

SPATIAL PATTERNS OF VACANCY AND REINVESTMENT IN BALTIMORE

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Introduction

Baltimore is a post-industrial city that has experienced population decline and long-term housing vacancy. The city's population peaked in 1950 and has steadily declined since. Much of the housing stock built during its industrial period remained, creating an oversupply to the current population (Mallach, 2018; Hackworth, 2016). At the same time, racial segregation and disinvestment have shaped neighborhood inequality. These historical patterns have contributed to uneven neighborhood stability, some related to issues of residential vacancy and its impacts.

This study examines how residential vacancy clusters spatially, how it relates to racial dynamics, and how it influences property values and land ownership transitions. Although the city encourages rehabilitation and redevelopment activities to address vacancy and related issues, key additional context is necessary for informed interventions. It is necessary to understand how vacancy clusters within communities with different racial demographics, how proximity to vacant homes impacts surrounding property prices, and who obtains previously unoccupied houses following reconstruction.

As vacancy influences economic outcomes, neighborhood stress, and land control, it is an urgent issue of economic and racial justice. By integrating geographical analysis with parcel-level ownership and property value data to examine how vacancy is concentrated, how it relates to other stress factors, and who acquires properties after redevelopment, this study will assess the vacancy issue towards developing informed interventions. These interventions can counteract harmful historical patterns and meet communities' needs. To this end, we ask four primary questions:

1. Does vacancy cluster spatially within certain neighborhoods?
2. How does vacancy correlate with other indicators of neighborhood stress?
3. How does vacancy relate to surrounding property values and does this relationship differ across neighborhoods with different racial compositions?
4. Who acquires formerly vacant properties following redevelopment, and how do ownership patterns vary by neighborhood type?

Method

This study uses GIS analysis to examine vacancy patterns, property values, ownership, and neighborhood conditions in Baltimore. To ensure high-resolution granular analysis, we performed a spatial join to aggregate Vacant Building Notice (VBN) point data to Baltimore Census Blocks and Tracts (Mieno, 2024). Census blocks were used for the fine-scale clustering analysis, while tracts were used for broader neighborhood comparisons. This point-to-polygon aggregation allowed for the calculation of vacancy density, which was normalized by land area to prevent area-based bias in the subsequent statistical analysis.

Spatial autocorrelation was assessed via Global Moran's I to test the null hypothesis of spatial randomness (Anselin, 1995). To identify localized regimes of vacancy and disinvestment, we employed Local Indicators of Spatial Association (LISA) to differentiate between statistically significant "High-High" clusters and spatial outliers (Anselin, 1995). Complementing these vector-based methods, Kernel Density Estimation (KDE) was applied to the VBN points to visualize the continuous intensity and "hotspots" of vacancy across the urban landscape (Figure 1) (Silverman, 1986).

Property value differences and ownership patterns were measured using Baltimore Real Property Information. Non-vacant residential parcels were grouped by distance to the nearest vacant parcel: within 75 ft, 75 to 200 ft, and over 200 ft. mean and median assessed values were compared across these distance groups. Neighborhood racial composition was added using Baltimore Neighborhood Statistical Areas. Ownership was examined for rehabbed vacant properties from 2022. These parcels were joined to Real Property data, and owner names were grouped as Individual, LLC/Investor, Government, or Nonprofit.

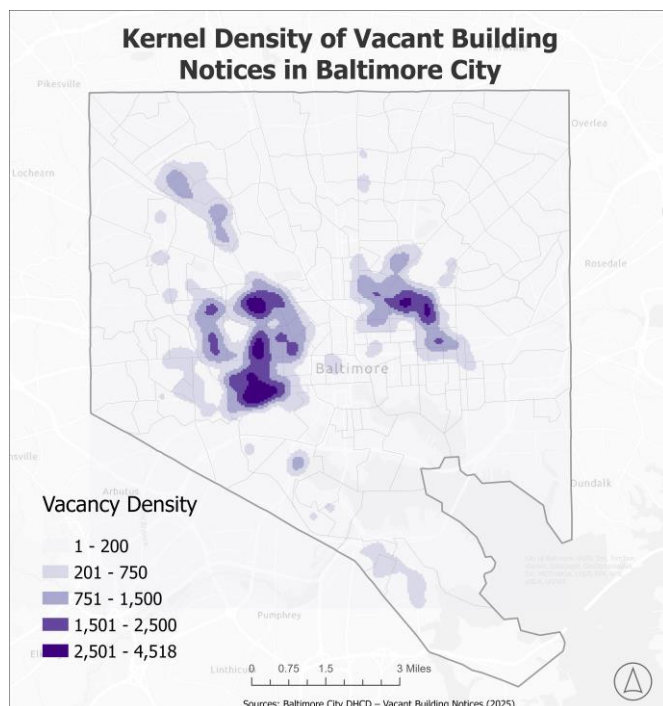


Figure 1: Spatial distribution and clustering of vacant properties across Baltimore City, 2025

