



Planning Tree Planting for Climate Resilience

Chris Belasco, PhD

Senior Manager of Digital Services and Chief
Data Officer

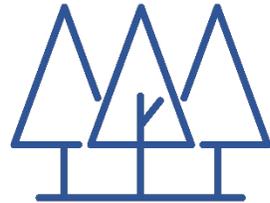
Department of Innovation and Performance
City of Pittsburgh

Tree Planting Planning for Climate Resilience



3°F

30-year climate predictions suggest up to a 3°F temperature increase in our area.



Trees are a climate adaptation solution!

- Trees absorb carbon, CO₂ and excess water.
- Trees reduce the average temperature by 3°F on a parcel.

\$1m project

In Partnership with Resilient Cities Catalyst, Tree Pittsburgh, Urbankind Institute – funding from Google.org and ICLEI.



With grant support from
Google.org



Update Pittsburgh's 2030 Climate Action Plan:

Policy Community Data

Mapping Trees with Auto Arborist Data



Goal: Identify areas that City can work with its partners to place trees for climate adaptation and improved equity.

Focus on neighborhoods with higher predicted heat risk and fewer trees where the City can plant.

Integrate data from Google.org's Auto Arborist, First Street's Risk Factor heat and flooding risk assessment, and RCC's estimated tree potential into tree planning.

Data is shared with city tree partners into agreement w/ Google.org.

CG & Google Merged Tree Data

- Google
- Cartegraph
- Cartegraph & Google

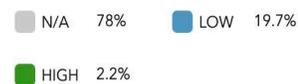
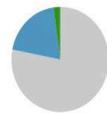
Heat Factor (First Street)

heatfactor

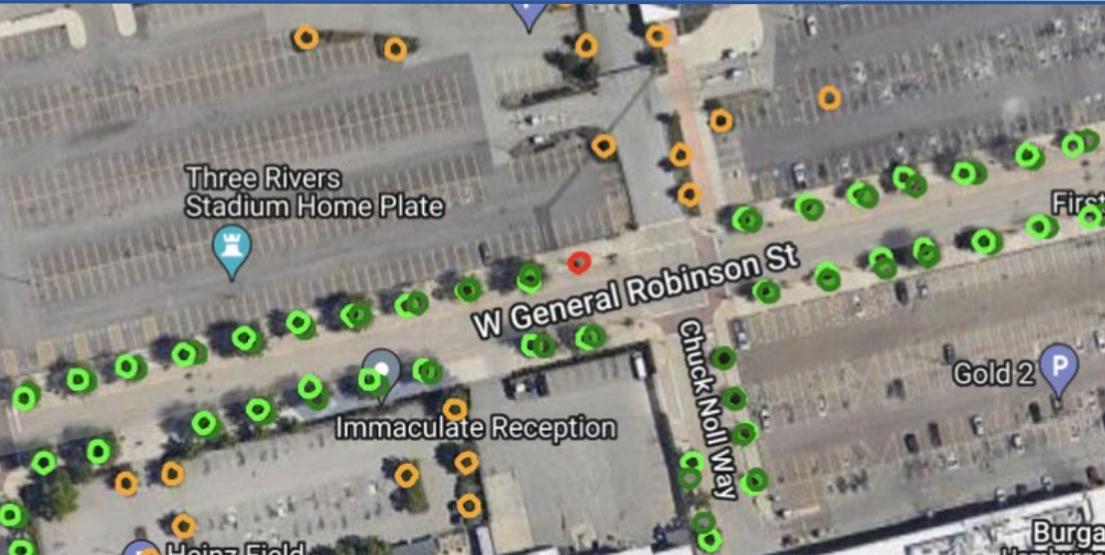


Merged Data (2m Snap)	495,779 trees
Google Detection	460,809 trees
Cartegraph	42,313

Google Genus ID Confidence



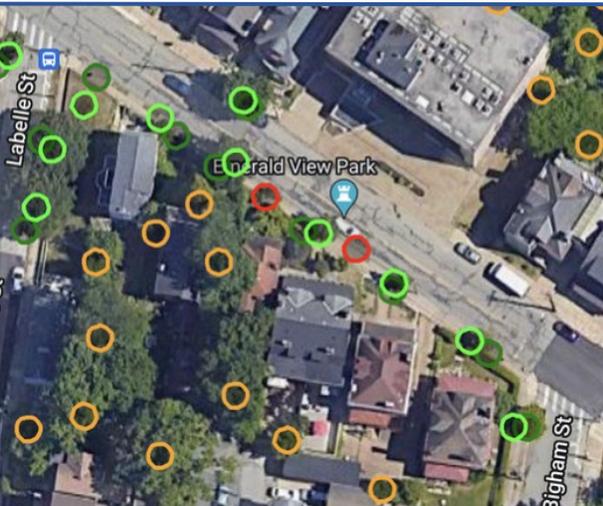
Model Detection



We correctly detect trees lining a parking lot



We correctly detect trees at Duquesne University



We correctly detect trees in a suburban area. Note the additionally predicted backyard trees that were not in the groundtruth set



