Assessing your Urban Forest Resource with i-Tree

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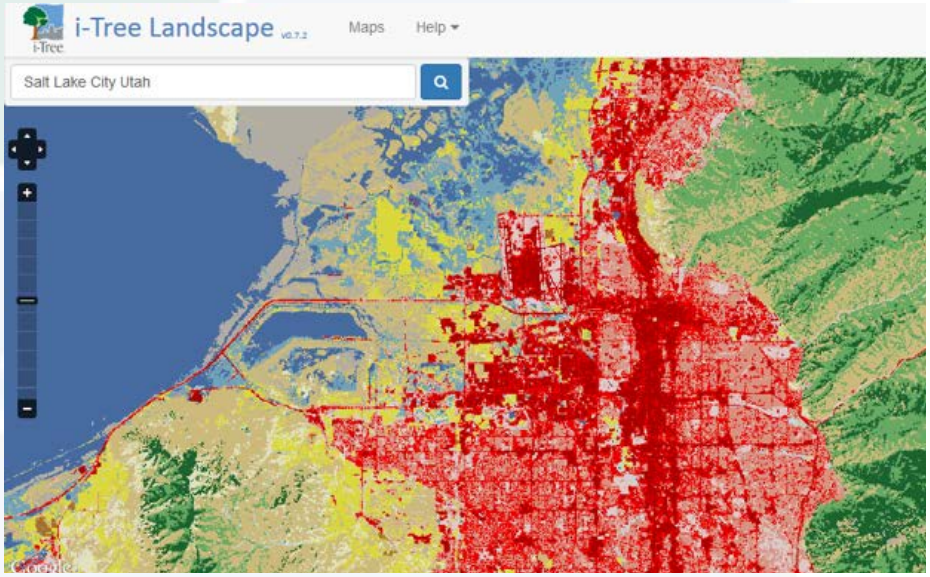
Plan for today…

- Overview of i-Tree 2015 core tools
- Ground-based assessment tools: *Streets, Eco & Design*
- Aerial assessment tools : *Canopy & Landscape*
- Implementation strategies

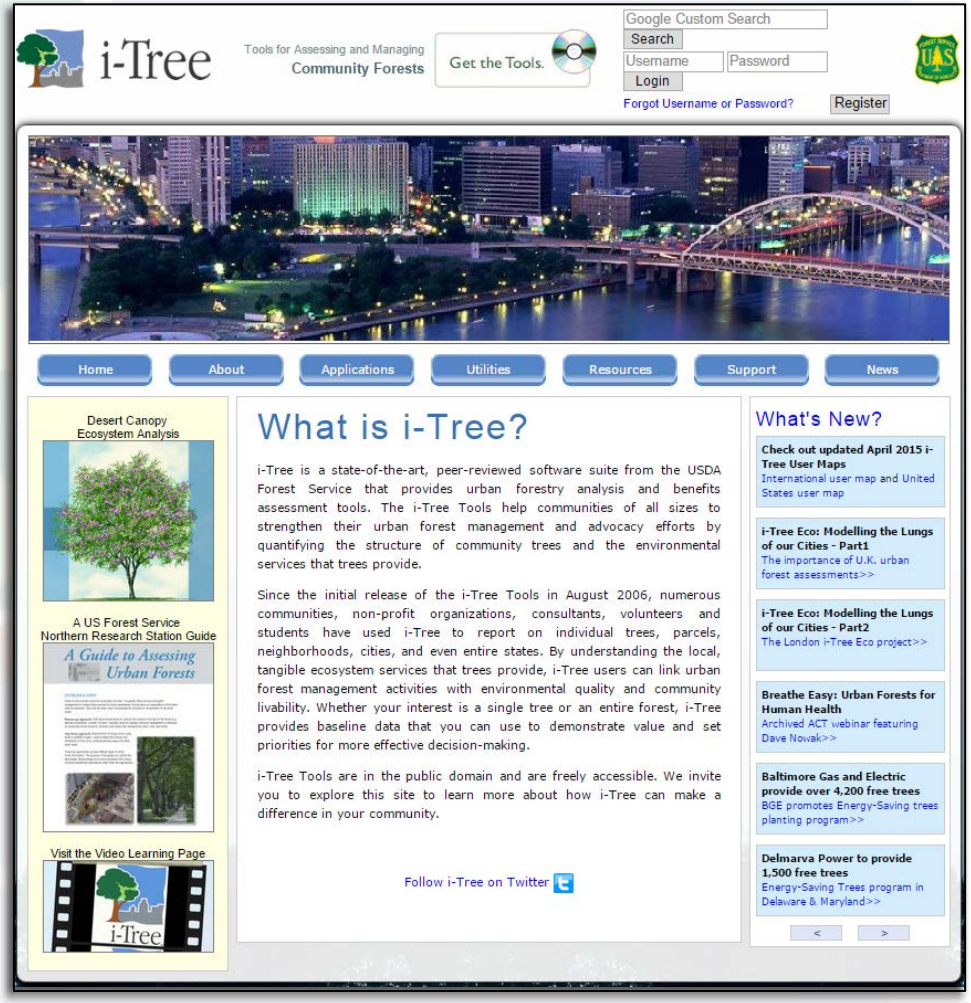


i-Tree…

"Putting USFS Urban Forest science into the hands of users"

- Free public domain software
- Based on peer-reviewed research
- Technical support
- Continuously improved

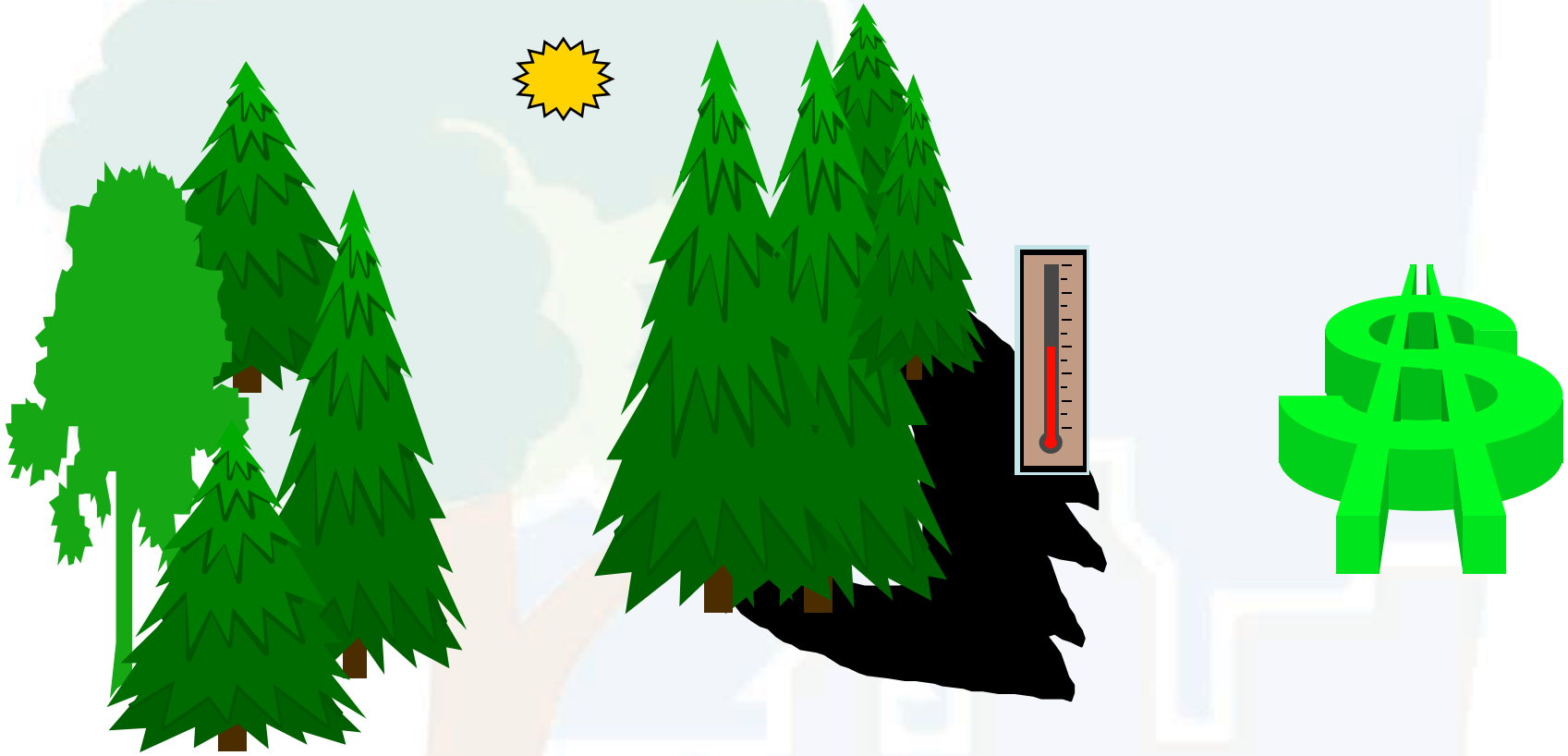
www.itreetools.org



i-Tree is a Cooperative Initiative among these partners

i-Tree · USFS · DAVEY · Arbor Day Foundation · SMA Society of Municipal Arborists · ISA · Casey Trees · ESF State University of New York College of Environmental Science and Forestry

The i-Tree Foundation:



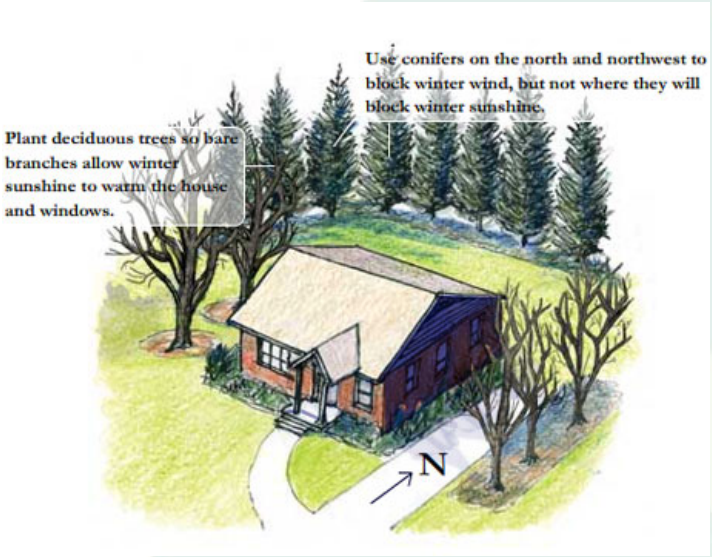
Structure ⇨ Function ⇨ Value

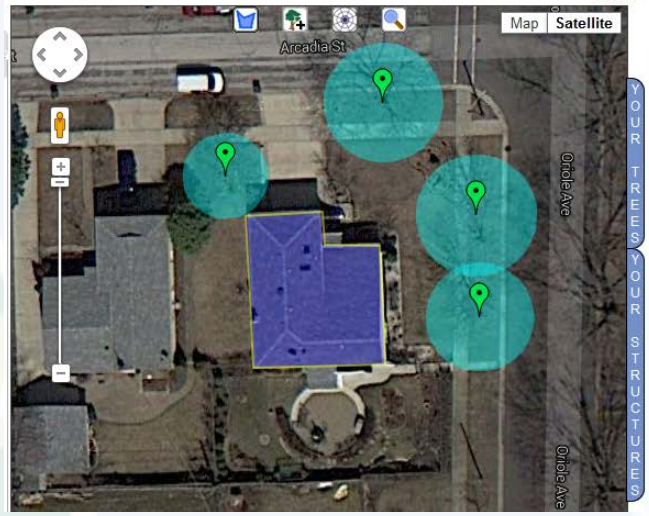
Structure → Function → Value

A Sacramento neighborhood. Credit: City of Sacramento

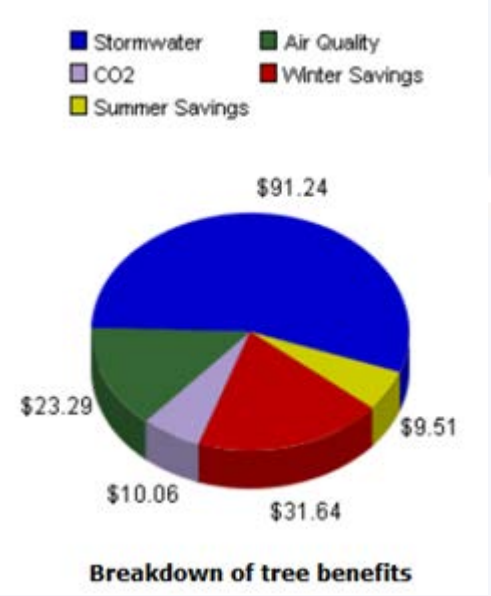
….city, region, state, watershed or neighborhood scale

Structure ⟹ Function ⟹ Value





Homeowner scale



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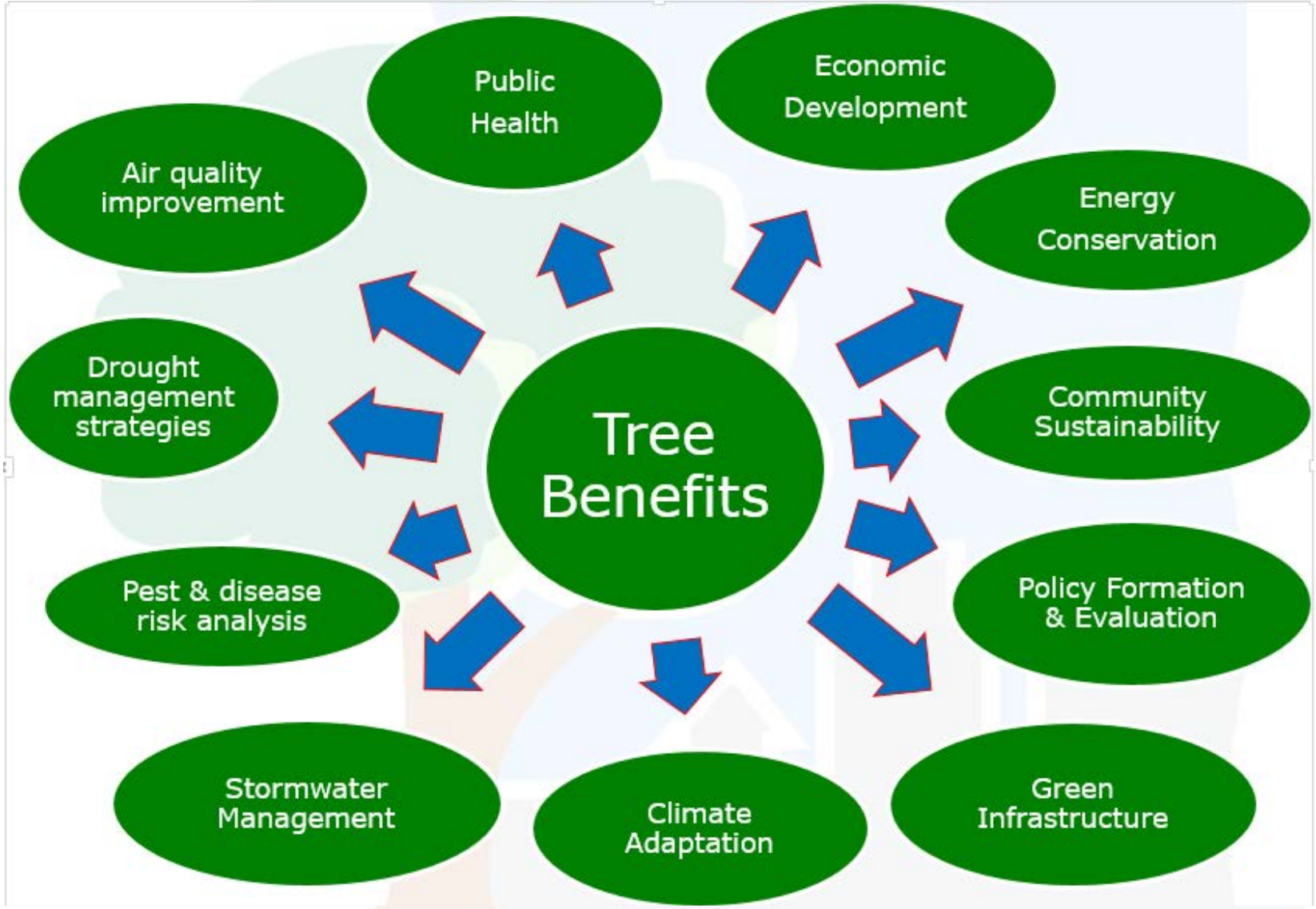
Why a tree benefit approach matters…



