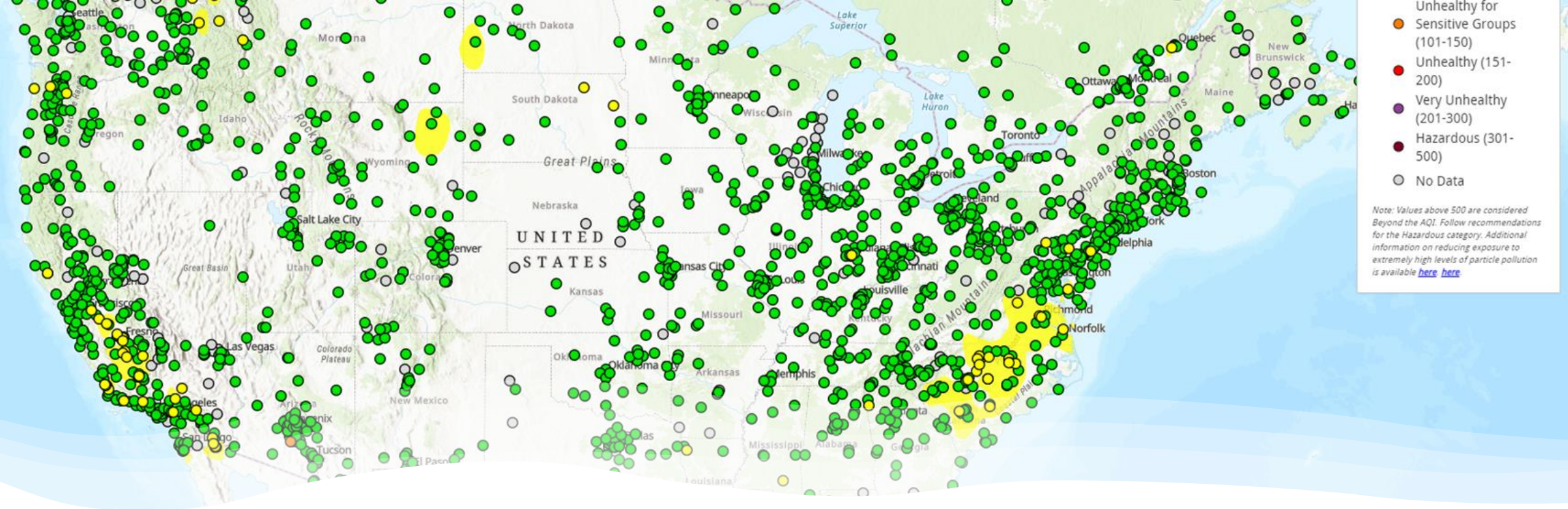




Disparities in air pollution exposure: Moving beyond the stationary monitor
Maeve MacMurdo- Cleveland Clinic

