

# NOISE BUFFERING ASSESSMENT AND TREES

## EXECUTIVE SUMMARY

August 2022



**SAVANNAH TREE  
FOUNDATION**  
*Our Trees - Our Future*





# NOISE BUFFERING ASSESSMENT AND TREES

## ABSTRACT

In 2022, Savannah Tree Foundation collaborated with Savannah College of Art and Design (SCAD) to enhance Savannah's urban tree canopy equity. Over the course of two quarters, graduate student researchers from a variety of backgrounds worked to address the greatest areas of opportunity and compare tree density, temperature readings and potential impacts thereof in four of Savannah's neighborhoods: specifically, Ardsley Park, Hudson Hill, West Savannah and Woodville.

Through countless hours of on-ground tree surveying, temperature monitoring and studying secondary research, the goal is to collect data to help Savannah Tree Foundation communicate with the public, develop new initiatives and successfully obtain grants through unbiased research.

### Image:

**The Ardsley Park Area benefits from tree canopy coverage along the streets of the neighborhood. People can enjoy outdoor activities such as walking their pets and jogging.**

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PLANT x ENGAGE x PROTECT



## About Savannah Tree Foundation

Founded in 1982, Savannah Tree Foundation protects and grows Chatham County's urban forest through tree planting, community engagement, and advocacy.

Trees are one of Chatham County's most treasured natural resources. Beyond their beauty and cultural significance, the impacts of trees are far-reaching and compounding, spanning from economic benefits to health improvements to climate change resilience. Trees are woven into almost every aspect of our lives.

**Savannah Tree Foundation has coordinated the planting of over 5,000 trees in Chatham County.**

While it is easy to take our live oaks and magnolias for granted, our trees are facing an increasing number of natural and man-made threats. Sprawling construction, increased severe weather, encroaching salt water levels, and a lack of funding for proper maintenance all contribute to tree loss in our region. If we are to continue enjoying the beauty and benefits of our trees, we must protect the trees we have and plant the trees of tomorrow. Properly cared for, our urban forest will create a safer and healthier community. Our trees will shape our future. For more information, visit [savannahtree.org](http://savannahtree.org).

**Image (Left): Savannah Tree Foundation founders Susie Williams, Linda Beam and Page Hungerpiller, 1978.**

### MISSION

Savannah Tree Foundation protects and preserves Chatham County's urban forest through tree planting, community engagement, and advocacy.



### VISION

To inspire and educate our community to create and sustain a healthy urban forest today, tomorrow, and forever.



# Introduction

A U.S. DEPARTMENT OF ENERGY STUDY REPORTS THAT TREES AND SHRUBS CAN REDUCE NOISE LEVELS BY 50 PERCENT AS PERCEIVED BY THE HUMAN EAR.

## **NOISE BUFFERING AND TREES**

This report attempts to explore the significance of noise on personal wellbeing through its impact on overall health and wellness. Noise pollution can be quantified as interfering with normal activities such as sleeping, conversation, or disrupting or diminishing one's quality of life. There are some key ways in which communities can reduce the impact of noise pollution and resulting disruption to daily life. We will explore these solutions at an individual and city-wide level as well as dive into the Savannah-specific noise pollution data by the target neighborhoods studied for this report.



# Key Insights



## NOISE POLLUTION IMPACT

**Noise pollution adversely affects the health of millions of people.**

Problems related to noise include stress related illnesses, high blood pressure, speech interference, hearing loss, sleep disruption, and lost productivity.

Noise Induced Hearing Loss (NIHL) is the most common and often discussed health effect, but research has shown that exposure to constant or high levels of noise can cause countless adverse health effects.

(EPA)



## NOISE ABSORPTION BY PLANTS

**Plants are contributors to sound absorption due to their dynamic surface area.**

Tree parts such as stems, leaves, branches, and wood absorb sound waves. Thick, rough bark and fleshy leaves are particularly most effective at sound absorption due to their dynamic surface area. In the case of shrubs, their size matters.



