

# i-Tree: A Tool for Science, Engineering and Design

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Powerpoint and Resources

[www.unri.org/bscworkshop/](http://www.unri.org/bscworkshop/)





www.itreetools.org

# i-Tree Quick Guide

Prepared for



## Just the Basics: Introducing i-Tree Tools



DAVEY



Arbor Day Foundation



ISA



ESF



NAASF

ver. 08212022

# i-Tree

Tools for Assessing and Managing Community Trees & Forests

[www.itreetools.org](http://www.itreetools.org)



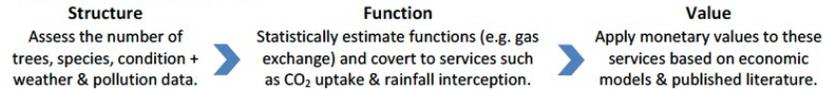
## What is i-Tree?

i-Tree is a suite of **free software tools for estimating and quantifying the benefits trees provide** to our communities. These benefits are typically expressed in dollars and amounts of carbon dioxide and air pollution removal (ozone, sulfur dioxide, etc.), as well as stormwater reduction. **Raising awareness** of these tree benefits increases the desire to nurture and protect trees.

## Who is using i-Tree?

- **Teachers, students, & homeowners** *learning* about trees beyond their aesthetic benefits.
- **Companies** *investing* in natural capital as part of their sustainability efforts.
- **Governments & organizations** *improving* their community forest management.
- **Consultants & Innovators** *developing* urban forest management plans, climate action plans, and interactive tree maps for their clients and the public.

## How does i-Tree work?



## Where does i-Tree come from?

i-Tree was **established in 2006** and is now used around the world. Based on peer-reviewed, publicly accessible **USDA Forest Service** research, the mission of i-Tree is to disseminate this science to large numbers of diverse users in an easy to use format.



*i-Tree is a non-profit, cooperative effort among these partners:*



## How do I get i-Tree?

Learn about these free tools at [www.itreetools.org](http://www.itreetools.org). Links to them as well as references, project examples, and video learning segments are available. Want to ask a question? User support is provided: [info@itreetools.org](mailto:info@itreetools.org).



### Tree Benefits! Growing 20 years in Ohio, USA, one red maple can:

- Remove 3,000 pounds of carbon dioxide from the atmosphere.
- Filter 15 pounds of pollution from the air we breathe.
- Save 500 kWh of electricity and 20 million BTU of fuel used for cooling & heating.
- Avoid 5,000 pounds of CO<sub>2</sub> and 30 pounds of pollution in powerplant emissions.
- Intercept 25,000 gallons of rainfall and avoid 4,500 gallons of runoff.

# i-Tree

Tools for Assessing and Managing Community Trees & Forests

www.itreetools.org



## MyTree

Explore the benefits of trees near you.

- Got 2 minutes?
- Go to [mytree.itreetools.org](http://mytree.itreetools.org) on your phone, tablet or laptop!

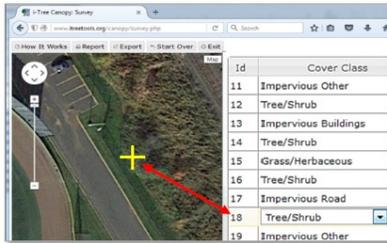
## i-Tree Canopy

Estimate tree & ground cover for a large project.

- A free web tool: [canopy.itreetools.org](http://canopy.itreetools.org)
- Simple, random sampling of a project area to estimate tree and ground cover.
- You also get total estimates of tree benefits: - CO<sub>2</sub> & air pollution removal - Stormwater reduction

4 easy steps & 30 minutes:

1. Draw project boundaries on a Google map.
2. Enter ground cover types to survey.
3. Select the ground cover you see on the map at random, auto-selected locations.
4. Click the Report button for results!



## i-Tree Eco

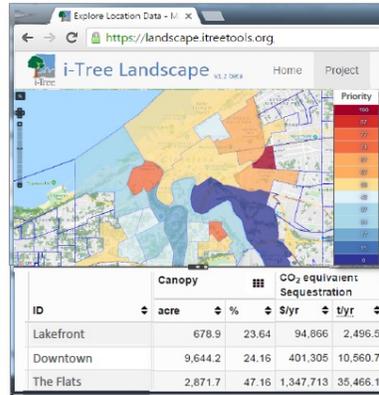
For community forestry managers.

- A free tool for Windows PCs.
- Supports street tree inventory imports.
- Includes mobile phone/tablet field data collection tools for complete or sample inventories.
- The best i-Tree estimates for tree benefits with comprehensive reports.
- Download Eco at [www.itreetools.org](http://www.itreetools.org)

## i-Tree Landscape

Learn about your entire community.

- A free web tool: [landscape.itreetools.org](http://landscape.itreetools.org)
- US watersheds, cities, census areas & more
- Get estimates of tree benefits in 10 minutes:
  - CO<sub>2</sub> mitigation
  - air pollution removal
  - stormwater reduction
  - health benefits
- Generate planting prioritization scenarios.



# i-Tree

Tools for Assessing and Managing Community Trees & Forests

www.itreetools.org



## OurTrees

Provides data on a community and its tree cover.

- Quick tree canopy and related information for any city or town within the continental United States using your a browser or Android / Apple device
- With inputs of a city or town it will estimate the amount of carbon dioxide and air pollution a city's trees remove, as well as stormwater impacts.

It's quick and easy! Just a couple of simple steps to get results.

1. Enter your city or town's name and state
2. Get a complete report immediately on your smartphone or computer



## i-Tree Design

Estimate tree & ground cover for a large project.

- A free web tool: [design.itreetools.org](http://design.itreetools.org)
- Just input location, species, tree size, and condition
- Calculates greenhouse gas mitigation, air quality improvements, and stormwater interception.

4 simple steps in minutes:

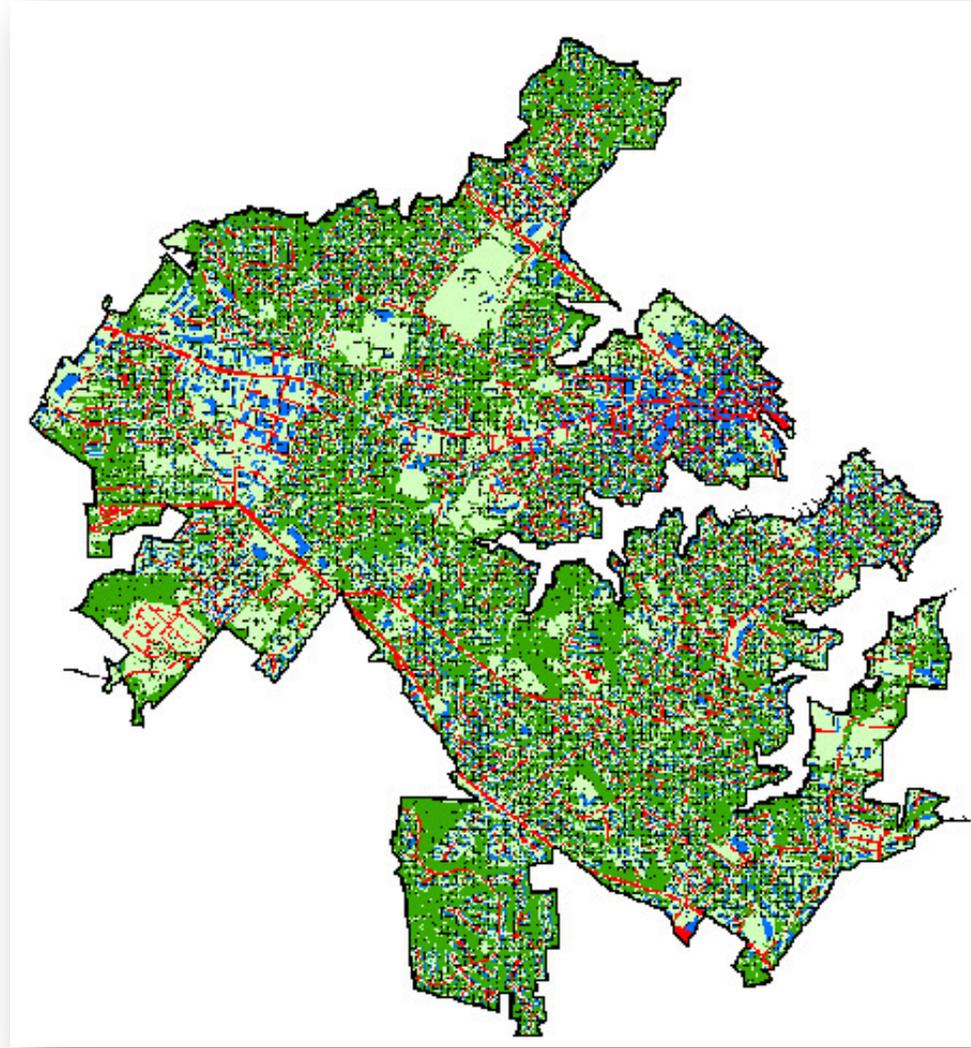
1. 'Draw' a building footprint on a Google Map
2. Virtually "plant" or place an existing or proposed tree location
3. Select tree species and size
4. Repeat or click Report button for your results!