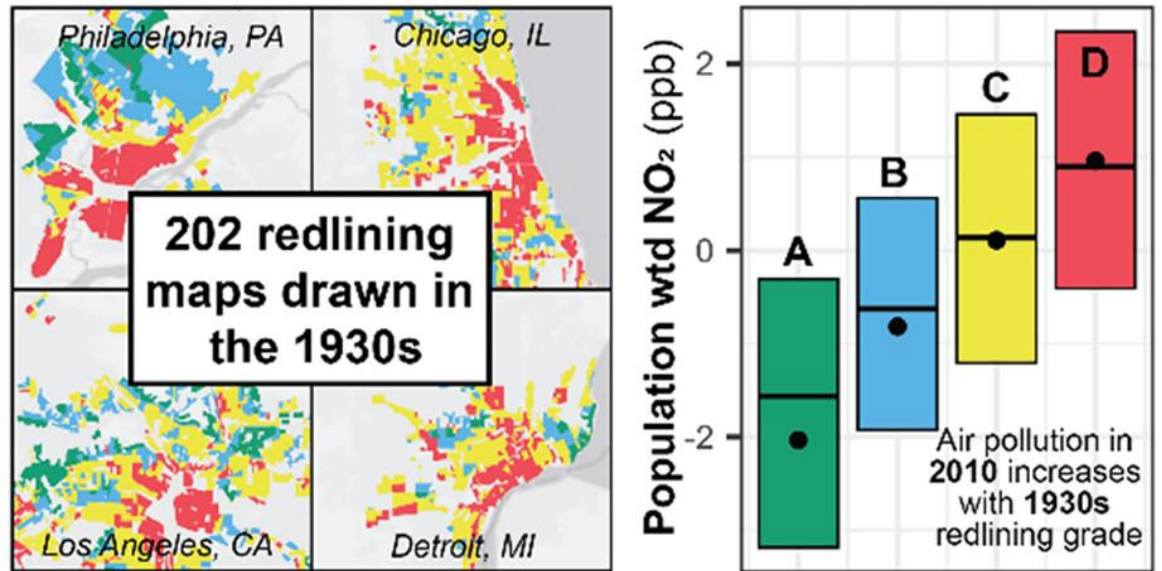
Objectives

- Air pollution as a driver of health disparities
- Cleveland- disparities and gaps
- Satellite data to advance EJ- case studies

Air pollution is an environmental injustice issue

- Residents of non-white majority communities experience disproportionate exposure to PM, CO₂ and NO₂
- Disparities in PM_{2.5} and NO₂ levels within communities are highest in historically redlined areas
- Significant disparities in industrial emissions and HAP exposure
- Excess mortality due to PM_{2.5} was disproportionately borne by black individuals

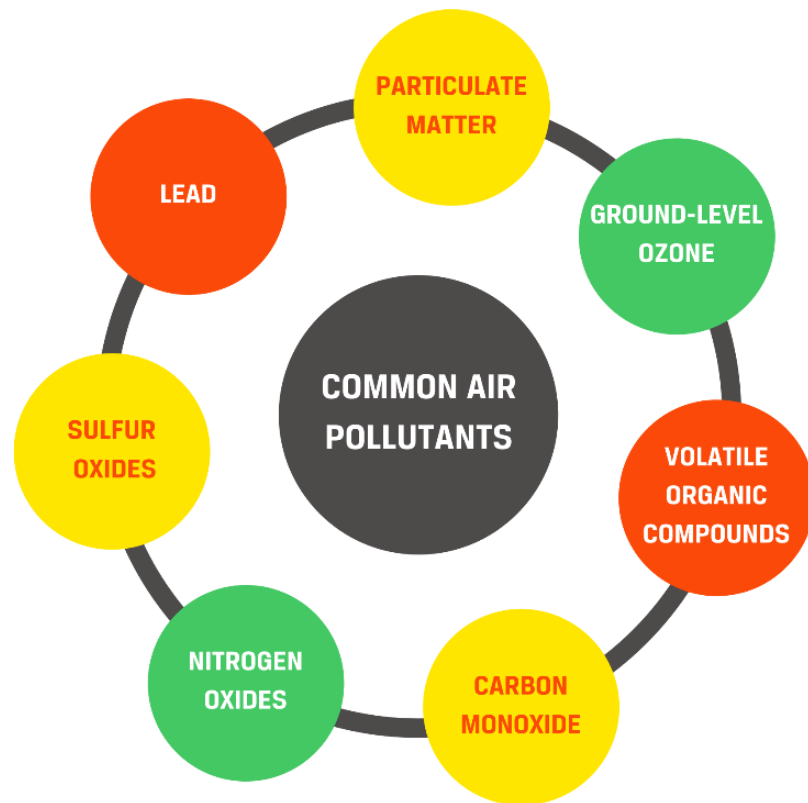
Modern air pollution disparities in historically redlined areas



Lane et. al *Environ. Sci. Technol. Lett.* 2022, 9, 4, 345–350



It's not just PM2.5



Cleveland- a case study



New Report: Cleveland's Air Quality Gets Worse, Residents Exposed to More Unhealthy Air Pollution

Lung Association "State of the Air" Report reveals that residents faced more days of poor air quality

