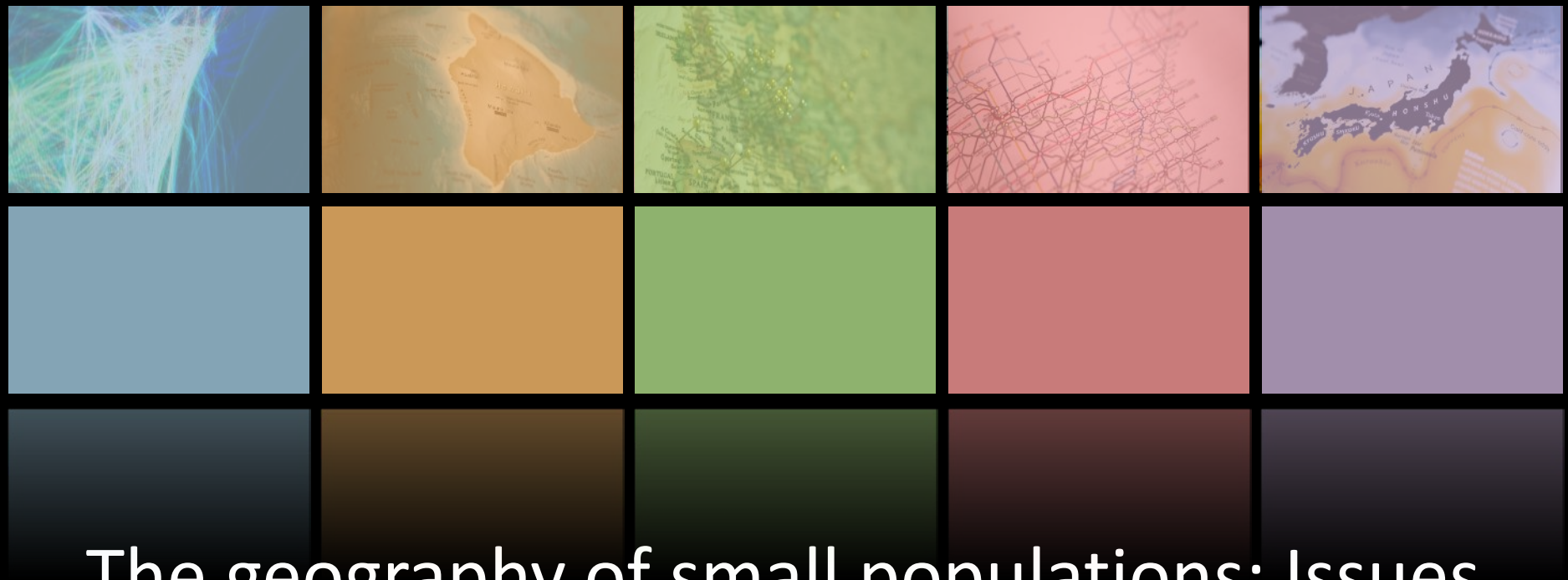

The geography of small populations: Issues in defining an appropriate geographic context

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Contextual variables are a key way that geography is incorporated into health research

Exploring the role of the built and social neighborhood environment in moderating stress and health.

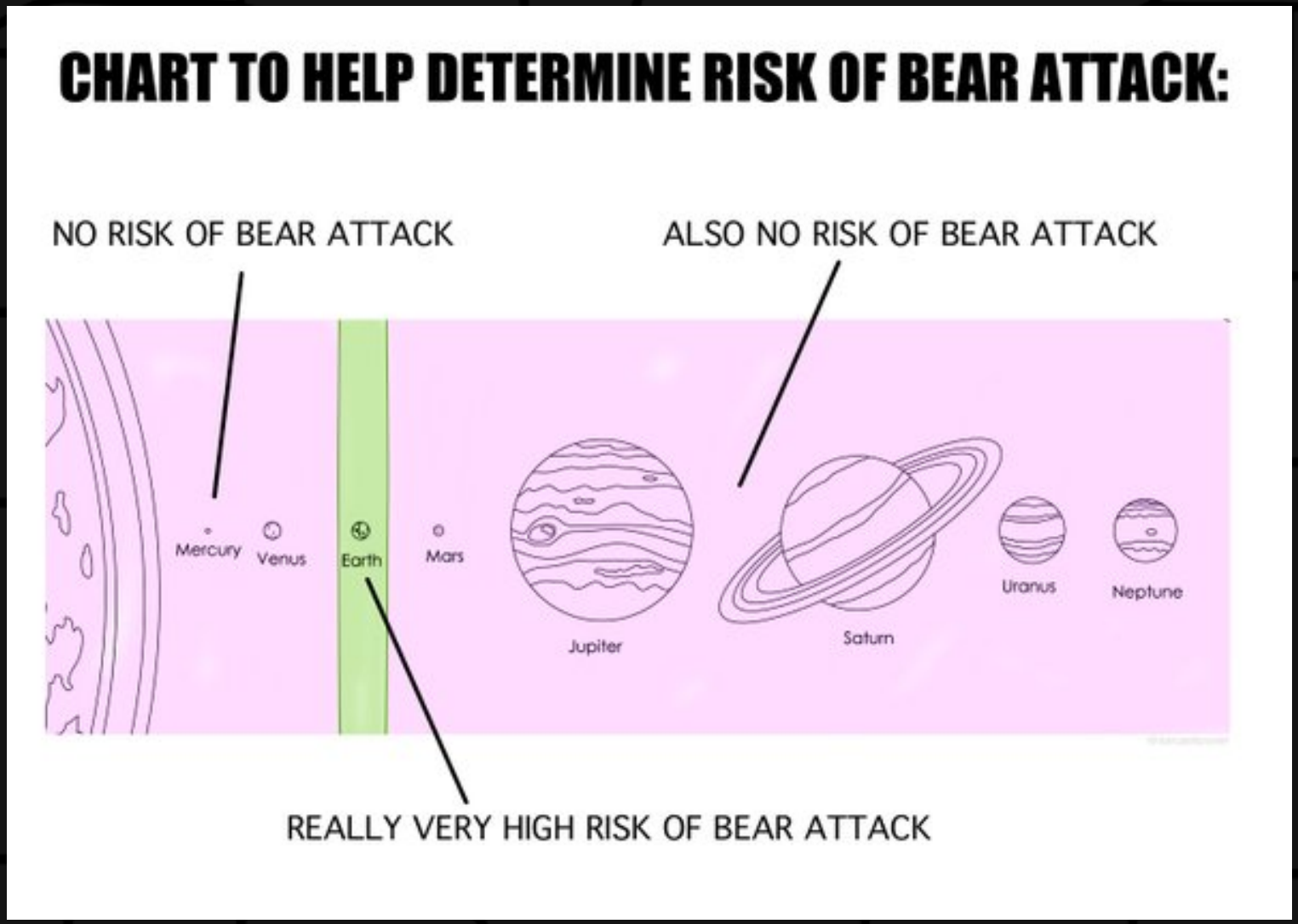
Insomnia and urban neighbourhood contexts – are associations modified by individual social characteristics and change of residence? Results from a population-based study using residential histories