# Urban Forests & Tree Canopy



# Urban Forests & Tree Canopy



Annapolis, MD

# Urban Forests & Tree Canopy



Brooklyn, NY

# Urban Forests & Tree Canopy



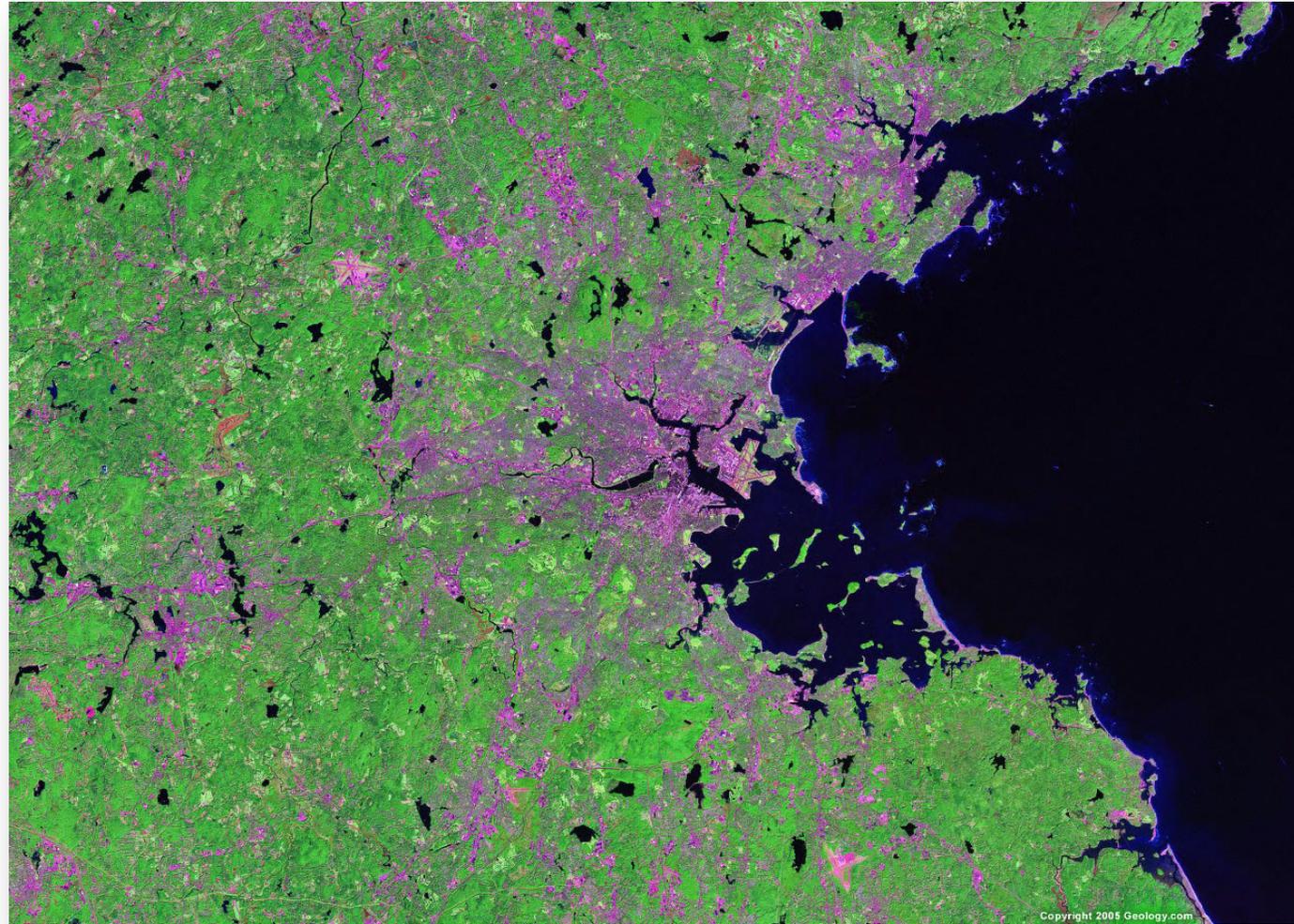
Chicago, IL

# Urban Forests & Tree Canopy



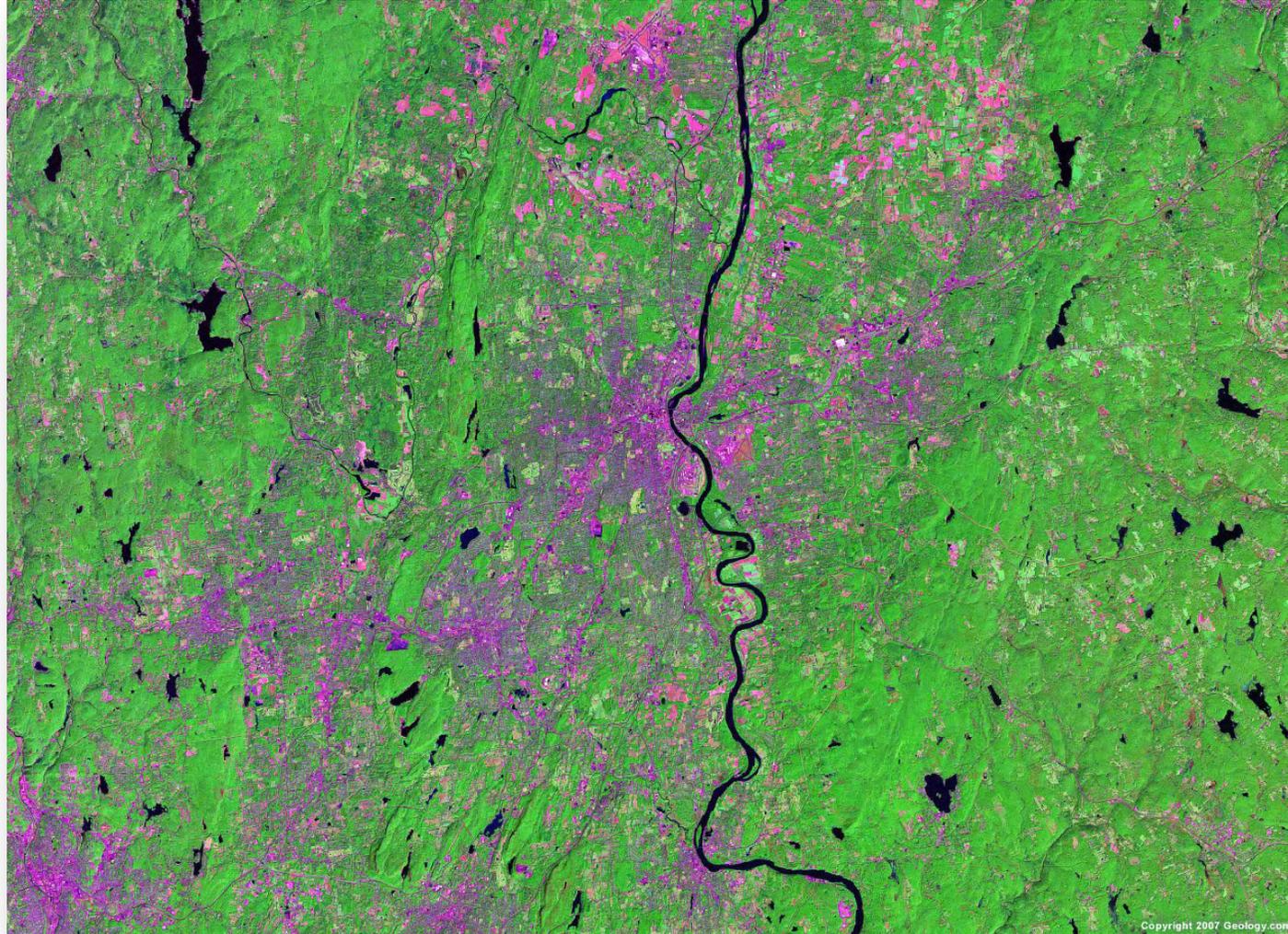
Detroit, MI

# Urban Forests & Tree Canopy



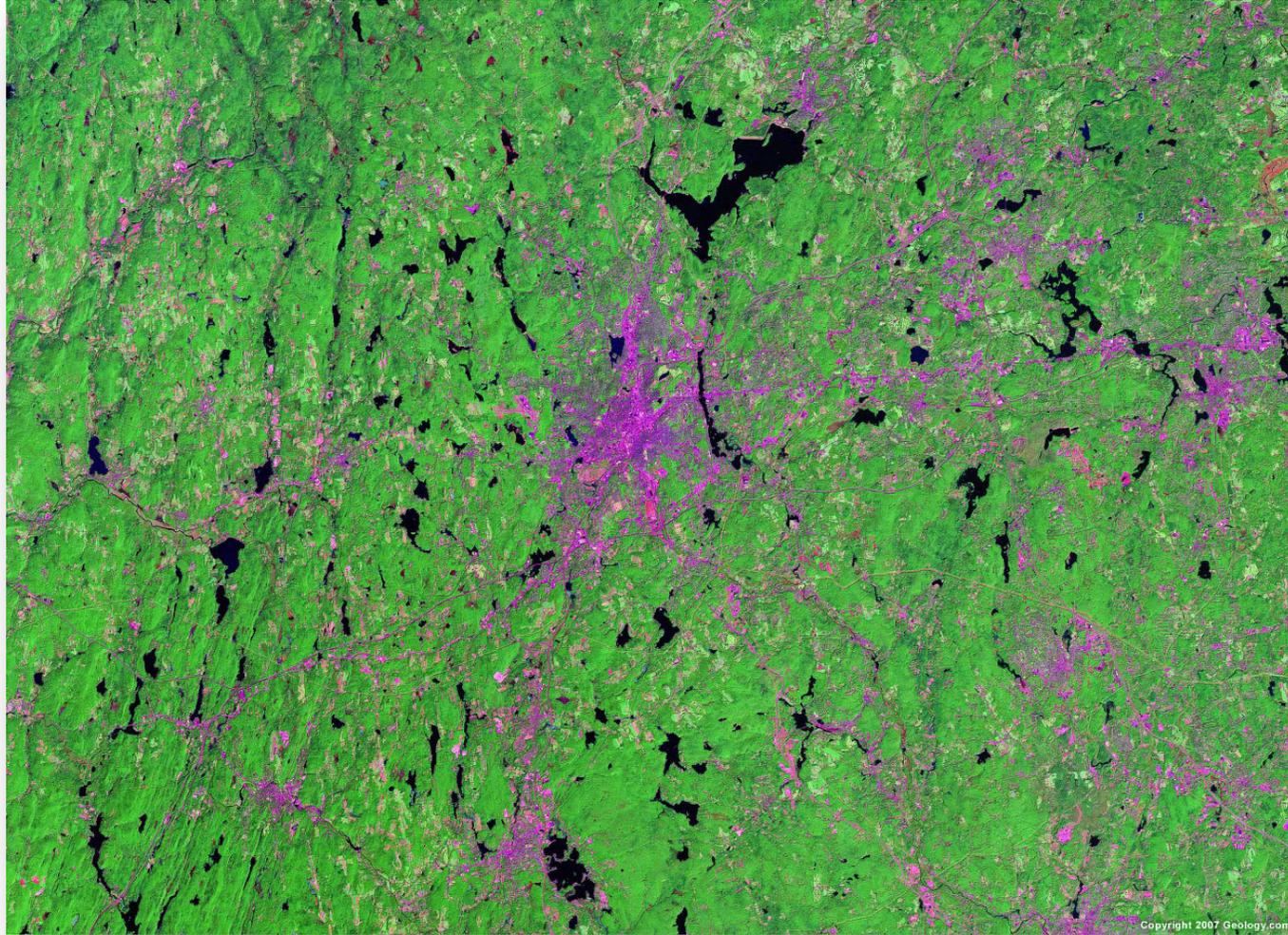
Boston, MA

# Urban Forests & Tree Canopy



Hartford, CT

# Urban Forests & Tree Canopy



Worcester, MA

# Urban Forests & Tree Canopy



# Urban Forests & Tree Canopy



# Urban Forests & Tree Canopy



# What is i-Tree?

🌳 A suite of tools to assess urban vegetation and their ecosystem services and values



# Public-Private Partnership

🌳 USDA Forest Service



🌳 Davey Tree Expert Co.



🌳 National Arbor Day Foundation



🌳 Society of Municipal Arborists



🌳 International Society of Arboriculture



🌳 Casey Trees



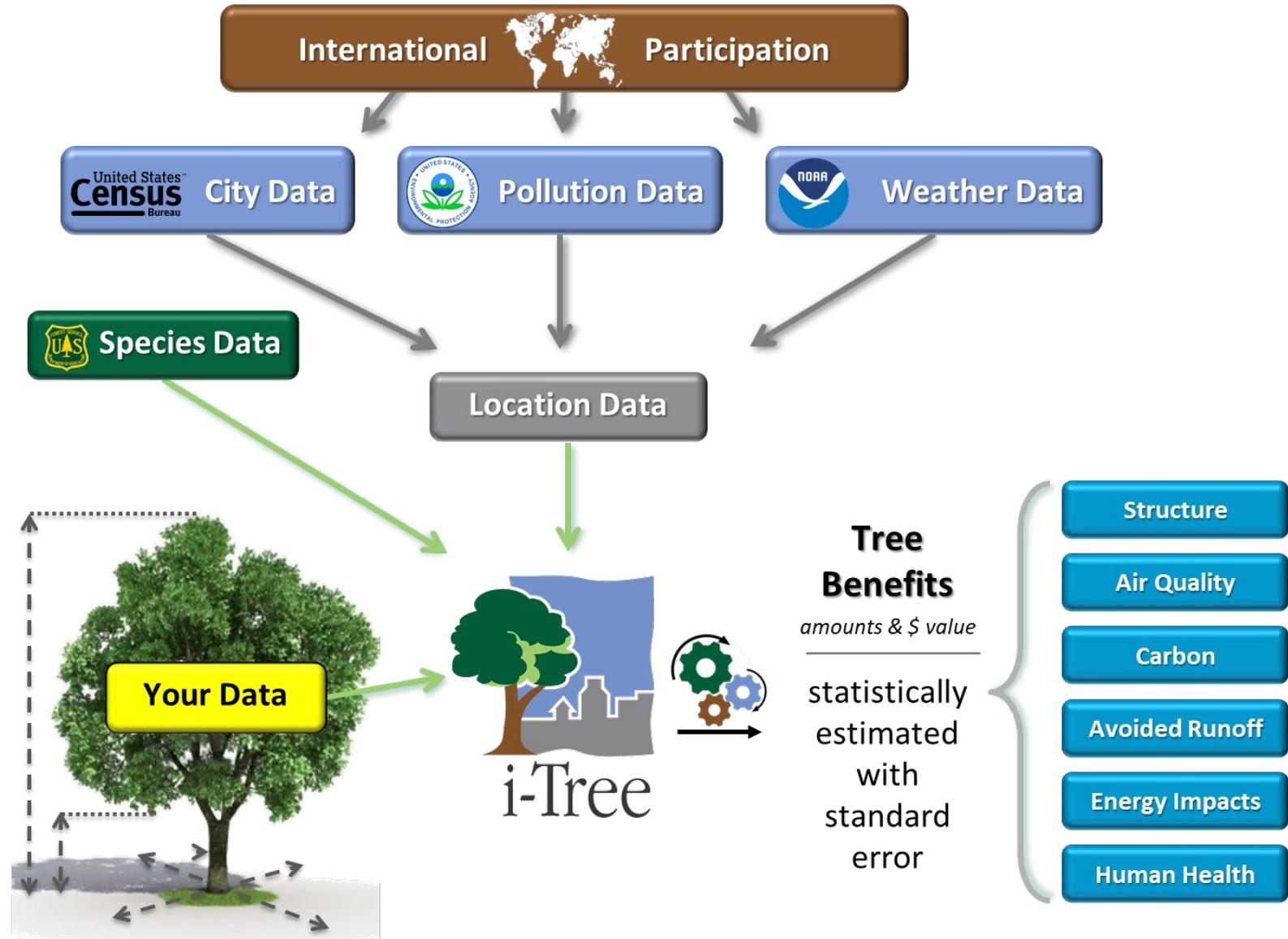
# What is i-Tree?

“Putting US Forest Service science into the hands of users.”

- Benefits-based approach
- Based on peer-reviewed research
- A 15-year collaborative effort
- Technical Support
- [www.itreetools.org](http://www.itreetools.org)



# i-Tree Conceptual Model Schematic



# Why i-Tree?

Opportunities for communities to...

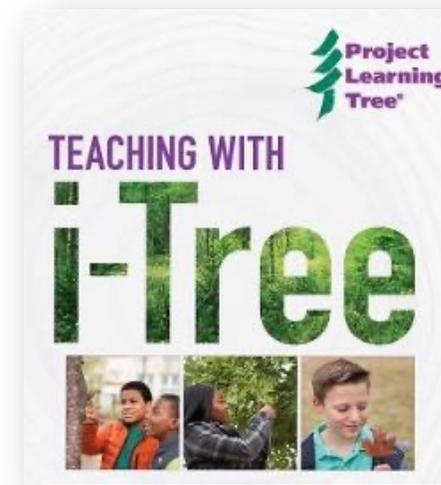
- Plan and manage urban forest resources more strategically to serve and protect citizens;
- Integrate urban forests in policies: sustainability, climate, resiliency, air quality, public health, stormwater, etc.;
- Support advocacy efforts with data;
- Improve preservation of trees and forests;
- Connect urban and rural forest importance.



# Why i-Tree?

Opportunities for communities to...

- Economic opportunities:  
attract & retain new businesses and residents;
- Promote green tourism and investment;
- Create green industry jobs;
- Sustainable development;
- Youth education & engagement;
- Develop new relationships & partnerships...



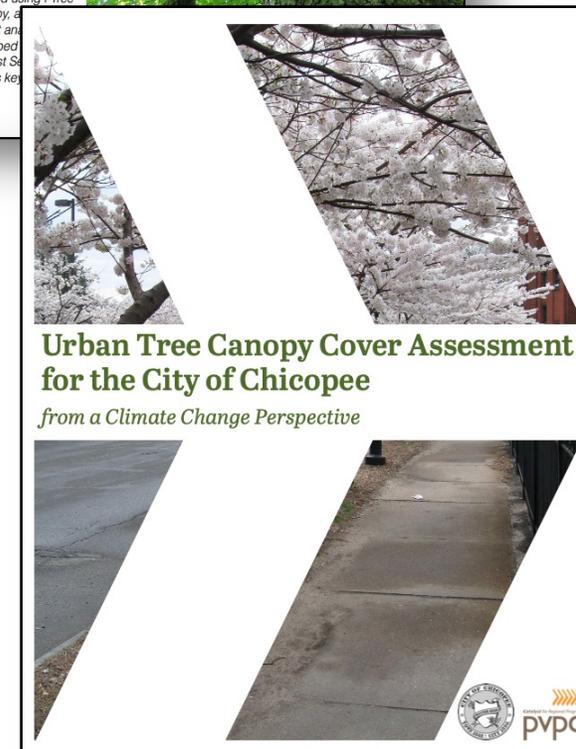
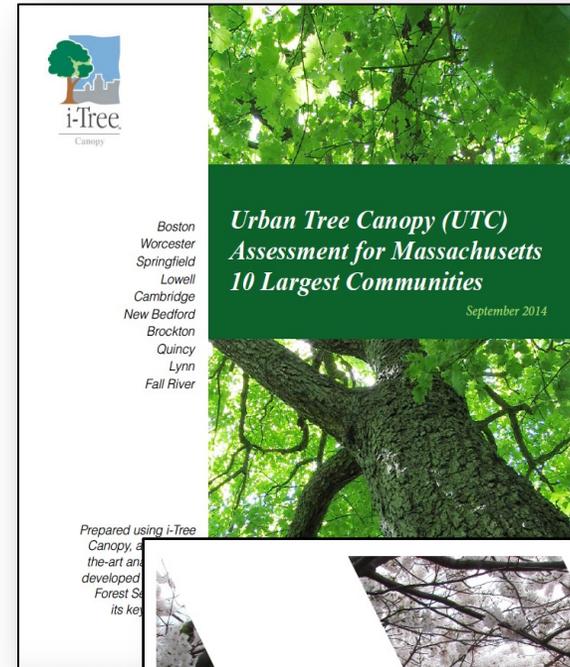
# i-Tree's Vision

*To improve forest and human health, and forest and city resiliency through easy-to-use technology that engages people globally in enhancing forest management.*

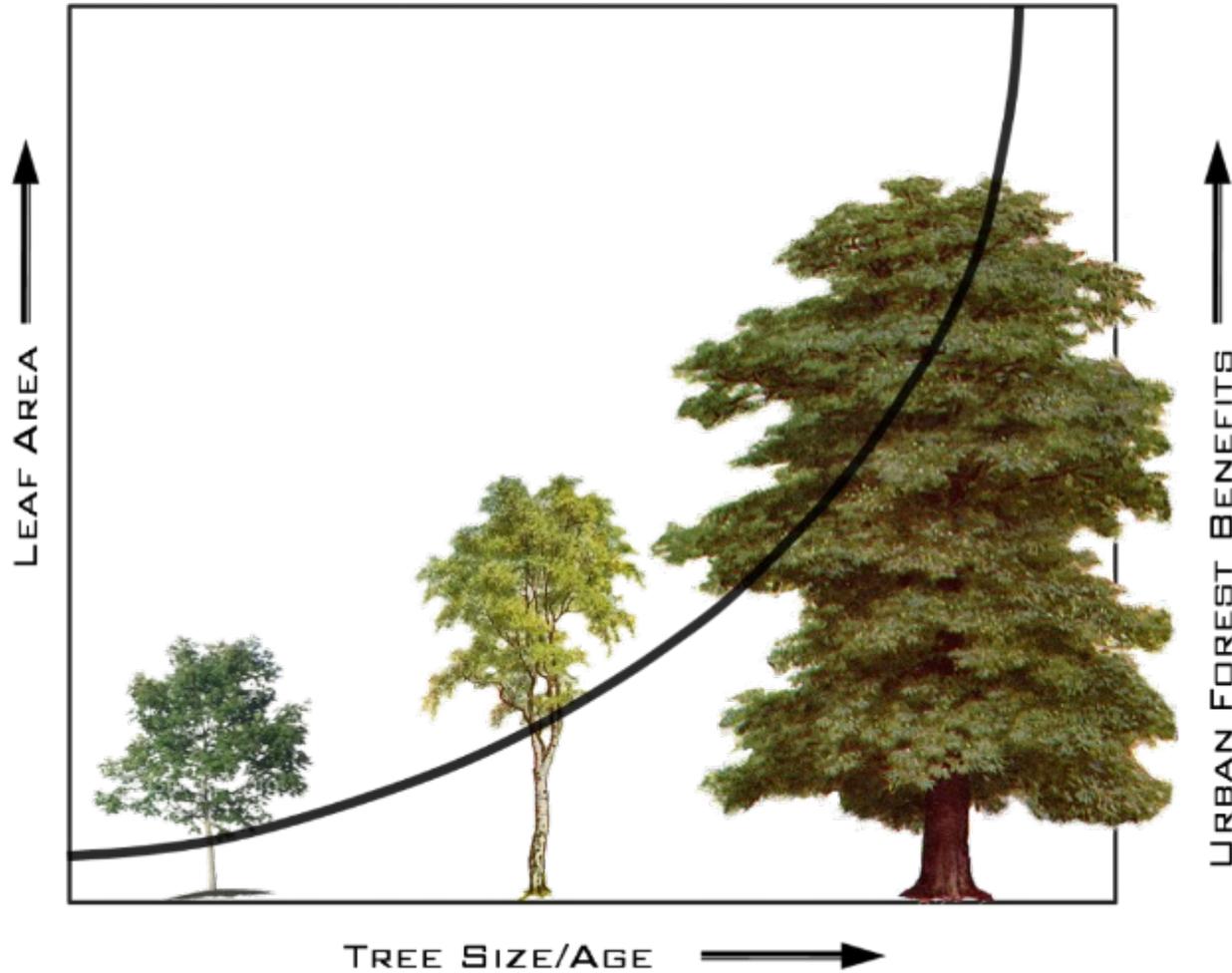


# Estimating Tree Benefits

- Air pollution removal
- Carbon storage and annual carbon sequestration
- Avoided stormwater run-off (*hydrology effects*)
- Energy effects (*home cooling & heating*)
- Structural assessment
- \$ Value for ecosystem services
- Public health impacts related to air quality



Tree species, size and leaf area area are key to calculating ecosystem services (benefits).



# Quantify Tree Benefits

with

# Research Science

Carbon dioxide storage and sequestration  
Air pollution removal  
Storm water reduction

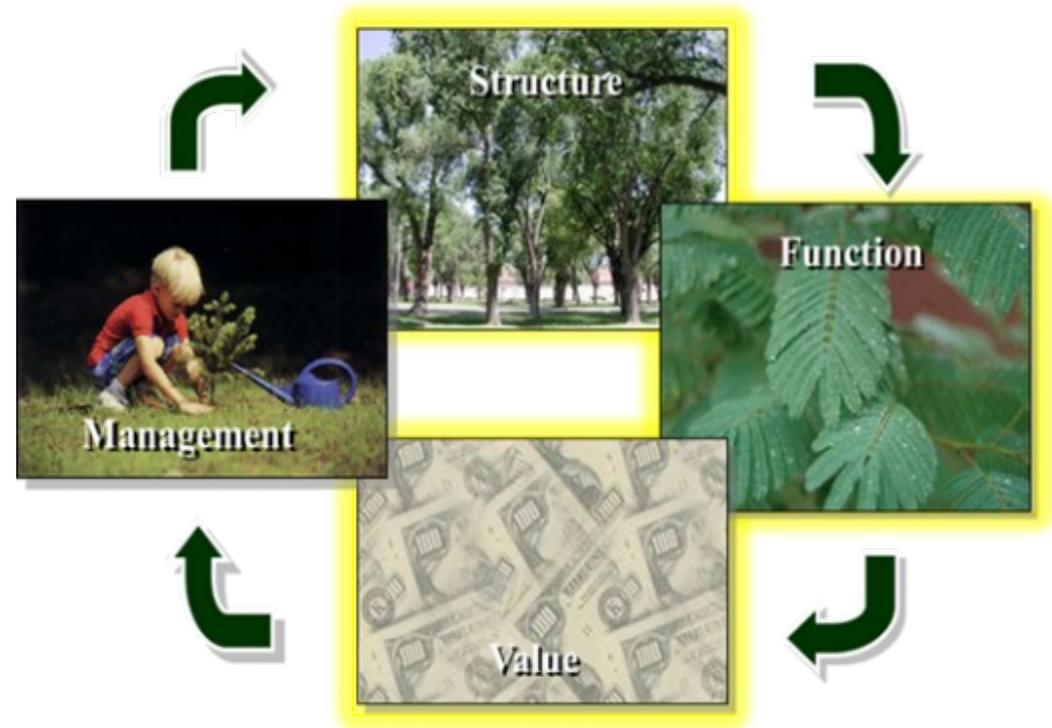
\$2.94 in benefits  
for every \$1.00 spent

## Benefit Summary for Pittsburgh's Street Trees

+ Benefits	Total (\$)
Energy	\$1,205,133
CO2	\$35,424
Air Quality	\$252,935
Stormwater	\$334,601
Aesthetic/Other	\$572,882
<b>Total Benefits</b>	<b>\$2,400,975</b>



The only infrastructure  
that increases in value  
over time.



