CENTER FOR WATERSHED PROTECTION

Coastal & Island Conference

Introduction to the i-Tree Software Toolkit

David V. Bloniarz, USDA Forest Service

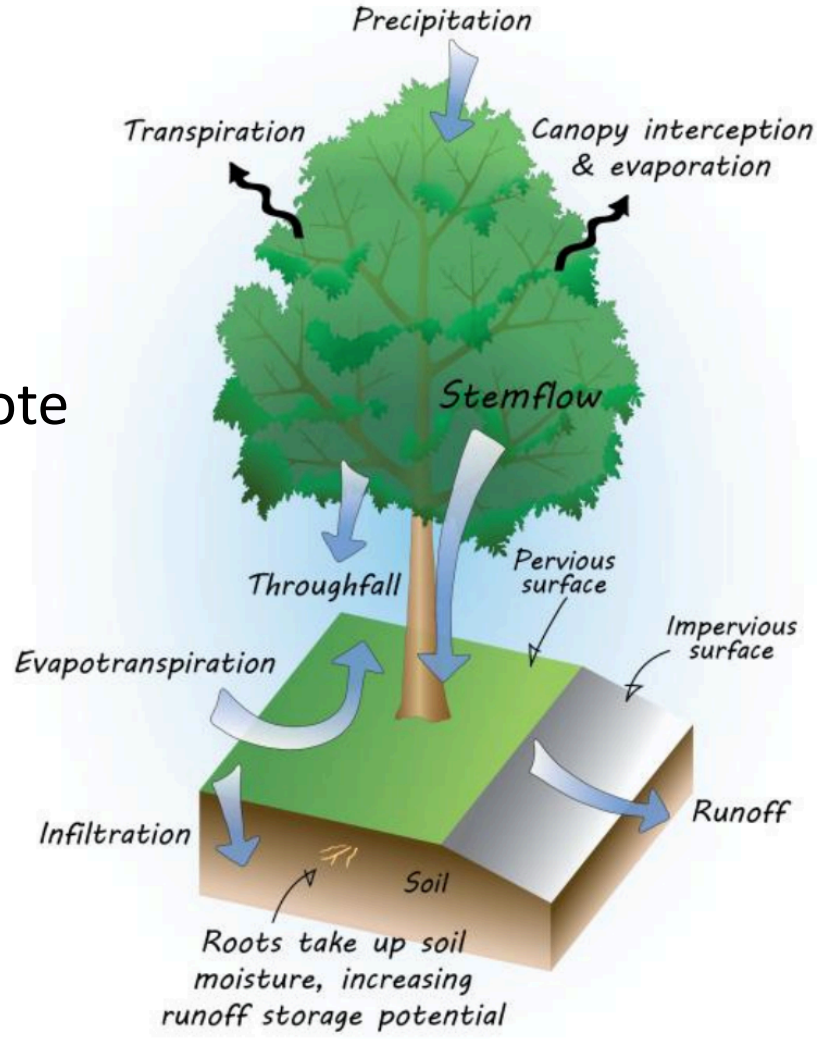
Powerpoint and Resources

www.unri.org/research-documents/

What are your challenges and opportunities related to resilience and sustainability ?

Trees are a key component in resilience and sustainability…

- Trees ***reduce stormwater runoff*** by capturing and storing rainfall in their canopy and releasing water into the atmosphere.
- Tree roots and leaf litter create soil conditions that promote the ***infiltration of rainwater*** into the soil.
- Trees help slow down and temporarily ***store runoff and reduce pollutants*** by taking up nutrients and other pollutants from soils and water through their roots.
- Trees help ***transform pollutants*** into less harmful substances.



EPA Publication 841 B 13 001

Trees are a key component in resilience and sustainability…

Year Completed	i-Tree Reference City	Number of Trees Studied	Annual Stormwater Benefits (dollars)	Rainfall Intercepted Annually by Trees (million gallons)
2006	Albuquerque, N.M.	4,586	$55,833	11.1
2005	Berkeley, Calif.	36,485	$215,645	53.9
2004	Bismarck, N.D.	17,821	$496,227	7.1
2007	Boise, Idaho	23,262	$96,238	19.2
2005	Boulder, Colo.	25,281	$357,255	44.9
2006	Charleston, S.C.	15,244	$171,406	28.3
2005	Charlotte, N.C.	85,146	$2,077,393	209.5
2004	Cheyenne, Wyo.	17,010	$55,301	5.7
2003	Fort Collins, Colo.	31,000	$403,597	37.4
2005	Glendale, Ariz.	21,480	$18,198	1.0
2007	Honolulu, Hawaii	235,800	$350,104	35.0
2008	Indianapolis, Ind.	117,525	$1,977,467	318.9
2005	Minneapolis, Minn.	198,633	$9,071,809	334.8
2007	New York City, N.Y.	592,130	$35,628,220	890.6
2009	Orlando, Fla.	68,211	$539,151	283.7
2003	San Francisco, Calif.	2,625	$466,554	99.2
2001	Santa Monica, Calif.	29,229	$110,784	3.2

www.fs.fed.us/psw/programs/uesd/ uep/tree_guides.php.

i-Tree is a key component in resilience and sustainability…

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

Arbor Day Foundation

ISA

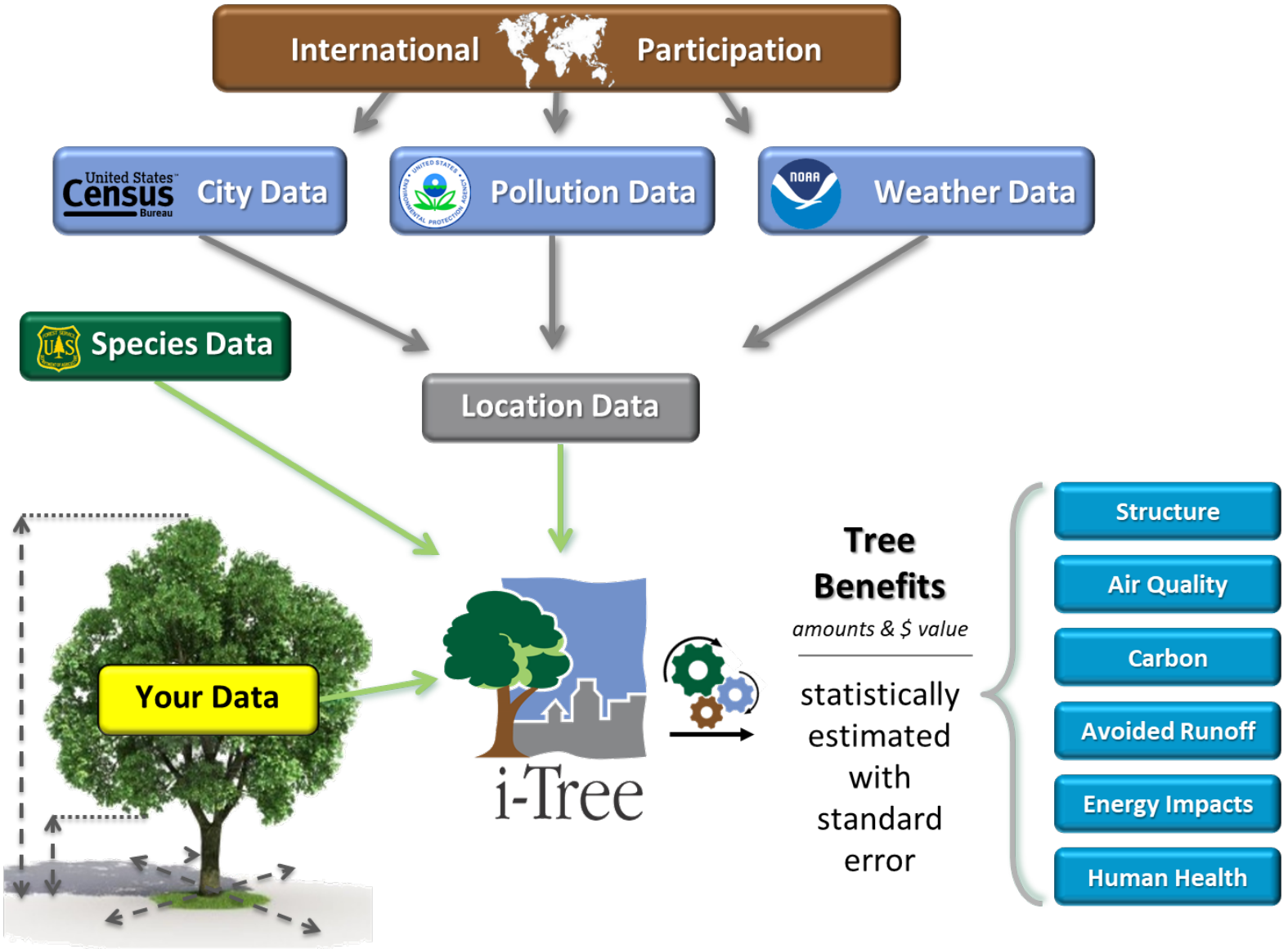
Casey Trees

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

NAASF

EPA
United States
Environmental Protection
Agency

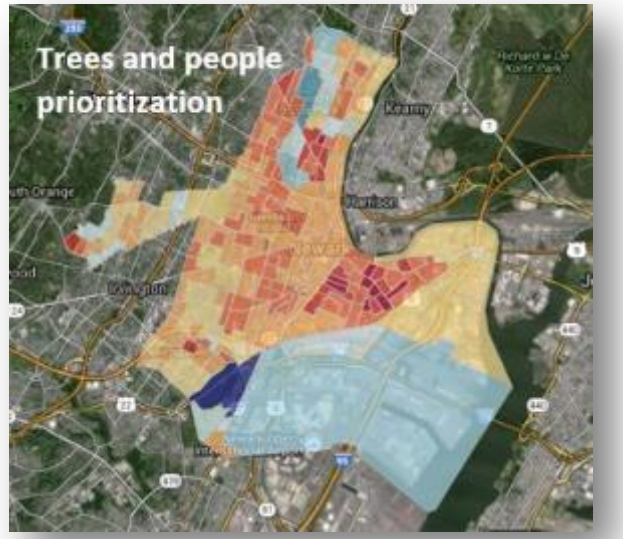
i-Tree Conceptual Model Schematic



Why i-Tree?

Opportunities for communities to…

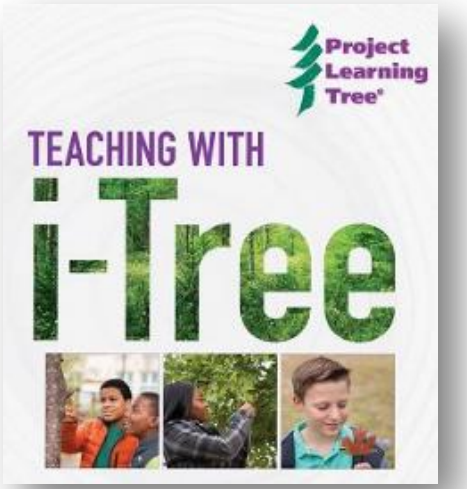
- ***Plan and manage*** urban forest resources more strategically to serve and protect citizens;
- ***Integrate urban forests in polici***es: sustainability, climate, resiliency, air quality, public health, stormwater, etc.;
- Support ***advocacy efforts*** with data;
- Improve ***preservation*** of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

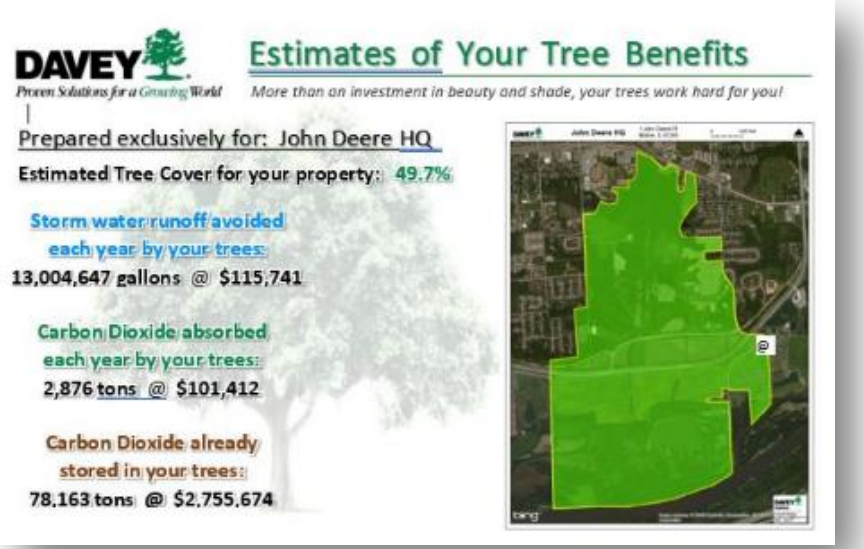


Why i-Tree?

Opportunities for communities to…

- ***Economic opportunities***:
  attract & retain new businesses and residents;
- ***Promote*** green tourism and investment;
- Create ***green industry jobs***;
- ***Sustainable*** development;
- Community ***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."

Quantify Tree Benefits *through* Research & Science!

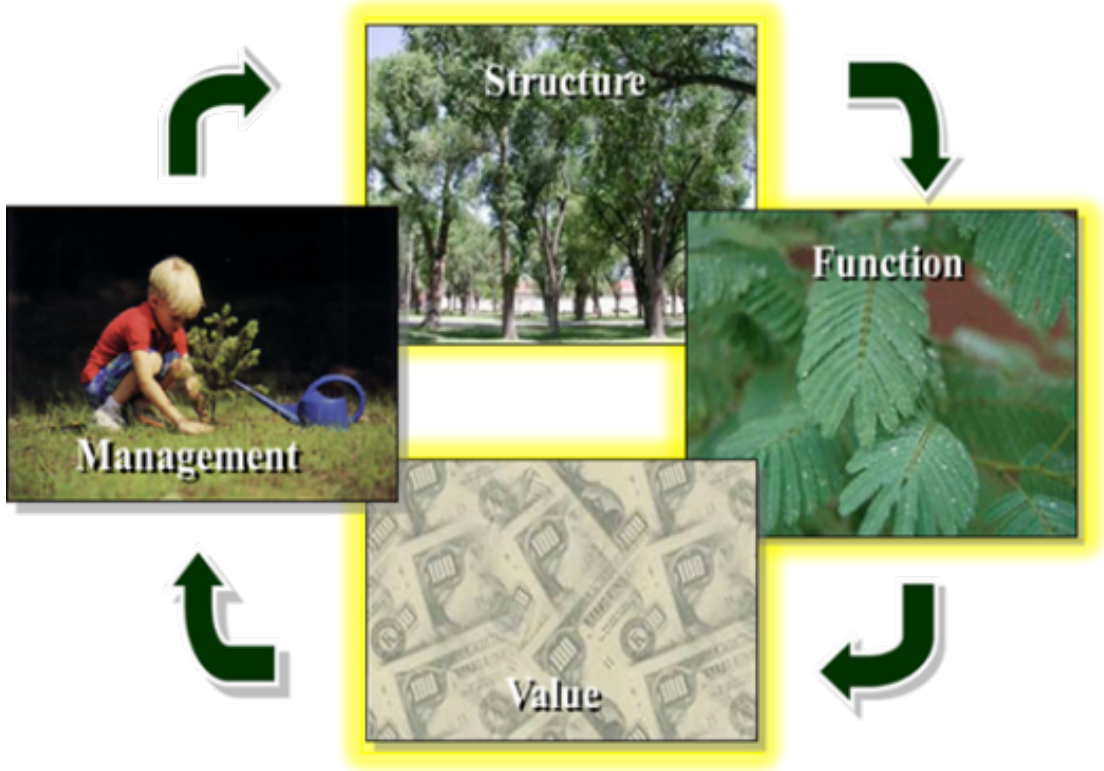
Carbon dioxide storage and sequestration
Air pollution removal
Storm water reduction

$2.94 in benefits
for every $1.00 spent

Benefit Summary for Pittsburgh's Street Trees

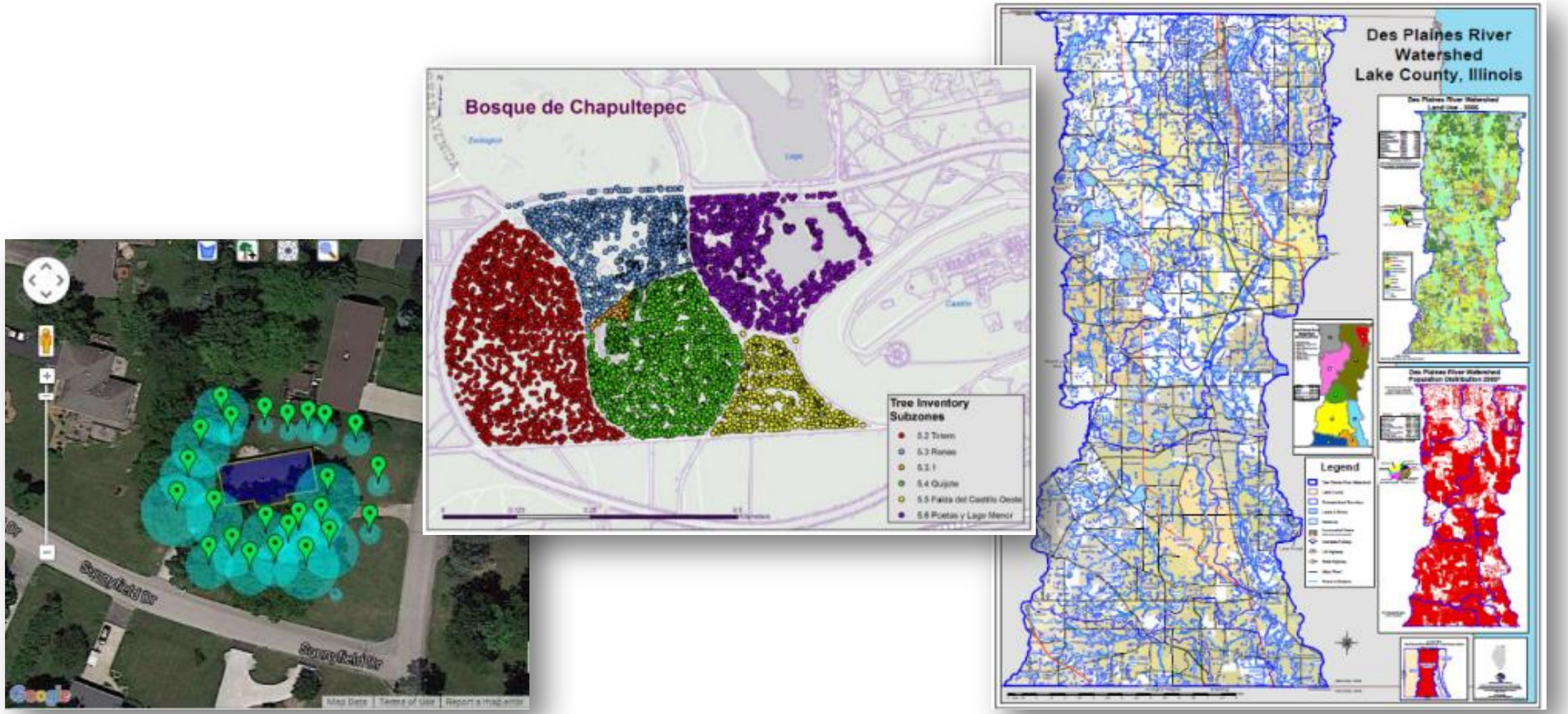
Benefits	Total ($)
Energy	$1,205,133
CO2	$35,424
Air Quality	$252,935
Stormwater	$334,601
Aesthetic/Other	$572,882
Total Benefits	$2,400,975

The only infrastructure that increases in value over time.



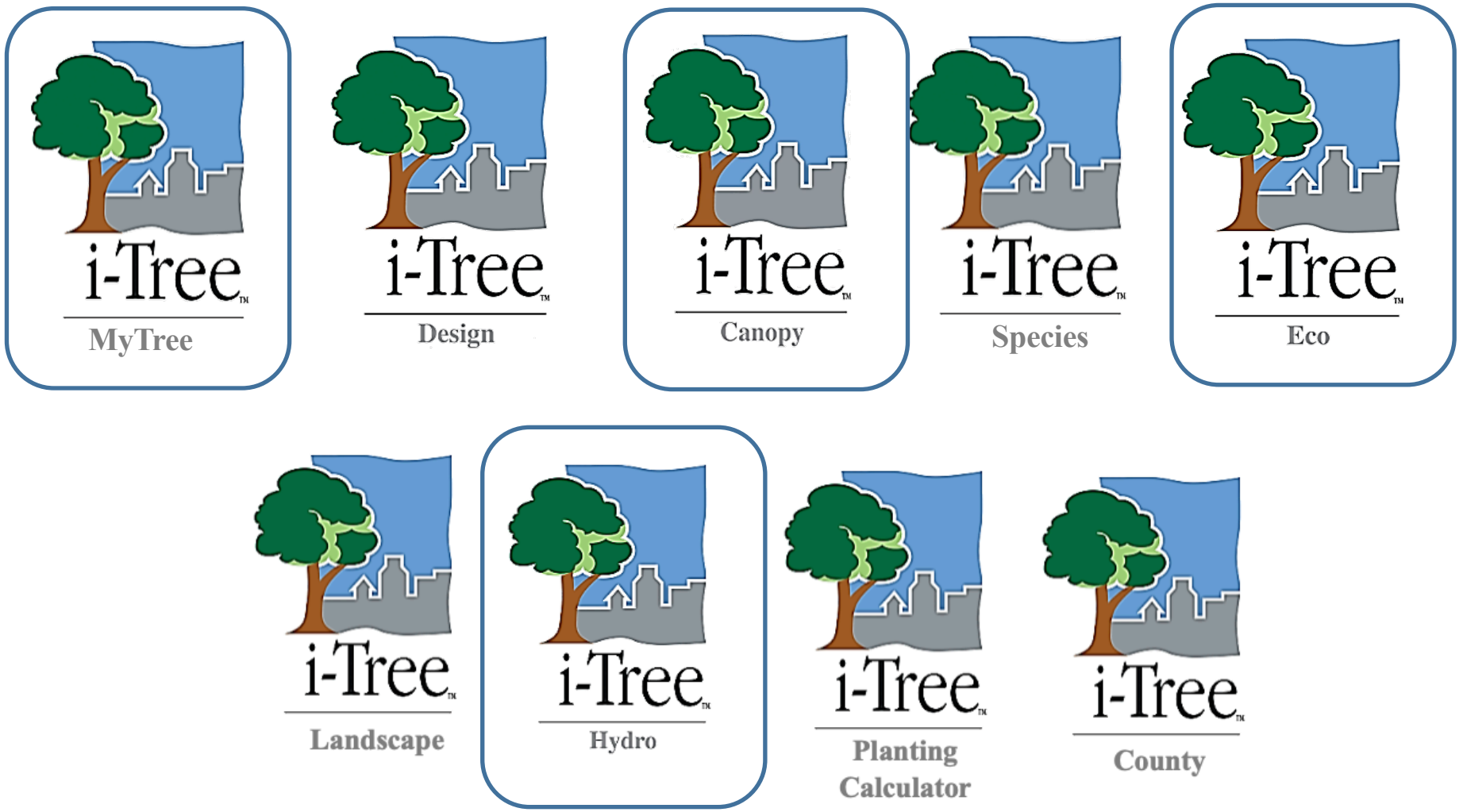
Structure ➡ Function ➡ Value

Concept applies to multiple scales and land types…



….home, park, forest, city, region or watershed.