The Impact of Neighborhood Social and Built Environment Factors across the Cancer Continuum: Current Research, Methodologic Considerations, and Future Directions

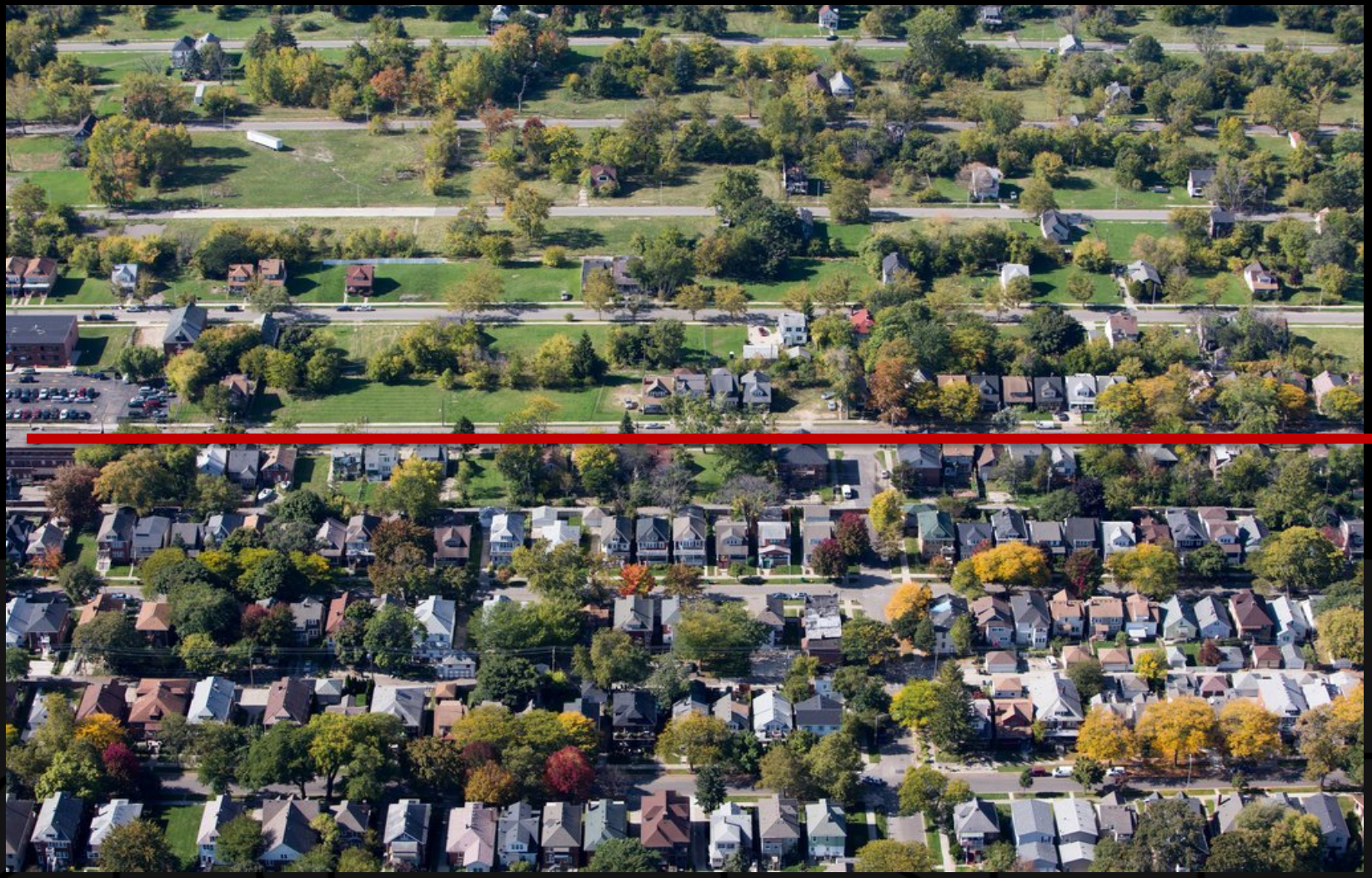
Neighborhood Socioeconomic Status and Substance Use by U.S. Adults

Beyond the Supermarket Solution: Linking Food Deserts, Neighborhood Context, and Everyday Mobility