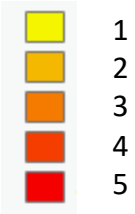


U.S. EPA downgrades Cleveland's status on standards for ground-level ozone

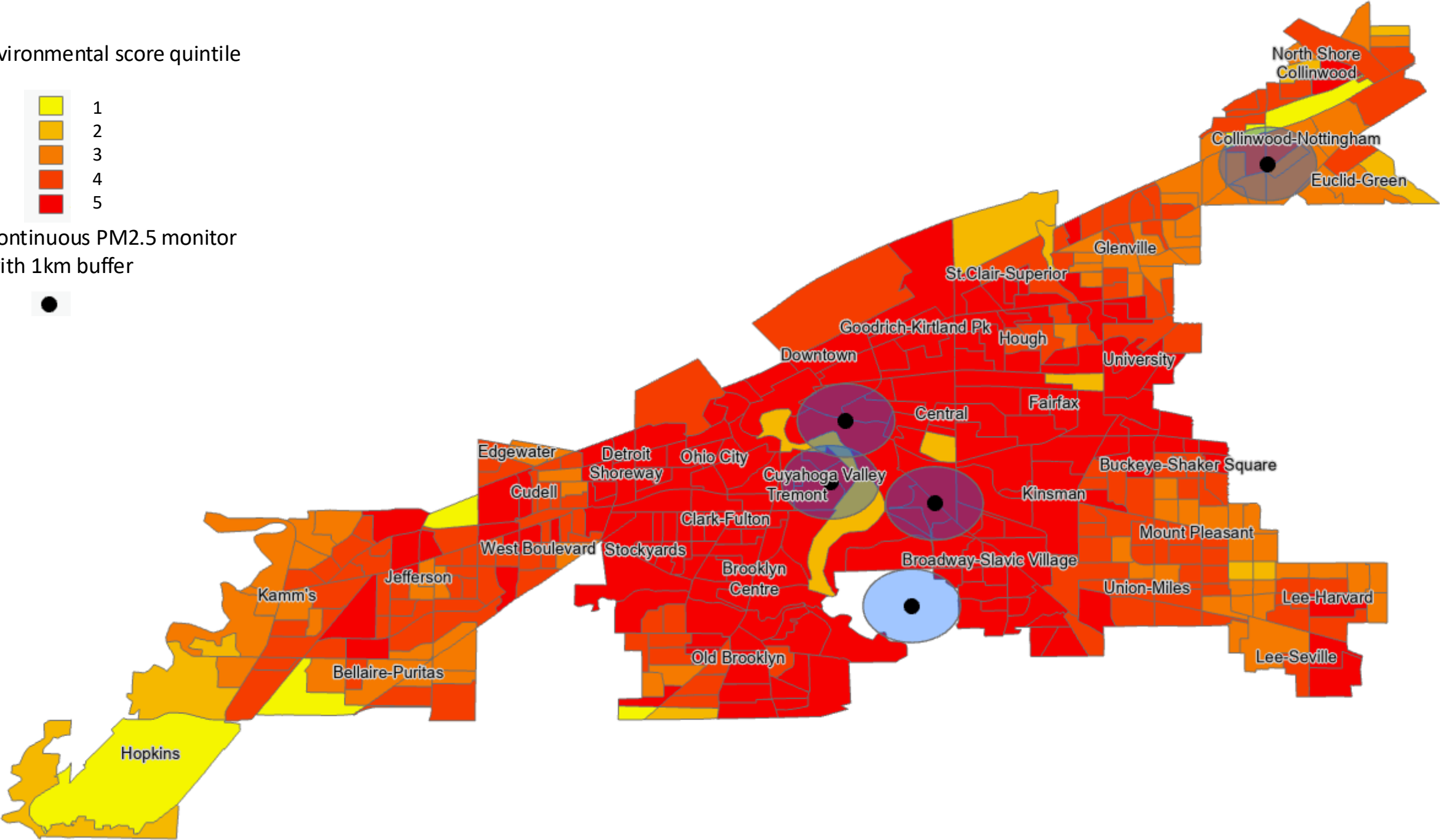
Updated: Sep. 23, 2022, 4:00 p.m. | Published: Sep. 22, 2022, 5:50 p.m.



