A Public Health Perspective On Urban Trees and Green Spaces

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DEPARTMENT OF EPIDEMIOLOGY

How can we build an evidence base relevant to the goal of healthy neighborhoods?

- Generating or refining ideas about how neighborhood environments could be changed to support health

- Evaluating the health impact of neighborhood changes (and related municipal policies) on health
  - Did we get the anticipated benefits? If not why?
  - If so, did benefit extend to vulnerable populations?
  - Were there any unanticipated health consequences?

Neighborhoods change

Tree planting campaigns & Million Trees NYC

THE MILLION TREE PROJECT

million trees LA

國際 2013 百萬森林計劃
香港區樹木護理及種植日
The 2013 Million Tree (Forest) Project & Network
Trees Conservation and Planting Day for Hong Kong Region

PLANT FOR THE PLANET

Tree planting campaigns & Million Trees NYC

million trees NYC

A PLANYC INITIATIVE WITH NYC PARKS AND NEW YORK RESTORATION PROJECT

Let´s NYC Breath

Leave your mark Plant a tree

Trees...

Increase property values.

Improve air quality by removing pollutants.

Beautify our city and make it a comfortable place to live, work and visit.

Lower summer air temperature by shading buildings.

Encourage neighborhood revitalization.

What can we do for trees in return?

million trees NYC

A PLANYC INITIATIVE WITH NYC PARKS AND NEW YORK RESTORATION PROJECT

www.milliontreesnyc.org

millionTreesNYC
A PLANYC INITIATIVE WITH NYC PARKS AND NEW YORK RESTORATION PROJECT

Trees for Public Health Neighborhoods

(description from the milliontreesNYC website, emphasis added)

"When planting one million new trees in a city as large as New York City, you have to start somewhere. The Parks Department has established six target neighborhoods that have been identified as neighborhoods of greatest need for trees. The six neighborhoods—referred to as Trees for Public Health neighborhoods (TPH)—were selected because they have fewer than average street trees and **higher than average rates of asthma** among young people. It is believed that additional trees in these neighborhoods will **reduce the pollutants that trigger respiratory disorders**, and contribute to healthier living standards."

HOME

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EVENTS

FAQ

NEWS ROOM

PROJECTS

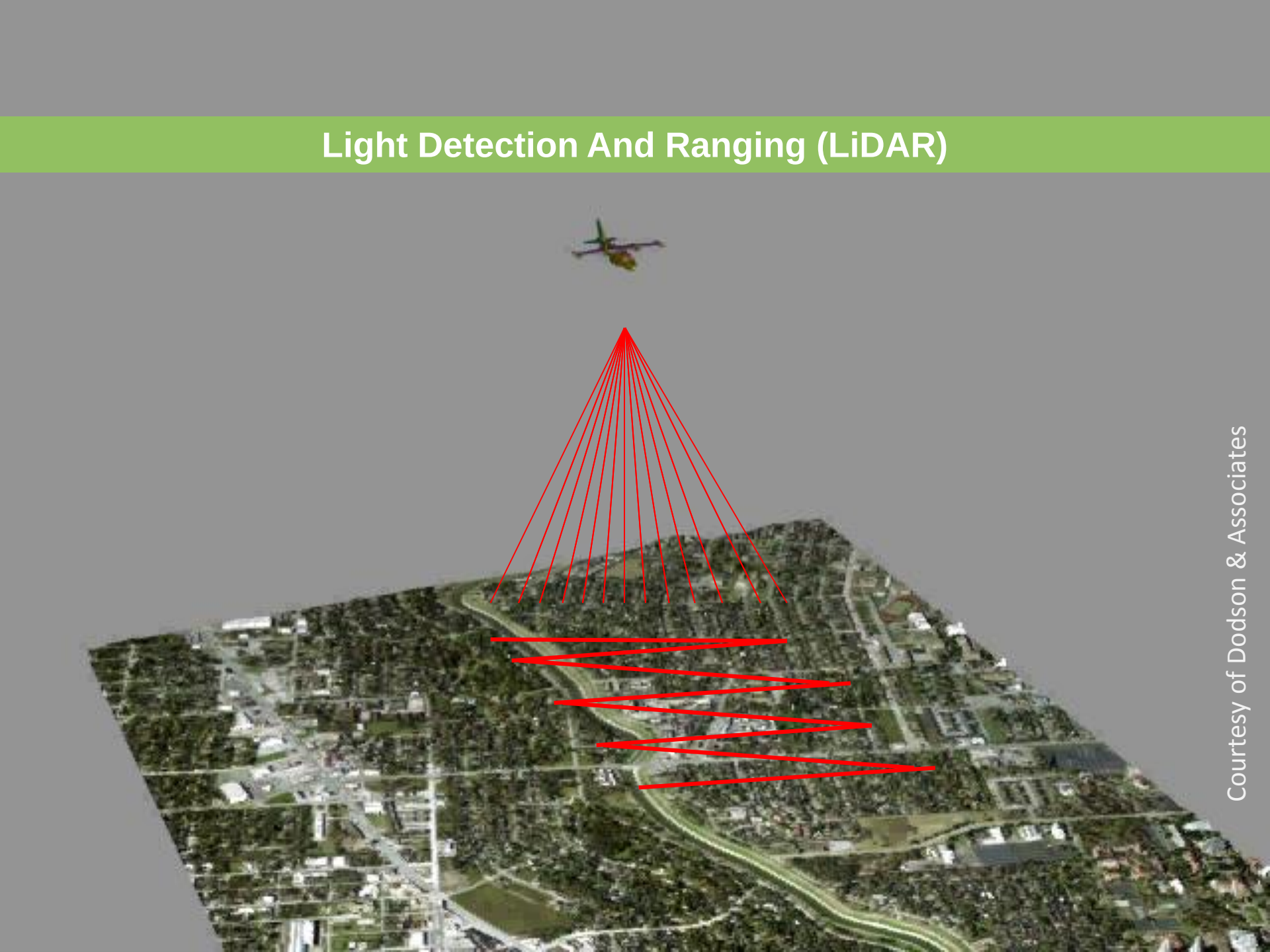
RESEARCH

The Urban Forest, Childhood Asthma and Community Air Quality (09-NA-IN539-09)