With contextual measures, it is important to get the SCALE right



Contextual measures assume that BOUNDARIES are meaningful

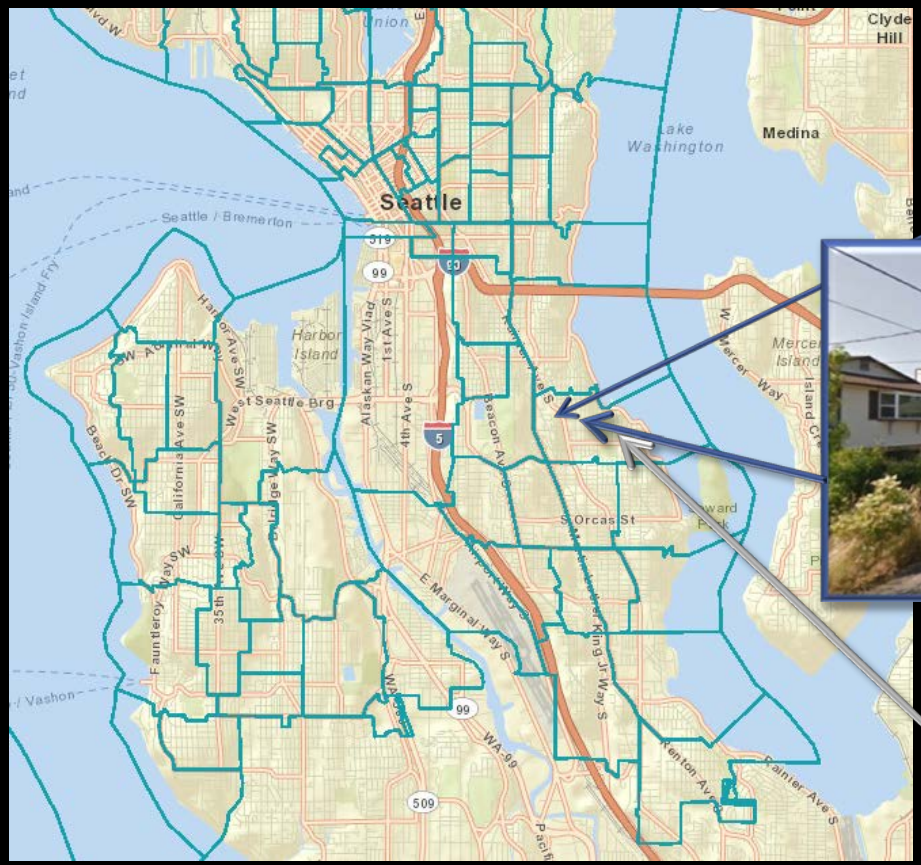


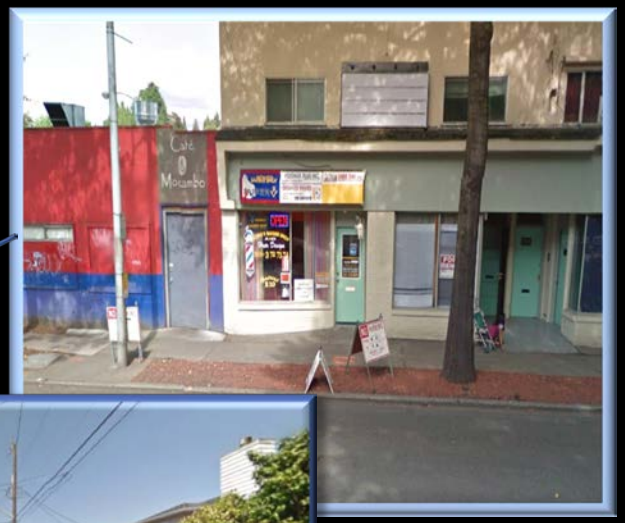
Detroit School District

Grosse Pointe Park School District

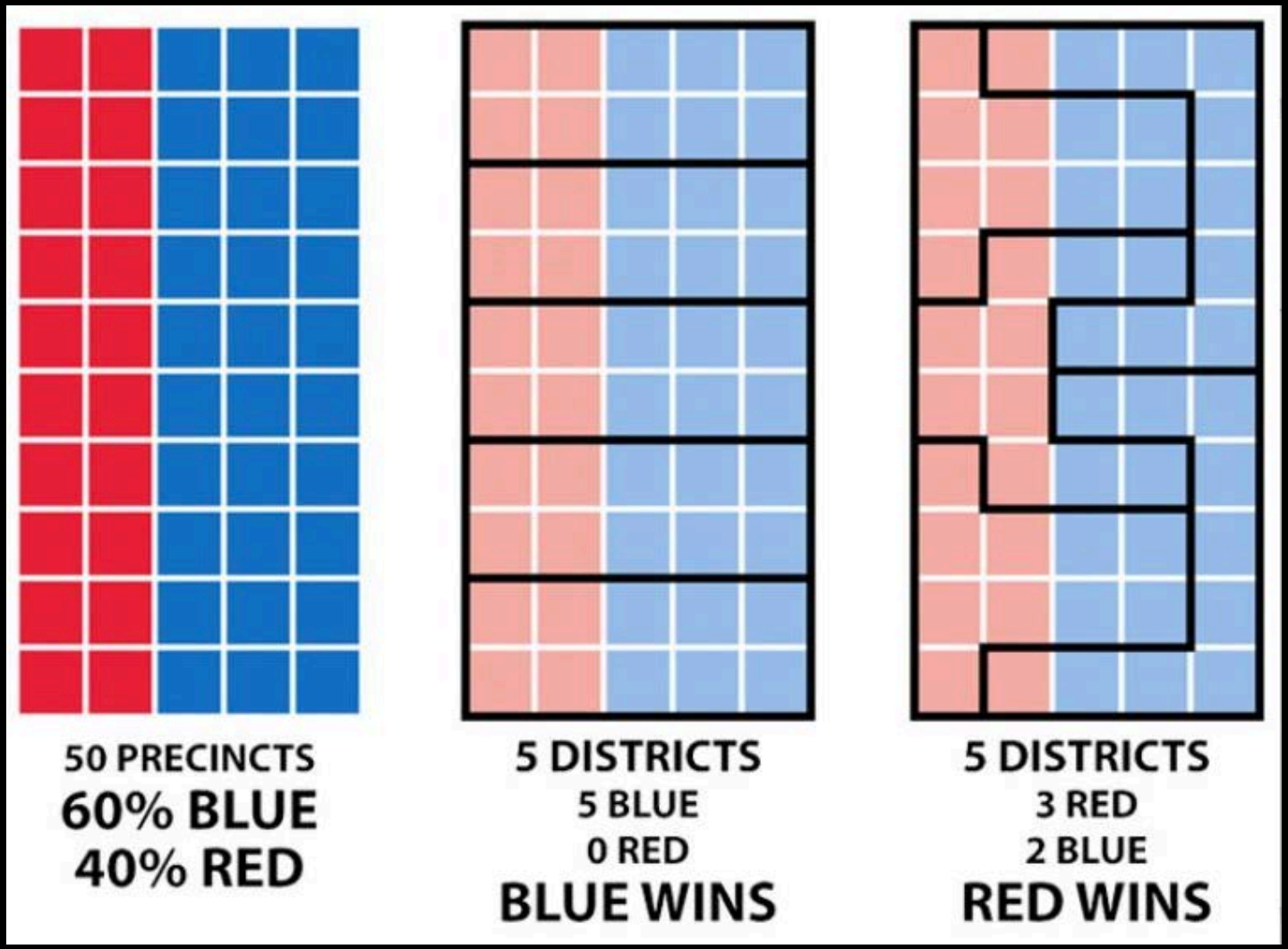
This is not always a reasonable assumption

Census Tracts in Seattle, WA





How we define contextual observations can condition outcomes



Outline

- Motivation
- Why contextual variables may be appropriate for ‘small populations’
- Visualizing the effects of scale and boundary choices on contextual variables
- Addressing uncertainty in contextual variables

Contextual variables may be useful when direct access to a population is not possible

Individual test scores or blood lead level may be ideal

…but a lot can be learned from a home address or other locational information available in administrative data