i-Tree Suite of Tools 2015

Web-based, run in your browser

Installed on a Windows desktop/laptop

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DAVEY

Arbor Day Foundation

ISA

Casey Trees

ESF
State University of New York
College of Environmental Science and Forestry

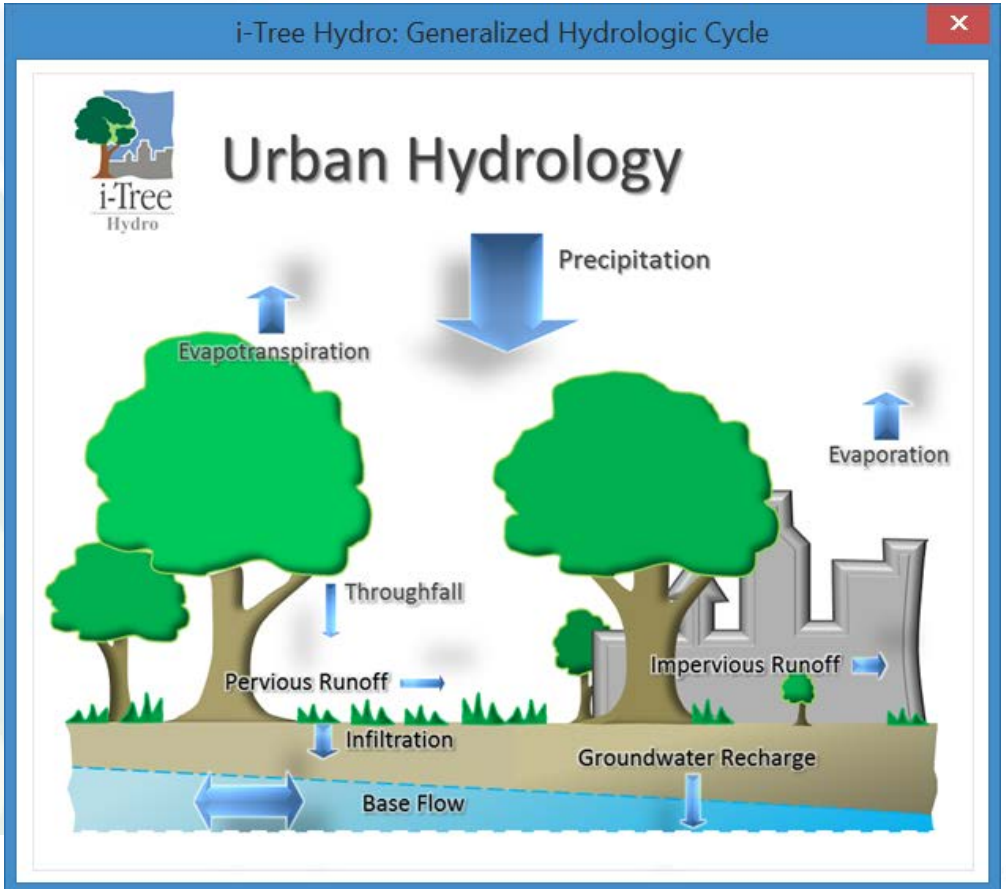
i-Tree Hydro

Quantifies effects of:

- Tree cover
- Impervious cover

on:

- Stream flow
- Water quality



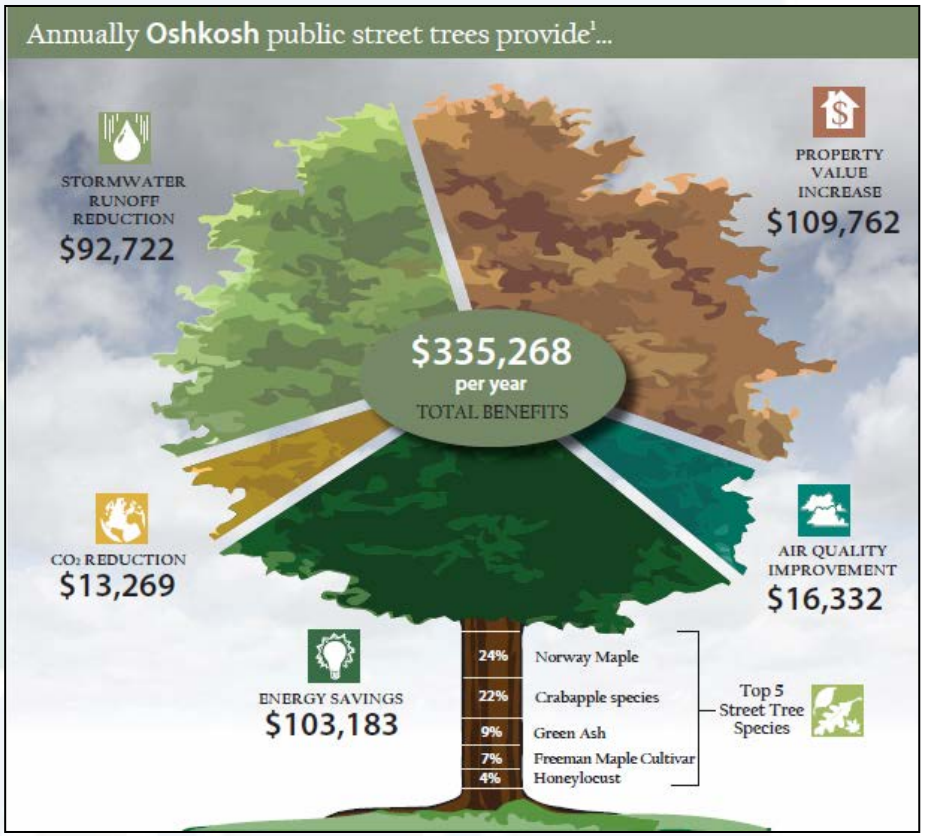
Model Parameters

Streamflow Predictions

	Total Runoff		Baseflow		Pervious Flow		Impervious Flow	
	Base	*Alternative*	*Base*	*Alternative*	*Base*	*Alternative*	*Base*	*Alternative*
Total Flow (cubic meters)	6,006,586.2	5,783,460.5	4,172,666.0	4,304,124.9	10,053.5	10,459.8	1,823,866.8	1,468,875.9
Highest Flow (cubic meters / hour)	15,080.6	13,412.9	1,205.5	1,243.0	4,018.9	4,181.4	13,365.8	10,775.4
Lowest Flow (cubic meters / hour)	23.7	24.4	23.6	24.3	0.0	0.0	0.0	0.0
Highest Flow Date	01/13/12	01/13/12	01/01/12	01/01/12	01/13/12	01/13/12	08/10/12	08/10/12
Lowest Flow Date	09/18/12	09/18/12	09/18/12	09/18/12	01/01/12	01/01/12	01/01/12	01/01/12
Median Flow (cubic meters / hour)	503.8	511.0	436.1	449.9	0.0	0.0	0.2	0.2

i-Tree Streets

- Structure (species condition, age distribution, importance, etc.)
- Function
  - Energy
  - Air pollution
  - Stormwater interception
  - Carbon
  - Aesthetic value
- Values ($)
- Some management needs
- Pest detection module (optional)

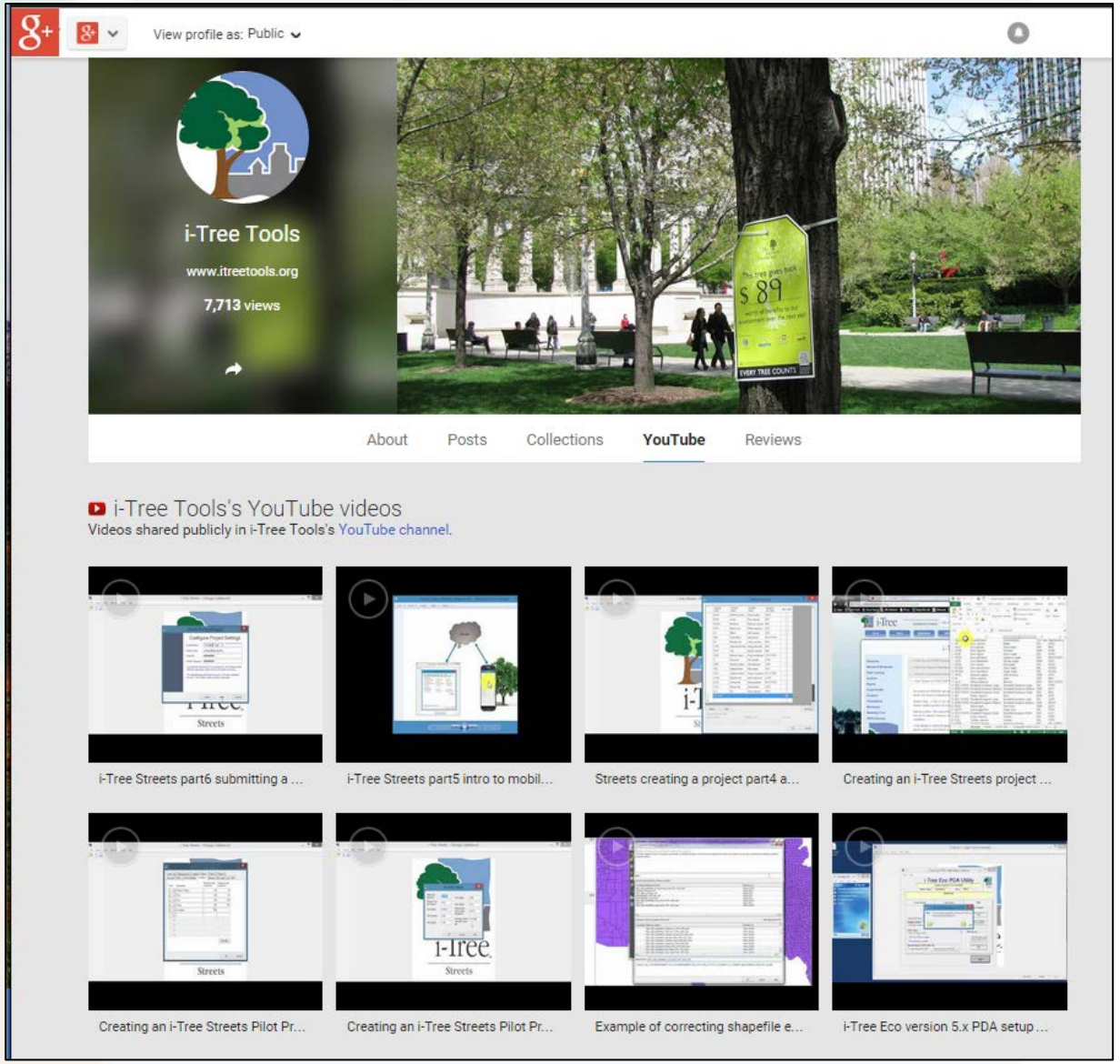


i-Tree Streets: Key considerations

- Regional U.S. model
- Easy to use
- Can import in existing street tree inventories
- Limitations for non-street tree applications
- Some data flexibility
- Not being upgraded in the future
- Future crosswalk to Eco

i-Tree Streets online learning resources

www.itreetools.org/mobile/



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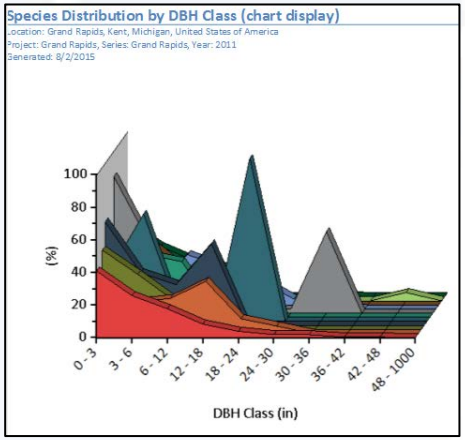
What is i-Tree Eco?

- Field-based assessment requiring inventory data
- Flagship software based on latest science & local data
- Originally developed for assessing whole urban forest
- Adapted for individual tree assessments
- Internationally functional



