Tree Canopy Coverage & Change Detection

City of Stonecrest, Georgia | 2017 – 2023

Final Results

PREPARED BY INTERDEV

SEPTEMBER 2025

THE CITY OF STONECREST GEORGIA

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Overview and Results

The purpose of the urban tree study is to assist the city by providing key decision makers and citizens with a quantitative method for monitoring tree canopies. Performing this study over several years is a powerful tool for understanding and monitoring important trends in the city's tree canopy.

Location Map

The study's result is a measurement of tree canopy for each meter of the city and overall percent coverage. This information will provide critical data for the city and its citizens to monitor trends in the tree canopy, pinpoint areas of most change, and assist in targeted tree-planting programs. It will help facilitate informed and educated conversations and decisions around preserving Stonecrest's valuable tree canopy.

This study does not aim to highlight the numerous important factors of maintaining the tree canopy, nor does this study aim to provide recommendations for changes to ordinances or policies used for tree preservation and replacement.

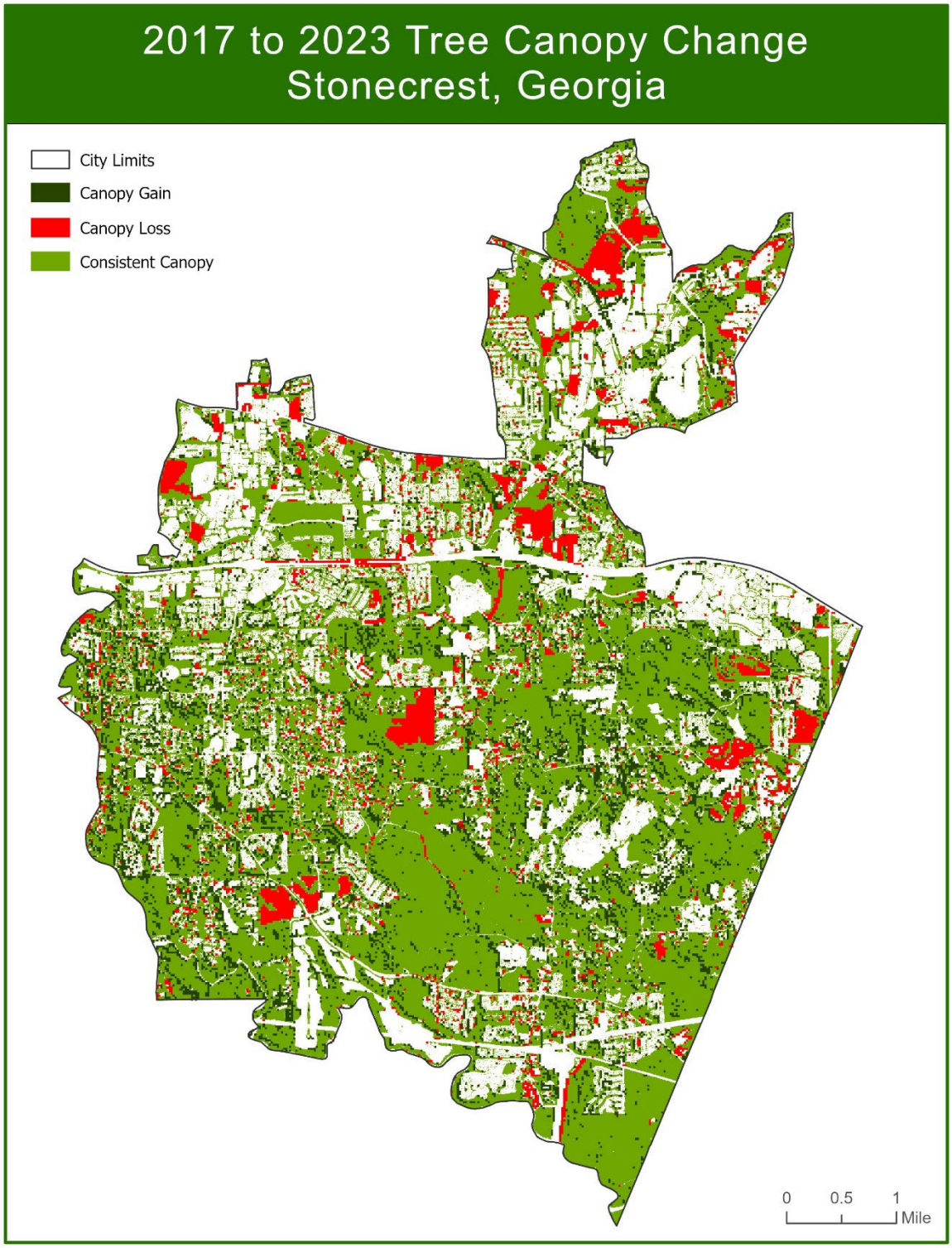
This analysis aims to provide the city with a measurement of tree canopy for each square meter of the city and overall percent coverage.

The table below shows the final results of this study:

Overall Results

Year	2017	2023	Difference
Canopy	61.46%	58.73%	**-2.73%**

The map on the following page depicts the areas of canopy gain, canopy loss, and no change. More detailed maps are in the Appendix.


2017 to 2023 Tree Canopy Change
Stonecrest, Georgia
City Limits
Canopy Gain
Canopy Loss
Consistent Canopy
0
0.5
1
Mile

Methodology

Aerial imagery collected in 2017 and 2023 is analyzed to measure the canopy coverage and change over time.

Imagery

The imagery was obtained through the U.S. Department of Agriculture National Agricultural Imagery Program (USDA NAIP). The NAIP imagery program provides 1-meter resolution aerial imagery collected during the "leaf-on" season on a 3-5-year cycle.

Using satellite imagery obtained through NAIP, this study performs a series of analyses using advanced GIS tools and processes to extract the tree canopy within the city limits. The NAIP imagery program was developed by the U.S. Department of Agriculture to provide satellite imagery during the "leaf-on" season allowing for a variety of different applications, mostly in the farming, agricultural, or timber industries. This study uses this imagery in the urban setting to help calculate Decatur's tree canopy.

NAIP imagery is important because it attempts to produce near identical conditions in imagery collection over 3-5 years. A critical factor in the determination of tree canopy coverage over time is the ability to compare two aerial imagery data sets that were taken years apart that are as close to identical as possible. Identical conditions include variables such as time of day, time of year, pixel size, camera angle, and cloud cover as well as other variables.

Below is side-by-side comparison of the 2017 and 2023 aerial imagery at Mall Parkway and Stonecrest Blvd. The imagery on the left was collected in September 2017. The imagery on the right was collected in September 2023. Notice the shadows of the trees (see red arrow), the shadows are similar in length and angle, indicating that these two aerial photos were taken at a similar time of day but eight years apart.

September 2017 NAIP Imagery

September 2023 NAIP Imagery

Analysis

The processing technique used in this study is called the *Iso Cluster Unsupervised Classification*. This process analyzes each pixel in the image to find natural clusters of values (or colors.) The process programmatically combines millions of pixel values down to 100 different values based on similar characteristics. In essence, it automatically simplifies the colors of the image.

