MAPPING LOUISVILLE'S URBAN TREES

COLLECTING BASELINE DATA FOR A HEALTHIER COMMUNITY

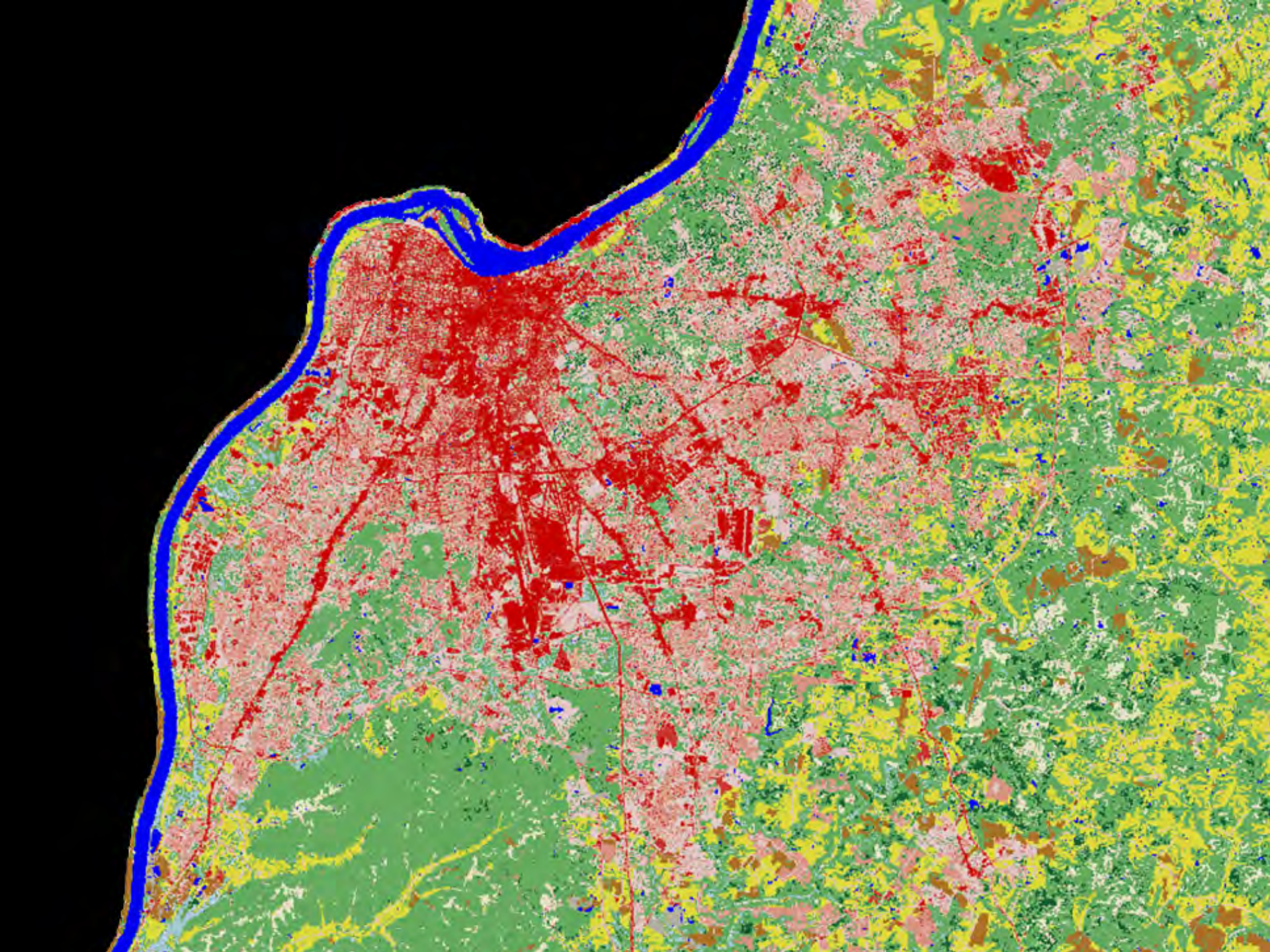
Presented by Patrick Smith, AICP

IN COOPERATION WITH

CITY collaborative

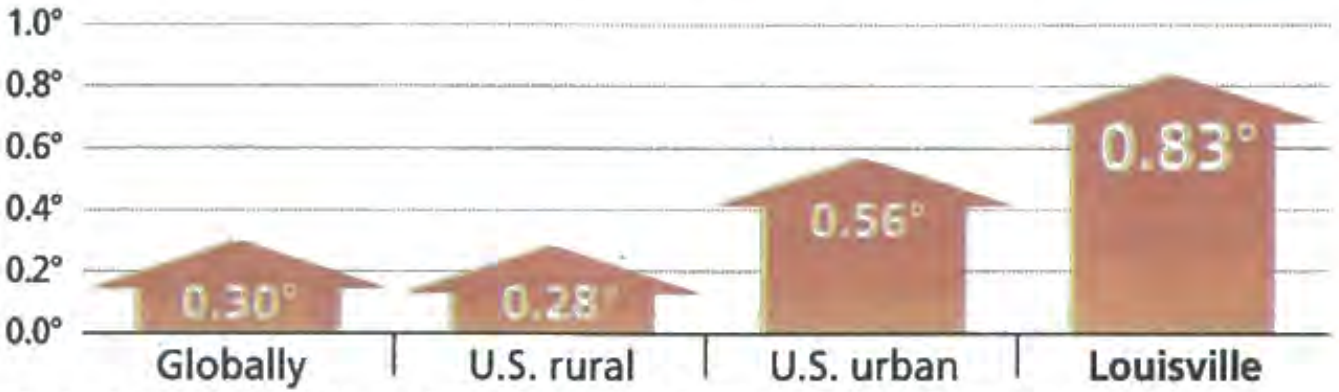
urban design studio

@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 fluctations 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.

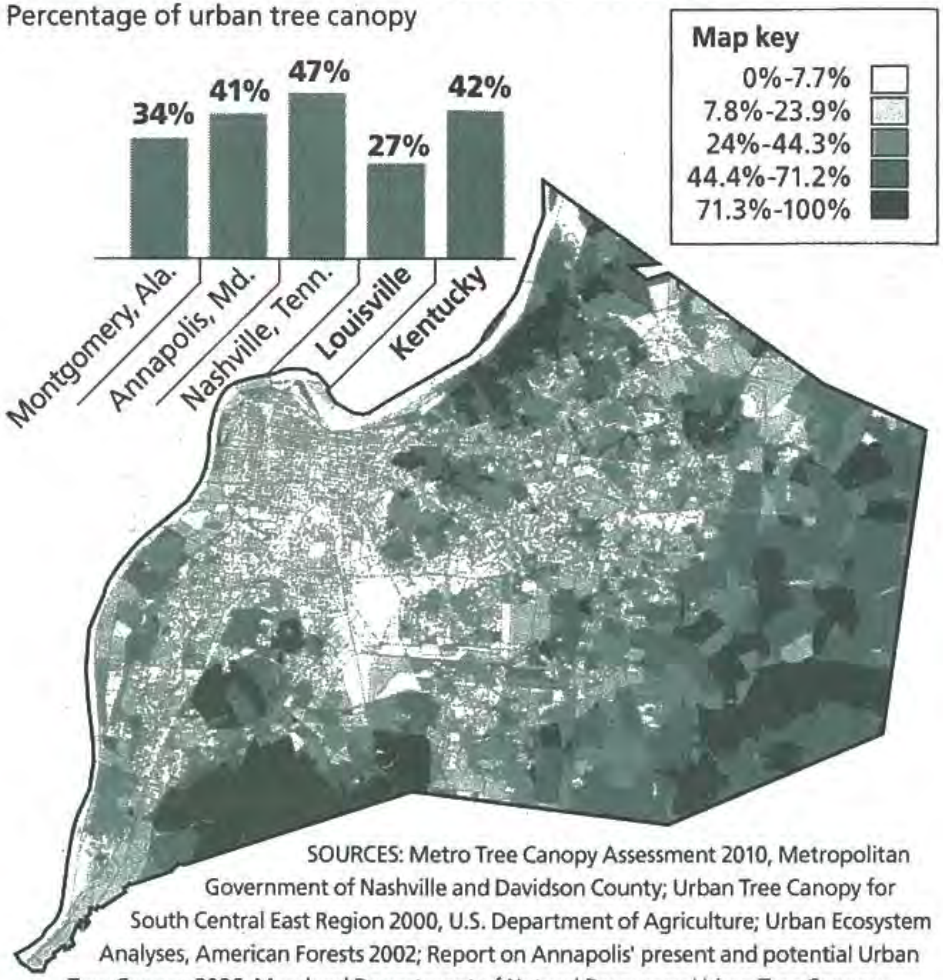
*Louisville's ranking was influenced by an excessively hot 2007.

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

STEVE REED/THE COURIER-JOURNAL

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

NRDC ISSUE BRIEF

MAY 2012 IB:12-05-C

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

Environmental Pollution 178 (2013) 395–402

Contents lists available at SciVerse ScienceDirect

Environmental Pollution

journal homepage: www.elsevier.com/locate/envpol

Modeled $PM_{2.5}$ removal by trees in ten U.S. cities and associated health effects

David J. Nowak [a,*], Satoshi Hirabayashi [b], Allison Bodine [b], Robert Hoehn [a]

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ARTICLE INFO

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Air pollution removal
Particulate matter
Mortality
Human health