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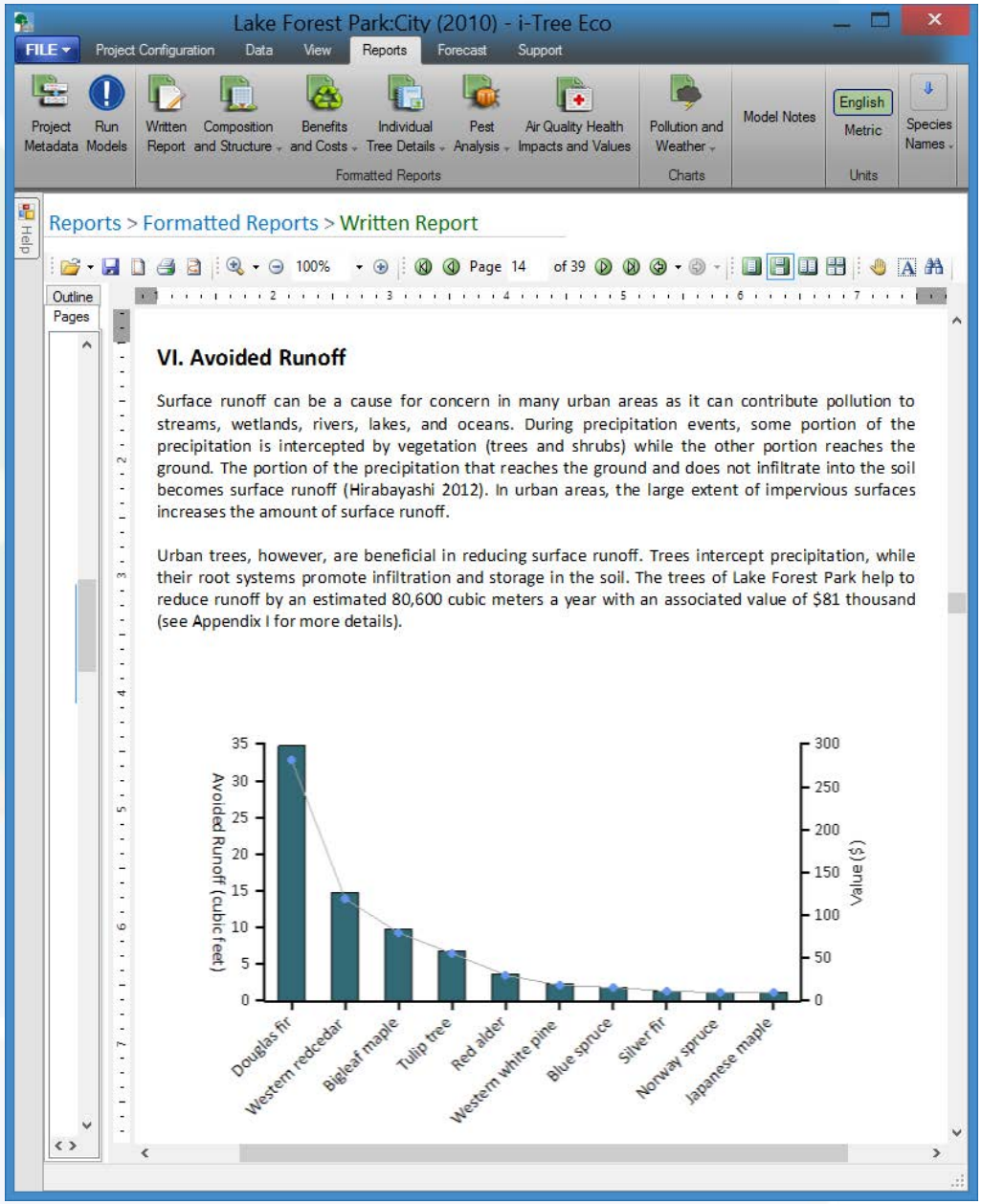
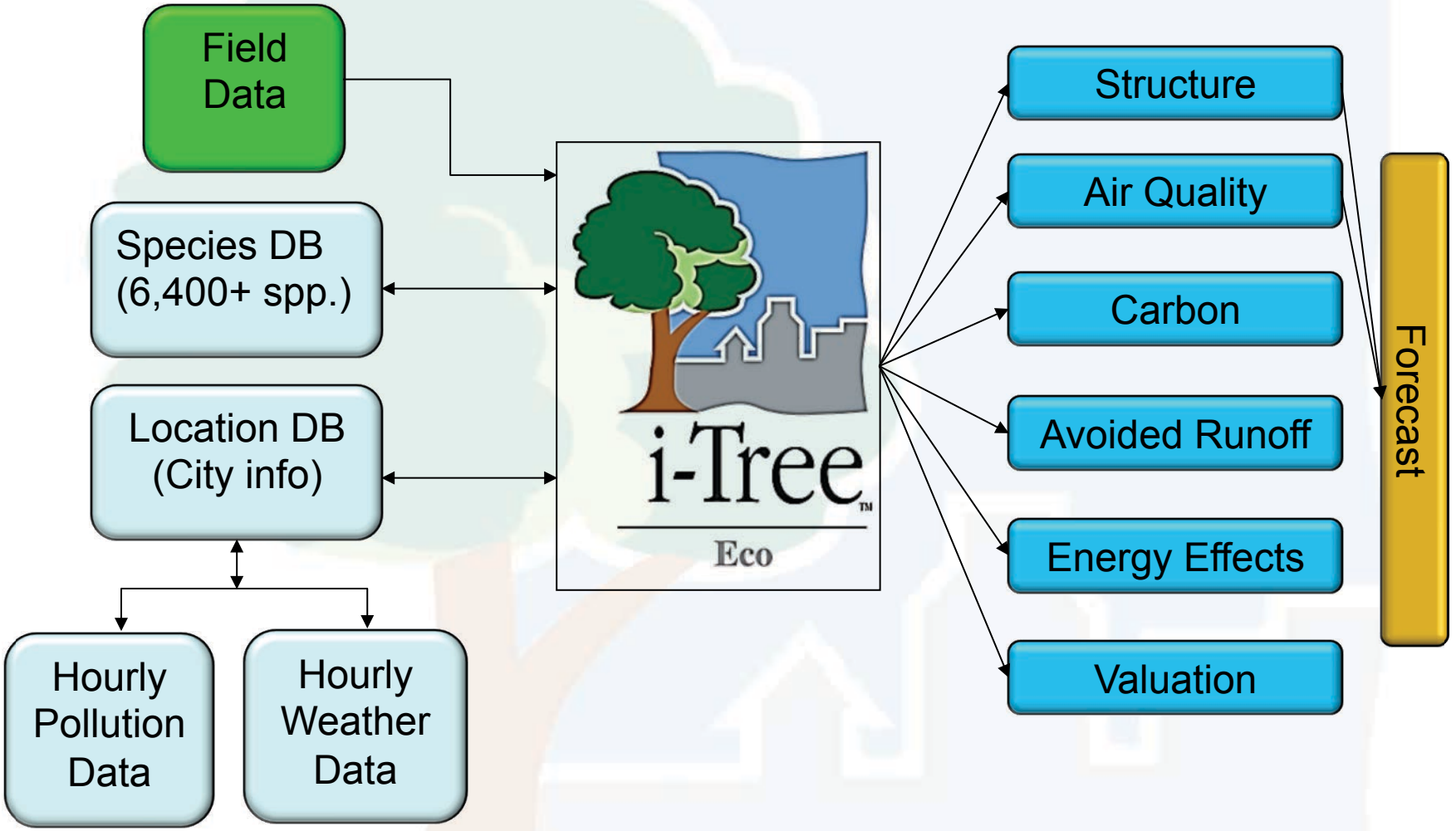
i-Tree Eco Assess:

- Structure (leaf area, biomass, condition, diameter distribution, importance, etc.)
- Function
  - Energy effects
  - Air quality
  - Carbon
  - Avoided runoff
  - Human health impacts
  - VOCs
- Value ($)
- Management info
  - Pest risk
  - Tree health
  - Exotic/invasive spp.



i-Tree Eco Model Schematic



www.itreetools.org/resources/archives.php

Providence i-Tree Eco Summary

Urban Forest Characteristics

- Number of trees: 415,000, or 34.4 trees per acre
- Tree cover: 23.9%
- Structural values: $582 million
- Most common species: Norway maple, Northern red oak, Honeylocust
- Percentage of trees less than 6" (15.2 cm) diameter: 49.6%
- Ground Cover: 59% impermeable vs. 41% permeable

Environmental Benefits

- Total annual environmental benefits: $4.7 million per year
  - Pollution removal: 91 tons/year ($3.5 million/year)
  - Carbon sequestration: 4,030 tons/year ($287 thousand/year)
  - Avoided runoff: 31.5 million gallons/year ($281 thousand/year)
  - Building energy savings: $591 thousand/year
  - Avoided carbon emissions: 500 tons/year ($35.6 thousand/year)
- Total estimated carbon storage: 124 thousand tons ($8.80 million)

Threats to our Urban Forest

- Pest Impacts: Asian Longhorned Beetle has the potential to impact 43.2% of the urban forest, a potential loss of $265 million. Emerald Ash Borer would affect 4.2%, worth $25.4 million.

Providence's Urban Forest: Structure, Effects and Values

i-Tree Eco System Analysis

February 2014

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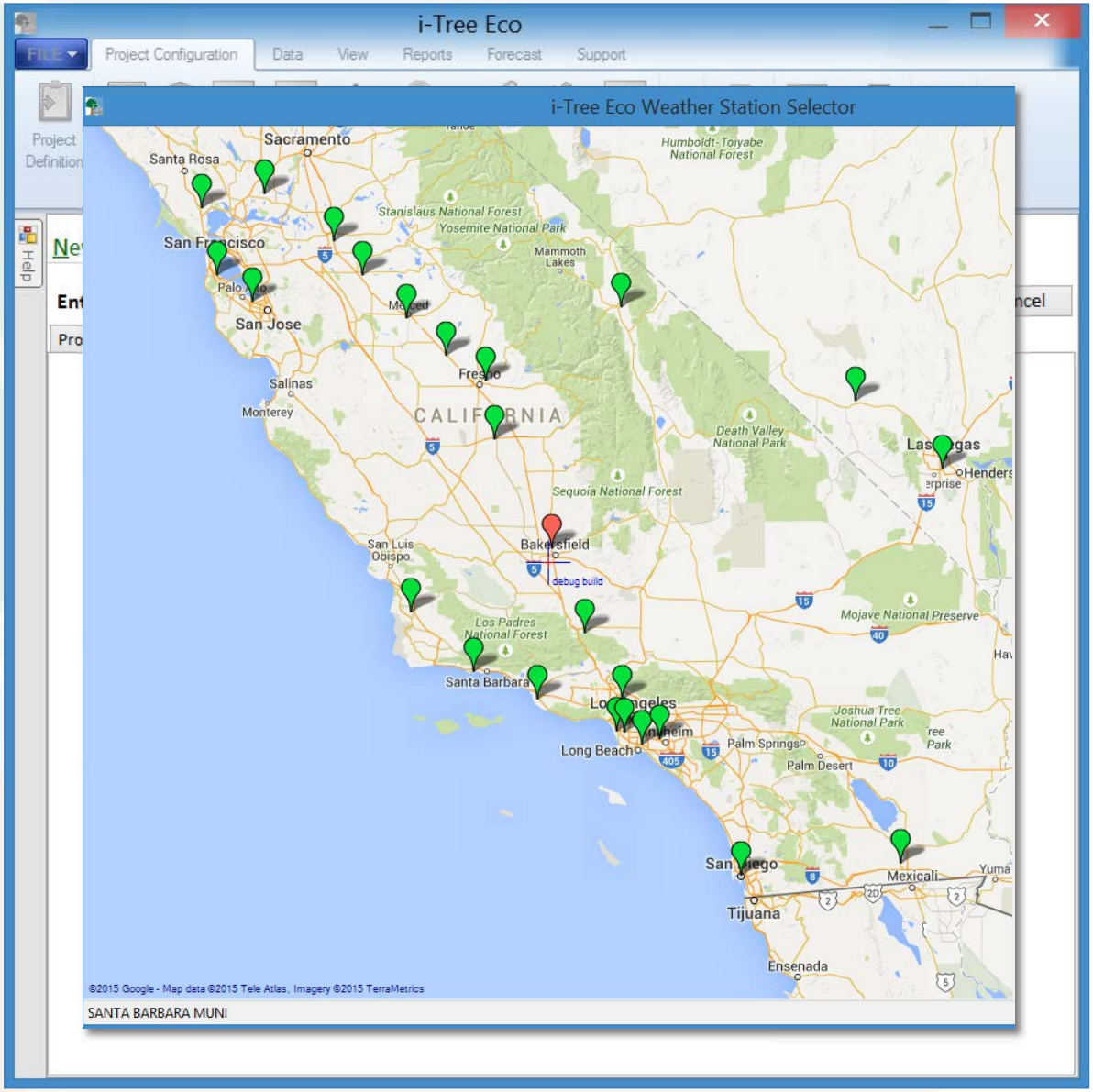
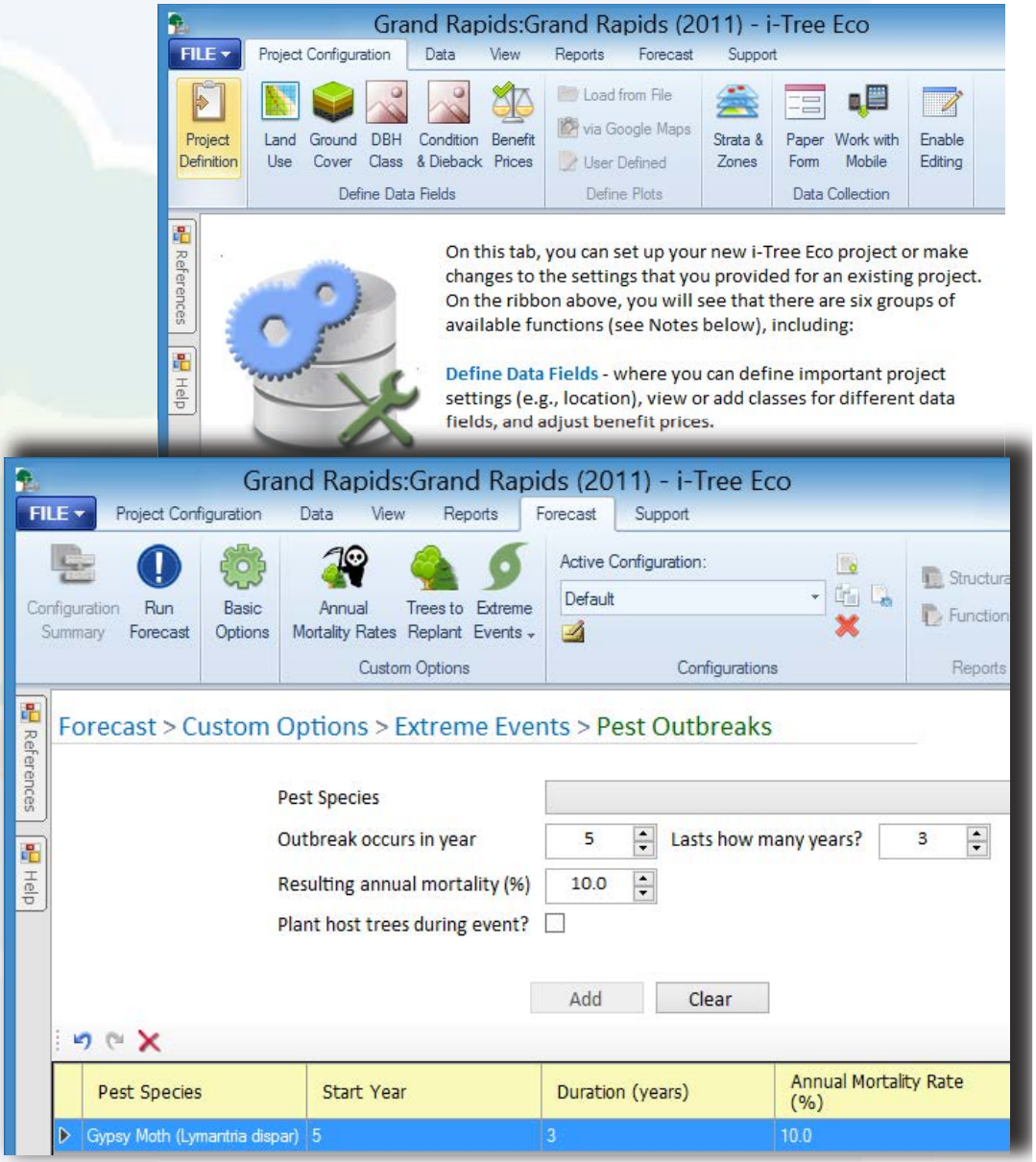
Eco 2015 Highlights…

- New user interface design
- Simplified & new data collection options
- Multiple years of hourly pollution & weather data now available



Eco 2015 Highlights…

- Forecasting capabilities
- Updated and expanded reporting options
- Automated processing for USA, AUS, CAN & UK projects



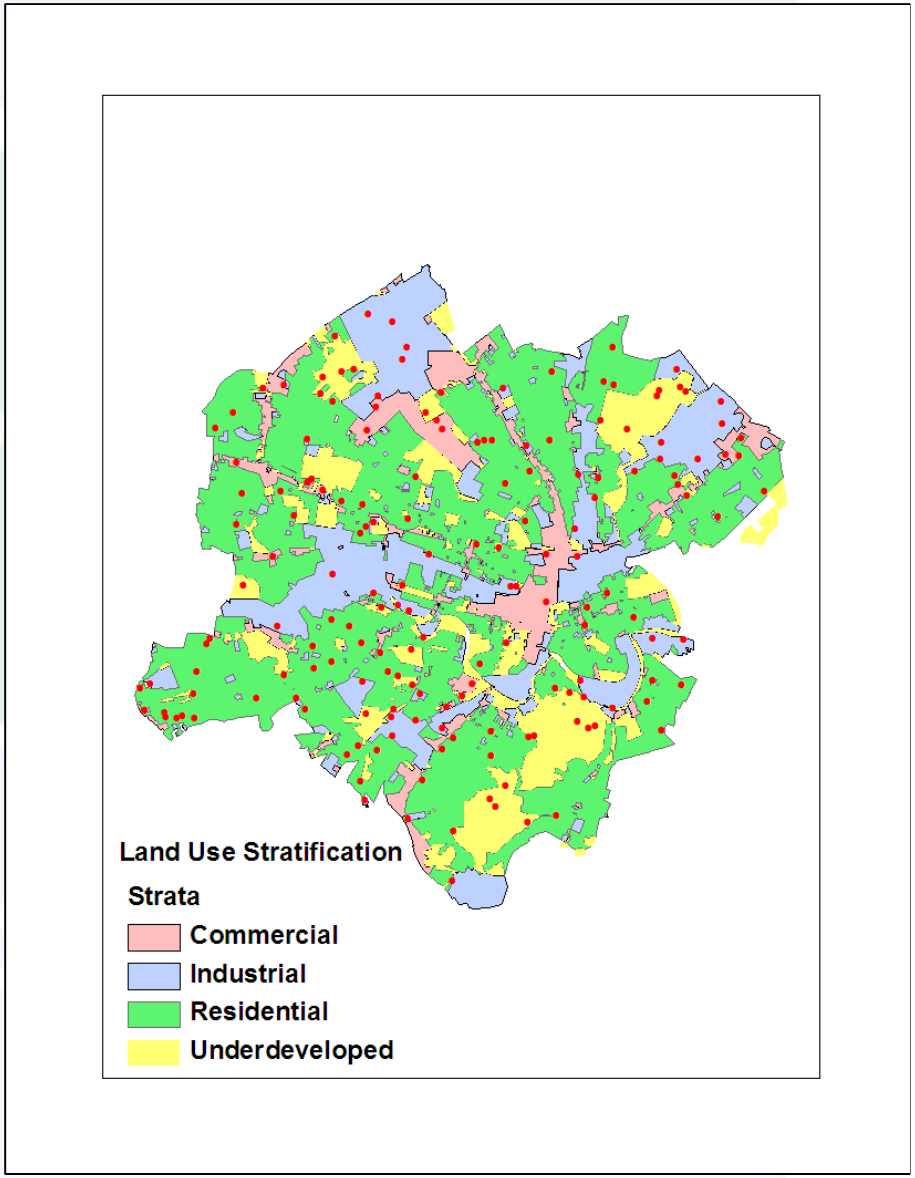
Eco "Classic" Tree Data Variables

1. Tree species
2. Diameter at breast height DBH
3. Total tree height
4. Height to live top
5. Height to crown base
6. Crown width (N-S & E-W)
7. % Crown missing
8. Condition (% dieback)
9. Crown light exposure
10. Direction to building
11. Distance to building
12. Land use

