

# MEMORANDUM

**TO:** Tom Armstrong, Principal Planner, BPS  
**FROM:** Nick Kobel, Principal, Kobel Solutions  
**CC:** Dwight Jefferson, Economic Planner, BPS  
**DATE:** Jul 25, 2022  
**SUBJECT:** Communicating change in vulnerability score, 2010 to 2020

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## Background

BPS requested an analysis of the change in neighborhood-level economic vulnerability over time using the revised methodology from June 2022. The new methodology [builds on previous work](#) but incorporates Black and Indigenous populations as a separate variable and also uses a household size-adjusted median household income in place of low-income households.

The boundaries of census tract change concurrently with the decennial census efforts. These changes present challenges to planners who wish to understand how sociodemographic indicators change over time and across consistent geographies. Using [population-weighted interpolation techniques](#), staff are better able to overcome changes to census tract boundaries and understand longitudinal population dynamics.

This memo highlights the results of applying interpolation techniques to 2010 and 2015 vulnerability data to allocate data into the most current 2020 census tract boundaries.

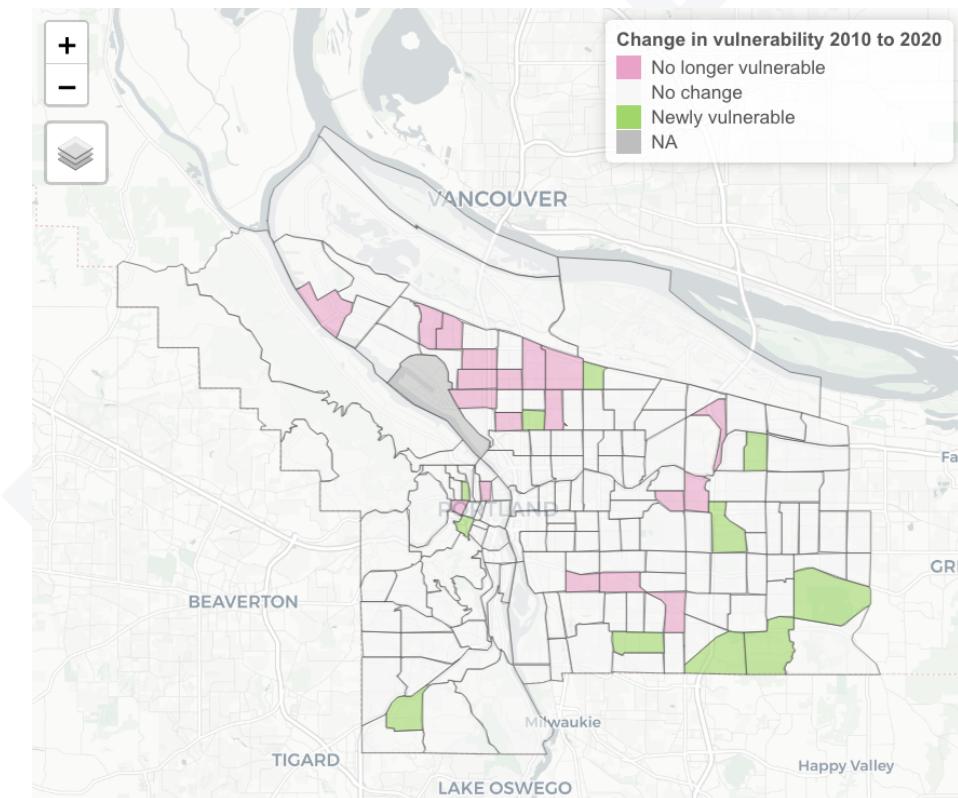
## Results

Maps 1-A and 1-B below show the changes in vulnerability status between 2010 and 2020 as well as 2015 and 2020. **This analysis focuses on the changes between 2010 and 2020.**