Environmental score quintile



Continuous PM2.5 monitor
with 1km buffer



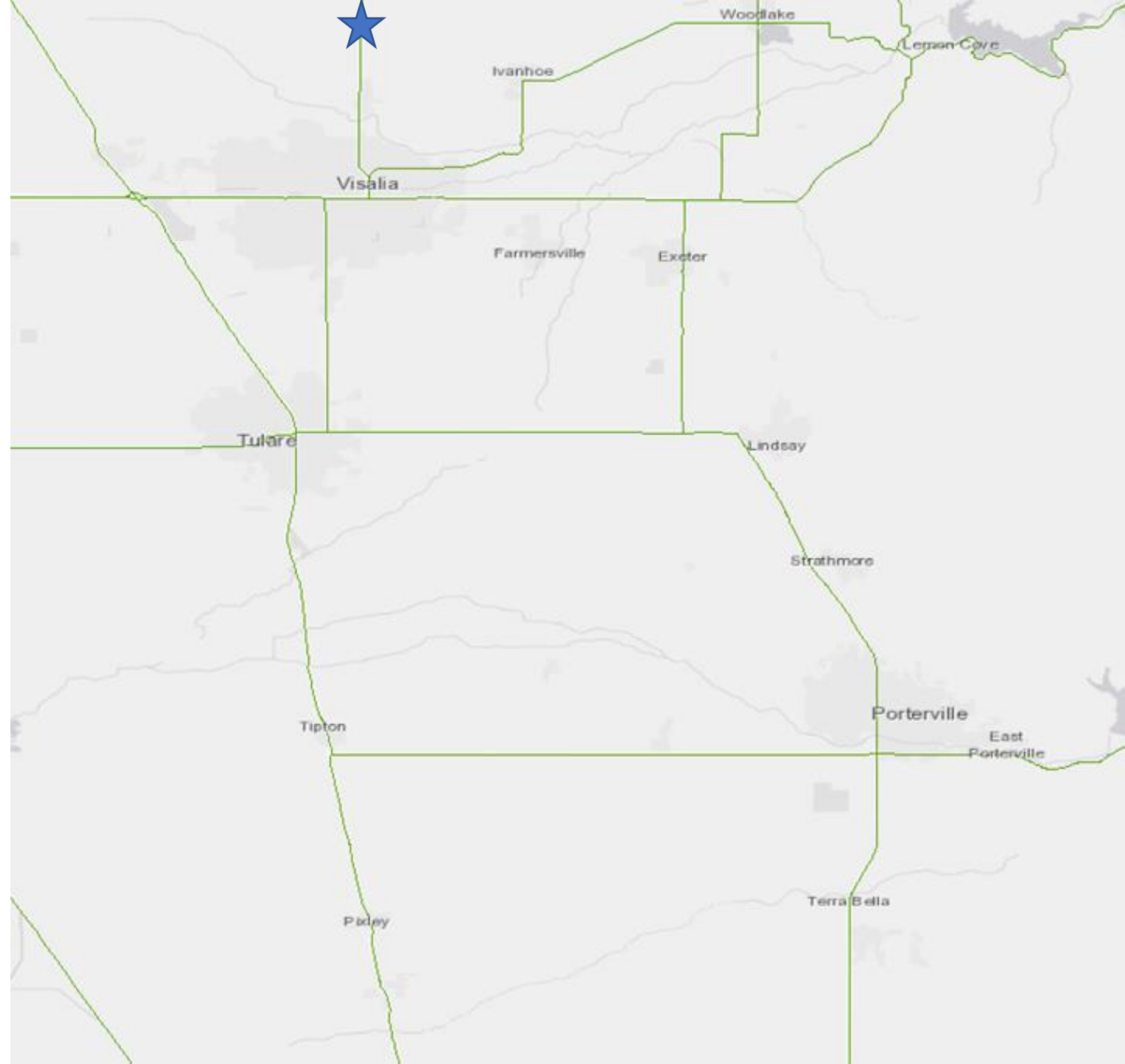
How can we quantify air pollution in individuals experiencing homelessness?

