

i-Tree Open Academy

2025

Session 1: Introduction to i-Tree

Understanding the benefits of trees for people, places, and planning

May 7, 2025

1:00pm ET



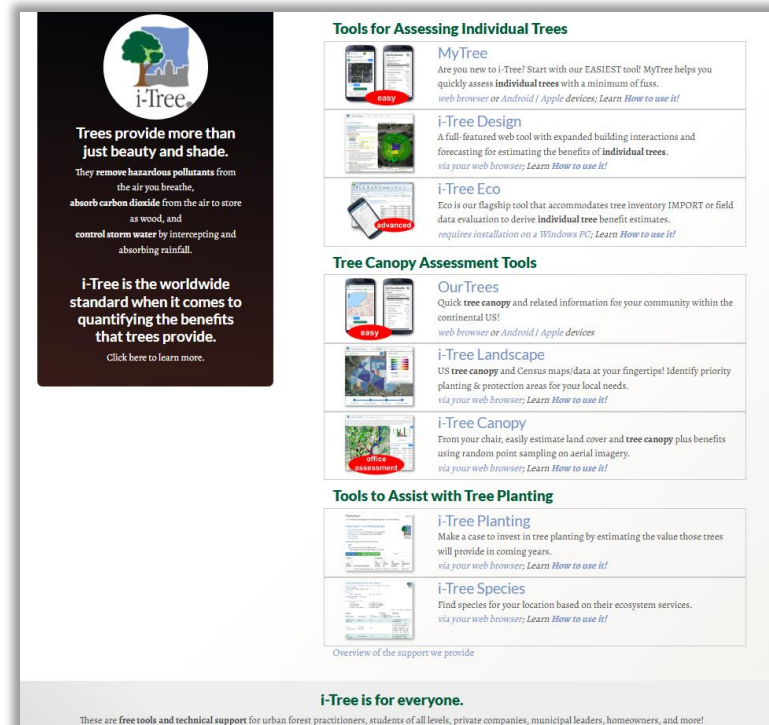
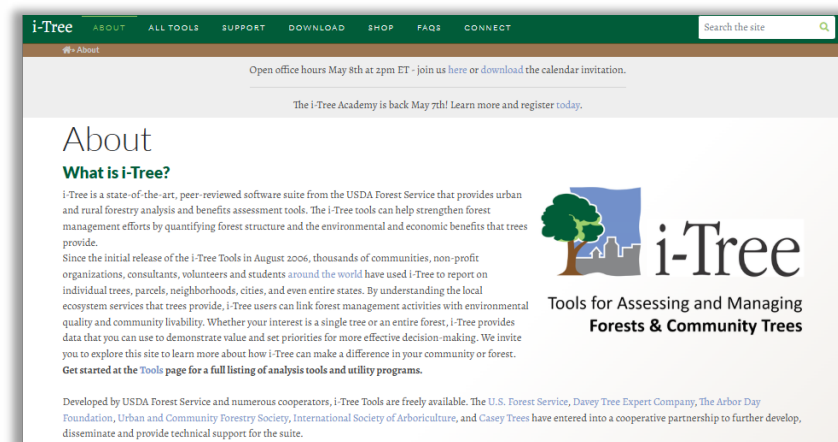
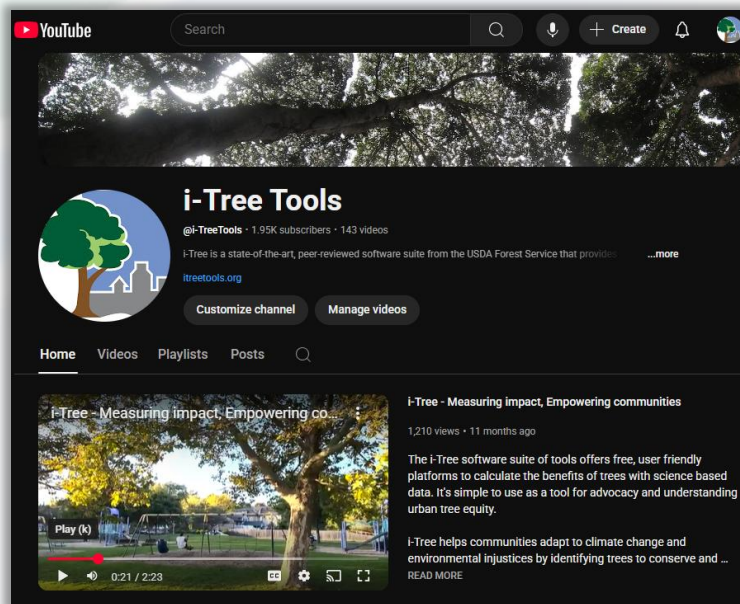
*i-Tree is a
Cooperative
Initiative
among these
partners*



Accessing the Science of Tree Benefits

Keeping up with your canopy

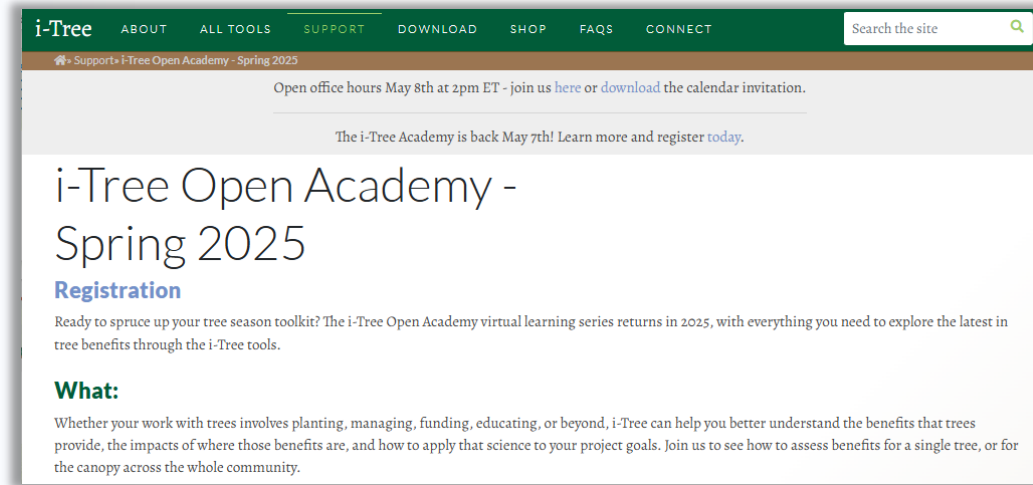
- 🌳 Learning series for wide variety of users
- 🌳 Easy to access live and via video
- 🌳 Use Chat window for questions
- 🌳 Q&A at the end with i-Tree Team and fellow i-Tree users
- 🌳 Certificates of participation available after Academy ends



Academy Resources

- Web page updated each week
- Exercises for each tool
- Office Hours
- Email us anytime

info@itreetools.org



The screenshot shows the i-Tree website header with navigation links: ABOUT, ALL TOOLS, SUPPORT, DOWNLOAD, SHOP, FAQs, CONNECT. A search bar is on the right. Below the header, there's a banner for "Support i-Tree Open Academy - Spring 2025" with text: "Open office hours May 8th at 2pm ET - join us [here](#) or [download](#) the calendar invitation." and "The i-Tree Academy is back May 7th! [Learn more](#) and register [today](#)." The main heading is "i-Tree Open Academy - Spring 2025". Under "Registration", it says: "Ready to spruce up your tree season toolkit? The i-Tree Open Academy virtual learning series returns in 2025, with everything you need to explore the latest in tree benefits through the i-Tree tools." Under "What:", it says: "Whether your work with trees involves planting, managing, funding, educating, or beyond, i-Tree can help you better understand the benefits that trees provide, the impacts of where those benefits are, and how to apply that science to your project goals. Join us to see how to assess benefits for a single tree, or for the canopy across the whole community."

