Results Summary

Seattle's Canopy Cover Assessment

January 2023   Office of Sustainability & Environment   City of Seattle

Overview

- Understanding canopy change data

- Key canopy change analyses

  - Environmental Equity Priority Area Analysis

  - Canopy Analysis by Management Unit

  - Climate Impacts

- Other canopy metrics

- Recommendations and next steps

Vision

A Seattle that is climate-resilient, with ample tree cover across the city (30%) that is equitably distributed, because trees deliver extraordinary benefits to our community.

Trees are critical infrastructure that provide essential benefits

- Sequester carbon

- Provide shade and heat reduction

- Absorb pollution

- Manage stormwater

- Improve physical and mental health

- Provide habitat

Canopy Cover Assessment Key Findings

- **We are slowly losing ground.** We lost 255 acres of canopy (net) - this is as big as Green Lake and represents a relative decline of -1.7% over 2016 canopy.

- **Loss is happening inequitably.** Neighborhoods impacted by racial and economic injustice started with less canopy and lost more than the citywide average,

- **Parks' natural areas and residential neighborhoods saw the greatest net losses.** These areas will need more investment, a strong regulatory framework, and partnerships with community to sustain and grow canopy.

- **Climate change is making it harder for our trees, and at the same time making them more essential.** Climate change brings new pests and diseases and increased watering and maintenance needs. At the same time, trees are critical climate infrastructure, protecting us from extreme heat and improving air quality.

Understanding Canopy Change Data

What is the tree canopy assessment?

LiDAR - 2021 **+** Imagery - 2021 **=** Tree Canopy Change – 2021 LiDAR
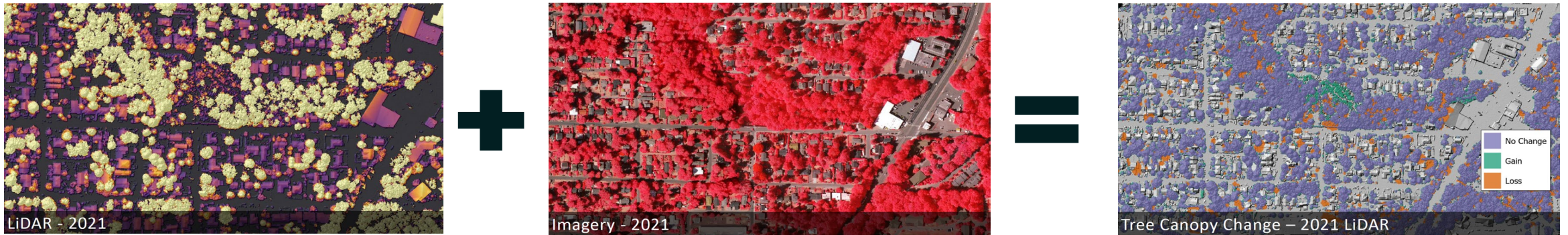
No Change
Gain
Loss

- We combine LiDAR data with aerial imagery to determine the amount of canopy cover and the change in cover since 2016.

- We focus on measuring canopy because it gives more detailed information than other methods such as tree counts (e.g., size, structure and distribution of the canopy)

- This round of assessment is our first opportunity for trend analysis.

*The Urban Forest Management Plan defines nine management units that cover all the land in the city. The management units consider trees based on their geographic location within the city.

Functionality lost without that tree canopy:

Net Loss = 255 Acres (about the size of Green Lake)

Carbon – hundreds of thousands of lbs CO_2/year not sequestered

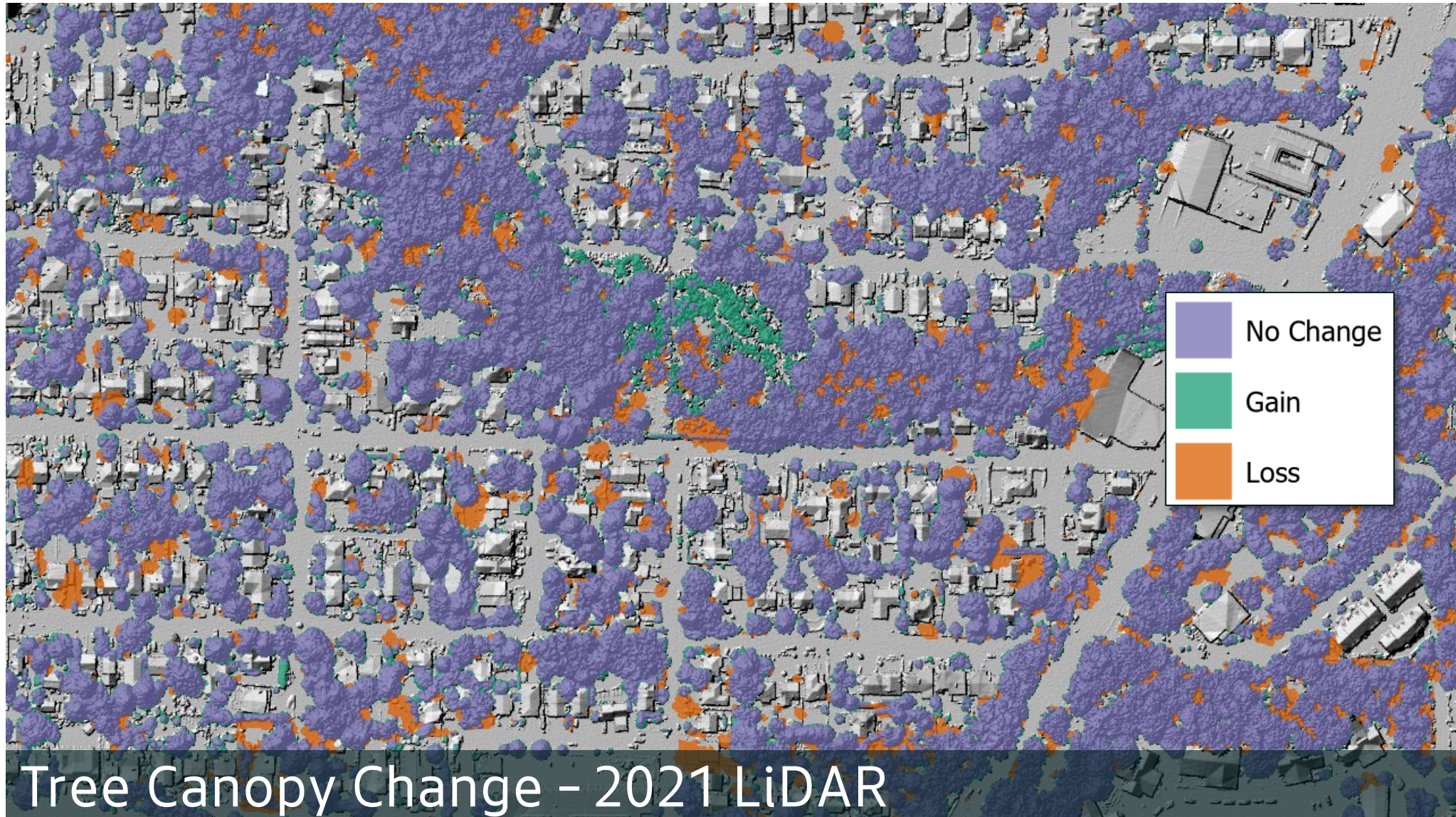**Stormwater** – millions of gallons of runoff not avoided

Heat/cooling – hundreds of acres shade lost; millions of gallons water not transpired;

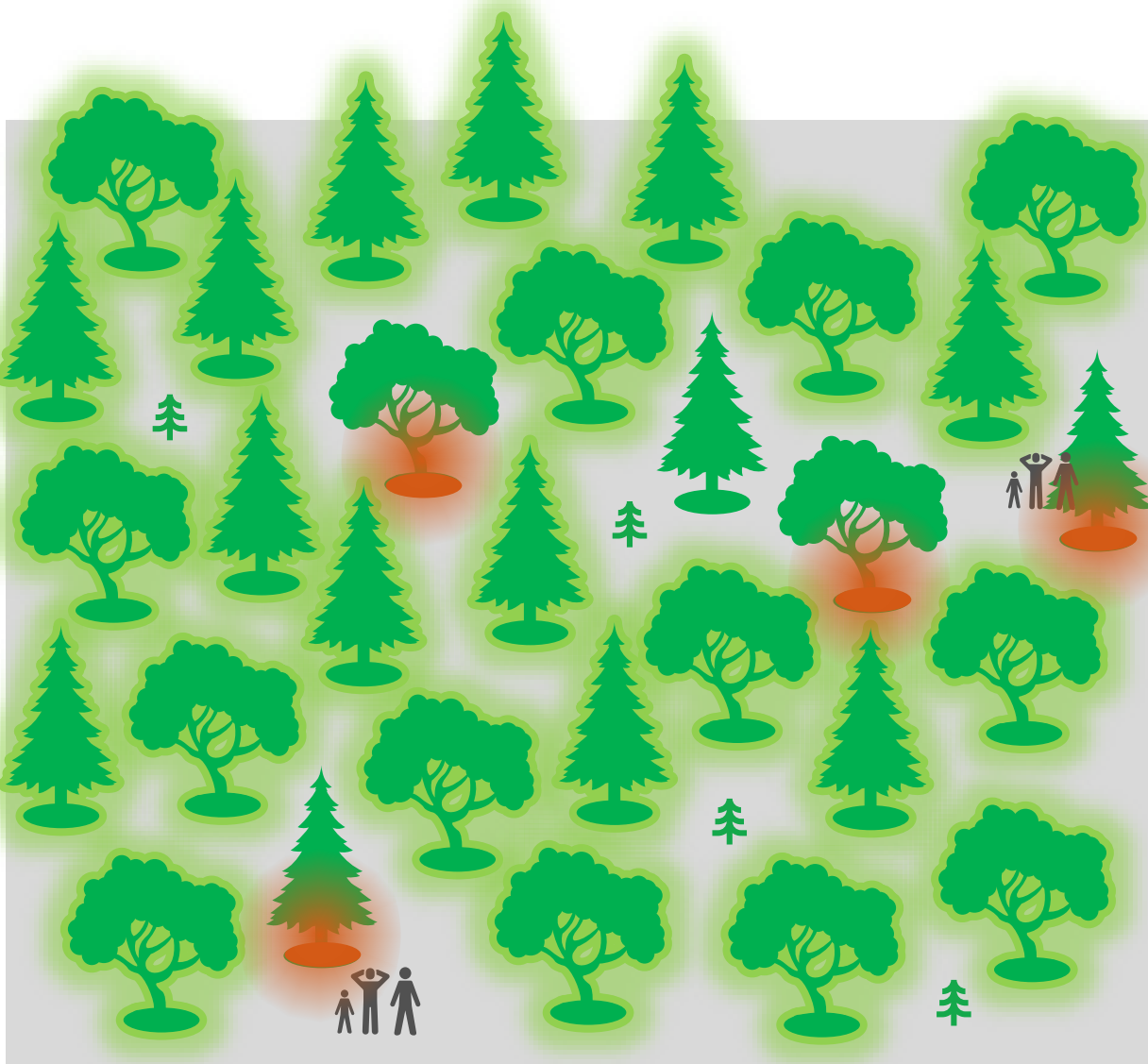**Air quality** – hundreds of thousands of lbs of pollutants not absorbed

