SAVANNAH TREE CANOPY EQUITY

EXECUTIVE SUMMARY

August 2022

SAVANNAH TREE
FOUNDATION
Our Trees – Our Future

SAVANNAH TREE CANOPY EQUITY

INTRODUCTION

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:

Savannah Tree Foundation is responsible for the first and only conservation easement for a single tree in the United States. The tree is the Candler Oak, located on SCAD property, and featured on the cover and to the left.

SAVANNAH TREE FOUNDATION

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**.

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.

"THE POOREST TRACTS,
AND THOSE WITH LOWEST AVERAGE
EDUCATION LEVELS, WITHIN A COUNTY
ARE SIGNIFICANTLY HOTTER
THAN THE RICHEST

(and more educated) neighborhoods for 76% of these counties
(54% for education); we also find that neighborhoods with higher
Black, Hispanic, and Asian population shares are hotter than the more
White, non-Hispanic areas in each county."

—Advancing Earth and Space Science

Introduction

SAVANNAH TREE CANOPY EQUITY

Tree canopy equity as a topic extends beyond just planting trees for use of shade or CO_2 absorption. The lack of trees in urban areas has far reaching implications and indicators of neighborhood safety, mental and physical health, climate change, poverty and overall quality of life. In this paper, we explore the broader implications of a scarcity of trees in urban areas on people's lives, with Savannah as a focus. We then explore solutions for balancing the inequitable distribution of trees in Savannah with inspiration from other cities that have tackled issues of the urban heat island effect.

Key Insights

REDUCTION IN CRIME

While sometimes overlooked, tree coverage benefits are directly and indirectly related to health, stress and crime.

Among minor crimes, there is less graffiti, vandalism and littering in outdoor spaces with trees as a part of the natural landscape than in comparable plant-less spaces.

(University of Washington)

MENTAL HEALTH AND HEALTH BENEFITS

Environmental health scientists have found epidemiological evidence of a link between trees and human health.

Urban trees are associated with a wide range of benefits including: reduced harms such as ultraviolet radiation, air pollution-related respiratory conditions, and excess heat stress; greater restorative capacities such as cognition and attention restoration and benefits to mood and mental health; and positive health effects such as better birth outcomes, immune functioning, active living, cardiovascular function, weight status, and social cohesion.

(International Journal of Environmental Research and Public Health)
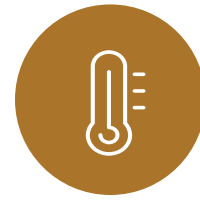
HEALTH EFFECTS OF EXTREME HEAT

It is not just extreme heat, even moderately hot days pose a risk to vulnerable individuals.

"Hot days can lead people to suffer from dehydration, heat exhaustion, and in extreme cases, heat stroke. But hot days are also associated with higher risk of a number of other conditions that are not typically thought to be "heat-related," such as [kidney] problems, skin infections, and pre-term birth among pregnant women. In fact, heat stroke, heat exhaustion, and dehydration account for a relatively small fraction of the total [health risks] associated with days of extreme heat. And interestingly, it's not just extreme heat that poses a risk. Even moderately hot days can place vulnerable individuals at higher risk."

(Science Direct)

EXTREME HEAT AND MENTAL HEALTH

Days of high heat can negatively impact mental health.

"A growing body of evidence suggests that days of high temperatures may negatively affect our mental health.

For example, a recent study in New York found that hot days were associated with higher risk of emergency room visits for substance abuse, mood and anxiety disorders, schizophrenia, and dementia."

(Science Direct)

EFFECTS OF URBAN HEAT ISLANDS

Urban Heat Islands contribute to a number of factors, including:

Increased Energy Consumption

Elevated Emissions of Air Pollutants and Greenhouse Gases

Compromised Human Health and Comfort

Impaired Water Quality

(EPA)

Exhaustion and dehydration, power grid failures and crumbling infrastructure all result in heat stress, which requires building heat resilience.

(World Health Organization)
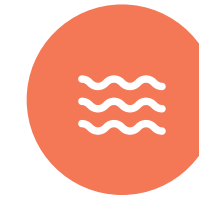
INCREASE IN HEAT WAVES

Heat wave exposure continues to rise in averages.

"Between 2000 and 2016, the number of people exposed to heat waves increased by around 125 million.

In 2015 alone, 175 million additional people were exposed to heat waves compared to average years."

(World Health Organization)

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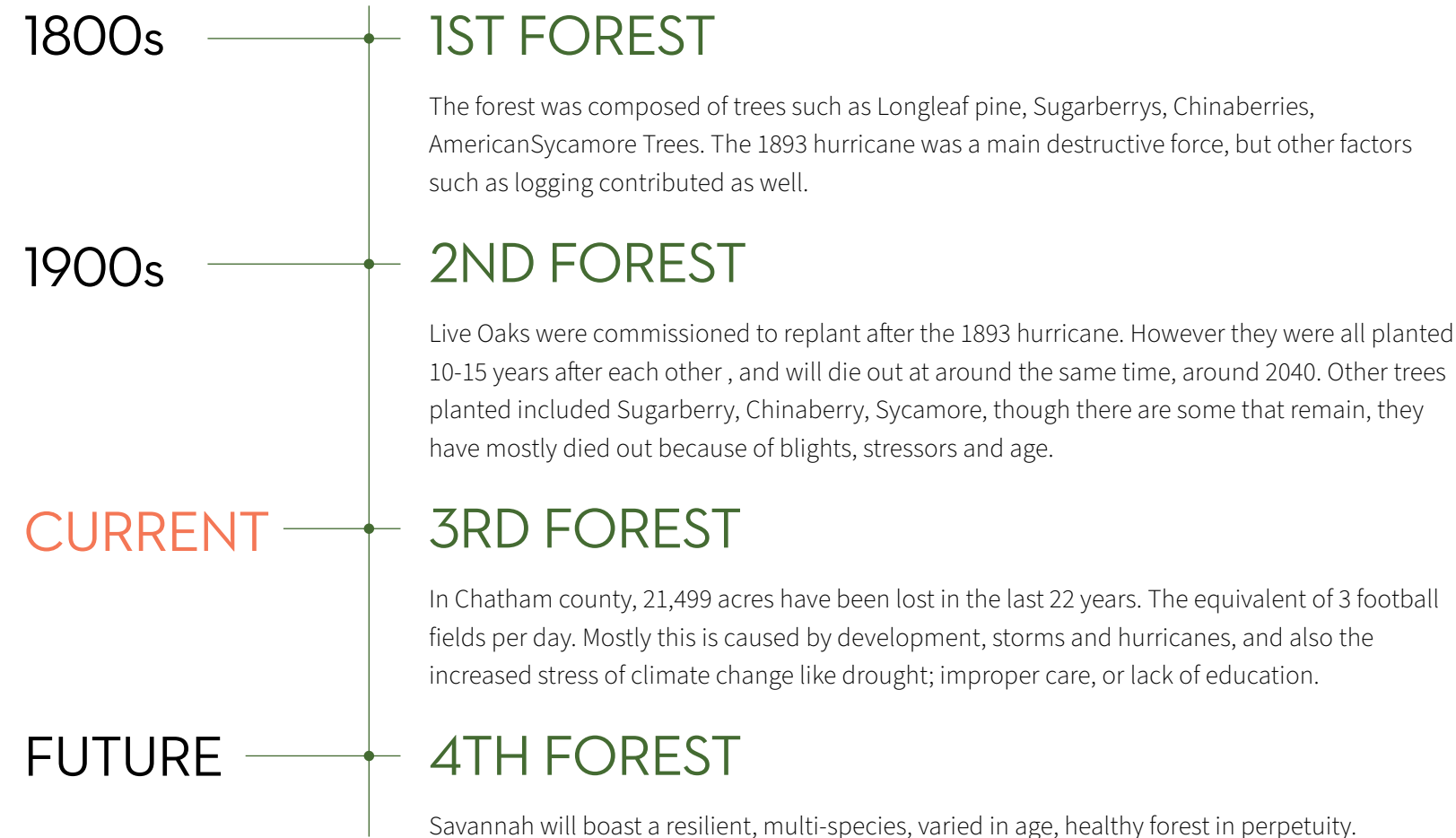
The developers of Ardsley Park, Savannah-natives Harry Hays Lattimore and William Lattimore, laid out the neighborhood according to a strict grid with one-acre landscaped parks placed in regular intervals and offset along the north-south corridor of Abercorn Street.

