

# **MAPPING LOUISVILLE'S URBAN TREES**

## **COLLECTING BASELINE DATA FOR A HEALTHIER COMMUNITY**

**Presented by Patrick Smith, AICP**

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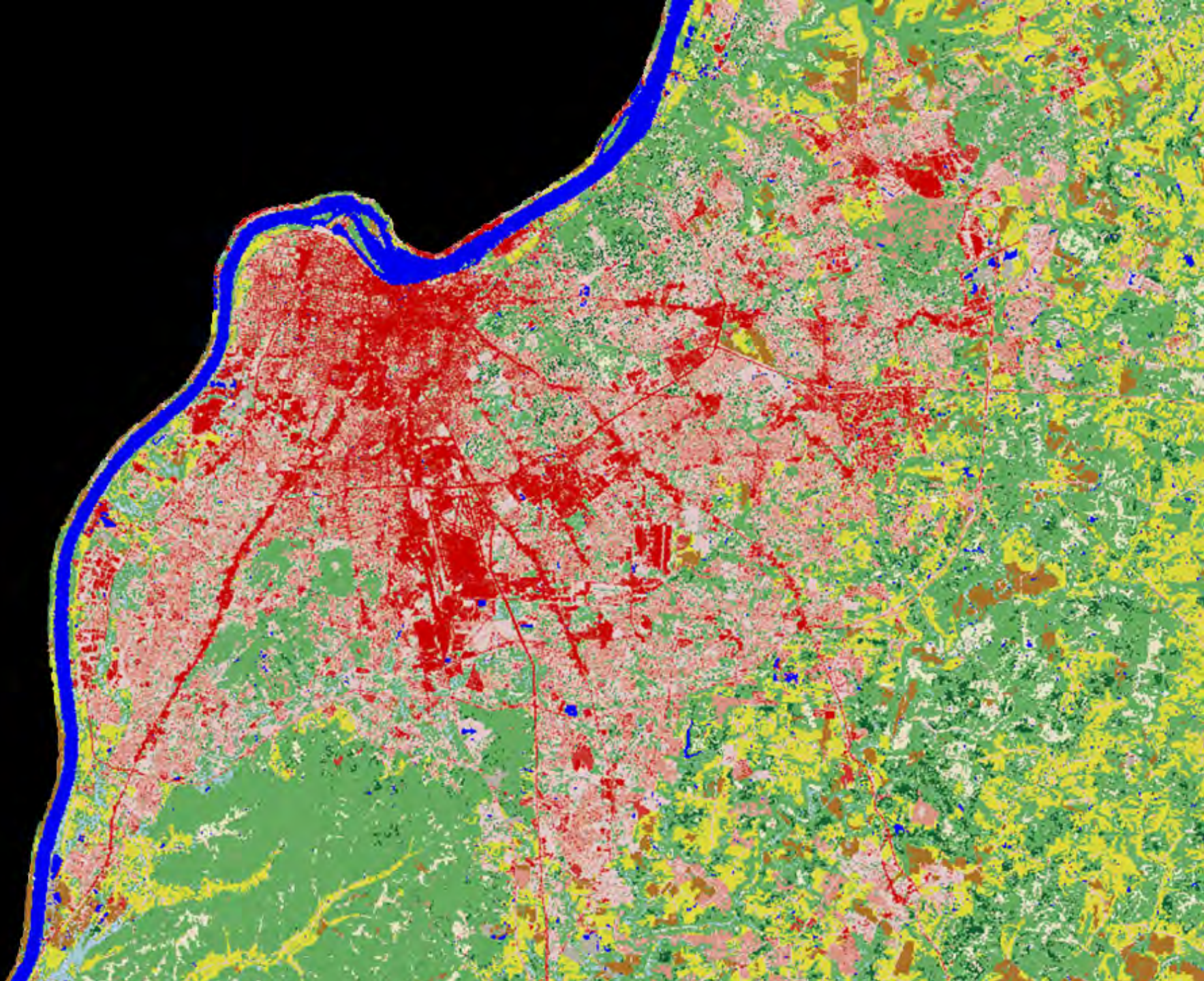
**IN COOPERATION WITH**

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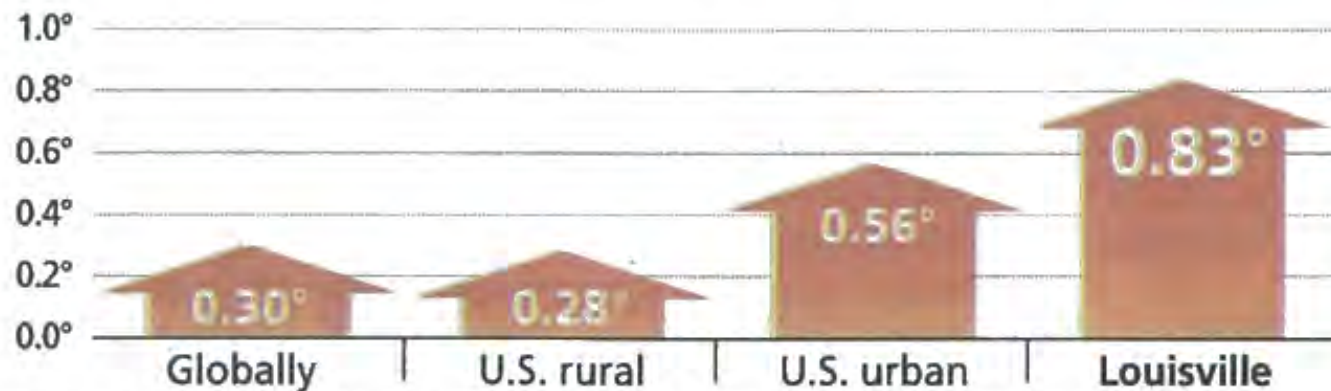
**@cityresearch**





## WARMING UP

Average temperature (Fahrenheit) change each decade\*, 1961-2010:



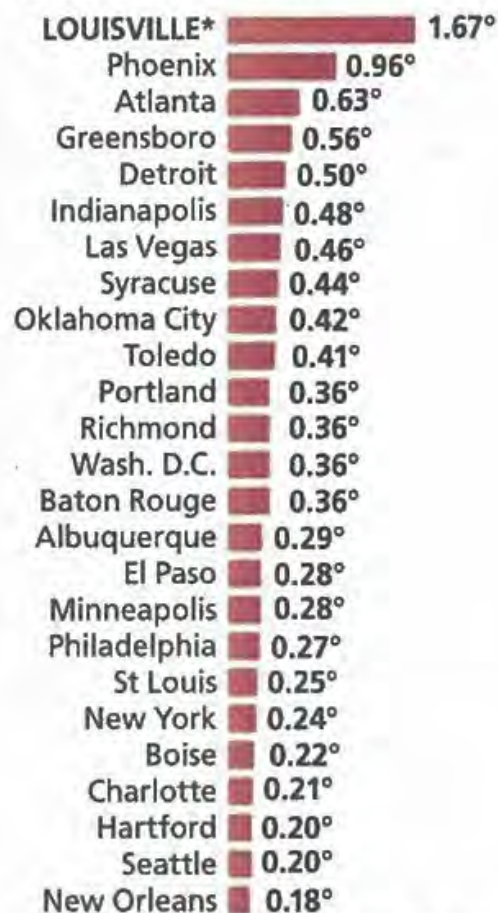
SOURCE: Associate Professor Brian Stone Jr., School of City and Regional Planning, Georgia Institute of Technology

\*Stone computed the average decadal change rate by analyzing temperature data for each ten-year period between 1961 and 2010. This allows for the analysis to account for cyclical fluctuations that might have resulted from weather phenomenon such as El Nino, producing an average decadal rate that provides a good basis for projecting forward, as well as an average snapshot of the recent past.

STEVE REED/THE COURIER-JOURNAL

## HEAT ISLANDS

Average change in the difference between urban and rural temperatures each decade, 1961-2010.



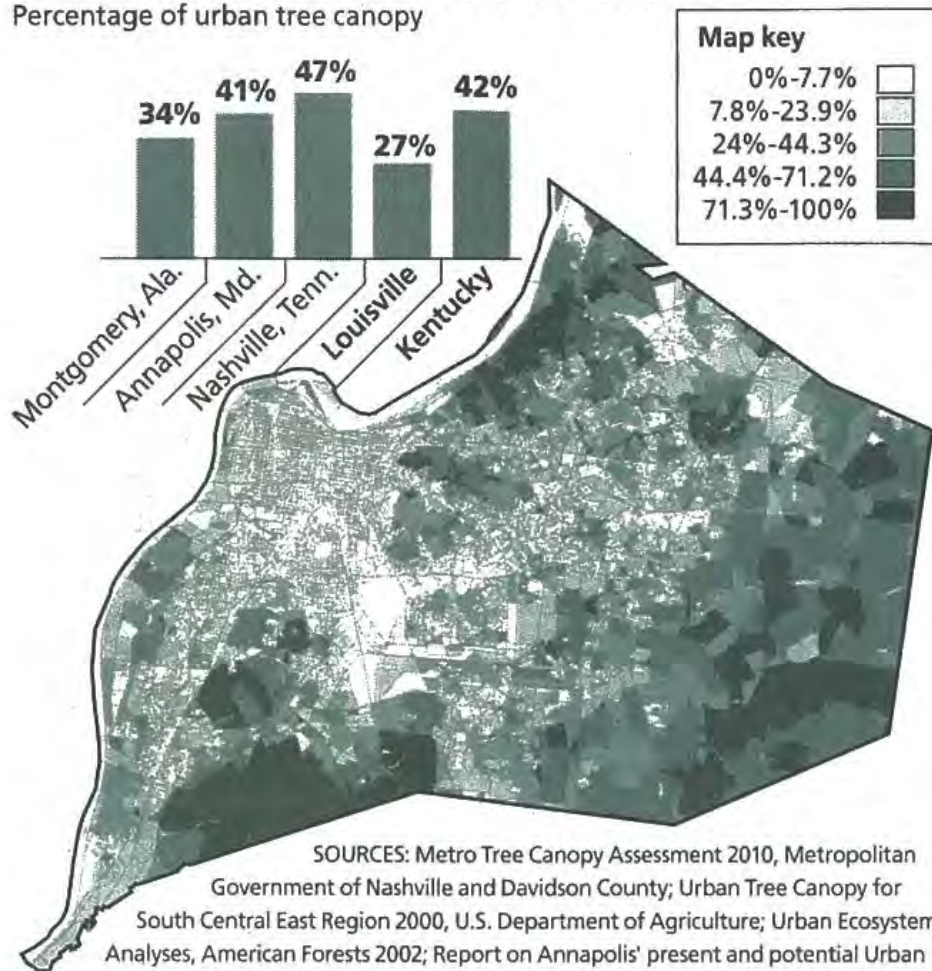
\*Louisville's ranking was influenced by an excessively hot 2007.

