Technology + Nature:
A New Collaboration to Fortify the City in the Forest

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Visionary Leadership to Save and Activate Greenspace

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Conservation

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Environmental Education

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Environmental and Nature-Inspired Arts

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Building upon our legacy of connecting people with nature to advance Conservation, Education, and the Art, we have partnered with Georgia Tech and the City of Atlanta for an innovative and informative TREE CANOPY STUDY.

Technology + Nature: A New Collaboration to Fortify the City in the Forest

Blue Heron Nature Preserve
Canopy Study

Denise Cardin PM
Director of Conservation and Operations

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Woodlands

Wetlands

Meadows

Riparian

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What is a tree canopy study?

- Canopy: tree leaves, branches, and stems that cover the ground when viewed from above.
- Shows patterns of canopy distribution and change over time.
- Canopy studies are relatively new, 20-25 years.

Why are trees important?

Urban forests are often overlooked in their ability to adapt and mitigate the impact of climate change.

1. Cooling effect, reduce heat island effect
2. Sequester carbon & reduce greenhouse gases
3. Reduce flooding & filter pollutants in stormwater runoff including 75-80% of the phosphorus
4. Filter pollutants in the air “scrubbing”
5. Provide habitat and food for wildlife

Thus creating a critical part of an urban ecosystem

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How & Why

2002

2012

2022

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Drone Deployment

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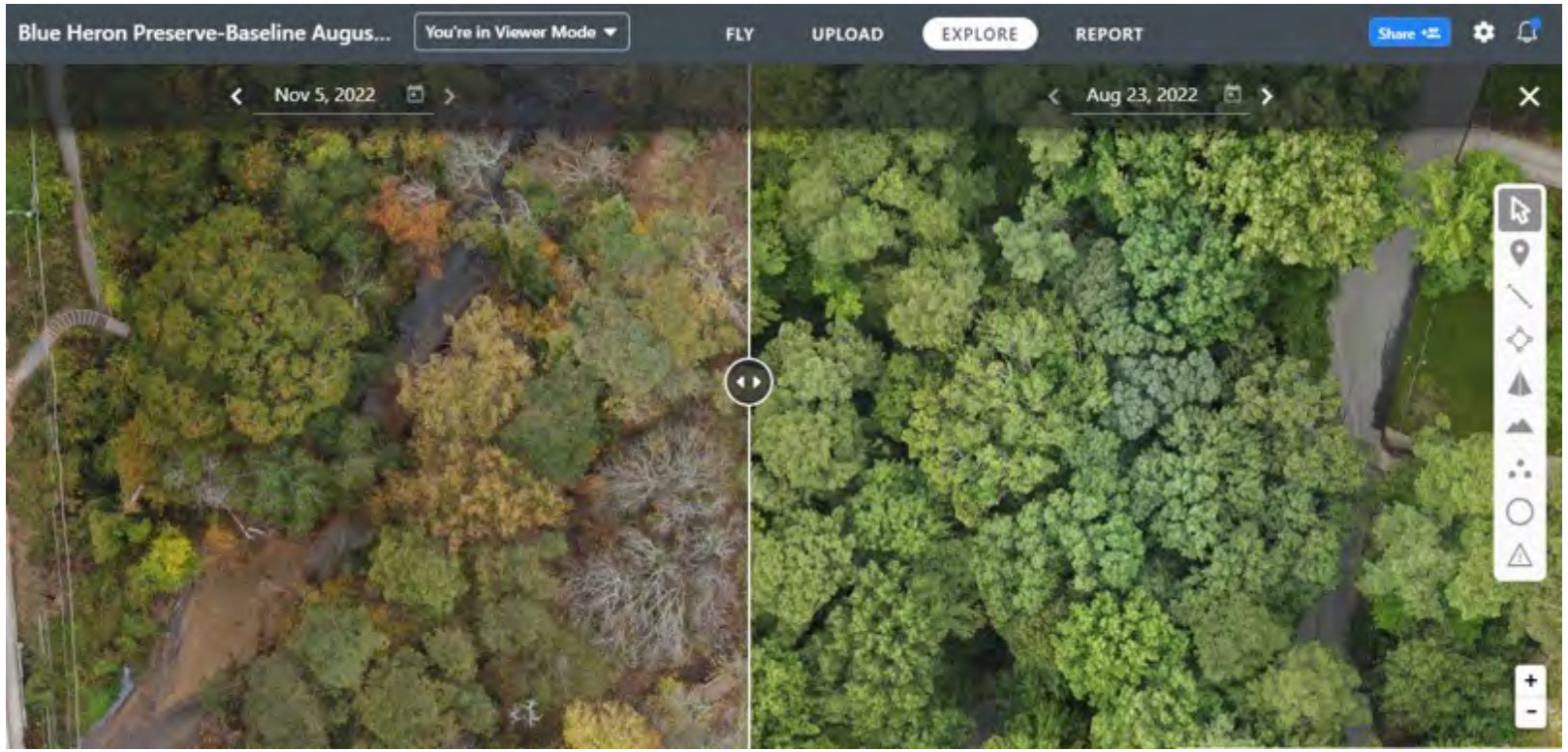
Baseline Canopy Data for Blue Heron Nature Preserve



Baseline Canopy Data: 2022-23
Follow-Up Canopy Data: 1 flight each season, every 3-5 years

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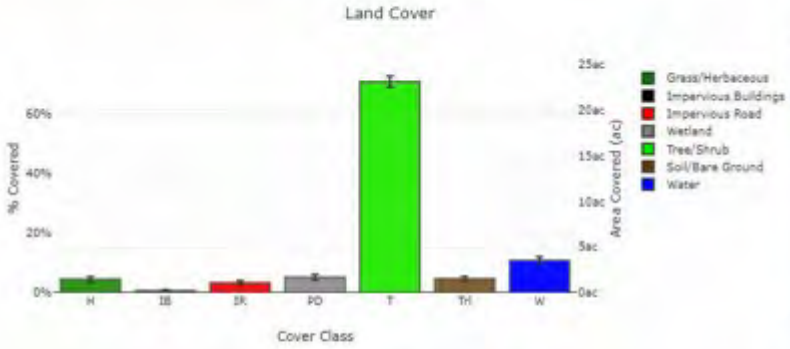
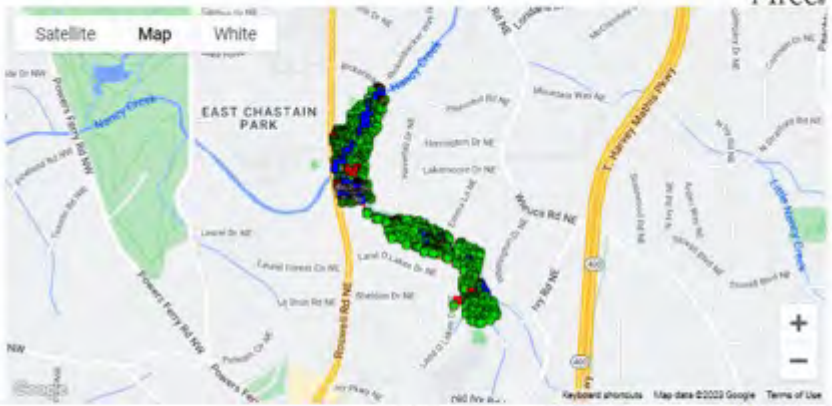
Tree Canopy Analysis

i-Tree Canopy

Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 1/5/2023





Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (ac) ± SE
H	Grass/Herbaceous	Meadow, Gardens	27	4.49 ± 0.84	1.47 ± 0.28
IB	Impervious Buildings	Office Building & FRC	4	0.67 ± 0.33	0.22 ± 0.11
IR	Impervious Road	Parking Lot, Driveway	20	3.33 ± 0.73	1.09 ± 0.24
PD	Wetland	Pond	31	5.16 ± 0.90	1.69 ± 0.29
T	Tree/Shrub		426	70.88 ± 1.85	23.16 ± 0.61
Trl	Soil/Bare Ground	Trails	28	4.66 ± 0.86	1.52 ± 0.28
W	Water	Nancy and Mill Creek	65	10.82 ± 1.27	3.53 ± 0.41
Total			601	100.00	32.67

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A Healthy Tree Canopy is A Natural and Economical Defense Against Climate Change

- Reduces CO_2 by 74%, CO2 makes up 82% of greenhouse gases (nearly 65% from fossil fuels)
- Reduces NO_2 by 50%, NO2 makes up 6% of greenhouse gases
- Lowers temperatures by six to ten degrees, including surrounding areas.