## SOUND DEFLECTION BY PLANTS

**Trees can also deflect and transform sound waves into other energy forms causing sound wave interference and reduce noise.**

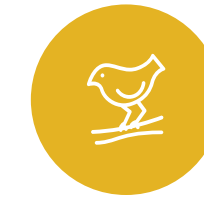
When sound waves hit the massive tree trunks, the trunks do not vibrate because they are rigid. Sound waves are reflected off the trunks and back toward the source. Whereas when sound hits a flexible surface like leaves, leaves will vibrate and sound waves are transformed into other energy forms. It can also change the phase of a sound, which can cause interference in sound waves and a reduction in noise.



## SOUND REFRACTION BY PLANTS

**Trees refract sound waves creating echoes that help sound disappear.**

As we know sound waves can be refracted. For example, if sound hit on solid floors, the waves bounce all over and create echoes; and with carpeting, the echoes disappear. Ground covering plants, vines on walls, and green walls help achieve the same effect.



## SOUND MASKING BY PLANTS

**Beyond masking sound through deflection and refractions, trees attract animal species such as bird and squirrels that help mask noise pollution.**

Trees mask annoying noise when branches sway, leaves rustle or stems creak. Trees and shrubs also attract birds and squirrels, whose chirping and squeaking helps mask noise pollution.



## TREE BARRIER AND SOUND REDUCTION

**Trees contribute to attenuating higher frequency sounds creating overall sound reduction.**

A tree barrier with an open distance of 100 feet can reduce sound by 21dB. Research shows that soft ground surfaces attenuate low-frequency noise, while trees and shrubs attenuate high frequencies.

A tactically designed 100-foot-wide tree barrier will reduce noise by 5 to 8 decibels (dBA).

(USDA)



# Who Does This Impact?

This research is based on four neighborhoods located in Savannah, Georgia. Here is an overview of the history of the neighborhoods included: Ardsley Park, Hudson Hill, West Savannah and Woodville.

The area that became Hudson Hill, West Savannah and Woodville originally belonged to the Yamacraw. In 1757, the lands were handed over to the crown who then distributed them to colonists. It then became the Royal Valley Plantation.

People settled in the area during the early 20th century, and residential development happened in the late nineteenth century.

Work was the magnet that brought families into West Savannah, Hudson Hill and Woodville, primarily through the railroad. However, this began to decrease by the 1970s, and crumbled in the 1990s.

The Ardsley Park neighborhood is the result of two planned subdivisions that were laid out in 1909 and 1910. This was a time of great growth and prosperity in Savannah and substantial houses of the neighborhood reflect this affluence.