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.**

ARDSLEY PARK

Residents
3,338
Average Income
$81,224

Demographics
84% White
12.4% Asian & other
2.9% Black

WEST SAVANNAH

Residents
3,653
Average Income
$22,578

Demographics
54.6% Black
28% White
16.5% Asian & other

HUDSON HILL

Residents
2,320
Average Income
$22,578

Demographics
78.4% Black
12% Asian & other
9.5% White

WOODVILLE

Residents
460
Average Income
$39,333

Demographics
52.9% Black
26.6% Asian & other
21.5% White

Source: point2homes.com and city-data.com

History of Savannah's Urban Forest

1800s — **1ST FOREST**
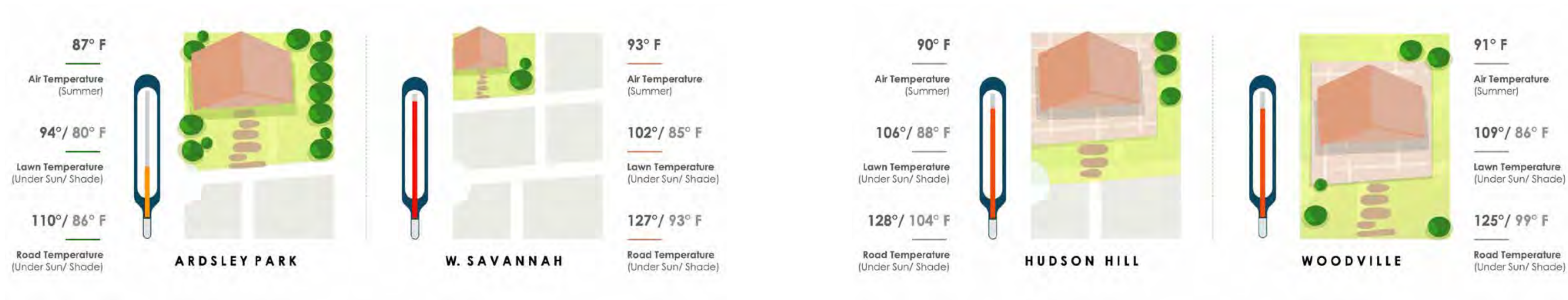
The forest was composed of trees such as Longleaf pine, Sugarberrys, Chinaberries, AmericanSycamore Trees. The 1893 hurricane was a main destructive force, but other factors such as logging contributed as well.

1900s — **2ND FOREST**

Live Oaks were commissioned to replant after the 1893 hurricane. However they were all planted 10-15 years after each other , and will die out at around the same time, around 2040. Other trees planted included Sugarberry, Chinaberry, Sycamore, though there are some that remain, they have mostly died out because of blights, stressors and age.

CURRENT — **3RD FOREST**

In Chatham county, 21,499 acres have been lost in the last 22 years. The equivalent of 3 football fields per day. Mostly this is caused by development, storms and hurricanes, and also the increased stress of climate change like drought; improper care, or lack of education.

FUTURE — **4TH FOREST**

Savannah will boast a resilient, multi-species, varied in age, healthy forest in perpetuity.

Impervious Land and Trees Per Lot Comparison
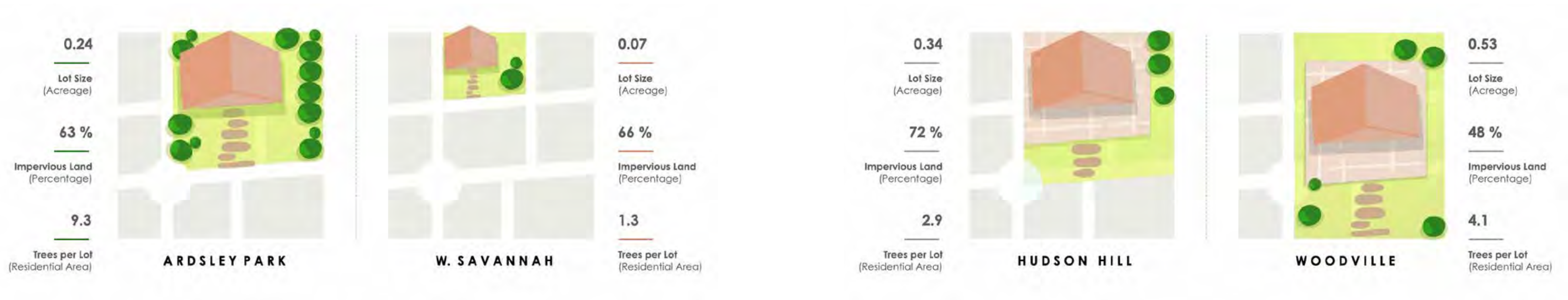
	ARDSLEY PARK
0.24	Lot Size (Acreage)
63 %	Impervious Land (Percentage)
9.3	Trees per Lot (Residential Area)

	W. SAVANNAH
0.07	Lot Size (Acreage)
66 %	Impervious Land (Percentage)
1.3	Trees per Lot (Residential Area)

	HUDSON HILL
0.34	Lot Size (Acreage)
72 %	Impervious Land (Percentage)
2.9	Trees per Lot (Residential Area)

	WOODVILLE
0.53	Lot Size (Acreage)
48 %	Impervious Land (Percentage)
4.1	Trees per Lot (Residential Area)

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.

Average Temperatures Lot Comparison

ARDSLEY PARK

87° F
Air Temperature (Summer)

94°/ 80° F
Lawn Temperature (Under Sun/ Shade)

110°/ 86° F
Road Temperature (Under Sun/ Shade)

W. SAVANNAH

93° F
Air Temperature (Summer)

102°/ 85° F
Lawn Temperature (Under Sun/ Shade)

127°/ 93° F
Road Temperature (Under Sun/ Shade)

HUDSON HILL

90° F
Air Temperature (Summer)

106°/ 88° F
Lawn Temperature (Under Sun/ Shade)

128°/ 104° F
Road Temperature (Under Sun/ Shade)

WOODVILLE

91° F
Air Temperature (Summer)

109°/ 86° F
Lawn Temperature (Under Sun/ Shade)

125°/ 99° F
Road Temperature (Under Sun/ Shade)

The above graphics depict our four focus neighborhoods, with the average lot sizes, house sizes and tree coverage by neighborhood. The large disparities in lot size and tree coverage have a direct effect on average temperature.

Trees Per Acre and Tree Benefits Over 10 Years*

ARDSLEY PARK
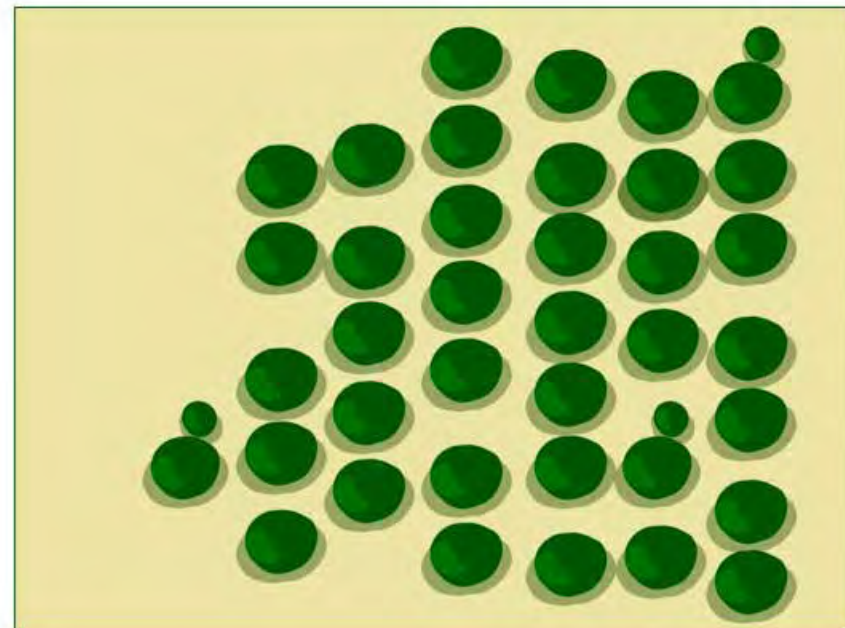
38.2

Trees per Acre
(Residential Area)