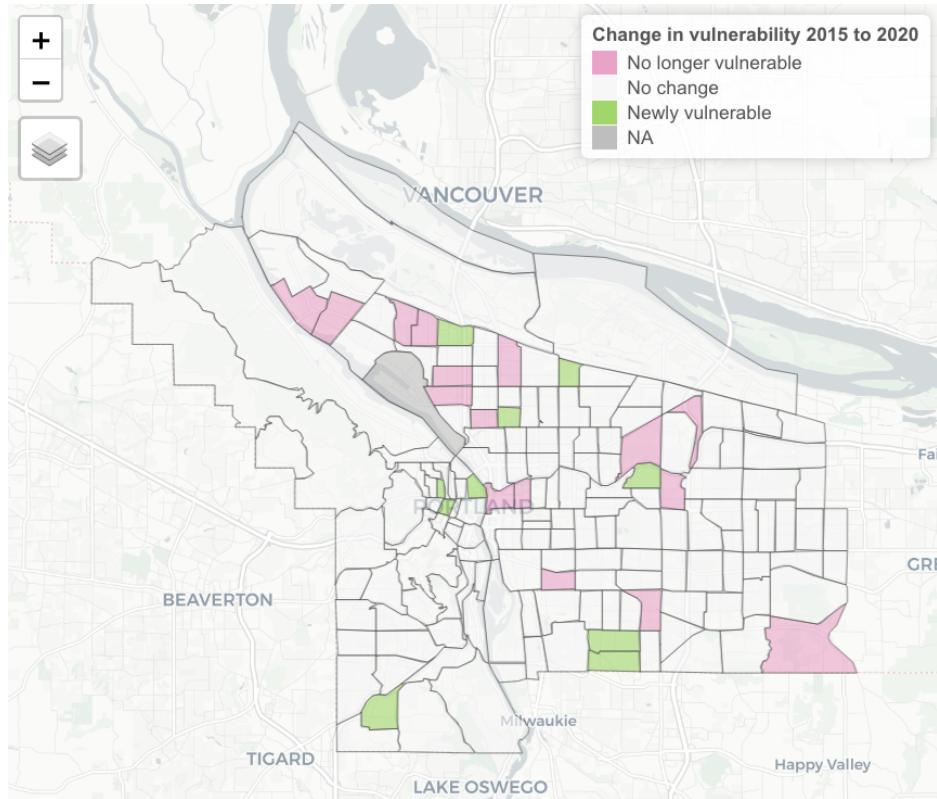
- **Vulnerability:** Decreases in the vulnerability score occurred in inner N/NE Portland, Powell corridor and Montavilla. Increases occurred in Parkrose Heights, Russell, Lents, Brentwood-Darlington, West Portland, and some parts of inner neighborhoods (Map 1-A).
- **People of color:** The population of color decreased in parts of North/Northeast, Argay, Madison South and Cully. Parts of East Portland, West Portland and in University Park experienced increases (Map 2-A). Overall, many parts of the city saw increases in the population of color (Map 2-B); however, this is due in part to natural population increases. We expect to see increases in diversity commensurate with population growth. Instead, some parts diversified faster than others (East and West Portland) while others experienced a decrease in overall diversity, as in North/Northeast (Map 2-C). Refer to PSU Population Research Center's 2010 to 2020 [map story](#) for more detailed changes by specific race categories.

- **Housing cost burden:** Households paying more than 30% of their income on rent or a mortgage increased in many parts of the city (Maps 3-A and 3-B). Increases can occur when people stay in place but pay more in rent; or they can occur due to an influx of lower-income households who may have been displaced to relatively cheaper neighborhoods but still pay a significant portion of their income on housing costs. Bates (2013) referred to these as “landing zones” and can be observed in St. Johns, Columbia East and parts of East Portland.
- **Household income:** Median household income varies with household size, so to adjust for this fact we divided median household income by the square root of the average household size and adjusted for inflation. Adjusted household income increased in inner neighborhoods, driven in part by growth in smaller studio and one-bedroom units, which pulled down the average household size. In some cases such as in outer Northeast and Hazelwood/Glenfair, household sizes decreased along with household incomes. (Maps 4-A and 4-B).