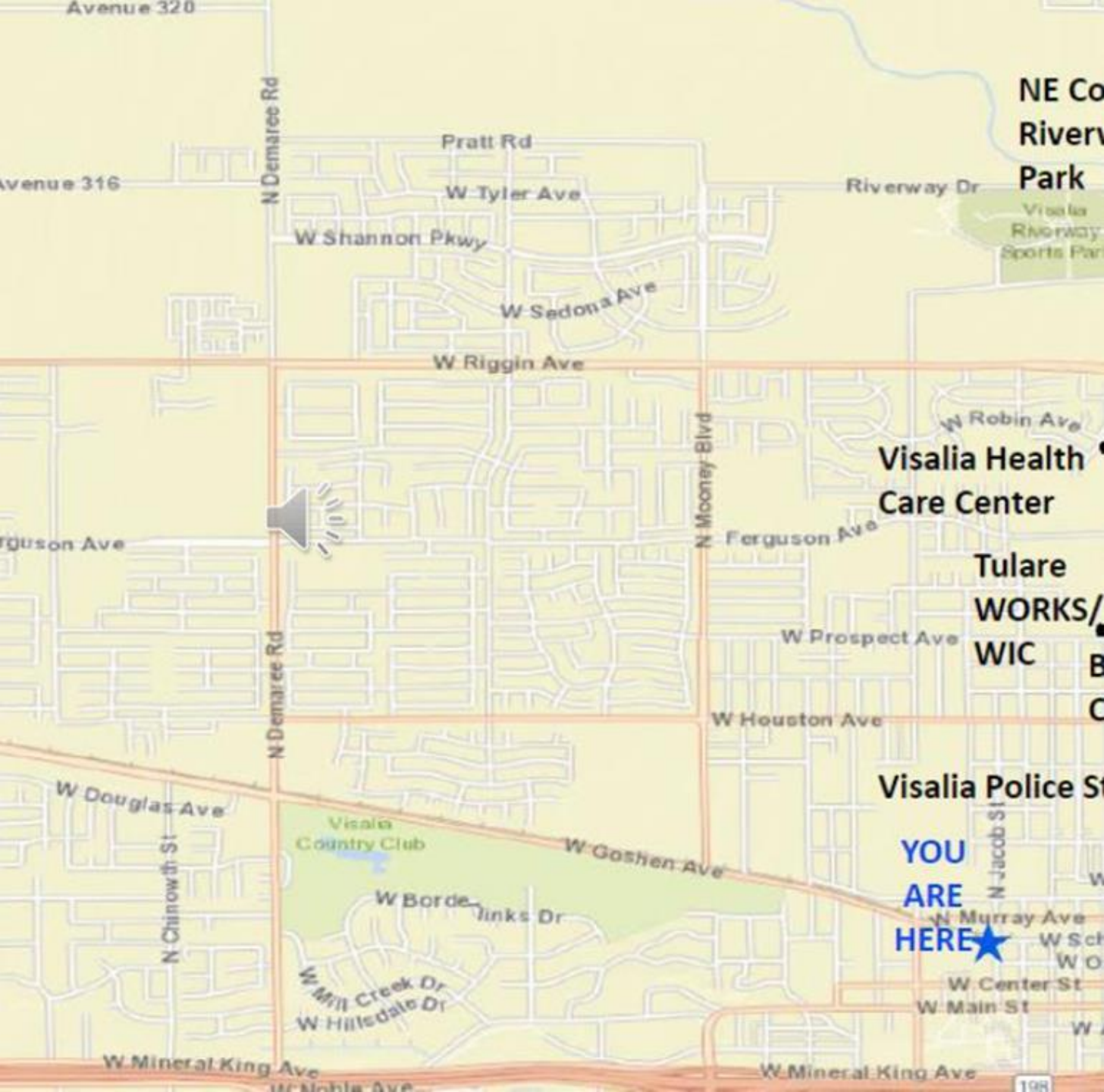
- Population of individuals experiencing homelessness is increasing.
- Unsheltered homelessness increasingly common
- Already at increased risk of respiratory disease
- Air pollution exposure may contribute to further disparities in health
- 90% of individuals experiencing homelessness report experiencing poor air quality
- By definition- don't have a home address.