# Research Science and Data Development



University Researchers



Planners, Engineers & Architects



Commercial Practitioners



Citizen Scientists

# What are your urban forestry challenges and opportunities?

*Executive Summary*

Pioneer Valley Planning Commission

## Pioneer Valley Climate Action and Clean Energy Plan

*Moving toward a carbon neutral future.  
Adapting to create resilient communities.*

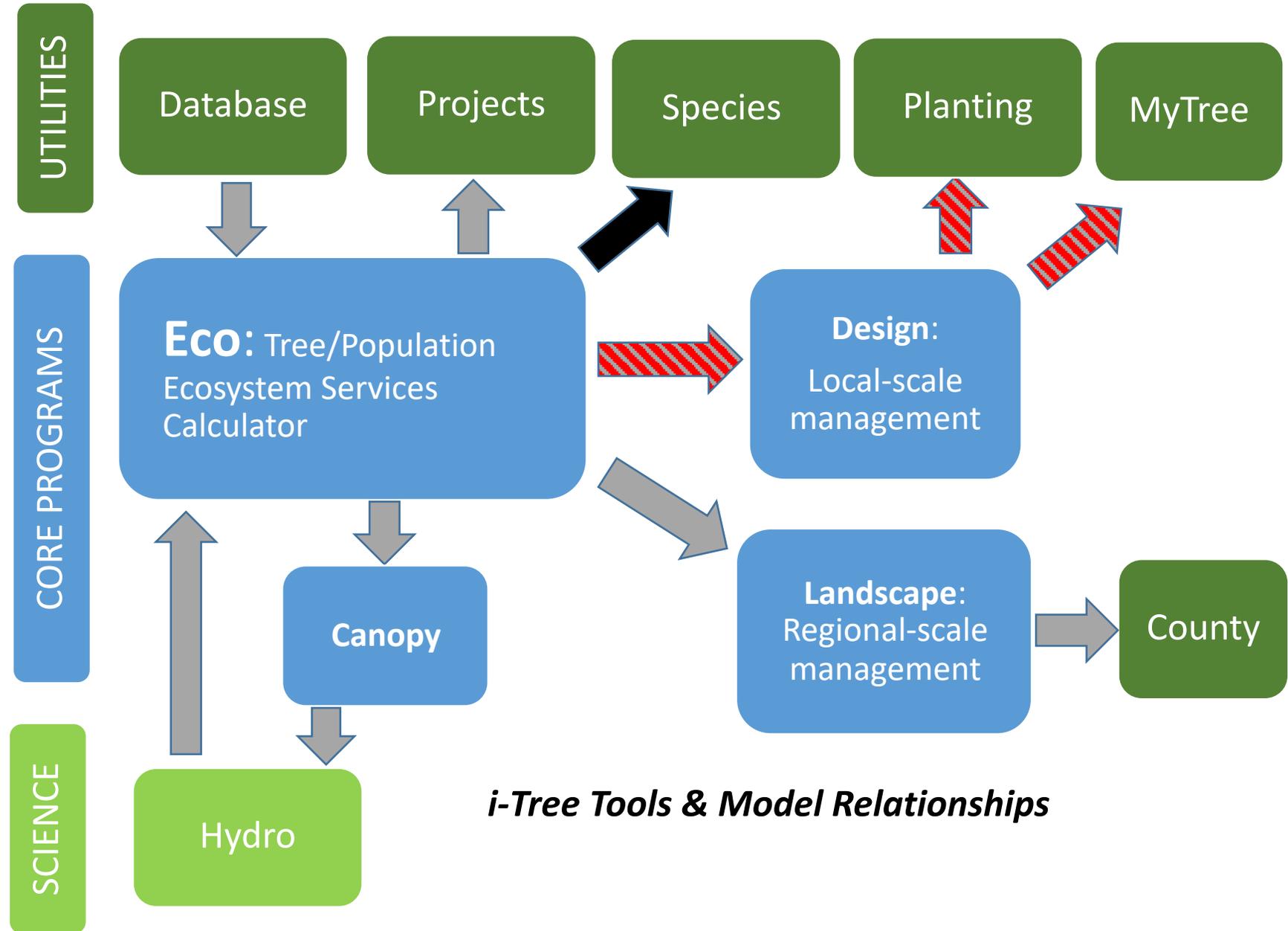
Produced by the Pioneer Valley Planning Commission with the support of the U.S. Department of Housing and Urban Development Sustainable Communities Initiative Regional Planning Grant Program.

March / 2014



# i-Tree Tool Selection Framework

- *My objectives?*
- *Tool advantages, limitations, and options?*
- *Available resources?*
- *Technical capacity or skillset?*
- *Timeline?*
- *Audience?*
- *What does success look like for me?*



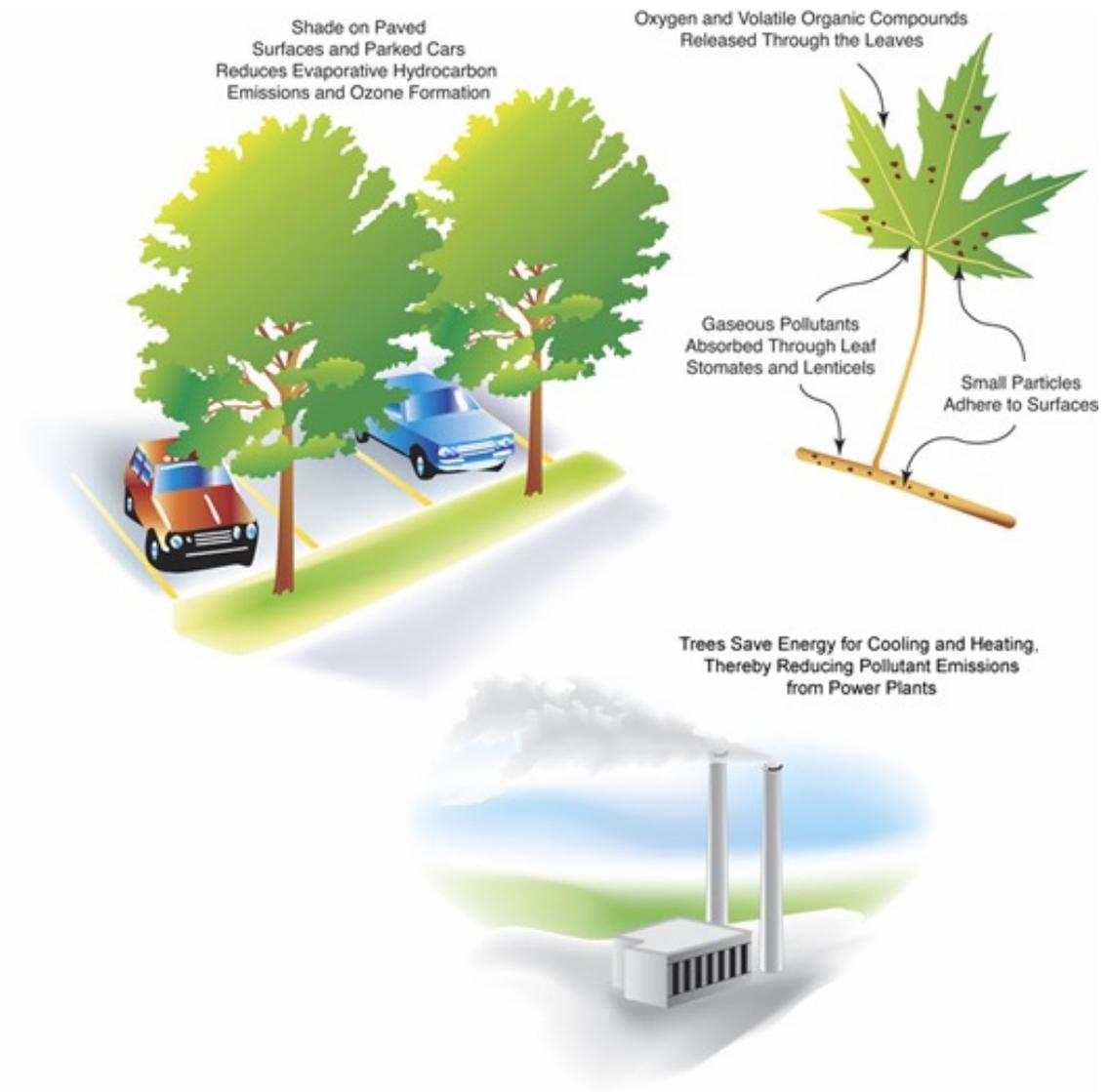
# The Foundation: Local Data

- Local Sample or Inventory
- Local information:
  - Weather
  - Pollution
  - Environmental Variables
- Hourly simulations



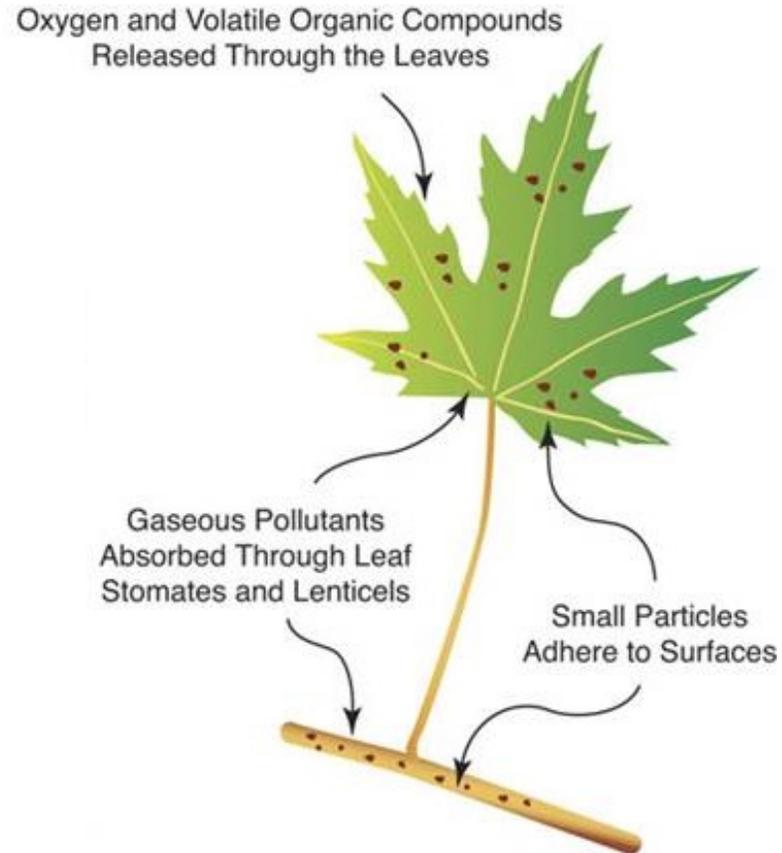
# Tree Benefit: Improve Air Quality

- Absorb pollutants through leaf surfaces
  - $O_3$  (ozone)
  - $NO_2$  (nitrogen dioxide)
  - $SO_2$  (sulfur dioxide)
- Intercept dust and/or particulate matter (PM10 and PM2.5)
- A reduction in energy production needs reduces creation of many air pollutants
- Release oxygen



# Improving Air Quality

- 15" Oak at 20 years (lbs):
  - $\text{NO}_2 = 0.98$
  - $\text{SO}_2 = 2.72$
  - $\text{PM}_{10} = 0.52$
  - Ozone = 0.84
  - VOCs = 0.21



# Tree Benefit: Reduce Carbon Dioxide CO<sub>2</sub>

- Trees are largely made of carbon so they take carbon out of the air and turn it into tissue (bark, leaves, wood, etc.)
- Tree can help reduce home energy needs, which also reduces additional carbon emissions released from power plants in the first place (*Secondary benefit*)



Image courtesy of the Center for Urban Forest Research

# Reducing Atmospheric Carbon Dioxide

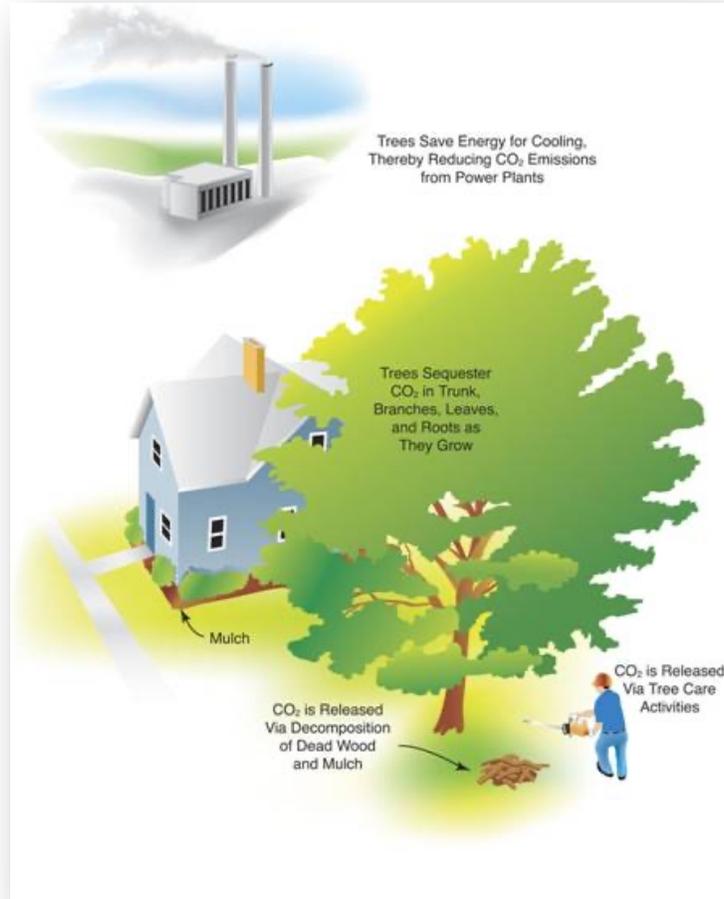
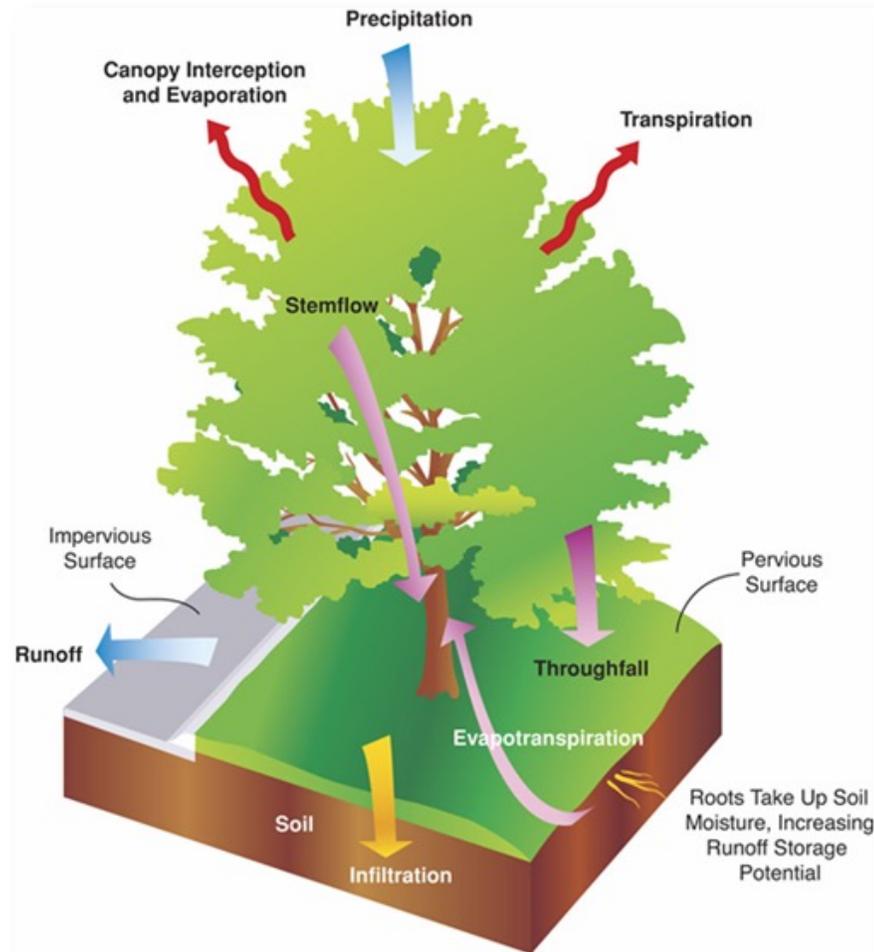


Image courtesy of the Center for Urban Forest Research

- 10" diameter deciduous shade trees*
- 🌳 100 trees remove five tons of CO<sub>2</sub>/year
  - 🌳 100 trees remove about 1000 lbs of pollutants per year, including:
    - 400 lbs of ozone
    - 300 lbs of particulates

# Tree Benefit: Hydrology Effects

- Intercepts and holds rain on leaves, branches, and other surfaces
- Reduces stormwater runoff
- Increases water storage in soil
- Increase infiltration and helps recharge aquifers (underground water)
- Reduces erosion