We miss small trees lining a downtown street beside tall buildings. We seem to particularly have problems with trees that lie in the shadow of a tall building (perhaps because these were not in the training set)

Our Approach

Model recall is 64% — this means 64% of groundtruth trees are matched to some prediction in the groundtruth set.

This also means that **Auto Arborist miss roughly 100%-64% = 36% of trees in Pittsburgh**

Most trees subject to shadow are in the urban canyon.

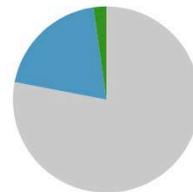
Combined Google estimate and City's Cartegraph Street Tree Inventory on a 2m snap.

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- Cartegraph
- Cartegraph & Google

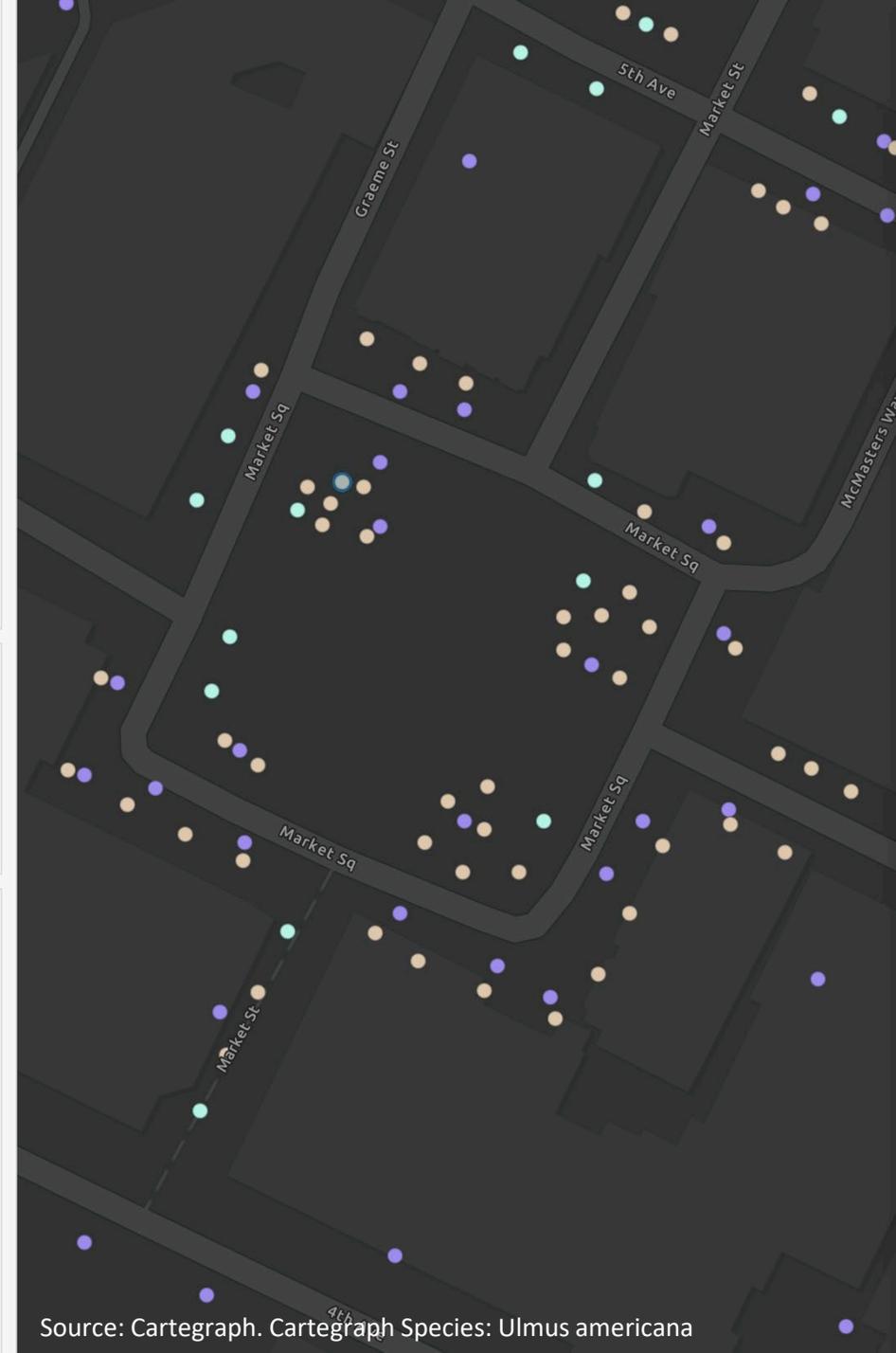
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N/A 78% LOW 19.7%

