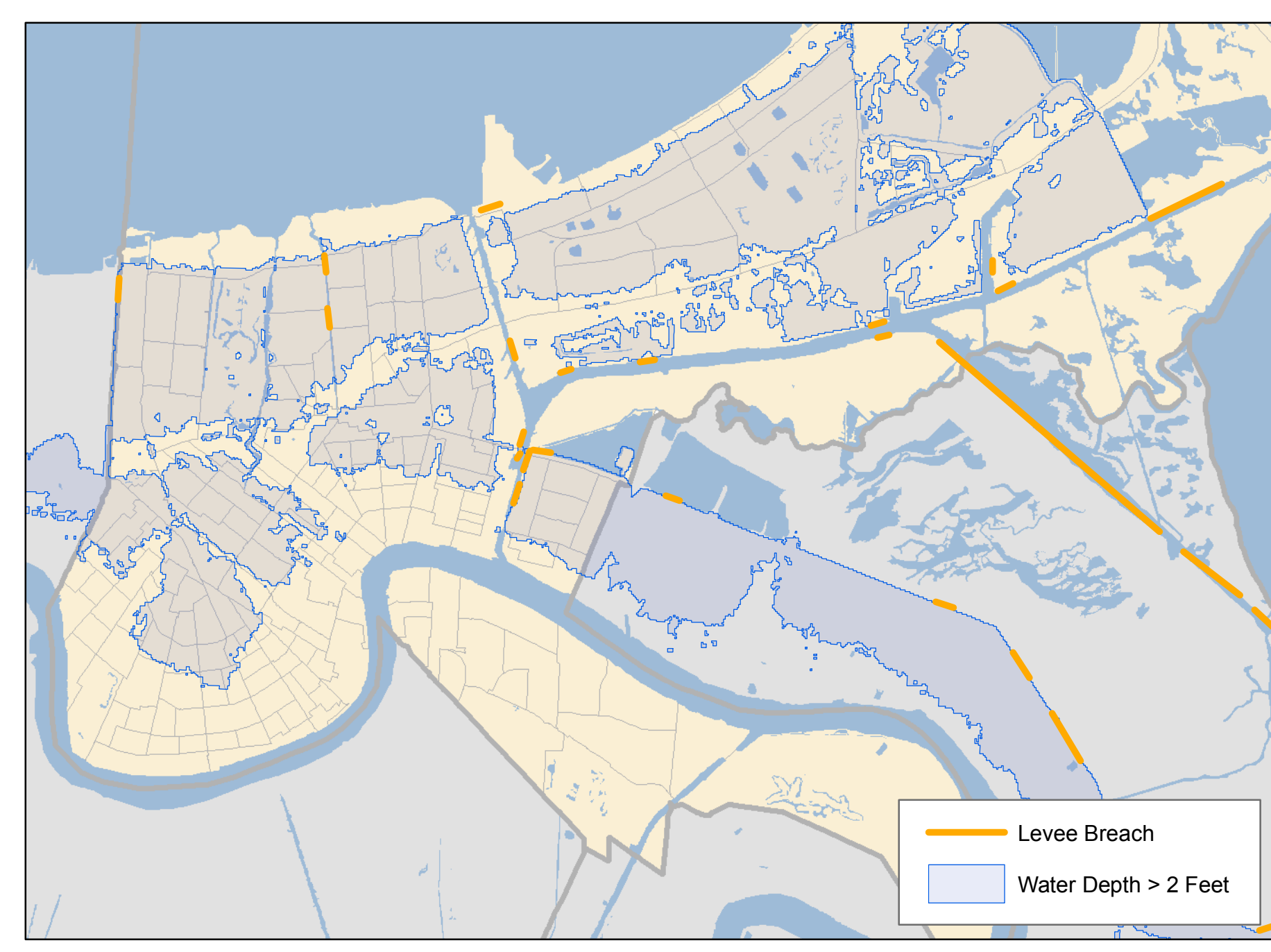
Katrina made landfall in southeast Louisiana on August 29, 2005 as a Category 3 hurricane. It was the costliest U.S. hurricane on record, with damage estimated at \$75 billion. Katrina was also the deadliest hurricane since 1928, with approximately 1,200 reported deaths in Louisiana and Mississippi (National Hurricane Center 2009).

