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

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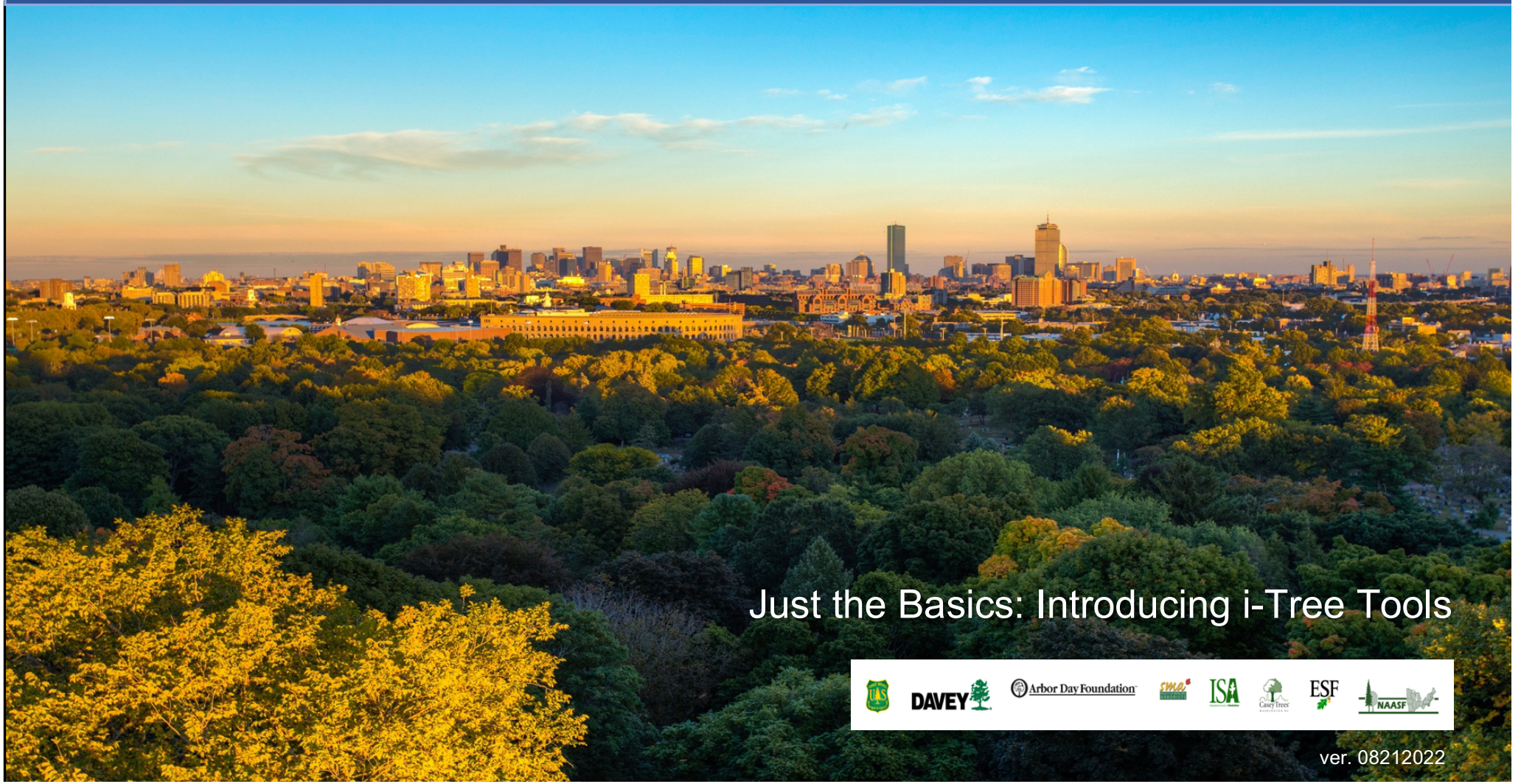
Powerpoint and Resources

www.unri.org/bscworkshop/

www.itreetools.org

i-Tree Quick Guide

Prepared for BSC GROUP



Just the Basics: Introducing i-Tree Tools

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i-Tree

Tools for Assessing and Managing Community Trees & Forests 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?

Structure
Assess the number of trees, species, condition + weather & pollution data.

Function
Statistically estimate functions (e.g. gas exchange) and covert to services such as CO_2 uptake & rainfall interception.

Value
Apply monetary values to these services based on economic models & published literature.

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:

DAVEY · Arbor Day Foundation · sma · ISA · Casey Trees · ESF

How do I get i-Tree?

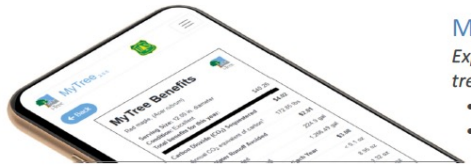
Learn about these free tools at **www.itreetools.org**. Links to them as well as references, project examples, and video learning segments are available. Want to ask a question? User support is provided: **info@itreetools.org**.

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_2 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 on your phone, tablet or laptop!

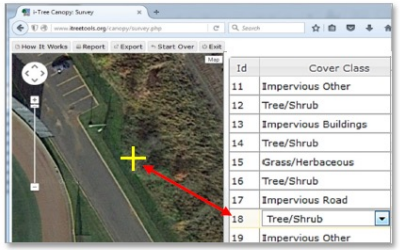
i-Tree Canopy

Estimate tree & ground cover for a large project.

- A free web tool: 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_2 & air pollution removal
  - Stormwater reduction

4 easy steps & 30 minutes:

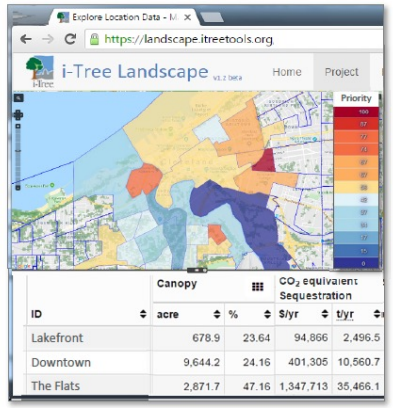
1. Draw project boundaries on a Google map.
2. Enter ground cover types to survey.
3. Select the ground cover you see on the map at random, auto-selected locations.
4. Click the Report button for results!



i-Tree Landscape

Learn about your entire community.

- A free web tool: landscape.itreetools.org
- US watersheds, cities, census areas & more
- Get estimates of tree benefits in 10 minutes:
  - CO_2 mitigation
  - air pollution removal
  - stormwater reduction
  - health benefits
- Generate planting prioritization scenarios.



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

i-Tree

Tools for Assessing and Managing Community Trees & Forests www.itreetools.org

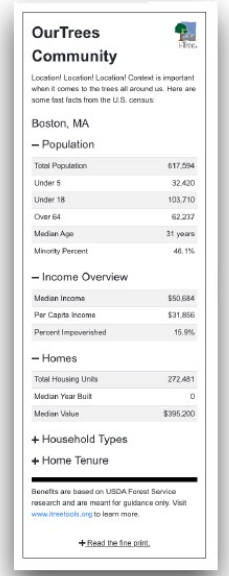
OurTrees

Provides data on a community and it's 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.

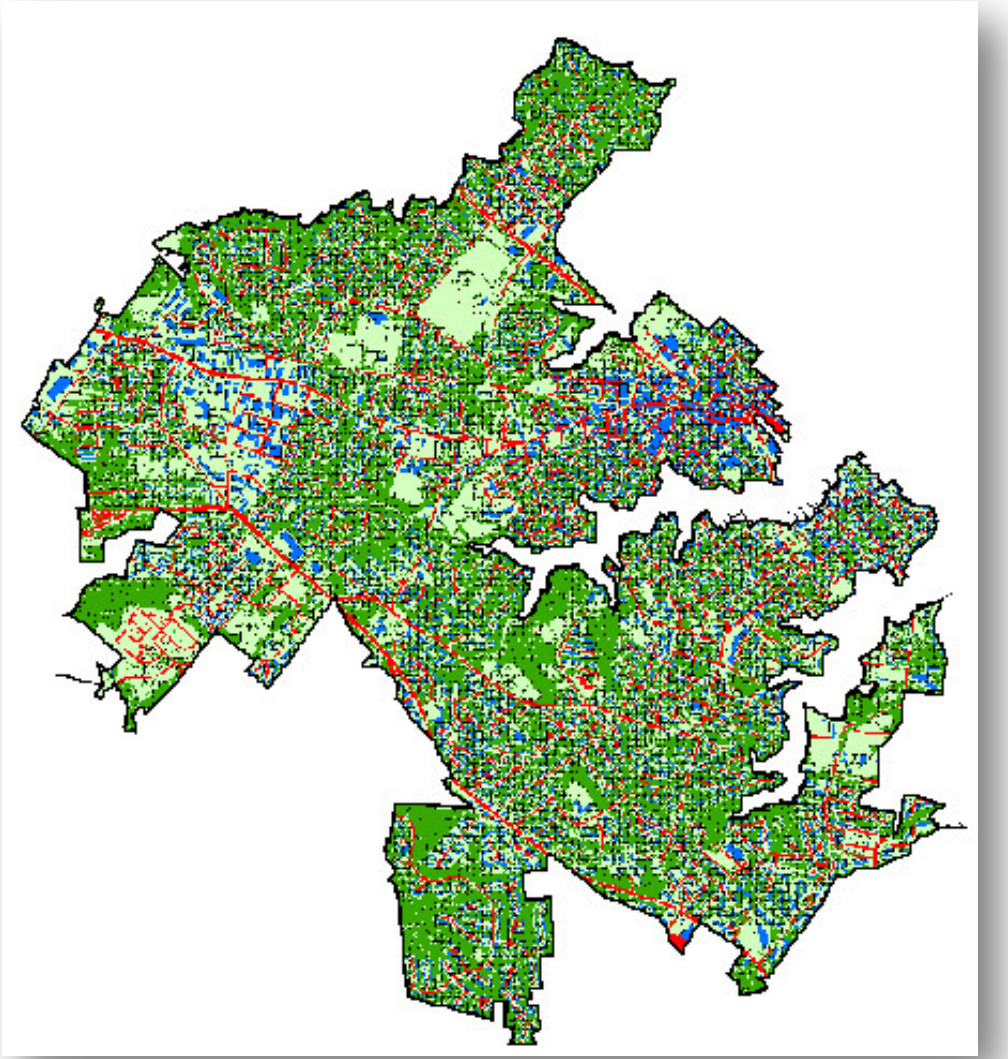
- A free web tool: design.itreetools.org
- Just input location, species, tree size, and condition
- Calculates greenhouse gas mitigation, air quality improvements, and stormwater interception.

