Whose Backyard Is It? Proximity Analysis Using GIS as a Tool for Environmental Justice

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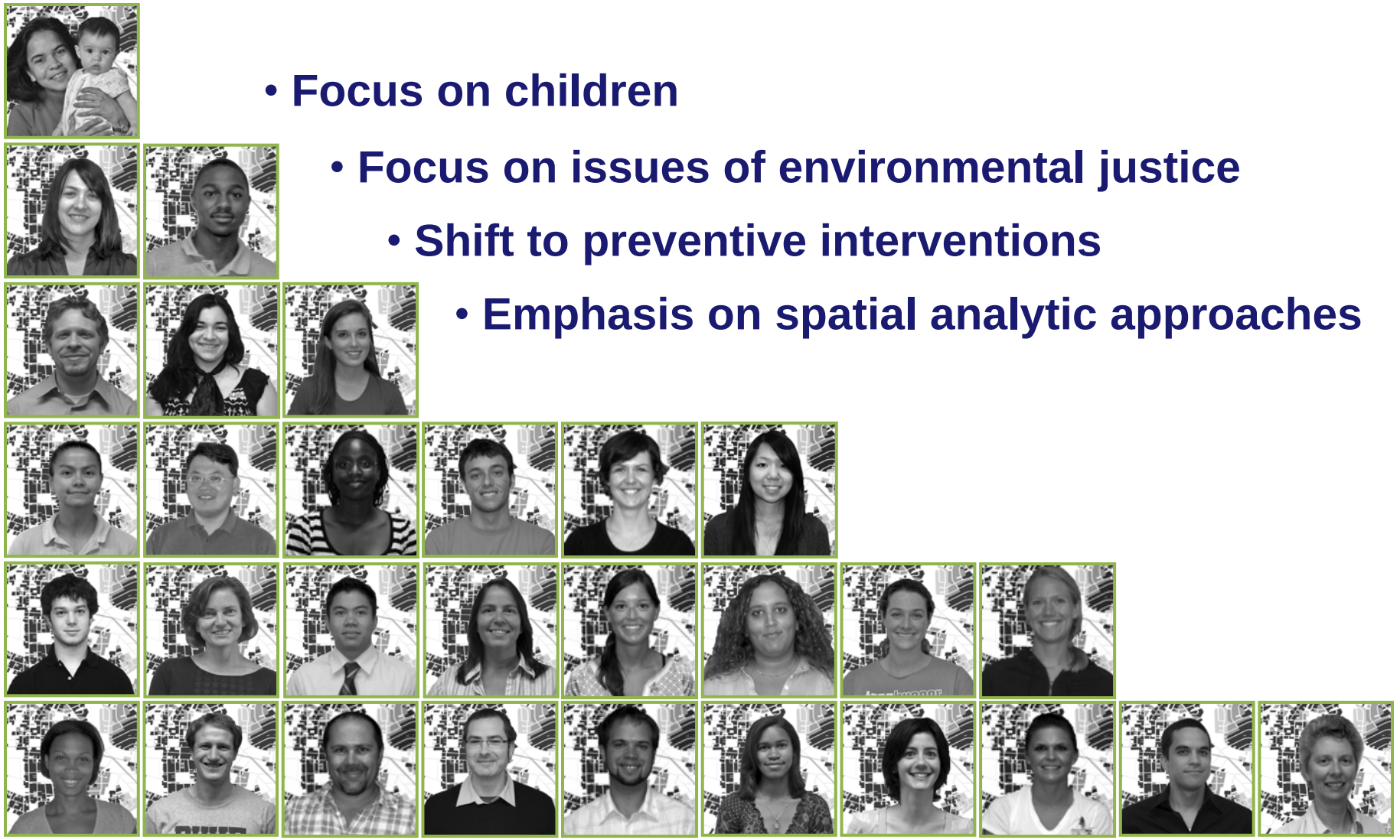
Children's Environmental Health Initiative



