Environmental Justice, Public Health and Landfills: Using Spatial and Statistical Analysis to Examine Type 1 Landfills in Houston, Texas.

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Introduction

- Most environmental justice (EJ) studies have shown that people of color and low-income communities are exposed to a higher level of environmental pollution and health risks than other race/ethnic group (UCC, 1987; Bullard, 1983; Mohai, et al., 2009; Maantay et al., 2010).

- These communities are targeted to host facilities that have negative environmental impacts such as landfills, toxic hazardous facilities, industrial facilities and Superfund site.

Negative environmental impacts of Landfills

- Climate change – Landfill gases e.g. Methane.
- Groundwater contamination- Leachate.
- Gas explosion and fires - Methane.
- Unpleasant odor - Ammonia and sulfides.
- Noise.
- Vegetation damage – CO2 and Methane.
- Infrastructure damage.
- Reduced property value.

(Jarup et al., 2002; Pradyumna, 2013).

Blue Ridge Landfill- In Fort bend County

Atastocita landfill over 500 trucks dump garbage each day - Houston Chronicle, 2015.

Photo Source: Melissa Phillip/Houston Chronicle Newspaper 2018.

Adverse effects of landfills on public health

- Respiratory diseases (Asthma, Allergies, Lung disease).
- Low birth weight.
- Birth defect / congenital disability in children.
- Cancer – Lungs, liver, kidney and brain cancer .
- Leukemia in children.

(Pirastu et al., 2010; Fazzo et al., 2011; Ulaszewska et al., 2011 and Maheshwari R, 2015).

Aim of study

- The purpose of this study is to determine if environmental inequalities still exists in siting toxic waste facilities.

- The problem of environmental injustice will be examined longitudinally by analyzing census tract data from 1980, 1990, 2000, 2010 and 2015 to detect any changes or trend in the sociodemographic over the decades.

Study Rationale

- The case of Bean v. Southwestern waste management in 1979 (Bullard, 1983).
- Recent studies in Houston still show inequalities in the distribution of environmental hazards (Bullard, 2014; CEG, 2016).
- August 2017, Hurricane Harvey hit the city of Houston and its environs.

Study Rationale

- The average person in the Houston MSA generates about 7.08 pounds of waste per day; higher than the average (4.3 pounds) generated in the United States per day (TCEQ, 2017).
- Houston and its environs have become one of the major industrial cities in the United States (The Manufacturers' News Inc., January 2013).
- Racial and Ethnic diversity (Chakraborty et al., 2014).

Demographic change in Houston from 1980 to 2015

Race \ Ethnicity	1980	1990	2000	2010	2015	Numerical Change
Total Population	**1,595,138**	**1,631,766**	**1,953,631**	**2,099,451**	**2,217,706**	**622,568**
White	52.00%	40.62%	30.81%	25.62%	25.51%	-268,269 -43.09%
Black or African American	27.36%	27.46%	24.97%	23.15%	22.66%	66,227
Hispanic or Latino	17.64%	27.61%	37.41%	43.81%	43.86%	691,454 111.06%
Asian	2.15%	4.11%	5.46%	6.15%	6.36%	106,887

Source: U.S. Census data

Literature Review

- Environmental justice (EJ) is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (U.S. EPA, 2013).

Literature Review

- Environmental Justice emerged from the Civil Right Movement in the 1960.
- EJ became widely recognized in the early1980s to address racial and ethnic inequalities and the non-involvement of the minority and low-income groups in environmental policies and decision making.
- In February 1994, President Clinton signed the executive Order 12898 into law to address and remedy environmental injustice in low-income and minority communities.

Methodology

- Mixed Method

  Both quantitative and qualitative methods.

- Data Collection – Primary and secondary sources.

  - Primary Sources - Questionnaires survey, interviews and field observation.
  - Secondary – Documentation- Journals, Agency reports, newspaper reports conference papers.

  Archival Records - EPA databases, US Census Bureau website, HGAC data, TCEQ, Harris County Public Health (HCPH) Data.