SOURCE: Associate Professor Brian Stone Jr., School of City and Regional Planning, Georgia Institute of Technology

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## LOUISVILLE LAGS ON URBAN FOREST

Percentage of urban tree canopy



SOURCES: Metro Tree Canopy Assessment 2010, Metropolitan Government of Nashville and Davidson County; Urban Tree Canopy for South Central East Region 2000, U.S. Department of Agriculture; Urban Ecosystem Analyses, American Forests 2002; Report on Annapolis' present and potential Urban Tree Canopy 2006, Maryland Department of Natural Resources; Urban Tree Canopy Analysis, University of Louisville, 2011; Evan Conder, Urban Tree Canopy Plan

STEVE REED/THE COURIER-JOURNAL

## Killer Summer Heat: Projected Death Toll from Rising Temperatures in America Due to Climate Change

This report was written by Peter Altman, with help from Dan Lashof, Kim Knowlton, Ed Chen, Laurie Johnson and Dr. Larry Kalkstein.



## Cumulative EHE-Attributable Mortality Caused by Climate Change, Estimate

Louisville	5,081
Detroit	4,109
Minneapolis	2,892
Cleveland	2,530
Dallas	1,885
Jacksonville	1,813
Memphis	1,645
Denver	1,551
Boston	1,404
St. Louis	1,285
Kansas City	1,280
Columbus	1,066
Chicago	1,034
Washington	942
Indianapolis	837
Baltimore	495
Buffalo	479
Pittsburgh	411
Houston	406
Providence	353





Contents lists available at SciVerse ScienceDirect

## Environmental Pollution

journal homepage: [www.elsevier.com/locate/envpol](http://www.elsevier.com/locate/envpol)



# Modeled PM<sub>2.5</sub> removal by trees in ten U.S. cities and associated health effects



David J. Nowak<sup>a,\*</sup>, Satoshi Hirabayashi<sup>b</sup>, Allison Bodine<sup>b</sup>, Robert Hoehn<sup>a</sup>

<sup>a</sup> USDA Forest Service, 5 Moon Library, SUNY-ESF, Syracuse, NY 13210, USA

<sup>b</sup> Davey Institute, 5 Moon Library, SUNY-ESF, Syracuse, NY 13210, USA

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Mortality

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### ABSTRACT

Urban particulate air pollution is a serious health issue. Trees within cities can remove fine particles from the atmosphere and consequently improve air quality and human health. Tree effects on PM<sub>2.5</sub> concentrations and human health are modeled for 10 U.S. cities. The total amount of PM<sub>2.5</sub> removed annually by trees varied from 4.7 tonnes in Syracuse to 64.5 tonnes in Atlanta, with annual values varying from \$1.1 million in Syracuse to \$60.1 million in New York City. Most of these values were from the effects of reducing human mortality. Mortality reductions were typically around 1 person yr<sup>-1</sup> per city, but were as high as 7.6 people yr<sup>-1</sup> in New York City. Average annual percent air quality improvement ranged between 0.05% in San Francisco and 0.24% in Atlanta. Understanding the impact of urban trees on air quality can lead to improved urban forest management strategies to sustain human health in cities.

Published by Elsevier Ltd.

# The Relationship Between Trees and Human Health

## Evidence from the Spread of the Emerald Ash Borer

Geoffrey H. Donovan, PhD, David T. Butry, PhD, Yvonne L. Michael, ScD,  
Jeffrey P. Prestemon, PhD, Andrew M. Liebhold, PhD,  
Demetrios Gatzliolis, PhD, Megan Y. Mao

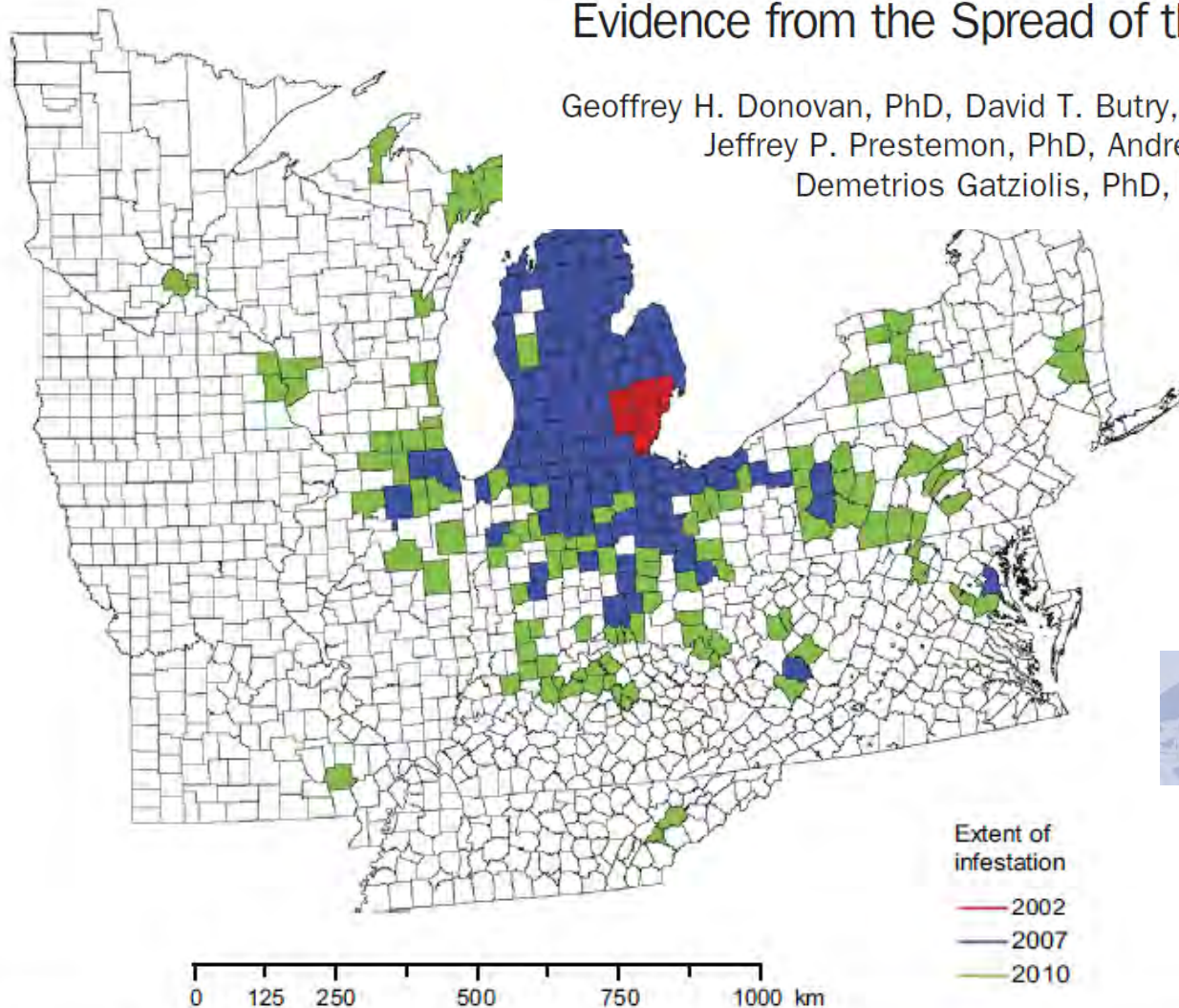
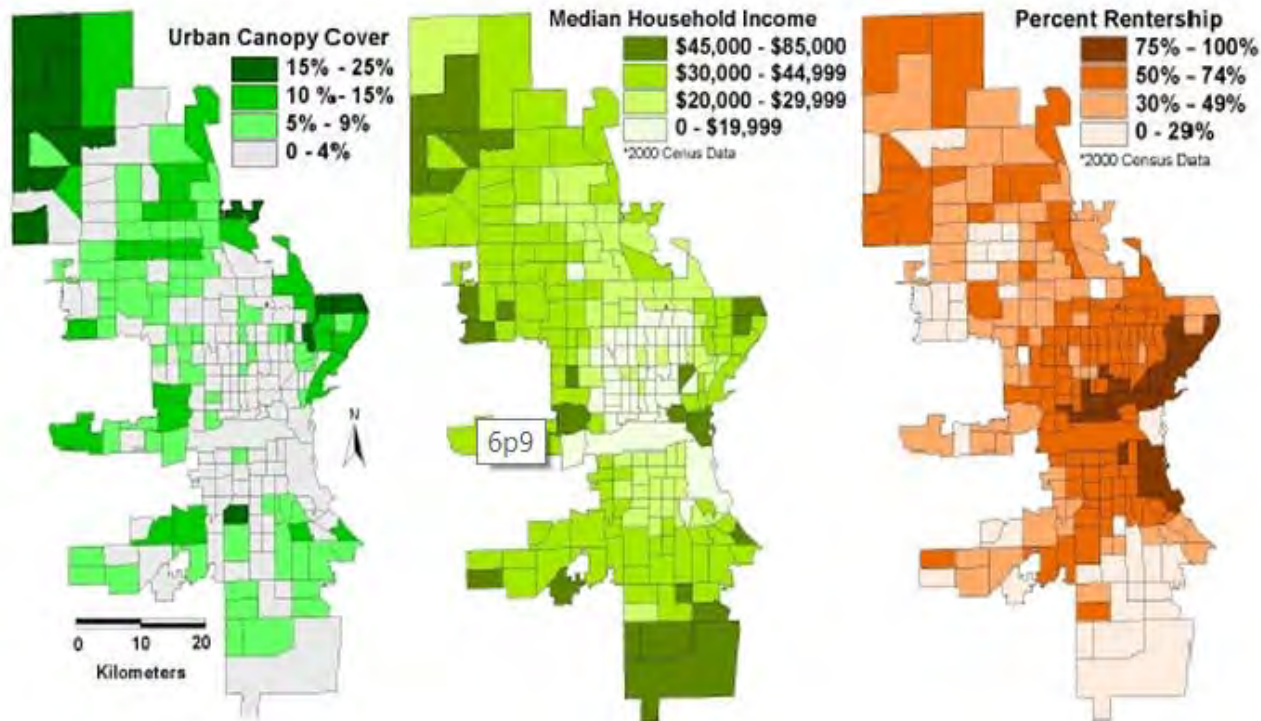


