

# i-Tree For Funding Opportunities

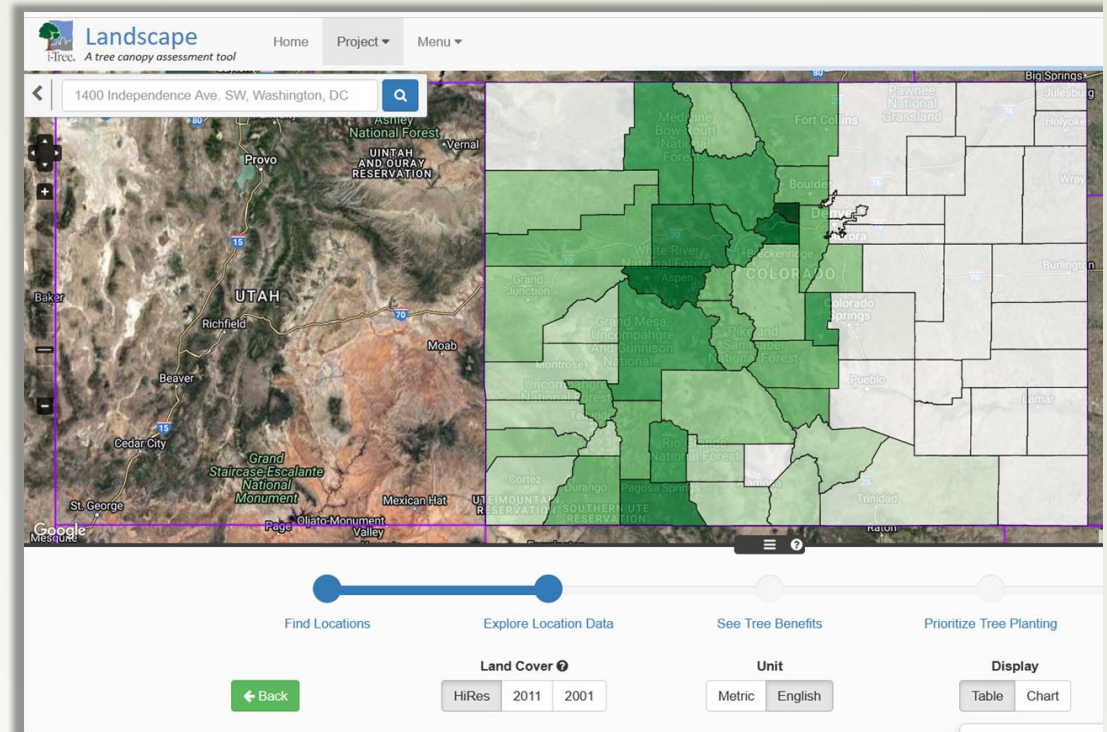
The Landscape of Canopy:  
*Benchmark, Prioritize, and Assess Impact*

May 3, 2023



# Looking Through Landscape to See Canopy in Action

- **Visualizing the environment** helps us see it in context
  - Trees + people + habitats + infrastructure: *connections*
- Landscape brings **USFS tree benefits science** to a nationwide map tool and offers a rich set of complimentary data
- Spatial distribution of resources and risks: visualizing **canopy impacts at neighborhood scale**
- Includes census demographic data and levels of environmental risk that can be used to **prioritize equity** across project locations



[landscape.itreetools.org](http://landscape.itreetools.org)

# Canopy, Climate, and Census Data on a National Scale

**Land Surface Temperature Difference**

- $\Delta -20^{\circ}\text{C}$ : (-36.0°F)
- $\Delta -16^{\circ}\text{C}$ : (-28.8°F)
- $\Delta -8^{\circ}\text{C}$ : (-14.4°F)
- $\Delta -4^{\circ}\text{C}$ : (-7.2°F)
- $\Delta -2^{\circ}\text{C}$ : (-3.6°F)
- $\Delta < 0^{\circ}\text{C}$ : (<0.0°F)
- $\Delta 0^{\circ}\text{C}$ : (0.0°F)
- $\Delta > 0^{\circ}\text{C}$ : (>0.0°F)
- $\Delta 2^{\circ}\text{C}$ : (3.6°F)
- $\Delta 4^{\circ}\text{C}$ : (7.2°F)
- $\Delta 8^{\circ}\text{C}$ : (14.4°F)
- $\Delta 16^{\circ}\text{C}$ : (28.8°F)
- $\Delta 20^{\circ}\text{C}$ : (36.0°F)

Land Surface Temperature Difference data derived from Landsat-8 Thermal Infrared Sensor Data. Temperature values are the difference from the median surface temperature for each Landsat scene - [landsat.usgs.gov](https://landsat.usgs.gov).

Close

## Temperature and Urban Heat Impacts

Next →

- Douglas-Fir Beetle (Dendroctonus...)
- Emerald Ash Borer (Agrilus plani...)
- Fir Engraver (Scolytus ventralis)
- Forest Tent Caterpillar (Malacosoma...)
- Goldspotted Oak Borer (Agrilus a...)
- Gypsy Moth (Lymantria dispar)
- Hemlock Woolly Adelgid (Adelge...)



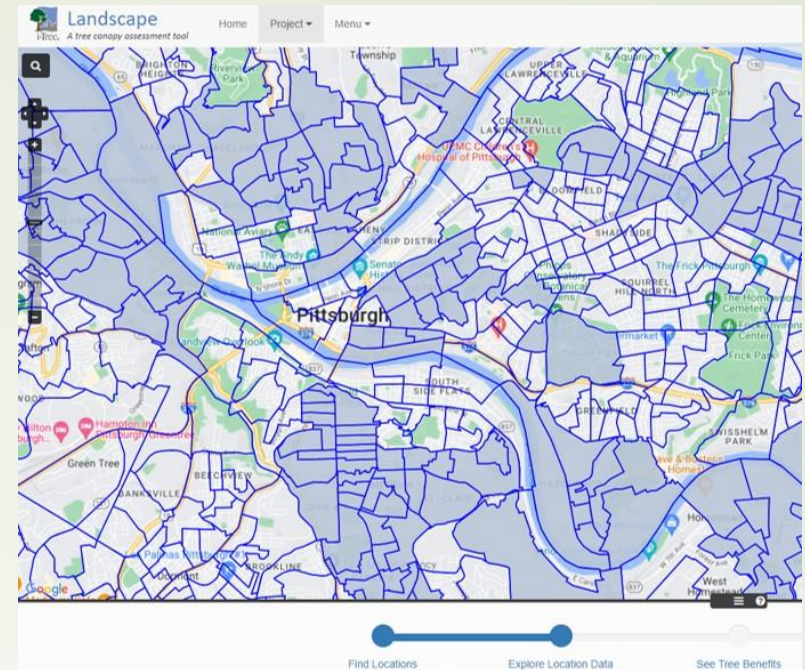
# i-Tree Landscape

## Benefits of Urban and Community Forests

- Mitigate flooding and stormwater runoff concerns
- Reduce urban heat island effects and energy costs
- Improve air quality and public health
- Mitigate greenhouse gas emissions