How:

All sessions will be streamed live via this [Microsoft Teams link](#). They will also be recorded and posted below as well as on the [i-Tree YouTube channel](#), so that you can catch up on anything you missed. There are no requirements for this course, and there will be self-directed exercises that you can use to gain experience using the tools. You are encouraged to submit any questions related to the course via info@itreetools.org, and there will be opportunities to ask questions during certain live sessions and office hours.

When:

Each session is one hour long and offered Wednesdays at 1:00 pm (Eastern US time). Note: Office hours days and times may vary.

- **March 20th – Introduction to i-Tree.** Understand the basic science of i-Tree and the USFS research behind it. Explore the relationships between the i-Tree tools and the data they provide. Start to consider which i-Tree tools will be best for the application you have in mind.
 - Video Recording
 - Presenter Slides
 - Self-Directed Exercise - Session 1
 - Q&A
- **March 27th – Online with MyTree, i-Tree Design, and i-Tree Planting.** Explore the easiest to use online i-Tree tools for individual trees. Get a better sense of their advantages and most common uses.
 - Video Recording
 - Presenter Slides
 - Self-Directed Exercise - Session 2
 - Q&A

Spring 2025 – i-Tree Open Academy

Session 1: Introduction to i-Tree

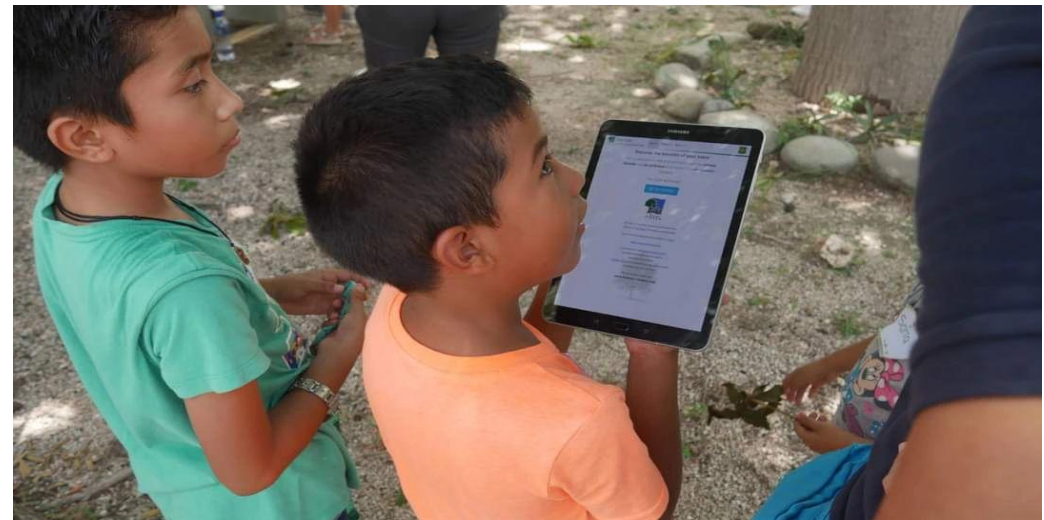
Understanding the benefits of trees for people, places, and planning



Jason Henning
Krista Heinlen
Ana Castillo
Jay Heppler
Alexis Ellis

Plan for today

1. What is i-Tree?
2. What results can I get from i-Tree?
3. Overview of the 2025 i-Tree tools
4. Introduction to the science of i-Tree
5. MyTree Demo and i-Tree uses



What is i-Tree?

“Putting USFS Urban Forest science into the hands of users”

- Public domain science
- Free tools and technical support
- Continuously improved

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



MyTree

Are you new to i-Tree? Start with our **EASIEST** tool! MyTree helps you quickly assess **individual trees** with a minimum of fuss. *web browser or Android / Apple devices; Learn [How to use it!](#)*



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; Learn [How to use it!](#)*



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; Learn [How to use it!](#)*

Tree canopy area assessment tools



OurTrees

Beta release: Quick **tree canopy** and related information for your community within the continental US! *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; Learn [How to use it!](#)*

www.itreetools.org



i-Tree is a Cooperative Initiative



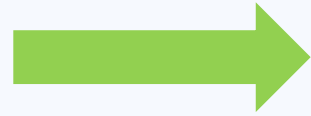
i-Tree's Vision

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



The i-Tree Framework: Demonstrating tree value

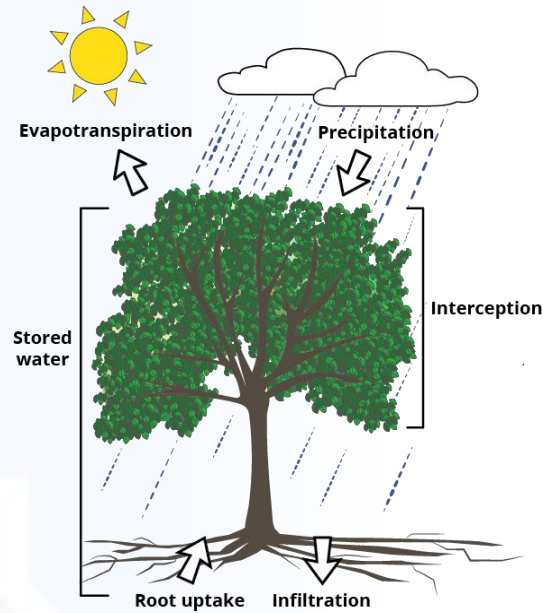
Structure



Function



Value



Total Annual Benefits = \$1,458,859,441

The benefits analysis measured and valued three specific ecosystem service functions of tree canopy: **air pollution removal**, **carbon sequestration** and **stormwater capture**.

EACH YEAR, WAKE COUNTY'S TREES:

- REMOVE 11,022 TONS OF POLLUTANTS FROM THE AIR**
- ABSORB 414,710 TONS OF CARBON DIOXIDE**
- INTERCEPT 8.1 BILLION GALLONS OF STORMWATER**

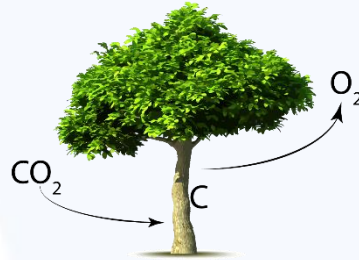
- Created 166,950 square feet of tree cover
- Released 14,838,972 gallons of water into the atmosphere
- Removed 831,933 pounds of carbon from the atmosphere

- Stopped 1,908,937 gallons of runoff
- Saving \$17,058.40 in runoff costs
- Saved \$11,794 in electricity costs

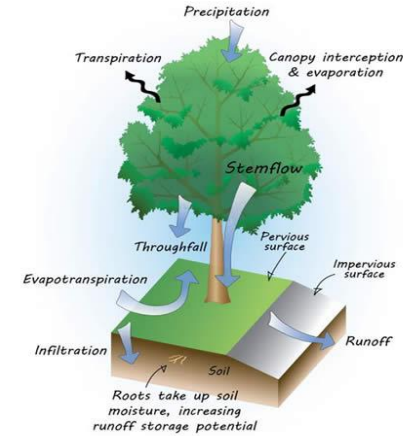
Baltimore Tree Trust

What does i-Tree Estimate and Why?