3.8

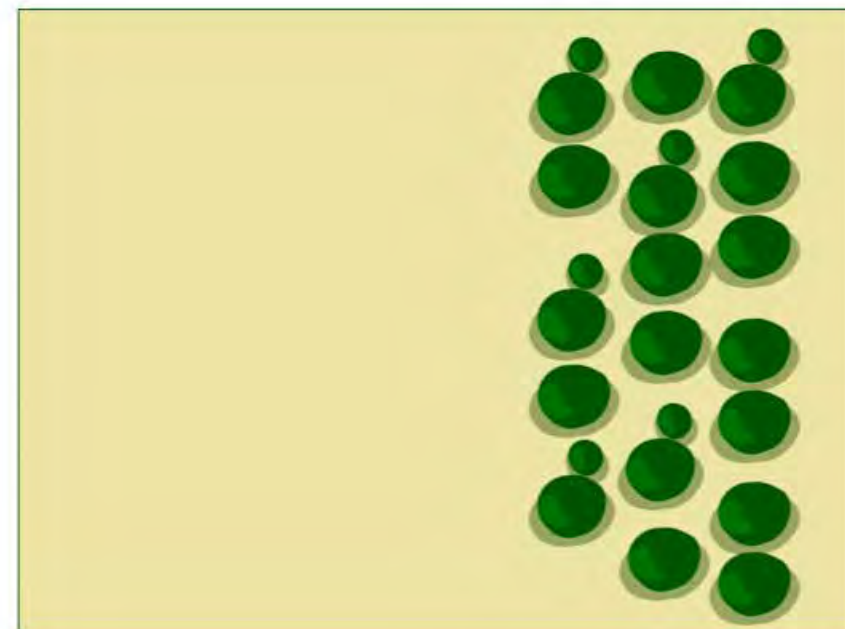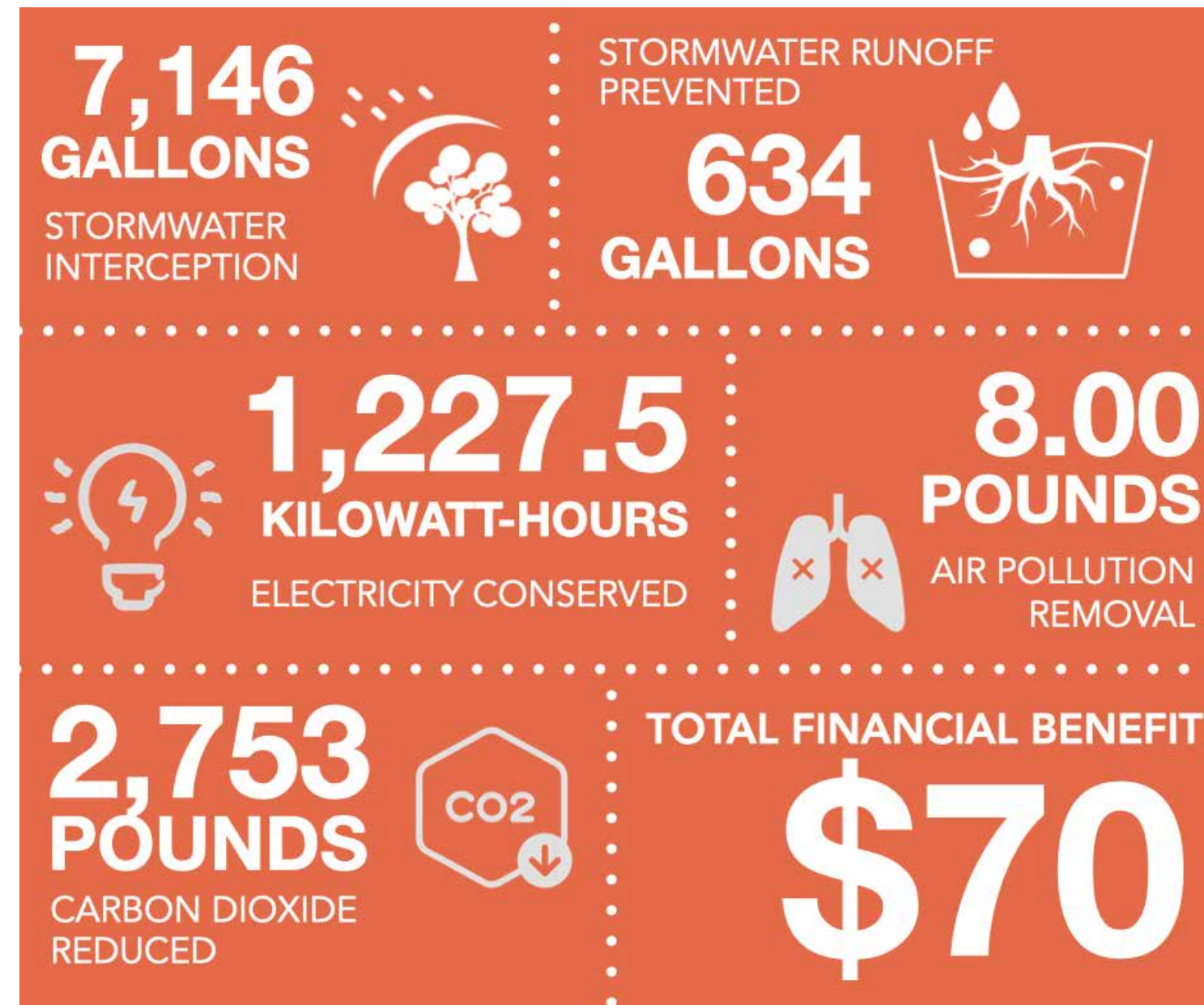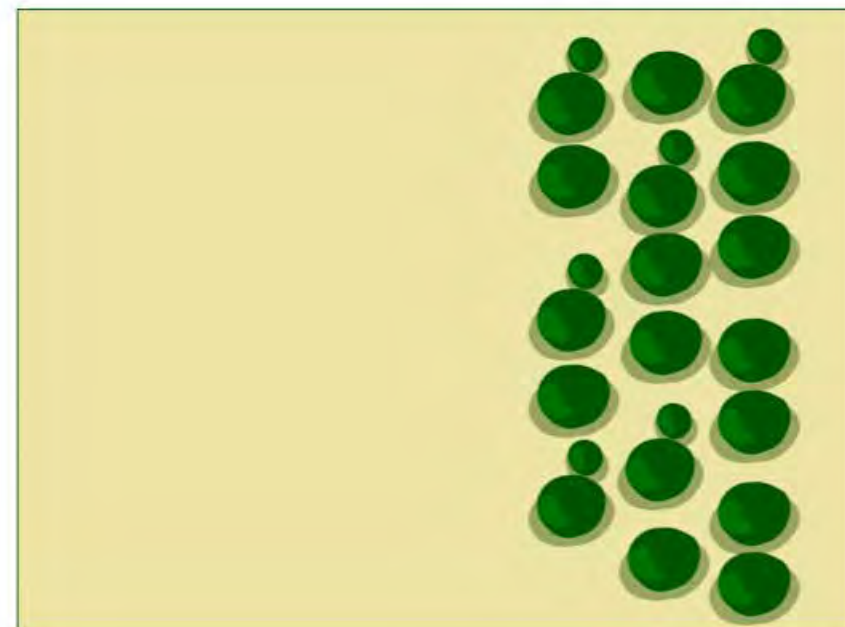Trees per Person
(Residential Area)

*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.

