Madisyn R. Cook

Why can't I breathe clean air?

Inadequate public policies failed to address systemic environmental racism in North St. Louis. Concentrated air pollution and health disparities persist in my community because of historic redlining and zoning practices.

What is Environmental Racism?

The disproportionate exposure of marginalized communities to pollution and environmental hazards.

Historical Context

Redlining (1930s-1960s): HOLC maps limited investment and homeownership;

- Result: Concentrated Black communities in areas with poor infrastructure and near industrial zones.

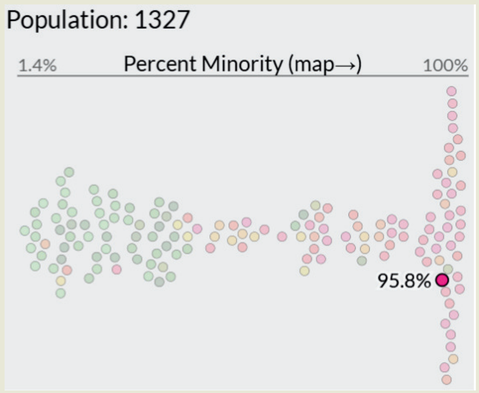

Figure 1. Racial Demographics in 1937 by HOLC Investment Grade

This plot illustrates the racial composition of St. Louis neighborhoods at the time of their 1930s Home Owners' Loan Corporation (HOLC) assessment. Each data point represents a specific residential section, positioned along a horizontal axis representing the "Percent Minority" population, ranging from 1.4% to 100%. Data points are color-coded by their historical investment grade: Green (A/Best), Blue (B/Still Desirable), Yellow (C/Definitely Declining), and Red (D/Hazardous).: The visualization demonstrates a direct correlation between high minority populations and the lowest investment grades. Historically "Hazardous" (Red) tracts are almost exclusively concentrated at the higher end of the racial spectrum, with a highlighted tract reaching 95.8% minority population. In contrast, "Best" (Green) and "Still Desirable" (Blue) tracts are strictly clustered at the low-minority end (1.4%–5%).
Note: Total population for the data set shown is 1327, representing the residents within the highlighted section at the time of the 1937 survey.

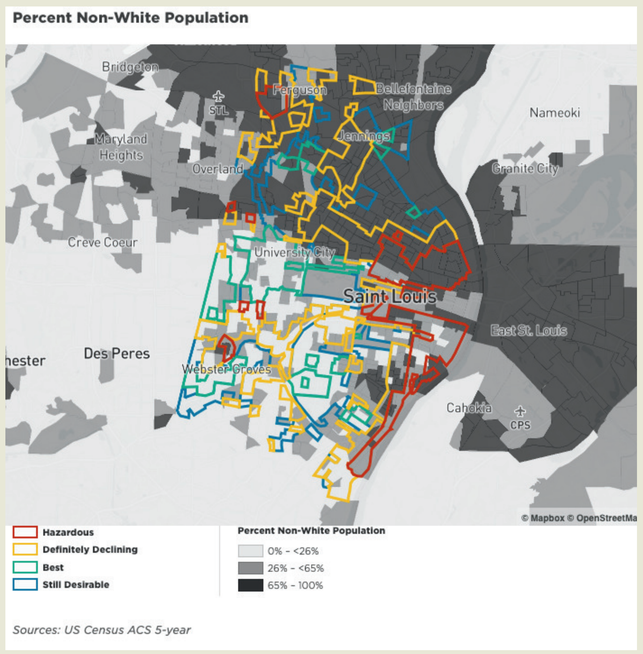

Figure 2. Historical HOLC Grades Superimposed on Modern Racial Demographics in St. Louis

This geospatial map overlays 1937 Home Owners' Loan Corporation (HOLC) residential security boundaries onto a choropleth map of modern (ACS 5-year) racial demographics in the St. Louis metropolitan area. Neighborhood boundaries are outlined according to their historical investment grade: Red (Hazardous), Yellow (Definitely Declining), Green (Best), and Blue (Still Desirable). Background shading represents the "Percent Non-White Population," categorized into three tiers: 0%–26% (light gray), 26%–65% (medium gray), and 65%–100% (dark gray). A high degree of spatial correlation exists between historical "Hazardous" (Red) and "Definitely Declining" (Yellow) classifications and modern-day areas with the highest non-white populations (65%–100%). This is particularly evident in the "Northside" of Saint Louis and neighboring areas like Ferguson and Jennings. Conversely, areas historically graded "Best" (Green) and "Still Desirable" (Blue) predominantly align with modern areas having the lowest non-white populations (0%–26%), primarily in the western and southern suburbs. Abbreviations: ACS = American Community Survey. Data Source: U.S. Census Bureau ACS 5-year estimates and Digital Scholarship Lab (University of Richmond) HOLC archives.