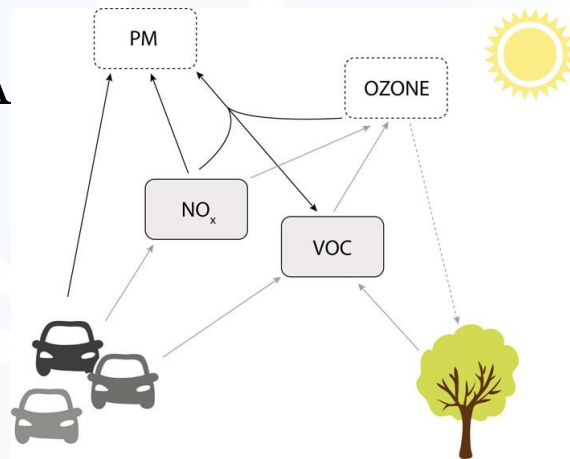
Carbon dioxide
Storage and sequestration of a greenhouse gas



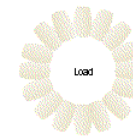
Stormwater
Avoided runoff, evaporation, transpiration



Air Quality
Interaction with EPA criterion pollutants resulting in improved health



Energy
Tree impacts on heating and cooling



The 2025 i-Tree Suite of Tools



Core individual tree tools



Utilities



Core canopy tools



...

* i-Tree Tools that can be used internationally

The science of i-Tree: Measurements to Benefits to Value



[Project: Grand Rapids] [Series: Grand Rapids] [Year: 2011] - i-Tree Eco v6.0.38

File Project Configuration Data View Reports Forecast Support

Submit to Mobile Retrieve from Mobile Paper Form Import Plots Reference Objects Ground Covers Land Uses Trees Shrubs Check Data Benefit Annual Prices Costs DBH Crown Health CSV KML Editing Mode: Off

Data Collection Inventory Data Inventory Value Report Classes Export

Data > Inventory Data > Plots

ID	Stratum	Address	Latitude (Y)	Longitude (X)	Date	Crew	Contact Info	Size (ac)	Photo
1	Government	1	42.9495608982	-85.7132110349	10/5/2011	Team 1		0.10	
2	Industrial	2	42.9434692842	-85.7080333908	10/4/2011	Team 1		0.10	
3	Residential	3	42.9701815381	-85.7454599609	10/6/2011	Team 2		0.10	
4	Government	4	42.9704362762	-85.6956109599	9/19/2011	Team 2		0.10	
5	Residential	5	43.0022338948	-85.6582107395	9/28/2011	Team 1		0.10	
6	Residential	6	42.9109116244	-85.6323807354	9/22/2011	Team 2		0.10	
7	Other	7	42.977424345	-85.6288578532	9/26/2011	Team 2		0.10	
8	Residential	8	42.9826129702	-85.7272888983	9/16/2011	Team 2		0.10	

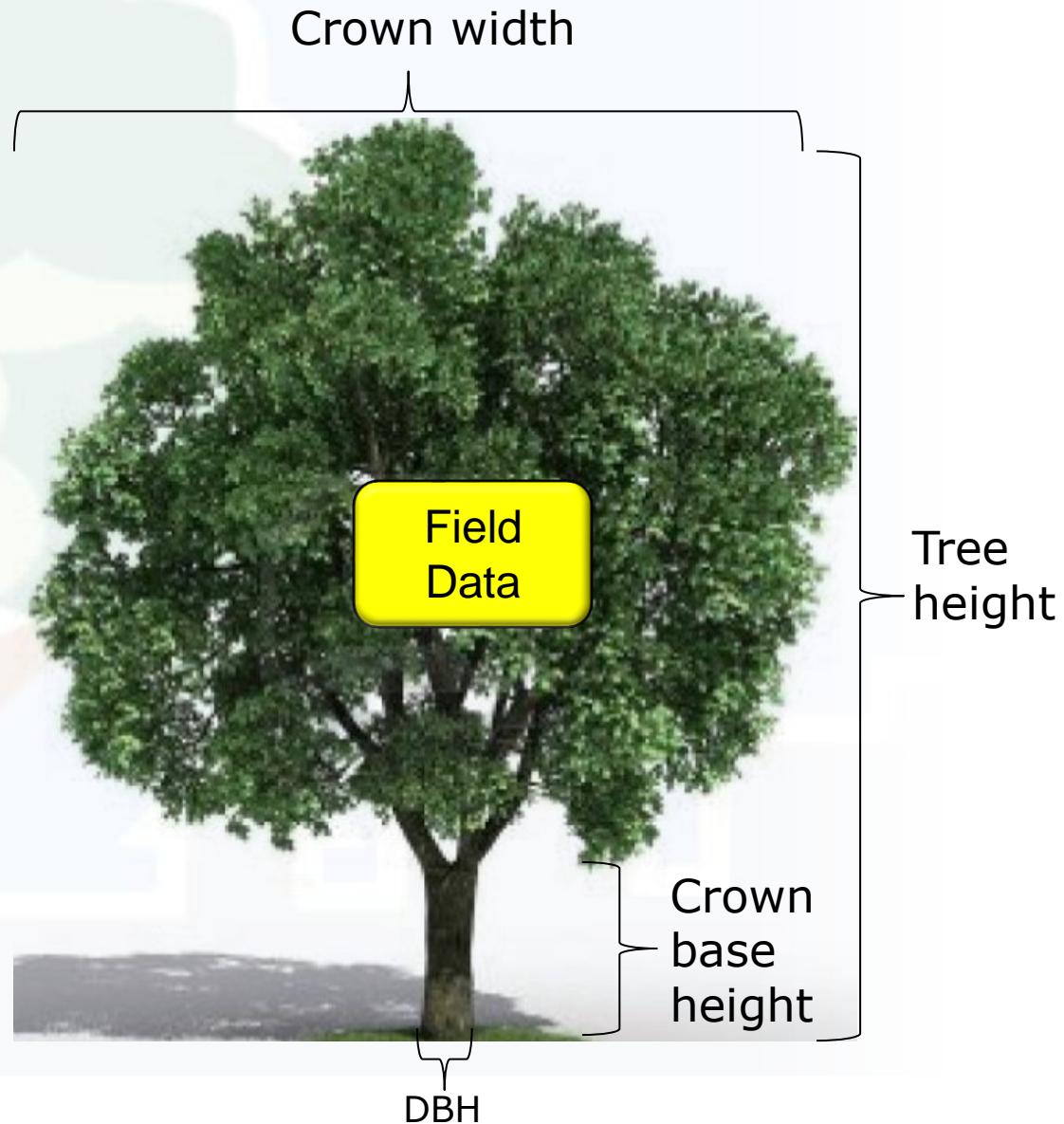
Trees

ID	Survey Date	Status	Distance (ft)	Direction	Species	Land Use	DBH 1 (in)
1	10/5/2011	Ingrowth	22.70	11	Northern hackberry (<i>Celtis occidentalis</i>)	Commercial/Industrial	
2	10/5/2011	Ingrowth	36.00	21	Black locust (<i>Robinia pseudoacacia</i>)	Commercial/Industrial	
3	10/5/2011	Ingrowth	14.00	34	Boxelder (<i>Acer negundo</i>)	Commercial/Industrial	
4	10/5/2011	Ingrowth	25.00	35	Black locust (<i>Robinia pseudoacacia</i>)	Commercial/Industrial	
5	10/5/2011	Ingrowth	30.00	35	Boxelder (<i>Acer negundo</i>)	Commercial/Industrial	