- Focus on children
- Focus on issues of environmental justice
- Shift to preventive interventions
- Emphasis on spatial analytic approaches

Proximity Analysis and Environmental Justice

- Geographic Information Systems (GIS) was used in two studies to evaluate EJ implications of proximity and exposure.
  - Toxics Release Inventory Burden Reduction Rule
  - Demographic assessment of populations exposed to poor air quality

- Objectives:
  - Illustrate the utility of GIS for assessing environmental policies
  - Describe potential disproportionate exposure to environmental hazards by certain populations

TRI Reporting Requirements

- Manufacturing facilities must report annually to TRI if:
  - Certain manufacturing sectors
  - Employ at least 10 people full-time
  - Process or use above a specified threshold of over 650 chemicals
- Form A
  - Facility information and list of chemicals
  - No details on releases or management
- Form R
  - Required for each TRI-listed chemical released in excess of certain thresholds
  - Detailed information on releases to air, land, water, underground injection, or transferred off-site
- Regulatory trend has been to add additional chemicals or lower reporting thresholds

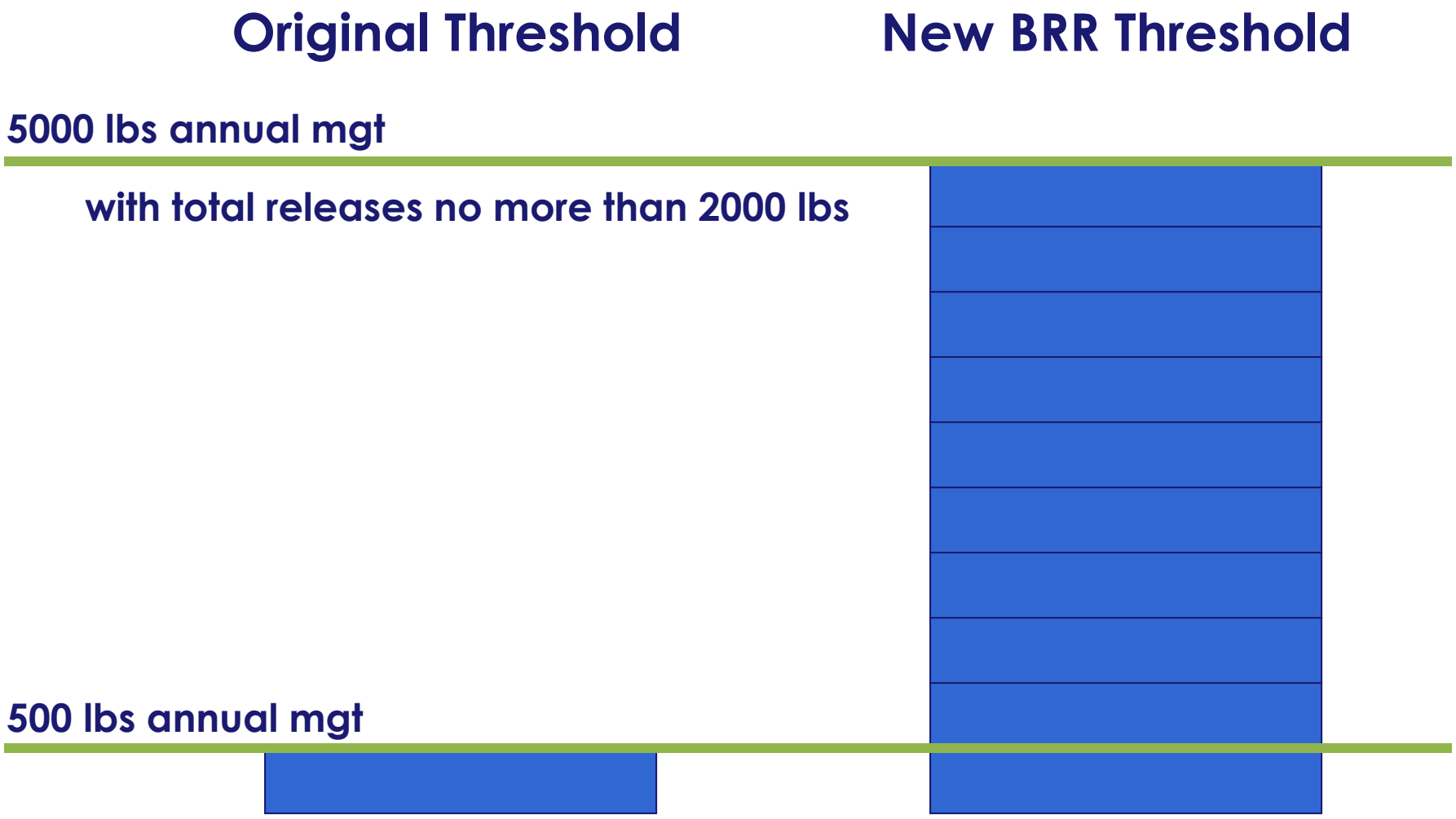
TRI Burden Reduction Rule

- **Issued in December 2006**
- **Changed reporting requirements**

Form A Thresholds for PBT Chemicals

Original Threshold	New BRR Threshold
500 lbs annual mgt with no releases	
Form A not permitted	

Form A Thresholds for non-PBT Chemicals



Research and Policy Questions

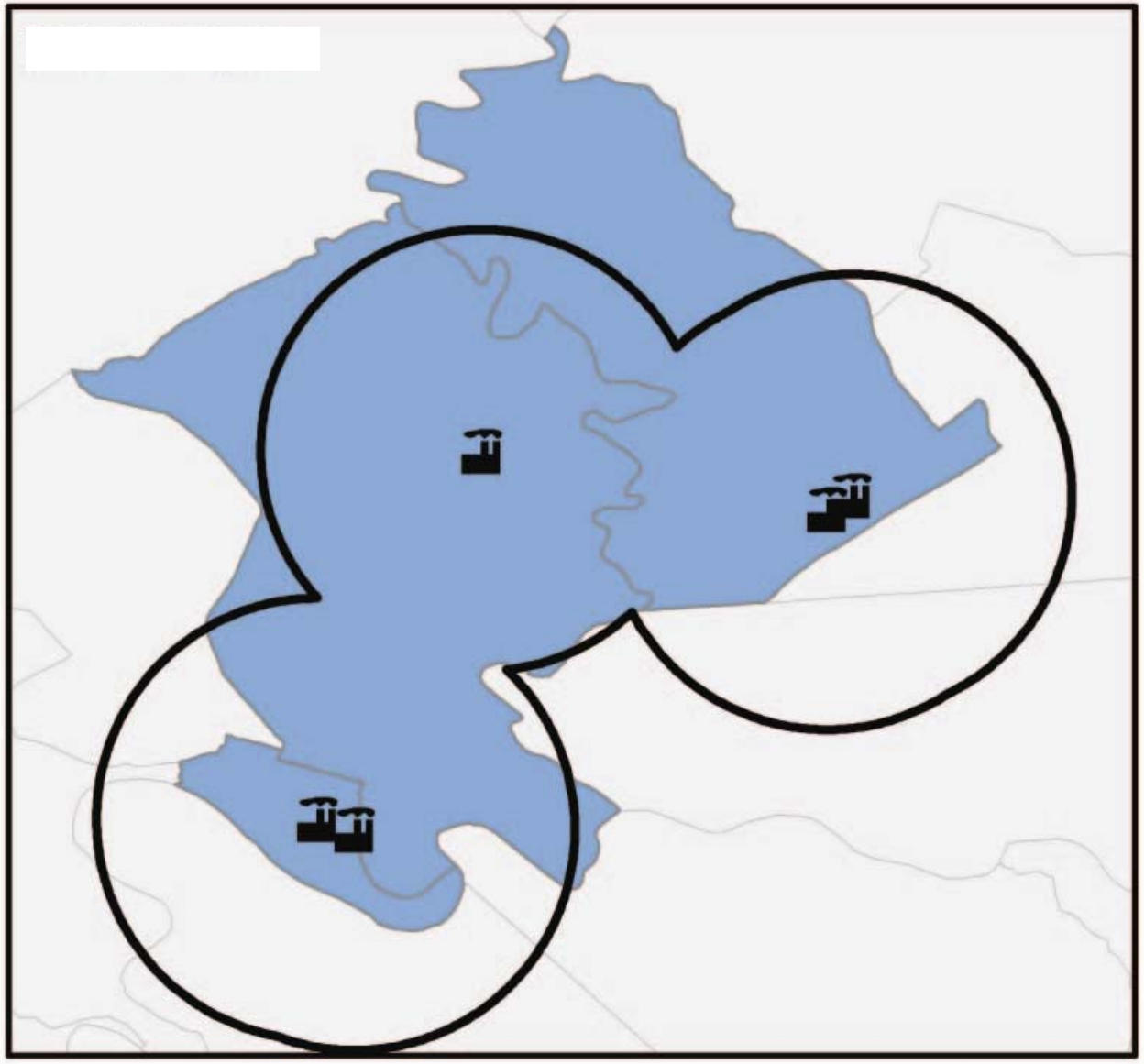
December 2006 TRI Burden Reduction Rule effectively reduced the # of facilities required to report