Air Pollution Hotspots

Industrial facilities like waste processing plants, landfills, and chemical factories are disproportionately located in low-income Black neighborhoods.

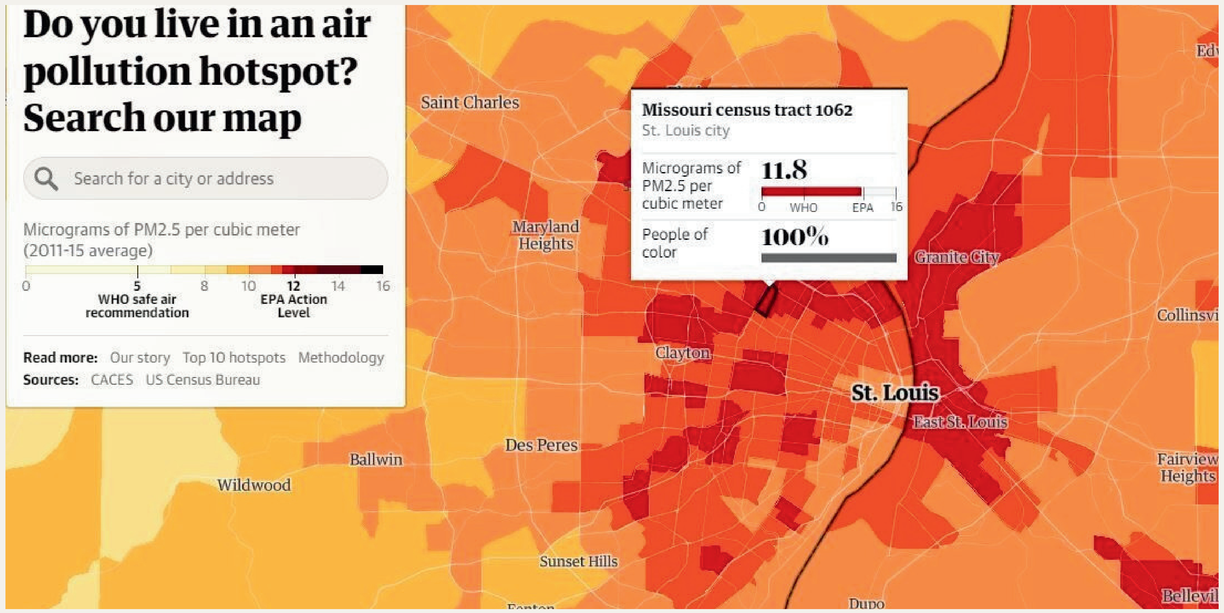

Figure 3. Disparities in Fine Particulate Matter (PM2.5) Exposure across St. Louis Census Tracts

This choropleth map illustrates average concentrations of fine particulate matter (PM2.5) in micrograms per cubic meter ($\mu g/m3$) across the St. Louis metropolitan area from 2011–2015. Data is visualized at the census tract level, with a color gradient ranging from light orange ($0\mu g/m3$) to dark red ($16\mu g/m3$). Reference markers are provided for the World Health Organization (WHO) safe air recommendation ($5\mu g/m3$) and the EPA (Environmental Protection Agency) action level ($12\mu g/m3$). Demographic data for "People of Color" is overlaid for the highlighted tract. Results: High concentrations of PM2.5 are concentrated in the urban core and industrial corridors (e.g., Granite City East St. Louis). The highlighted section, Missouri Census Tract 1062, shows a PM2.5 level of 11.8 $\mu g/m3$. which is significantly above the WHO recommendation and nears the EPA action level. This tract is recorded as having a 100% population of people of color, illustrating a sharp intersection between environmental hazards and racial demographics. Data Source: Center for Air, Climate, and Energy Solutions (CACES) and U.S. Census Bureau.

Hypothesis

- My null hypothesis is that there is no differences between my census track and the Clayton or other wealthier and white St. Louis neighborhoods.

Recommendations

- Institutionalize community decision-making through a binding Environmental Equity Review Board with real authority over zoning and industrial permits in historically redlined neighborhoods.

- Hold polluters financially accountable by establishing a dedicated health and environmental reparations fund to support asthma prevention, air filtration in schools, and mobile health services.

