

Welcome to **BREATHE**

**Bridging Research, Equity, and
Asthma Through Healthy
Environments**



**Monday
July 27, 2026
1-2:30pm**

**Virtual
Microsoft Teams**

What is BREATHE?

A coalition of scientists, community organizers, public servants, and Cincinnatians interested in improving air quality in the region.

Using collaborative, data-driven, systems-level approaches to improving our air quality and asthma rates by addressing the City's built environment.

Vision: Quarterly meetings to collaborate and learn about air quality research and actions to improve air quality within the Cincinnati region.

Agenda

- Introduction & Recap of April Meeting
- Coalition Victories
- Presentations
 - Green Heart Louisville - Dr. Aruni Bhatnagar
 - Metro - Nathan Groh
- Upcoming Events or Calls to Action
- Next Meeting Info

4/13/26 Meeting Recap

- Introduction & Recap of January Meeting
- Coalition Victories
- Presentations
 - Cardinal Land Conservancy
 - Greening Greater Cincinnati for Equity and Health – Jessica Spencer
 - Southwest Ohio Air Quality Agency – Ron Bitner & Dawn Mays
- Upcoming Events or Calls to Action
- Next Meeting Info
- Air Monitor Show and Tell & networking



Coalition Victories



- City OES & CHD installed 28 additional purple air monitors at CPS Schools. Intent is to have each CPS school host one purple air monitor.
- RISE selected 4 new Communities & Teams for Year 4 of the grant for 2026-2027
 - ejsensors.com
- Reds Community Day at Winton Hills 7/23/26
 - [Reds community makeover to bring major changes to Winton Hills - WLWT](#)

Any Additional Victories?



THE GREEN HEART PROJECT

Aruni Bhatnagar, PhD, Department of Medicine, University of Louisville
Christina Lee Brown Envirome Institute

Environmental Effects

Oxygen production

Filtration and
dissipation of air
pollutants

Phytoremediation of
soil pollutants

Buffering noise

Decreased heat

Blocking light

Regulation of water
flow

Increased
biodiversity

Carbon
sequestration

Improved soil health



Human Effects

Decrease in all-
cause and
cardiovascular
mortality

Lower risk of
cardiovascular
disease

Lower risk of
hospital admissions

Better mental health

Better blood
pressure

Lower risk of
diabetes

More physical
activity

Terpene inhalation
Immunoregulation



Social Effects

Increased social
cohesion

Prevention of storm
water run off

Lower power
consumption

Decrease in crime
rates





Greenspaces benefit both – the environment and human health

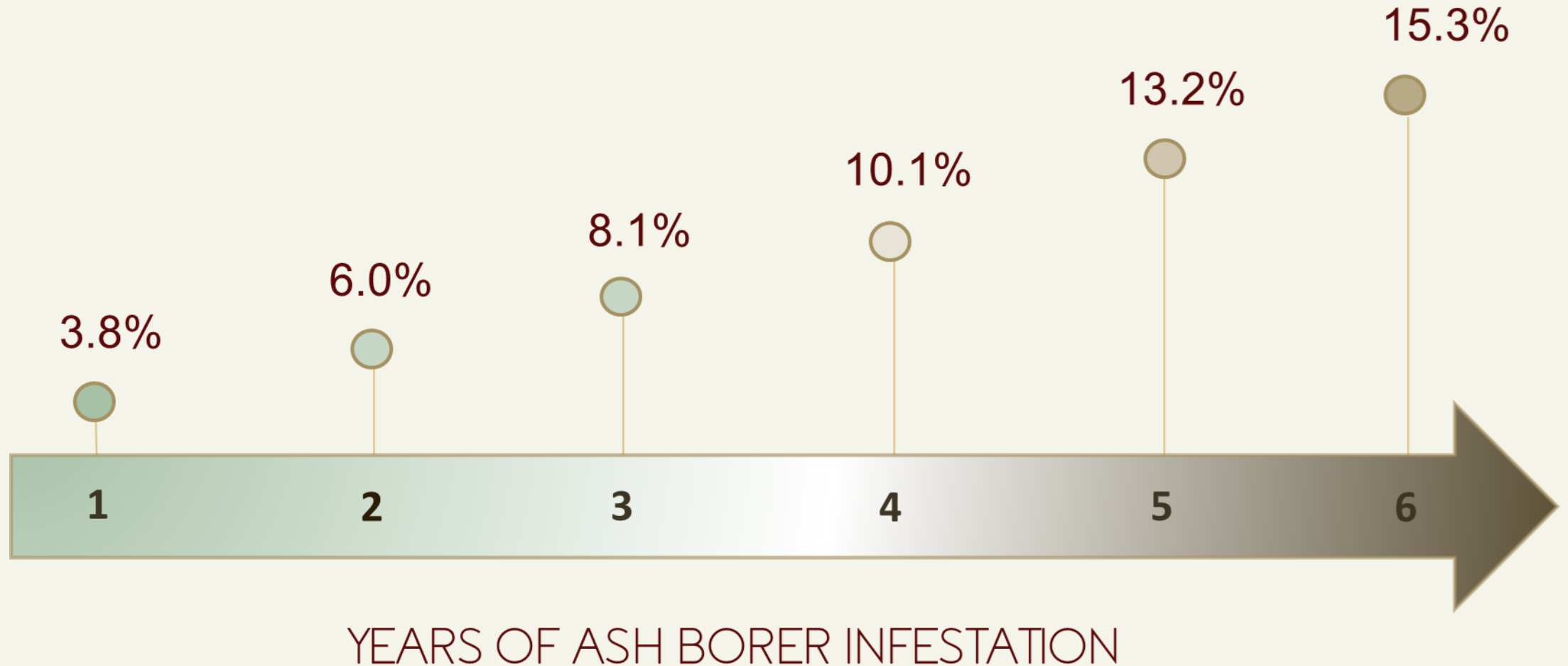


In England...

The rate of cardiovascular mortality in least green areas was twice that of greenest areas.

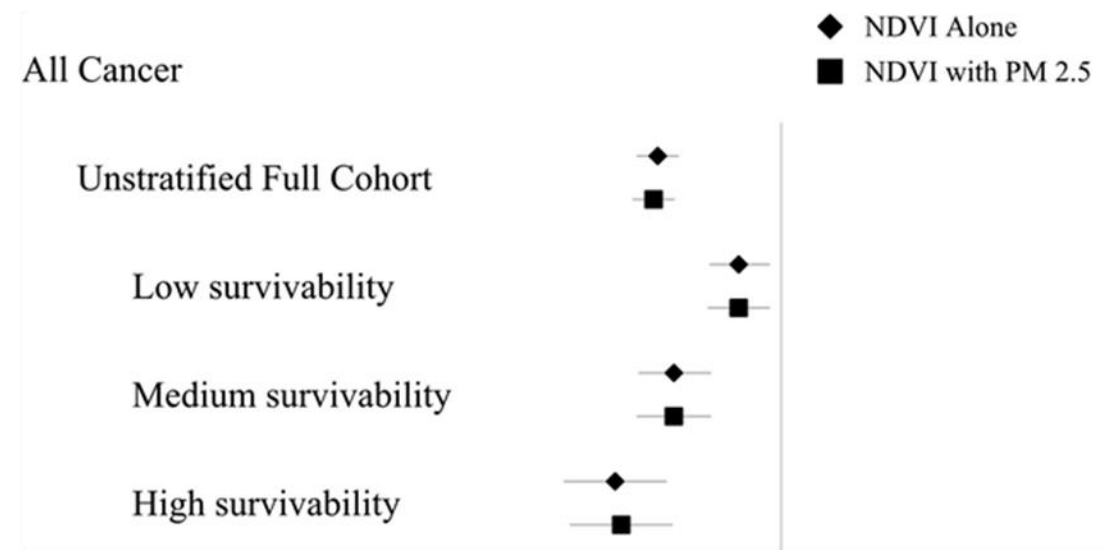
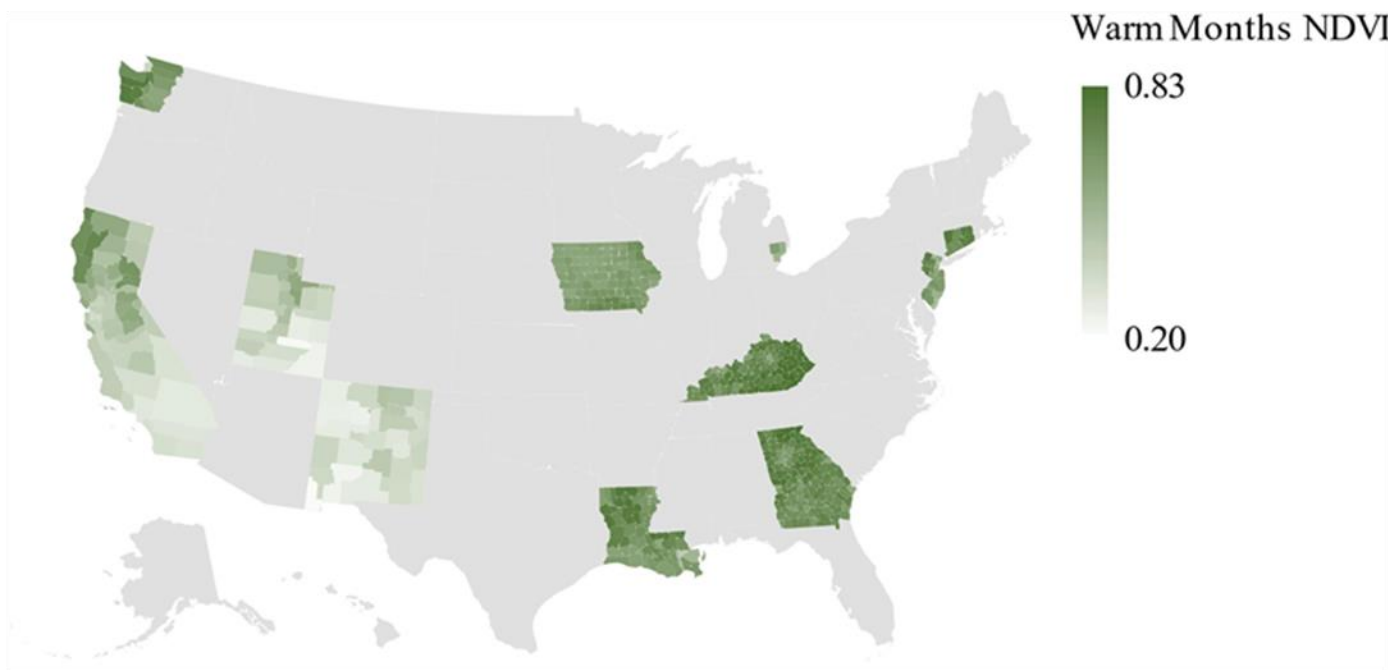


INCREASE IN CARDIOVASCULAR MORTALITY



THE US NATIONAL CANCER INSTITUTE'S SURVEILLANCE, EPIDEMIOLOGY AND END RESULTS (SEER) COHORT

Cohort of 5,529,005 individuals. 2,263,874 deaths



GREEN SPACES

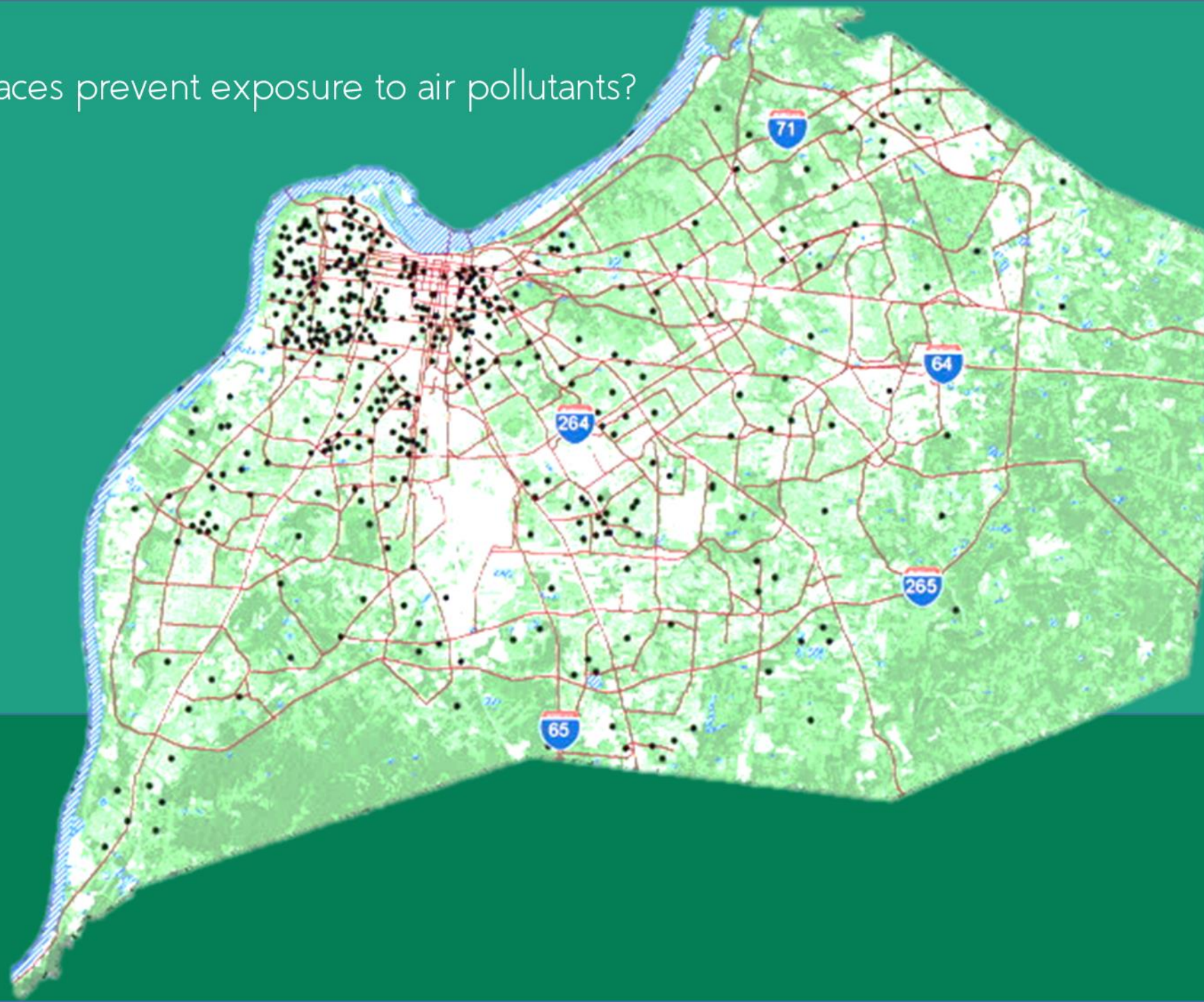
Proximity to green spaces is associated with a decrease in cardiovascular mortality