Figure 1. Counties where the emerald ash borer had been detected in 2002, 2007, and 2010



# Wealth, homeownership, and trees connect in Milwaukee, WI.



Variable	Urban Canopy	Residential Canopy
Household Income	<i>0.285</i>	<i>0.436</i>
% Rentership	-0.124	-0.473
% Vacancy	<i>-0.195</i>	<i>-0.434</i>
% Non-Hispanic White	<i>0.138</i>	0.133
% African-American	-0.059	-0.013
% Hispanic	<i>-0.149</i>	<i>-0.250</i>

Ball Square, Somerville

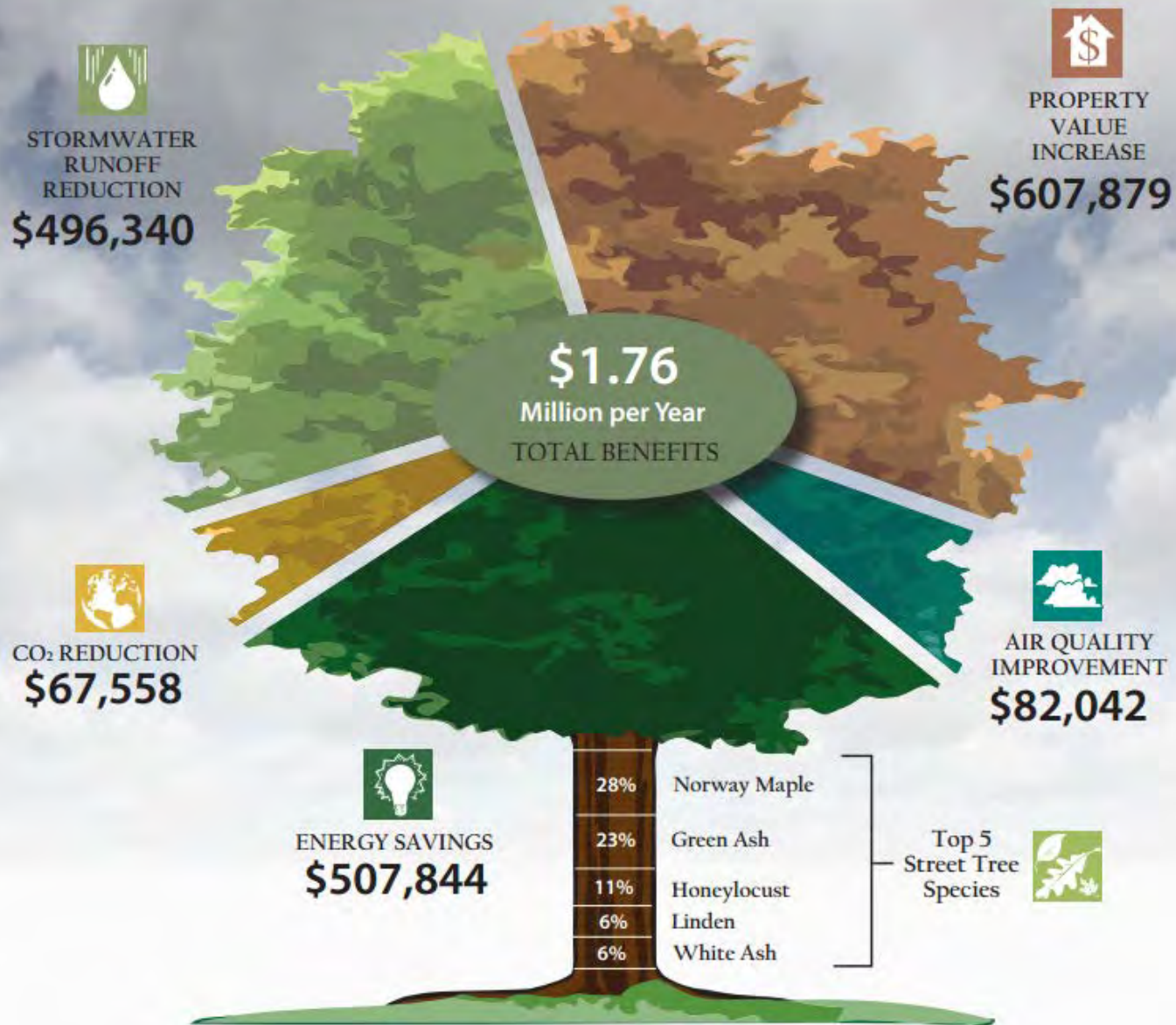


West Cambridge





# Annually **Fond du Lac** public street trees provide<sup>1</sup>...



# Of concern to all!

## A tree is worth \$193,250

according to Professor T.M. Das of the University of Calcutta. A tree living for 50 years will generate \$31,250 worth of oxygen, provide \$62,000 worth of air pollution control, control soil erosion and increase soil fertility to the tune of \$31,250, recycle \$37,500 worth of water and provide a home for animals worth \$31,250. This figure does not include the value of fruits, lumber or beauty derived from trees. Just another sensible reason to take care of our forests.

From Update Forestry  
Michigan State University

### THE VALUE OF A TREE



### SAVE OUR MOTHER EARTH



# **Tree Canopy vs Tree Inventory**



# i-Tree

Tools for Assessing and Managing  
Community Forests

Get the Tools.



[Forgot Username or Password?](#)

[Home](#)[About](#)[Applications](#)[Utilities](#)[Resources](#)[Support](#)[News](#)

## i-Tree Vue



### i-Tree Vue

i-Tree Vue allows you to make use of the freely available National Land Cover Database (NLCD) satellite-based imagery to assess your community's land cover, including tree canopy, and some of the ecosystem services provided by your current urban forest. The effects of planting scenarios on future benefits can also be modeled.

Recent enhancements allow users to make regional adjustments to canopy and impervious estimates based on recent research. In addition, a simple clipping tool allows users to refine basic area of interest boundaries from NLCD images within the Vue application. Interactivity with Google Maps allows for improved NLCD image interpretation.

The new [Vue Executive Summary Report](#) offers a quick snap-shot of relevant ecosystem service estimates and cover characteristics.

NLCD data consists of (3) [types of imagery](#): derived from Landsat satellite data:

- 29 Land Cover classifications
- Percent Impervious Cover
- Percent Tree Canopy

Each imagery data set has a resolution of 30 meters.

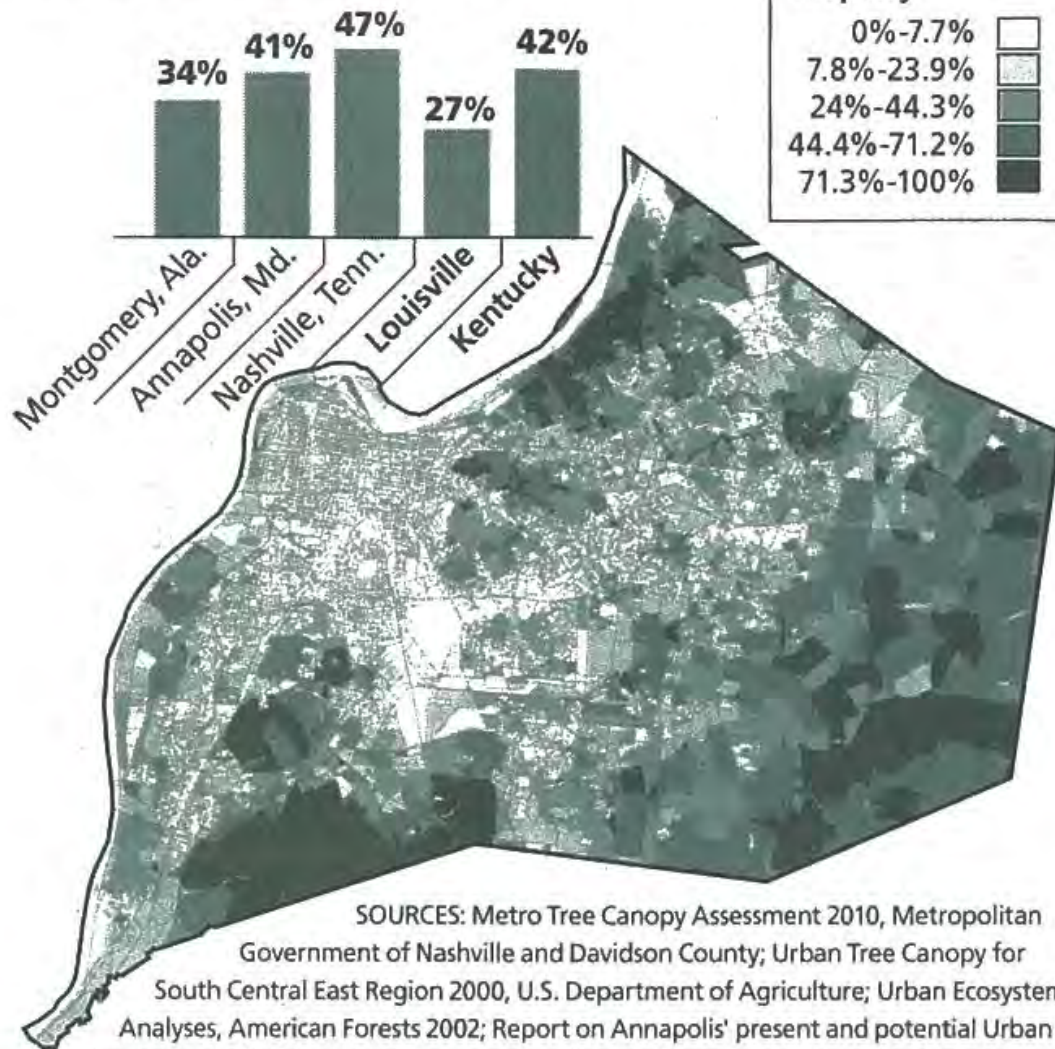
i-Tree Vue allows everyday users to easily utilize the imagery datasets and quickly assess their region's broad characteristics over these three areas.