Research Question

- **Research Question #1:**

Using Spatial analysis

Is there a comparison between the racial and socioeconomic characteristics of proximate areas (census units or buffer zones) that contain hazards to areas that do not contain hazards?

Research Question #2:

Using statistical analysis

Is there a relationship between the socio-demographic characteristics and the presence of toxic waste facilities?

- **Research Question #3:**

Is there any relationship between the landfill sites and any health problems among residents living in proximity to these landfill sites?

Census variables used to evaluate demographic and economic characteristics around Landfills

Name	Variables
Race and Ethnicity	% of White % of African American
	% of Hispanics % of Asians
Income	Median Housing Income
	% Person below poverty line
Age	Population under 5
	Population 65 and over
Housing	Median value of owned occupied housing unit
	% of owner occupied
	% of Renter occupied
Education Attainment	No degree
	High School Grad
	Bachelor degree or higher
Occupational Status	Employed
	Unemployed

Brief description of study area

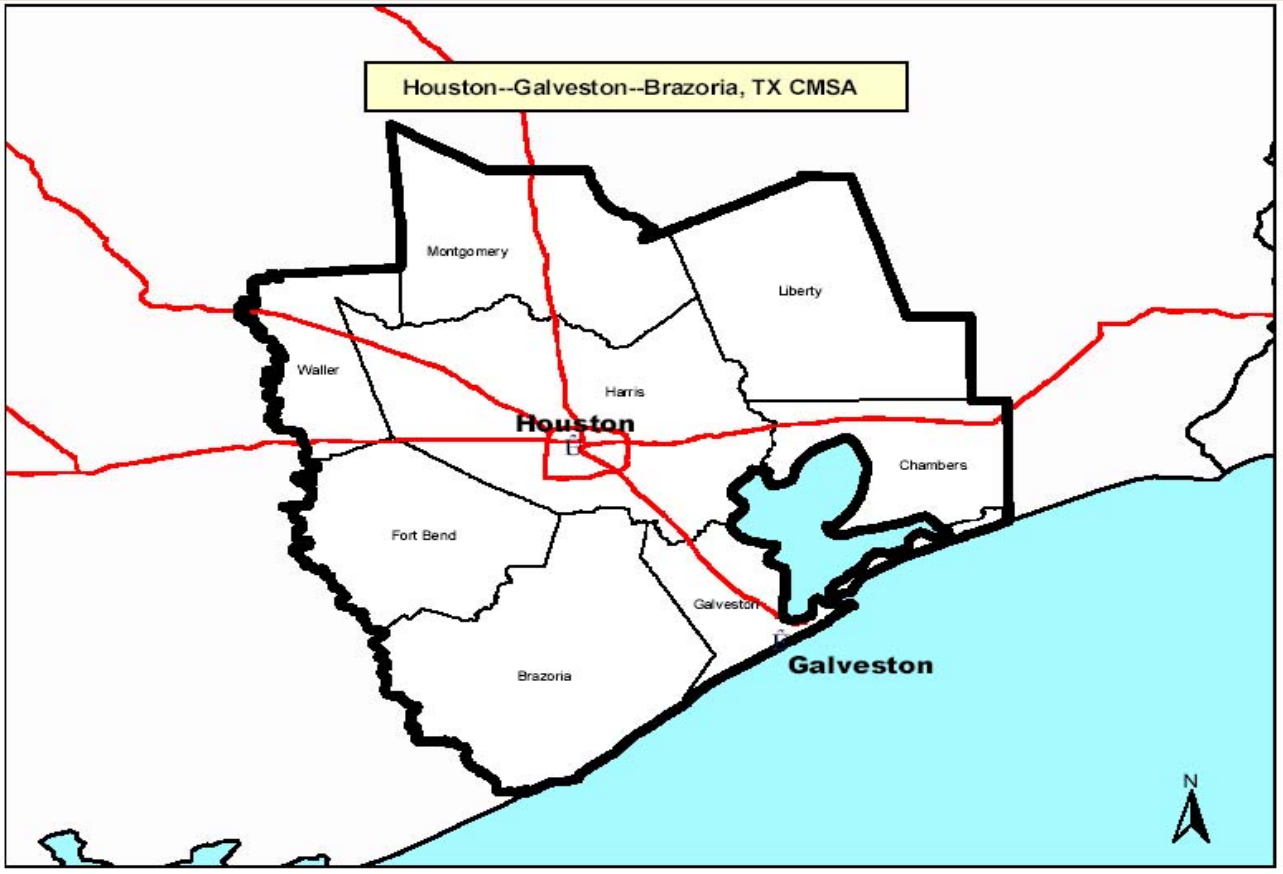
- The Houston metropolitan area (HMA) is the fifth-largest metropolitan area in the United States and the second-largest in Texas with a total population of 6.77 million.