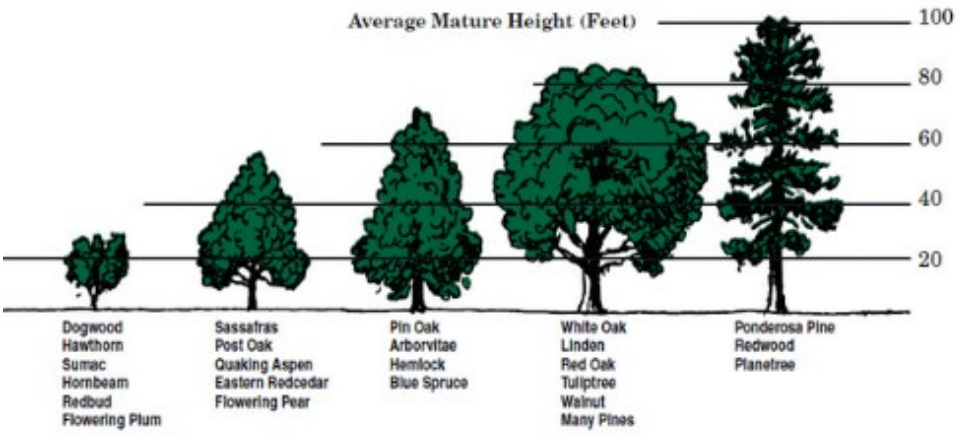
Once all the pixel values are combined into 100 manageable values, the analyst reviewed each of the 100 values and classified them as *Canopy*, *Non-Canopy*, or *Unknown*. We are training the database by essentially using this command:

"We've identified [this] pixel as being tree canopy, now go ahead and identify all similar pixel values as tree canopy."

This command then programmatically assigns all other pixels that have similar values to a tree canopy. This process is then repeated 100 times (one for each of the 100 *Iso Cluster Unsupervised Classification* classes).

If a value is classified as *Unknown*, the analyst will then repeat the *Iso Cluster Unsupervised Classification* process only on the *Unknown* values, and the process is repeated until there are no more *Unknowns.*

This study focuses on high canopy only, as shown in the graphic below. Small shrubs and low-lying vegetation were not considered as part of the tree canopy. In some cases, very thick low-lying vegetation (as in abandoned empty lots) will show up as tree canopy. The study attempts, through our Quality Control (QC) process (see next section), to limit this vegetation from being classified as canopy cover. For this study, we are classifying all low vegetation as *Non-Canopy*.

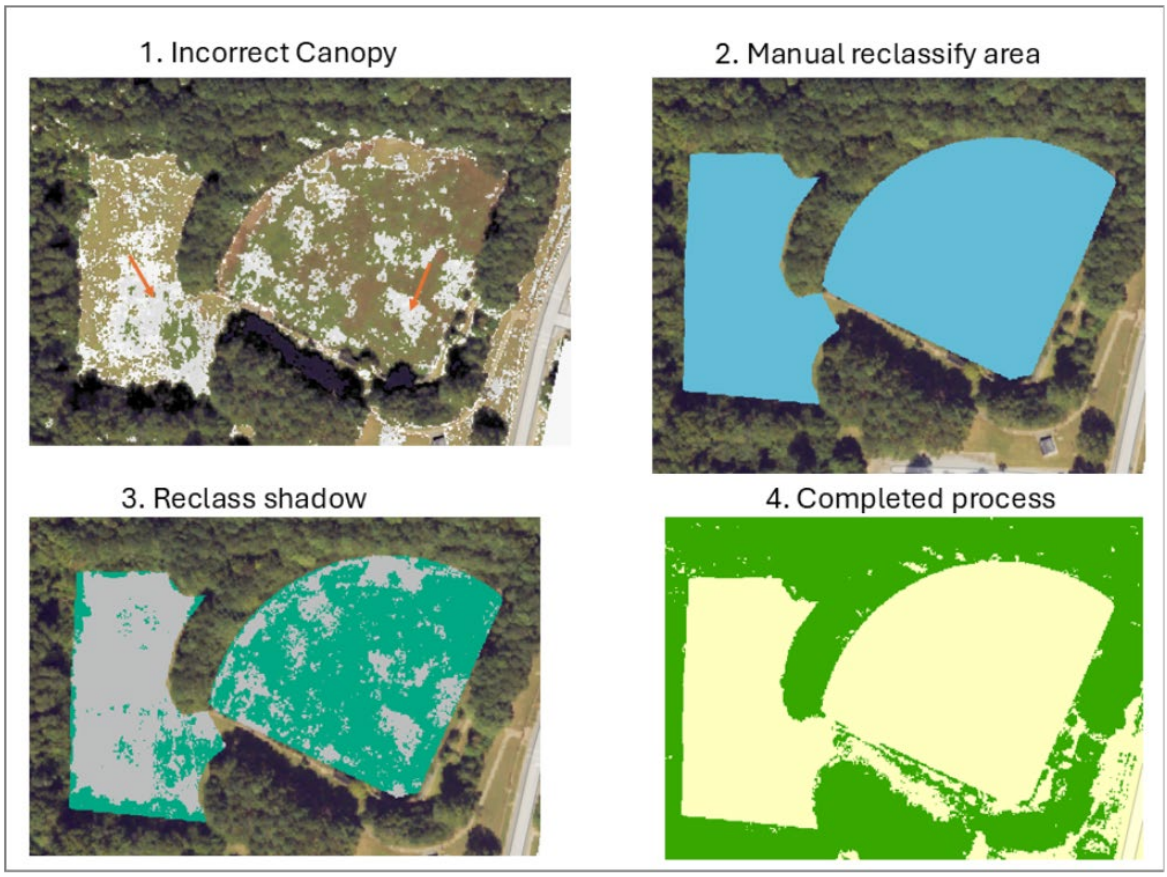


This image shows examples of vegetation that are classified as Tree Canopy. Image Source: Arbor Day Foundation

Quality Control (QC)

Once the analysis was complete, the analyst visually inspected and identified major errors in the classification process. Errors are identified and corrected in the method outlined below. In this example, the baseball fields have been identified as having major errors.

1. Several thick patches of grass are incorrectly classified as tree canopy on this baseball field.
2. Our analyst created a polygon-shaped baseball field over the area that needs to be corrected.
3. Pixels within the polygon are reclassified within the baseball field layer to Non-Canopy.
4. All pixels on the baseball field are classified correctly.