# Trees & Energy – Summer Effects

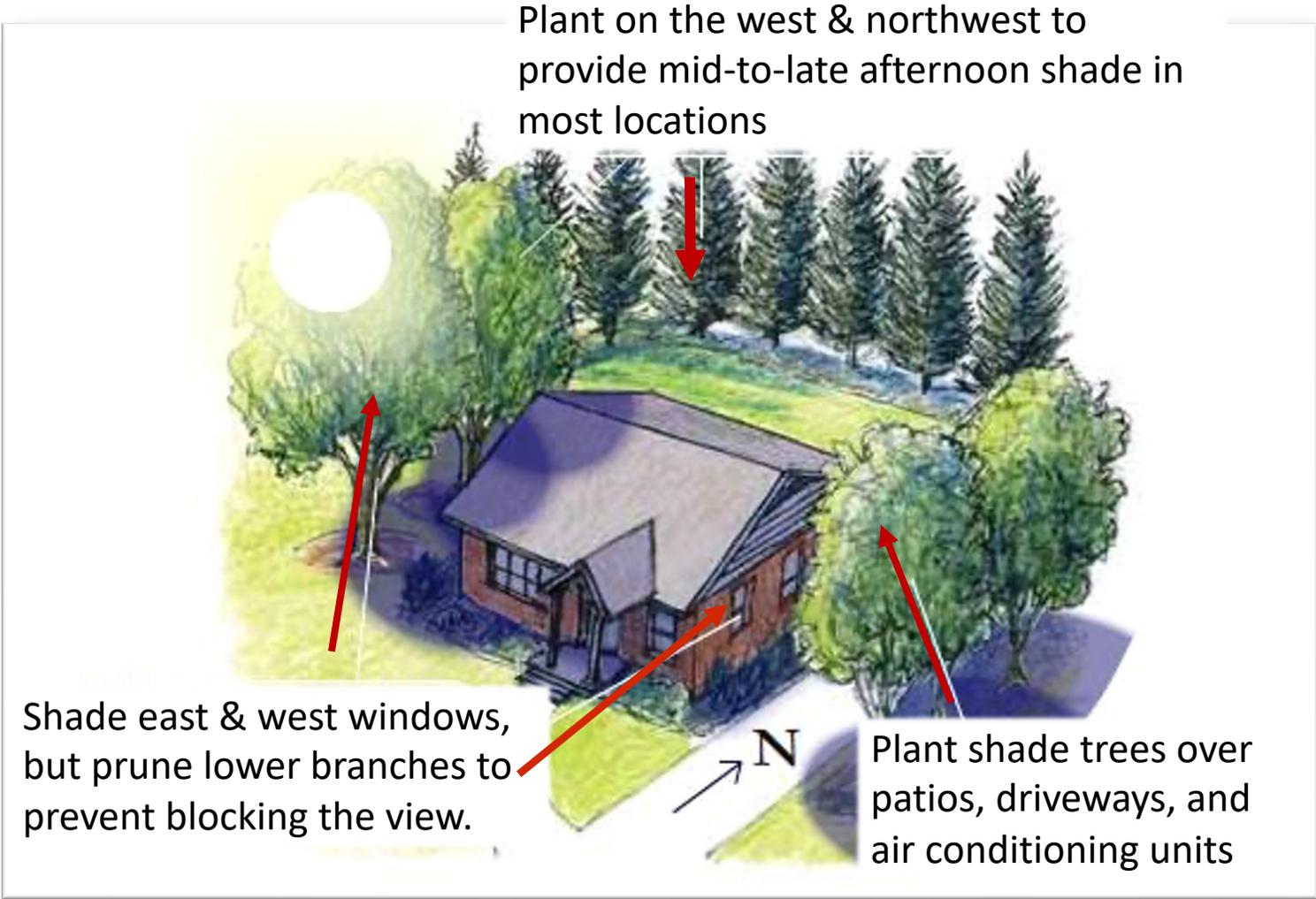
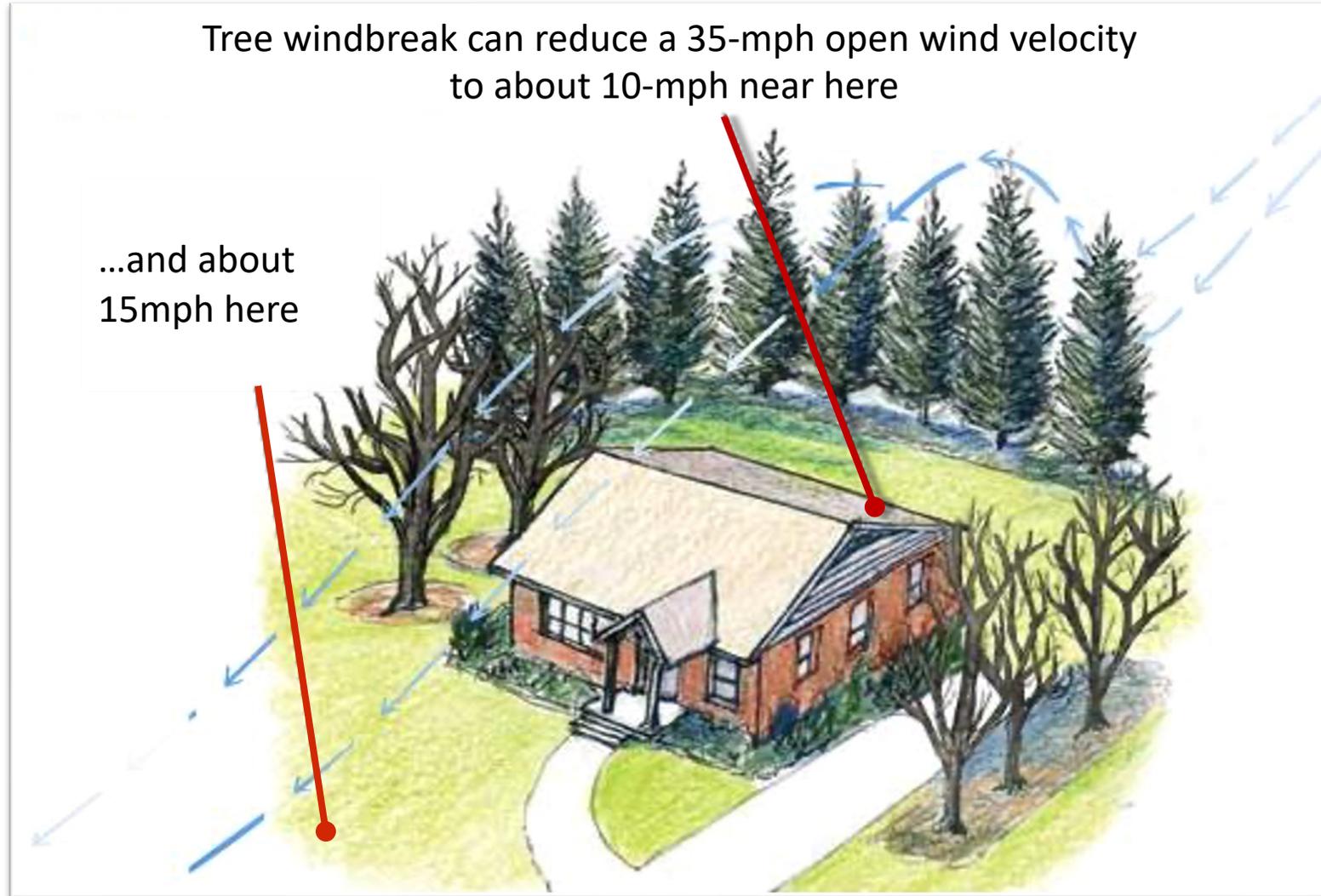


Image courtesy of Arbor Day Foundation  
<https://www.arborday.org/trees/>

# Trees & Energy – Winter Effects



# Tree Benefit: Energy Effects Summary

- Trees shade buildings and built surfaces (summer)
- Act as a wind break reducing heat loss when cold (winter)



- 🌳 Trees cool the air – (climate effect)
- 🌳 Reduce energy demand at power generation source  
(*Secondary benefit*)

# Conserving Energy



## *Northeast U.S. Average*

- Save up to 30% of annual air conditioning costs
- Save 10-25% of winter heating costs

USDA Forest Service, i-Tree, 2021

# www.itreetool.org Resources

i-Tree delivers current, peer-reviewed tree benefits estimation science from the USDA Forest Service to all types of users with free tools and support.



**The trees around you:**  
remove hazardous pollutants from the air you breathe,  
absorb carbon dioxide from the air to store as wood,  
and control storm water by intercepting and absorbing rainfall.

**Trees provide more than just beauty and shade.**

**They work hard for all of us, every day!**

[Click here to learn more.](#)

## Tools for assessing individual trees



easy

### MyTree

Are you new to i-Tree? Start with our EASIEST tool! MyTree helps you quickly assess **individual trees** with a minimum of fuss.  
*via your web browser or Android | Apple devices*



### i-Tree Design

A full-featured web tool with expanded building interactions and forecasting for estimating the benefits of **individual trees**.  
*via your web browser*



advanced

### i-Tree Eco

Eco is our flagship tool that accommodates tree inventory IMPORT or field data evaluation to derive **individual tree** benefit estimates.  
*requires installation on a Windows PC*

## Tree canopy area assessment tools



easy

### OurTrees

Beta release: Quick **tree canopy** and related information for your community within the continental US!  
*via your web browser or Android | Apple devices*



### i-Tree Landscape

US **tree canopy** and Census maps/data at your fingertips! Identify priority planting & protection areas for climate & social issues.  
*via your web browser*



office assessment

### i-Tree Canopy

From your chair, easily estimate land cover and **tree canopy** plus benefits using random point sampling on aerial imagery.  
*via your web browser*

[More tools...](#)

MyTree

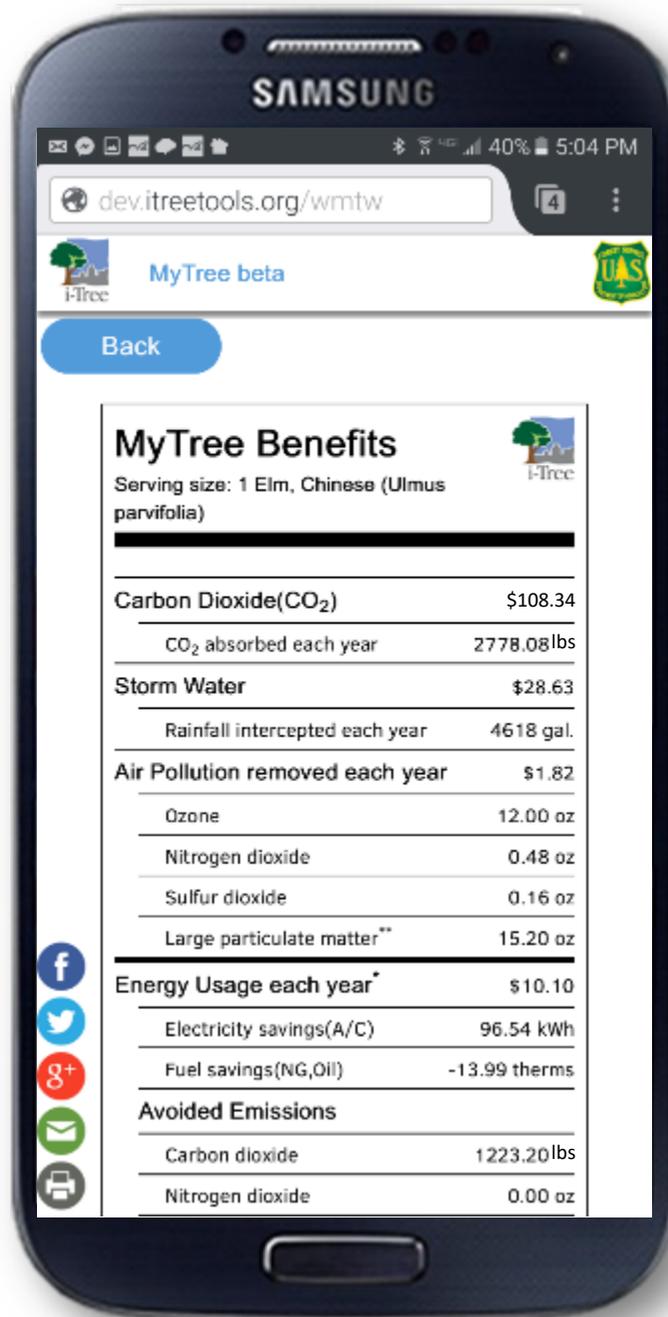
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i-Tree™

MyTree



i-Tree on the go...

for individual or multiple trees!



MyTree

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# i-Tree quick summary data for any community

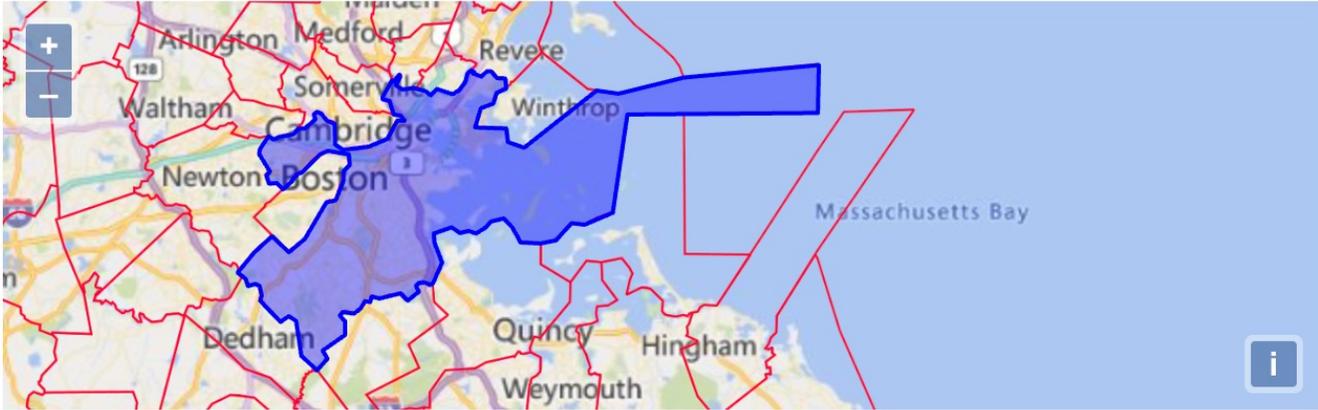


**OurTrees**  
A tree canopy assessment tool.

Home Project ▾ Menu ▾

## Where is your community?

*For the CONTINENTAL U.S., enter a city and state above and/or use the map below.*



Streets  Satellite

*Some locations may fail to calculate if no matching location is found in our database — if your calculation fails please edit your location by spelling out any abbreviations or try using a nearby city.*



# i-Tree quick summary data Boston, MA

## OurTrees Benefits

Trees in Boston, MA

### Serving Size:

16.96% tree canopy on 5,240 acres

60.45% impervious surfaces over 18,677 acres

**Total benefits for this year: \$7,532,749**

#### Annual values:

**Carbon Dioxide Uptake \$896,712**

Carbon Sequestered 5,256 tn

CO<sub>2</sub> Equivalent<sup>1</sup> 19,273 tn

**Storm Water Mitigation \$923,081**

Runoff Avoided 103 MG/yr

Rainfall Intercepted 307 MG/yr

**Air Pollution Removal \$5,712,957**

Carbon Monoxide 4,632 lb/yr

Ozone 178,000 lb/yr

Nitrogen Dioxide 61,033 lb/yr

Sulfur Dioxide 17,627 lb/yr

PM<sub>2.5</sub> 12,898 lb/yr

#### Values are totals to date:

**Carbon Dioxide Uptake \$34,197,062**

Carbon Storage 200,453 tn

CO<sub>2</sub> Equivalent<sup>1</sup> 734,994 tn

Benefits are based on USDA Forest Service research and are meant for guidance only. Visit [www.itreetools.org](http://www.itreetools.org) to learn more.

[+ Read the fine print.](#)

## OurTrees

### Community

Location! Location! Location! Context is important when it comes to the trees all around us. Here are some fast facts from the U.S. census:

Boston, MA

#### – Population

Total Population 617,594

Under 5 32,420

Under 18 103,710

Over 64 62,237

Median Age 31 years

Minority Percent 46.1%

#### – Income Overview

Median Income \$50,684

Per Capita Income \$31,856

Percent Impoverished 15.9%

#### – Homes

Total Housing Units 272,481

Median Year Built 0

Median Value \$395,200

#### + Household Types

#### + Home Tenure

Benefits are based on USDA Forest Service research and are meant for guidance only. Visit [www.itreetools.org](http://www.itreetools.org) to learn more.

[+ Read the fine print.](#)

# i-Tree Canopy

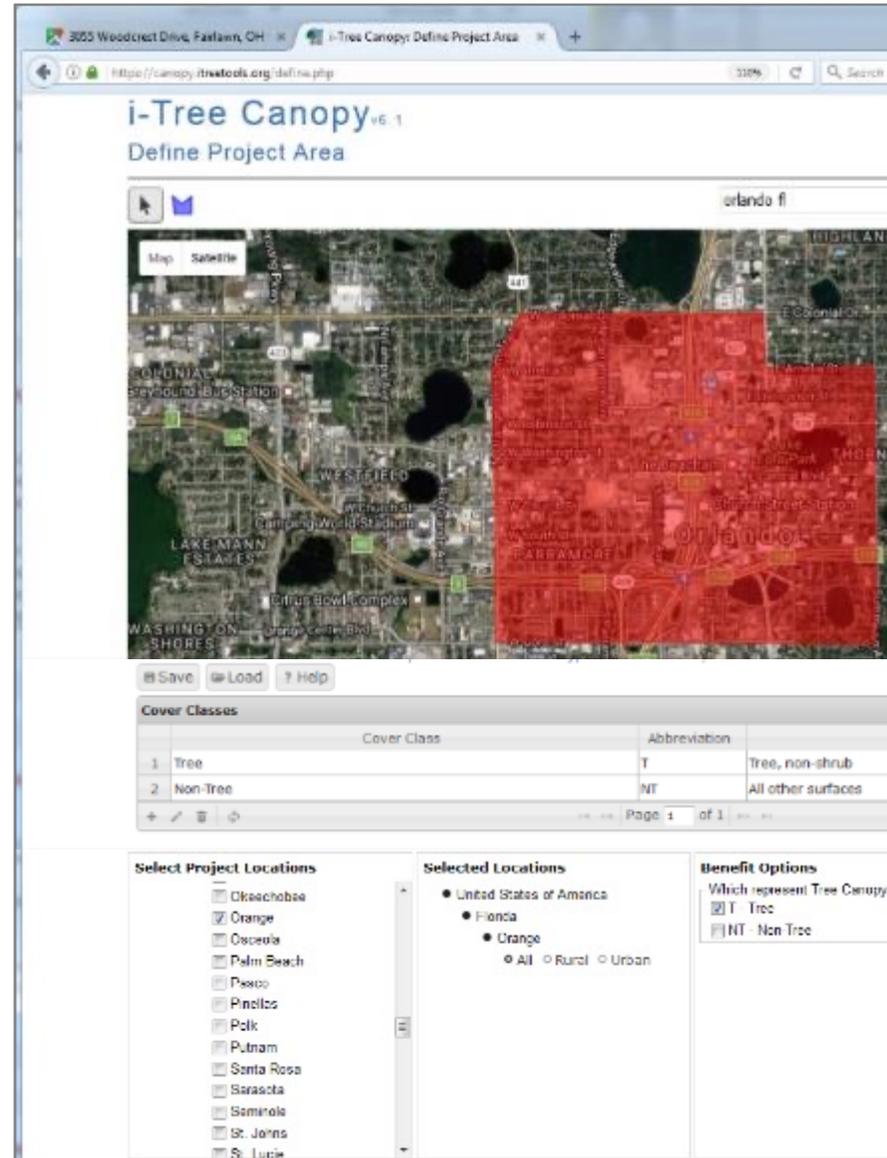
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# i-Tree Canopy

Quick, statistical estimate of Canopy cover and associated benefits.