  (U.S. Census Bureau 2016 estimates).

- The Greater Houston covers about 9,444 square miles in land area and is made up of eight counties namely: Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller (HGAC, 2018).

(H-GAC, U.S Census Bureau)

Map of Study Area



Source: https://www.fhwa.dot.gov/planning/census_issues/ctpp/data_products/journey_to_work/jtw8.cfm

Landfills in HMA

- There are 198 active landfill sites in Texas.

- There are 27 active landfill sites in the Houston Metropolitan area.
- There are twelve (12) type 1 landfills and fifteen (15) type IV landfills.

(TCEQ, 2018; HGAC, 2018; US Census Bureau)

Type 1 landfills are examined because they accept all types of wastes including organic matter that are capable of causing obnoxious odors and attracting birds or animals.

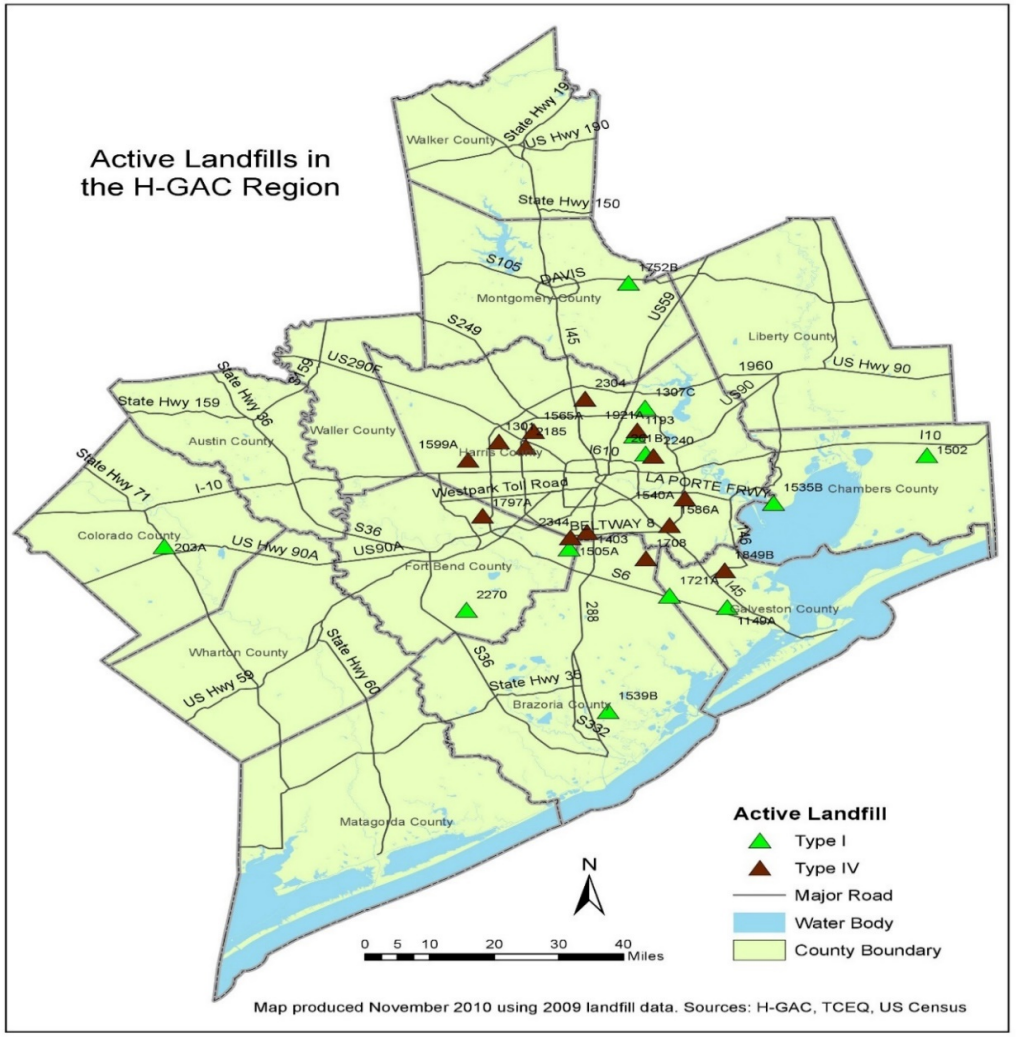

Active Landfills in the H-GAC Region
Walker County
State Hwy 19
US Hwy 190
State Hwy 150
S105
DAVIS
1752B
Montgomery County
US59
S249
I45
Liberty County
US290F
1960
US Hwy 90
State Hwy 6
State Hwy 159
2304
1307C
US90
1565A
1921A
1193
Waller County
1307
2185
1599A
Harris County
I610
2240
I10
1502
Austin County
State Hwy 71
I-10
Westpark Toll Road
1797A
LA PORTE FRWY
1540A
1535B
Chambers County
1586A
2344
BELTWAY 8
1403
1708
1505A
1849B
Colorado County
203A
US Hwy 90A
S36
US90A
Fort Bend County
S6
1721A
I45
2270
288
Galveston County
1149A
Wharton County
State Hwy 60
US Hwy 59
S36
State Hwy 35
Brazoria County
1539B
S32
Matagorda County