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

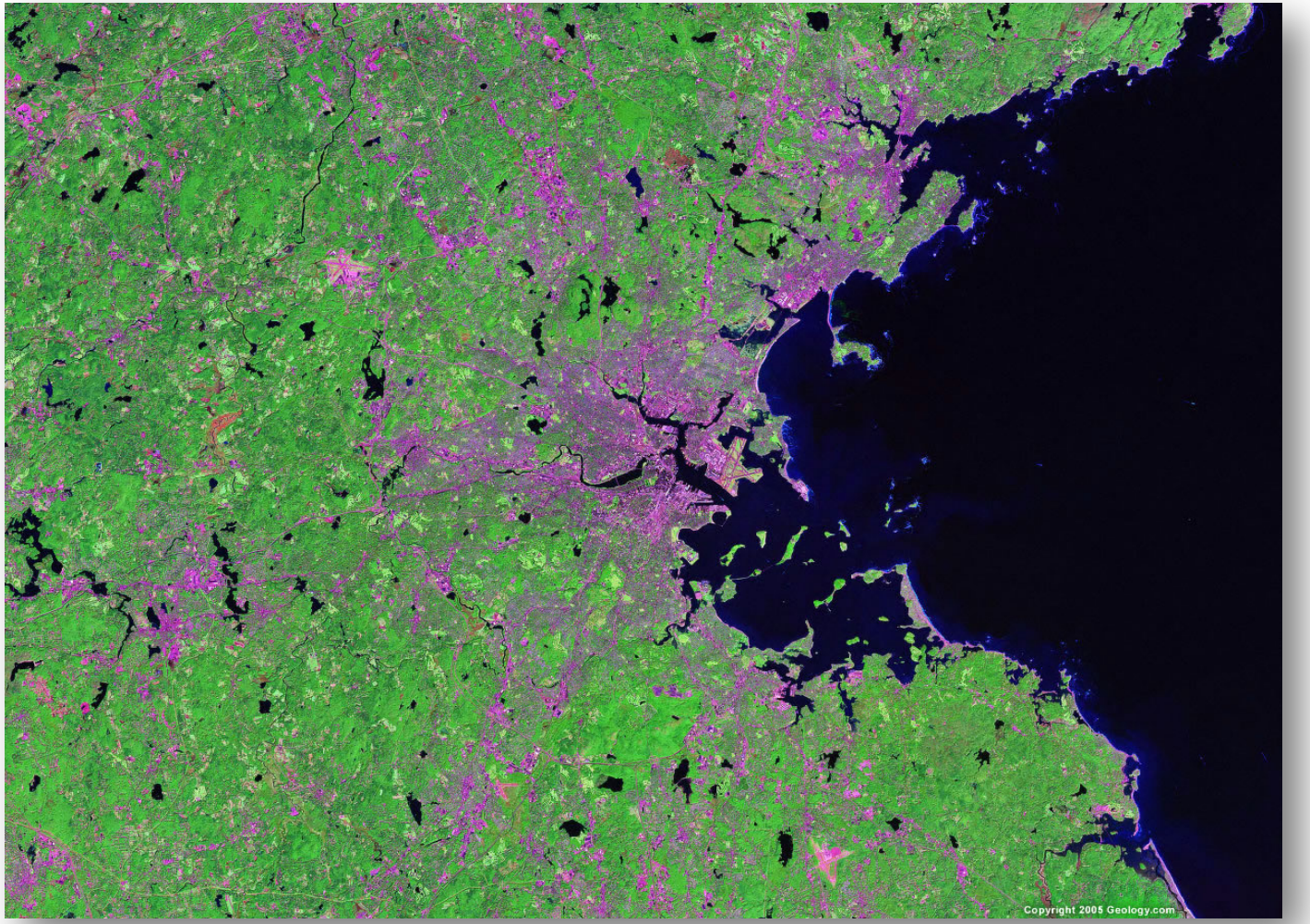
Urban Forests & Tree Canopy

Chicago, IL

Urban Forests & Tree Canopy

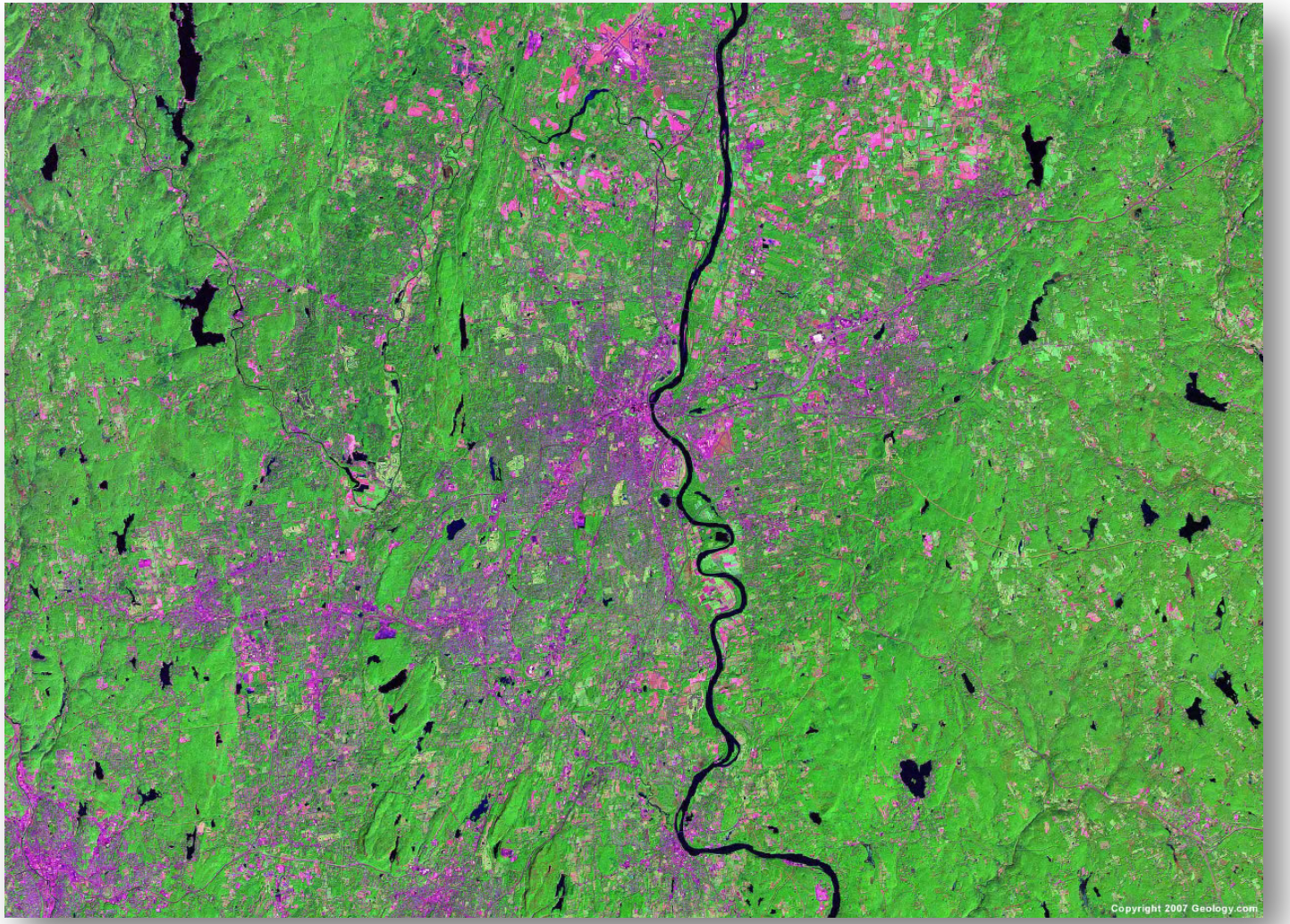
Detroit, MI

Urban Forests & Tree Canopy



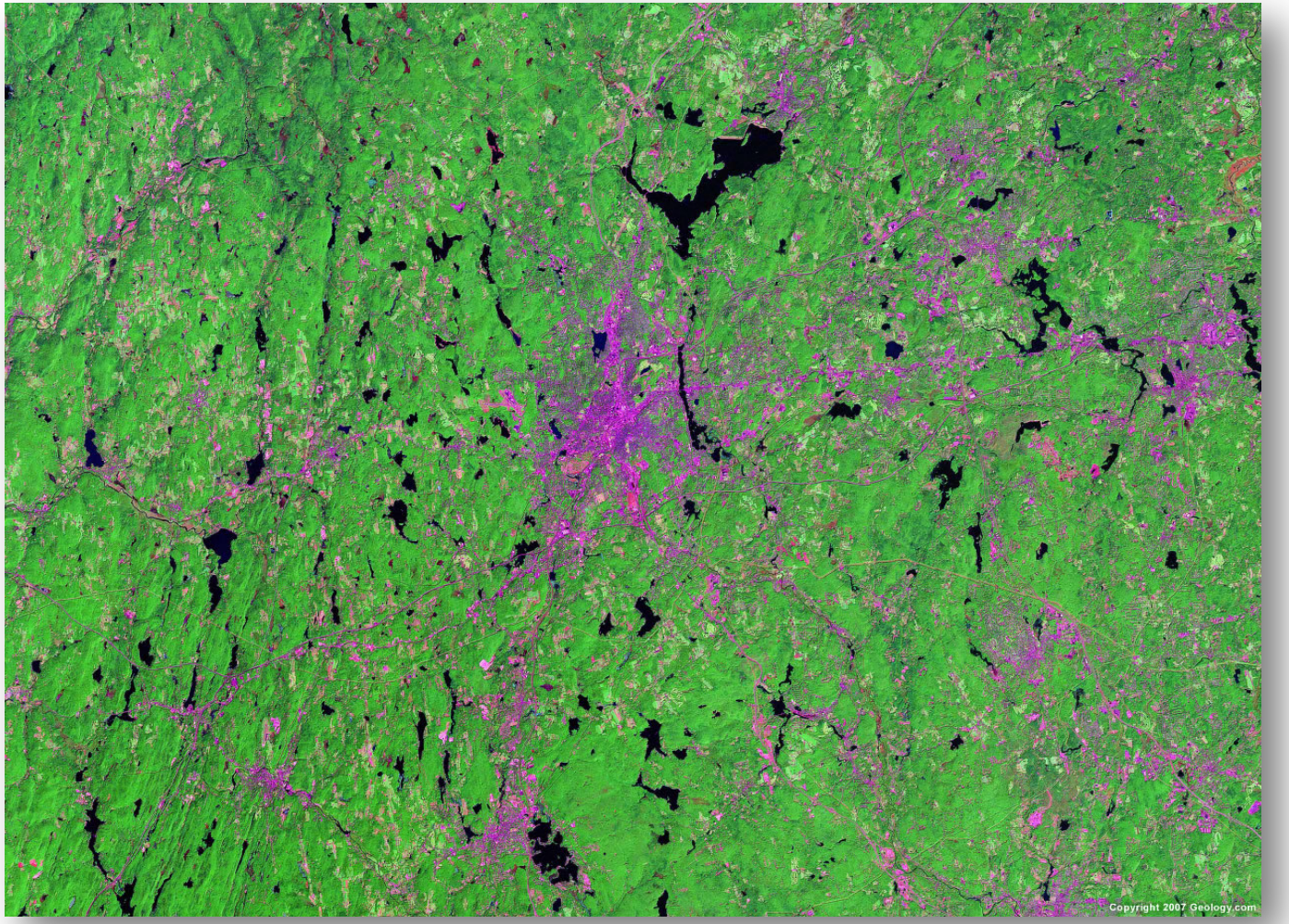
Boston, MA

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

DAVEY

Arbor Day Foundation

ISA

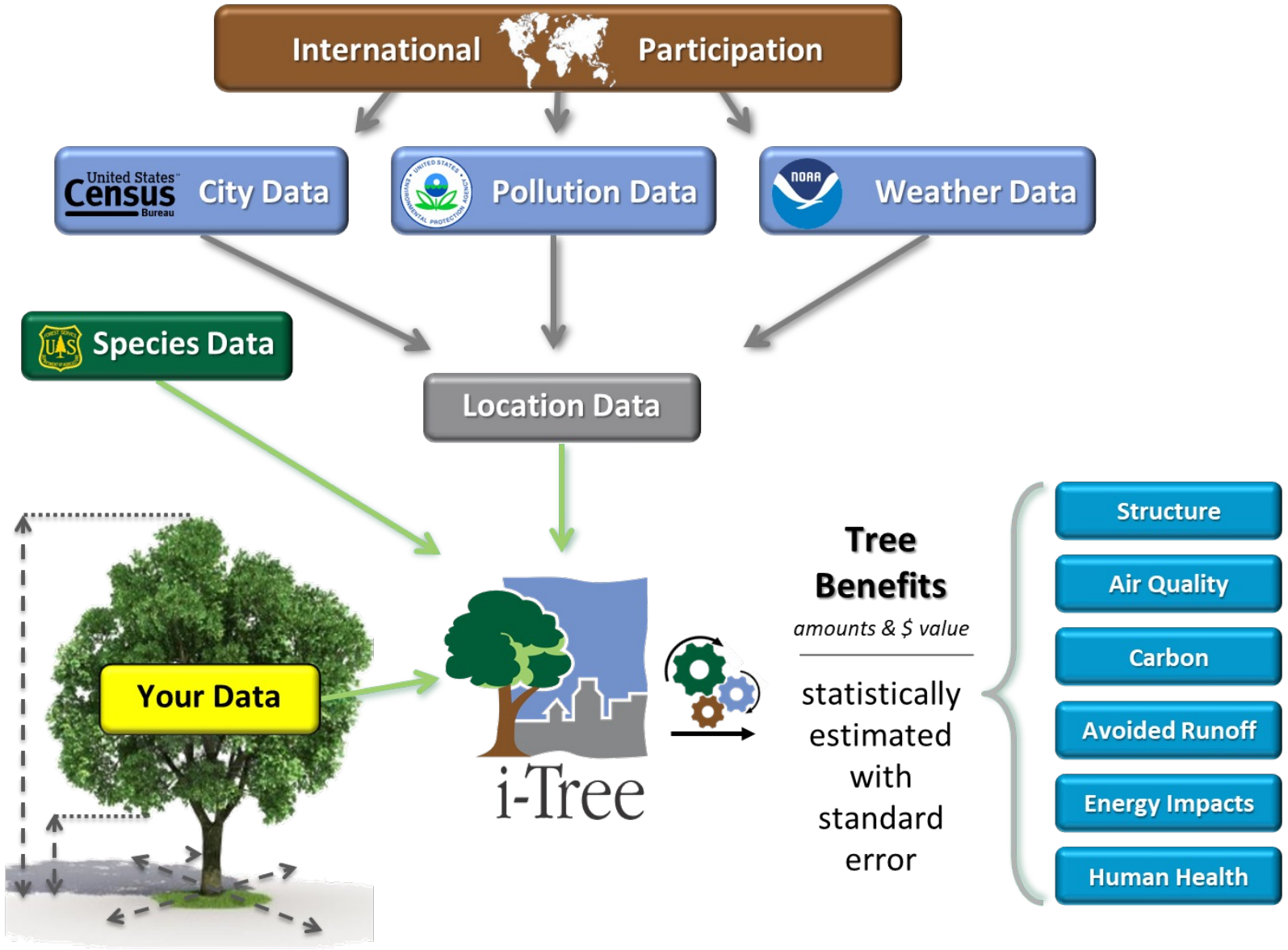
Casey Trees

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

NAASF

EPA
United States
Environmental Protection
Agency

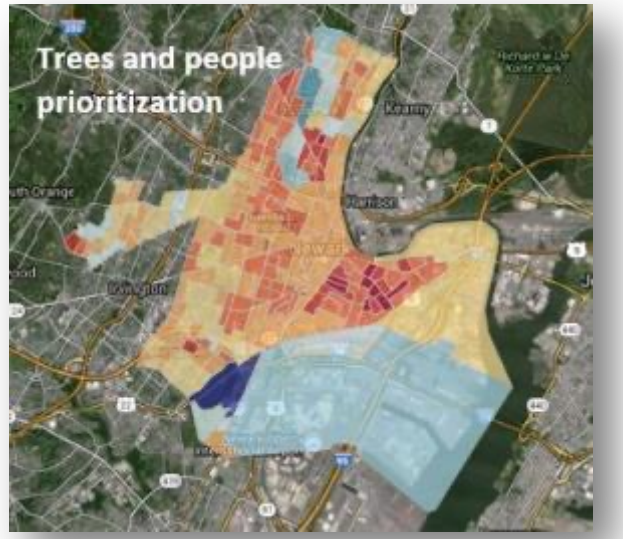
i-Tree Conceptual Model Schematic



Why i-Tree?

Opportunities for communities to…

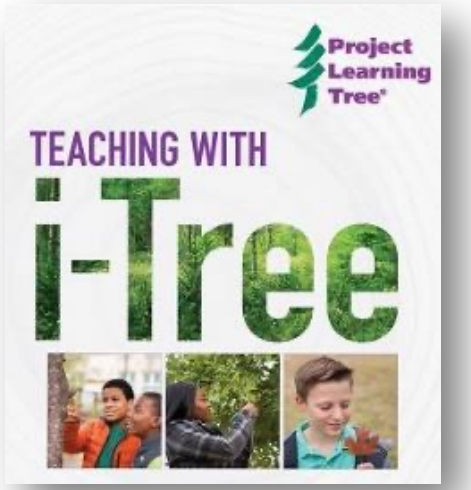
- Plan and manage urban forest resources more strategically to serve and protect citizens;
- Integrate urban forests in policies: sustainability, climate, resiliency, air quality, public health, stormwater, etc.;
- Support advocacy efforts with data;
- Improve preservation of trees and forests;
- Connect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

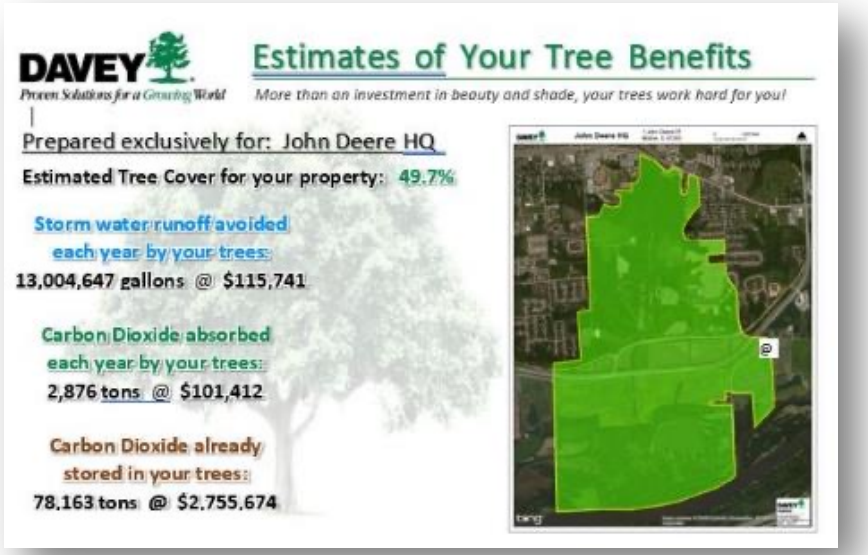


Why i-Tree?

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…



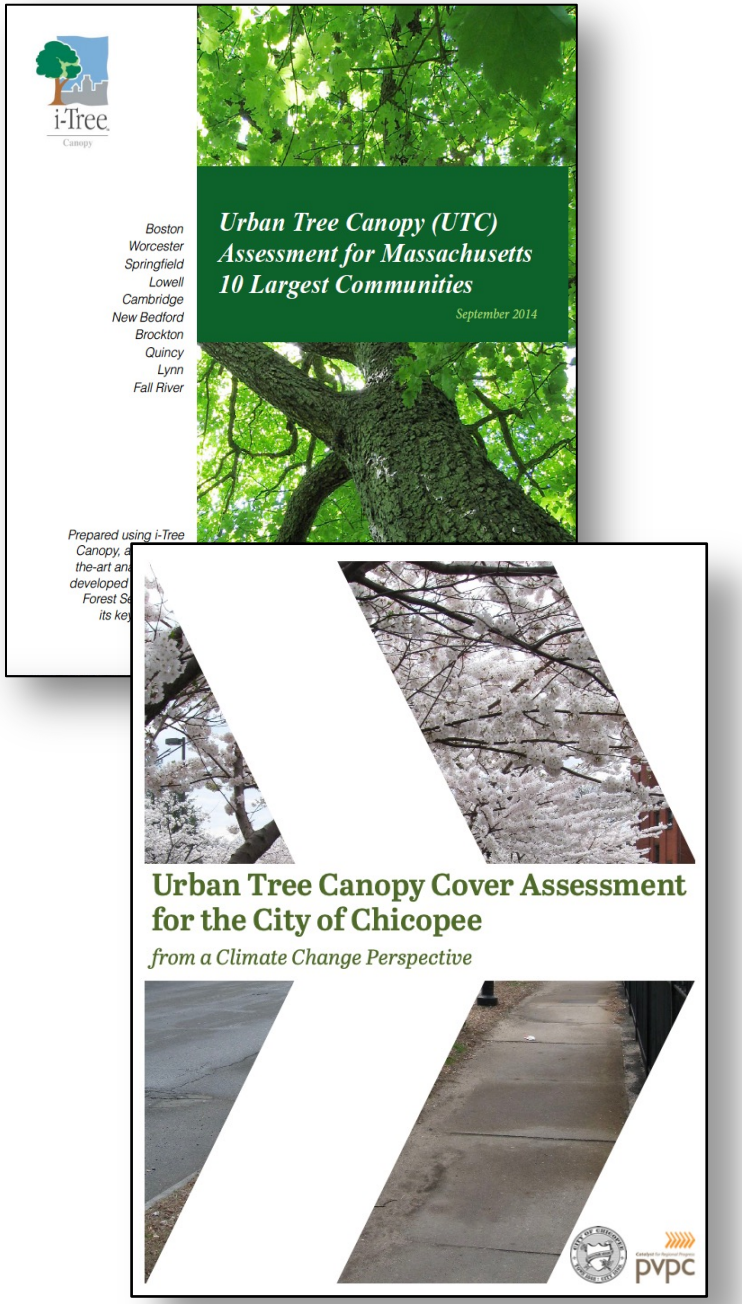


i-Tree's Vision

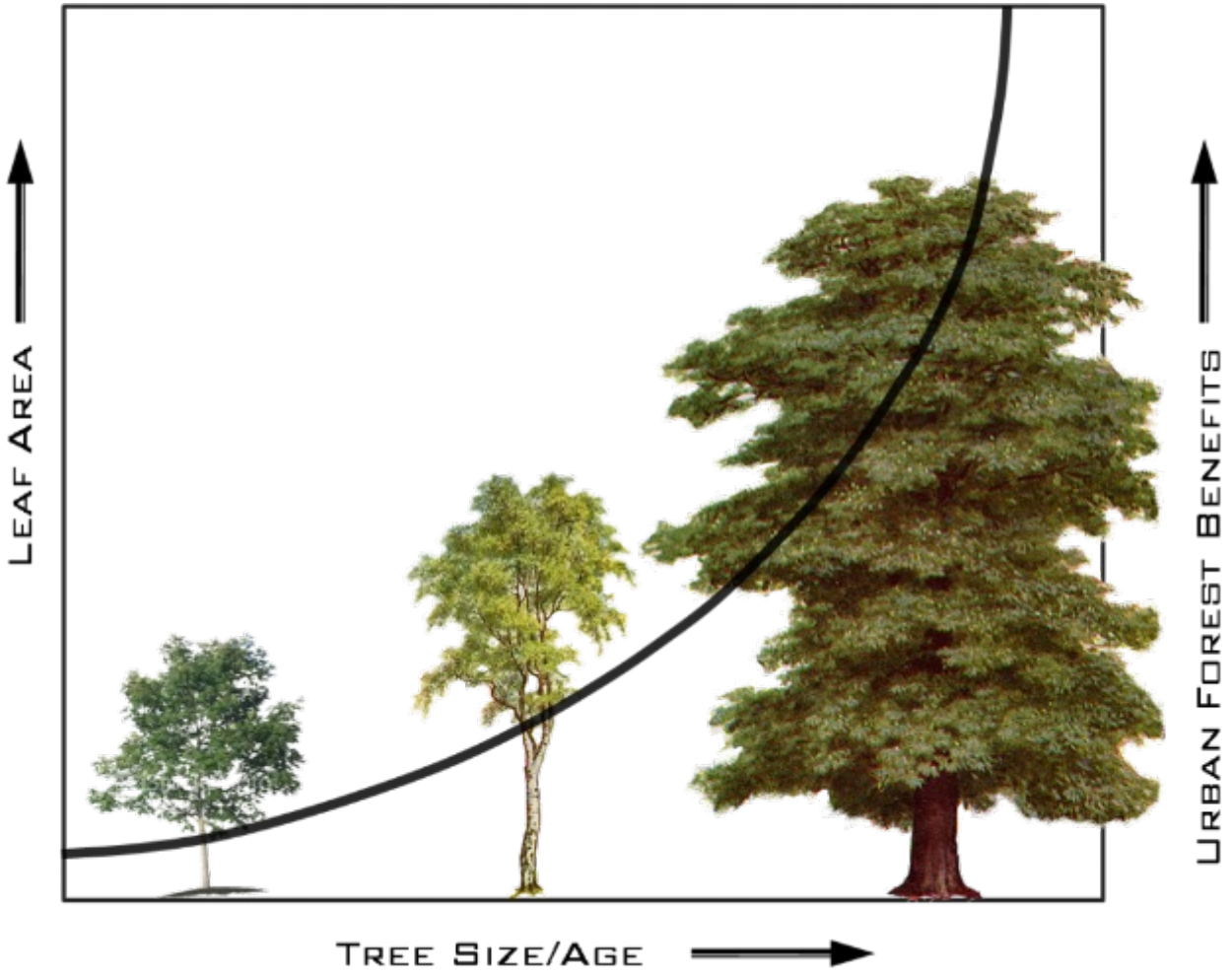
To improve forest and human health, and forest and city resiliency through easy-to-use technology that engages people globally in enhancing forest management.

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

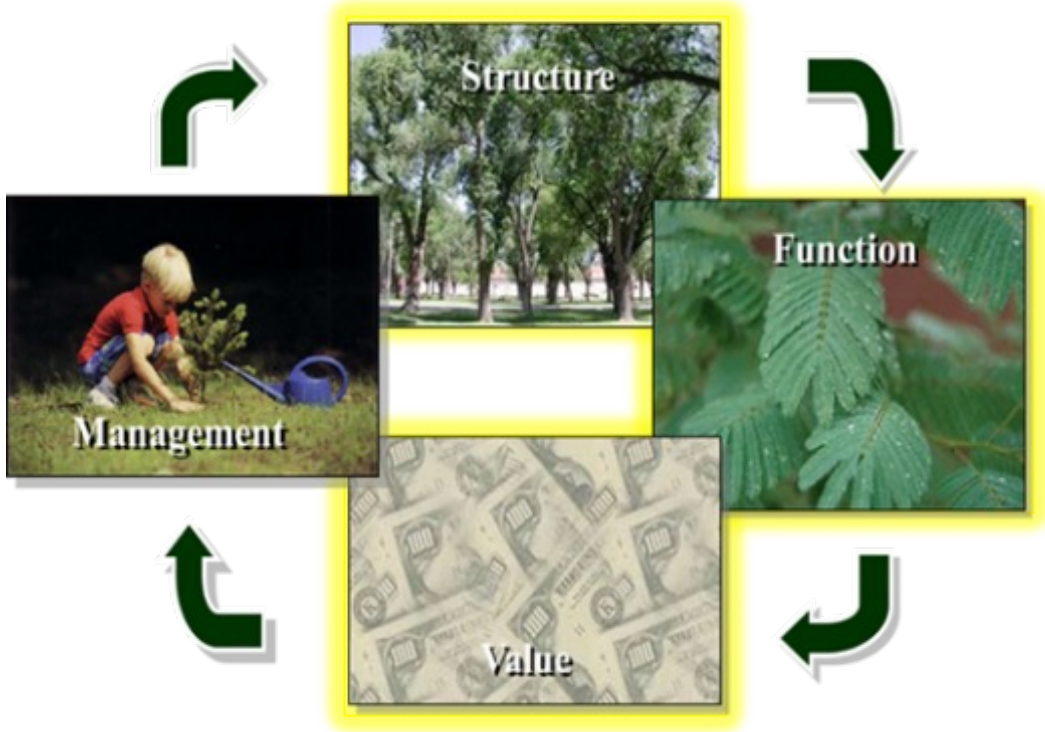
Carbon dioxide storage and sequestration
Air pollution removal
Storm water reduction

$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
Total Benefits	$2,400,975

The only infrastructure that increases in value over time.