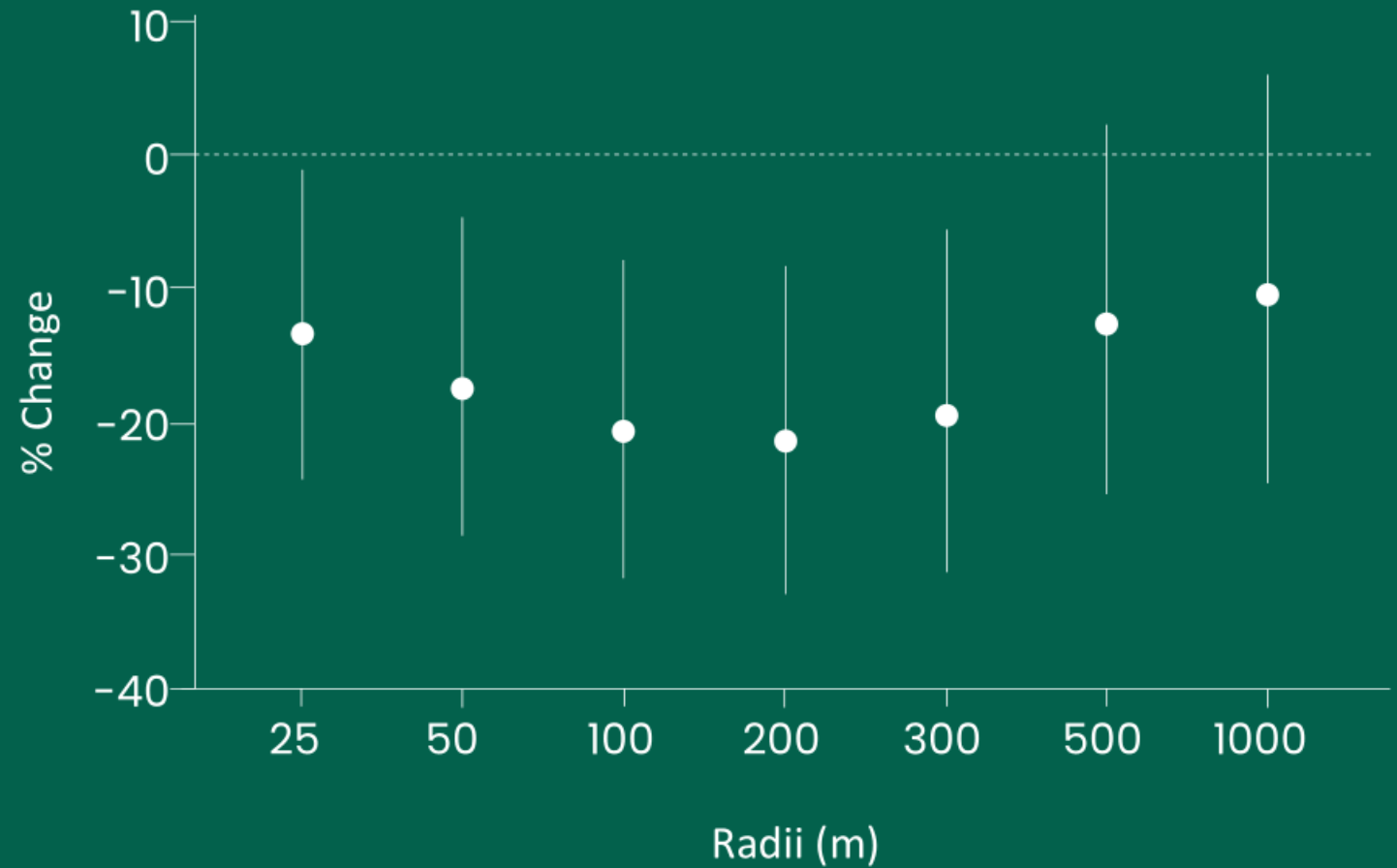
Many studies show that proximity to green spaces is associated with a decrease in all-cause and cardiovascular mortality.



Do green spaces prevent exposure to air pollutants?



Residential distance to
greenness and urinary
VOC metabolites.





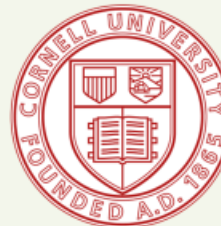
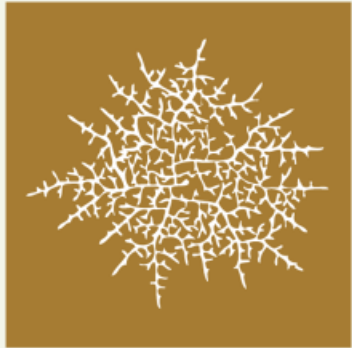
VOC's





GREEN
HEART
LOUISVILLE





Central Hypothesis

Exposure to neighborhood greenery diminishes the risk of cardiovascular disease by decreasing the levels of air pollution.



Neighborhood Selection

- ✓ Low to middle-income
- ✓ Low tree canopy
- ✓ High traffic
- ✓ Mixed race residents
- ✓ Neighborhood goal — improving tree canopy



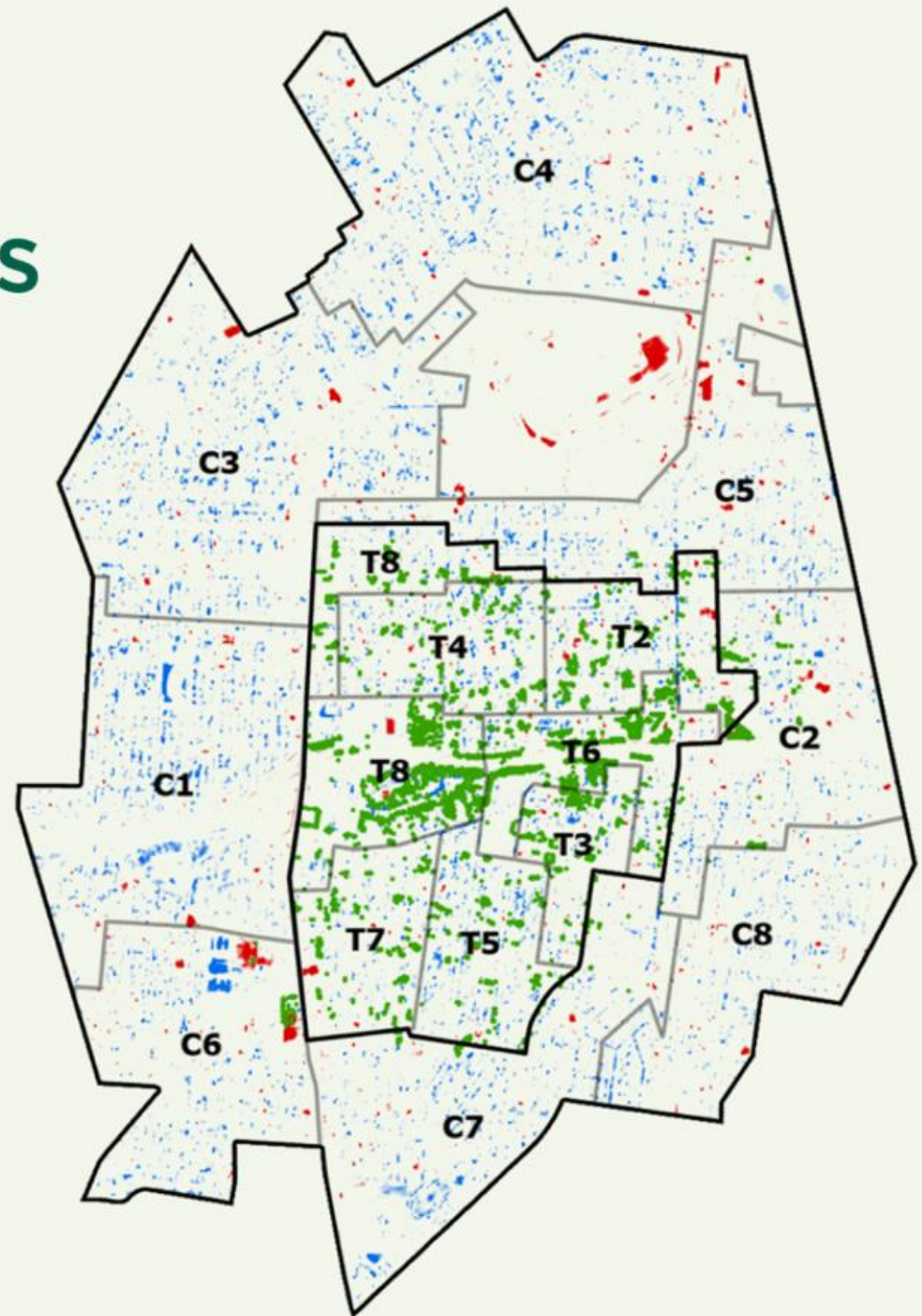


Community Engagement

- ☑ Community advisory board
- ☑ Community outreach
- ☑ Door-to-door canvassing
- ☑ Contacting area businesses