- Create custom cover classes
- Random point locations
- Does not automatically assign cover class at point



Cover Class	Description	Abbr.	Points	% Cover
Tree	Tree, non-shrub	T	11	10.3 ±5.0
Non-Tree	All other surfaces	NT	49	81.7 ±5.0

Abbr.	Benefit Description	Value	±SE	Amount
CO	Carbon Monoxide removed annually	\$174.40	±47.52	656.72 lb
NO2	Nitrogen Dioxide removed annually	\$156.26	±42.58	1,511.65 lb
O3	Ozone removed annually	\$9,249.84	±2,520.35	9.48 T
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$17,942.75	±4,888.94	848.77 lb
SO2	Sulfur Dioxide removed annually	\$6.22	±1.69	133.89 lb
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$6,763.14	±1,842.78	2.48 T
CO2seq	Carbon Dioxide sequestered annually in trees	\$81,603.57	±22,234.90	2,314.64 T
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$1,321,118.93	±359,971.39	37,472.84 T ±1

Enhanced UI coming soon!

The screenshot shows the i-Tree Canopy web application interface. At the top, the browser address bar shows 'localhost:8001/map#'. The application header includes the i-Tree logo, 'i-Tree Canopy v6.1', and navigation links for 'Home', 'Project', 'Menu', and 'i-Tree'. A 'Feedback' link is also present.

A configuration instruction reads: "Configuration step 1 of 3: Use the map and tools provided to define the area you want to survey. The easiest option is to select a pre-existing boundary, but you can draw your own areas right on the map, or load in one or more shapefiles."

The main interface features a map with a search bar at the top left. A central dialog box titled "Select a Shapefile" is open, containing two file selection fields: "Shapefile (\*.shp):" and "Projection (\*.prj):", each with a "Choose File" button and a "Browse" button. A warning message below these fields states: "Using projections other than WGS84 (EPSG:4326) may not produce the correct results. This feature is currently experimental." The dialog has "OK" and "Cancel" buttons at the bottom.

On the right side, a sidebar contains several sections: "Just curious? Dive right into survey mode with an existing project." with a "Launch Our Example Project" button; "Ready to survey your own area? Use these functions to define map areas."; "US Boundaries" with a list of administrative areas (US Census Block Groups, US Census Places, County Subdivisions, US Counties, US 115th Congressional Districts, US States) each with a selection icon and a color-coded line; a "Load ESRI Shapefile" button; and "Draw or Add Areas" with "Select", "Draw", and "Delete" buttons.

At the bottom right, there is a "Next" button. The Google logo is visible in the bottom left corner of the map area, and map data attribution is at the bottom center.

# i-Tree Canopy preview

The screenshot shows the i-Tree Canopy web application interface. At the top, the browser address bar shows 'localhost:8001/map#'. The application header includes the i-Tree logo, the text 'i-Tree Canopy v6.1', and navigation links for 'Home', 'Project', 'Menu', and 'i-Tree'. A 'Feedback' link is also present.

Below the header, a configuration step is displayed: **Configuration step 1 of 3:** Use the map and tools provided to define the area you want to survey. The easiest option is to select a pre-existing boundary, but you can draw your own areas right on the map, or load in one or more shapefiles.

The main area features a satellite map of the United States. A red polygon is drawn over the Northeastern United States. A red arrow points from the 'Draw' button in the right-hand panel to this polygon.

The right-hand panel contains several sections:

- Launch Our Example Project** (button)
- Ready to survey your own area? Use these functions to define map areas.**
- US Boundaries** (dropdown menu)
- Administrative** (checkboxes and colored lines for:
  - US Census Block Groups (blue)
  - US Census Places (pink)
  - County Subdivisions (red)
  - US Counties (orange)
  - US 115<sup>th</sup> Congressional Districts (grey)
  - US States (purple)
- Load ESRI Shapefile** (button)
- Draw or Add Areas** (section header)
- Use one of these tools to work with the map.** (instructions)
- Select** (blue button with icon), **Draw** (blue button with pencil icon), **Delete** (red button with trash icon)

At the bottom right, there is a 'Next' button. The Google logo is visible in the bottom left corner of the map area, and map data attribution is at the bottom right.

# i-Tree Canopy preview

i-Tree Canopy v6.1 Home Project Menu i-Tree Feedback

**Configuration step 1 of 3:** Use the map and tools provided to define the area you want to survey. The easiest option is to select a pre-existing boundary, but you can draw your own areas right on the map, or load in one or more shapefiles.

Search

Just curious? Dive right into survey mode with an existing project.

Launch Our Example Project

Ready to survey your own area? Use these functions to define map areas.

US Boundaries

Administrative

- US Census Block Groups
- US Census Places
- County Subdivisions
- US Counties
- US 115<sup>th</sup> Congressional Districts
- US States

Load ESRI Shapefile

Draw or Add Areas

Use one of these tools to work with the map.

Select Draw Delete

Google

Map data ©2019 Imagery ©2019 NASA, TerraMetrics Terms of Use

Next

# i-Tree Canopy preview

i-Tree Canopy v6.1 Home Project Menu i-Tree Feedback

**Conduct your survey:** With each point you add, the map will shift to a new, random location where you assess the land cover at the yellow crosshairs in the center of the map. The more points you survey, the lower your standard error, and the more precise your sampling will be. More points provide a better estimation of Land Cover across your study area.



ID	Cover Class	Latitude	Longitude
1	Impervious Other	41.74094	-72.65320
2	Impervious Road	41.74315	-72.66277
3	Tree/Shrub	41.76941	-72.68937
4	Grass/Herbaceous	41.78738	-72.69409
5	Tree/Shrub	41.73479	-72.67216
6	Impervious Other	41.78946	-72.66989
7	Tree/Shrub	41.79791	-72.71115
8	Tree/Shrub	41.74369	-72.66156
9	Grass/Herbaceous	41.80402	-72.71483
10	Grass/Herbaceous	41.79908	-72.65136

+ Page 1 of 50

Map data ©2019 Imagery ©2019 Terms of Use Report a map error

i-Tree Canopy v6.1  
Cover Assessment and Tree Benefits Report  
Estimated using random sampling statistics on 7/17/19

Cover Class	% Covered
H (Grass/Herbaceous)	~22%
T (Tree/Shrub)	~25%
IB (Impervious Buildings)	~15%
IR (Impervious Road)	~8%
IO (Impervious Other)	~21%
W (Water)	~4%
S (Soil/Bare Ground)	~3%

Cover Class	Description	Abbr.
Grass/Herbaceous		H
Tree/Shrub		T
Impervious Buildings		IB

Cover Class	Description	Count	%	±SE
H	Grass/Herbaceous	113	22.6 ± 1.87	4.06 ± 0.34
T	Tree/Shrub	131	26.2 ± 1.97	4.71 ± 0.35
IB	Impervious Buildings	74	14.8 ± 1.59	2.66 ± 0.29
IR	Impervious Road	43	8.60 ± 1.25	1.55 ± 0.23
IO	Impervious Other	105	21.0 ± 1.82	3.76 ± 0.33
W	Water	21	4.20 ± 0.90	0.76 ± 0.16
S	Soil/Bare Ground	13	2.60 ± 0.71	0.47 ± 0.13

### Tree Benefit Estimates: Carbon (English units)

Description	Carbon (T)	±SE
Sequestered annually in trees	4,129.69	±309.82
Stored in trees (Note: not an annual rate)	103,711.91	±7,784.82

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points.

### Tree Benefit Estimates: Air Pollution (English units)

Abbr.	Description	Value (USD)	±SE	Amount (T)	±SE
CO	Carbon Monoxide removed annually	\$2,042.42	±153.30	3.29	±0.25
NO2	Nitrogen Dioxide removed annually	\$1,955.81	±146.80	8.15	±0.61
O3	Ozone removed annually	\$77,039.58	±5,782.38	57.57	±4.32
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$156,116.15	±11,717.65	2.86	±0.21
SO2	Sulfur Dioxide removed annually	\$120.28	±9.03	1.54	±0.12
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$26,900.62	±2,019.09	7.99	±0.60
<b>Total</b>		<b>\$264,174.87</b>	<b>±19,828.23</b>	<b>81.41</b>	<b>±6.11</b>

Air Pollution Estimates are based on these values in \$/ton/yr: CO 2.178 @ \$922.27; NO2 3.308 @ \$240.80; O3 30.860 @ \$1,342.80; PM2.5 1.688 @ \$34,670.16; SO2 1.020 @ \$70.22; PM10\* 3.284 @ \$3,377.10. Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points.

### Tree Benefit Estimates: Hydrological (English units)

Abbr.	Benefit	Value (USD)	±SE	Amount (Mgal)	±SE
AVRO	Avoided Runoff	\$191,147.69	±14,347.02	21.39	±1.61
E	Evaporation	N/A	N/A	223.52	±16.78
I	Interception	N/A	N/A	224.07	±16.82
T	Transpiration	N/A	N/A	370.12	±27.78
PE	Potential Evaporation	N/A	N/A	1,864.93	±139.98
PET	Potential Evapotranspiration	N/A	N/A	1,369.84	±102.82

Hydrological Estimates are based on these values in \$/Mgal/yr: AVRO 4.04; E 47.2; I 47.6; T 78.6; PE 205.9; PET 290.8. Hydrological Value is based on amount of Avoided Runoff @ \$2,395.92/Mgal/yr. Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points.

About i-Tree Canopy  
The concept and prototype of this program were developed by David L. Nowak, Jeffrey T. Walton, and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Gillesworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

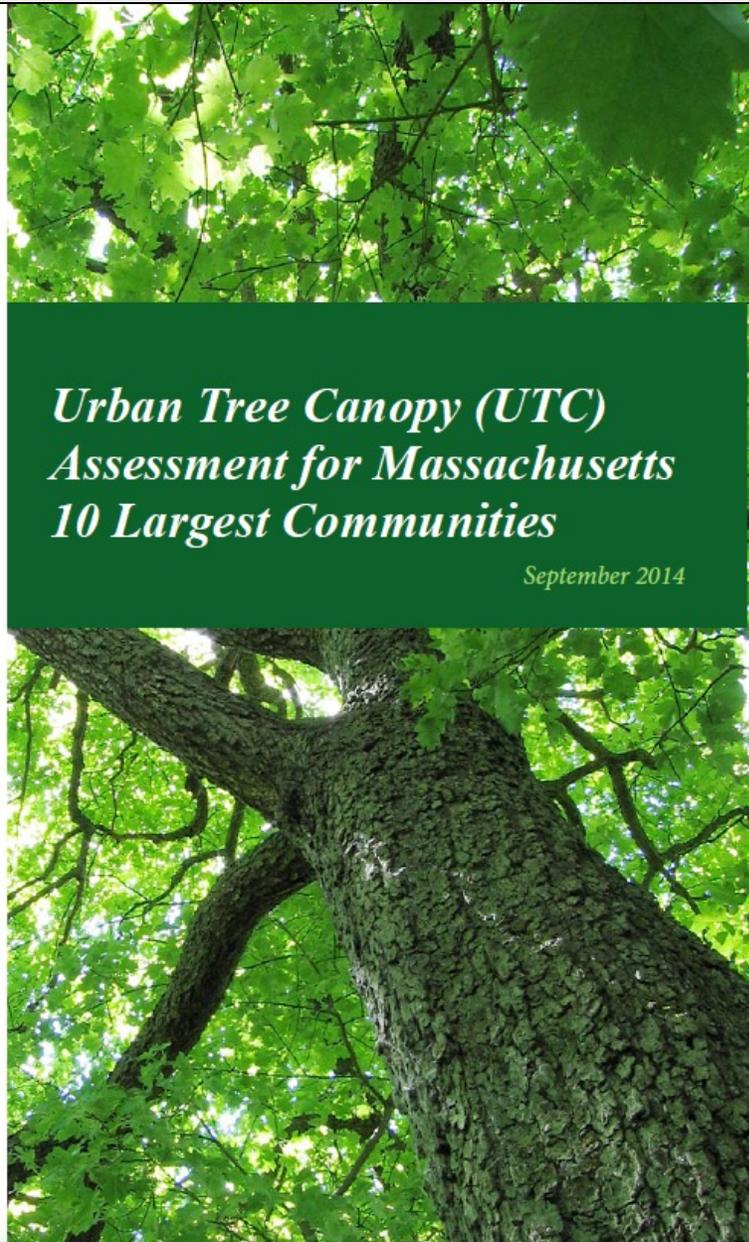
Limitations of i-Tree Canopy  
The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. As the number of points increase, the precision of the estimate will increase as the standard error of the estimate will decrease. If too few points are classified, the standard error will be too high to have any real certainty of the estimate.

Use of this tool indicates acceptance of the EULA.



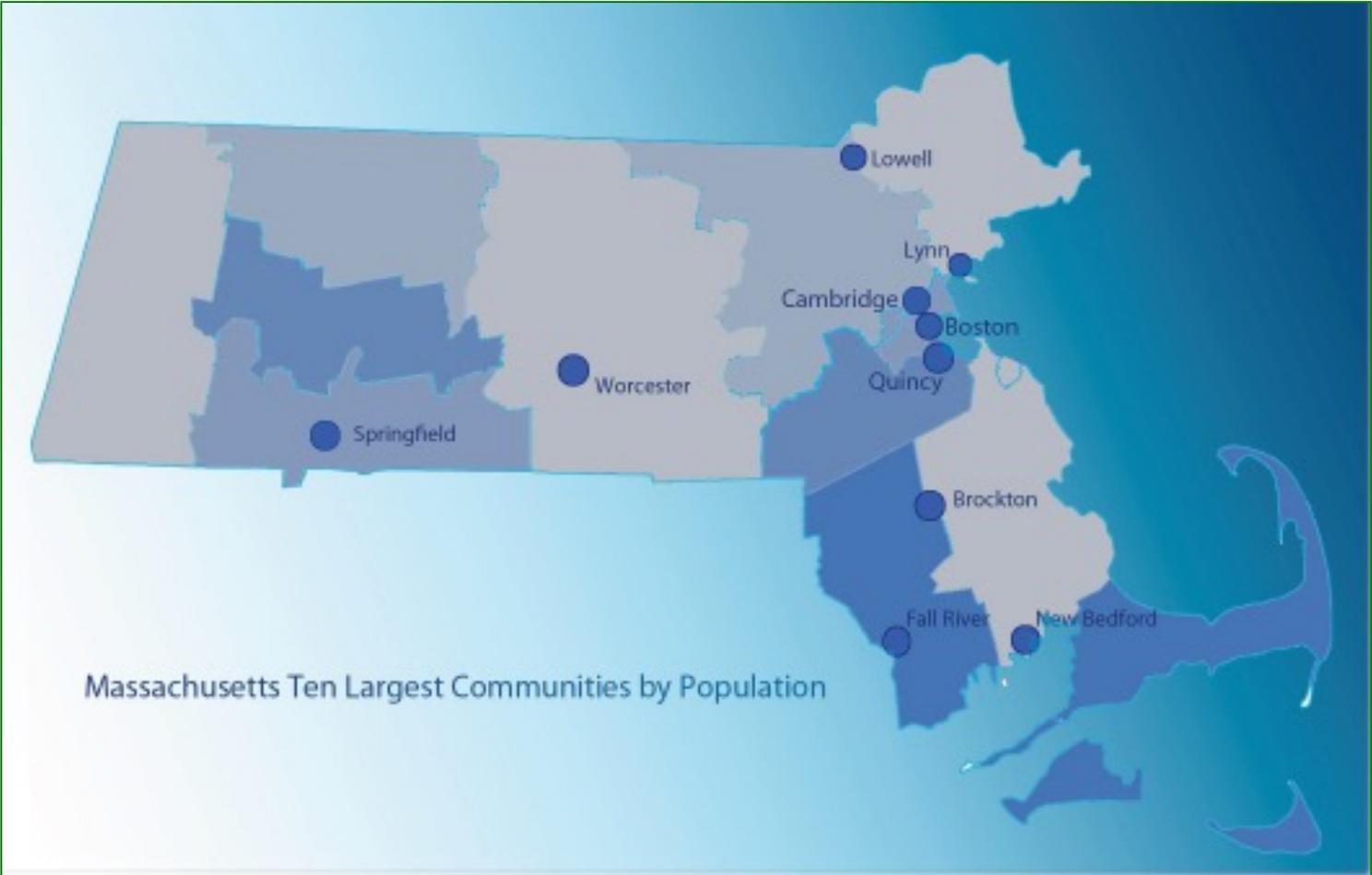
*Boston  
Worcester  
Springfield  
Lowell  
Cambridge  
New Bedford  
Brockton  
Quincy  
Lynn  
Fall River*

*Prepared using i-Tree  
Canopy, a state-of-  
the-art analysis tool,  
developed by the US  
Forest Service and  
its key research  
partners.*