Research Science and Data Development

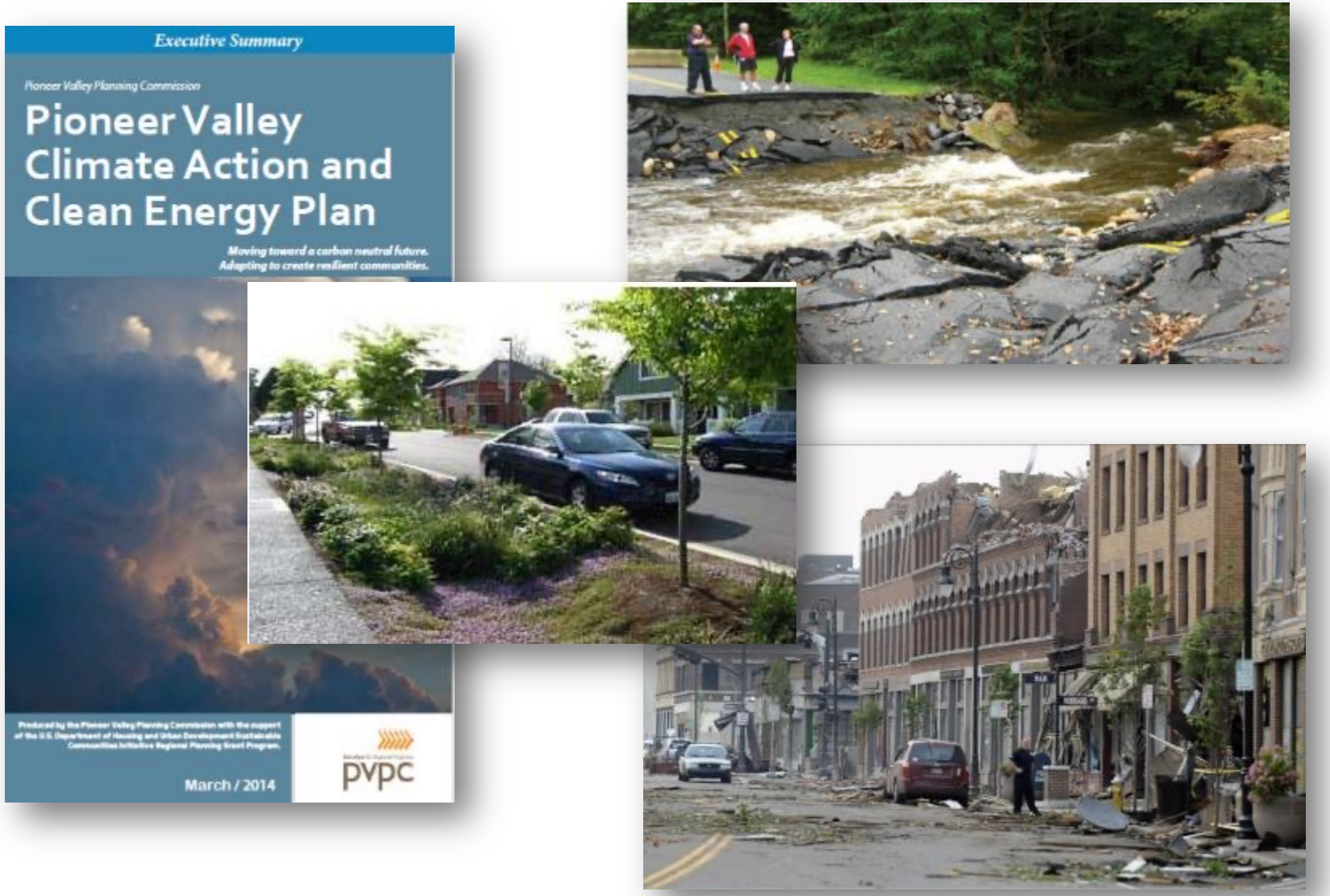
University Researchers

Planners, Engineers & Architects

Commercial Practitioners

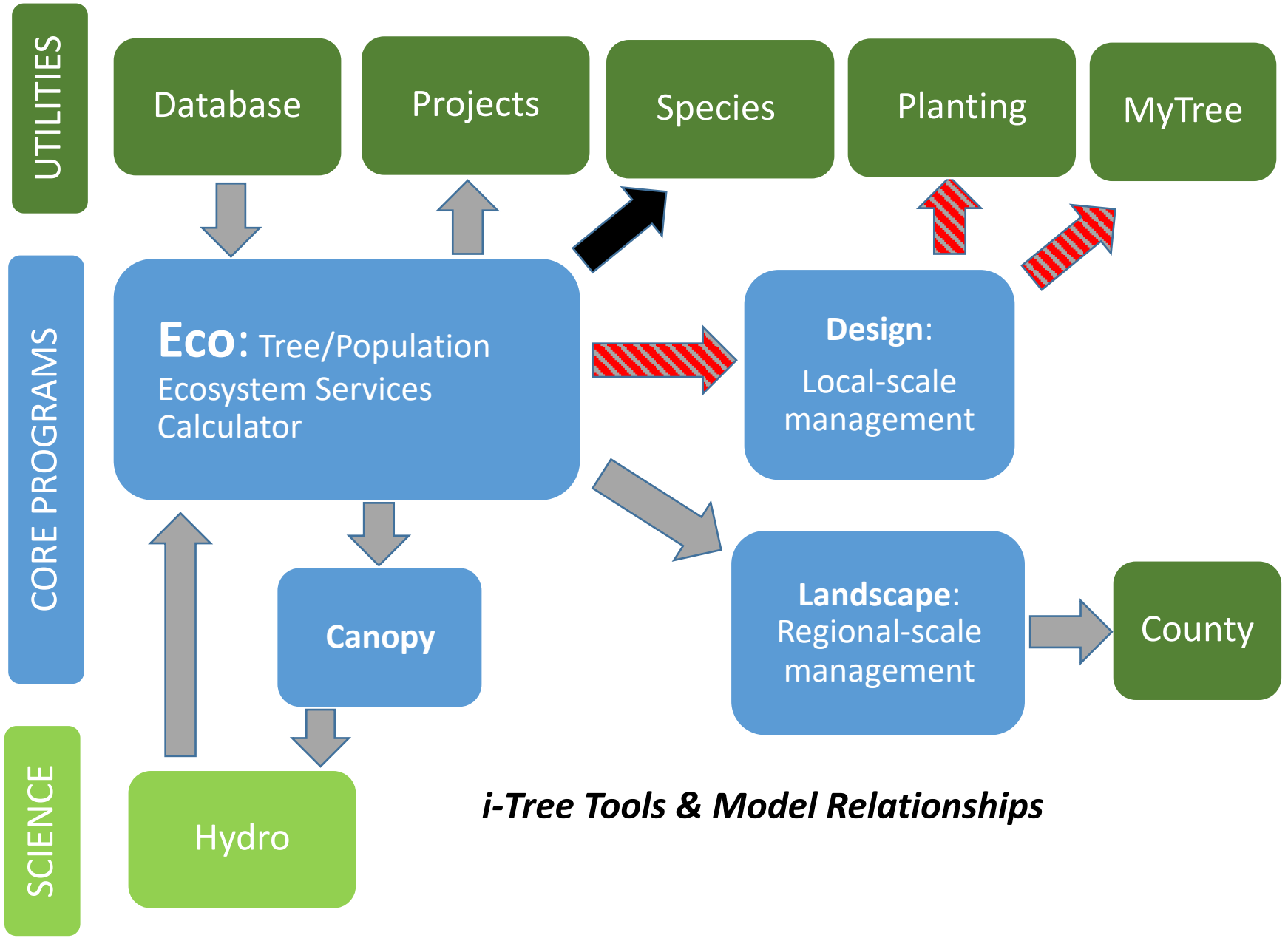
Citizen Scientists

What are your urban forestry challenges and opportunities?



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?*



i-Tree Tools & Model Relationships

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

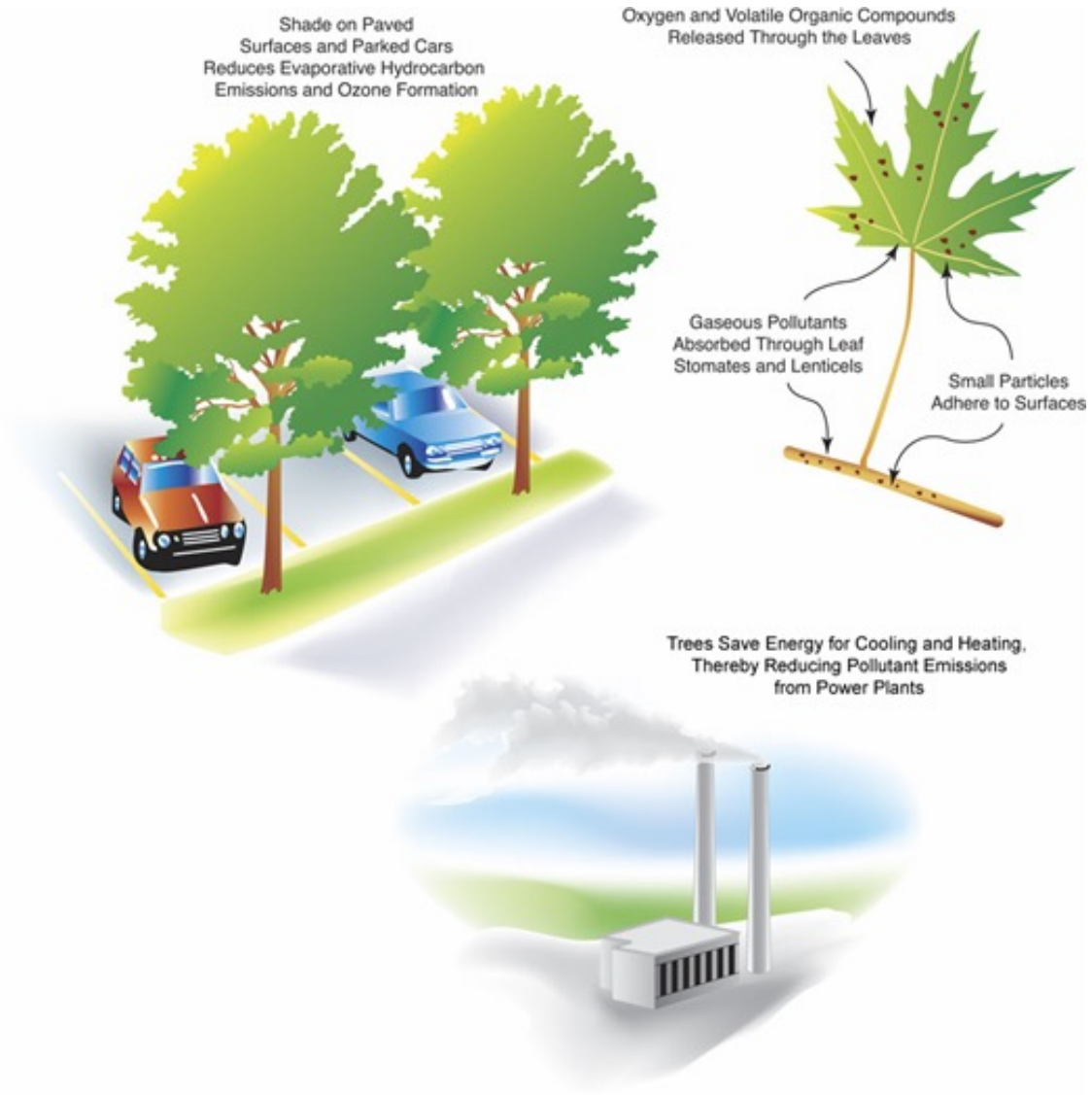
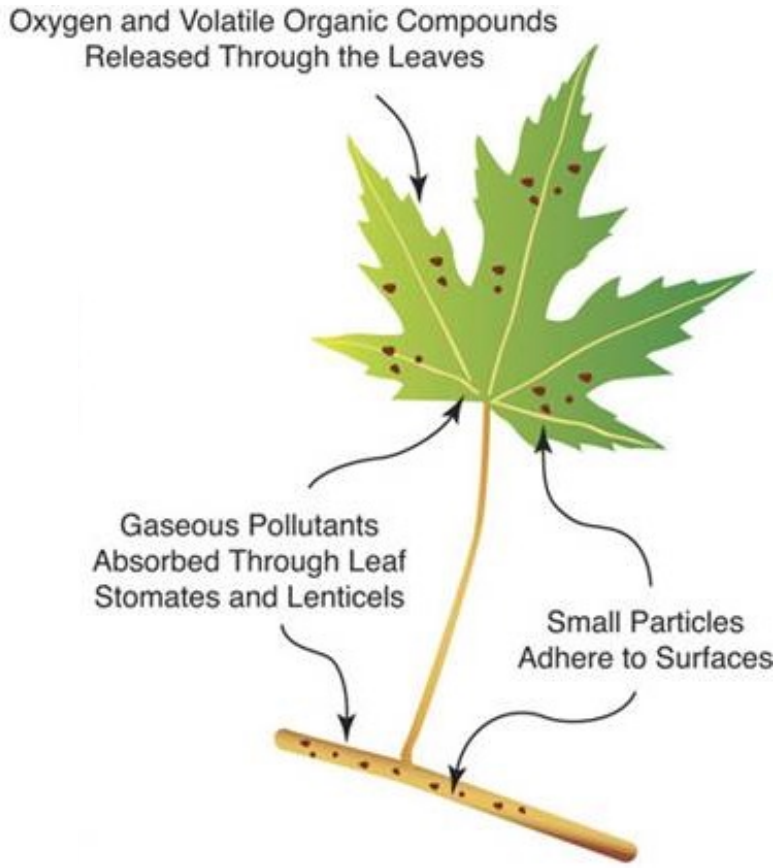


Image courtesy of the Center for Urban Forest Research

Improving Air Quality

- 15” Oak at 20 years (lbs):
  - NO_2 = 0.98
  - SO_2 = 2.72
  - PM_{10} = 0.52
  - Ozone = 0.84
  - VOCs = 0.21



USDA Forest Service, Springfield, MA i-Tree, 2019

Image courtesy of the Center for Urban Forest Research

Tree Benefit: Reduce Carbon Dioxide CO_2

- 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

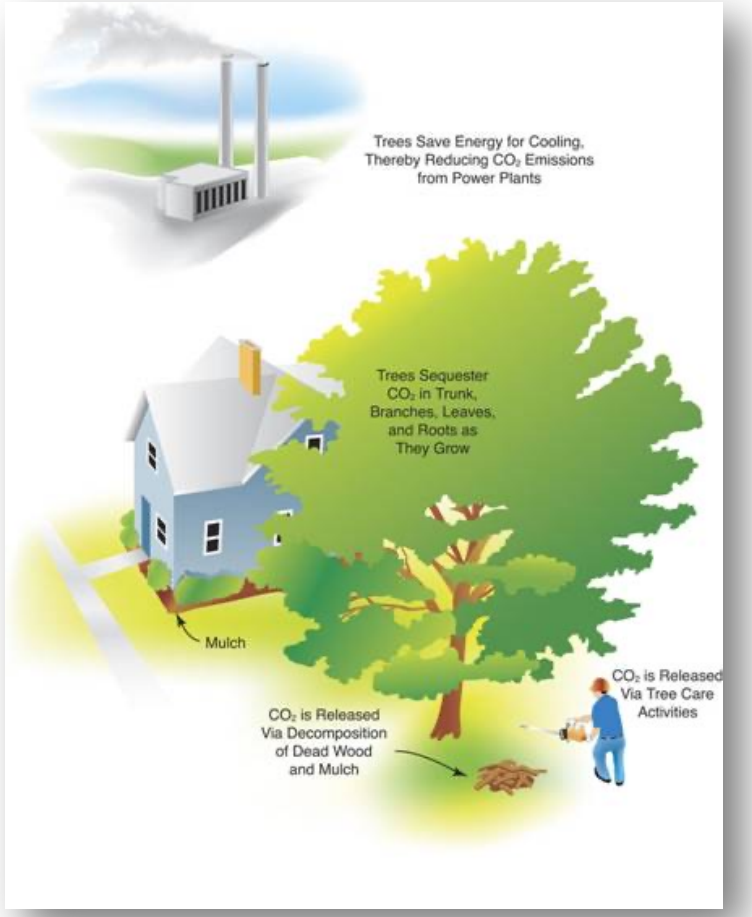


Image courtesy of the Center for Urban Forest Research

10" diameter deciduous shade trees

- 100 trees remove five tons of CO_2/year
- 100 trees remove about 1000 lbs of pollutants per year, including:
  - 400 lbs of ozone
  - 300 lbs of particulates