ABSTRACT

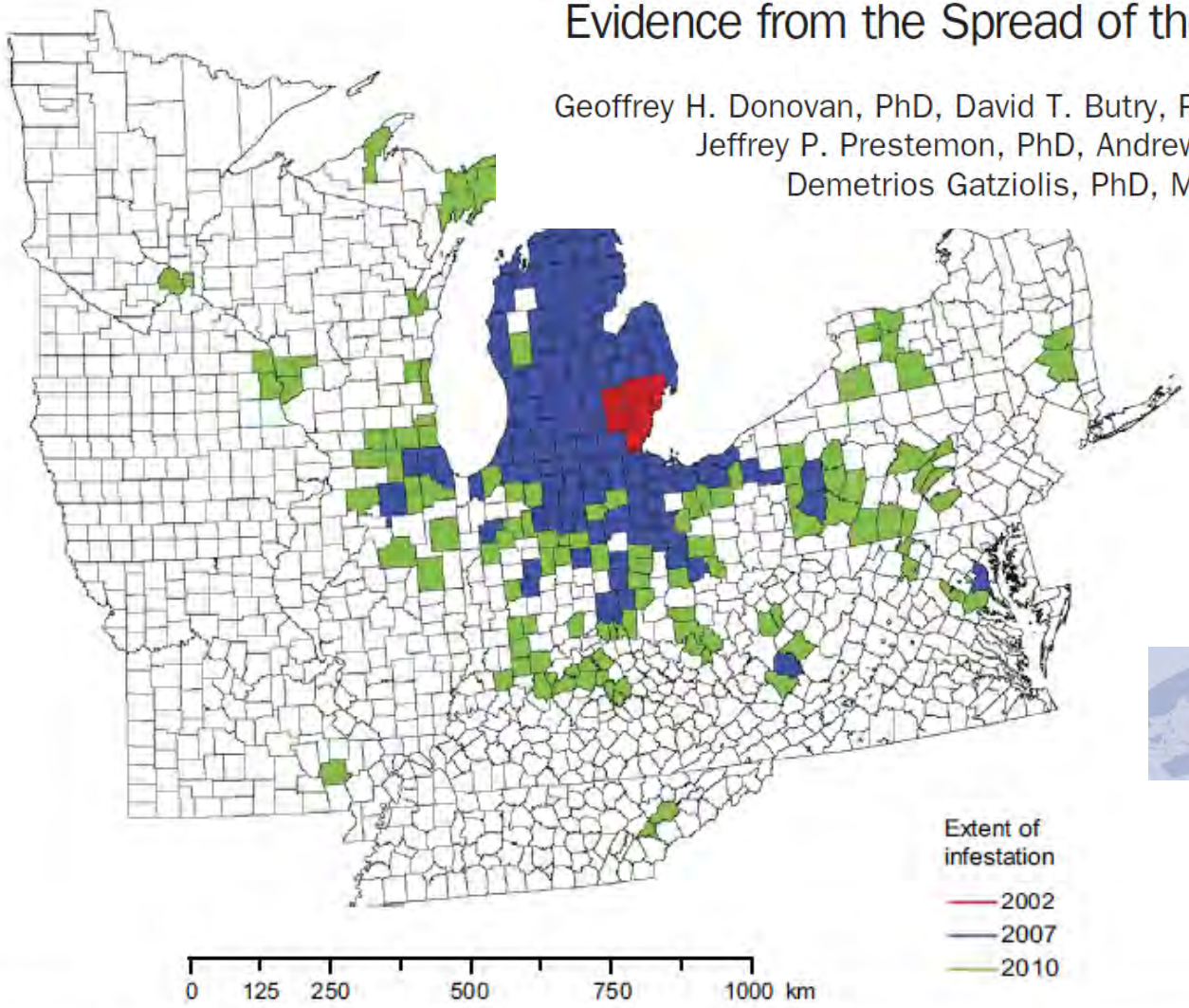
Urban particulate air pollution is a serious health issue. Trees within cities can remove fine particles from the atmosphere and consequently improve air quality and human health. Tree effects on $PM_{2.5}$ concentrations and human health are modeled for 10 U.S. cities. The total amount of $PM_{2.5}$ 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^{-1} per city, but were as high as 7.6 people yr^{-1} 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

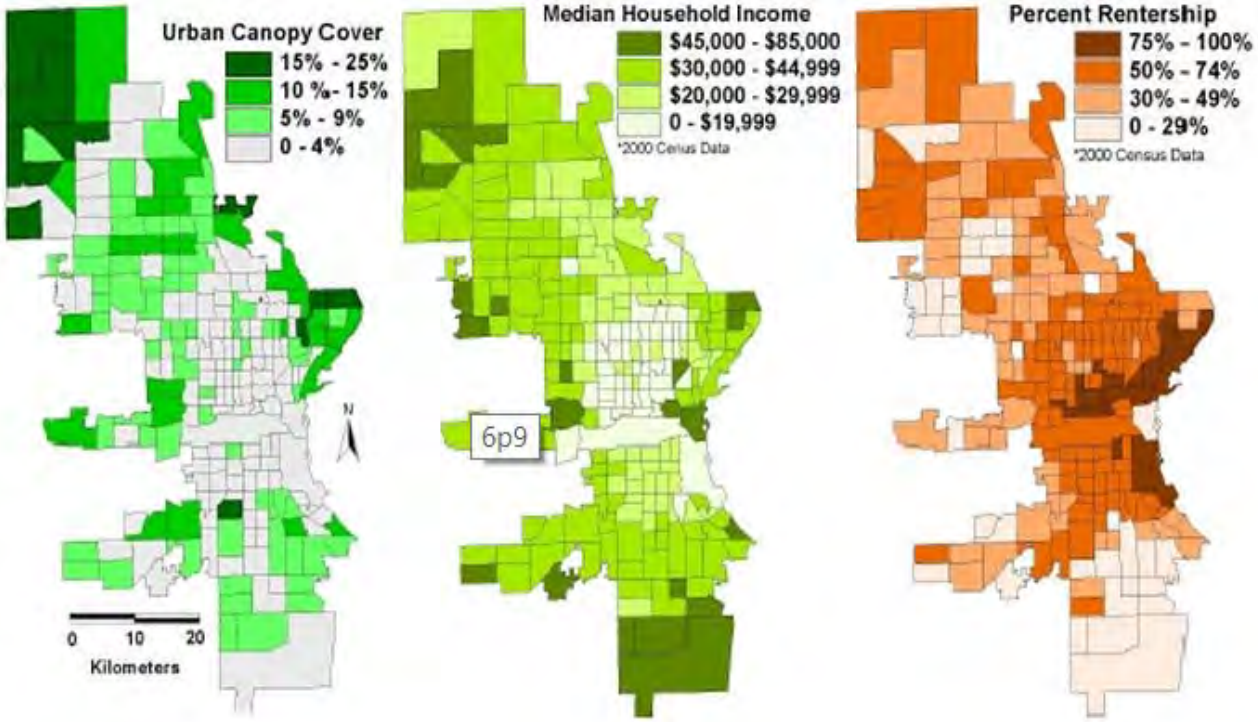
Geoffrey H. Donovan, PhD, David T. Butry, PhD, Yvonne L. Michael, ScD,
Jeffrey P. Prestemon, PhD, Andrew M. Liebhold, PhD,
Demetrios Gatziolis, PhD, Megan Y. Mao



AMERICAN JOURNAL OF
Preventive Medicine

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

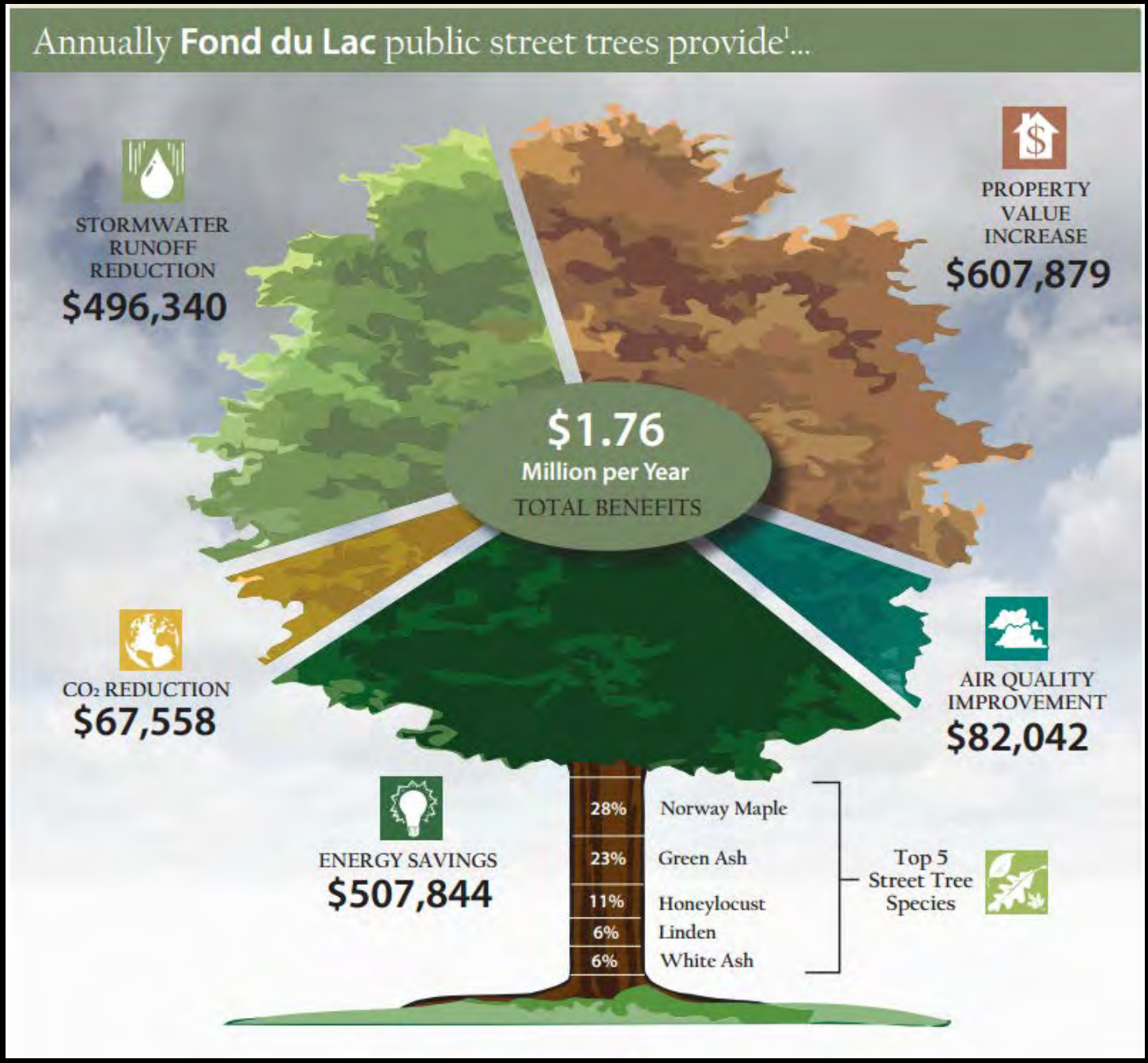
Wealth, homeownership, and trees connect in Milwaukee, WI.



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

Ball Square, Somerville

West Cambridge


Annually Fond du Lac public street trees provide[1]...
STORMWATER RUNOFF REDUCTION
$496,340
PROPERTY VALUE INCREASE
$607,879
$1.76
Million per Year
TOTAL BENEFITS
CO2 REDUCTION
$67,558
AIR QUALITY IMPROVEMENT
$82,042
ENERGY SAVINGS
$507,844
28% Norway Maple
23% Green Ash
11% Honeylocust
6% Linden
6% White Ash
Top 5 Street Tree Species

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 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:

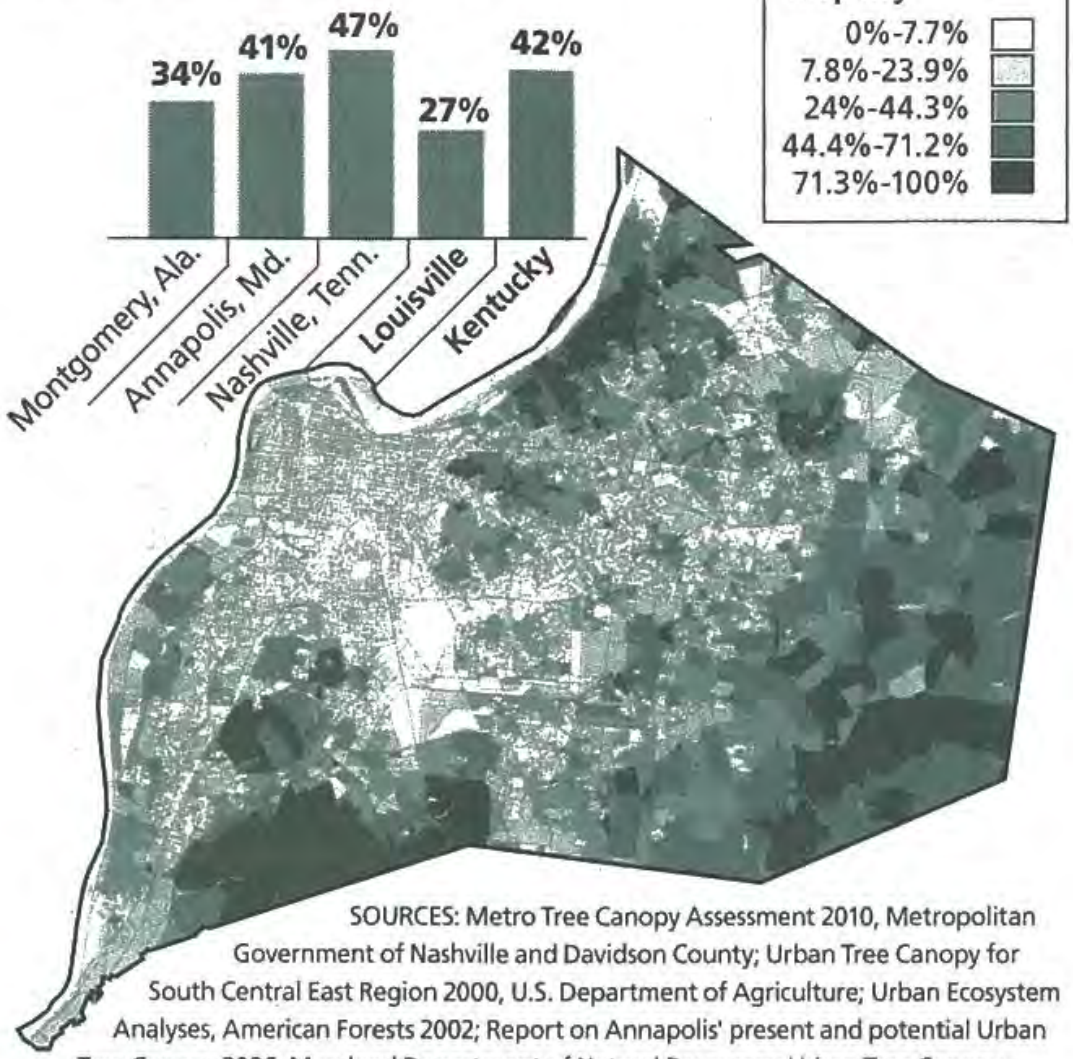
- 29 Land Cover classifications
- Percent Impervious Cover
- Percent Tree Canopy

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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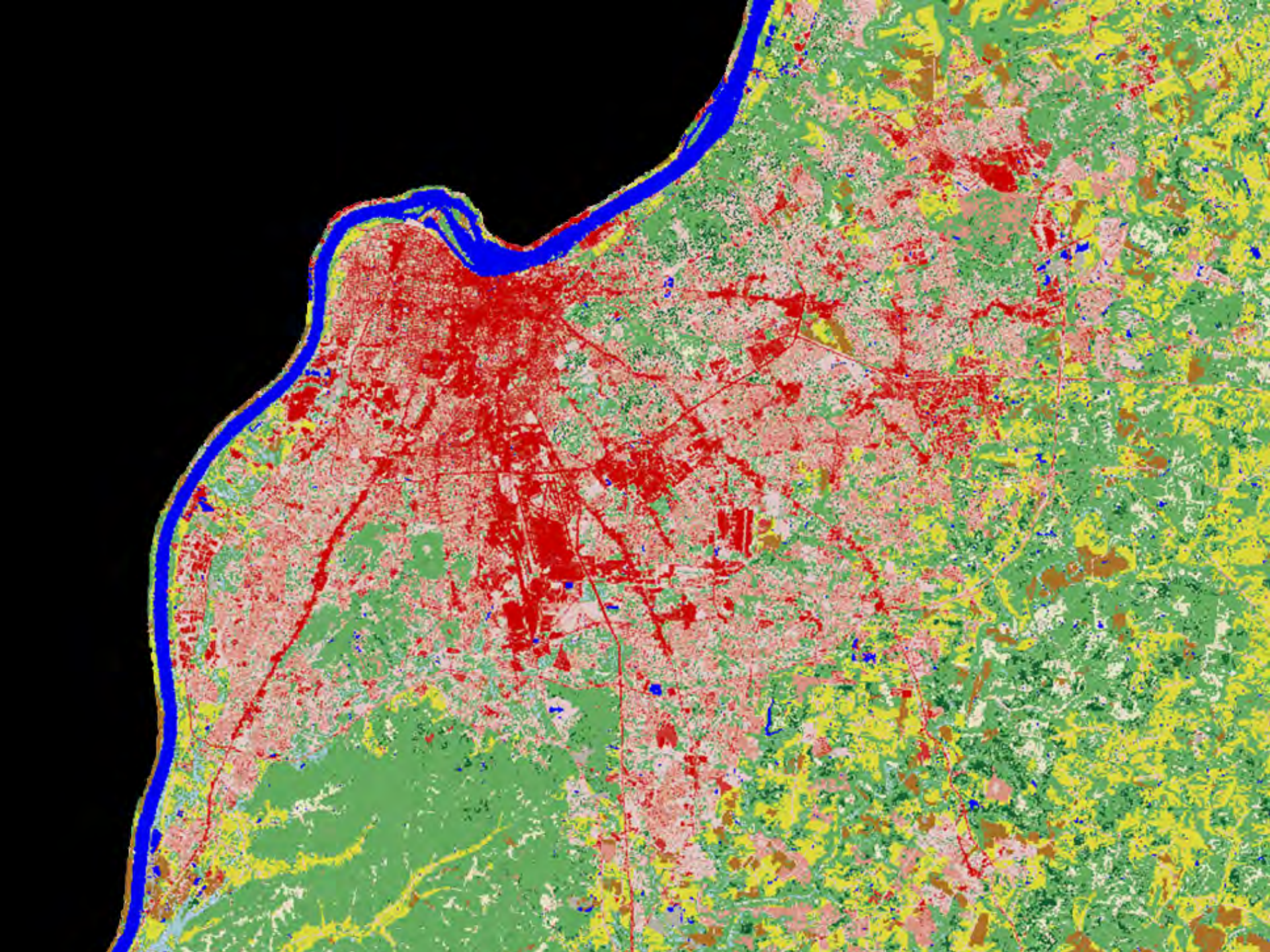
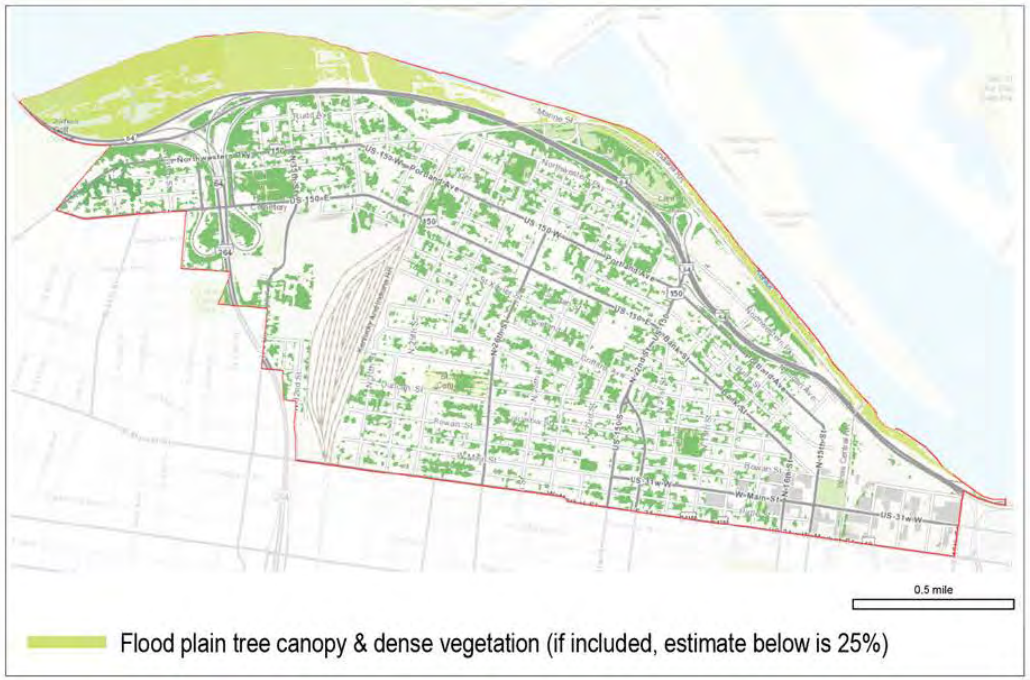


Leaf-on multi-spectral aerial imagery from the National Agriculture Imagery Program (NAIP)