Study area neighborhood clusters





Hyperspectral Scan

LEAF AREA INDEX



MAX CANOPY HEIGHT



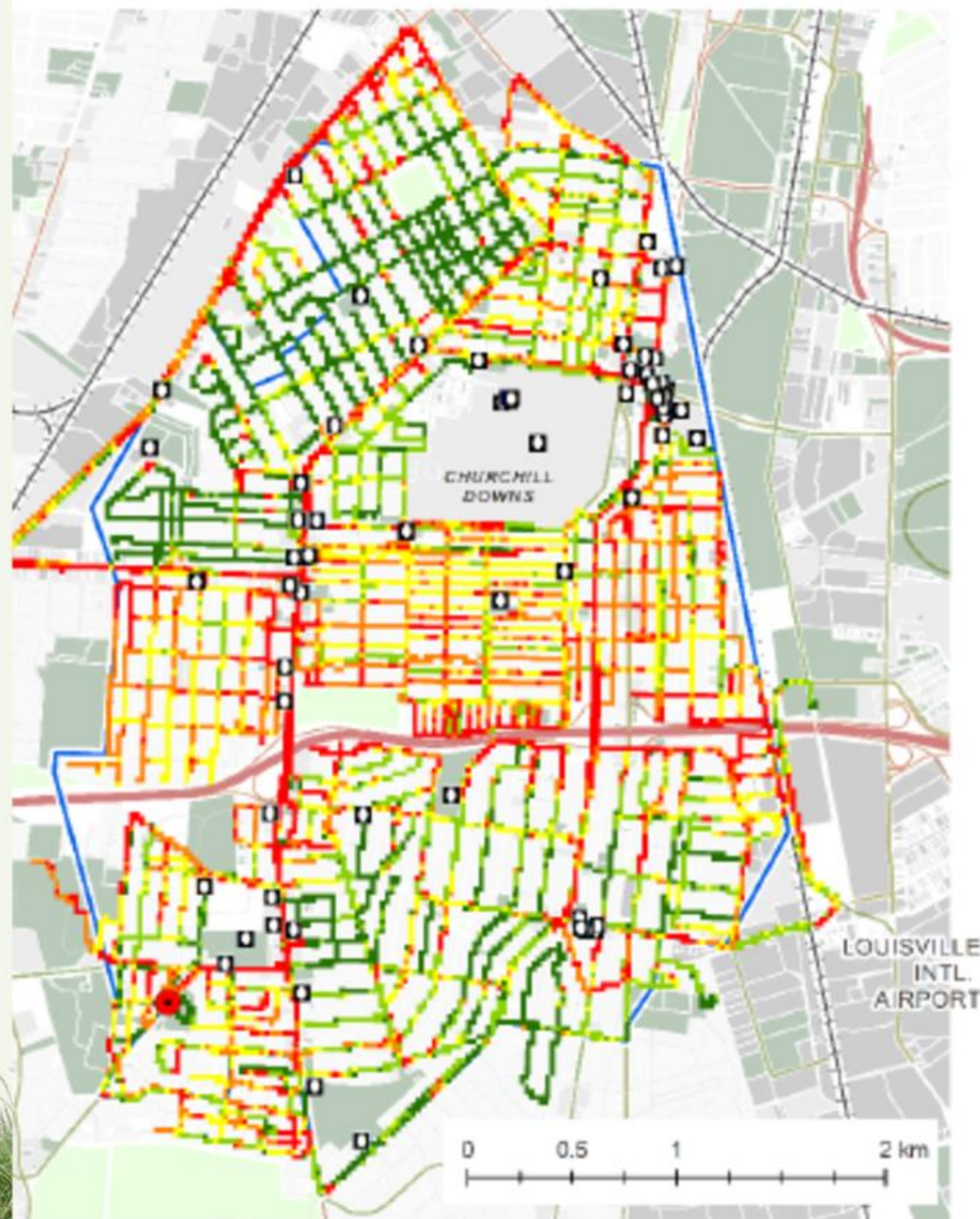
TREE VIEW INDEX

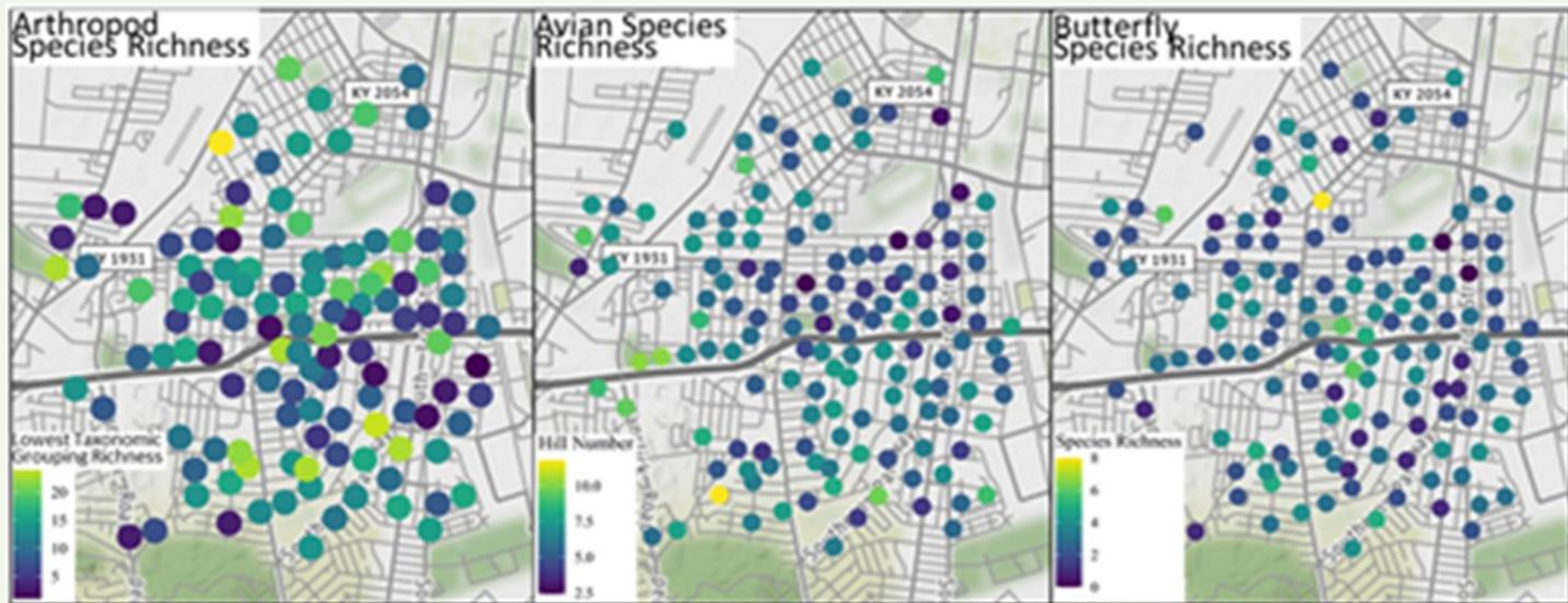


Fixed Site Air Pollution Monitoring



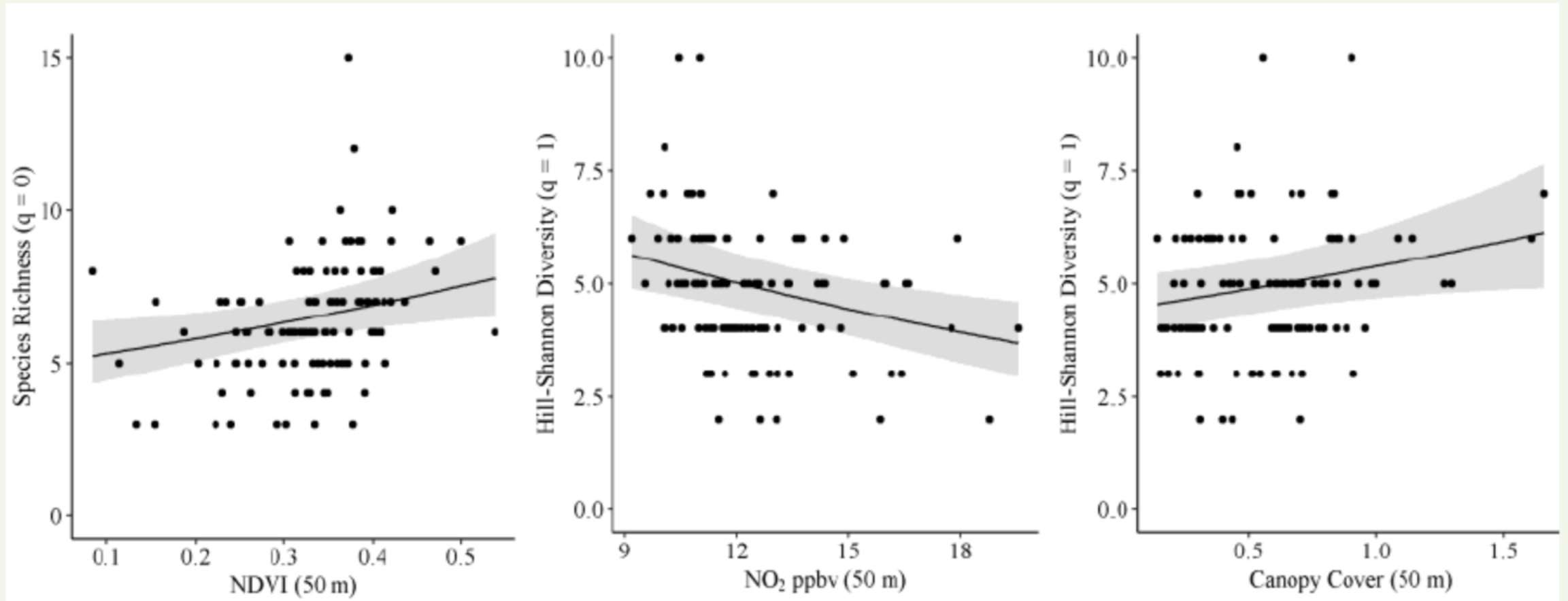
Distribution of Air Pollutants in the Green Heart Neighborhood





Map of 140 locations sampled from 2019-2021

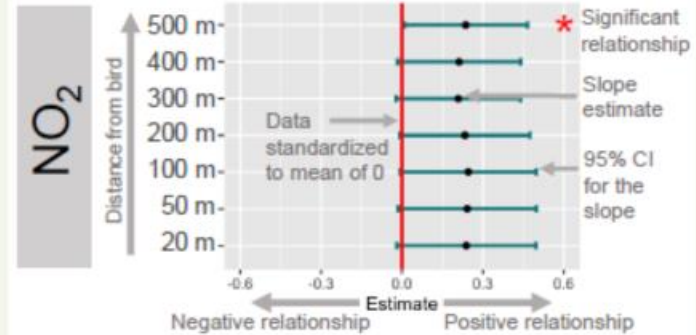
Relationship of Bird Species Richness with Vegetation and Air Pollution



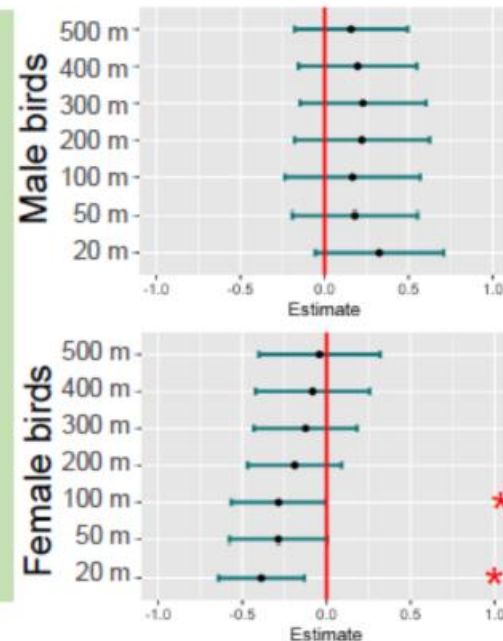
Relationship of Pollution and Greenness with Bird Stress



Corticosterone

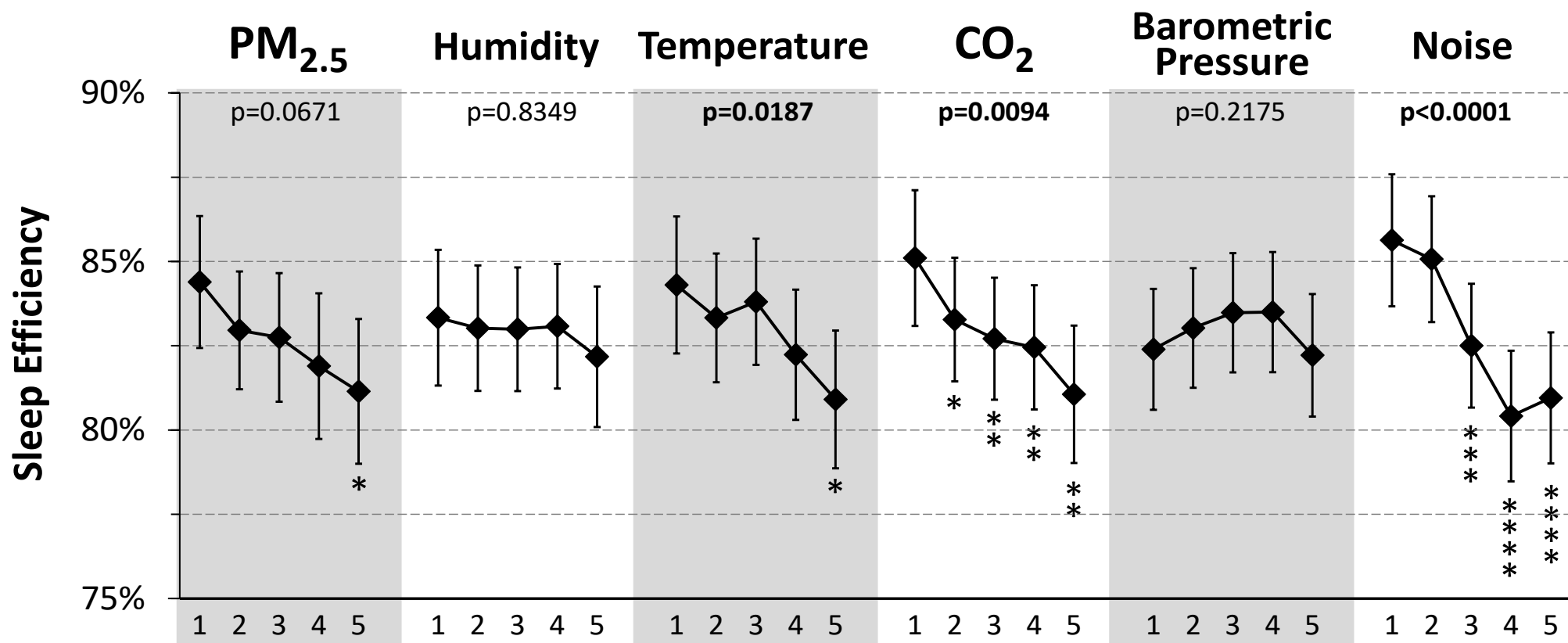


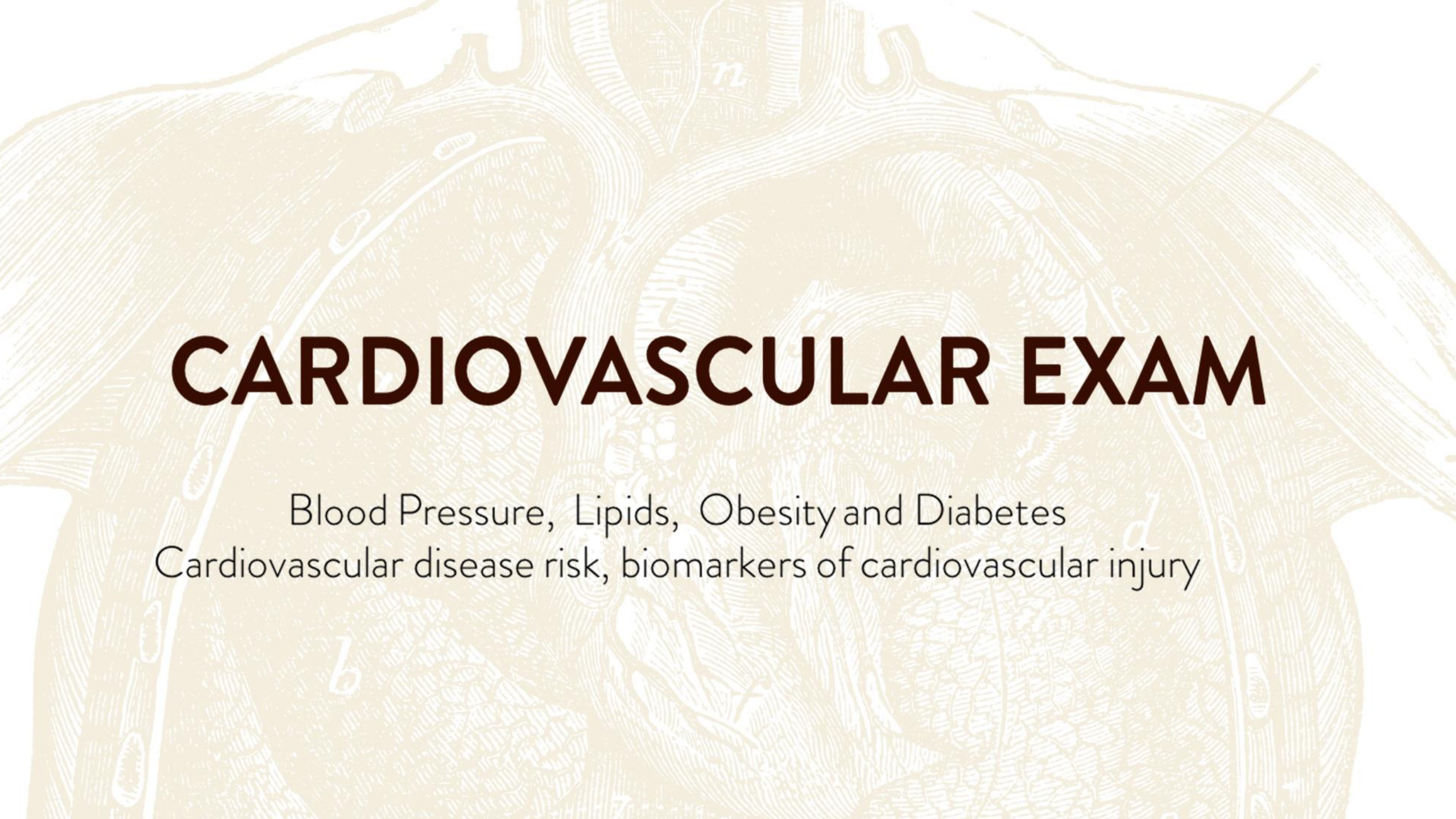
Leaf area index



N=69

SLEEP





CARDIOVASCULAR EXAM

Blood Pressure, Lipids, Obesity and Diabetes
Cardiovascular disease risk, biomarkers of cardiovascular injury