Both losses and gains contribute to net canopy change

Legend:
- No Change
- Gain
- Loss

Tree Canopy Change – 2021 LiDAR

Loss + Gain = Net Change

Loss

- Happens suddenly, as an event
- Has both immediate and long-lasting environmental and quality of life impacts
- Cannot be reversed

Gains

- Accrue gradually, over long periods of time
- Require continual tree care and maintenance
- Are not always visible or noticed
- Remain vulnerable to climate and other impacts

We are slowly losing ground in our overall canopy coverage
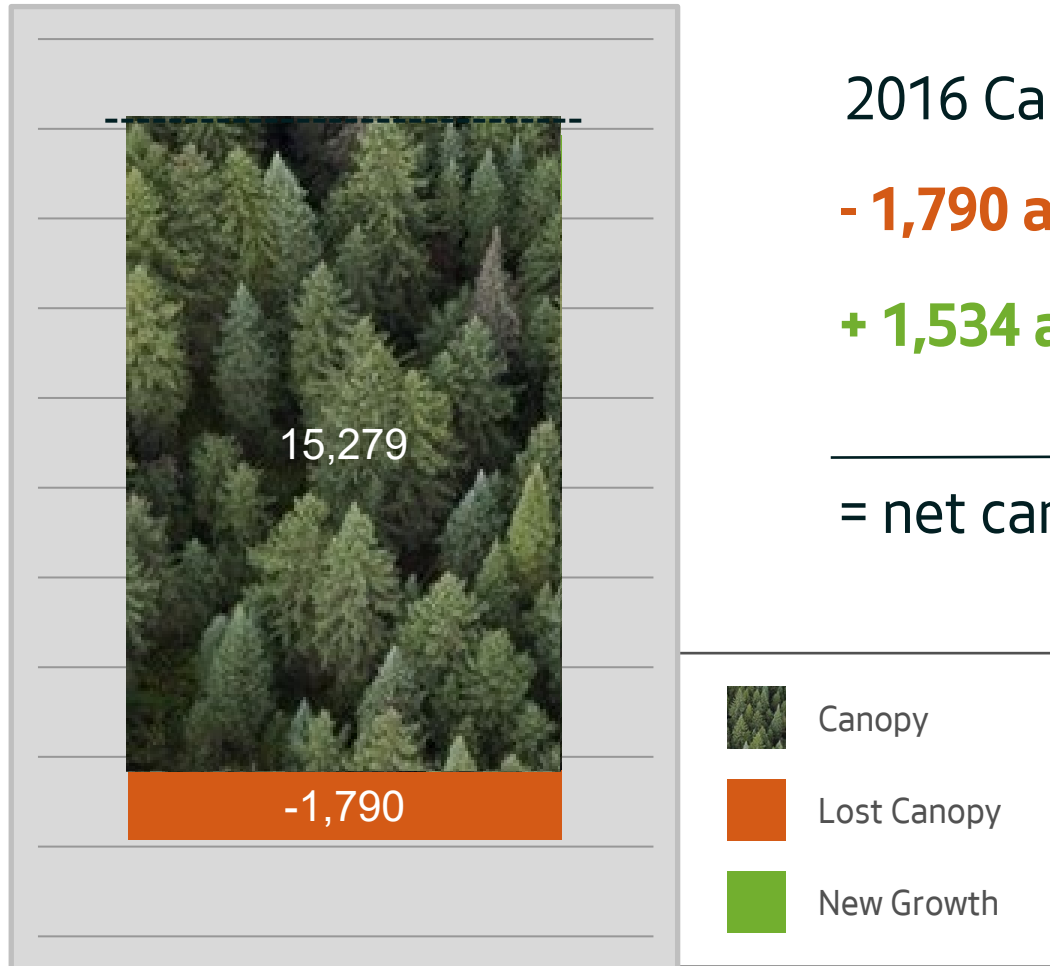
2016 Canopy: **15,279 acres**

- 1,790 acres of canopy lost (trees removed or fallen)

+ 1,534 acres of canopy gained (growth of existing trees, newly planted trees)

= net canopy loss of **255 acres**

Legend:
- Canopy
- Lost Canopy
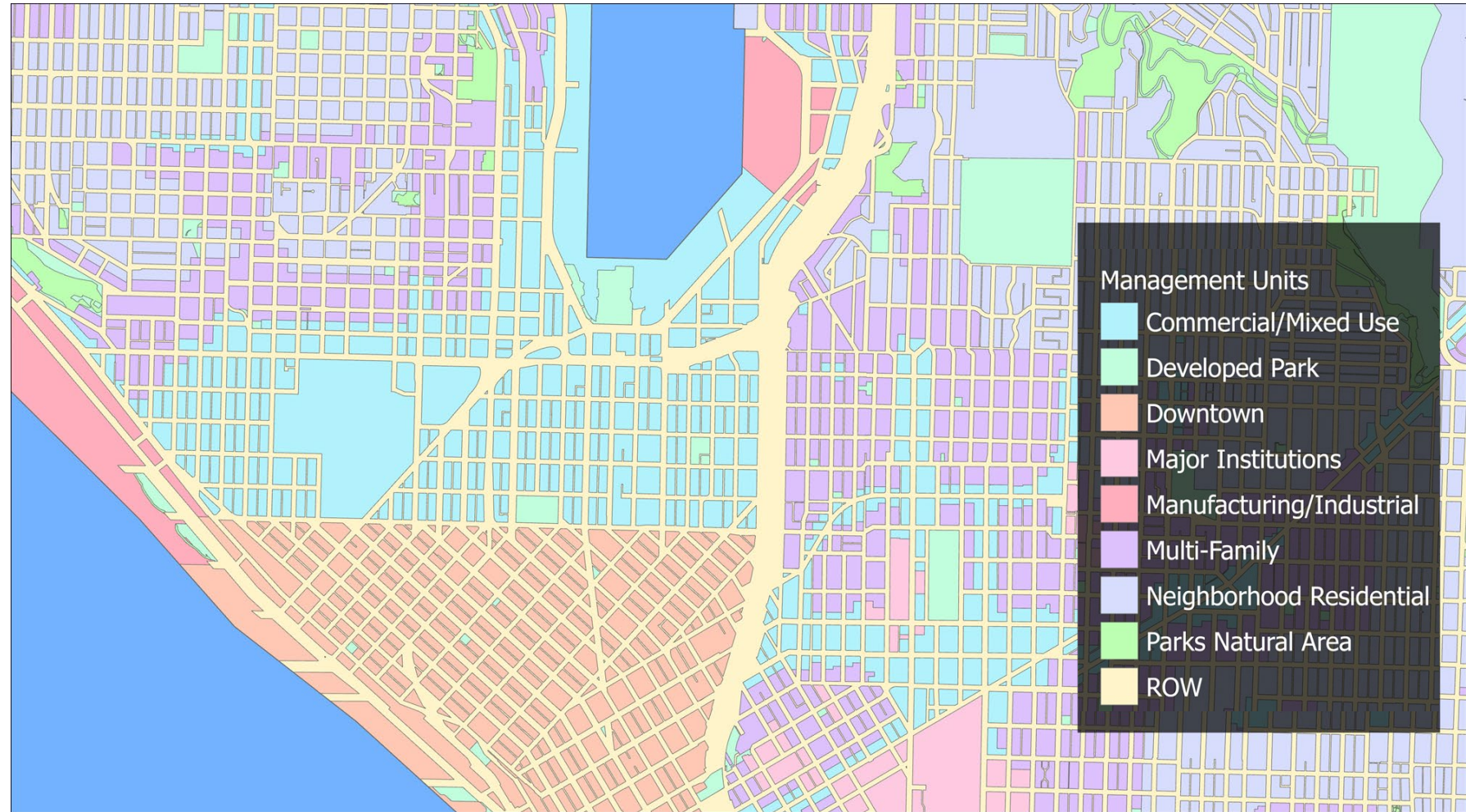- New Growth

We are slowly losing ground for many reasons

Reasons for gains and losses citywide

- **Changing Climate:** Hotter, drier summers stress trees

- **Aging trees:** More susceptible to drought and pests

- **Competing uses:** Construction of infrastructure projects such as for transportation and utilities

- **A growing city:** Population and housing growth

- **Tree protection and maintenance:** Mature, cared-for trees add canopy as they grow