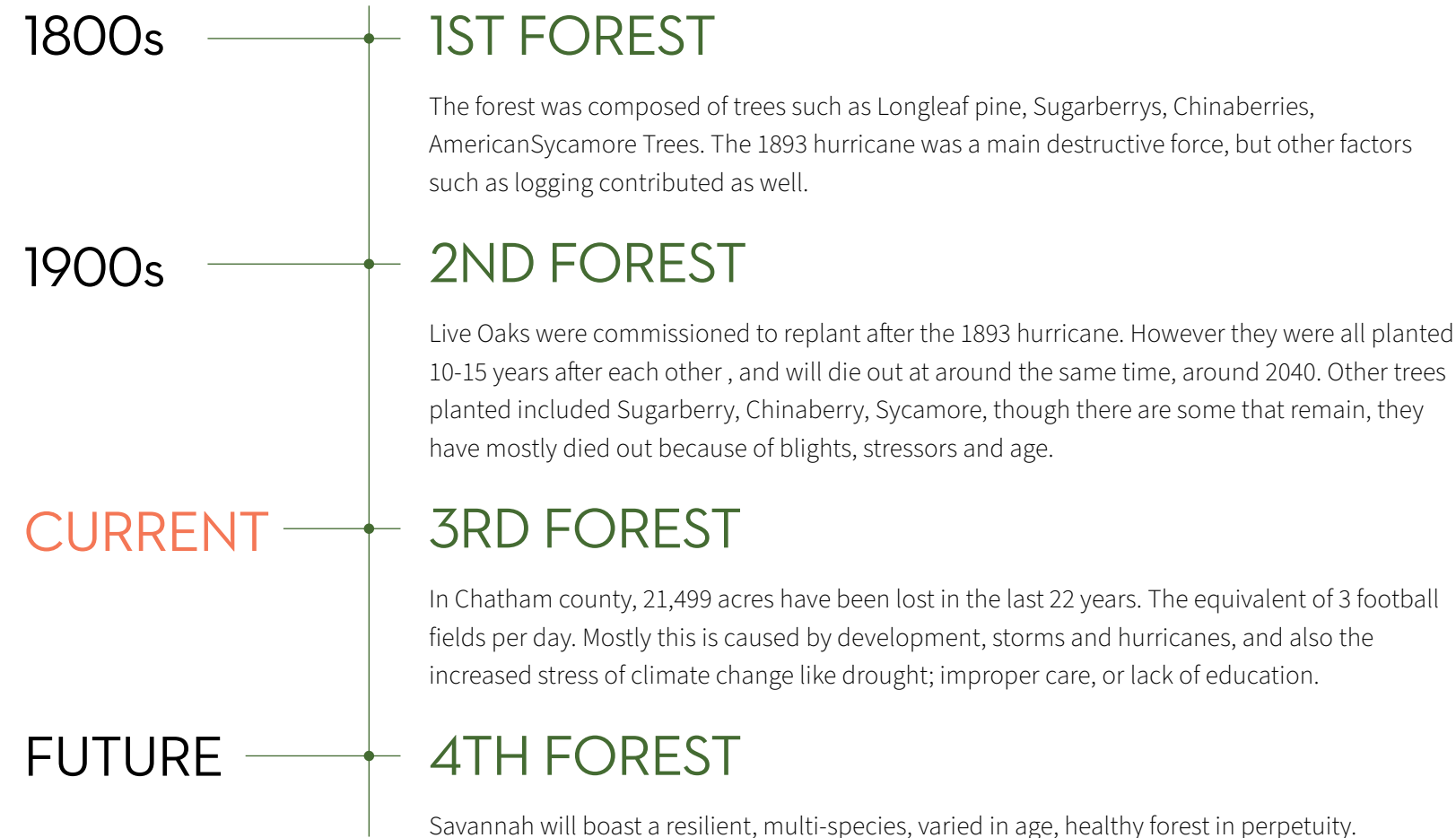
The developers of Ardsley Park, Savannah-natives Harry Hays Lattimore and William Lattimore, laid out the neighborhood according to a strict grid with one-acre landscaped parks placed in regular intervals and offset along the north-south corridor of Abercorn Street.

**Sources: *Low Land and the High Road: Life and community in Hudson Hill, West Savannah, and Woodville Neighborhoods*, Public Library of Savannah's historical records and Historic Savannah Foundation.**

<b>ARDSLEY PARK</b>	
<b>Residents</b> 3,338	<b>Demographics</b> 84% White
<b>Average Income</b> \$81,224	12.4% Asian & other 2.9% Black
<b>WEST SAVANNAH</b>	
<b>Residents</b> 3,653	<b>Demographics</b> 54.6% Black
<b>Average Income</b> \$22,578	28% White 16.5% Asian & other
<b>HUDSON HILL</b>	
<b>Residents</b> 2,320	<b>Demographics</b> 78.4% Black
<b>Average Income</b> \$22,578	12% Asian & other 9.5% White
<b>WOODVILLE</b>	
<b>Residents</b> 460	<b>Demographics</b> 52.9% Black
<b>Average Income</b> \$39,333	26.6% Asian & other 21.5% White