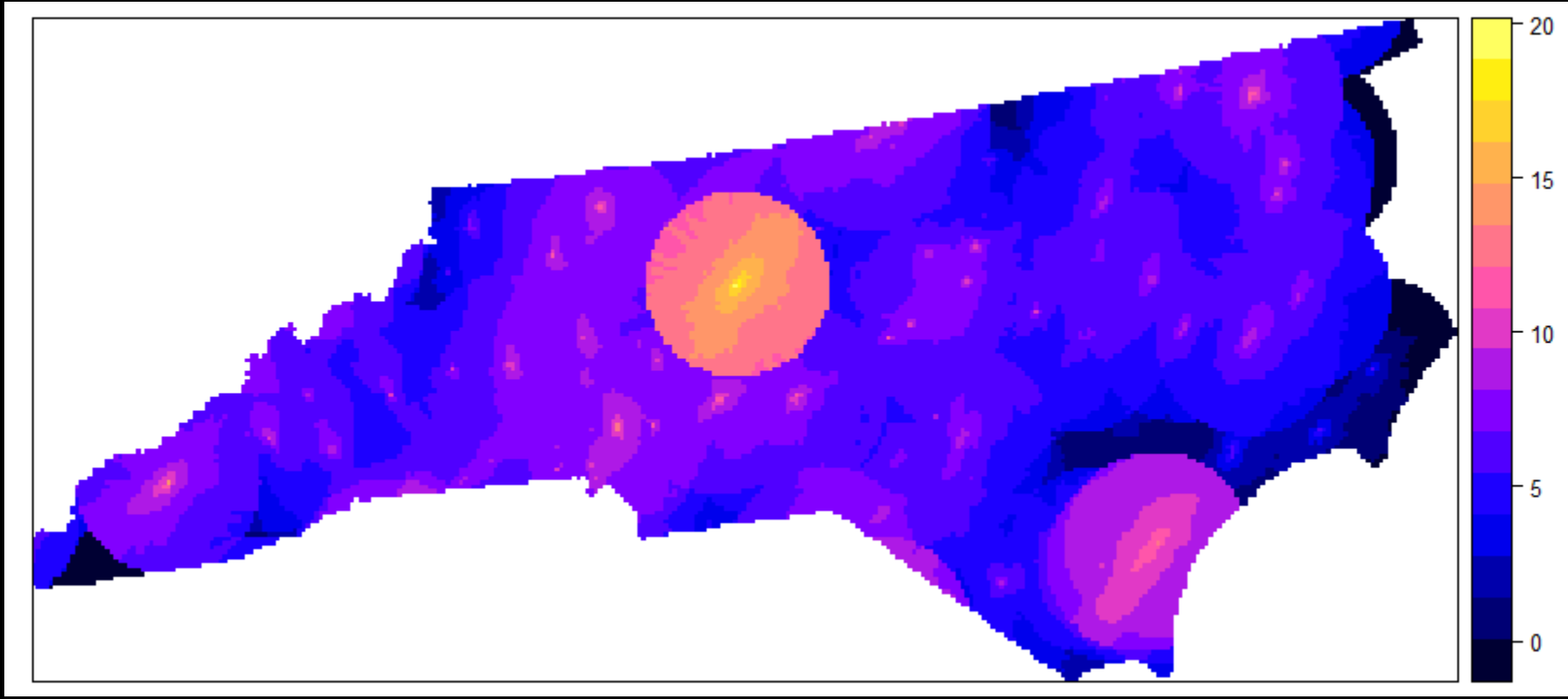
Example Contextual Variables:

- Demographic characteristics (Census)
- Environmental Toxicity (EPA)
- Educational Context (SABINS, Census)
- Crime (NCHS)
- Economy (BLS)

Example: Environmental Toxicity for poor kids in rural places

Airborne chemical toxicity in NC for 2007

800 m^2 grid cells



‘Small Populations’ can also refer to a geographically concentrated group

- Ex. Asian immigrants concentrated in Seattle’s ‘International District’
- Individuals living proximate to a chemical plant

- In this case the issue is not contextual variables, but getting the area of effect right.
  - With small geographic regions variability tends to be much higher unit to unit
  - Change over time because very difficult with changes in small unit boundaries

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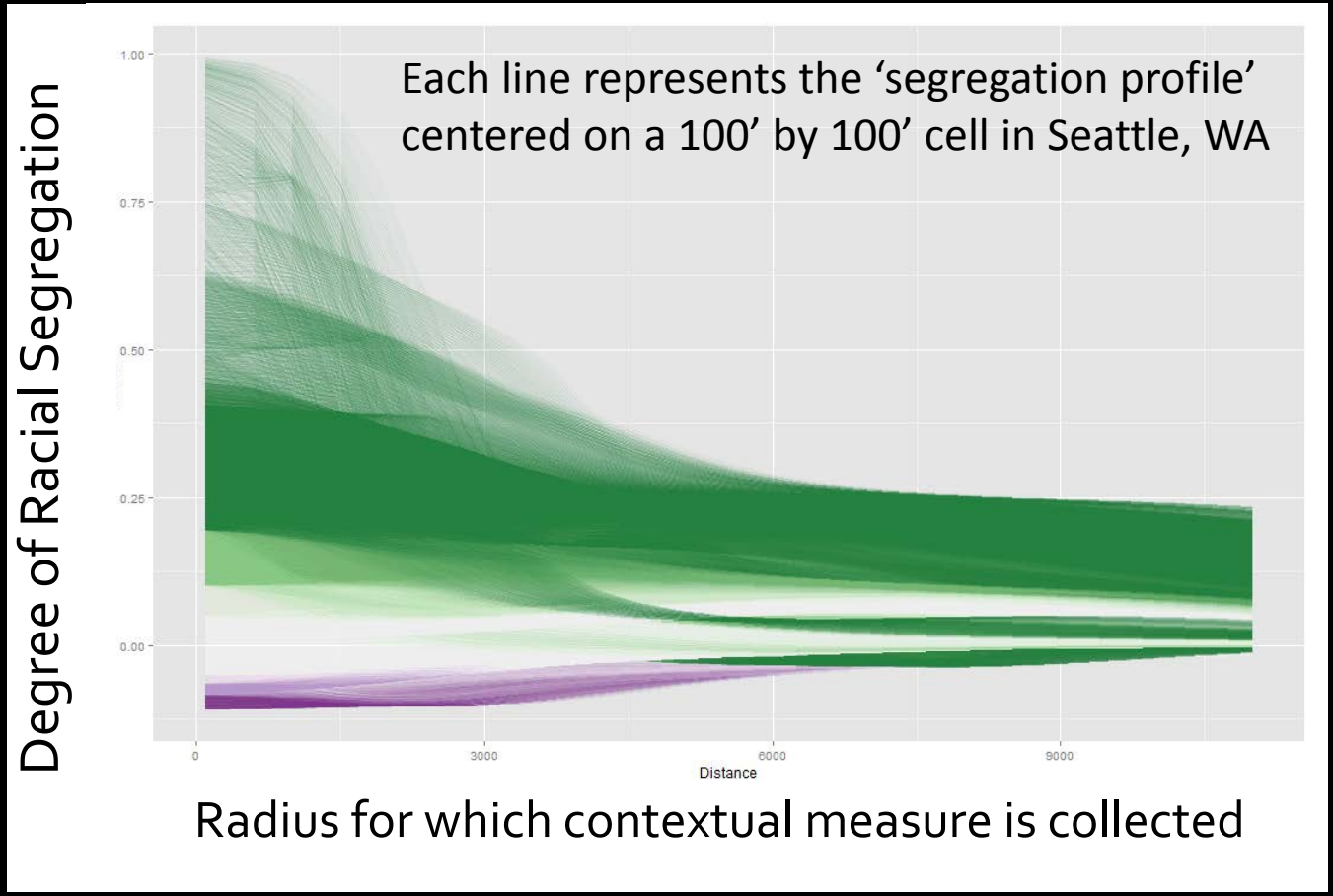
Contextual variables need to match the process they expect to evaluate