The map shows the percentage of pre-Katrina addresses that are now receiving mail, i.e. those receiving mail in March 2009 as a percentage of those receiving mail in June 2005. The central business district (CBD) and the main tourist centers, such as the French Quarter (F.Q.), experienced limited damage compared to many residential neighborhoods. Local leaders strongly supported the recovery of the central business district and tourist areas (GNOCDC 2009). In addition, social vulnerability index (SVI) values range from the least vulnerable to the middle third. High mail delivery rates in the CBD and F.Q. reflect these factors. In contrast, areas that were heavily damaged in the flooding, such as Lakeview and Gentilly, at the southern end of Lake Pontchartrain, and the Lower 9th Ward, just north of the Mississippi River, have mail delivery numbers less than half of pre-Katrina numbers, regardless of SVI value. The Lower 9th Ward, with

tracts in the most vulnerable socioeconomic category, has mail delivery less than 25% of pre-Katrina numbers; recovery is slow or non-existent. Additionally, areas in the flood zone that experienced more limited flooding and lower mortality are slower to recover where the SVI value is in the highest third. For instance, the tracts to the northwest of Bywater, as well as the tracts near Broadmoor show lower rates of mail delivery with higher SVI values. So, as would be expected, the heavily damaged areas have been slow to recover no matter the demographic characteristics. Areas with socioeconomically vulnerable populations, however, are also slow to recover even without heavy flood damage. Those areas that experienced heavy damage and have socioeconomic vulnerable populations are the slowest to recover.

The next step to understanding geographic variation in recovery is to examine the data quantitatively. Initial regression analysis, not shown here, indicates that both the Katrina-related drowning probabilities and the SVI household composition domain are statistically significant and explain 33% of the variance in the mail delivery data. To properly specify the model, in the near future we'll explore other possible explanatory variables, such as landuse.

**References:**  
National Hurricane Center. <http://www.nhc.noaa.gov/HAW2/english/history.shtml>. Accessed October 21, 2009.  
Greater New Orleans Community Data Center <http://www.gnocdc.org>. September, 2009.

