

Putting Geospatial Assessment Tools to Use Online:

How Cities Prioritize Livability and Health Outcomes through the Lens of Urban Forestry

TPBE3 | 06.04.17

PHS Urban Forest Cloud

Tree ID 1259 - Silverball

| Tree |
|------------------------------------|
| Tree Tender Group: PHS Tree People |
| Type: Street |
| Address #: 5637 |
| Street: Almond St. |
| Site ID: 1-F |
| Season Planted: 2015 Fall |
| Species (Common): Silverball |
| Maturity Status: Unchecked |

Layers

- Tree Tender Groups
- Trees
- Watershed Partners

View Plan Grow

Use the slider bars below to weight your priorities.

Reset

Census Block Groups

Urban Heat Island: None

Energy Savings: None

Stormwater Reduction: None

Water Quality: None

Connectivity: None

Economic Vitality: High

Filter by Site Suitability: Low High

Canopy Assessment

Site Suitability

High

Medium

Low

Paper is in peer review by Cities and the Environment (CATE) journal



Presented by:
Ian S. Hanou

Technology & Trees



❖ Software: Urban Forest Cloud

- Web, mobile, and desktop
- Subscription and custom tools
- 100+ software clients/users

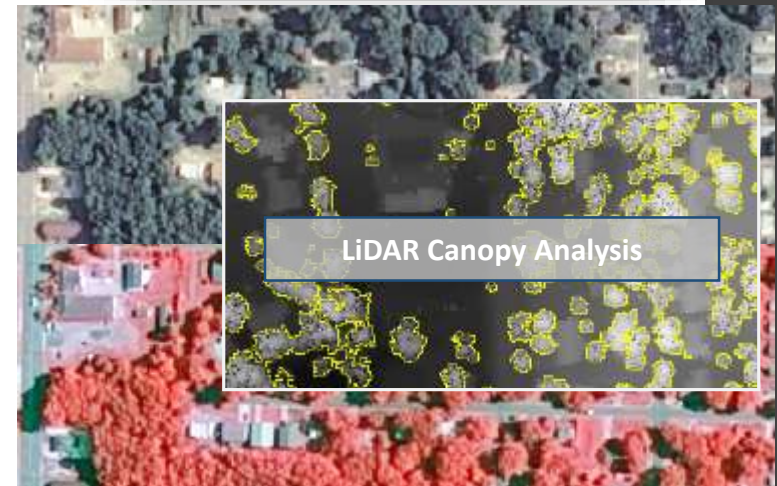
❖ GIS/RS Canopy Analysis

❖ Ecosystem Services Analysis / i-Tree

❖ Tree Inventory & Risk Assessment

❖ Management Plans

Founded 2012, offices in CO, CA, PA, NC



Introduction / Agenda

Intro

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Summary

- **The Geospatial Urban Forest** ... tree inventory and Urban Tree Canopy (UTC) assessment
- **Technology** ... achieve greatest return on investment from efficiency to assess, manage, plan, track, and monitor the urban forest
- **Applications** ... outreach, manage, plan, monitor, prioritize, track work and programs, visualize & quantify oUTComes
- **Case Studies** ... benefits, considerations, and impacts of developing online urban forestry data and prioritization tools; evolving roles & recommendations

An Explosion of Online Urban Forestry Tools

- **CanVis and C-CAP Land Cover Atlas** (NOAA Digital Coast)
- **Cool-Connect-Absorb** (Trust for Public Land)
- **UTC Mapper** (Virginia Tech)
- **Health Impact Assessment** (US Environmental Protection Agency)
- **Healthy Trees, Healthy Cities** (The Nature Conservancy)
- **i-Tree Suite** (USDA Forest Service, Davey Institute, etc.)
- **Open Tree Map** (Azavea)
- **STEW-MAP** (Center for Neighborhood Technology/US Forest Service)
- **Trees and Health** (Portland State University)
- **Urban Forest Cloud: Tree Plotter and Canopy Planner** (Plan-It Geo)

Impact on outcomes ...
change in culture and outreach ...
recommendations for practitioners ...

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Tree Inventories: Moving Online

- 67% of U.S. cities have some inventory; 83% computerized systems (Hauer, Peterson 2015)
- Collect, share, and analyze data from anywhere in real-time
- Public or private property (crowdsourced)
- Manage trees, planting activities, volunteers, work orders, and UTC data without knowing you're "doing GIS" (Hanou 2016)