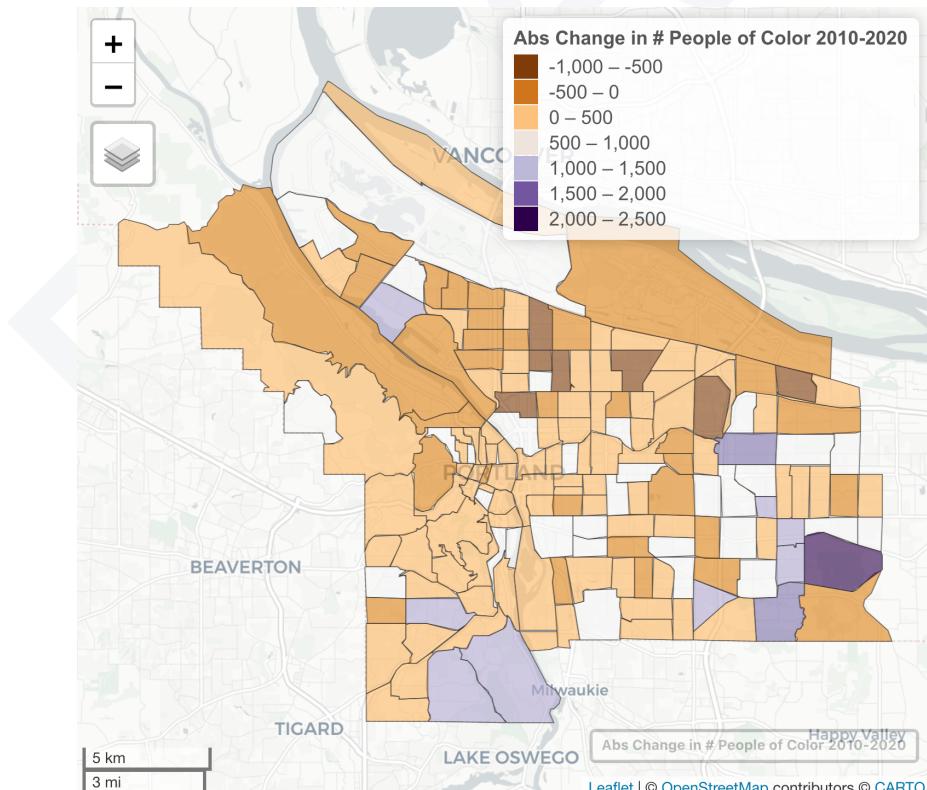
**Map 1-A:** Change in vulnerability status 2010 to 2020.



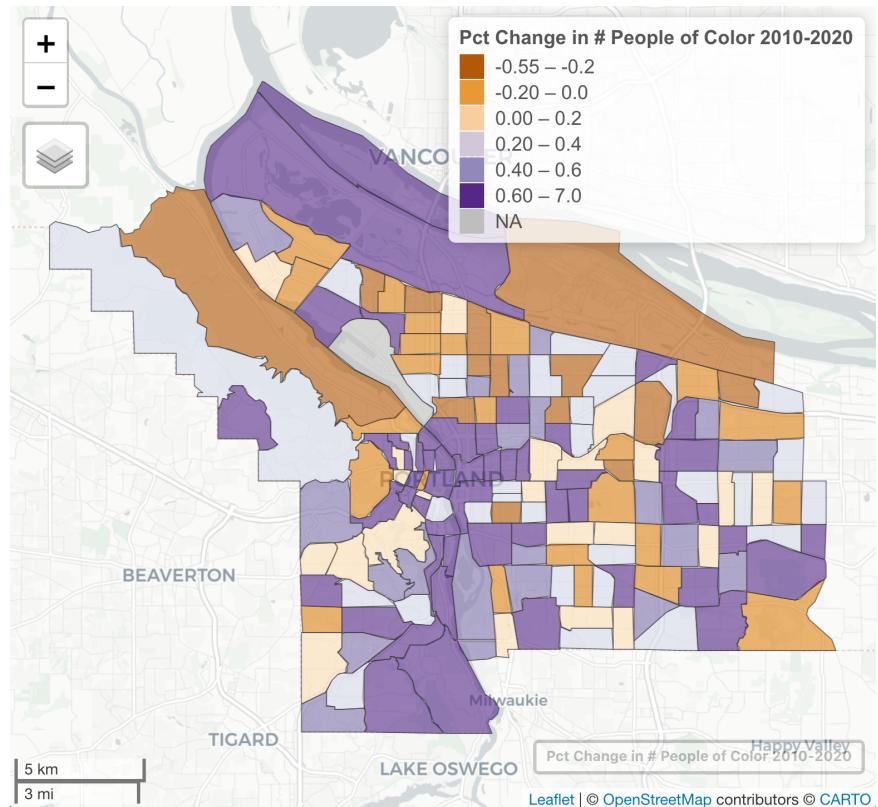
**Map 1-B:** Change in vulnerability status 2015 to 2020.



