Redefining Heat Vulnerability in New York City

Sebastian Andersson, Hui Lu
Jiuyu Wang, Xifan Wang
Leah Meisterlin | ASA | Spring 2021

Research Question

How can data on the built environment and heat hospitalizations alter and improve existing heat vulnerability indices in New York City?

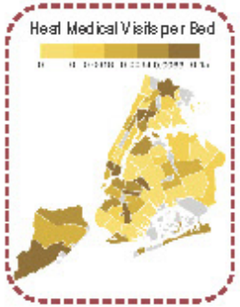
Background

Current measurements of heat vulnerability in New York City only capture part of the realities facing its population. We saw a need and a potential to improve on the city's Heat Vulnerability Index (HVI), by including data from the built environment, and by considering heat stress hospitalizations. Accurately capturing the causes and spatial distribution of heat vulnerability is important both for policy formation and social justice.

Method 1: HVI

Our Heat Vulnerability Index (HVI) is adopted from the existing NYC HVI and engineered with two more layers. Values from seven layers were normalized and then added together to get the total HVI score.

- *% Population(pop) < Federal Poverty Level*
- *% Non-Latinx Black pop*
- *% Households without AC*
- *Daytime Summer Surface Temperature*
- *Cooling Center Density*
- *% Green Space*
- *Street Trees per SF*

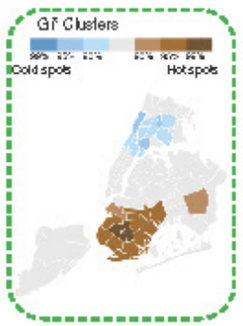


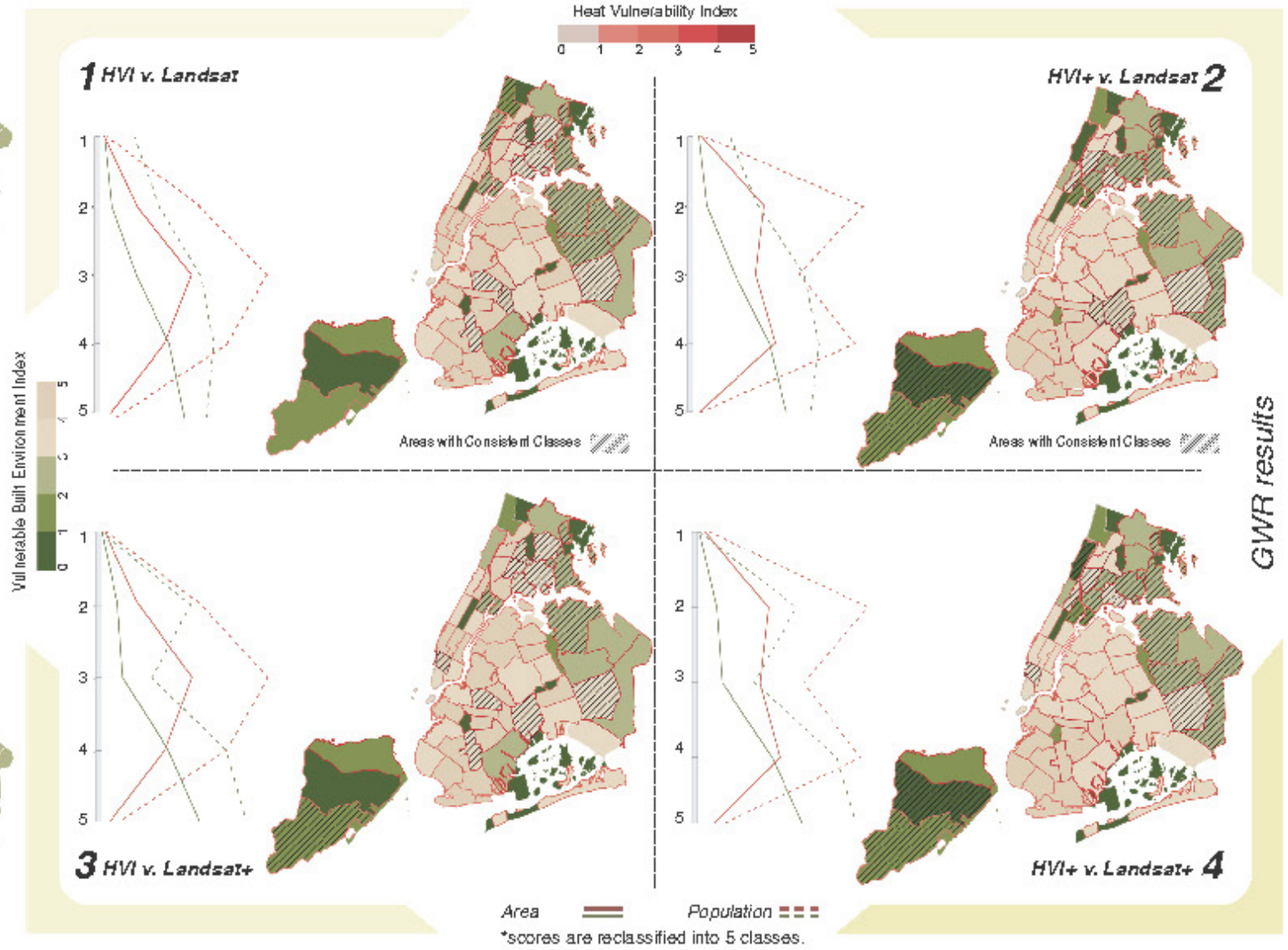
Method 2: Hospitalizations

Our measurement of hospitalization is operationalized by the ratio of emergency visits to hospitalization capacity, which represented by bed numbers available.

Ratio = Visits : Beds

Values from ratio layer was normalized and added to clasified seven layers with a ratio of 1:7 to get new HVI index.





GWR results

	R^2	Residual
1	0.35	30.6
2	0.31	32.3
3	0.30	41.3
4	0.24	44.5

*scores are reclassified into 5 classes.

Method 3: NDVI & NDWI

The NDVI and the NDWI are two standard indices that are generated from remote sensing, reflecting the coverage of vegetation and water bodies. The sum of these two indices reflect the overall green space environment.

Method 4: Getis Ord-Gi*

The Getis Ord-Gi* is a hot spot analysis tool used to calculate statistics for each feature within the context of neighboring features. The results show where features with either high or low values cluster spatially. Negative values are assigned to cold spots while positive values for hot spots range from -3 to 3. Clusters are calculated from pre 1960 building densities per area per community district. The new index is calculated by a 1:1 ratio of cluster values to NDVI+NDWI.

Findings

Our findings indicate that the current HVI index of New York City does not adequately capture the whole reality of heat vulnerability in the city. The different results of our overlays of the HVI, along with variations of our added data, show that all the combinations of data we are putting forth are telling their own story of heat vulnerability in NYC. Across our four overlay analyses, we also get different results for to what extent specific areas and populations are affected.

GWR

Even though building density and hospitalization capacity are vital factors to heat vulnerability, including them in built environment index and HVI respectively does not improve the significance of the regression result, thus they cannot be used to explain each other.To conclude, the open space index that indicates vegetation and water body coverage explains the distribution of HVI best.

Data Sources:
New York City Department of Health and Mental Hygiene, Department of City Planning
New York State Department of Health
NYC Open data
USGS