The 2020 i-Tree Suite of Tools



i-Tree

i-Tree is a Cooperative Initiative among these partners

USFS

DAVEY

Arbor Day Foundation

SMA Society of Municipal Arborists

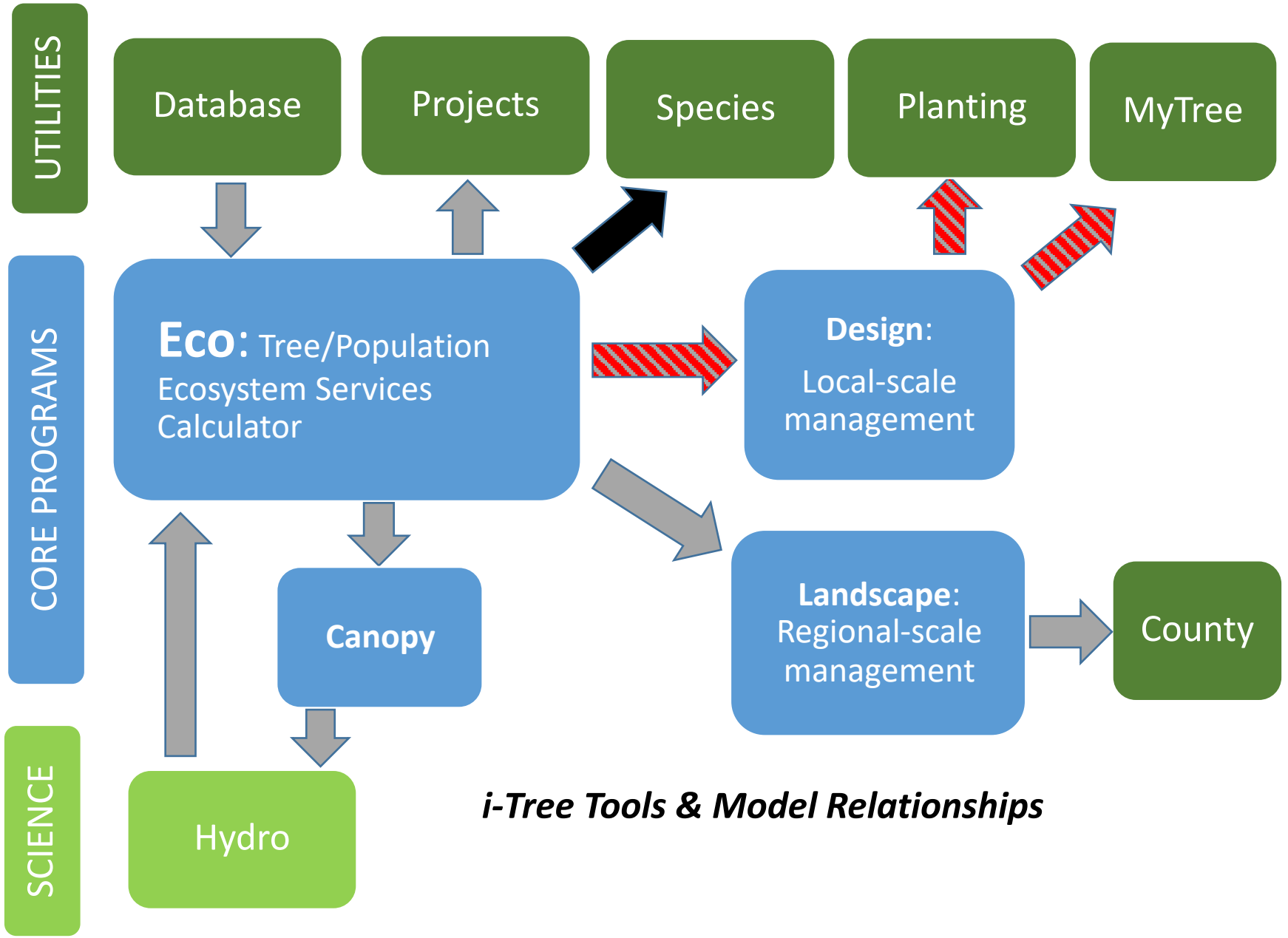
ISA

Casey Trees

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

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

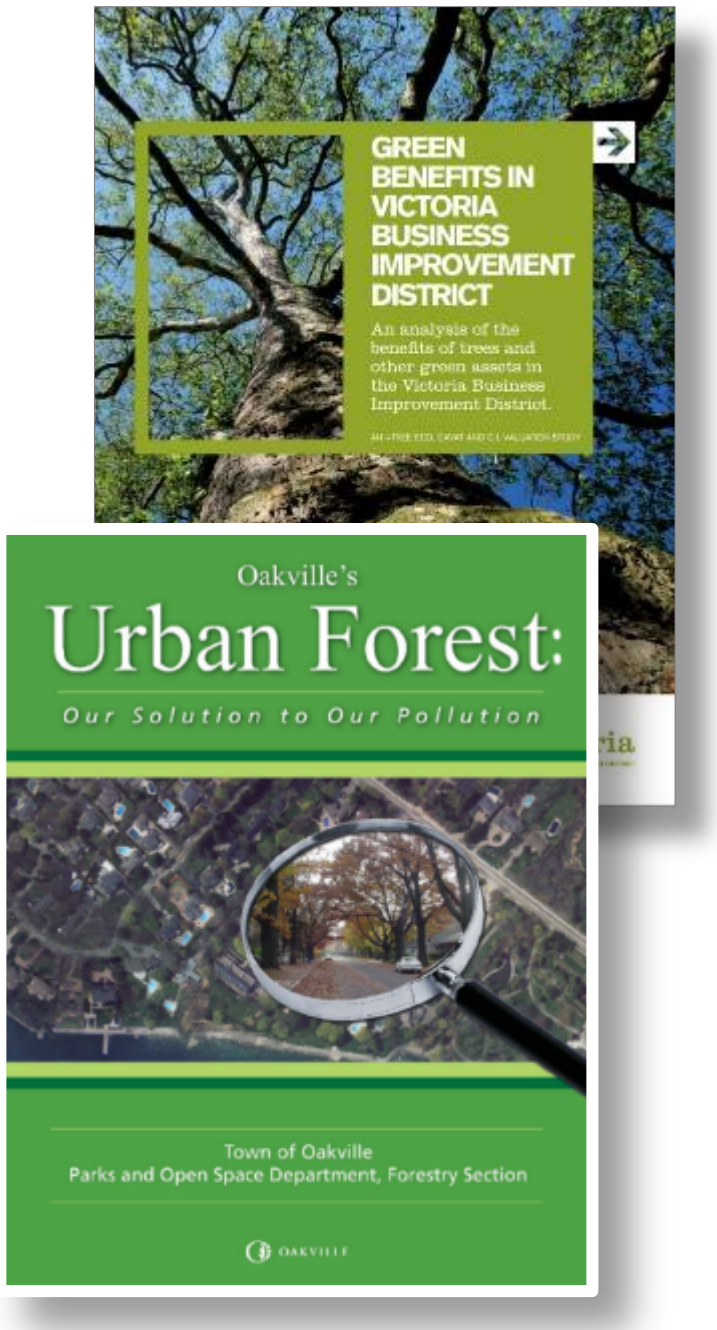
The Foundation: Local Data

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

i-Tree Estimates Tree Benefits:

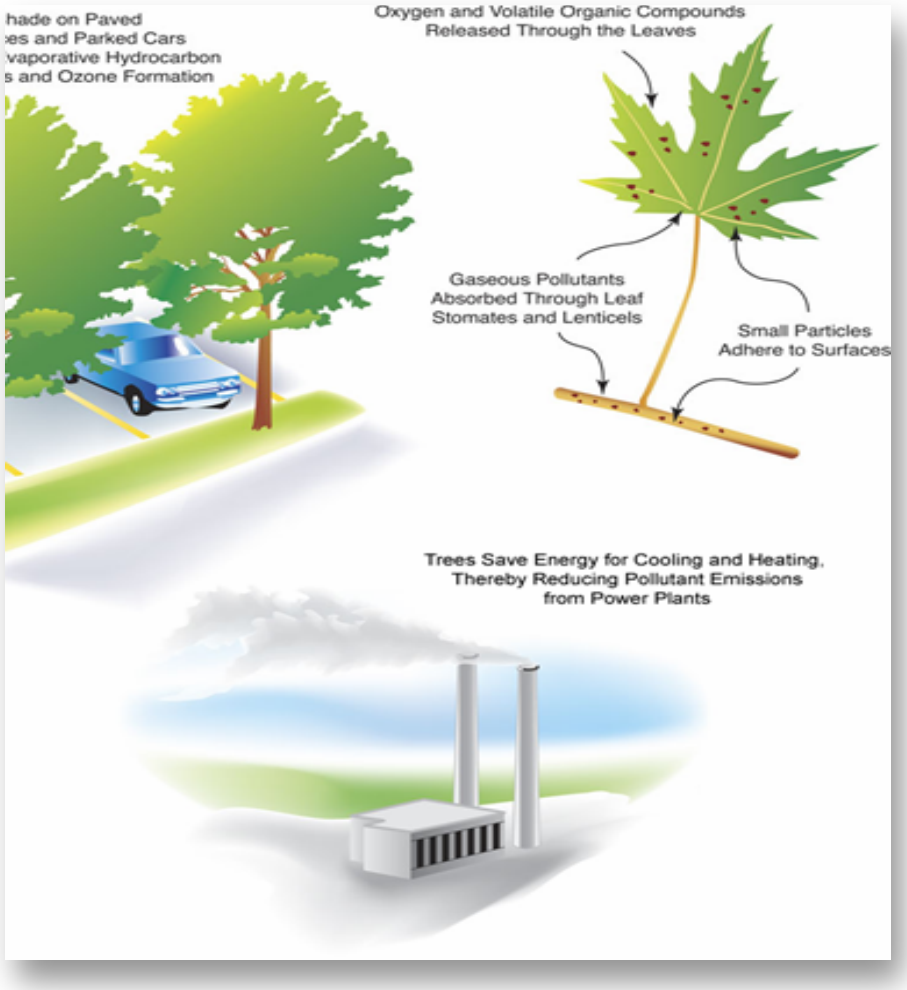
- Air pollution removal
- Carbon storage and annual carbon sequestration
- Avoided stormwater run-off *(hydrology effects)*
- Energy effects (*cooling & heating*)
- Structural assessment
- $ Value for ecosystem services
- Public health impacts related to air quality

**Some model functions depend on tool and data collected, or are limited when applied outside the U.S. due to available research.*



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



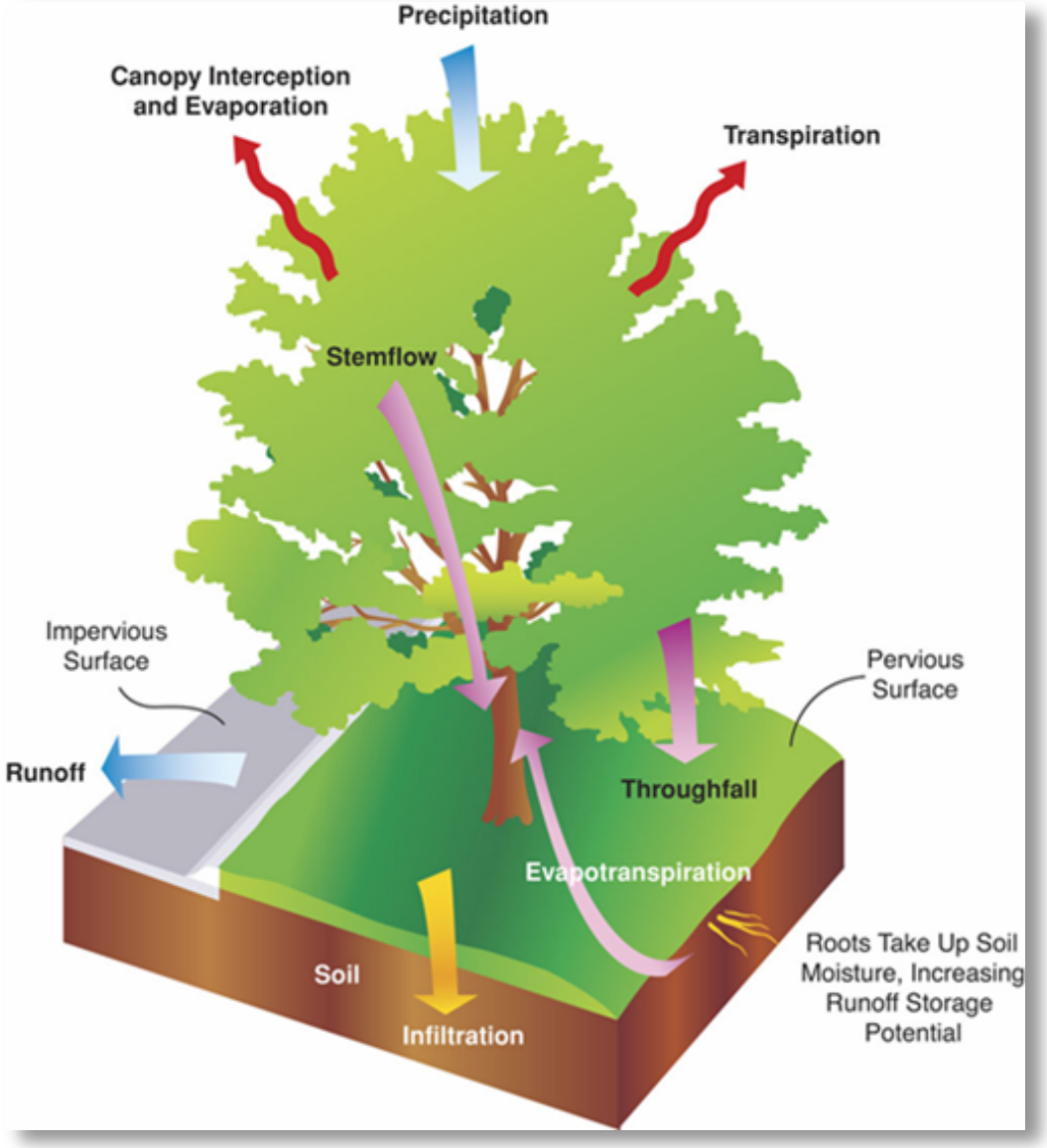
Tree Benefit: Reduce Carbon Dioxide CO_2

- 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*)

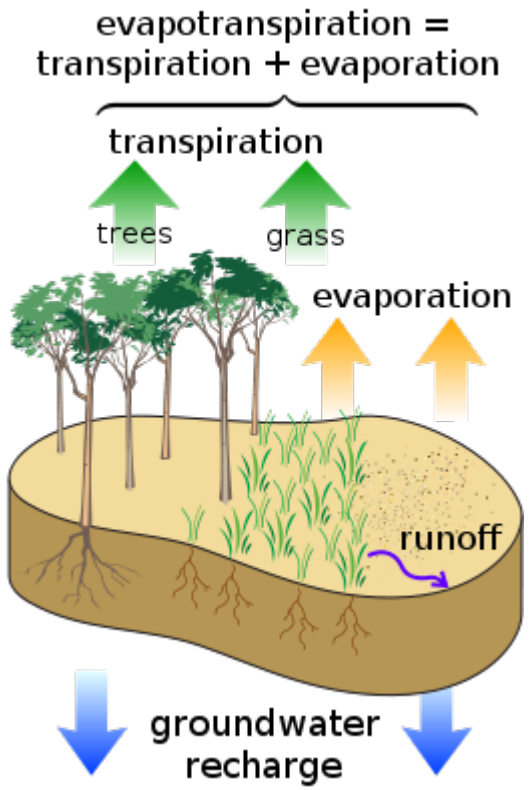
Tree Benefit: Hydrology Effects

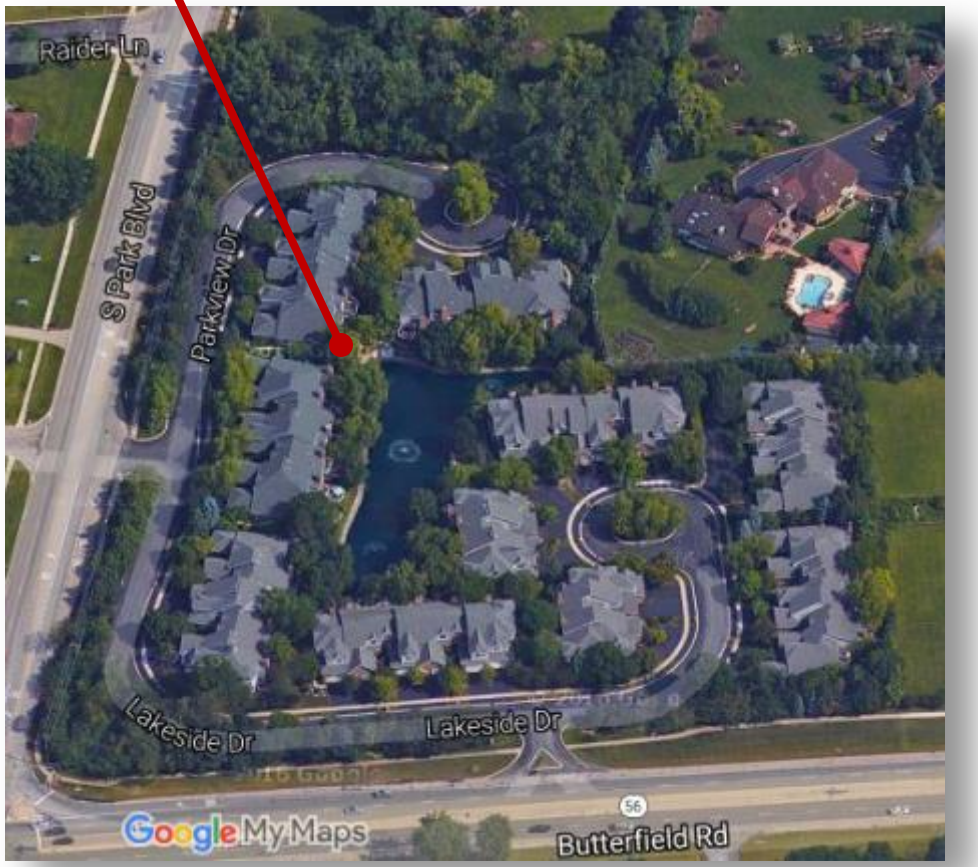
- Intercepts and holds rain on leaves, branches, and other surfaces
- Reduces stormwater runoff
- Increases water storage in soil
- Increase infiltration and helps recharge aquifers (underground water)
- Reduces erosion



Trees & Energy – Combined Climate Effects

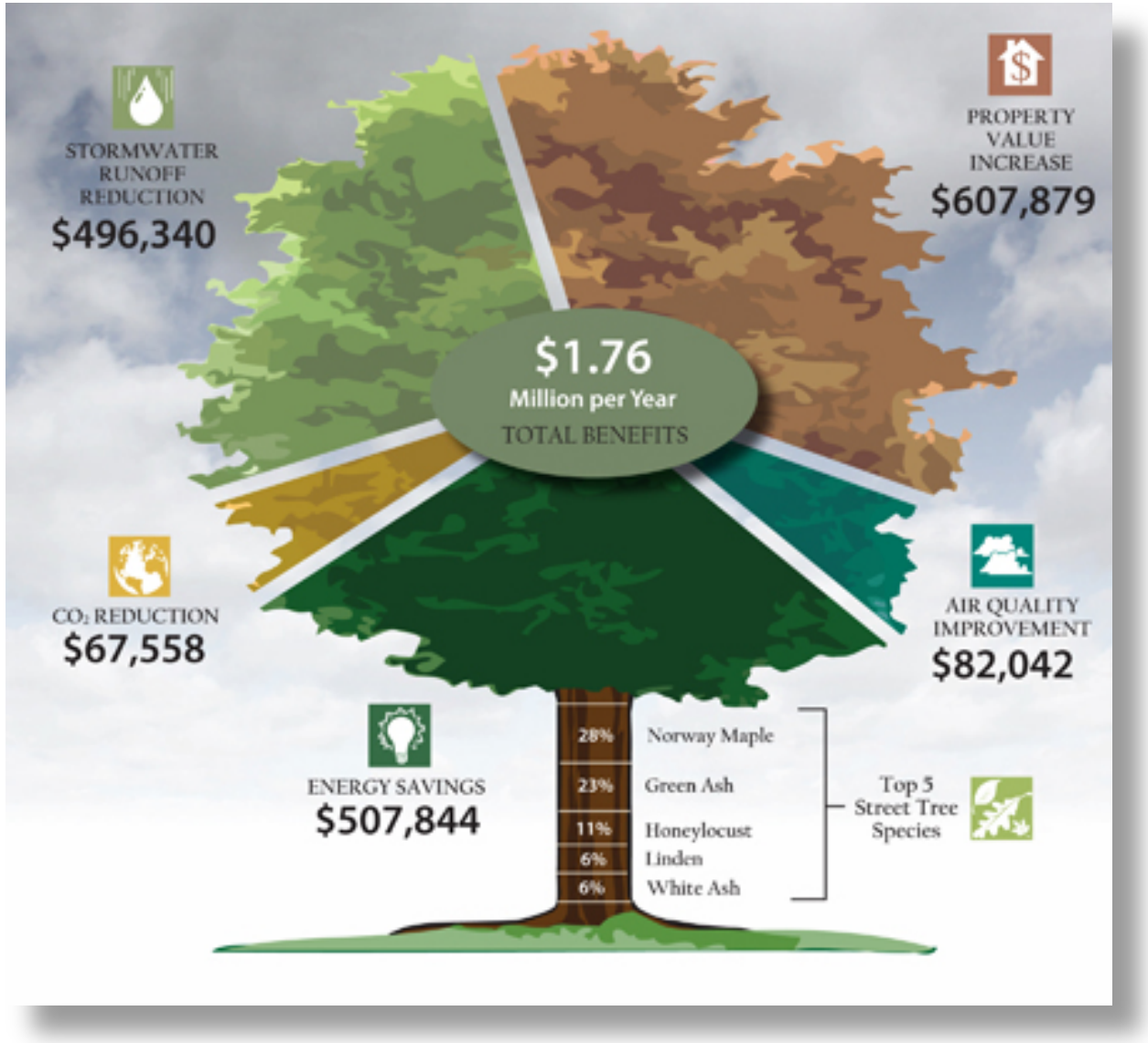
Combined effects of transpirational cooling along with shading of below canopy built surfaces can reduce air temps by as much as 9°F.