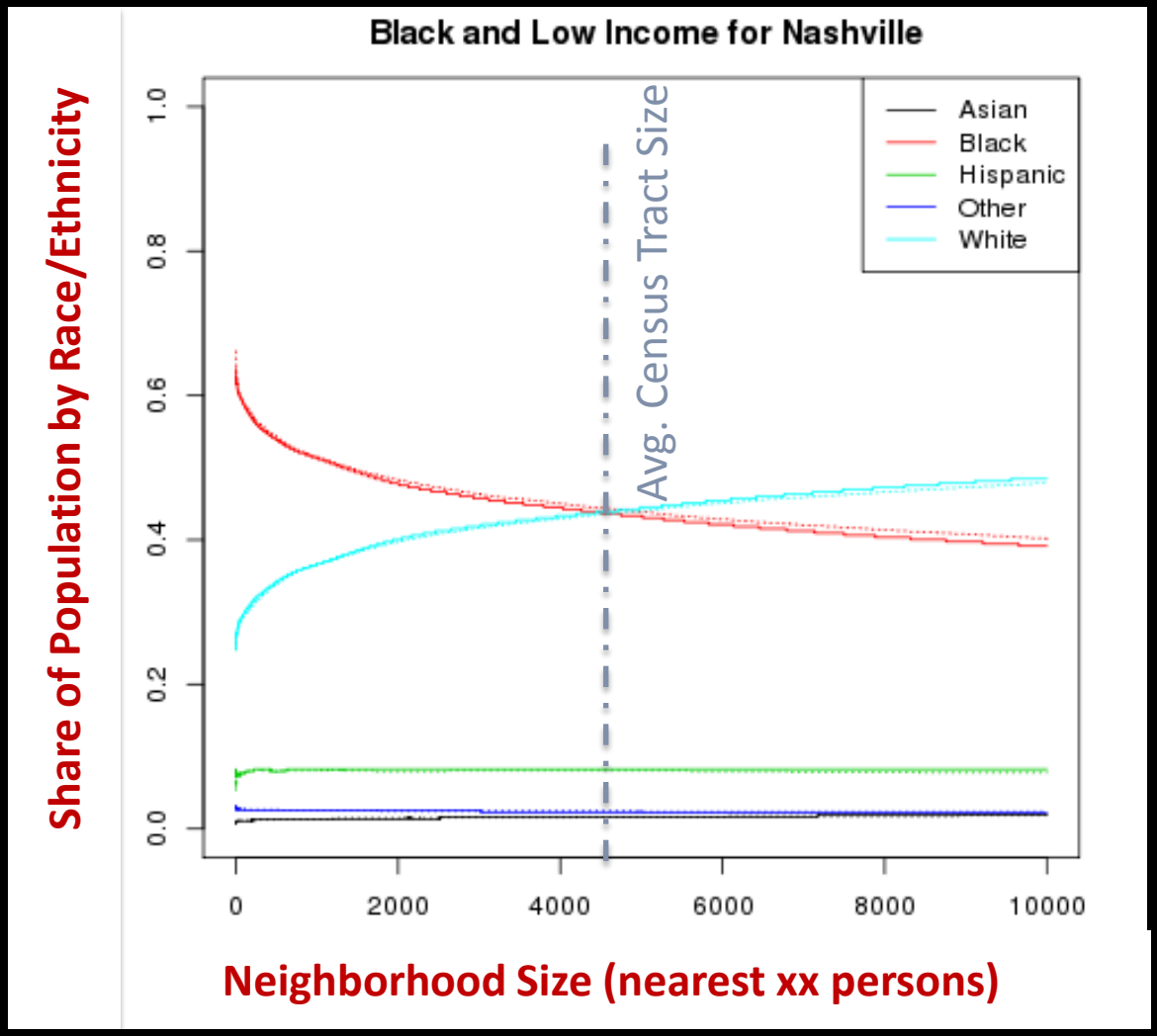
- At small scales (small populations) variability is higher
- At too large scales there is regression to the mean

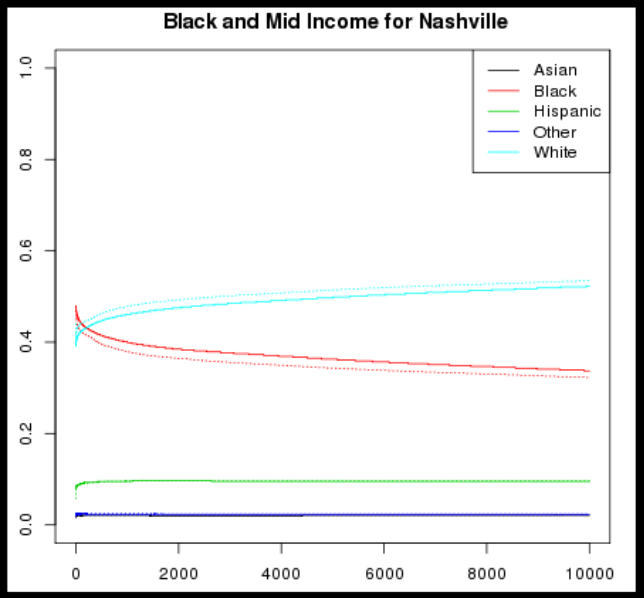
Demographic measures tend to have higher intensity and higher variability at small scales.