## Delivering Benefits Where They Are Needed Most

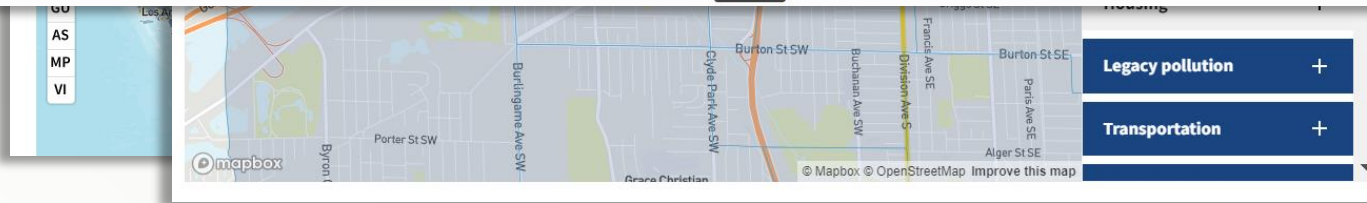
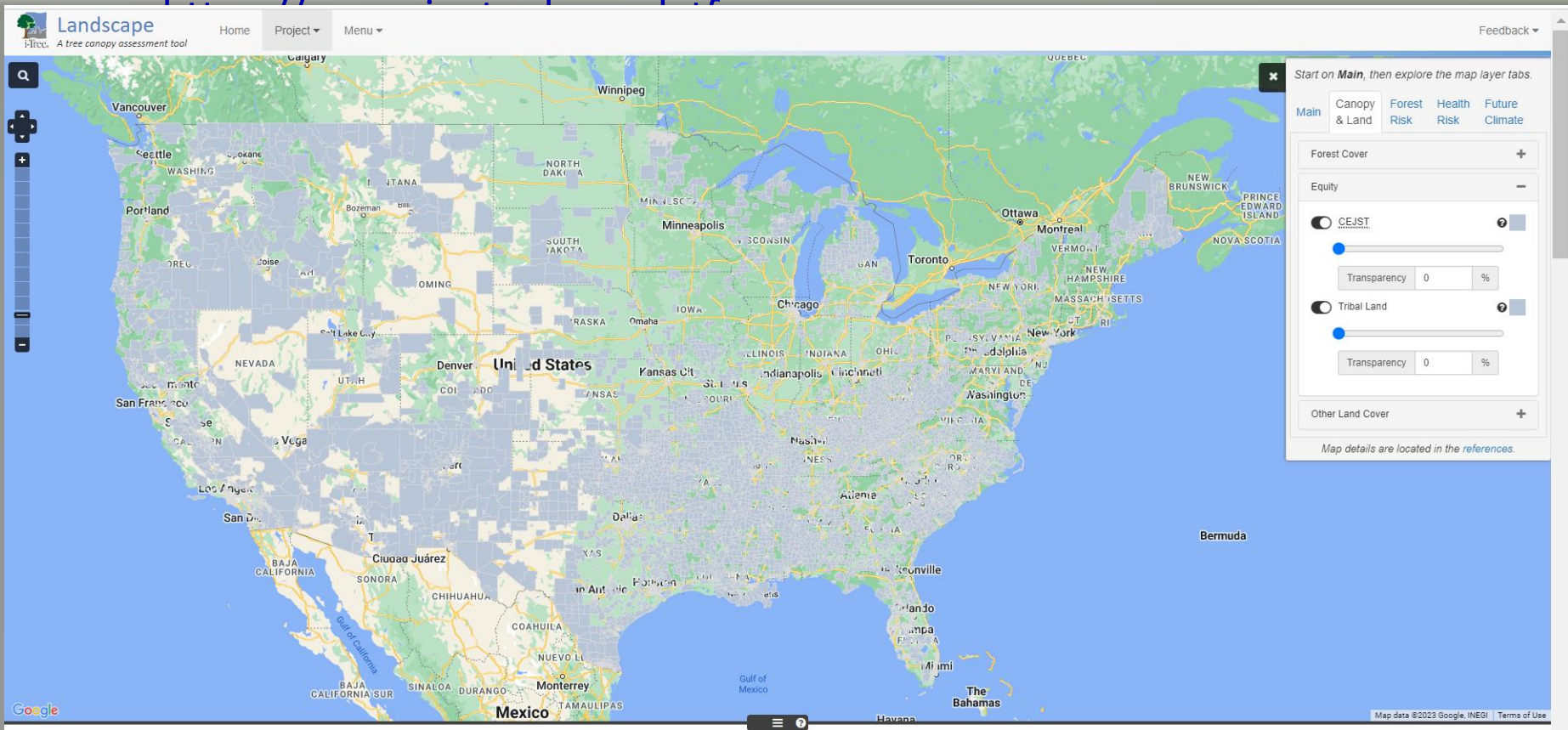
- Landscape can help you build a custom prioritization analysis
- **Climate and Economic Justice Screening Tool Layers**
- Visuals and data to support funding requests