Psychosocial Evaluation





Planting the first tree



Transplant large trees



PBS 
**NEWS
HOUR**





GREEN
HEART
LOUISVILLE

GROWING HEALTHIER COMMUNITIES
louisville.edu/greenheart

WHY TIME KEEPS ON SLIPPING p. 18



DISCOVER

SCIENCE FACT MYTHS

SAVE THE EARTH!

A HOW-TO GUIDE

- WHAT YOU CAN DO (THAT REALLY WORKS) p. 44
- CAN TREES IMPROVE HEART HEALTH? p. 50
- INSIDE AMERICA'S SECRET WATER SOURCE p. 58
- WHY HUMANS NEED NATURE p. 66

BONUS
ONLINE
CONTENT
CODE p. 1

PLUS ALIENS AND OUR ECOSYSTEM p. 100



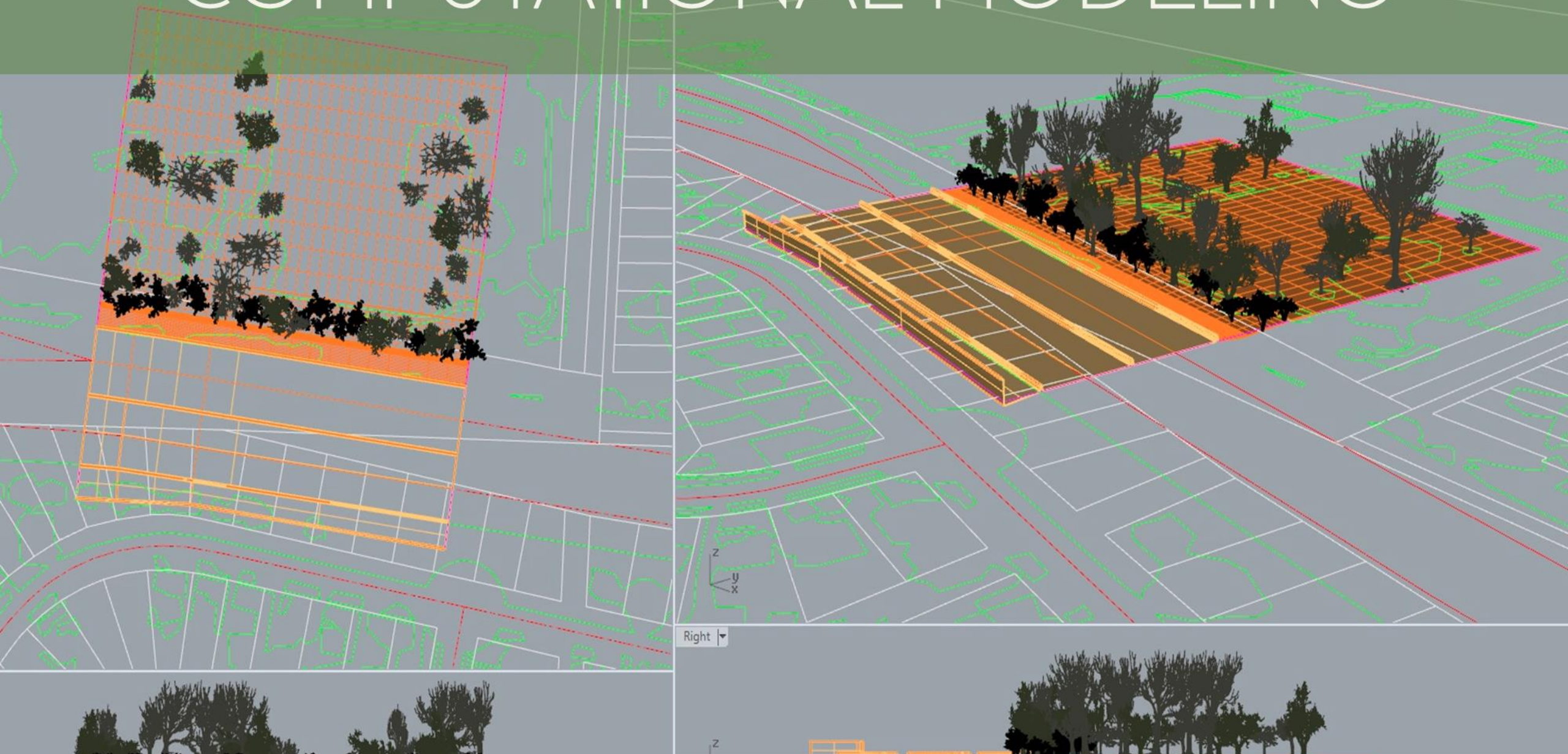




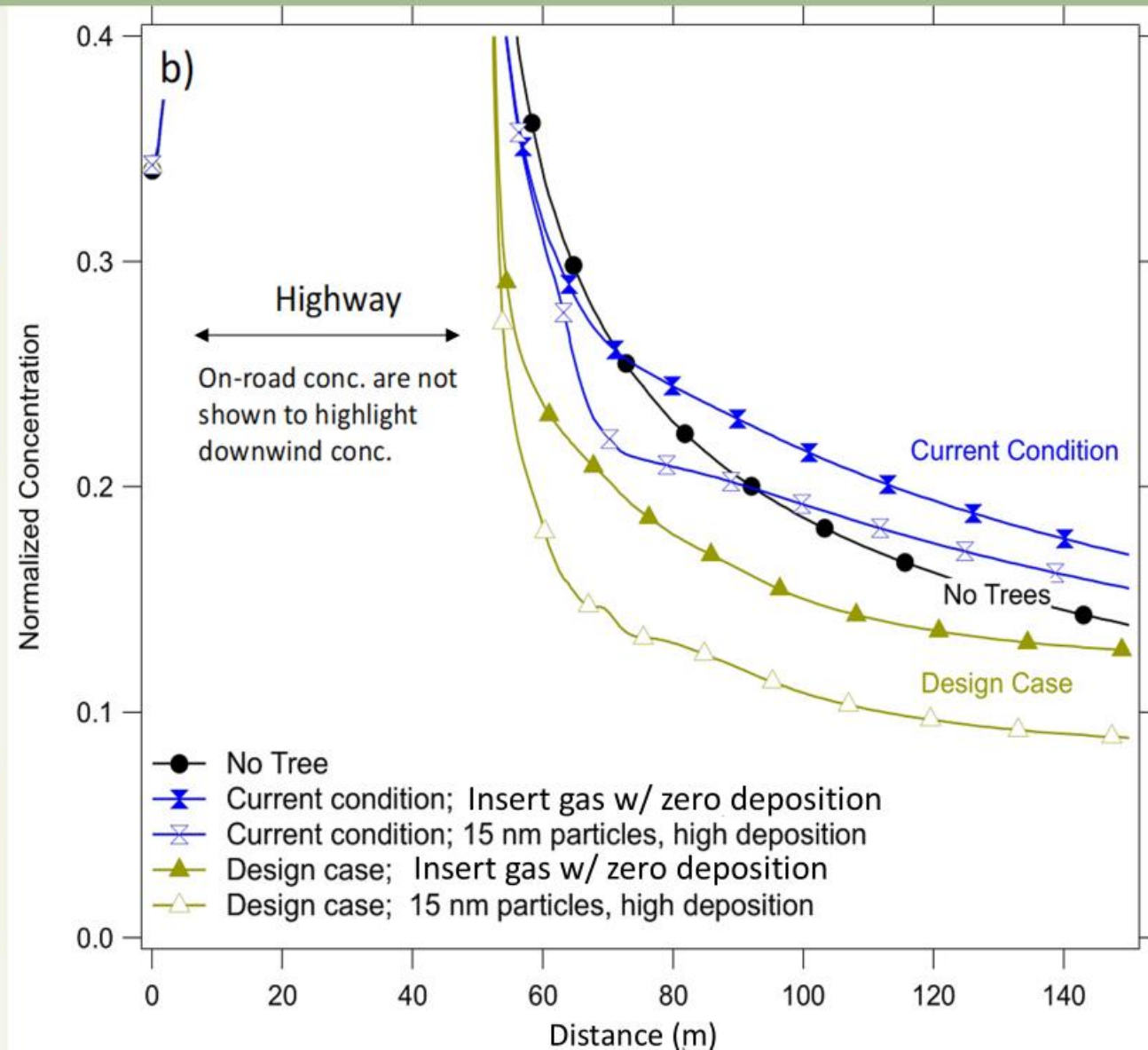
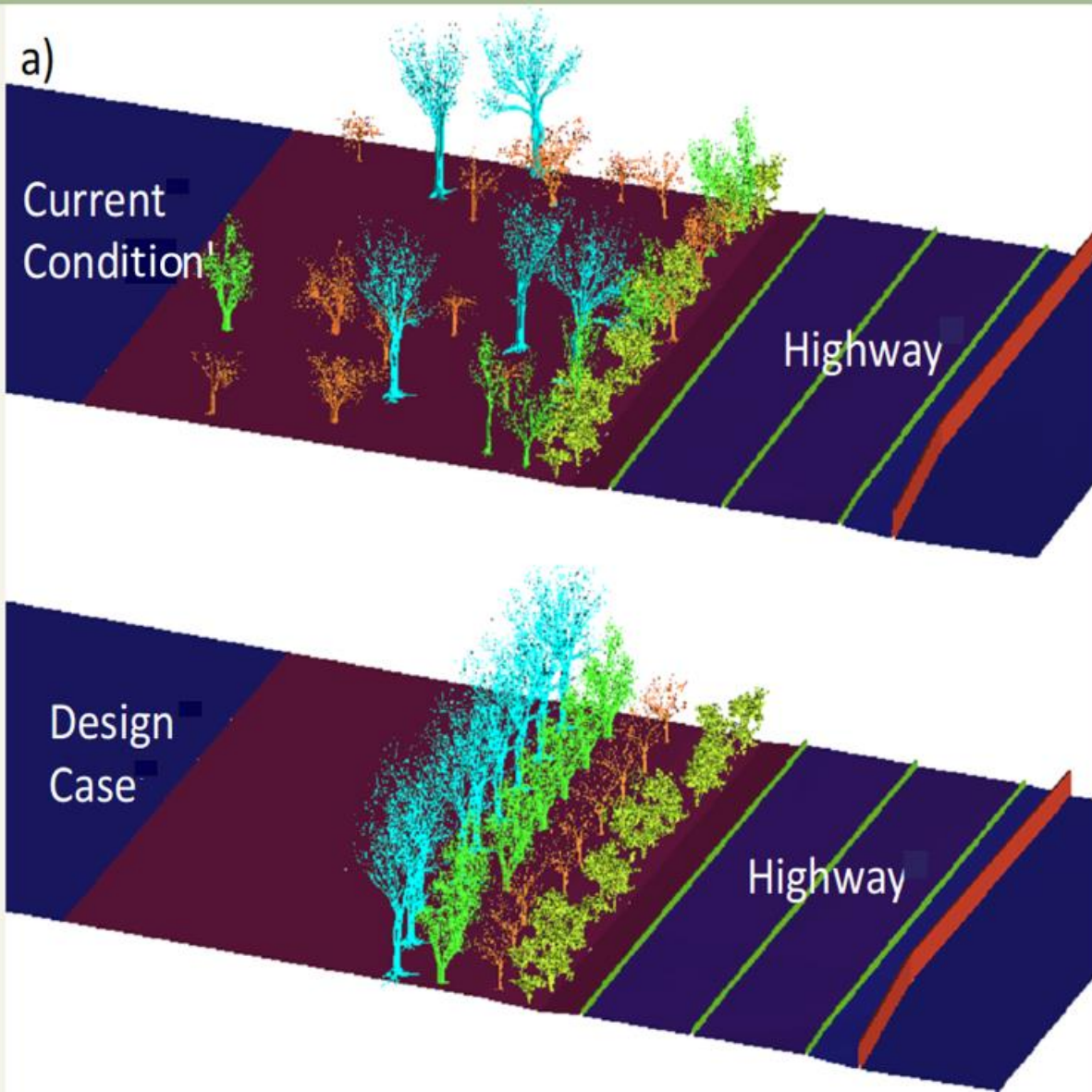