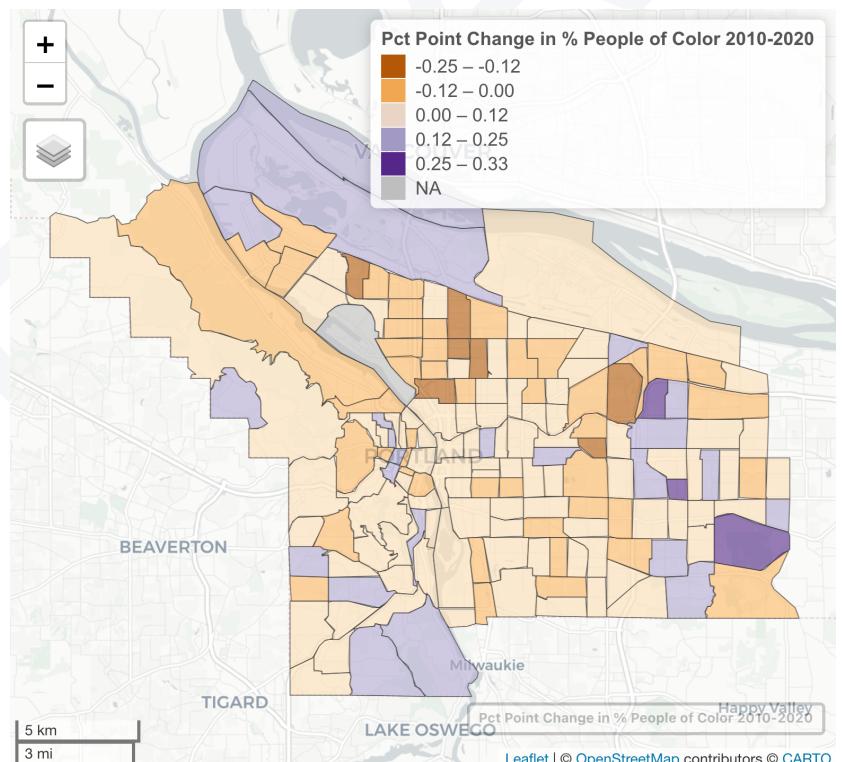
**Map 2-A:** Absolute change in the number of people of color between 2010 and 2020.



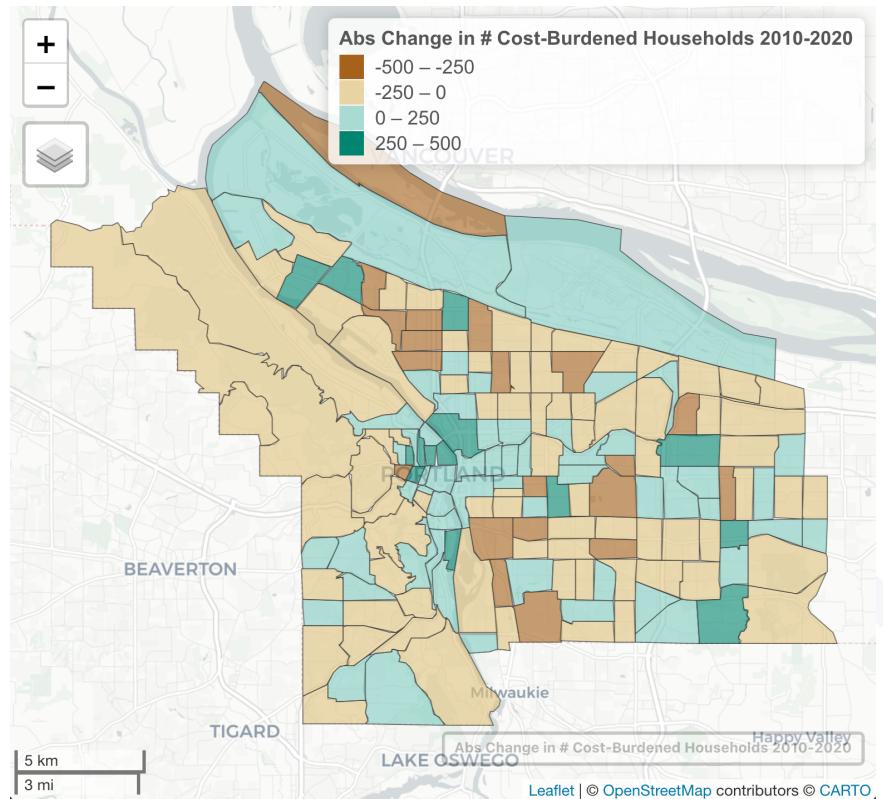
**Map 2-B:** Percentage change in the number of people of color between 2010 and 2020.