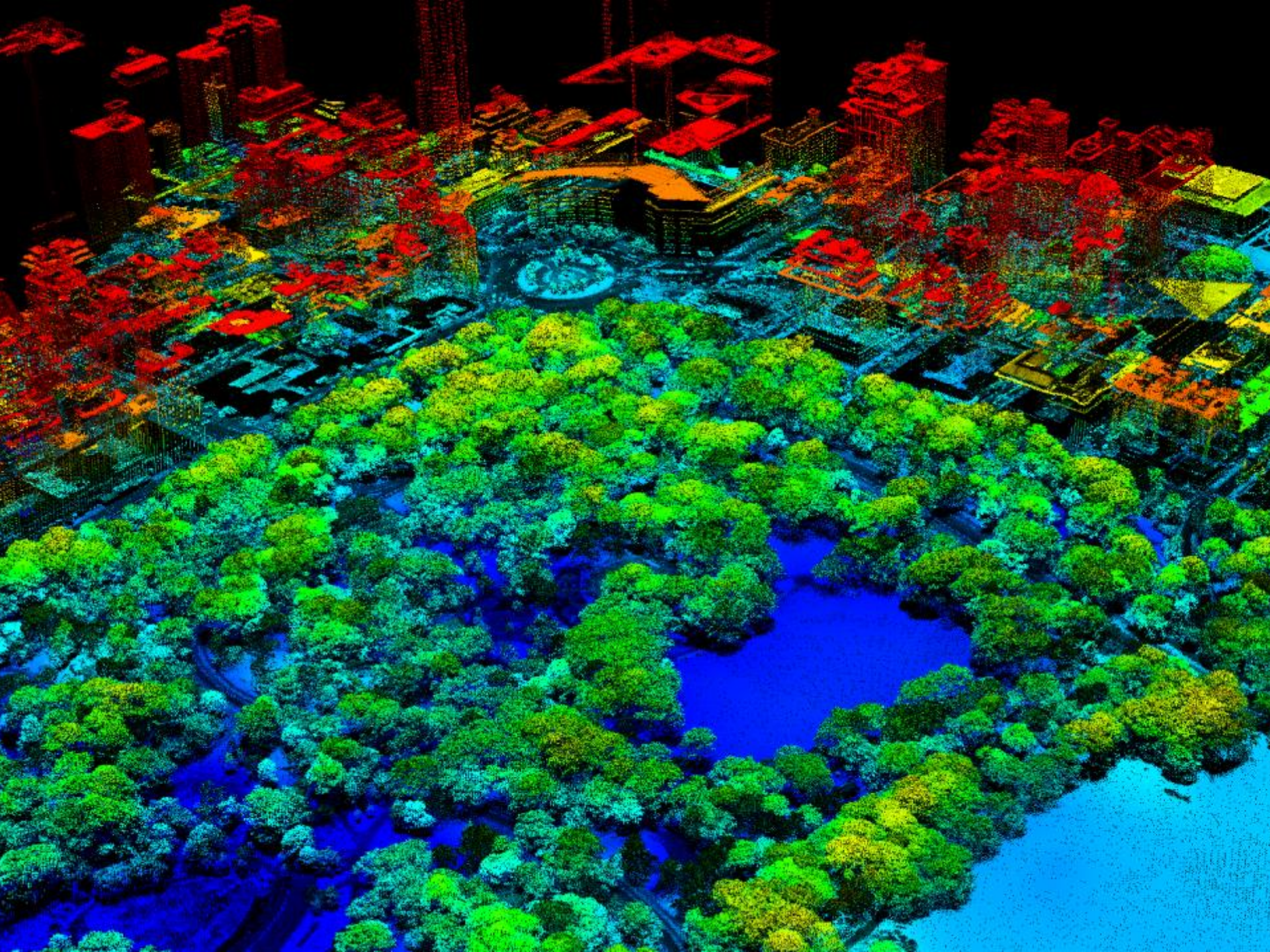
Grant Number
09-NA-IN539-09

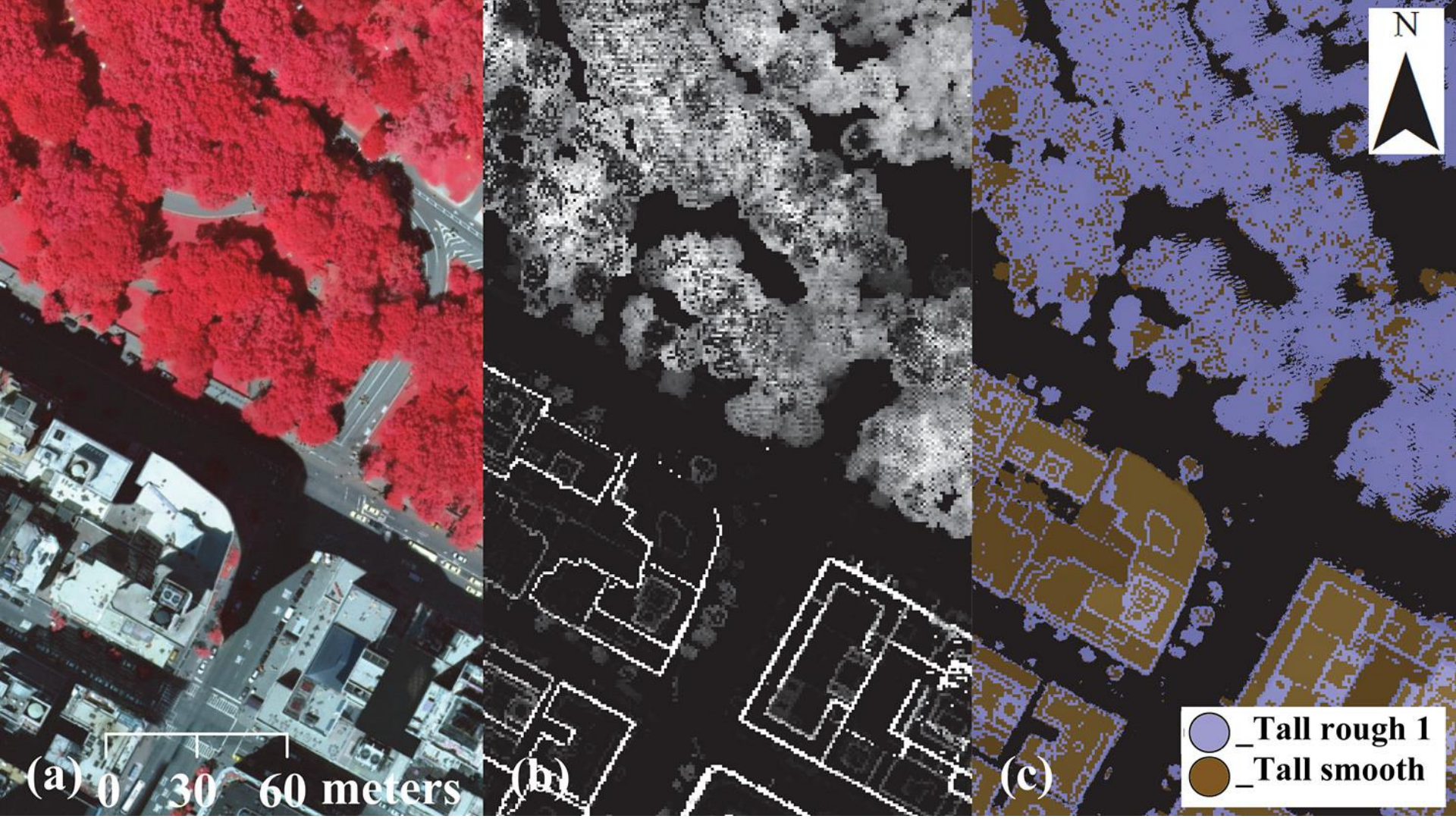
We propose an innovative research collaboration to examine and describe the linkages between urban forest structure, community-scale air quality, and respiratory health. The partners will include Columbia University, the New York City Department of Health and Mental Hygiene, the New York City Department of Parks and Recreation, City University of New York's Queens College Center for the Biology of Natural Systems and the University of Vermont Spatial Analysis Lab. We will bring together health data from high-risk children in New York City with detailed urban forest inventories and air quality monitoring in the neighborhoods where they live. Specific attention will be paid to the public health effects that the urban forest may have on childhood asthma which is most likely mediated through changes in community air quality. This study could provide direction for municipal governments and community groups towards mitigating the health effect of air pollution through improved planning and maintenance of urban forests. The national target audiences for this research include cities and municipalities with high air pollution levels.