- **New plantings:** New trees planted and stewarded

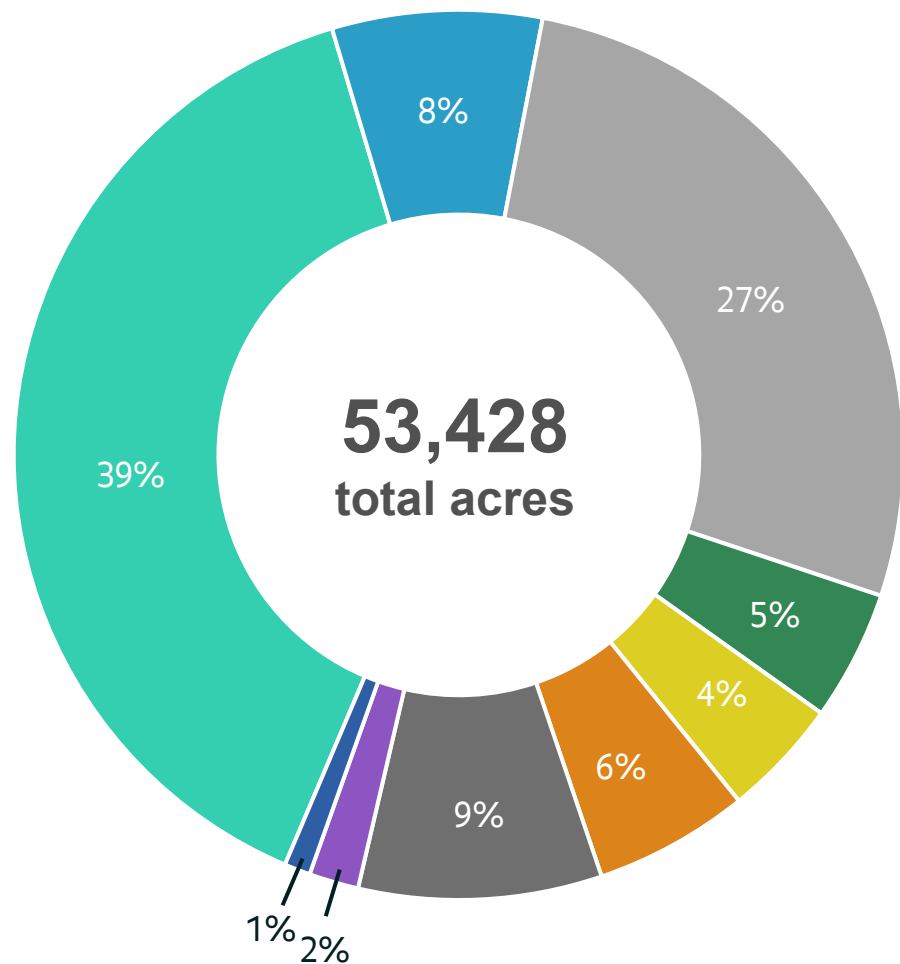# Canopy Analysis by Management Unit (Land Use)

What is a Management Unit?

- The urban forest is divided into 9 management units

- Each unit is distinct, based on physical characteristics

- Units may be governed by different policy frameworks and/or land use regulations

Management Units
- Commercial/Mixed Use
- Developed Park
- Downtown
- Major Institutions
- Manufacturing/Industrial
- Multi-Family
- Neighborhood Residential
- Parks Natural Area
- ROW

City Land Area by Management Unit

53,428 total acres

Management Unit	Total Land Area (acres)
Neighborhood Residential	20,841
Multifamily	4,074
Right of Way	14,482
Parks Natural Area	2,526
Developed Parks	2,305
Commercial / Mixed Use	3,010
Manufacturing / Industrial	4,722
Major Institutions	963
Downtown	505

Canopy losses were greatest in Parks Natural Areas and Neighborhood Residential

Tree Canopy Changes 2016-2021

Category	Value	Change	Loss
Neighborhood Residential	7,121	-87 acres -1.2%	-870
Right of Way	3,493	-10 acres -0.3%	-424
Parks Natural Area	2,176	-111 acres -5.1%	-182
Multifamily	951	-18 acres -1.9% (117)	-135
Developed Parks	708	-6 acres -0.8% (54)	-60
Commercial / Mixed Use	352	-5 acres -1.4% (45)	-50
Manufacturing / Industrial	211	-6 acres -2.8% (26)	-32
Major Institutions	241	-11 acres -4.6% (22)	-33
Downtown	24	3 / 24	-3

16
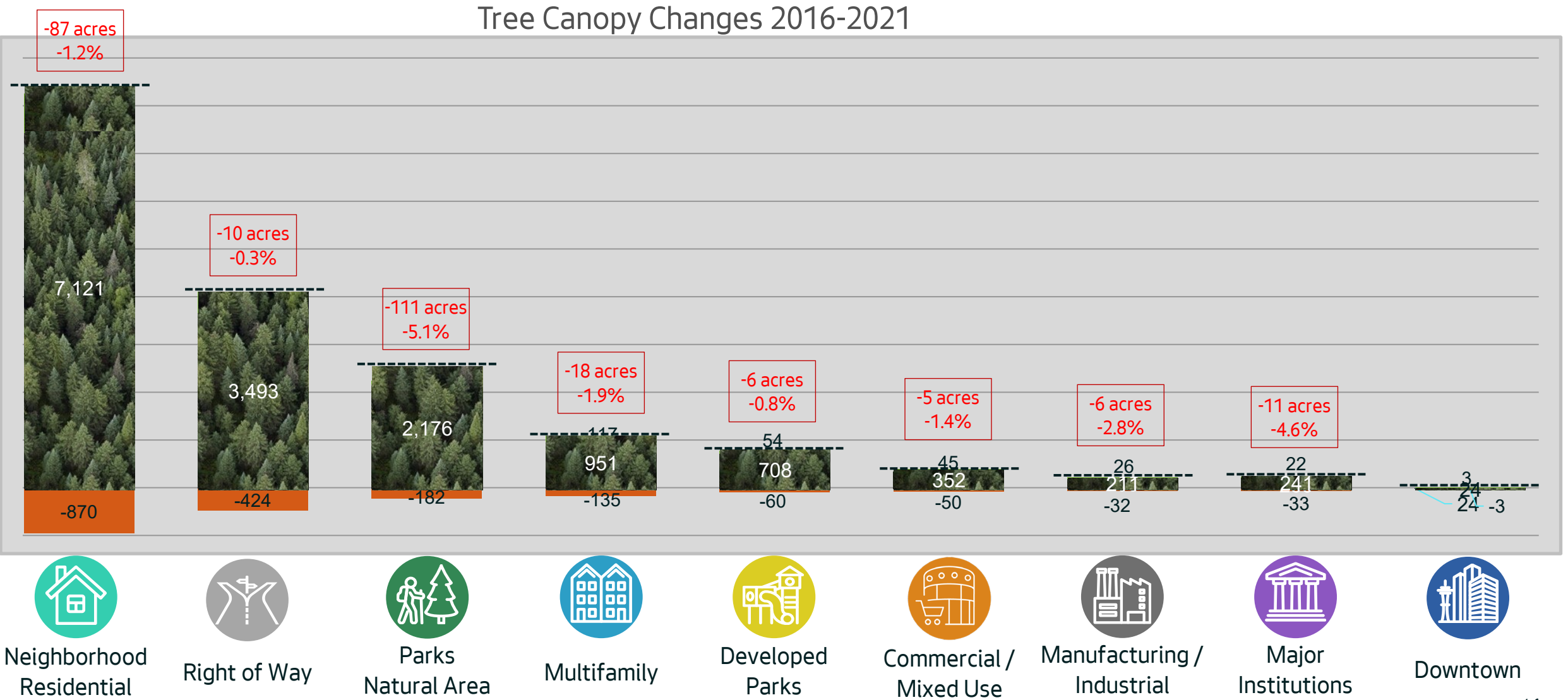
Losses and gains: Parks Natural Areas
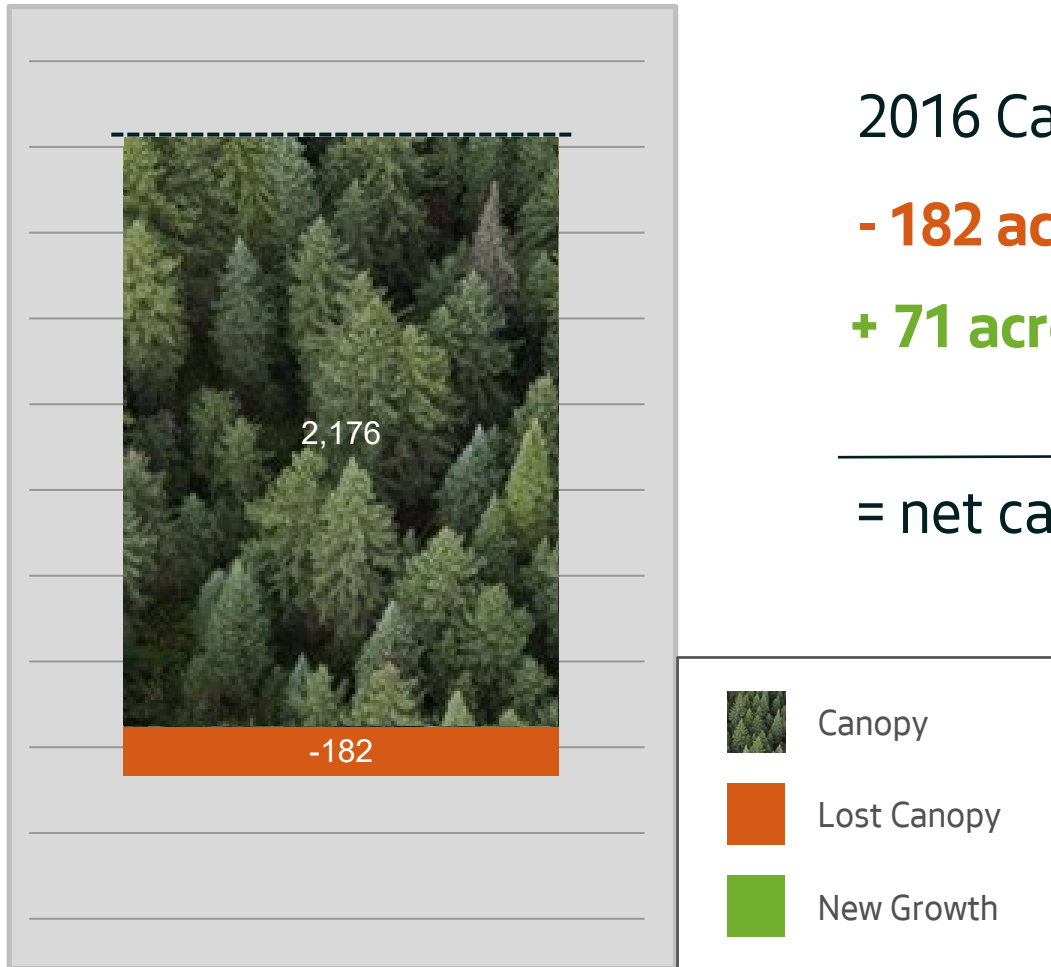
2016 Canopy: **2,176 acres**