To account for the multidimensional nature of urban decline, we developed a Neighborhood Stress Index (NSI) at the tract level. The index utilizes a composite scoring methodology integrating three standardized variables (z-scores): vacancy density, median household income, and 311 sanitation/litter requests (2023-2025). Each variable was standardized before being combined into the index. High-stress areas were further examined through 3D geovisualizations to analyze the volumetric intersection of median income and vacancy density (Eilola et al., 2023).

Then, we utilized a hedonic pricing model to measure property value suppression (Kim et al., 2015). Finally, following a categorical ownership audit via Maryland SDAT records, we classified post-rehabilitation buyers into individual, LLC, or non-profit entities to determine reinvestment patterns (Akers and Seymour, 2018).

Results

Statistical testing confirms that residential vacancy is not randomly distributed across Baltimore but is highly concentrated in specific spatial regimes. The Global Moran’s I analysis of Census Block vacancy yields a z-score of 93.26 ($p < 0.0001$), providing overwhelming evidence of spatial clustering (Table 1).

Moran's Index	0.506221
Expected Index	-0.000098
Variance	0.000029
z-score	93.259222
p-value	0.000000

Table 1: Global Moran’s I Summary

The Kernel Density Estimation (KDE) map (Figure 1) shows where vacant properties are most concentrated, with notable concentrations in Old West Baltimore and the Broadway East corridor. The Local Moran’s I (LISA) Cluster Map (Figure 2) supports this pattern by identifying statistically significant High-High clusters, where census blocks with high vacancy are surrounded by other high-vacancy blocks. Using census blocks provides a more granular view of these local patterns and helps reveal concentrations that may be less visible at larger geographic scales. Many of these clusters also fall within Baltimore’s “Black Butterfly,” a term used to describe predominantly Black neighborhoods shaped by long-term segregation and disinvestment. These present-day patterns can also be viewed in the context of Baltimore’s history of discriminatory housing practices, including blockbusting and uneven investment, which contributed to racialized neighborhood change and persistent housing inequality (Mahmoudi et al., 2024).

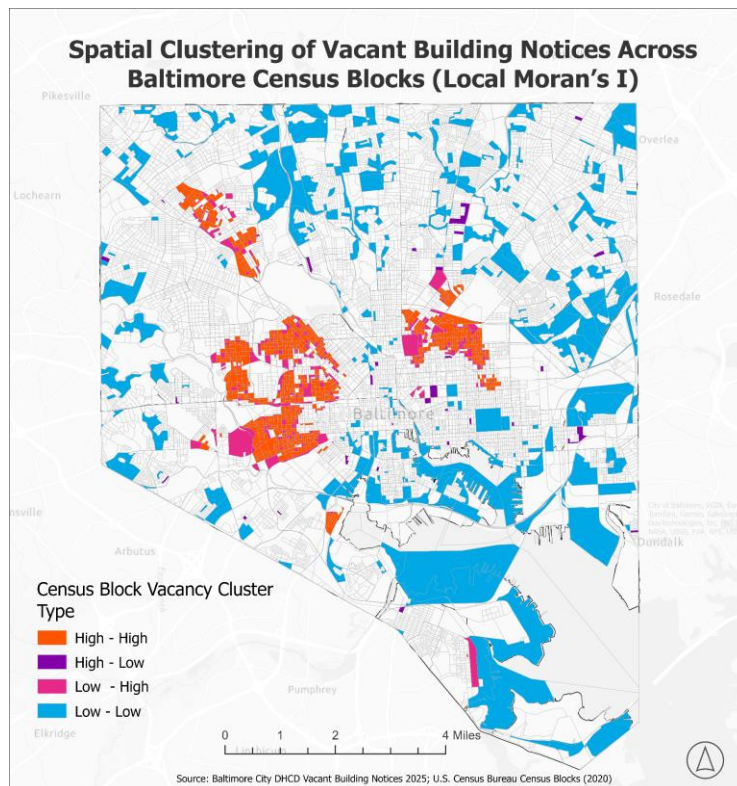


Figure 2: Spatial Clustering of Vacant Building Notices showing hot spots and cold spots in Baltimore Census Blocks, 2025