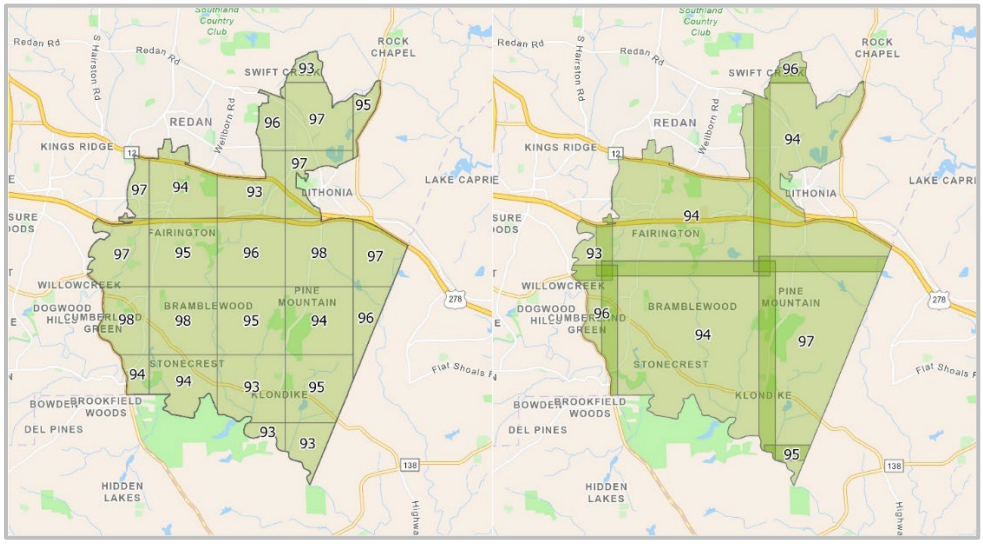


Quality Control Process

Accuracy Assessment

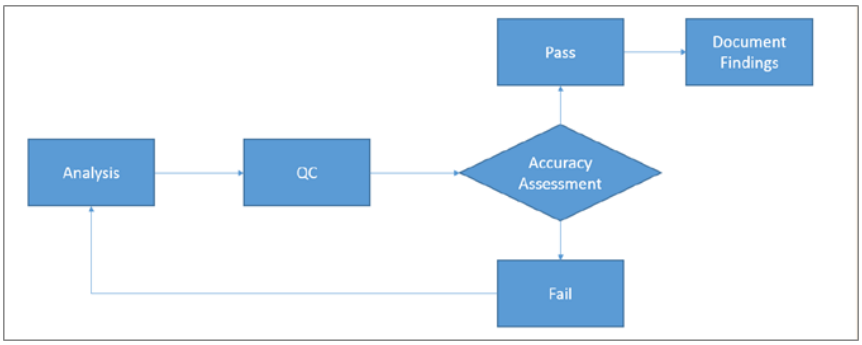
Using a random point generator, 100 points were created within the defined grid area for each study year. Each one of those points were manually classified by our analyst as Canopy or Non-canopy. We compared those classifications with the classifications determined in the automated classification process described above.

To meet accuracy standards, both the individual grids and the overall results were required to achieve a minimum accuracy of 90 percent. Over 3,000 points were generated and individually evaluated to validate these results. The final accuracy for each year following this assessment was 95 percent.



Accuracy Assessment Year 2017 (left) and 2023 (right)

A review of several other tree canopy studies indicated that an accuracy assessment greater than 90% is well above the industry standard for this type of study. If less than 90 points matched, then our team would go back and fix the errors until we received a higher than 90% accuracy threshold. The graphic below shows the process.



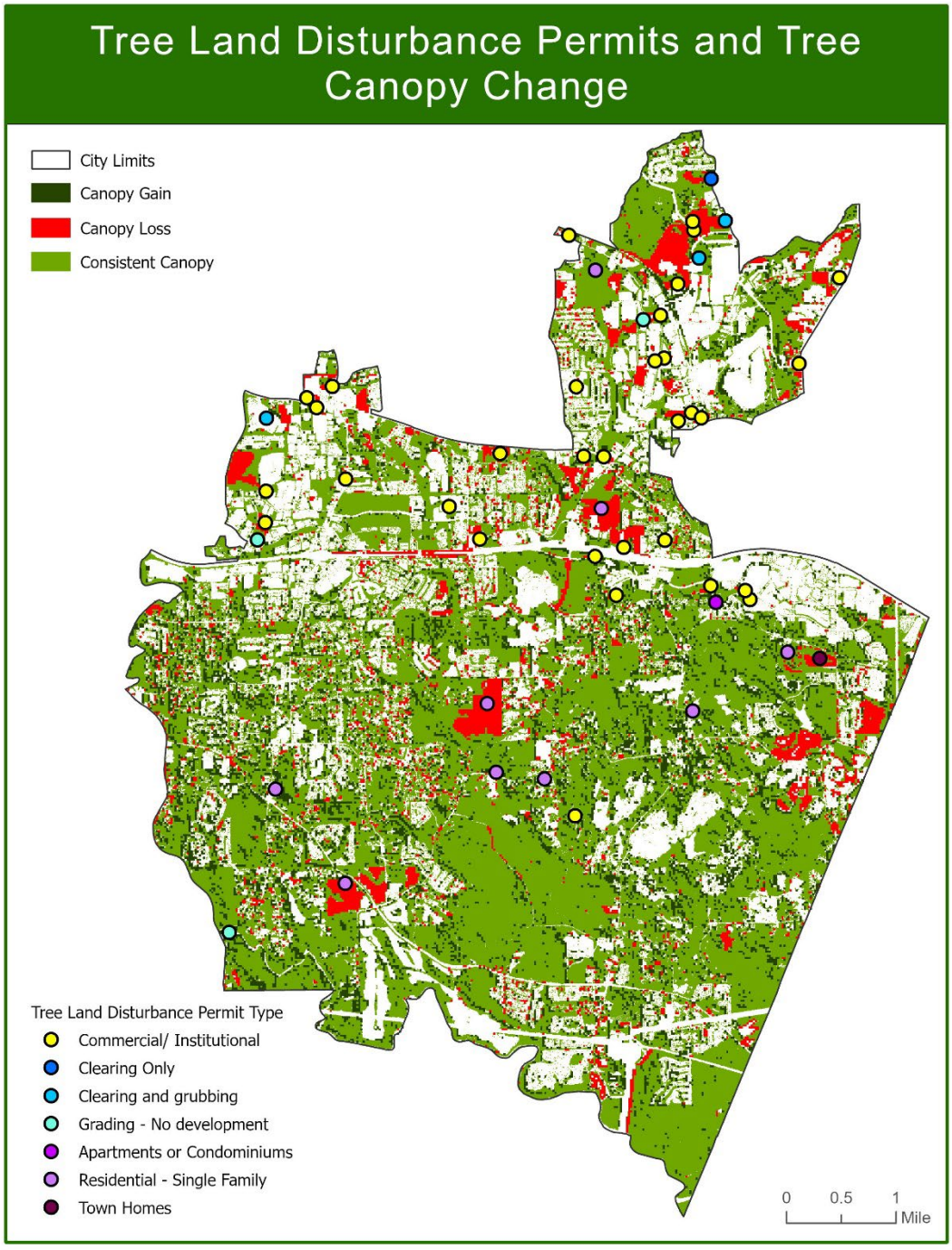
Results by Land Use Type

The following table shows the results of canopy change calculations broken down by Land Use type.

Land Use Category	Canopy 2017	Canopy 2023	Difference
City Center	48.33%	44.65%	-3.68%
Conservation / Open Space	74.99%	81.69%	+6.70%
Heavy Industrial	48.36%	41.09%	-7.27%
Institutional	50.10%	54.57%	+4.47%
Light Industrial	43.21%	39.40%	-3.81%
Neighborhood Center	39.03%	30.38%	-8.65%
Office Professional	67.12%	64.14%	-2.98%
Regional Center	38.03%	40.75%	+2.72%
Rural Residential	68.23%	74.42%	+6.19%
Suburban	59.84%	62.24%	+2.40%
Urban Neighborhood	53.26%	56.07%	+2.81%

