



Environmental Injustice in Harris County, TX

A spatial investigation of the impact of Hurricane Harvey on flooding and toxic releases in Harris County, TX

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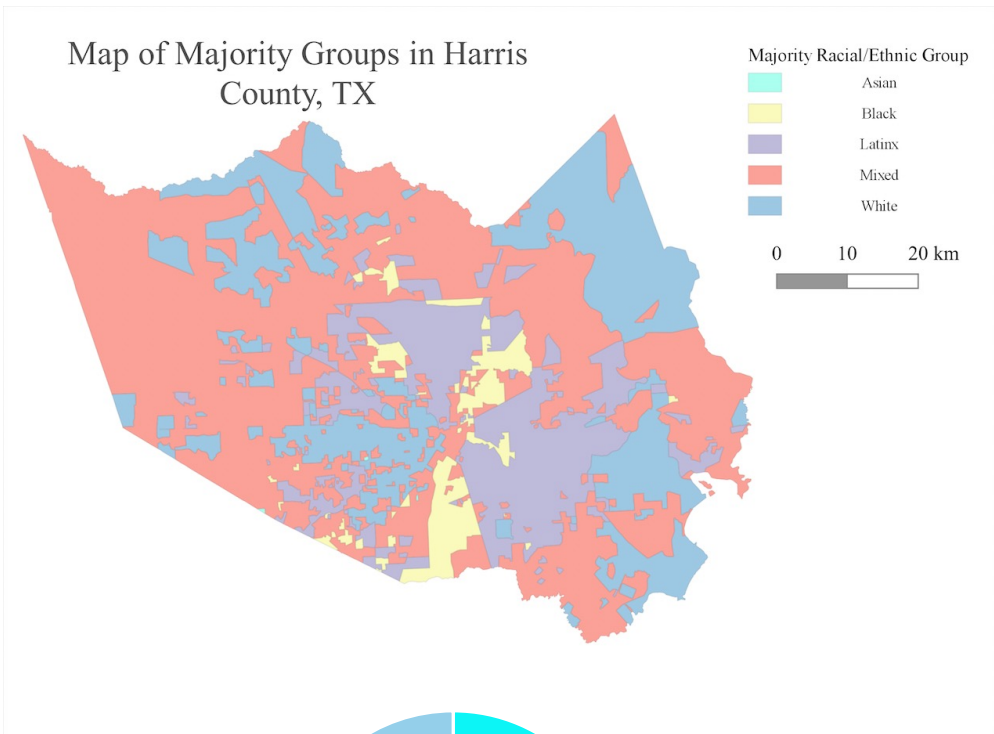


Figure 1 (Top-left): Majority Group in Harris County, TX (2018)

The devastating Hurricane Harvey in 2018 caused extensive flooding in Harris County, TX, affecting various racial and ethnic groups differently. The Latinx and Black communities are spatially clustered in the central east area, but we can see that a large proportion of majority groups in Harris County are mixed (concentrated in the county's west). This suggests that the racial-ethnic groups in the county are well integrated.

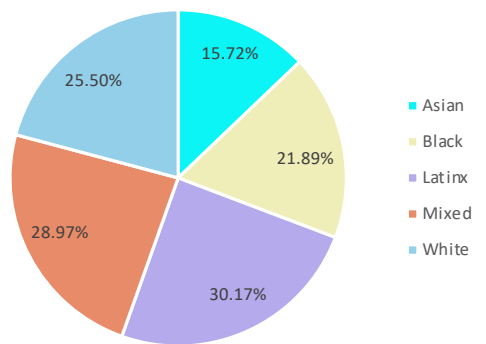


Figure 2 (Bottom-left): Percent of Flooded Building Areas per Majority Group

The pie chart presents the percent of flooded building area for each majority group in Harris County, TX. An average of 24.45% of buildings were affected due to the flood. The mixed and Latinx communities were disproportionately affected, at 28.97% and 30.17% respectively. This suggests social inequality in location of these communities and poor infrastructure in these areas that led to a larger proportion of flooded building areas.