Eco Project Considerations

Inventory Methods

- Complete inventory (parks, campuses, street trees)
- Random sample plots (recommend 200, 1/10th acre for larger urban areas)
- Stratification options (sample & inventories)



Eco Data Collection

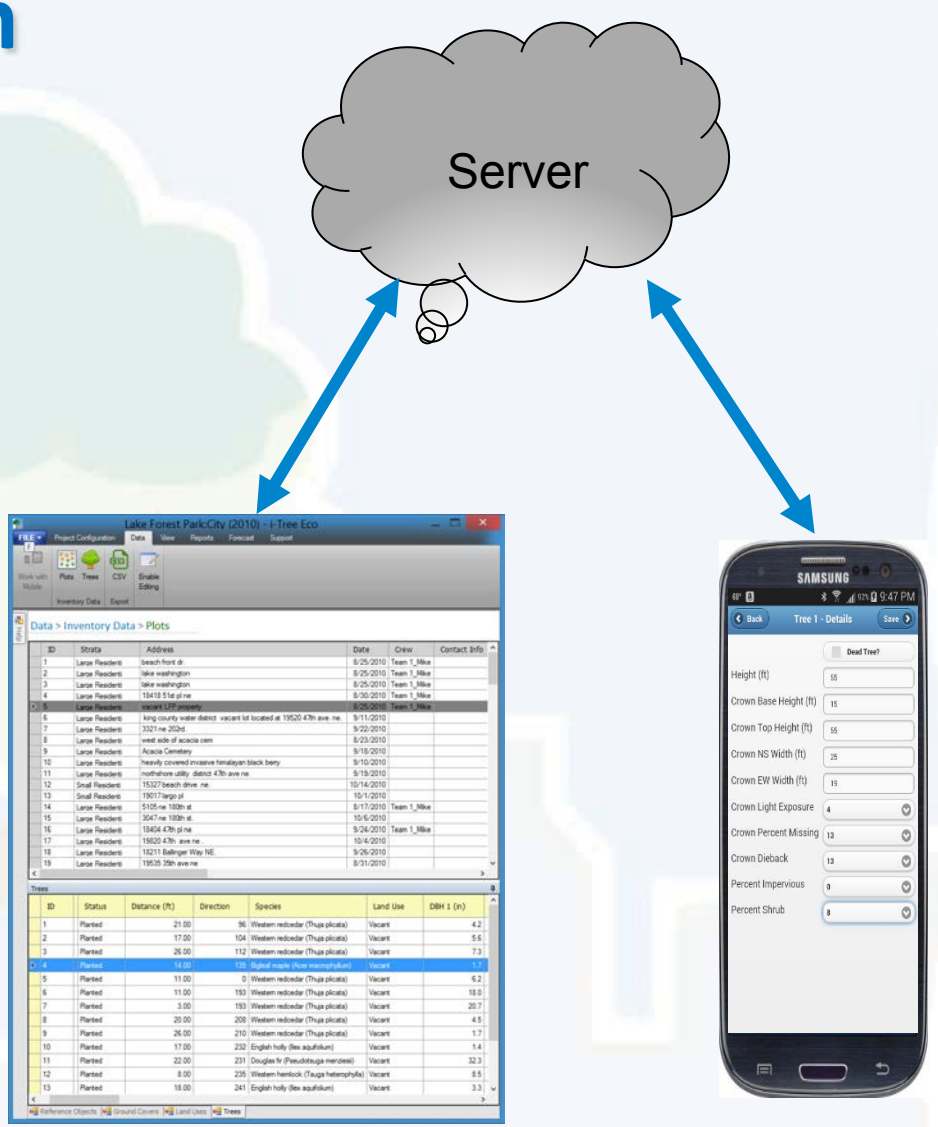
- Web-enabled mobile device, ~~PDA~~ or paper

Eco inventory data link

http://goo.gl/lSzU2E

Eco sample plot data link

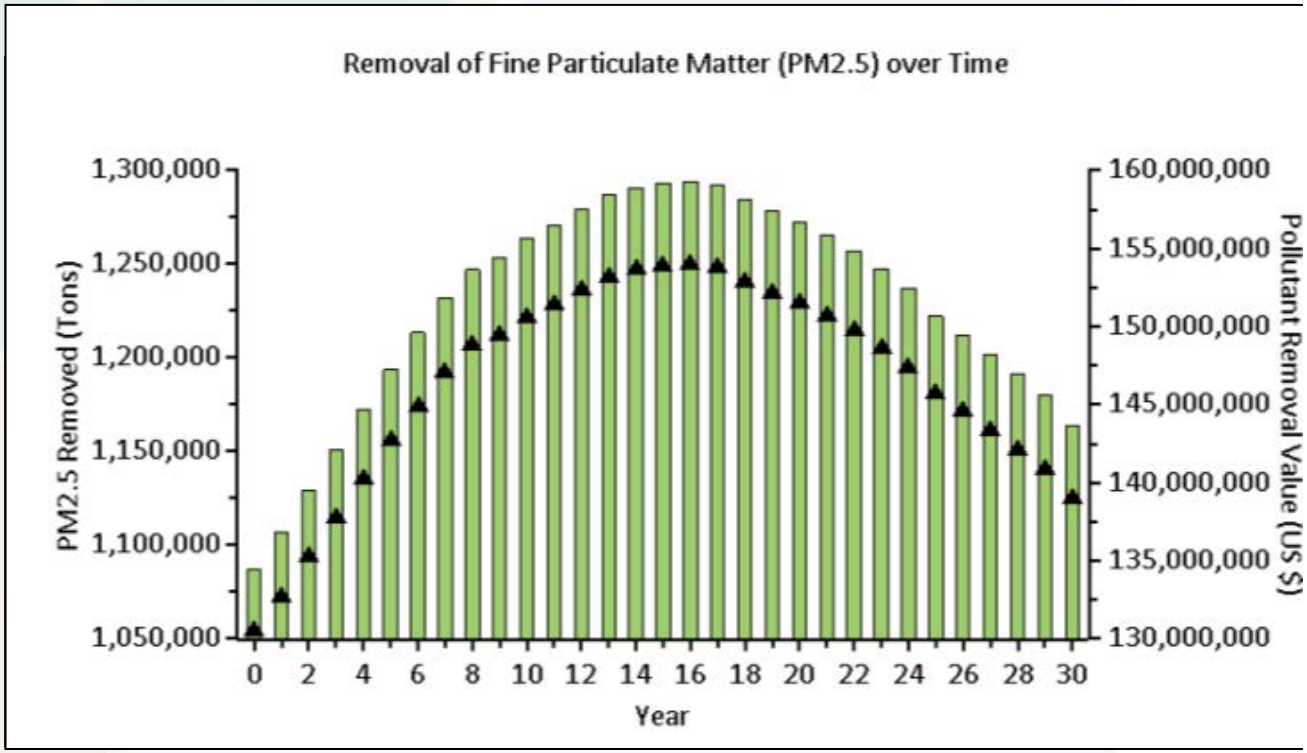
http://goo.gl/nMzjw0



www.itreetools.org/mobile/

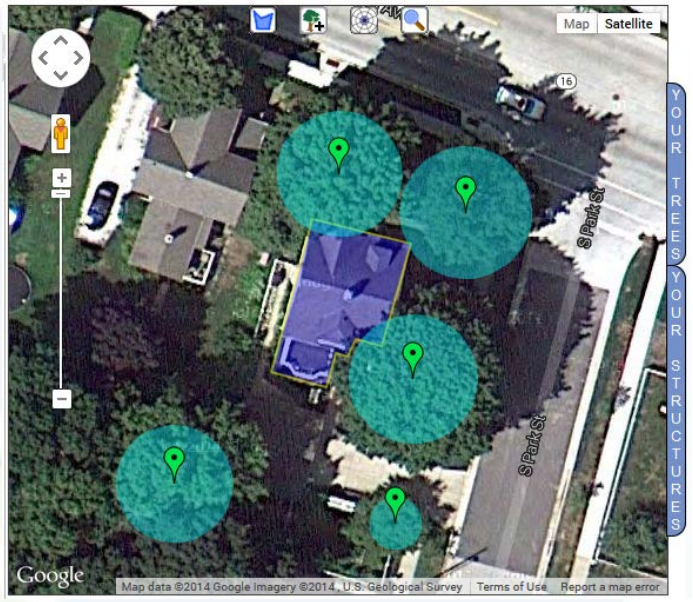
i-Tree Forecast - What is it?

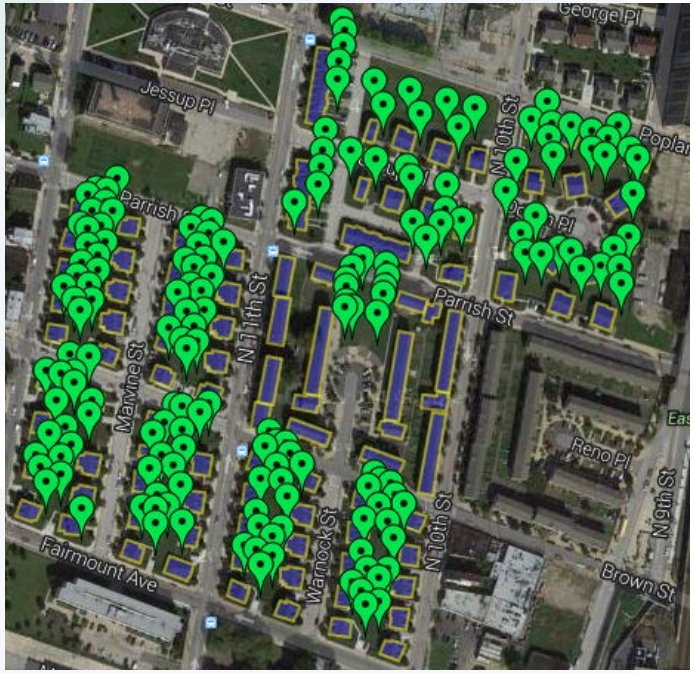
- A new module within i-Tree Eco 2015
- Project tree growth over time
- Include population modeling
- User guided planting and mortality
- Projects changes in selected tree benefits



i-Tree Design

- Analysis of individual trees associated with structures
- Calculates benefits over time
- General public use
- Web accessible





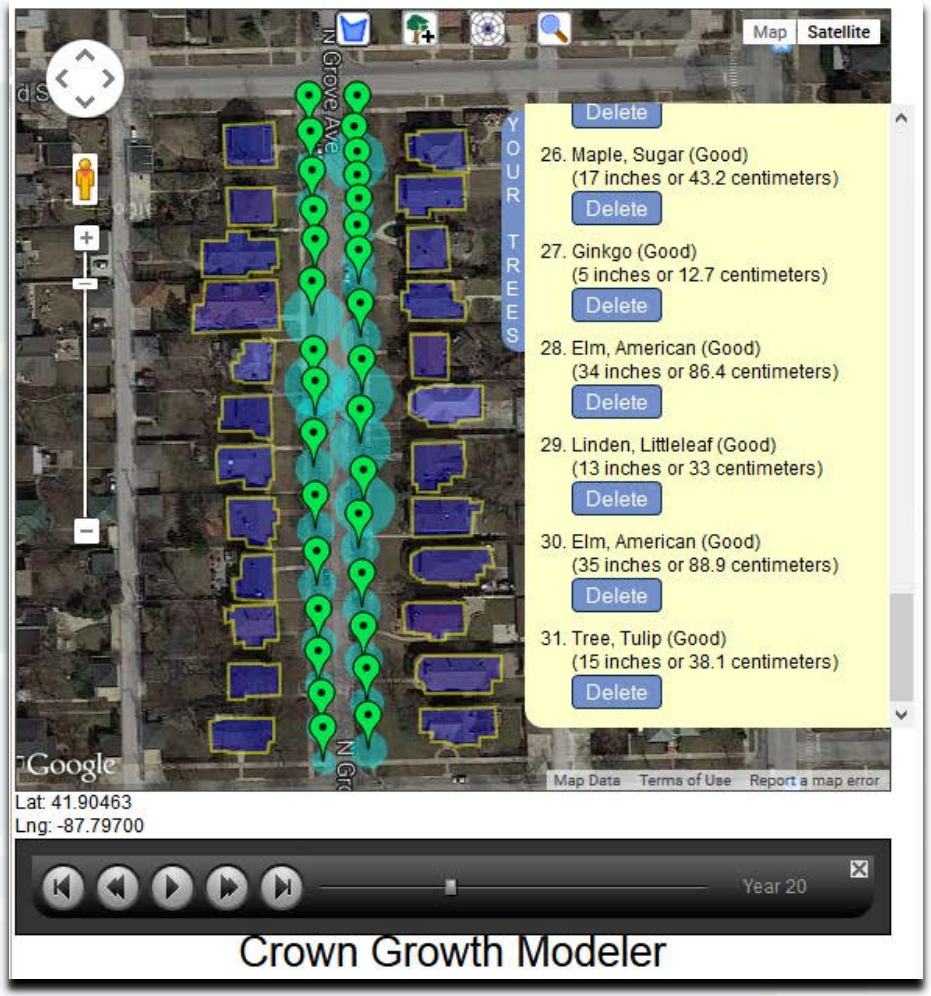
http://www.itreetools.org/design.php

i-Tree Design

Estimates 4 core ecosystem services

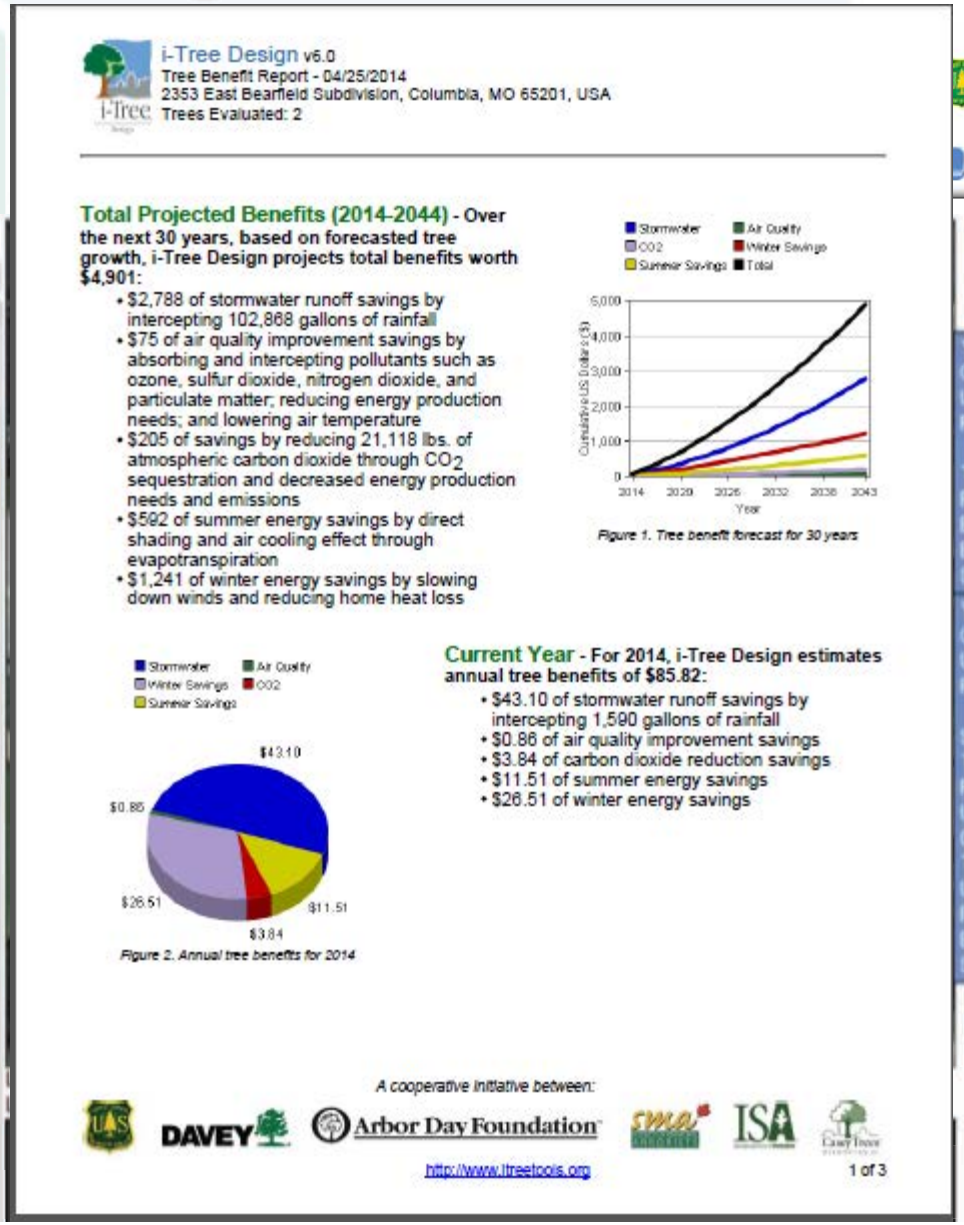
- Stormwater interception
- Energy (impacts on heating/cooling)
- Air quality improvement
- Carbon sequestration

Determine value ($) of current and future benefits



How does i-Tree Design work?