Tyler Park
Tree Canopy and Dense Vegetation, 2010

42% ESTIMATED TREE CANOPY COVERAGE IN TYLER PARK

Portland
Tree Canopy and Dense Vegetation, 2010

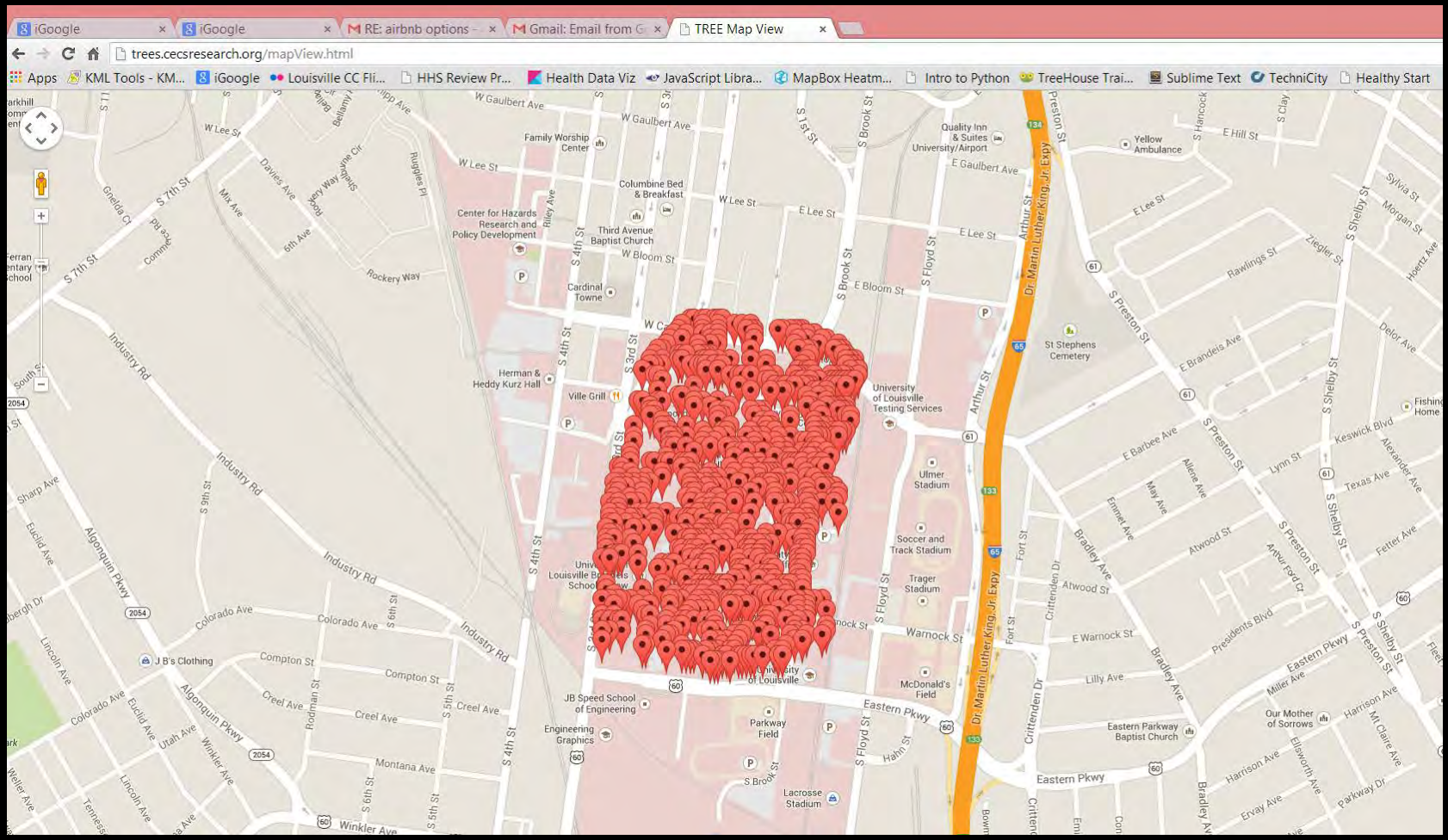


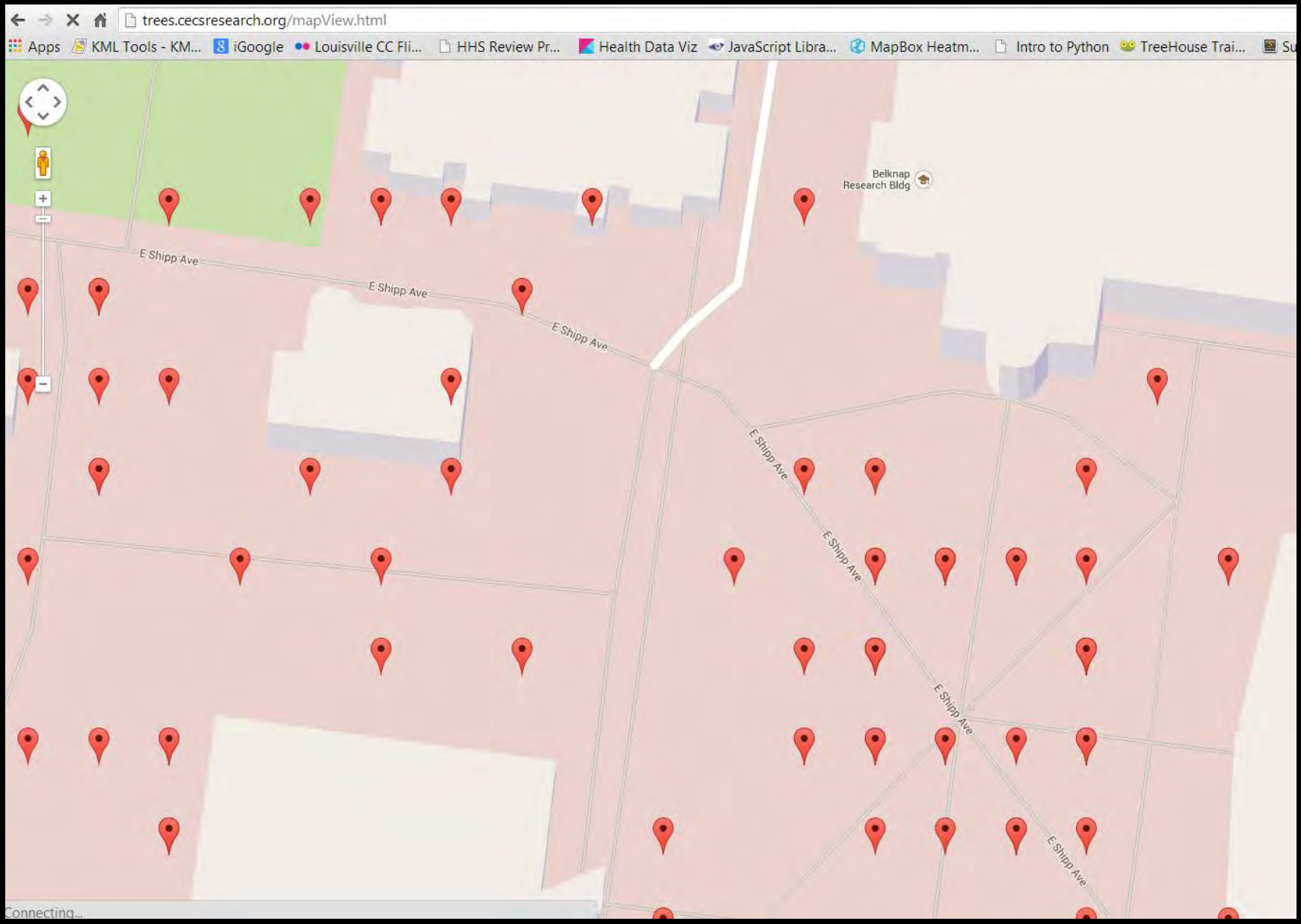
20% ESTIMATED TREE CANOPY COVERAGE IN PORTLAND

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
DAVEY
RESOURCE GROUP


iGoogle
iGoogle
RE: airbnb options -
Gmail: Email from G
TREE Map View
trees.cecsresearch.org/mapView.html
Apps
KML Tools - KM...
iGoogle
Louisville CC Fli...
HHS Review Pr...
Health Data Viz
JavaScript Libra...
MapBox Heatm...
Intro to Python
TreeHouse Trai...
Sublime Text
TechniCity
Healthy Start
W Gaulbert Ave
W Lee St
Family Worship Center
Columbine Bed & Breakfast
Center for Hazards Research and Policy Development
Third Avenue Baptist Church
Cardinal Towne
W Bloom St
E Bloom St
E Lee St
S 7th St
Rockery Way
Herman & Heddy Kurz Hall
Ville Grill
S 4th St
S 3rd St
S Brook St
S Floyd St
S 1st St
Quality Inn & Suites University/Airport
Yellow Ambulance
E Gaulbert Ave
E Hill St
Arthur St
Dr. Martin Luther King, Jr Expy
St Stephens Cemetery
University of Louisville Testing Services
S Preston St
E Brandeis Ave
E Barbee Ave
Keswick Blvd
Lynn St
Texas Ave
S Shelby St
Ulmer Stadium
Soccer and Track Stadium
Trager Stadium
Fort St
Crittenden Dr
Bradley Ave
Atwood St
Warnock St
E Warnock St
Presidents Blvd
Eastern Pkwy
Lilly Ave
McDonald's Field
JB Speed School of Engineering
Engineering Graphics
Parkway Field
Lacrosse Stadium
Eastern Parkway Baptist Church
Our Mother of Sorrows
Harrison Ave
Ervay Ave
Parkway Dr
Industry Rd
Colorado Ave
Compton St
Creel Ave
Montana Ave
Winkler Ave
Algonquin Pkwy
Sharp Ave
Euclid Ave
Lincoln Ave
Utah Ave
Rodman St
J B's Clothing
Davies Ave
Mix Ave
6th Ave
Riley Ave
Ruggles Pl
Gnelda Ct
Bellamy Ave
Shadow Ln
Fetter Ave
Morgan St
Sylvia St
Hoertz Ave
Rawlings St
Ziegler St
Delor Ave
Alexander Ave
Alene Ave
Emmet Ave
May Ave
Miller Ave
Harrison Ave
Mt Claire Ave
Ellsworth Ave
Hahn St


trees.cecsresearch.org/mapView.html
Apps
KML Tools - KM...
iGoogle
Louisville CC Fli...
HHS Review Pr...
Health Data Viz
JavaScript Libra...
MapBox Heatm...
Intro to Python
TreeHouse Trai...
Belknap
Research Bldg
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Connecting...

TREE APP

A UWRL PROJECT

HOMEPAGE 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] 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_2/year: 0.00 lbs

Weight of CO_2 in life: 462.37 lbs

Weight of Carbon: 126.11 lbs

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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: 0 200 400 800 feet

Walking Time: 0 1 2 3 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

Available on the App Store

ANDROID APP ON Google play

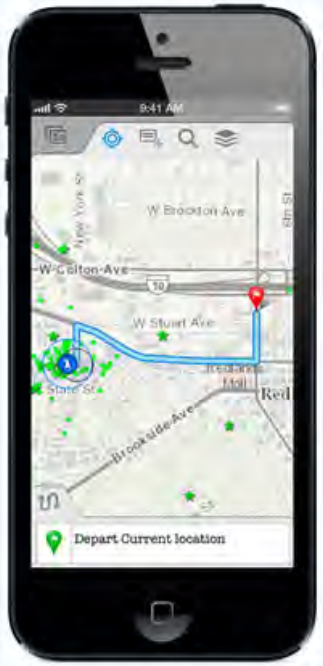
Collector App

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.