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# i-Tree Landscape

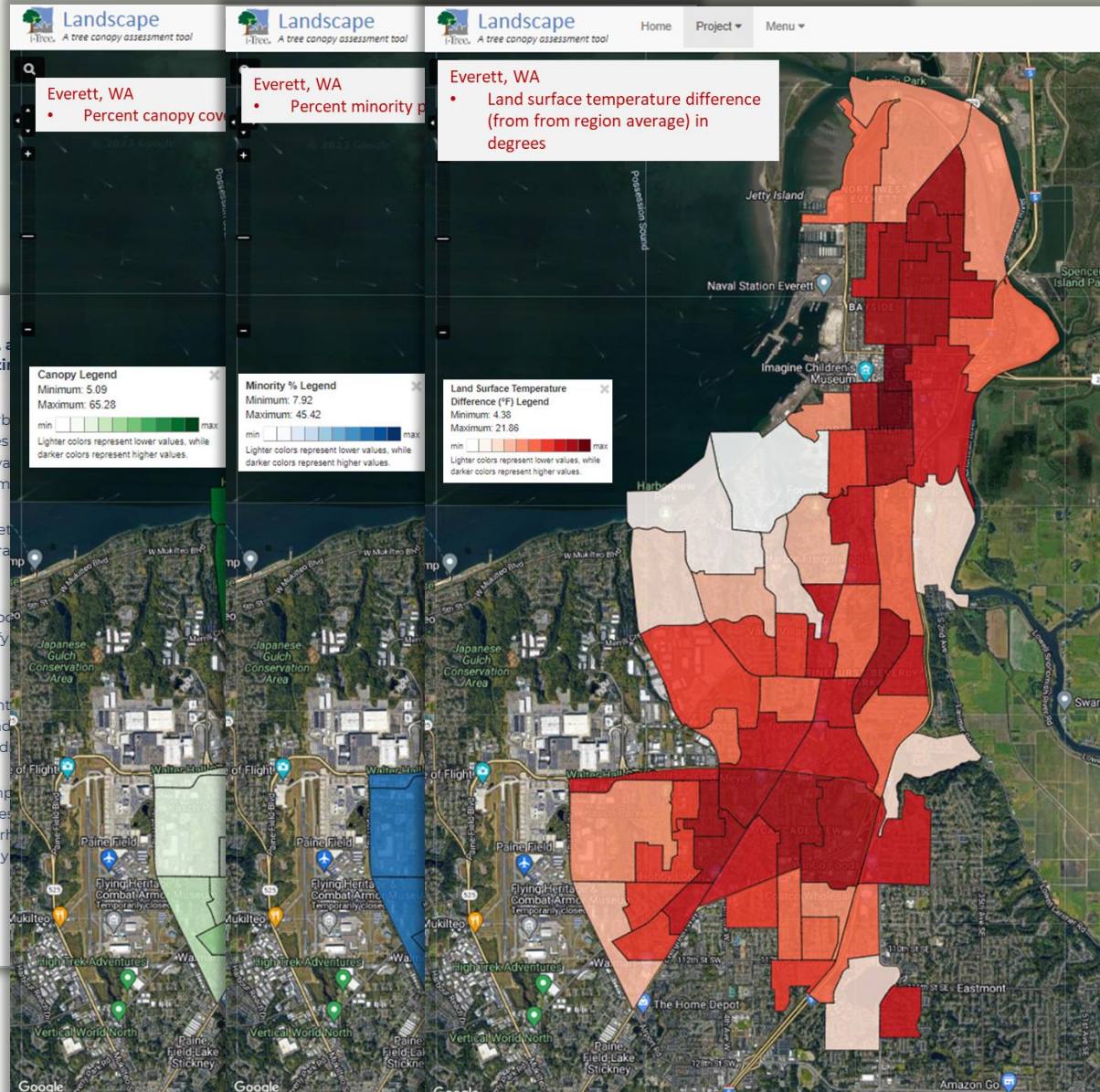
## CEJST Community Designations





# Benefits on a Community Scale

## Everett, WA



### Trees

#### Goal 9.9 Establish, replace, and rights of way recognizing benefits.

Policy 9.9.1. Develop an Urban Forest Plan that sets a vision and strategies for the City of Everett on public and private lands, and coordinate interdepartmental implementation.

Policy 9.9.2. Educate Everett residents on the benefits and best management practices for trees on public properties.

Policy 9.9.3 Review and update the Urban Forest Plan program for parks. Identify opportunities for tree planting.

Policy 9.9.4 Prioritize maintenance of trees managed by the Parks and Recreation Department, and develop maintenance plans, add trees to the inventory.

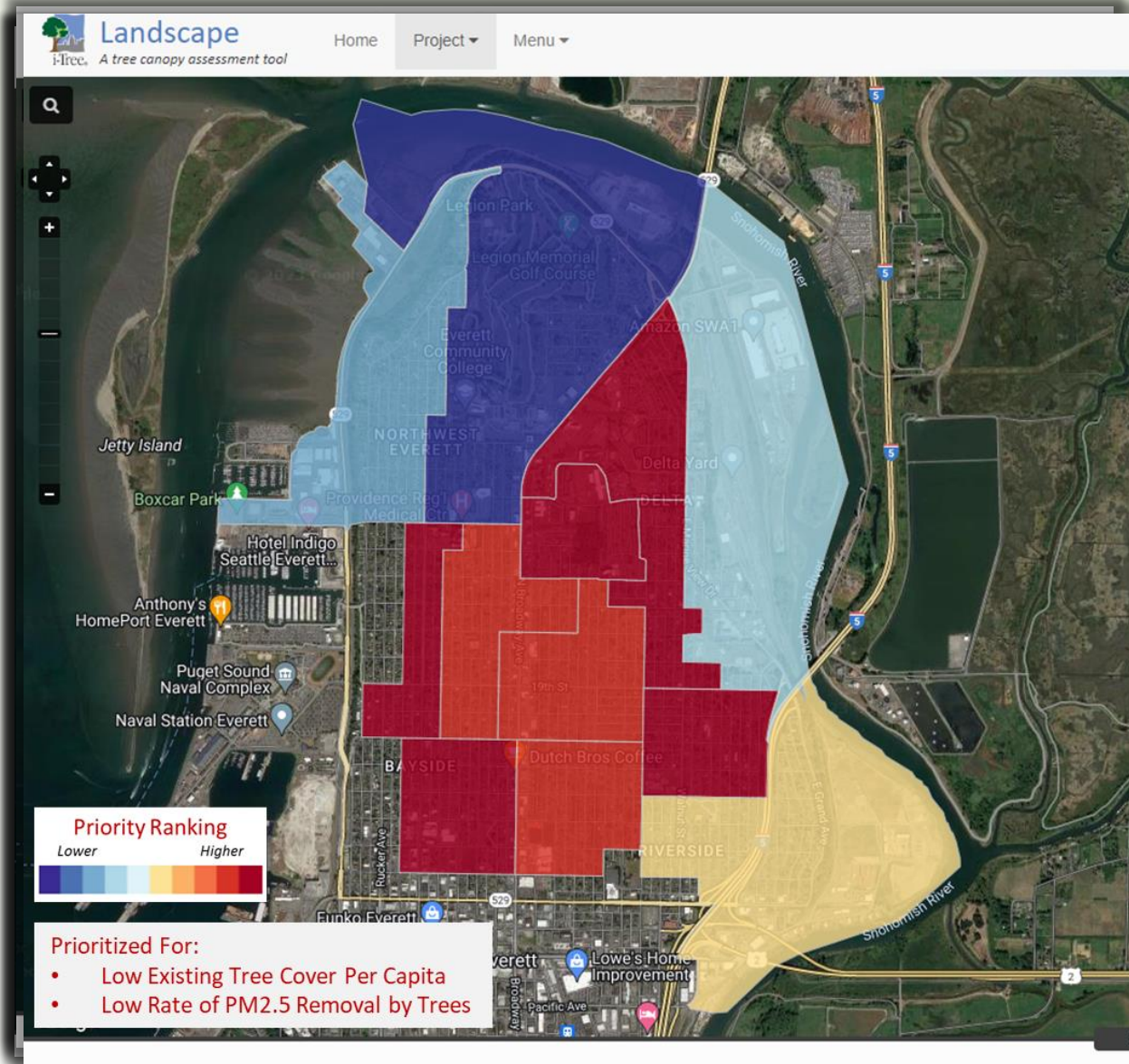
Policy 9.9.5 Maintain or improve tree canopy in parks, parklands and streetscapes. Strategically and equitably plant trees to reduce heat island effects.