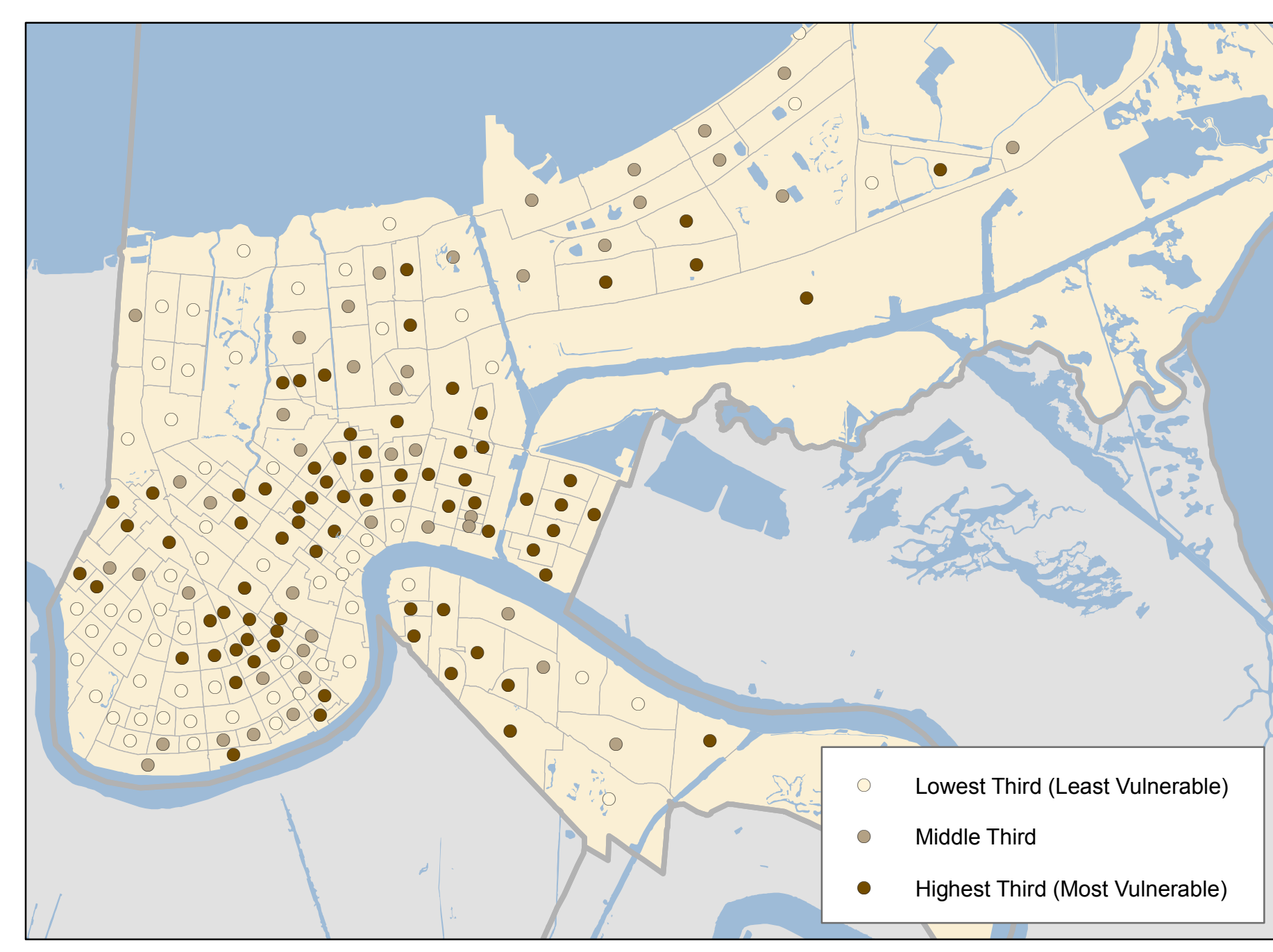


**Flooding**

The Katrina storm surge caused flooding along the U.S. Gulf Coast in the states of Mississippi and Louisiana. With much of New Orleans below sea level, the surge also caused catastrophic levee breaches resulting in massive destruction and loss of life. Houses were lifted off their foundations by the force of flowing water and much of the area was reduced to scattered rubble. The flooding affected an estimated 77% of the population of Orleans Parish (Gabe, et al. 2005).

**Data Sources:** Flood data were obtained from the National Oceanic and Atmospheric Administration (NOAA).  
Levee locations were obtained from The Times-Picayune and Jonkman, et al.

**References:**  
Gabe, T.; G. Falk; M. McCarty; V. Mason. 2005. Hurricane Katrina: Social demographic characteristics of impacted areas. Order Code RL33141. 11/4/05. Washington, DC: Congressional Research Service.  
Jonkman, S.N.; B. Maaskant; E. Boyd; M.L. Levitan. 2009. Loss of Life Caused by the Flooding of New Orleans After Hurricane Katrina: Analysis of the Relationship Between Flood Characteristics and Mortality. Risk Analysis 29(5):676-698.  
Schleifstein, M. 2009. The Times-Picayune. Study of Hurricane Katrina's dead show most were old, lived near levee breaches. [http://www.nola.com/news/index.ssf/2009/08/answers\\_are\\_scarce\\_in\\_study\\_of.html](http://www.nola.com/news/index.ssf/2009/08/answers_are_scarce_in_study_of.html). Accessed August 28, 2009.