HIGH 2.2%



Source: Cartegraph. Cartegraph Species: *Ulmus americana*

Heat Analysis in Beltzhoover

Planted trees on and around Climax St 11/2023.

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- Google
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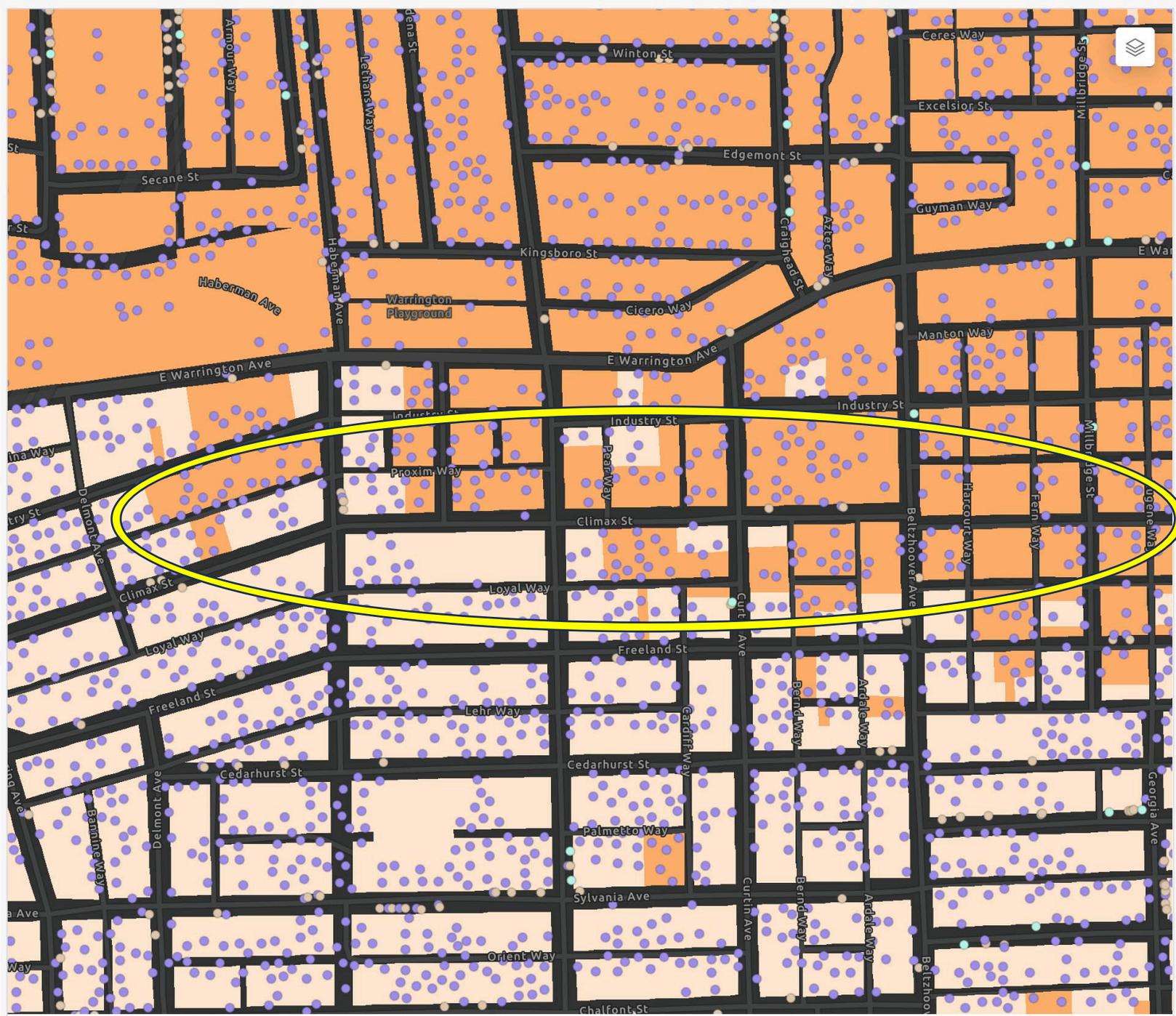
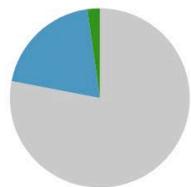
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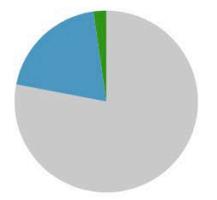
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Heat Analysis in Hazelwood