Results by Development

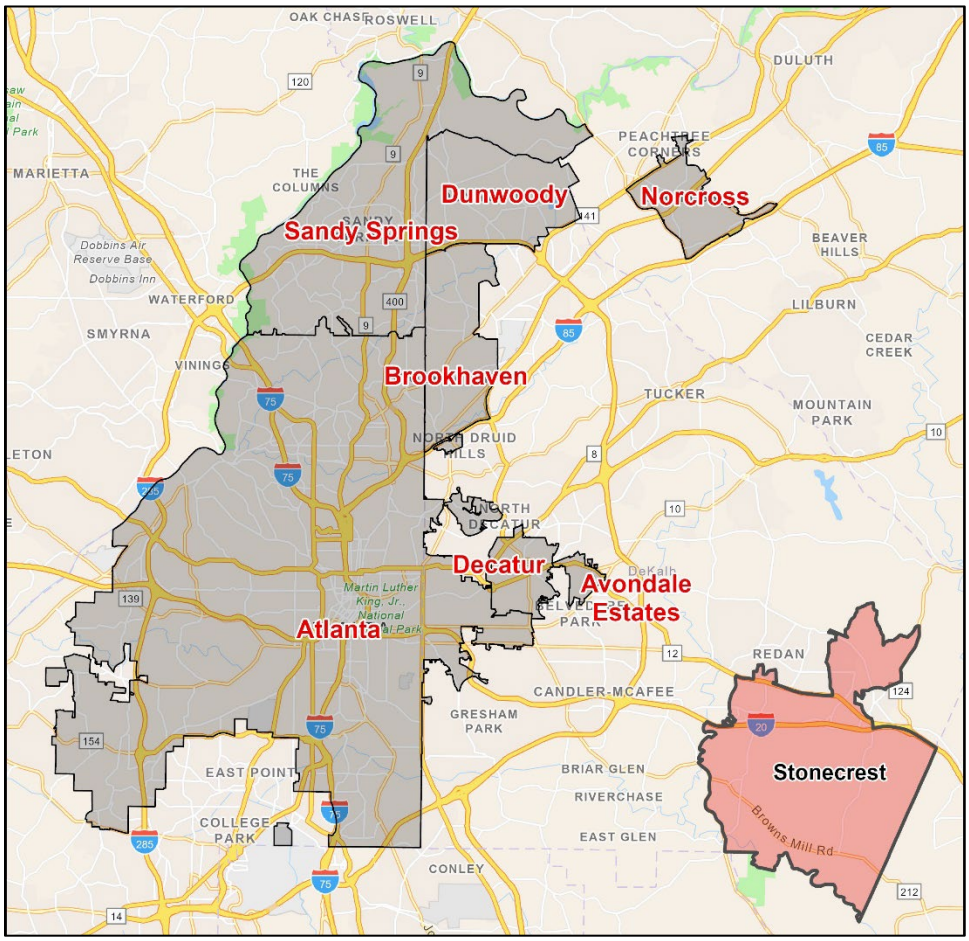
The map below shows the number of Tree Land Disturbance Permits issued by the City between 2019 and 2023, categorized by permit type. Permit data from 2017 and 2018 is not included, as records from those years are either unavailable in the current data system or may have been managed by DeKalb County before Stonecrest was established.



Comparison of Cities

A quick comparison of tree canopy coverage for other cities in the Atlanta area:

Metro Atlanta Comparison Cities	Year	Percent Tree Canopy Coverage
City of Atlanta	2018	46.5%
City of Avondale Estates	2015	54.0%
City of Brookhaven	2023	45%
City of Decatur	2019	57%
City of Dunwoody	2019	47%
City of Norcross	2015	41.1%
City of Sandy Springs	2023	54.5%
City of Stonecrest	2023	58.73%