Tree Benefit Estimates: Carbon (English units)

Description	Carbon (T)	±SE	CO_2 Equiv. (T)	±SE	Value (USD)	±SE
Sequestered annually in trees	39.64	±0.00	145.34	±0.00	$6,760	±0
Stored in trees (Note: this benefit is not an annual rate)	996.46	±0.00	3,650.03	±0.00	$169,777	±0

Currency is in USD and rounded. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Amount sequestered is based on 1,365 T of Carbon, or 5,005 T of CO_2, per acre and rounded. Amount stored is based on 34,291 T of Carbon, or 125,697 T of CO_2, per ac and rounded. Value (USD) is based on $170.55/T of Carbon, or $46.51/T of CO_2 and rounded. (English units: T = tons (2,000 pounds), ac = acres)

Tree Benefit Estimates: Air Pollution (English units)

Abbr.	Description	Amount (lb)	±SE	Value (USD)	±SE
CO	Carbon Monoxide removed annually	26.18	±0.00	$1	±0
NO2	Nitrogen Dioxide removed annually	142.77	±0.00	$2	±0
O3	Ozone removed annually	1,421.95	±0.00	$100	±0
SO2	Sulfur Dioxide removed annually	89.97	±0.00	$0	±0
PM2.5	Particulate Matter less than 2.5 microns removed annually	69.10	±0.00	$296	±0
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	476.30	±0.00	$73	±0
Total		2,226.28	±0.00	$382	±0

Currency is in USD and rounded. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Air Pollution Estimates are based on these values in lb/ac/yr) @ $/lb/yr and rounded: CO 0.902 @ $0.04 | NO2 4.917 @ $4.01 | O3 48.968 @ $0.07 | SO2 3.098 @ $0.00 | PM2.5 2.379 @ $2.99 | PM10* 16.403 @ $0.15 (English units: lb = pounds, ac = acres)

Air Pollution | Hydrological | Carbon

Air Pollution Benefits

Abbreviation	Description	Removal Rate (lbs/ac/yr)	Monetary Value ($/T/yr)
CO	Carbon Monoxide removed annually	0.902	$85.08
NO2	Nitrogen Dioxide removed annually	4.917	$26.86
O3	Ozone removed annually	48.968	$140.47
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	16.403	$304.43
PM2.5	Particulate Matter less than 2.5 microns removed annually	2.379	$5,975.67
SO2	Sulfur Dioxide removed annually	3.098	$7.45

Currency is in USD. English Units: lbs = pounds, T = ton, ac = acre

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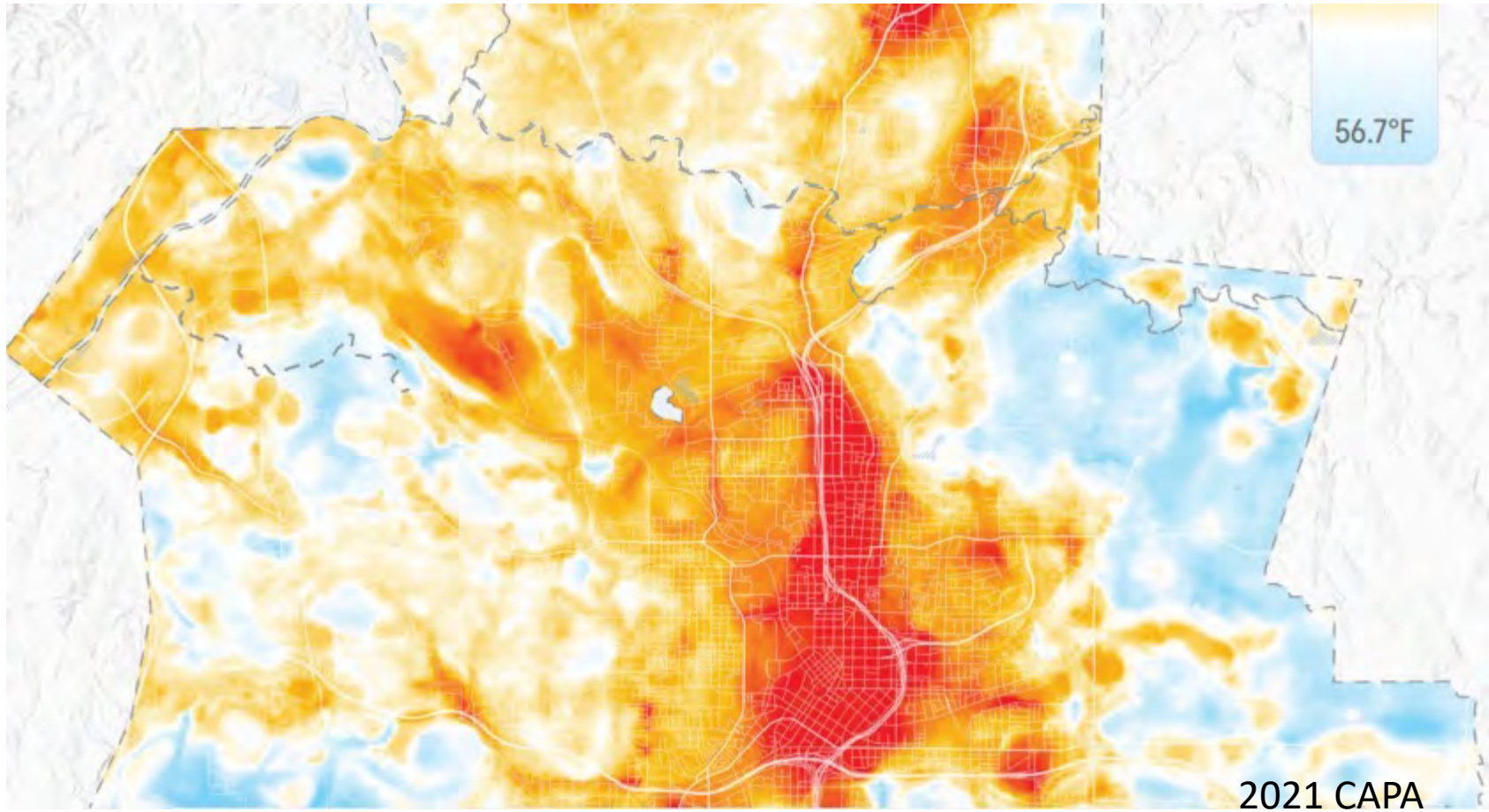
Atlanta is A Heat Island

In addition to increased temperatures due to climate change…

Heat Islands are urbanized areas experiencing higher temperatures than outlying areas due to high amounts of impermeable surfaces (streets, pavement, development).



2021 CAPA

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Almost Immediate Results from Monitoring

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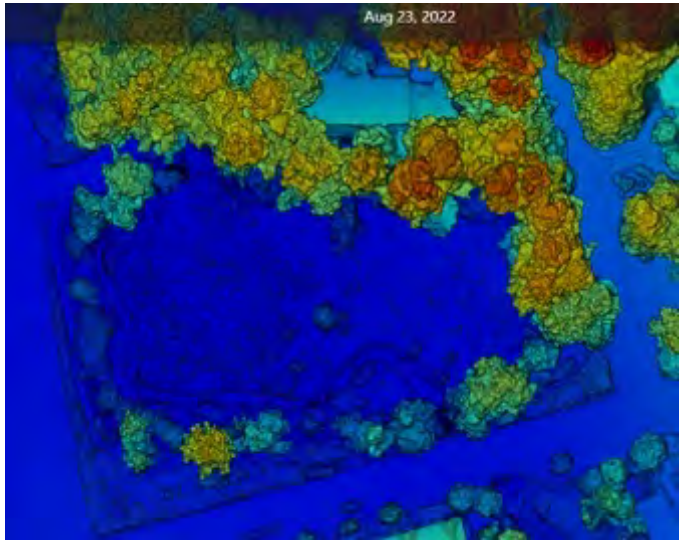
Leveraging Technology

Canopy apps: iTree, iCanopy, Google Earth

Drone Deployment: Infrared

Software: iNaturalist, eBird, iPlant



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Technology + Nature

Collaborations among organizations as a collective and embracing new methodologies in technology, can Fortify our City in the Forest.