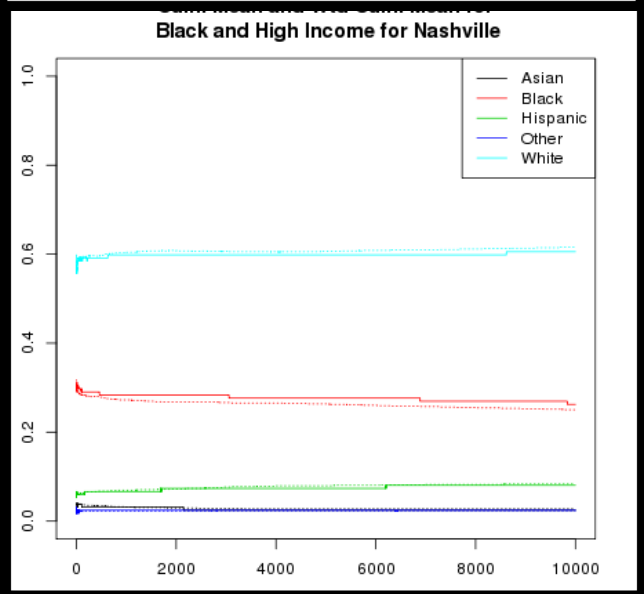


Fowler, Christopher S. (2015) "Segregation as a multiscalar phenomenon and its implications for neighborhood-scale research: the case of South Seattle 1990-2010" *Urban Geography.* ***37*** (1), 1-25.

Context changes a lot by the time we get to units the size of Census tracts



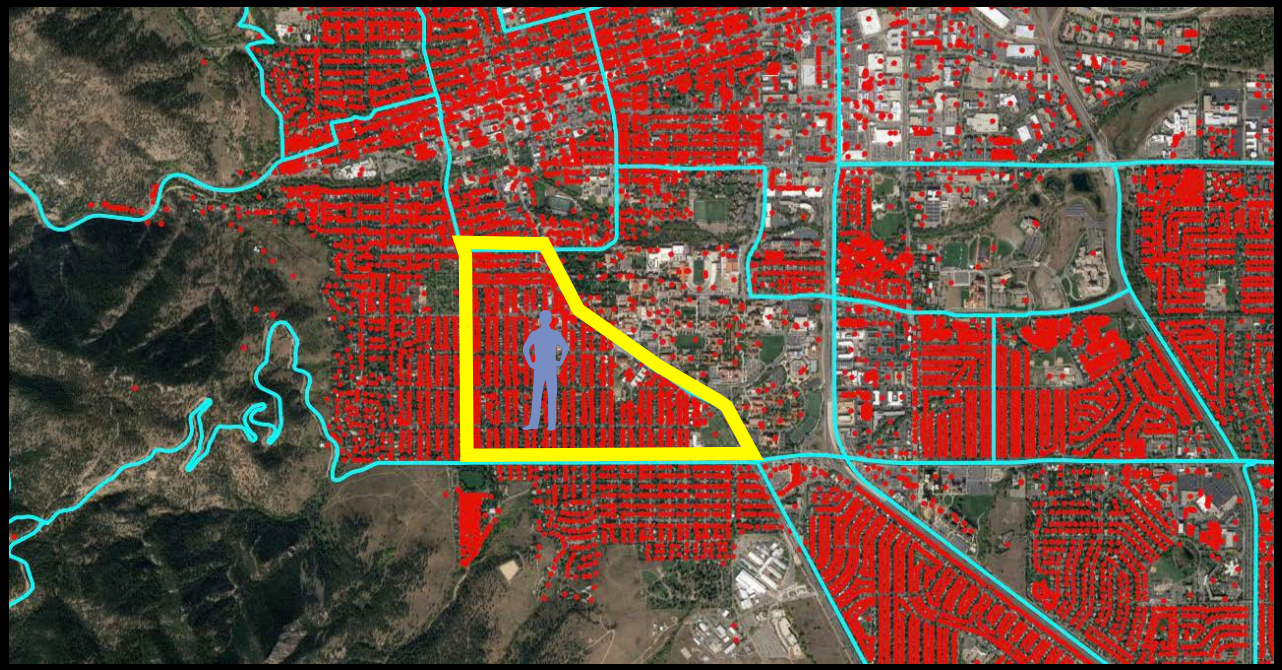




Boundaries vary in quality

- Some research questions have clearly defined geographic boundaries
  - Variation in property tax rates ➔ municipalities
  - Administrative units:, school districts, counties, states, etc.
- Others do not…
  - Rural vs. urban differentials ➔ need to draw the line between "urban" and "rural"
- Other issues
  - Edge effects ➔ equally valid for the household at the center and the one along the border?
  - Scale ➔ Does the size match the social phenomenon being studied?

Boundaries: Often the solution is as simple as mapping the boundaries and determining their suitability visually.



If boundaries are not suitable then things get challenging.

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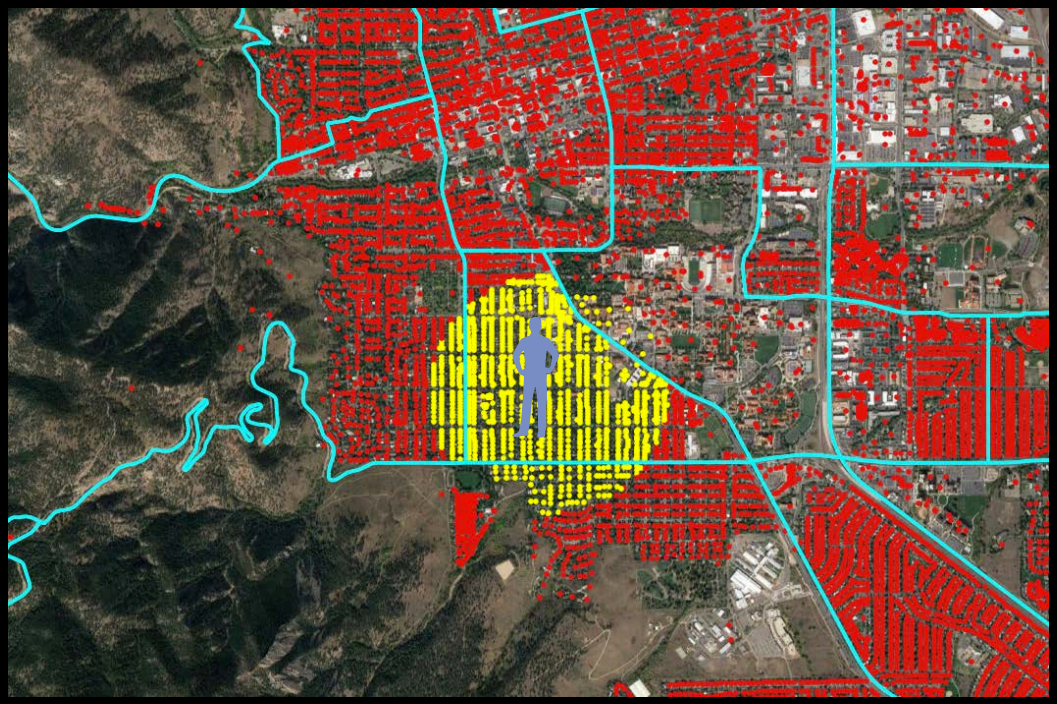
Addressing uncertainty in the use of contextual variables

- Problem: How do we know if we have the right scale or the right boundaries?