Reference Objects Ground Covers Land Uses Trees Shrubs



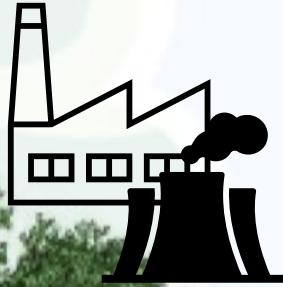
i-Tree Eco model basics: Start with your tree data



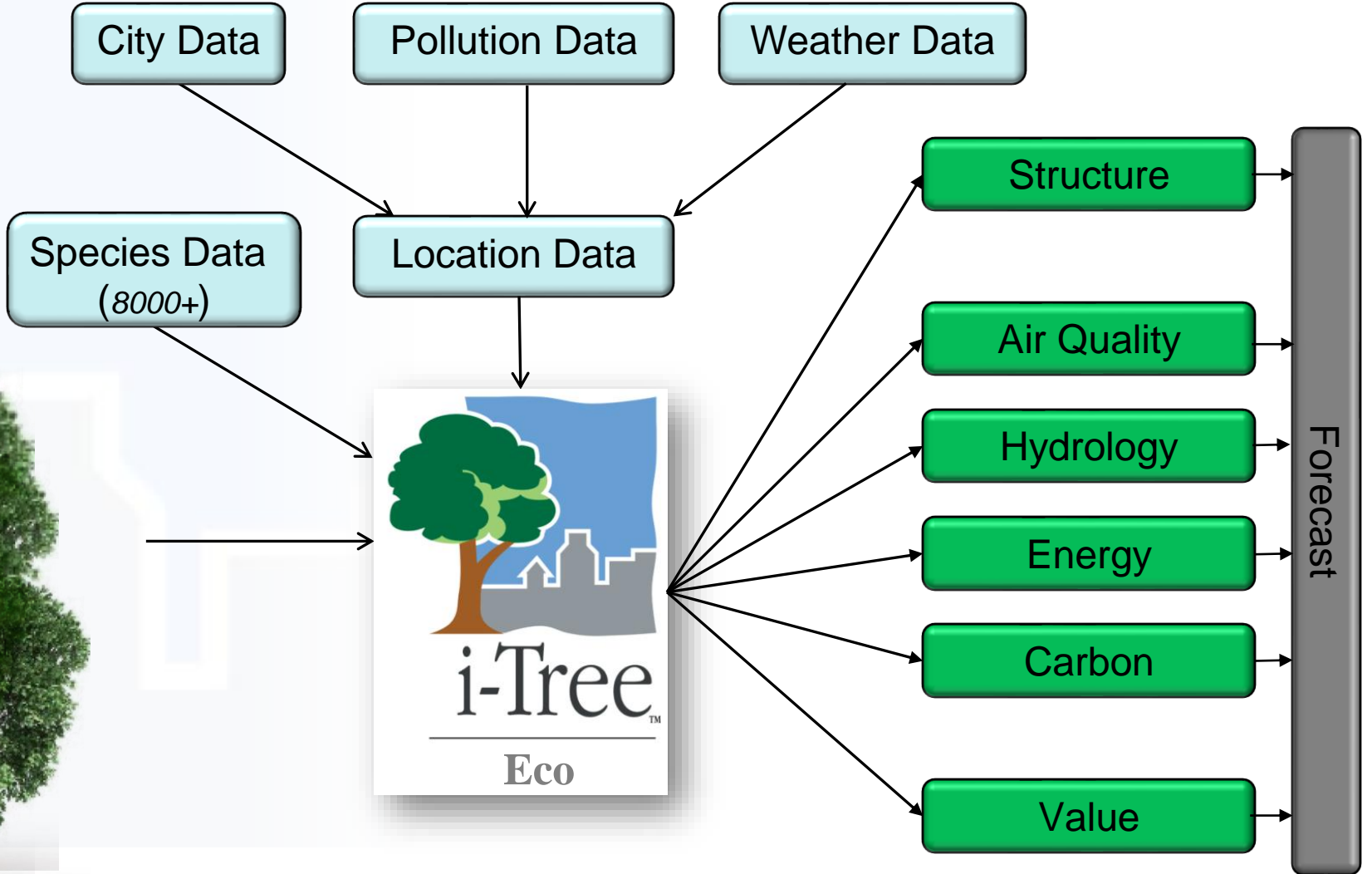
Key field variables

- **DBH**
- **Species**
- Crown measurements
- Tree health
- Building interactions
- Light availability

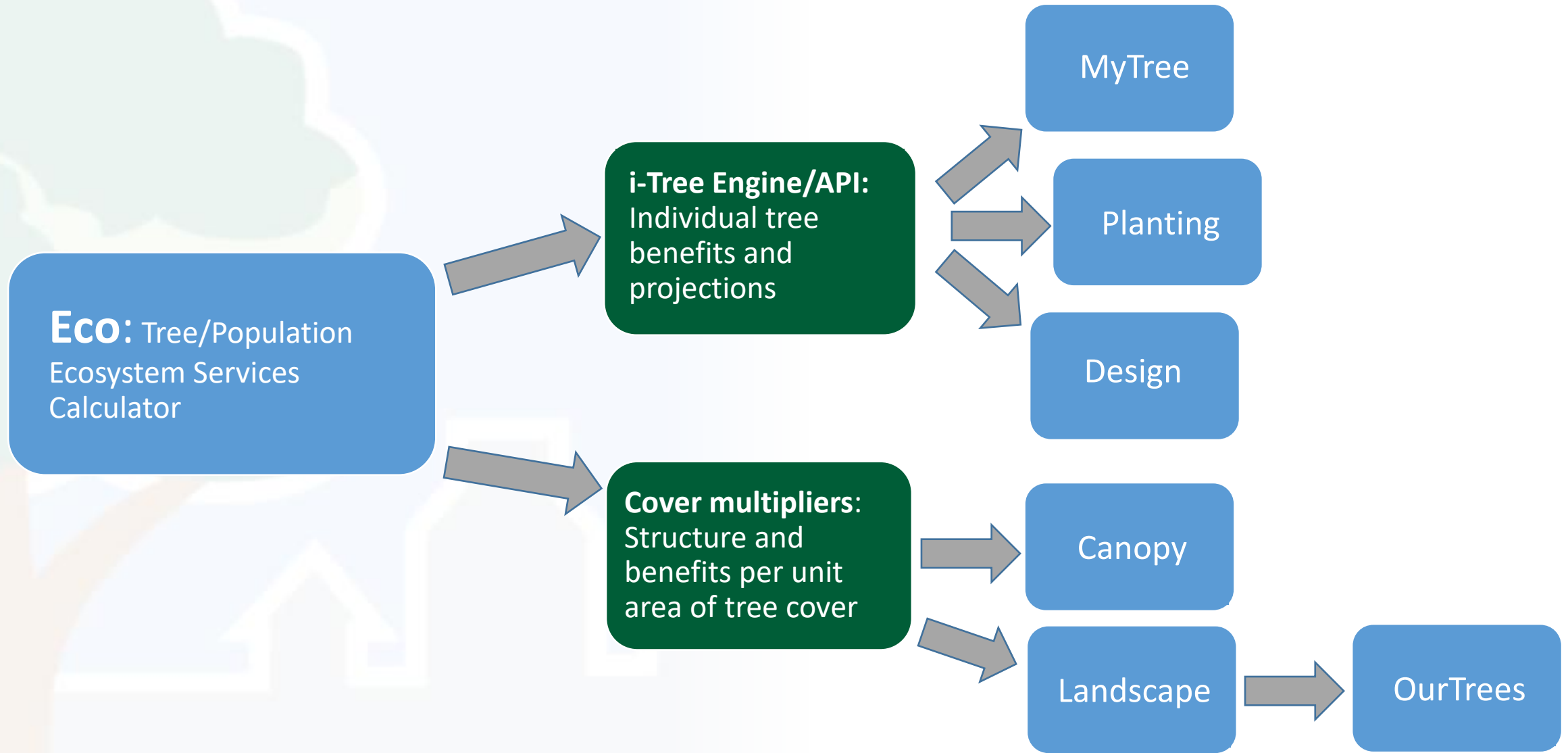
i-Tree model basics: Inventory data → tree benefits