# Benefits on a Community Scale

Everett, WA

Delta  
Neighborhood





# View Strengths and Priorities Across Geographies

**Priority Index** 100

Map details are located in the references.

Choose a boundary area to analyze:  
US Census Block Group

Use these tools to work with the map:  
+ Navigate Identify  
Select Box-Select  
Geo-Swap Clear  
Process 26 Start Over

Planting Prioritization +  
Map details are located in the references.

Find Locations Explore Location Data See Tree Benefits Prioritize Tree Planting Generate Results

**Land Cover**  
HiRes 2011 2001

**Common Scenarios**  
Population Minorities Poverty

**How To Prioritize Tree Planting**  
To map optimal areas to plant trees, create a "Priority Planting Index" scenario from user-specified, weighted criteria (under Custom Scenarios) or use one of the Common Scenarios (above). Scenarios are based upon the **Land Cover** dataset selected (above) - HiRes, 2011, 2001.

The three **Common Scenarios** are:

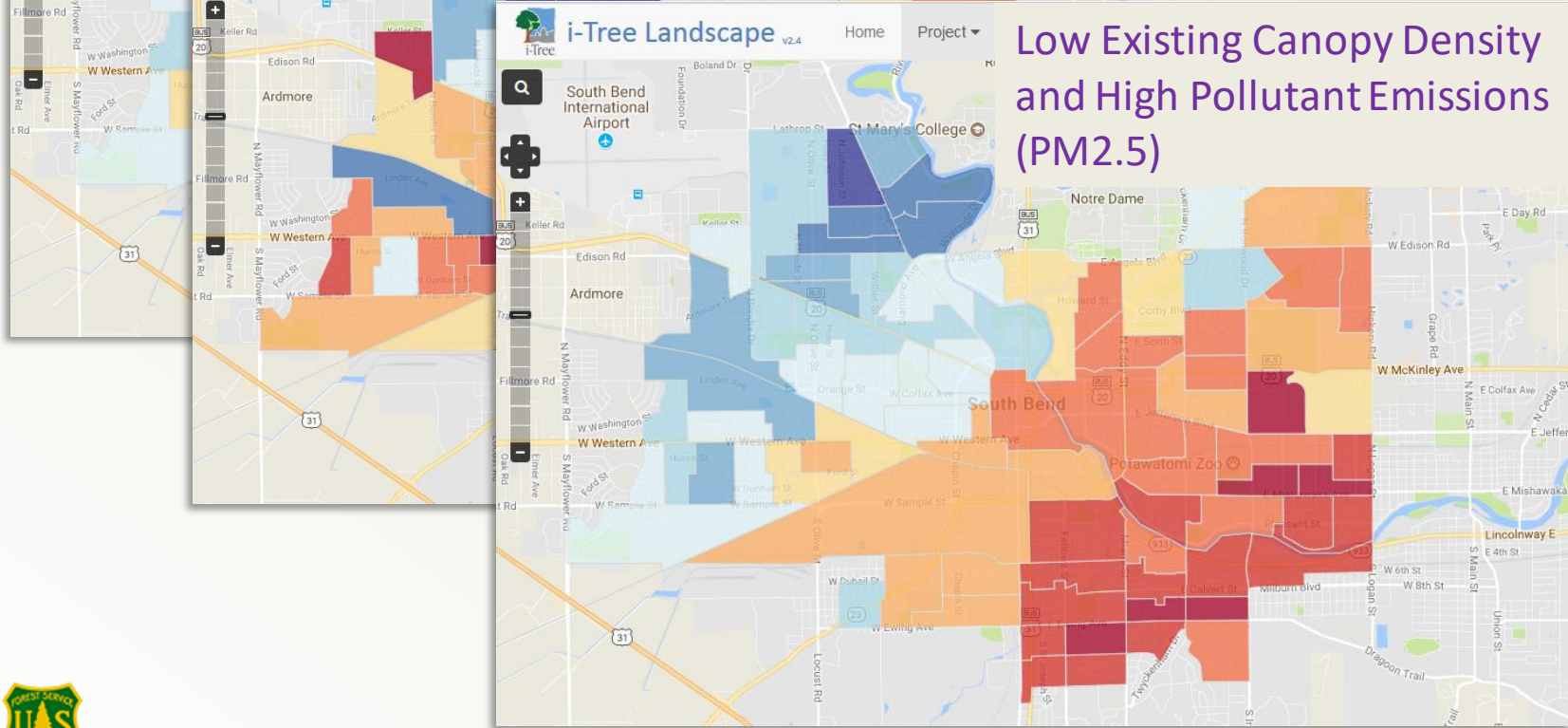
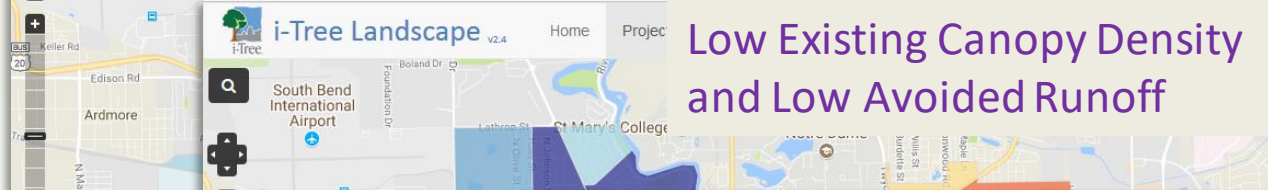
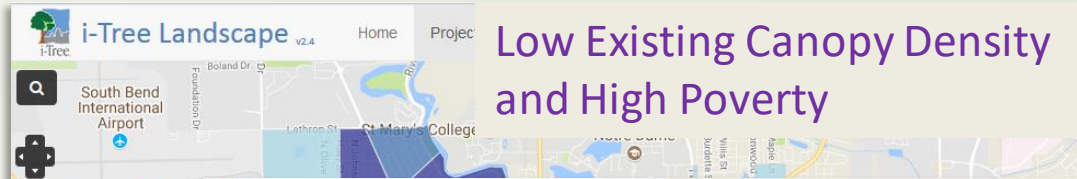
- Population:** (default) an index weighted towards areas of relatively high population density, low tree cover per capita, and high available planting space.
- Minorities:** an index weighted towards areas of relatively high minority population