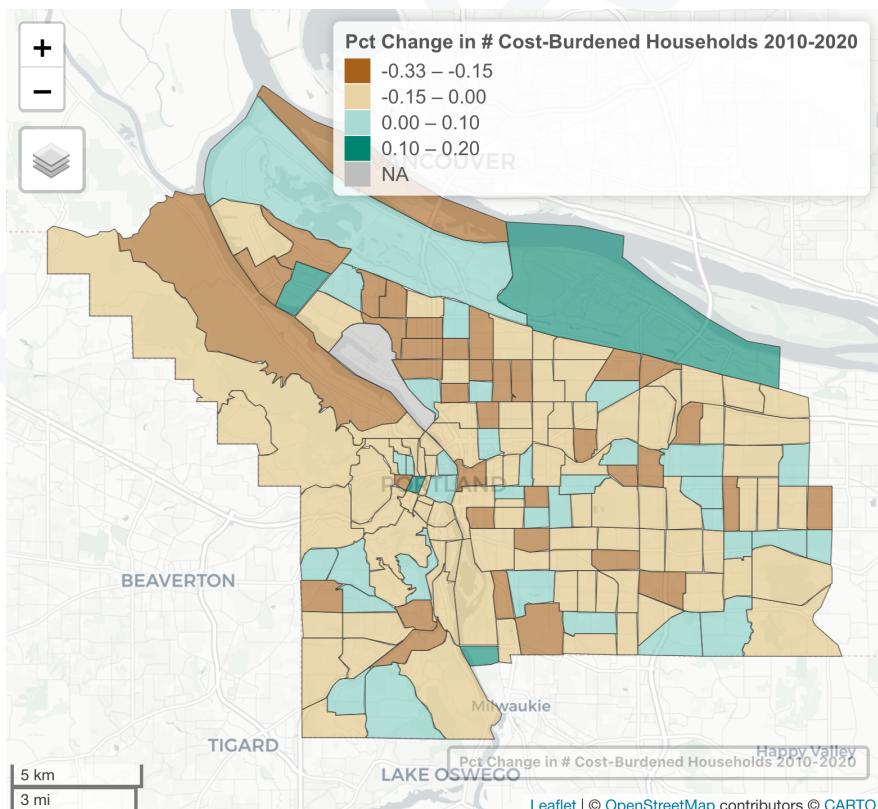
**Map 2-C:** Percentage point change in the percentage of people of color, 2010 to 2020.



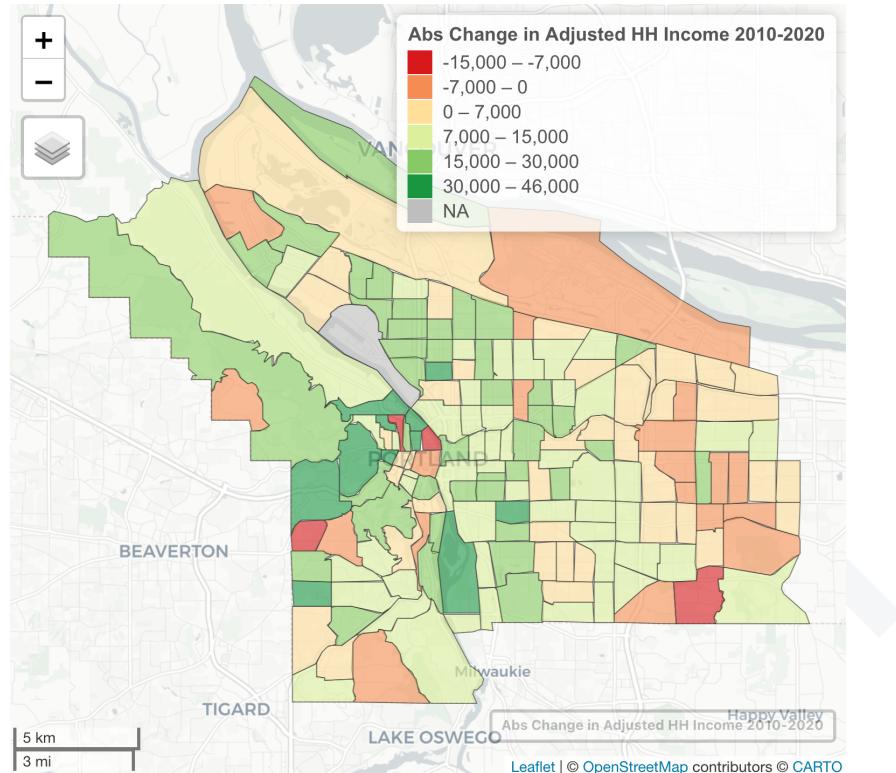
**Map 3-A:** Absolute change in the number of cost-burdened households, 2010 - 2020.