Field Data

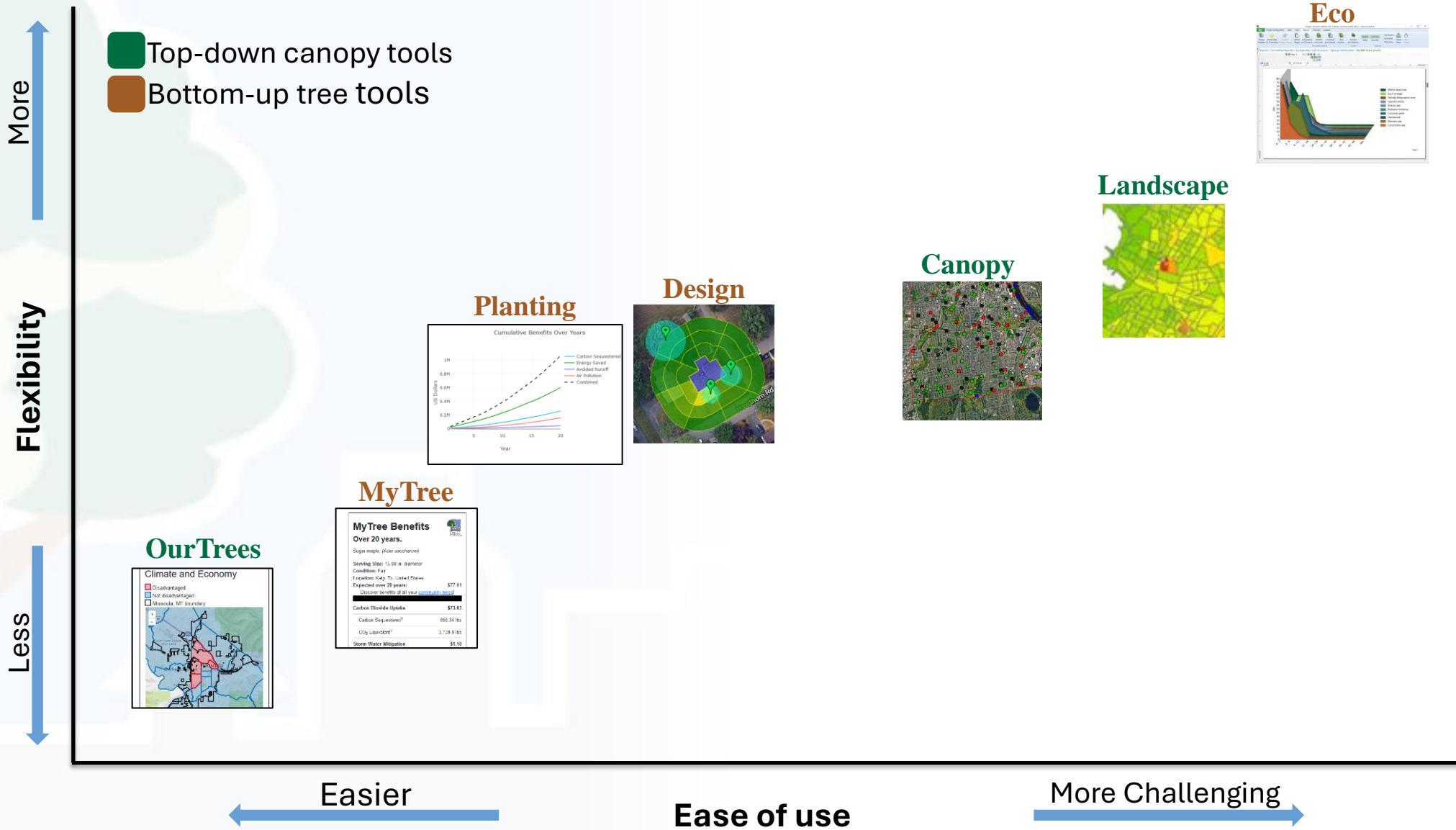


i-Tree Tool Relationships



i-Tree is a Cooperative Initiative among these partners





- Top-down canopy tools
- Bottom-up tree tools

More

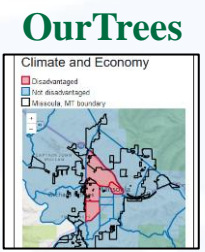
Flexibility

Less

Easier

Ease of use

More Challenging



MyTree

MyTree Benefits Over 20 years.

Species: Sugar maple (Acer saccharum)

Species Size: 15.00 m diameter

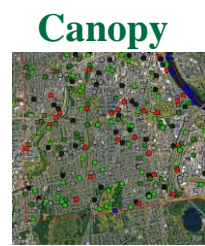
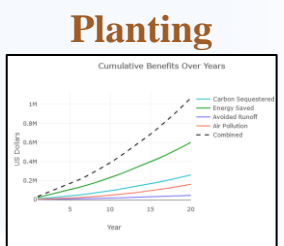
Condition: Fair

Location: Only To: Lashed Street

Expected over 20 years: \$77.01

Discover benefits of all your community trees!

Carbon Dioxide Uptake	\$73.03
Carbon Sequestration	655.34 lbs
CO ₂ Equivalent	2,129.9 lbs
Storm Water Mitigation	\$1.10



Science of i-Tree - Air pollution benefits

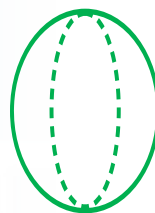
Step 1: Estimate tree structure: Leaf surface area