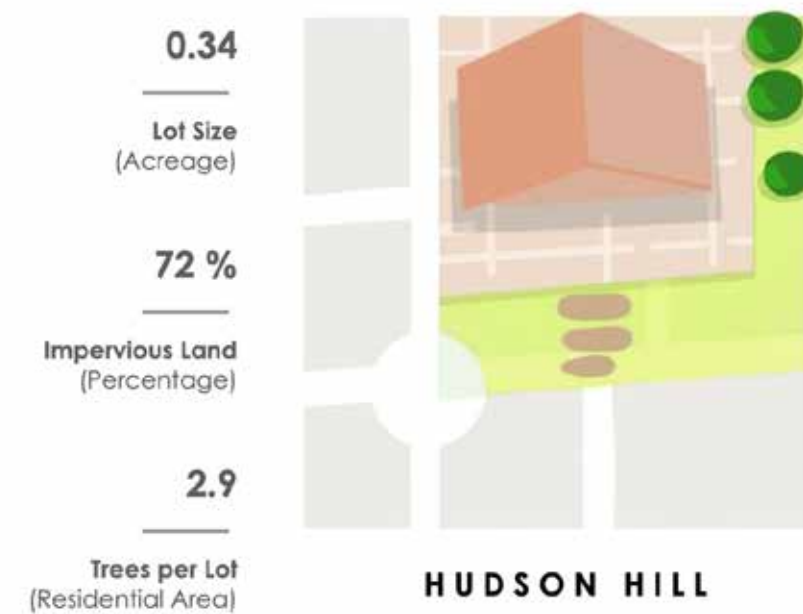
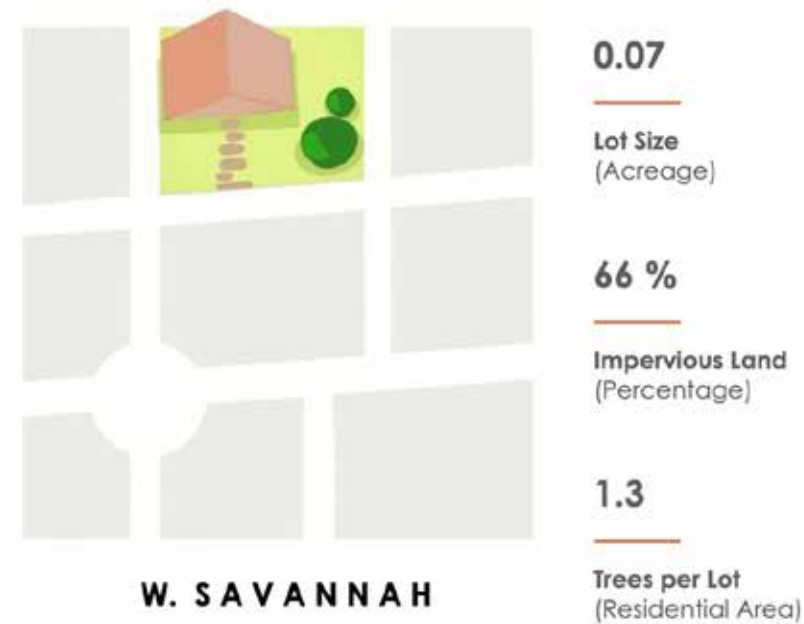
Source: point2homes.com and city-data.com

# History of Savannah's Urban Forest





# Impervious Land and Trees Per Lot Comparison

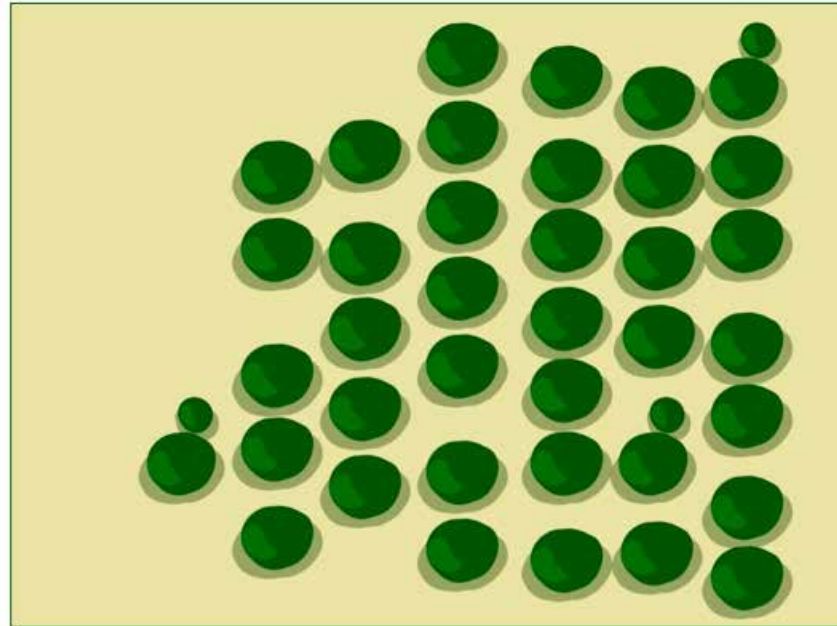


The above graphics depict our four focus neighborhoods, with the average lot sizes, house sizes and tree coverage by neighborhood. While the percentage of impervious land may seem similar across neighborhoods, the above graphics illustrate the contrast between lot size and tree coverage.