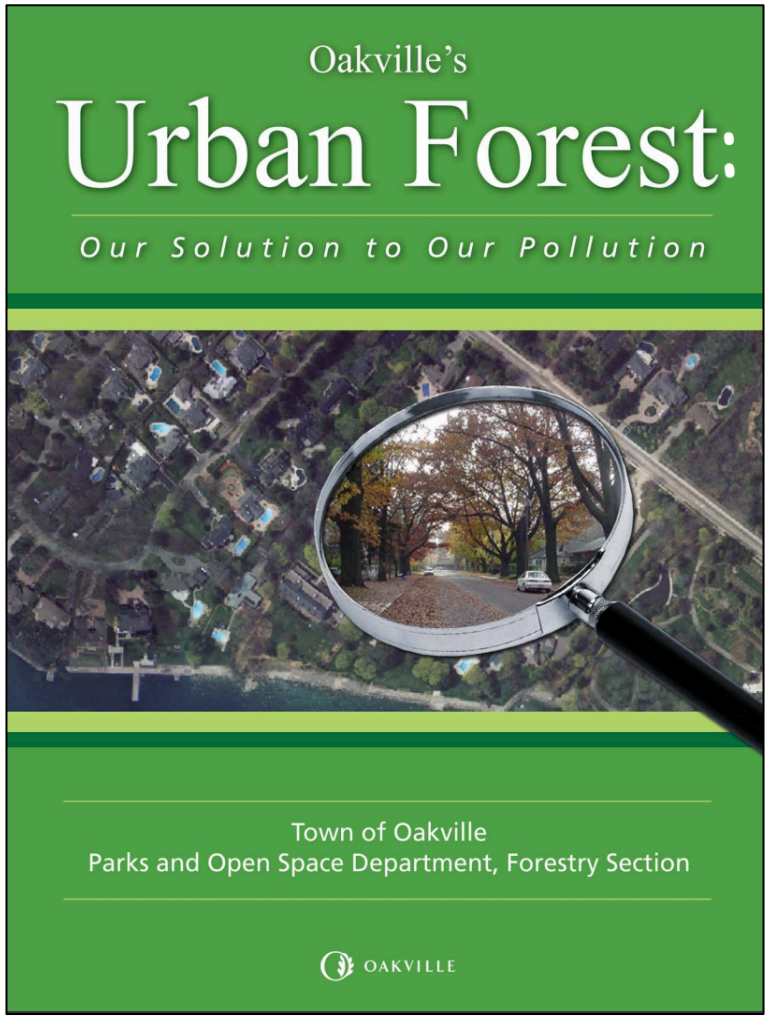


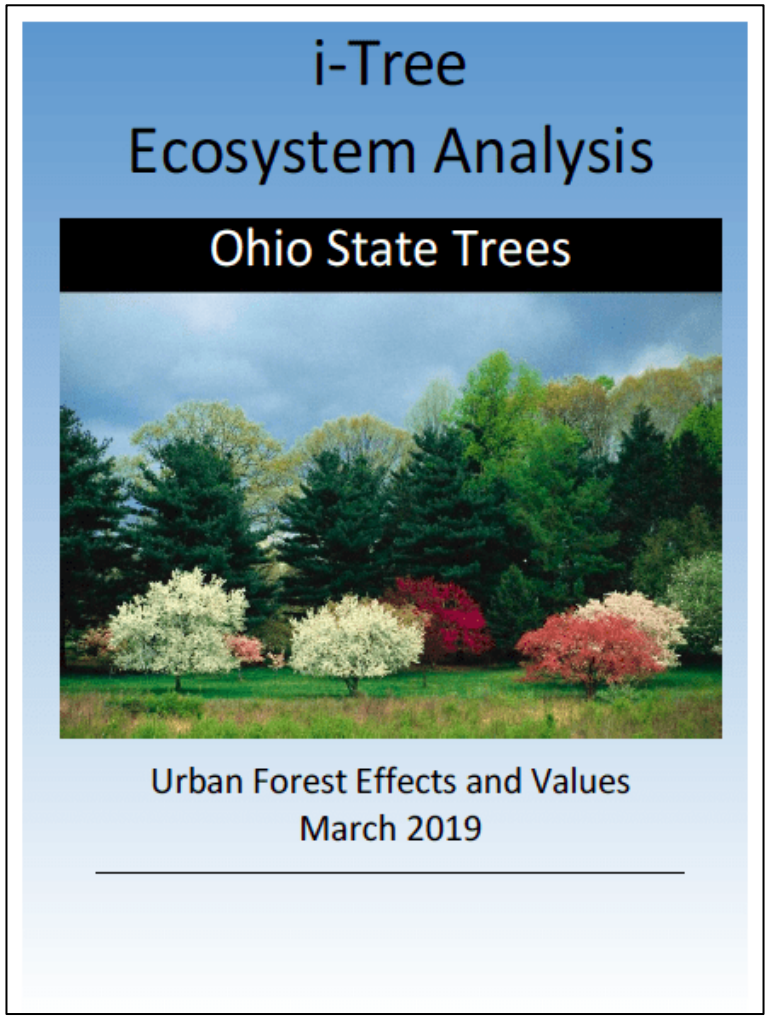
Source: Akbari et al.,1992. Cooling Our Communities: A Guide on Tree Planting and Light Colored Surfacing.

Benefit-Based Approach



i-Tree… Using quantitative data to tell your story.

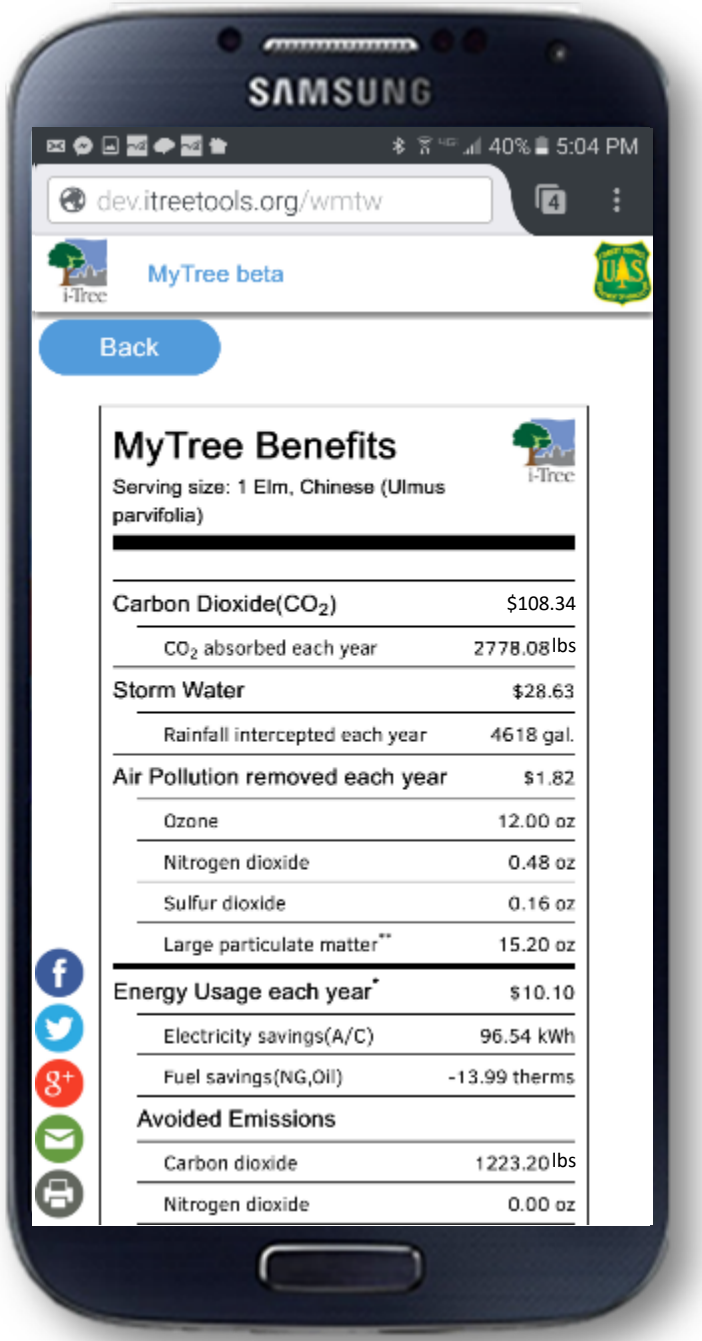




MyTree

i-Tree

MyTree



i-Tree on the go…

for individual or multiple trees!

Tree Facts

Serving Size: 14 in DBH (35.6 cm)
Species: Pin Oak, ***Quercus palustris***

Amount Per Serving	
Carbon sequestered 259 lbs	avoided 257 lbs
	% Annual Value*
Total Carbon 537 lbs	
O3 $1.96	
VOC(Volatile Organic Compounds) $0.93	
NO2(Deposited) $0.85	
NO2(Avoided) $3.36	
SO2(Deposited) $0.25	
SO2(Avoided) $1.40	
PM10(Deposited) $1.77	
PM10(Avoided) $0.39	
Conserved Kilowatt/hours 96 KwH	
Reduced oil/natural gas consumption 28 therm(s)	
Stormwater intercepted 1,527 gallons	

Property value increase $103.00	Natural Gas $39.93
Stormwater $12.21	Electricity $12.92

*It should be noted that trees themselves emit biogenic volatile organic compounds (BVOCs) which can contribute to ground-level ozone production. This may negate the positive impact the tree has on ozone mitigation for some high emitting species (e.g. Willow Oak or Sweetgum). However, the sum total of the tree's environmental benefits always trumps this negative.

Source
[illegible]

USDA Forest Services Center for Urban Forest Research

i-Tree Tools CD-ROM [illegible]

42000 06200

i-Tree Eco

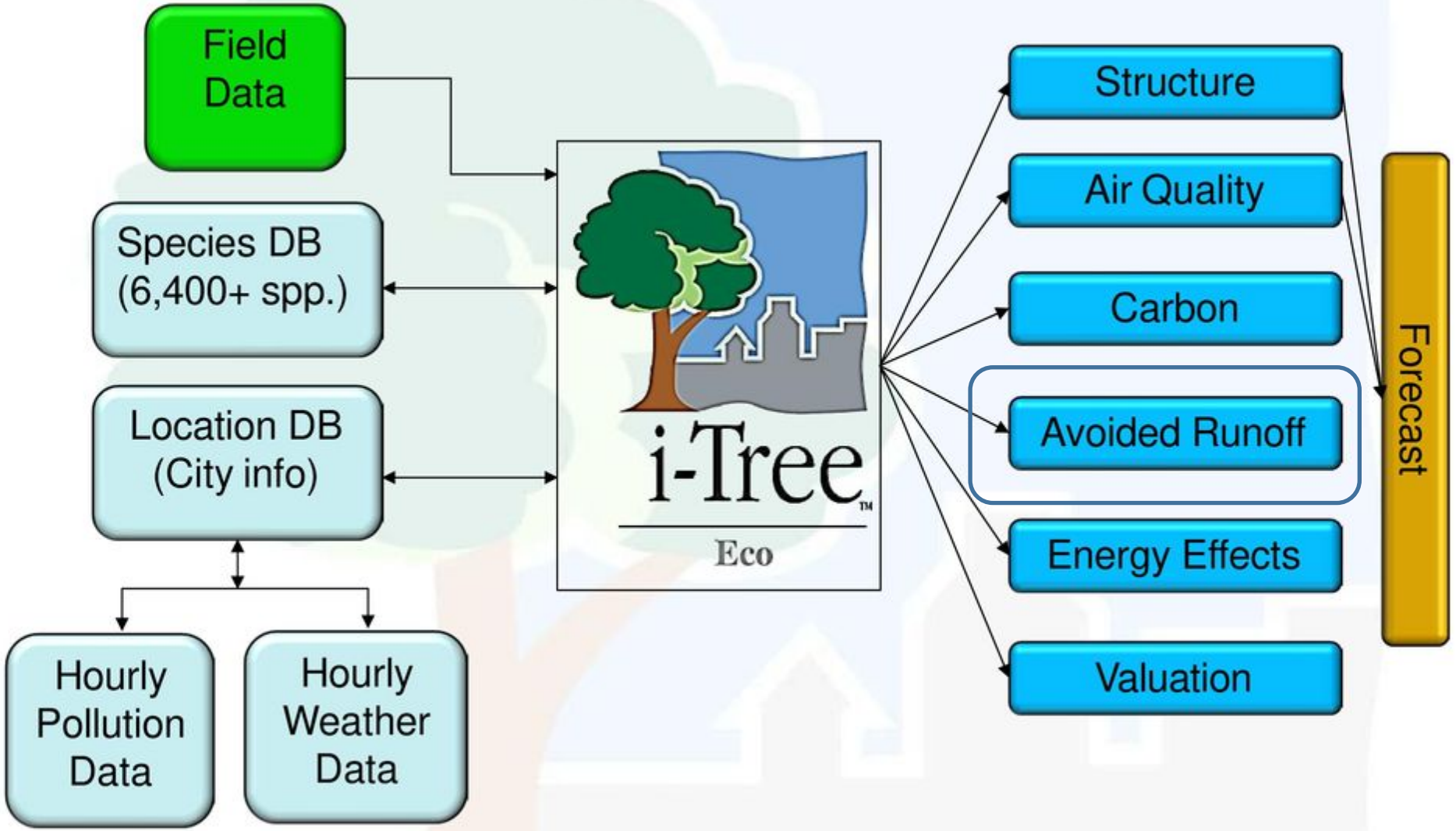
i-Tree Eco v6

Flagship tool with best estimates for Composition and Benefits.

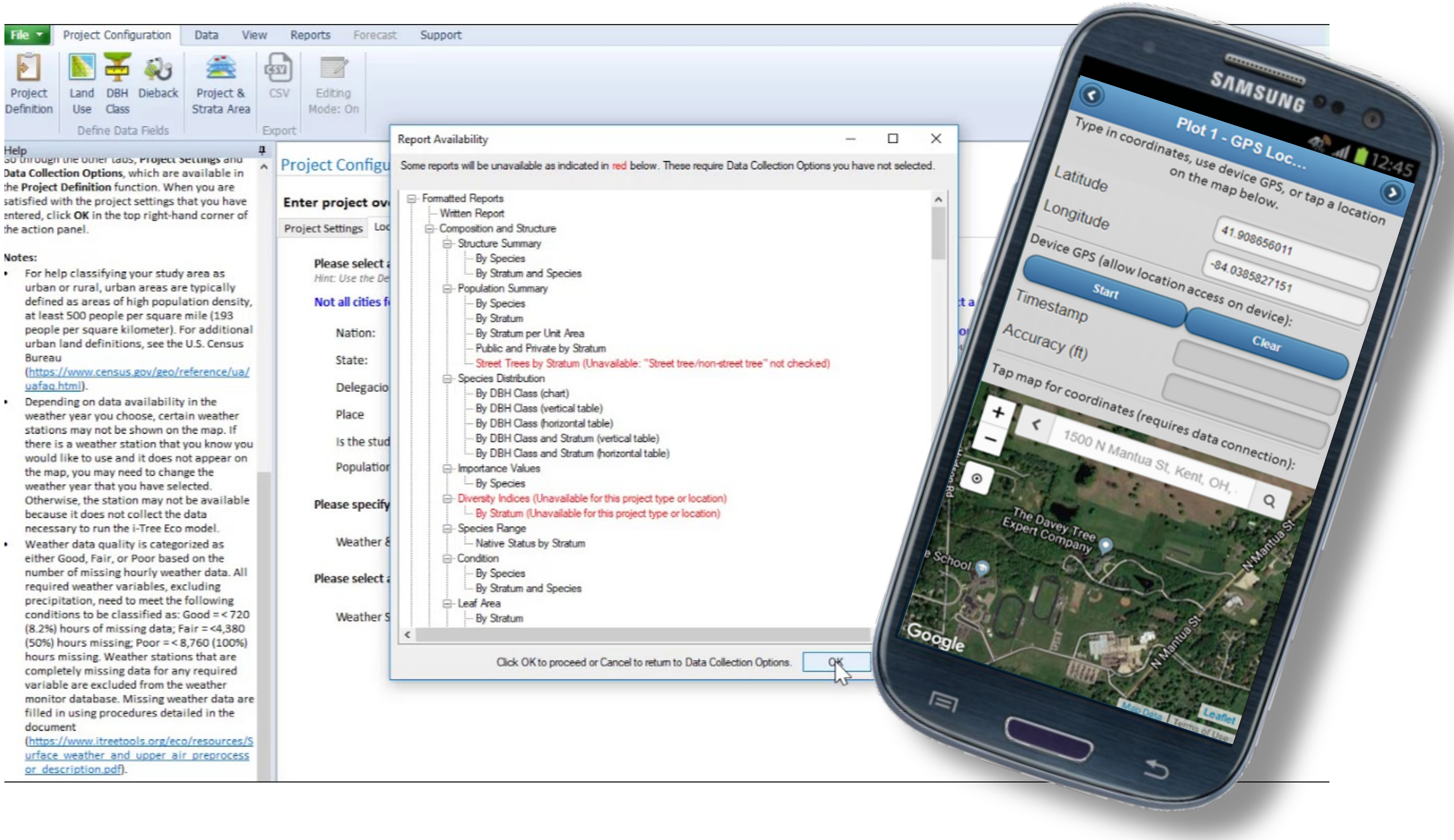
- User interface & Help text
- Reporting
- Tree inventory import
- Mobile data collector
- Help text

Plot Sampling & Complete Inventories

i-Tree Eco Model Schematic



www.itreetools.org/resources/archives.php


File
Project Configuration
Data
View
Reports
Forecast
Support
Project Definition
Land Use
DBH Class
Dieback
Define Data Fields
Project & Strata Area
CSV
Export
Editing Mode: On
Help
Data Collection Options, which are available in the Project Definition function. When you are satisfied with the project settings that you have entered, click OK in the top right-hand corner of the action panel.
Notes:
For help classifying your study area as urban or rural, urban areas are typically defined as areas of high population density, at least 500 people per square mile (193 people per square kilometer). For additional urban land definitions, see the U.S. Census Bureau (https://www.census.gov/geo/reference/ua/uafaq.html).
Depending on data availability in the weather year you choose, certain weather stations may not be shown on the map. If there is a weather station that you know you would like to use and it does not appear on the map, you may need to change the weather year that you have selected. Otherwise, the station may not be available because it does not collect the data necessary to run the i-Tree Eco model.
Weather data quality is categorized as either Good, Fair, or Poor based on the number of missing hourly weather data. All required weather variables, excluding precipitation, need to meet the following conditions to be classified as: Good = < 720 (8.2%) hours of missing data; Fair = <4,380 (50%) hours missing; Poor = < 8,760 (100%) hours missing. Weather stations that are completely missing data for any required variable are excluded from the weather monitor database. Missing weather data are filled in using procedures detailed in the document (https://www.itreetools.org/eco/resources/Surface_weather_and_upper_air_preprocessor_description.pdf).
Project Configu
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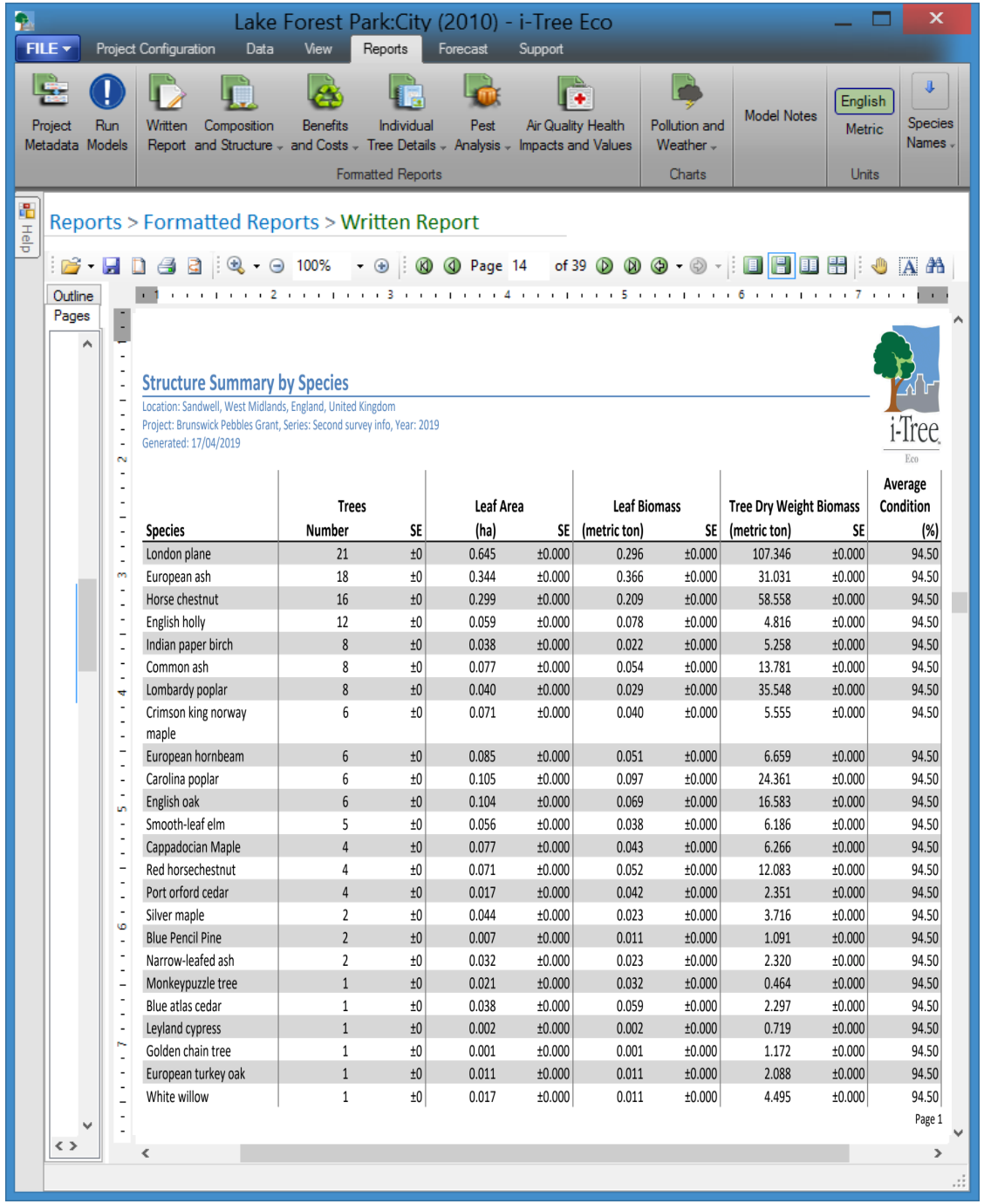
Report Availability
Some reports will be unavailable as indicated in red below. These require Data Collection Options you have not selected.
Formatted Reports
Written Report
Composition and Structure
Structure Summary
By Species
By Stratum and Species
Population Summary
By Species
By Stratum
By Stratum per Unit Area
Public and Private by Stratum
Street Trees by Stratum (Unavailable: "Street tree/non-street tree" not checked)
Species Distribution
By DBH Class (chart)
By DBH Class (vertical table)
By DBH Class (horizontal table)
By DBH Class and Stratum (vertical table)
By DBH Class and Stratum (horizontal table)
Importance Values
By Species
Diversity Indices (Unavailable for this project type or location)
By Stratum (Unavailable for this project type or location)
Species Range
Native Status by Stratum
Condition
By Species
By Stratum and Species
Leaf Area
By Stratum
Click OK to proceed or Cancel to return to Data Collection Options.
OK
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 Assesses:

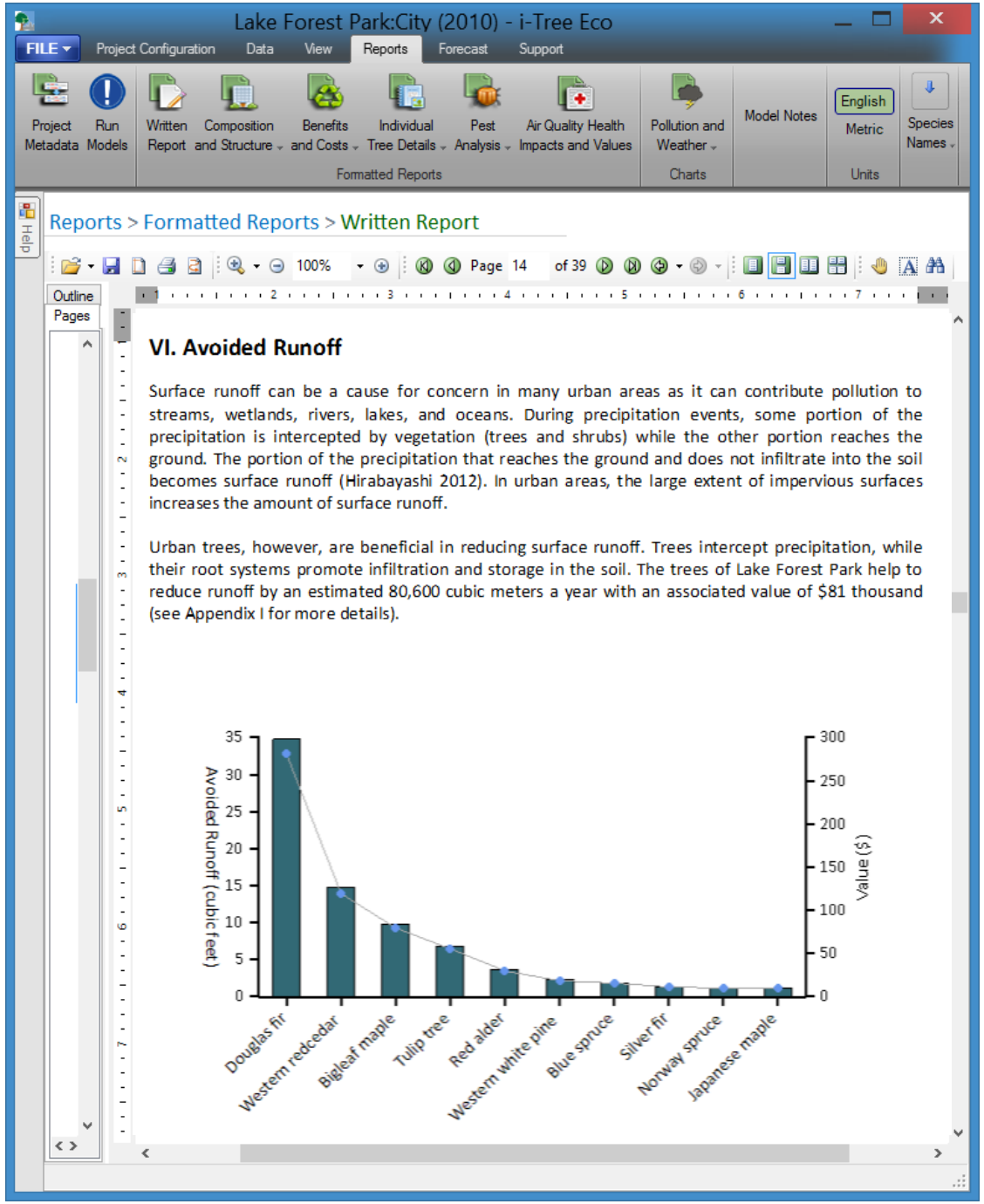
- Structure
- Function
  - Air quality
  - Carbon
  - Avoided runoff
  - Energy effects
  - Human health impacts
- Value ($)
- Management info
  - Pest risk
  - Tree health
  - Exotic/invasive species



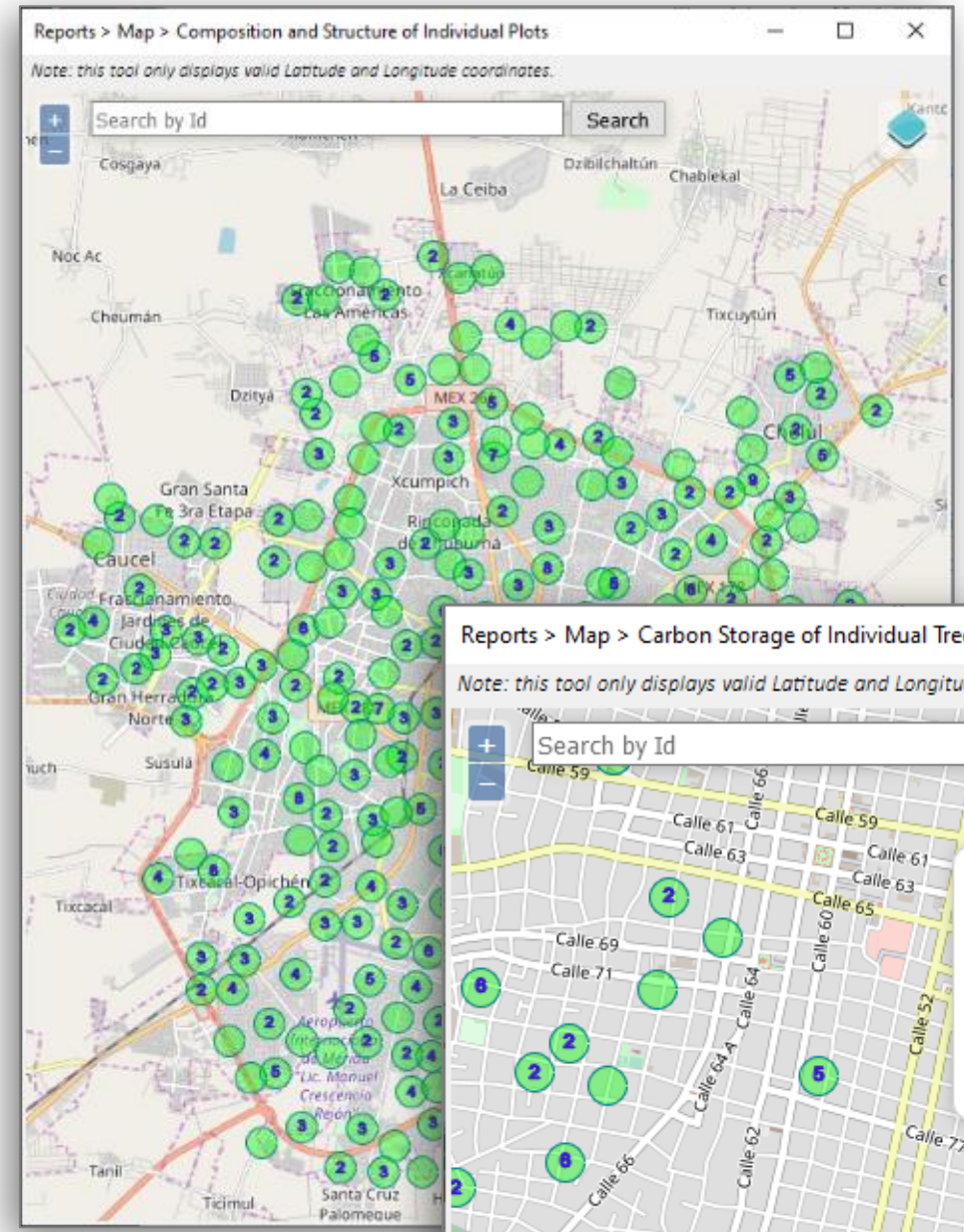
Species	Trees Number	SE	Leaf Area (ha)	SE	Leaf Biomass (metric ton)	SE	Tree Dry Weight Biomass (metric ton)	SE	Average Condition (%)
London plane	21	±0	0.645	±0.000	0.296	±0.000	107.346	±0.000	94.50
European ash	18	±0	0.344	±0.000	0.366	±0.000	31.031	±0.000	94.50
Horse chestnut	16	±0	0.299	±0.000	0.209	±0.000	58.558	±0.000	94.50
English holly	12	±0	0.059	±0.000	0.078	±0.000	4.816	±0.000	94.50
Indian paper birch	8	±0	0.038	±0.000	0.022	±0.000	5.258	±0.000	94.50
Common ash	8	±0	0.077	±0.000	0.054	±0.000	13.781	±0.000	94.50
Lombardy poplar	8	±0	0.040	±0.000	0.029	±0.000	35.548	±0.000	94.50
Crimson king norway maple	6	±0	0.071	±0.000	0.040	±0.000	5.555	±0.000	94.50
European hornbeam	6	±0	0.085	±0.000	0.051	±0.000	6.659	±0.000	94.50
Carolina poplar	6	±0	0.105	±0.000	0.097	±0.000	24.361	±0.000	94.50
English oak	6	±0	0.104	±0.000	0.069	±0.000	16.583	±0.000	94.50
Smooth-leaf elm	5	±0	0.056	±0.000	0.038	±0.000	6.186	±0.000	94.50
Cappadocian Maple	4	±0	0.077	±0.000	0.043	±0.000	6.266	±0.000	94.50
Red horsechestnut	4	±0	0.071	±0.000	0.052	±0.000	12.083	±0.000	94.50
Port orford cedar	4	±0	0.017	±0.000	0.042	±0.000	2.351	±0.000	94.50
Silver maple	2	±0	0.044	±0.000	0.023	±0.000	3.716	±0.000	94.50
Blue Pencil Pine	2	±0	0.007	±0.000	0.011	±0.000	1.091	±0.000	94.50
Narrow-leafed ash	2	±0	0.032	±0.000	0.023	±0.000	2.320	±0.000	94.50
Monkeypuzzle tree	1	±0	0.021	±0.000	0.032	±0.000	0.464	±0.000	94.50
Blue atlas cedar	1	±0	0.038	±0.000	0.059	±0.000	2.297	±0.000	94.50
Leyland cypress	1	±0	0.002	±0.000	0.002	±0.000	0.719	±0.000	94.50
Golden chain tree	1	±0	0.001	±0.000	0.001	±0.000	1.172	±0.000	94.50
European turkey oak	1	±0	0.011	±0.000	0.011	±0.000	2.088	±0.000	94.50
White willow	1	±0	0.017	±0.000	0.011	±0.000	4.495	±0.000	94.50

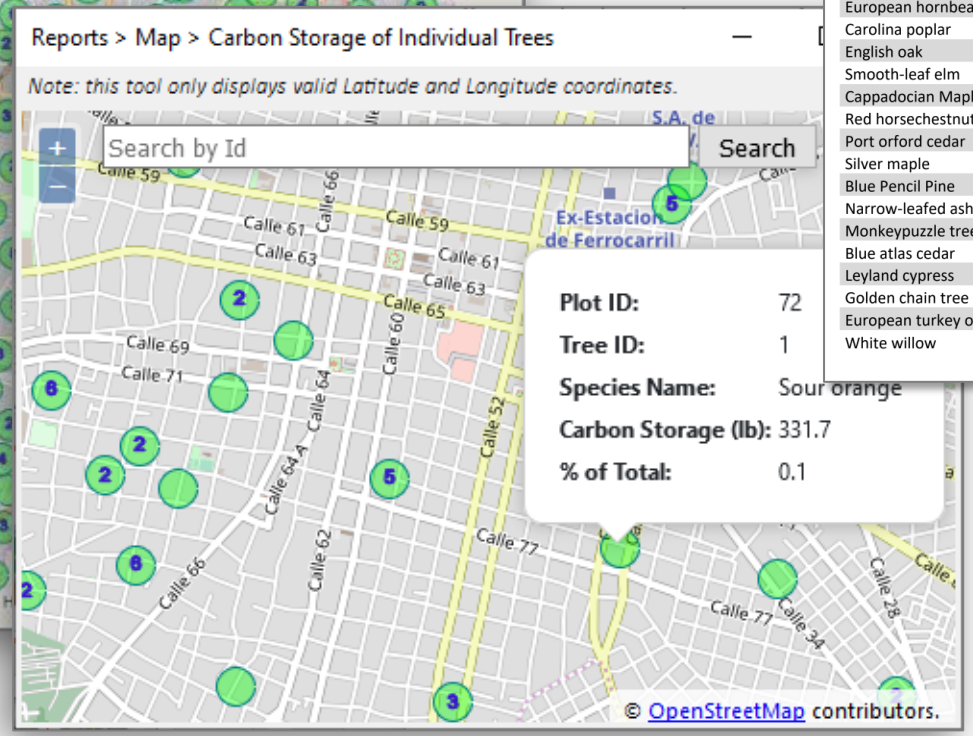
i-Tree Eco Assesses:

- Structure
- Function
  - Air quality
  - Carbon
  - Avoided runoff
  - Energy effects
  - Human health impacts
- Value ($)
- Management info
  - Pest risk
  - Tree health
  - Exotic/invasive species



i-Tree Eco v6





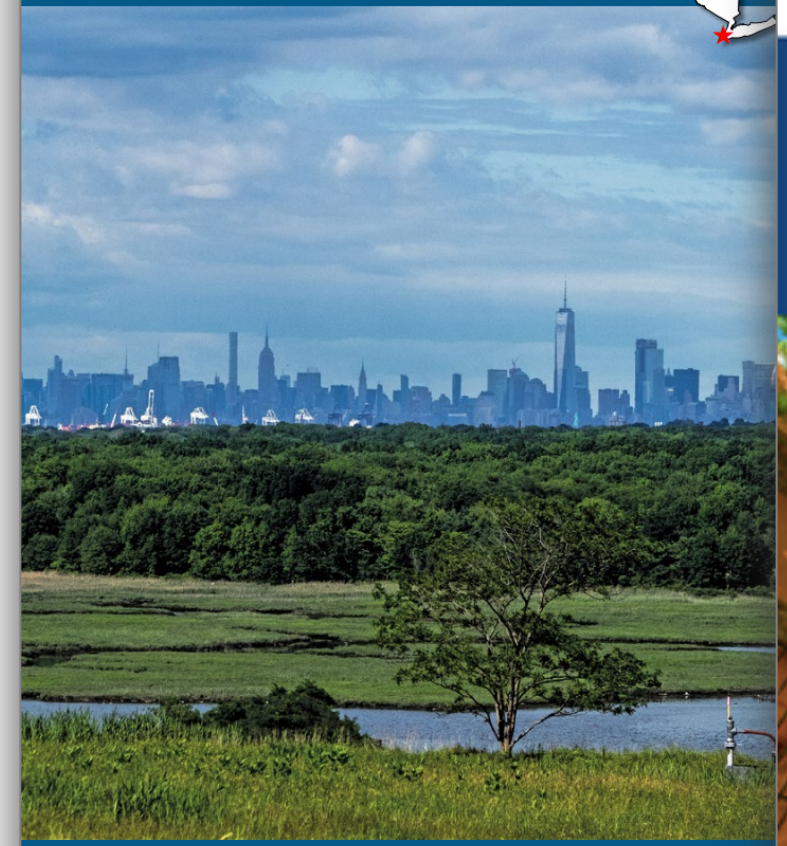
Structure Summary by Species

Location: Sandwell, West Midlands, England, United Kingdom
Project: Brunswick Pebbles Grant, Series: Second survey info, Year: 2019
Generated: 17/04/2019

Species	Trees Number	SE	Leaf Area (ha)	SE	Leaf Biomass (metric ton)	SE	Tree Dry Weight Biomass (metric ton)	SE	Average Condition (%)
London plane	21	±0	0.645	±0.000	0.296	±0.000	107.346	±0.000	94.50
European ash	18	±0	0.344	±0.000	0.366	±0.000	31.031	±0.000	94.50
Horse chestnut	16	±0	0.299	±0.000	0.209	±0.000	58.558	±0.000	94.50
English holly	12	±0	0.059	±0.000	0.078	±0.000	4.816	±0.000	94.50
Indian paper birch	8	±0	0.038	±0.000	0.022	±0.000	5.258	±0.000	94.50
Common ash	8	±0	0.077	±0.000	0.054	±0.000	13.781	±0.000	94.50
Lombardy poplar	8	±0	0.040	±0.000	0.029	±0.000	35.548	±0.000	94.50
Crimson king norway maple	6	±0	0.071	±0.000	0.040	±0.000	5.555	±0.000	94.50
European hornbeam	6	±0	0.085	±0.000	0.051	±0.000	6.659	±0.000	94.50
Carolina poplar	6	±0	0.105	±0.000	0.097	±0.000	24.361	±0.000	94.50
English oak	6	±0	0.104	±0.000	0.069	±0.000	16.583	±0.000	94.50
Smooth-leaf elm	5	±0	0.056	±0.000	0.038	±0.000	6.186	±0.000	94.50
Cappadocian Maple	4	±0	0.077	±0.000	0.043	±0.000	6.266	±0.000	94.50
Red horsechestnut	4	±0	0.071	±0.000	0.052	±0.000	12.083	±0.000	94.50
Port orford cedar	4	±0	0.017	±0.000	0.042	±0.000	2.351	±0.000	94.50
Silver maple	2	±0	0.044	±0.000	0.023	±0.000	3.716	±0.000	94.50
Blue Pencil Pine	2	±0	0.007	±0.000	0.011	±0.000	1.091	±0.000	94.50
Narrow-leafed ash	2	±0	0.032	±0.000	0.023	±0.000	2.320	±0.000	94.50
Monkeypuzzle tree	1	±0	0.021	±0.000	0.032	±0.000	0.464	±0.000	94.50
Blue atlas cedar	1	±0	0.038	±0.000	0.059	±0.000	2.297	±0.000	94.50
Leyland cypress	1	±0	0.002	±0.000	0.002	±0.000	0.719	±0.000	94.50
Golden chain tree	1	±0	0.001	±0.000	0.001	±0.000	1.172	±0.000	94.50
European turkey oak	1	±0	0.011	±0.000	0.011	±0.000	2.088	±0.000	94.50
White willow	1	±0	0.017	±0.000	0.011	±0.000	4.495	±0.000	94.50

USDA
United States Department of Agriculture

The Urban Forest of New York City



Forest Service | Northern Research Station | Resource Bulletin NRS-117 | September 2018

USAID
FROM THE AMERICAN PEOPLE

TECHNICAL REPORT

I-TREE URBAN FOREST ASSESSMENT IN SANTO DOMINGO's COLONIAL CIT

March 2016

This publication was produced for review by the United States Agency for International Development. It was prepared by Jerry Bauer, Marwin Pérez and Sofía Olivero.

Forest Research

Evaluation of i-Tree Eco surveys in Great Britain

Impacts and key lessons: The views of stakeholders

Clare Hall, Liz O'Brien, Kathryn Hand, Susanne Raum, 2018

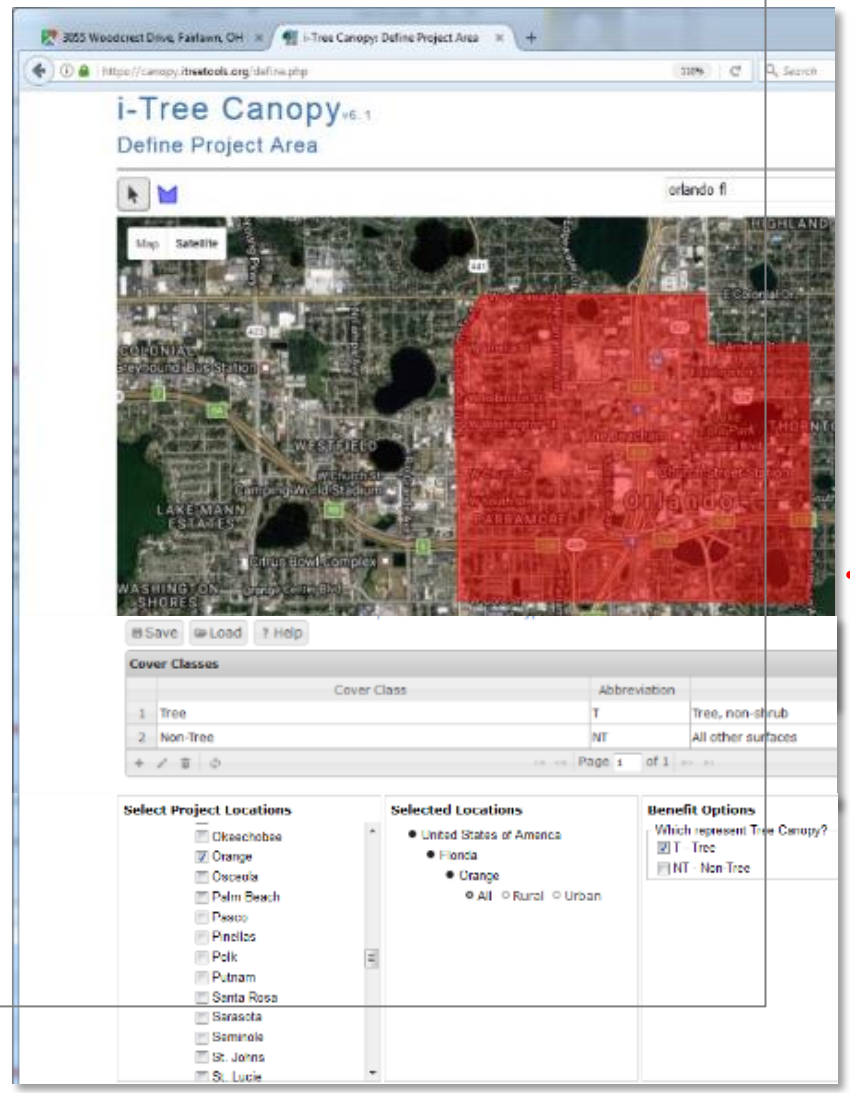
The Research Agency of the Forestry Commission

i-Tree Canopy

i-Tree Canopy

Quick, statistical estimate of Canopy cover and associated benefits.