Light Detection And Ranging (LiDAR)



Courtesy of Dodson & Associates





Tree canopy classification

MacFaden SW, et al. 2012. High-resolution tree canopy mapping for New York City using LiDAR and Object-based image analysis. Journal of Applied Remote Sensing, Vol 6.

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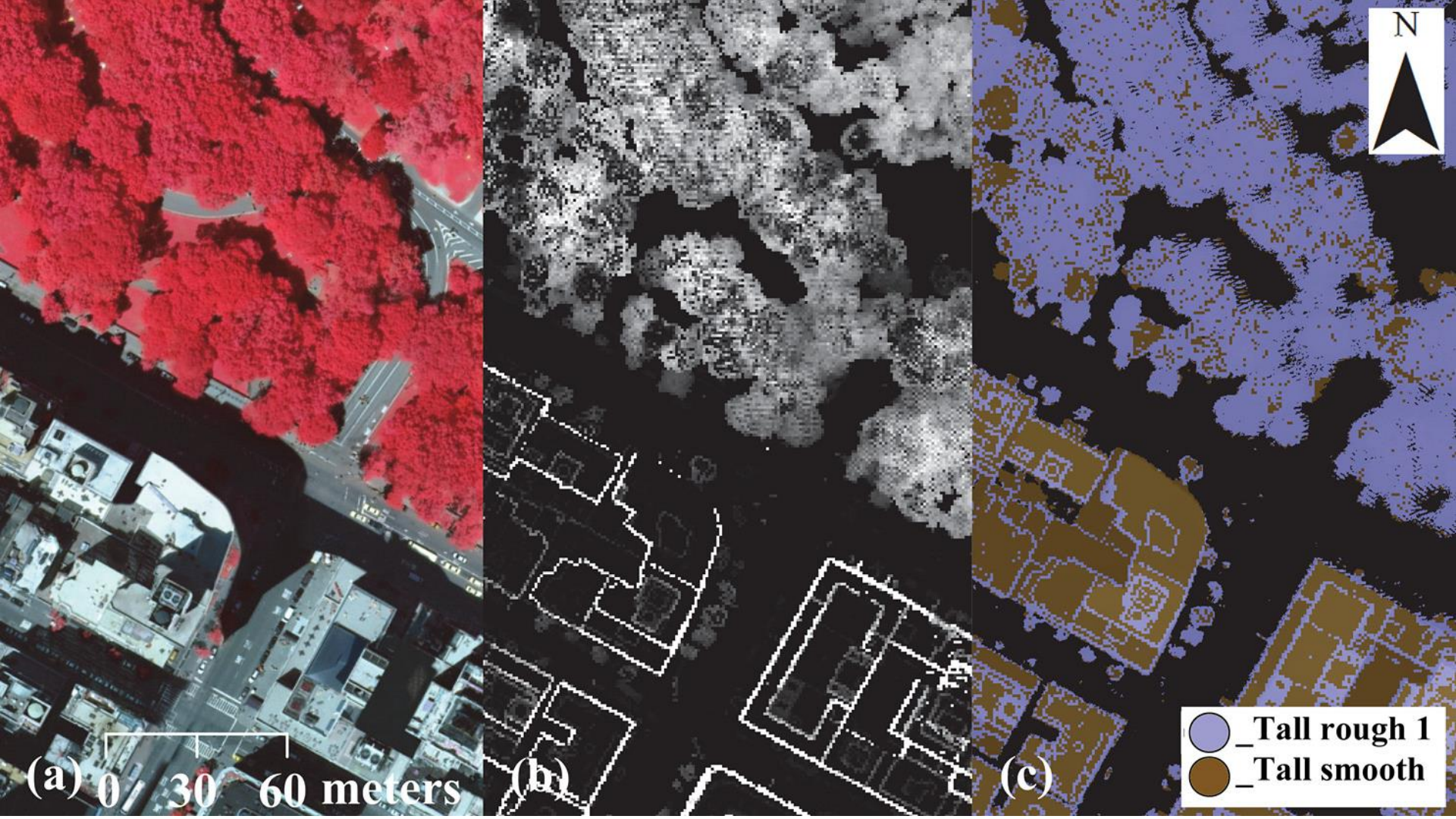
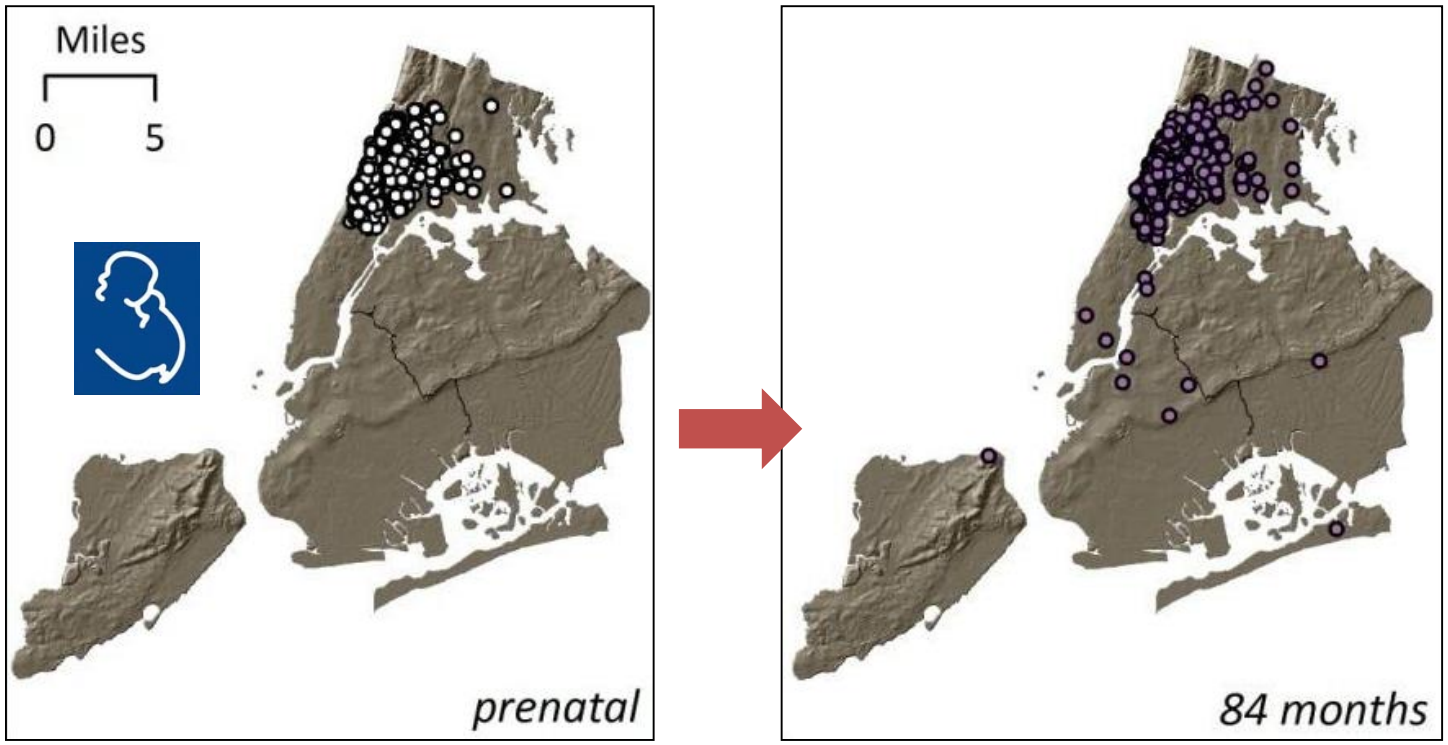