## LOUISVILLE LAGS ON URBAN FOREST

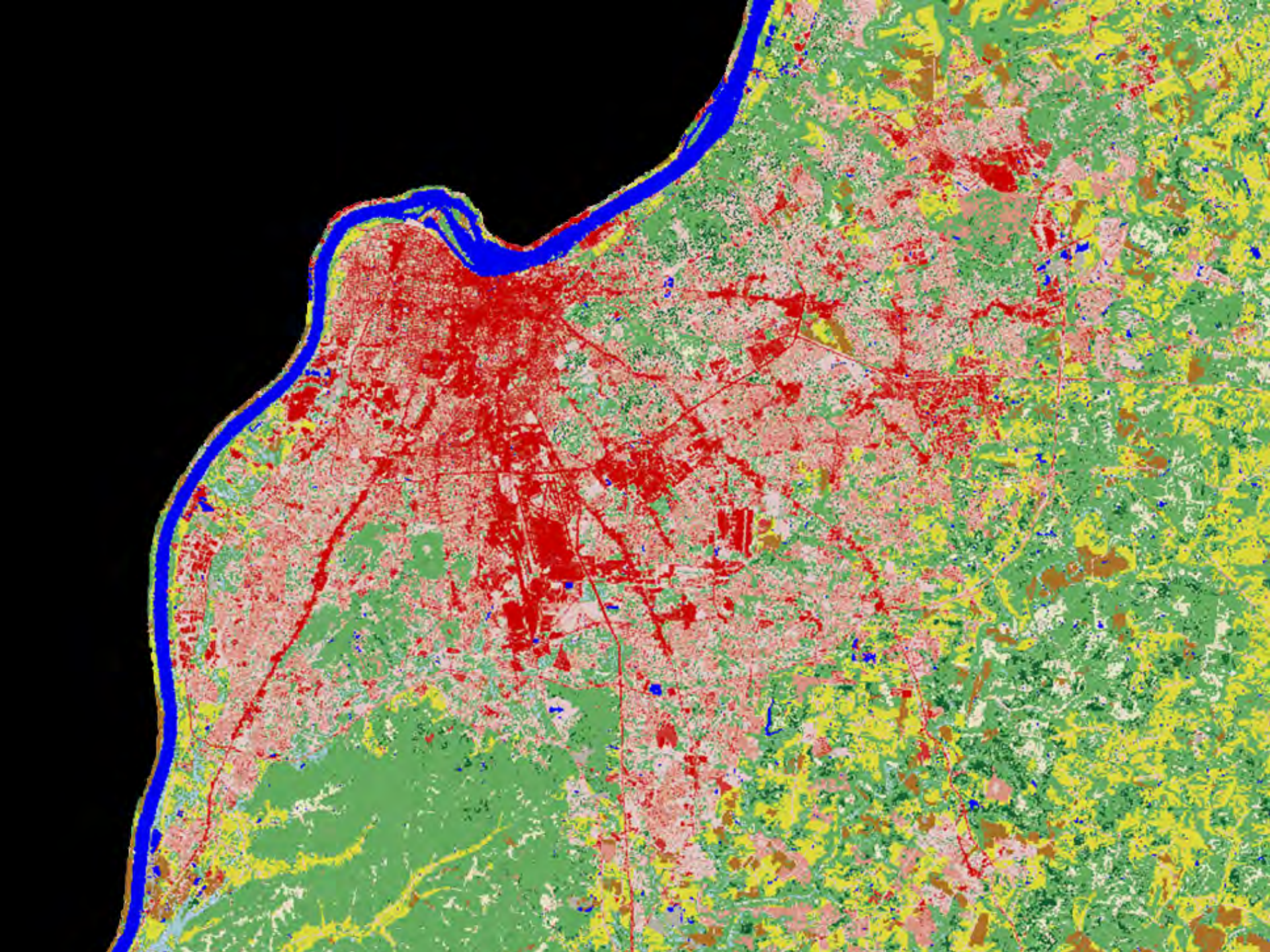
Percentage of urban tree canopy



SOURCES: Metro Tree Canopy Assessment 2010, Metropolitan Government of Nashville and Davidson County; Urban Tree Canopy for South Central East Region 2000, U.S. Department of Agriculture; Urban Ecosystem Analyses, American Forests 2002; Report on Annapolis' present and potential Urban Tree Canopy 2006, Maryland Department of Natural Resources; Urban Tree Canopy Analysis, University of Louisville, 2011; Evan Conder, Urban Tree Canopy Plan

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# Leaf-on multi-spectral aerial imagery from the National Agriculture Imagery Program (NAIP)