- **Was the information lost evenly distributed across the demography of the United States?**
- **Does spatial scale affect interpretation of results?**

Methods

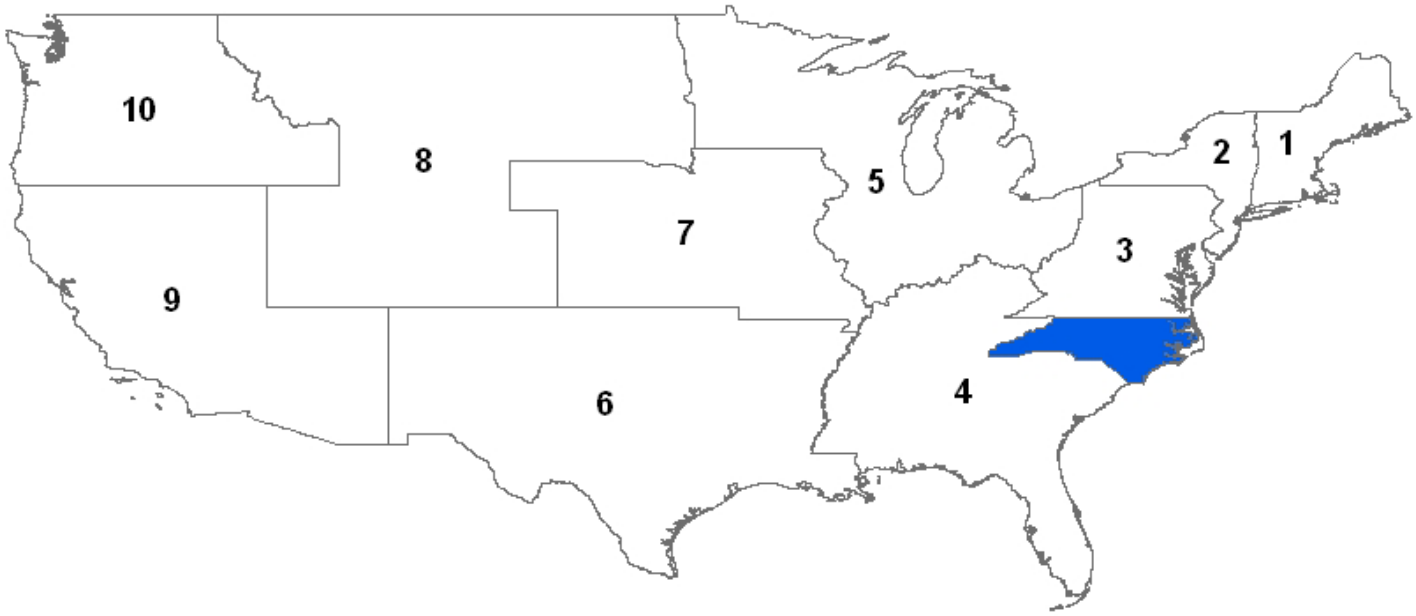
- For TRI 2005 data, determine which Form Rs would be converted to Form As under the new regulation
- Classify each facility as:
  - No change in reporting
  - Limited reporting
  - No longer reporting
- Georeference all TRI 2005 facilities
- Construct 1km, 3km, and 5km buffers around each TRI 2005 facility and compare demographics of buffers according to change in reporting status