Active Landfill
Type I
Type IV
Major Road
Water Body
County Boundary
N
0 5 10 20 30 40
Miles
Map produced November 2010 using 2009 landfill data. Sources: H-GAC, TCEQ, US Census

Table 1: Type 1 Landfills in Houston Metropolitan Area

S/N	County	Type	Landfill Site Name	Year Permitted	Remaining Years
1	Brazoria	1	Seabreeze Environmental Landfill	2006	31.4
2	Chambers	1	Chambers County Landfill	2013	459
3	Chambers	1	Baytown Landfill	1998	26
4	Colorado	1	Altair Landfill	1973	5.7
5	Fort Bend	1	Blue Ridge Landfill	1992	94
6	Fort Bend	1	Fort Bend Regional Landfill	2004	30
7	Galveston	1	Galveston County Landfill	1978	54
8	Galveston	1	Coastal Plains Landfill	1985	22
9	Harris	1	McCarty Road Landfill	1971	19
10	Harris	1	Whispering Pines Landfill	1978	10
11	Harris	1	Atascocita Landfill	1991	28
12	Montgomery	1	Security Landfill		24

Source: http://www.h-gac.com/community/solidwaste/management/documents/active_landfills.pdf; TCEQ,2015

Methods of Data Analysis

Spatial Analysis

- Spatial coincidence (Unit-Hazard Coincidence method)- Assumes that people living in the host unit are closer to the environmental hazard than those living in the non host unit.

  The sociodemographic characteristics of the host geographic units are compared to the non-host geographic (Maantay et al., 2010).

- Distance-based methods (*Buffer Analysis*)- circular buffers around point sources of hazards facilities to identify areas and populations exposed to their adverse effects (Mohai and Saha, 2006).