COMPUTATIONAL MODELING



DESIGNING BUFFERS







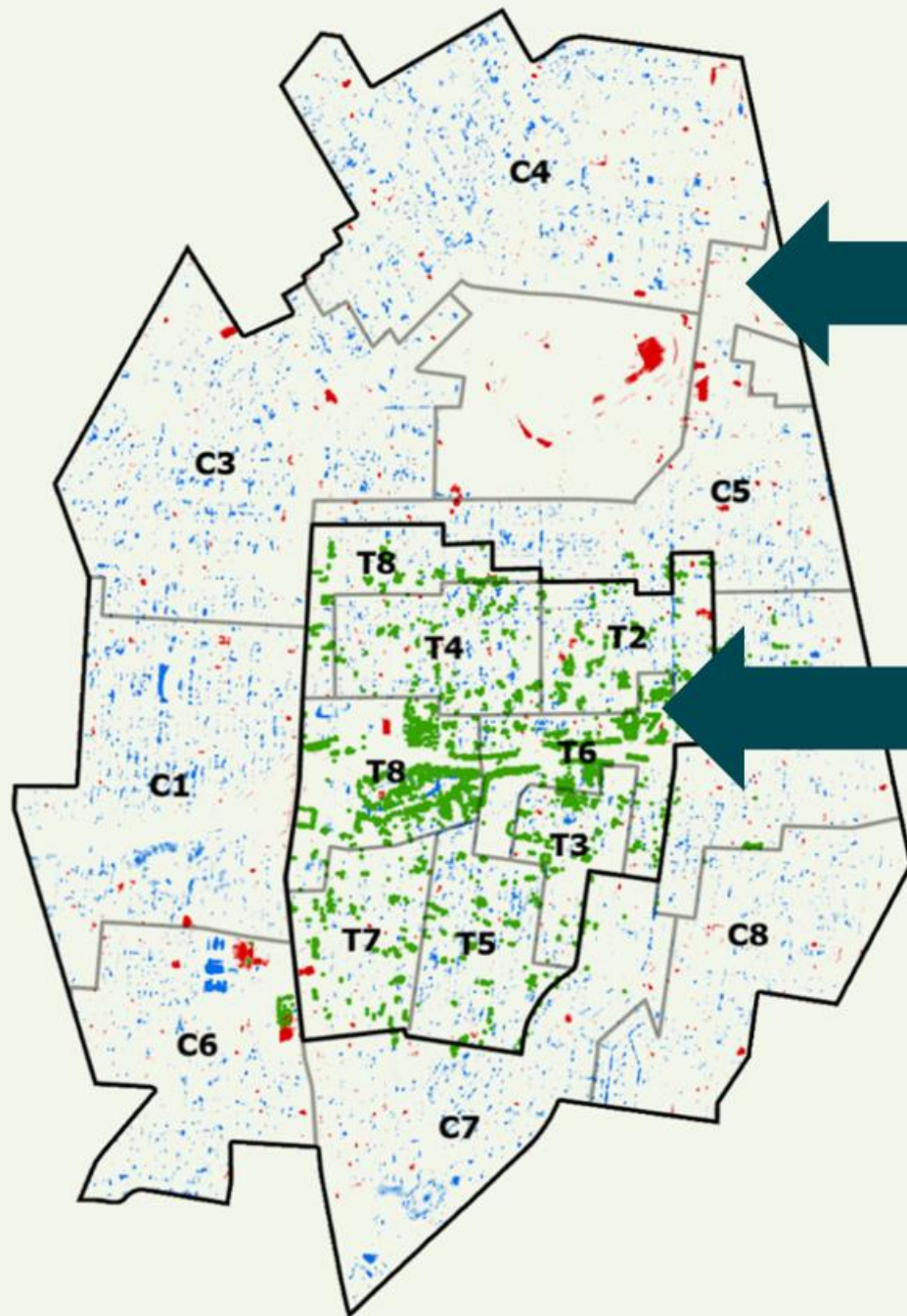




The Washington Post







C-Clusters

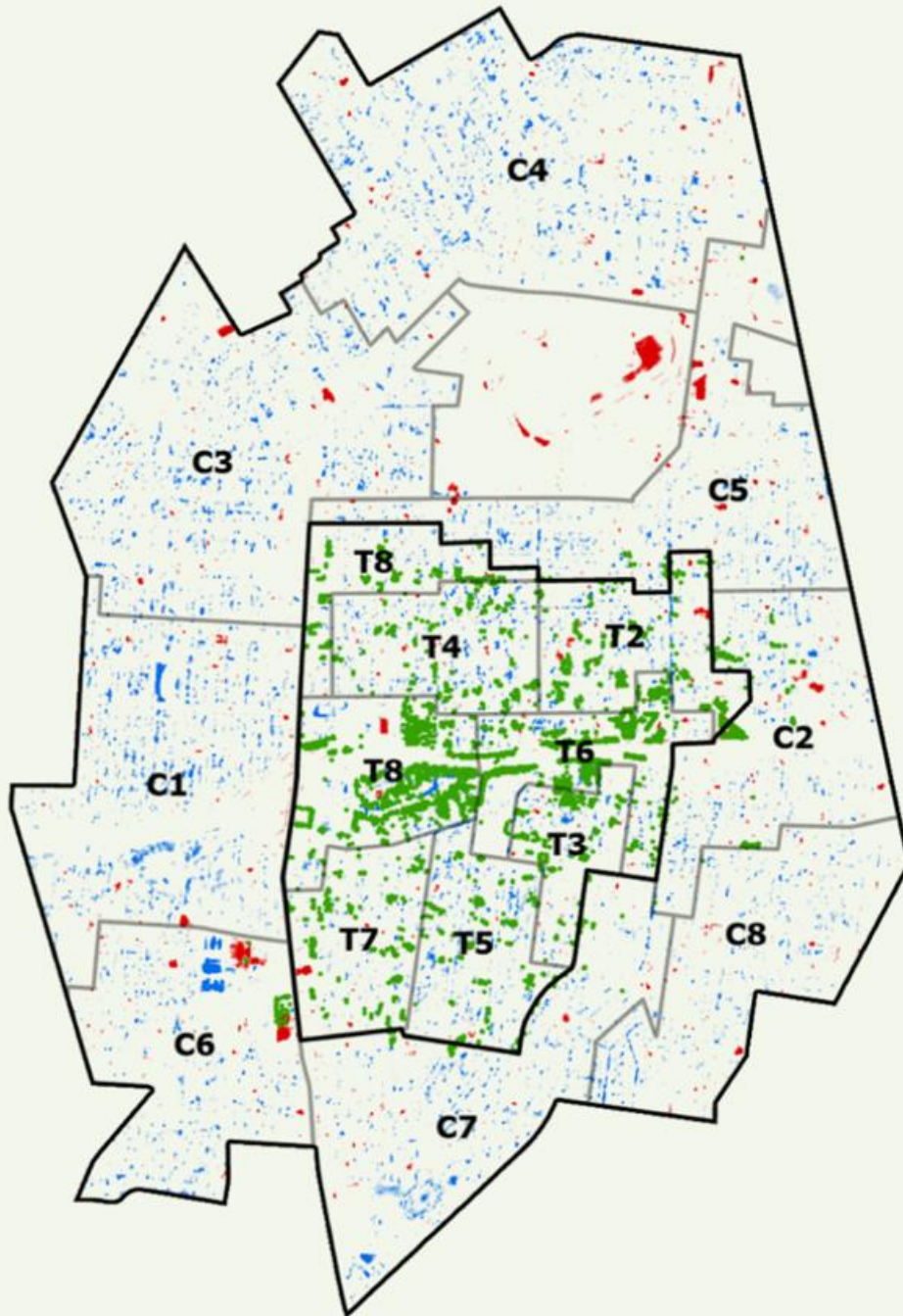
20,148 Trees

T-Clusters

6,108 Trees

+ 8,425 Evergreen Trees

+ 630 Deciduous Trees



42 species of evergreen trees from 5 different families

- ✓ Pinaceae
- ✓ Cupressaceae
- ✓ Taxaceae
- ✓ Aquifoliaceae
- ✓ Magnoliaceae

Deciduous tree families

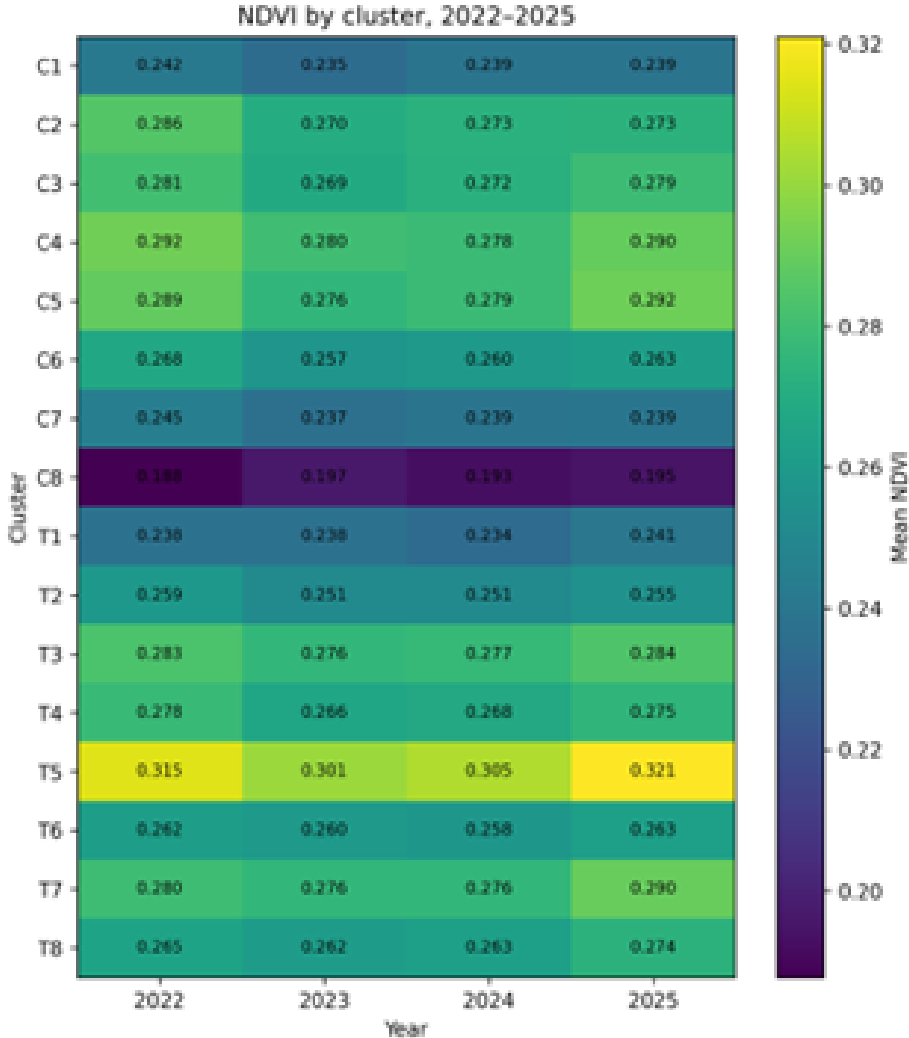
- ✓ Dogwood
- ✓ Oak
- ✓ Serviceberry

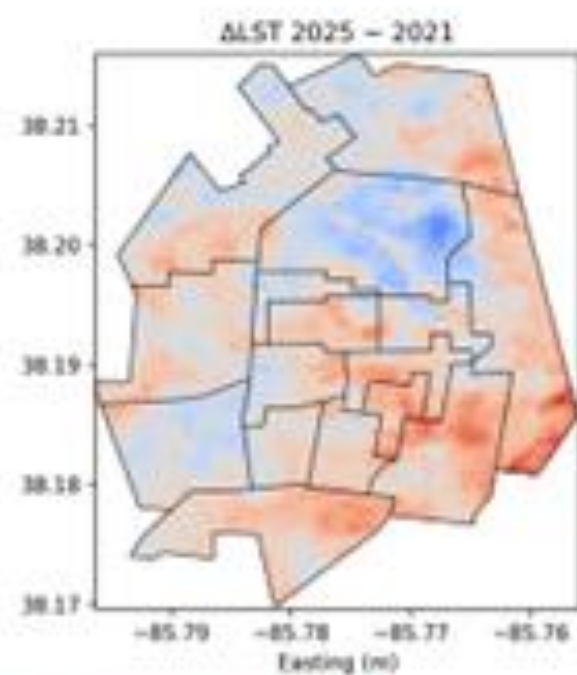
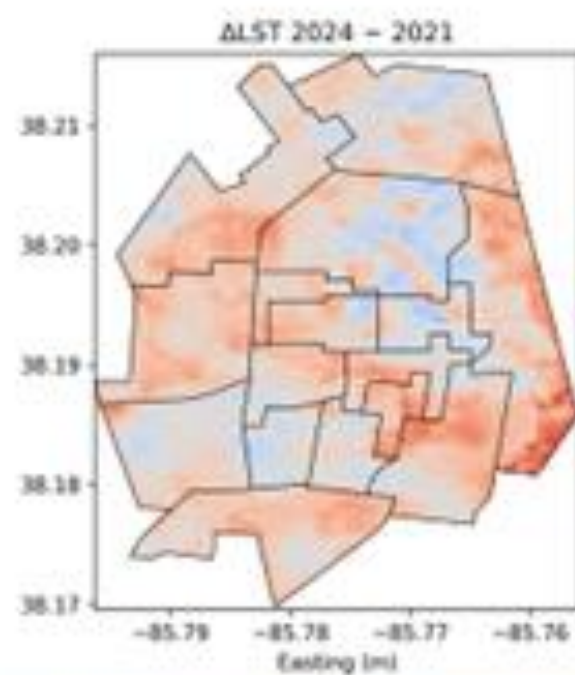
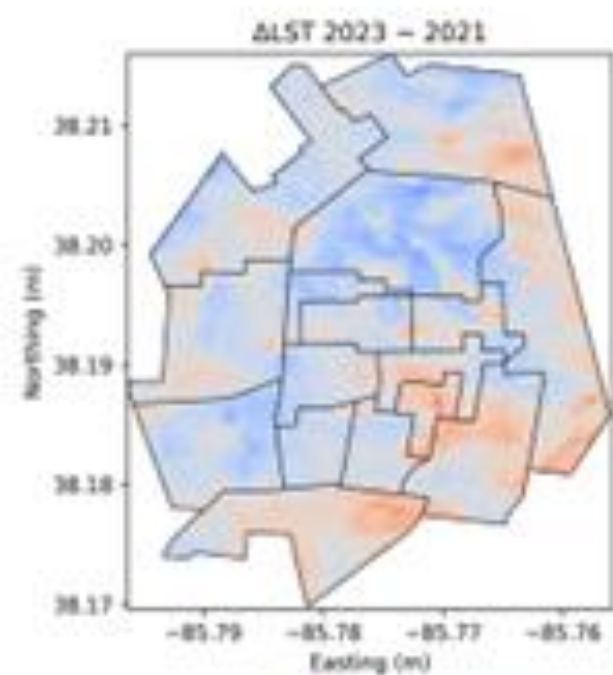