Atlanta's Urban Tree Canopy and The Importance of Natural Areas

Taryn Heidel

Senior Arborist

City of Atlanta, Department of Parks and Recreation

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City of Atlanta Urban Tree Canopy Studies

- 3 Urban Tree Canopy studies completed by Tony Giarrusso, Associate Director, Center for Spatial Planning Analytics and Visualization at Georgia Tech.
- **These canopy studies focus on quantity and patterns of change.** The canopy study does not cover quality of canopy (biodiverse, regenerative, age, healthy soils), although hundreds of individual sites were inspected to further analyze canopy trends and details of canopy quality were noted.
- **2008:** Established an accurate baseline tree canopy estimate and developed methodologies and procedures for future studies.
- **2014:** Second urban tee canopy assessment and included canopy change analysis between 2008-2014.
- **2018:** Third canopy assessment and change analysis for Atlanta.

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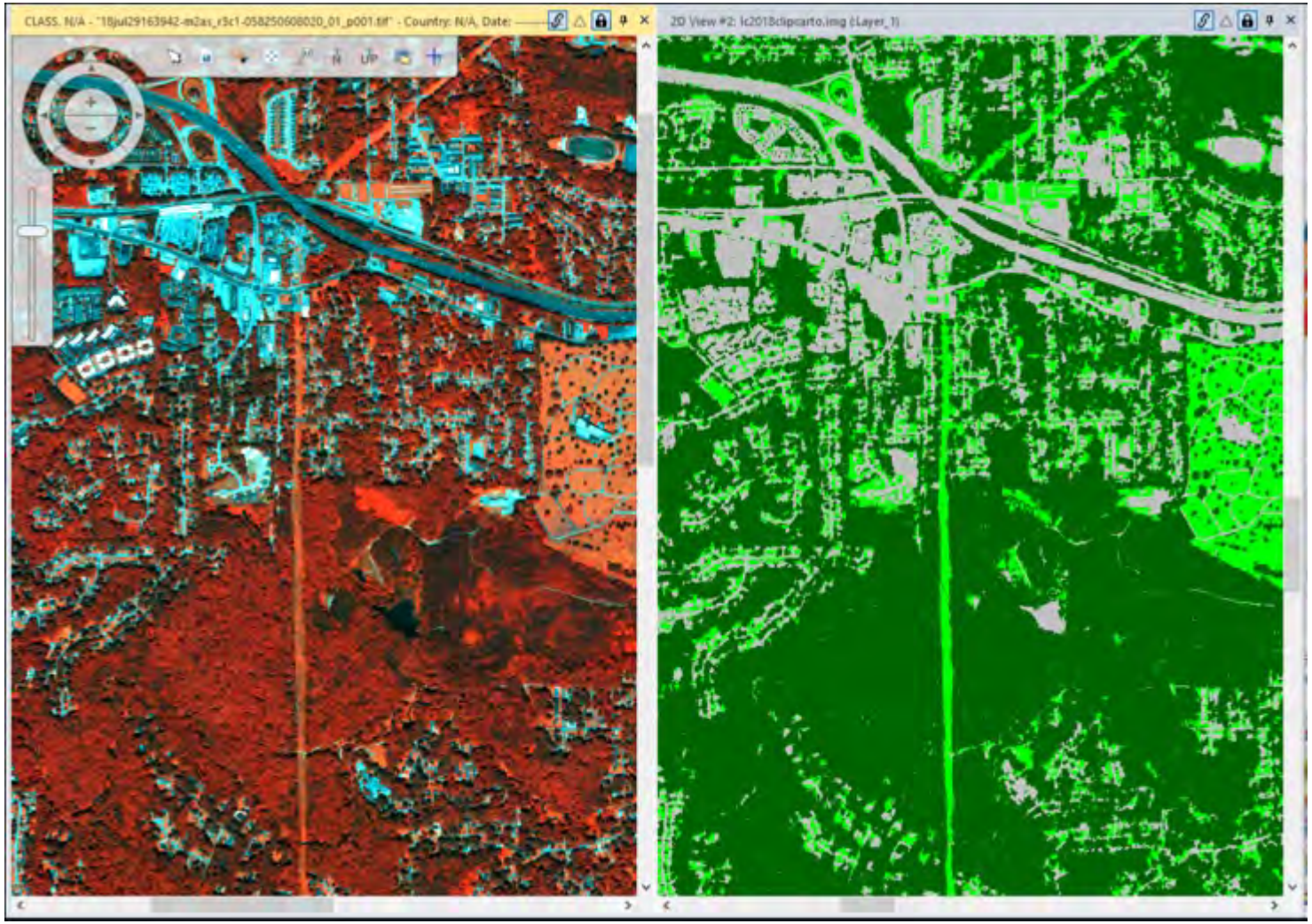
Methodology

- Aerial imagery + multi-spectral imagery
- The satellite image is classified into three separate categories: Tree canopy (dark green), Non-Tree Vegetation (light green) and Non-Vegetation (gray).