- Scale Solution: Run the analysis using different scales
  - Blocks, Block Groups, Tracts for Demographic Data
  - e.g. Root, E. D. (2012). Moving neighborhoods and health research forward: using geographic methods to examine the role of spatial scale in neighborhood effects on health. *Annals of the Association of American Geographers*, *102*(5), 986-995

Boundary Solution: How much do boundaries matter for the statistics being calculated

- The tract has 1000 people in it.
- For each of those 1000 people calculate the context based on their 1000 NEAREST NEIGHBORS



Standard Deviation of Individual Context

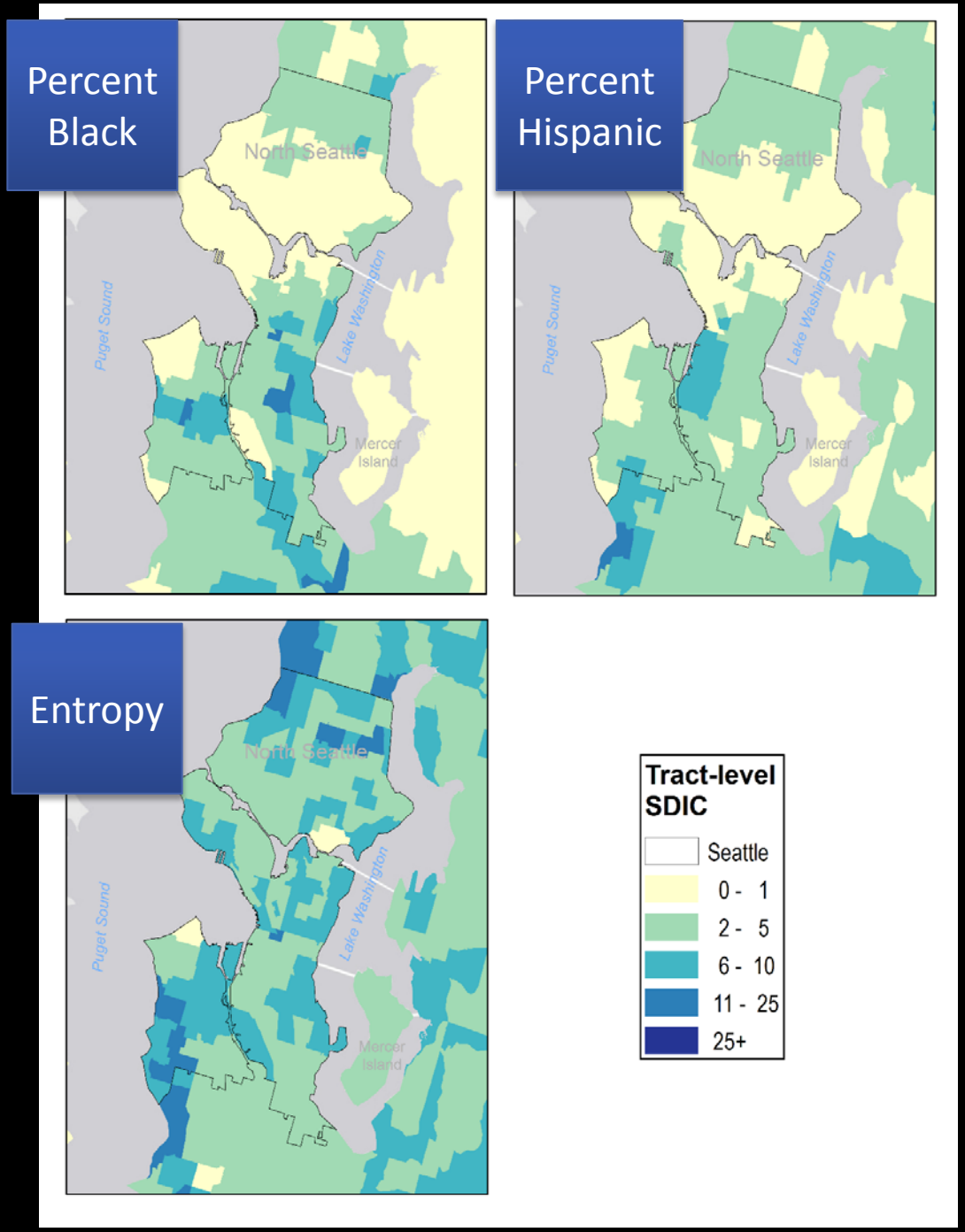
The degree to which individual experience varies within a geographic unit