Green Heart composite figure: NDVI and land surface temperature

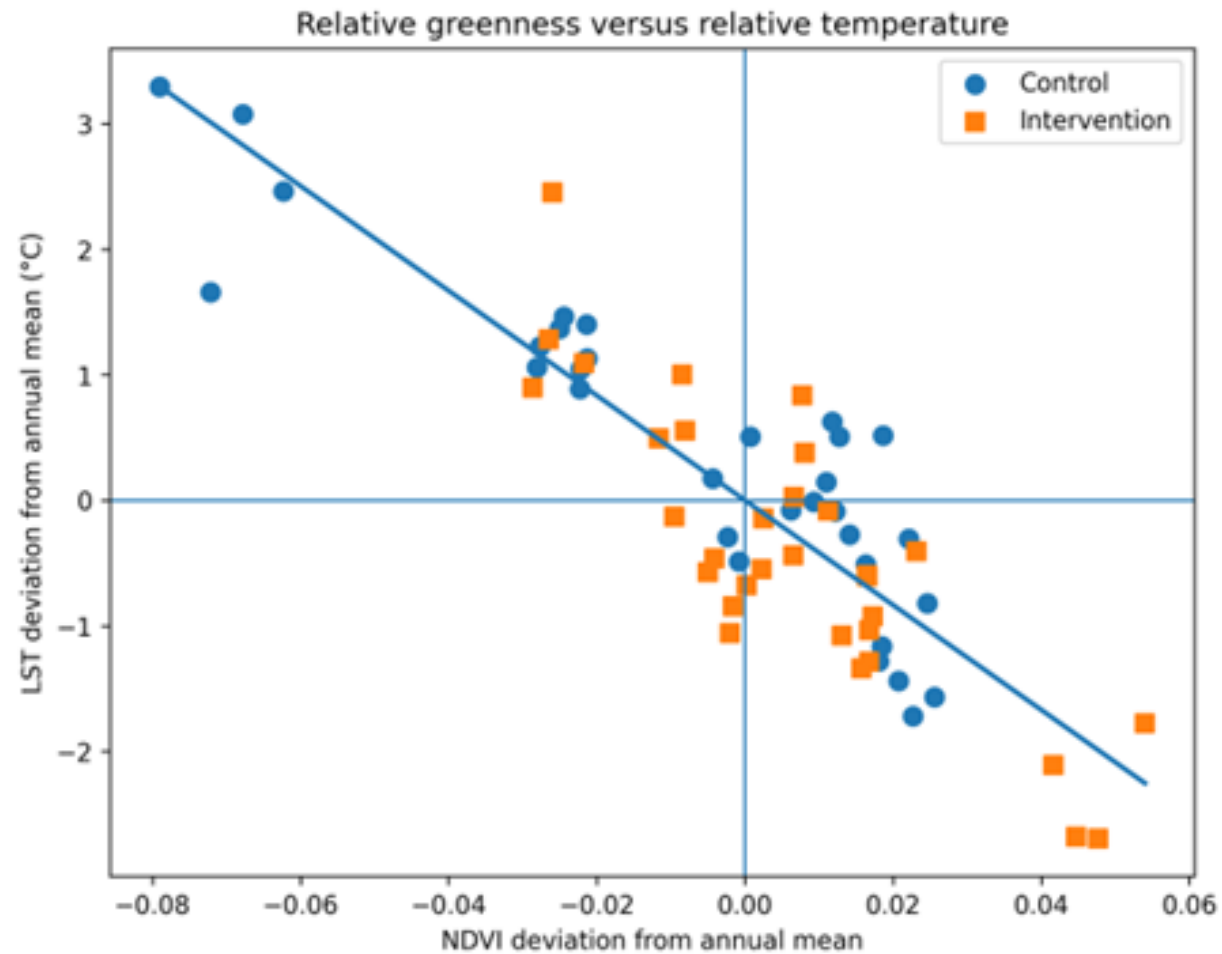
Panels show cluster-level NDVI, Δ LST relative to 2021, the NDVI-LST association, and group-level NDVI trajectories.

A Cluster-level NDVI





C NDVI-LST regression



NDVI = normalized difference vegetation index; Δ LST = land surface temperature change. All summaries are based on cluster-level summer comp

A 0.38 C lower LST per 0.01
higher NDVI, $p < 0.001$

GREEN HEART TIME LINE

Outcome: high-sensitivity C-reactive protein (hsCRP)

Data Collected: biological samples, CVD risk assessment, lifestyle factors

[illegible]

BASELINE DEMOGRAPHICS

Observations:

Baseline: 775

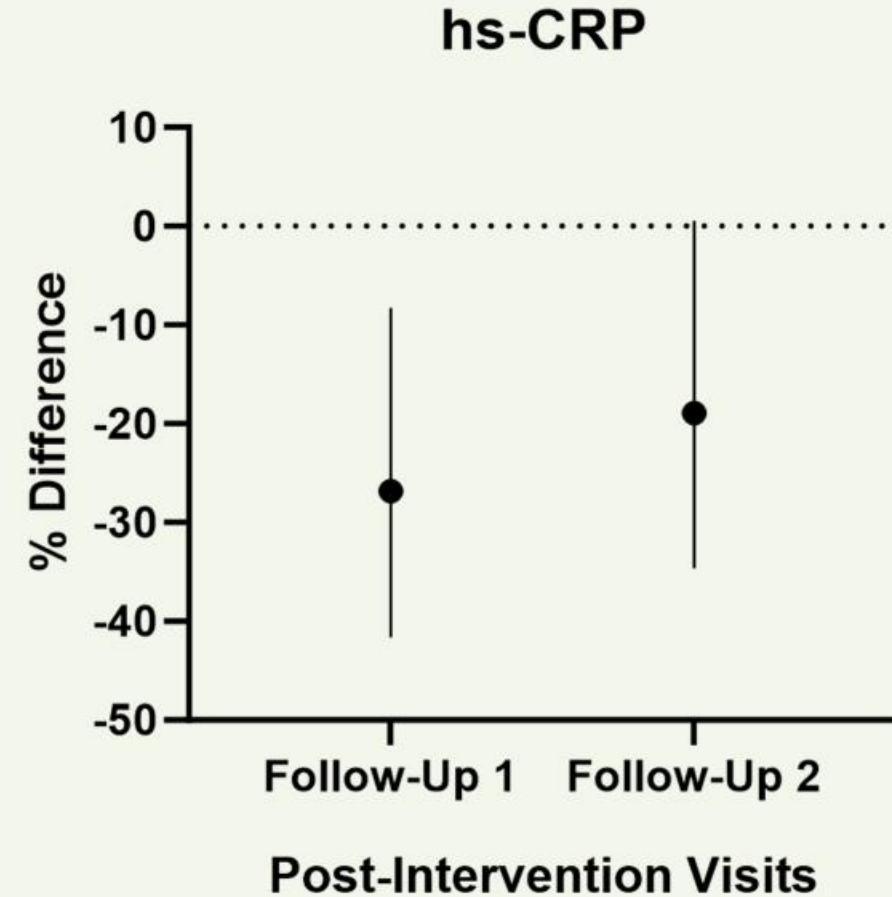
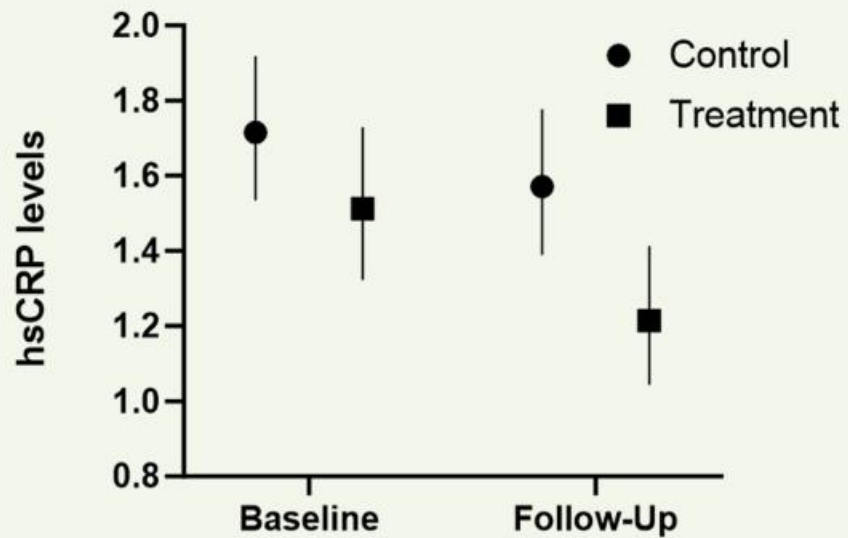
Post-Greening
(2022): 380

Post-Greening
(2023): 427

Categorical Variable	Total n (%)	Control	Treatment
n	775	473	302
Sex			
Female	466 (60.1)	275 (58.1)	191 (63.3)
Male	309 (39.9)	198 (41.9)	111 (36.8)
Race			
NH White	613 (79.1)	353 (74.6)	260 (86.1)
NH Black	121 (15.6)	91 (19.2)	30 (9.9)
Other	41 (5.3)	29 (6.1)	12 (4.0)
Income			
<\$45,000	399 (51.5)	246 (52.0)	153 (50.7)
>\$45,000	376 (48.5)	227 (48.0)	149 (49.3)
Education (n=624)			
≤ High School Diploma	234 (30.2)	150 (31.8)	84 (27.8)
Some College	288 (37.2)	184 (39.0)	104 (34.4)
≥ Four -year degree	252 (32.6)	138 (29.2)	114 (37.8)
Continuous Variable- mean (SD)			
Age (years)	48.7 (12.8)	48.9 (12.7)	48.4 (13.0)
BMI	30.3 (7.3)	30.8 (7.4)	29.5 (7.1)
hsCRP	3.6 (4.6)	3.6 (4.5)	3.6 (4.6)