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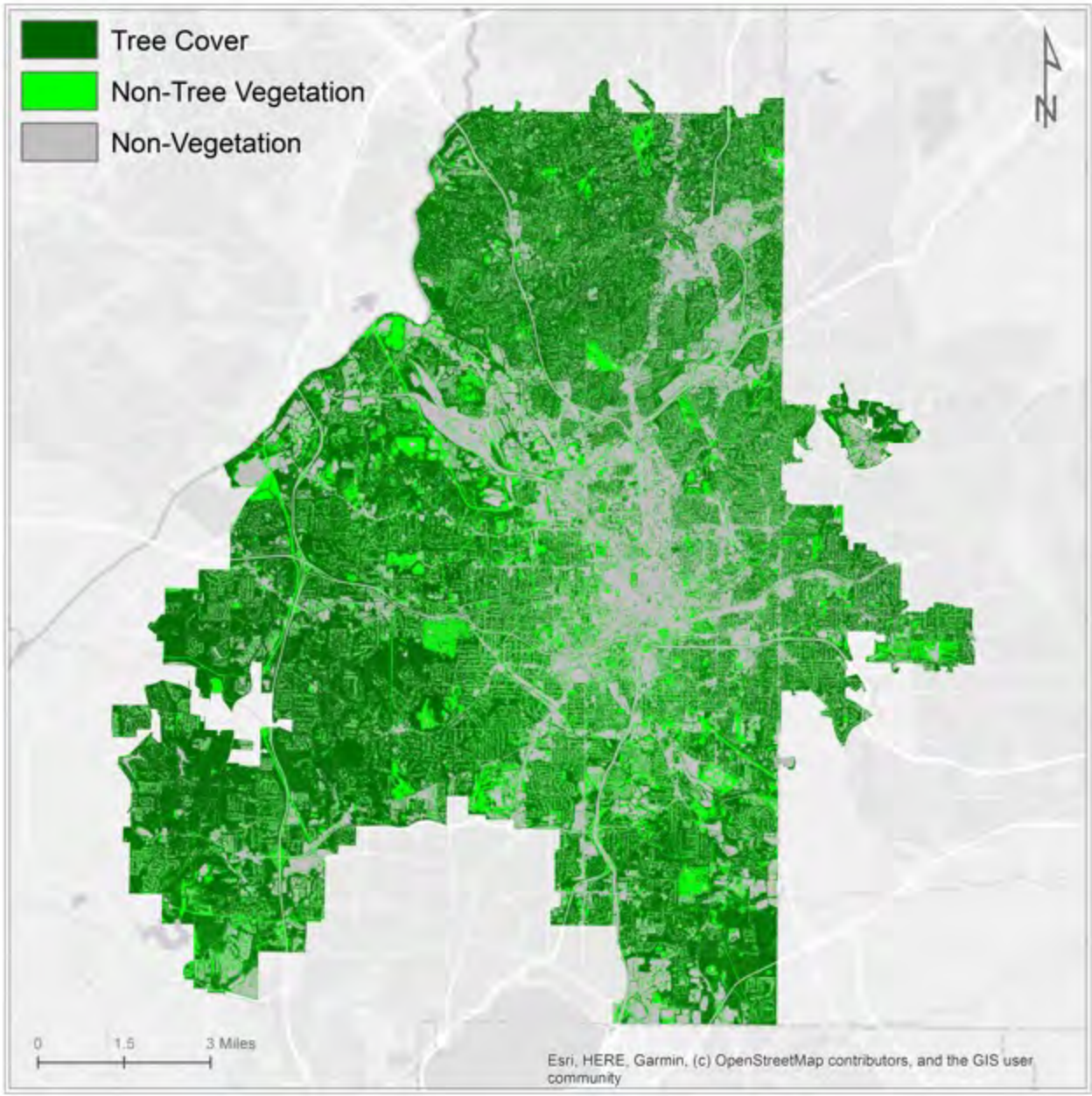
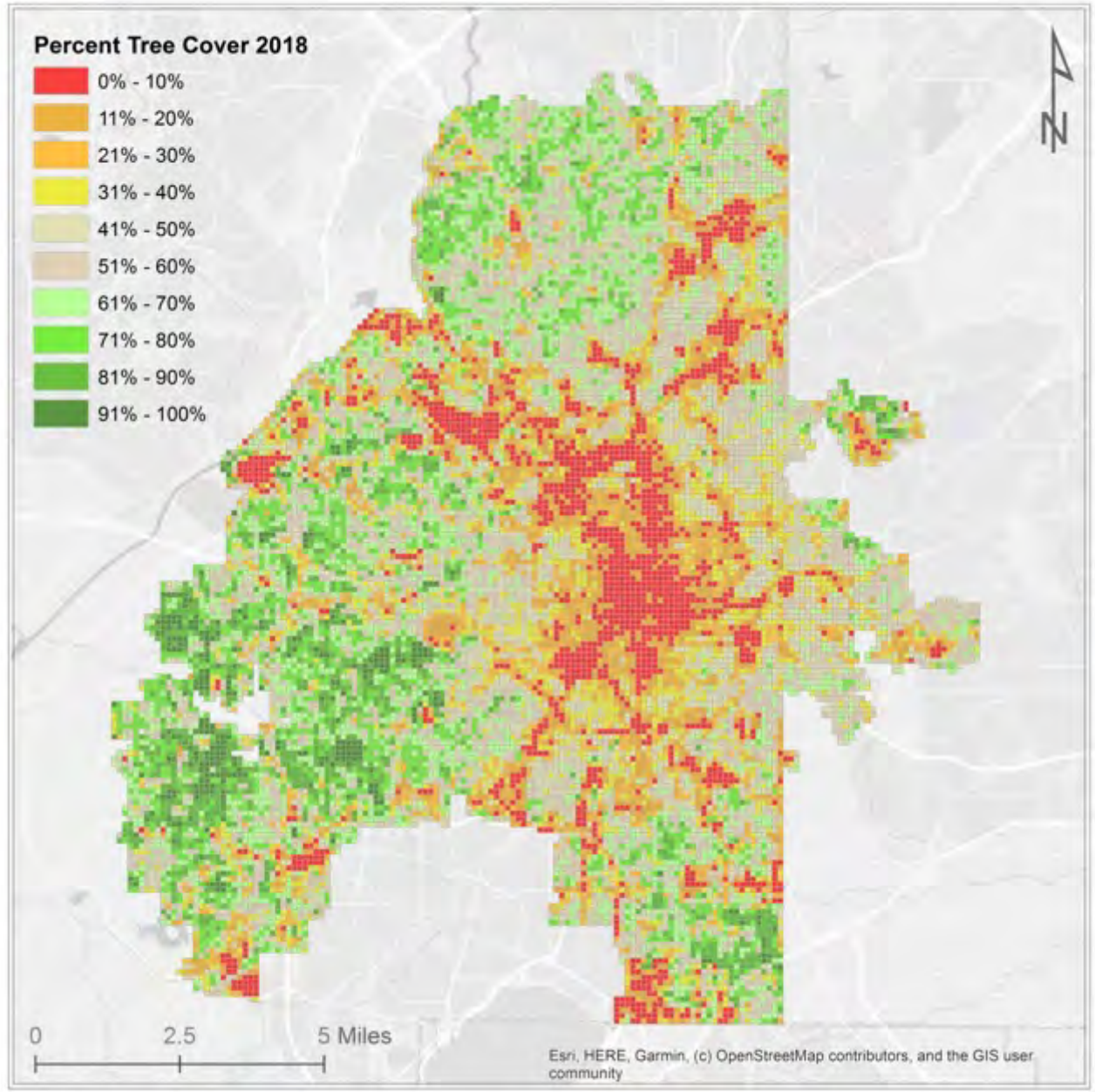
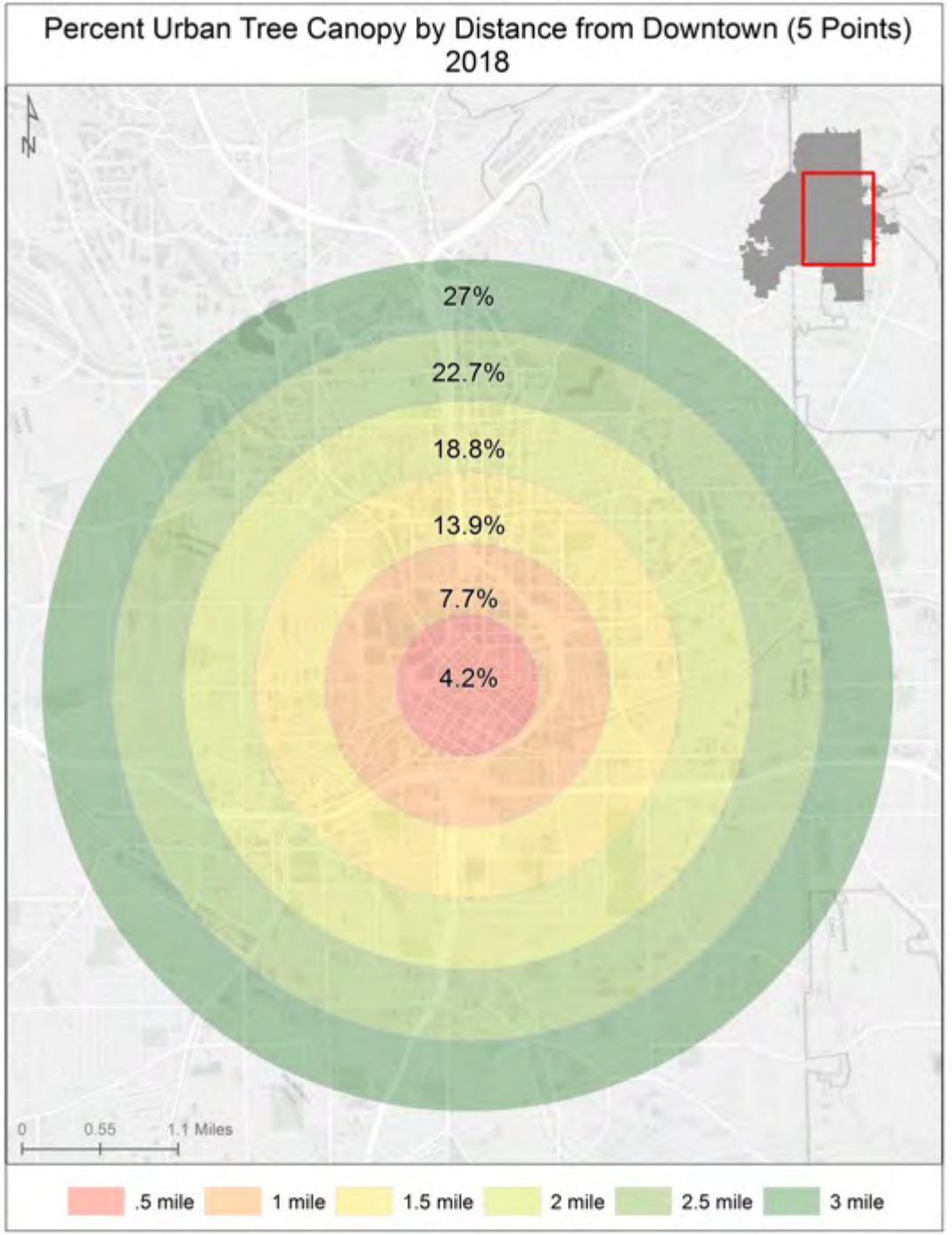