Tree canopy classification

Do trees predict asthma & allergy?

- Tree canopy linked to addresses from the Columbia Center for Children's Environmental Health (CCCEH) birth cohort

- Dominican and African American women were recruited from Northern Manhattan and The Bronx, and births occurred 1998-2006



Demographics & outcome prevalence

48% Male

65% Dominican

35% African American

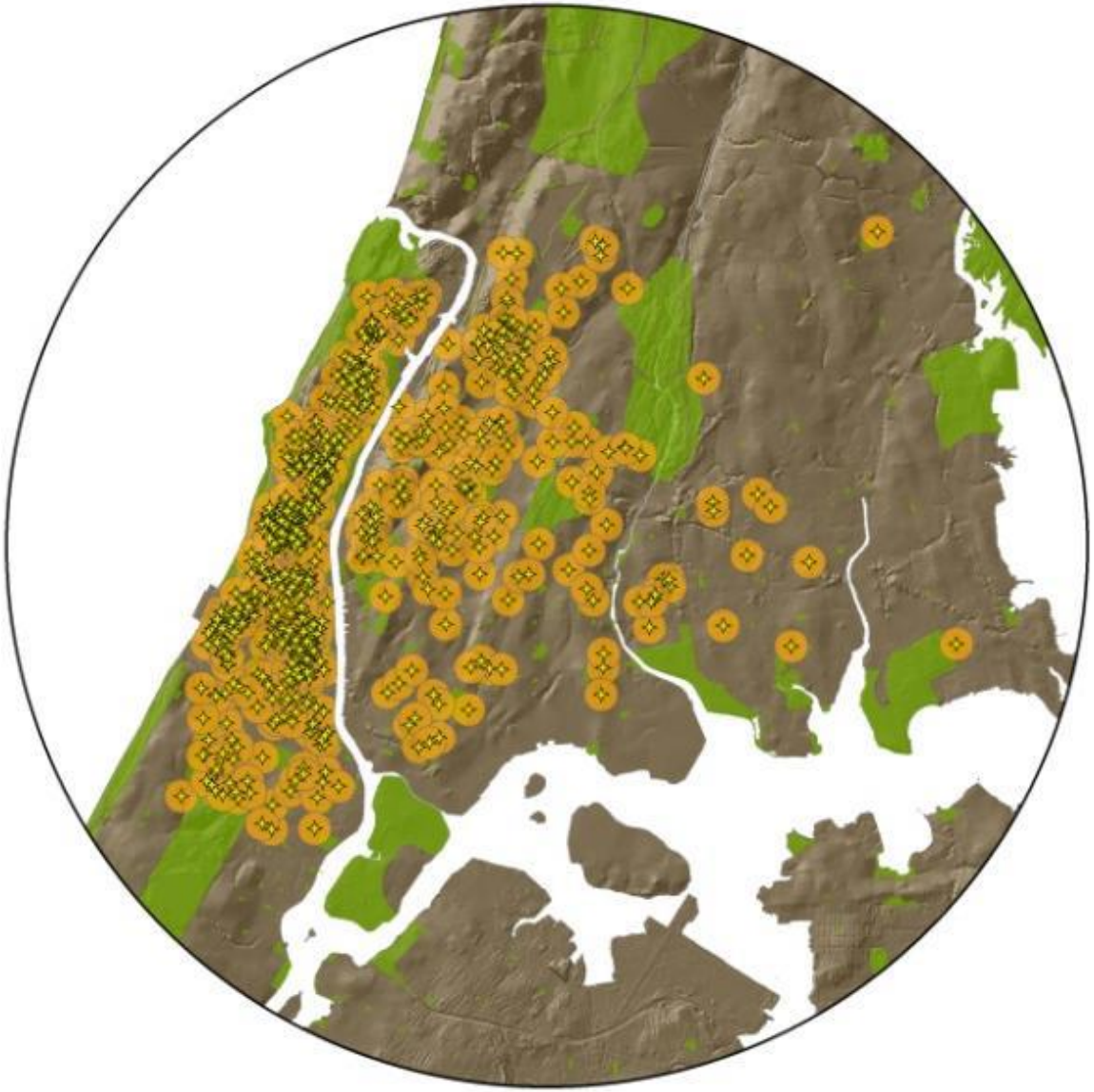
36% Reported Asthma at Age 7

25% Reported Wheeze at Age 7

45% IgE Antibody Response to Allergen at Age 7

19% IgE Antibody Response to Tree Pollen at Age 7

Neighborhoods



For each of the 3,784 addresses geocoded, multiple neighborhoods were defined

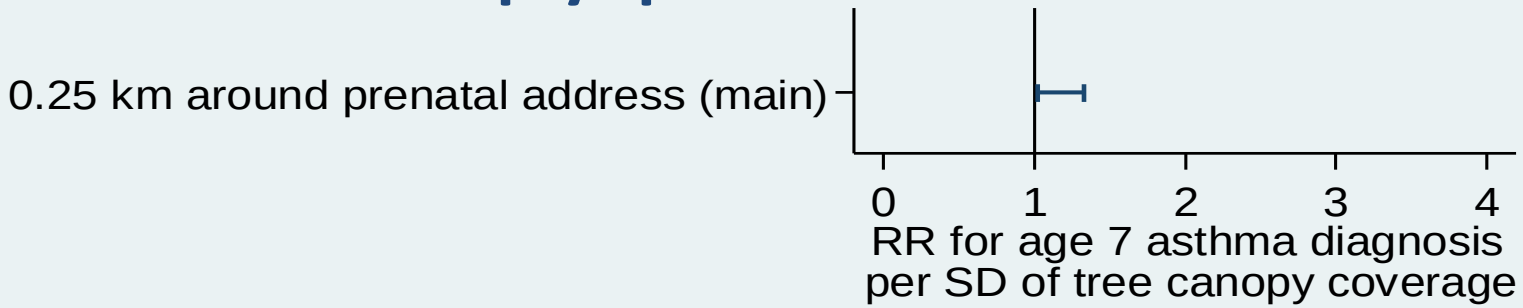
Census tract

Circular buffer

Network buffer

Does tree canopy prevent asthma?