129,100 GALLONS
STORMWATER INTERCEPTION

STORMWATER RUNOFF PREVENTED
11,453 GALLONS

11,152 KILOWATT-HOURS
ELECTRICITY CONSERVED

190.0 POUNDS
AIR POLLUTION REMOVAL

55,102 POUNDS
CARBON DIOXIDE REDUCED

TOTAL FINANCIAL BENEFIT
$2,939
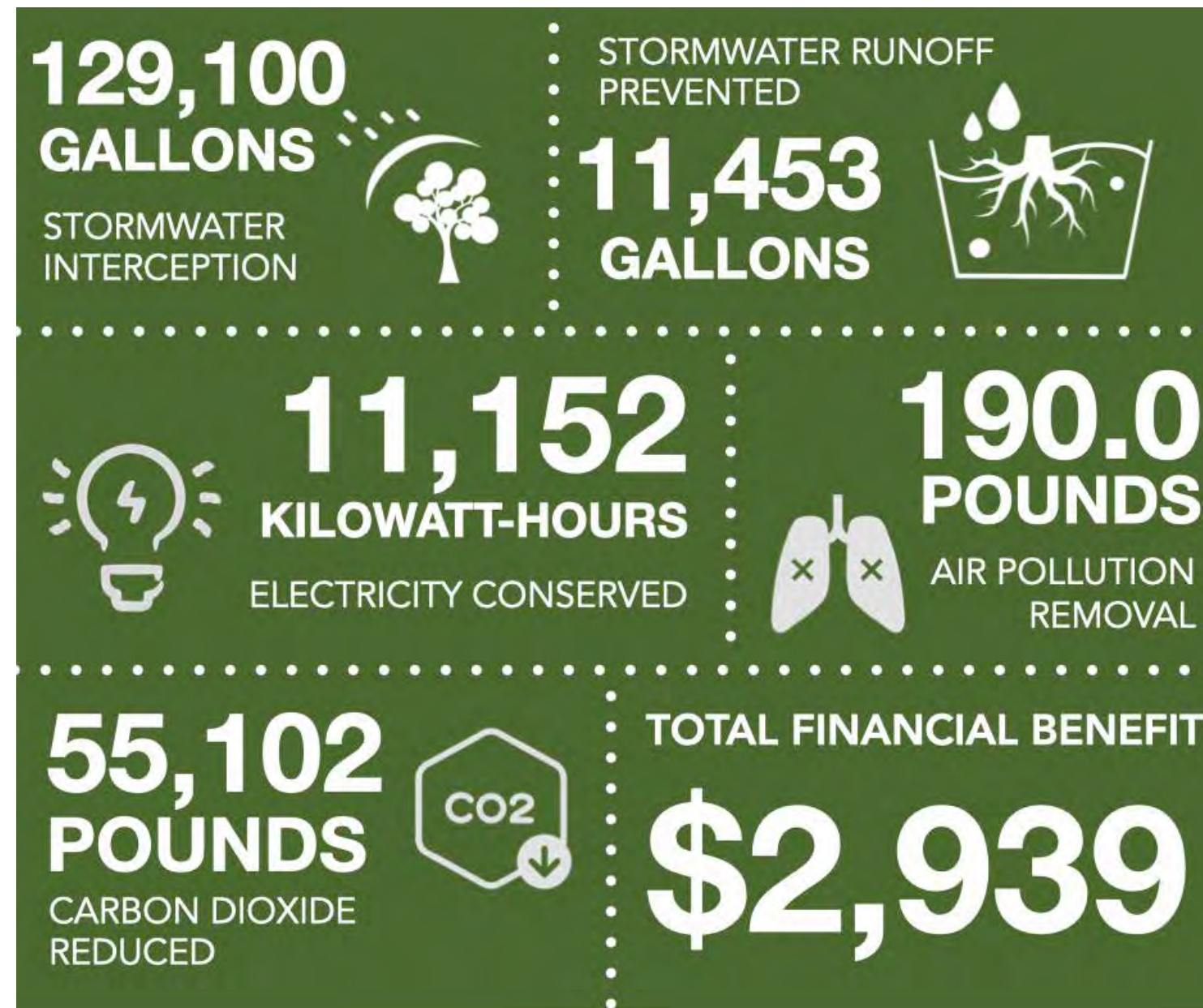
Trees Per Acre and Tree Benefits Over 10 Years*

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.