## Tyler Park

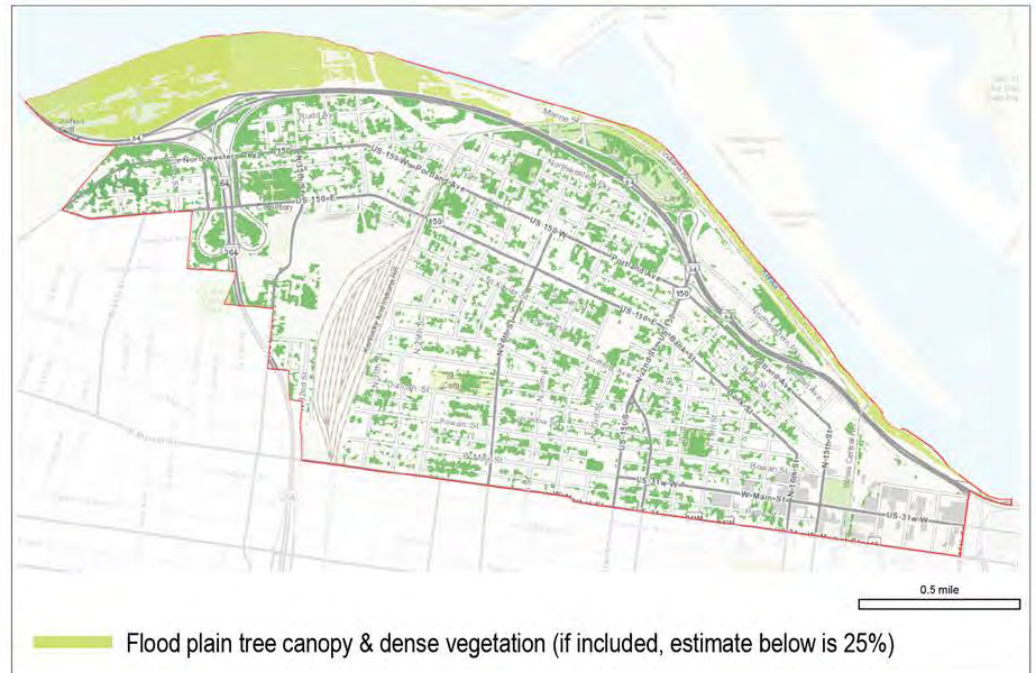
Tree Canopy and Dense Vegetation, 2010



**42%** ESTIMATED TREE  
CANOPY COVERAGE  
IN TYLER PARK

## Portland

Tree Canopy and Dense Vegetation, 2010



**20%** ESTIMATED TREE CANOPY COVERAGE  
IN PORTLAND

Data Source: USDA Farm Service Agency, National Agricultural Imagery Program

**How have others approached  
tree inventories?**



+

Sites

+

Reports

+

Tools

Help

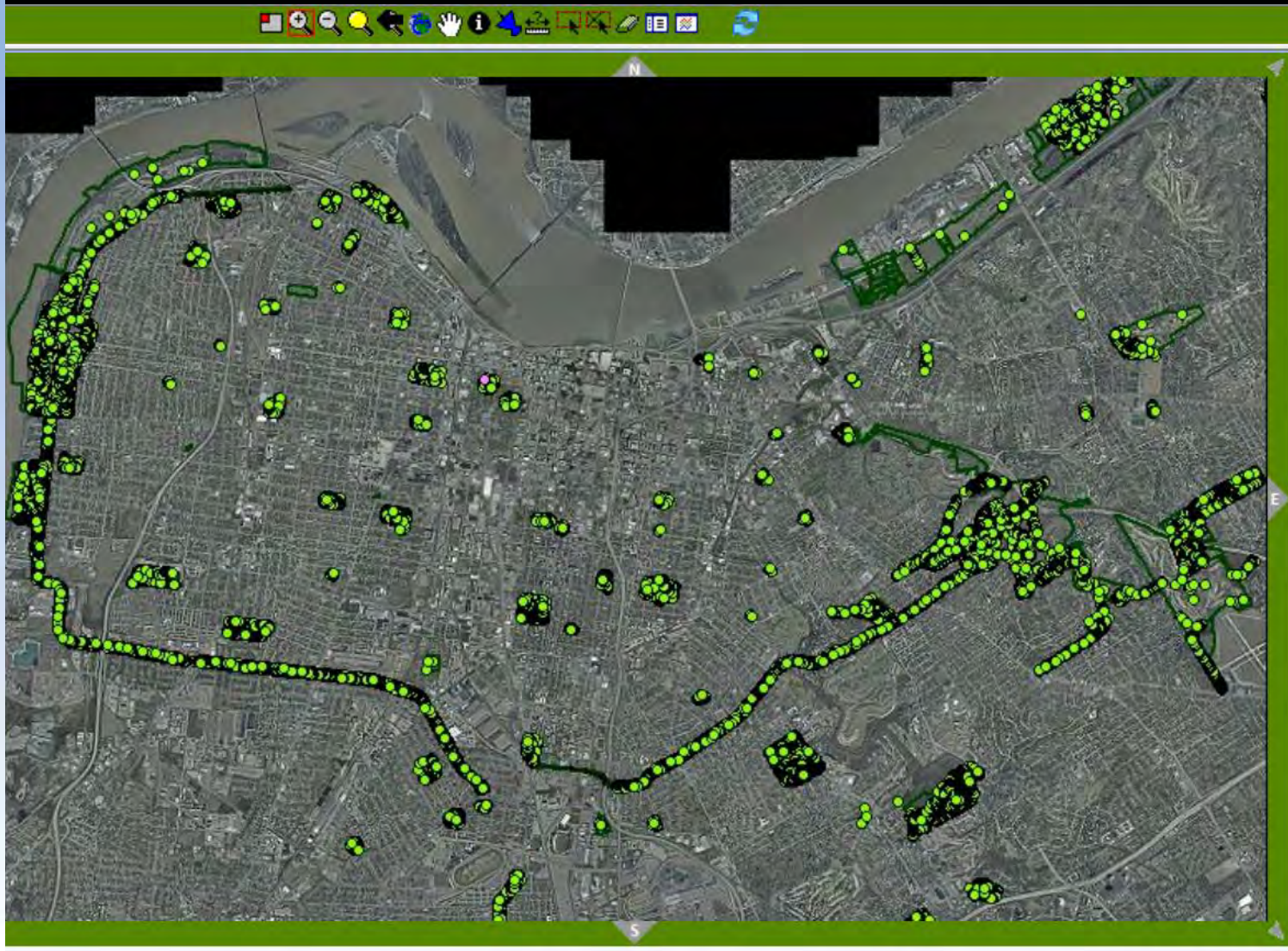
Sampler

Log Off

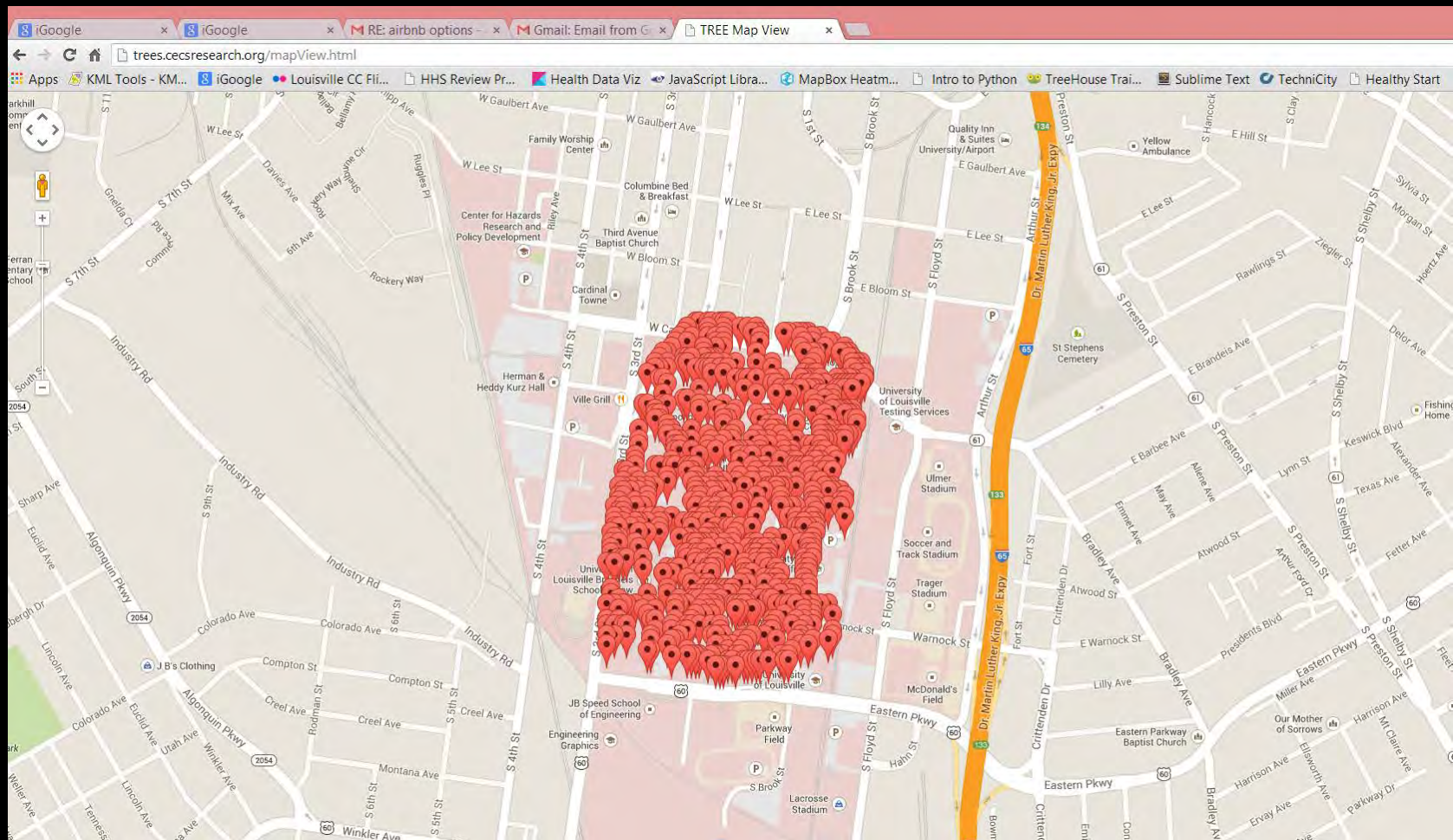
Toggle Map-Off

GIS Help

Refresh











# TREE APP

A UWRL PROJECT

HOME PAGE

TREE MAP

DOWNLOAD APP

## ABOUT UWRL

The Urban Wildlife Research Lab (UWRL) conducts research focused on the interactions of humans and wildlife in urban settings. Study locations include the campus of University of Louisville, urban parks throughout Jefferson County, and abroad. Dr. Tommy Parker is Principal Investigator and Faculty mentor for the Graduate and Undergraduate students in the UWRL. Dr. Parker and lab personnel seek to advance the field of Urban Ecology through significant, high quality research. Visit the UWRL webpage at [\[http://UrbanWildlifeResearchLab.org\]](http://UrbanWildlifeResearchLab.org) to learn more.

## Tree Information

### Basic Information

Species: Japanese Flowering Cherry

Age: 0

Location: 38.2158, -85.7582

Monetary Value: \$2,163.51

### Tree Measurements

Height: 10.7 ft

Volume: 31.63

Dry Weight: 252.23 lbs

Green Weight: 347.90 lbs

### Environmental Information

Weight of CO<sub>2</sub>/year: 0.00 lbs

Weight of CO<sub>2</sub> in life: 462.37 lbs

Weight of Carbon: 126.11 lbs



## Street Trees



### Legend

- ..... Trees located in public right-of way
- ..... Trees planted with 2012 MSD grant (LDMD watering program)
- ..... Future tree plantings under phase II
- Management District Boundary

### Louisville Central Business District

Prepared By: Louisville Downtown Management District

Scale: 0 200 400 600 feet  
Walking Time: 0 1 2 3 4 minutes  
Date: June, 2013

## Apps for Smartphones and Tablets

### Overview

#### Collector App

#### ArcGIS App

#### Windows 8 App

#### For Developers

#### System Requirements

#### Brochures/Articles/ Podcasts

#### Demos



## Collector App

Collector for ArcGIS improves your productivity with intuitive data collection. It's designed specifically for iPhone and Android smartphones.

- Capture, update, and report spatial and tabular information directly from your Android or Apple device.
- Plan routes and get directions.
- Improve your data quality with data-driven forms.
- Capture photos and video.
- Integrate information into your organization's GIS.
- Configure the app to fit your organization's workflow.

Data captured in the field using the Collector app can be displayed in an [Operations Dashboard](#).

Download the free Collector app from the [Apple App Store](#) or [Google Play](#) and [get started](#).

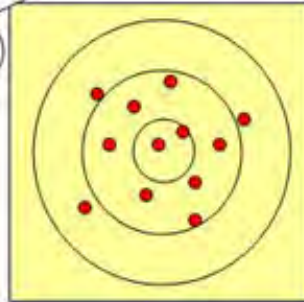


Plan routes and get driving directions with the Collector for ArcGIS app on your iPhone or Android smartphone.