USDA Forest Service, Brattleboro, VT, i-Tree, 2020

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

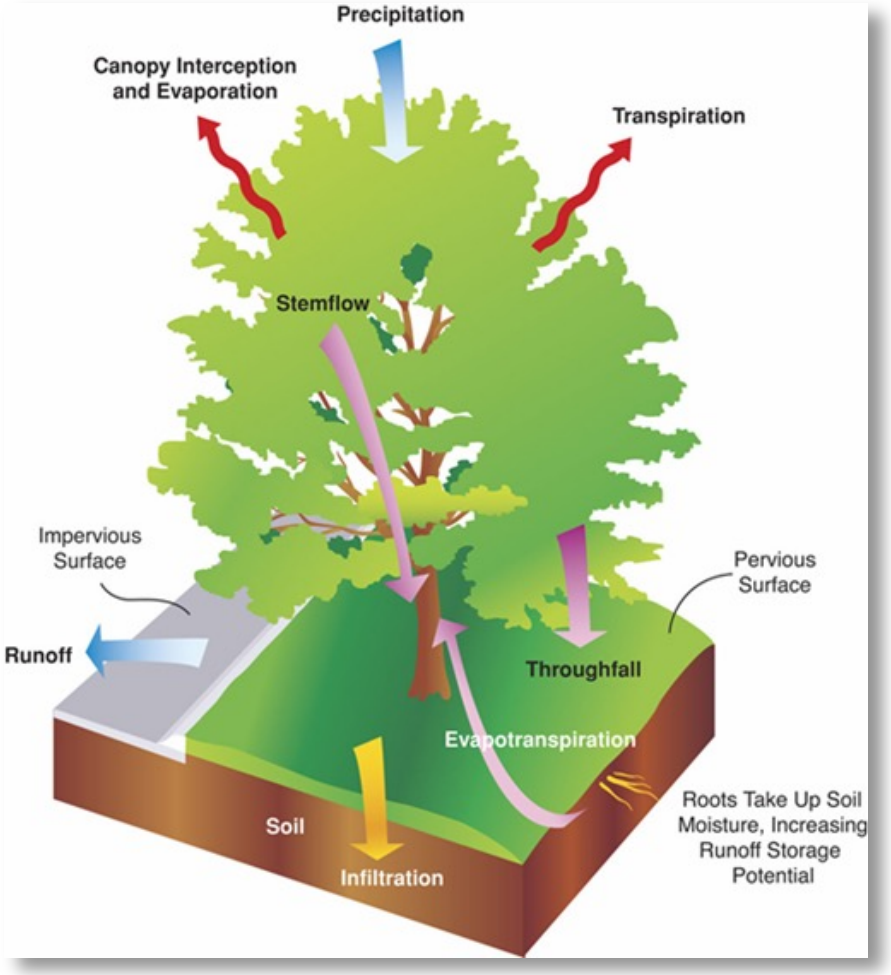


Image courtesy of the Center for Urban Forest Research

Trees & Energy – Summer Effects

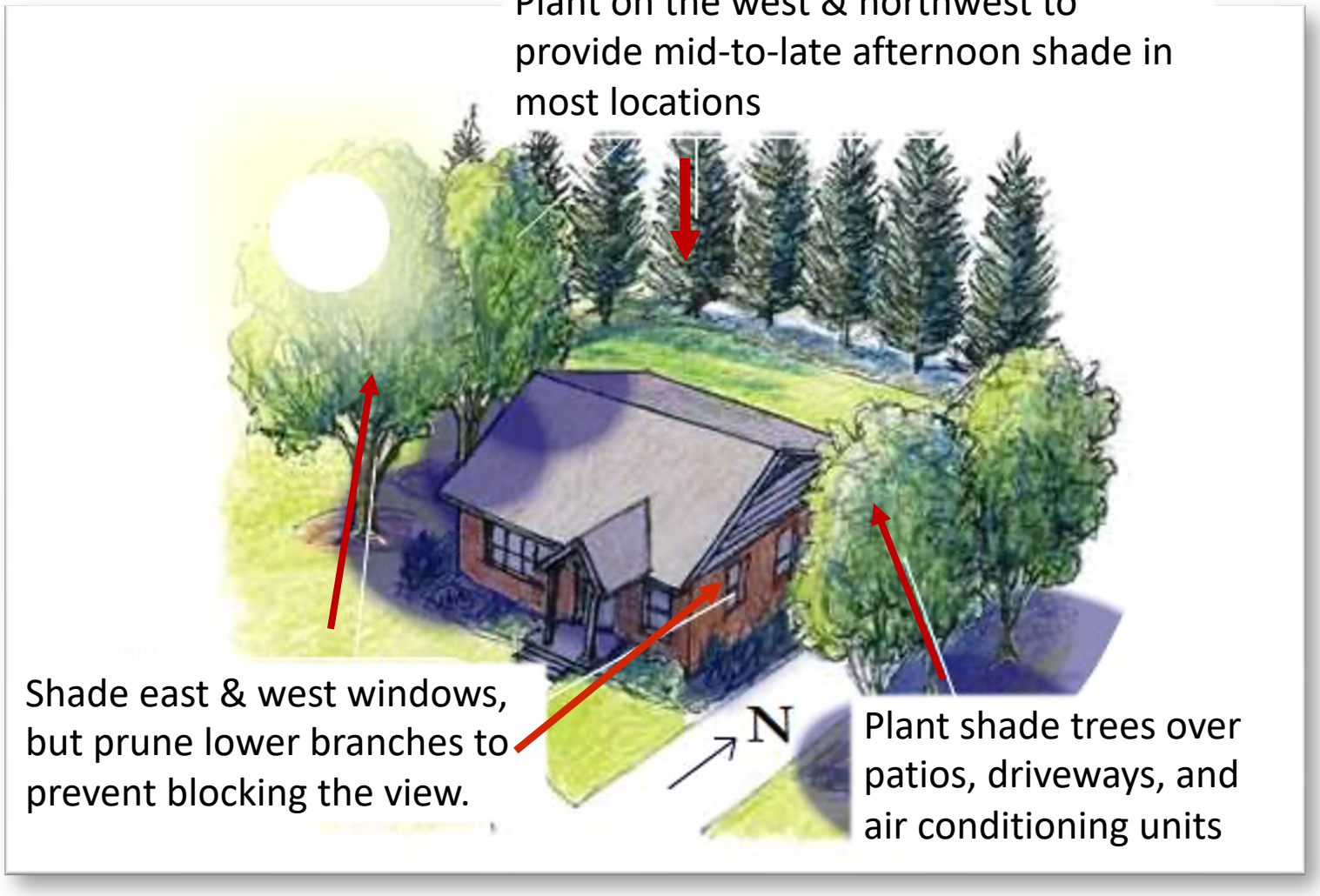


Image courtesy of Arbor Day Foundation
https://www.arborday.org/trees/

Trees & Energy – Winter Effects

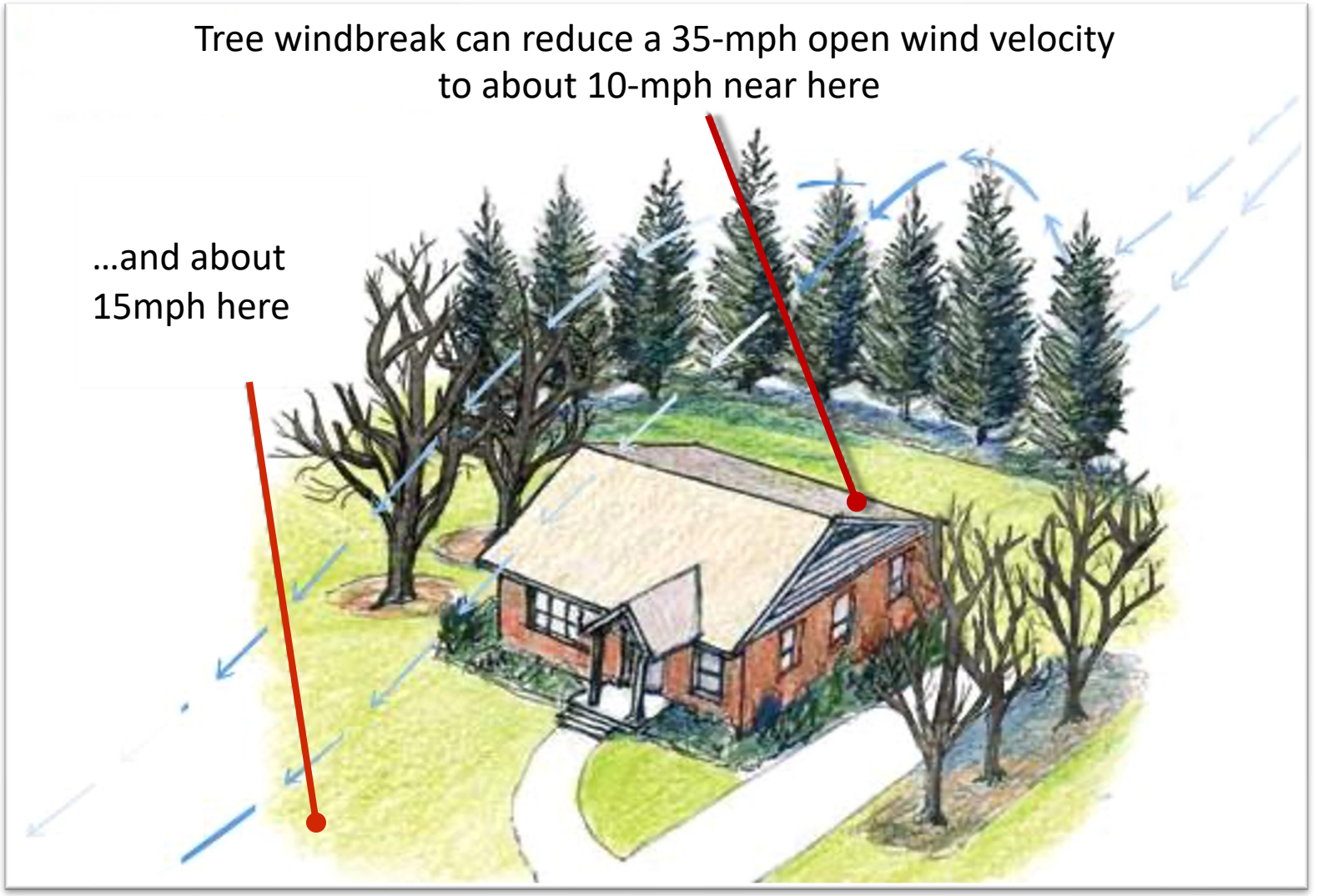
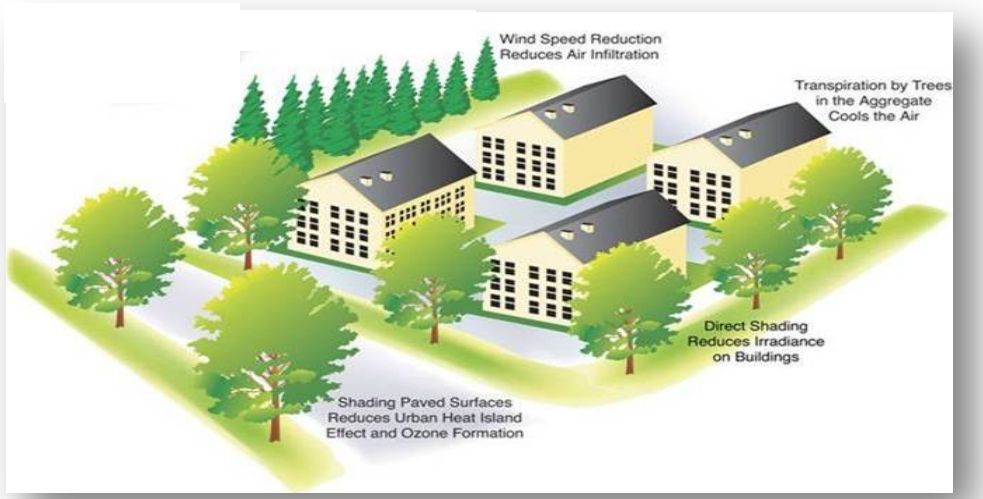


Image courtesy of Arbor Day Foundation
https://www.arborday.org/trees/

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*)

Image courtesy of the Center for Urban Forest Research

Conserving Energy

Northeast U.S. Average

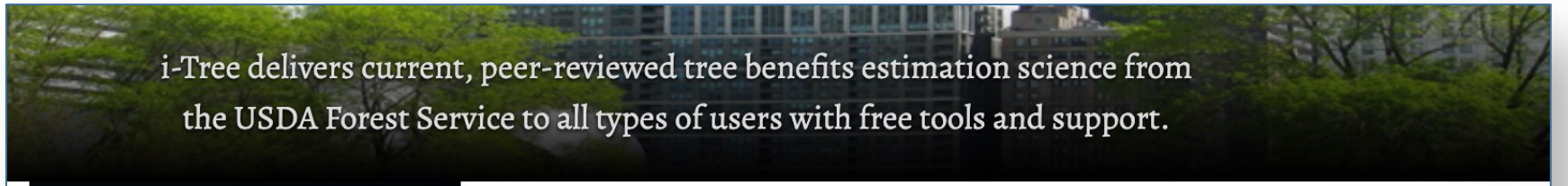
- Save up to 30% of annual air conditioning costs

- Save 10-25% of winter heating costs

USDA Forest Service, i-Tree, 2021

Image courtesy of the Center for Urban Forest Research

www.itreetool.org Resoures



i-Tree

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

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

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

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

i-Tree Canopy

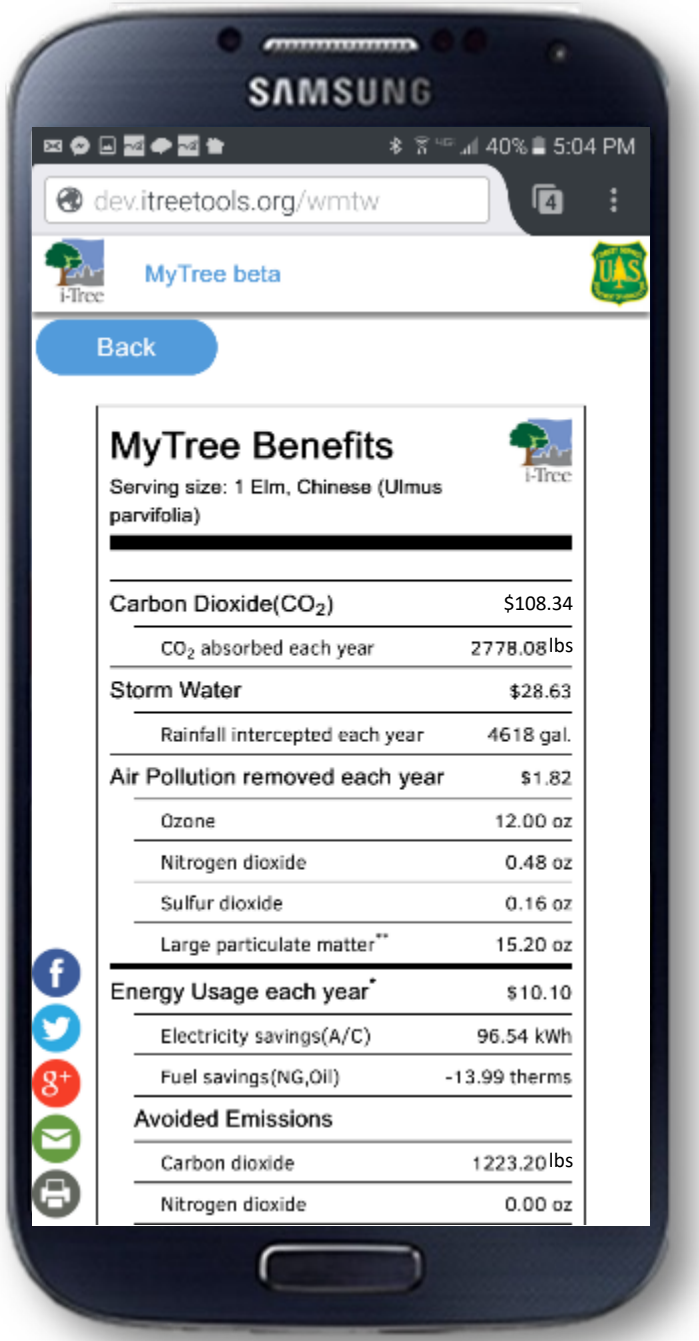
From your chair, easily estimate land cover and **tree canopy** plus benefits using random point sampling on aerial imagery.
via your web browser

More tools...

MyTree

i-Tree

MyTree

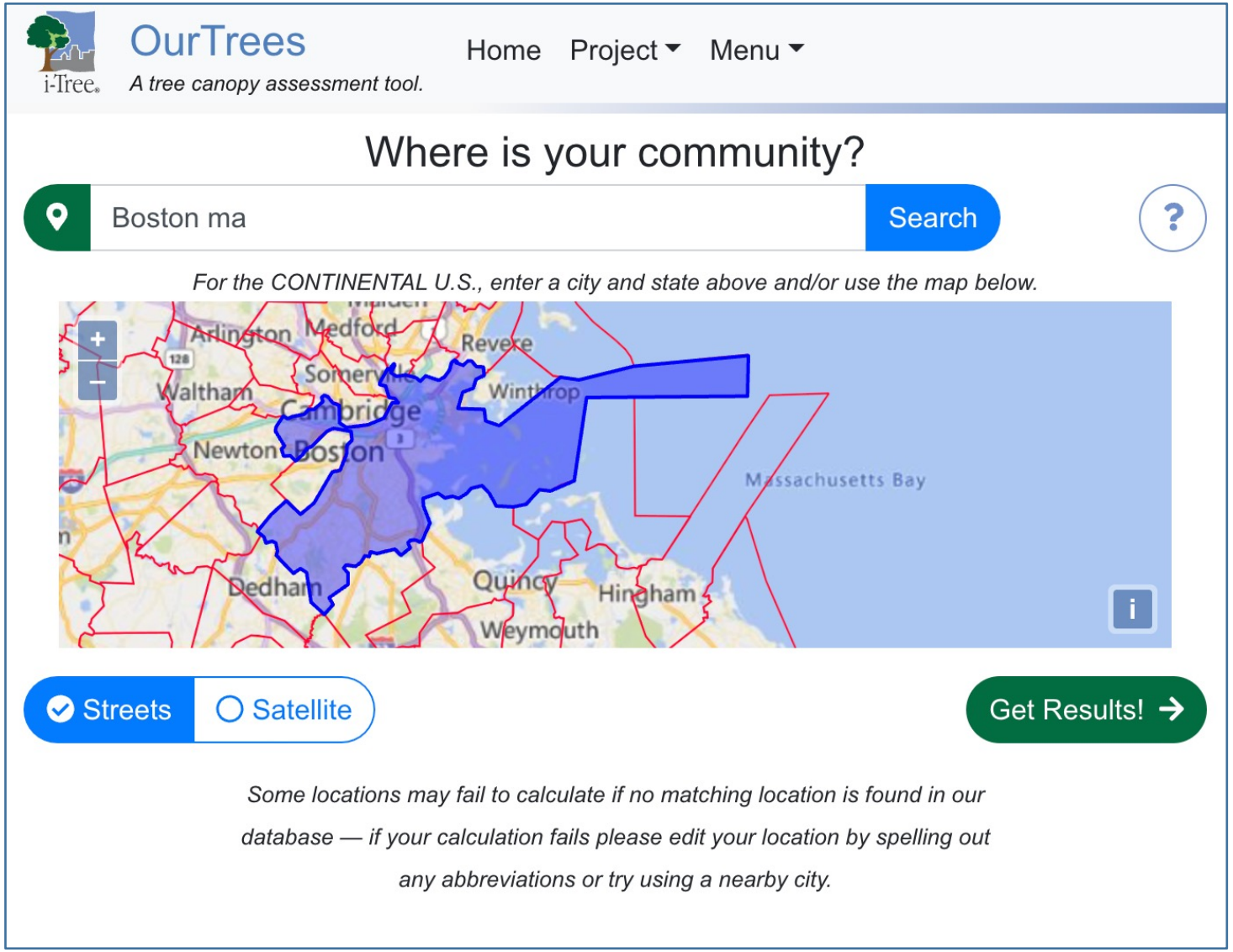


i-Tree on the go…

for individual or multiple trees!

MyTree

i-Tree quick summary data for any community



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_2 Equivalent[1]	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
$PM_{2.5}$	12,898 lb/yr

Values are totals to date:	
Carbon Dioxide Uptake	**$34,197,062**
Carbon Storage	200,453 tn
CO_2 Equivalent[1]	734,994 tn

Benefits are based on USDA Forest Service research and are meant for guidance only. Visit 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 to learn more.

+ Read the fine print.

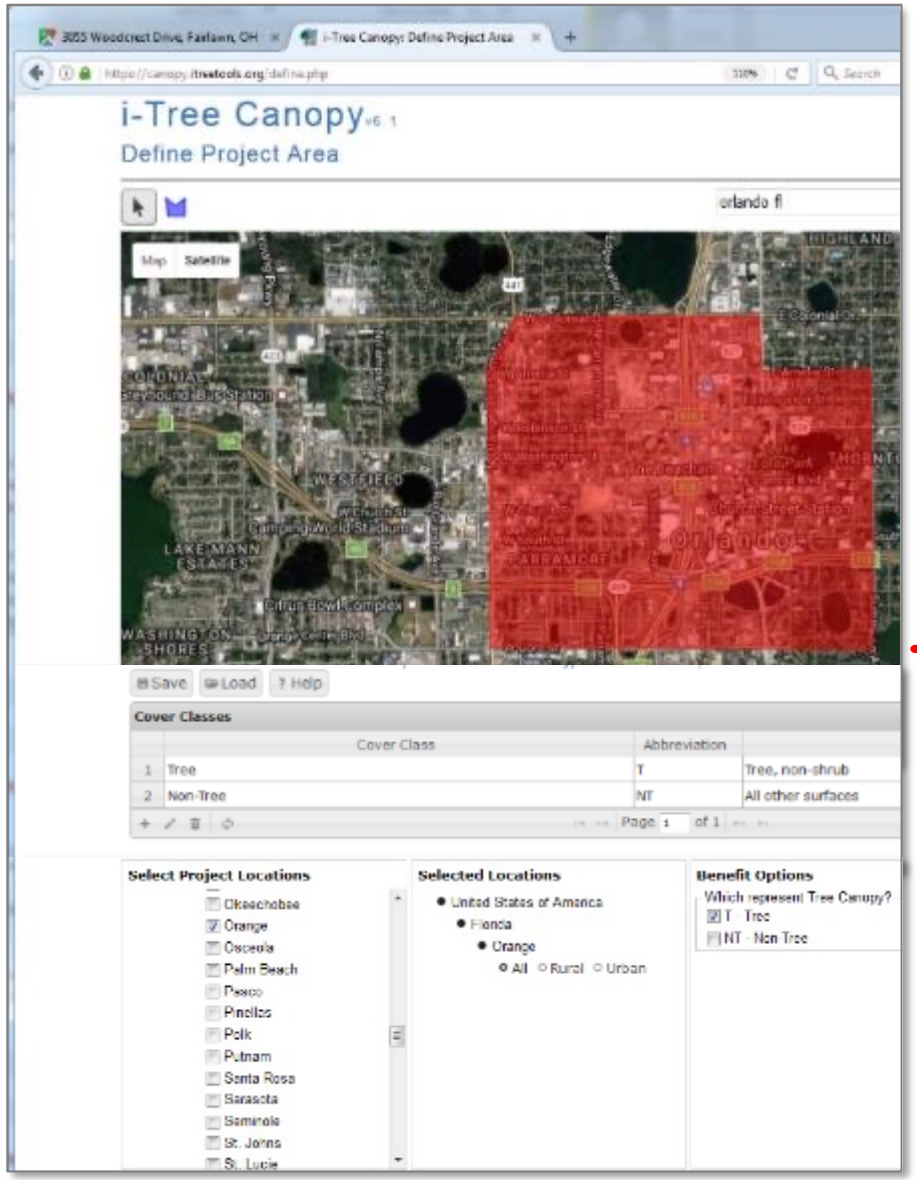
i-Tree Canopy

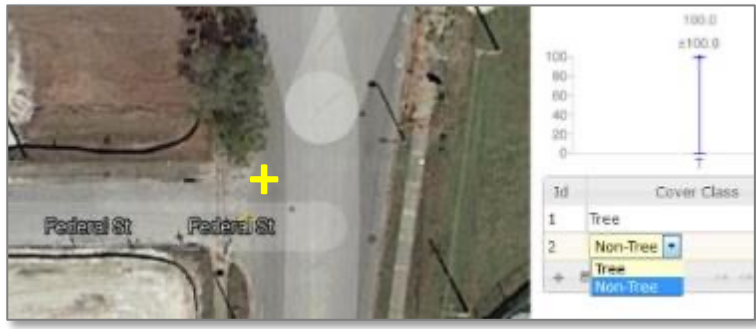
i-Tree Canopy

Quick, statistical estimate of Canopy cover and associated benefits.

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

Enhanced UI coming soon!