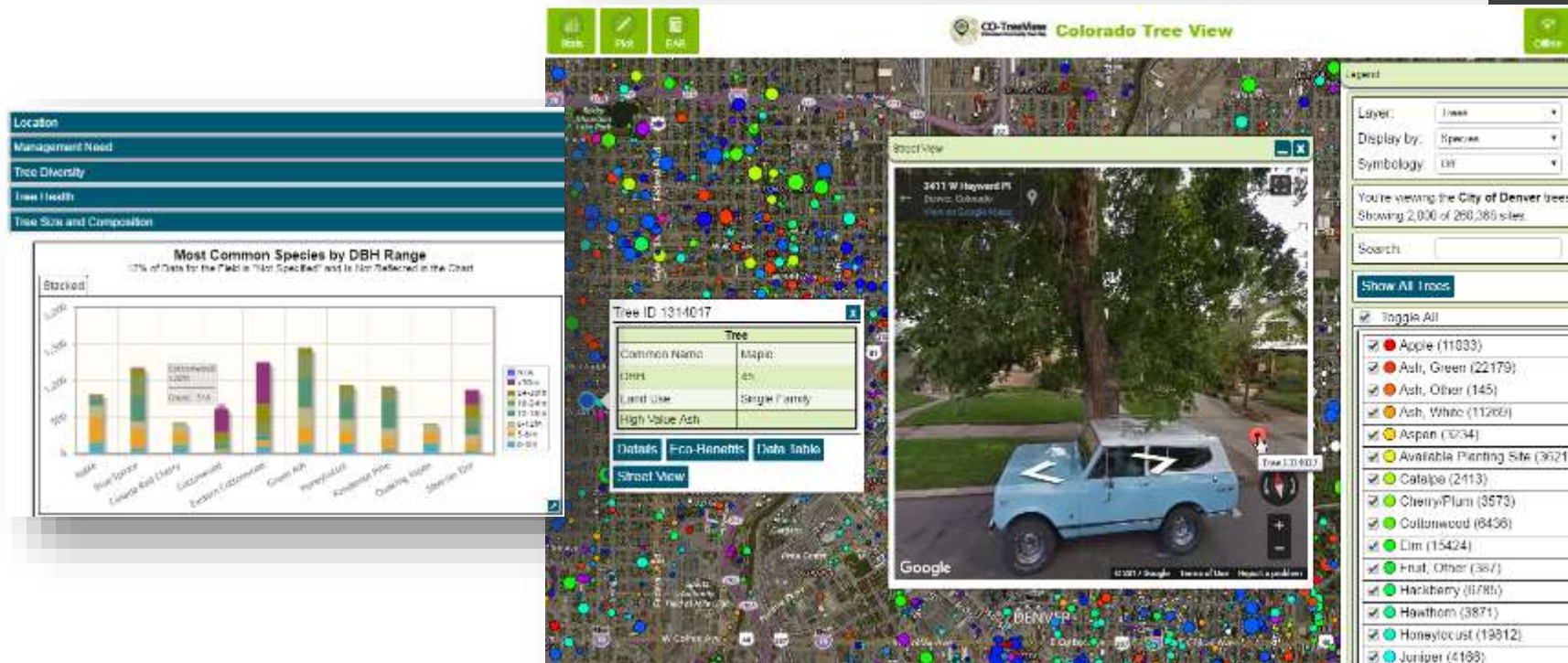


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Tree Canopy Assessment: Moving Online

Intro

- Geospatial analysis of urban tree canopy (UTC) and potential planting areas using LiDAR, multispectral imagery, and GIS inputs
- A key performance metric and indicator for environmental health
- Identify partners, funding, stewardship, needs, and priorities
- Majority of canopy/planting space on private land (O'Neil-Dunne 2009)
- Direct outreach, policy, and management for greatest impact on community sustainability, equity, access, and environmental goals

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oUTCcomes

“UTC prioritization works by matching known benefits of trees, to places lacking those benefits, and then matches those locations to organizations positioned to manage those issues that trees help to ameliorate.” (Locke et al. 2013)

Tree Canopy Assessment Components

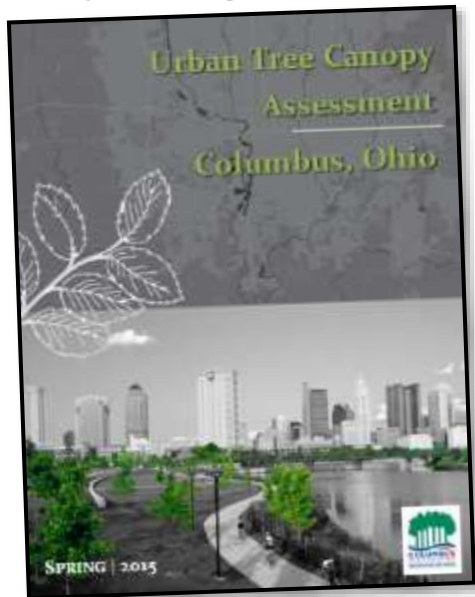
Land cover mapping



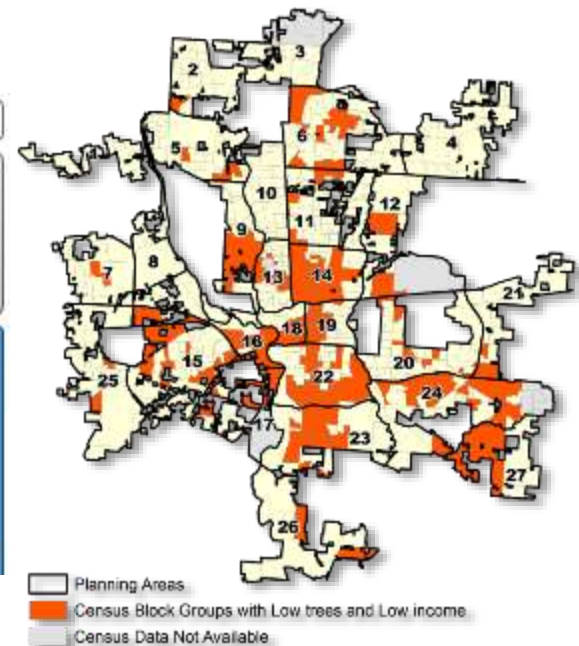
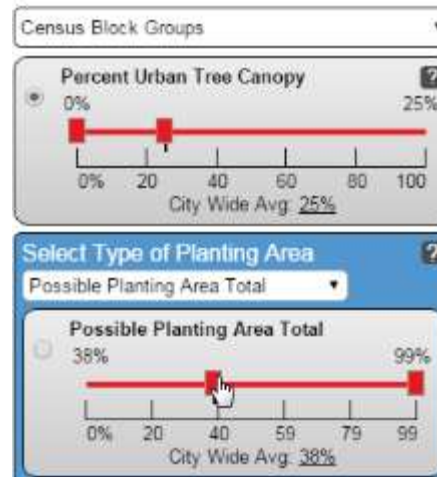
Maps & Metrics