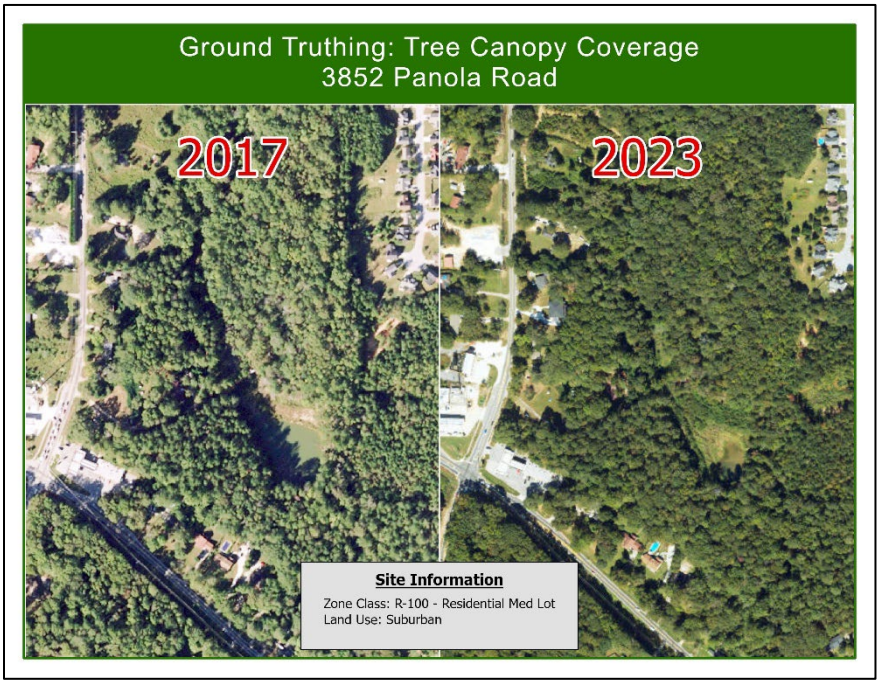


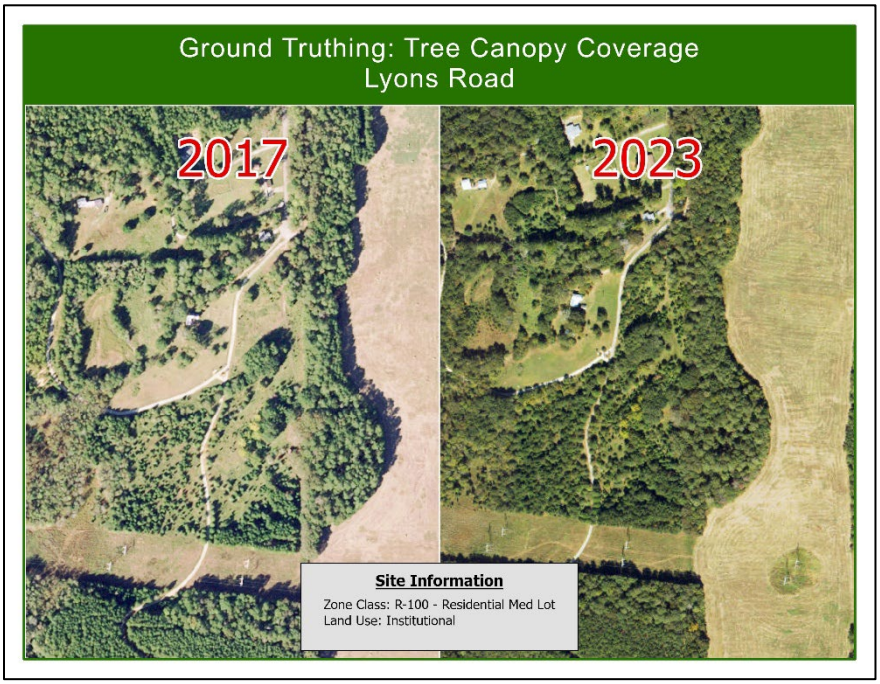
Location Map

Ground Truthing Exercise

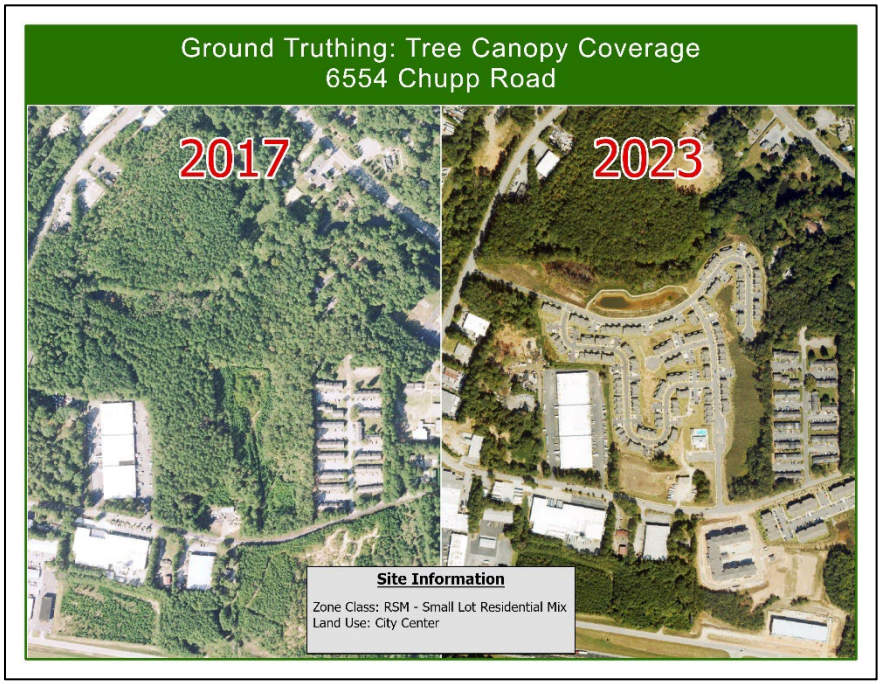
Maps were created from selected sites exhibiting canopy loss and gain to validate the study's findings. The maps below highlight key areas of change; all maps produced for the ground truthing exercise can be found in the appendix.

Examples of Canopy Gain





Examples of Canopy Loss



i-Tree Canopy Report

i-Tree Canopy is a free online tool that estimates tree canopy cover by randomly generating sample points, which are then manually classified as canopy or non-canopy. This report was used to augment our results and provide additional estimates of the benefits associated with tree cover. The i-Tree Canopy results are listed below:

Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (mi²) ± SE
NT	Non-Tree	All other surfaces	40	40.00 ± 4.90	15.24 ± 1.87
T	Tree	Tree, non-shrub	60	60.00 ± 4.90	22.87 ± 1.87
Total			**100**	**100.00**	**38.11**

Tree Benefit Estimates: Carbon (English units)

Description	Carbon (kT)	±SE	CO_2 Equiv. (kT)	±SE	Value (USD)	±SE
Sequestered annually in trees	19.98	±1.63	73.25	±5.98	$8,644,325	±705,806
Stored in trees (Note: this benefit is not an annual rate)	501.68	±40.96	1,839.50	±150.19	$217,091,424	±17,725,441

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 0.874 kT of Carbon, or 3.203 kT of CO_2, per mi²/yr and rounded. Amount stored is based on 21.940 kT of Carbon, or 80.446 kT of CO_2, per mi² and rounded. Value (USD) is based on $432,727.12/kT of Carbon, or $118,016.49/kT of CO_2 and rounded. (English units: kT = kilotons (1,000 tons), mi² = square miles)

Tree Benefit Estimates: Air Pollution (English units)

Abbr.	Description	Amount (T)	±SE	Value (USD)	±SE
CO	Carbon Monoxide removed annually	6.61	±0.54	$2,584	±211
NO2	Nitrogen Dioxide removed annually	33.06	±2.70	$811	±66
O3	Ozone removed annually	351.49	±28.70	$40,764	±3,328
SO2	Sulfur Dioxide removed annually	33.02	±2.70	$140	±11
PM2.5	Particulate Matter less than 2.5 microns removed annually	17.37	±1.42	$85,314	±6,966
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	124.90	±10.20	$244,699	±19,980
Total		**566.45**	**±46.25**	**$374,311**	**±30,562**

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 T/mi²/yr @ $/T/yr and rounded:
CO 0.289 @ $391.02 | NO2 1.446 @ $24.54 | O3 15.372 @ $115.97 | SO2 1.444 @ $4.24 | PM2.5 0.760 @ $4,911.46 | PM10* 5.462 @ $1,959.12 (English units: T = tons (2,000 pounds), mi² = square miles)

Tree Benefit Estimates: Hydrological (English units)

Abbr.	Benefit	Amount (Mgal)	±SE	Value (USD)	±SE
AVRO	Avoided Runoff	13.14	±1.07	$117,416	±9,587
E	Evaporation	1,084.14	±88.52	N/A	N/A
I	Interception	1,089.55	±88.96	N/A	N/A
T	Transpiration	1,679.97	±137.17	N/A	N/A
PE	Potential Evaporation	8,243.15	±673.05	N/A	N/A
PET	Potential Evapotranspiration	8,243.15	±673.05	N/A	N/A

Currency is in USD and rounded. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Hydrological Estimates are based on these values in Mgal/mi²/yr @ $/Mgal/yr and rounded:
AVRO 0.575 @ $8,936.00 | E 47.413 @ N/A | I 47.649 @ N/A | T 73.470 @ N/A | PE 360.495 @ N/A | PET 360.495 @ N/A (English units: Mgal = millions of gallons, mi² = square miles)