- Circular Buffer – Within one, two and three miles.

Spatial Analysis

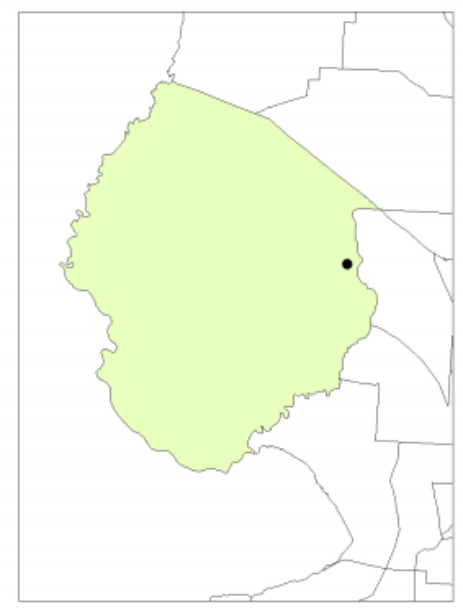


Figure 1

Unit-Hazard Coincidence

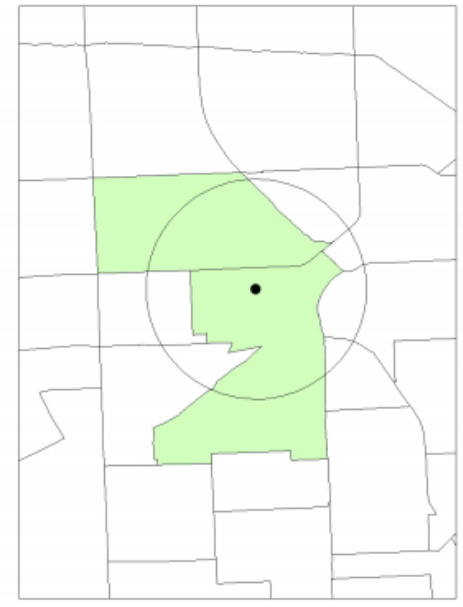


Figure 2

50% areal containment using one mile radius

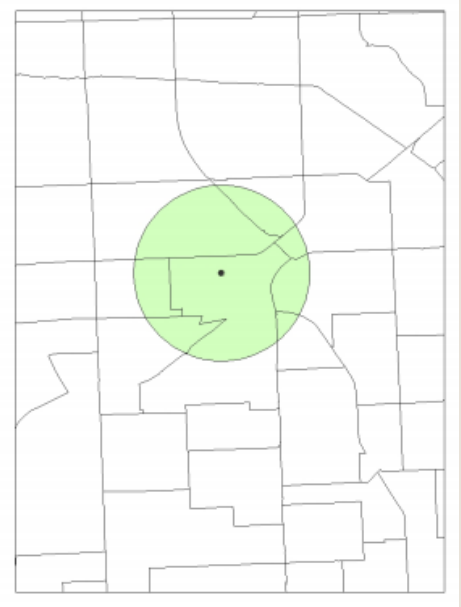


Figure 3

Areal apportionment using a one mile radius

Source: Mohai and Saha, 2006

Methods of Data Analysis

Statistical Analysis

- Spatial regression will be used to determine if there is a significant relationships between environmental hazards and the socio-demographic characteristic such as race / ethnicity or income .
- Spatial regression accounts for multicollinearity and the effects of spatial autocorrelation amongst the demographic variables
- Chakraborty et al., 2011)

Conclusion

Despite the EJ movement, policies and regulation, there are still environmental disparities related to the distribution of Landfill sites in the H-GAC region.

Environmental planners should therefore continue to advocate for this communities.

Policy Implication

- Study like this may be useful to community-based organizations (CBOs) seeking to advocate for their communities.
- Serve as information to the federal and local agencies while giving license to companies to operate.
- Health-related agencies can benefit from this research because it can facilitate further studies on the negative health impacts of the community around the facilities.

THANK YOU...