- 182 acres of canopy lost (trees removed or fallen)

+ 71 acres of canopy gained (growth of existing trees, newly planted trees)

= net canopy loss of **111 acres**

Legend:
- Canopy
- Lost Canopy
- New Growth

Losses and gains: Parks Natural Areas

Reasons for losses and gains include:

Losses

- **Tree stress:** Trees failing/losing limbs, falling or needing to be removed due to age, drought stress and pest susceptibility

- **Conifer succession planting:** Aging deciduous trees removed to allow for conifer establishment

Gains

- **(Slow gain) Seedlings used for new plantings:** Plantings per year increased beginning in 2015. The smaller trees used – typically bare-root to 1-gallon size – mean that growth is slower in early years.

- **(Slow gain) Our natural areas have more conifers:** Conifers grow more slowly than deciduous trees but provide more ecosystem benefits.

- **Natural regeneration:** New trees resulting from natural regeneration in the forest ecosystem

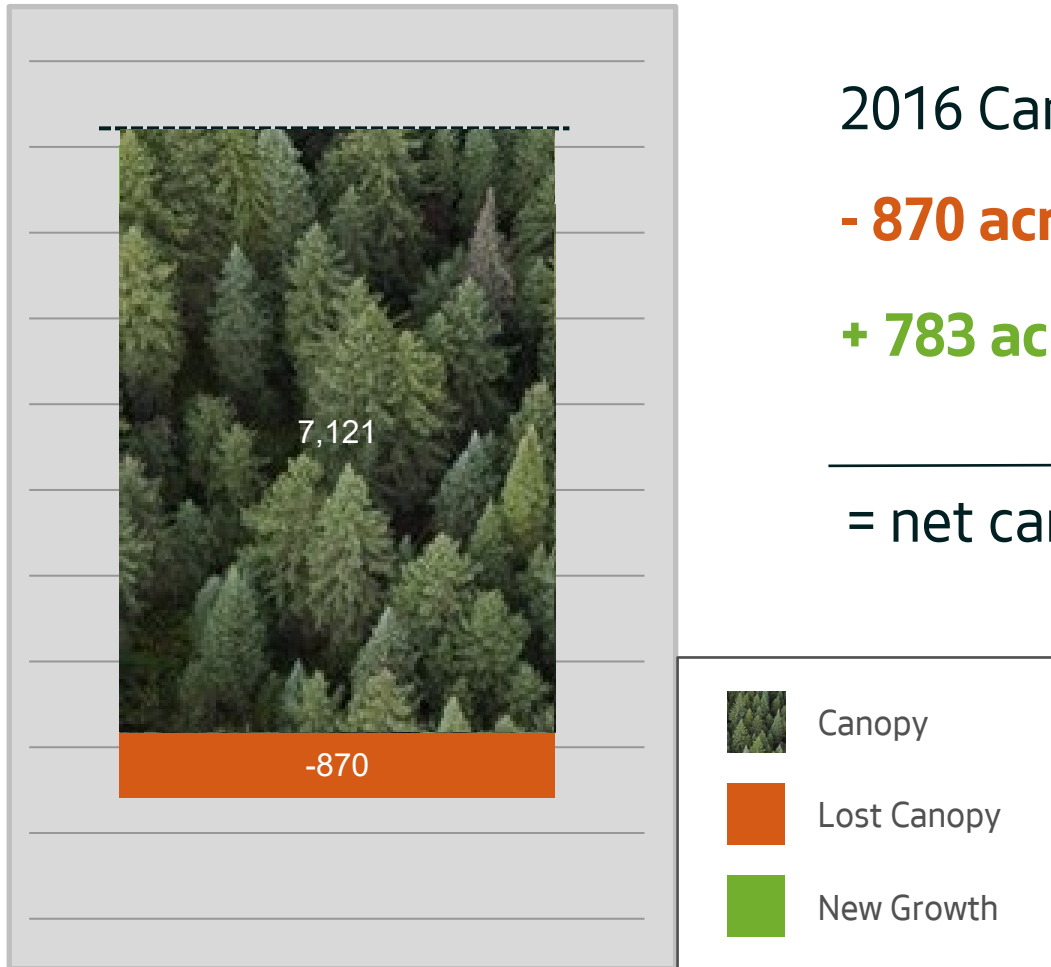# Losses and gains: Neighborhood Residential

2016 Canopy: **7,121 acres**

- 870 acres of canopy lost (trees removed or fallen)

+ 783 acres of canopy gained (growth of existing trees, newly planted trees)

= net canopy loss of **87 acres**

Legend:
- Canopy
- Lost Canopy
- New Growth

Losses and gains: Neighborhood Residential

Reasons for losses and gains include:

Losses

- **Aging trees, changing climate:** Trees fallen or removed as hazards

- **Property owner/occupant priorities:** Trees removed by residents to allow for other uses

- **Housing for a growing city:** Trees removed for development

Gains

- **Tree protection and maintenance:** Protection and care of existing trees, allowing them to add more branches and leaves over time

- **New plantings:** New trees planted in yards and in planting strips by residents alone or with support from Trees for Neighborhoods and other city programs
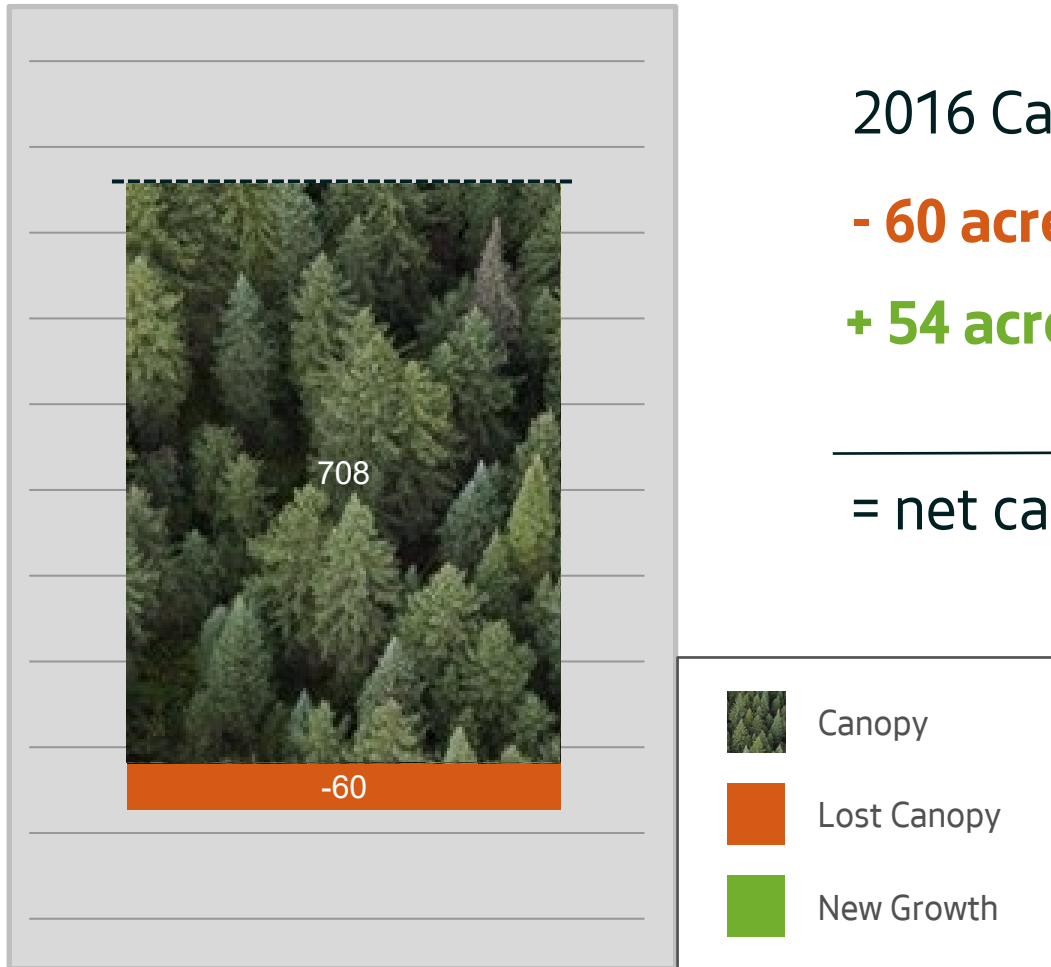
Losses and gains: Developed Parks

2016 Canopy: **708 acres**

- 60 acres of canopy lost (trees removed or fallen)

+ 54 acres of canopy gained (growth of existing
trees, newly planted trees)