1. With at least dbh and species we can predict crown size measurements

$$\text{Red maple height} = e^{(2.6393 + (\ln(\text{DBH}) * 0.5613))}$$

18 in dbh red maple has an estimate height of 70 ft

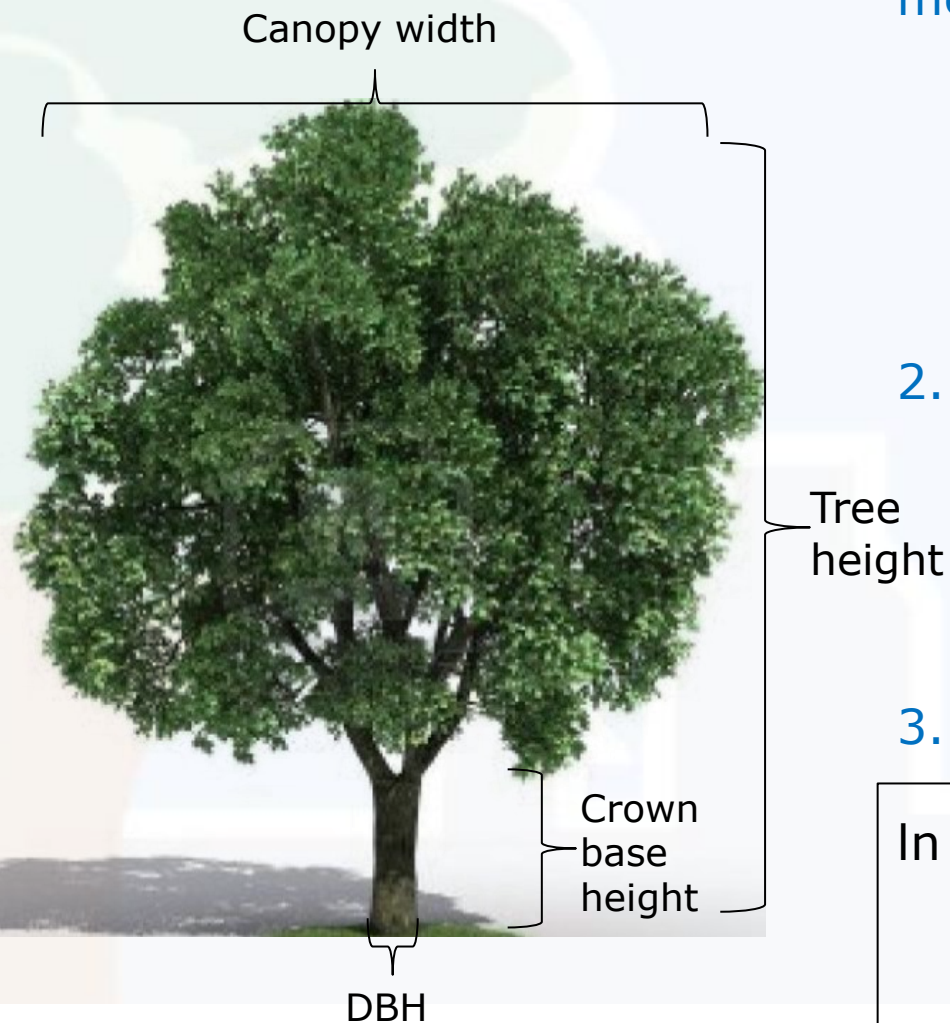
2. With crown size measurements we can estimate crown surface



3. With crown surface we can estimate leaf surface area

$$\begin{aligned} \ln \text{ of leaf area} = & -4.33 + 0.29 * \text{ht} + \\ & +0.7312 * \text{crown diam} \\ & + 5.72 \text{ species leaf density} \\ & + -0.015 \text{ crown surface area} \end{aligned}$$