Reporting



Analysis Tools



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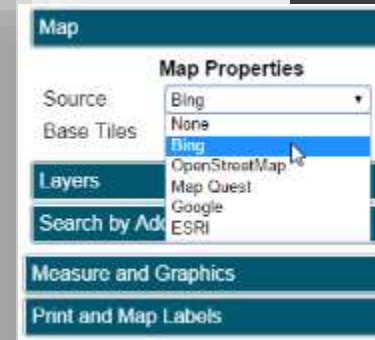
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Tech & Software Overview

- Software as a Service (SaaS)
- Browser and Cloud-based vs. Native App
 - URL, no install or other GIS/GPS software
- Mobile (tablet/smartphone, on or offline)
- GIS and map-based
 - Place tree / work order location on imagery
 - Base maps to choose from
 - No GPS required
- Open source technologies
- Administer users/permissions
- Open data sources/considerations



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Case Studies (CS #1-5)



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CS #1: Baton Rouge Green



- Relationship b/w government and nonprofit
- >10,000 trees tracked in online map; share urban forest data and quantify ecosystem services
- LADOTD highway ramp relocation; 110 crape myrtles, area with low canopy. Had data and tool to show the values:
 - *Stormwater regulation (79,206 gallons/year), air pollution removal (84 lbs./year), carbon storage (12,101 lbs.), and carbon sequestration (5,660 lbs./year)*
- Letter: advocating for smart development and appropriate conservation of UTC; zero net loss and 3:1 replacement ratio
- BRG justified their role in protection/mitigation plans by sharing their experience/qualifications using the tool

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CS #1: Baton Rouge Green

The screenshot displays the 'Baton Rouge Green Inventory' web application. The interface is divided into several main sections:

- Left Sidebar:** Contains navigation menus for 'The Basics' (Account, Settings, Support, Take a Tour), 'In The Map' (Layers, Map), 'Map Properties' (Tiles Source: OpenStreetMap, Base Tiles: Light), 'Search by Address', 'Measure and Graphics' (Draw, Measure), 'Print and Map Labels' (Labels, Print), and 'My Data' (Save Custom Interactive Map).
- Map:** Shows a street map with green tree icons representing the inventory. A specific tree is highlighted with a callout box.
- Callout Box (Tree ID 1333):** Provides detailed information for a tree at 8924 Florida Blvd, including its common name (Common Crapemyrtle (MEDIUM)), DBH (6), status (Alive), and primary maintenance. It also offers buttons for 'Details', 'Eco-Benefits', 'Data Table', and 'Street View'.
- Eco-Benefits Panel:** A vertical stack of metrics for the selected tree:
 - Overall:** Overall Monetary Benefit: \$8
 - Stormwater Management:** Runoff Prevention (Gallons): 362; Stormwater Monetary Benefit: \$2.19
 - Property Value:** Property Value Total: \$1.70
 - Energy Conservation:** Energy Saved (kWh): 26
- Legend:** Shows the current layer is 'Trees', displayed by 'Species' with 'Off' symbology. It lists 918 of 10,475 sites and includes a search bar with 'myrtle'. A 'Toggle All' section shows three checked items: 'Common Crapemyrtle (14)', 'Common Crapemyrtle (MEDIUM) (3,927)', and 'Common Crapemyrtle (SMALL) (5/8)'. Below is a bar chart with 'Pie' and 'Bar' tabs, showing a single bar at approximately 4000. The 'Layers' section at the bottom shows 'Parcels' and 'Street Centerlines' as options to zoom in to view.

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CS #2: Pennsylvania Horticultural Society

- Founded 1827, greening, education, plant and care for trees
- Programs: Tree Tenders, Plant One Million, riparian, tree giveaway, Tree Checkers maintain, monitor, and report their tree health
- Tree and project data was historically managed and reported in 26 spreadsheets; cumbersome/tedious upkeep

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PHS Urban Forest Cloud: a browser-based map and database application

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- Streamline collecting/managing tree health monitoring data and new planting requests
- From paper forms or spreadsheets → smartphones or tablets
- More convenient for Tree Tenders to sign-up neighbors
- Easier permit process w/City of Philadelphia. In 1st season, 1/3 of planting applications were via the UFC
- Attach a photo while inspecting trees in the field
- Central data location and standard format
- Dashboard summarizes results, species mix, health metrics, etc.