= net canopy loss of **6 acres**

Losses and gains: Right of Way

Chart values:
- 3,493
- -424

Legend:
- Canopy
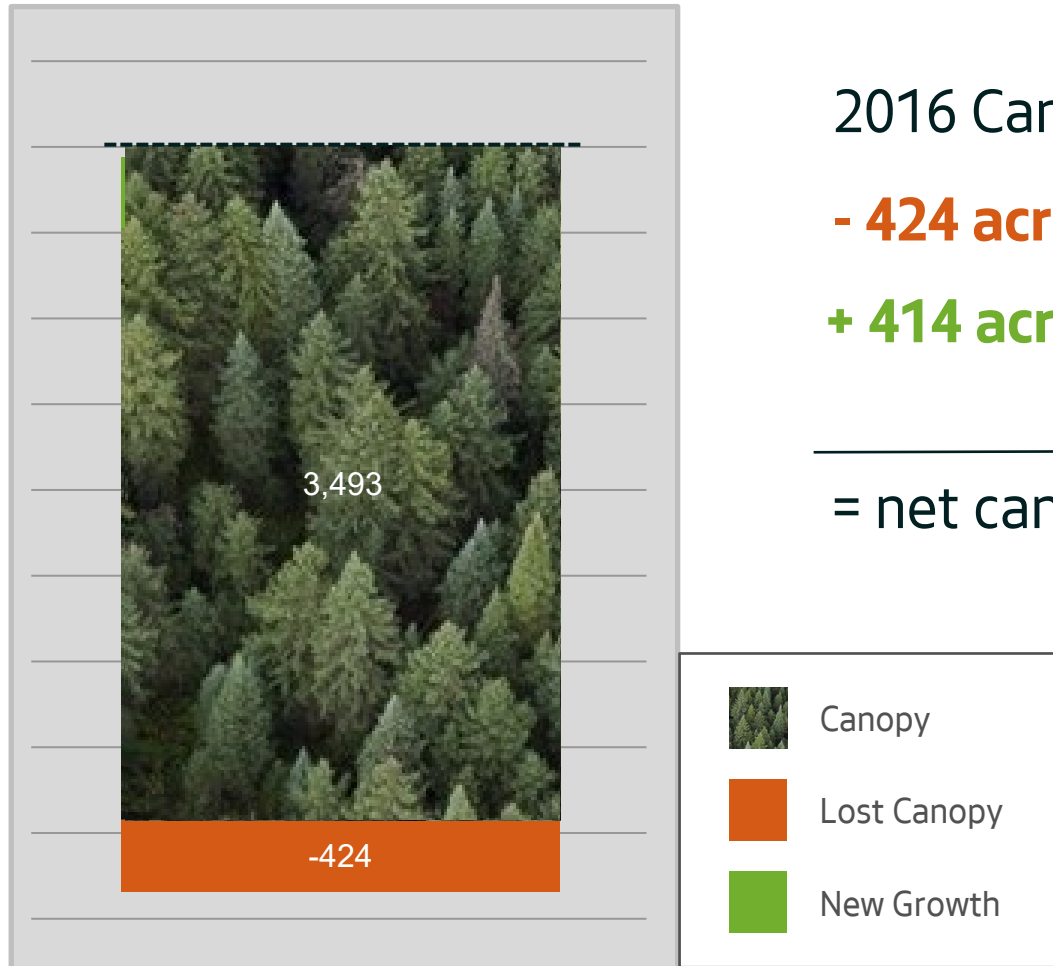- Lost Canopy
- New Growth

2016 Canopy: **3,486 acres**

- 424 acres of canopy lost (trees removed or fallen)

+ 414 acres of canopy gained (growth of existing trees, newly planted trees)

= net canopy loss of **10 acres**

Losses and gains: Right of Way

Reasons for losses and gains include:

Losses

- **Competing uses in the ROW:** Trees removed for transportation or utility projects

- **Limited space for many uses:** Trees compete for space, priority with the many types of infrastructure below ground in ROW

- **Increasing maintenance needs:** Age, drought stress, and pest susceptibility mean trees need longer establishment periods and more frequent pruning than currently available
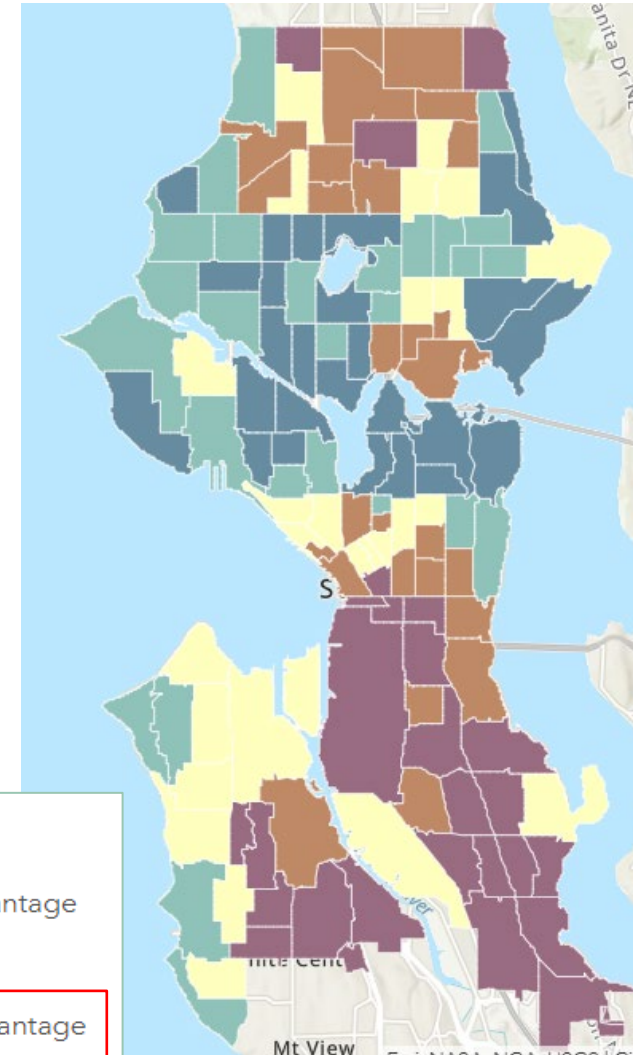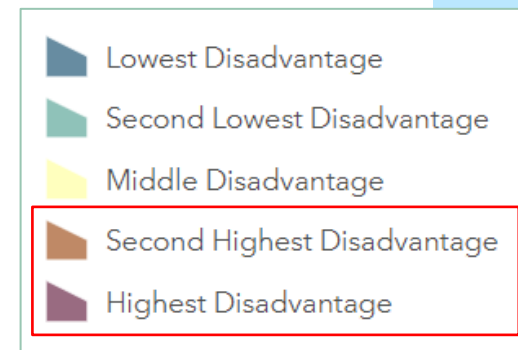
Gains

- **Tree protection and maintenance:** Protection and care of existing trees, allowing them to add more branches and leaves over time

- **New plantings:** New trees planted 1.5" diameter and larger) by city departments and by residents

- **Creative strategies to align ROW uses:** New technologies or strategies to care for the trees that are there and plant new ones.

Environmental Equity Priority Area Analysis

Defining Environmental Equity Priority Areas

- The city aims to prioritize urban forestry efforts in low-canopy areas, many of which are in low-income and BIPOC neighborhoods.

- OPCD produces the Race and Social Equity Composite (RSE) Index, which includes data on race, language, origin, socioeconomic disadvantage, and health disadvantage.

- This RSE Index divides census tracts into quintiles based on their level of disadvantage.

- The areas within the two highest levels of disadvantage are prioritized in our urban forestry work.

Source:
https://www.seattle.gov/documents/Departments/SDOT/NSF/Race%20and%20Social%20Equity%20Map.pdf