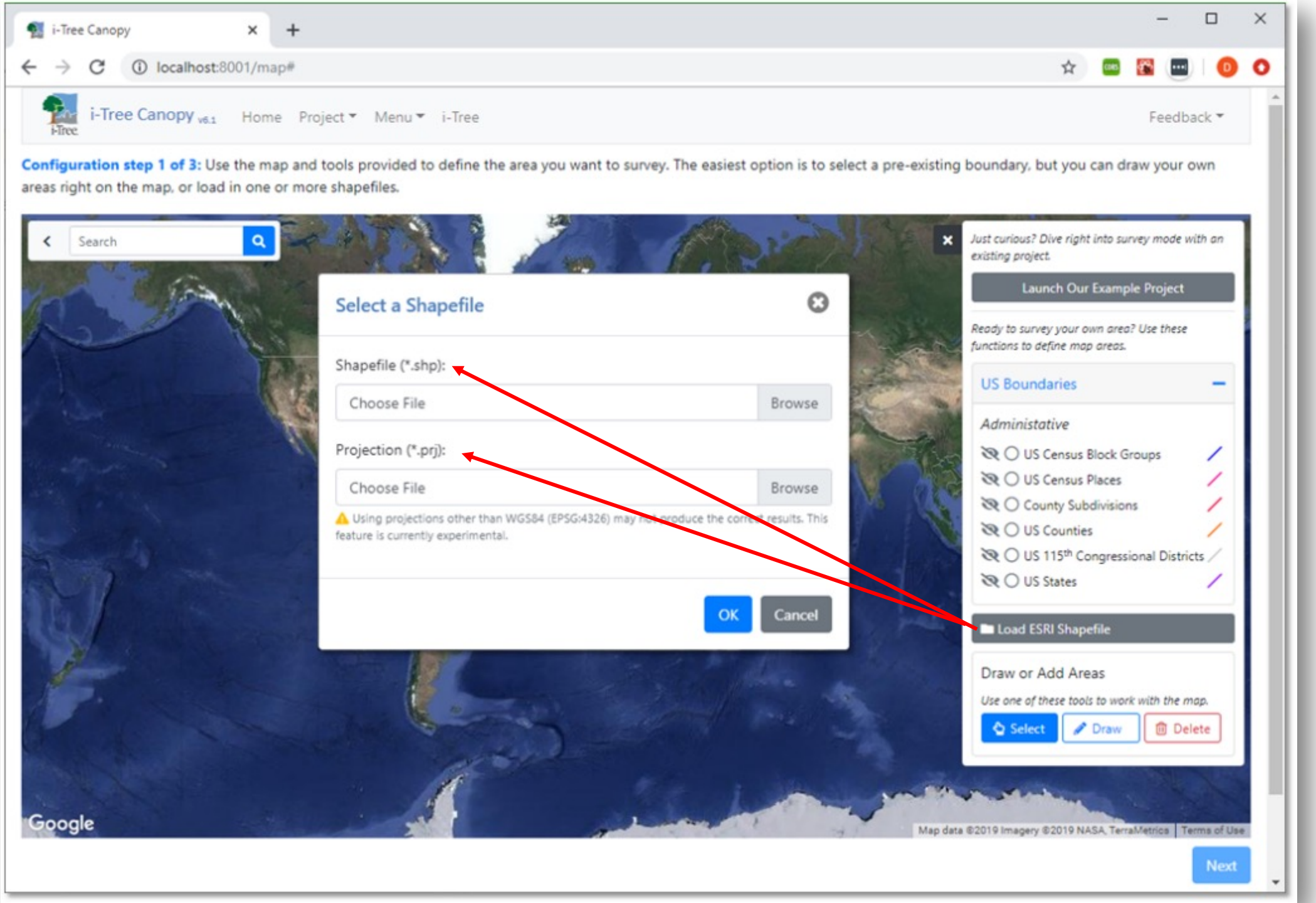




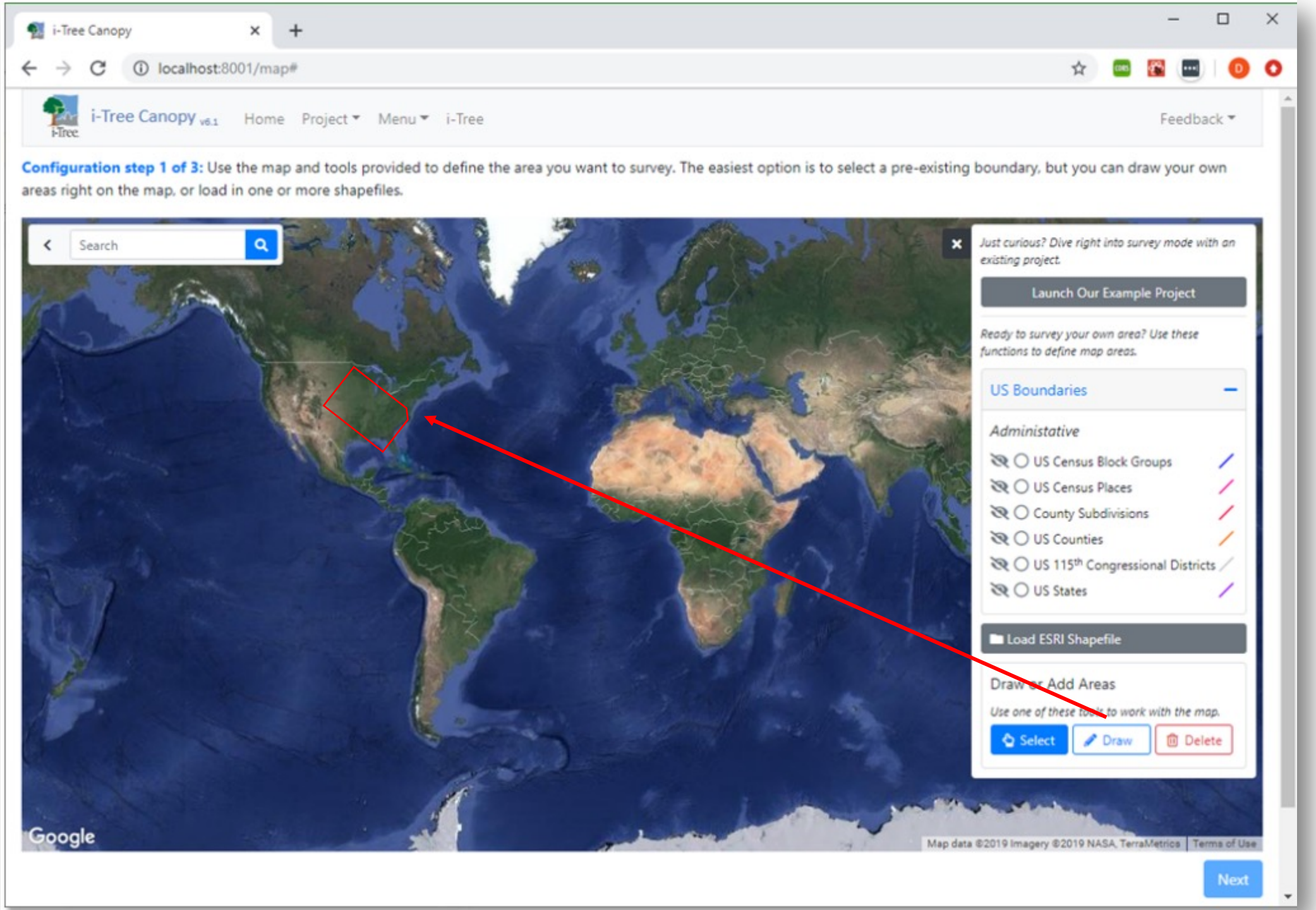
Cover Class	Description	Abbr.	Points	% Cover
Tree	Tree, non-shrub	T	11	18.3 ±5.0
Non-Tree	All other surfaces	NT	49	81.7 ±5.0

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

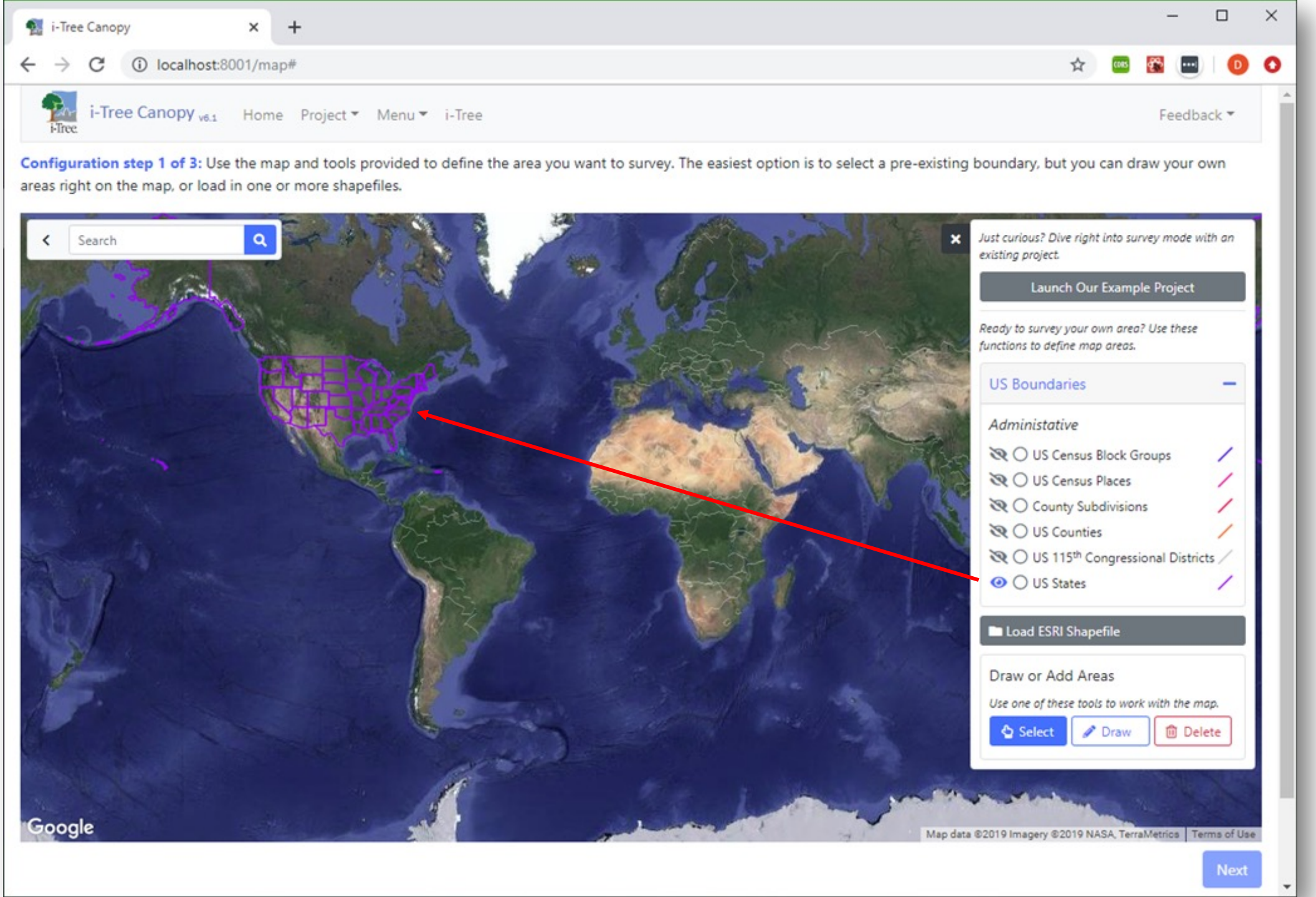
i-Tree Canopy *preview*



i-Tree Canopy *preview*



i-Tree Canopy *preview*



i-Tree Canopy preview

i-Tree Canopy

localhost:8001/survey

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

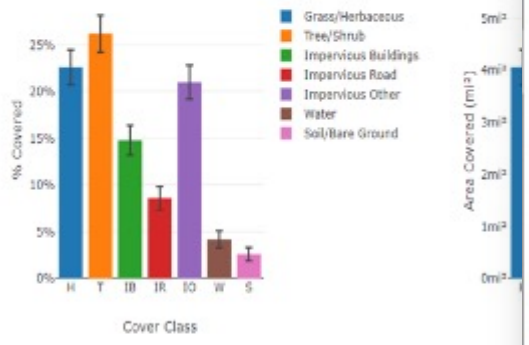
i-Tree Canopy *preview*

i-Tree Canopy v6.1

Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 11/14/19

Land Cover



Cover Class	Description	Abbr.
Grass/Herbaceous		H
Tree/Shrub		T
Impervious Buildings		IB
Impervious Road		IR
Impervious Other		IO
Water		W
Soil/Bare Ground		S
Total		

Abbr.	Description			
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	3.78 ± 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
Total				

Tree Benefit Estimates: Carbon (English units)

Description	Carbon (T)	±SE
Sequestered annually in trees	4,129.69	±309
Stored in trees (Note: not an annual rate)	103,711.91	±7,784

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
Total		**$264,174.87**	**±19,828.23**	**81.41**	**±6.11**

Air Pollution Estimates are based on these values in lbs/acre/yr @ $/T/yr CO 2,178 @ $622.27 | NO2 5,308 @ $240.88 | O3 38,960 @ $1,342.88 | PM2.5 1,688 @ $54,670.18 | SO2 1,030 @ $78.22 | PM10 5,284 @ $2,377.52. 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/in/ft/yr: AvRO 4.54 | E 47.5 | I 47.6 | T 78.6 | PE 395.9 | PET 290.8 . Hydrological Value is based on amount of Avoided Runoff at $0.996.60/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

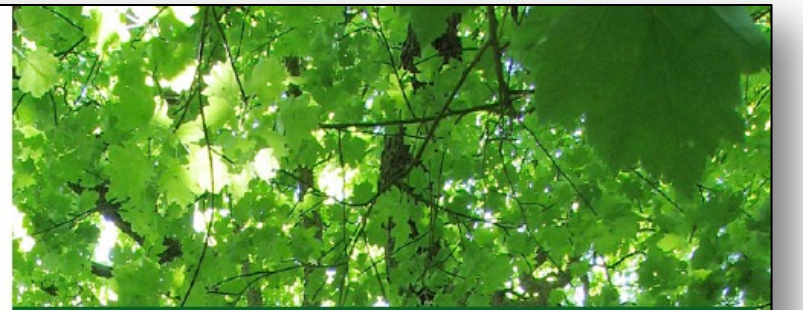
The concept and prototype of this program were developed by David J. Nowak, Jeffrey T. Walton, and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company)

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.

DAVEY · Arbor Day Foundation · ISA · Casey Trees

Use of this tool indicates acceptance of the EULA.

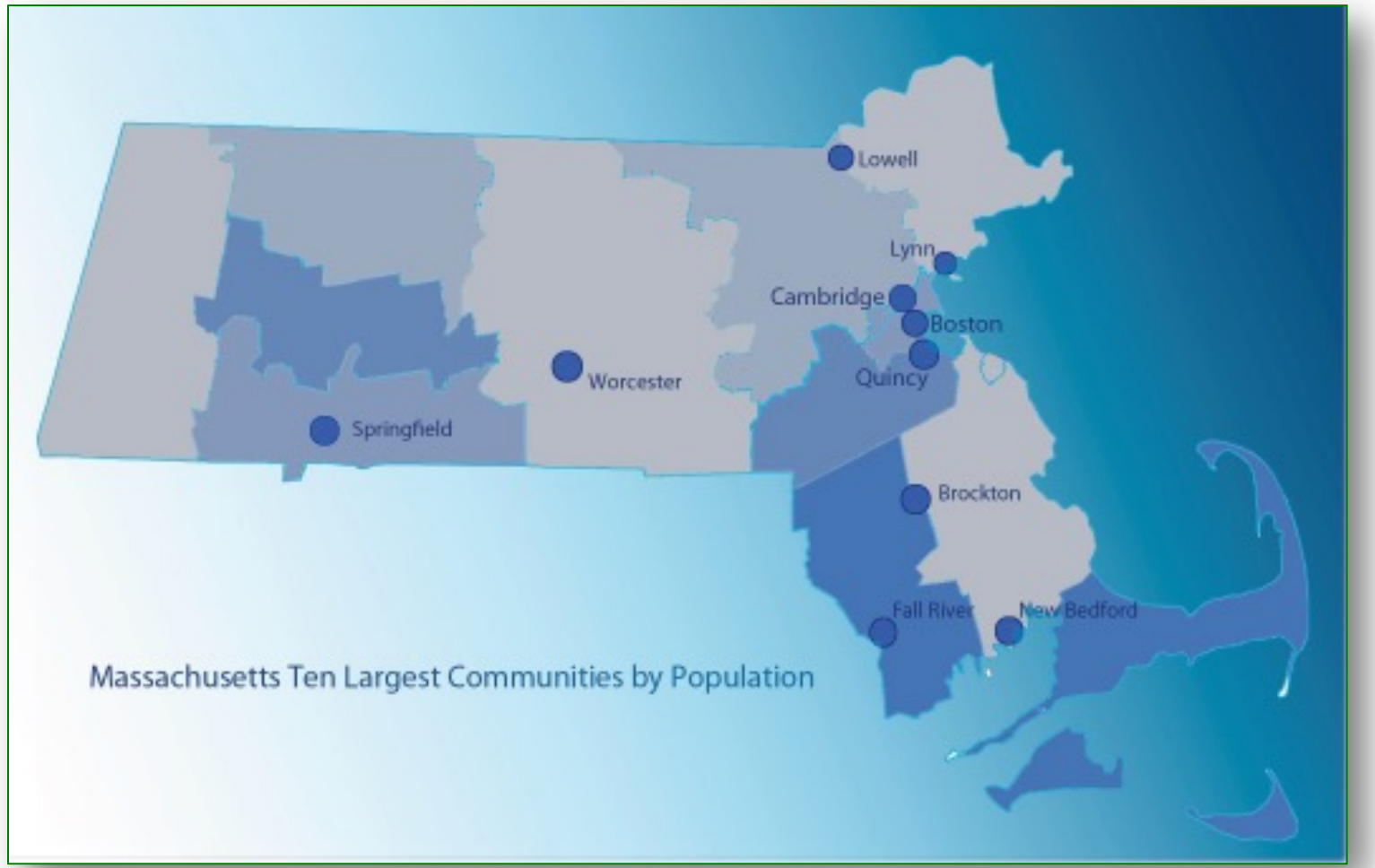


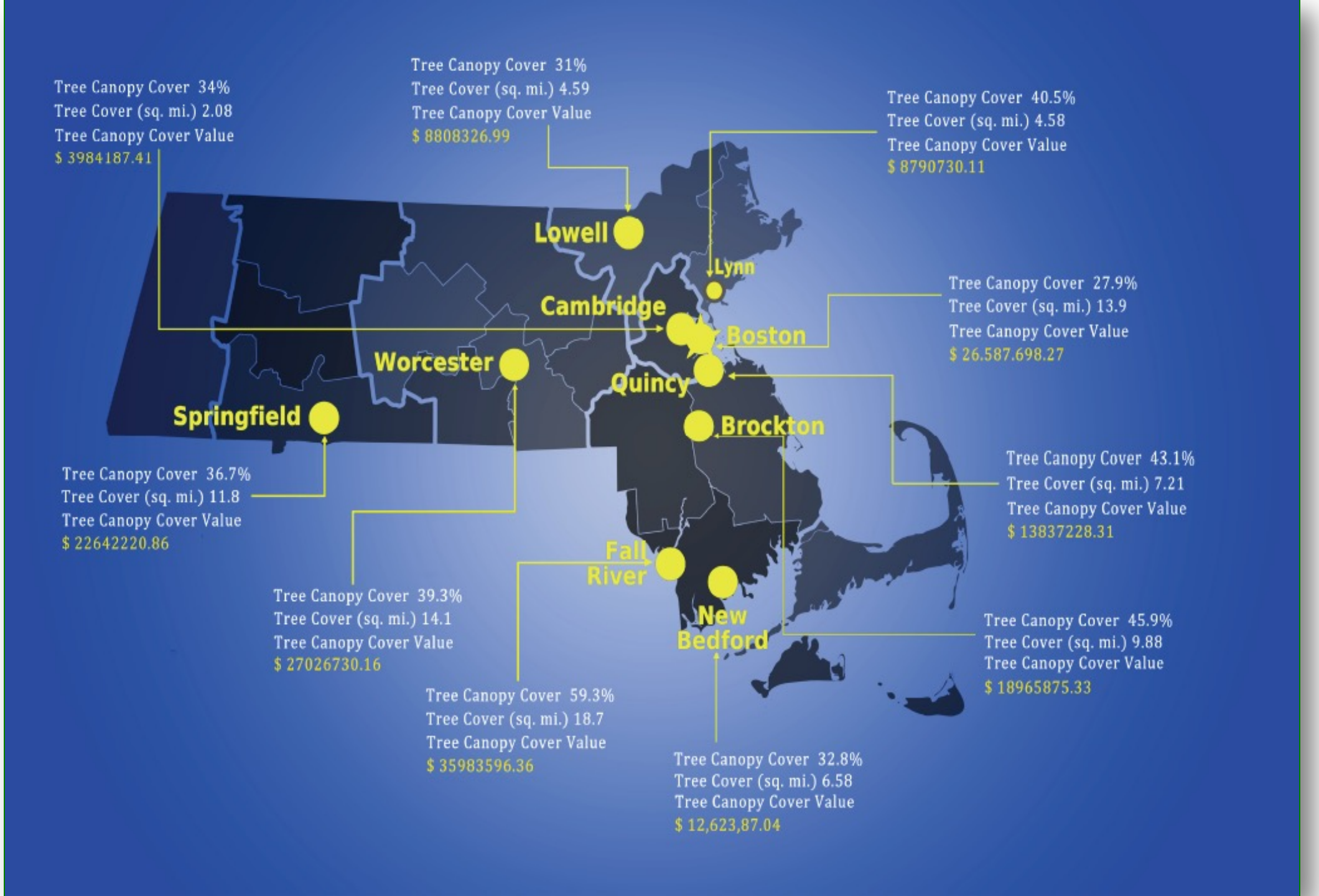
Urban Tree Canopy (UTC) Assessment for Massachusetts 10 Largest Communities

September 2014

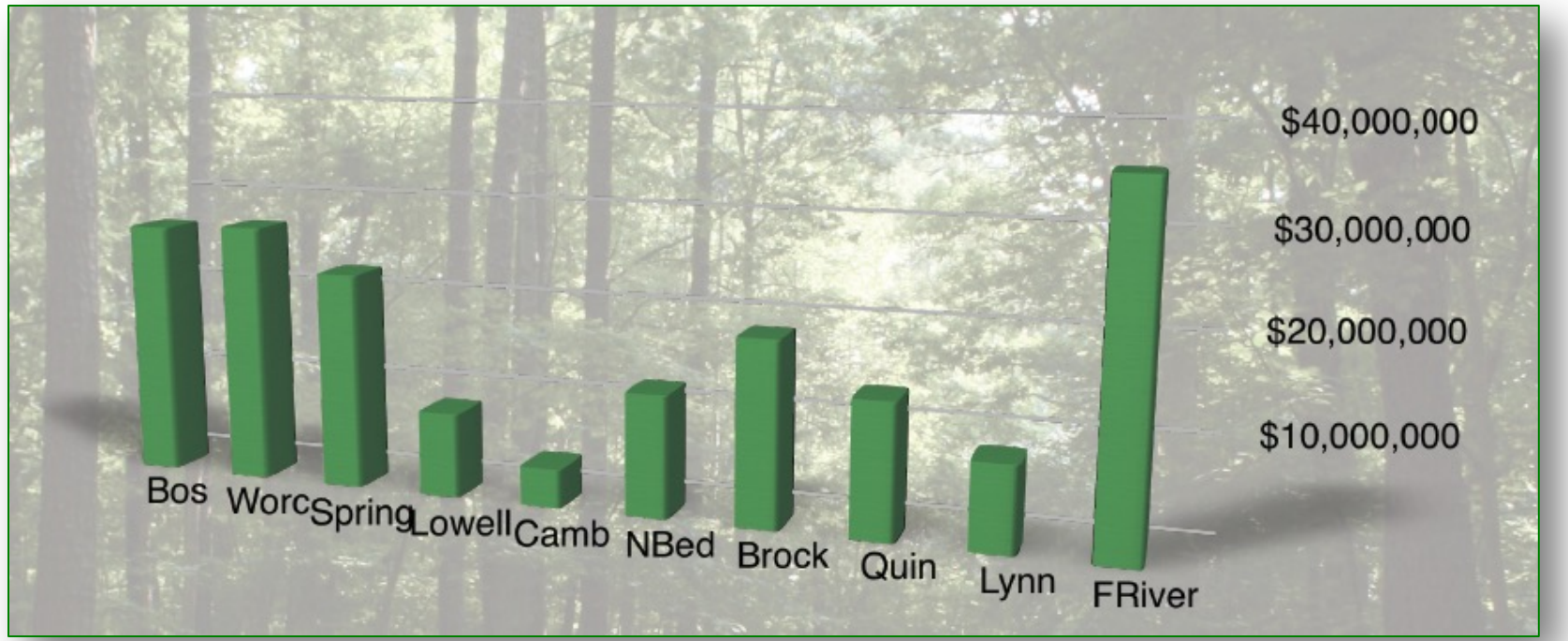
Boston
Worcester
Springfield
Lowell
Cambridge
New Bedford
Brockton
Quincy
Lynn
Fall River