Leaf surface area
for our 18 in red
maple =
5,842 sq ft



Leaf surface area of 18" dbh trees

Eastern white pine



5,516 sq ft

Honeylocust



4,281 sq ft

Northern red oak



6,038 sq ft

Step 2: Estimate tree function

Gas exchange - NO_2 , O_3 , SO_2

Deposition - particulate matter ($\text{PM}_{2.5}$) and CO

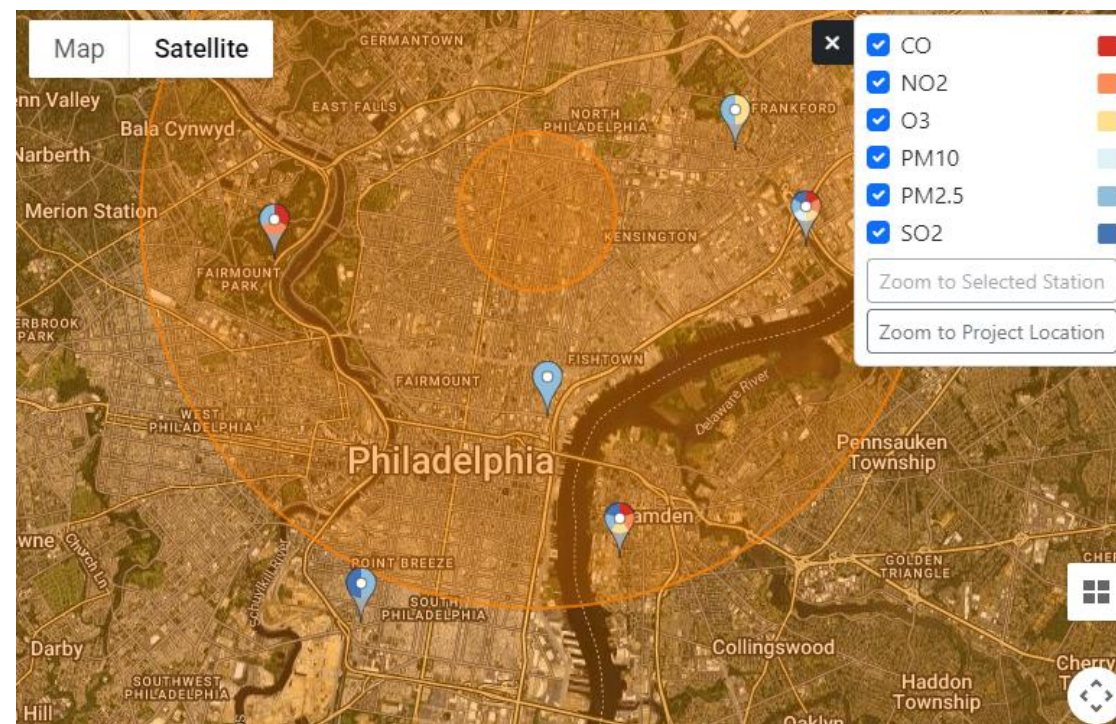
Local hourly weather data

- windspeed
- sunlight
- rainfall
- humidity

Local hourly pollution data

Tree structure data

- leaf area
- leaf on/off dates
- deciduous vs. evergreen

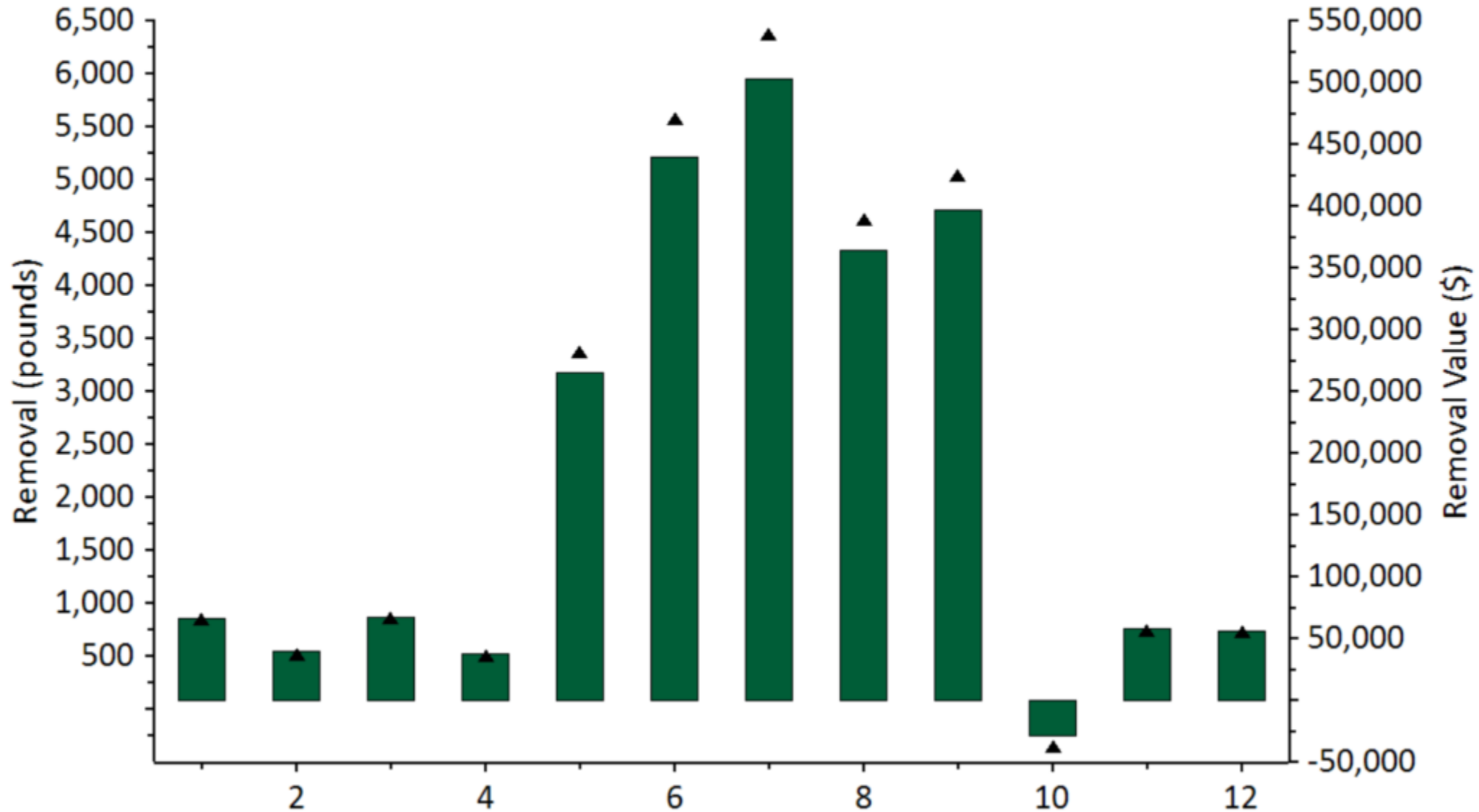


Pollution removal by trees in Grand Rapids, MI



▲ Removal
■ Value

PM2.5 Removal by Month

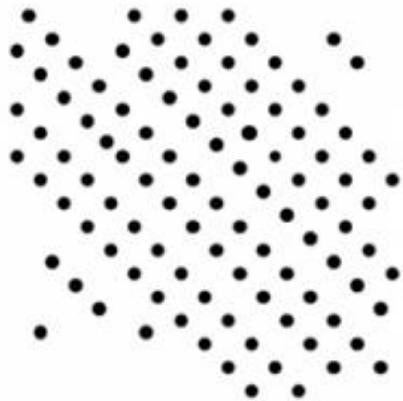


Step 3: Estimating value

Monetary value of pollution removal by trees



Benefits Mapping and analysis program (BenMAP)



→ \$5,000/admission →

$$100 \cdot \$5,000 = \mathbf{\$500,000}$$

An air quality policy reduces the number of hospital admissions by 100

The economic value of each avoided admission is \$5,000 in the year 2010

The economic value is the number of cases multiplied by the value of each admission

Inputs:

Local census data

- total population
- population by age

Estimates of pollution reduction

Grand Rapids, MI pollution removal value

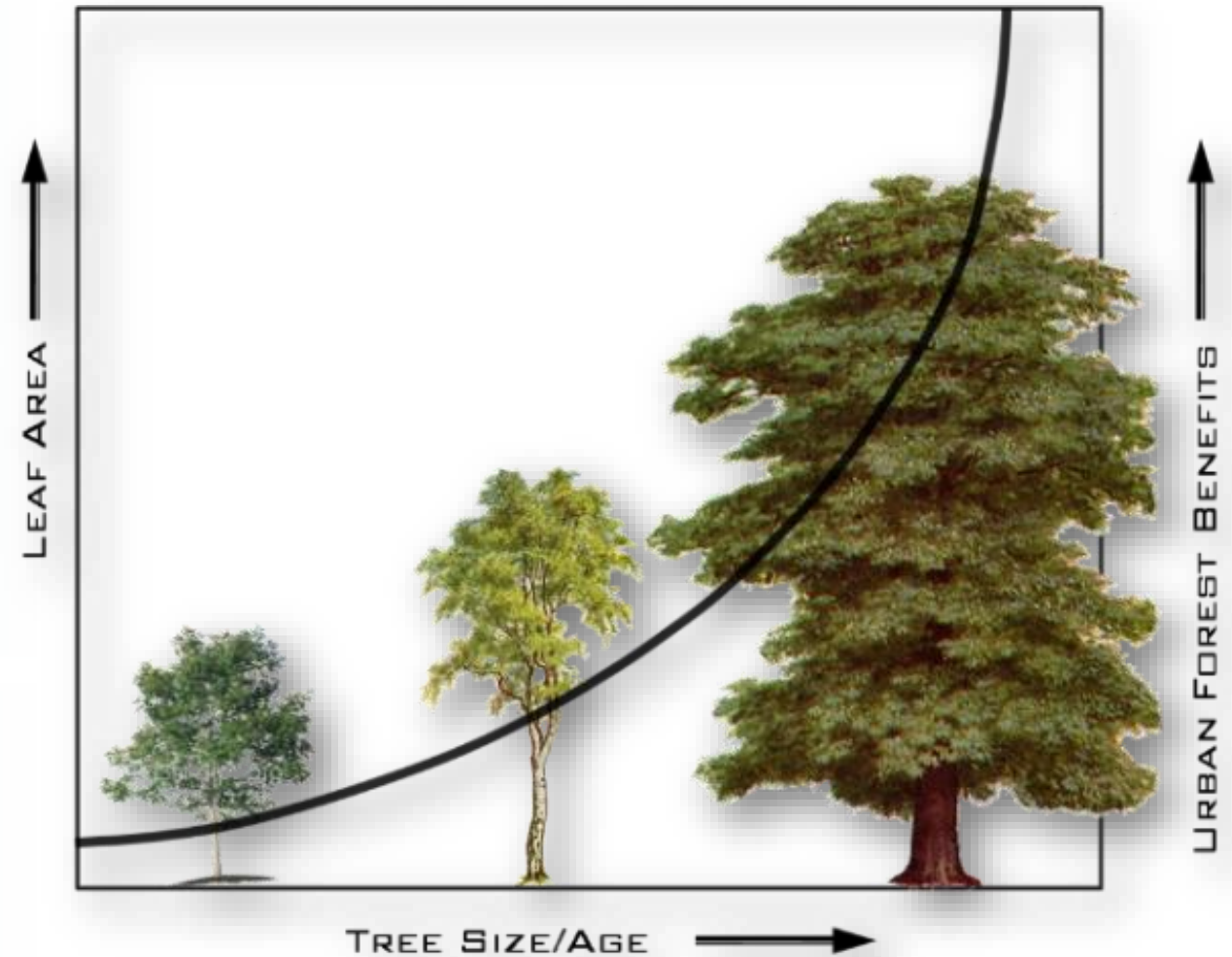


	PM2.5	
	Incidence (Reduction/yr)	Value (\$/yr)
Acute Bronchitis	0.206	18.12
Acute Myocardial Infarction	0.051	4,543.25
Acute Respiratory Symptoms	112.666	11,043.29
Asthma Exacerbation	88.133	7,164.56
Chronic Bronchitis	0.086	24,042.76
Emergency Room Visits	0.134	55.73
Hospital Admissions		
Hospital Admissions, Cardiovascular	0.030	1,164.32
Hospital Admissions, Respiratory	0.026	821.49
Lower Respiratory Symptoms	2.486	129.08
Mortality	0.285	2,214,131.18
School Loss Days		
Upper Respiratory Symptoms	2.048	91.95
Work Loss Days	19.238	3,298.60
Total	225.389	2,266,504.33