Lowest Disadvantage

Second Lowest Disadvantage

Middle Disadvantage

Second Highest Disadvantage

Highest Disadvantage

Highest disadvantaged areas started with less tree canopy

2016 Canopy in RSE Index Categories (acres)

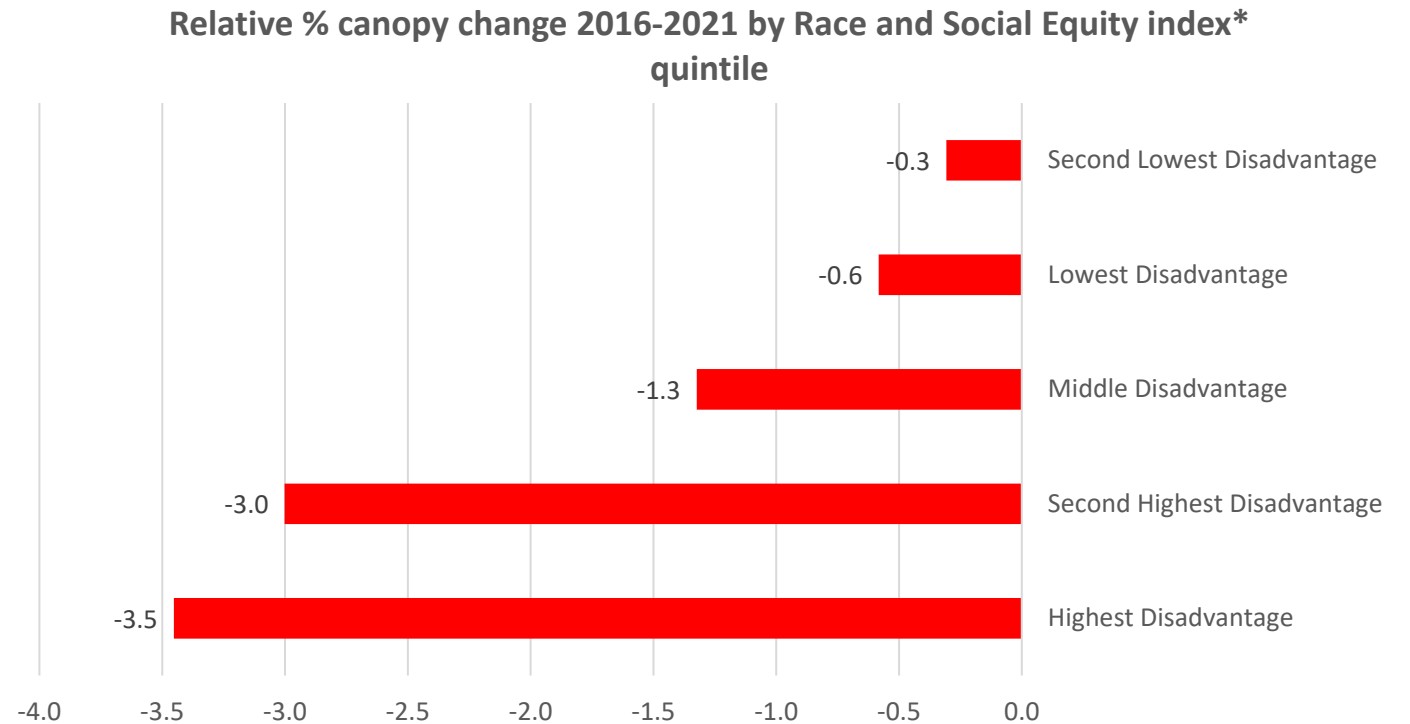| Category	Acres
Two lowest disadvantage categories	6,863
Two highest disadvantage categories	5,786
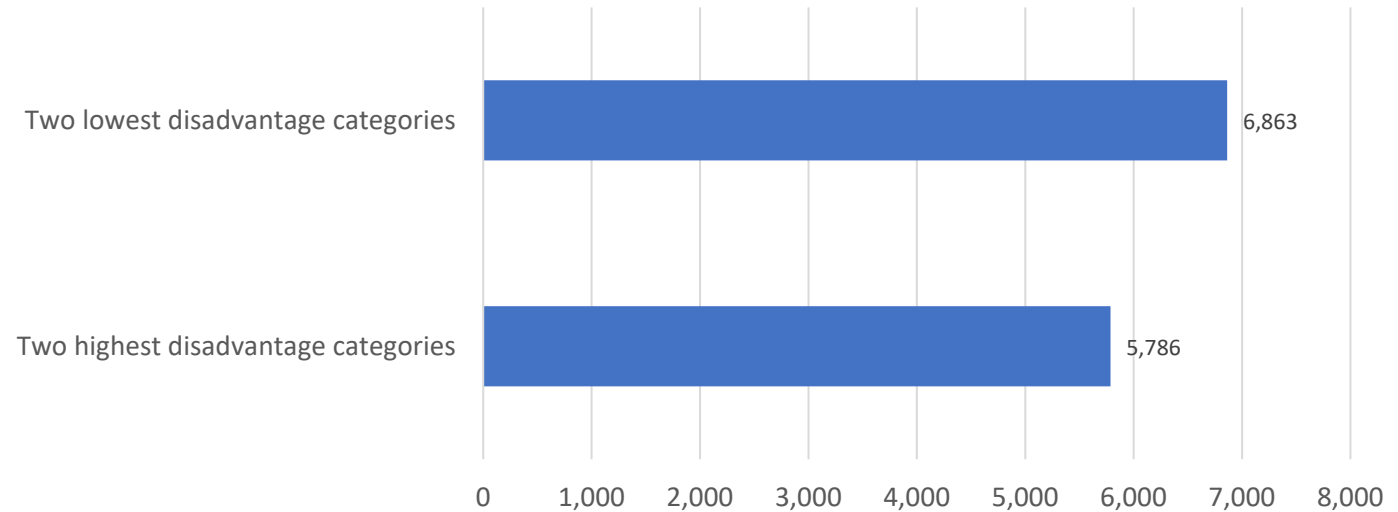
In 2016, the priority areas – the two highest levels of disadvantage – had 16% lower canopy than the areas in the two lowest categories of disadvantage.

*The **race and social equity composite index**, produced by the Office of Planning and Community Development, includes data on race, language, origin, socioeconomic disadvantage, and health disadvantage. It is used as a tool for City planning, program, and investment priorities. More information can be found at:
https://www.seattle.gov/documents/Departments/SDOT/NSF/Race%20and%20Social%20Equity%20Map.pdf

Highest disadvantaged areas saw the highest losses

Relative % canopy change 2016-2021 by Race and Social Equity index* quintile

- -0.3 — Second Lowest Disadvantage
- -0.6 — Lowest Disadvantage
- -1.3 — Middle Disadvantage
- -3.0 — Second Highest Disadvantage
- -3.5 — Highest Disadvantage

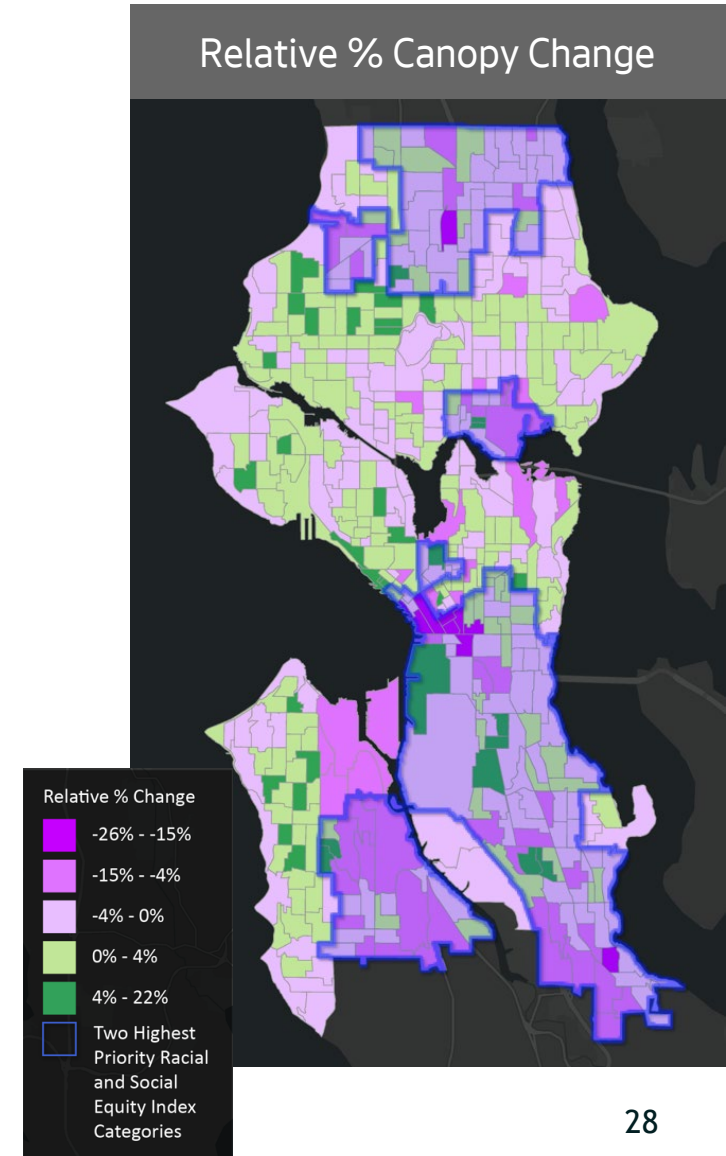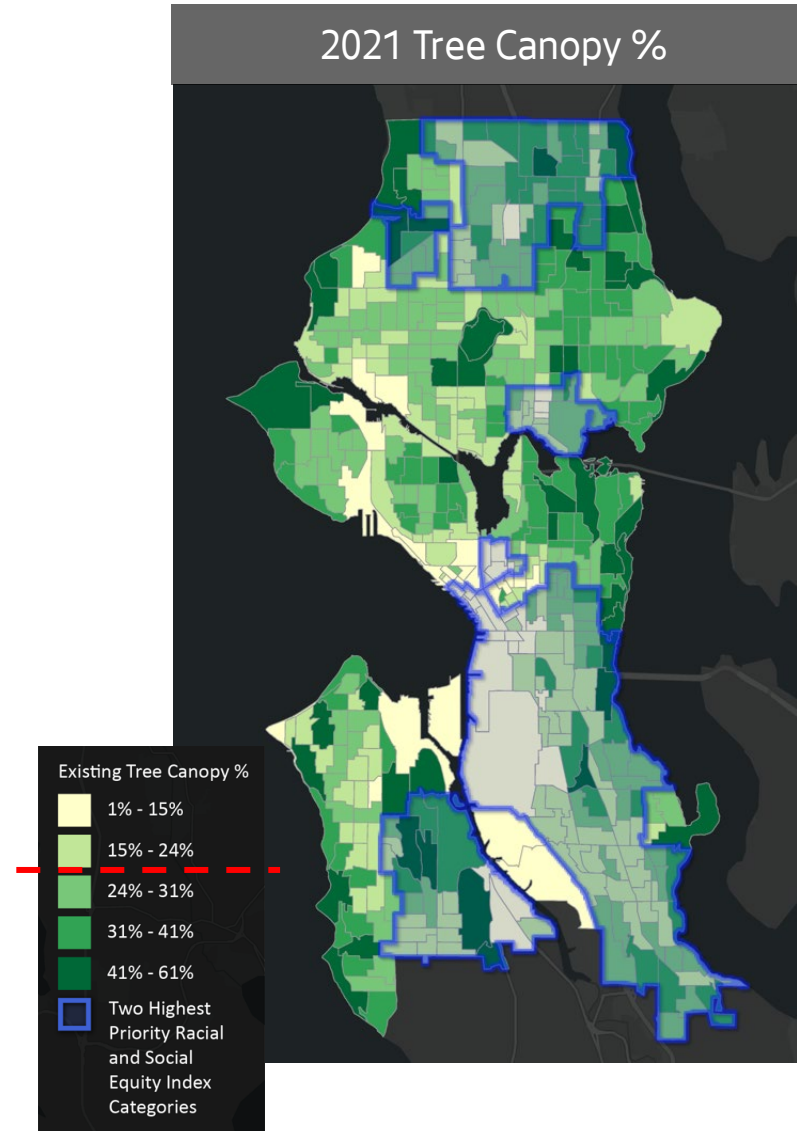(x-axis: -4.0, -3.5, -3.0, -2.5, -2.0, -1.5, -1.0, -0.5, 0.0)

- The highest losses were in the highest disadvantage categories.