**Custom Scenario**  
I want to prioritize for areas that have a...

High Low Avoided Runoff  
Importance (weight) 50 %



# Inform Community Decisions and Prioritize Strategies



# Benchmark Canopy Assets

- **i-Tree Canopy**
  - Combining the magic of Google with US Forest Service science

*There's a map for that...*

**i-Tree Canopy v7.1** Home Project Menu i-Tree Feedback

**Conduct your survey:** Add survey points by clicking or tapping the **+** button below. With each point you add, the map will shift to a new, random location where you assess the land cover at the yellow crosshairs in the center of the map. The more points you survey, the lower your standard error, and the more precise your sampling will be. More points provide a better estimation of Land Cover across your study area.

**Cover Class**

% Covered: 40%, 30%, 20%, 10%, 0%  
Area Covered (mi<sup>2</sup>): 15mi<sup>2</sup>, 10mi<sup>2</sup>, 5mi<sup>2</sup>, 0mi<sup>2</sup>

BE G I T W

previous: 33.0%±1.92 Tree: 23.7%±1.74 Water: 1.1%±0.12  
[View Results](#) [Report](#)

| ID | Cover Class | Latitude | Longitude |
|----|-------------|----------|-----------|
| 1  | Impervious  | 41.63463 | -86.24499 |
| 2  | Impervious  | 41.65614 | -86.27871 |
| 3  | Grass       | 41.75738 | -86.32580 |
| 4  | Grass       | 41.66447 | -86.30023 |
| 5  | Impervious  | 41.66999 | -86.20212 |
| 6  | Grass       | 41.73040 | -86.33129 |
| 7  | Impervious  | 41.69898 | -86.27998 |
| 8  | Grass       | 41.61184 | -86.21994 |
| 9  | Grass       | 41.66045 | -86.32086 |
| 10 | Bare Earth  | 41.71759 | -86.31191 |

[Save](#) Save often - don't lose your data!

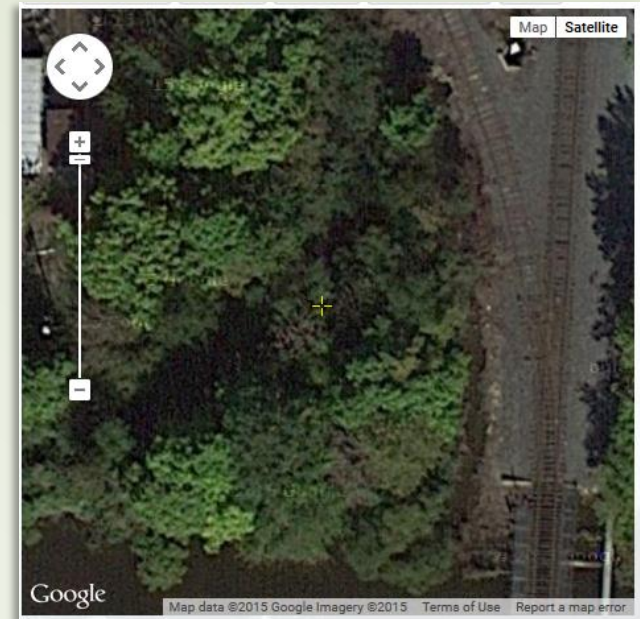
Google Tamarack  
Map data ©2021 Imagery ©2021 TerraMetrics Terms of Use Report a map error

IAS DAVEY Arbor Day Foundation SMA ARBORISTS ISA Case Trees

[canopy.itreetools.org](http://canopy.itreetools.org)

# Benchmark Canopy Assets – i-Tree Canopy

- The view from the top
  - Baseline assessment of your canopy cover: *what do I have?*
  - Estimate air pollution and carbon benefits of tree canopy, with associated dollar values
  - Ability to measure change over time



| Land Use   | Description                    | % Cover    |
|------------|--------------------------------|------------|
| Tree       | Tree/Large Shrub               | 23.7 ±1.74 |
| Impervious | Road/Building/Other Impervious | 33.0 ±1.92 |
| Grass      | Grass/Herbaceous/Crop          | 36.8 ±1.97 |
| Bare Earth | Bare ground/Soil               | 3.83 ±0.78 |
| Water      | Water                          | 2.67 ±0.66 |

# Benchmark Canopy Assets – i-Tree Canopy

- User-driven configuration
  - Random point sample survey of land use
  - Analysis considers your location factors

■ *Complete a survey in an afternoon*

■ CJEST tracts available for boundary selections

**Tree Benefit Estimates: Carbon (English units)**

| Description  | Carbon (kT) | ±SE    | CO <sub>2</sub> Equiv. (kT) | ±SE    | Value (USD)  | ±SE        |
|--|-------------|--------|-----------------------------|--------|--------------|------------|
| Sequestered annually in trees                              | 7.06        | ±0.52  | 25.87                       | ±1.90  | \$915,276    | ±67,107    |
| Stored in trees (Note: this benefit is not an annual rate) | 217.02      | ±15.91 | 795.75                      | ±58.34 | \$28,153,880 | ±2,064,197 |