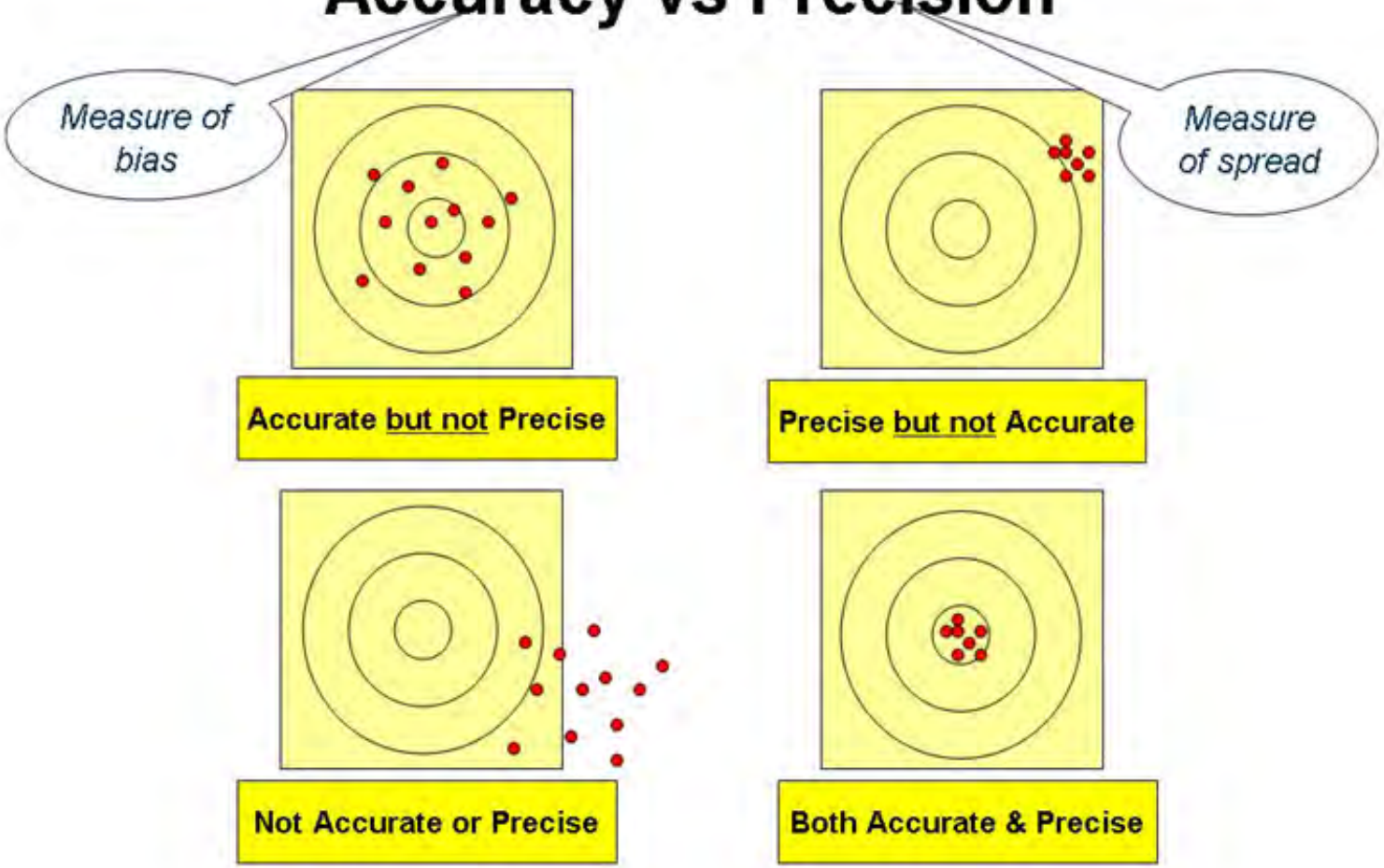
Data captured in the field using the Collector app can be displayed in an Operations Dashboard.

Download the free Collector app from the Apple App Store or Google Play and get started.

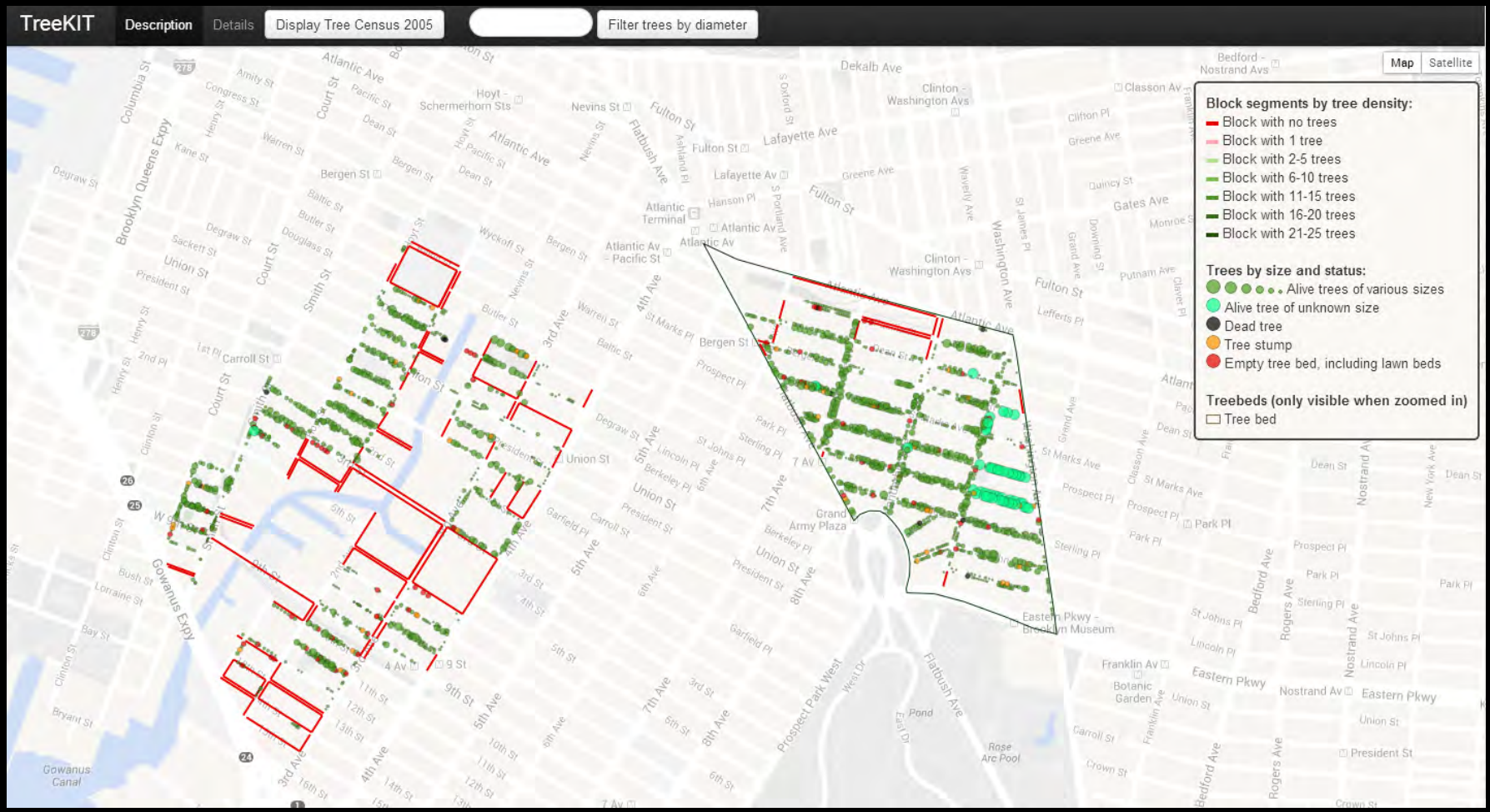


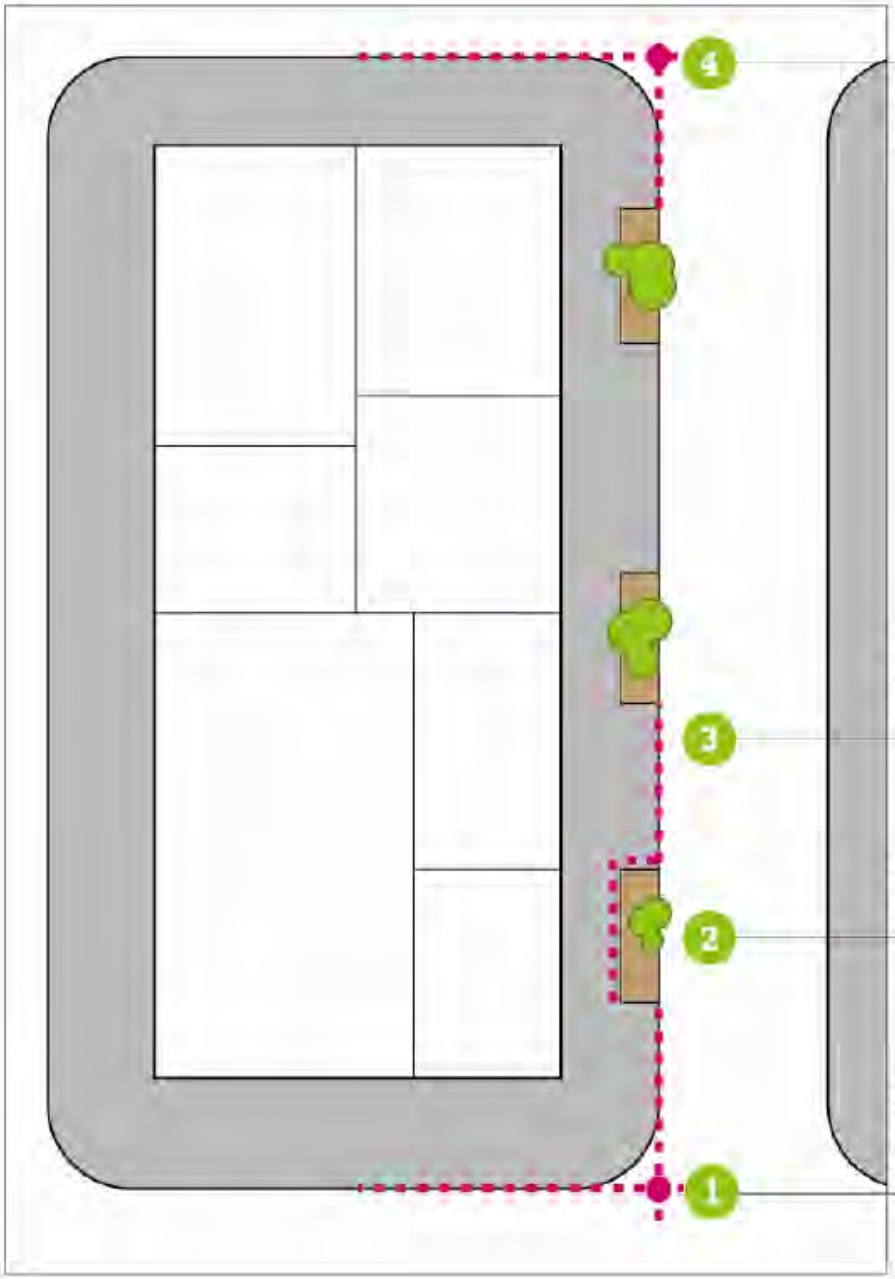
Plan routes and get driving directions with the Collector for ArcGIS app on your iPhone or Android smartphone.