- By 2021, canopy in these areas was 20% lower than the areas in the two lowest categories of disadvantage.

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https://www.seattle.gov/documents/Departments/SDOT/NSF/Race%20and%20Social%20Equity%20Map.pdf

Using the data to identify critical neighborhoods to focus equity and resilience planning

In neighborhoods of higher disadvantage, data show:

- Gains in some areas, e.g.:
  - East Duwamish greenbelt
  - Longfellow Creek

- Losses in more areas, e.g.:
  - Northgate light rail project area
  - West Duwamish greenbelt
  - Rainier Valley

2021 Tree Canopy %

Existing Tree Canopy %
- 1% - 15%
- 15% - 24%
- 24% - 31%
- 31% - 41%
- 41% - 61%
- Two Highest Priority Racial and Social Equity Index Categories

Relative % Canopy Change

Relative % Change
- -26% - -15%
- -15% - -4%
- -4% - 0%
- 0% - 4%
- 4% - 22%
- Two Highest Priority Racial and Social Equity Index Categories

Climate Impacts

Temperatures are higher in lower canopy areas

5% increase in canopy = 2° cooler temperature
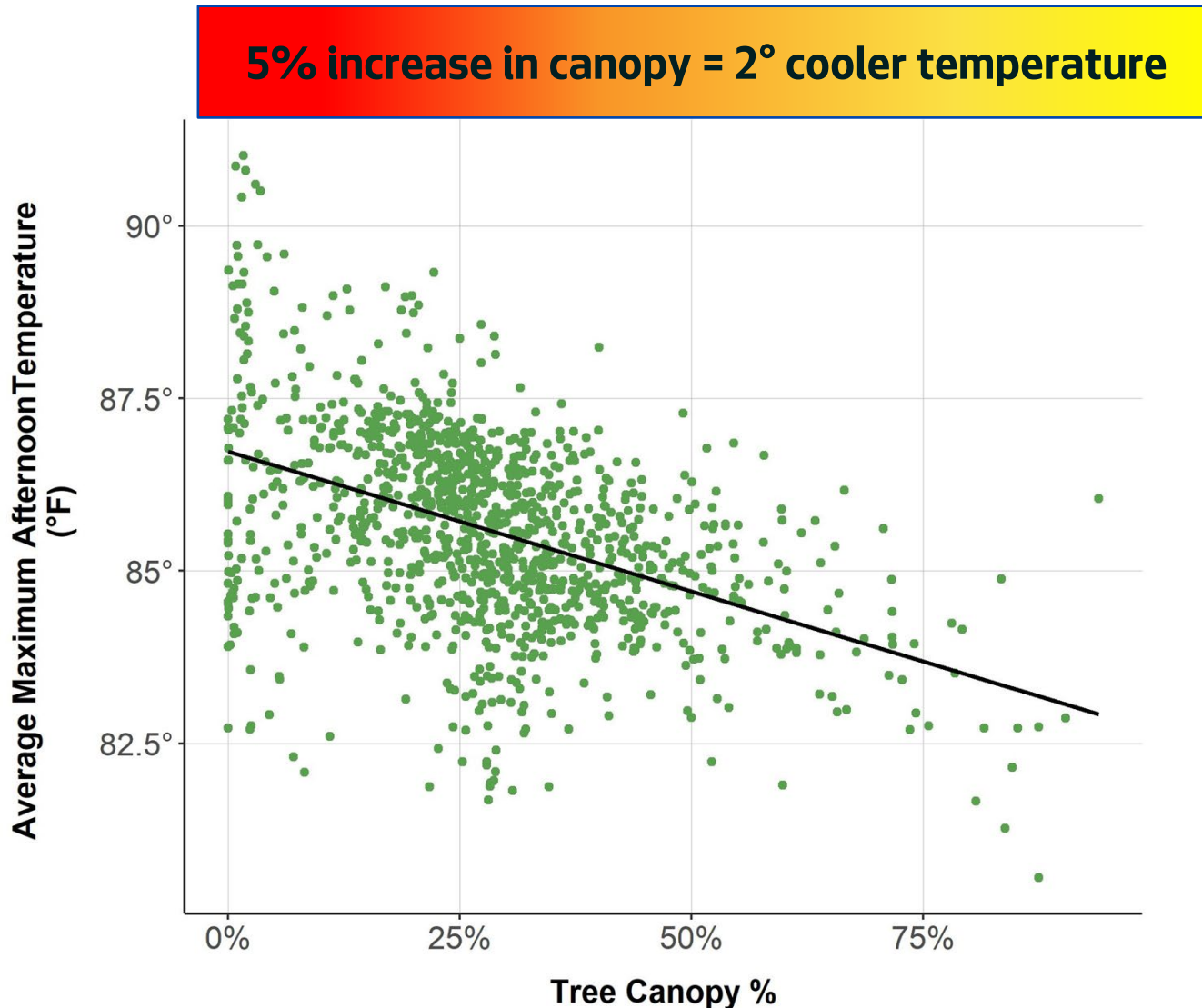
- Based on an analysis of King County Heat Watch Data and the 2021 Canopy Cover, the consultant determined that a 5% increase in canopy resulted in 2 degrees cooler temperature.

- Climate change will bring more heat waves, hotter temperatures.

- Increasing canopy in low-canopy neighborhoods is a critical aspect of our long-term heat preparedness strategy.

Temperatures are higher in lower canopy areas

Higher canopy, lower temperature

Existing Tree Canopy %
- 0% - 10%
- 11% - 25%
- 26% - 38%
- 39% - 58%
- 59% - 100%

Average Maximum Afternoon Temperature (F)
- 80 - 83
- 83 - 84
- 84 - 85
- 85 - 86
- 86 - 87
- 87 - 88
- 88 - 92

Neighborhood hotspots – lower canopy, higher temperatures

Industrial areas/transportation corridors – mostly lower canopy, higher temperatures
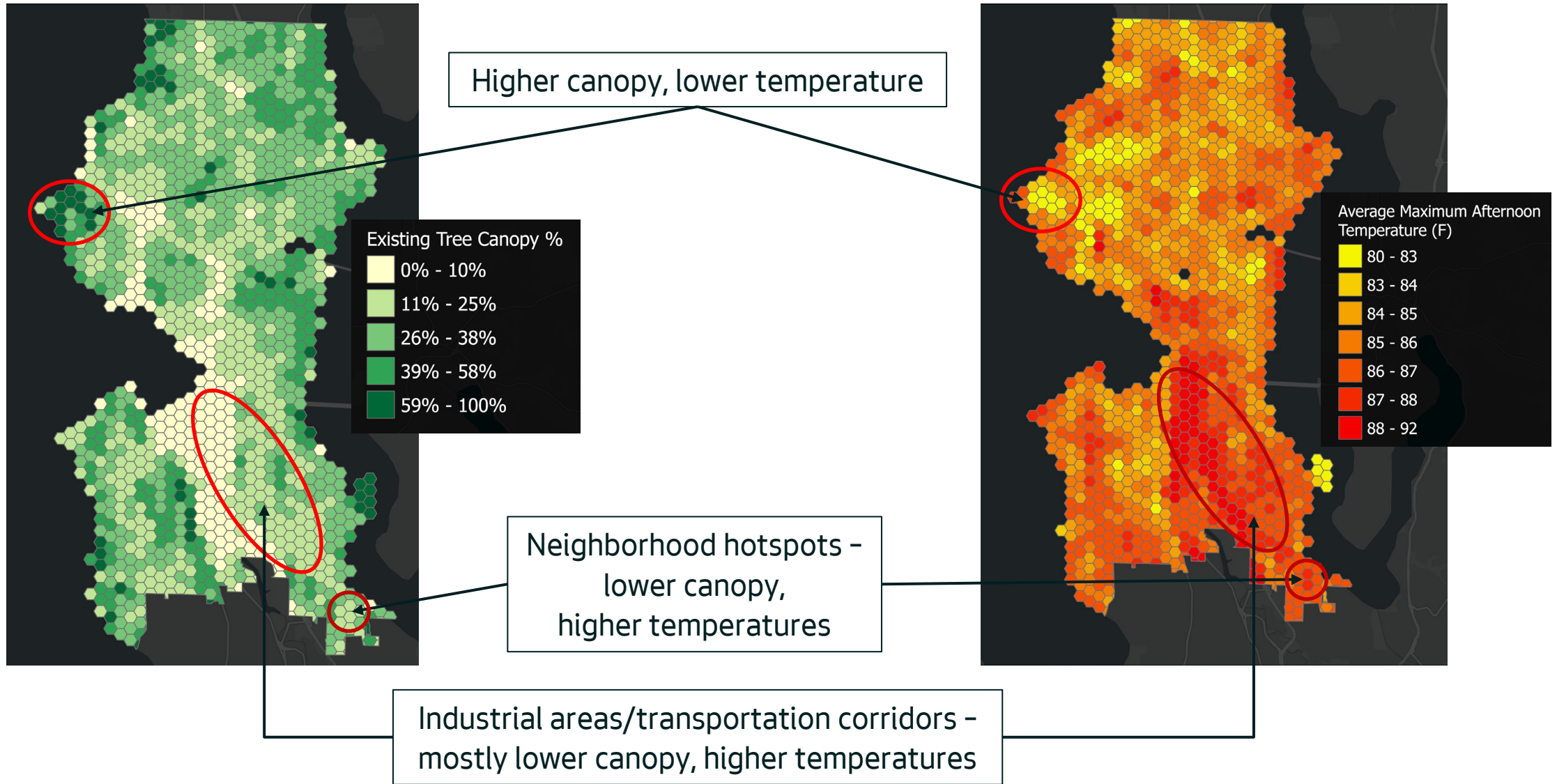
Climate Change is harming our trees

- Our summers are hotter and drier.