Does tree canopy prevent asthma? No

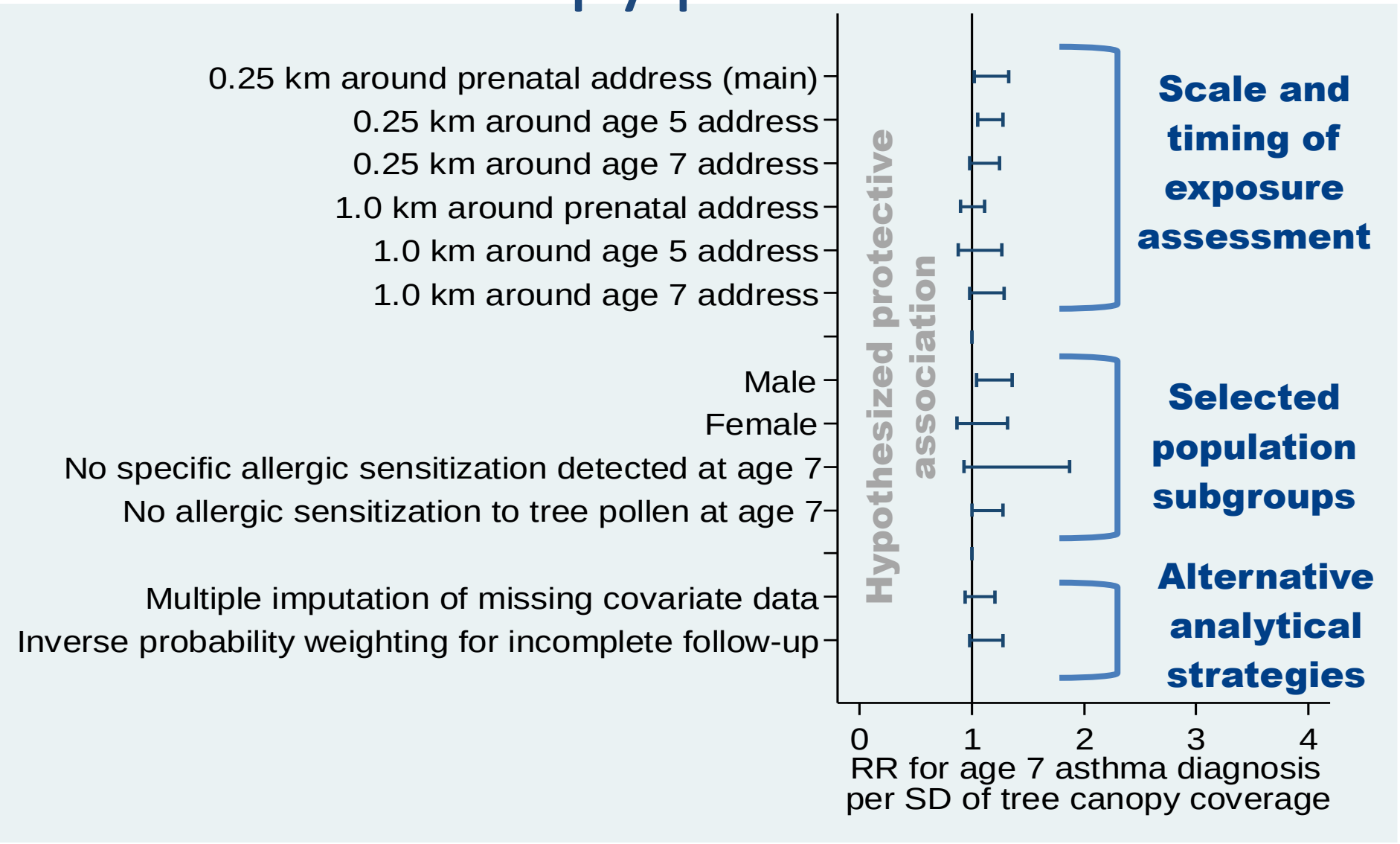


95% confidence interval for estimated relative risks (RRs) for a 1 standard deviation (SD) higher neighborhood tree canopy are shown

Covariates: sociodemographic characteristics, parity, tobacco exposure, maternal asthma, and neighborhood characteristics (poverty, population density, parks, and traffic volume)

Lovasi GS, et. al. Urban tree canopy and asthma, wheeze, rhinitis, and allergic sensitization to tree pollen in a New York City birth cohort. Environ Health Perspect 2013;121(4):494-500, 500e1-6.

Does tree canopy prevent asthma? No



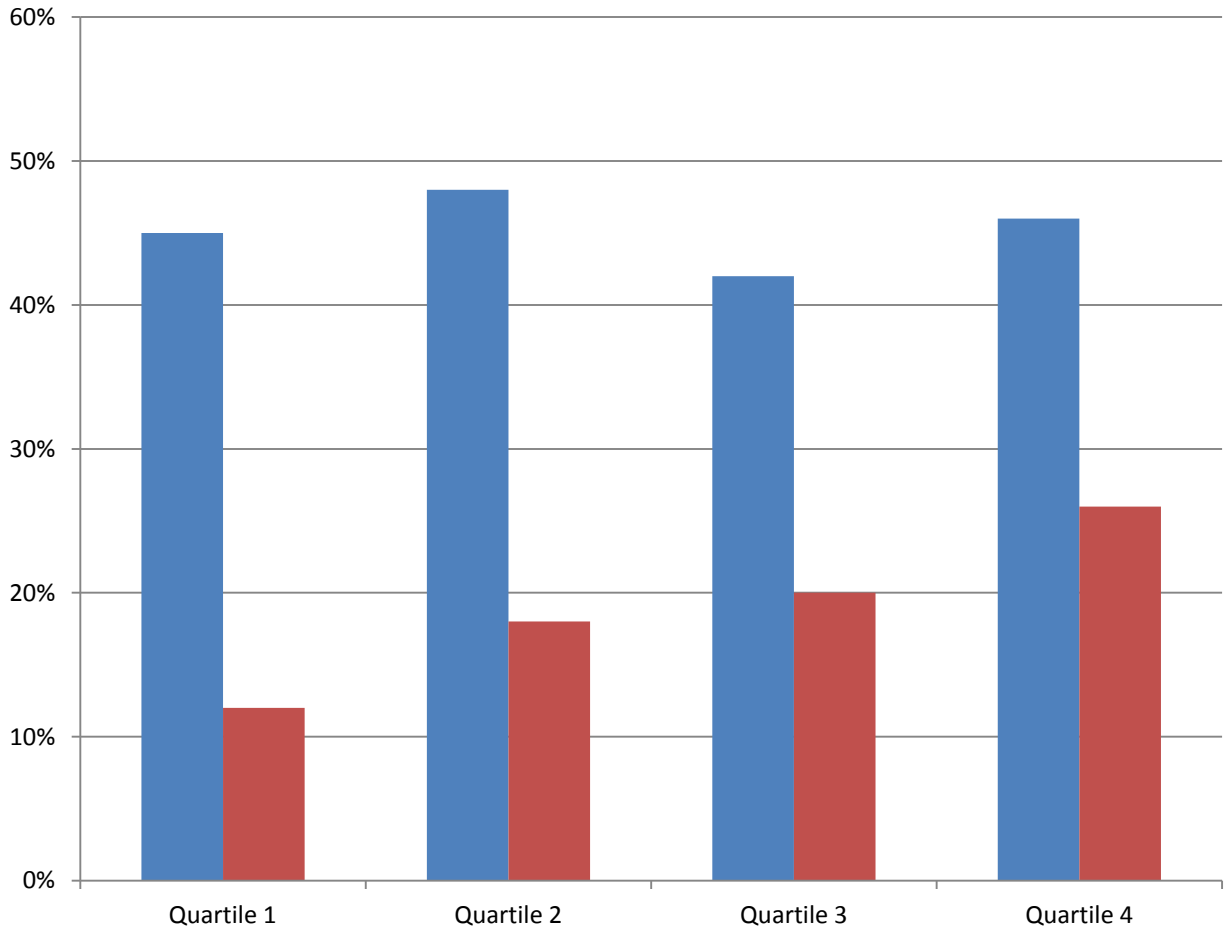
Lovasi GS, et. al. Environ Health Perspect 2013;121(4):494-500, 500e1-6.