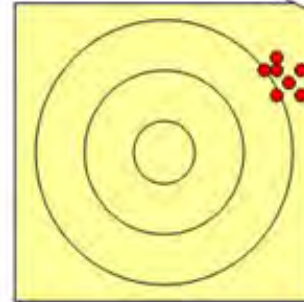
# Accuracy vs Precision

*Measure of  
bias*

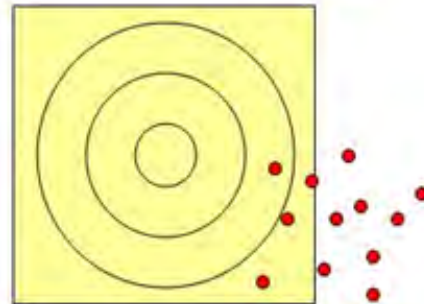


**Accurate but not Precise**

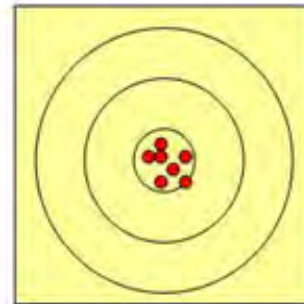
*Measure  
of spread*



**Precise but not Accurate**

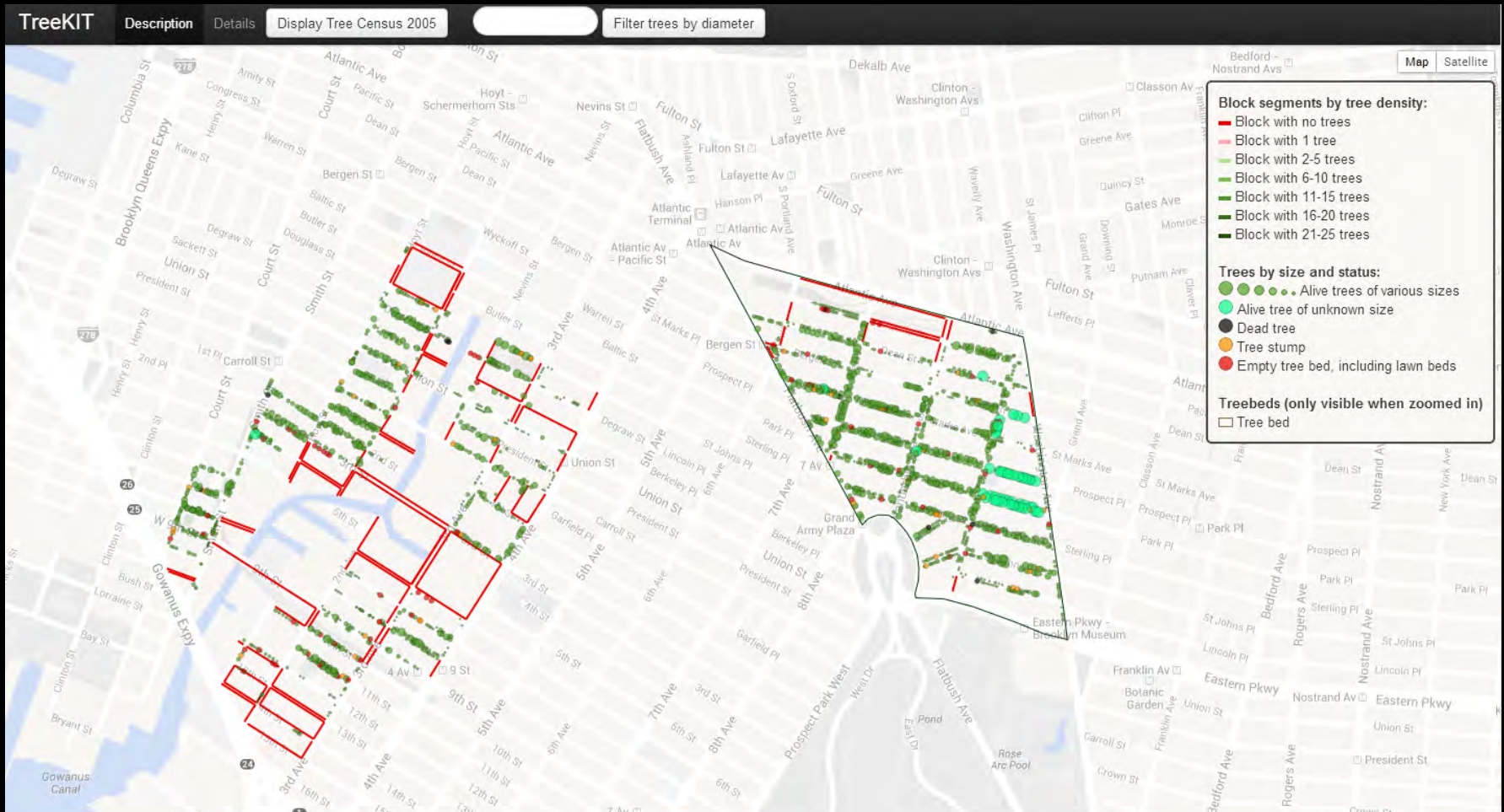


**Not Accurate or Precise**

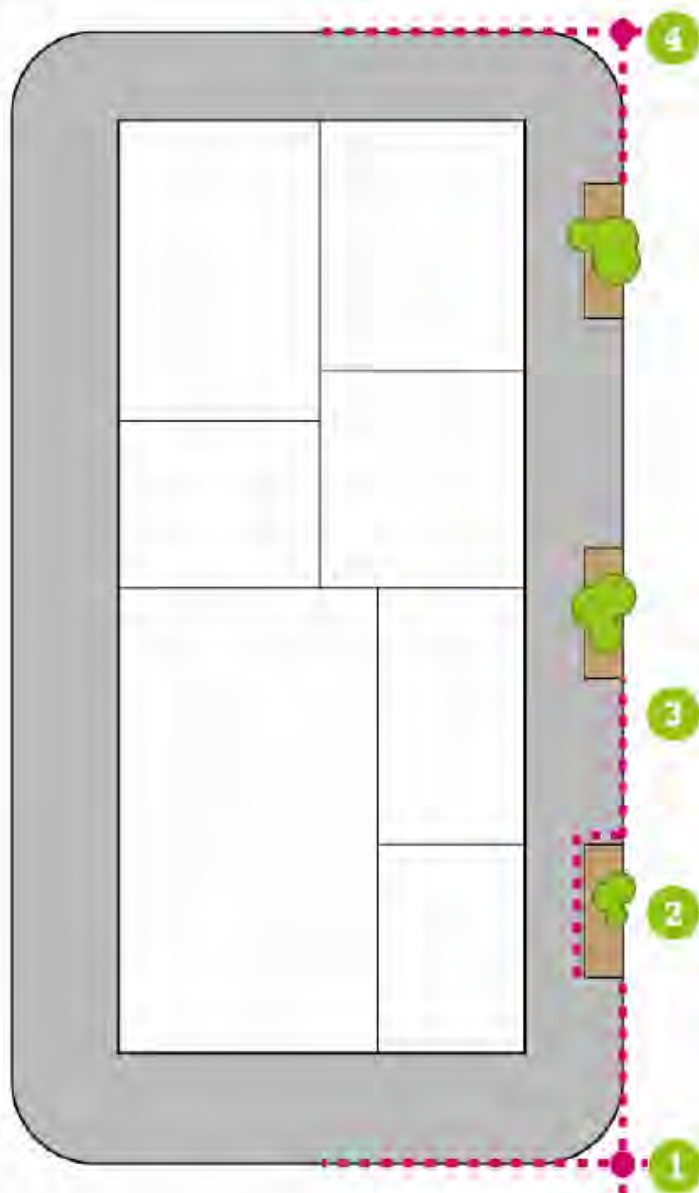


**Both Accurate & Precise**

# TreeKIT methodology in NYC







The final distance is found between the edge of the last tree bed and the end point.

The distance is measured between the edge of this tree bed and the next bed and this process is repeated for each tree bed on the street.

The length and width of the tree bed is measured and the DBH, species and status of the tree are recorded.

Start point is found at the extruding perpendicular curb edges of street corner. The distance is measured between the start point and the edge of the first tree bed

**Block segments by tree density:**

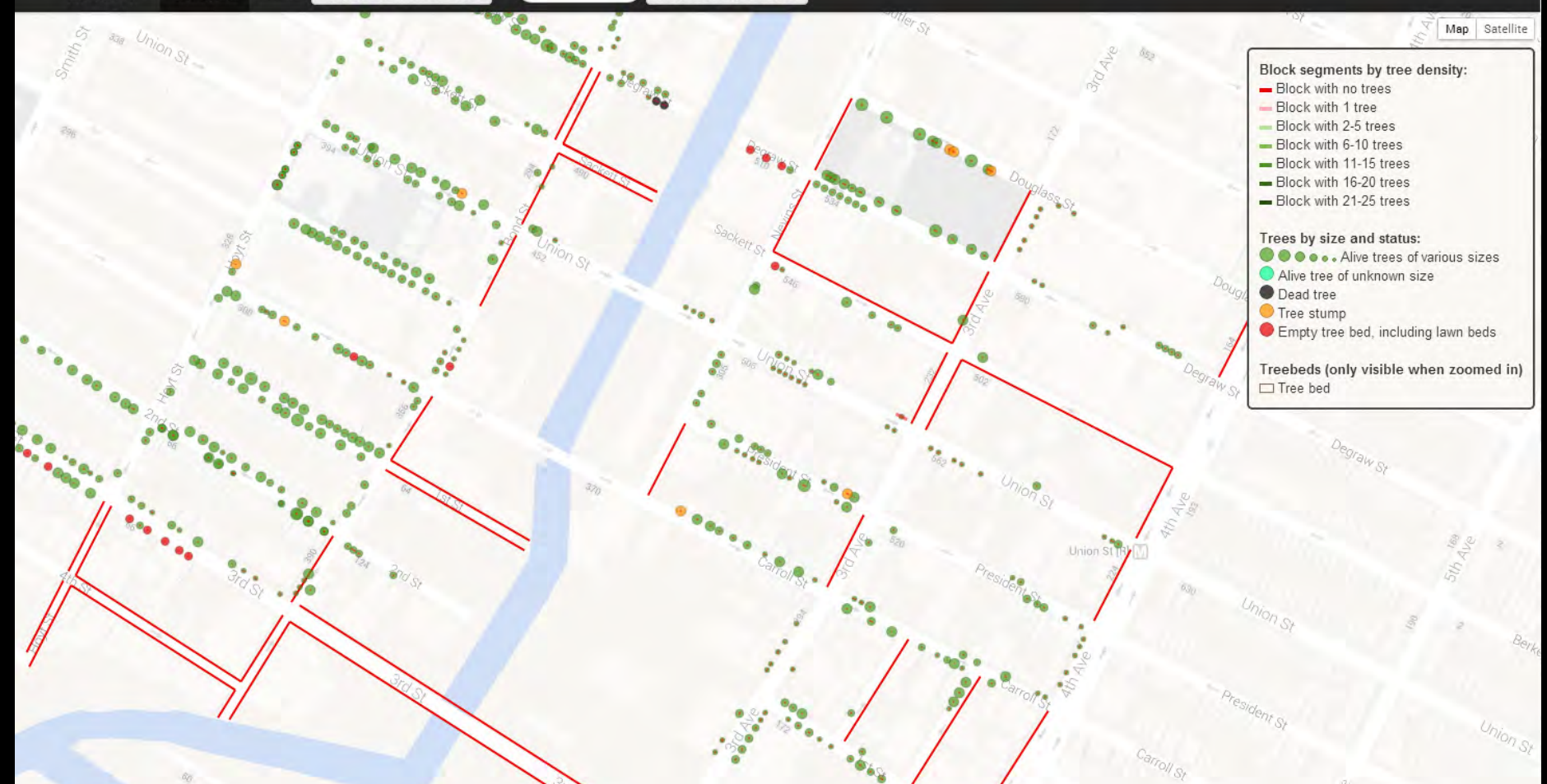
- Block with no trees
- Block with 1 tree
- Block with 2-5 trees
- Block with 6-10 trees
- Block with 11-15 trees
- Block with 16-20 trees
- Block with 21-25 trees