## *Urban Tree Canopy (UTC) Assessment for Massachusetts 10 Largest Communities*

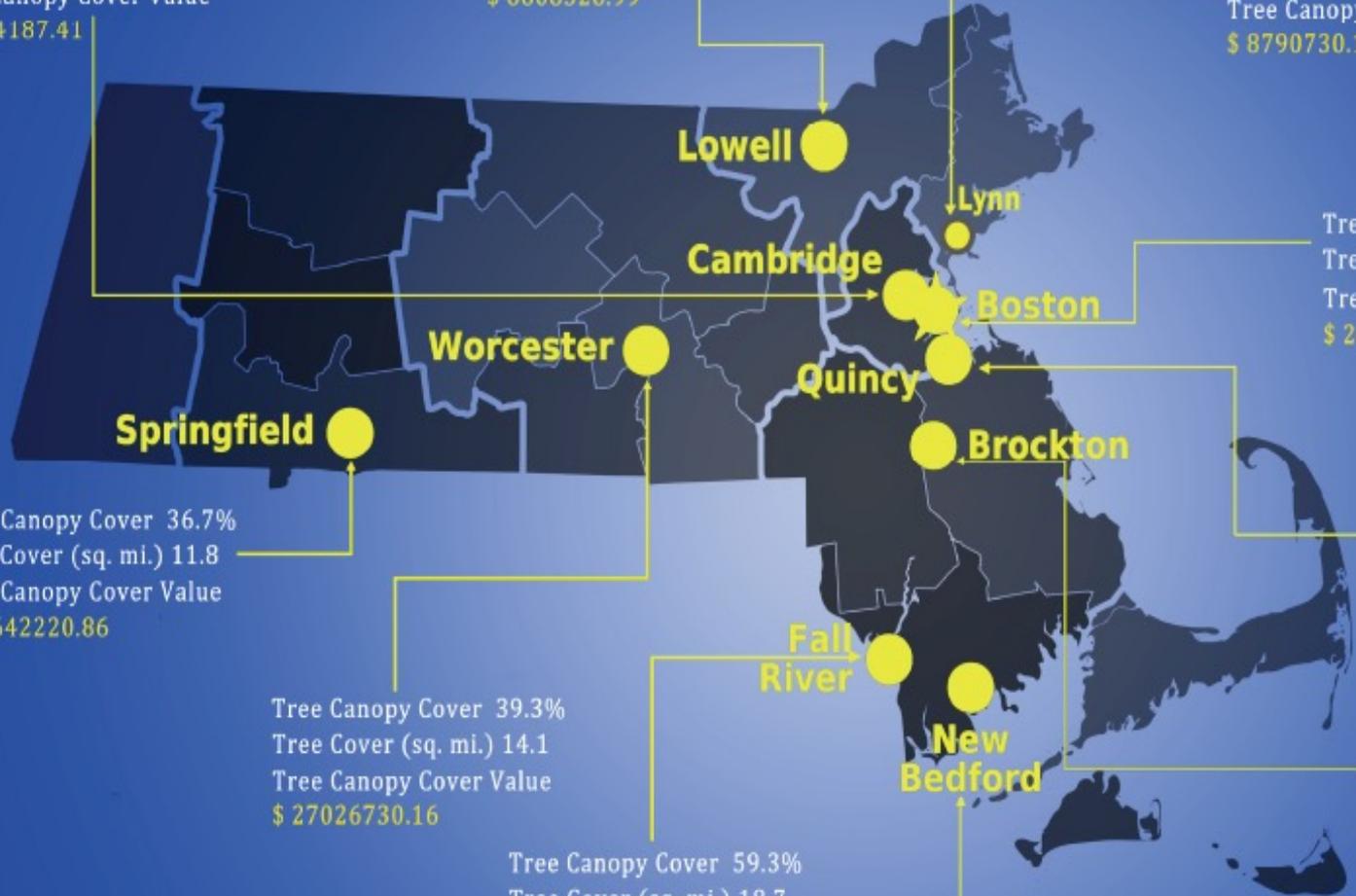
*September 2014*



Tree Canopy Cover 34%  
Tree Cover (sq. mi.) 2.08  
Tree Canopy Cover Value  
\$ 3984187.41

Tree Canopy Cover 31%  
Tree Cover (sq. mi.) 4.59  
Tree Canopy Cover Value  
\$ 8808326.99

Tree Canopy Cover 40.5%  
Tree Cover (sq. mi.) 4.58  
Tree Canopy Cover Value  
\$ 8790730.11



Tree Canopy Cover 27.9%  
Tree Cover (sq. mi.) 13.9  
Tree Canopy Cover Value  
\$ 26,587,698.27

Tree Canopy Cover 36.7%  
Tree Cover (sq. mi.) 11.8  
Tree Canopy Cover Value  
\$ 22642220.86

Tree Canopy Cover 43.1%  
Tree Cover (sq. mi.) 7.21  
Tree Canopy Cover Value  
\$ 13837228.31

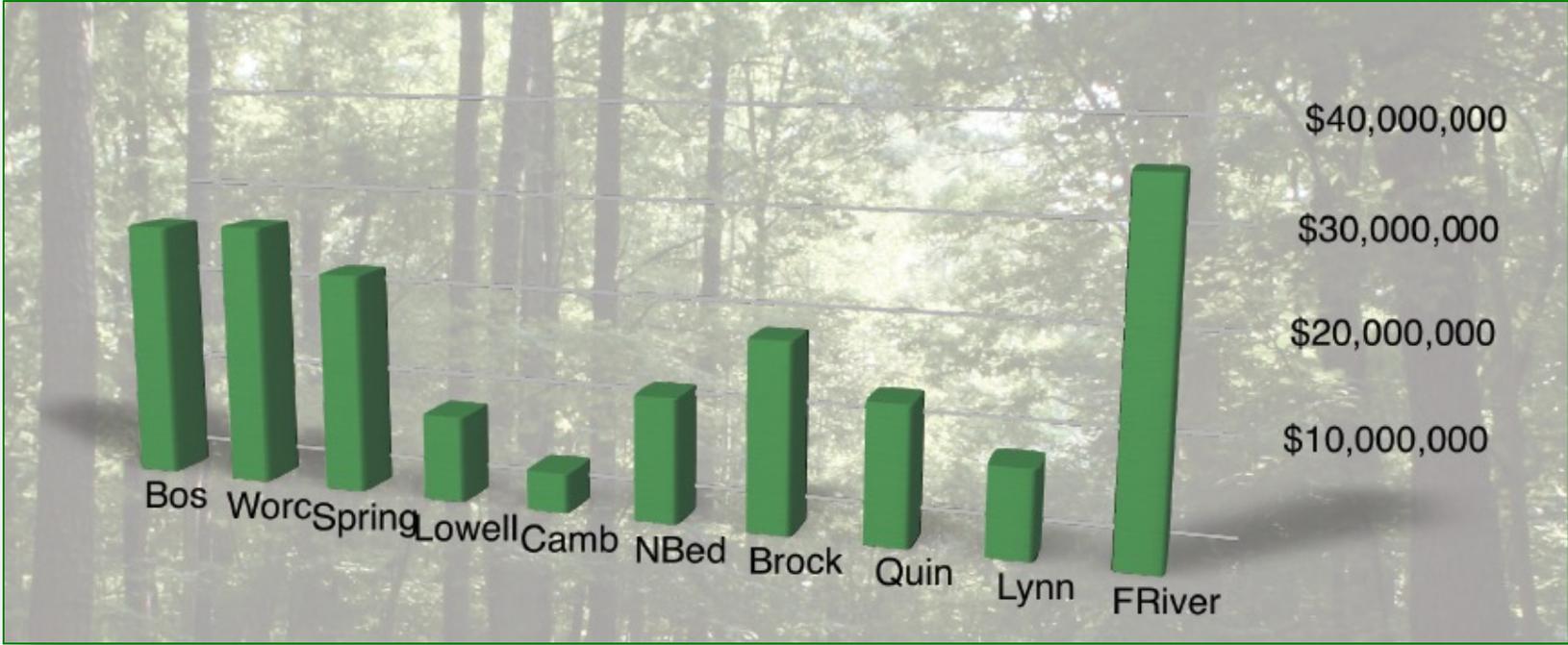
Tree Canopy Cover 39.3%  
Tree Cover (sq. mi.) 14.1  
Tree Canopy Cover Value  
\$ 27026730.16

Tree Canopy Cover 45.9%  
Tree Cover (sq. mi.) 9.88  
Tree Canopy Cover Value  
\$ 18965875.33

Tree Canopy Cover 59.3%  
Tree Cover (sq. mi.) 18.7  
Tree Canopy Cover Value  
\$ 35983596.36

Tree Canopy Cover 32.8%  
Tree Cover (sq. mi.) 6.58  
Tree Canopy Cover Value  
\$ 12,623,870.04

City Size Rank	City	% Canopy Cover	Report by Area (mi
1	Boston	27.9	13.9
2	Worcester	39.3	14.1
3	Springfield	36.7	11.8
4	Lowell	31	4.59
5	Cambridge	34	2.08
6	New Bedford	32.8	6.58
7	Brockton	45.9	9.88
8	Quincy	43.1	7.21
9	Lynn	40.5	4.58
10	Fall River	59.3	18.7



# Boston Urban Forest Canopy Assessment

## Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$340.09	±19.34	4.01 T	±0.23
NO2	Nitrogen Dioxide removed annually	\$585.50	±33.30	21.87 T	±1.24
O3	Ozone removed annually	\$30,491.74	±1,734.09	217.84 T	±12.39
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$63,032.01	±3,584.69	10.59 T	±0.60
SO2	Sulfur Dioxide removed annually	\$102.33	±5.82	13.78 T	±0.78
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$22,136.22	±1,258.91	72.97 T	±4.15
CO2seq	Carbon Dioxide sequestered annually in trees	\$844,821.44	±48,045.80	43,629.95 T	±2,481.28
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$25,626,188.94	±1,457,385.70	1,323,438.65 T	±75,265.21

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in lbs/acre/yr and \$/T/yr: CO 0.902 @ \$85.08 | NO2 4.917 @ \$26.86 | O3 48.968 @ \$140.47 | PM2.5 2.379 @ \$5,975.67 | SO2 3.098 @ \$7.45 | PM10\* 16.403 @ \$304.43 | CO2seq 9,807.385 @ \$19.43 | CO2stor is a total biomass amount of 297,489.961 @ \$19.43*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

### Limitations of i-Tree Canopy

The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. As the number of points increase, the precision of the estimate will increase as the standard error of the estimate will decrease. If too few points are classified, the standard error will be too high to have any real certainty of the estimate.

### A Cooperative Initiative Between:



[www.itreetools.org](http://www.itreetools.org)

Impervious Surfaces	IS	373	46.6 ±1.76
Other	O	83	10.4 ±1.08

i-Tree Eco

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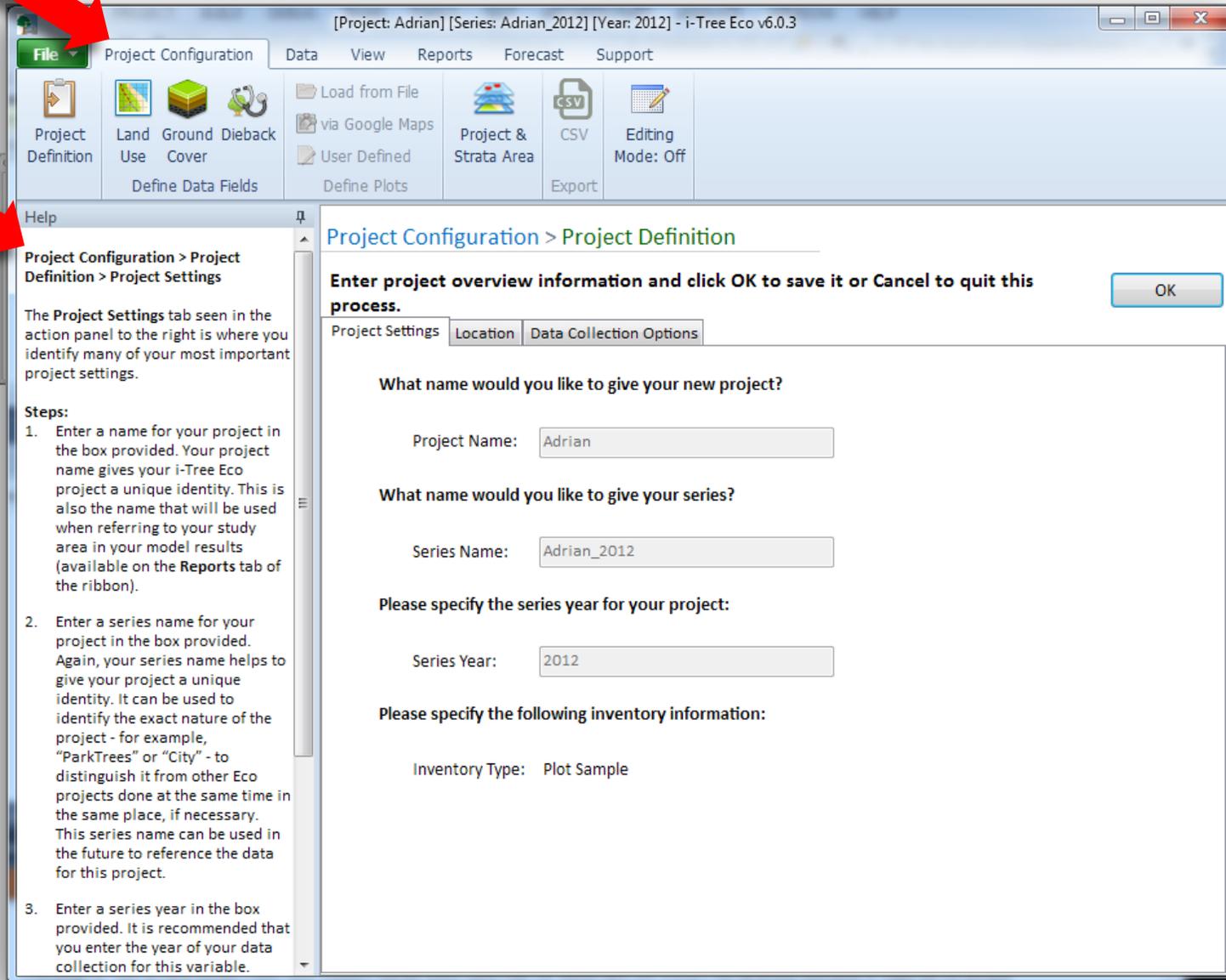


# i-Tree Eco v6

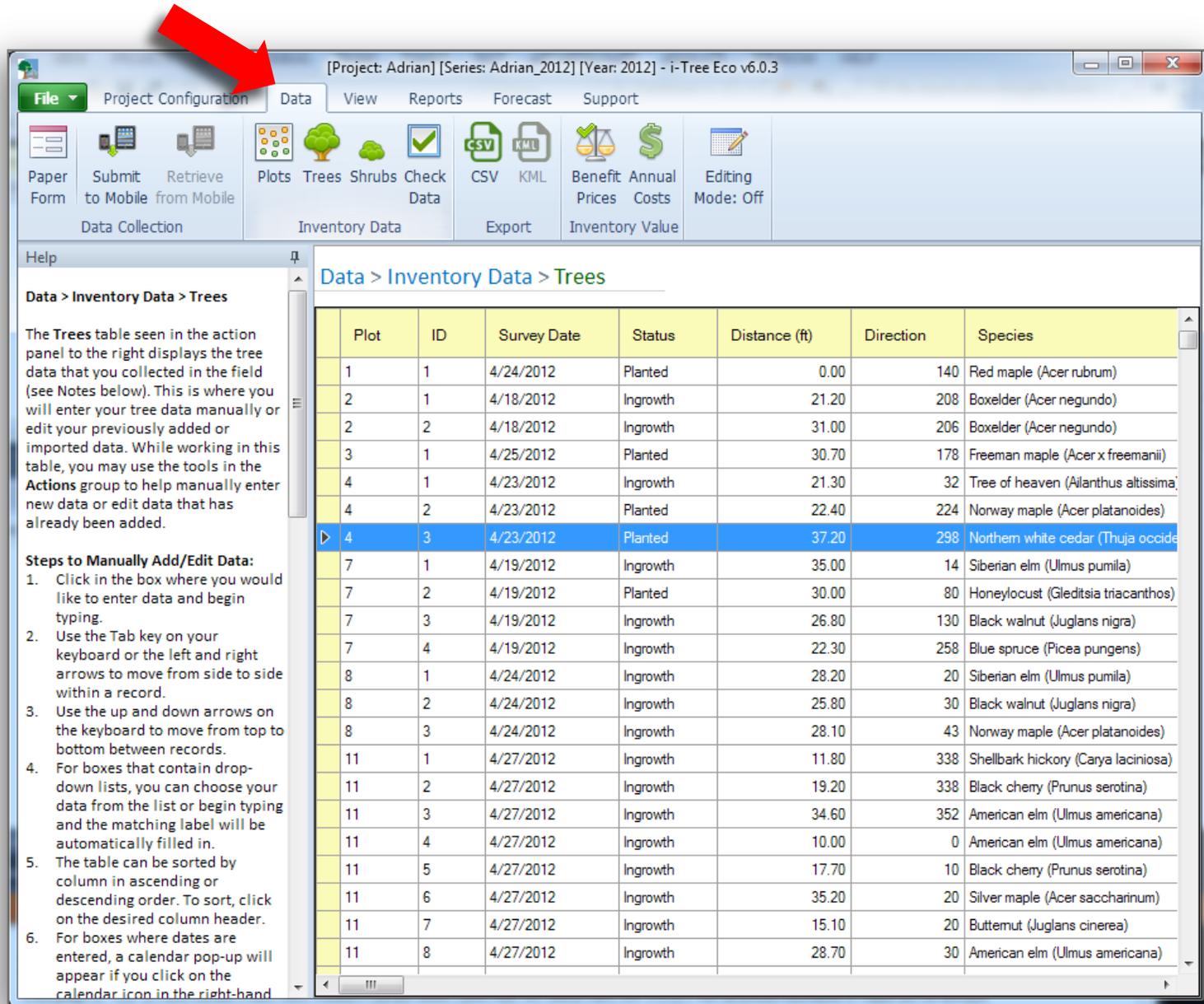
Flagship tool with best estimates for Composition and Benefits.

- User interface & Help text
- Reporting
- Tree inventory import
- Mobile data collector
- Help text

***Plot Sampling & Complete Inventories***



# i-Tree Eco v6



[Project: Adrian] [Series: Adrian\_2012] [Year: 2012] - i-Tree Eco v6.0.3

File Project Configuration **Data** View Reports Forecast Support

Paper Form Submit to Mobile Retrieve from Mobile Plots Trees Shrubs Check Data CSV KML Benefit Annual Prices Costs Editing Mode: Off

Help

Data > Inventory Data > Trees

The Trees table seen in the action panel to the right displays the tree data that you collected in the field (see Notes below). This is where you will enter your tree data manually or edit your previously added or imported data. While working in this table, you may use the tools in the Actions group to help manually enter new data or edit data that has already been added.