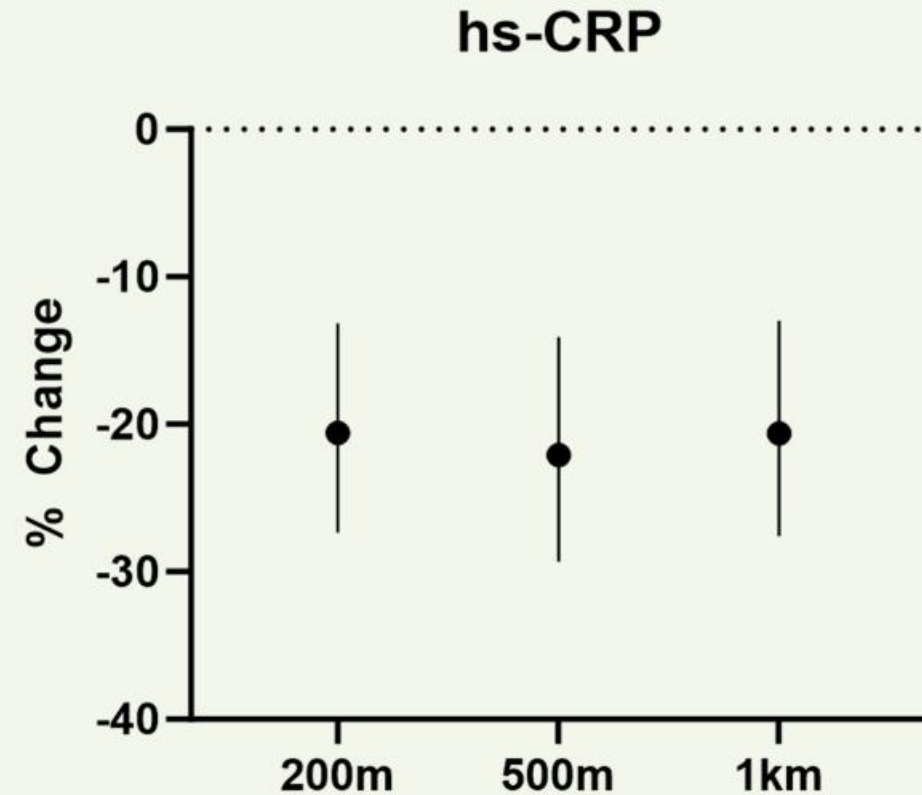
EFFECT OF THE GREENING INTERVENTION

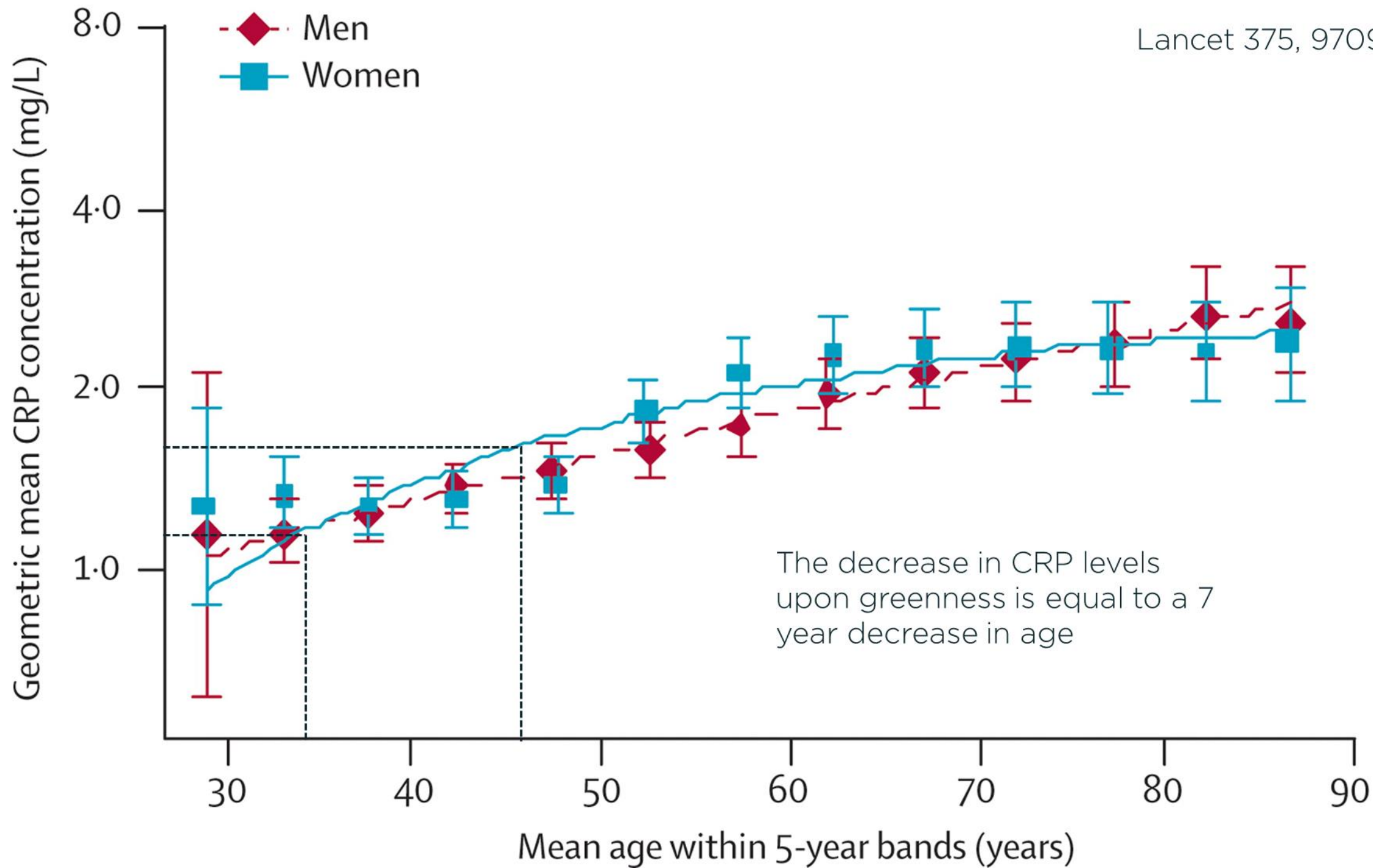
Overall Treatment effect
-22.7% (95% CI: -33.9, -9.6)



OBSERVATIONAL ANALYSIS

- 790 unique participants recruited in the summer months
- NDVI – LANDSAT at 30-meter resolution, yearly summer average
- 4 visits from 2018 thru 2023
- % Change in hs-CRP per 0.1 increase in NDVI.







\$5M



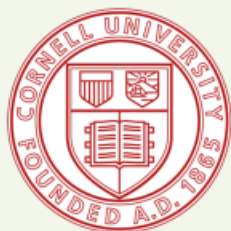
\$8.9M



\$8.2M

Total Project Cost

\$22.1M



TRAGER MICROFOREST



429
Suite 100



Site Plan

This site plan looks to maximize: nature within the urban realm; vibrancy of place; and public interaction with people and nature. The plan provides a central boardwalk that surrounds a Miyawaki Forest located within the center of the site. The MicroForest has three entrance points to manage and control access into the site. These entrances vary from a portal, to an active plaza, to a potential pop-up structure. The site's street facing edges enhance the urban experience by providing seat walls, lighting and a forest experience along city sidewalks. Key elements on the site include:

- A portal entrance
- Central boardwalk
- Miyawaki Forest
- Educational Signage
- Pop-up Structure with an outdoor courtyard
- Bioswale bumpout areas to enhance the urban edge







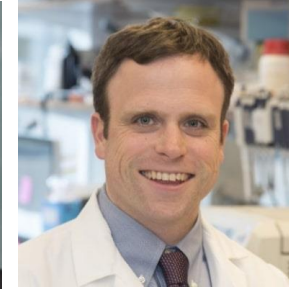
A photograph of a garden area. In the foreground, a long, low, reddish-brown metal wall serves as a sign, with the words "TRAGER MICROFOREST" in black, sans-serif capital letters. The wall is set back from a gravel path by a bed of plants, including tall, thin, yellow-green stalks and clumps of white-flowered plants. To the right, a concrete retaining wall is visible. The background is filled with a dense forest of trees, including several tall, thin evergreens and many deciduous trees with bright yellow-green foliage. A brick building is partially visible behind the trees. A utility pole with wires is on the left, and a string of small, dark, bell-shaped lights hangs across the upper part of the image.

TRAGER MICROFOREST

Creating healthier cities of tomorrow



- ✓ New ways to prevent chronic disease
- ✓ New way to decrease air pollution
- ✓ Development of new urban policies, guidelines, building codes
- ✓ A new model of healthy, urban living that could be replicated worldwide



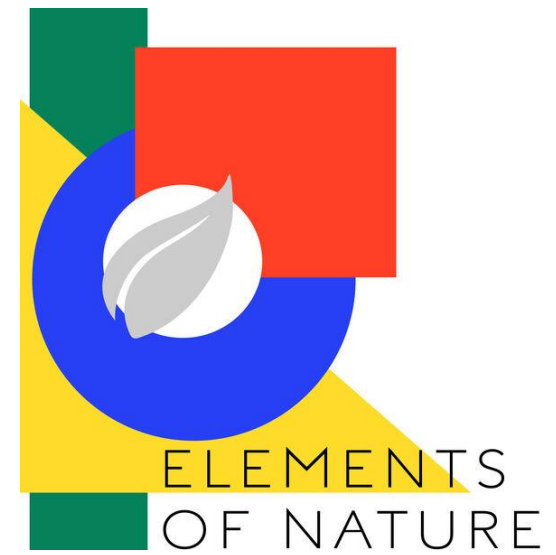
GREEN HEART
LOUISVILLE

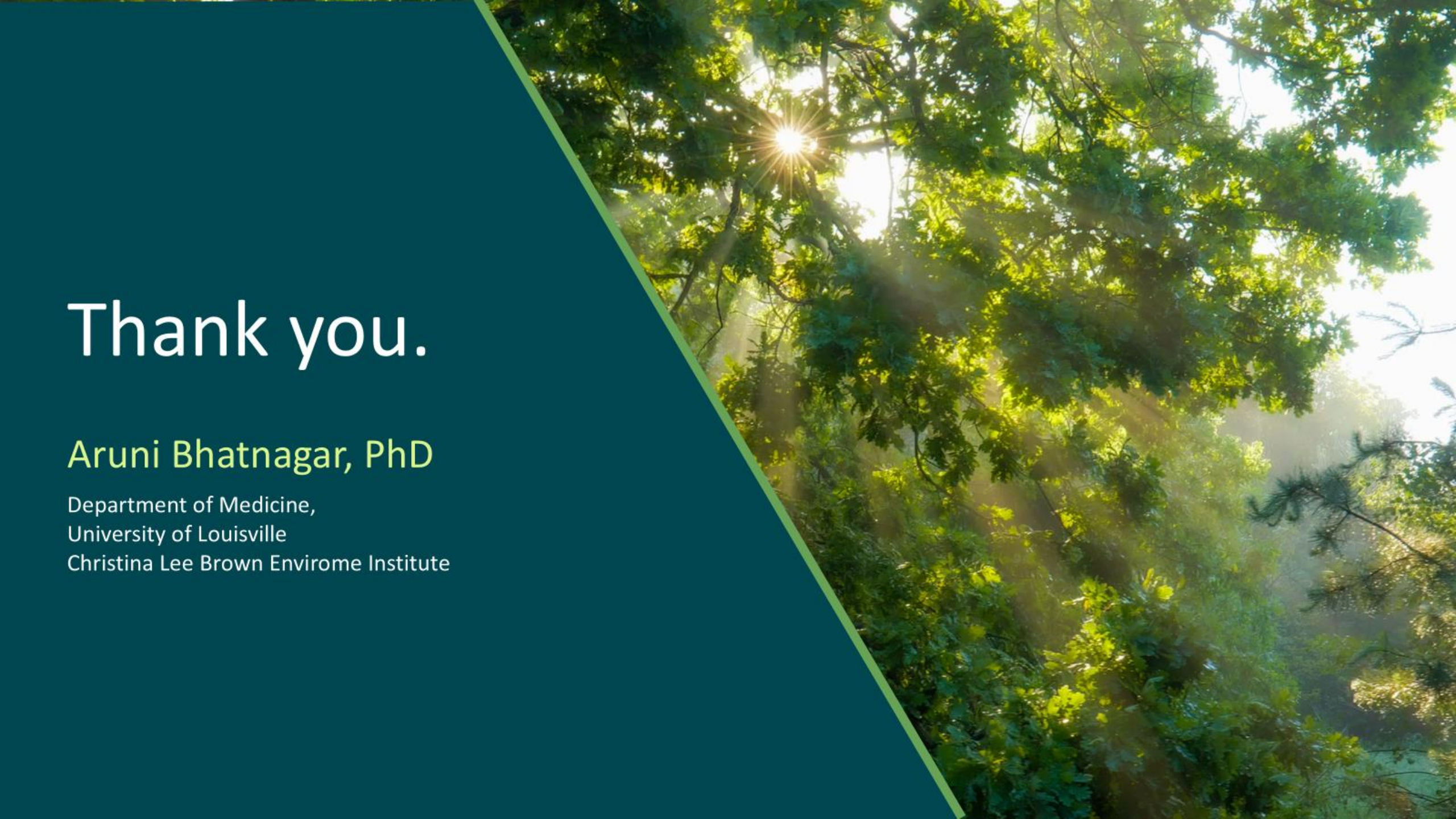


Issues in Toxicology

Edited by Aruni Bhatnagar

Environmental Cardiology





Thank you.

Aruni Bhatnagar, PhD

Department of Medicine,
University of Louisville
Christina Lee Brown Envirome Institute



METRO FLEET – BEBs and Hybrids

BEB, hybrid, and geofencing work underway | July 2026





BATTERY-ELECTRIC BUS PROGRAM

Building the operating foundation before scaling the fleet

Battery-electric buses: what Metro has put in motion

20,160

BEB miles operated year-to-date

4,200

diesel gallons avoided

43 MT

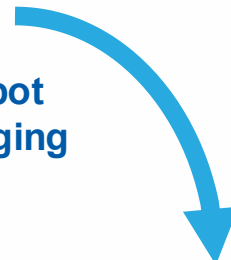
estimated CO₂e avoided vs.
equivalent diesel operation

6 GILLIG battery-electric buses on site – 7 more coming

The charging program is designed around overnight depot charging, six 180 kW chargers, and 18 overhead dispensers.

The early work is about proving the daily process: charge, dispatch, recover, maintain, and measure.

Depot
charging



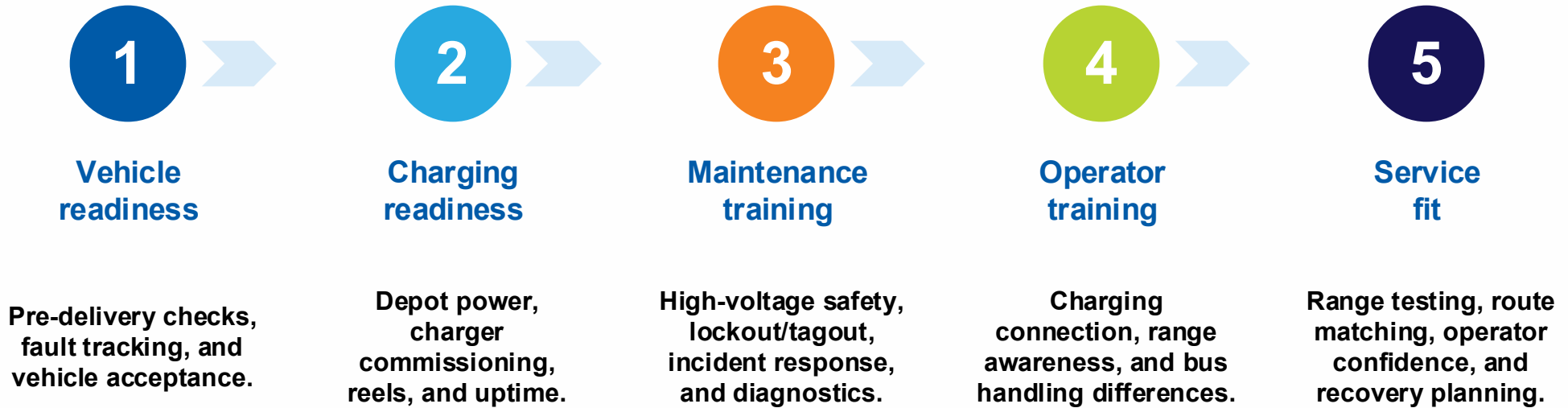
Launch footprint

6 buses

6 chargers at 180 kW each

18 overhead dispensers

BEB launch work is operational, not just technical



The launch gives Metro a way to learn where BEBs fit best and where constraints are.