Tree Cover
Non-Tree Vegetation
Non-Vegetation
N
0
1.5
3 Miles
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community


Percent Tree Cover 2018
0% - 10%
11% - 20%
21% - 30%
31% - 40%
41% - 50%
51% - 60%
61% - 70%
71% - 80%
81% - 90%
91% - 100%
N
0
2.5
5 Miles
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

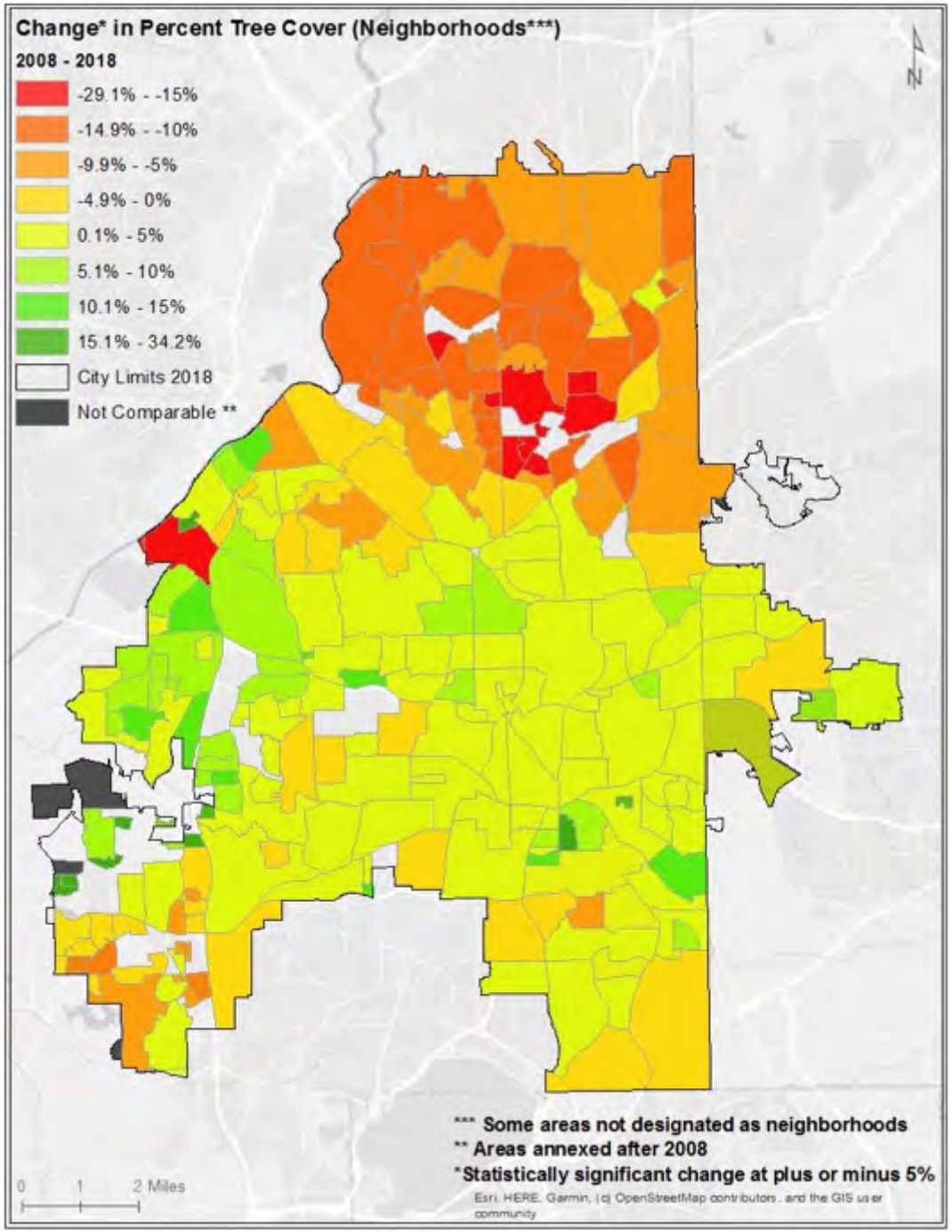
Urban tree canopy coverage is driven by land use and varies significantly across the city, from less than 10% downtown to over 90% in nature preserves. Canopy coverage is extremely low at the city center and slowly gains coverage as one moves outward from downtown.

Tree Canopy Coverage by Zoning		
Zoning Category	Canopy Coverage within Zoning Area	Contribution to Overall Tree Canopy
Single-Family Residential	58%	76%
Multi-Family Residential	40%	8%
Industrial	24%	6%
Commercial	21%	2%
Office/Institutional	37%	2.3%



UTC Change 2008-2018

- The percent urban tree canopy coverage for 2018 was 46.5%, a slight decrease from 2014 and almost 1.5% less than 2008, which equated to an estimated ***.43 acres of canopy lost per day between 2008 - 2018***.
- Canopy change varies greatly across the city, with a majority of loss coming from the northern parts of the city.



Canopy Loss

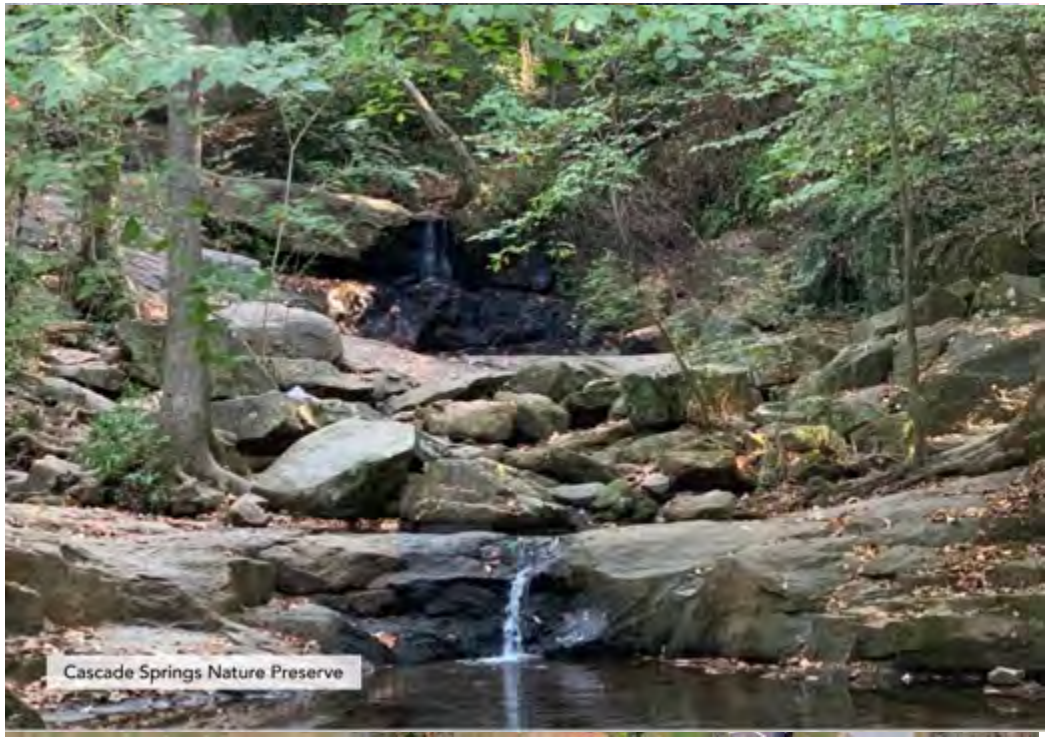
- Single-family redevelopment was the most common cause of loss, followed by construction of new developments
- While all of these sites have replanted trees as required, the new trees are generally not the same quality or type as the trees lost.

Canopy Gain

- Most of the ***significant canopy growth*** observed between 2008-2018, was ***actually regrowth of forest on lands cleared for development*** but left undeveloped or partially developed (Pipe Farms).
- Canopy growth was also observed in younger street trees and neighborhood trees planted in single-family neighborhoods and multi-family developments constructed between 2000 - 2008.
- Canopy growth observed in a few City of Atlanta parks.