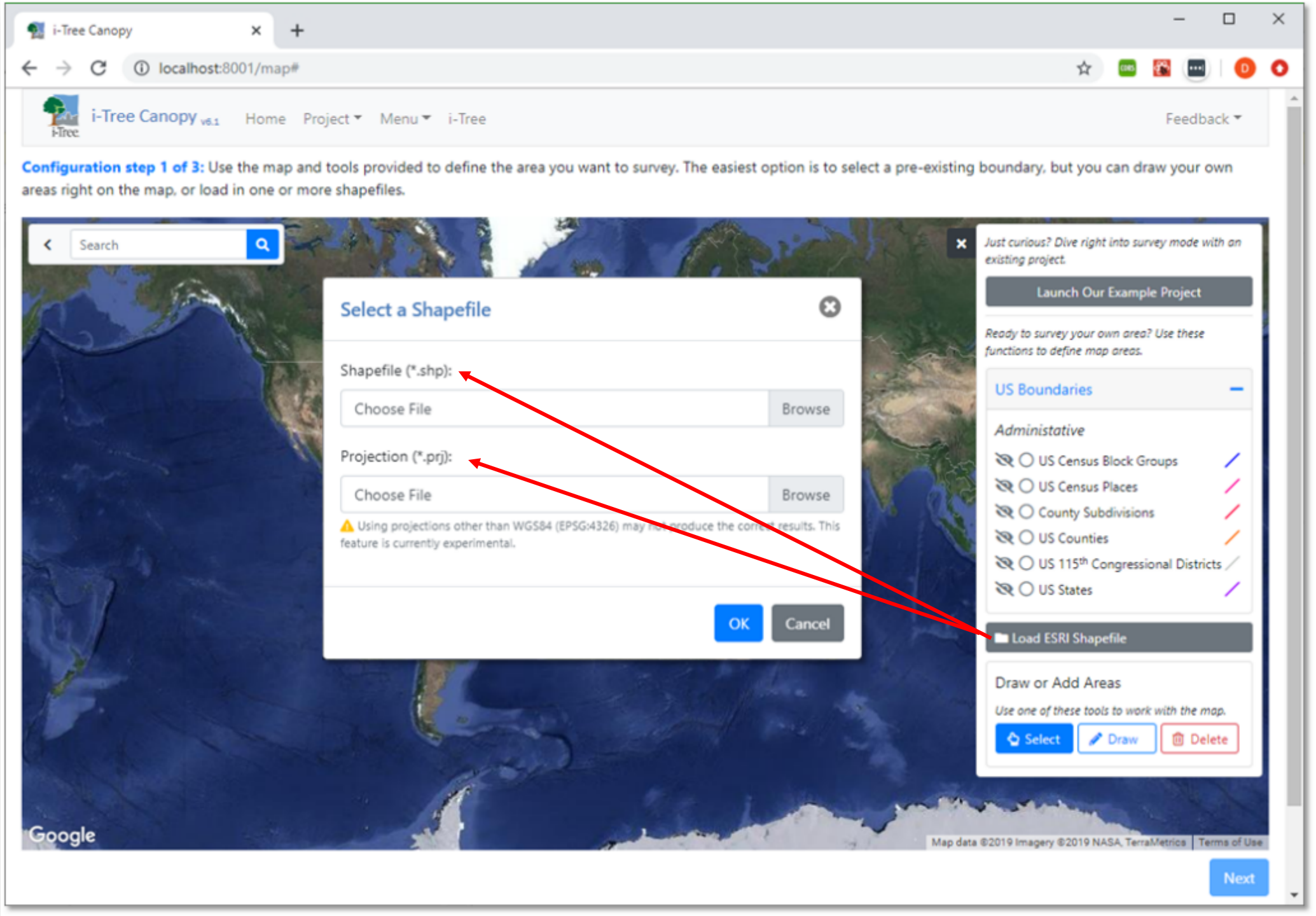
- Create custom cover classes
- Random point locations
- Does not automatically assign cover class at point



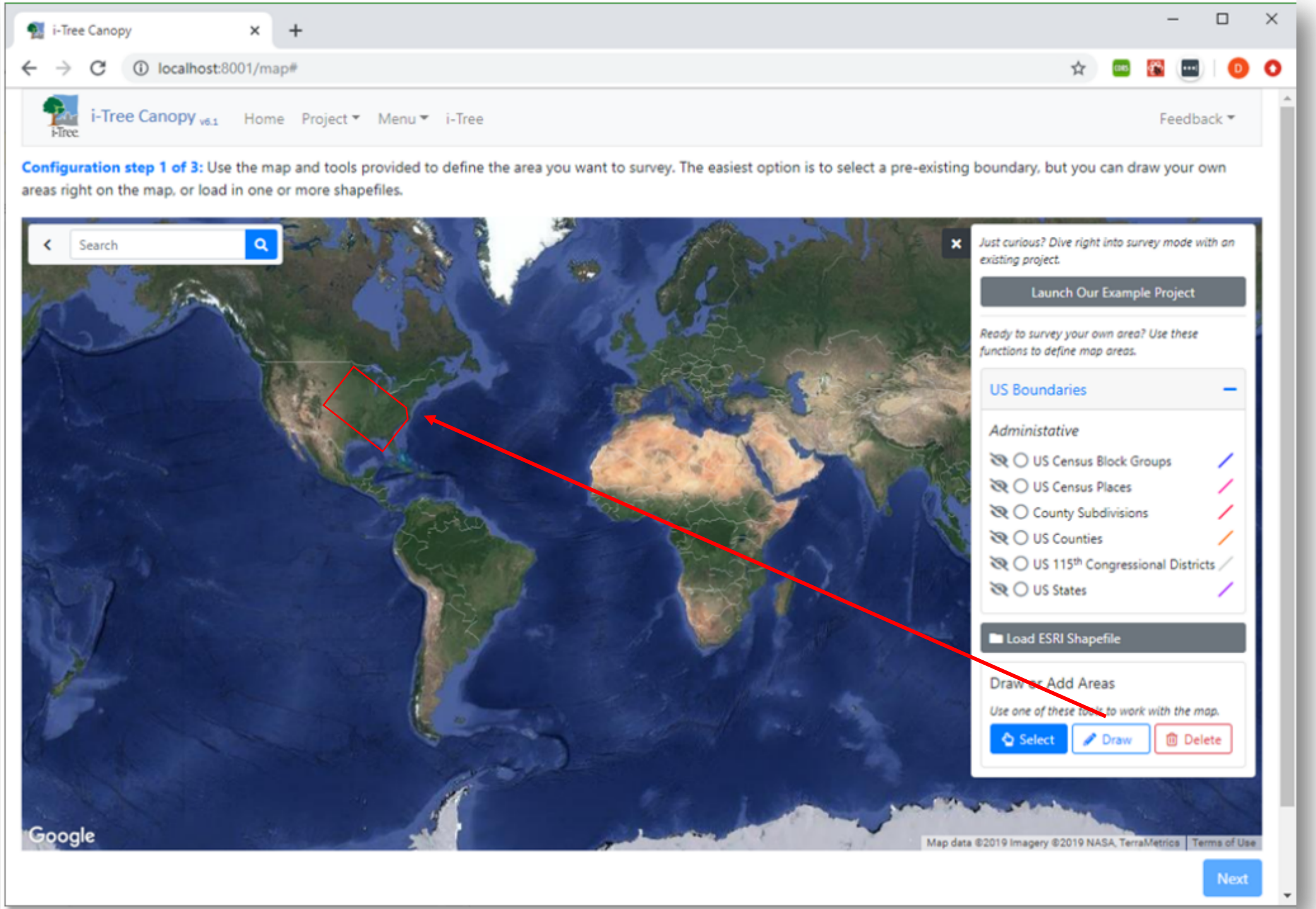
Cover Class	Description	Abbr.	Points	% Cover
Tree	Tree, non-shrub	T	11	18.3 ±5.00
Non-Tree	All other surfaces	NT	49	81.7 ±5.00

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	$174.40	±47.52	656.72 lb	±178.94
NO2	Nitrogen Dioxide removed annually	$156.26	±42.58	1,511.65 lb	±411.89
O3	Ozone removed annually	$9,249.84	±2,520.35	9.48 T	±2.58
PM2.5	Particulate Matter less than 2.5 microns removed annually	$17,942.75	±4,888.94	848.77 lb	±231.27
SO2	Sulfur Dioxide removed annually	$6.22	±1.69	133.89 lb	±36.48
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	$6,763.14	±1,842.78	2.48 T	±0.68
CO2seq	Carbon Dioxide sequestered annually in trees	$81,603.57	±22,234.90	2,314.64 T	±630.68
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	±10,210.40

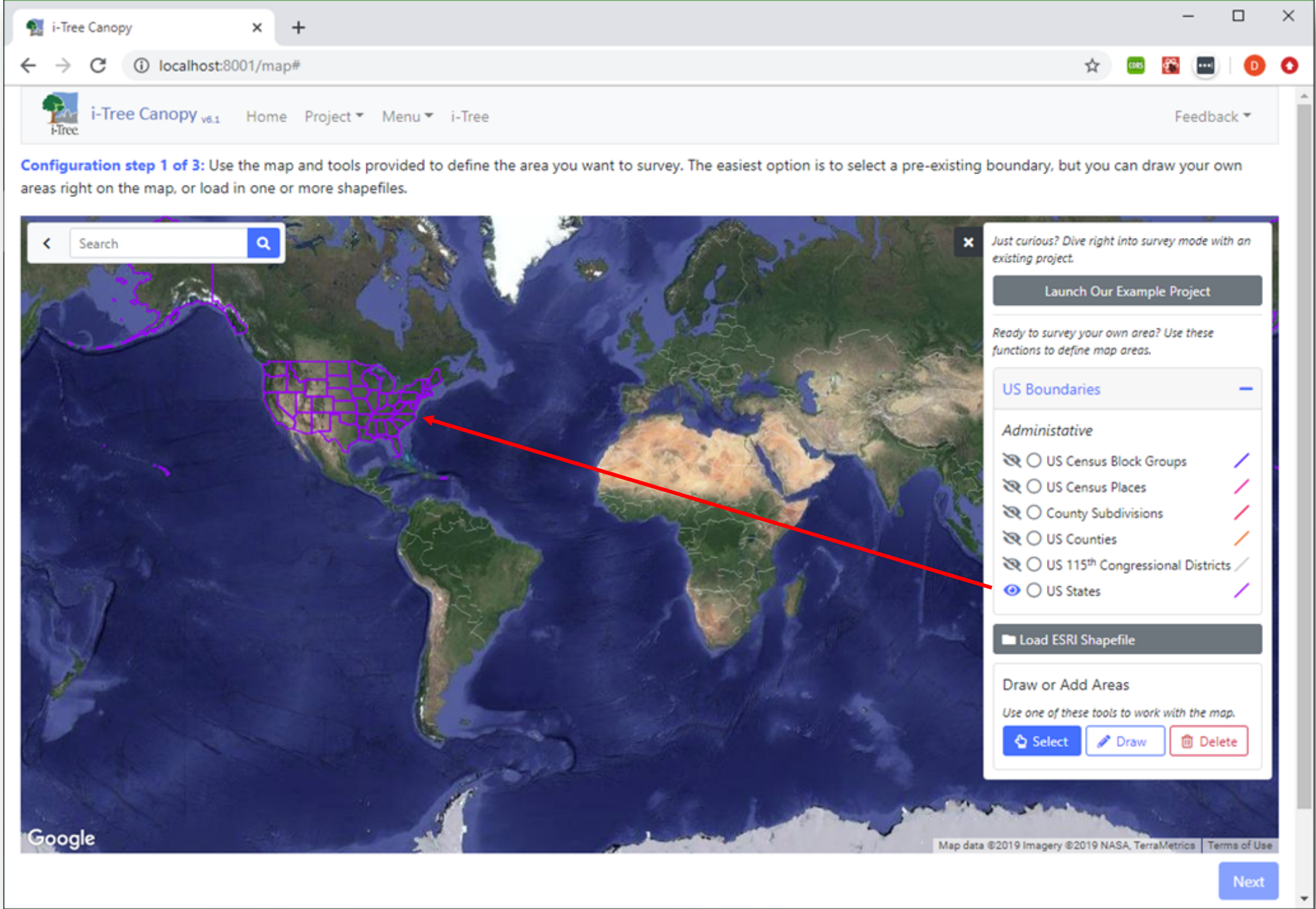
i-Tree Canopy *preview*



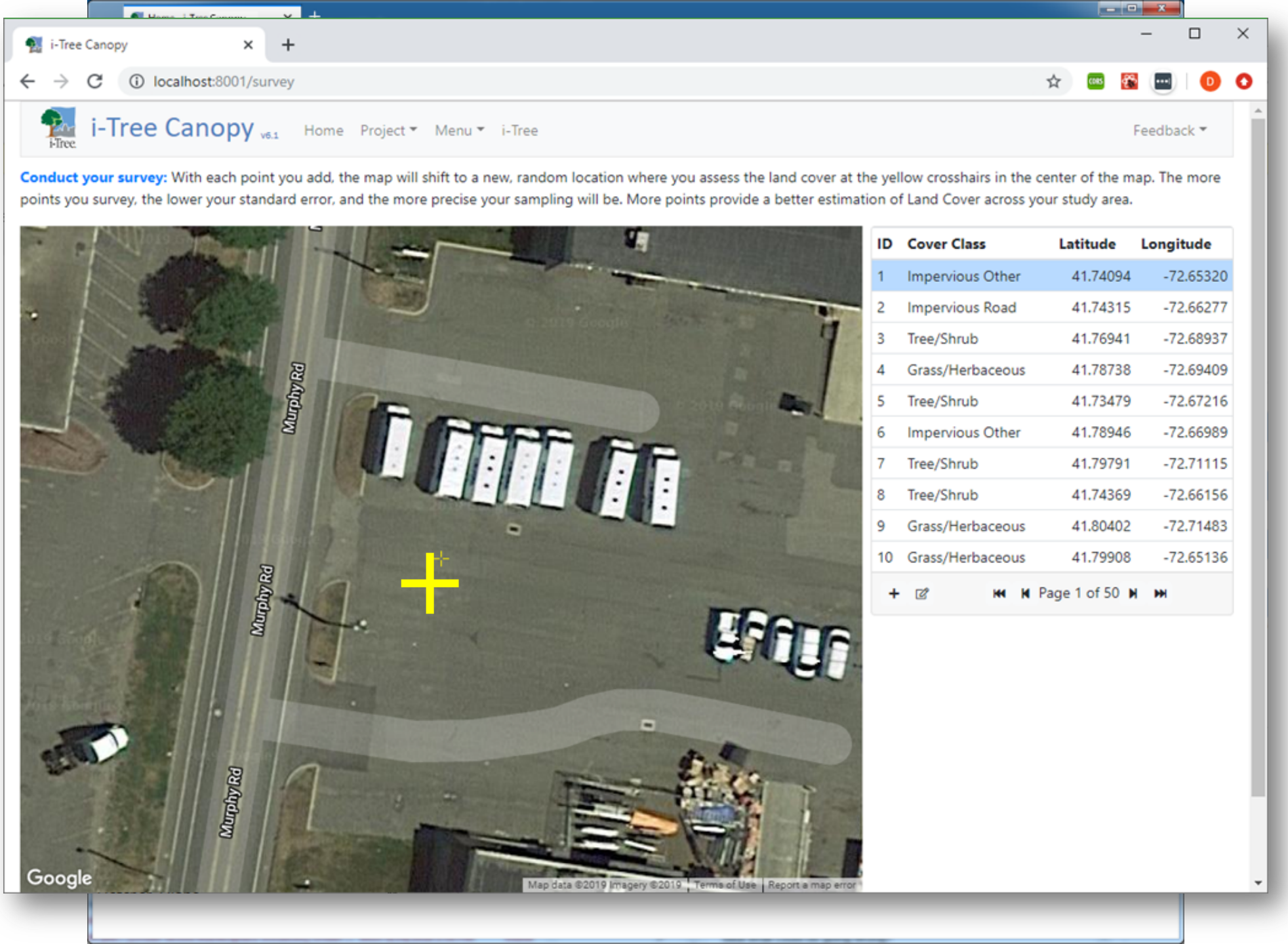
i-Tree Canopy *preview*



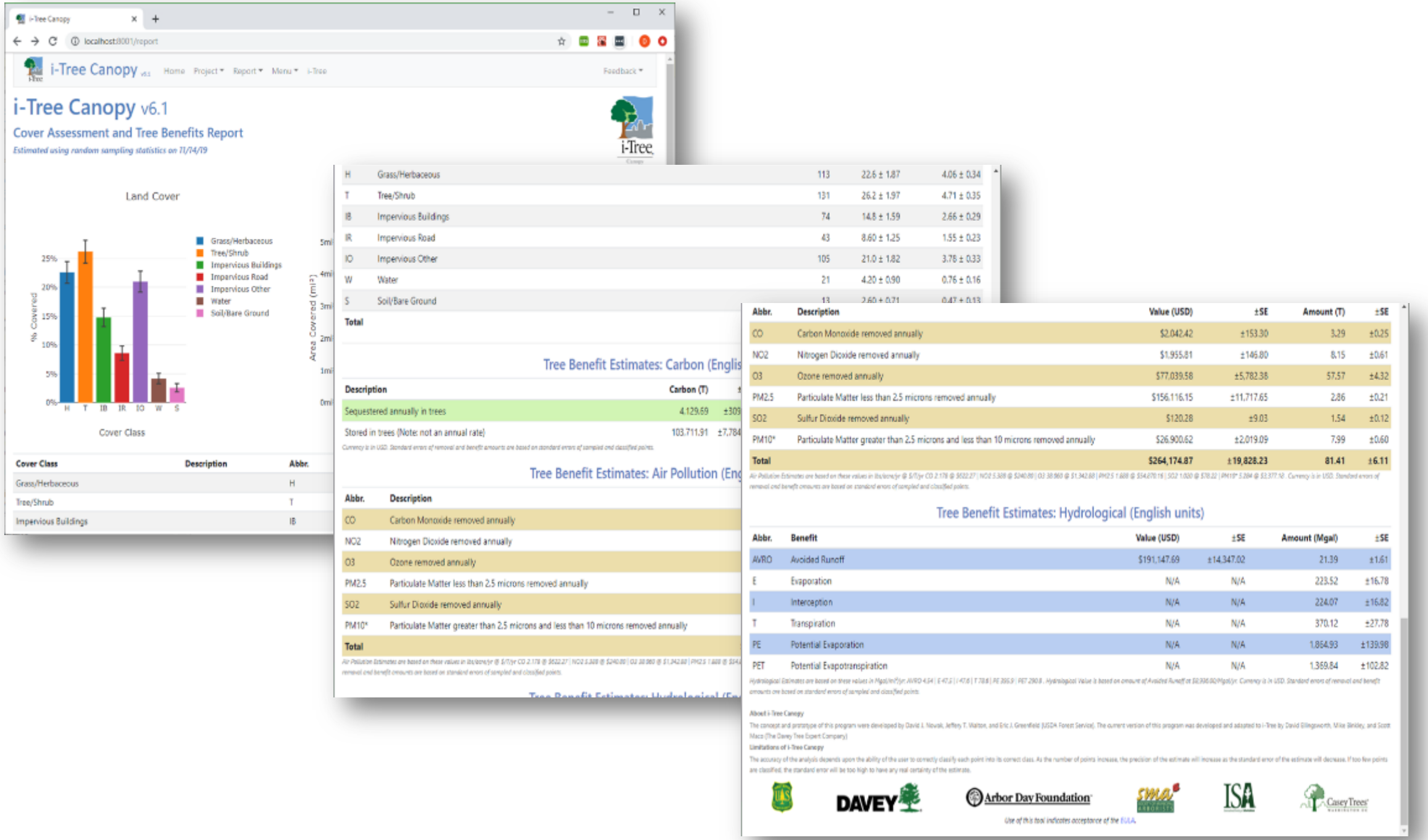
i-Tree Canopy *preview*



i-Tree Canopy *preview*



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		

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 @ $240.80 | O3 38,960 @ $1,342.88 | PM2.5 1,688 @ $54,670.16 | 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/ft²/yr. AVRO 4.64 | E 47.5 | I 47.6 | T 78.8 | PE 395.9 | PET 290.8 . Hydrological Value is based on amount of Avoided Runoff at $8,936.60/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, 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.

Use of this tool indicates acceptance of the EULA.

i-Tree Hydro

i-Tree Hydro: Model interface

i-Tree Hydro

File Steps Outputs Help

Welcome to i-Tree Hydro!