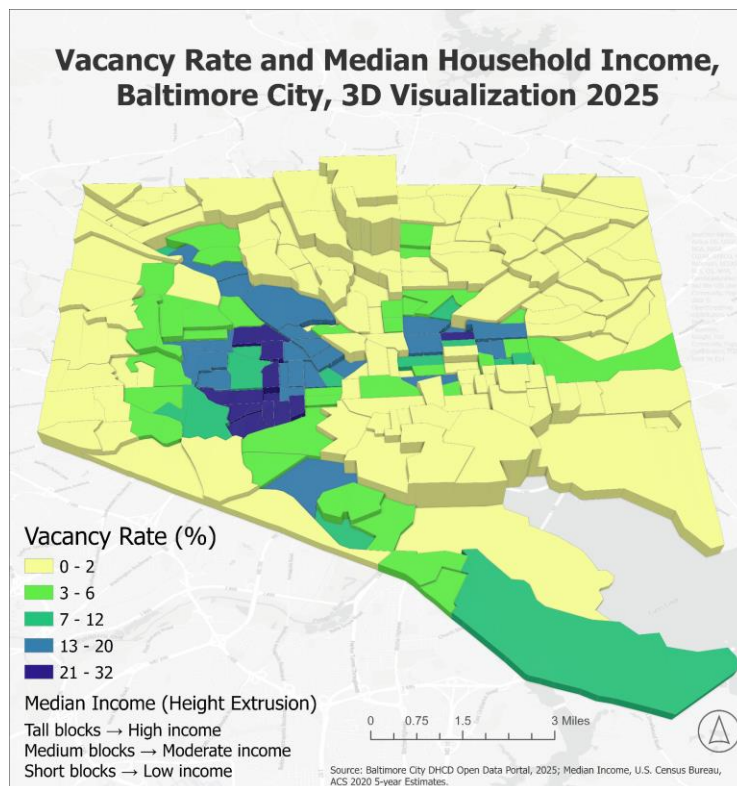


Figure 3: 3D Map representing Vacancy Rate and Median Income in Baltimore city

To examine the socioeconomic drivers of this distribution, a 3D Geovisualization was developed to intersect median household income with vacancy density. The 3D model reveals topographic sinks where extreme vacancy levels (Z-axis) coincide with the city's lowest income percentiles, illustrating a collapse of traditional property market mechanics in these zones.

To advance beyond univariate analysis, this study introduces a composite Neighborhood Stress Index (Figure 4). By integrating vacancy, income, and 311 sanitation requests, the index identifies tracts under extreme systemic pressure. The "Highest Stress" zones (Indices 7-12) align almost perfectly with the LISA High-High clusters, suggesting that vacancy is a primary anchor for a broader suite of urban stressors.