Parkland Tree Canopy Cover

- Atlanta Parks make up 4.5% of the City's land area and 5.2% of the City's canopy.
- Average tree canopy cover on parkland is 54% (higher than 46.5% overall tree canopy coverage).
- Among parks over 20 acres in size, canopy coverage ranges from a low of 12% at Boulevard Crossing to a high of 92% at Cascade Springs Nature Preserve.



Boulevard Crossing Park – Trust for Public Land

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Parkland Area

11.1 acres per 1,000 residents

- Nature preserves: 1.4 acres per 1,000 residents (12.8%)
- Other parks: 6.7 acres per 1,000 residents (60.6%)
- Other public greenspace (APS & DWM): 3 acres per 1,000 residents (26.6%)

Median parkland area for similar cities is 13.3 acres per 1,000 residents

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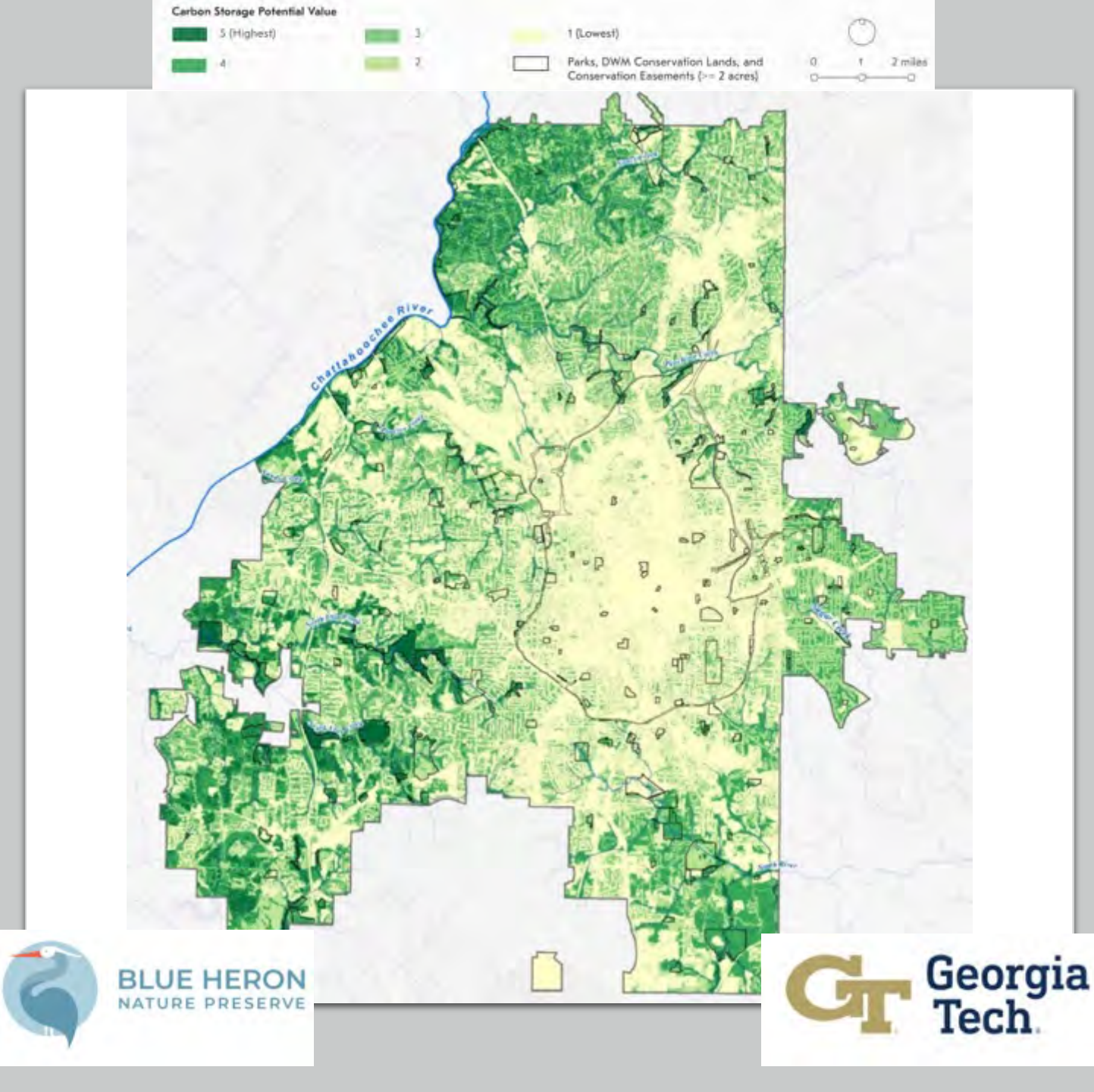
Carbon Storage Potential Value

- The presence of tree canopy alone does not determine carbon storage potential.
- Natural areas are more important for carbon storage than other types of parks and street trees.
- Urban forests and their soils are the primary form of carbon storage in Atlanta.



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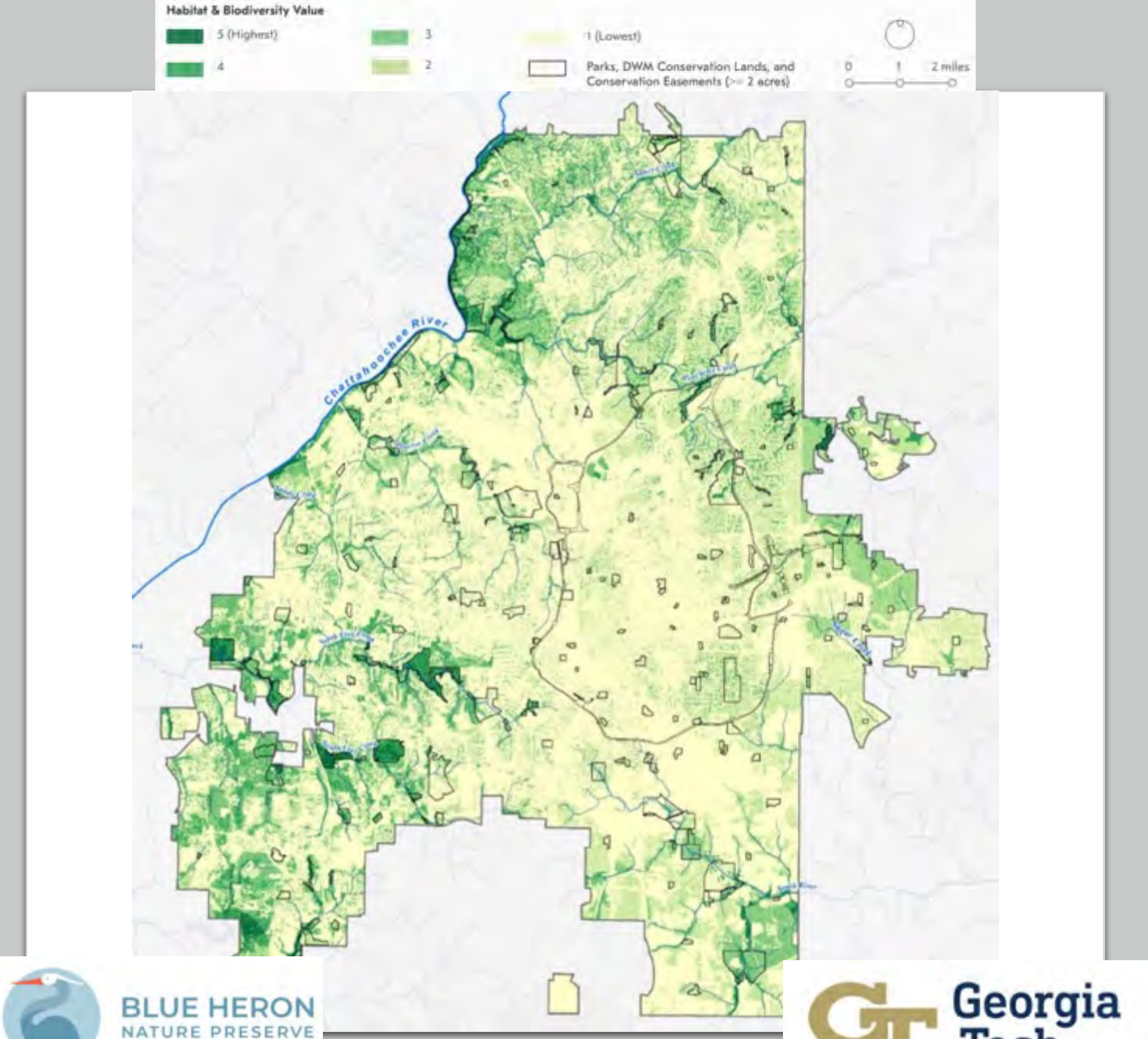
Habitat & Biodiversity Value

- Native plants are needed to support healthy native beneficial insect, bird, and other wildlife populations.
- Higher native plant biodiversity allows our urban ecosystems to be more resilient to environmental stress.
- Larger natural areas and wildlife corridors (connections between natural areas) are need to support habitat and safe movement for wildlife.