**Steps to Manually Add/Edit Data:**

1. Click in the box where you would like to enter data and begin typing.
2. Use the Tab key on your keyboard or the left and right arrows to move from side to side within a record.
3. Use the up and down arrows on the keyboard to move from top to bottom between records.
4. For boxes that contain drop-down lists, you can choose your data from the list or begin typing and the matching label will be automatically filled in.
5. The table can be sorted by column in ascending or descending order. To sort, click on the desired column header.
6. For boxes where dates are entered, a calendar pop-up will appear if you click on the calendar icon in the right-hand

Plot	ID	Survey Date	Status	Distance (ft)	Direction	Species
1	1	4/24/2012	Planted	0.00	140	Red maple ( <i>Acer rubrum</i> )
2	1	4/18/2012	Ingrowth	21.20	208	Boxelder ( <i>Acer negundo</i> )
2	2	4/18/2012	Ingrowth	31.00	206	Boxelder ( <i>Acer negundo</i> )
3	1	4/25/2012	Planted	30.70	178	Freeman maple ( <i>Acer x freemanii</i> )
4	1	4/23/2012	Ingrowth	21.30	32	Tree of heaven ( <i>Ailanthus altissima</i> )
4	2	4/23/2012	Planted	22.40	224	Norway maple ( <i>Acer platanoides</i> )
4	3	4/23/2012	Planted	37.20	298	Northern white cedar ( <i>Thuja occidentalis</i> )
7	1	4/19/2012	Ingrowth	35.00	14	Siberian elm ( <i>Ulmus pumila</i> )
7	2	4/19/2012	Planted	30.00	80	Honeylocust ( <i>Gleditsia triacanthos</i> )
7	3	4/19/2012	Ingrowth	26.80	130	Black walnut ( <i>Juglans nigra</i> )
7	4	4/19/2012	Ingrowth	22.30	258	Blue spruce ( <i>Picea pungens</i> )
8	1	4/24/2012	Ingrowth	28.20	20	Siberian elm ( <i>Ulmus pumila</i> )
8	2	4/24/2012	Ingrowth	25.80	30	Black walnut ( <i>Juglans nigra</i> )
8	3	4/24/2012	Ingrowth	28.10	43	Norway maple ( <i>Acer platanoides</i> )
11	1	4/27/2012	Ingrowth	11.80	338	Shellbark hickory ( <i>Carya laciniosa</i> )
11	2	4/27/2012	Ingrowth	19.20	338	Black cherry ( <i>Prunus serotina</i> )
11	3	4/27/2012	Ingrowth	34.60	352	American elm ( <i>Ulmus americana</i> )
11	4	4/27/2012	Ingrowth	10.00	0	American elm ( <i>Ulmus americana</i> )
11	5	4/27/2012	Ingrowth	17.70	10	Black cherry ( <i>Prunus serotina</i> )
11	6	4/27/2012	Ingrowth	35.20	20	Silver maple ( <i>Acer saccharinum</i> )
11	7	4/27/2012	Ingrowth	15.10	20	Butternut ( <i>Juglans cinerea</i> )
11	8	4/27/2012	Ingrowth	28.70	30	American elm ( <i>Ulmus americana</i> )

Flagship tool with best estimates for Composition and Benefits.

- User interface & Help Text
- Reporting
- Tree inventory import
- Mobile data collector
- Help text

Plot Sampling & Complete Inventories.

# i-Tree Eco v6

The screenshot displays the i-Tree Eco v6.0.3 software interface. The main window is titled "i-Tree Eco - Adrian Plot Based Sample Project" and shows a "Result View" with a table of "Total Estimates for Trees in Adrian by Species". A red arrow points to the title bar. Below the table, a list of species is shown with their corresponding values. To the right, a bar chart titled "Carbon Storage in Adrian by Land Use" is visible. The interface includes a menu bar (File, Edit, View, Reports, Tools, Help) and a toolbar with options like "Export", "PDF", "Metric", and "English".

Species	Number of Trees	Carbon (kg)	Gross Eq. (kg)	Net Eq. (kg)	Leaf Area (m <sup>2</sup> )	Leaf Biomass (kg)	Value (\$)
Balsam poplar	20,312	11,207.0	3,226.0	1,481.4	277.0	71.7	140.0
Common ash	20,948	4,624.0	1,406.0	779.4	49.1	16.9	49.9
Green ash	17,947	10,070.0	3,706.0	2,007.0	115.5	4.0	107.0
Red maple	17,127	3,242.0	1,027.0	584.7	74.2	24.3	66.4
Red pine	17,120	3,764.0	1,468.0	804.4	74.0	27.0	61.2
White pine	12,769	4,752.0	1,202.0	1,222.0	22.4	22.2	22.4
Scotch larch	10,000	3,400.0	440.0	240.0	22.0	10.0	7.0
White spruce	9,995	4,514.0	1,719.0	1,063.0	89.0	30.4	85.7
Red spruce	9,886	2,402.0	3,400.0	1,029.0	45.4	120.0	39.1
White oak	9,288	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Black oak	9,014	2,007.0	1,006.0	589.0	49.1	16.2	24.2
Red oak	7,988	4,851.0	1,001.0	1,001.0	1.7	1.0	17.3
Northern red pine	7,417	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	7,229	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	7,124	4,480.0	1,029.0	66.7	11.8	9.0	7.0
Red spruce	6,823	3,882.0	1,097.0	519.0	42.7	10.0	40.7
Scotch larch	6,820	3,242.0	1,027.0	429.0	45.4	120.0	40.0
Common ash	6,748	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Black oak	6,427	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	6,000	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	4,710	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	4,601	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	4,600	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	3,886	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Scotch larch	3,823	3,882.0	1,097.0	519.0	42.7	10.0	40.7
White oak	3,200	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Black oak	2,988	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	2,988	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	2,410	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	2,229	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	2,200	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	1,820	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Scotch larch	1,820	3,882.0	1,097.0	519.0	42.7	10.0	40.7
White oak	1,124	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Black oak	1,006	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	1,000	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	429	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	429	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	429	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Scotch larch	429	3,882.0	1,097.0	519.0	42.7	10.0	40.7
White oak	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Black oak	429	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	429	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	429	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	429	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	429	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Scotch larch	429	3,882.0	1,097.0	519.0	42.7	10.0	40.7
White oak	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Black oak	429	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	429	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	429	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	429	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	429	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Scotch larch	429	3,882.0	1,097.0	519.0	42.7	10.0	40.7
White oak	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Black oak	429	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	429	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	429	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	429	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	429	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Scotch larch	429	3,882.0	1,097.0	519.0	42.7	10.0	40.7
White oak	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Black oak	429	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	429	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	429	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	429	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	429	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Scotch larch	429	3,882.0	1,097.0	519.0	42.7	10.0	40.7
White oak	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Black oak	429	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	429	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	429	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	429	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	429	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Scotch larch	429	3,882.0	1,097.0	519.0	42.7	10.0	40.7
White oak	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Black oak	429	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	429	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	429	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	429	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	429	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Scotch larch	429	3,882.0	1,097.0	519.0	42.7	10.0	40.7
White oak	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Black oak	429	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	429	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	429	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	429	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	429	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Scotch larch	429	3,882.0	1,097.0	519.0	42.7	10.0	40.7
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Northern red pine	429	3,484.0	1,011.0	429.0	19.0	19.0	19.0
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White spruce	429	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
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Northern red pine	429	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	429	3,275.0	1,000.0	674.0	22.7	22.0	22.4
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Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
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Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
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Black oak	429	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	429	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	429	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	429	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	429	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Scotch larch	429	3,882.0	1,097.0	519.0	42.7	10.0	40.7
White oak	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Black oak	429	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	429	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	429	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	429	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	429	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Scotch larch	429	3,882.0	1,097.0	519.0	42.7	10.0	40.7
White oak	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Black oak	429	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	429	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	429	3,484.0	1,011.0	429.0	19.0	19.0	19.0
White pine	429	3,275.0	1,000.0	674.0	22.7	22.0	22.4
White spruce	429	3,200.0	1,000.0	1,000.0	0.0	0.0	0.0
Red spruce	429	1,820.0	1,124.0	748.0	11.0	100.0	3.0
Scotch larch	429	3,882.0	1,097.0	519.0	42.7	10.0	40.7
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Black oak	429	2,007.0	1,006.0	589.0	21.9	16.2	24.2
Red oak	429	3,000.0	1,000.0	1,000.0	0.0	0.0	0.0
Northern red pine	429	3,484.0	1,011.0	429.0			

# i-Tree Eco v6

Flagship tool with best estimates for Composition and Benefits.

- User interface & Help text
- Reporting
- Tree inventory import
- Mobile data collector
- Basic mapping

Plot Sampling & Complete Inventories.

Select an inventory column below and then define how to import it into Eco. Repeat for EACH column BEFORE clicking Next.

SPF	DBH	Trunks	Cond	Cavity	WeakFork
Acer platanoides	10	1	Popr		

**Review the results of your processed data.**

Total records processed: 520  
Total records skipped: 37  
Total records to import: 483

**Processed Data to Import:**

Species	DBH 1 (in)
Acer platanoides	10
Acer platanoides	10
Acer platanoides	10
Acer platanoides	16
Acer platanoides	10
Acer platanoides	8
Acer platanoides	21
Acer platanoides	21
Acer platanoides	16
Acer platanoides	10
Acer platanoides	14
Acer platanoides	10
Acer rubrum	1
Acer rubrum	1

Click Finish to complete the import process or click Back to revise your settings and reprocess your data.  
Please review your data after clicking Finish. Additional modifications may be required to meet your project specific requirements.

< Back Finish Cancel

Platanus x acerifolia Platanus x acerifolia  
Prunus serotina Prunus serotina

< Back Next > Cancel

# i-Tree Eco v6

Active\_Use [Year: 2010] - i-Tree Eco v6.0.3

**Tree - General**

Species: [ ]  
Land Use: Residential  
Status: [ ]  
Direction (\*): 32  
Distance (ft): 21.3  
Street Tree?: [ ]  
Comment: from tmp - se building co

**Plot 4**

Plot Info  
Land Uses  
Ground Covers  
Reference Objects  
Trees  
Shrubs  
Mark Plot as Completed

**Tree 1 - Details**

Dead Tree? [ ]  
Crown Condition: 85% - 90%  
Height (ft): 7  
Crown Top Height (ft): 7  
Crown Base Height (ft): 1  
Crown NS Width (ft): 1  
Crown EW Width (ft): 1  
Crown Percent Missing: 93  
Crown Light Exposure: 4  
Percent Impervious: 0  
Percent Shrub: 63

**Mobile Interface Screens:**

- Tree - General (Left)
- Plot 4 (Middle)
- Tree 1 - Details (Right)

**Desktop Application Details:**

- Toolbar: Paper Form, Submit to Mobile, Help
- Help Text: i-Tree Eco offers recording the field. One record your data collector mobile data enabled mobile smartphone your collected from the web tab of ribbon functionality have to down web-based in form.
- Text: The purpose function seen the right is to configuration will be able to mobile device mobile data below).
- \*IMPORTANT: Before you can mobile data collector device, you must see configuration here (see If you do not submit your project configuration, you will not be able to access the mobile data collector from your mobile device.
- Table:

3259			
3260	11/1/2010	Unknown	bur

**Plot 1 - GPS Loc...**

Type in coordinates, use device GPS, or tap a location on the map below.

Latitude: 41.908656011  
Longitude: -84.0385827151

Device GPS (allow location access on device):  
Start [ ] Clear [ ]

Timestamp: [ ]  
Accuracy (ft): [ ]

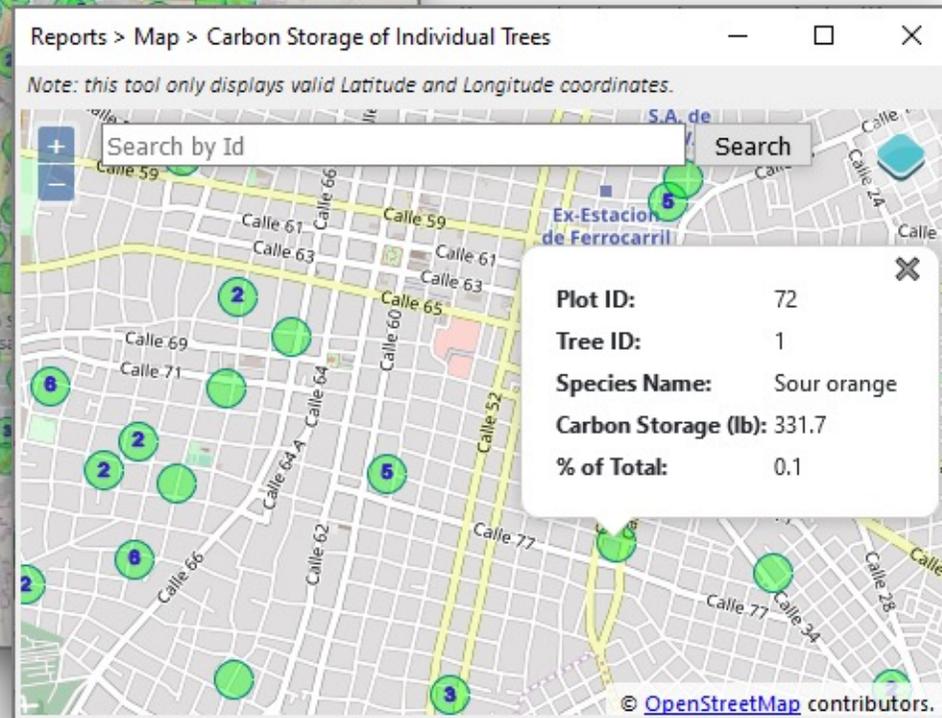
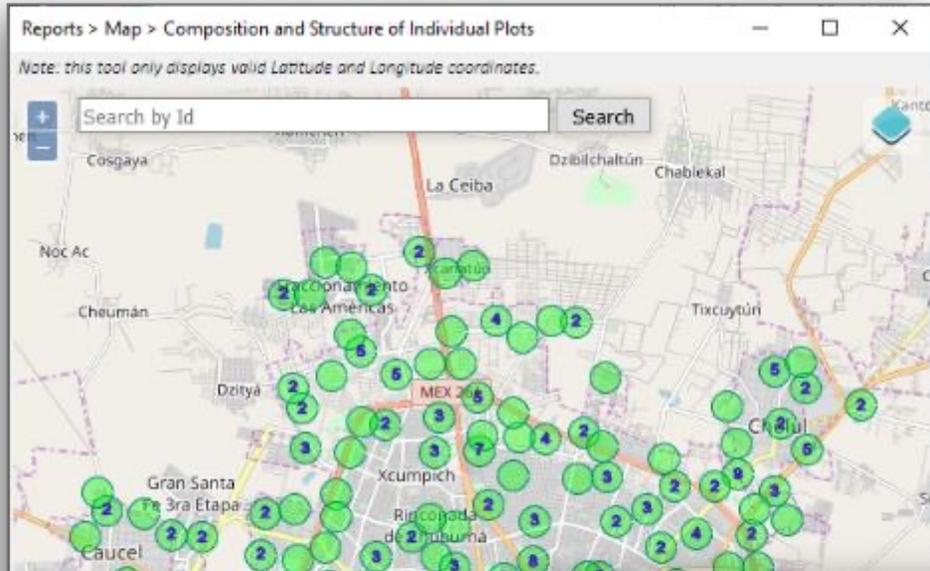
Tap map for coordinates (requires data connection):

1500 N Mantua St, Kent, OH, .

The Davey Tree Expert Company

Leaflet

# i-Tree Eco v6



Flagship tool with best estimates for Composition and Benefits.

- User interface & Help text
- Reporting
- Tree inventory import
- Mobile data collector
- Basic mapping

**Plot Sampling & Complete Inventories**

# i-Tree Landscape

---



# i-Tree Landscape

Gateway to tree benefits – available to anyone and everyone in the US.

- Uses existing boundaries.
- Canopy, Land, and Impervious Cover across the US.
  - UTC – send us yours!
    - High Resolution Urban Tree Canopy Assessments
- 250+ map layers
  - 7 base maps
  - 10 boundaries, plus 26 federal types
  - 7 canopy and land
  - 6 forest risk, plus 47 pests
  - 17 health risk
  - 144 future climate
  - Up to 18 new ones coming with v5.0
- 1,000's of data attributes and tree benefits organized for easy exploration.
- Planting prioritization tool

The screenshot displays the i-Tree Landscape web application interface. On the left, a map shows a blue-shaded area over a city, with a search bar containing "1400 Independence Ave". Below the map is a "Find Locations" button. The main panel on the right is titled "Start on Main, then explore the map layer tabs." and contains a list of map layers under the "Future Climate" tab. The layers are organized into two groups: RCP 4.5 and RCP 8.5, each with years from 2020 to 2100. A "Note" at the bottom of the layer list states: "Note: Predicted temperature and precipitation based on CCSM4.0 from National Center for Atmospheric Research. Map details are located in the references." On the far right, a "Boundaries" panel lists various boundary types under categories: Administrative, Forest (US Forest Service), Water, and US Federal Lands. Each boundary type has a radio button and a small colored square icon.

Start on Main, then explore the map layer tabs.

Main Canopy & Land Forest Risk Health Risk Future Climate

Climate 2020 (RCP 4.5) +

Climate 2030 (RCP 4.5) +

Climate 2040 (RCP 4.5) +

Climate 2050 (RCP 4.5) +

Climate 2060 (RCP 4.5) +

Climate 2070 (RCP 4.5) +

Climate 2080 (RCP 4.5) +

Climate 2090 (RCP 4.5) +

Climate 2100 (RCP 4.5) +

Climate 2020 (RCP 8.5) +

Climate 2030 (RCP 8.5) +

Climate 2040 (RCP 8.5) +

Climate 2050 (RCP 8.5) +

Climate 2060 (RCP 8.5) +

Climate 2070 (RCP 8.5) +

Climate 2080 (RCP 8.5) +

Climate 2090 (RCP 8.5) +

Climate 2100 (RCP 8.5) +

Note: Predicted temperature and precipitation based on CCSM4.0 from National Center for Atmospheric Research. Map details are located in the references.