Formula used: $(\text{flooded building area}) / (\text{total building area}) * 100$

Figure 3 (Top-right): Overview of Actual Flooded Area vs FEMA's Predicted Flooded Area, Harris County, TX

The map presents an overview of the area that was flooded compared to the area FEMA predicted to flood in Harris County, TX. It shows which zones that were not predicted to flood, such as the eastern area of the county, were flooded. FEMA did not well predict the flooding area, as more area surrounding the predicted areas were affected. This map shows how FEMA data is unreliable, reasons for which could be outdated predictions based on historical flooding and development, unpredictable climate change, and rising sea levels.

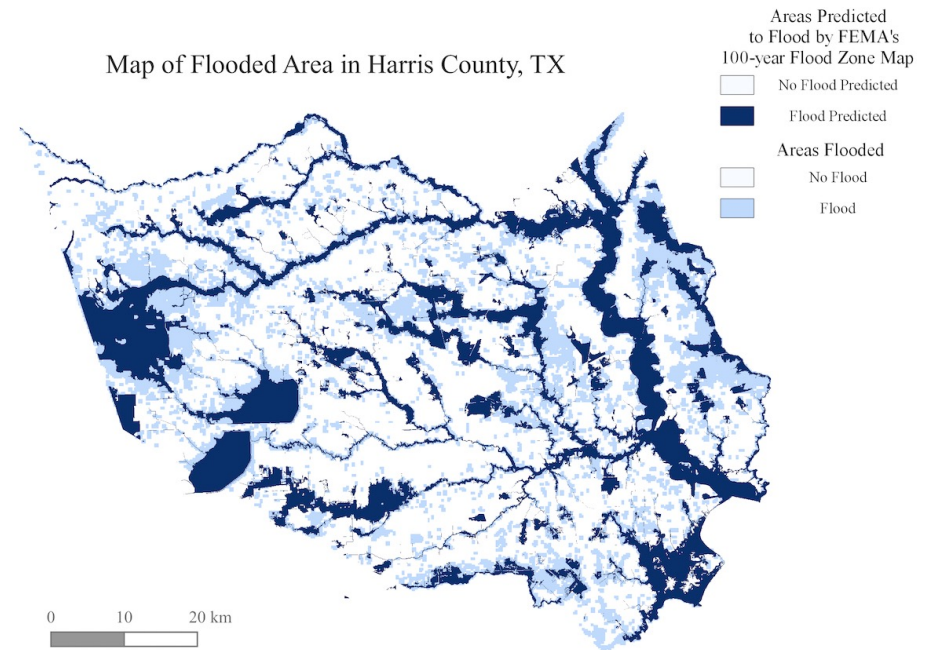
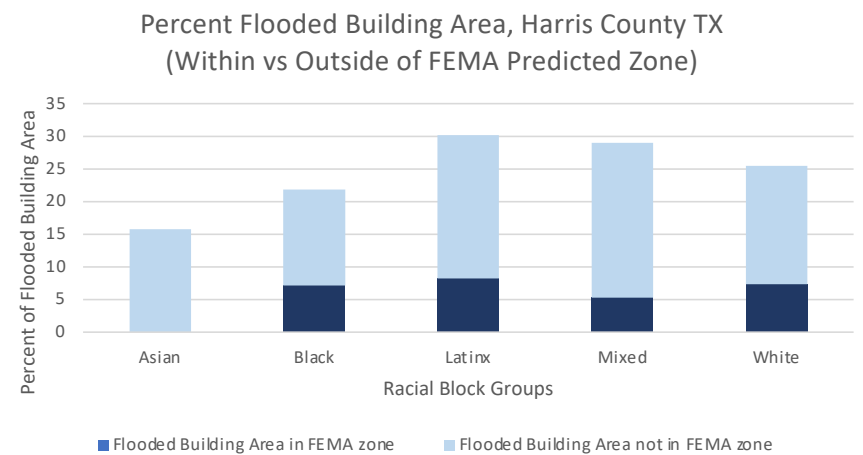


Figure 4 (Bottom-right): Overview of FEMA Flood Prediction Accuracy According to Racial Block Group

The graph represents how much of flooded building area for each majority group in Harris County, TX, were accurately predicted by FEMA and were not. FEMA was not able to predict flooding for a large part of all groups, but the Latinx and mixed communities were the most affected. The total percent of Latinx flooded building area reached 30.17%, 21.93% of which were unpredicted by FEMA. Similarly, 23.70% of mixed flooded building areas suffered due to unreliable predictions. It is most likely that the communities living in the unpredicted areas were more harshly affected as they did not have the right preparation (ex. investing in flood insurance) than those who were in the FEMA zone.