7,146 GALLONS
STORMWATER INTERCEPTION

STORMWATER RUNOFF PREVENTED
634 GALLONS

1,227.5 KILOWATT-HOURS
ELECTRICITY CONSERVED

8.00 POUNDS
AIR POLLUTION REMOVAL

2,753 POUNDS
CARBON DIOXIDE REDUCED

TOTAL FINANCIAL BENEFIT
$70

Trees Per Acre and Tree Benefits Over 10 Years*
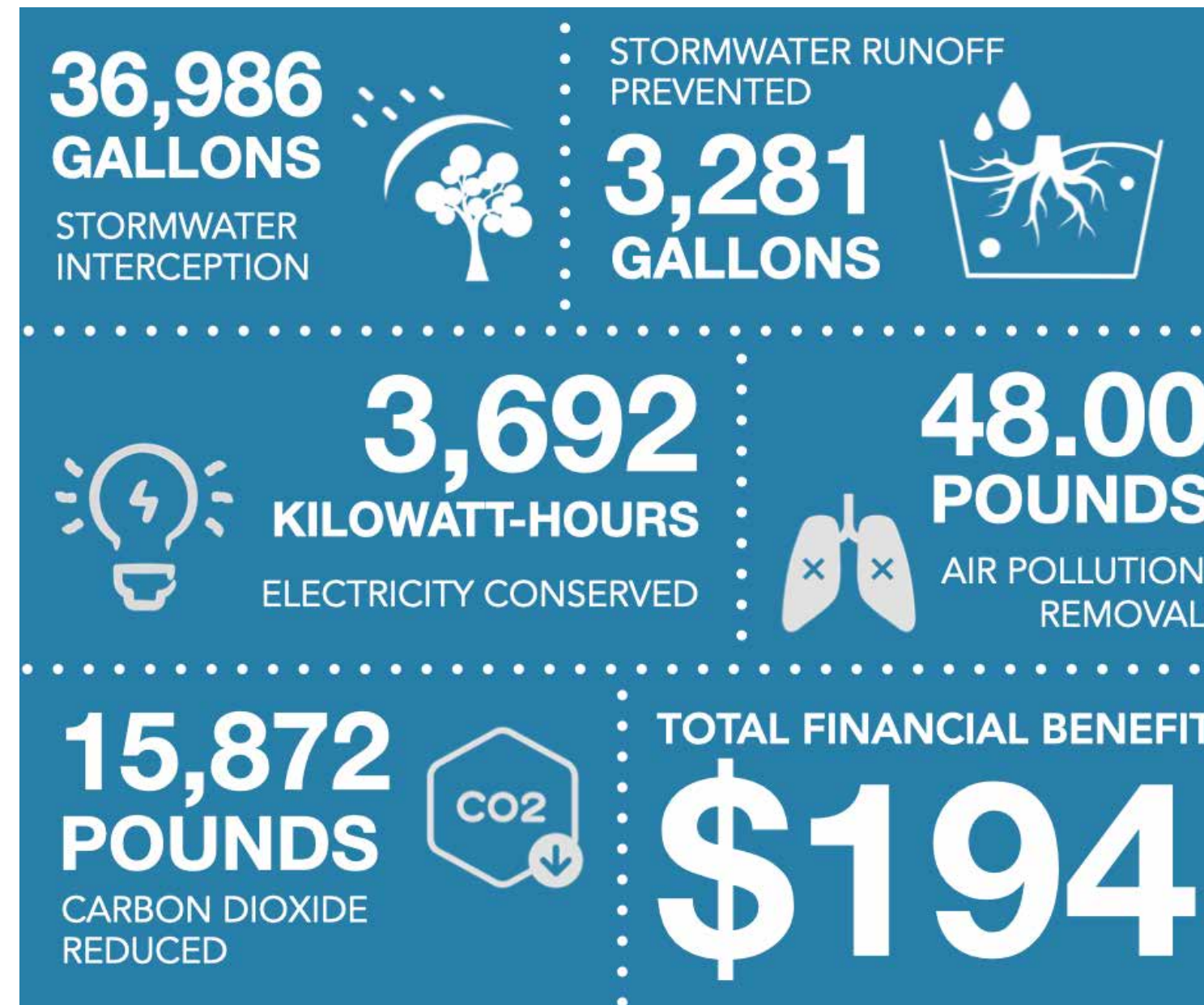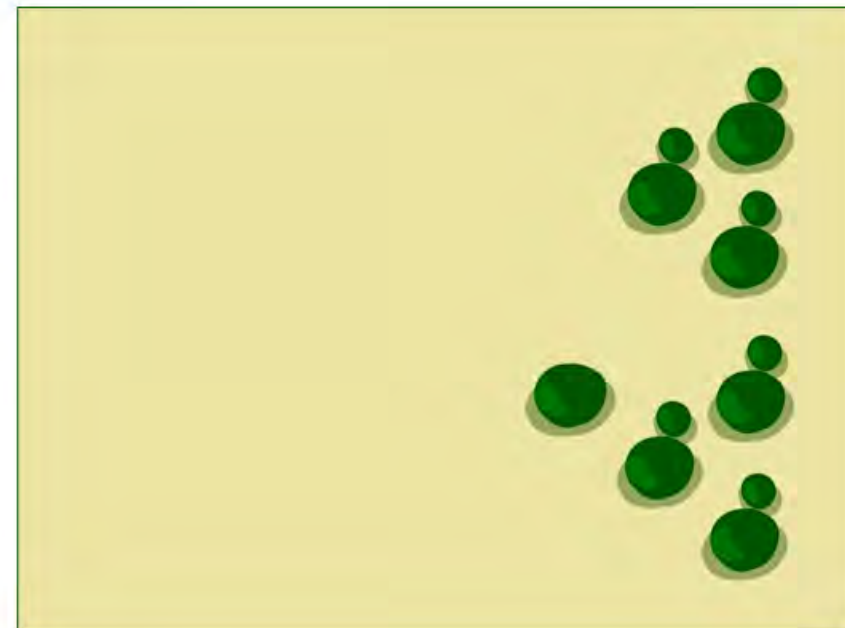
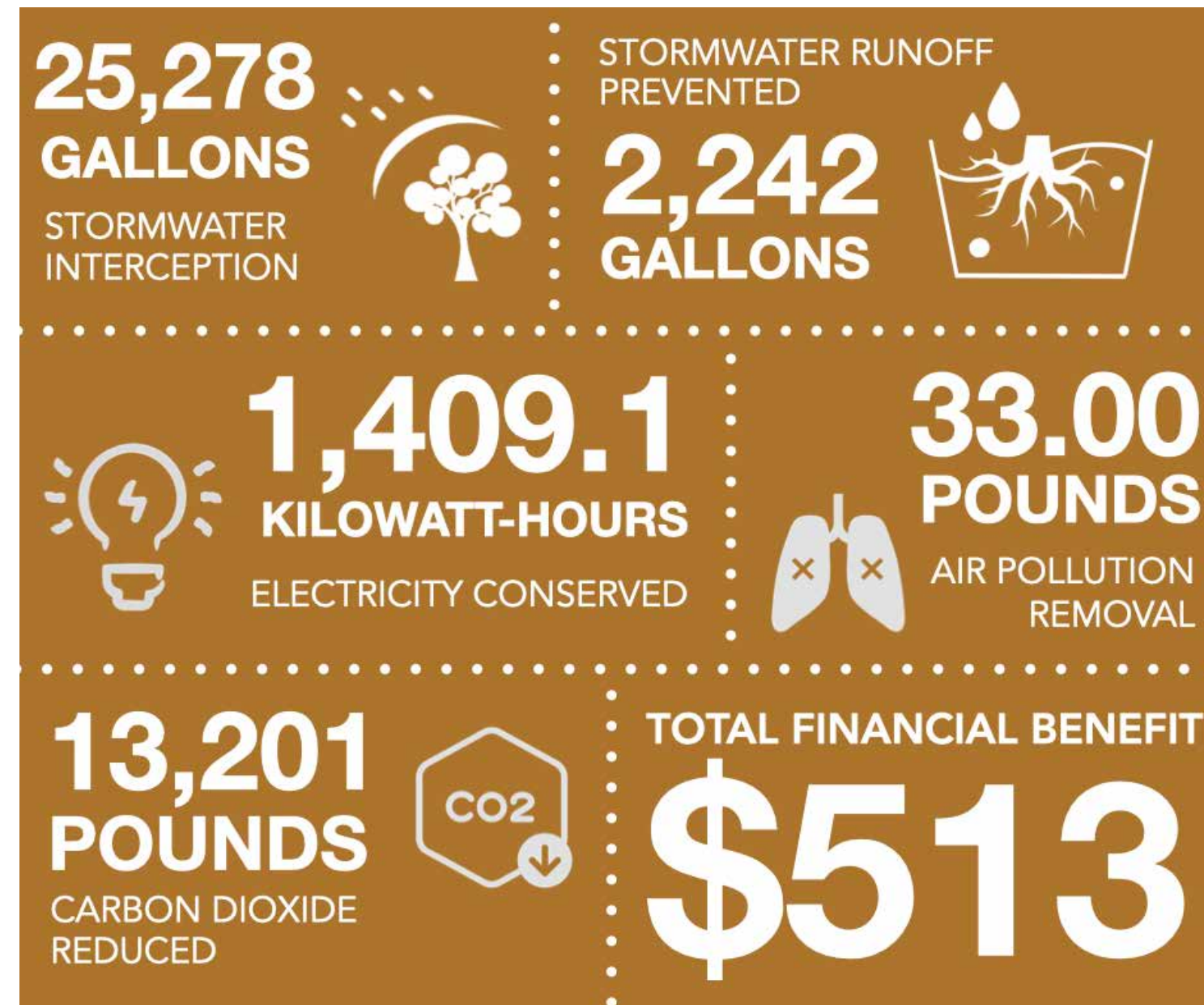## HUDSON HILL

8.53

Trees per Acre
(Residential Area)

1.1

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.

36,986 GALLONS
STORMWATER INTERCEPTION

STORMWATER RUNOFF PREVENTED
3,281 GALLONS

3,692 KILOWATT-HOURS
ELECTRICITY CONSERVED

48.00 POUNDS
AIR POLLUTION REMOVAL

15,872 POUNDS
CARBON DIOXIDE REDUCED

TOTAL FINANCIAL BENEFIT
$194

Trees Per Acre and Tree Benefits Over 10 Years*

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.

25,278 GALLONS
STORMWATER INTERCEPTION

STORMWATER RUNOFF PREVENTED
2,242 GALLONS

1,409.1 KILOWATT-HOURS
ELECTRICITY CONSERVED

33.00 POUNDS
AIR POLLUTION REMOVAL

13,201 POUNDS
CARBON DIOXIDE REDUCED

CO2

TOTAL FINANCIAL BENEFIT
$513

Tree Impact Example: Candler Oak

AS THE OLDEST TREE IN SAVANNAH, THE CANDLER OAK SITS JUST OFF FORSYTH PARK AND ITS REIN SPANS THE HISTORY OF THE CITY.

At the time it took root, it was situated on a beautiful wooded bluff bordering a river. For over 300 years, this city landmark has provided shade on the hottest days to those who needed it most while making the area healthier for its residents and guests. Trees like this and the other most populous trees across the city, help to combat increasing climate issues by sequestering carbon, emitting oxygen and assisting with storm water mitigation.

Although the Candler Oak is renowned for its age and size, both which directly contribute to carbon sequestration, trees provide the most benefit when diverse species are planted with purpose in order to address the needs of the community. Savannah, in particular, benefits greatly from its popular Eastern Red Cedar, Tupelo, Longleaf Pine and Bald Cypress trees which are drought tolerant and love areas prone to flooding. The Tupelo also has the added benefit of supporting the declining bee population.