PHS Urban Forest Cloud

Tools PHS Plot

- TreeVitalize Philadelphia Street Trees
- TreeVitalize Watersheds
- TreeVitalize Municipalities
- Free Tree Giveaway Table

Reset

Free Tree Giveaway

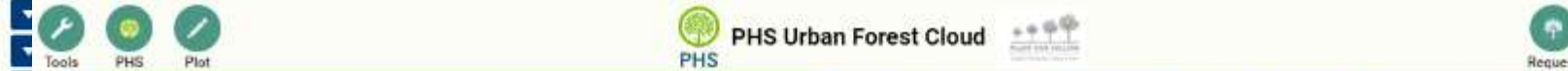
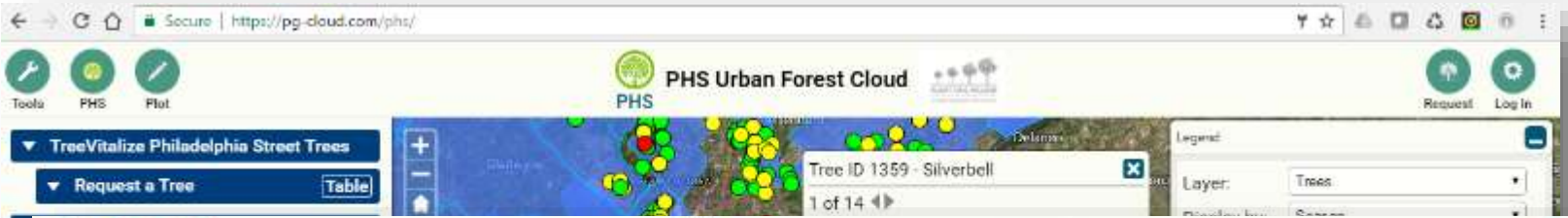
Please pledge the following before applying:

- I will plant my tree in the City of Philadelphia on property I own, or property on which I have permission to plant.
- I will plant my tree in the ground (NOT in a container or in the sidewalk).
- I will plant my tree within 15 days of pick-up.
- I will water my tree (20 gallons a week).
- I agree to allow TreePhilly PHS to contact me for follow-up information about my tree.
- I understand that receiving a tree through the Tree Giveaway program does not guarantee its survival, and Philadelphia Parks & Recreation is not required to supply a replacement tree should my tree die.

I agree to the above terms. (Check to agree)* Yes

| Request | Remains | Species |
|----------------------|---------|----------------------------|
| <input type="text"/> | 0 | Cherry, Japanese flowering |
| <input type="text"/> | 10 | Cherry, sargent |
| <input type="text"/> | 0 | Cherry, sargent |
| <input type="text"/> | - | Cherry |

Desired Tree Species *(subject to availability)*



Request a Tree Table

[Reset](#)

Property Owner Request to Plant a Street Tree in Philadelphia

Fill out this form to request a street tree from PHS. You will not be able to edit the form after you submit. You will be notified of the status of your application. Approved trees will be planted in April or November if the local Tree Tenders group is planting at that time.

A Tree Tenders group is responsible for planting your tree. Type in the address for the tree request below and a Tree Tenders group will automatically be assigned to your application. If there is not a Tree Tenders group in the area, then PHS will do their best to assign one to you or provide you with information on how to get a tree (Leave the option as "Assign Me One").

Application Deadline: requests submitted May to mid November may get planted the following April and requests submitted mid November to April may be planted the following November if approved. You will be contacted by your local Tree Tenders group or PHS regarding the status of your application.

Questions? Contact your local Tree Tenders group leader, or Dana Dentice at PHS (215-988-1618).

Property Street Number*

Property Street Name*

Property Zip*

Property Owner Name*

Phone*

E-Mail*

Property Owner Mailing Address (if different from planting property address)

Tree Tender Group ID 307

| Tree Tender Group | |
|-------------------|----------------------------|
| State | PA |
| Organization Name | Whitpain Twp. Tree Tenders |
| Partners | |
| Contact | Michelle Compton |
| Phone | 856-304-1684 |
| E-Mail | |
| Last Name | Compton |
| FIPS | 84688 |
| City/Municipality | WHITPAIN |
| Type | County |

[Details](#) [Data Table](#)

Legend: Tree Tender Groups
Showing 170 of 186 tree tender groups.

- Whitpain District Advisory Council Tree
- Friends Tree Tenders
- Township Tree Tenders
- Lincoln High School Tree
- Tree Tenders
- Whitpain-North Philly Tree Tenders
- Assign Me One
- Whitpain Tree Tenders
- Whitpain Planters (Buckingham & ...)
- Whitpain Tree Tenders
- Beaver Family Tree Tenders
- Bella Vista Tree Tenders
- Bensalem Township Shade Tree Commission
- Bensalem Tree Tenders
- Brewery121 Tree Tenders
- Breyer Court Tree Tenders
- Bridgeport Tree Tenders
- Bristol Borough Tree Tenders
- Bristol-Bensalem Tree Tenders
- Bryn Gweld Homesteads Tree Tenders
- Bucke County Master Gardeners

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CS #3: Columbus, Ohio BranchOut Program