# Trees Per Acre and Per Person

## ARDSLEY PARK



**38.2**

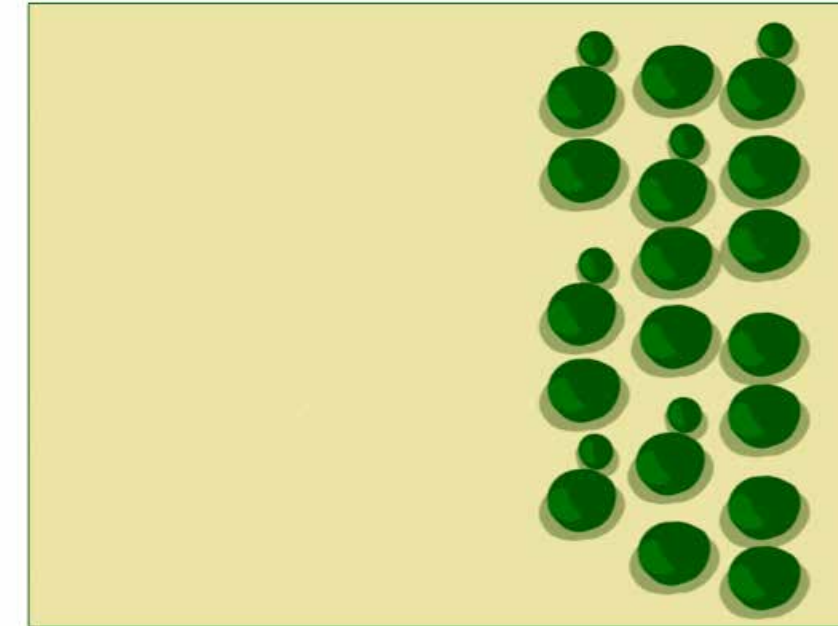
**Trees per Acre**  
(Residential Area)



**3.8**

**Trees per Person**  
(Residential Area)

## WEST SAVANNAH



**18.6**

**Trees per Acre**  
(Residential Area)



**0.5**

**Trees per Person**  
(Residential Area)

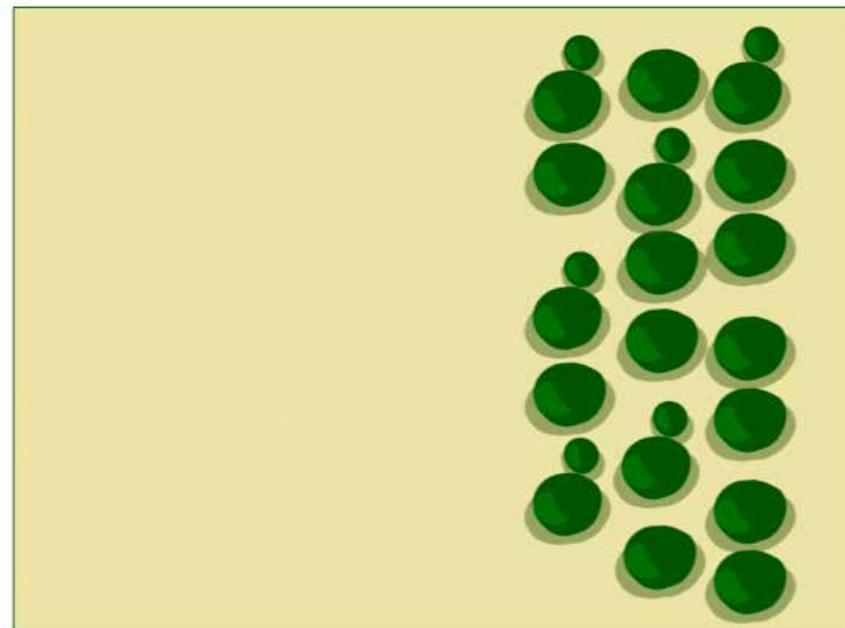
\*Average Tree Density across the neighborhoods is extrapolated from the average number of healthy trees per acre of residential land. Fact comparisons based on potential benefits from trees per average lot across the neighborhoods. Figures are extrapolated from itree canopy. Average benefit per lot is calculated over 10 years.