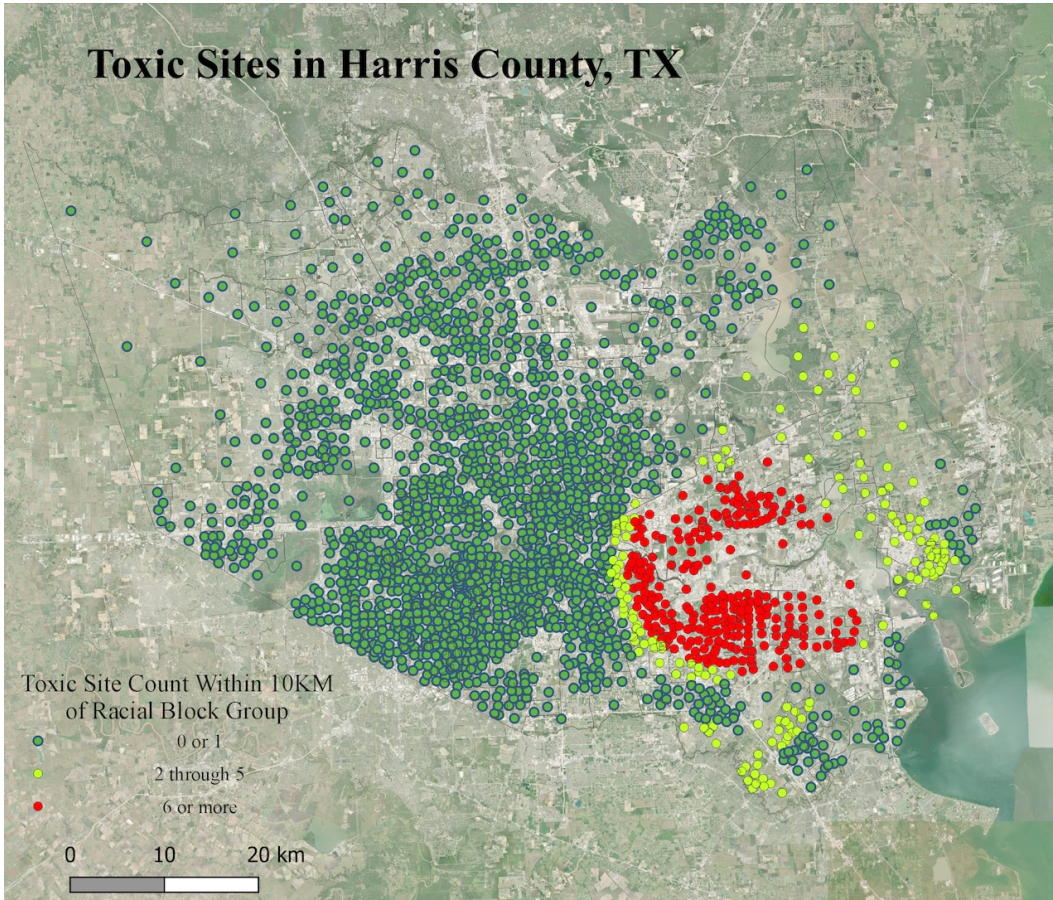


Figure 5 (Top-left): Toxic Sites Within 10KM of Racial Block Group in Harris County, TX

The graph of toxic site counts reflect how residents in Harris County, TX, generally face pollution. The only areas where there are no toxic sites within 10KM of the racial block group are the northeast and northwest. Every other area has a toxic site around them in different extents – however, the ‘6 or more’ toxic sites within 10km of racial block groups center around the Greater Fifth Ward neighborhood in the southeastern area of Harris County. The ‘2 through 5’ sites surround the ‘6 or more’ area, suggesting that the populations living in the entire southeastern area are at risk. The majority group located in this area is most likely enduring the impact of pollution, which may be vulnerability to illness and worse housing conditions. These problems would lead to a greater flood impact and access to recovery programs in the area.