What is Hydro?
How to Run i-Tree Hydro
About the Sample Project
New Project Steps

General References:

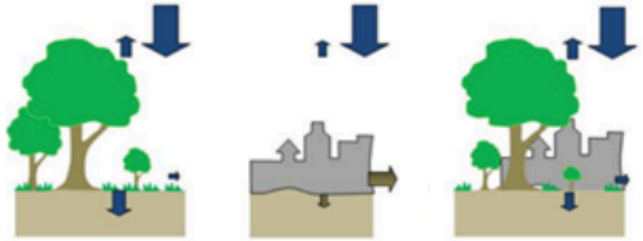
i-Tree Hydro webpage
Hydrologic Cycle
Soil Profile
User's Manual

What is Hydro?

i-Tree Hydro is a simulation tool that analyzes how land cover influences the volume and quality of runoff. It can analyze historical or future hydrological events and allow the user to contrast runoff volume and quality from existing land cover (referred to as the Base Case) with runoff from the Alternative Case land cover. The i-Tree Hydro model differs from other i-Tree products in the following ways:

- The model simulation area is loaded into the program either as a digital elevation model (DEM) file or as a topographic index (TI) file. It is not hand-delineated in the program by the user. If the user is interested in a watershed, they can load a DEM or TI file. If the user is interested in a city or parcel that is not defined by a single watershed they load a TI file.

- The model simulation can be run in calibration mode or non-calibration mode. For calibration runs the user loads observed streamflow data from a gauging station and the model will identify the optimal hydrological parameters to fit the observed streamflow data. Observed streamflow data are provided for thousands of watershed areas. For non-calibration runs the user can use previously calibrated parameters or independently set the land cover and hydrological parameter values by adjusting the default values that the model provides.



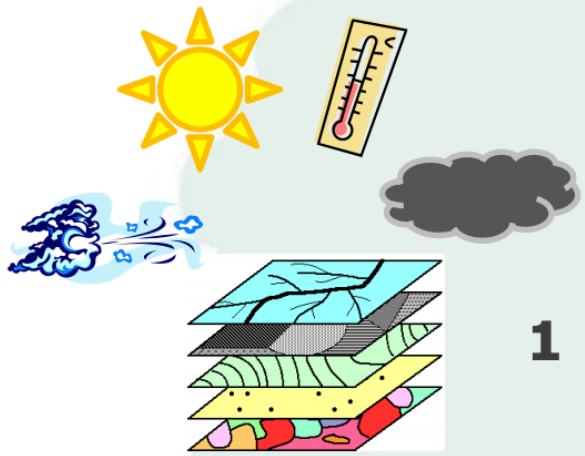
Current Project:

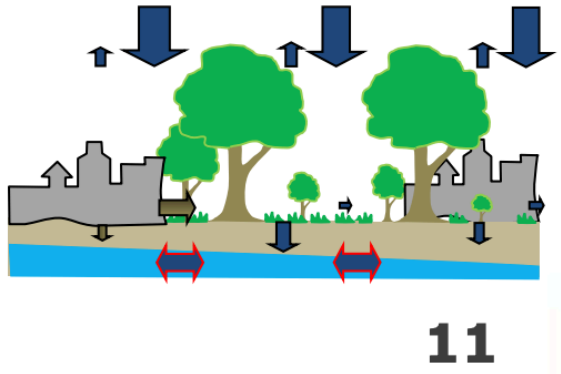
No project loaded.

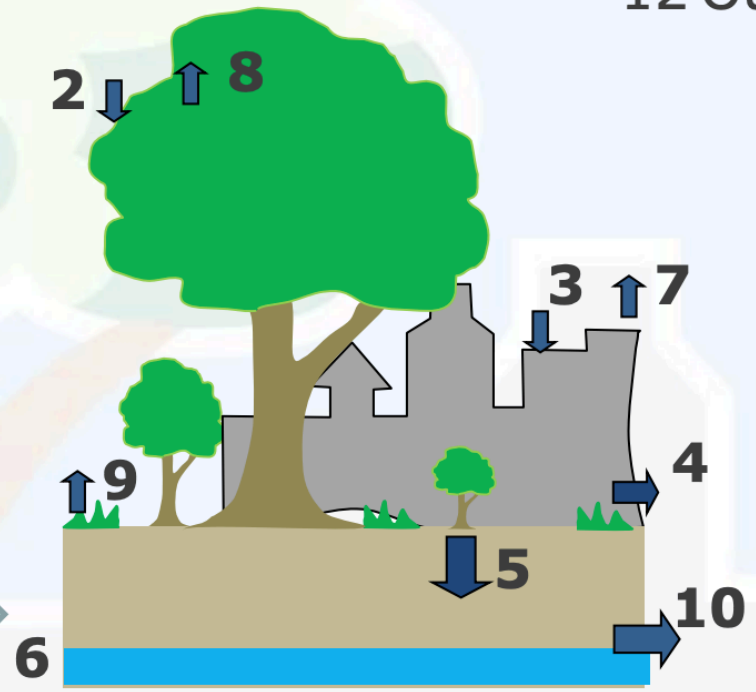
i-Tree Hydro

Hydro Conceptual Models

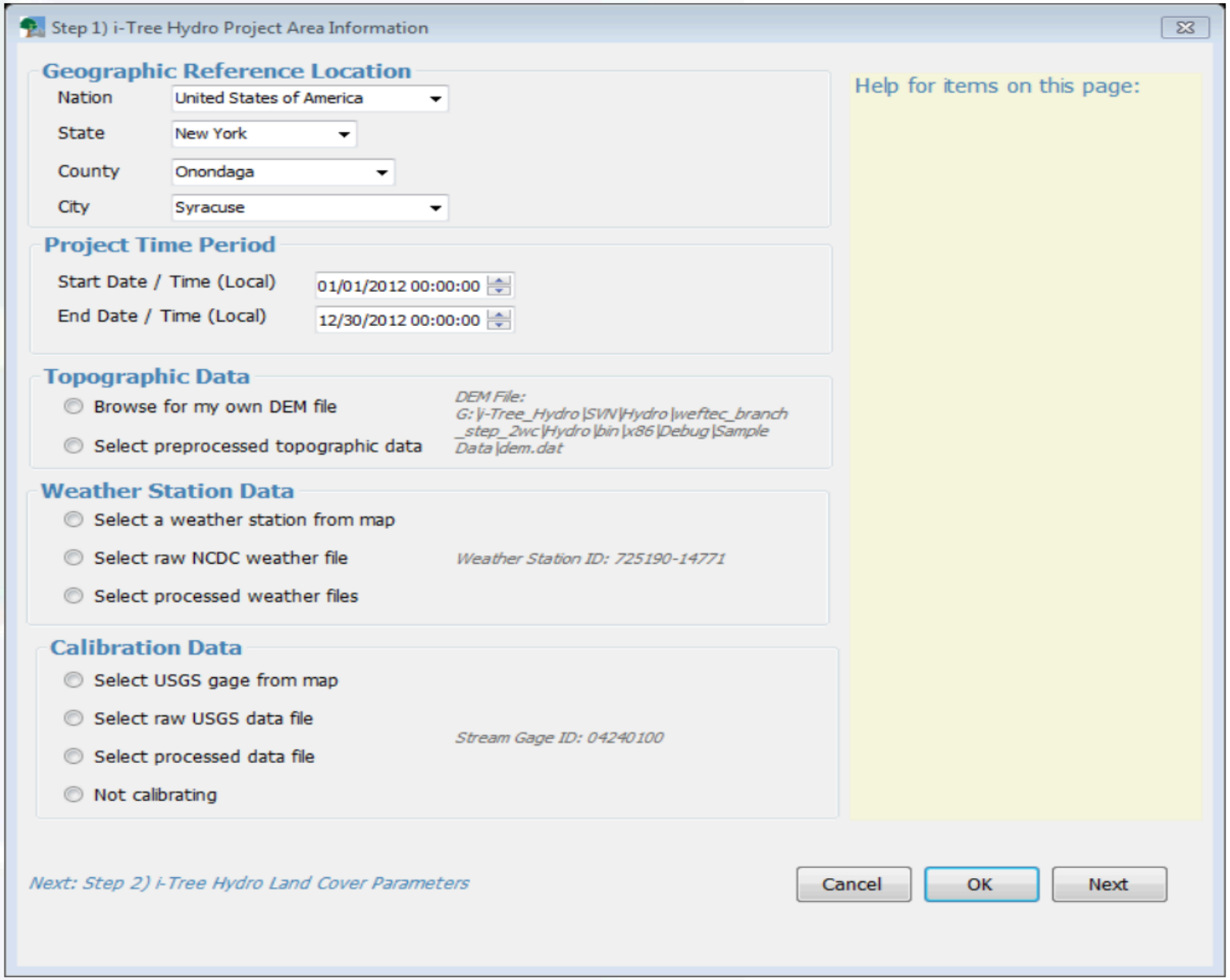
1 Inputs
2 Canopy Interception
3 Depression Storage
4 Surface Runoff
5 Infiltration
6 Soil Moisture
7 Surface Evaporation
8 Veg Evaporation
9 Evapotranspiration
10 Subsurface Runoff
11 Spatial Distribution
12 Outputs



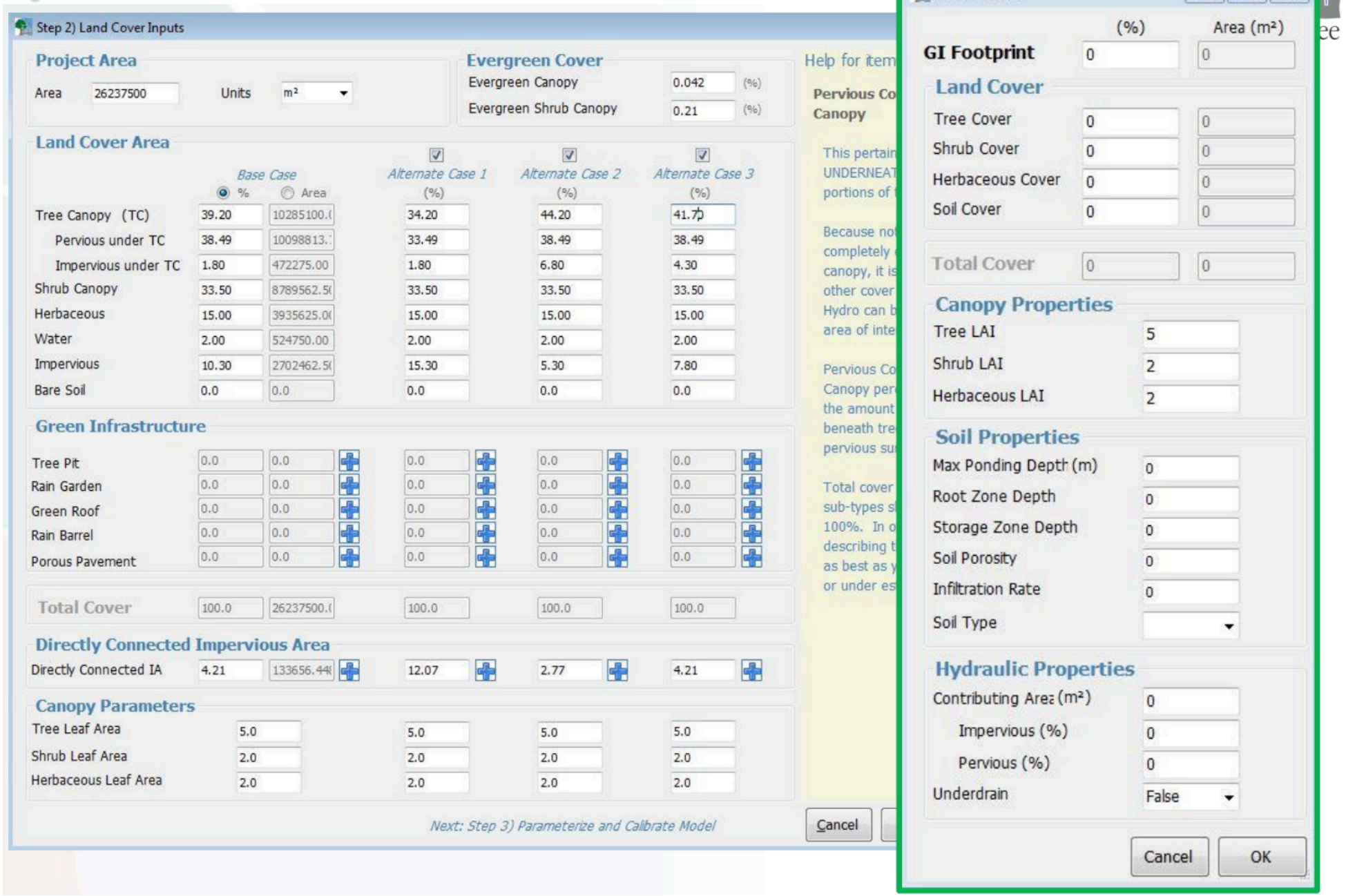




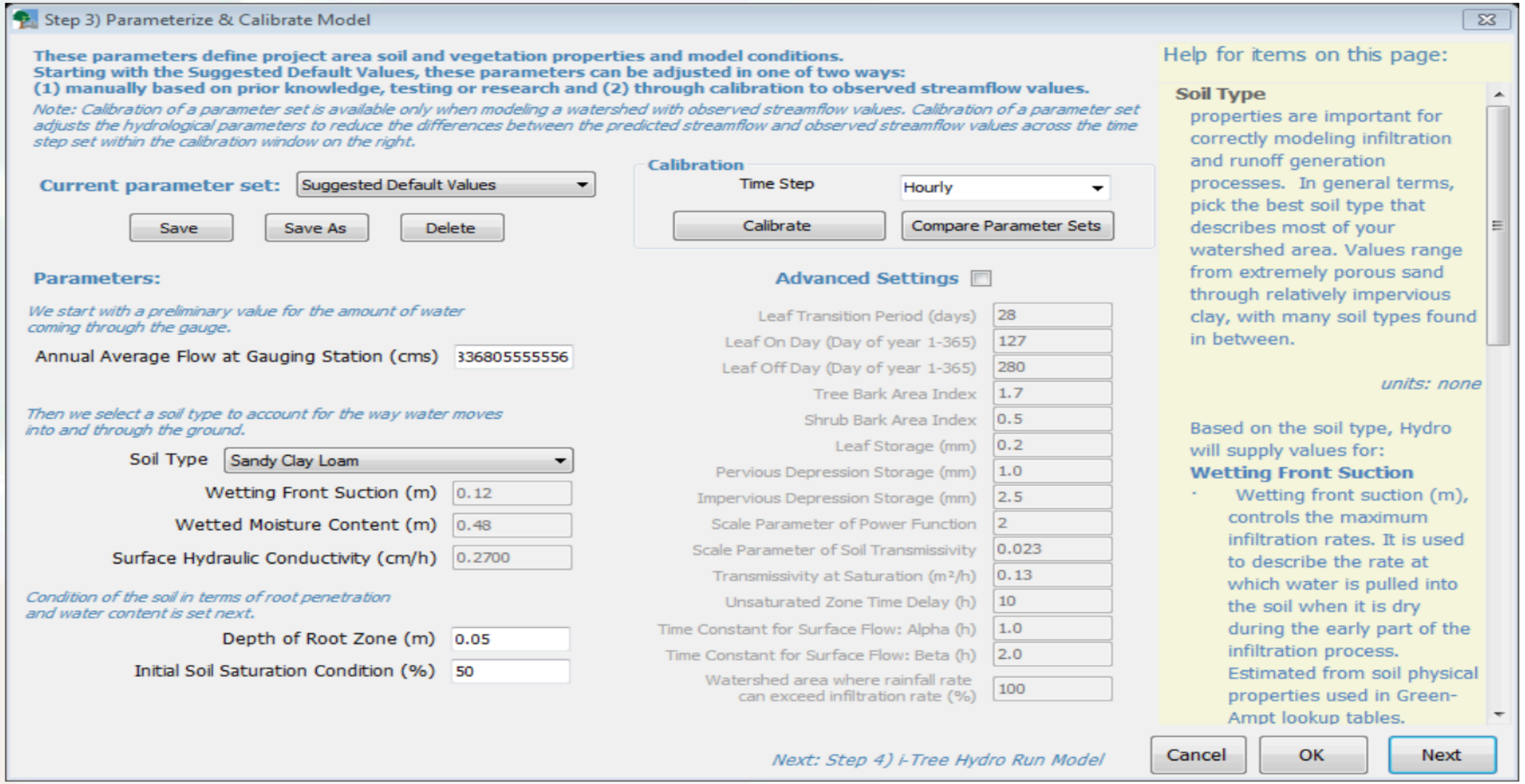
Hydro - Inputs



Hydro - Inputs



Hydro - Inputs



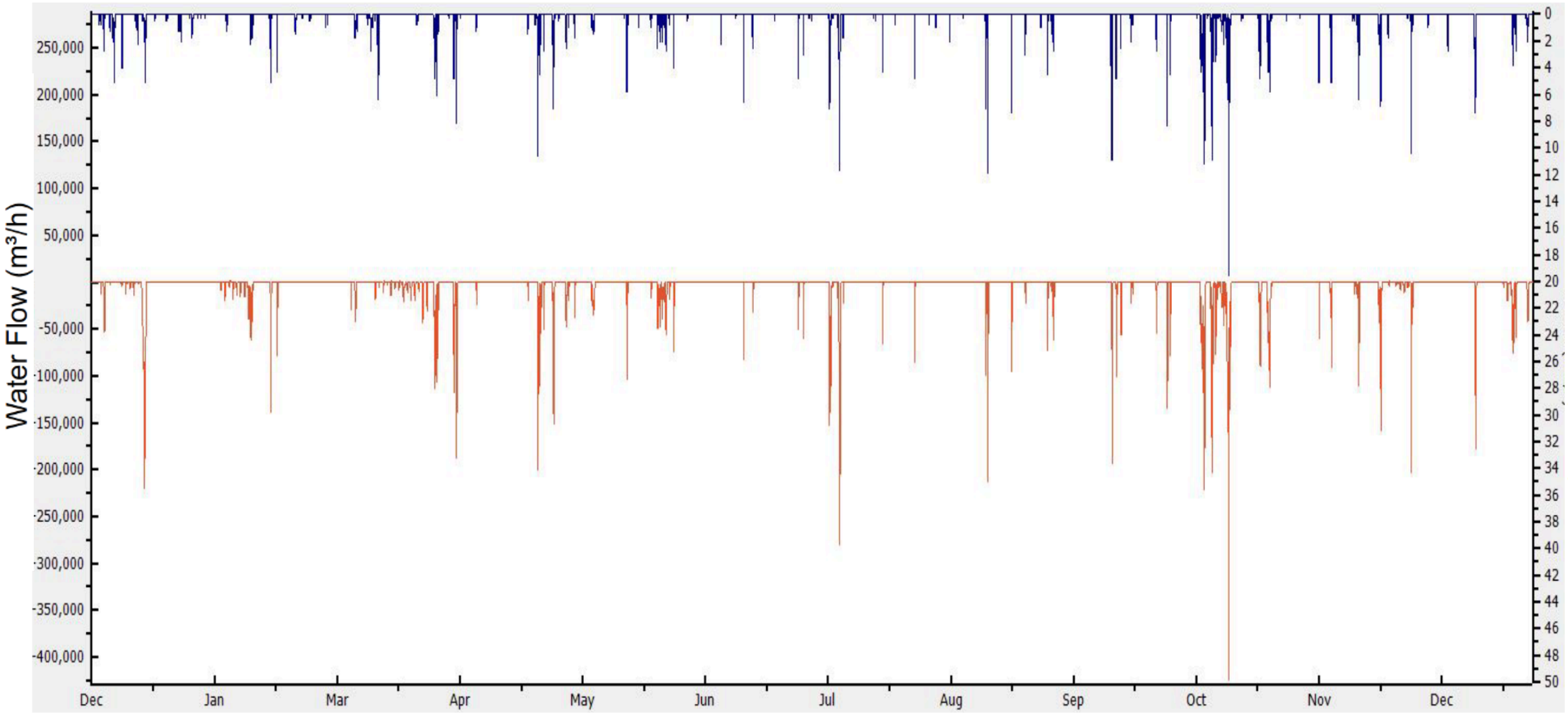


Figure 4: The graph above subtracts the flow rates modeled for 2010 from 2015 to show the net difference between the two years. The bottom line shows that difference in impervious surface flow, while the top line shows precipitation.