While the large trees are always popular for shade and beauty, it is also important to nurture the existing smaller tree populations such as the Souther Catalpa and the Two-Wing Silverbell which are needed to help replace the aging Crape Myrtle trees throughout the county.
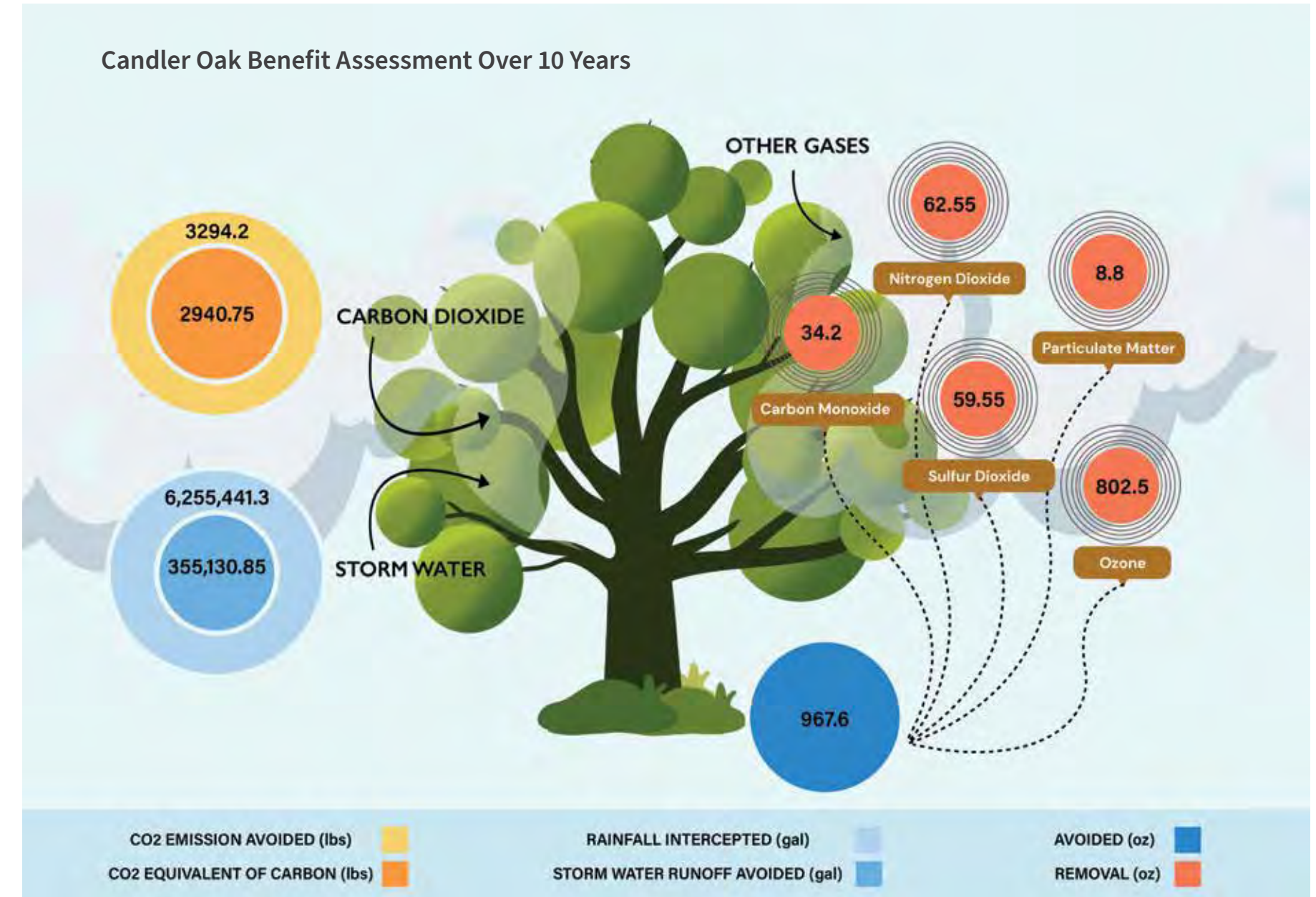
The benefits of these and other appropriate trees are reflected in the Candler Oak and all that this living organism has given the city of Savannah throughout its storied history.

Candler Oak, 1870

Candler Oak, Currently

Candler Oak Benefit Assessment Over 10 Years

OTHER GASES

3294.2 / 2940.75 — CARBON DIOXIDE

6,255,441.3 / 355,130.85 — STORM WATER

34.2 — Carbon Monoxide

62.55 — Nitrogen Dioxide

8.8 — Particulate Matter

59.55 — Sulfur Dioxide

802.5 — Ozone

967.6

CO2 EMISSION AVOIDED (lbs)
CO2 EQUIVALENT OF CARBON (lbs)
RAINFALL INTERCEPTED (gal)
STORM WATER RUNOFF AVOIDED (gal)
AVOIDED (oz)
REMOVAL (oz)

Health Impacts of Air Pollution

RESPIRATORY

- Wheezing and coughing
- Shortness of breath
- Asthma attacks
- Worsening COPD
- Lung cancer

OTHER

- Premature death
- Susceptibility to infections
- Heart attacks and strokes
- Impaired cognitive functioning
- Metabolic disorders
- Pre-term births and low birth weight

Source: American Lung Association 2022 State of Air Report

Health Impacts of Exposure to Extreme Heat

Indirect Impacts

Impact on Health Services
- Increased Ambulance Call-Outs and Slower
- Response Times
- Increased Number of Hospital Admissions
- Heat Cramps
- Storage of Medicines

Increased Risk of Accidents
- Drowning
- Work-related Accidents
- Injuries and Poisonings

Increased Transmission
- Food and Waterborne Diseases
- Marine Algal Blooms

Potential Disruption of Infrastructure
- Power
- Water
- Transport
- Productivity

Direct Impacts

Heat Illness
- Dehydration
- Heat Cramps
- Heat Stroke

Accelerated Death from
- Respiratory Disease
- Cardiovascular Disease
- Other Chronic Disease (mental health, renal disease)

Hospitalization
- Respiratory Disease
- Diabetes Mellitus
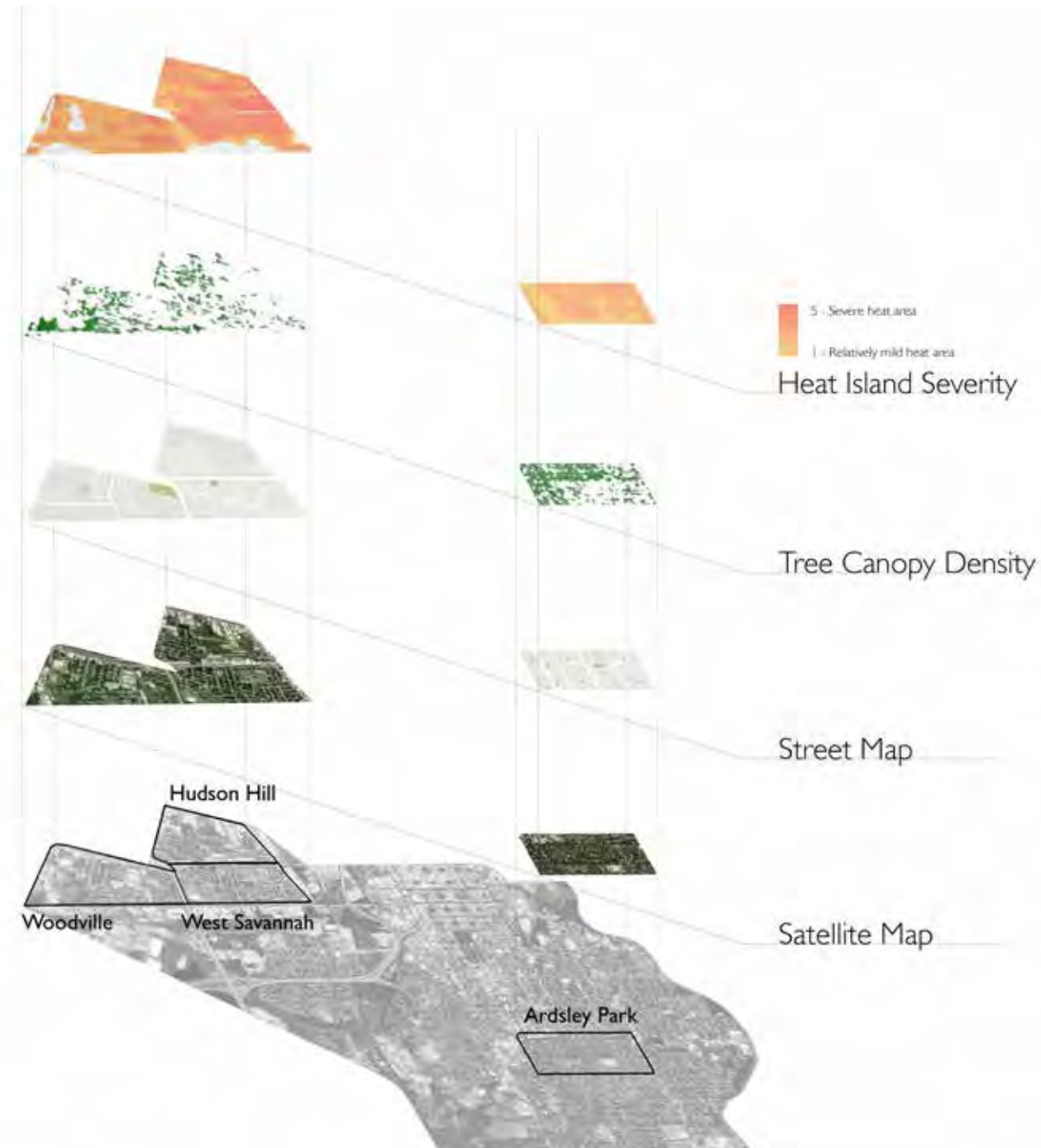- Renal Disease
- Stroke
- Mental Health Conditions