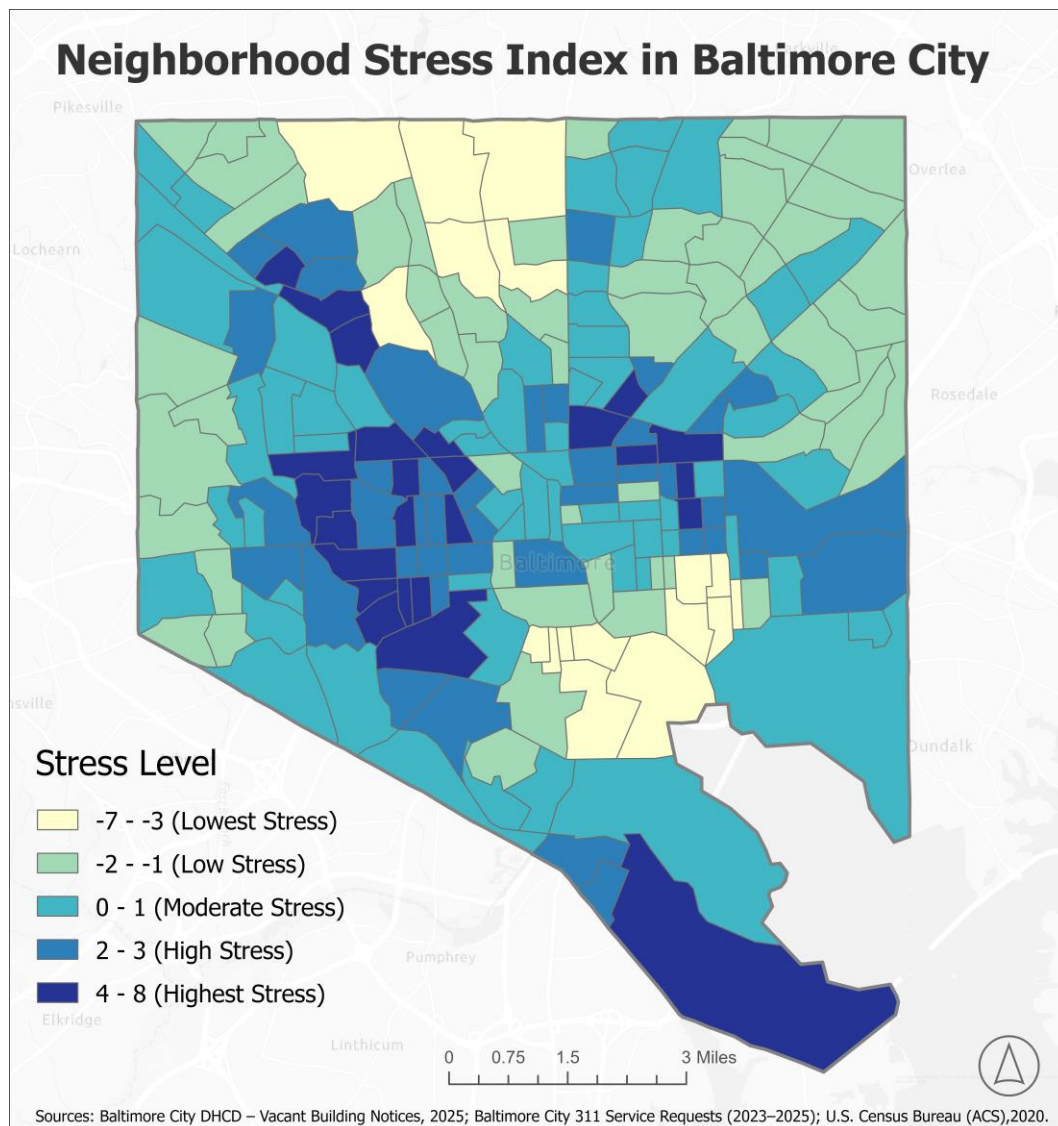


Figure 4: Neighborhood stress based on vacancy, median income, and litter-related 311 complaints across Baltimore City.

The relationship between vacancy proximity and property values was examined by comparing mean property values within 0–75 feet, 75–200 feet, and more than 200 feet of vacant buildings. Using 2020 Census data, Neighborhood Statistical Areas (NSAs) were also classified as majority-Black or non-majority-Black to examine differences in this relationship across neighborhood racial composition. As shown in Table 2, properties near vacant buildings had lower mean values in majority-Black NSAs than in non-majority-Black NSAs. These differences should be interpreted as spatial associations rather than causal effects, as property values may also reflect broader socioeconomic, housing, and neighborhood conditions.

Distance from Vacant Building	Majority-Black NSA Mean	Non-Majority-Black NSA Mean
0–75 ft.	\$90178	\$160198.5
75–200 ft.	\$131147.7	\$208273.4
>200 ft.	\$164653.3	\$285474.5
Value Difference (0–75 ft. vs. >200 ft.)	\$-74,475.3	\$-125,276

Table 2: Mean Property Values by Distance from Vacant Buildings in Majority-Black and Non-Majority-Black Neighborhood Statistical Areas (NSAs)

Discussion and Conclusion

This research proves that vacancy in Baltimore is clustered and correlates strongly with other markers of neighborhood stress and with race. In the context of Baltimore’s historical and current political realities, this research demonstrates the results of ongoing structural and racialized divestment. The alignment between LISA “High-High” clusters and the Highest Stress index tracts suggests that municipal intervention cannot treat vacancy as a singular housing issue. Rather, it must address vacancy alongside cumulative neighborhood stressors and racial disparities.

While community members often advocate for turning the vacancy problem into positive solutions such as affordable housing or artist spaces, the possibility of such changes is highly dependent on who acquires formerly vacant properties. Our findings about acquisition of formerly vacant properties demonstrate that the overwhelming preponderance of individuals and LLC/Investors may obstruct such positive outcomes.

Cumulatively, this research provides a data-driven foundation for developing more equitable housing policies and practices. Such policies and practices can intervene in uneven neighborhood stress and systemic extraction of neighborhood wealth rather than continuing to reproduce these inequalities.

Acknowledgements

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