# Trees Per Acre and Per Person

## HUDSON HILL



**8.53**

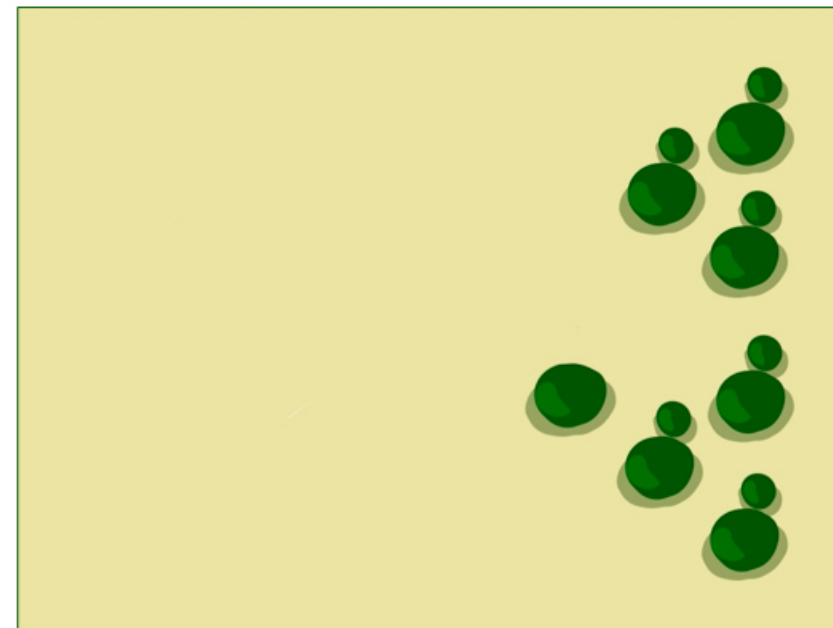
**Trees per Acre**  
(Residential Area)