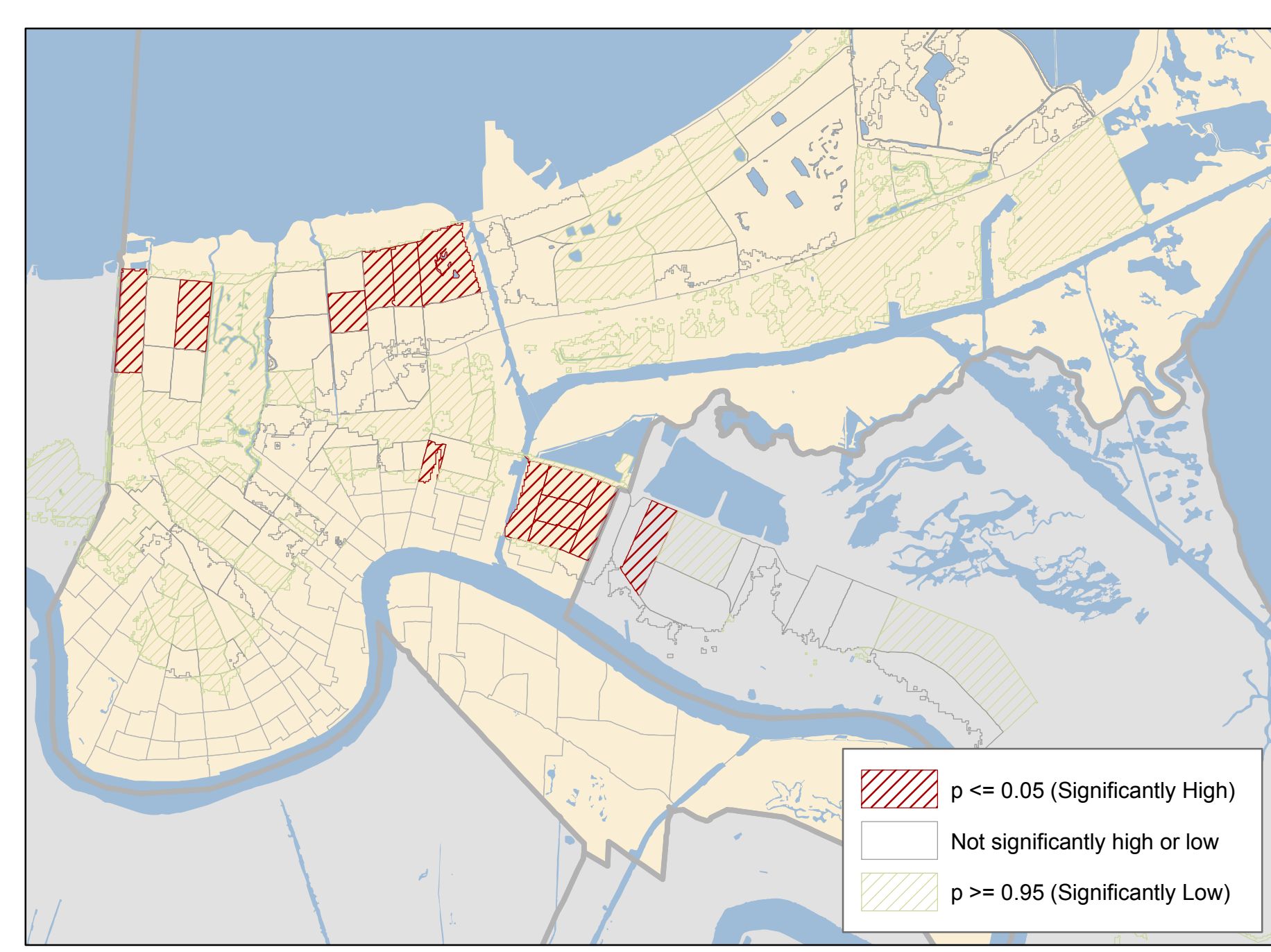


**Social Vulnerability Index (SVI) - Household Composition Domain**

ATSDR/GRASP collaborated with CDC's Office of Terrorism Preparedness and Emergency Response (OTPER) to produce a social vulnerability index (SVI) to assist state partners in all phases of the disaster cycle, including preparedness, response, and recovery. The index helps planning officials determine the locations of their most vulnerable populations. In New Orleans, for example, the majority of Katrina fatalities were elderly with almost half older than 75 years of age. We analyzed sociodemographic attributes, such as age, race, and economic status, to identify four overarching domains that are closely associated with varying social vulnerability to disaster. The domains that form the basis of the SVI are, 1) socioeconomic status; 2) household composition and disability; 3) minority status and language; and 4) housing and transportation. The data for the four domains comprise 15 variables from the US Census Bureau at the census tract level.

Visual examination of scatterplots and initial quantitative analysis indicated an association between mail delivery, our proxy for recovery, and the household composition domain, which includes relatively high percentages of residents 65 years and older, 17 years and younger, single parents, and/or those with disabilities.