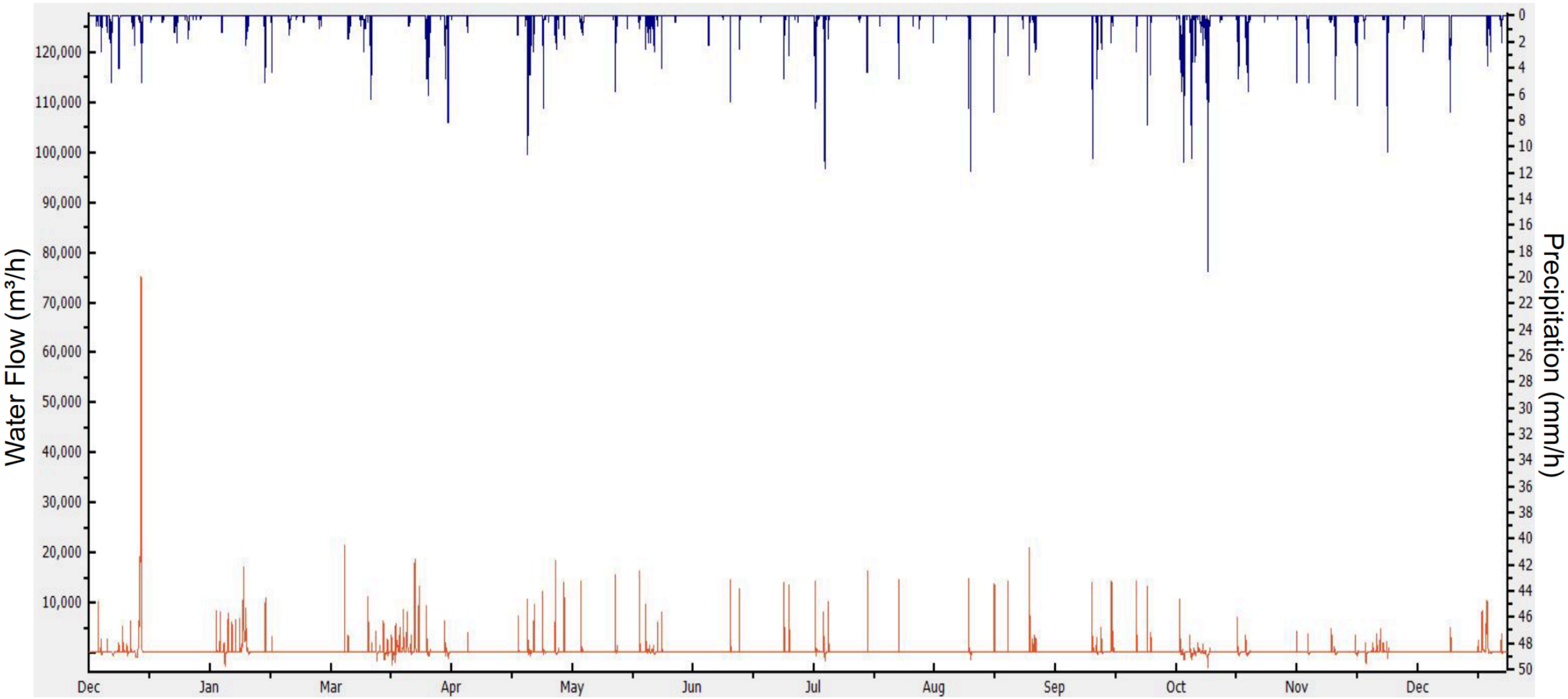
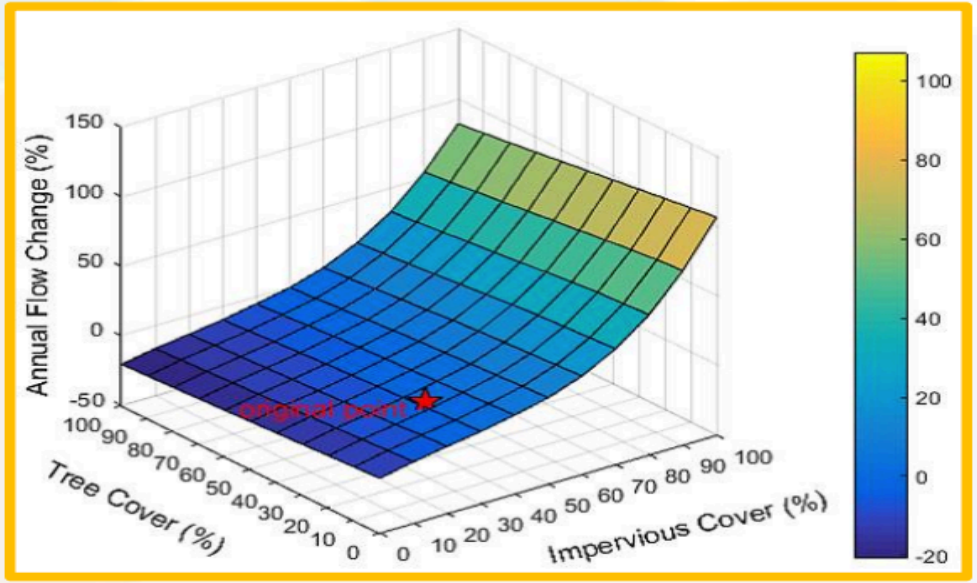
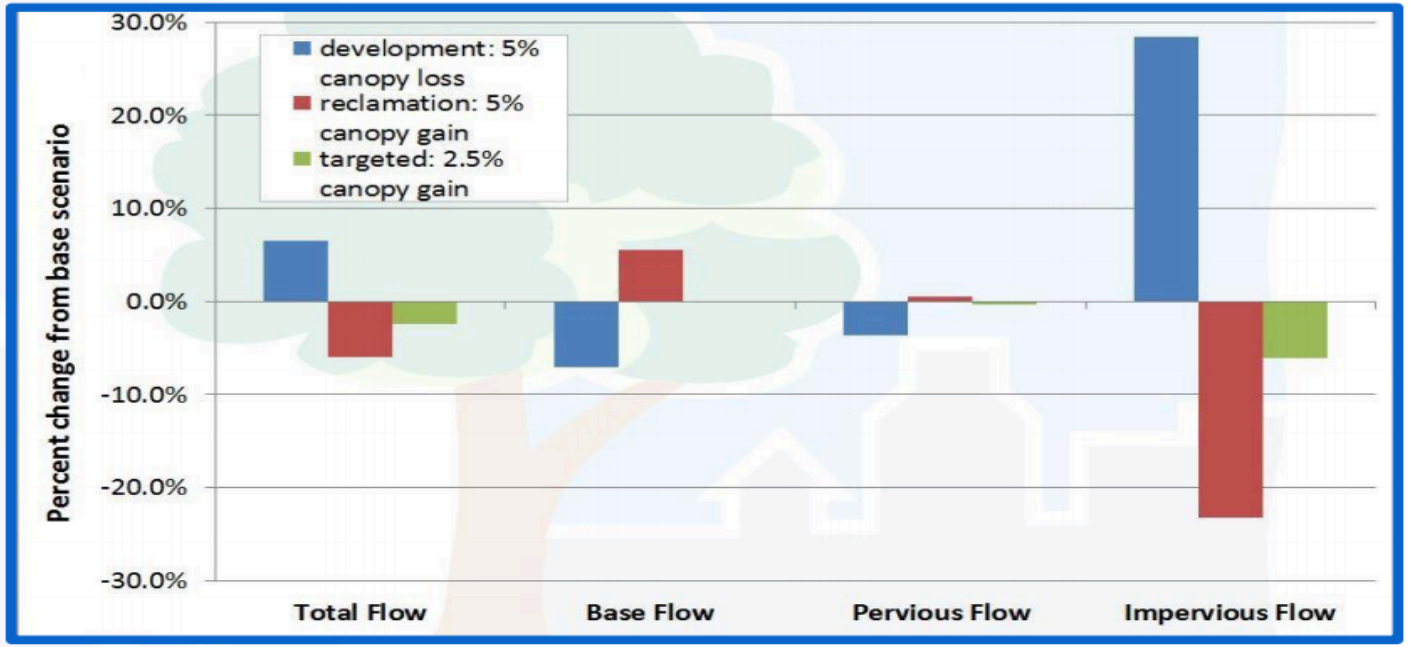


Figure 4: The graph above subtracts the flow rates modeled for 2008 from 2010 to show the net difference between the two years. The bottom line in each shows that difference in impervious surface flow, while the top line shows precipitation.

Exported Outputs & Examples of Additional Processing

Site condition	Total flow (m^3)	Base flow (m^3)	Pervious flow (m^3)	Impervious flow (m^3)
Current	12,322	5,063	4,700	2,559
Post-development	37,277	6,488	14,327	16,462
Increased Gallons	6.6 million	376 K	2.5 million	3.7 million
Percent Increase	303%	28%	305%	643%



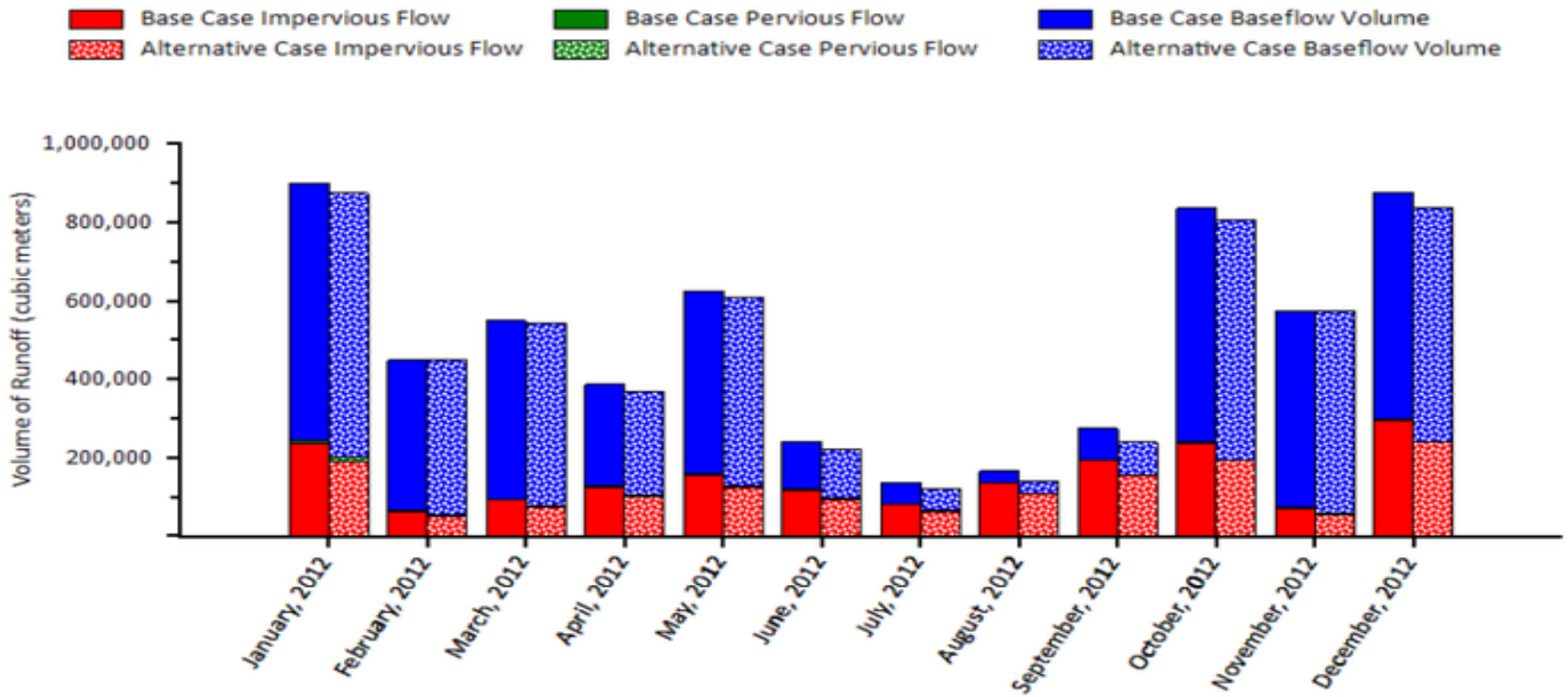


Exported Outputs & Examples of Additional Processing

i-Tree Hydro Executive Summary

Project Location: Syracuse, New York
Project Time Span: 01/01/2012 - 12/30/2012

Base Case vs. Alternative Case Predicted Streamflow Components



Note: Solid colors represent Base Case values while the hatched pattern indicates Alternative Case values

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

i-Tree Planting

Get Started

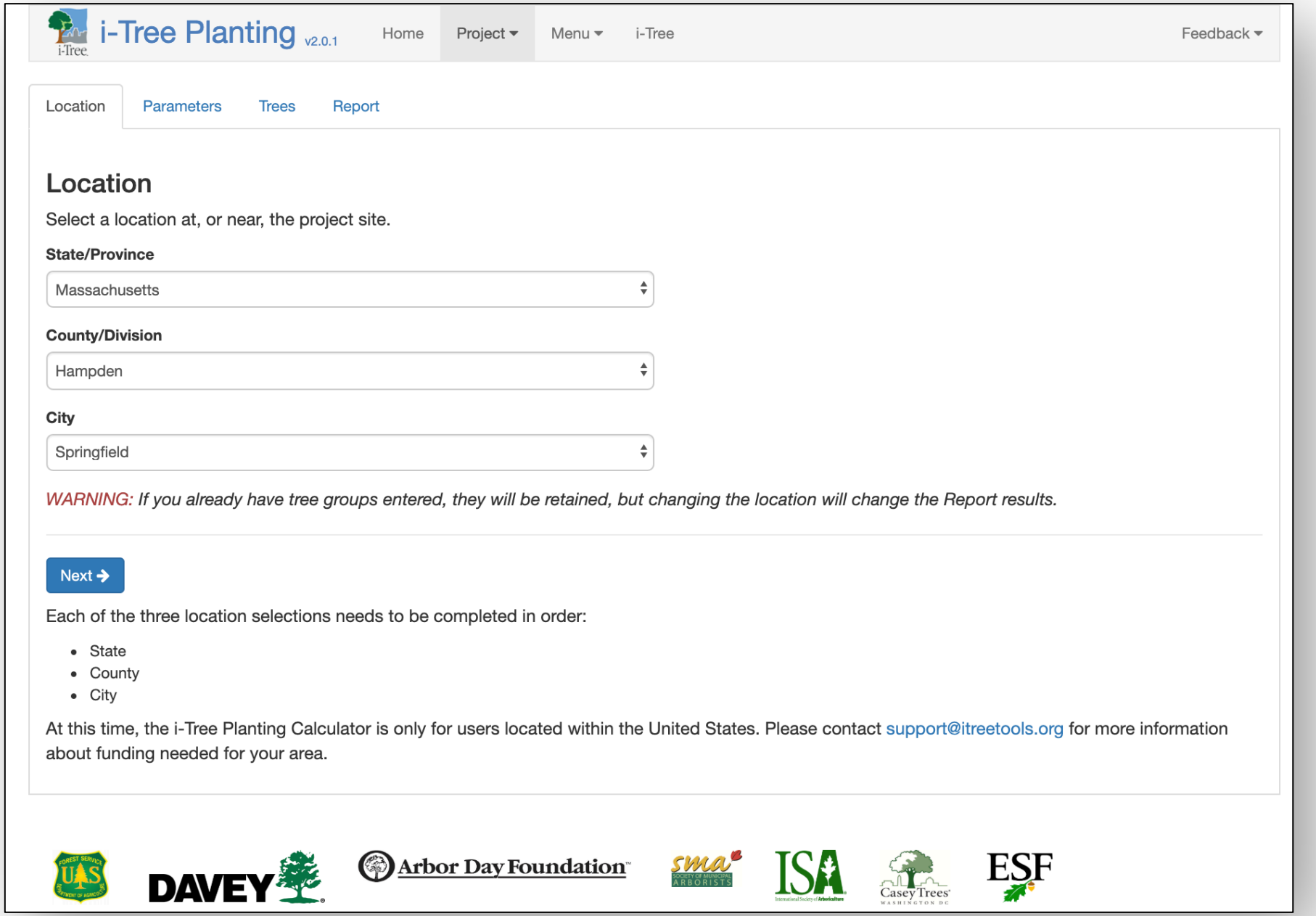
Use of this tool indicates acceptance of the EULA.

california urbanforests council

Urban Ecos

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION CAL FIRE SINCE 1885

A collaborative initiative with



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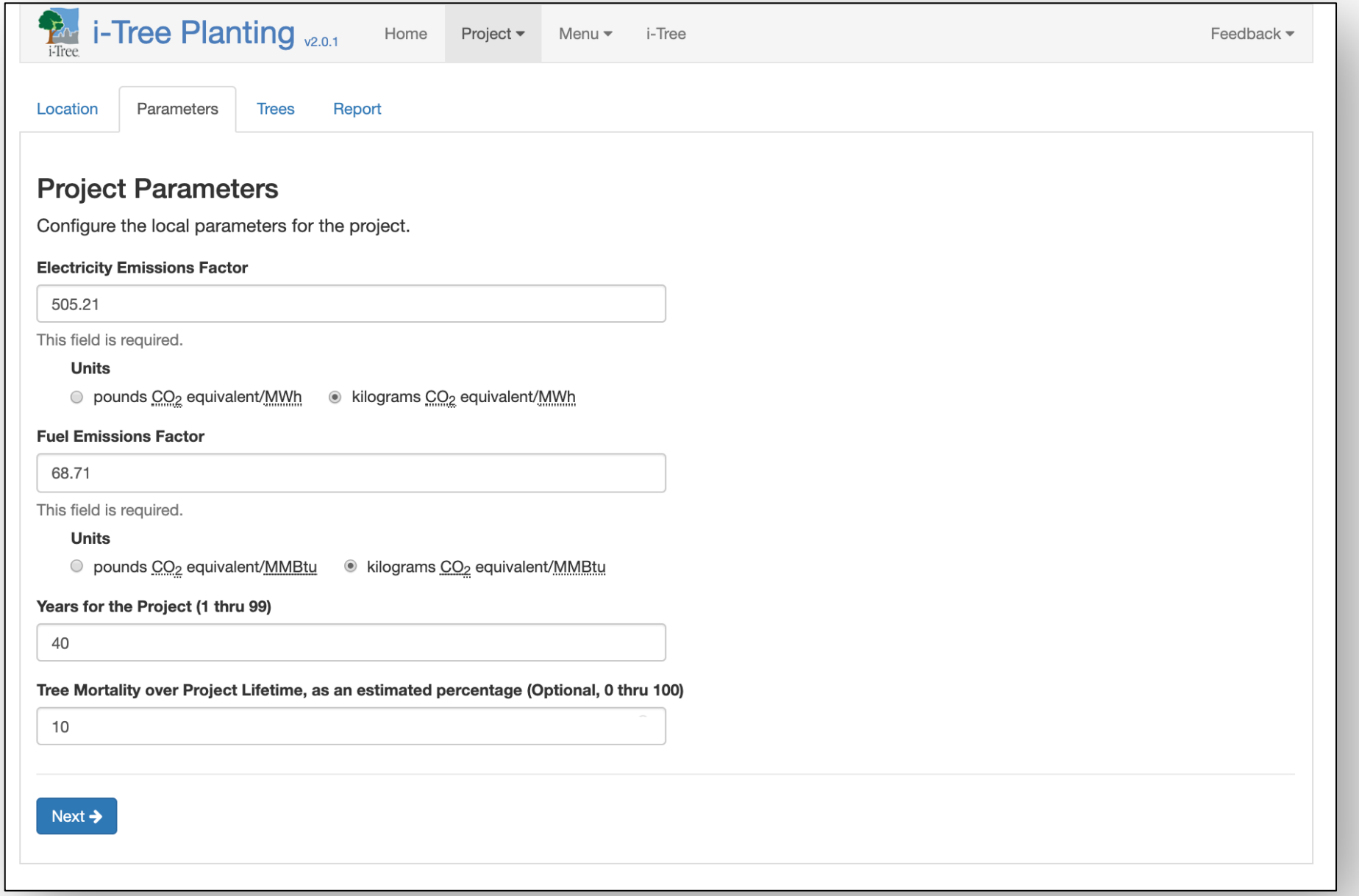

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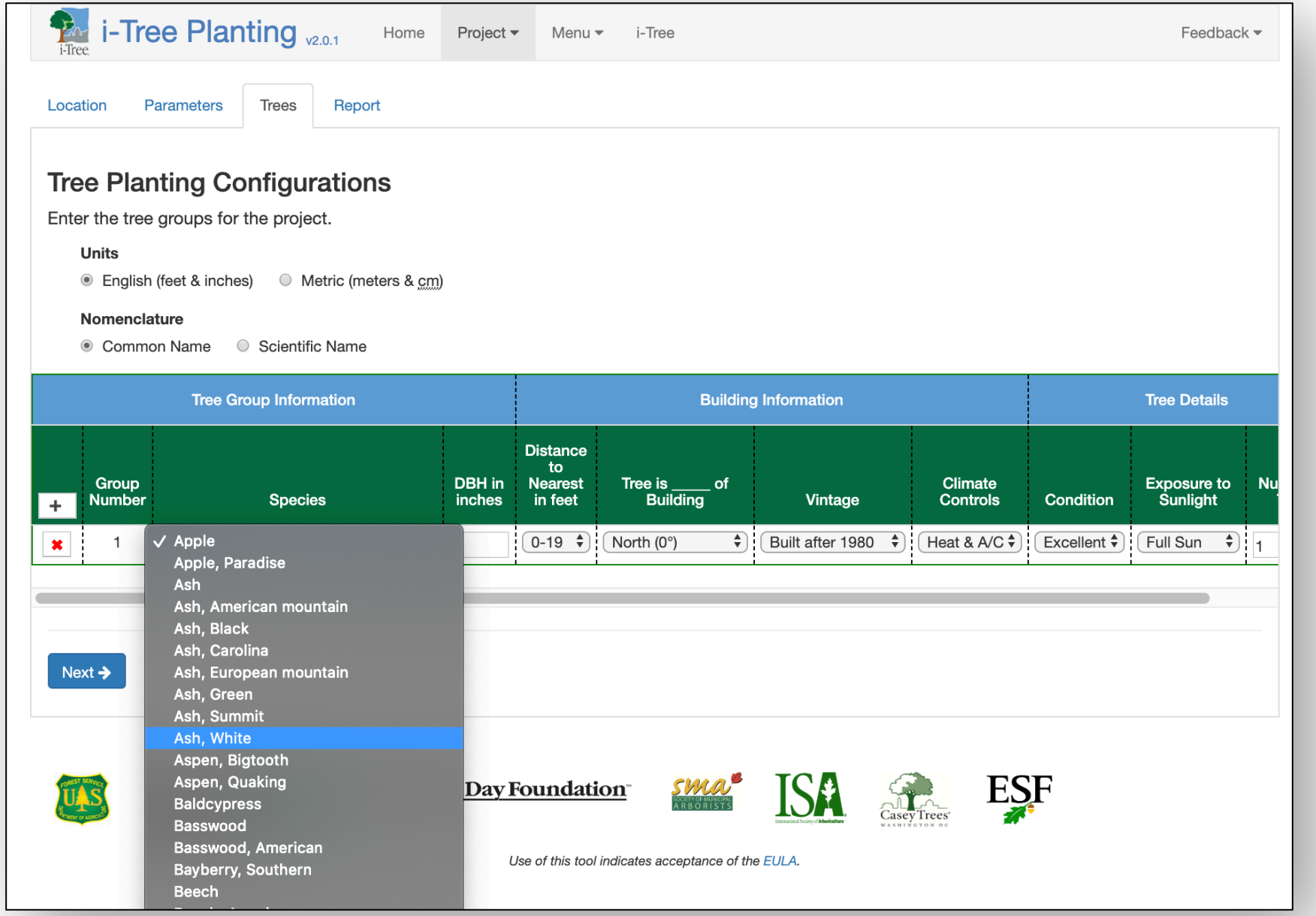