Does tree canopy predict allergic sensitization (IgE antibody) to tree pollen?

Tree pollen mix included 5 species

- *Acer negundo* (boxelder)
- *Betula verrucosa* (European white birch)
- *Corylus avellana* (Common filbert)
- *Quercus alba* (White oak)
- *Platanus x acerifolia* (London planetree)

Does tree canopy predict allergic sensitization (IgE antibody) to tree pollen? Yes



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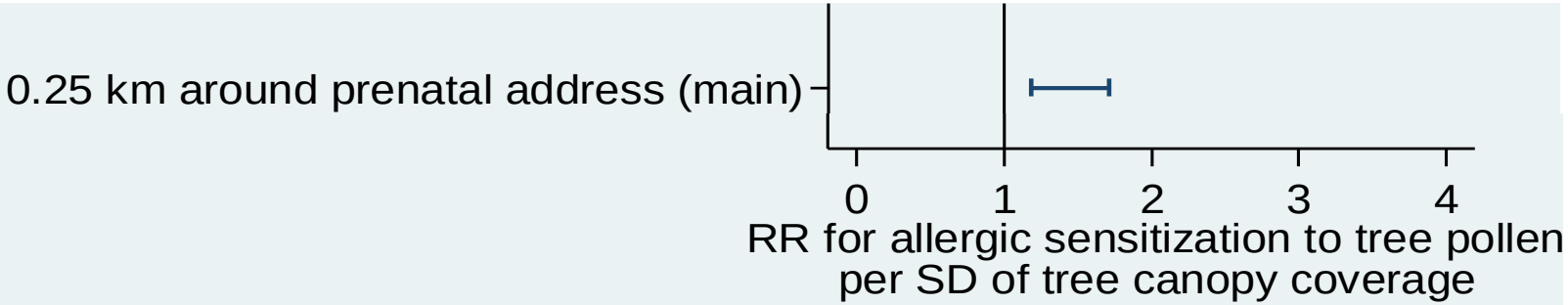

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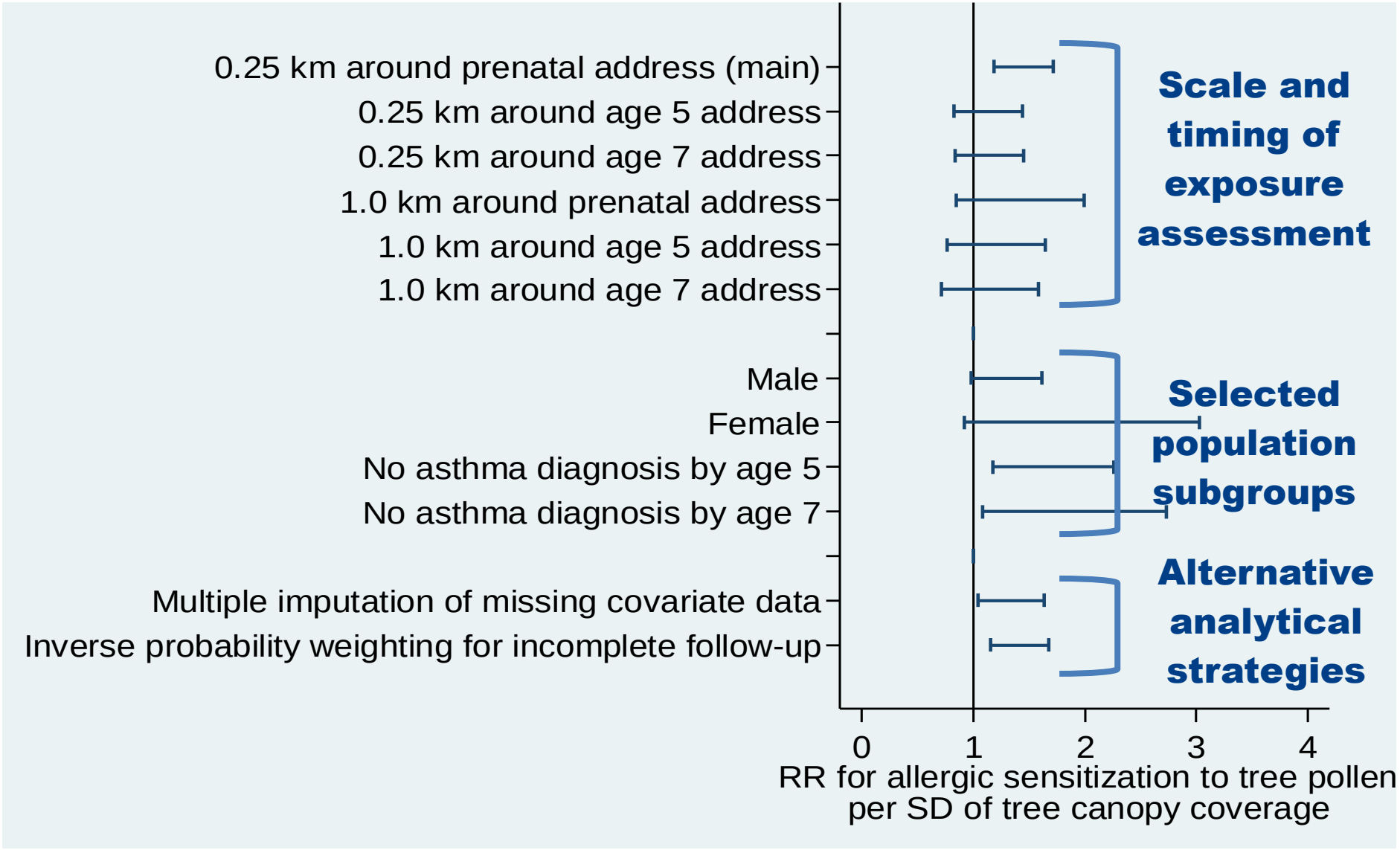