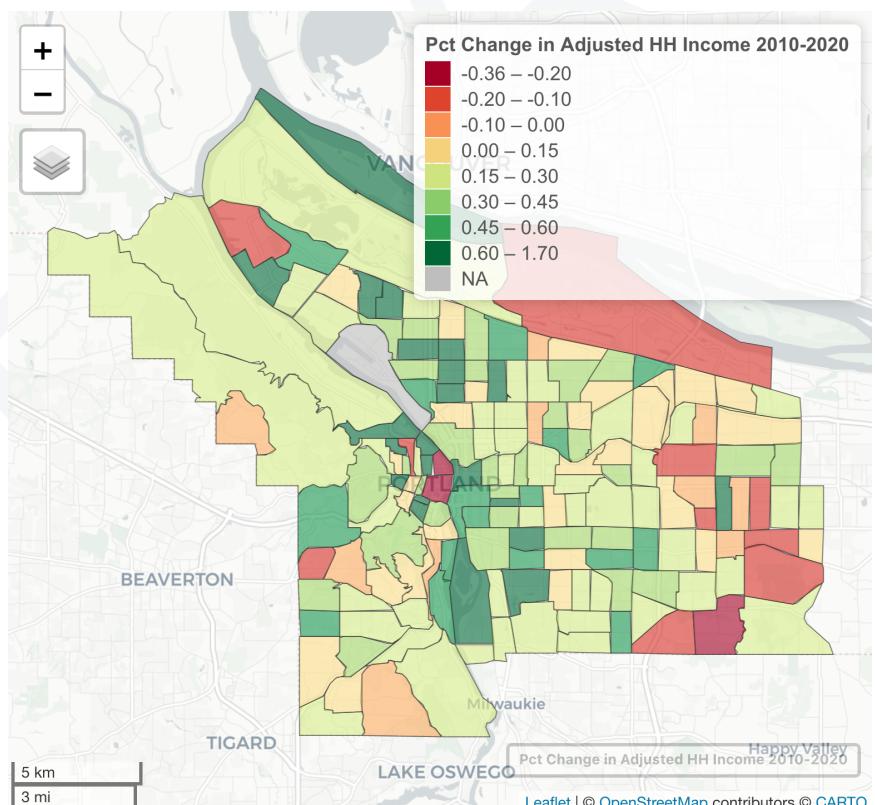
**Map 3-B:** Percentage change in the number of cost-burdened households, 2010 - 2020.



**Map 4-A:** Absolute change in size-adjusted household income (2020 dollars), 2010 - 2020.



**Map 4-B:** Percent change in size-adjusted household income (2020 dollars), 2010 - 2020.



## **Methodology**

### Economic vulnerability scoring

Each census tract in Portland is ranked using a percentile rank method across 5 vulnerability indicators:

1. Percent people of color
2. Percent Black and Indigenous population
3. Percent of adults without a 4-year degree
4. Percent of households paying more than 30% on housing costs (cost burdened)
5. Household size-adjusted median household income (inversely ranked)
  - a. Calculated as  $\text{median\_household\_income} / \sqrt{\text{average\_household\_size}}$

The raw percentile rank scores are then summed together and stretched between 0 and 100. A tract is flagged as being vulnerable if it scores 60 or higher (approximately the upper two-fifths of the distribution).