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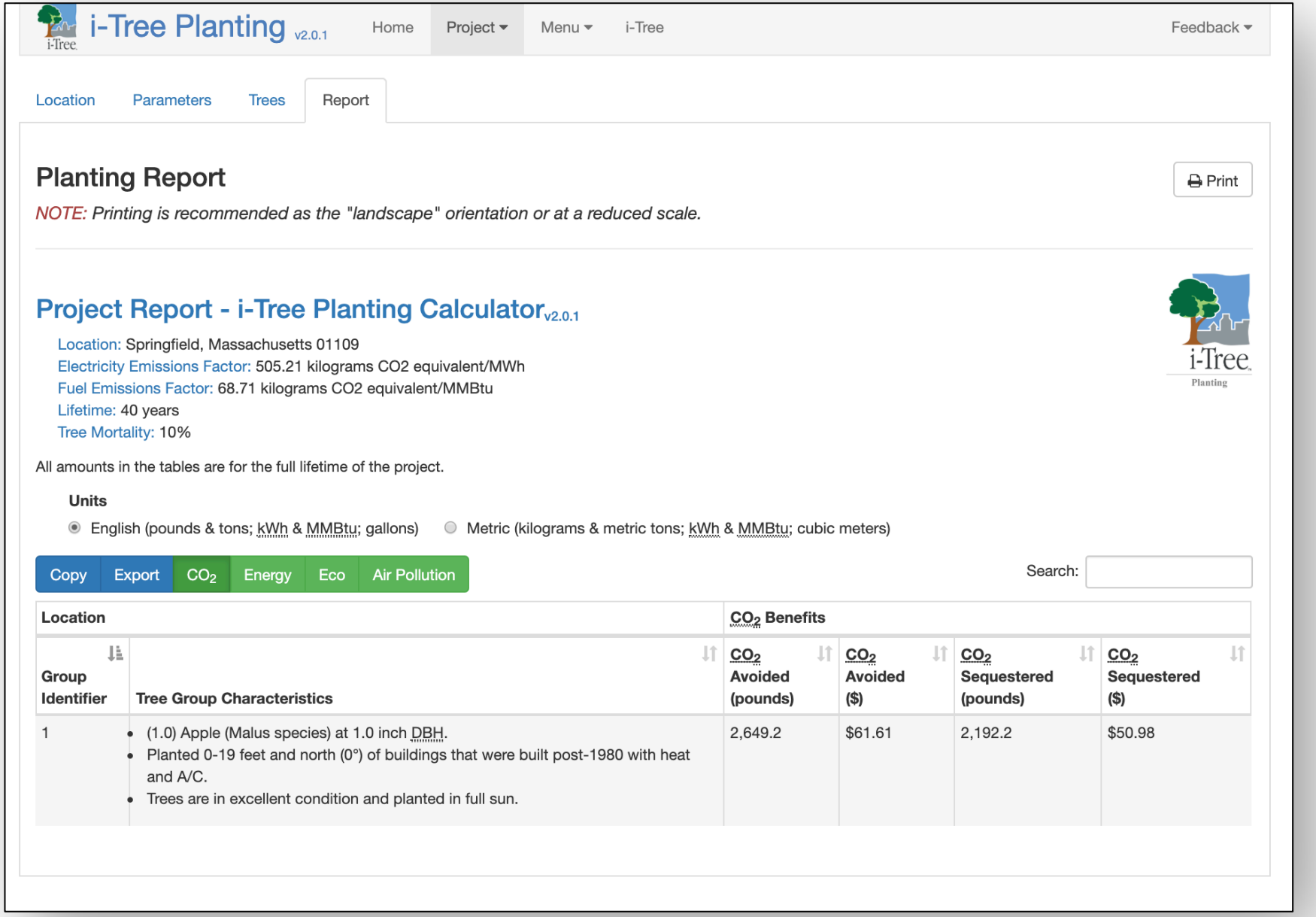
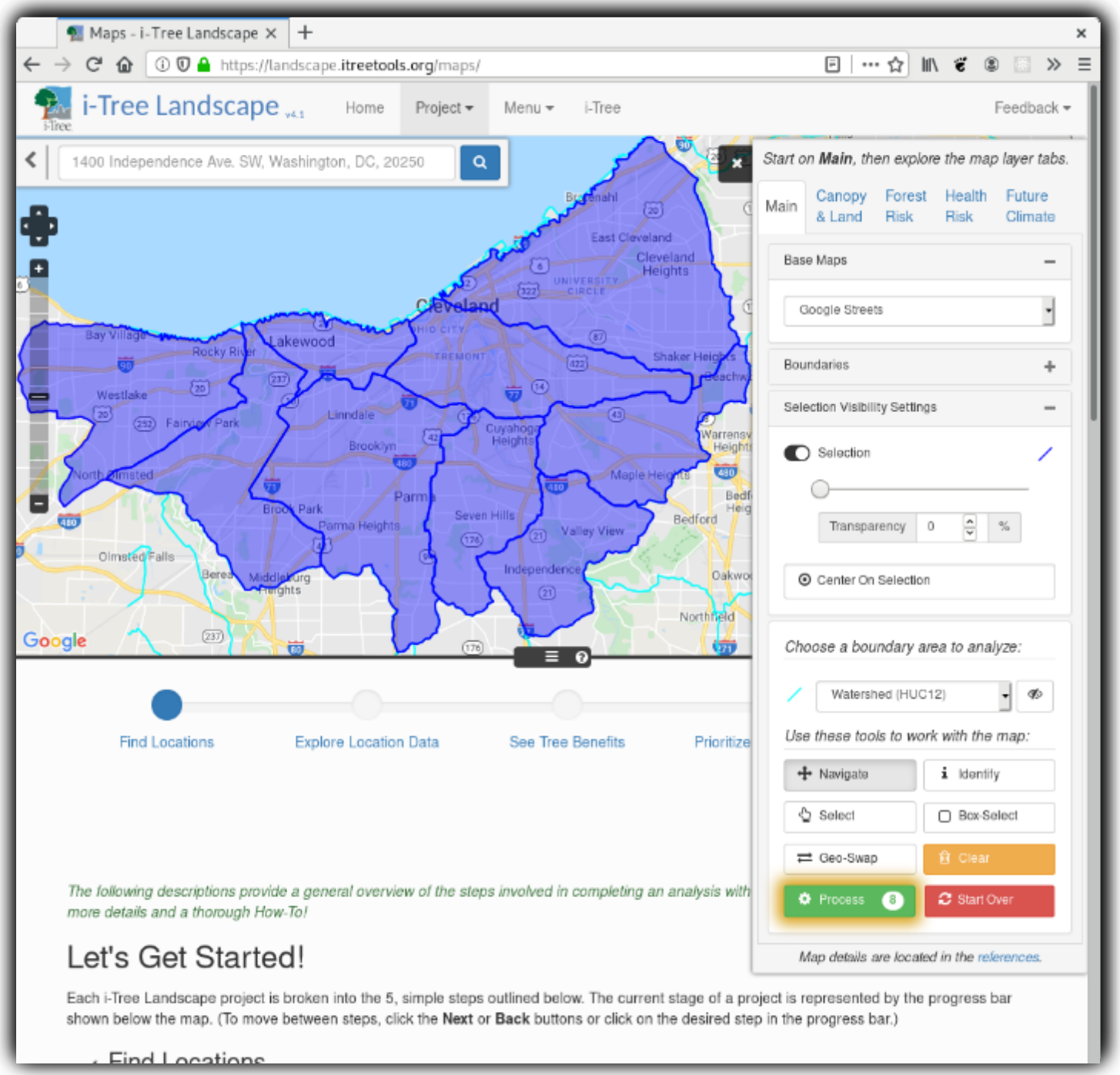


i-Tree Landscape

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



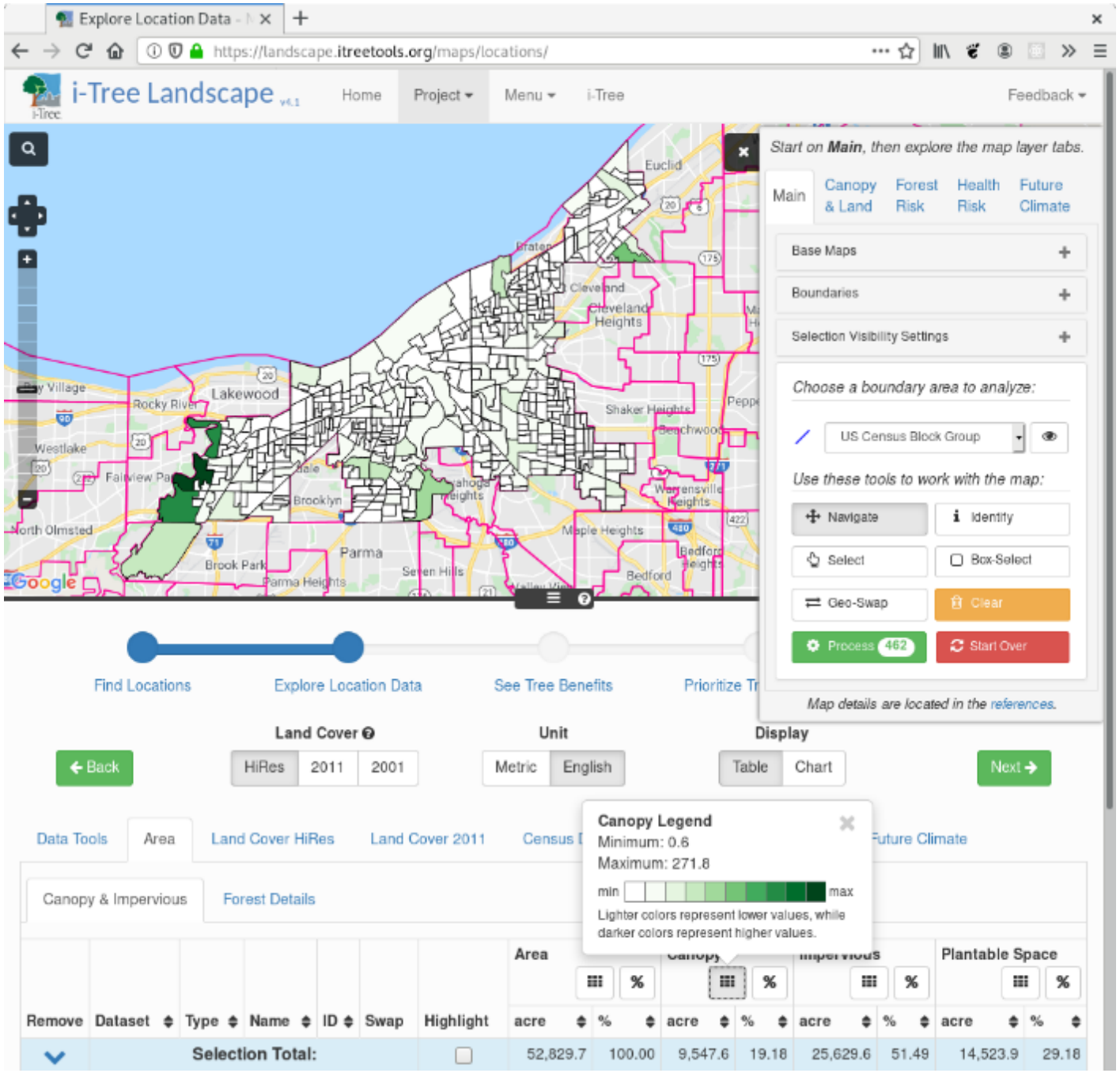
i-Tree Landscape

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

A good place to get 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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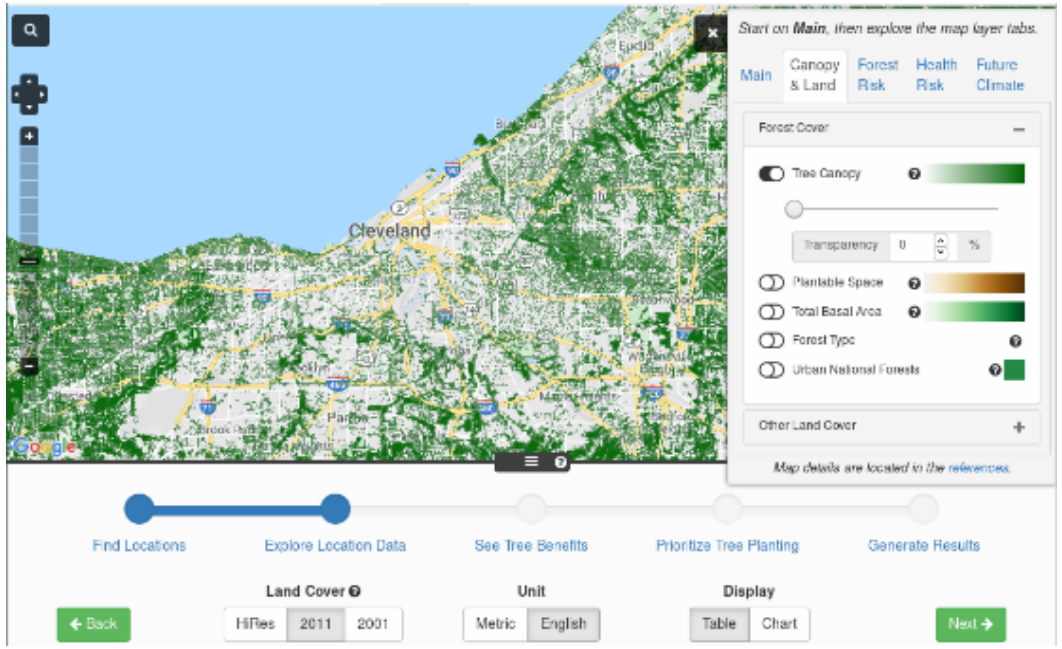

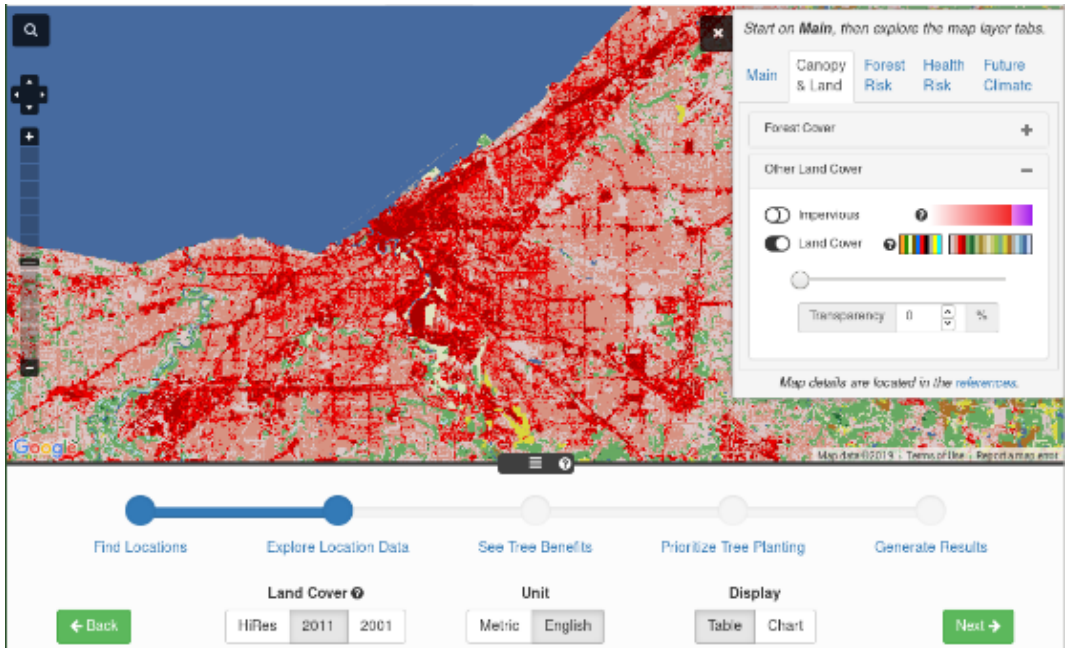

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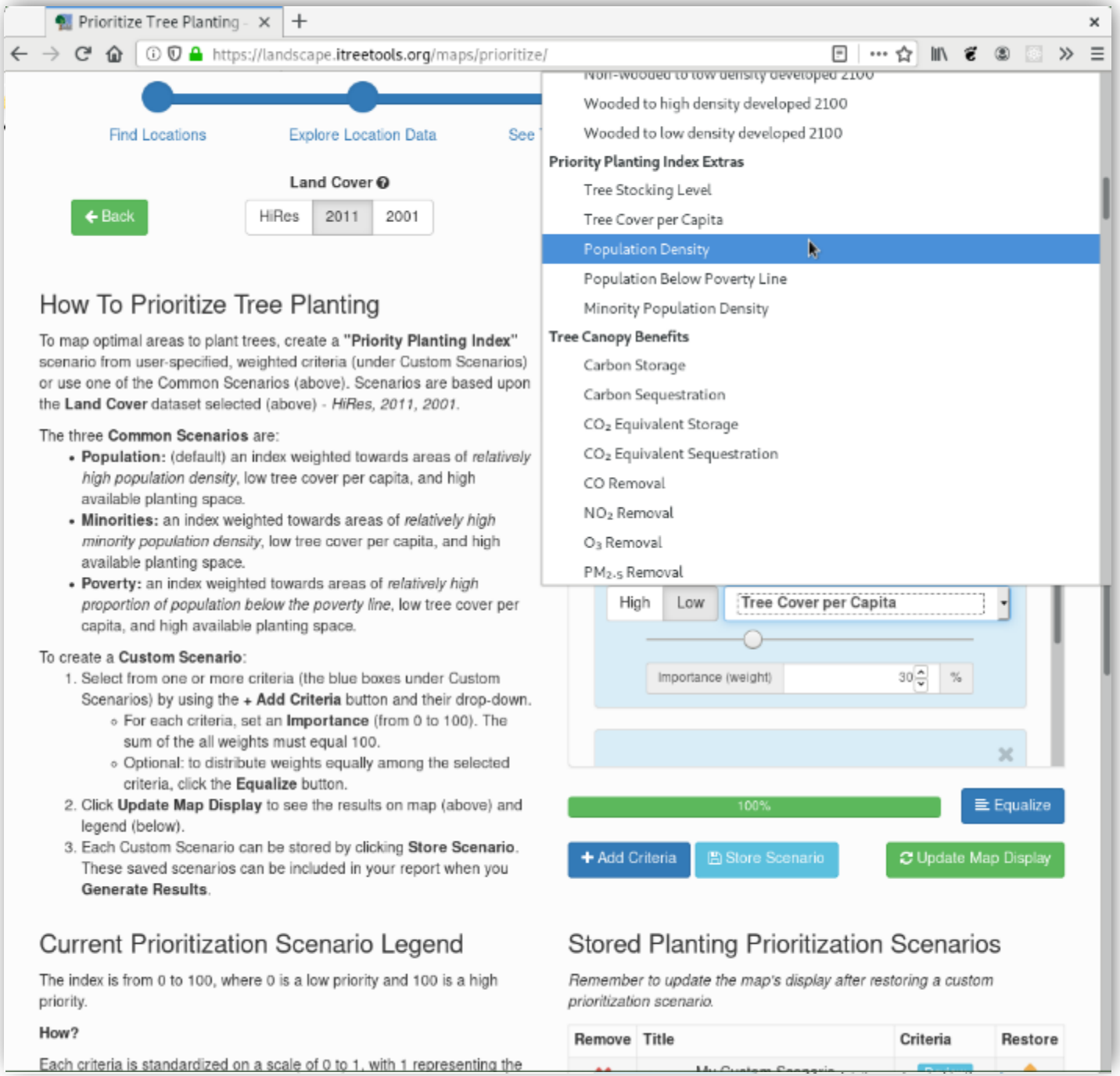


i-Tree Landscape

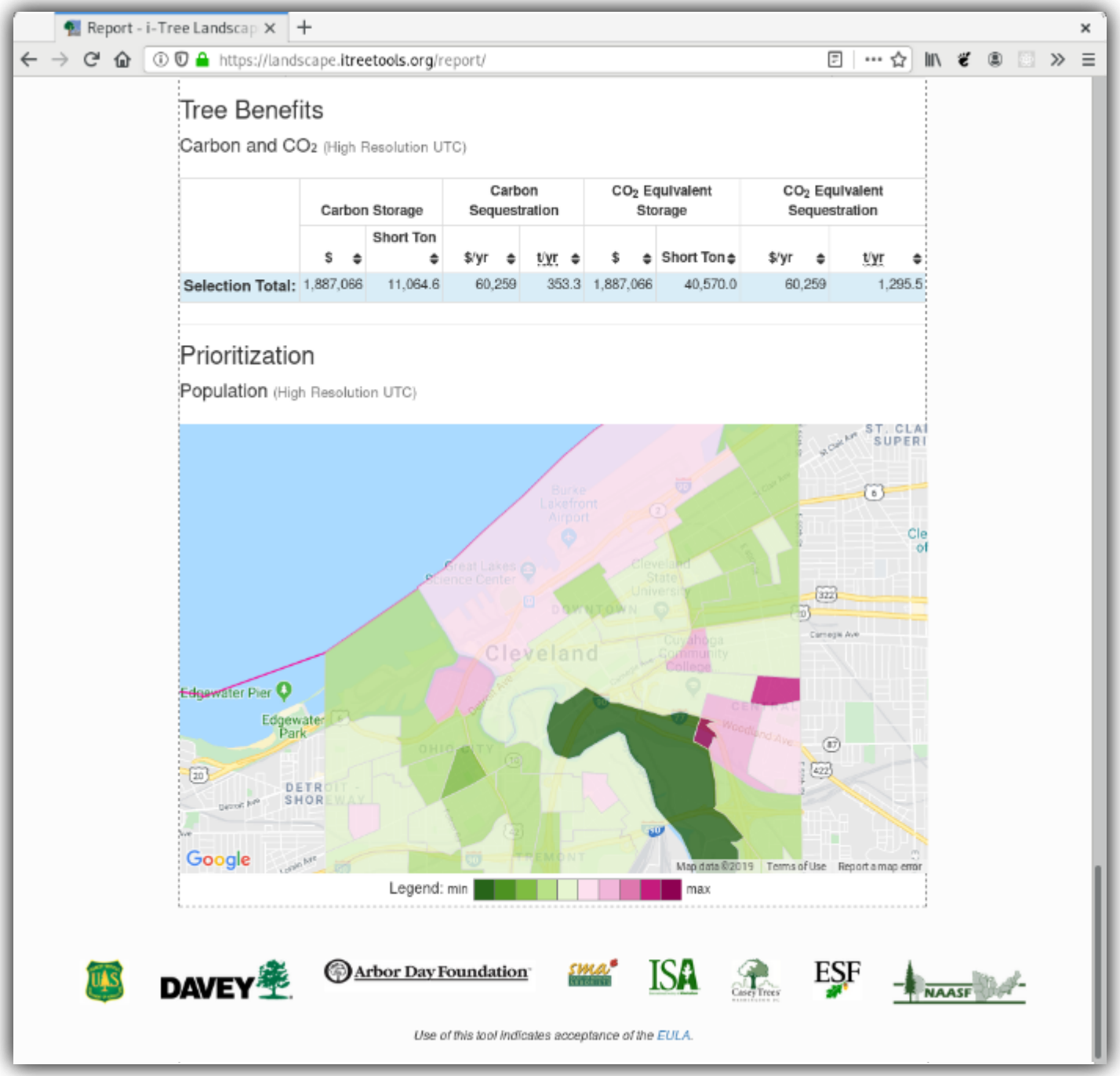
Gateway to tree benefits – available to anyone and everyone in the US.

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



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www.unri.org

i-Tree Website
www.itreetools.org