50% Areal Method

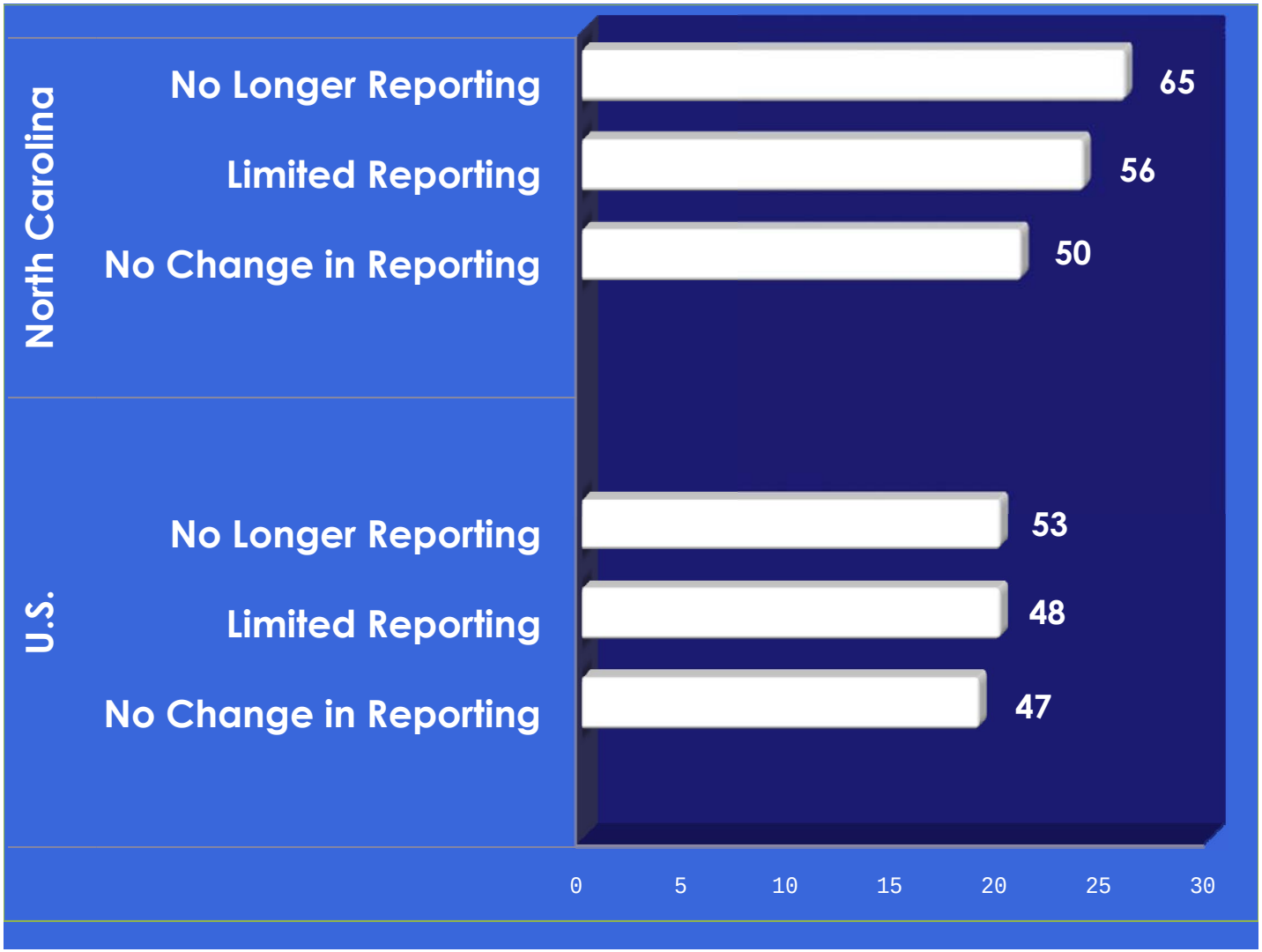


Spatial Scales

- United States
- EPA Regions
- North Carolina

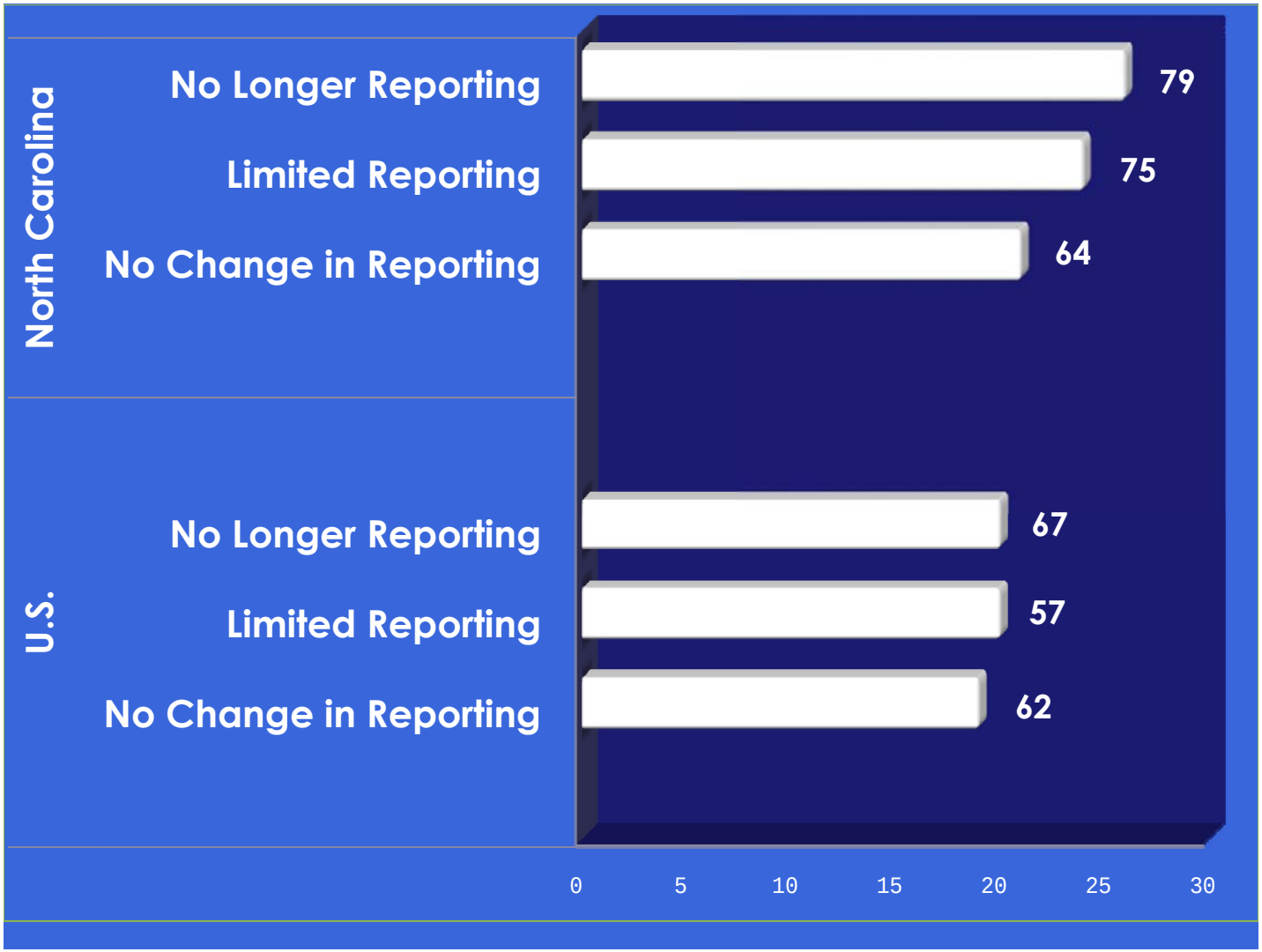


% Minority in Proximity to TRI Facilities



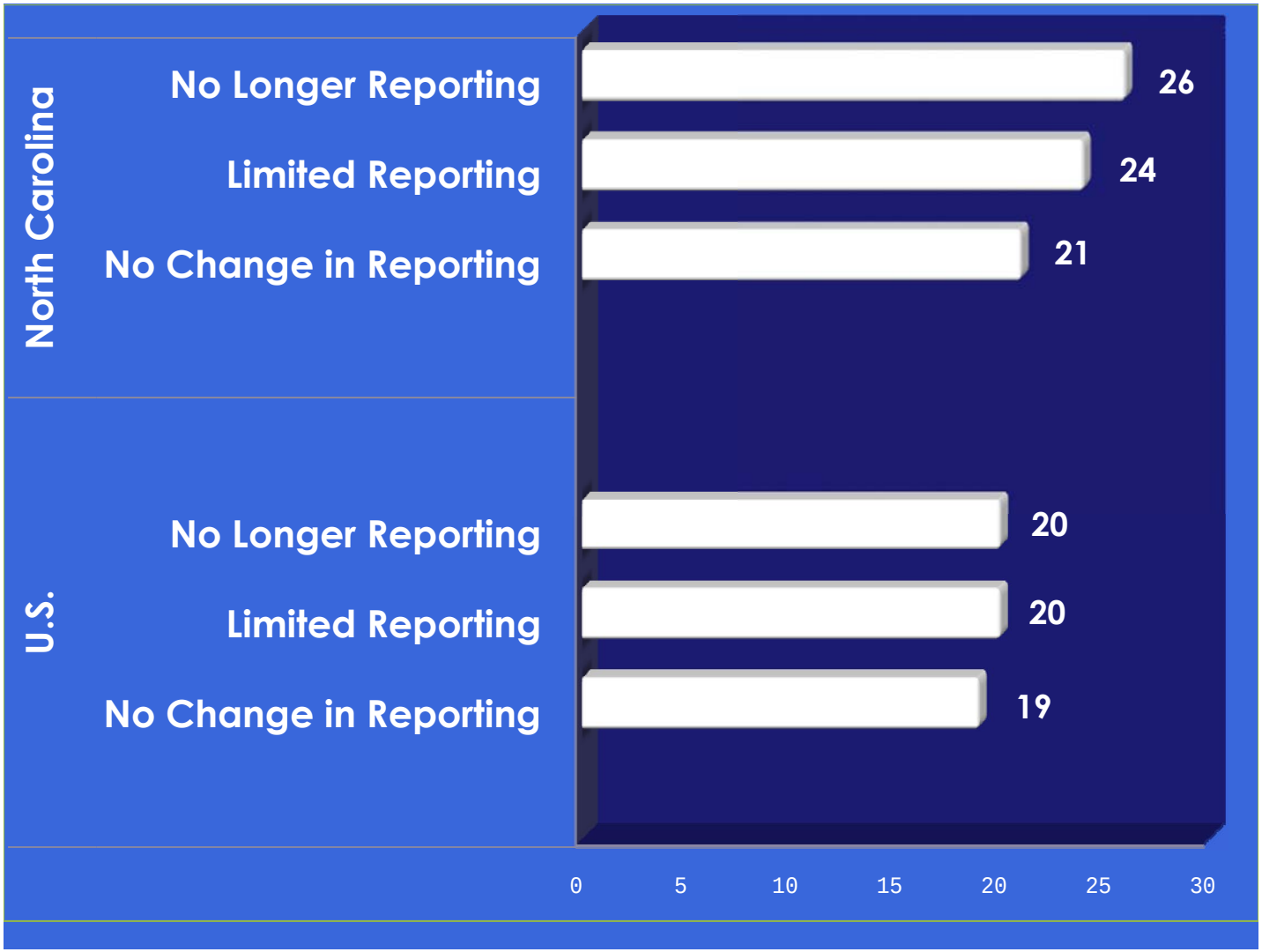
1 km buffer

% Minority < 5 Years in Proximity to TRI Facilities



1 km buffer

% in Poverty in Proximity to TRI Facilities



1 km buffer

Conclusions

- TRI facilities eligible for reduced reporting are more likely to be located in proximity to communities with a higher percentage of minority and low-income residents
- Differences more pronounced for minorities than for low-income residents
- Demographic differences more apparent at increasingly resolved geographic scales

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Proximity Analysis and Environmental Justice

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Assessing Air Quality