Conclusions

We did not find the hypothesized protective association between urban tree cover and childhood asthma development, but did see **elevated risk of IgE sensitization to tree pollen** with increased tree cover within 0.25 km of the address reported during pregnancy

Pattern of associations has been replicated in preliminary analyses of a second SES population (an HMO-based case-control study)

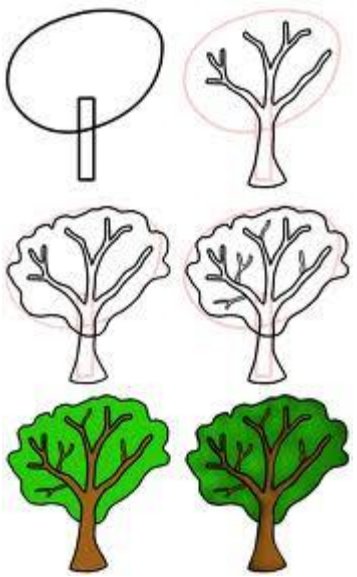
Recognizing possible oversimplification

Quantifying canopy coverage or surface area of trees may miss some important aspects of the urban forest (species and sex distribution, placement, maturity)

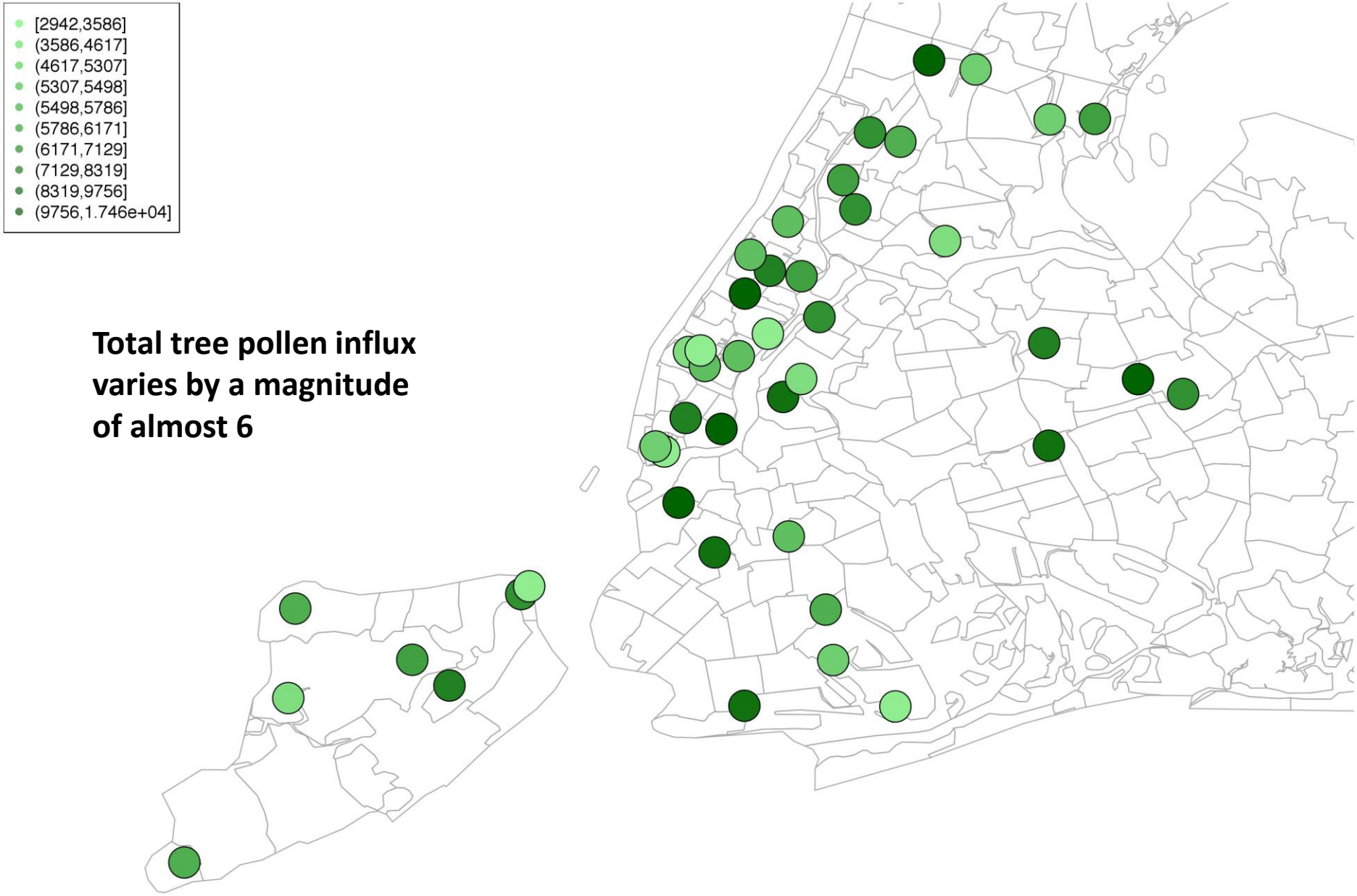
The assumed link between trees and cleaner air ignores the dominant influence of traffic patterns and air movement, and the complex mix of pollutants and pollen

Public correspondence in response to the tree planting raised issues around the dual public and private nature of the sidewalk, territoriality, responsibility, aesthetics and place attachment

Rae, Ruth A., et. al. Cities and the Environment 3.1 (2011): 10.