### Interpolation

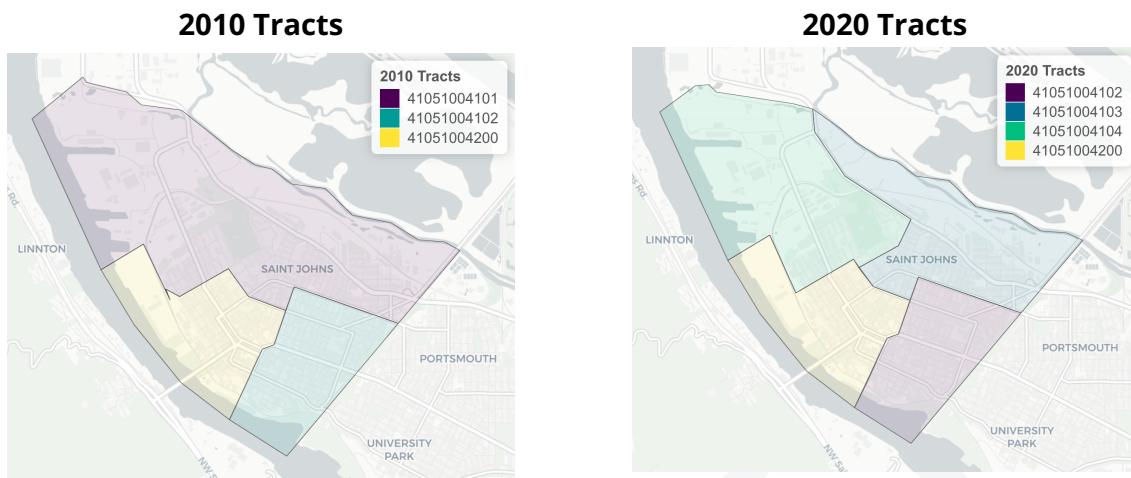
Spatial interpolation is a process of allocating spatial data from one zone to another zone based on the proportion of overlapping spatial characteristics. Basic areal interpolation looks at the percentage of area overlap of two polygons, and it assumes an even distribution of population. A more sophisticated approach when we do not wish to make such an assumption is to incorporate known distributions of population at a finer geographic level. This is called **population-weighted interpolation**. The most granular census data are housing unit and population counts at the block level. Census blocks roughly correspond to city blocks. By converting block polygons to point-level data, we can use the distribution of known population counts to allocate data from less granular datasets.

For example, tract 41.01 in St. Johns was split into two tracts (41.03 and 41.04) between 2010 and 2020. As such, we can use the known 2020 population- or unit-count distribution in the two new tracts to estimate how the 2010 data should be spatially allocated to each of the new tracts.

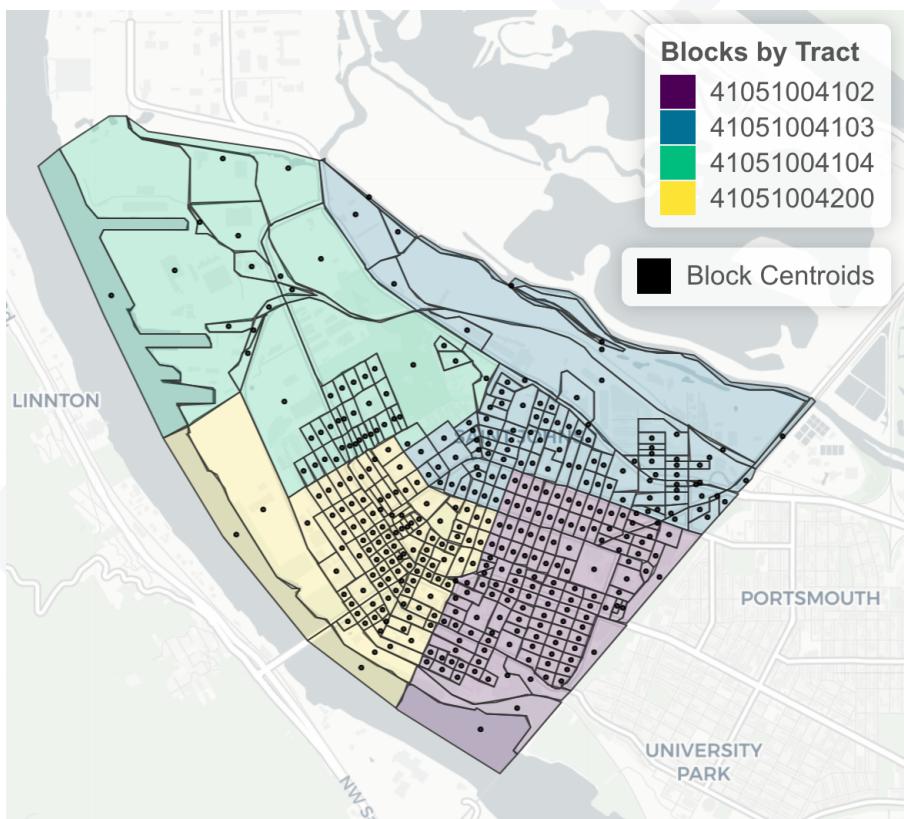
A major limitation of using population-weighted interpolation is that it is not feasible to calculate margins of error. As such, comparisons between years should be used with caution.