**Trees by size and status:**

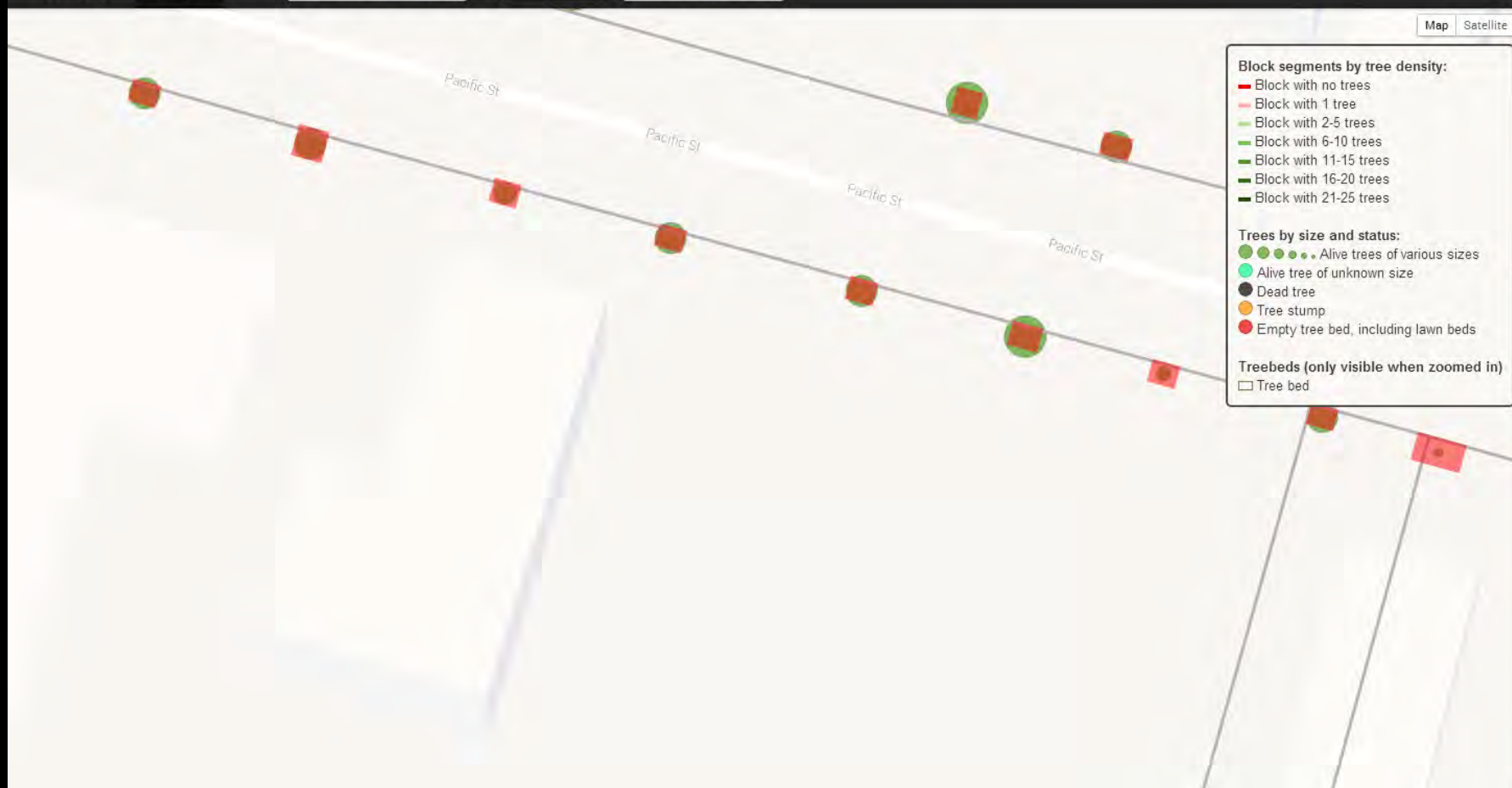
- Alive trees of various sizes
- Alive tree of unknown size
- Dead tree
- Tree stump
- Empty tree bed, including lawn beds

**Treebeds (only visible when zoomed in)**

- Tree bed







# **Mapping Urban Trees in Downtown Louisville**















Id

- 0
- 1
- 2
- 3
- 4

## ArcToolbox

- ArcToolbox
  - 3D Analyst Tools
  - Analysis Tools
  - Cartography Tools
  - Conversion Tools
  - Data Interoperability Tools
  - Data Management Tools
  - Geocoding Tools
  - Geostatistical Analyst Tools
  - Linear Referencing Tools
  - Multidimension Tools
  - Network Analyst Tools
  - Schematics Tools
  - Server Tools
  - Spatial Analyst Tools
  - Spatial Statistics Tools
  - Tracking Analyst Tools



## 5000 Trees: A look at preliminary data for LouTreeMap

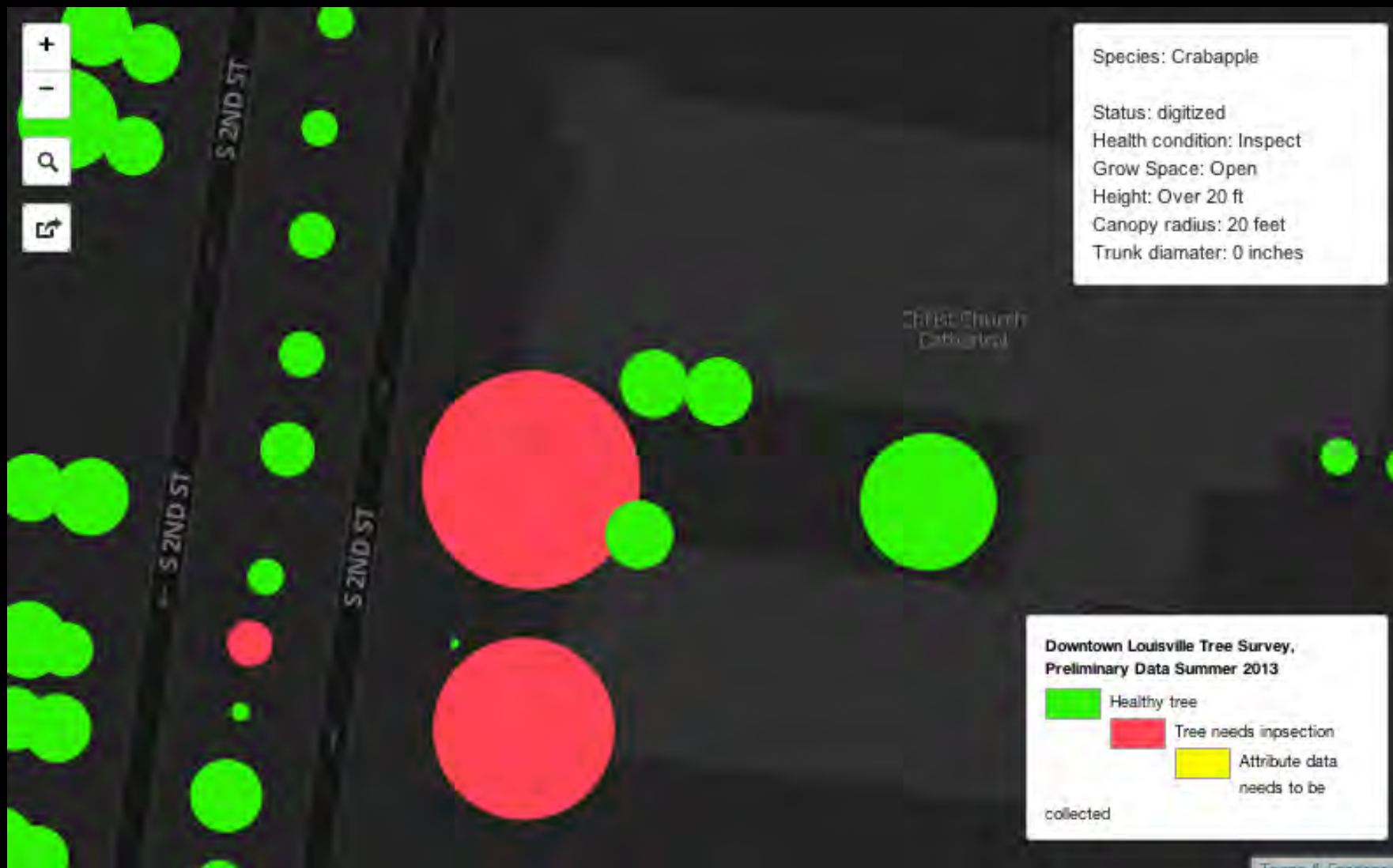


Welcome to 5000 Trees: A look at the preliminary data for LouTreeMap.

The data associated with these points were collected in the spring and summer of 2013. Every tree in the Downtown pilot study area has been located and plotted on the map (there were almost 5000 trees in our Downtown study area), but keep in mind that these data are only a snapshot in time (much of the data collection work was conducted in Late April/ May 2013 and partially updated in July 2013), and it's likely that there have already been new trees added and existing trees lost. The circular polygons on the map (shown in green and red) represent the 1000 trees for which our fantastic volunteers have collected attribute data, including species, size, condition, etc. In some cases these data are incomplete, and keep in mind the data is incomplete for all the tree locations depicted with a yellow dot, except for maybe a brief note. We're currently looking for best methods for engaging volunteers and partners in completing the attribute data collection. Stay tuned and email [info@citycollaborative.org](mailto:info@citycollaborative.org) if you need to get in touch.