**1.1**

**Trees per Person**  
(Residential Area)

## WOODVILLE



**7.6**

**Trees per Acre**  
(Residential Area)



**1.6**

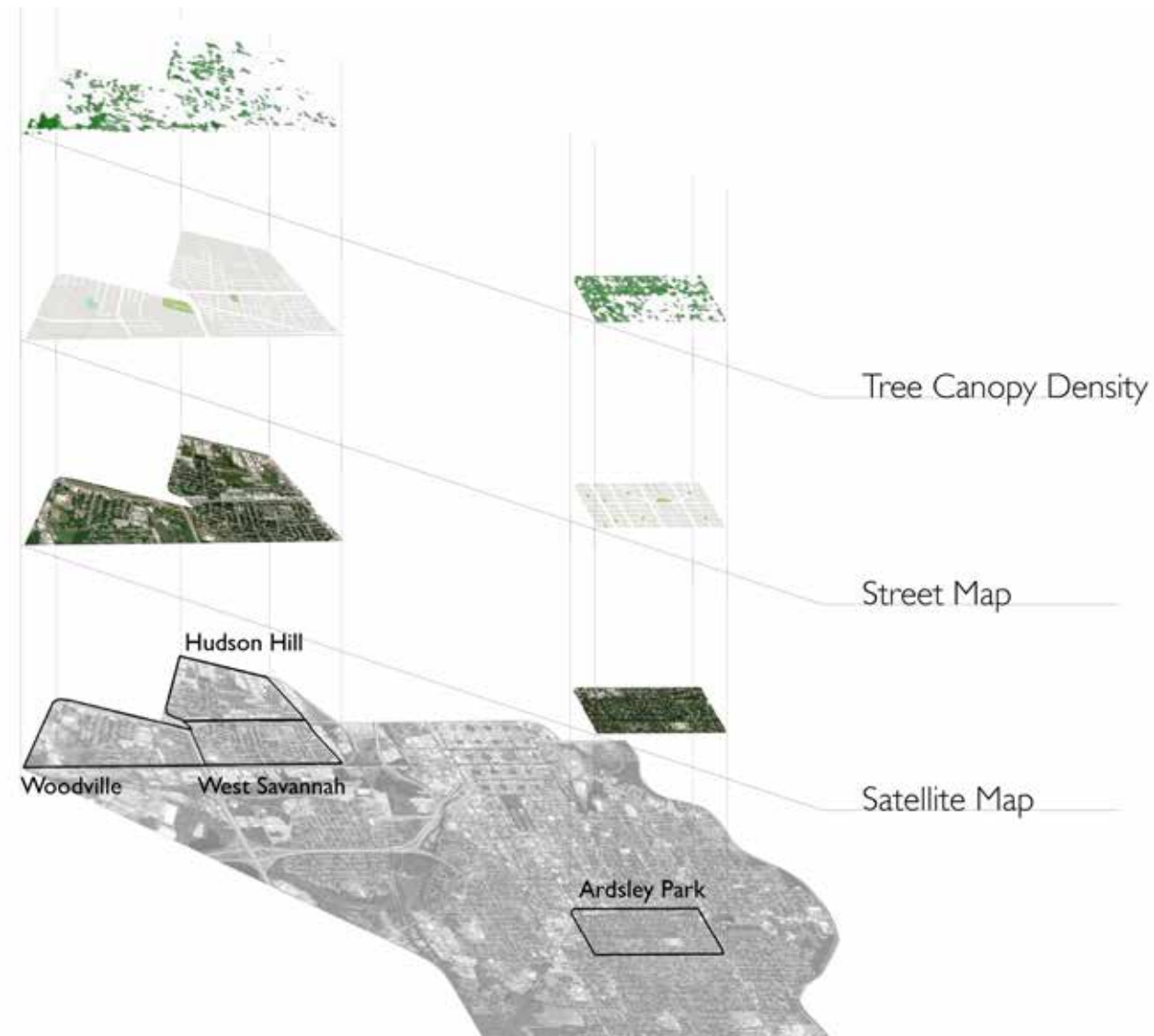
**Trees per Person**  
(Residential Area)

\*Average Tree Density across the neighborhoods is extrapolated from the average number of healthy trees per acre of residential land. Fact comparisons based on potential benefits from trees per average lot across the neighborhoods. Figures are extrapolated from itree canopy. Average benefit per lot is calculated over 10 years.



# Heat Stack Map

The map depicts the location of all four neighborhoods, Ardsley Park, West Savannah, Hudson Hill and Woodville, in relation to each other. The layers of maps including satellite map, street map, tree canopy density, heat island severity and flood hazard level. Comparing to Ardsley Park, the other 3 neighborhoods, with less tree canopy density, have higher heat island level and face more risk of flood hazard.



Source: arcgis.com

Funding for this project was provided by the U.S. Forest Service (USFS). RedCastle Resources, Inc. produced the dataset under contract to the USFS. Geospatial Technology and Applications Center., Savannah Area GIS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, EPA, NPS

# Annual Average Daily Traffic (GDOT)

## ARDSLEY PARK

## WEST SAVANNAH



Average daily traffic calculated based on data collected from the Georgia Traffic Monitoring Program located on the public roads in Georgia, estimated using total annual traffic divided by 365.

# Neighborhood Data Comparison

		ARDSLEY	HUDSON HILL	WOODVILLE	W. SAVANNAH
Avg Trees per Lot		9.37	2.91	4.06	1.34
Avg Tree Density (Trees per Acre)		38.2	8.53	7.6	18.6
Healthy/Unhealthy Ratio		22:1	9:1	7:1	7:1
Established/New Ratio		74:1	44:1	30:1	4:1
Percentage Impervious		63.3%	72%	48.3%	66.7%
Avg Tress ~15ft of Road		3.4	0.9	1.4	0.26
Temp Range (in degree F)	Spring	--	Partly Sunny : 70°-80° Sunny : 80°-85°	Cloudy : 75°-80° Sunny : 80°-85°	--
	Summer	Partly Cloudy : 80°-85° Sunny : 85°-90°	Sunny : 85°-95°	Sunny : 85°-95°	Sunny : 90°-95°
Avg Temp (LS, LSH, RS, RSH)		94°/ 80°/ 110°/ 86°	106°/ 88°/ 128°/ 104°	113°/ 86°/ 121°/ 94°	100°/ 85°/ 127°/ 93°
Avg Road-Lawn Temp Diff (In Sun)		16°	22°	8°	27°
Avg Spring Summer Diff		--	6°-8°	7°-9°	--
Avg Day to Night Diff		14°	18°	18°	17°
Avg Lot Size(Acres)		0.24	0.34	0.53	0.072
Avg Humans per Lot/Household		2.45	2.45	2.45	2.45