Table 1 (Bottom-left): Block Groups and Population with Toxic Sites, Harris County, TX

Toxic Sites within 10km	Block Groups (Count)	Total Population
0 or 1	1719	3,710,078
2 through 5	156	305,612
6 or more	269	509,829
Total	2144	4,525,519

The table shows the block group count that have ‘0 or 1’, ‘2 through 5’, or ‘6 or more’ toxic sites within 10km of the majority race/ethnic group. Although majority of the population in Harris County live in areas where there are ‘0 to 1’ toxic sites, concerns need to be raised on the 18% of the total population who are at a higher health risk as they live near 2 or more toxic sites.

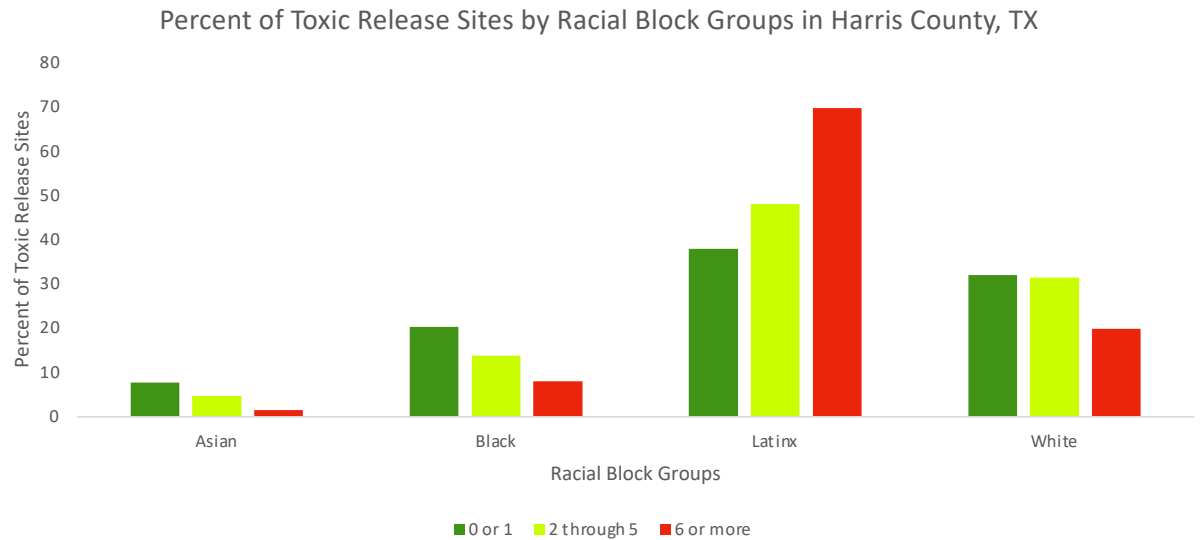
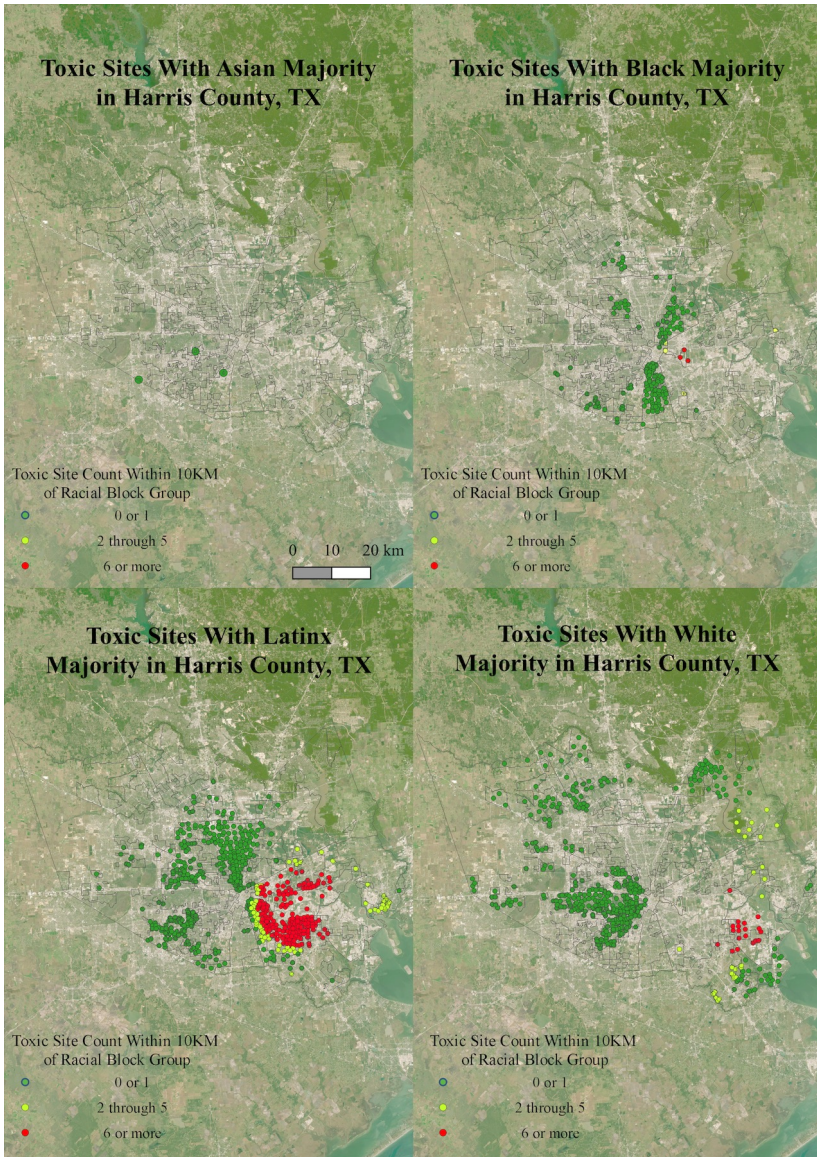