- Drought stress and age make our trees more susceptible to pests and diseases.

- This requires longer establishment periods to ensure trees stay alive in these hotter, drier summers.
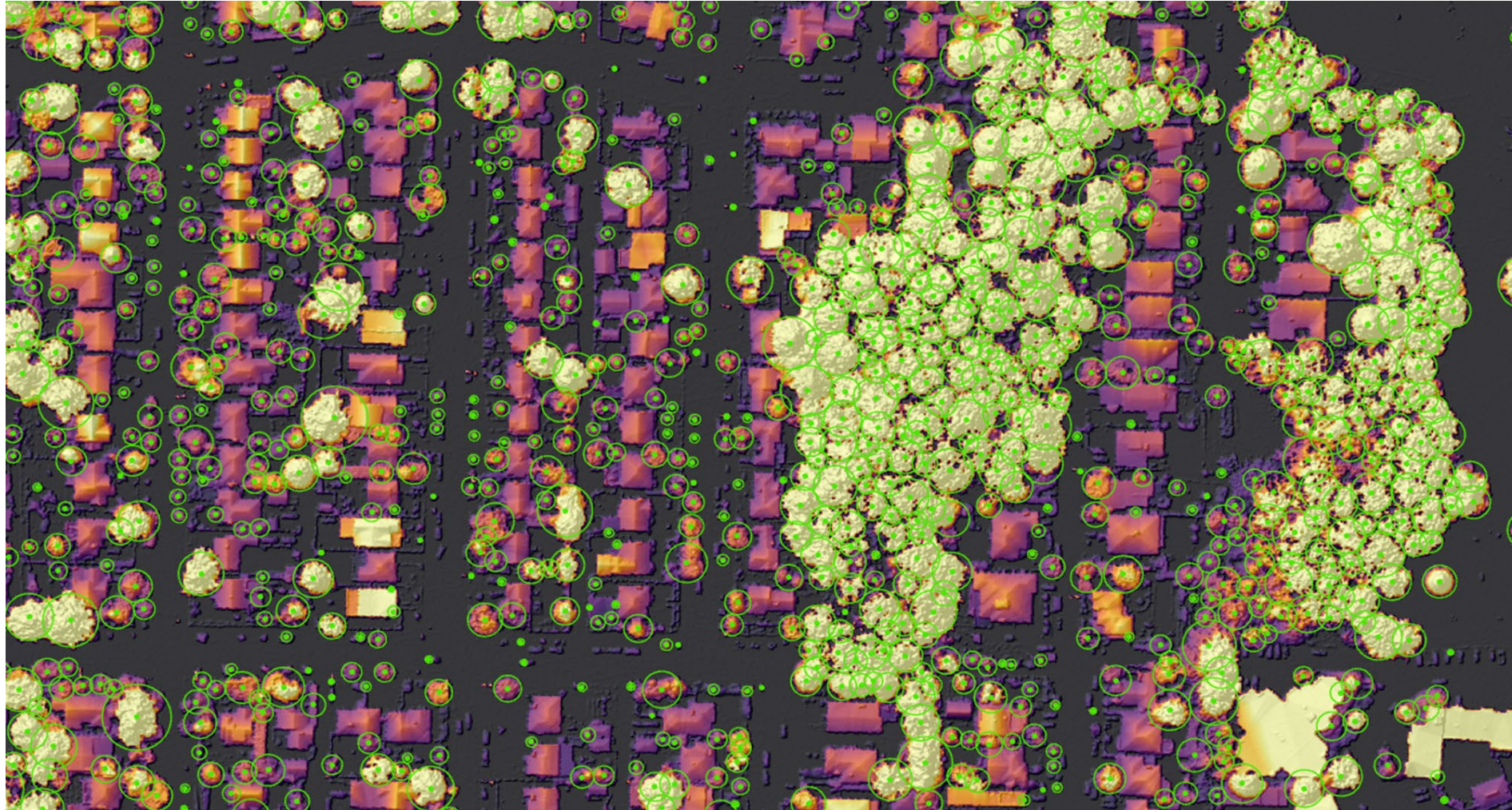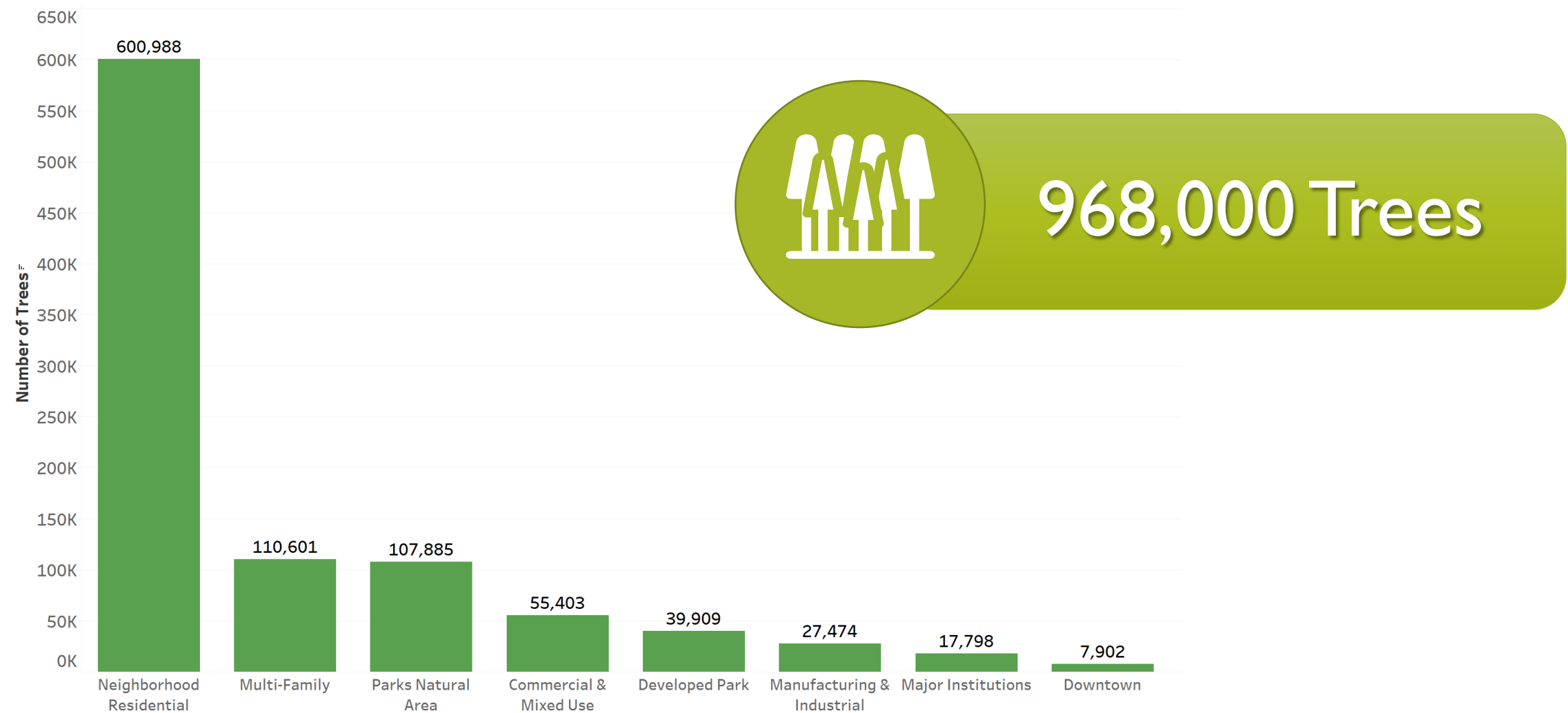

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Other Canopy Metrics

Total number of trees

Methodology:

A point is placed at roughly the center of each tree and a circle placed around it based on the diameter of the tree as approximated by tree height

Total number of trees

968,000 Trees

Number of Trees

Category	Value
Neighborhood Residential	600,988
Multi-Family	110,601
Parks Natural Area	107,885
Commercial & Mixed Use	55,403
Developed Park	39,909
Manufacturing & Industrial	27,474
Major Institutions	17,798
Downtown	7,902

Evergreen to deciduous ratio

Why this matters

- Seattle's native forest had a higher component of evergreen trees, with a smaller mix of deciduous trees.

- Today, that composition is reversed; we have a higher component of deciduous trees and smaller conifer component.

- Conifers provide greater ecosystem services

  - They retain their leaf area all year, so on an annual basis they:

    - Intercept more rainwater

    - Absorb more pollutants

- Around homes, they provide year-round privacy and wind protection

- They generally have longer life spans, so provide more ecosystem services overall throughout their lifetime

2021 data reflect a higher ratio of conifers to deciduous trees

37% Conifers

63% Deciduous

- This is a 9% increase in the conifer component of our urban forest since the 2016 assessment.

- Reasons for change
  - Second-growth forest is primarily deciduous and reaching the end of its lifespan; those trees are coming down at a greater rate
  - We prioritize conifers in City work:
    - Actively promote conditions for and plant conifers in natural area restoration
    - Encourage selection of conifers where appropriate when working with residents to select trees for planting
    - Select conifers where appropriate for street tree and park plantings

Recommendations and Next Steps

Recommendations

- **Do a lot more of what's working** – Increase resources for activities like maintenance, street and park plantings, Trees for Neighborhoods.

- **Focus on equity** – Develop a comprehensive plan for investment in the equitable distribution and resilience of the urban forest.

- **Get real about climate change** – plant more native trees, provide more maintenance funding to ensure care of trees facing more heat, less water, higher pest/disease susceptibility, focus on heat islands and neighborhood hotspots.

- **Align housing production and tree preservation/planting strategies** – balanced tree protections are important to retain large trees while supporting housing growth.