Total Tree Pollen Influx

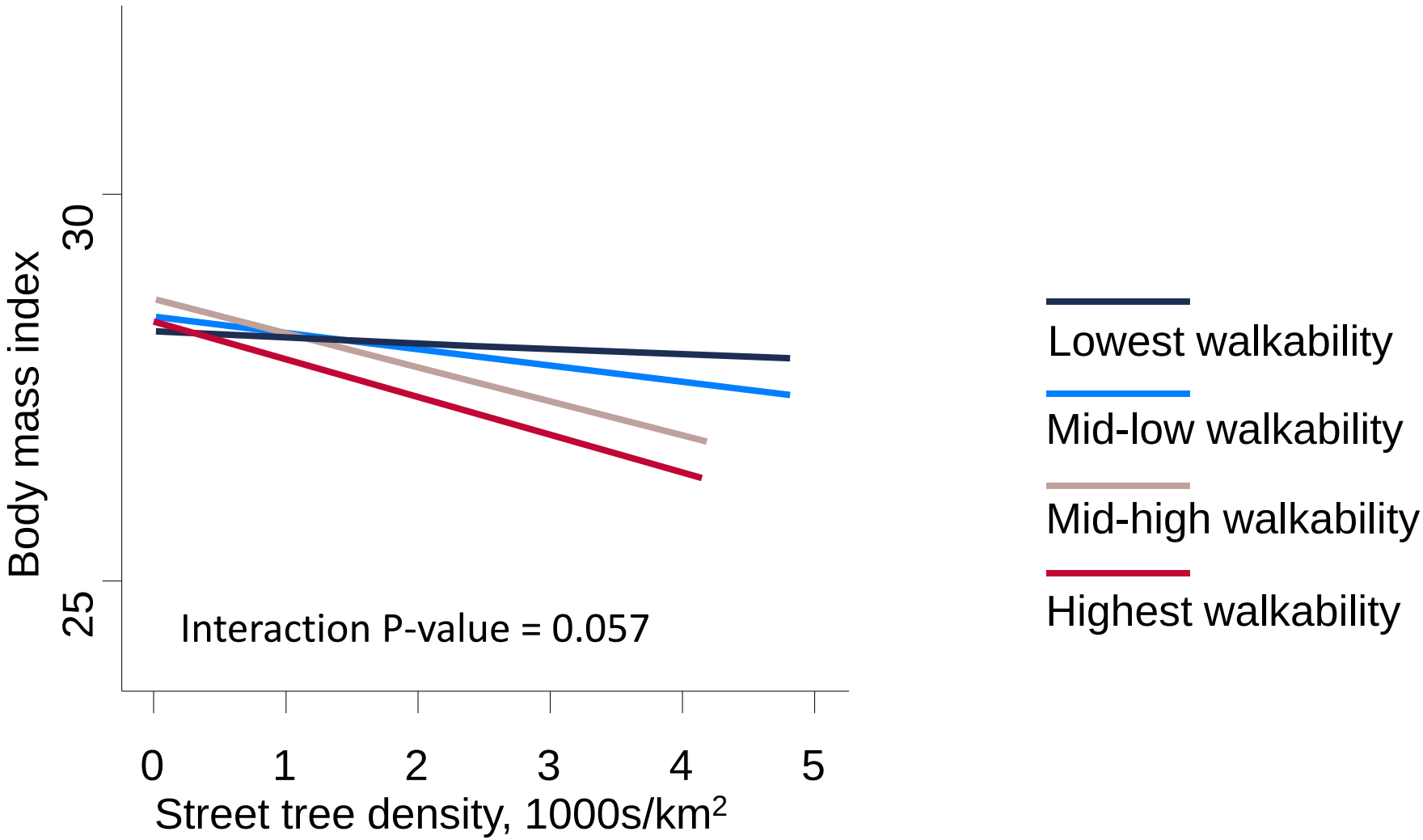


Total tree pollen influx varies by a magnitude of almost 6

Other outcomes

Other work points to protective associations of street trees with active transportation, physical activity or lower BMI

Juxtaposing **multiple outcomes** when studying the urban built environment may give a better picture of the pathways involved, as well as trade-offs or co-benefits



Lovasi GS, et al. *American Journal of Preventive Medicine*. 2012.

Stronger Associations of Trees with Walking in Higher Income Areas

Aesthetic characteristics:	RR	RR, high poverty	RR, low poverty
Sidewalk café	**1.09**	1.02	**1.13**
Street tree density	1.03	0.96	**1.08**
Clean streets	1.03	1.02	0.98
Safety hazard indicators:			
Pedestrian-auto fatalities	0.97	0.97	**0.95**
Homicides	1.02	0.96	1.06

* Single model with all aesthetic and safety characteristics entered simultaneously, adjusting for demographics, neighborhood composition, and walkability

Lovasi GS, et al. *Annals of Behavioral Medicine*. 2013.

Trees and Traffic Hazards Predict Activity in Young Kids

Aesthetic characteristics:	Difference in counts/min	Difference in summed skinfolds
Street tree density	**24**	-0.6
Park access	-11	**-1.0**
(others evaluated but NS: playgrounds, filthy sidewalks)		
Safety hazard indicators:		
Homicides	4	-0.6
Pedestrian-auto fatalities	**-16**	**1.0**
(others evaluated but NS: vacant housing, traffic volume)		

Each built environment characteristic has been rescaled to have a standard deviation of 1

Lovasi GS, et. al. *J Urban Health 2011.*

Trees and Homicides Predict Obesity in Preschool-Aged Children

	OR for obese vs normal weight
Aesthetic characteristics:	
Street tree density (100s/km^2)	**0.90**
Safety hazard indicators:	
Homicides (rate per 10,000	**1.22**
Pedestrian-auto fatalities	1.02

Each built environment characteristic has been rescaled to have an inter quartile range of 1

Lovasi GS, et. al. in revision 2013 at *Preventive Medicine*

Moving Toward Action to Promote Activity and Health?

While these point to the possibility of safety and aesthetics as determinants of physical activity and adiposity, available data are limited

We need to assess the modifiable street-level factors that may protect pedestrians or put them at risk

Acknowledgements

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  Robert Wood Johnson Foundation (H&SS, ALR)

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  Built Environment and Health research group at Columbia University

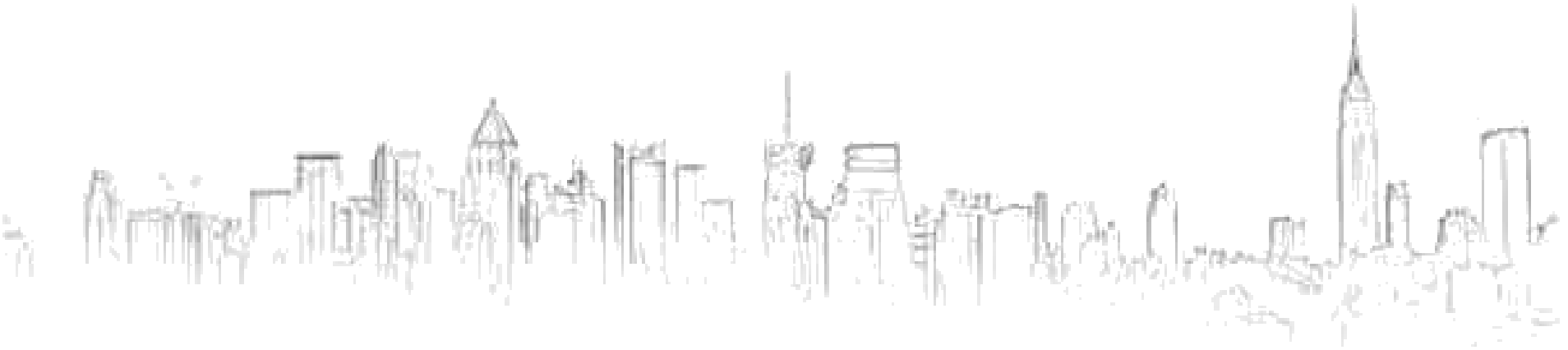
  Columbia Center for Children's Environmental Health

  New York City Department of Health and Mental Hygiene

  New York City Department of Parks & Recreation

  University of Vermont Spatial Analysis Laboratory

  USC Institute for Health Promotion & Disease Prevention Research



Thanks for your attention

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