Boundaries

Administrative

- US Census Block Groups
- US Census Places
- US County Subdivisions
- US Counties
- US 115<sup>th</sup> Congressional Districts
- US States

Forest (US Forest Service)

- National Forests
- Ranger Districts
- CFLR Boundaries

Water

- Watershed (HUC12)

US Federal Lands

- Native American Reservation +
- Bureau of Land Management +
- Bureau of Reclamation +
- Department of Defense +
- Department of Energy +
- Forest Service +
- Fish and Wildlife Service +
- National Park Service +

# i-Tree Landscape

Gateway to tree benefits – available to anyone and everyone in the US.

A good place to get people started in i-Tree.

A quick tour of...

- Location Data
  - Making a selection
  - Land Cover classifications
    - and tree canopy
  - Thematic mapping

The screenshot displays the i-Tree Landscape web application interface. The browser address bar shows the URL <https://landscape.itreetools.org/maps/locations/>. The application header includes the i-Tree logo, version v4.1, and navigation links for Home, Project, Menu, and i-Tree. A search bar is located in the top left corner.

The main map area shows a geographic view of Cleveland, Ohio, with various data layers overlaid. A sidebar on the right contains a navigation menu with tabs for Main, Canopy & Land, Forest Risk, Health Risk, and Future Climate. Below the menu are sections for Base Maps, Boundaries, and Selection Visibility Settings. A dropdown menu for 'Choose a boundary area to analyze:' is set to 'US Census Block Group'. Below this are tools for 'Navigate', 'Identify', 'Select', 'Box-Select', 'Geo-Swap', 'Clear', 'Process 462', and 'Start Over'. A note at the bottom of the sidebar states 'Map details are located in the references.'

The bottom section of the interface features a progress bar with four steps: Find Locations, Explore Location Data (currently active), See Tree Benefits, and Prioritize Tree. Below the progress bar are controls for 'Land Cover' (HiRes, 2011, 2001), 'Unit' (Metric, English), and 'Display' (Table, Chart). A 'Canopy Legend' popup is visible, showing a color scale from light green (Minimum: 0.6) to dark green (Maximum: 271.8), with the text 'Lighter colors represent lower values, while darker colors represent higher values.'

At the bottom, there are tabs for 'Data Tools', 'Area', 'Land Cover HiRes', 'Land Cover 2011', 'Census', and 'Future Climate'. Below these are sub-tabs for 'Canopy & Impervious' and 'Forest Details'. A table displays data for the selected area, including 'Area', 'Canopy', 'Impervious', and 'Plantable Space' in both acre and percentage. The 'Selection Total' row shows: 52,829.7 acre (100.00%), 9,547.6 acre (19.18%), 25,629.6 acre (51.49%), and 14,523.9 acre (29.18%).

# i-Tree Landscape

Gateway to tree benefits – available to anyone and everyone in the US.

A good place to get people started in i-Tree.

A quick tour of...

- Tree Benefits
  - Carbon (CO<sup>2</sup>), air pollution, hydrology
- Planting Prioritization
  - Weighted prioritizations
    - Custom scenarios
  - Maintenance vs new planting
    - (vs highest priority; i.e. both)

The screenshot shows the i-Tree Landscape web application interface. The browser address bar displays the URL: <https://landscape.itreetools.org/maps/prioritize/>. The main navigation bar includes "Find Locations", "Explore Location Data", and "See". Below this, there is a "Land Cover" section with a "Back" button and a dropdown menu showing "HiRes", "2011", and "2001".

### How To Prioritize Tree Planting

To map optimal areas to plant trees, create a "Priority Planting Index" scenario from user-specified, weighted criteria (under Custom Scenarios) or use one of the Common Scenarios (above). Scenarios are based upon the **Land Cover** dataset selected (above) - *HiRes, 2011, 2001*.

The three **Common Scenarios** are:

- **Population:** (default) an index weighted towards areas of *relatively high population density*, low tree cover per capita, and high available planting space.
- **Minorities:** an index weighted towards areas of *relatively high minority population density*, low tree cover per capita, and high available planting space.
- **Poverty:** an index weighted towards areas of *relatively high proportion of population below the poverty line*, low tree cover per capita, and high available planting space.

To create a **Custom Scenario**:

1. Select from one or more criteria (the blue boxes under Custom Scenarios) by using the **+ Add Criteria** button and their drop-down.
  - For each criteria, set an **Importance** (from 0 to 100). The sum of the all weights must equal 100.
  - Optional: to distribute weights equally among the selected criteria, click the **Equalize** button.
2. Click **Update Map Display** to see the results on map (above) and legend (below).
3. Each Custom Scenario can be stored by clicking **Store Scenario**. These saved scenarios can be included in your report when you **Generate Results**.

**Current Prioritization Scenario Legend**

The index is from 0 to 100, where 0 is a low priority and 100 is a high priority.

**How?**

Each criteria is standardized on a scale of 0 to 1, with 1 representing the

**Priority Planting Index Extras**

- Non-wooded to low density developed 2100
- Wooded to high density developed 2100
- Wooded to low density developed 2100

**Tree Canopy Benefits**

- Carbon Storage
- Carbon Sequestration
- CO<sub>2</sub> Equivalent Storage
- CO<sub>2</sub> Equivalent Sequestration
- CO Removal
- NO<sub>2</sub> Removal
- O<sub>3</sub> Removal
- PM<sub>2.5</sub> Removal

**Tree Cover per Capita**

High Low **Tree Cover per Capita**

Importance (weight) 30 %

100% Equalize

+ Add Criteria Store Scenario Update Map Display

**Stored Planting Prioritization Scenarios**

Remember to update the map's display after restoring a custom prioritization scenario.

Remove	Title	Criteria	Restore
	My Custom Scenario		

# i-Tree Landscape

Gateway to tree benefits – available to anyone and everyone in the US.

A good place to get people started in i-Tree.

A quick tour of...

- Reporting
  - Title and description
  - Example tables
  - Example thematic map
  - Example prioritization map

landscape.itreetools.org

The screenshot displays a web browser window with the URL <https://landscape.itreetools.org/report/>. The page is titled "Report - i-Tree Landscape" and contains the following sections:

### Tree Benefits

Carbon and CO<sub>2</sub> (High Resolution UTC)

	Carbon Storage		Carbon Sequestration		CO <sub>2</sub> Equivalent Storage		CO <sub>2</sub> Equivalent Sequestration	
	\$	Short Ton	\$/yr	t/yr	\$	Short Ton	\$/yr	t/yr
<b>Selection Total:</b>	1,887,066	11,064.6	60,259	353.3	1,887,066	40,570.0	60,259	1,295.5

### Prioritization

Population (High Resolution UTC)

Legend: min [color scale] max

At the bottom of the page, there are logos for several organizations: UAS, DAVEY, Arbor Day Foundation, CMAA, ISA, Casey Trees, ESF, and NAASF. Below the logos is the text: "Use of this tool indicates acceptance of the EULA."

# i-Tree Planting

---





# Welcome to the i-Tree Planting Calculator! v2.0.1

The i-Tree Planting Calculator is designed to help you estimate the long-term environmental benefits from a tree planting project. The focus is on greenhouse gases, but many co-benefits are included.

This is a newly updated version of i-Tree Planting. Please [clear](#) your web browser's cache for this site before using.

Users enter the following information:

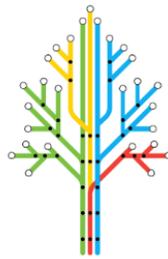
- Tree species
- Size of trees at planting
- Information on the distance and direction to the nearest building (optional)
- Information about the tree's growing conditions
- Estimated mortality (optional)
- The number of trees with each configuration
- Project lifetime (number of years)
- Specific greenhouse gas values (optional)

The following information is calculated (in units and associated dollar values) for the project life time:

- Greenhouse Gas (GHG) sequestered and avoided (owing to reductions in energy use)
- Energy conserved
- Air pollutants captured and avoided
- Stormwater filtered
- Tree total biomass



Use of this tool indicates acceptance of the [EULA](#).



Urban Ecos



A collaborative initiative with



 **i-Tree Planting** v2.0.1 [Home](#) [Project](#) [Menu](#) [i-Tree](#) [Feedback](#)

[Location](#) [Parameters](#) [Trees](#) [Report](#)

## Location

Select a location at, or near, the project site.

**State/Province**

**County/Division**

**City**

**WARNING:** *If you already have tree groups entered, they will be retained, but changing the location will change the Report results.*

[Next →](#)

Each of the three location selections needs to be completed in order:

- State
- County
- City

At this time, the i-Tree Planting Calculator is only for users located within the United States. Please contact [support@treetools.org](mailto:support@treetools.org) for more information about funding needed for your area.

---

A collaborative initiative with



 **i-Tree Planting** v2.0.1 [Home](#) [Project](#) [Menu](#) [i-Tree](#) [Feedback](#)

[Location](#) [Parameters](#) [Trees](#) [Report](#)

## Project Parameters

Configure the local parameters for the project.

**Electricity Emissions Factor**

This field is required.

**Units**

pounds CO<sub>2</sub> equivalent/MWh  kilograms CO<sub>2</sub> equivalent/MWh

**Fuel Emissions Factor**

This field is required.

**Units**

pounds CO<sub>2</sub> equivalent/MMBtu  kilograms CO<sub>2</sub> equivalent/MMBtu

**Years for the Project (1 thru 99)**

**Tree Mortality over Project Lifetime, as an estimated percentage (Optional, 0 thru 100)**

[Next](#) →

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**i-Tree Planting** v2.0.1 Home Project Menu i-Tree Feedback

Location Parameters **Trees** Report

### Tree Planting Configurations

Enter the tree groups for the project.

**Units**  
 English (feet & inches)  Metric (meters & cm)

**Nomenclature**  
 Common Name  Scientific Name

Tree Group Information				Building Information				Tree Details		
	Group Number	Species	DBH in inches	Distance to Nearest in feet	Tree is ____ of Building	Vintage	Climate Controls	Condition	Exposure to Sunlight	Number
<input checked="" type="checkbox"/>	1	<ul style="list-style-type: none"><li>✓ Apple</li><li>Apple, Paradise</li><li>Ash</li><li>Ash, American mountain</li><li>Ash, Black</li><li>Ash, Carolina</li><li>Ash, European mountain</li><li>Ash, Green</li><li>Ash, Summit</li><li><b>Ash, White</b></li><li>Aspen, Bigtooth</li><li>Aspen, Quaking</li><li>Baldcypress</li><li>Basswood</li><li>Basswood, American</li><li>Bayberry, Southern</li><li>Beech</li></ul>		0-19	North (0°)	Built after 1980	Heat & A/C	Excellent	Full Sun	1

Next →

Use of this tool indicates acceptance of the EULA.

A collaborative initiative with



i-Tree Planting
v2.0.1

Home
Project ▾
Menu ▾
i-Tree

Feedback ▾

Location
Parameters
Trees
Report

Print

## Planting Report

NOTE: Printing is recommended as the "landscape" orientation or at a reduced scale.

---

### Project Report - i-Tree Planting Calculator v2.0.1

Location: Springfield, Massachusetts 01109  
 Electricity Emissions Factor: 505.21 kilograms CO2 equivalent/MWh  
 Fuel Emissions Factor: 68.71 kilograms CO2 equivalent/MMBtu  
 Lifetime: 40 years  
 Tree Mortality: 10%

All amounts in the tables are for the full lifetime of the project.

**Units**

English (pounds & tons; kWh & MMBtu; gallons)
  Metric (kilograms & metric tons; kWh & MMBtu; cubic meters)

Copy
Export
CO<sub>2</sub>
Energy
Eco
Air Pollution

Search:

Location		CO <sub>2</sub> Benefits			
Group Identifier	Tree Group Characteristics	CO <sub>2</sub> Avoided (pounds)	CO <sub>2</sub> Avoided (\$)	CO <sub>2</sub> Sequestered (pounds)	CO <sub>2</sub> Sequestered (\$)
1	<ul style="list-style-type: none"> <li>(1.0) Apple (Malus species) at 1.0 inch DBH.</li> <li>Planted 0-19 feet and north (0°) of buildings that were built post-1980 with heat and A/C.</li> <li>Trees are in excellent condition and planted in full sun.</li> </ul>	2,649.2	\$61.61	2,192.2	\$50.98



# i-Tree Wood Marketplace

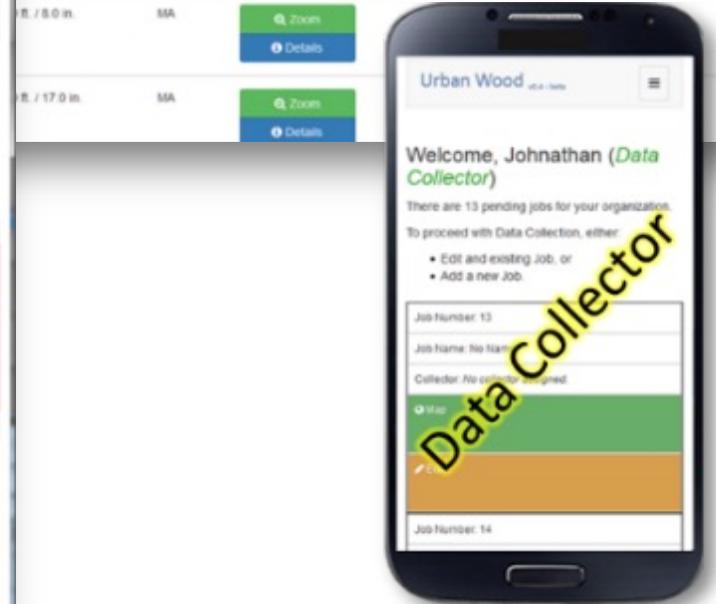
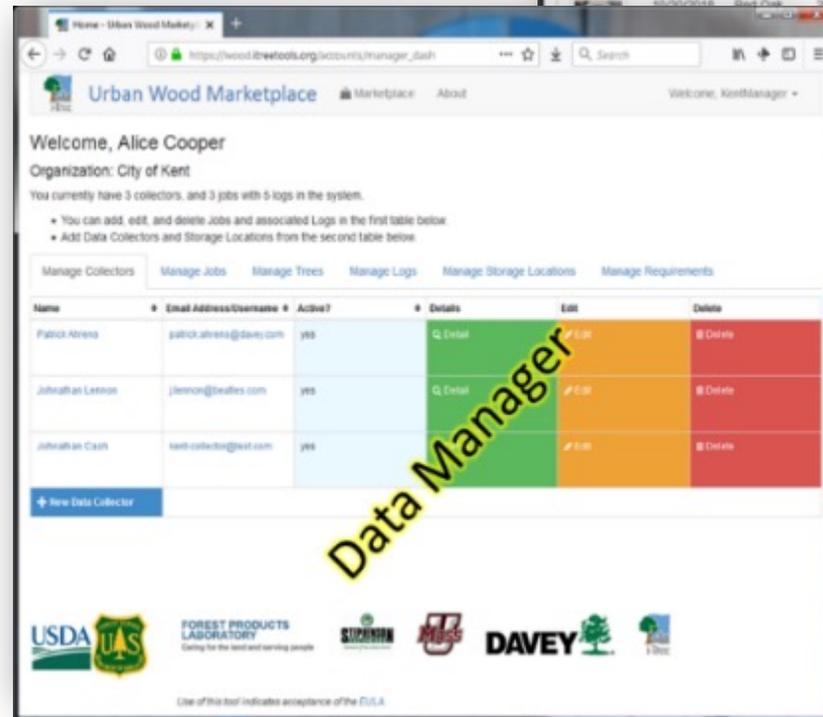
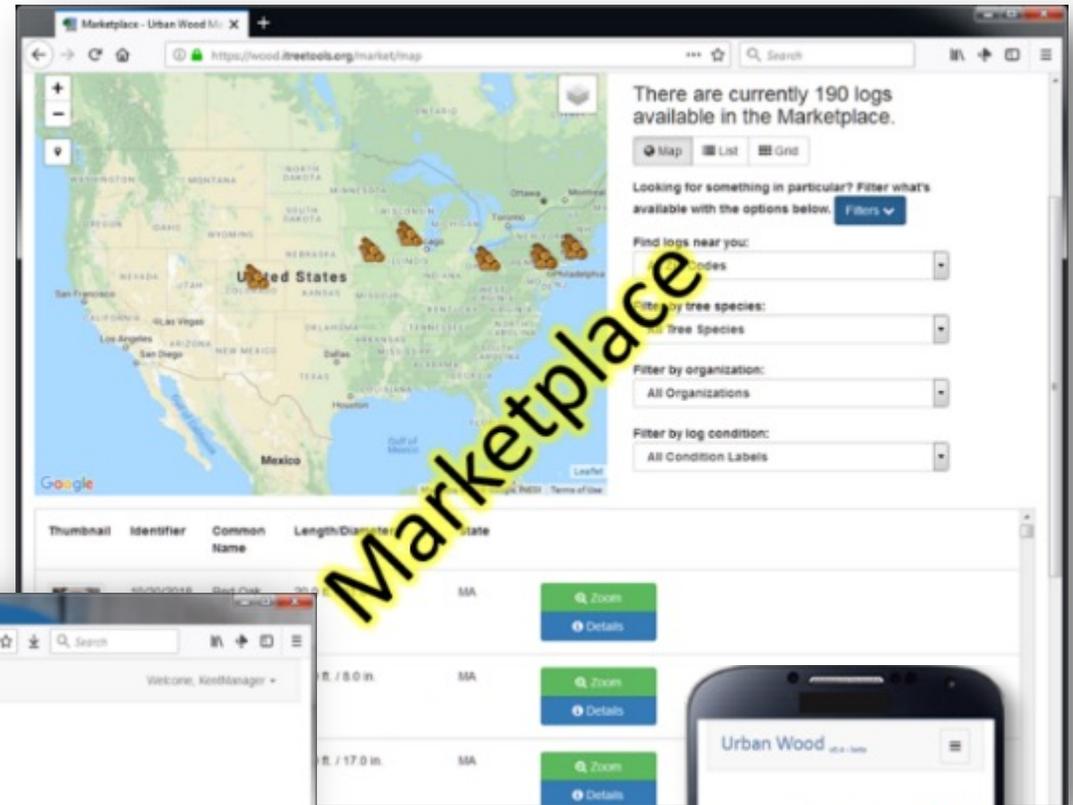
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# Wood Marketplace

“Connecting urban wood harvests to the creative community.”

- Municipalities
- Tree Care Companies
- Artisans
- Woodworkers
- Furniture Makers
- Individuals





[www.itreetools.org](http://www.itreetools.org)

[www.unri.org](http://www.unri.org)

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