That learning matters before larger capital decisions are made.



HYBRID FLEET SCALE- UP

Cleaner operation with familiar fueling, service, and dispatch practices

A practical transition is already underway

413 MT

estimated CO₂e avoided vs.
equivalent diesel operation

20

hybrid coaches in service

144k+

LTD hybrid ZE-mode miles

Metro is testing cleaner propulsion in real service

The work is being tied to maintenance, charging, operator training, route planning, and emissions accounting.

Geofencing gives Metro a way to use hybrid electric-mode capability more deliberately where it matters most.



Hybrid launch
Scale-up
Geofenced operation

Figures shown are current internal planning and estimates; final program benefits depend on duty cycle, weather, charging, fuel price, and vehicle availability.

Hybrids are already producing measurable electric-mode operation

403,872

total 2026 YTD hybrid miles

39,388

2026 YTD electric-mode miles

10%

share of hybrid miles in full-electric mode

2026 YTD PERFORMANCE

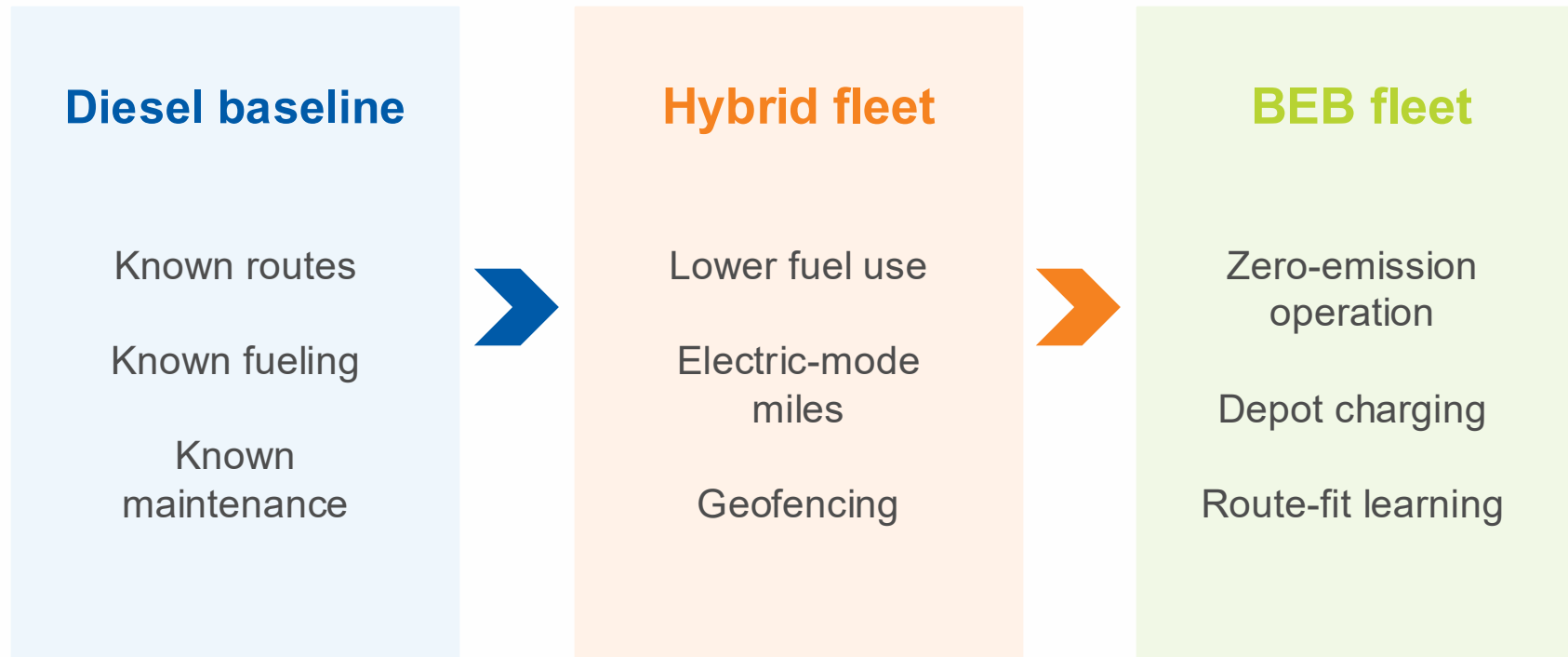


Hybrid buses allow Metro to reduce fuel use and emissions while leveraging existing fueling and maintenance infrastructure.

As more coaches arrive, the value of tracking electric-mode performance grows.

The current YTD hybrid estimate indicates approximately \$26k in fuel savings and 130 metric tons of CO₂e avoided versus an equivalent diesel operation.

The hybrid program creates a bridge between today's fleet and tomorrow's fleet



The bridge is important because Metro must still deliver service every day as the technology mix evolves.

Hybrids give Metro a scalable, lower-risk step that can support emissions goals while BEB infrastructure and operating practices mature.

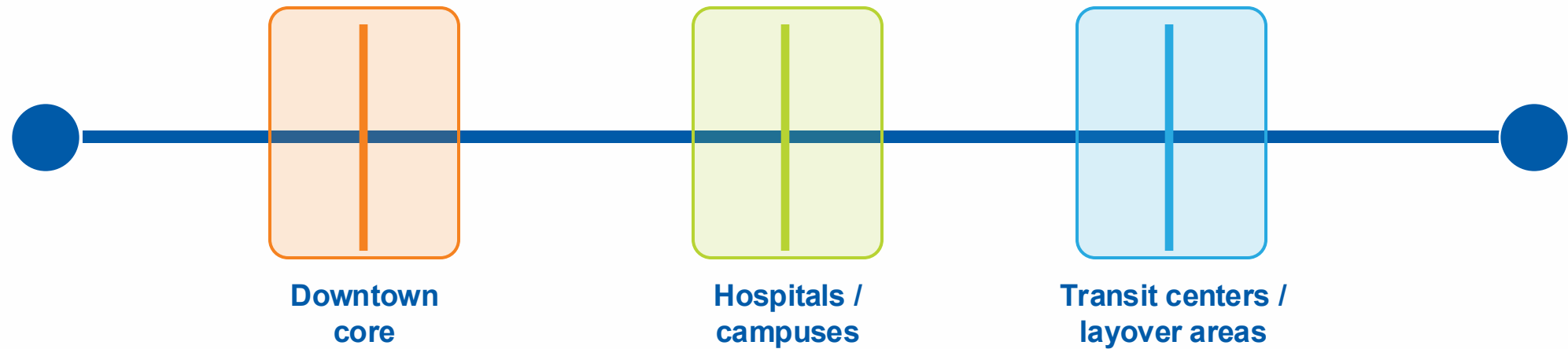


GEOFENCING

Using hybrid electric-mode capability where it has the highest operating value

Geofencing turns electric-mode miles into a targeted operating tool

Geofencing defines zones where the bus should prioritize quieter, lower-emission operation.



The value is deliberately placed electric-mode miles.

How geofencing can help Metro

Public-facing benefit

Quieter curbside operation and reduced street-level exhaust.

Operational benefit

A repeatable way to prioritize EV operation.

Analytical benefit

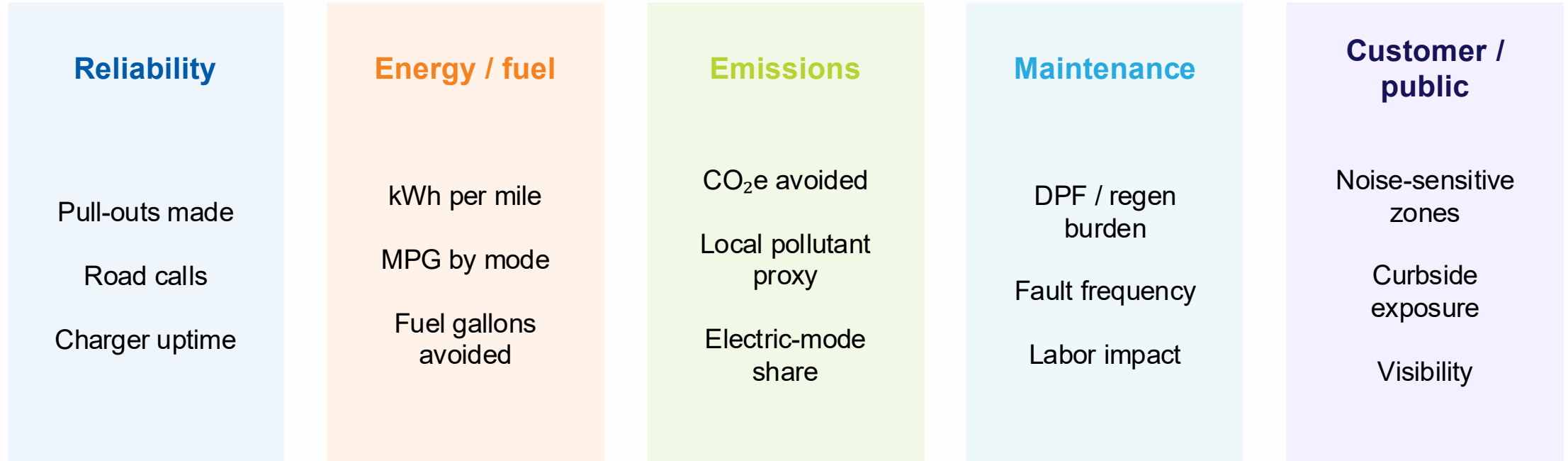
Cleaner before-and-after comparisons.

Planning benefit

Evidence for where future BEB service or hybrid deployment should be prioritized.

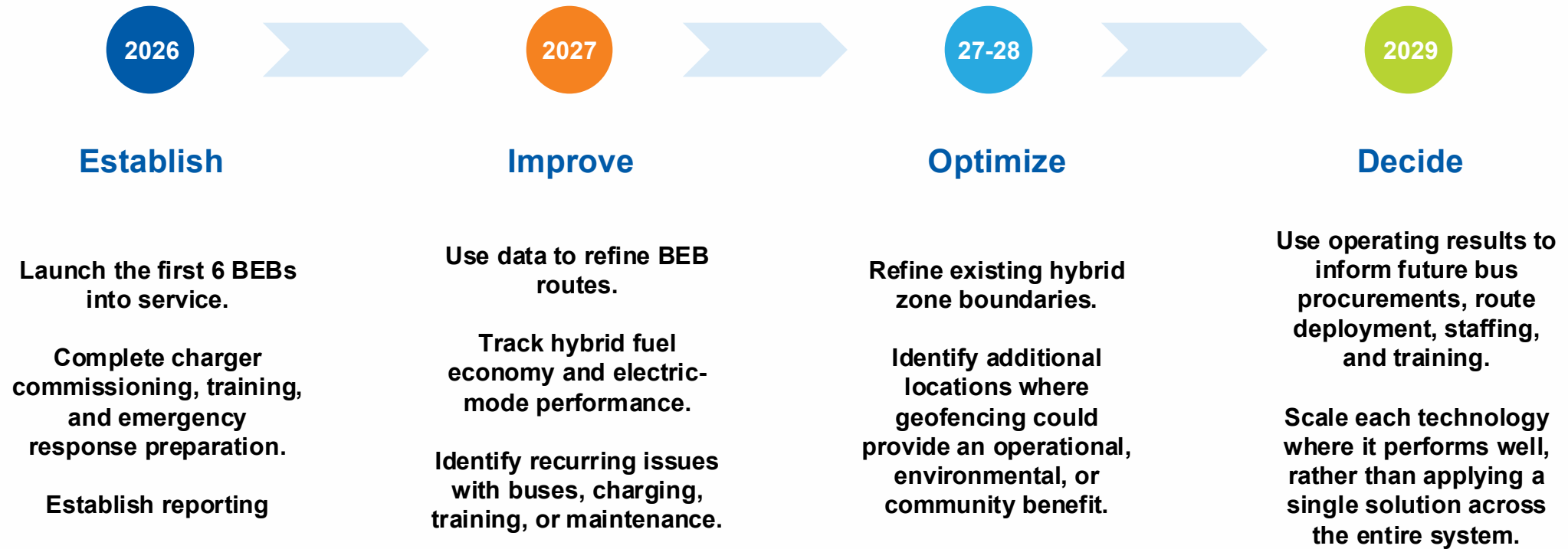
Goal: treat geofencing as a measurement, not just a software feature.

The work is measured with a common scorecard



The scorecard gives our leadership a clearer basis for future decisions on fleet, infrastructure, and policy.

Near-term roadmap



The goal is disciplined scaling: prove the operating model, measure the benefits, and then expand where the data supports it.



QUESTIONS?

Nathan Groh
Alternative Fuels Program Manager
Cincinnati Metro
Email: nathan.groh@go-metro.com

Upcoming Events



- **October 2026:** ReLeaf is giving away 1000 trees, celebrating with a Night in the Trees
- **October 2026** – second [Miyawaki Forest to be installed in Camp Washington](#) with Taking Root, Cincy Parks, and others
- **October 27:** [Let's Grow Local](#) Madisonville

Upcoming Meetings

2026

- Q4: Monday, September 28
 - In person, at Cincinnati Zoo & Botanical Garden
 - More info to come soon
 - Let us know if you are interested in speaking!

Interested in hosting a meeting or field trip? Let us know!