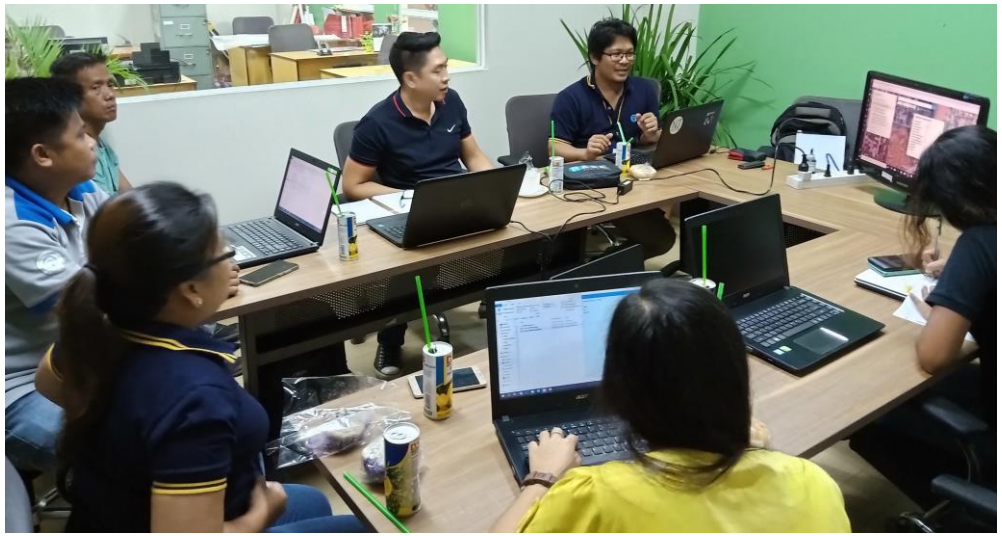
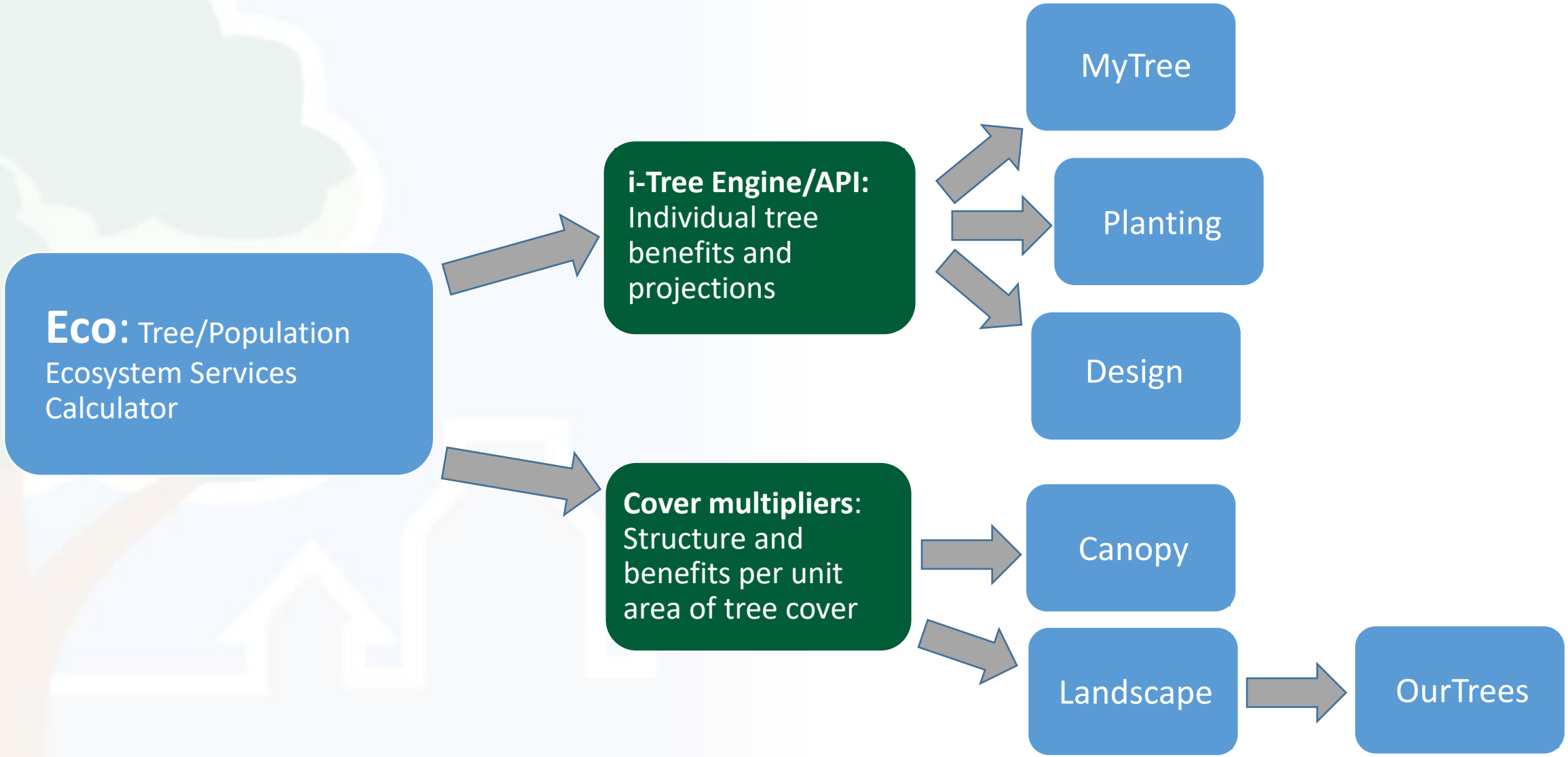
Plan for today