Figure 6 (Left): Toxic Sites According to Racial Group in Harris County, TX

A map of toxic sites within 10km of racial block groups reflect how '6 or more' toxic sites are overwhelmingly clustered in majority Latinx living areas. Some 2 through 5 sites around Latinx communities found near the coastal area on the southeast suggests that people living in that area are suffering from pollution and are prone to flood. We can infer that environmental injustice is occurring in Harris County as the Latinx community inhabit toxic spaces that can cause health threats.

Figure 7 (Top-right): Percent of Toxic Sites According to Racial Group in Harris County, TX

The graph of percent of toxic release sites according to racial groups in Harris County shows the disproportionate number of toxic release sites in areas the Latinx community live in. The Latinx community has the highest number of toxic release sites in all categories (0 or 1, 2 through 5, 6 or more) compared to other race and ethnic groups. This graph suggests that systemic racism continues in Harris County, where the number of toxic release sites located in the southeast leaves the Latinx community susceptible to flooding and health risks.

Data

- United States Census API <https://www.census.gov/developers> via R tidycensus <https://walkerke.github.io> – Block group and demographic shapefiles of Harris County, TX
- Environmental Integrity Project via public reports and U.S. Coast Guard National Response Center Data <https://environmentalintegrity.org/news/harvey-map/> - Toxic releases shapefile of pollution released onto land and into water, not including air pollution in Harris County, TX
- The Flood Observatory <https://floodobservatory.colorado.edu/> and the Harris County Flood Control District <https://www.hcfd.org/Hurricane-Harvey> - Image of actual flooded area in Harris County, TX
- Raster layer of building footprints from a shapefile of 2018 Texas buildings retrieved from ARCGIS <https://www.arcgis.com/home/item.html?id=2f3cfc9e544a4485a6cbbf0d721c0a2c> processed by Derrick Burt on Jan 2023
- Raster layer of areas predicted to flood by FEMA's 100-year flood zone map retrieved from a shapefile of FEMA's 100-year flood zones in Harris County, TX, FEMA's National Flood Hazard Layer (NFHL) Viewer <https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd> processed by Derrick Burt on Oct 2022

Images

- Harvey Hit 5 Years Ago. Its Floodwaters Did Not Strike Equitably. <https://www.nytimes.com/2022/08/25/climate/hurricane-harvey-climate-change.html> – Photo of overwhelmed neighborhoods in Harris County, TX / NY Times, Elena Shao
- Google Satellite World Imagery – Harris County, TX