Methods

- Collaboration with Tulare County Department of Housing and Human Services
- Semi-rural county in Inland California.
- Highest rate of unsheltered homelessness per county.
- Also potentially high rates of air pollution exposure... but only one continuous PM2.5 monitor!





Methods

- Data collection performed during annual PIT survey magnet events
- Individuals experiencing homelessness invited to complete local knowledge mapping
- “Safe” daytime and night time locations, locations of service use and unsafe spaces mapped
- Stationary emitters, toxic release emissions facilities, traffic density and major roadways mapped
- Satellite derived models of annual PM2.5 concentrations utilized to map air pollution exposure within an individuals “activity space”

Results

- 32% of night locations and 52.1% of daytime locations within 300 feet of a major roadway
- Proximity to stationary emitters was common for both day and night locations
- Not just one emission source.
- Exposure to PM2.5 consistently higher than NAAQS standard (though varied by location)

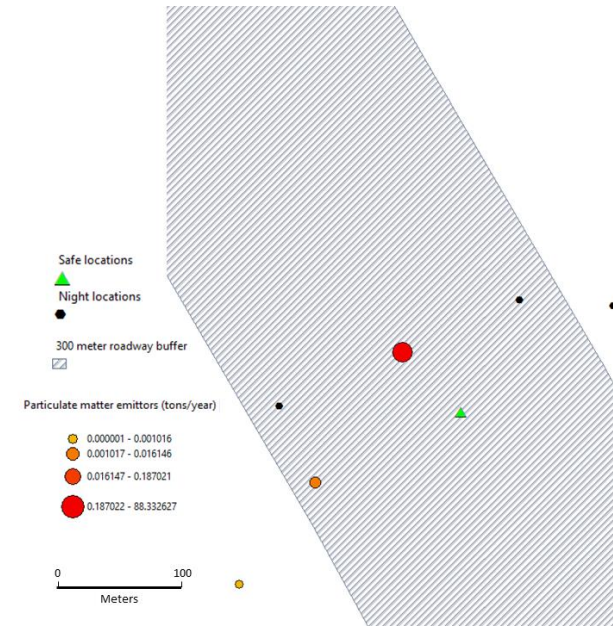


Table 2. Distribution of activity space size and fine particulate matter (PM2.5) concentration by township within Tulare County. SD—standard deviation; IQR—interquartile range.

Variable	Visalia	Tulare	Porterville	p-Value
Annual mean PM2.5 ($\mu\text{g}/\text{m}^3$) (SD)	15.6 (1.1)	14.17 (1.36)	15.3 (1.63)	0.98
Emitter count (<i>n</i>)	203	102	73	<0.001
Emitter density (emitters/ m^3)	5.59	4.85	4.12	0.89
Activity space-specific mean annual PM2.5 ($\mu\text{g}/\text{m}^3$) (SD)	16.64 (0.27)	15.39 (0.41)	16.52 (0.62)	<0.001
Nocturnal location mean annual PM2.5 ($\mu\text{g}/\text{m}^3$)(SD)	16.05 (1.27)	15.52 (0.63)	16.33 (1.0)	0.04
Median emitters per activity space (emitters/ m^3) (IQR)	11 (4–18)	11 (2–14)	3 (0–10)	0.07
Median activity space size (km)(IQR)	6.96 (3.26–11.5)	5.04 (1.02–9.43)	3.02 (0.01–5.74)	0.07