1. Setting up your first project
2. Key decisions
3. Putting i-Tree Eco results to work
4. Is i-Tree Eco right for you?



i-Tree Tool Relationships



The i-Tree Eco Framework

Structure

- Summary of field measurements
- Leaf area
- Condition
- Species distribution
- Diameter distribution

Function

- Air quality improvement
- Energy effects
- Carbon storage & sequestration
- Hydrology effects
- Shade ultraviolet effects (UV)
- Foodscape characteristics
- Wildlife suitability – avian focus
- Volatile organic compounds
- Leaf nutrients, wood production, and more

Value

- Monetary value
- Equivalent values
- Health outcomes
- Cost Benefit analysis
- Summaries for management

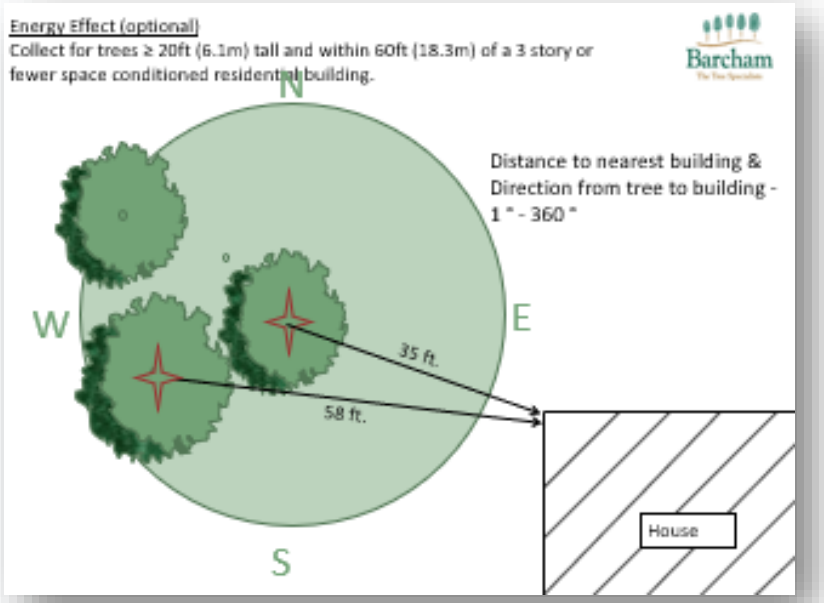
Key Decision 1:
What data will you collect?