Accuracy vs Precision



TreeKIT methodology in NYC



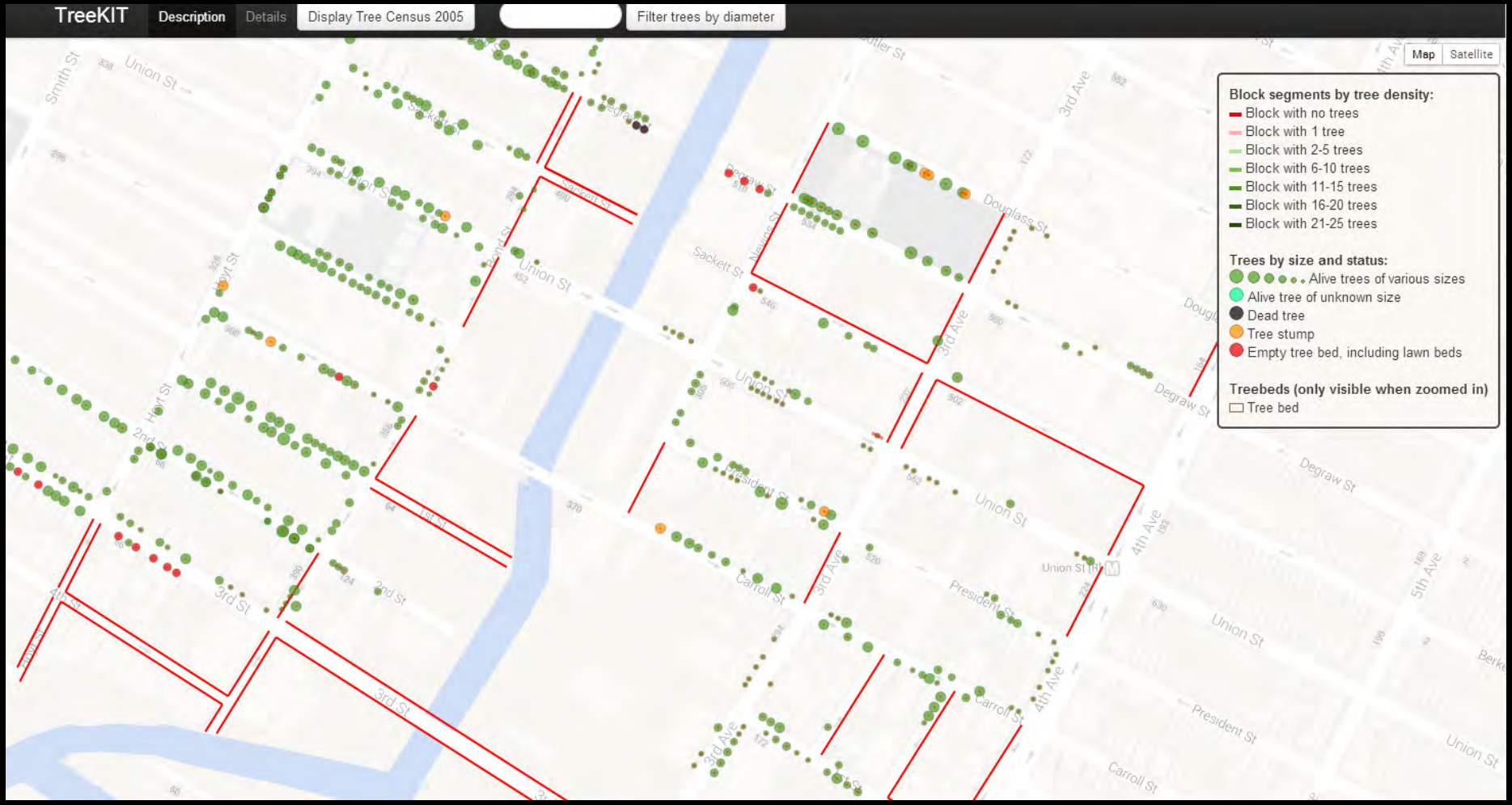


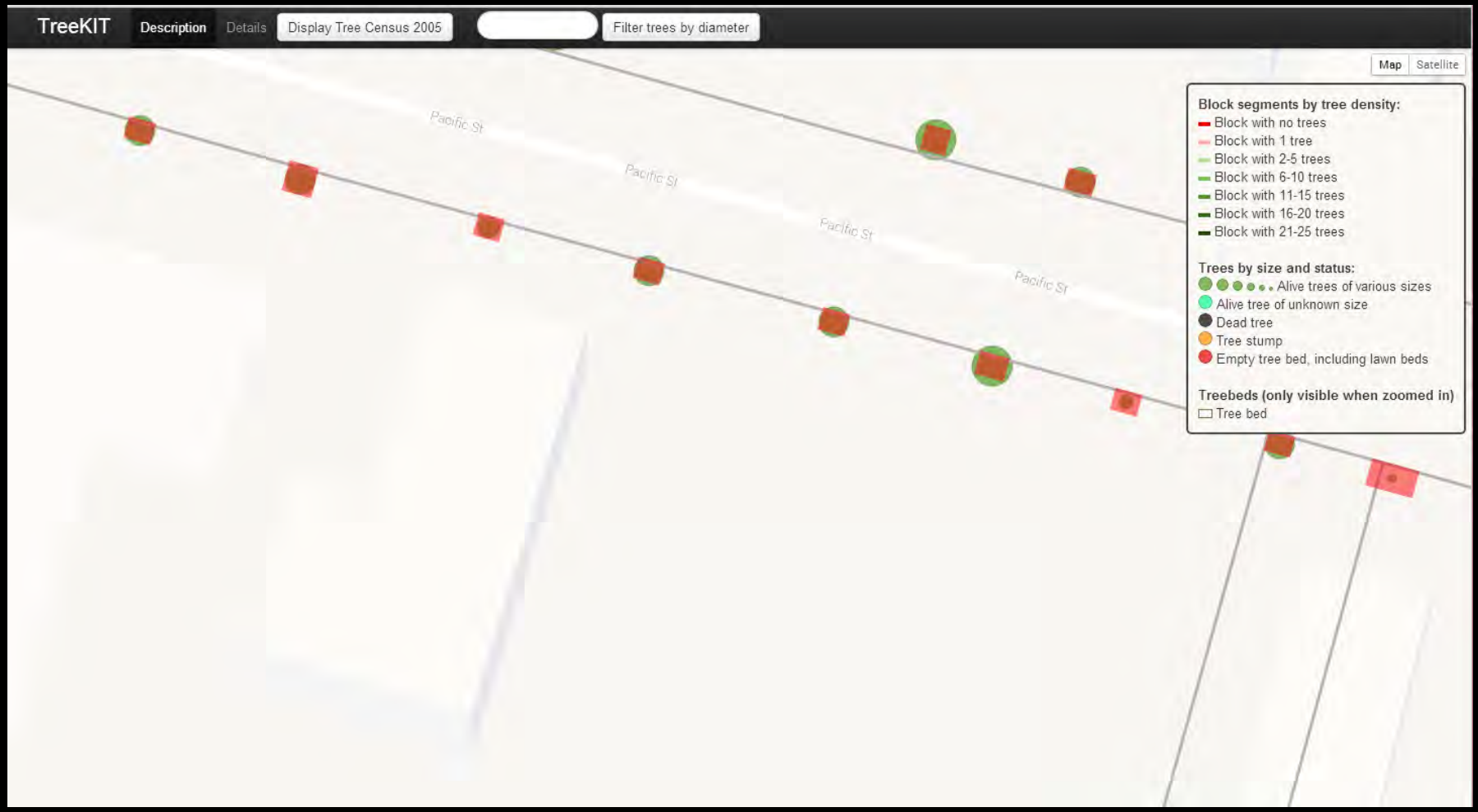
4. The final distance is found between the edge of the last tree bed and the end point.

3. 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.

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

1. 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


TreeKIT
Description
Details
Display Tree Census 2005
Filter trees by diameter
Map
Satellite
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
Union St
Sackett St
Degraw St
Douglass St
Carroll St
President St
3rd Ave
4th Ave
5th Ave
2nd St
3rd St
Hoyt St
Smith St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Alive tree of unknown size
Dead tree
Tree stump
Empty tree bed, including lawn beds
Treebeds (only visible when zoomed in)
Tree bed

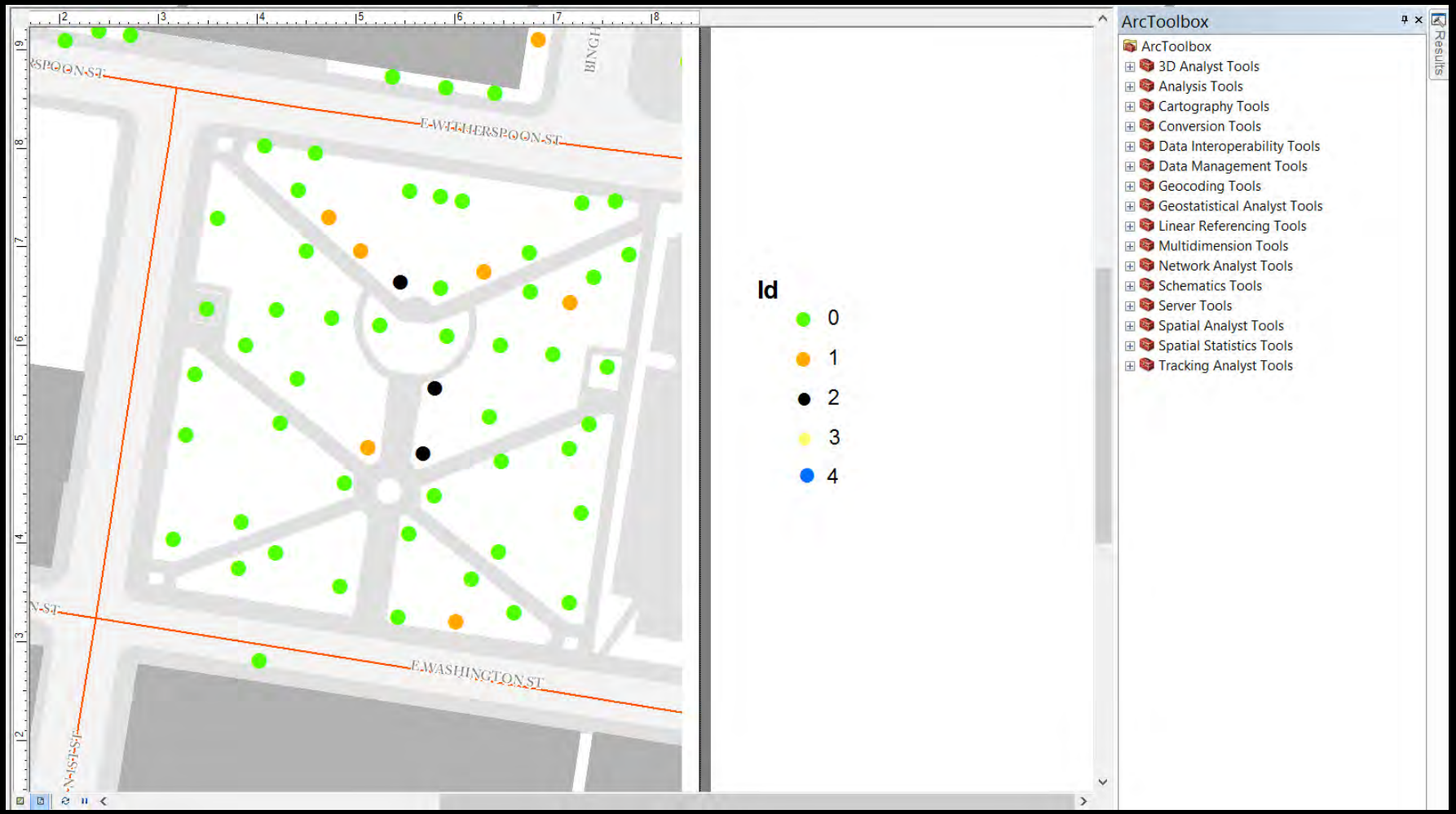
Mapping Urban Trees in Downtown Louisville

Sustainable
Agrarian Urbanism

3rd & Ali

W RIVER RD
I 64 EAST
BINGHAM WAY
I 64 WEST
RIVER RD
I 64 RAMP
I 65 RAMP
E WITHERSPOON ST
W MAIN ST
PIKE ST
W MARKET ST
CONCRETE ALY
W JEFFERSON ST
CEDAR ST
E MAIN ST
E MARKET
PRODUCE
E JEFFERSON ST
I 65 RAMP
I 65 SOUTH
BALLARD ST
W CHESTNUT ST
MAGAZINE ST
W BROADWAY
E BROADWAY
ARENA PLZ
N 2ND ST
N 4TH ST
N 6TH ST
N 8TH ST
N 1ST ST
N FLOYD ST
N PRESTON ST
S FLOYD ST
S 1ST ST
S 2ND ST
S 3RD ST
S 4TH ST
S 5TH ST
S 6TH ST
S 7TH ST
S 8TH ST
ARMORY PL
CATHEDRAL WAY
ROY WILKINS AVE
ONE WAY