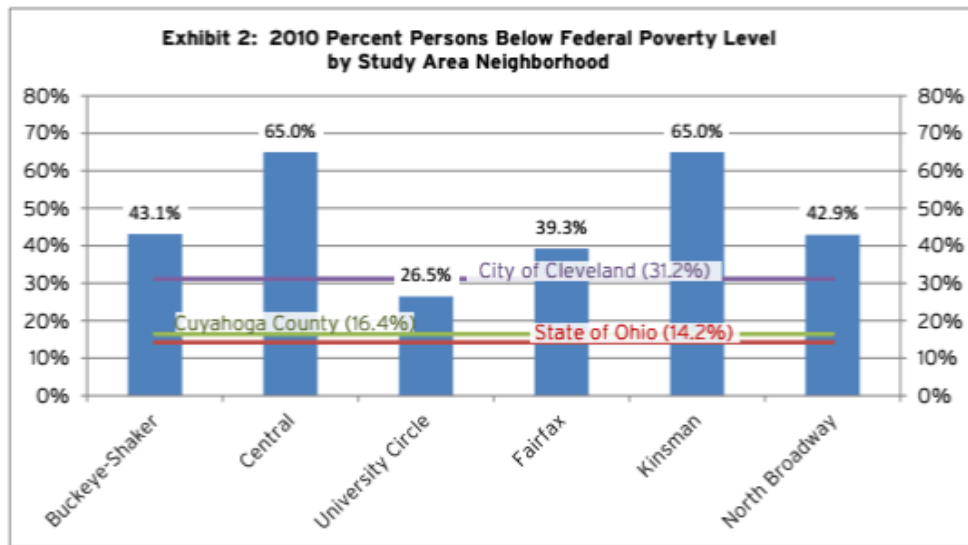
Significance



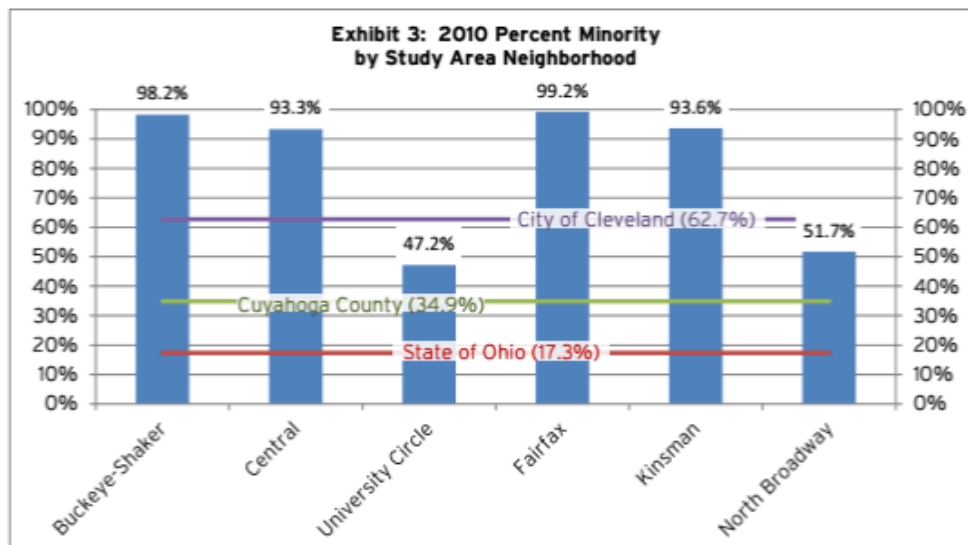
- Individuals experiencing unsheltered homelessness face exposure to ambient air pollution from **multiple** sources
- Housing first policies are likely to reduce overall air pollution exposure and may have major health benefits
- Policies targeting traffic emissions likely to have a major impact in reducing exposure
- Considering “safe spaces” in city planning/approval for further stationary emitter sites
- **Local knowledge mapping is feasible and effective as a tool for air pollution exposure assessment**