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 0.713 kT of Carbon, or 2.615 kT of CO<sub>2</sub>, per mi<sup>2</sup>/yr and rounded. Amount stored is based on 21.940 kT of Carbon, or 80.446 kT of CO<sub>2</sub>, per mi<sup>2</sup> and rounded. Value (USD) is based on \$129,727.42/kT of Carbon, or \$35,380.20/kT of CO<sub>2</sub> and rounded. (English units: kT = kilotons (1,000 tons), mi<sup>2</sup> = square miles)

**Tree Benefit Estimates: Air Pollution (English units)**

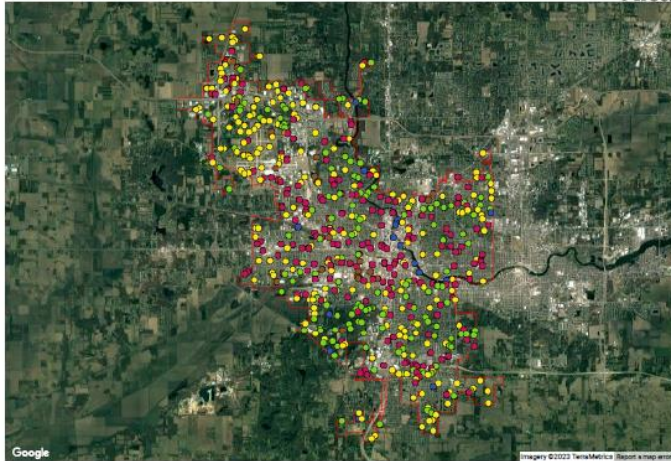
| Abbr.              | Description   | Amount (T)    | ±SE           | Value (USD)        | ±SE            |
|--------------------|---|---------------|---------------|--------------------|----------------|
| CO                 | Carbon Monoxide removed annually  | 5.26          | ±0.39         | \$7,015            | ±514           |
| NO <sub>2</sub>    | Nitrogen Dioxide removed annually   | 19.83         | ±1.45         | \$8,586            | ±630           |
| O <sub>3</sub>     | Ozone removed annually  | 124.98        | ±9.16         | \$299,050          | ±21,926        |
| SO <sub>2</sub>    | Sulfur Dioxide removed annually   | 12.36         | ±0.91         | \$1,793            | ±131           |
| PM <sub>2.5</sub>  | Particulate Matter less than 2.5 microns removed annually                             | 8.52          | ±0.62         | \$817,867          | ±59,965        |
| PM <sub>10</sub> * | Particulate Matter greater than 2.5 microns and less than 10 microns removed annually | 34.86         | ±2.56         | \$218,527          | ±16,022        |
| <b>Total</b>       |   | <b>205.81</b> | <b>±15.09</b> | <b>\$1,352,839</b> | <b>±99,188</b> |



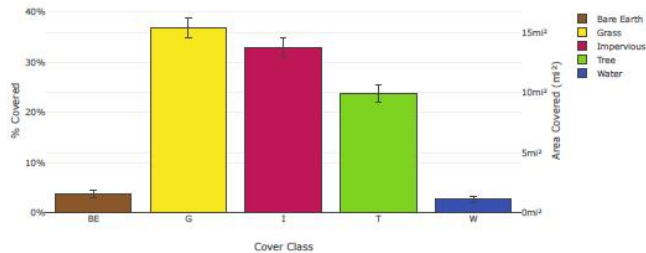
# Benchmark Canopy Assets and Impacts

## i-Tree Canopy

Cover Assessment and Tree Benefits Report  
Estimated using random sampling statistics on 6/3/2023



Land Cover



| Abbr.        | Cover Class | Description                    | Points     | % Cover ± SE  | Area (mi²) ± SE |
|--------------|-------------|--------------------------------|------------|---------------|-----------------|
| BE           | Bare Earth  | Bare ground/Soil               | 23         | 3.83 ± 0.78   | 1.60 ± 0.33     |
| G            | Grass       | Grass/Herbaceous/Crop          | 221        | 36.83 ± 1.97  | 15.39 ± 0.82    |
| I            | Impervious  | Road/Building/Other Impervious | 198        | 33.00 ± 1.92  | 13.79 ± 0.80    |
| T            | Tree        | Tree, Large Shrub              | 142        | 23.67 ± 1.74  | 9.89 ± 0.73     |
| W            | Water       | Water                          | 16         | 2.67 ± 0.66   | 1.11 ± 0.27     |
| <b>Total</b> |             |                                | <b>600</b> | <b>100.00</b> | <b>41.80</b>    |

### Tree Benefit Estimates: Carbon (English units)

| Description  | Carbon (KT) | ±SE    | CO <sub>2</sub> Equiv. (KT) | ±SE    | Value (USD)  | ±SE        |
|--|-------------|--------|-----------------------------|--------|--------------|------------|
| Sequestered annually in trees                              | 7.06        | ±0.52  | 25.87                       | ±1.90  | \$915,276    | ±67,107    |
| Stored in trees (Note: this benefit is not an annual rate) | 217.02      | ±15.91 | 796.75                      | ±58.34 | \$28,153,880 | ±2,064,197 |

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 0.713 KT of Carbon, or 2.615 KT of CO<sub>2</sub>, per mi<sup>2</sup>/yr and rounded. Amount stored is based on 21.940 KT of Carbon, or 80.446 KT of CO<sub>2</sub>, per mi<sup>2</sup> and rounded. Value (USD) is based on \$129,727.42/KT of Carbon, or \$35,380.20/KT of CO<sub>2</sub>, and rounded. (English units: KT = kilotons (1,000 tons), mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Air Pollution (English units)

| Abbr.        | Description   | Amount (T)    | ±SE           | Value (USD)        | ±SE            |
|--------------|---|---------------|---------------|--------------------|----------------|
| CO           | Carbon Monoxide removed annually  | 5.26          | ±0.39         | \$7,015            | ±514           |
| NO2          | Nitrogen Dioxide removed annually   | 19.83         | ±1.45         | \$8,586            | ±530           |
| O3           | Ozone removed annually  | 124.98        | ±9.16         | \$299,050          | ±21,926        |
| SO2          | Sulfur Dioxide removed annually   | 12.36         | ±0.91         | \$1,793            | ±131           |
| PM2.5        | Particulate Matter less than 2.5 microns removed annually                             | 8.52          | ±0.62         | \$917,867          | ±59,965        |
| PM10*        | Particulate Matter greater than 2.5 microns and less than 10 microns removed annually | 34.86         | ±2.56         | \$218,527          | ±16,022        |
| <b>Total</b> |   | <b>206.81</b> | <b>±16.09</b> | <b>\$1,362,839</b> | <b>±98,188</b> |