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


Lowell
Lynn
Cambridge
Boston
Quincy
Worcester
Springfield
Brockton
Fall River
New Bedford
Massachusetts Ten Largest Communities by Population


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
Lowell
Lynn
Cambridge
Boston
Tree Canopy Cover 27.9%
Tree Cover (sq. mi.) 13.9
Tree Canopy Cover Value
$ 26.587.698.27
Worcester
Quincy
Springfield
Brockton
Tree Canopy Cover 43.1%
Tree Cover (sq. mi.) 7.21
Tree Canopy Cover Value
$ 13837228.31
Tree Canopy Cover 36.7%
Tree Cover (sq. mi.) 11.8
Tree Canopy Cover Value
$ 22642220.86
Fall River
Tree Canopy Cover 39.3%
Tree Cover (sq. mi.) 14.1
Tree Canopy Cover Value
$ 27026730.16
New Bedford
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
$ 12,623,87.04

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	Qunicy	43.1	7.21
9	Lynn	40.5	4.58
10	Fall River	59.3	18.7


$40,000,000
$30,000,000
$20,000,000
$10,000,000
Bos
Worc
Spring
Lowell
Camb
NBed
Brock
Quin
Lynn
FRiver

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

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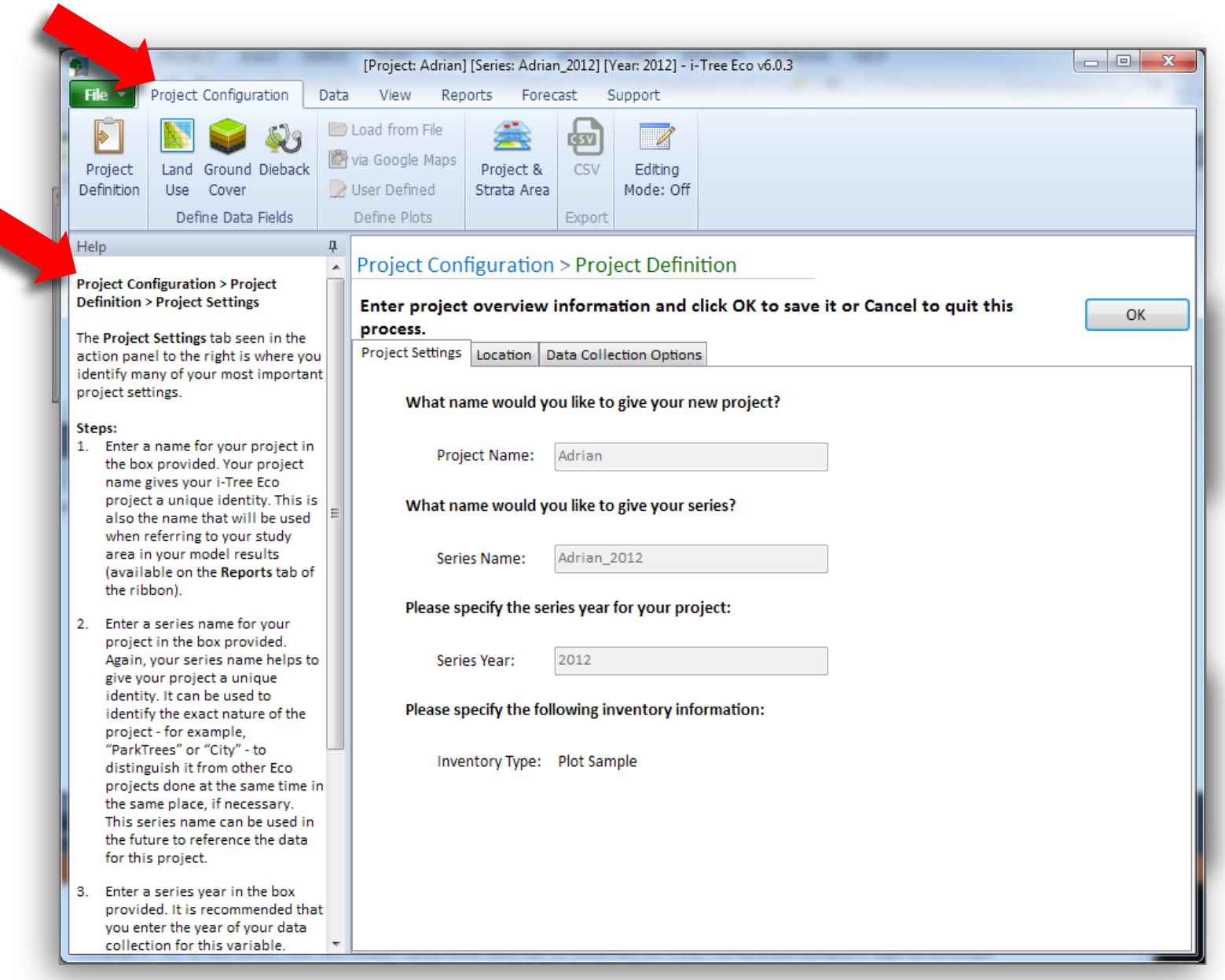
A Cooperative Initiative Between:

www.itreetools.org

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

i-Tree Eco

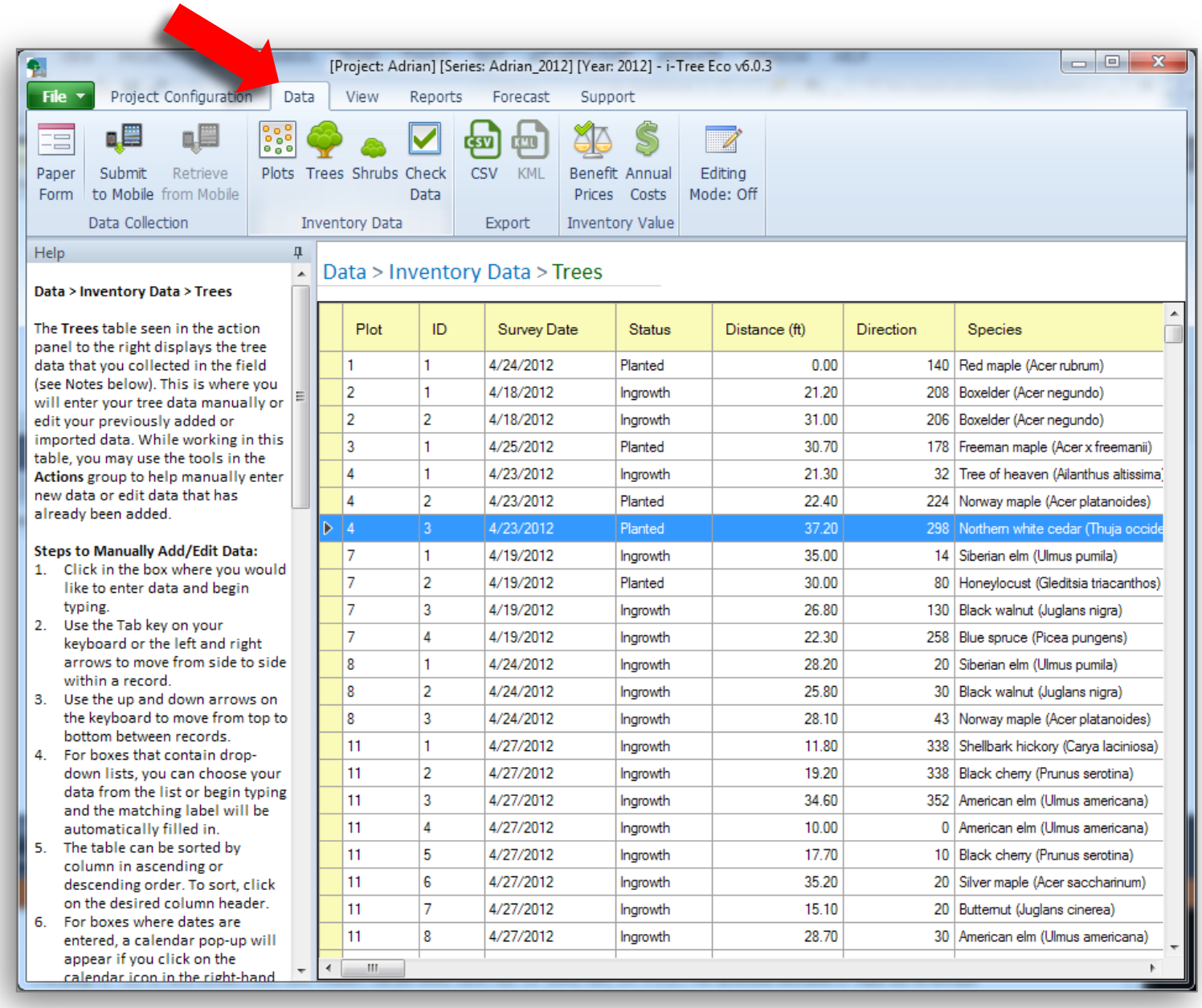


i-Tree Eco v6

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



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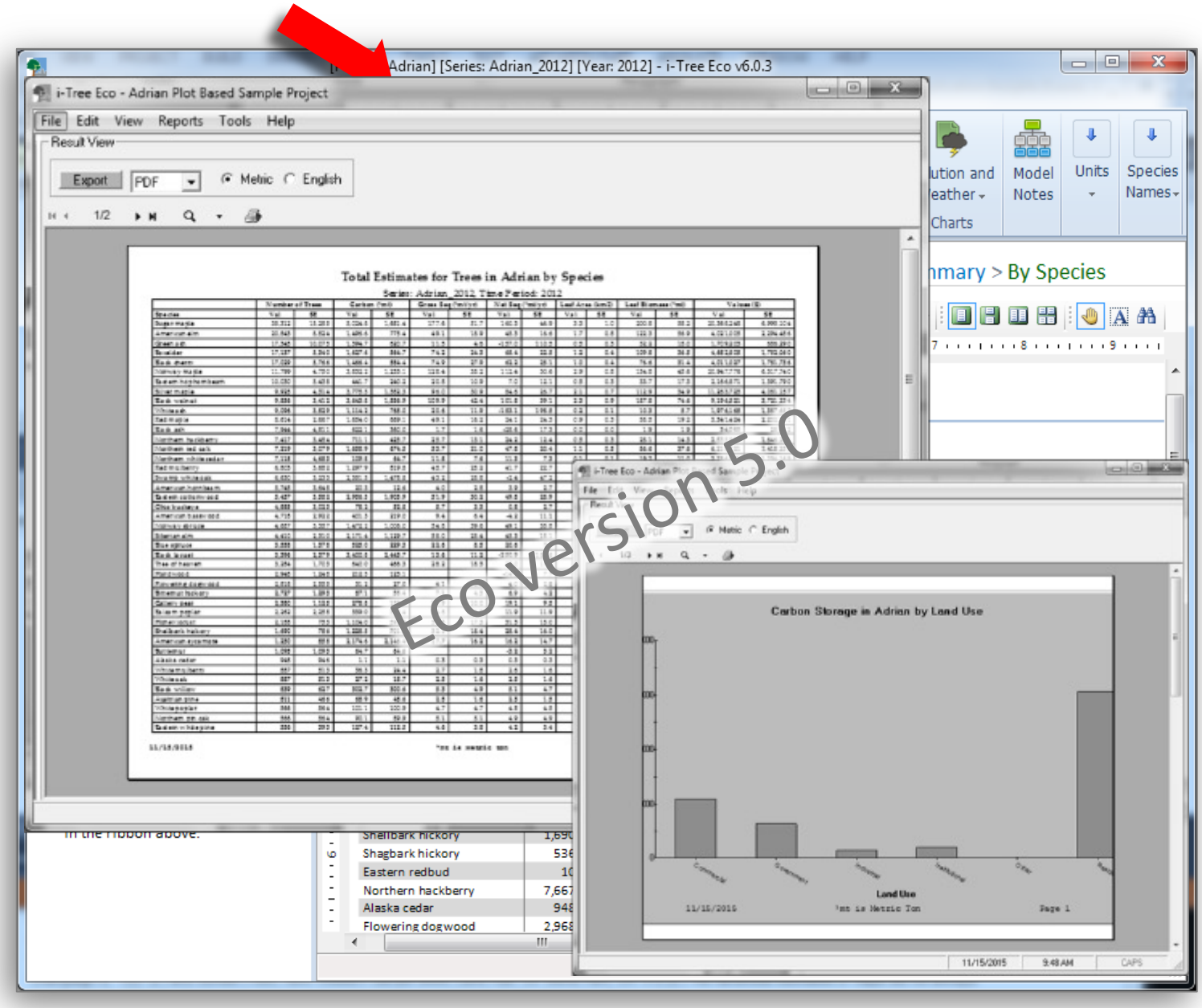

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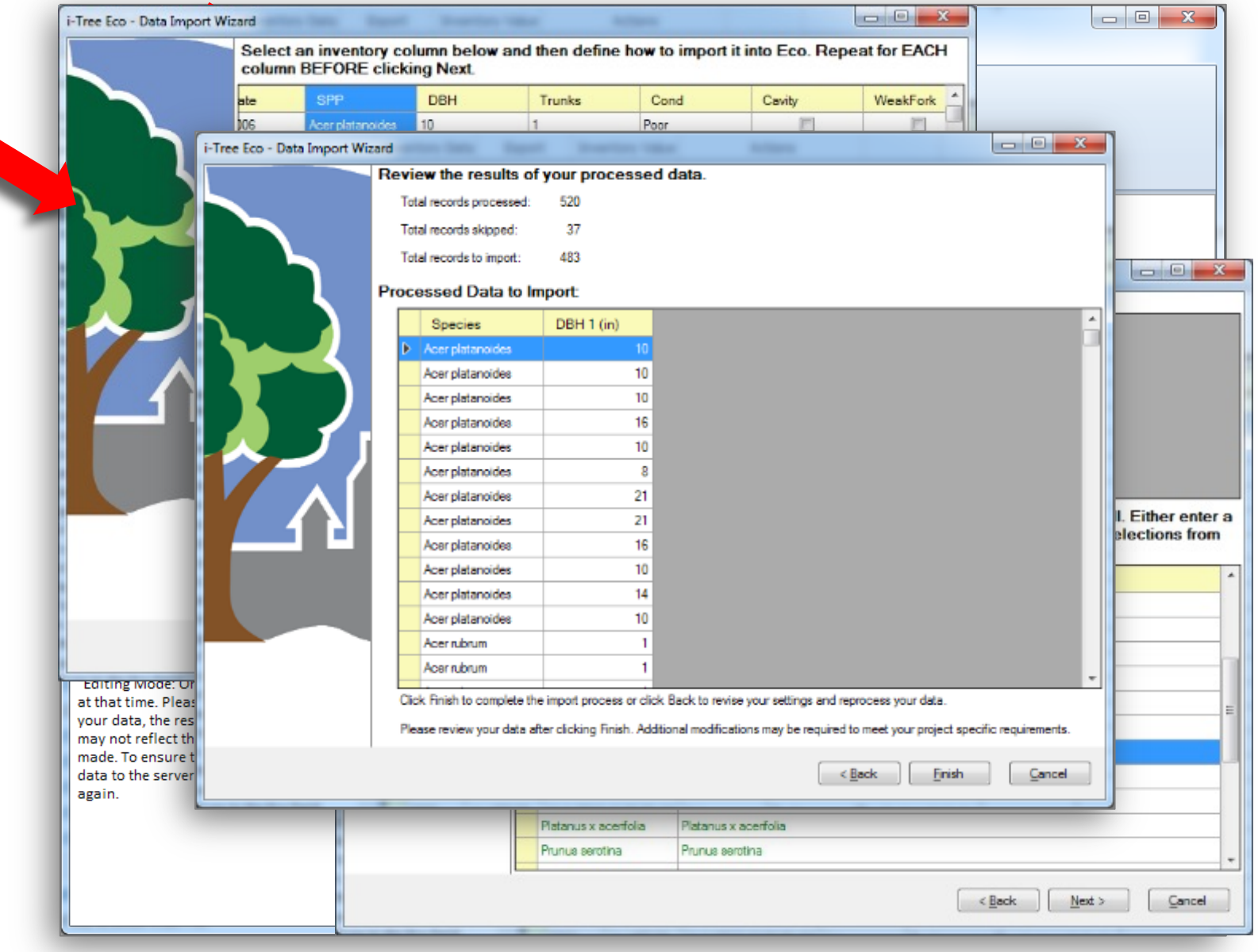