- Used methodology to “grade” air quality developed by American Lung Association (State of the Air 2009)
  - Ozone and $PM_{2.5}$ levels at each monitor
  - Describes annual trends in pollution levels
  - Lists cleanest/dirtiest cities
  - Quantifies number of citizens in non-attainment areas
- Ozone and daily $PM_{2.5}$ levels
  - County-level grading system A to F
- Annual $PM_{2.5}$
  - County-level “Pass” or “Fail” based on design values
  - “Incomplete” for sites with some monitoring data

Air Quality Research and Policy Questions

Does implementation of the Clean Air Act ensure the right to clean air in both disadvantaged and advantaged communities in the United States?

- Is the composition of communities with air quality data different from those without data?

- Is there an association between air quality and race, age, or income?

Our Approach

- Compared demographics of counties with incomplete or no data to “graded” counties.
- Compared counties with A/B grades (daily O_3 and $PM_{2.5}$) and “pass” (annual $PM_{2.5}$) to F and “fail” counties.
- Compared 20% of counties with best and worst air quality for each pollutant.
- Compared 5km buffer around each monitor graded A/B to buffer around monitors graded F.

Findings

1. Placement of monitors emphasizes urban and densely populated areas:

   Rural areas with older, non-Hispanic white populations are less likely to have monitoring information.

2. Using ALA grades for counties: areas with worst air quality have larger proportion of children and minorities; lower proportion of elderly compared to best areas.

3. Both methods (buffer and cleanest/dirtiest comparison) found children, minorities, and low income populations are overrepresented in areas with poor air quality.

Air Quality Research and Policy Questions

Does implementation of the Clean Air Act ensure the right to clean air in both disadvantaged and advantaged communities in the United States?

- Is the composition of communities with air quality data different from those without data?

YES

- Is there an association between air quality and race, age, or income?

YES

Conclusions

- GIS can be used as a tool to evaluate the environmental justice effects of policy change or implementation.

- Methods are important:
  - Spatial scales: National, regional, state, facility
  - Size of buffers
  - Population estimates: centroid, 50% areal, population-weighted

- Think outside the box: the effects of policy change are not always measured in tons of pollution – information is the foundation of environmental justice!

Acknowledgements

- National Institute of Environmental Health Sciences
- U.S. Environmental Protection Agency
- Office of Research Support, Duke University

http://www.nicholas.duke.edu/cehi/