2015 Tree Canopy Assessment & Online Canopy Planner Tool

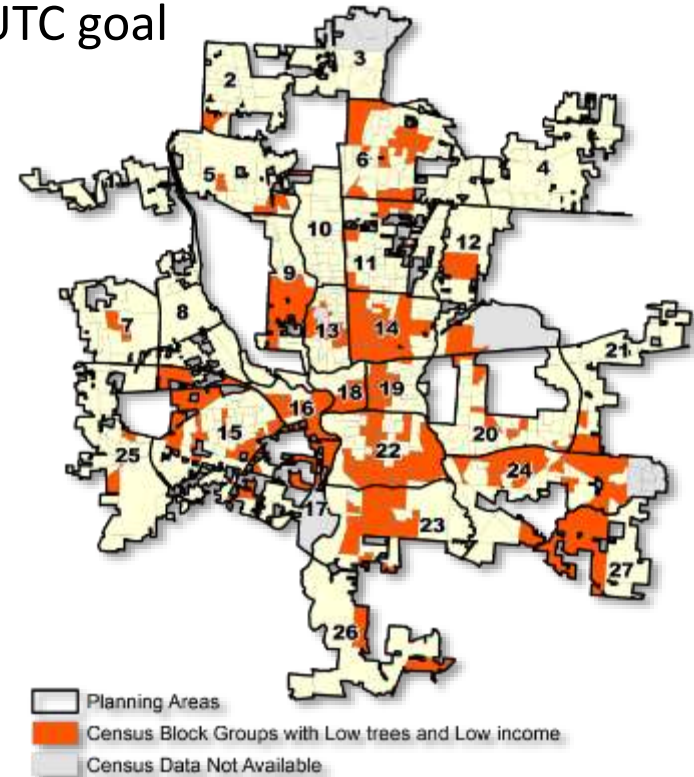
- U.S. Mayors Climate Protection Agreement (2007) and Green Team
- Greenspace Working Group (2012)
- Role of UTC in climate change and sustainability
- Est'd loss of 200,000 ash trees citywide (Emerald Ash Borer)
- Need for an outreach campaign and UTC goal

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oUTComes: buy-in, collaboration, and a framework

- ✓ Role of citizens, private property/partnerships
- ✓ 300,000 tree planting goal and 27% UTC goal
- ✓ Site-specific tracking tools and landscape-scale visualization of urban forest data online
- ✓ Proactive management, need for defined standards
- ✓ Watershed-scale assessment & planning

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The screenshot displays the 'COLUMBUS Tree Canopy Planner' web application. The interface includes a top navigation bar with icons for Tools, Sign Up, Stats, Canopy, and Plot, and a 'Log In' button. A central map shows the Columbus area with numerous red and green markers representing tree events. A 'Volunteer Sign Up' form is visible on the left, with fields for First Name, Last Name, Email, and Phone Number, and checkboxes for various activities like 'Unloading trees', 'Inventory stock', 'Planting', 'Watering', etc. An 'Event ID 110' popup window provides details for a specific event: 'American Addition, Phases 2 and 3', 'Completed' status, 'Restoration' purpose, 'City of Columbus' organization, 'Erin Miller' organizer, '175' trees planted, and a date of '09/09/2016'. On the right, a legend shows 'Events' with a 'Symbology' dropdown set to 'Off'. Below the legend, a 'Show All Trees' button and a 'Toggle All' checkbox are present. A donut chart at the bottom right shows the distribution of events: 66 Completed (red), 5 Planned (green), and 1 Other (yellow).

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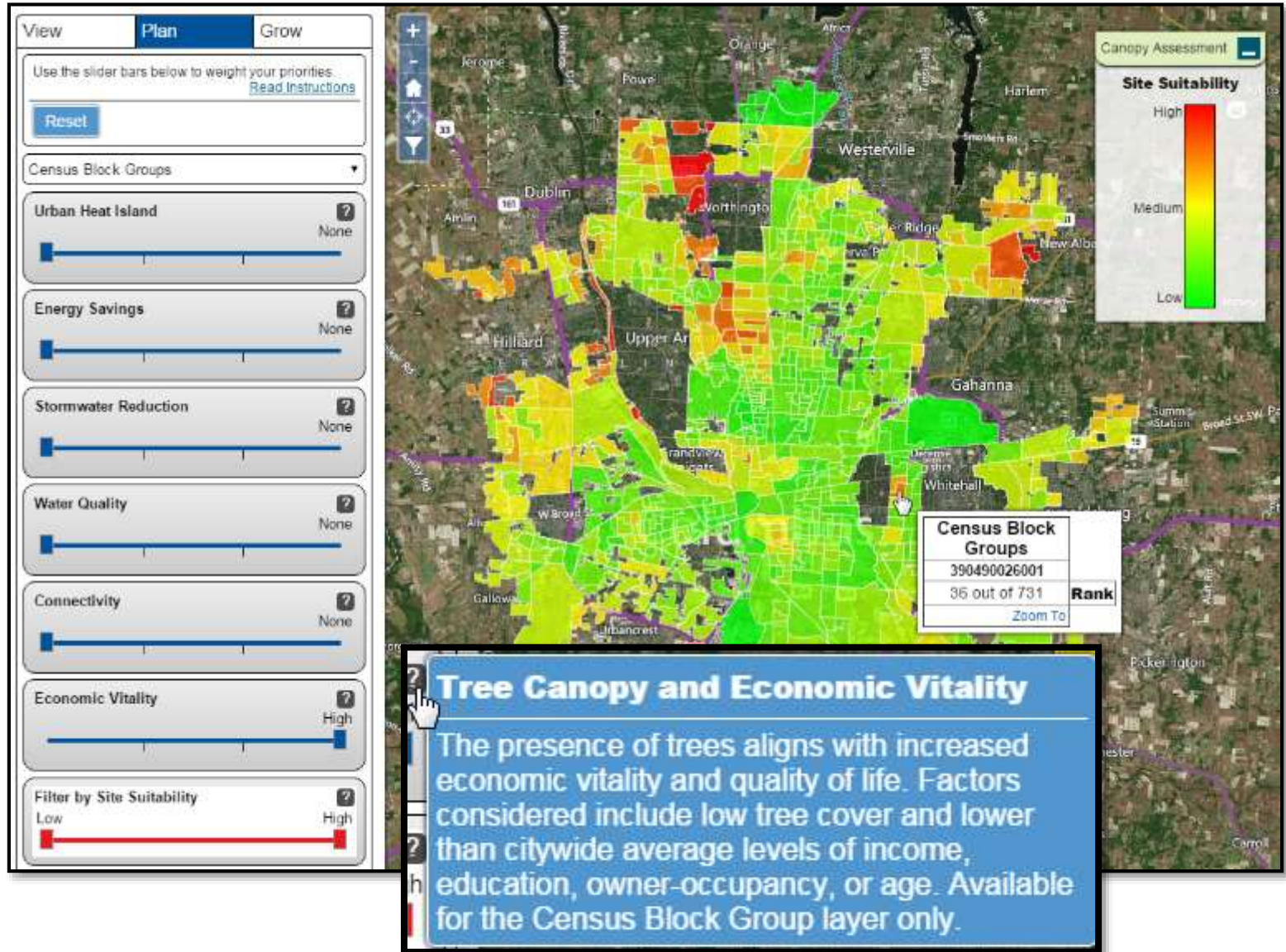
CS #3: Columbus, Ohio BranchOut Program