Source: World Health Organization

Heat Stack Map

The map depicts the location of all 4 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

Heat Island Severity
5 - Severe heat area
1 - Relatively mild heat area

Tree Canopy Density

Street Map

Satellite Map

Hudson Hill

Woodville   West Savannah

Ardsley Park
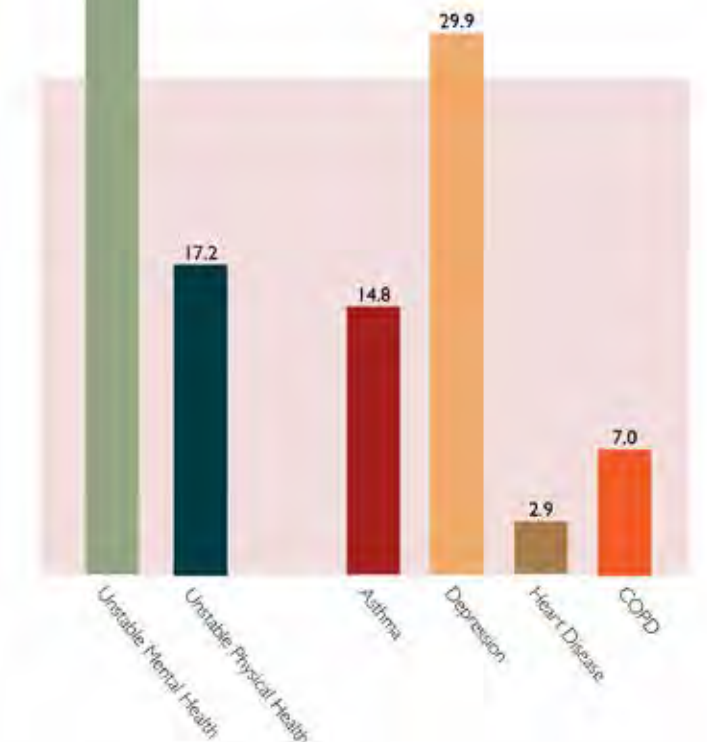
Health Comparison

ARDSLEY PARK
10.8%
Poor General Health
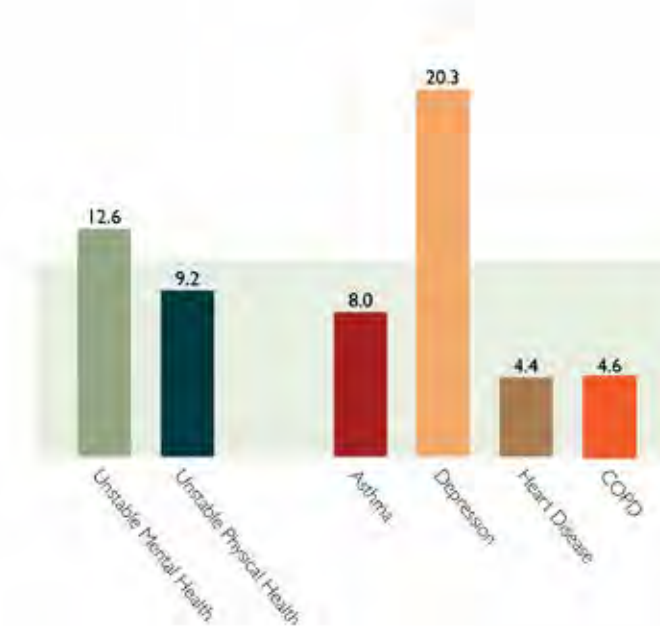
WEST SAVANNAH
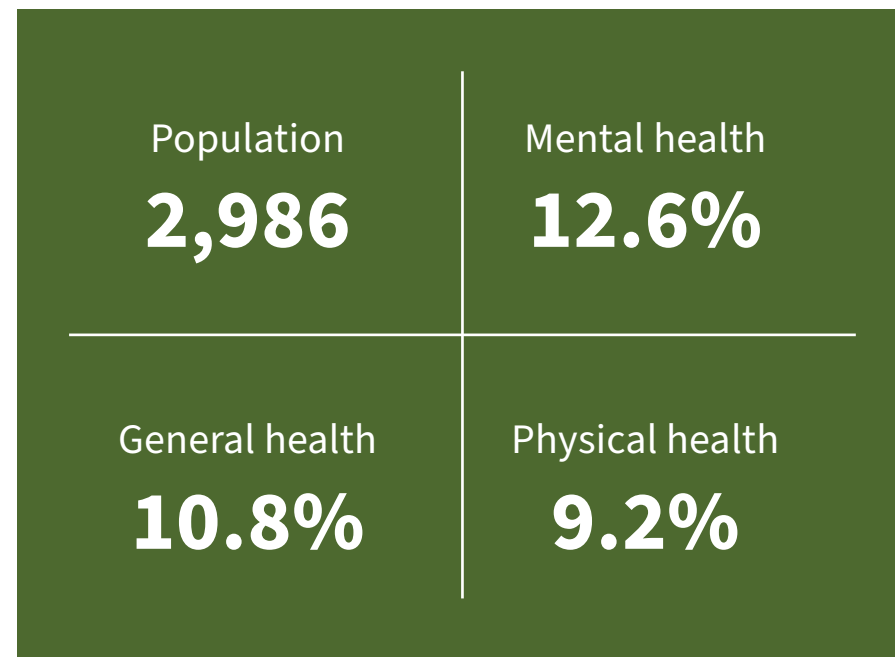# 27.4%
Poor General Health