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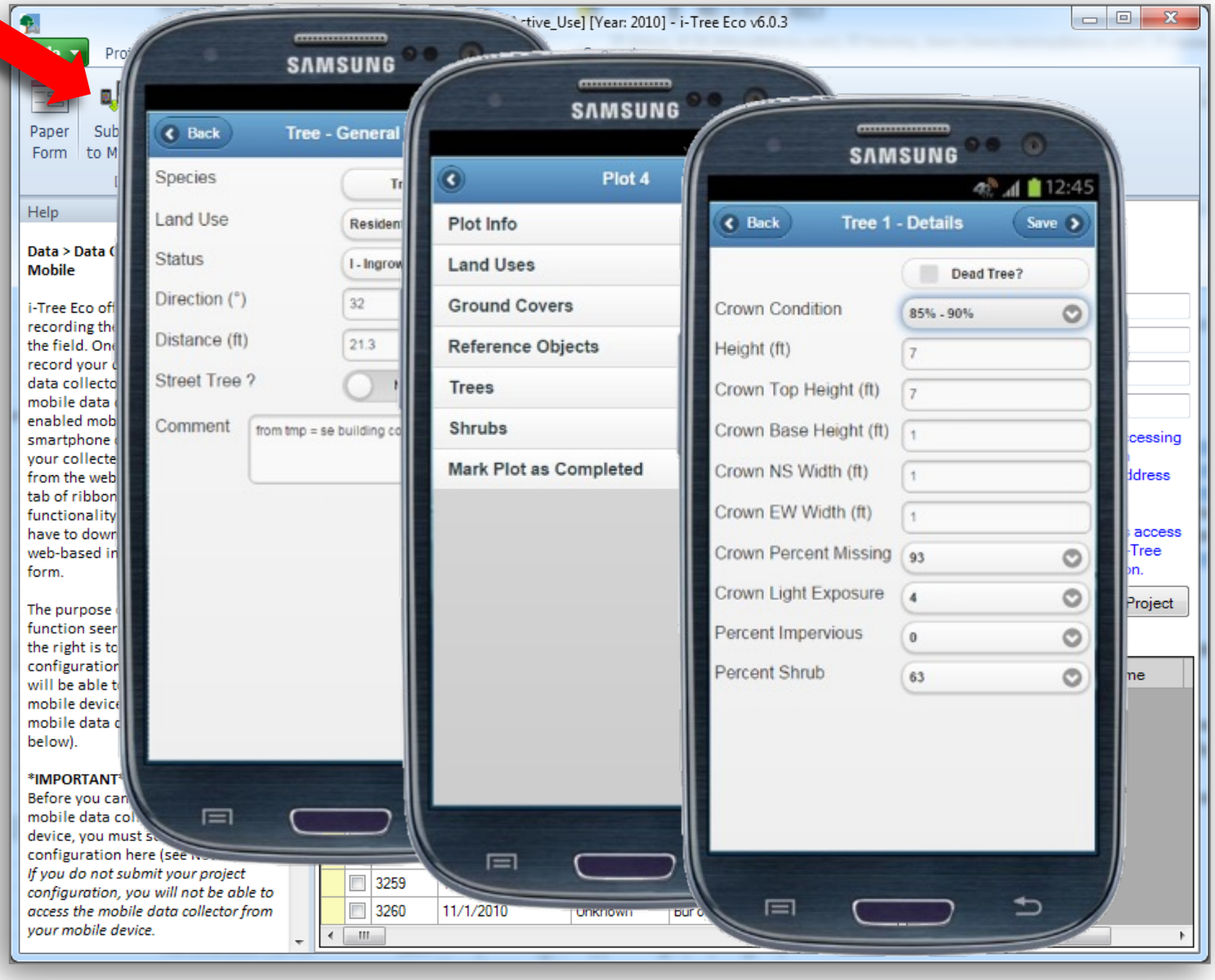
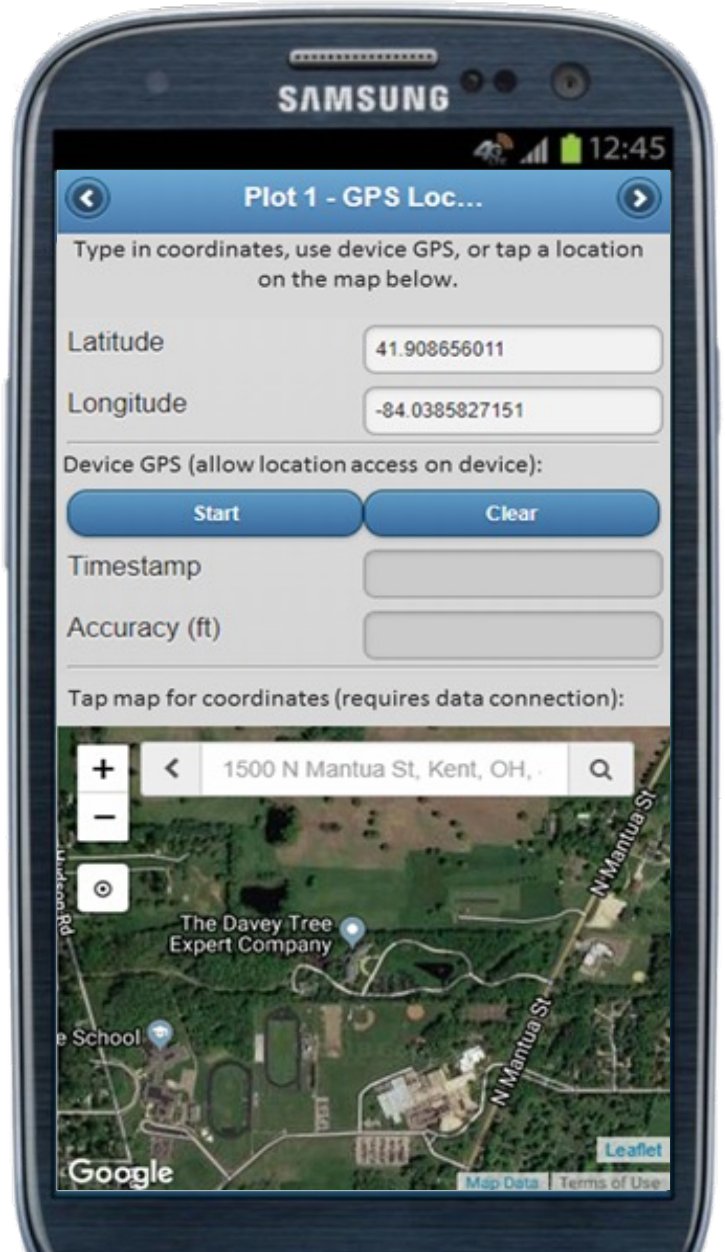
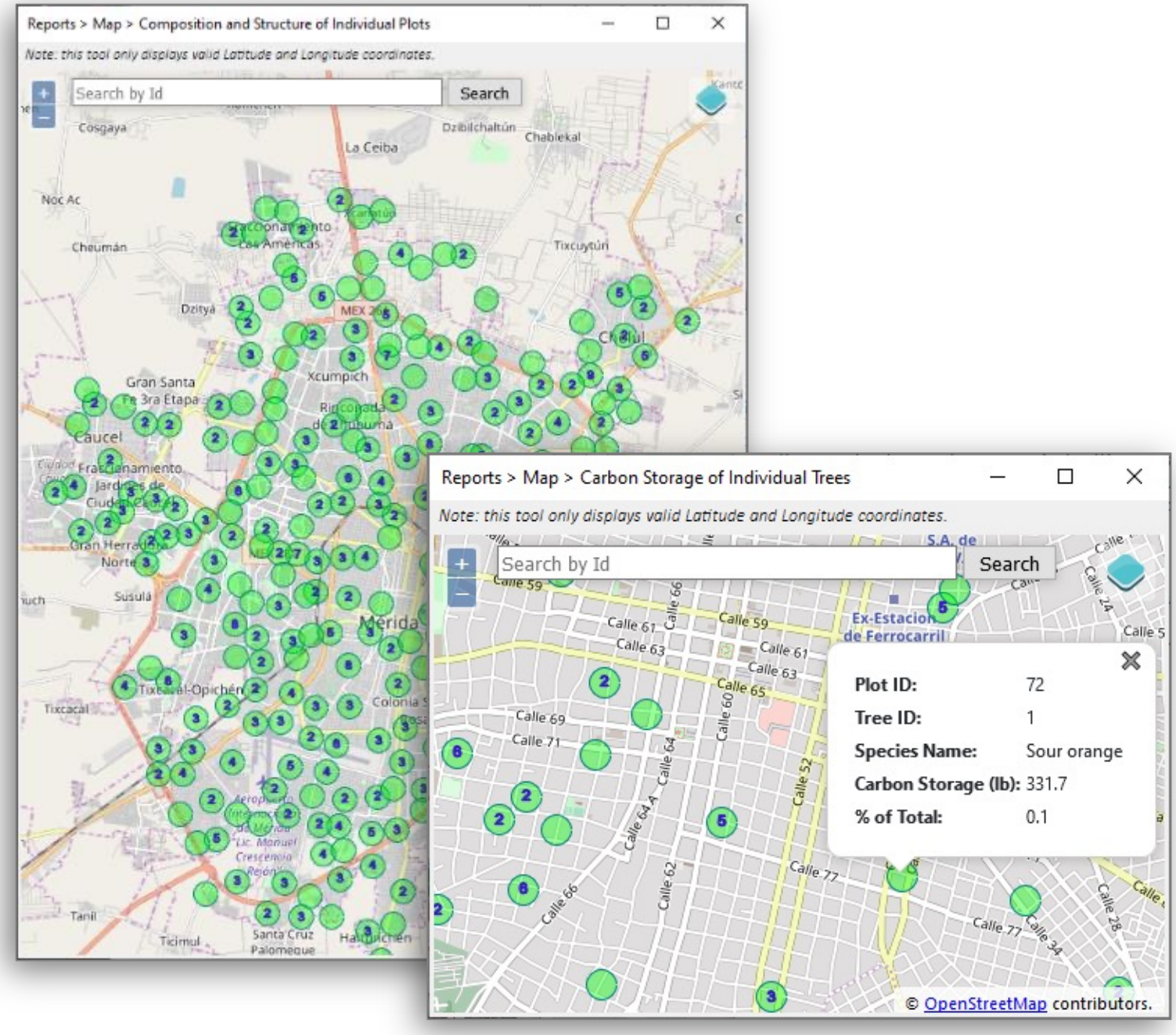

SAMSUNG
Back
Tree - General
Species
Land Use
Status
Direction (°)
Distance (ft)
Street Tree ?
Comment
Plot 4
Plot Info
Land Uses
Ground Covers
Reference Objects
Trees
Shrubs
Mark Plot as Completed
12:45
Back
Tree 1 - Details
Save
Dead Tree?
Crown Condition
85% - 90%
Height (ft)
Crown Top Height (ft)
Crown Base Height (ft)
Crown NS Width (ft)
Crown EW Width (ft)
Crown Percent Missing
Crown Light Exposure
Percent Impervious
Percent Shrub
Paper Form
Help
IMPORTANT
If you do not submit your project configuration, you will not be able to access the mobile data collector from your mobile device.


SAMSUNG
12:45
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
N Mantua St
Google
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

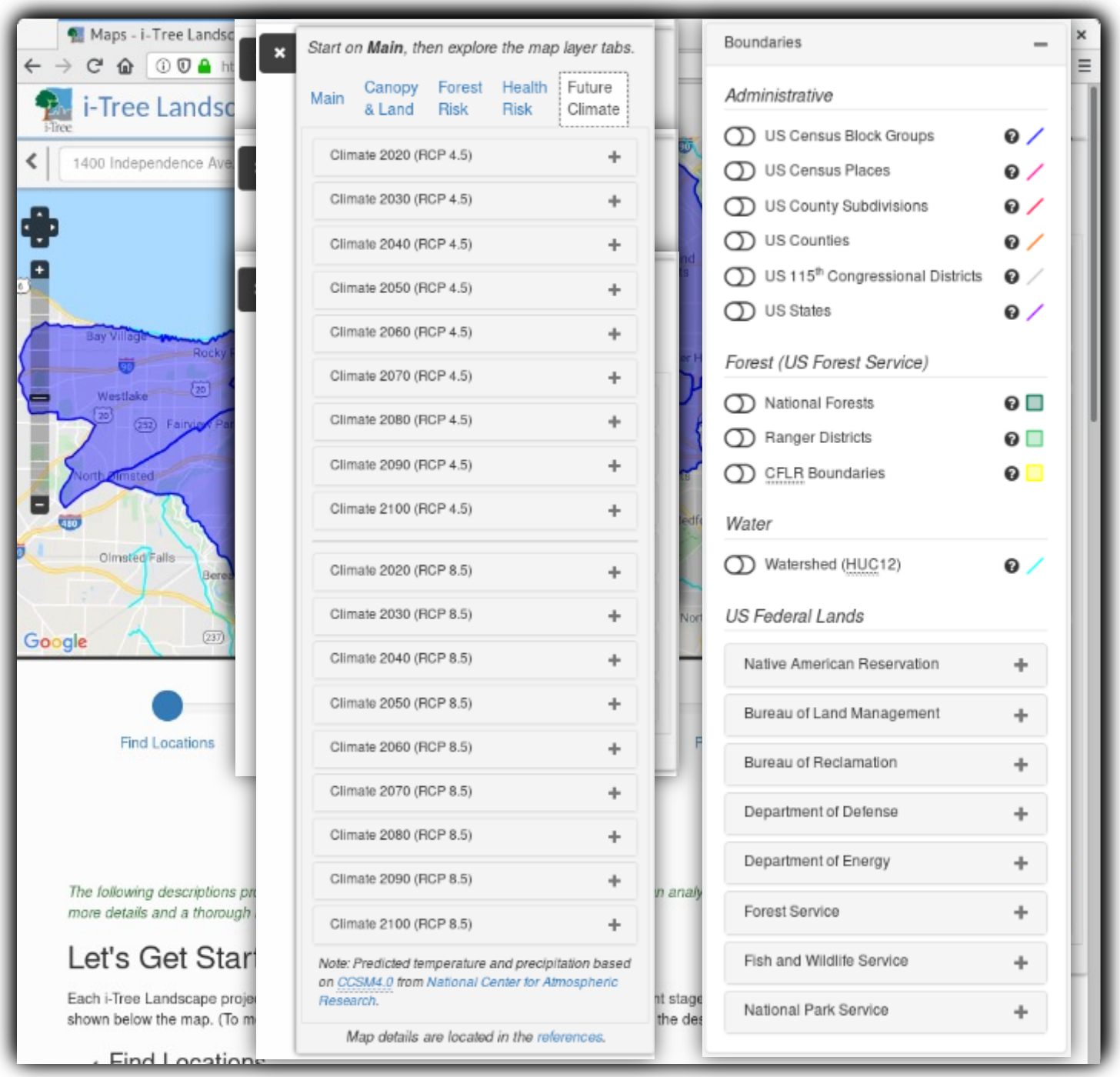
Plot Sampling & Complete Inventories

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



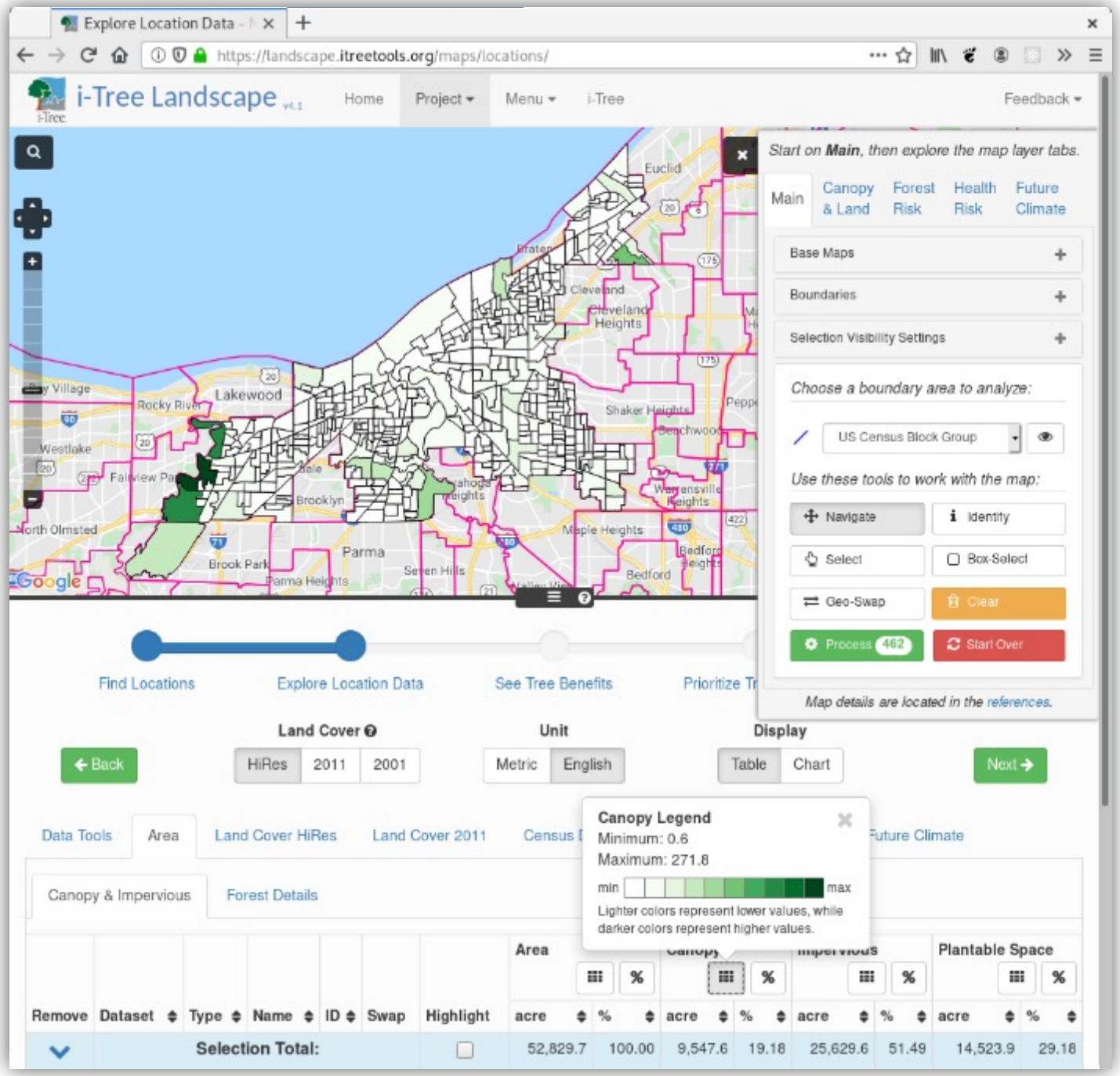
i-Tree Landscape

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



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

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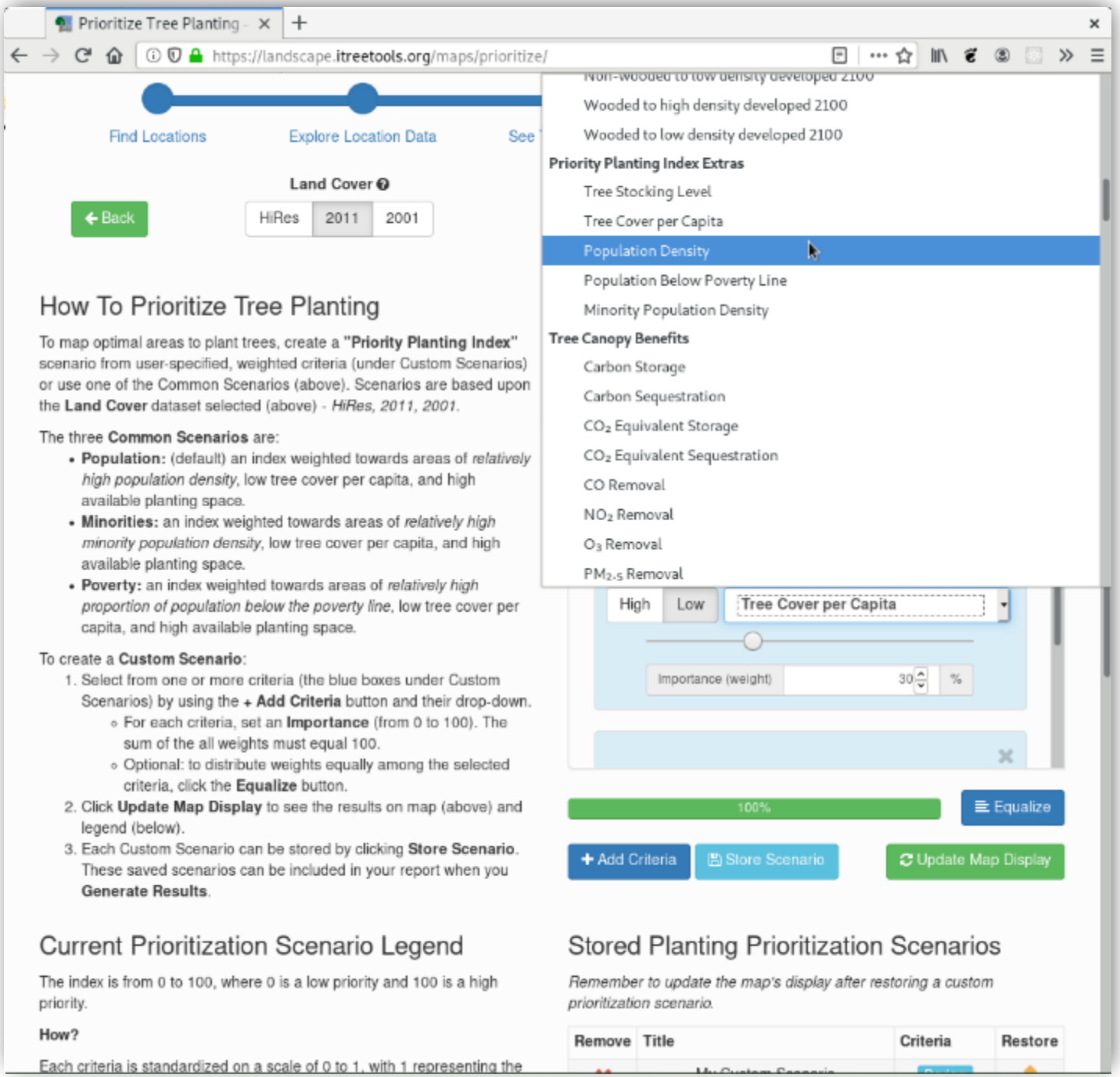
A quick tour of…

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



i-Tree Landscape

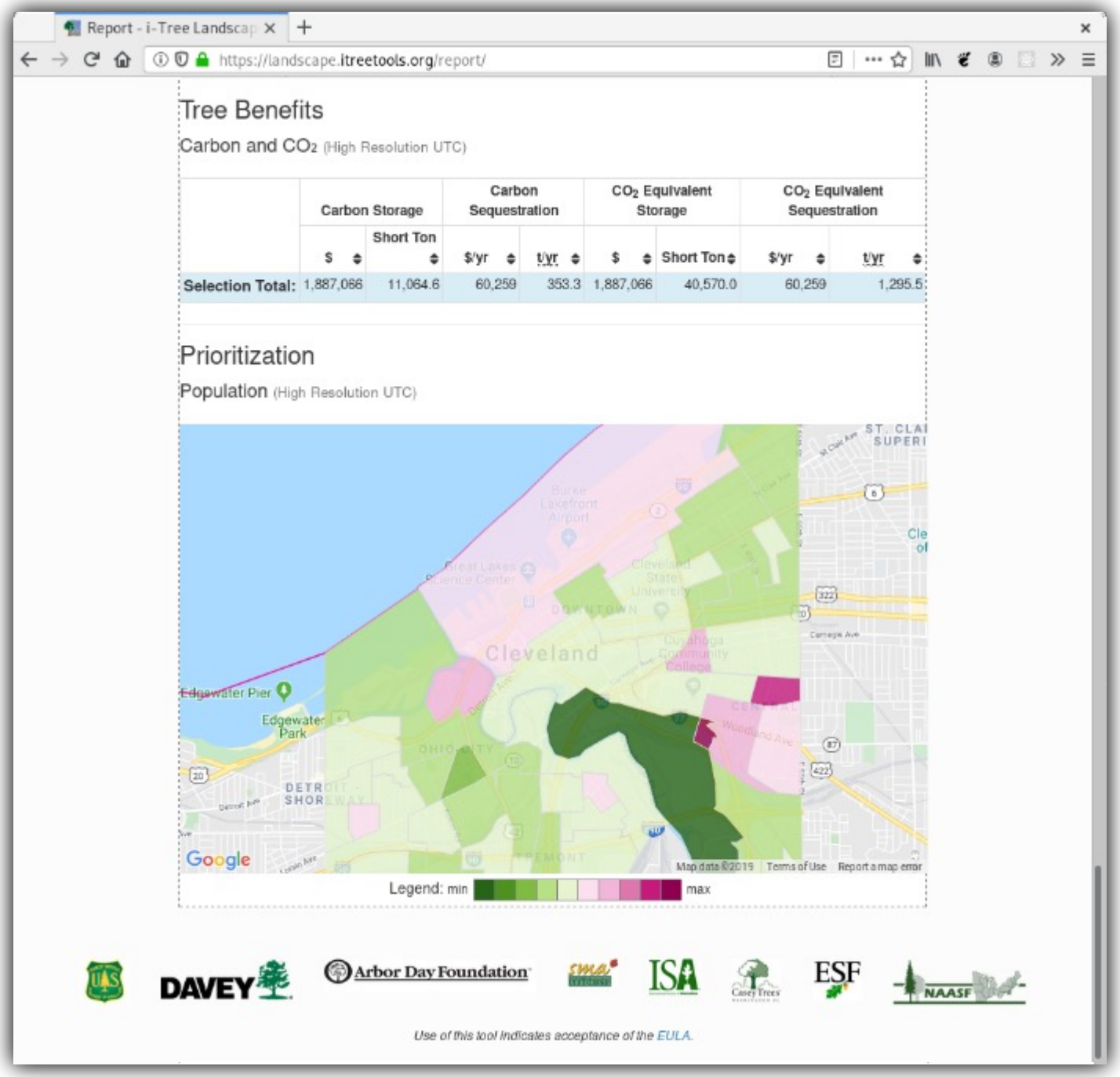
Gateway to tree benefits – available to anyone and everyone in the US.