## Conclusions

A lesser known but still important benefit of tree coverage is that of noise reduction and the resulting ripple effect to overall quality of life. Less noise helps communities lower their stress levels along with other stress related health outcomes. The immense imbalance of not only tree coverage but also the respective amount of traffic in the focus neighborhoods of West Savannah and Ardsley Park illustrates the urgency with which a tree equity plan is needed for West Savannah and similar neighborhoods.

Helping Savannah's largely non-white communities properly plant and maintain trees contributes to better overall health, wellness and quality of life for all residents.

# Methodology



1

Survey the tree canopy, temperatures and impervious surface data in the neighborhoods of Ardsley Park, West Savannah, Woodville and Hudson Hill.

2

Conduct and compile ethnographic data (surveys, interviews and conversations).

3

Compile secondary research related to the impact Urban Heat Islands (UHI), including quality of life, health, mental health, livability and other factors.

4

Visualize data in reports through infographics.

5

Share these findings with Savannah Tree Foundation and government partners, community leaders, local businesses and SCAD to build collaborative capacity for a comprehensive and equitable Savannah tree management plan.

## Terms

**Urban Forest:** all trees within a densely populated area, including trees in parks, on streetways, and on private property

**Urban Heat Island:** this occurs when cities replace natural land cover with dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat.

**Sound Attenuation:** the damping of sound

**AADT:** the total volume of vehicle traffic of a highway or road for a year divided by 365 days



# About SCADServe

The multidisciplinary course, GOOD 560 Design for Good, directly supports the mission of SCAD SERVE, our community service design studio. Focusing on four critical areas of need — food, clothing, shelter, and environment — SCAD SERVE empowers the SCAD community to listen to the needs of its neighbors and local leaders, and create meaningful design solutions that improve quality of life.

Volunteerism, public service, and social impact are and always have been an integral part of SCAD's character. GOOD 560 Design for Good employs our students' collective brilliance through elevated, design-for-good solutions that make a difference in our hometowns of Atlanta and Savannah. For more information, visit [scad.galaxydigital.com](http://scad.galaxydigital.com).

## Images (Right):

Summer and Spring GOOD 560 class members (listed below).

Lia Alemán, Design for Sustainability M.F.A. • Sofia Alturas, Design for Sustainability M.A. Shreyas • Athreya, Design for Sustainability M.F.A. • Lindsay Brine, Service Design M.F.A. • María Carrau, Architecture M.A. • Kiera Ceysens, Design for Sustainability M.F.A. • Ankit Charturvedi, Design for Sustainability M.F.A. • Yushan Chen, Service Design M.F.A. • Emma Covelto, Design for Sustainability M.F.A. • Amber Francis, Service Design M.A. • Tanvi Gudipudi, Design for Sustainability M.F.A. • Vivek Gupta, Design for Sustainability M.A. and Jewelry M.A. • Seth Holland, Design for Sustainability M.F.A. • Olivia Loeffler, Design for Sustainability M.F.A. • Anirbaan Mukherjee, Design for Sustainability M.F.A. • Kanchi Parekh, Design Management M.A. • Morgan Rizzo, Design for Sustainability M.A. • Daniela Rodriguez, Design for Sustainability M.A. • Riley Shelton, Design for Sustainability M.F.A. • Olivia Snow, Design for Sustainability M.F.A. • Brittany Snyder, Design for Sustainability M.F.A. • Harshini Vasu, Design for Sustainability M.F.A. • Professor Scott Boylston, Graduate Coordinator, Design for Sustainability Program • Professor Saty Sharma, Design for Sustainability Program



## MISSION

To enhance Savannah Tree Foundation's efforts in ensuring tree canopy equity through gathering and synthesizing data, experiences, and community relationships.





Published in conjunction with SCADServe