Many thanks to Professor Troy D. Abel and Dr. Rebekah Paci-Green for their mentorship and advising throughout this research.

Social Vulnerability

- These areas have fewer resources to cope with pollution, flooding, or extreme weather events.

- The map shows that North St. Louis, a predominantly Black neighborhood, has the highest social vulnerability.

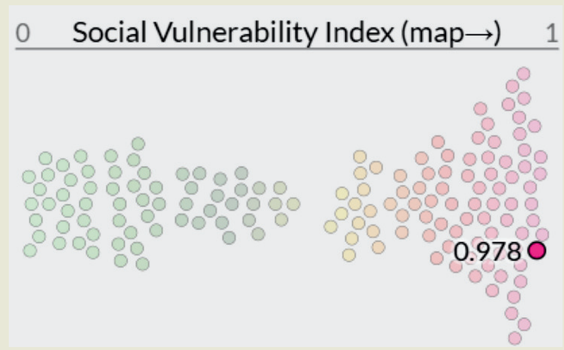

Figure 4. Social Vulnerability Index by Historical HOLC Grade in St. Louis

This beeswarm plot correlates modern (2018) CDC Social Vulnerability Index (SVI) scores with 1937 Home Owners' Loan Corporation (HOLC) residential security grades. Each data point represents a single census tract in St. Louis, positioned along a horizontal axis from 0 (lowest vulnerability) to 1 (highest vulnerability). Data points are color-coded by their historical grade: Green (A/Best), Blue (B/Still Desirable), Yellow (C/Definitely Declining), and Red (D/Hazardous). Historically "Hazardous" (Red) tracts are heavily clustered at the far right of the scale, with a highlighted tract reaching an SVI of 0.978. Conversely, "Best" (Green) tracts are concentrated at the low-vulnerability end of the spectrum.

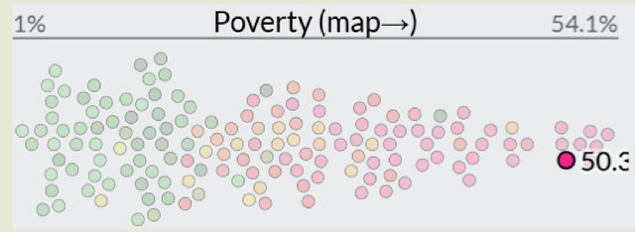

Figure 5. Modern Poverty Rates Relative to Historical Redlining Grades

This beeswarm plot displays the percentage of residents living below the federal poverty line in modern St. Louis census tracts, categorized by their 1930s HOLC investment grade. The X-axis represents the poverty percentage, ranging from 1% to a maximum of 54.1%. Individual tracts are color-coded based on their historical grade (A through D). Results: A clear disparity is visible between grades; tracts historically graded 'A' and 'B' exhibit significantly lower modern poverty rates, while those graded 'D' (Red) show the highest economic distress. The highlighted data point indicates a historically redlined tract with a current poverty rate of 50.3%.
Note: Poverty data is derived from the U.S. Census Bureau's American Community Survey (ACS) 5-year estimates.

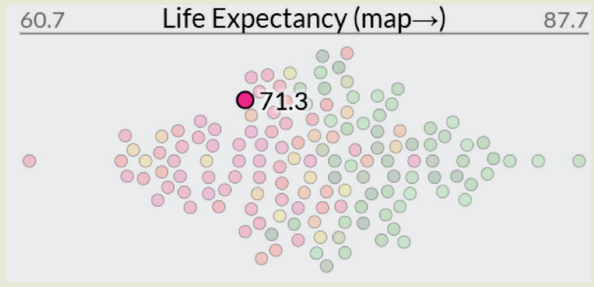

Figure 6. Correlation Between Historical Housing Policy and Modern Life Expectancy

This beeswarm plot maps the average life expectancy at birth (in years) for St. Louis census tracts against their historical HOLC grades. The X-axis spans from 60.7 years to 87.7 years. Colors represent the 1937 neighborhood classifications: Green (A), Blue (B), Yellow (C), and Red (D). The visualization demonstrates a stark "health gap" based on historical investment. While "Grade A" tracts reach life expectancies of 87.7 years, the highlighted "Grade D" tract shows a life expectancy of only 71.3 years. This represents a 16.4-year difference in life span correlated with 80-year-old housing boundaries.
Data Source: All Beeswarm plot maps provided by the National Center for Health Statistics (NCHS).

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Want to read my paper and references?