1. Navigate to www.itreetools.org/design in an up-to-date web browser (Firefox or Chrome preferred)
2. Enter an address
3. Draw the footprint of residential structures
4. Add in trees (species, dbh, condition, light)
5. Look at crown growth
6. Estimate benefits overtime
7. Print or save report and project



i-Tree Design v6.0
Tree Benefit Report - 04/25/2014
2353 East Bearfield Subdivision, Columbia, MO 65201, USA
Trees Evaluated: 2

Total Projected Benefits (2014-2044) - Over the next 30 years, based on forecasted tree growth, i-Tree Design projects total benefits worth $4,901:

- $2,788 of stormwater runoff savings by intercepting 102,868 gallons of rainfall
- $75 of air quality improvement savings by absorbing and intercepting pollutants such as ozone, sulfur dioxide, nitrogen dioxide, and particulate matter; reducing energy production needs; and lowering air temperature
- $205 of savings by reducing 21,118 lbs. of atmospheric carbon dioxide through CO_2 sequestration and decreased energy production needs and emissions
- $592 of summer energy savings by direct shading and air cooling effect through evapotranspiration
- $1,241 of winter energy savings by slowing down winds and reducing home heat loss

Stormwater, Air Quality, CO2, Winter Savings, Summer Savings, Total

Figure 1. Tree benefit forecast for 30 years

Stormwater, Air Quality, Winter Savings, CO2, Summer Savings

$43.10, $0.86, $26.51, $11.51, $3.84

Figure 2. Annual tree benefits for 2014

Current Year - For 2014, i-Tree Design estimates annual tree benefits of $85.82:

- $43.10 of stormwater runoff savings by intercepting 1,590 gallons of rainfall
- $0.86 of air quality improvement savings
- $3.84 of carbon dioxide reduction savings
- $11.51 of summer energy savings
- $26.51 of winter energy savings

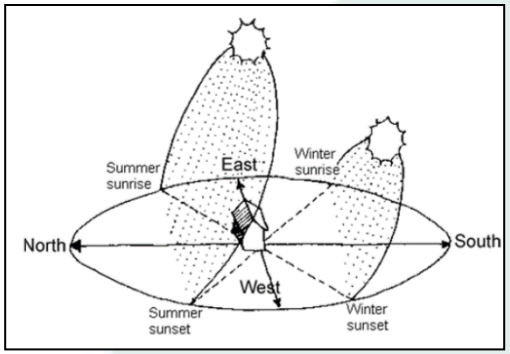
A cooperative initiative between:

http://www.itreetools.org

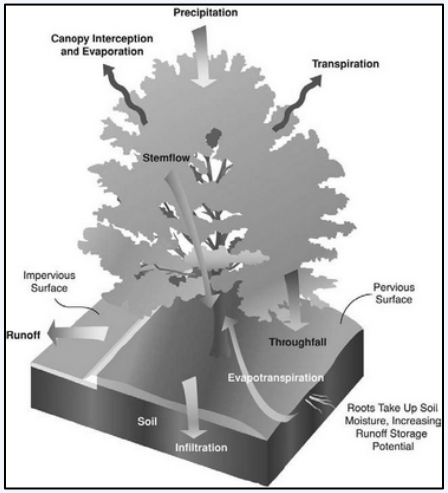
1 of 3

i-Tree is a Cooperative Initiative among these partners

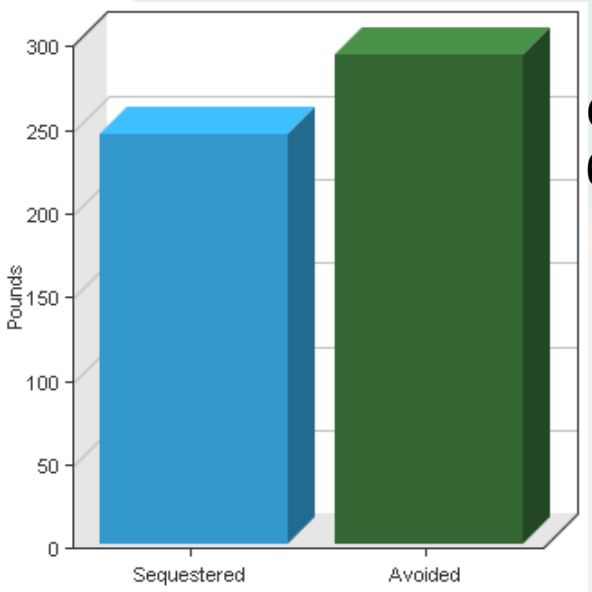
Provides a $ value for tree benefits



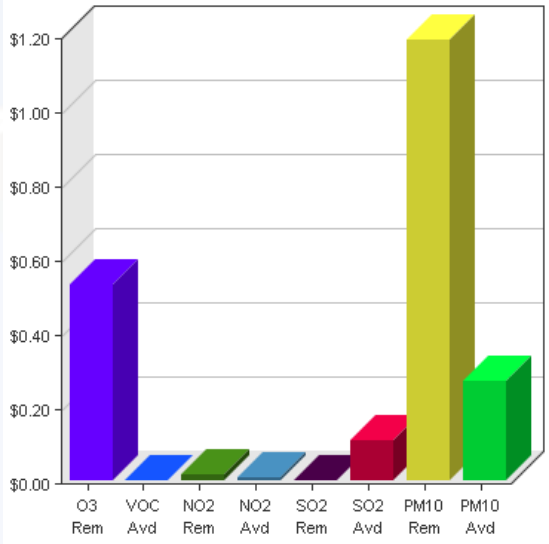
Energy
305.7 kwh = $35.85
21.6 therms = $35.00



Stormwater
5,714 gallons = $56.57



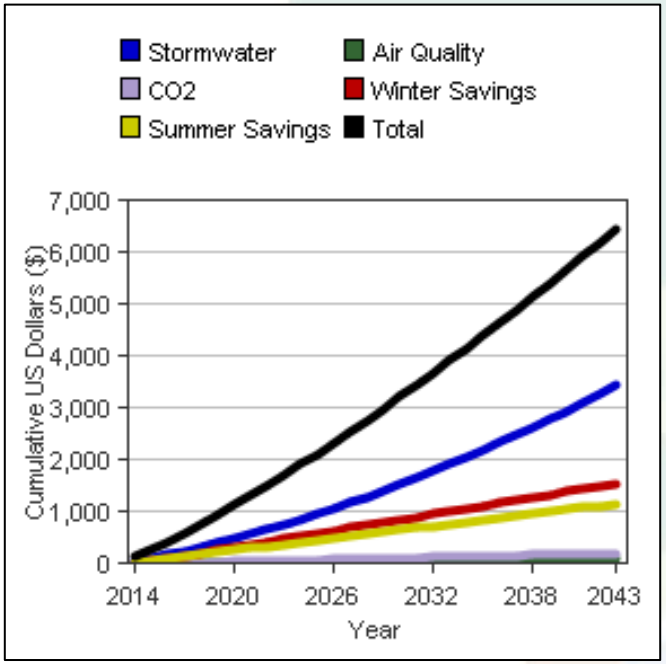
Carbon dioxide
612 lbs = $5.95



Air Quality
Improved health = $2.23

Total benefits this year = $136

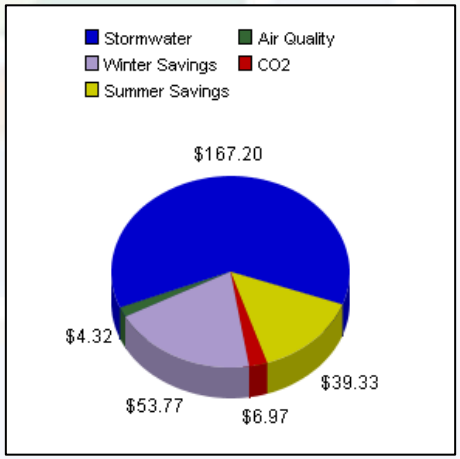
Shows trees are an investment

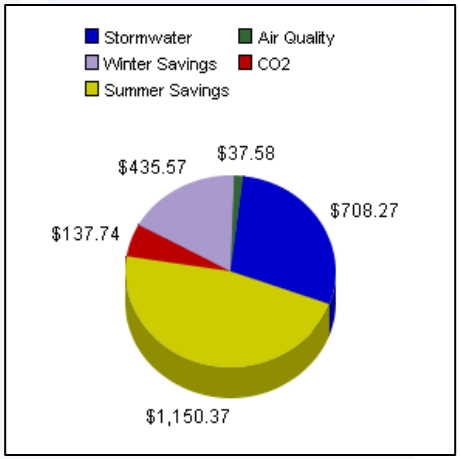


$6,476 worth of benefits over the next 30 years …and growing

Benefits in 2044 = **$272**

To date = **$2,470**





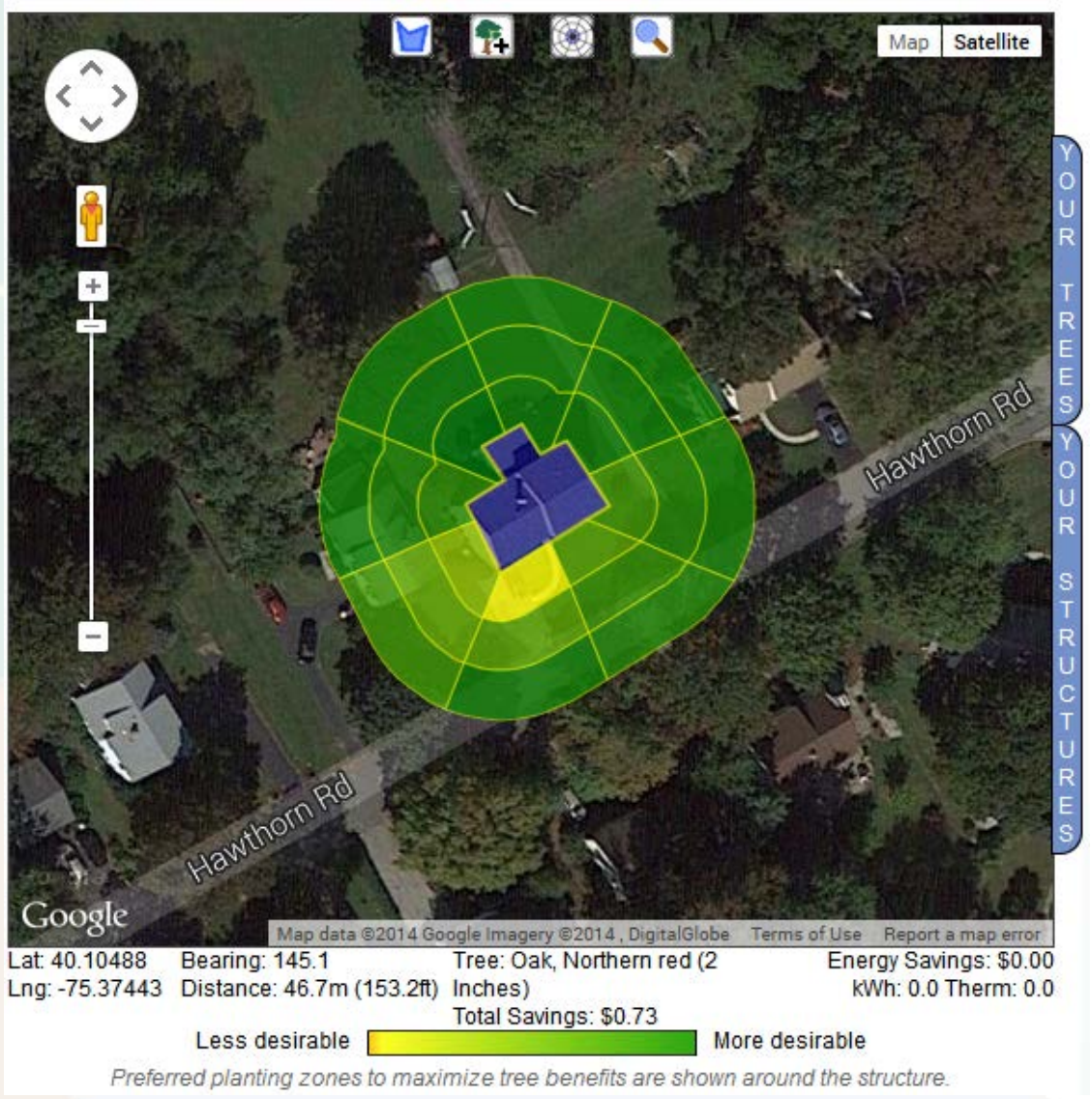
Strategy 1: Engage Residential & Private Property Owners

Existing trees

- My trees have value?
- Improve care
- Printable report

Proposed trees

- Where to plant
- Support giveaways
- Canopy goals

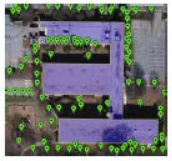


Strategy 2: Advocacy and Outreach

From very simple…

TREES FOR TOMORROW

Bethune School District
Bethune Elementary School
220 Northside Drive NW, Atlanta, Georgia



Fast Facts

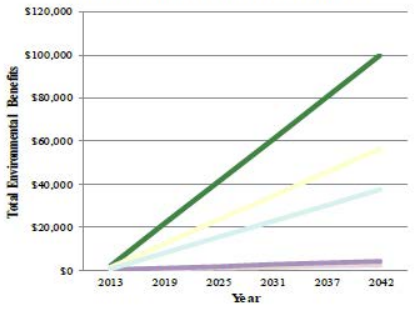
Number of Possible Strategic Tree Plantings	18
Number of Existing Trees on School Property	130
Current Year Annual Tree Benefits (2013)	$1,816
Future Year Annual Tree Benefits (2043)	$4,661
Total Projected Tree Benefits (2013–2043)	$99,797

Strategically planting trees around the north, west, and east side of school buildings, in court yards, by the entrance and exit, near paved drives, parking lots, playgrounds, and recreational fields can maximize the benefits trees provide Bethune Elementary School. Trees that grow large generally provide the greatest benefits compared to small- or medium-growing trees. Optimizing the space available for trees to grow will be key in future planting efforts for increased benefits.