References and Data Sources

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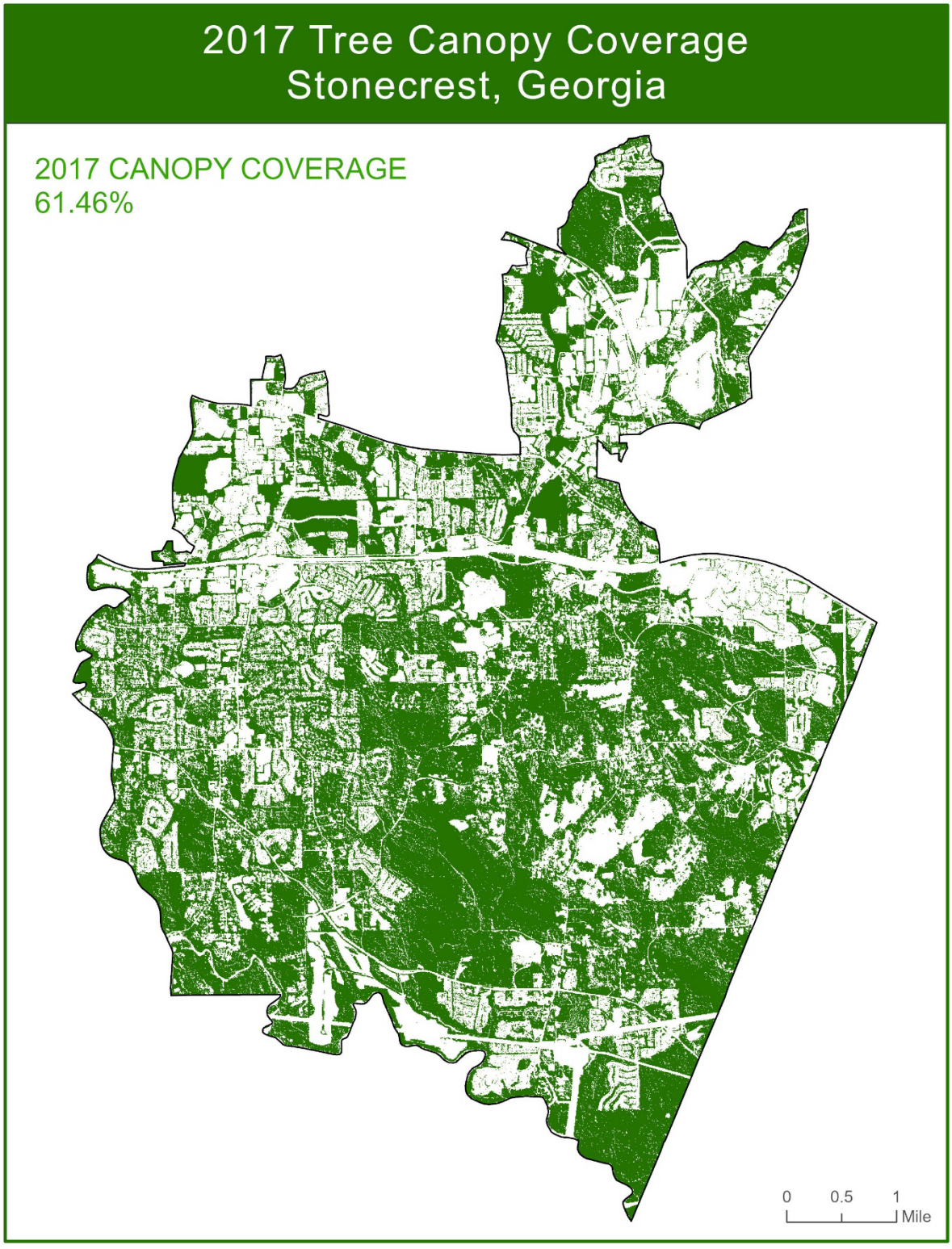