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Plant Canopy

Replant Quantity

- Planting projects paid for through the Tree Trust Fund

Replant Quality

- Tree Protection Ordinance Update 1: establishing an approved planting list that prioritizes native species and does not allow invasive trees to be planted

Figure 71. Questionable Plantings at New Developments

"Trees planted on the redeveloped sites rarely represented the same species or diversity of trees that had been removed. The most commonly replanted trees were red maples, and many were non-native, ornamental species. Both the quantity and quality of the city's urban forest will change based on this pattern."

- 2018 City of Atlanta Urban Tree Canopy Assessment and Change Analysis (2008-2018)

Prevent Canopy Loss

Acquire Parkland & Natural Areas

- Active ATL Master Plan: Acquire 275 acres per year for 10 years (2,750 acres total) with goal of 13 acres per 1,000 population, and preserving 50% of the land as natural area and goal of providing a park within a 10-min walk for all Atlantans

Prevent the Spread of Invasive Plants

- Tree Protection Ordinance Update 1: removes recompense requirement for removal of invasive trees and requires invasive vines to be removed from trees saved

The Lake Charlotte Nature Preserve was once slated to become a landfill. The 216.5 acre forest was the first park acquired using the Tree Trust Fund. (Matthew Pearson/WABE)

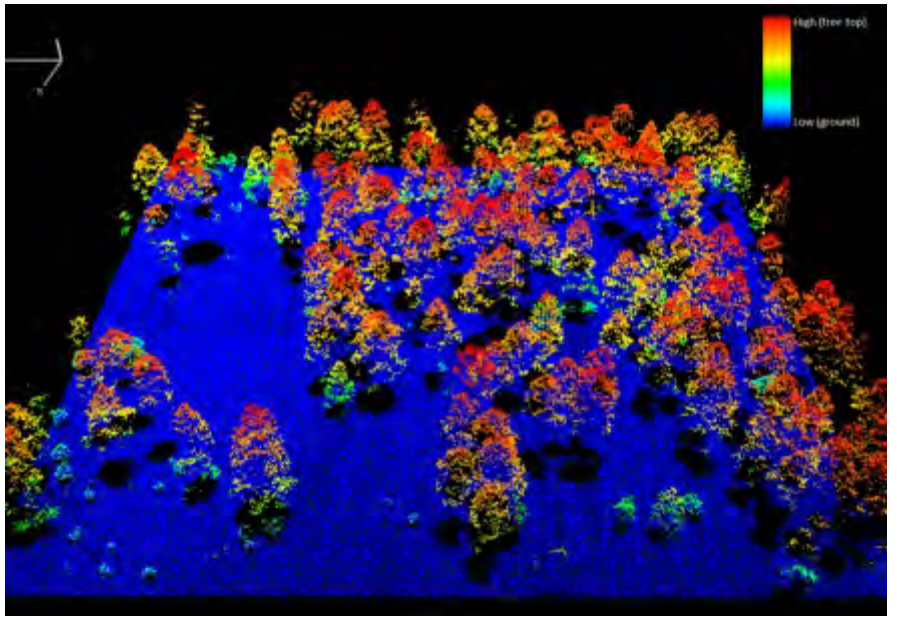
Preserve Canopy

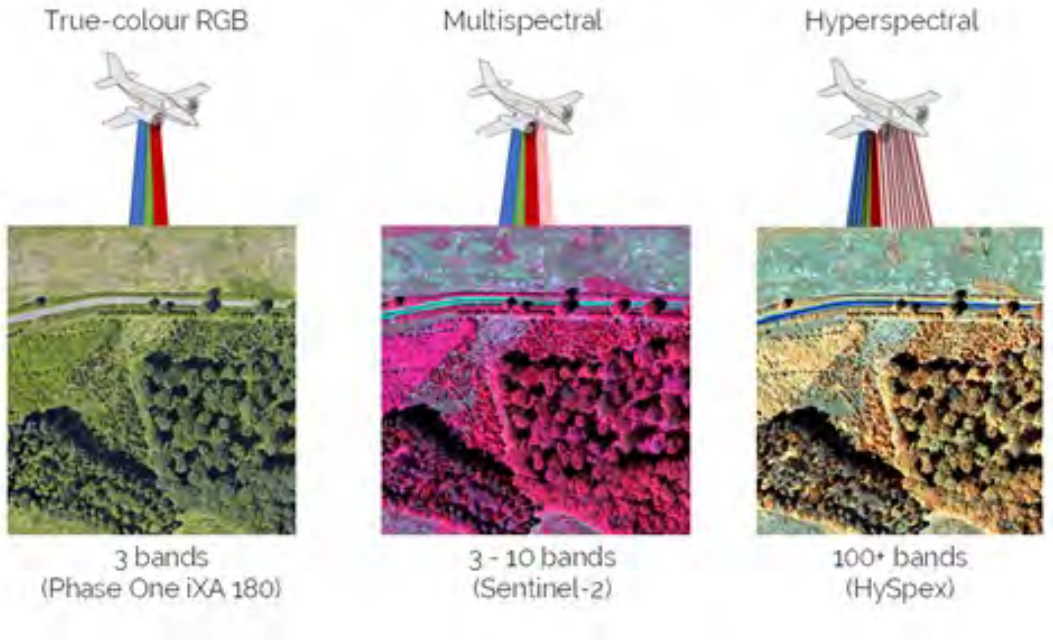
Conserve Existing Canopy by Maintaining Natural Areas

- Activate ATL: Objective 1.7 – Invest in natural areas in parks for the dual purpose of preserving and protecting Atlanta's abundant tree canopy and wildlife habitat, while encouraging visitation for human respite and refuge.
  - Establish project list of priority natural areas with potential for improvements
  - Develop natural areas improvement strategies.

Park Tree Canopy Studies

- Monitor canopy cover, and help us work to increase canopy cover in parks (aerial images, multispectral imagery)
- Monitor tree death, disease, forest health and maturity, and invasive plant infestations for maintenance purposes to help us preserve canopy in parks (aerial images, hyperspectral imagery, and LIDAR)





Use of Drone Technology at the Blue Heron Nature Preserve

Javier Irizarry, Ph.D., P.E.