W JEFFERSON ST
W LIBERTY ST
S 4TH ST
CATHEDRAL WAY
MUHAMMAD ALI BLVD
see attached sketch.
80
Feet
21


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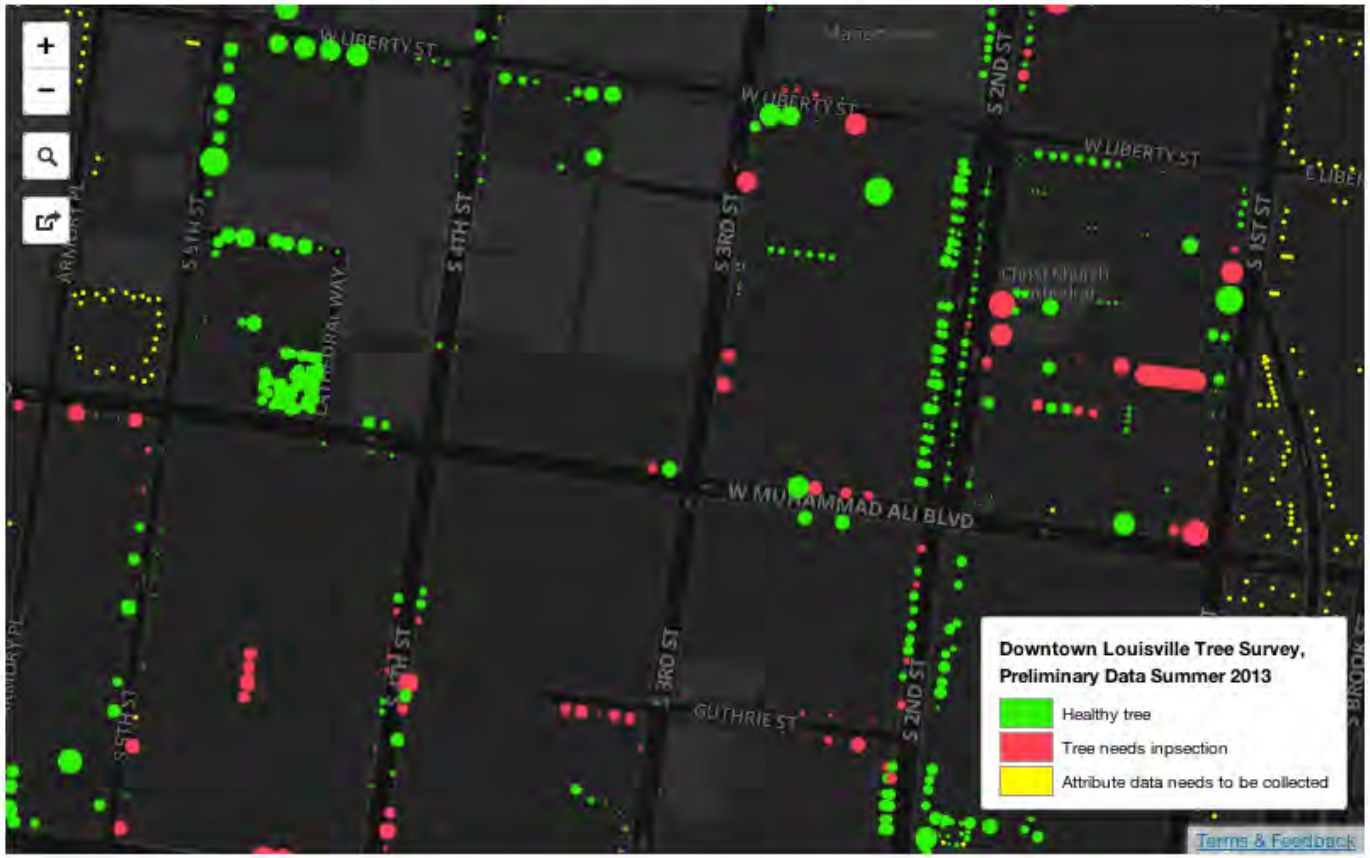
ArcToolbox
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Multidimension Tools
Network Analyst Tools
Schematics Tools
Server Tools
Spatial Analyst Tools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

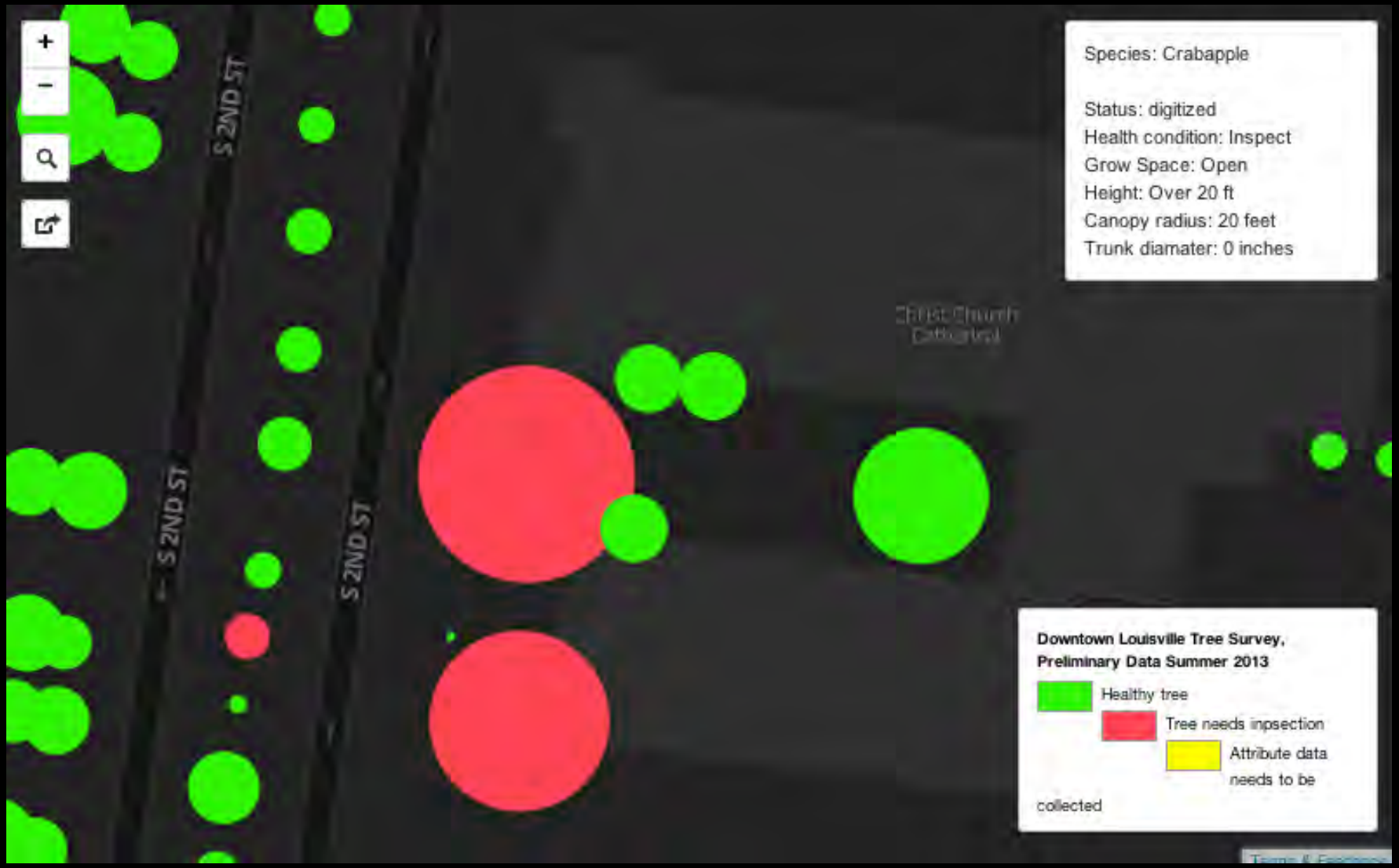
5000 Trees: A look at preliminary data for LouTreeMap



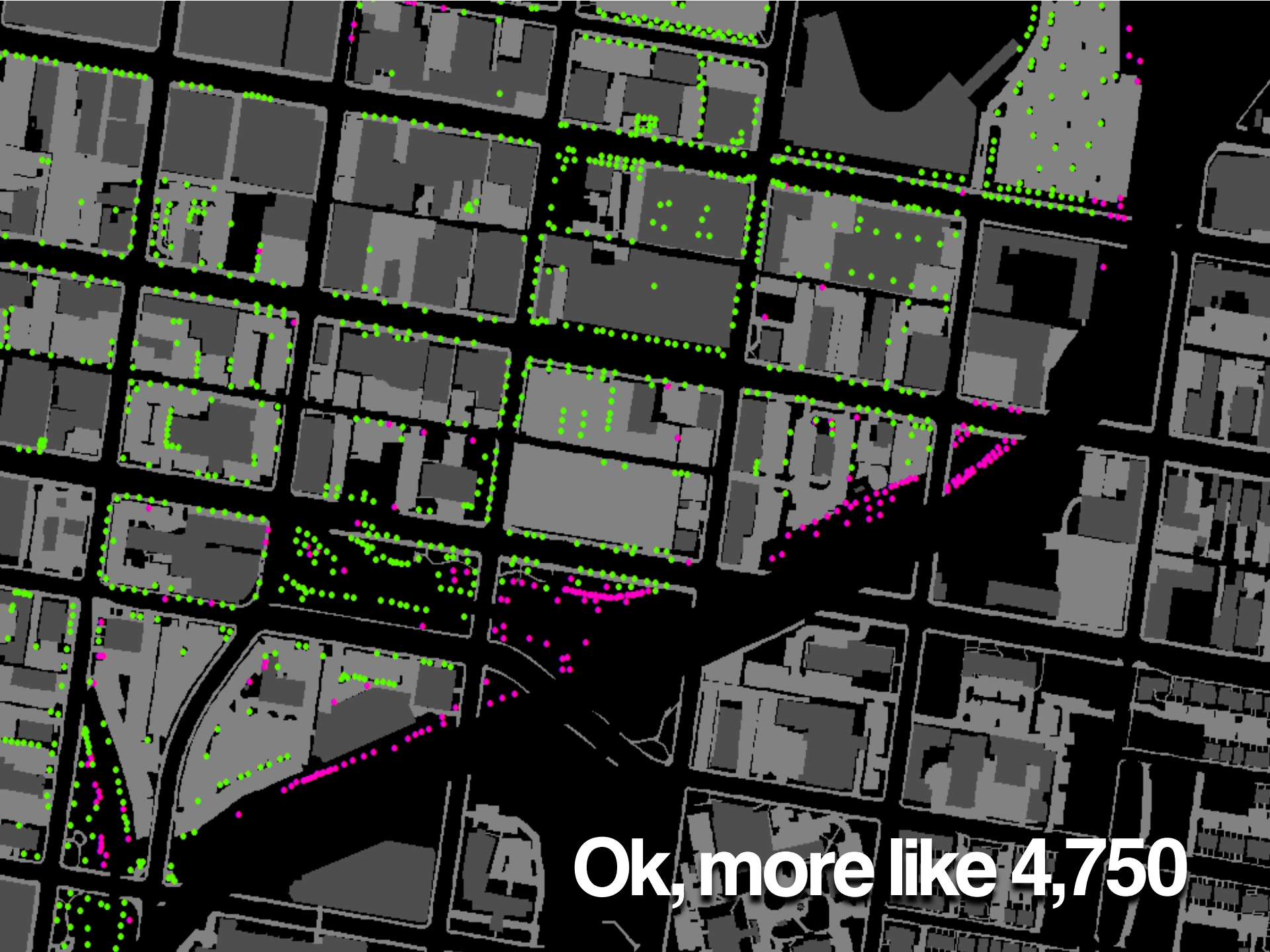
Welcome to 5000 Trees: A look at the preliminary data for LouTreeMap.