**Data Source:** U.S. Census Bureau 2000 Census of Population and Housing.

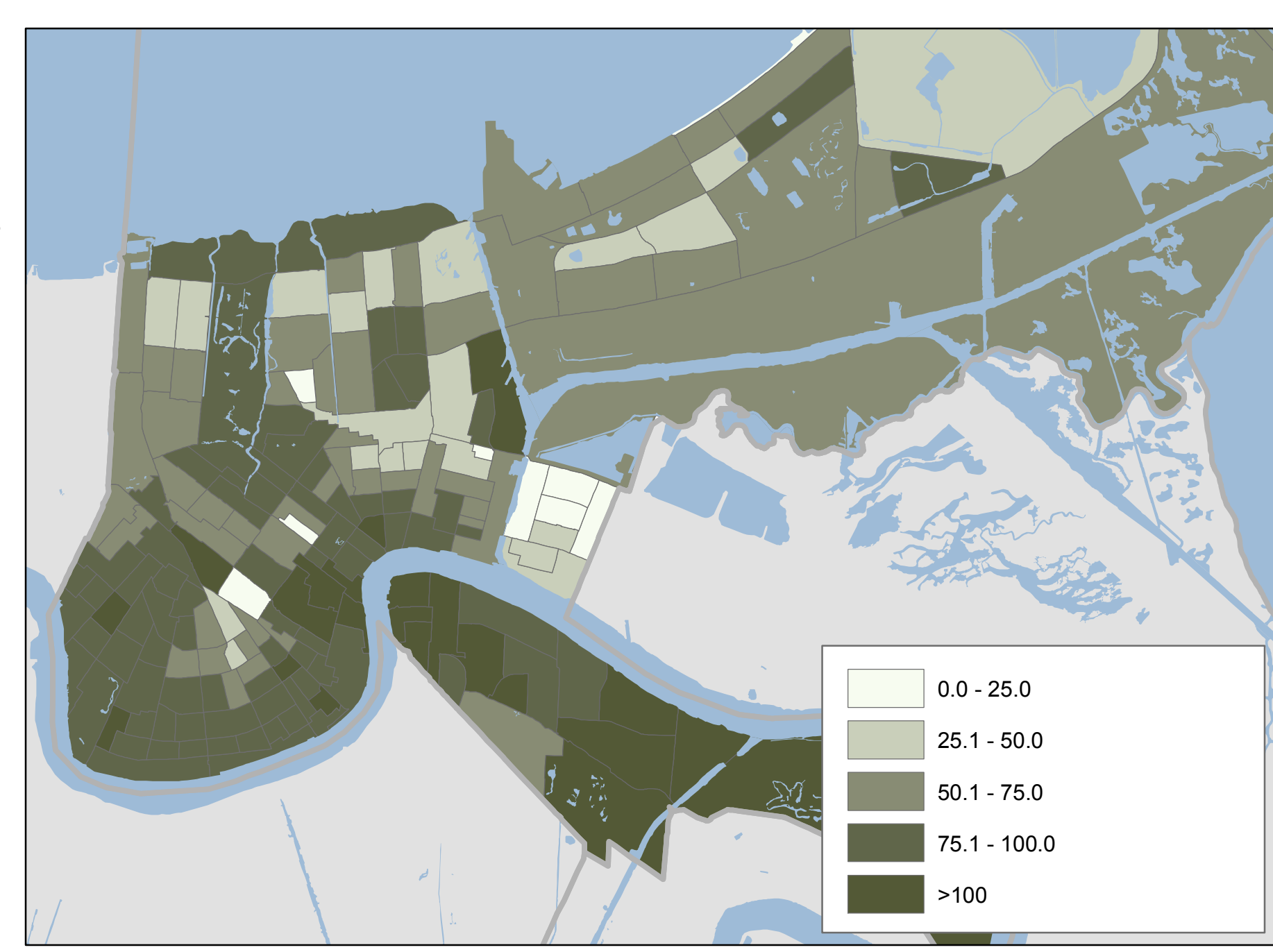


**Katrina-related Drownings**

We examined Katrina-related drowning fatalities because most of the Louisiana deaths were from drowning (58% of the deaths in the flood zone) and because the drowning deaths were probably directly due to the physical impacts of the flooding. The deaths were statistically rare events given the population in the flood zone. We therefore used the Poisson distribution to determine the probability and statistical significance of the observed number of deaths for each census tract, or portion of tract, within the flood zone (Cromley and McLafferty 2002). For a tract of a specified population, the Poisson test tells us if the number of deaths is significantly higher or lower than the death rate for the entire flood zone. Death records were geocoded and then aggregated to census tract level. Pre-storm evacuation data were unavailable, so we estimated the exposed population based on an area proportion algorithm. The 2000 census population for each tract was multiplied by the geographic area, or proportion, of each tract within the flood zone. An ATSDR/GRASP developer created geoprocessing tools to perform both the Poisson test and the area proportion calculations.

**Data Sources:** Death records were obtained from the Louisiana Office of Public Health and include data collected by the Hurricane Katrina Disaster Mortuary Operational Response Team (DMORT) and death certificates from Louisiana vital statistics. Population data are from the U.S. Census Bureau's 2000 Census of Population and Housing.

**Reference:**  
Cromley, E.K., S.L. McLafferty. 2002. GIS and Public Health. New York: The Guilford Press.



**Addresses Receiving Mail, March 2009 as a Percentage of Addresses Receiving Mail, June 2005**

The Congressional Research Service estimates that about half of persons displaced by Katrina lived in New Orleans. Many were poor, African American, elderly, or young children (Gabe, et al. 2005). To explore the recovery phase of the disaster cycle, and how it is affected by multiple variables, we mapped Orleans Parish census tract level mail delivery data, which serves as one indicator of recovery; the return of residents to the affected area.

**Data Source:** Mail delivery data are driven by Valassis Lists. From a compilation by the Greater New Orleans Community Data Center <http://www.gnocdc.org>. September, 2009.

*The findings and conclusions in this presentation have not been formally disseminated by the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry and should not be construed to represent any agency determination or policy.*

**Authors:**  
Elaine J. Hallisey, MA; Barry Flanagan, PhD;  
Edward Gregory, PhD; Brian Lewis, BS

Geospatial Research, Analysis & Services Program/ATSDR/CDC