Using i-Tree Design, new trees were plotted in these areas with consideration for proper spacing between trees and individual site space restrictions. The results show there is the potential for 18 or more trees. In 30 years, planting and maintaining 18 additional trees would increase the environmental benefits by 6% at Bethune Elementary School.

Tree Benefit Type	Projected Benefits with Possible Future Trees (30 Years)	Change (Existing vs. Possible)
Stormwater Management	$56,463	6%
Energy Savings	$37,213	6%
Carbon Dioxide Reduction	$4,006	7%
Air Quality Improvement	$2,115	7%
Total Benefits	$99,797	6%

Total Tree Benefits Forecasted for 30 Years



AMERICAN FORESTS

Launched in spring 2013, American Forests developed a project dedicated to the assessment, restoration, and monitoring of urban forests in five cities. The ultimate purpose is to raise awareness of the critical importance of trees to the well-being of the City. In Atlanta, Georgia, the focus is on determining how the urban forest surrounding the City's schoolyards improves students' well-being. Twenty-six schools and 51 districts are included in this project. This factsheet is a single piece of a much greater educational effort by American Forests' Community ReLeaf program.

For more information, visit the Community ReLeaf website or call American Forests.

DAVEY RESOURCE GROUP

… to more involved

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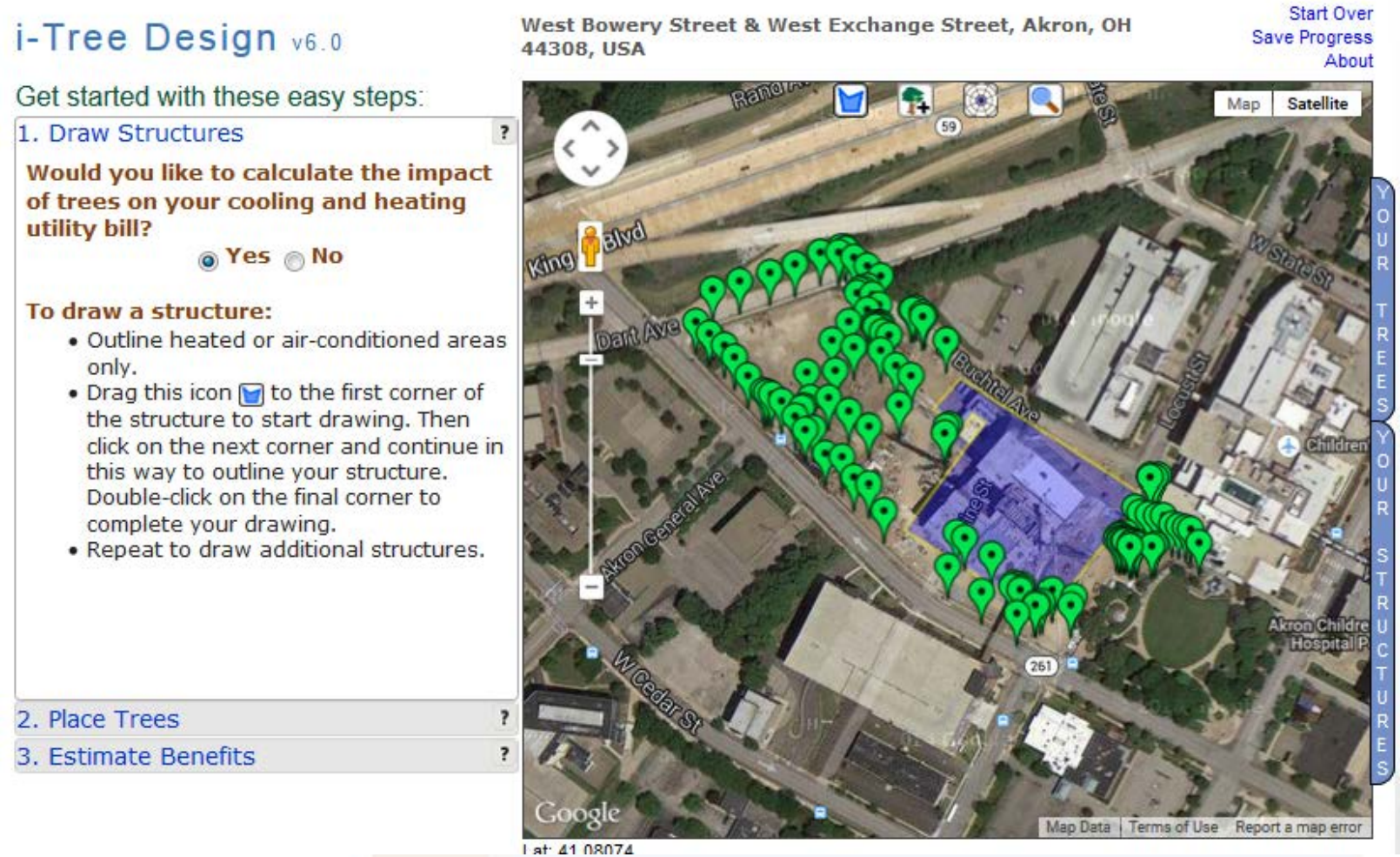
Strategy 3: Corporate/Campus Sustainability Efforts

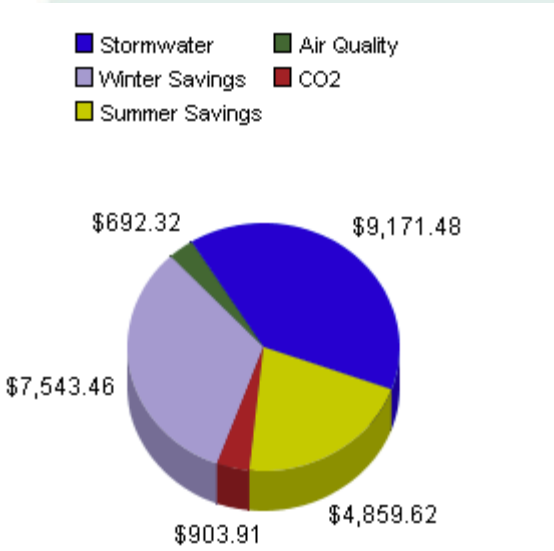


Strategy 4: Evaluating tree energy effects

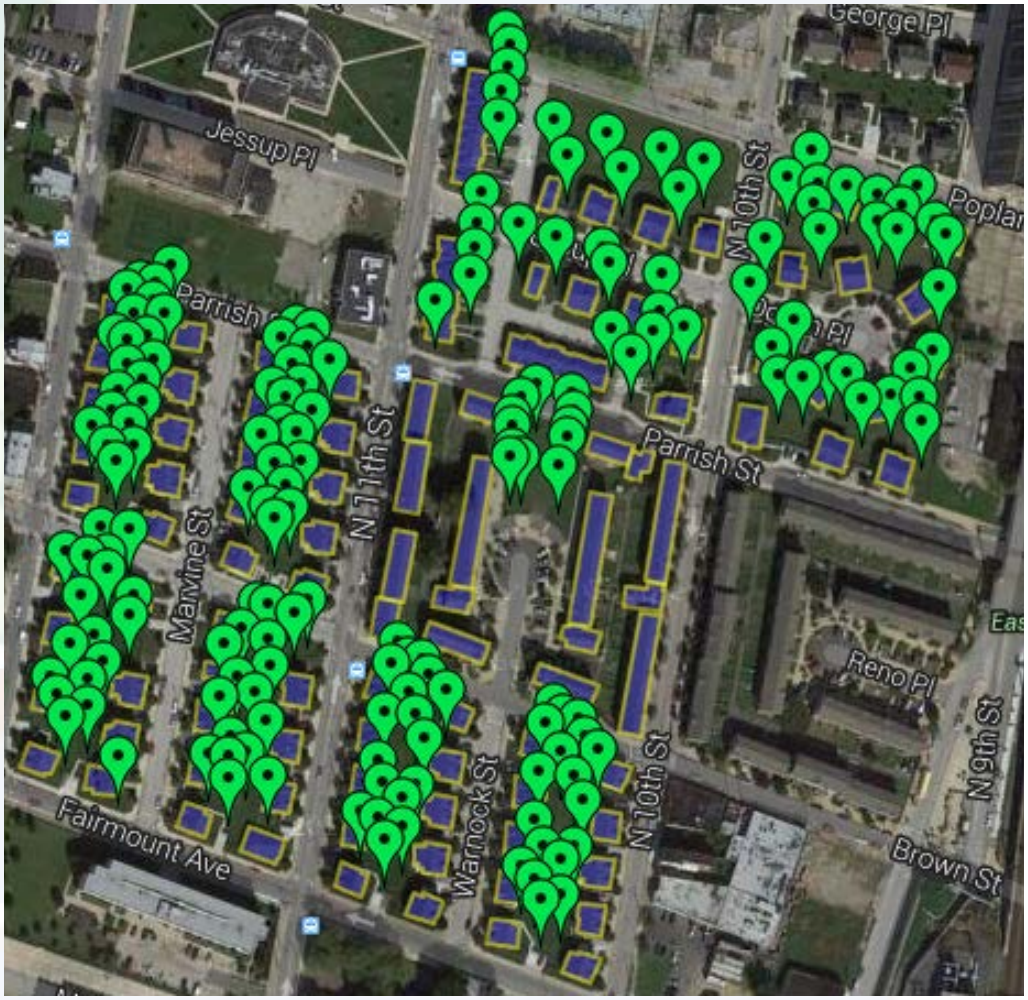
Pennsylvania Horticultural Society planting for the Philadelphia Housing Authority

Savings over the next 30 yrs

- **$108,000** in winter
- **$87,000** in summer



Benefits in year 30



http://www.urbanforest.org

TREE FOUNDATION OF KERN

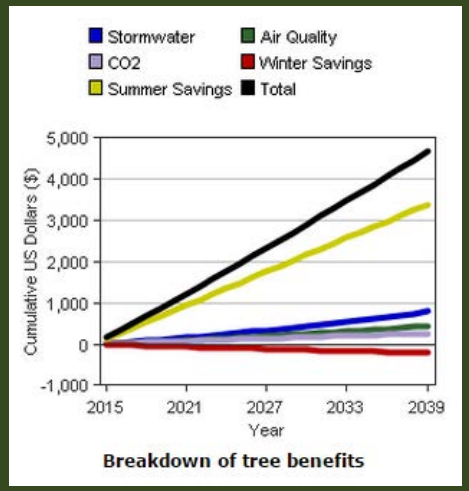
About the Tree Foundation » Home

Home

Planting Trees with The Tree Foundation of Kern

The Tree Foundation of Kern is a small local nonprofit organization dedicated to the advancement of sustainable urban and community forestry. Our mission is to provide a better shade canopy in our county, beautify our local landscape, help improve our air quality and educate our citizens about trees, their benefits and their care.

How do we do this?



Breakdown of tree benefits

Find out how much your trees are worth?

- Home
- Donate/Tickets
- About the Tree Foundation
- San Miguel Commemorative Grove Program
- Become a Member
- Trees Remember
- Citizen Forester
- Become a Volunteer
- Calendar
- Tree Links
- Tree Planting Guide
- Tree Tips
- More Tree Tips
- How To Hire an Arborist
- Tree Care Economics
- 50 Careers in Trees
- Pruning Tips

i-Tree

i-Tree is a Cooperative Initiative among these partners

DAVEY

Arbor Day Foundation

sma SOCIETY OF MUNICIPAL ARBORISTS

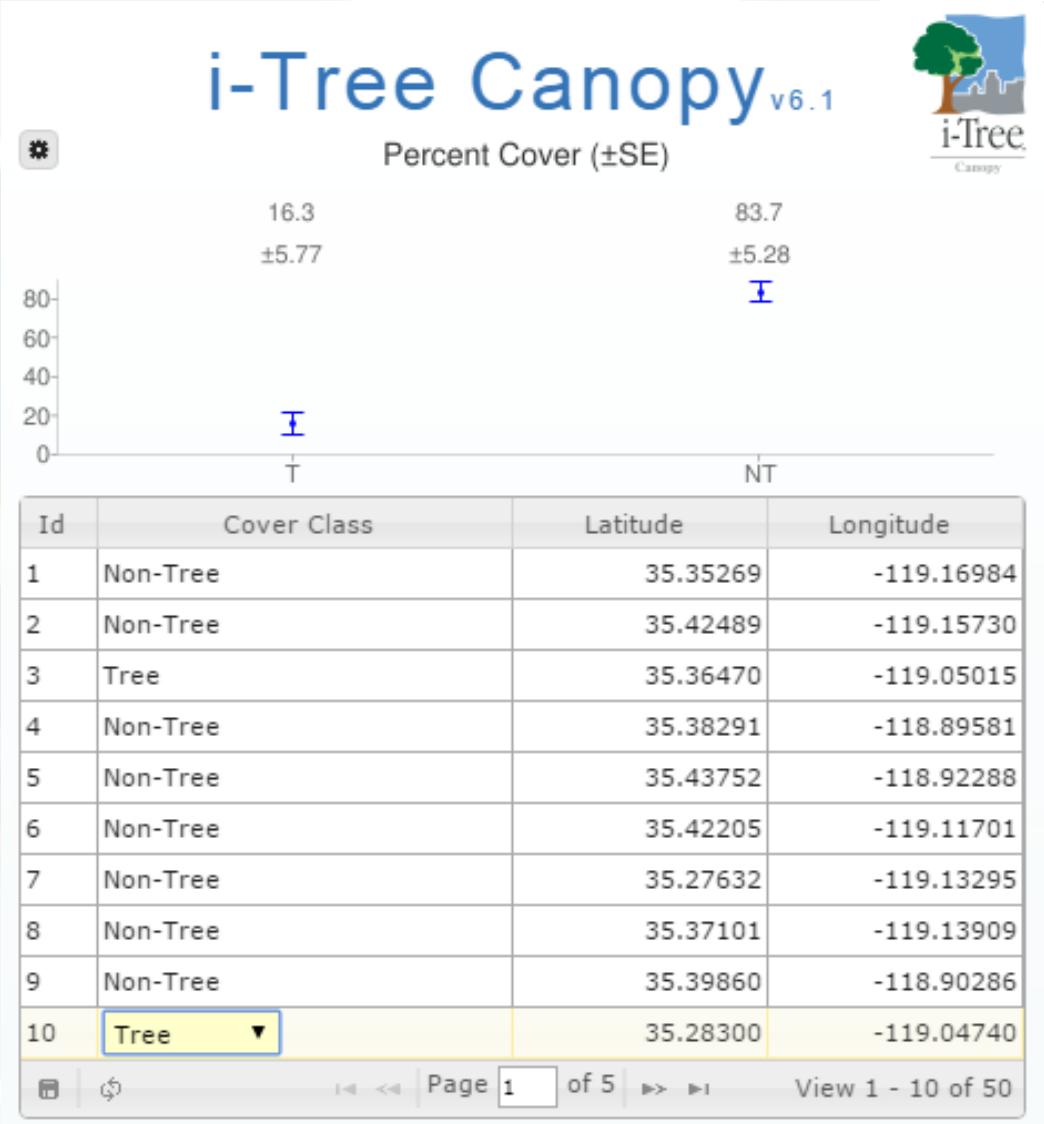
ISA

Casey Trees WASHINGTON DC

ESF State University of New York College of Environmental Science and Forestry

i-Tree Canopy

- Web based survey tool
- Estimates the amount of canopy cover and other cover types
- Estimates pollution removal, CO2 sequestration & storage
- Doesn't require GIS expertise
- Printable report summary
- Canopy change assessment is possible



Id	Cover Class	Latitude	Longitude
1	Non-Tree	35.35269	-119.16984
2	Non-Tree	35.42489	-119.15730
3	Tree	35.36470	-119.05015
4	Non-Tree	35.38291	-118.89581
5	Non-Tree	35.43752	-118.92288
6	Non-Tree	35.42205	-119.11701
7	Non-Tree	35.27632	-119.13295
8	Non-Tree	35.37101	-119.13909
9	Non-Tree	35.39860	-118.90286
10	Tree	35.28300	-119.04740