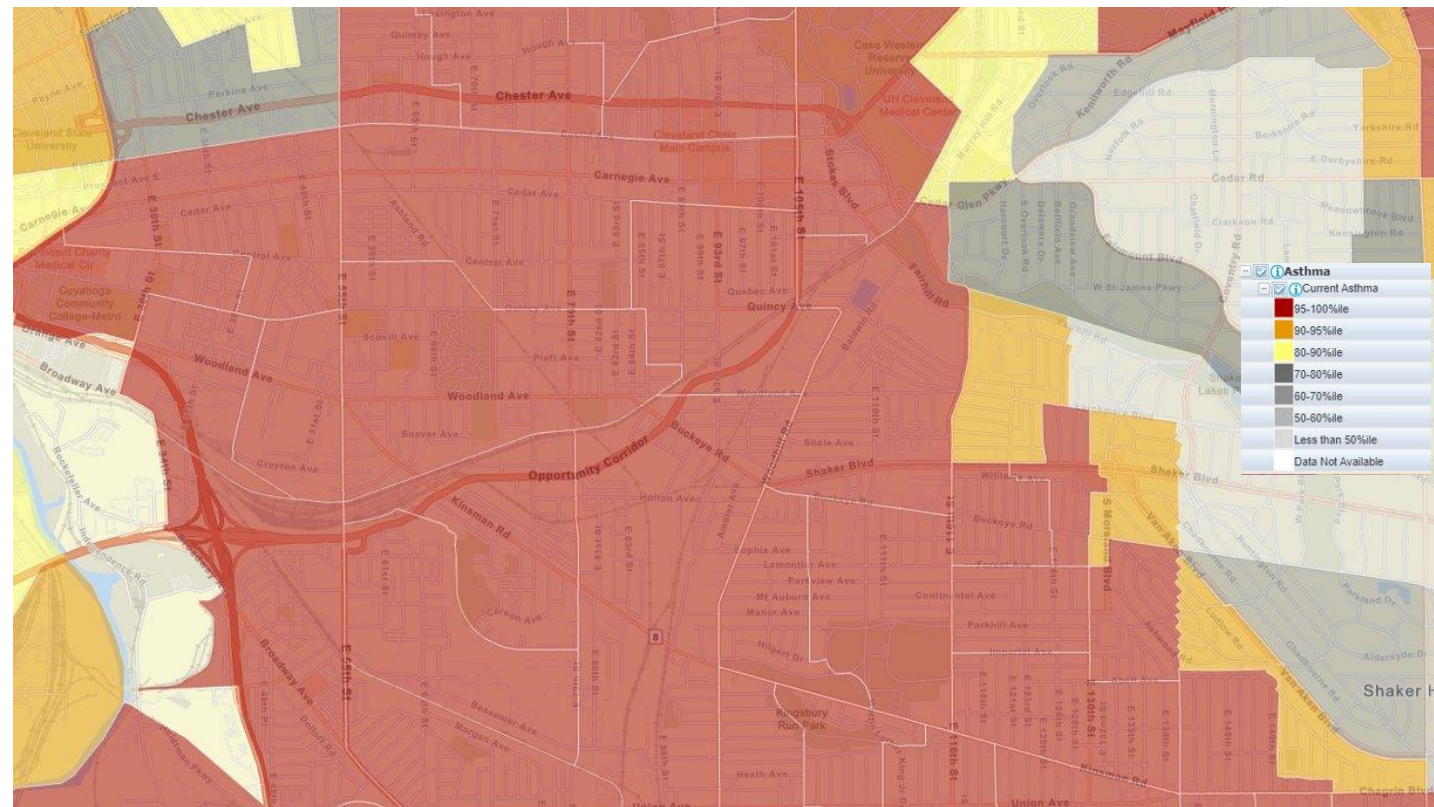
Utilizing Satellite Derived Data to model the impact of development at a community level



Source: State, County, and City data based U.S. Census Bureau (Factfinder Quickfacts accessed on August 13, 2012)
Neighborhood data based on 2006-2010 American Community Survey (Block Group data downloaded August 10, 2012)



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Aims:



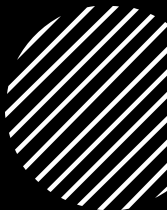
Quantify the change in traffic related air pollution observed in the neighborhoods impacted by the opportunity corridor utilizing satellite derived measures of PM2.5 and NO2.



Evaluate temporal trends in adult asthma related emergency room utilization in census blocks intersected by the opportunity corridor.



Challenges



Next steps



Satellite derived measurements
on PM_{2.5} to monitor
occupational exposure



Using satellite derived data to
support EJ interventions



Thinking co-exposure!