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



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

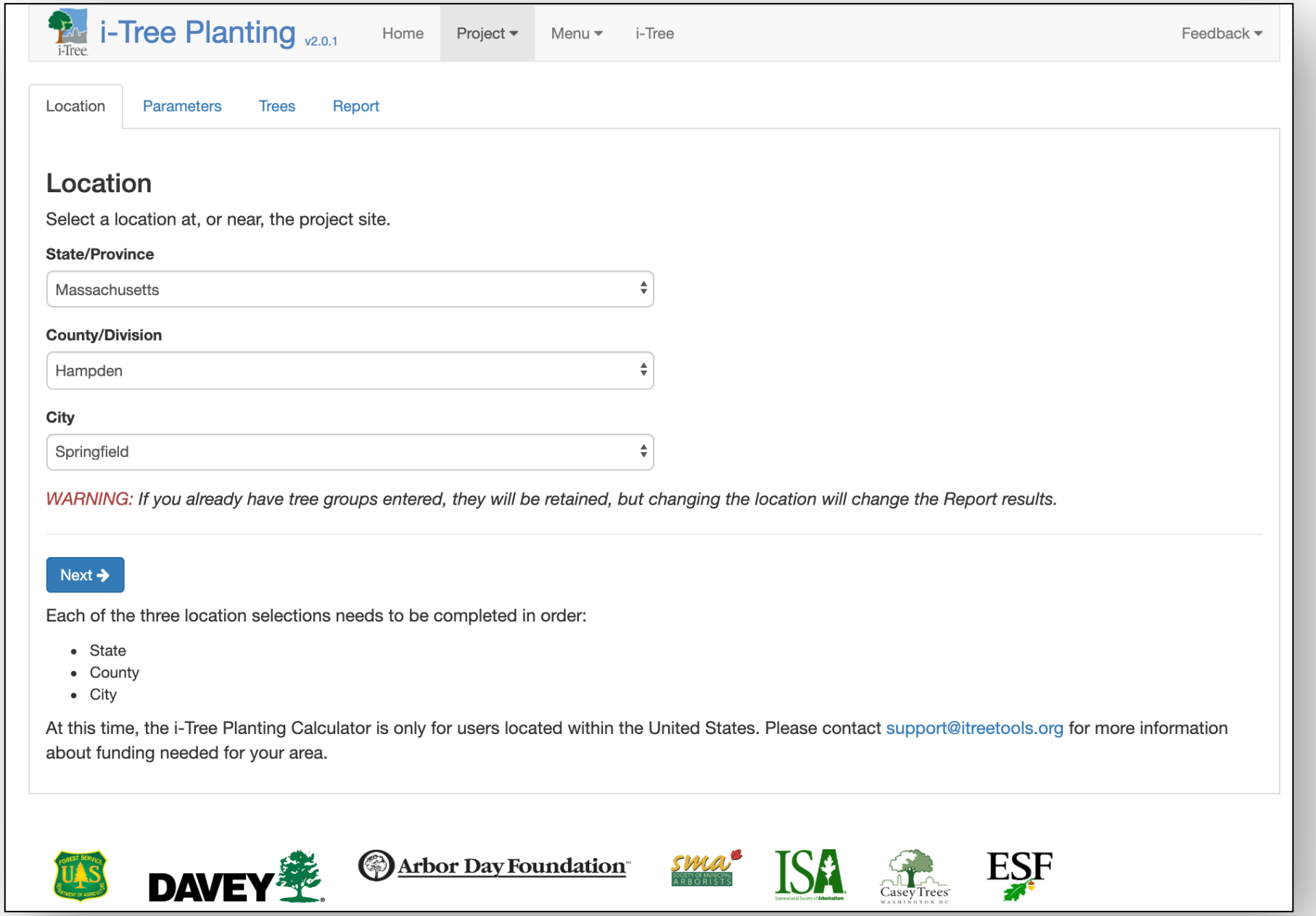
Urban Ecos

i-Tree Planting

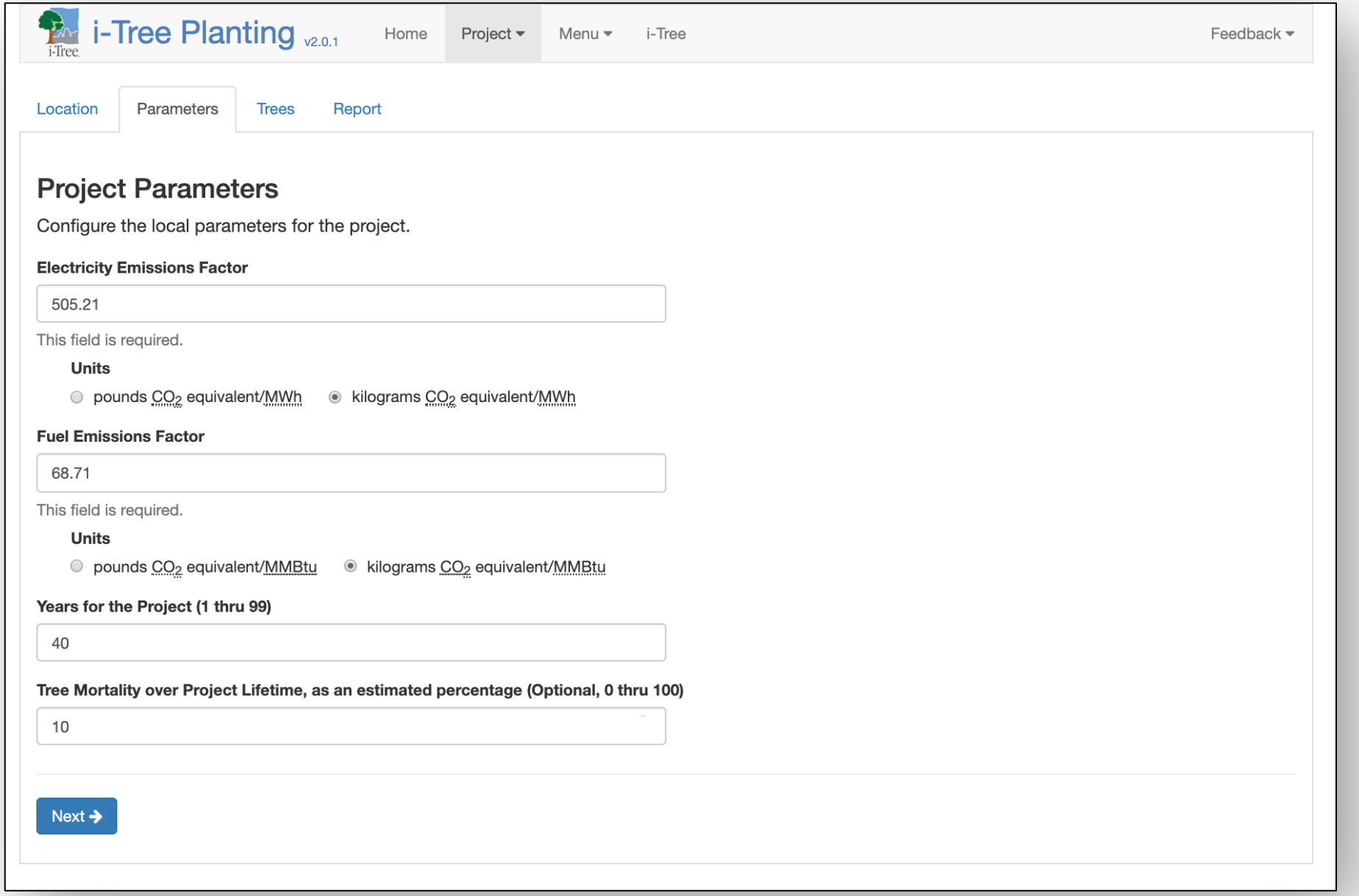
Get Started

Use of this tool indicates acceptance of the EULA.

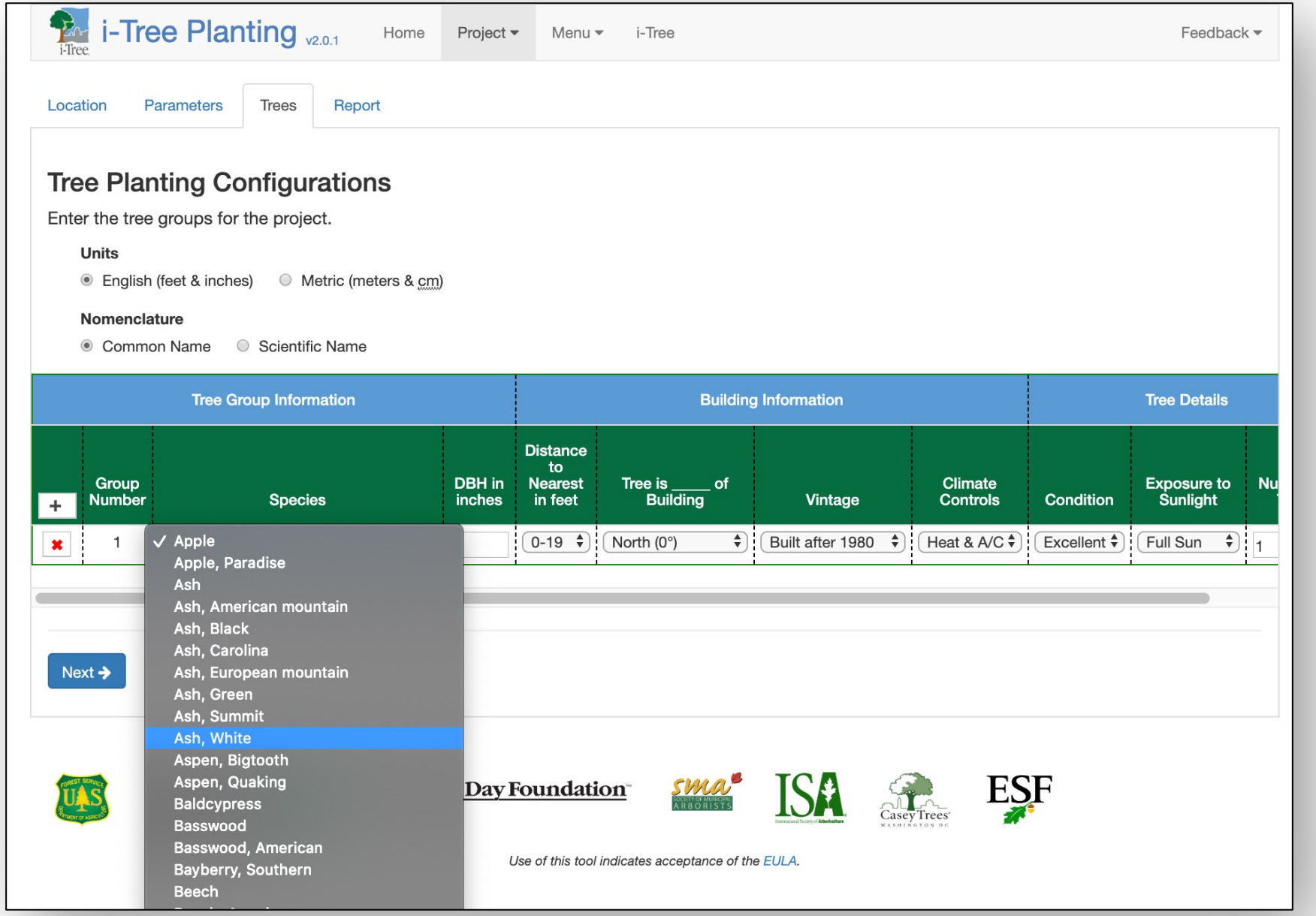
A collaborative initiative with



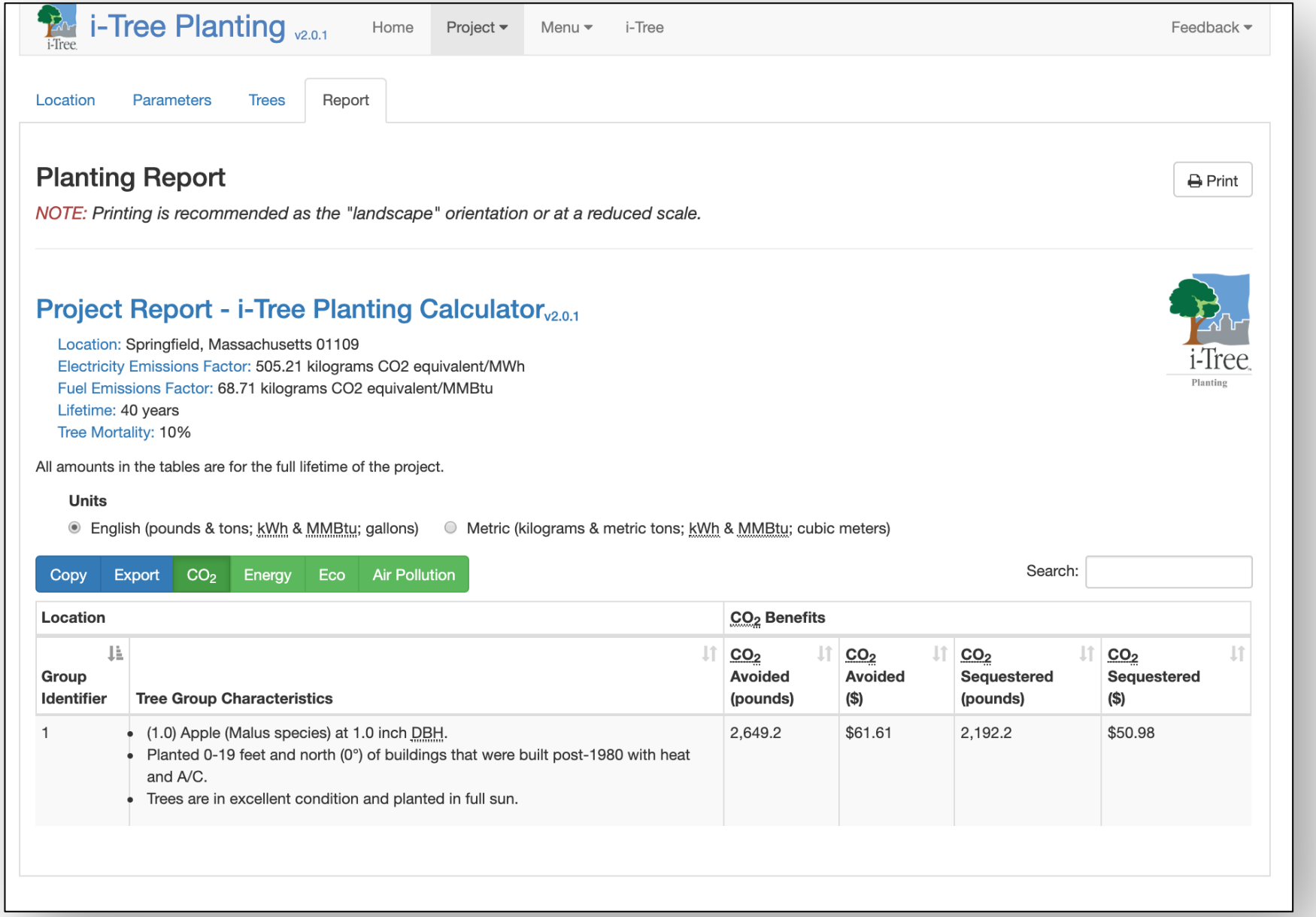
A collaborative initiative with



A collaborative initiative with



A collaborative initiative with

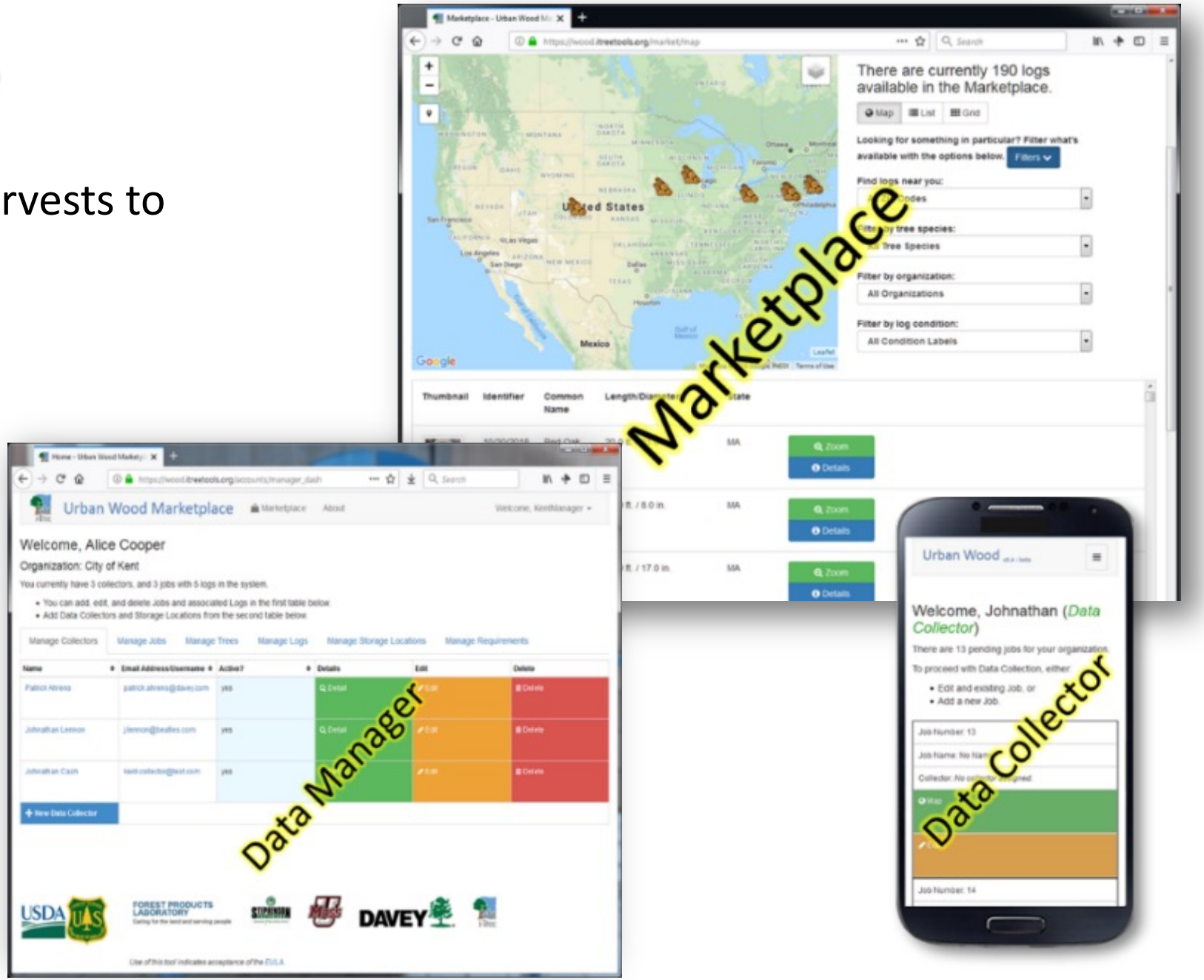


i-Tree Wood Marketplace

Wood Marketplace

"Connecting urban wood harvests to the creative community."

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



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