Georgia Institute of Technology

Atlanta

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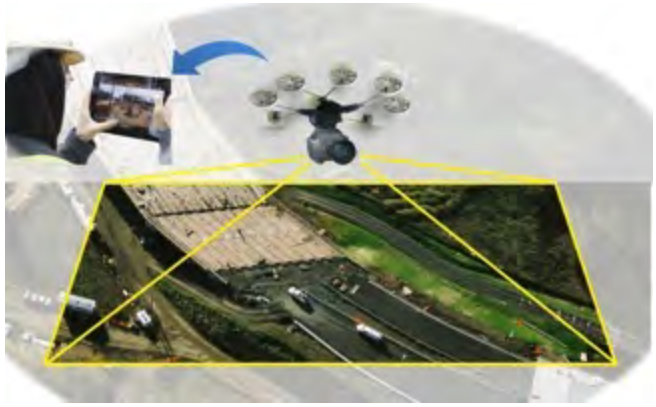
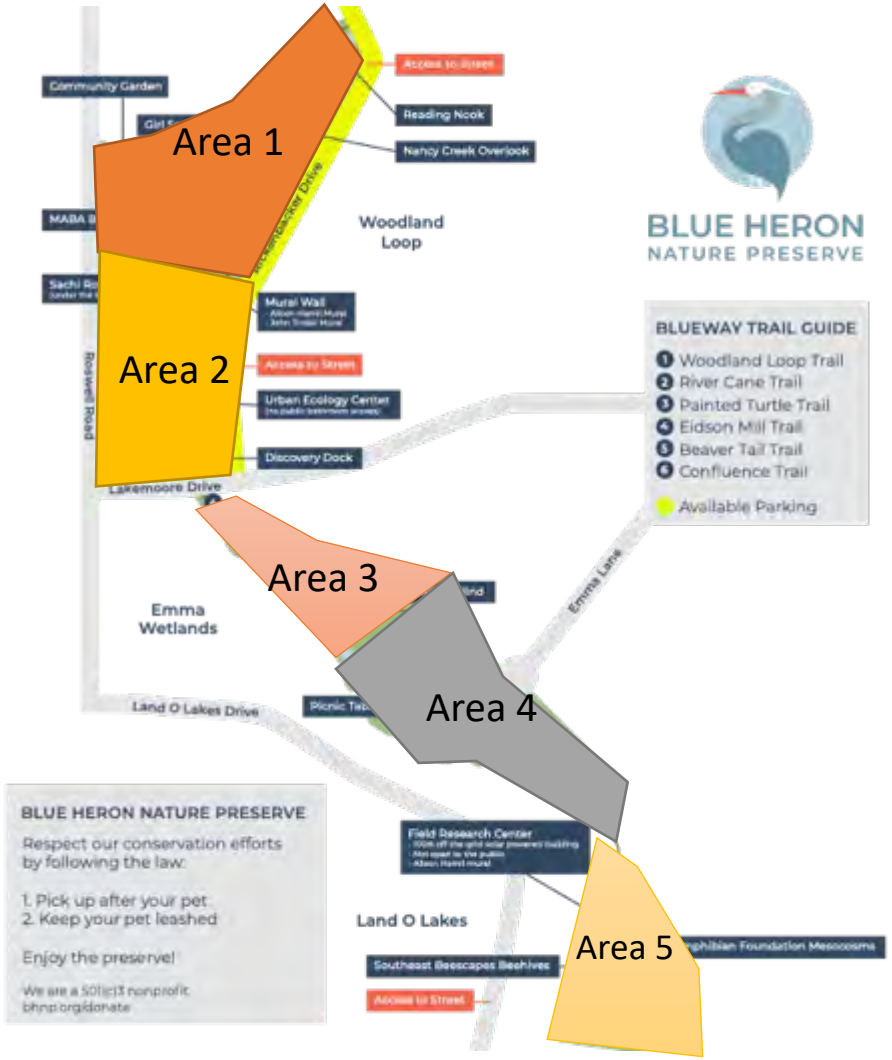
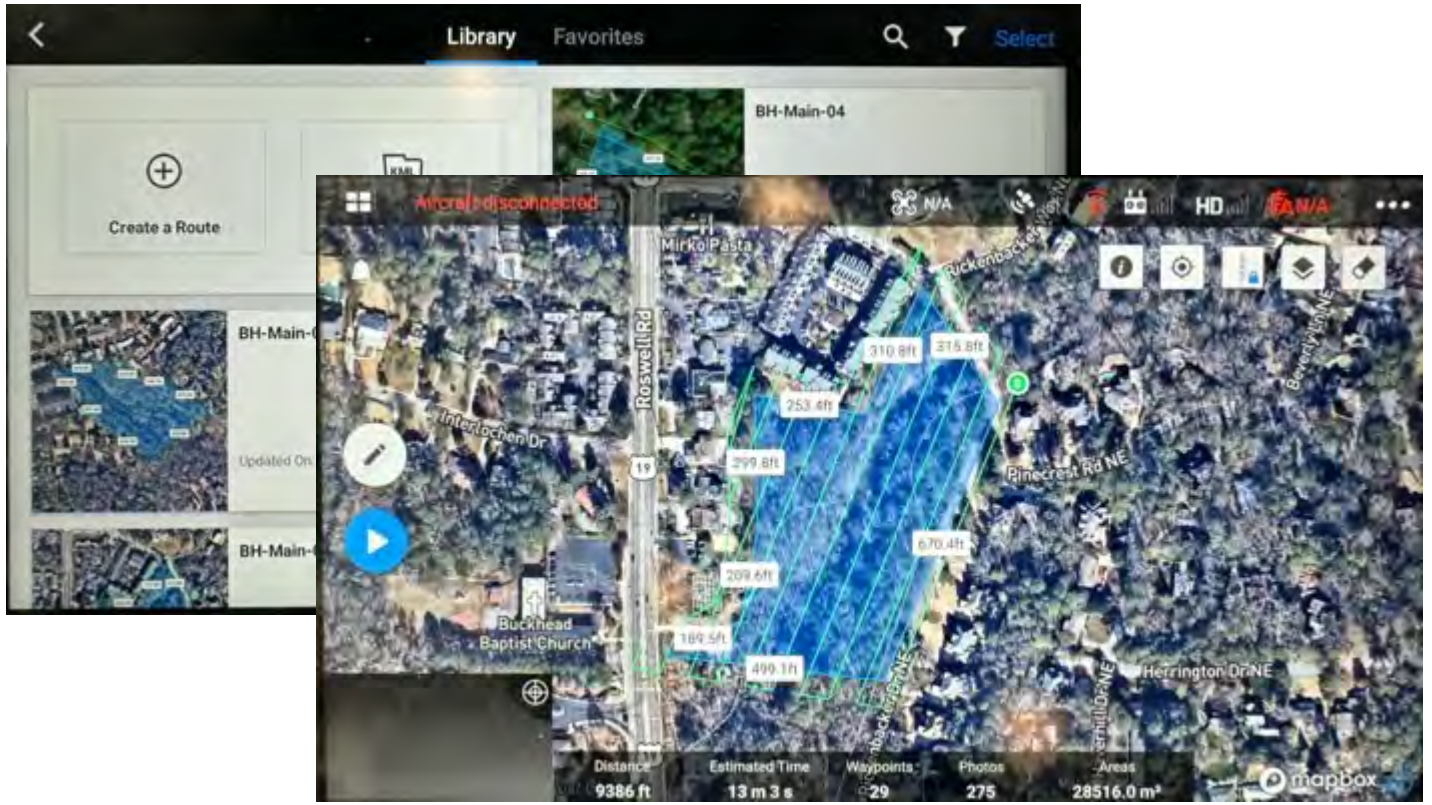
Drone applications in the built environment



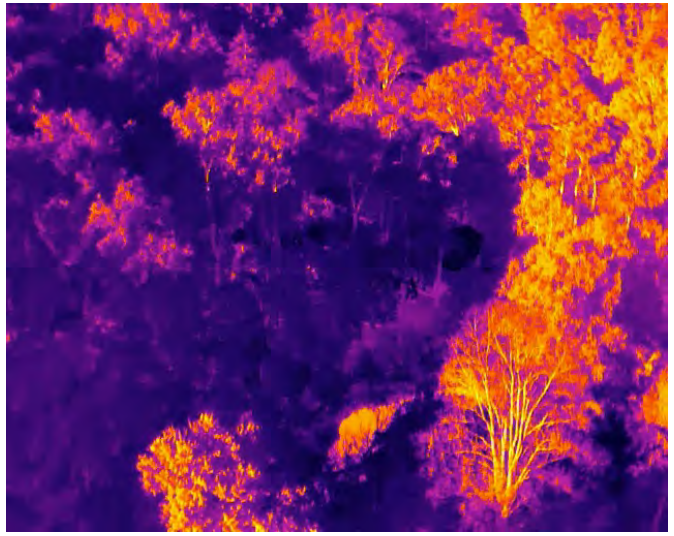
Blue Heron Nature Preserve Data Collection Plan





5 Flights
Approx. 10-15 minutes each
Once per season (Summer 2022, Fall 2022, Winter 2023, Spring 2023)

Baseline-Summer



Comparison-Summer vs. Fall