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/mi<sup>2</sup>/yr @ \$/T/yr and rounded:  
CO 0.532 @ \$1,333.50 | NO2 2.005 @ \$432.97 | O3 12.634 @ \$2,392.86 | SO2 1.250 @ \$145.05 | PM2.5 0.861 @ \$95,979.82 | PM10\* 3.524 @ \$6,268.44 (English units: T = tons (2,000 pounds), mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Hydrological (English units)

| Abbr. | Benefit                      | Amount (Kgal) | ±SE       | Value (USD) | ±SE  |
|-------|------------------------------|---------------|-----------|-------------|------|
| AV/RO | Avoided Runoff               | 598.69        | ±73.22    | \$8,924     | ±554 |
| E     | Evaporation                  | 5,014.88      | ±367.68   | N/A         | N/A  |
| I     | Interception                 | 5,015.94      | ±367.76   | N/A         | N/A  |
| T     | Transpiration                | 12,259.59     | ±899.59   | N/A         | N/A  |
| PE    | Potential Evaporation        | 46,900.01     | ±3,438.63 | N/A         | N/A  |
| PET   | Potential Evapotranspiration | 33,172.17     | ±2,432.13 | 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 Kgal/mi<sup>2</sup>/yr @ \$/Kgal/yr and rounded:  
AVRO 100.962 @ \$8.94 | E 506.978 @ N/A | I 507.095 @ N/A | T 1,240.391 @ N/A | PE 4,741.345 @ N/A | PET 3,353.532 @ N/A (English units: Kgal = thousands of gallons, mi<sup>2</sup> = square miles)

#### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffrey T. Walton, and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company)

#### Limitations of i-Tree Canopy

The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. As the number of points increase, the precision of the estimate will increase as the standard error of the estimate will decrease. If too few points are classified, the standard error will be too high to have any real certainty of the estimate.



Additional support provided by:

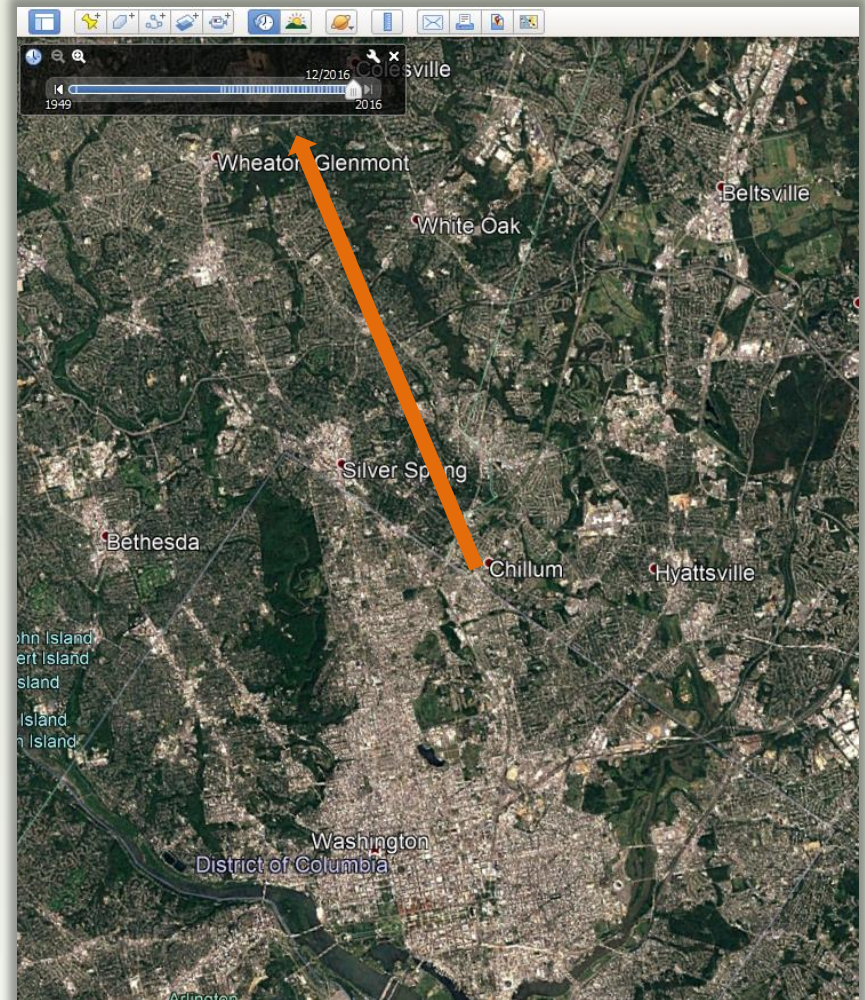


[canopy.itreetools.org](http://canopy.itreetools.org)



# Canopy Change Survey

- Utilizes **Google Earth Pro** to evaluate trends and projects with historic images
  - Free to download
  - Canopy points to KML
  - Capture changes to your sample over time



| Land Use    | 2005  | 2016      |
|-------------|-------|-----------|
| Tree        | 23.0% | 23.7% (+) |
| Impervious  | 32.1  | 33.0 (+)  |
| Grass       | 38.4  | 36.8 (-)  |
| Bare Ground | 4.33  | 3.83 (-)  |
| Water       | 2.16  | 2.67 (+)  |