Moved tree planting from Hazelwood Greenway

To predicted warmer portion of neighborhood 3/2024

Next Steps

- Simplifying decision-making tool for our partners – getting feedback to improve our process.
- Building out plan for climate defense:
 - According to analysis from Penn State, a minimum of 30% local canopy cover is needed to avoid significant warming in an area over the next 25 years.
 - Plant nearest the most at-risk parcels
 - How to automate knowing where to plant at the City block level.



Sampling Estimates Vary Widely!!!



Challenge: Considerable distance between Auto Arborist and other sources.

US Forestry Service Urban Forest Stats Estimate

3,080,971 live trees with a standard error of 346,718 across 100 plot samples in government and private locations

Difficult to ground truth!



Frontiers in Tree Canopy Equity

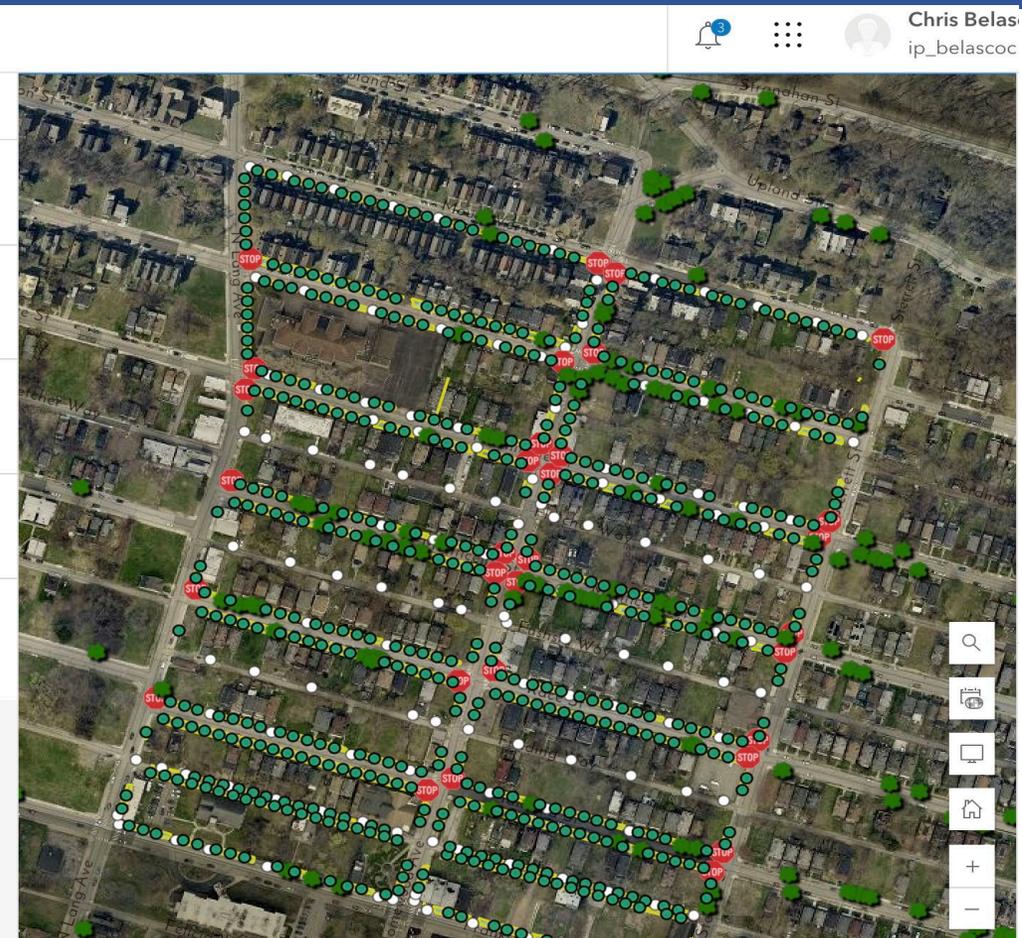


30% Tree Canopy Coverage Target Per Census Tract
How can we automate knowing how many street trees we can plant?



Tree Planting Test Area

- Legend
- Potential Trees
- Tree Inventory
- Street Signs
- Light Fixtures
- Potential Planting Areas





Thank You!