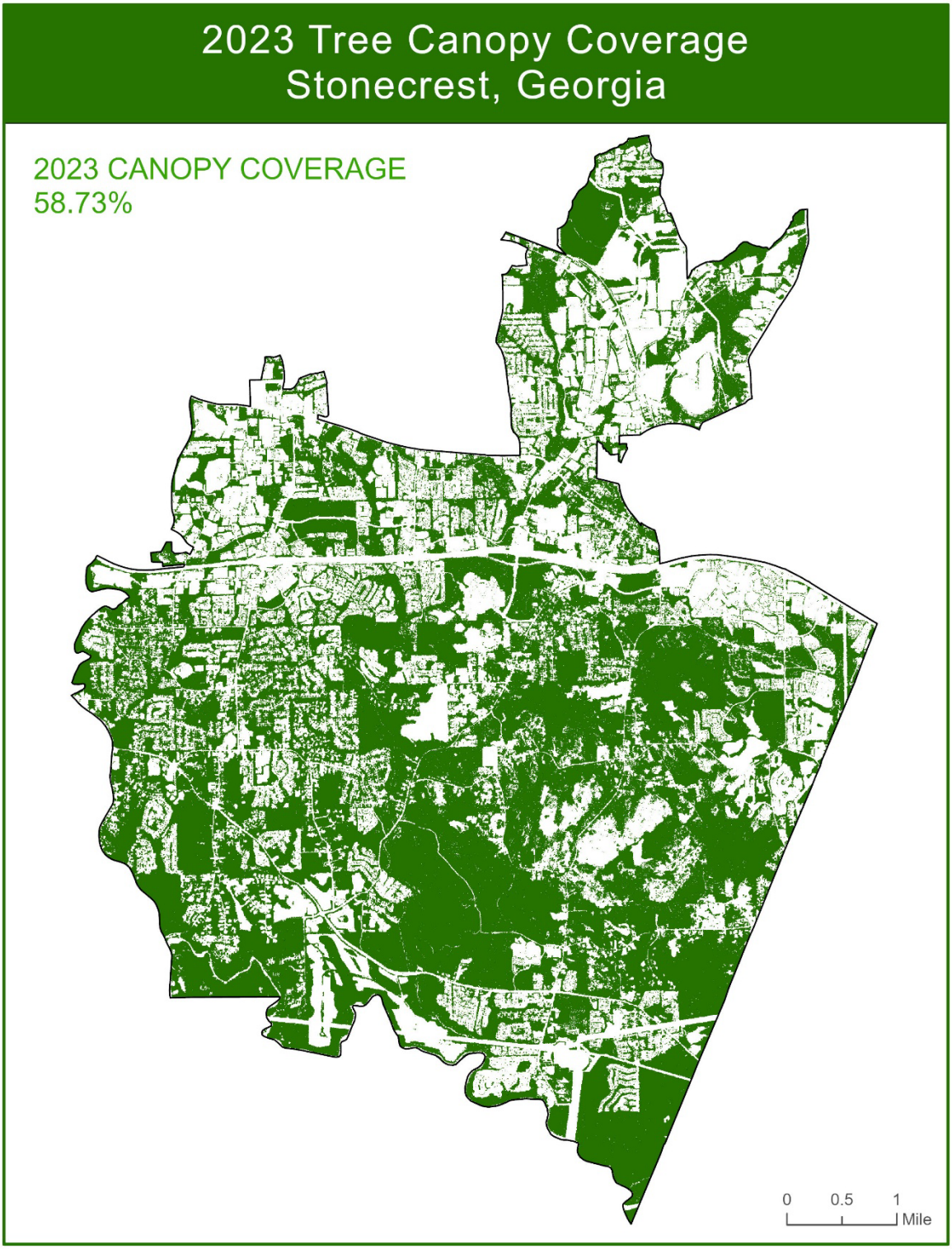
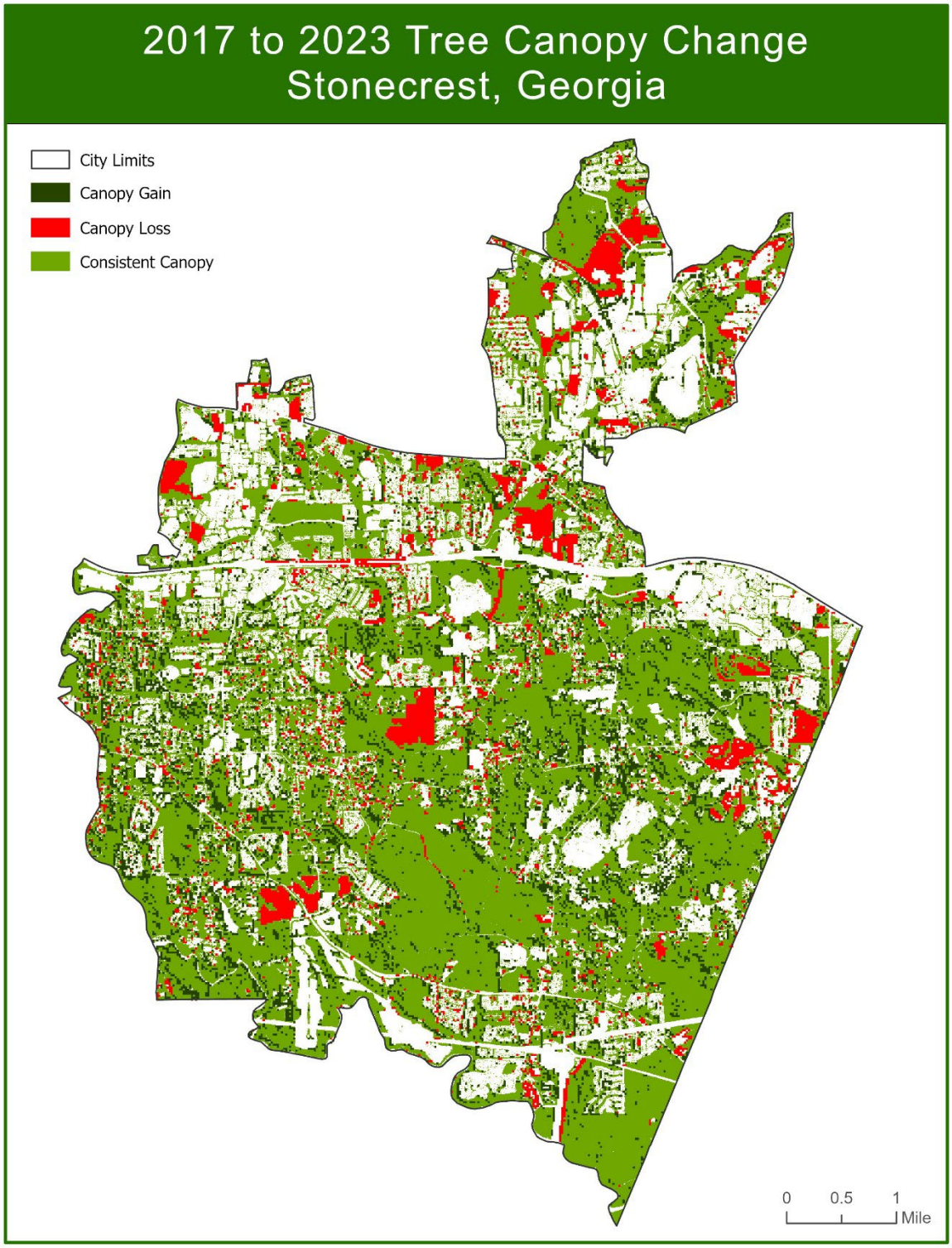
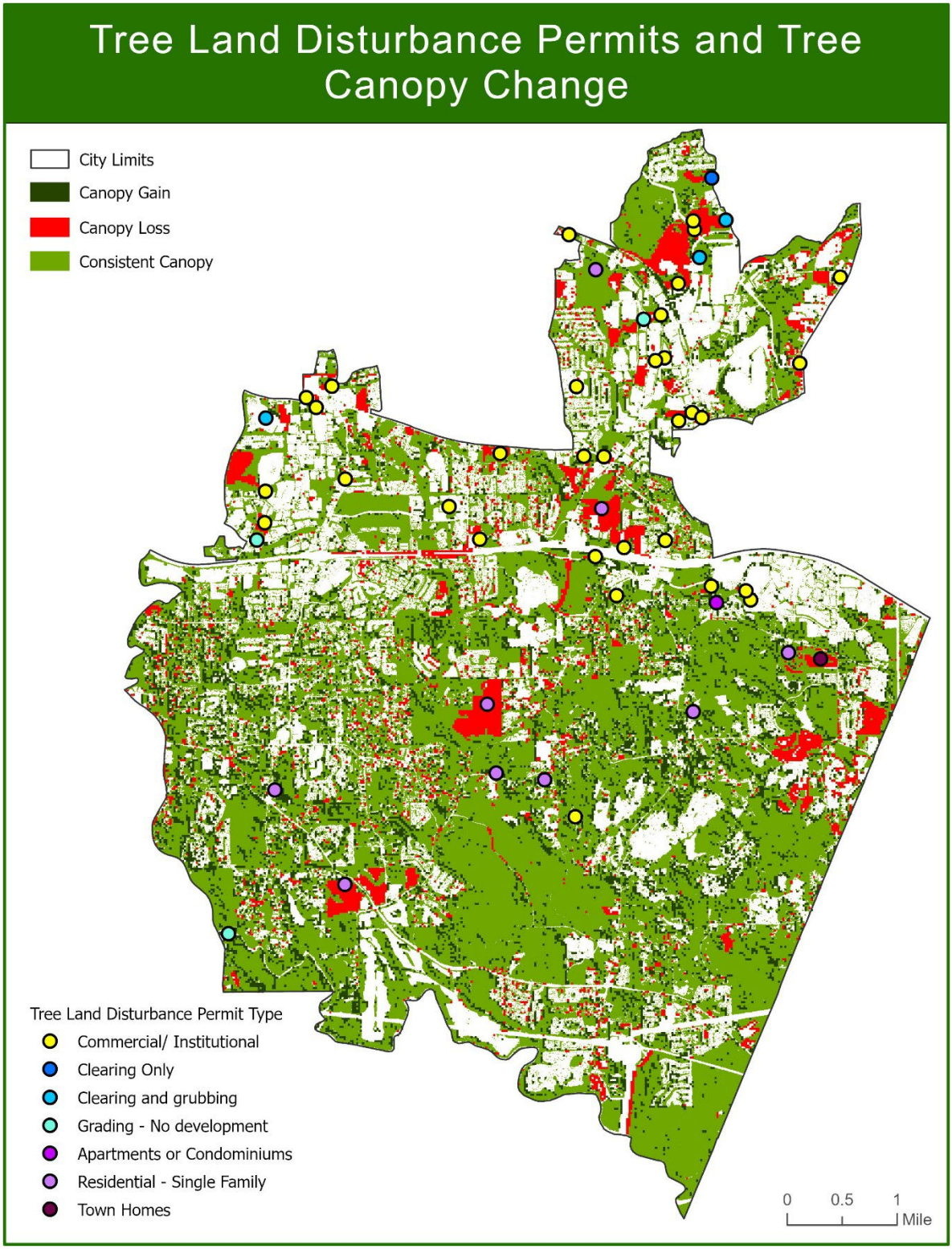
Appendix