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keep
Indianapolis
beautiful INC.

CS #4: Keep Indianapolis Beautiful

Mission: to engage diverse communities to create vibrant public places, helping people and nature thrive™

Background: 2006 hot spot priorities map: *tree canopy, impervious surfaces, industrial lands, traffic counts, childhood asthma, crime, and income*. Tracked plantings in GIS and stored nursery orders, projects, and volunteer info in MS Access. New strategic tool to identify overlapping initiatives, partners, be visible online, and educate. And build social capital and “tree culture”!

Phase 1: interactive hotspot & weighting app; overlay priorities on where we’ve been planting; criteria well-vetted by diverse board members; formulating a “health layer” is in-progress

- Increasing from 33% to 34% UTC requires 267,000 new shade trees

Phase 2: migrated KIB’s tree planting, volunteer, and project management database to the cloud. All staff can now access tree, project and volunteer data via tablet, not just GIS specialists.

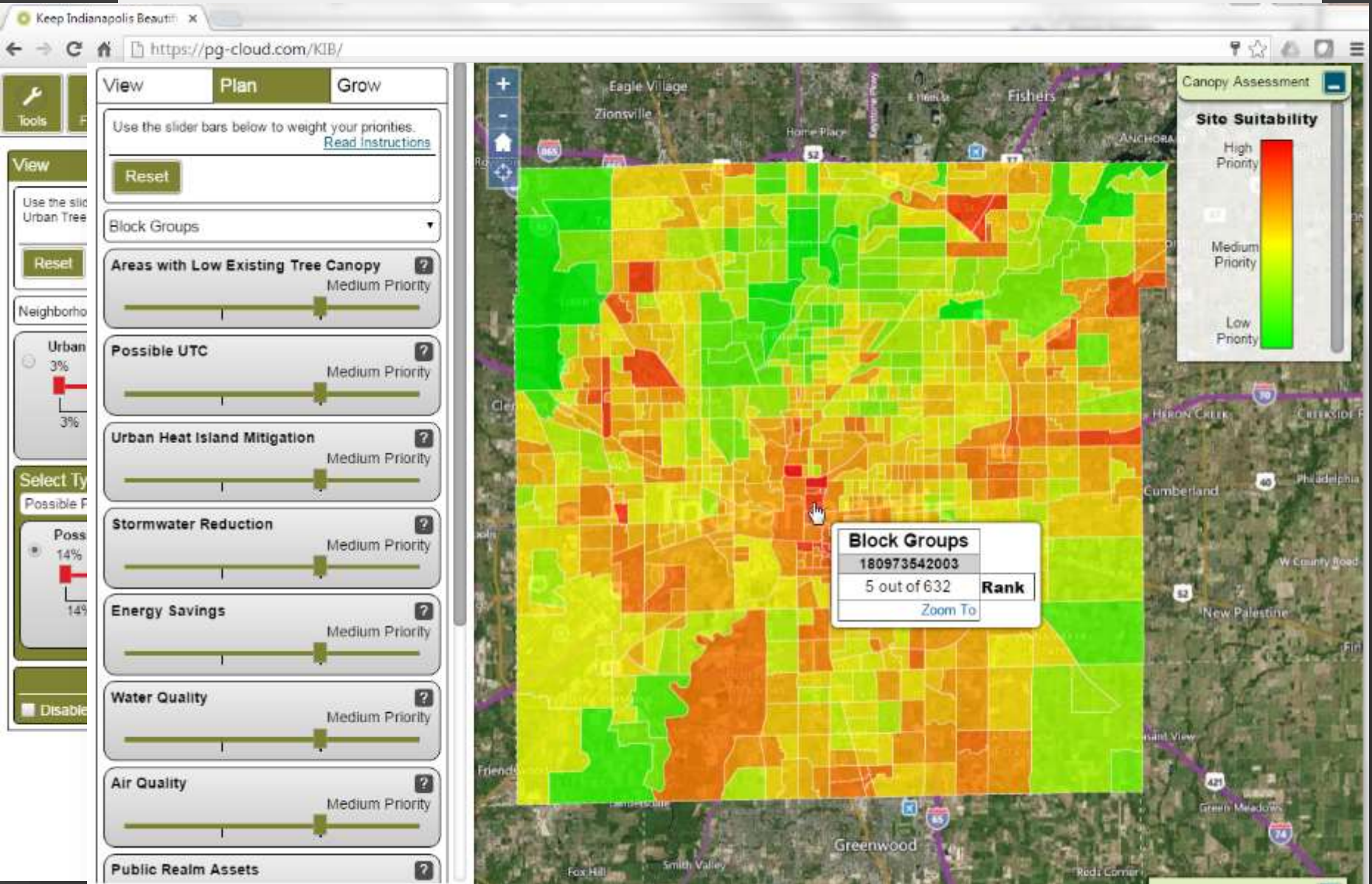
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Phase 1 example: the selection of priority criteria is a reflection of KIB's mission statement and purpose as an organization