The chart compares the average percentage of health conditions including mental health, physical health and 4 major diseases of Ardsley Park and West Savannah. West Savannah has a much higher average prevalence of most health conditions.
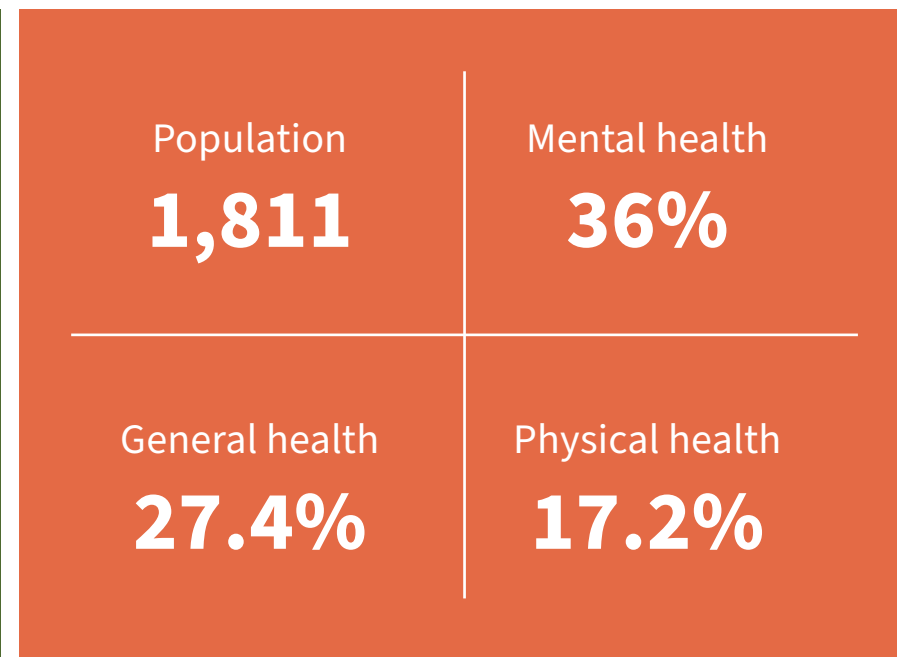
Neighborhood Health Statistics

ARDSLEY PARK

Population **2,986**	Mental health **12.6%**
General health **10.8%**	Physical health **9.2%**

WEST SAVANNAH

|	
Population **1,811**	Mental health **36%**
General health **27.4%**	Physical health **17.2%**

The data above is based on Center for Disease Control statistics from a study documenting the annual prevalence from years 2011-2015 of the above health statuses. The percentages indicate the number of people experiencing poor health outcomes in 14 out of the previous 30 days.

Average Temperatures
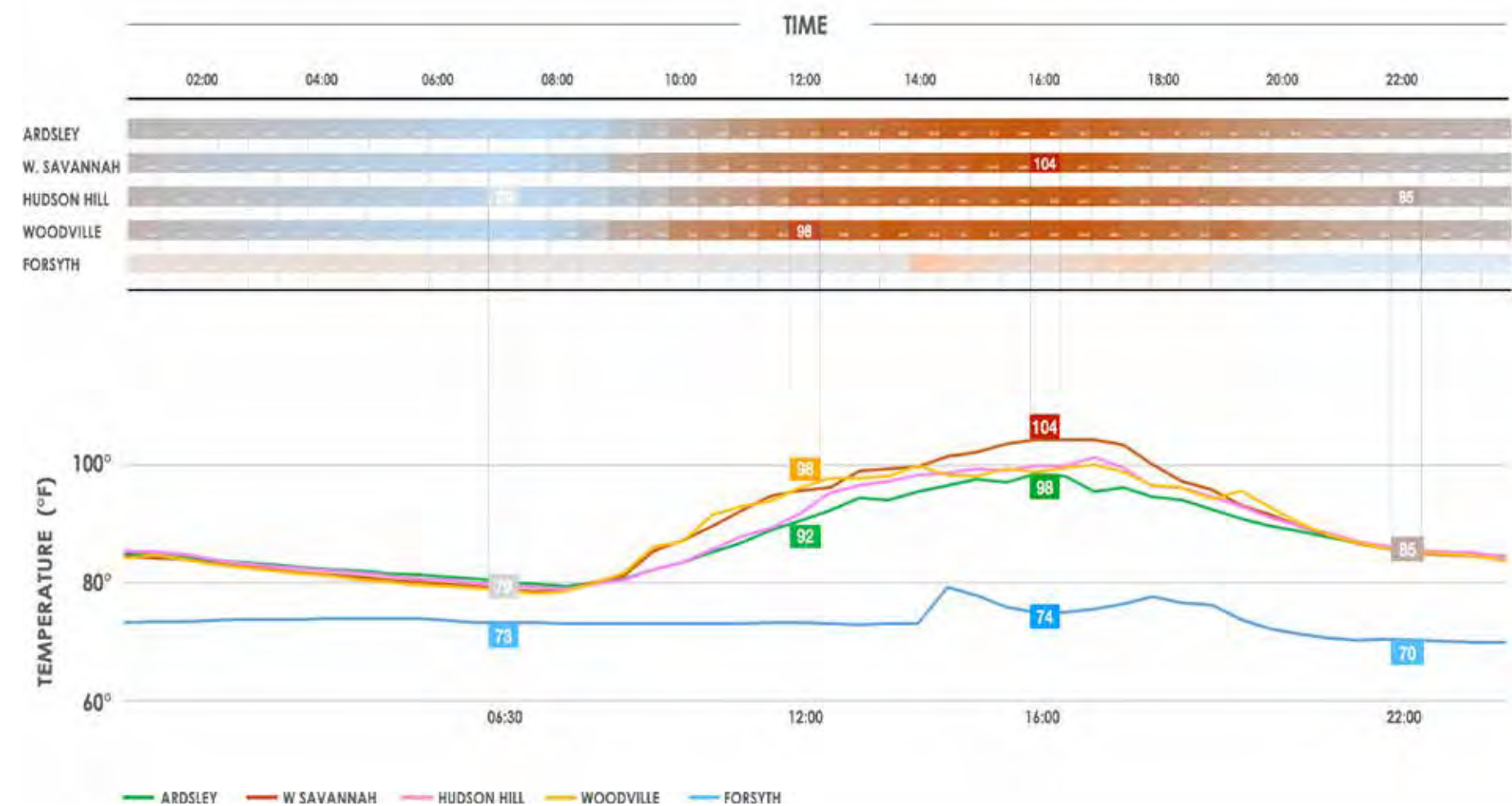
Ways to Mitigate UHI Effect

⊕ **Reintroduce vegetation** – expand green cover, plant street trees, install 'green roofs,' etc

⊕ **Introduce 'cool roofs'** that feature bright coatings to reflect more sunlight and absorb less heat

⊕ **Become a "sponge city"** that has transformed hard surfaces, such as roads and pavements, into permeable surfaces that can absorb, seep, purify and store water and later release stored water for use. The adoption of porous bricks and porous concrete could lower pavement surface temperature by 12 and 20°C, respectively and the air temperature by up to 1°C.

⊕ **Adopt climate resilient development principles**

⊕ **Incorporate more efficient physical infrastructure**, such as district-level cooling that efficiently uses energy to mechanically cool large areas in cities

⊕ **Consider nature-based solution**s, such as increasing the extent and density of green spaces in cities and on walls and roofs

⊕ **Integrate inclusive planning of urban stakeholders** to ensure that vulnerable urban residents are protected

⊕ **Adopt sustainable cooling solutions:** switching to propane as a refrigerant could lessen the global temperature increase from space cooling

Conclusions

Savannah is home to substantial historical events, beautiful neighborhoods and boasts trees as one of the many attractions that visitors can enjoy. The benefits of trees are widely acknowledged as providing not only relief from the heat but also cleaner air, storm water retention, noise buffering and fortification against climate change. However, not all of Savannah's residents enjoy these benefits. Many of Savannah's lower-income and non-white neighborhoods experience inadequate tree coverage and the resulting negative health outcomes, higher stress levels, increased crime, property damage from flooding, lower property values, severe heat days, more poor mental health days, lower financial benefits, greater air pollution and an overall increased urban heat island effect.

Addressing the tree canopy inequity among Savannah neighborhoods is an urgent first step in enhancing and supporting the broader community.

Methodology

SCAD SERVE X SAVANNAH TREE FOUNDATION — Our Trees – Our Future

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.

Climate Resilient Development: a solutions framework that successfully combines strategies to deal with climate risks (adaptation) with actions to reduce greenhouse gas emissions (mitigation) which result in improvements for nature's and people's well-being – for example by reducing poverty and hunger, improving health and livelihoods, providing more people with clean energy and water and safeguarding ecosystems on land, in lakes and rivers and in the ocean.

SCAD SERVE

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**.

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 Ceyssens, Design for Sustainability M.F.A. • Ankit Charturvedi, Design for Sustainability M.F.A. • Yushan Chen, Service Design M.F.A. • Emma Covello, 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

SAVANNAH TREE FOUNDATION
OUR TREES · OUR FUTURE