This allocation method was applied to all vulnerability indicators for 2010 and 2015 ACS 5-year estimates, which used 2010 census tract delineations. The result is an estimate of 2010 and 2015 data at 2020 census tract delineations. Once population counts were established, we could calculate the vulnerability score as normal.

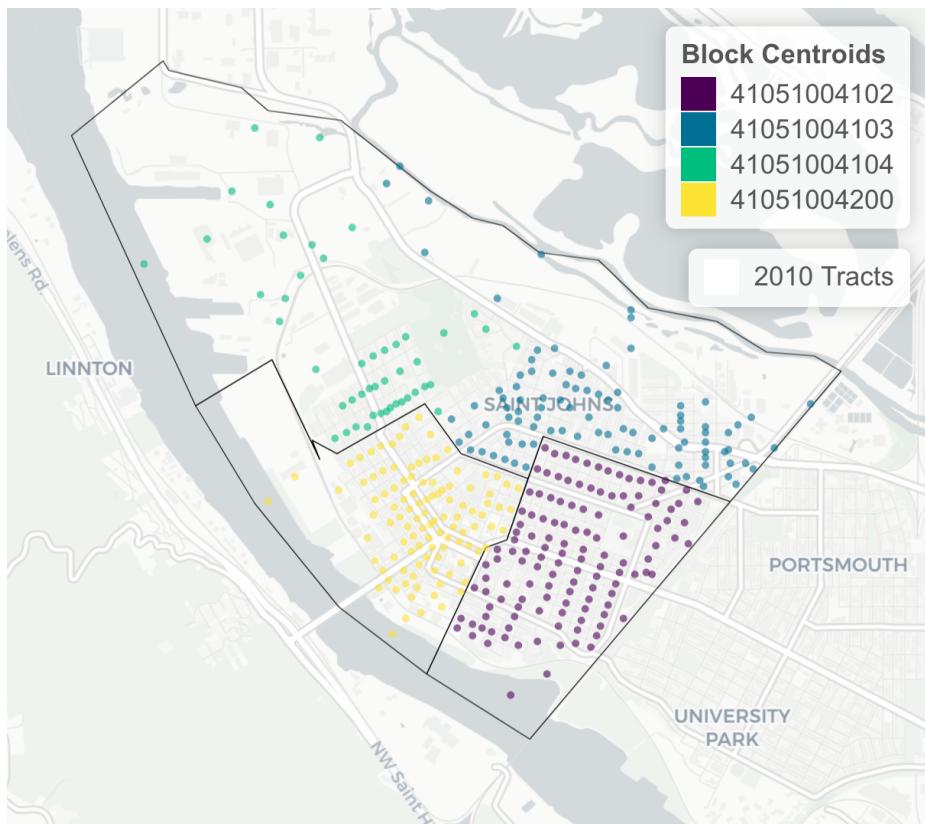
**Map M-1:** 2010 and 2020 census tracts in the St. Johns neighborhood.



**Map M-2:** St. Johns census blocks and their centroids, colored by 2020 census tract.



**Map M-3:** 2020 block centroids overlaid onto 2010 tract boundaries.



### Attachments

- Spreadsheet of change calculations by census tract, 2010 to 2020
- Map of vulnerability score 2010
- Map of vulnerability score 2015
- Map of vulnerability score 2020