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 if you need to get in touch.

Species: Zelkova
Status: digitized
Health condition: Fine
Grow Space: Tree Well
Height: 10 ft - 20 -ft
Canopy radius: 9 feet
Trunk diamater: 5.5 inches
Christ Church Cathedral
S 2ND ST
S 1ST ST
S BROOK ST
W MUHAMMAD ALI BLVD
Downtown Louisville Tree Survey, Preliminary Data Summer 2013
Healthy tree
Tree needs inpsection
Attribute data needs to be collected


S 2ND ST
S 2ND ST
S 2ND ST
Species: Crabapple
Status: digitized
Health condition: Inspect
Grow Space: Open
Height: Over 20 ft
Canopy radius: 20 feet
Trunk diamater: 0 inches
Downtown Louisville Tree Survey, Preliminary Data Summer 2013
Healthy tree
Tree needs inpsection
Attribute data needs to be collected

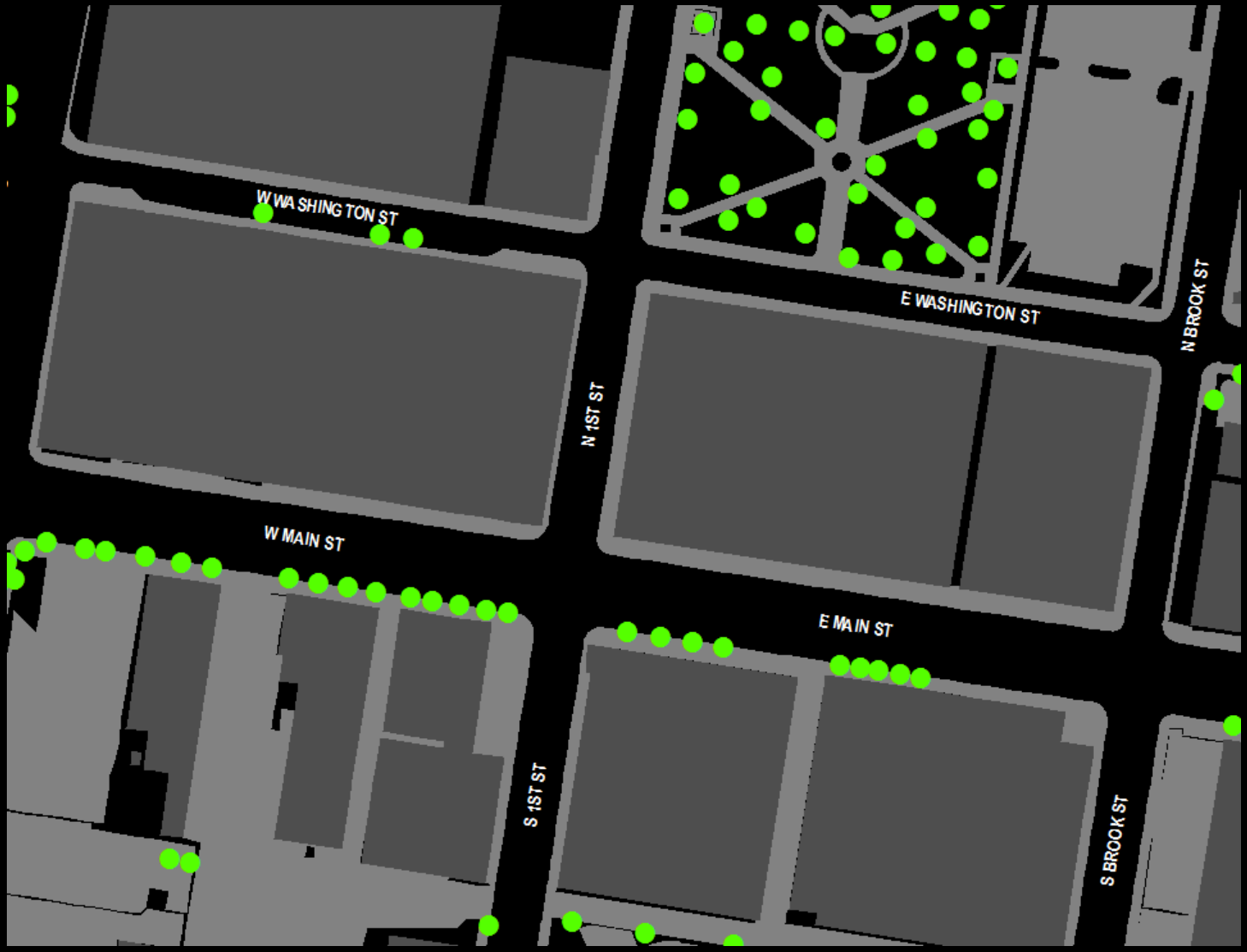
5000 trees?


Ok, more like 4,750

IN GOD WE TRUST
LIBERT
2002
D

Ash Trees

Young Trees



Opportunities for Planting

Supporting Citizen Science & Providing Tools for Volunteers & Citizen Foresters

opentreemap

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 ›

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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

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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 overwritting 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 overwritting 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

HTTPS clone URL

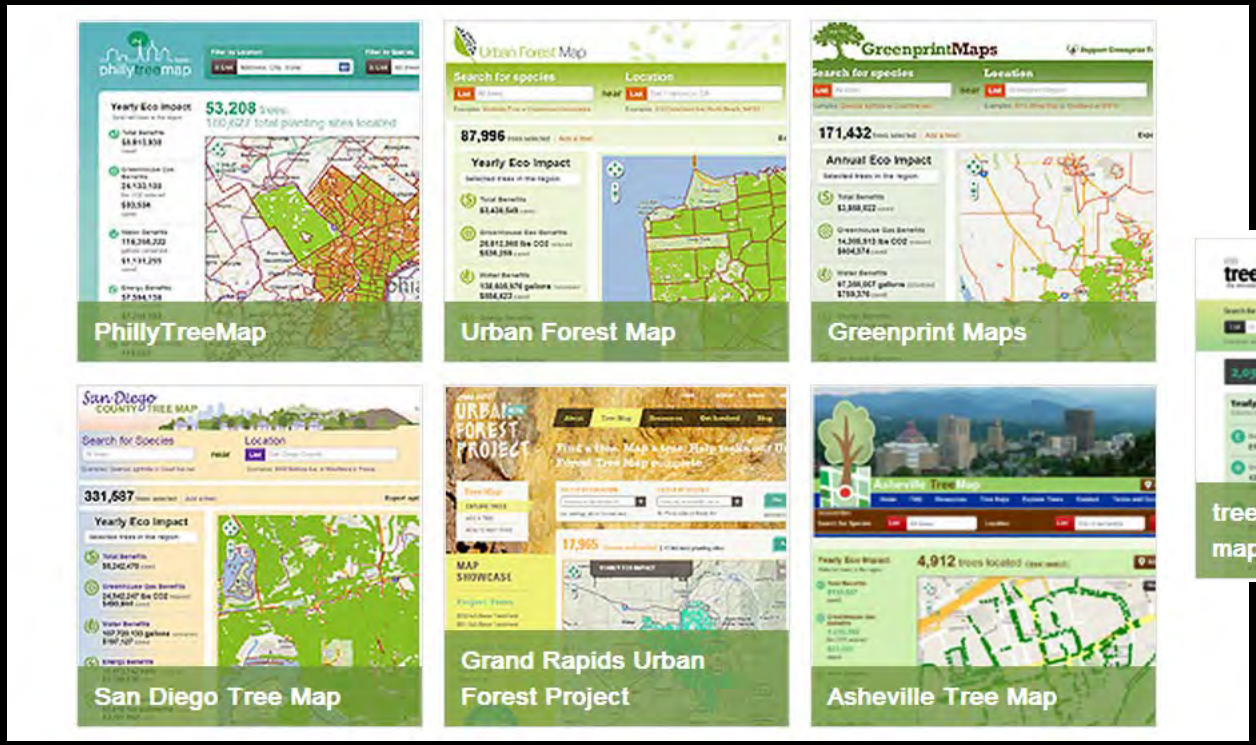
https://github.com

You can clone with HTTPS, or Subversion.

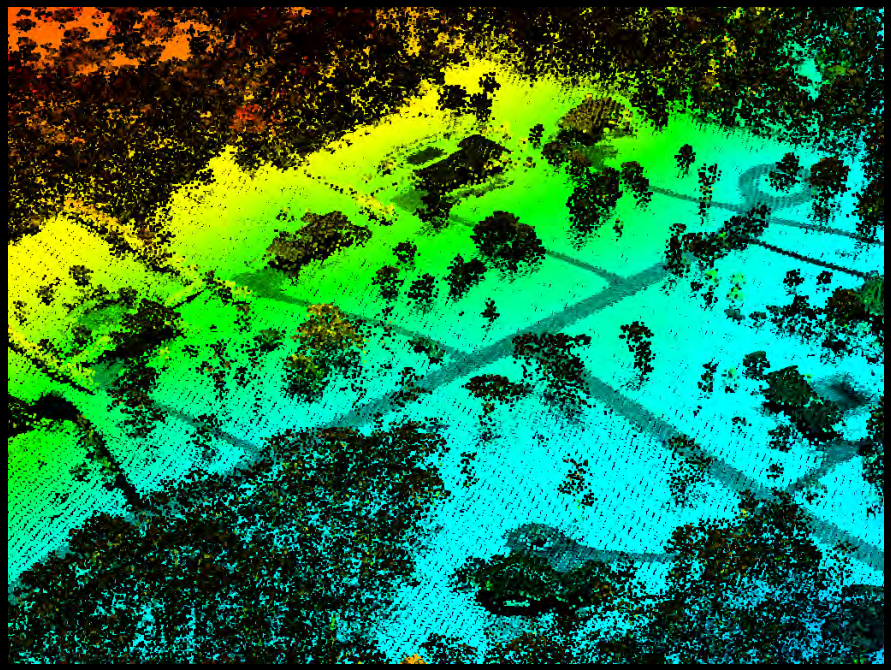
Clone in Desktop

Download ZIP

OPEN TREE MAP – GITHUB



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