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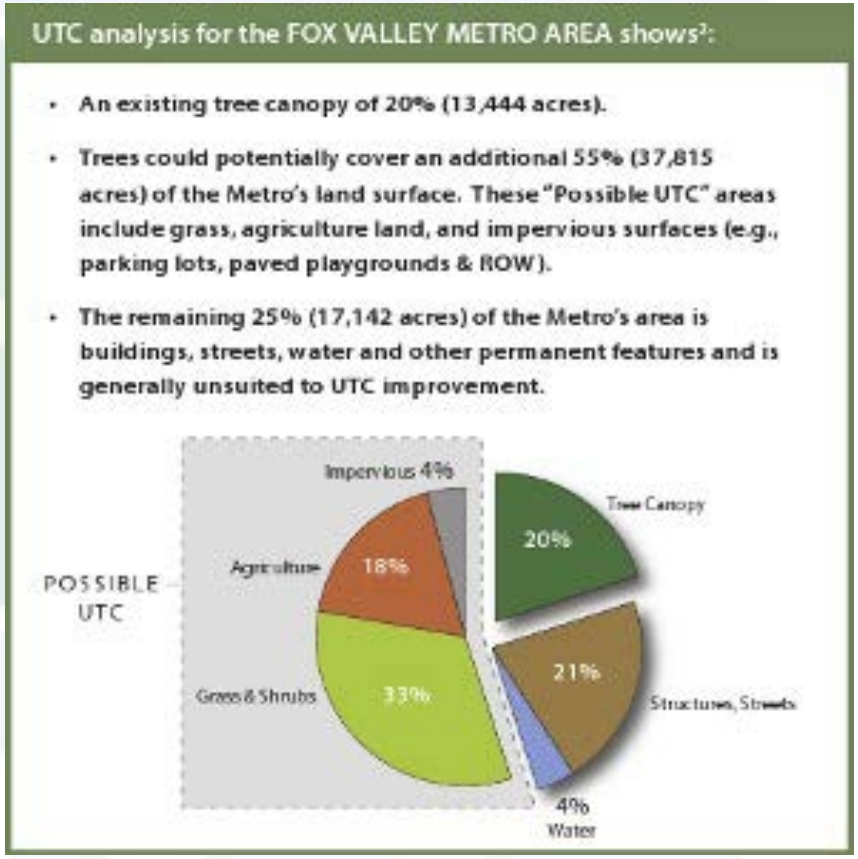
http://www.itreetools.org/canopy/index.php

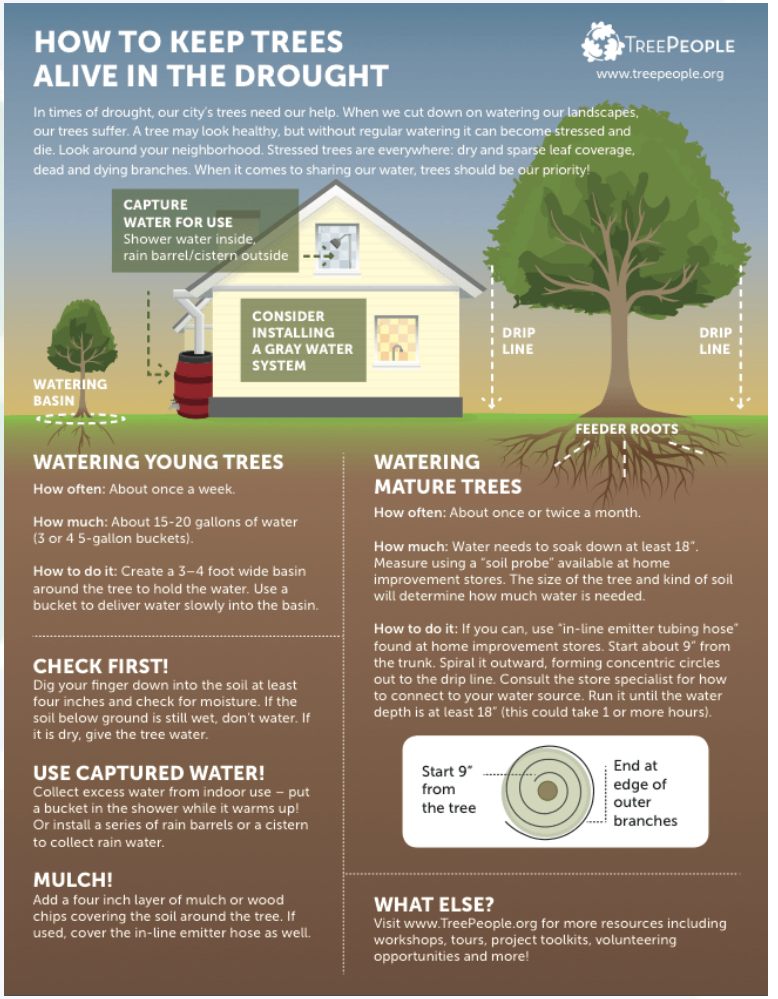
Who is using i-Tree Canopy?

- Municipal foresters, UF Coordinators, planners,
- Educators, schools, volunteers, neighborhood groups
- Tree planting program coordinators
- Anyone interested in assessing community canopy & goal setting



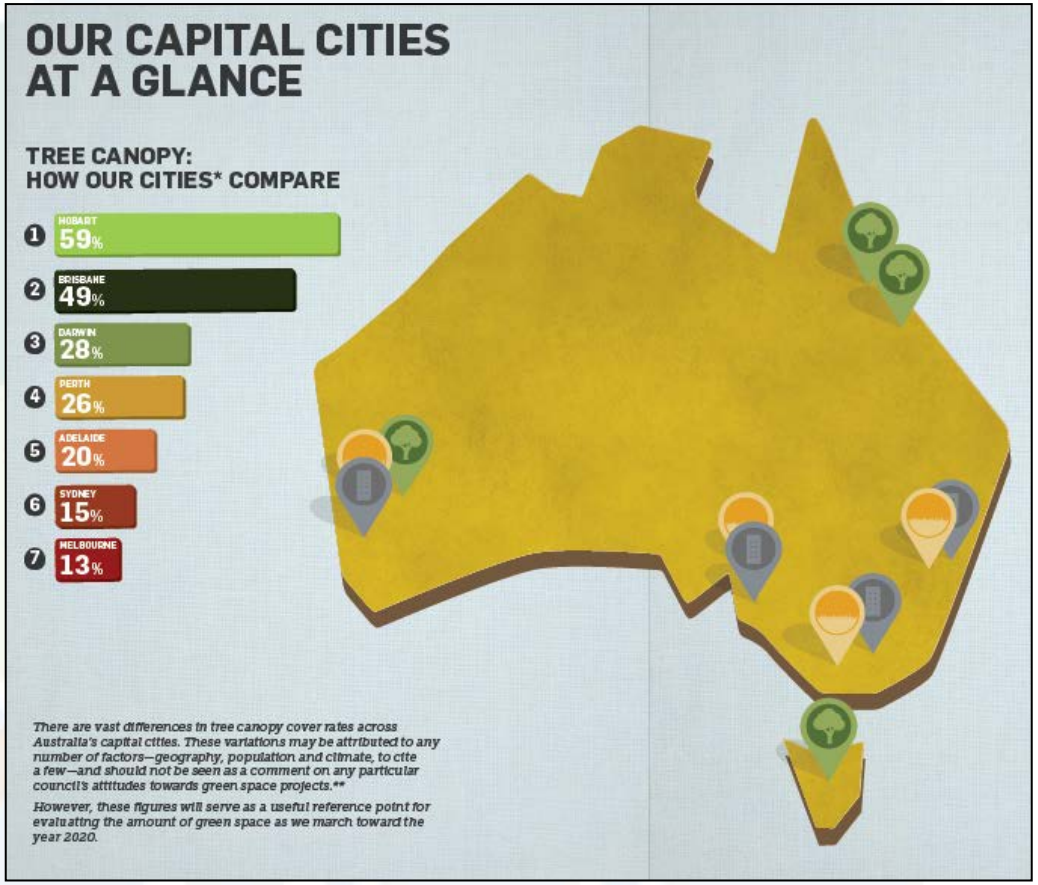
i-Tree Canopy Strategies

- Establish base line data for goal setting
- Monitor changes due to development, pest & diseases, storms, drought, land use change, etc.
- Determine areas for priority tree planting
- i-Tree Canopy estimates can be used in other i-Tree tools such as Hydro



www.treepeople.org

i-Tree Canopy Strategies



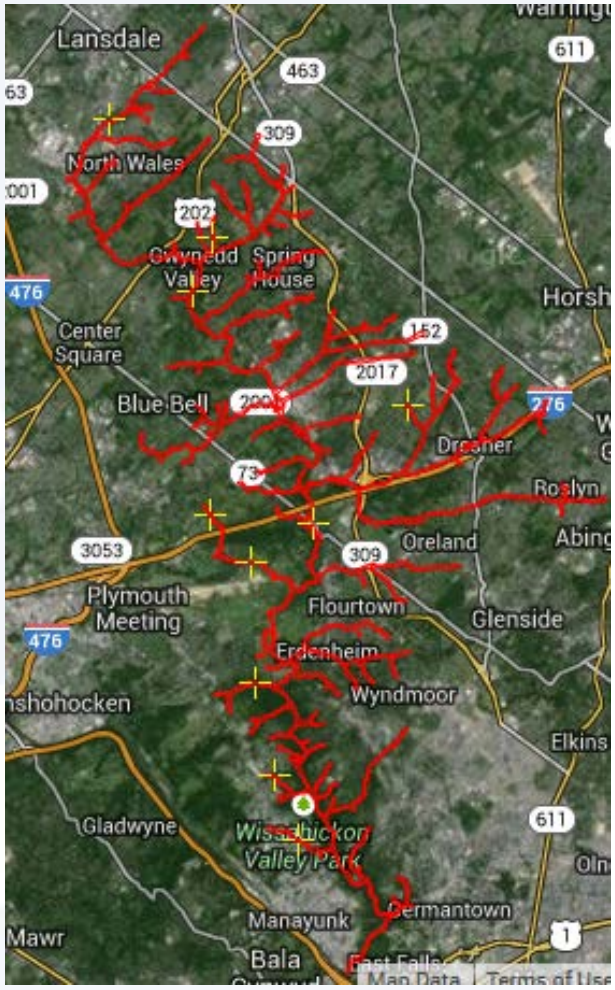
Where Are All the Trees: An analysis of tree canopy cover in urban Australia

- Compare canopy between cities, neighborhoods, school districts, political wards, etc.

Monitoring with i-Tree Canopy

Example: Assess change in tree cover in a 100ft buffer for Wissahickon creek.

- What % of buffer is tree covered?
- What % could tree cover be added?
- How has cover changed (2006-2011)?



Monitoring with i-Tree Canopy

Cover type	2006	2011
Tree/Shrub	60.5% ±3	64.5% ±3
Possible Tree/Shrub	22% ±3	18% ±3
Tree/Shrub -Not Possible	12% ±2	12% ±2
Water	5.5% ±2	5.5% ±2

Atmospheric Polutant Removals	2006 amount	2006 value	2011 amount	2011 value$
CO	1,533 lb	$1,019	1,635 lb	$1,086
NO2	11.73 T	$19,861	12.51 T	$21,174
O3	34.48 T	$595,761	36.76 T	$635,151
SO2 removed	3.09 T	$1,994	3.29 T	$2,125
Particulate Matter 2.5-10µ	12.18 T	$76,068	12.99 T	$81,097
CO2 sequestered	8,692.48 T	$168,315	9,267.19 T	$179,444
Total		$863,018		$920,077

Change in tree cover in a 100ft buffer for Wissahickon Creek.

i-Tree is a Cooperative Initiative among these partners

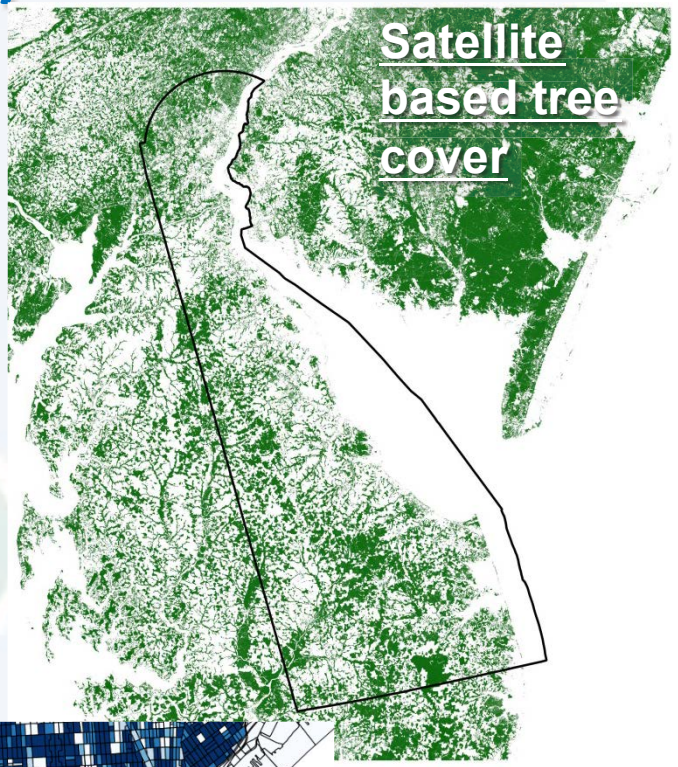
i-Tree · DAVEY · Arbor Day Foundation · sma Society of Municipal Arborists · ISA · Casey Trees · ESF State University of New York College of Environmental Science and Forestry

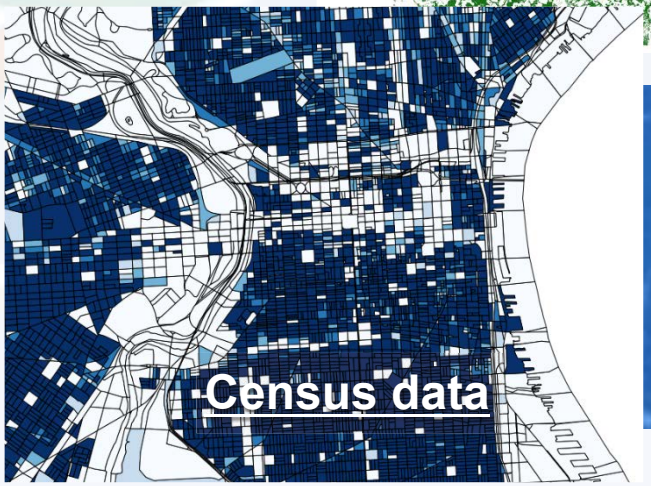
i-Tree Landscape (coming soon)

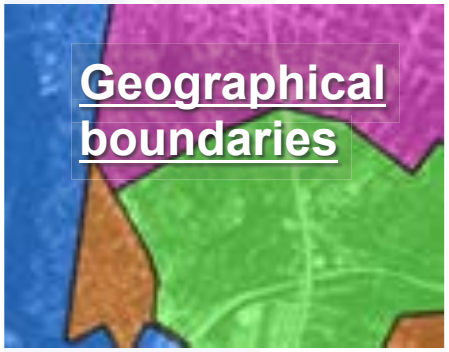
Make spatial data accessible.

Support strategic planning around locating trees.

Show how tree benefits and people interact.