CS #4: Keep Indianapolis Beautiful

Phase 2 example

Keep Indianapolis Beautiful Tree Canopy Planner

Tools Forms Plot Canopy

Nursery Inventory Table

Reset

Nursery Inventory

Nursery Name: Adopt-A-Block
Latin Name: Acer saccharum
Genus: Acer
Species: saccharum
Variety/Cultivar:
Common Name: sugar Maple
Species Code: ACSA2
Container Size:
Rooted In?:
Date Tagged: 08/21/2016
Calliper:
Tree Height (ft):
Cost Per Tree:
Notes:
Reserved at Nursery:
* Required

Submit

Project Details

Delete Save & Close Load Last

Location Project Description Volunteers Mulch

Current Funder:
PR Value:
Corporate Group: Corporate Group
Permit Number:
Project Name: Super Bowl Planting
Project Description: Plant up to 250 trees on Fall Creek.
Project Date: 10/21/2011
Project Start: 7 :00 AM
Project End: 11 :00 AM
Project Manager: Nate Faris
Partner Organization: Hillenbrand
Contact: Chris R Lowery
Program: Neighborhoods

Trees in Transit

Instructions Sort Options Fields

View and edit your data in tabular format here. Upon opening Data Table, the most previously edited the chart first. Select another field if you would like to sort by other data entries in the inventory datab "Refresh" button to update the table...

Common Name:
Pogues Run
rridor trees.
sites.
leaf dogwood (3)
Basswood (3)
beech (3)
hornbeam (3)
sss (3)
ignolia (2)

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CS #5: Portland State University: HtHp

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- 2011 U.S. Forest Service, National Urban & Community Forestry Advisory Council grant, “Healthy Trees, Healthy People” (HtHp)
- Identify canopy design to improve public health outcomes; quantify benefits and role in addressing air pollution and urban heat
- 13 U.S. cities: land use, tree canopy, air pollution, and urban heat data → empirical relationship of canopy design & environmental stressors
- Developed spatially explicit online GIS tool
- Surveyed how professionals identify and prioritize planting and how an online map may help
- Results informed the tool to help UF, planning, and health professionals identify and prioritize sites benefiting historically underserved areas



Summary

CS #5: Portland State University: HtHp

View, weight (rank), and filter six different criteria, including:

- % tree canopy cover
- Traffic-related air quality
- Urban heat island index
- % of residents < age 18
- % of residents > age 65
- % of residents living under poverty level

Canopy 30-m National Land Cover Database (NLCD) from the U.S. Geologic Survey (USGS). TRAQ index derived by PSU using GIS analysis and empirical research from Portland, Oregon, then extrapolated to 12 cities.

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trees and health app

assess
find the hottest and dirtiest places in your city, and the neighborhoods where residents are most vulnerable

prioritize
prioritize tree planting locations to maximize the positive public health impacts of new trees

plan
set neighborhood-specific canopy goals, and estimate how many new trees are needed to reach them

overview - trees and health app

Urban street trees slow traffic, provide sidewalk shade, improve air quality, and reduce the urban heat island effect - contributing to improved health outcomes for children, older adults, and those living in poverty. Air quality vulnerability varies between neighborhoods - and so does the presence of trees - but new trees are rarely planted with this in mind.

Select your city to see a neighborhood-by-neighborhood map of tree cover, urban heat island effect, and demographics to prioritize locations where new trees could contribute the most to public health outcomes.

would you like a guided tutorial?
 yes no

Don't see your city? Want to participate? [Link](#)

select a city to begin:

- Albuquerque, NM
- Atlanta, GA
- Baltimore, MD
- Cincinnati, OH
- Denver, CO
- Houston, TX
- Minneapolis, MN
- Orlando, FL
- Phoenix, AZ
- Pittsburgh, PA
- Portland, OR
- Sacramento, CA
- Tampa, FL
- Treasure Valley, ID