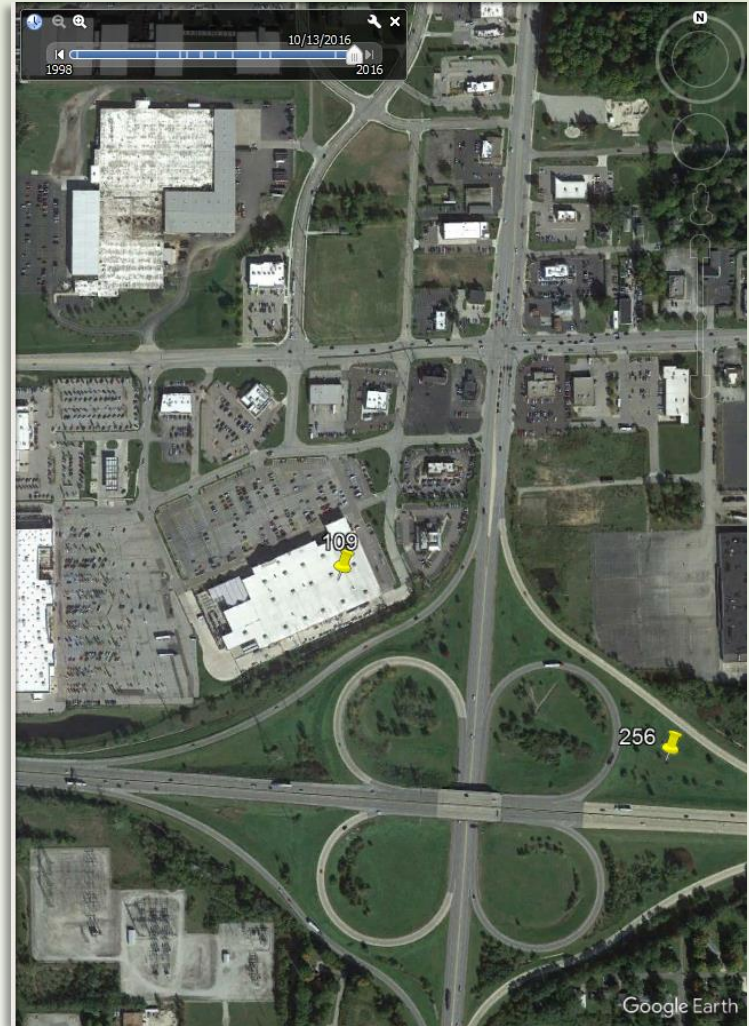


# Canopy Change Over Time

2005



2016



# Canopy – Now What?

- Putting canopy in context can be meaningful to community stories
- Results can drive conversations with communities
  - Opportunities for input, engagement, and stewardship

■ *What you have, where you have it, and where you want to go next*

## OAKS OF NORTH LAWDALE


### Community Roots That Grow On Trees

*Spotlight: North Lawndale, Chicago, IL*

The ways that trees benefit a community are as numerous as their branches. Planning for trees, understanding their benefits, planting them and caring for them fosters engagement, stewardship and sustainability.

When you add that to their public health and environmental advantages, trees can have a positive impact on neighborhoods for generations.

Inspired by the 7000 Oaks art installation, the Oaks of North Lawndale project partners neighborhood residents with the city and the School of the Art Institute of Chicago in an effort to nurture a greener, peaceful, and re-forested community.



*Photo courtesy of Foundation for Human Square*


In September 2017, SAIC set up its mobile foundry at their Monon Square campus, site of the project launch event with artist Heide Hayes, who joined residents in the melting of weapons to create shovel heads which were used to plant the first trees.

**The Oaks of North Lawndale project could raise canopy coverage in the neighborhood to at least 23%, representing an increase of more than 38% over current canopy amounts.**

Trees would be planted over a multi-year period, providing opportunities for sustained collaboration among neighbors, artists and educators at SAIC, a local tree nursery and gardeners, the North Lawndale Employment Network and job skills training programs, along with other organizations.

Trees in urban environments are known to...

- improve human health.
  - Improve air quality
  - Improve respiratory health, overall well-being, and reduce stress
  - Protect from harmful UV light
- benefit the community.
  - Reduce crime by fostering neighborhood social interactions
  - Lower summer air temperatures and reduce energy costs
  - Provide aesthetic benefits and promote community equity
  - Enhance property values
- provide environmental services.
  - Reduce stormwater runoff
  - Absorb carbon dioxide – a greenhouse gas that traps heat in the atmosphere



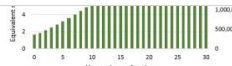
**7,000 trees can**

**Impacts from 7,000 newly planted trees in North Lawndale as they grow to maturity over 30 years**

SAIC School of the Art Institute of Chicago

DAVEY Institute

**the community of North face temperatures about 10 than the regional average. trees in Douglas Park help ice by more than 3 degrees.**



Equipment Value

Years since planting

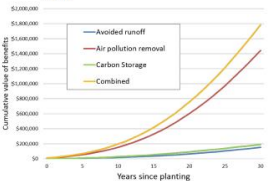
- Trees improve public health by removing harmful air pollutants. Poor air quality is a common problem in many urban communities. It can contribute to serious respiratory health problems such as childhood asthma, bronchitis, and other cardiovascular health incidents.
- Trees help absorb stormwater runoff and reduce the risk of flooding. Precipitation is caught by leaves and filtered through soil, instead of running over pavement and impervious city surfaces that can overwhelm water and sewer lines during a heavy rainstorm.

Where the numbers come from: The benefits and values associated with trees were estimated using i-Tree Eco and Landscape software from the US Forest Service. The programs use local weather, pollution, and population data to estimate how the woody and leafy parts of trees interact with the environment and the people who live there.

The growth was predicted using i-Tree's Forecast module, and assumed that all trees are cared for and survive to maturity. The growth predictions consider local climate along with the rates different sizes and species of trees typically grow. Five common trees were modeled to represent future tree species to be planted.


➢ **views new people try cooling the surrounding air and providing shade. Higher temperatures magnify health risks, increase energy use, and worsen air pollution impacts. Increasing and protecting community tree canopy can help lessen these negative impacts.**

➢ **Trees absorb carbon dioxide from the air and store it as wood. Carbon dioxide (CO2) is a greenhouse gas that traps heat in the atmosphere. It enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, and fire wood, and also as a result of certain chemical reactions (e.g., manufacturing of cement).**



Cumulative Value of Benefits

Years since planting



Planting Loss to canopy | Year 10 10,520 sq ft canopy | Year 30 103,225 sq ft canopy

A typical block of newly planted street trees (left) would see an increase of more than 10,000 sq ft. in canopy coverage, and the environmental, economic, and health benefits that come with them.

Want to get involved? Visit <https://www.facebook.com/oaksofnorthlawndale/> to learn more about the project and how to lend a hand.

Powered by i-Tree and The Davey Institute.

i-Tree represents cutting-edge peer reviewed, data based. Service research designed into tools and applications easily used by everyone.

[www.i-treetools.org](http://www.i-treetools.org)