The following pages contain a series of maps identifying tree canopy coverage and tree canopy change between the years of 2017 and 2023.


2017 Tree Canopy Coverage
Stonecrest, Georgia
2017 CANOPY COVERAGE
61.46%
0
0.5
1
Mile


2023 Tree Canopy Coverage
Stonecrest, Georgia
2023 CANOPY COVERAGE
58.73%
0
0.5
1
Mile

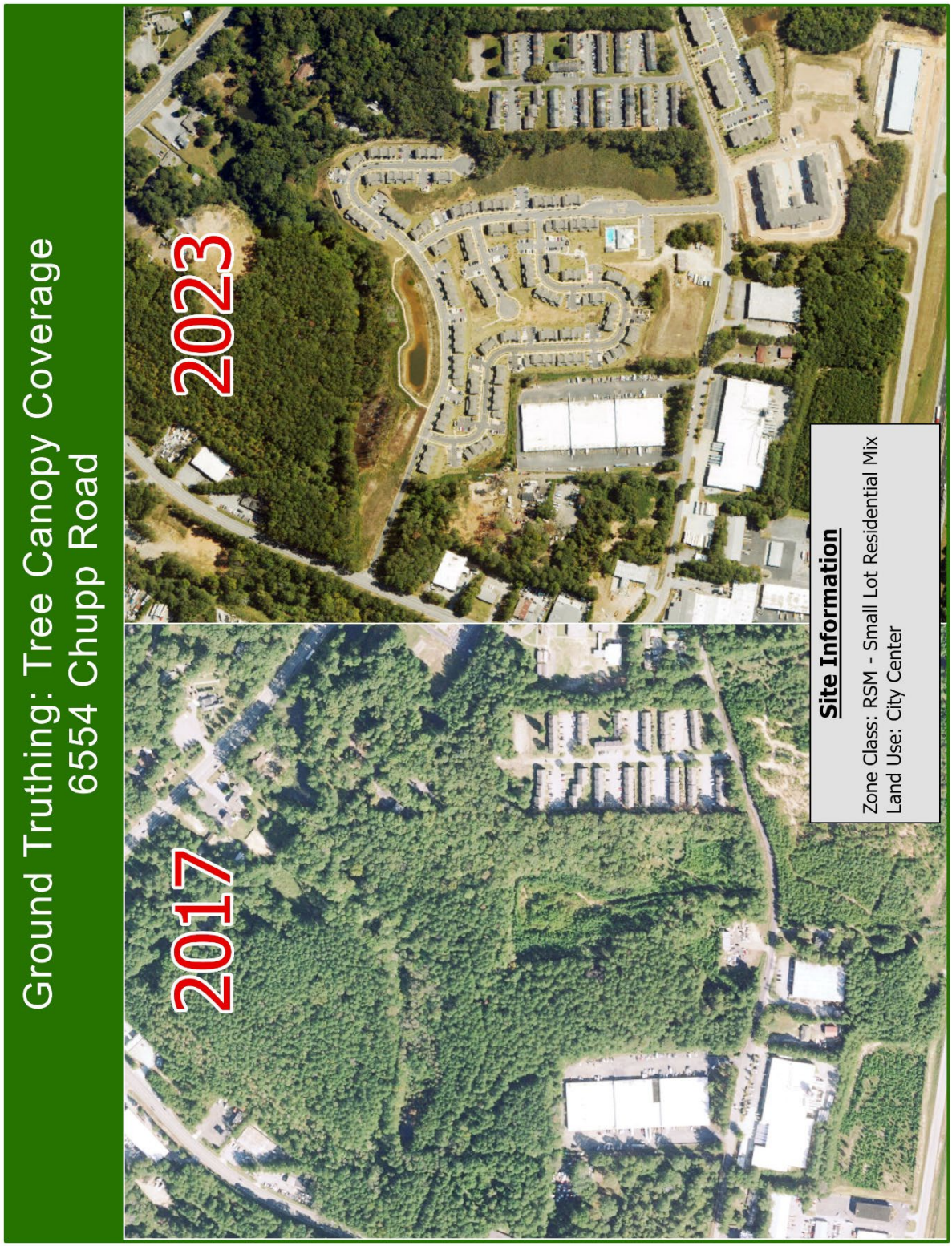

2017 to 2023 Tree Canopy Change
Stonecrest, Georgia
City Limits
Canopy Gain
Canopy Loss
Consistent Canopy
0
0.5
1
Mile

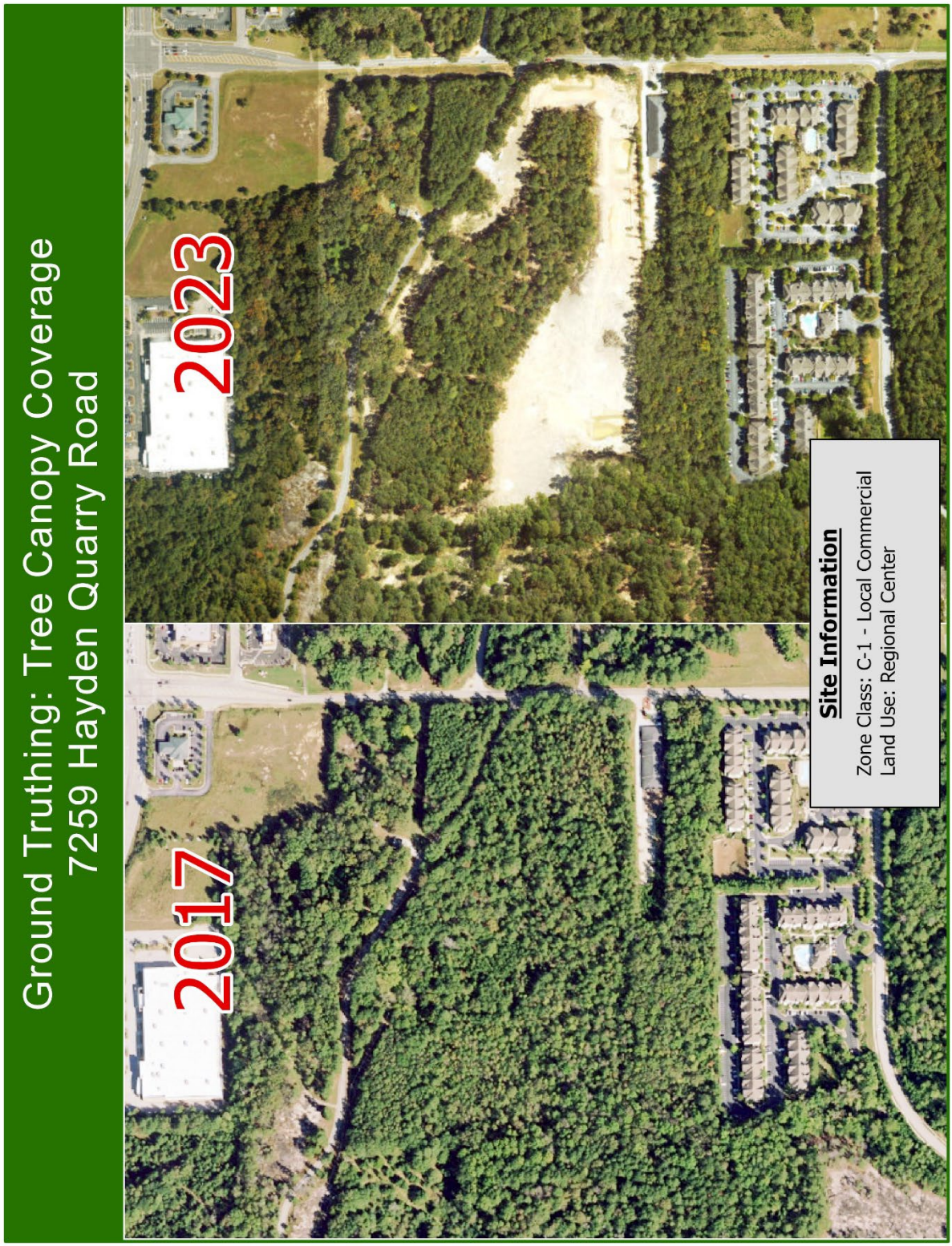

Tree Land Disturbance Permits and Tree Canopy Change
City Limits
Canopy Gain
Canopy Loss
Consistent Canopy
Tree Land Disturbance Permit Type
Commercial/ Institutional
Clearing Only
Clearing and grubbing
Grading - No development
Apartments or Condominiums
Residential - Single Family
Town Homes
0
0.5
1
Mile


Ground Truthing: Tree Canopy Coverage
3852 Panola Road
2023
2017
Site Information
Zone Class: R-100 - Residential Med Lot
Land Use: Suburban

Ground Truthing: Tree Canopy Coverage
6206 Covington Highway
2023
2017
Site Information
Zone Class: RSM - Small Lot Residential Mix
Land Use: Neighborhood Center


Ground Truthing: Tree Canopy Coverage
2295 Park Central Boulevard
2023
2017
Site Information
Zone Class: M - Light Industrial
Land Use: Light Industrial


Ground Truthing: Tree Canopy Coverage
6554 Chupp Road
2023
2017
Site Information
Zone Class: RSM - Small Lot Residential Mix
Land Use: City Center


Ground Truthing: Tree Canopy Coverage
7259 Hayden Quarry Road
2017
2023
Site Information
Zone Class: C-1 - Local Commercial
Land Use: Regional Center

Ground Truthing: Tree Canopy Coverage
7345 Rockland Road
2017
2023
Site Information
Zone Class: OD - Office-Distribution
Land Use: Office Professional

Ground Truthing: Tree Canopy Coverage
Lithonia Industrial Blvd Expansion


Ground Truthing: Tree Canopy Coverage
Lyons Road
2023
2017
Site Information
Zone Class: R-100 - Residential Med Lot
Land Use: Institutional

Ground Truthing: Tree Canopy Coverage
Stonecrest Industrial Way