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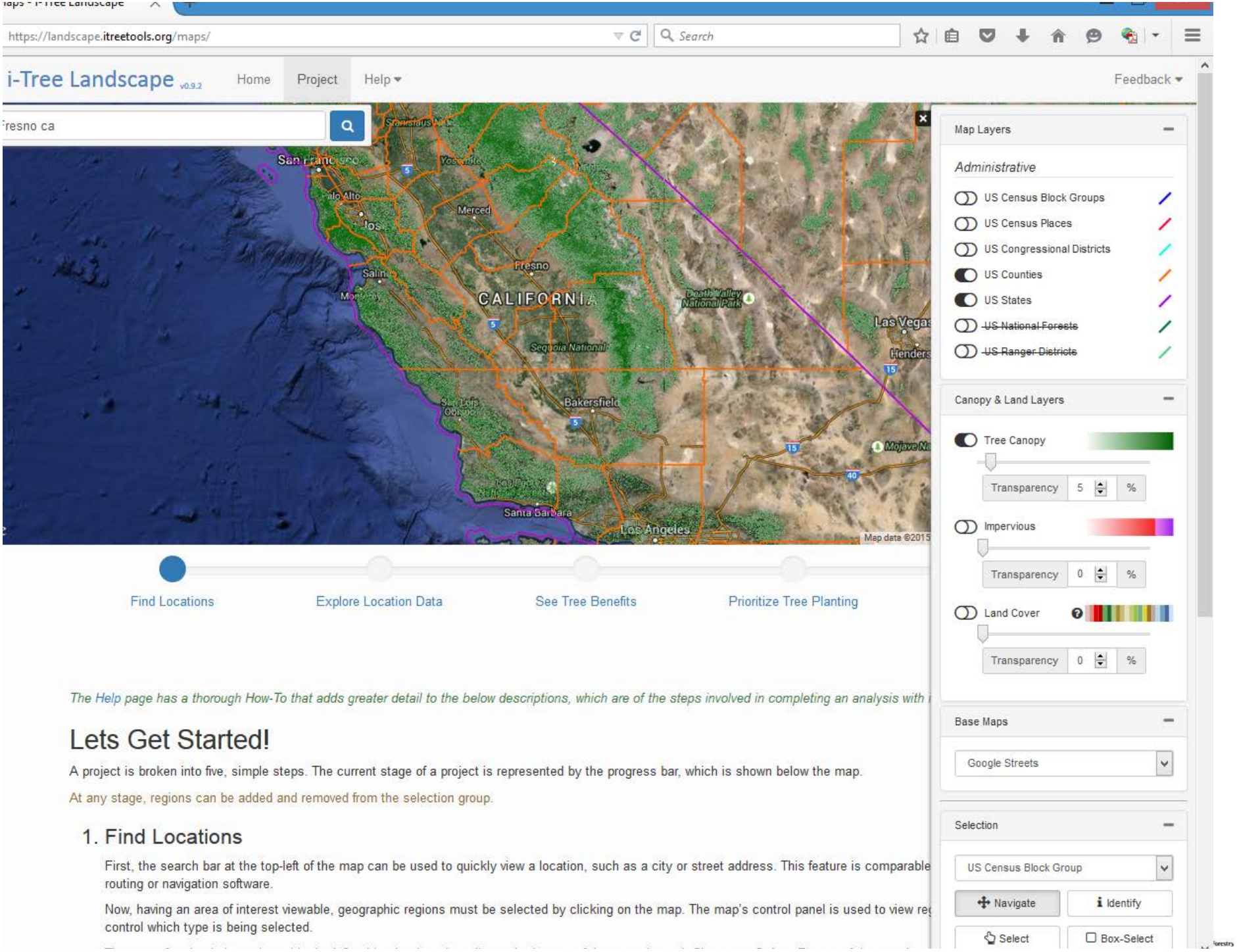
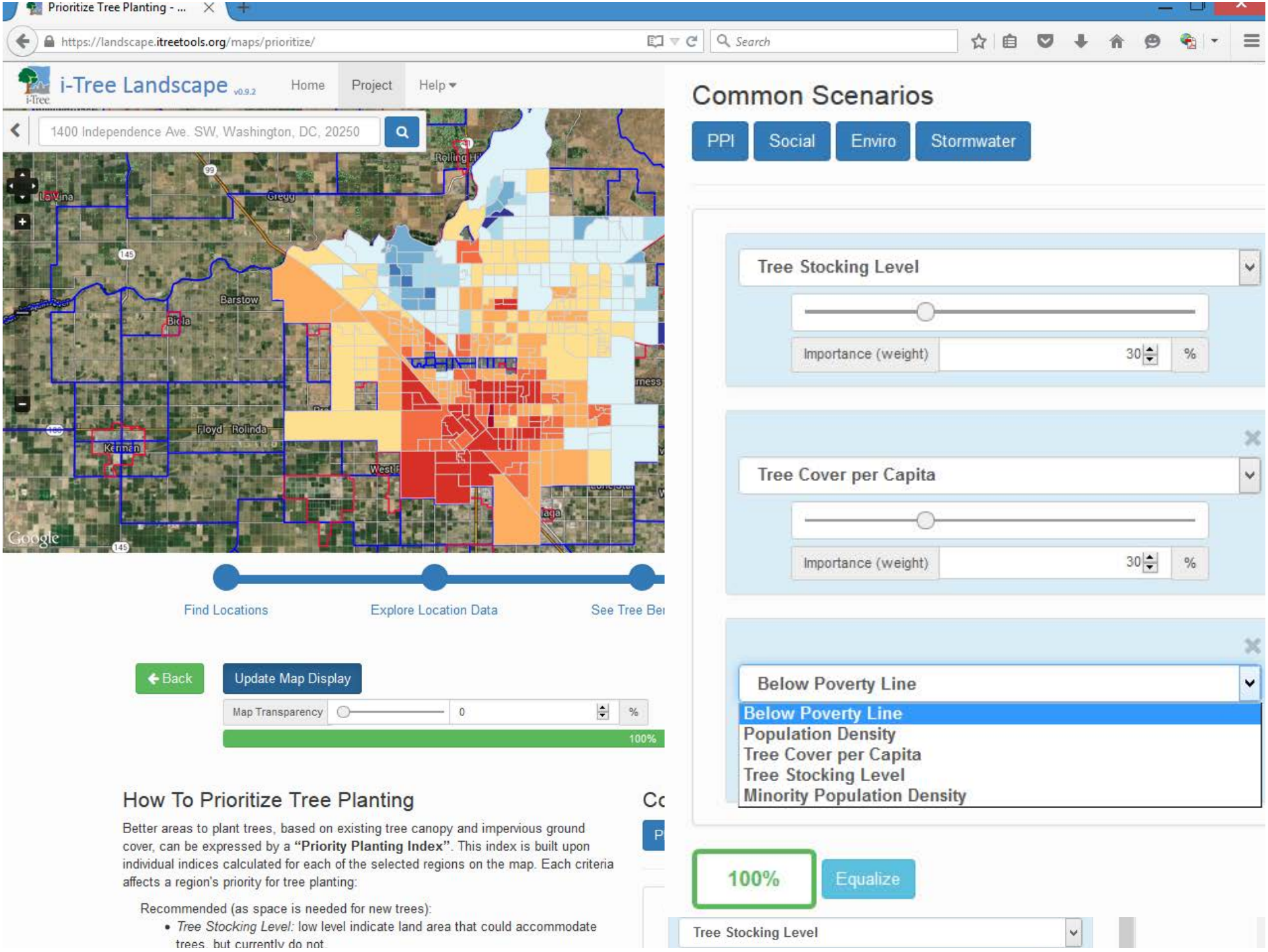

https://landscape.itreetools.org/maps/
Search
i-Tree Landscape v0.9.2
Home
Project
Help
Feedback
Fresno ca
San Francisco
Merced
Fresno
CALIFORNIA
Bakersfield
Santa Barbara
Los Angeles
Las Vegas
Map data ©2015
Map Layers
Administrative
US Census Block Groups
US Census Places
US Congressional Districts
US Counties
US States
US National Forests
US Ranger Districts
Canopy & Land Layers
Tree Canopy
Transparency 5 %
Impervious
Transparency 0 %
Land Cover
Transparency 0 %
Base Maps
Google Streets
Selection
US Census Block Group
Navigate
Identify
Select
Box-Select
Find Locations
Explore Location Data
See Tree Benefits
Prioritize Tree Planting
The Help page has a thorough How-To that adds greater detail to the below descriptions, which are of the steps involved in completing an analysis with
Lets Get Started!
A project is broken into five, simple steps. The current stage of a project is represented by the progress bar, which is shown below the map.
At any stage, regions can be added and removed from the selection group.
1. Find Locations
First, the search bar at the top-left of the map can be used to quickly view a location, such as a city or street address. This feature is comparable
routing or navigation software.
Now, having an area of interest viewable, geographic regions must be selected by clicking on the map. The map's control panel is used to view re
control which type is being selected.


Prioritize Tree Planting - ...
https://landscape.itreetools.org/maps/prioritize/
Search
i-Tree Landscape v0.9.2
Home
Project
Help
1400 Independence Ave. SW, Washington, DC, 20250
Common Scenarios
PPI
Social
Enviro
Stormwater
Tree Stocking Level
Importance (weight)
30
%
Tree Cover per Capita
Importance (weight)
30
%
Below Poverty Line
Below Poverty Line
Population Density
Tree Cover per Capita
Tree Stocking Level
Minority Population Density
Find Locations
Explore Location Data
Back
Update Map Display
Map Transparency
0
%
100%
How To Prioritize Tree Planting
Better areas to plant trees, based on existing tree canopy and impervious ground cover, can be expressed by a "Priority Planting Index". This index is built upon individual indices calculated for each of the selected regions on the map. Each criteria affects a region's priority for tree planting:
Recommended (as space is needed for new trees):
Tree Stocking Level: low level indicate land area that could accommodate trees, but currently do not
100%
Equalize
Tree Stocking Level

Additional i-Tree resources

www.itreetools.org

Videos

Documentation

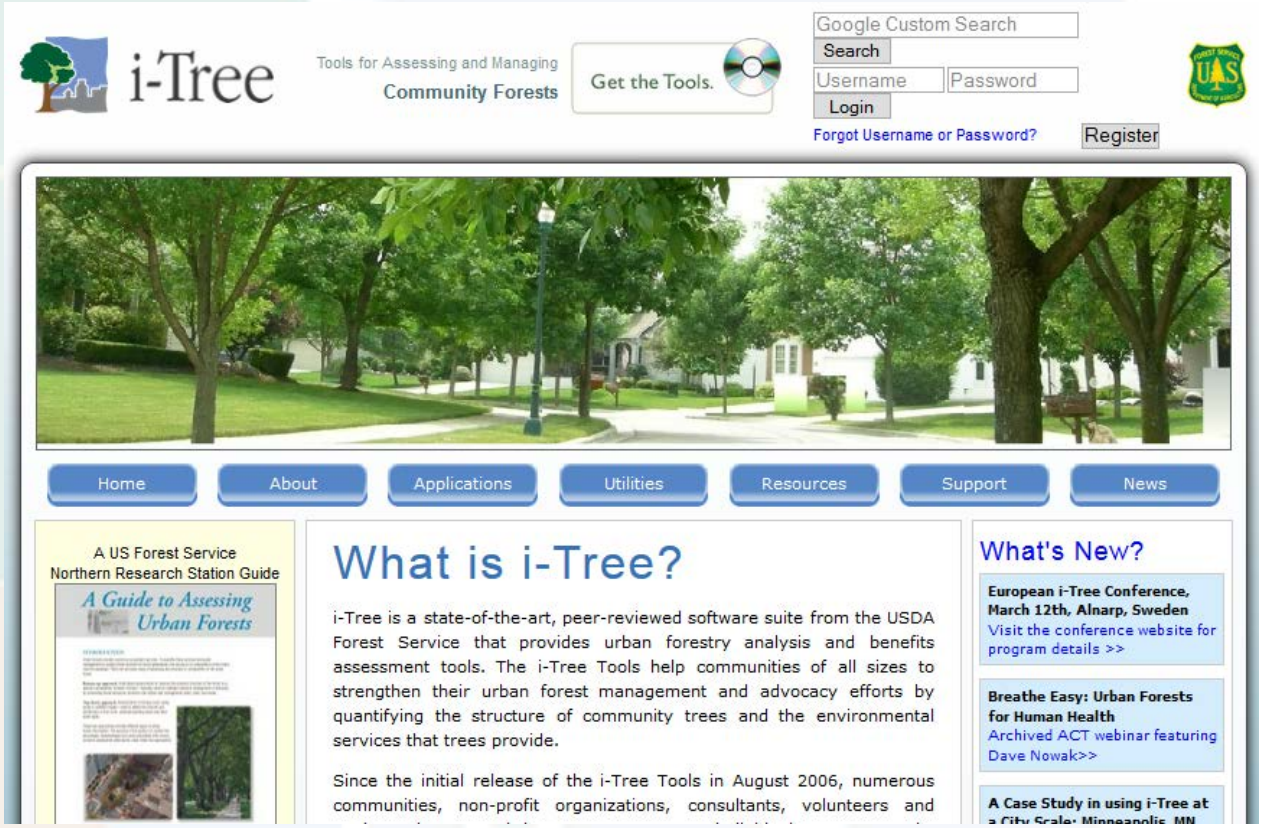
Online tools

Newsletter

Support

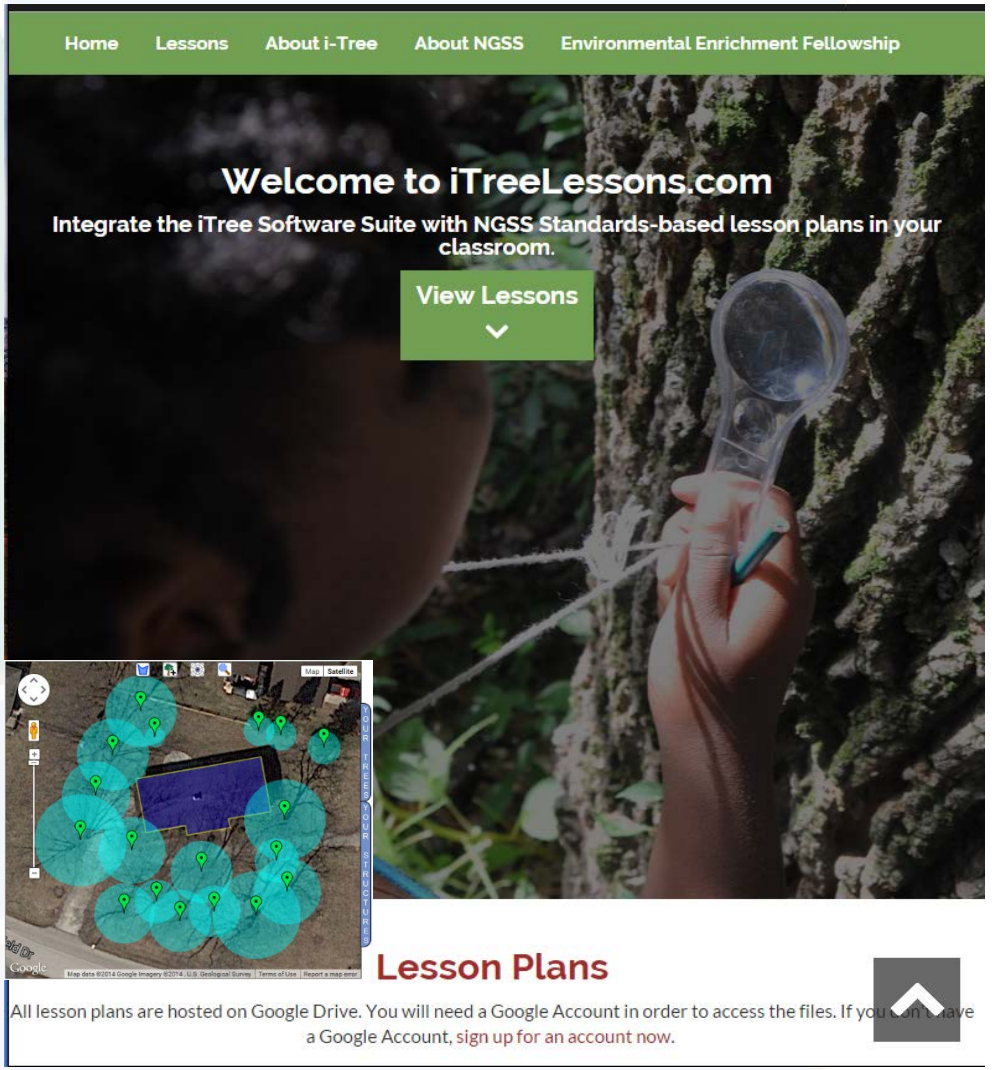
Examples

Downloads



Closing thoughts…

- Consider resources, objectives and available tool options
- Demonstrate tree value on ALL lands
- Use tools to engage new audiences & build allies to advance common objectives
- Leverage resources to enhance community trees



Questions…

Web-based, run in your browser

www.itreetools.org

Installed on a Windows desktop/laptop

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al.zelaya@davey.com