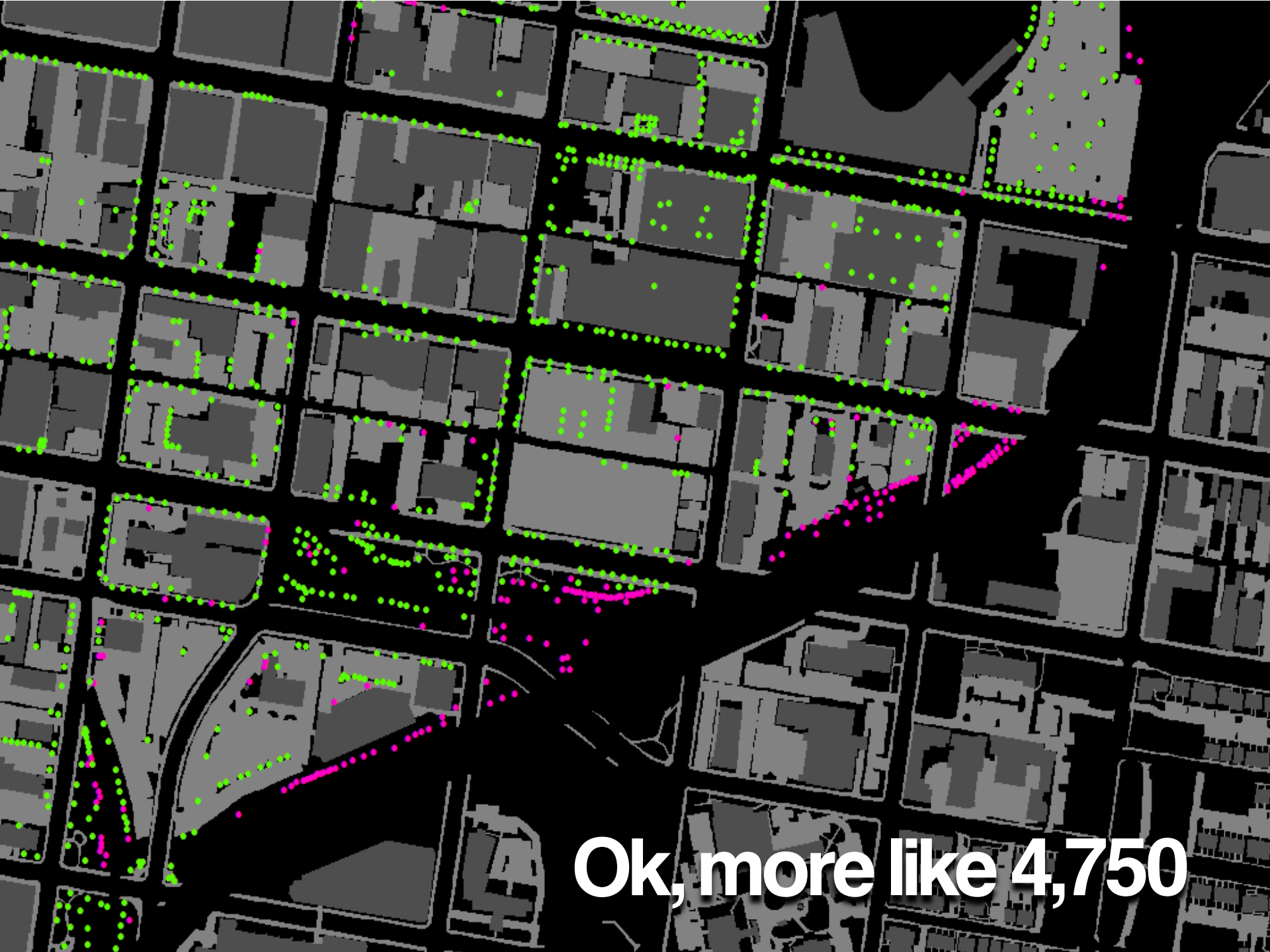






**5000 trees?**





Ok, more like 4,750



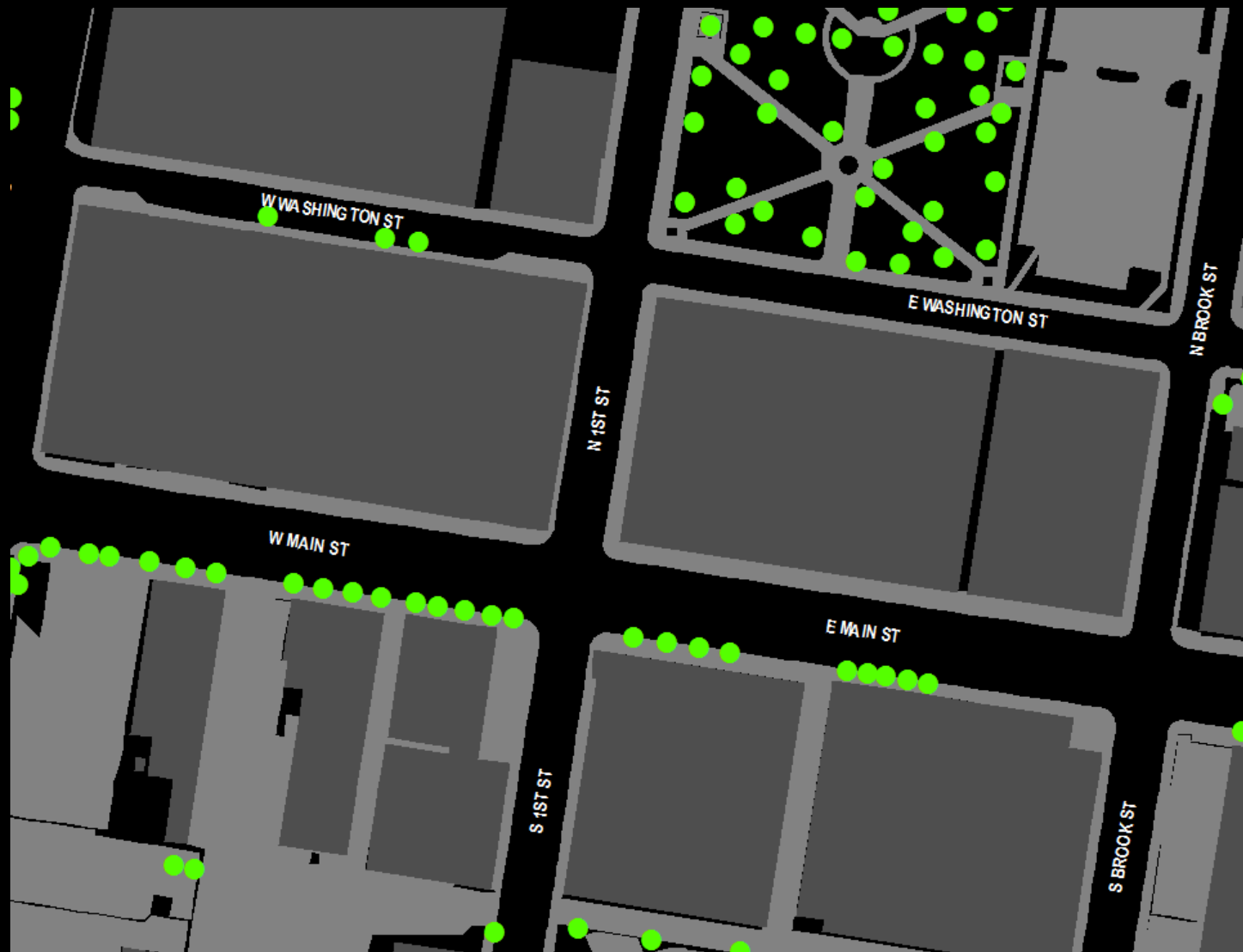


Ash Trees





**Young Trees**



# Opportunities for Planting



# **Supporting Citizen Science & Providing Tools for Volunteers & Citizen Foresters**



*Add and edit tree details collaboratively with other OpenTreeMap users.*

Start creating greener and healthier communities.

[Get Started on Github](#) >

[Get iOS Code on Github](#) >

[Get Android Code on Github](#) >

[Join the Developers Mailing List](#) >

[Join the News Mailing List](#) >

[Overview](#)

[Resources](#)

[Support & Services](#)

[Future Developments](#)

## Open source software for collaborative, geographically-enabled urban forest inventory

Urban street trees have myriad proven benefits for communities including providing shade, improving air quality, assisting with stormwater runoff, raising property values, decreasing utility bills, and enhancing the look and feel of communities.

### Acknowledgements

Urban Ecos

USDA National Institute of Food and Agriculture

Calfire

Azavea

TreeKIT

Christian Wolfsgruber



PUBLIC



azavea / OpenTreeMap

★ Star

110

🍴 Fork

49

OpenTreeMap is a wiki-inspired, web-based geographic tree inventory application that enables individuals, organizations, and governments to work together and collaboratively map the urban forest. OpenTreeMap is a project of Azavea and Urban Ecos. The code is currently being used to create PhillyTreeMap.org, UrbanForestMap.org, GreenprintMaps.org... <http://www.azavea.com/opentreemap/>

📦 1,316 commits

🌿 14 branches

📦 5 releases

👤 13 contributors



🌿 branch: v1.3 ▾

OpenTreeMap / +

Fix model to handle correctly overwriting species



ahinz authored 6 days ago

latest commit 6b9ec2ac59 📄



api

Merge remote-tracking branch 'upstream/v1.3' into v1.3

18 days ago



classfaves

initial commit

3 years ago



importer

Fix model to handle correctly overwriting species

6 days ago



polygons

Merge pull request #142 from steventlamb/bug/show\_photo\_edits

3 months ago



profiles

Add template profile\_detail.html, change edit\_profile.html to match, ...

3 months ago



qs\_tiles

initial commit

3 years ago



registration\_backend

Set minimum password length of 6

a month ago



scripts

Re-add search view script (delete in d3332e7)

11 months ago



static

Hack to allow LA to show all species

13 days ago



templates

Include underscore on the status page

13 days ago



tilecache

remove mapserver

a year ago

<> Code

🔔 Issues

20

🔗 Pull Requests

1

📖 Wiki

📶 Pulse

📊 Graphs

🌐 Network

HTTPS clone URL

<https://github.com>



You can clone with [HTTPS](#), or [Subversion](#).

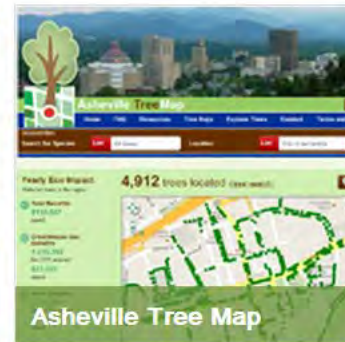


Clone in Desktop



Download ZIP

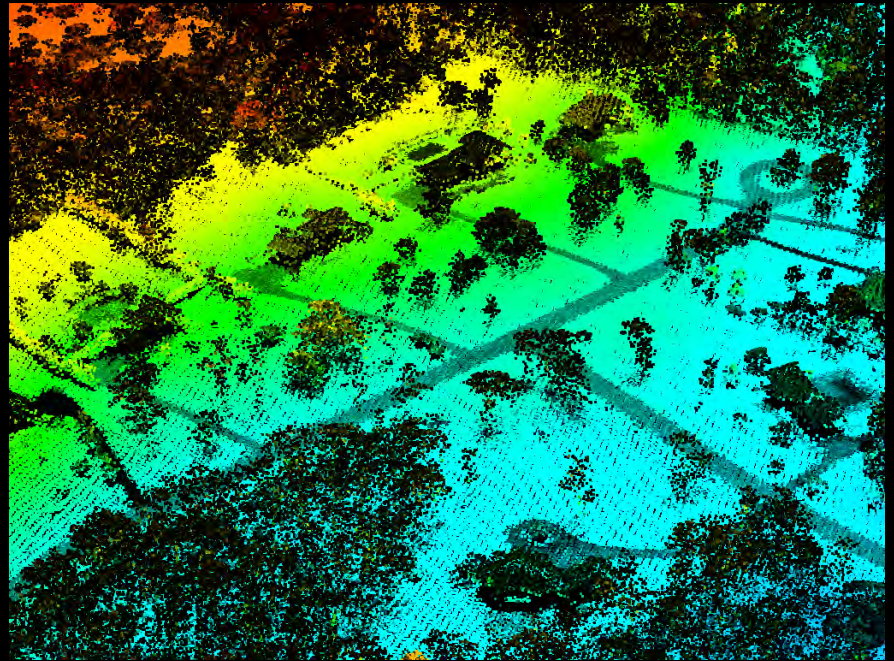
# OPEN TREE MAP — GITHUB



treezilla - the monster map of trees



**LIDAR** is a remote sensing technology that measures distance by illuminating a target with a laser and analyzing the reflected light. The term "lidar" comes from combining the words light and radar



**Creating an Open Data set that  
encourages citizens and officials to  
engage, edit, and expand**