[read](#) the science behind urban

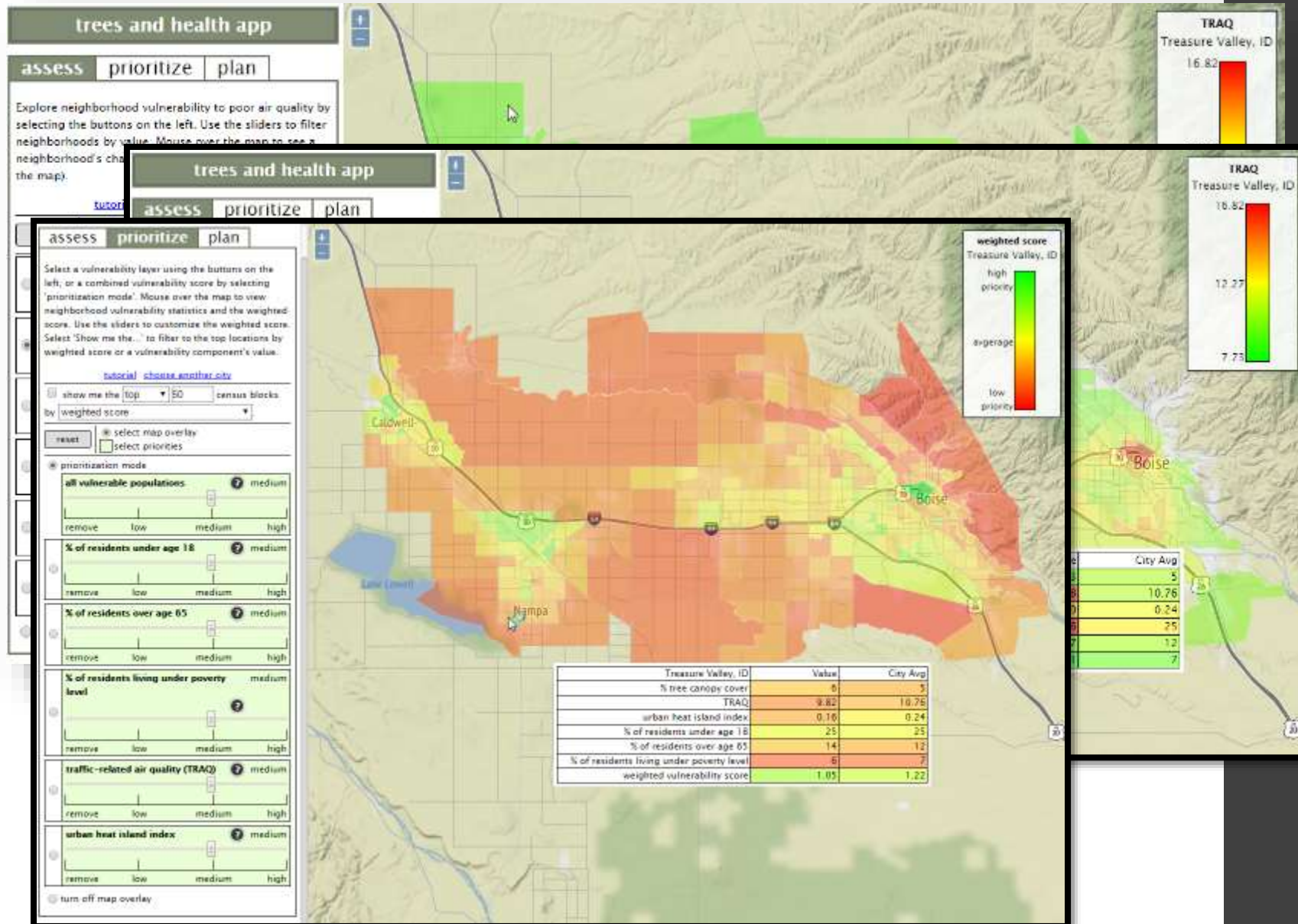
CS #5: Portland State University: HtHp

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CS #5: Portland State University: HtHp

Unexpected but welcome results ...

- New partners at the same table for the 1st time
 - o Environmental justice, public health, and environmental
- “Groups with similar missions who had not been at the same table until now can be convened, allowing scientific and demographic data to be explored and compared across neighborhoods and cities.” (Vivek Shandas)
- Viewing data in an online interactive map, one participant stated:

“We are far more biologically impoverished than I realized” (when comparing neighborhoods).

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Challenges & Limitations



Urban and community forestry is about people, then about trees

- Not all decision makers or users will be impacted or comfortable with online tools
- Some users can be intimidated by maps and tools and leery of the learning curve
- Not all stakeholders will have access to online tools (underserved and low income areas)

Don't try to create a perfect model

- Apply a meaningful process and provide a framework for data-driven decision making and implementation, followed by on-the-ground verification

Always be a role for tree professionals and urban forest managers

- Implementing large-scale planting initiatives successfully requires proper standards and techniques, suitable nursery stock, and maintenance plans for young tree care

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Future Research



- Impact of online tools: ROI, volunteerism, canopy cover, stewardship, funding, and urban tree culture
- Drones and Unmanned Aerial Vehicles; limited more by regulation than by technical capabilities
- Augmented Reality: practical and theoretical uses
 - Monitoring, immersive (remote) plant identification for educational purposes, etc.)
- Cloud-based, real-time technologies (e.g. smart watches and dashboards) may drive efficiencies and possibilities
- What's the full potential of “**the geospatial urban forest**”?

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Recommendations



Planning

- Community knowledge + experts, inclusive, local priorities
- Define audience, goals, messaging
- What is needed, a tool or solutions?

Tool Development

- Choose meaningful, familiar geographic scales
- Spatial extent of GIS inputs (e.g. spotty health data across a study area)
- Identify highly correlated criteria and existing derived layers

Applications

- Create interactive, visual, educational tools; list websites on criteria, research, and tree care for longevity and maximum benefits
- Set UTC goals based on science, data, and a collaborative planning process, not political appeal

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Contacts & Web Resources

1. **Robert Seemann**, www.batonrougegreen.com/ and <https://pg-cloud.com/BatonRougeGreen/>
2. **Dana Dentice**, www.plantonemillion.org/ and <https://pg-cloud.com/PHS>
3. **John Bowers**, www.columbus.gov/branch-out/ and <https://pg-cloud.com/Columbus/>
4. **Nate Faris**, www.kibi.org/ and <https://pg-cloud.com/KIB/>
5. **Vivek Shandas**, Portland State, www.treesandhealth.org/ and <http://map.treesandhealth.org/>
6. This research paper: www.digitalcommons.lmu.edu (Cities and the Environment, CATE)

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THANK YOU!



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