$$SDIC = \sqrt{\frac{\sum_{i \in c}(x_i - x_c)^2}{k}}$$

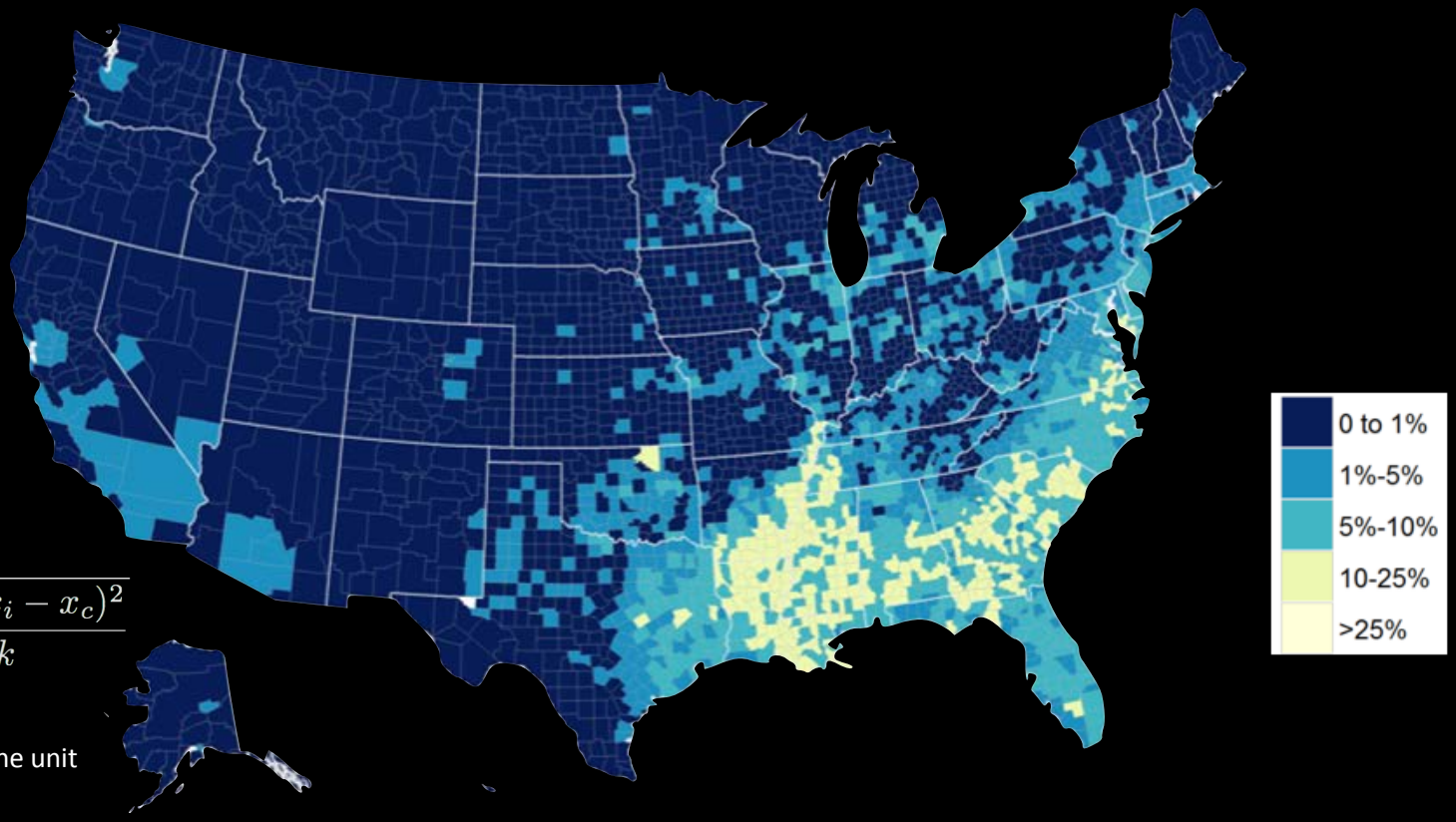
c = contextual unit (like tract)
k= number of people in the unit

Tract-level variation in SDIC for City of Seattle and surrounding area.

'Worst Case' Scenario: Egocentric measures of Percent Black at 0% and 100% within the same tract



The uneven geography of context: County average of tract-level SDIC for Pct. Black



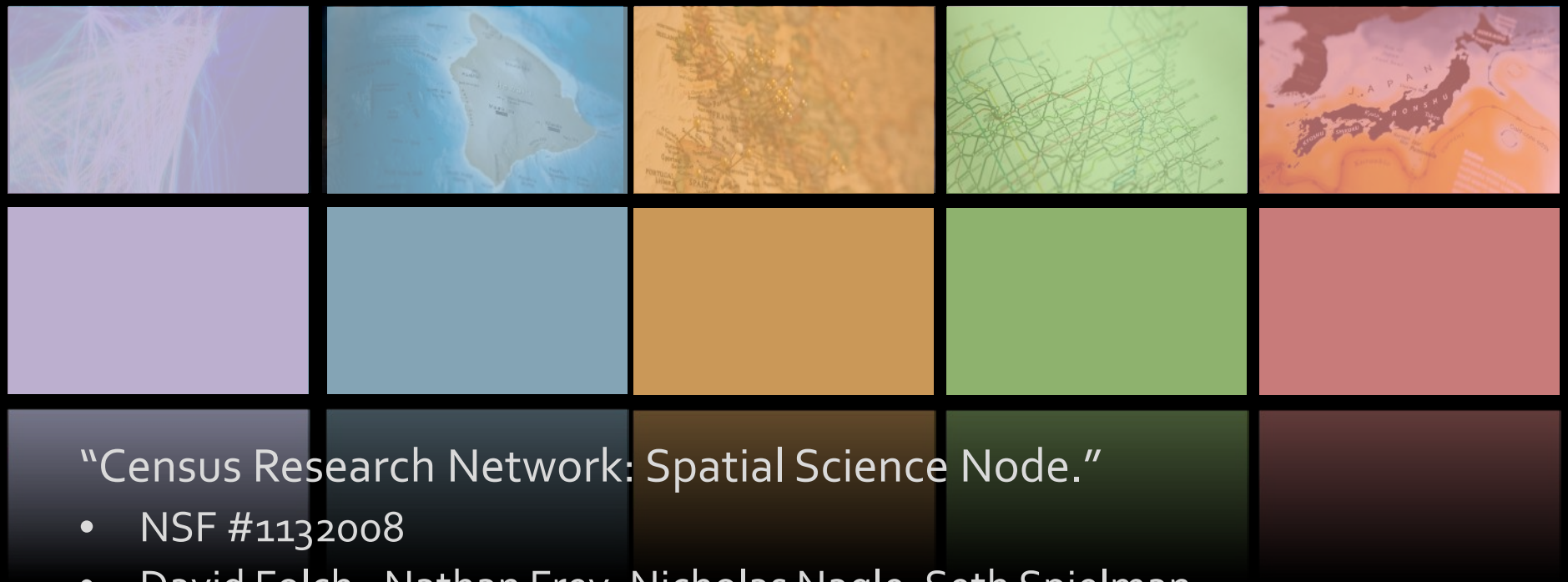
$$SDIC = \sqrt{\frac{\sum_{i \in c}(x_i - x_c)^2}{k}}$$

c = contextual unit (tract)
k= number of people in the unit

Concluding thoughts:

- Contextual variables are often appropriate for small populations
- Care is necessary in defining SCALE and BOUNDARIES for contextual variables.
- There are techniques for measuring the impact of uncertainty with respect to both scale and boundary issues.
- If all else fails, we do have individual-level data for generating custom contexts.

Acknowledgements



"Census Research Network: Spatial Science Node."

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- David Folch , Nathan Frey, Nicholas Nagle, Seth Spielman

"Early Life Stress and the Environmental Origins of Disease: A Population-based Prospective Longitudinal Study of Children in Rural Poverty."

- NIH #1UG3OD023332-01
- David Folch, Levon Mikaelian, Clancy Blair