Unique Features of the i-Tree Science



- i-Tree is local
- i-Tree is species specific
- i-Tree benefits are specific to your tree
- i-Tree is powered by large databases
- Consistent and comparable between places and over time
- Research is continuously updated



Understanding i-Tree



Northern Research Station | General Technical Report NRS-200-2023 | April 2024

Understanding i-Tree: 2023 Summary of Programs and Methods

David J. Nowak



i-Tree™

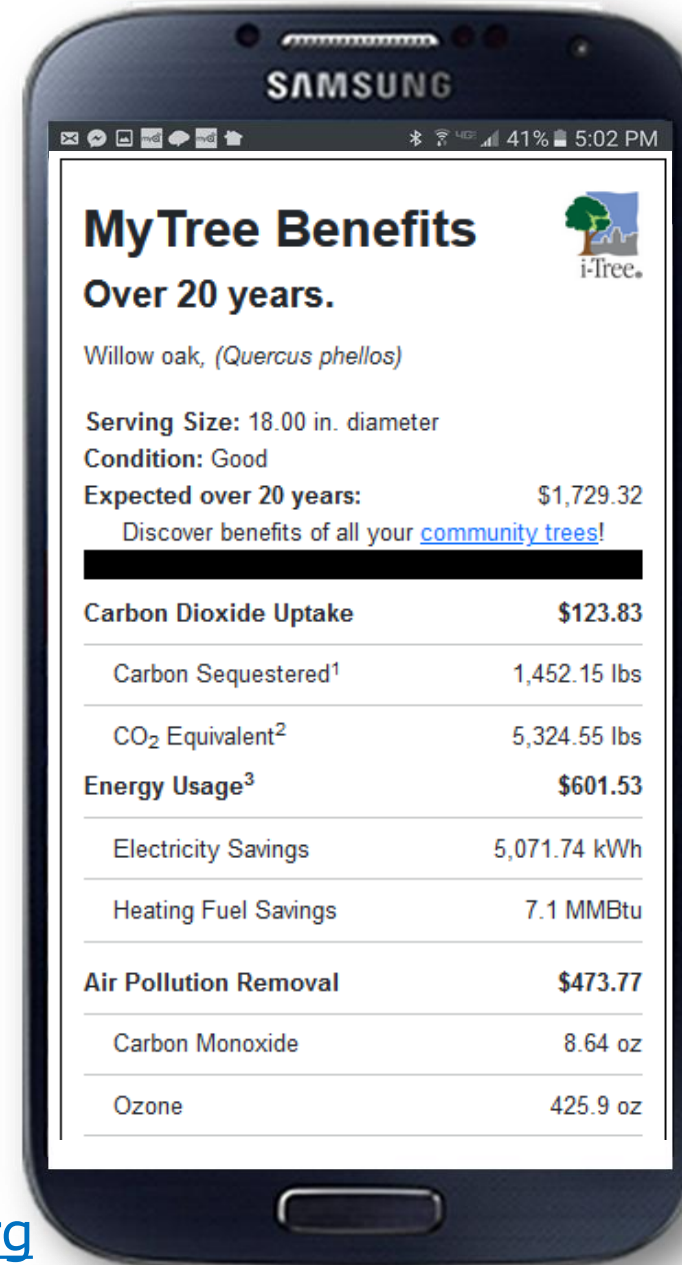
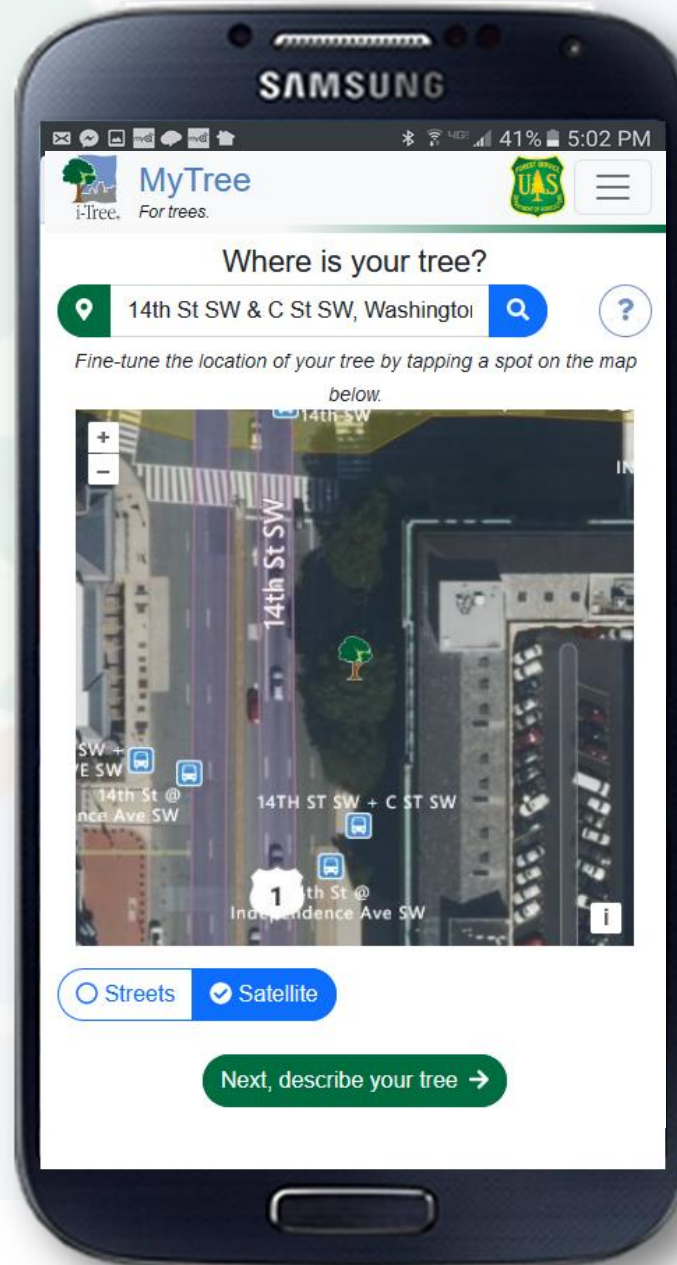


Table 2.—Summary of which directly field-measured characteristics are used to estimate derived variables and ecosystem services. D= directly used; I= indirectly used; C= conditionally used.

	DERIVED VARIABLES		ECOSYSTEM SERVICES										
	Leaf Area	Leaf Biomass	Carbon Storage	Gross Carbon Sequestration	Net Carbon Sequestration	Energy Effects	Air Pollution Removal	Avoided Runoff	Transpiration	VOC Emissions	Compensatory Value	Wildlife Suitability	UV Effects
DIRECT MEASURES													
Species	D	D	D	D	D	D	I	I	I	D	D		
Diameter at breast height (d.b.h.)			D	D	D						D	D	
Total height	D	D	C	C	C	D	I	I	I	I		D	
Crown base height	D	D	C				I	I	I	I			
Crown width	D	D	C				I	I	I	I			
Crown light exposure			C	D	D								
Percent crown missing	D	D	C	C	C	D	I	I	I	I			
Crown health (condition/dieback)				D	D						D	D	
Field land use				D							D	D	
Distance to building						D							
Direction to building						D							
Percent tree cover						D	D	D				D	D
Percent shrub cover							D					D	
Percent building cover						D							
Ground cover composition							I					D	

<https://research.fs.usda.gov/treesearch/68438>

MyTree: Making i-Tree Easy



MyTree.itreetools.org