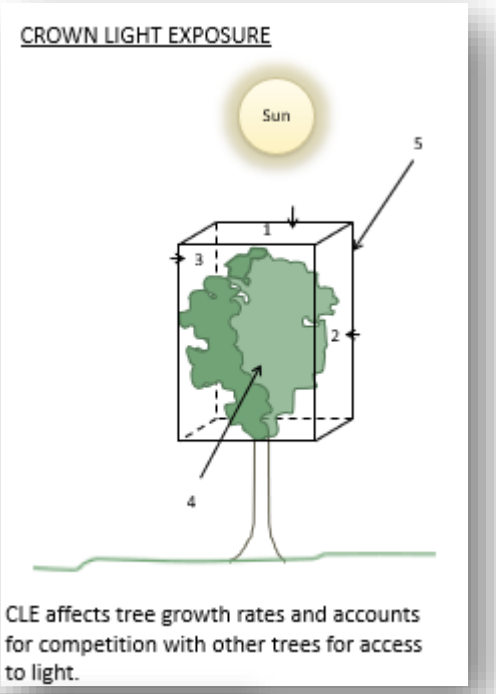
Minimum Required Tree Data

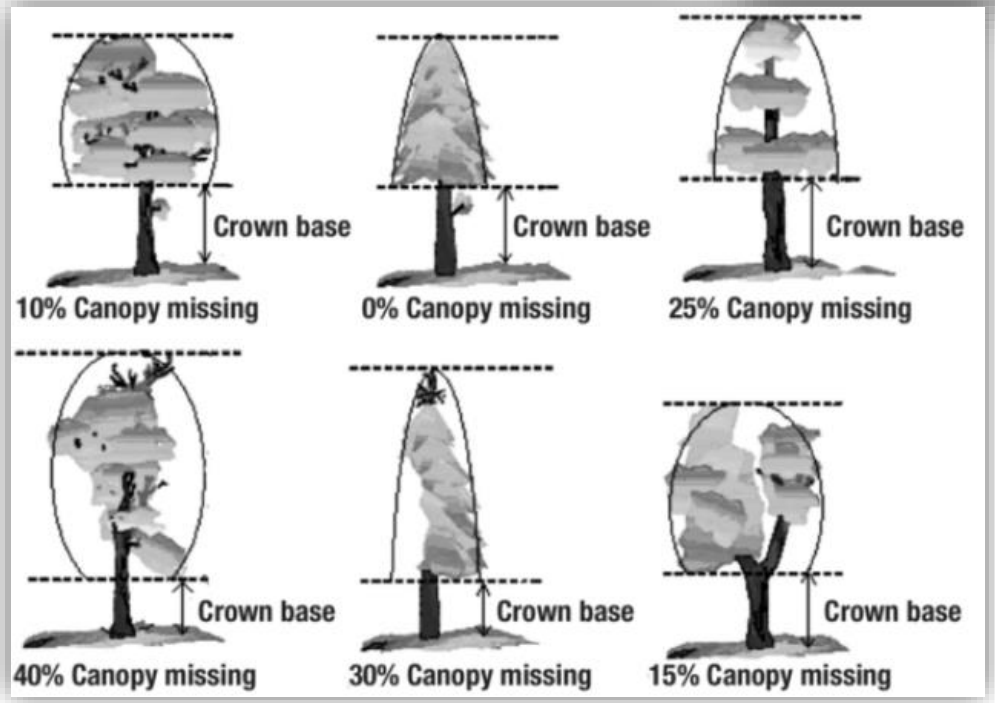
1. Tree species
2. Diameter at breast height (DBH)

<u>Optional</u> but Recommended Tree Data

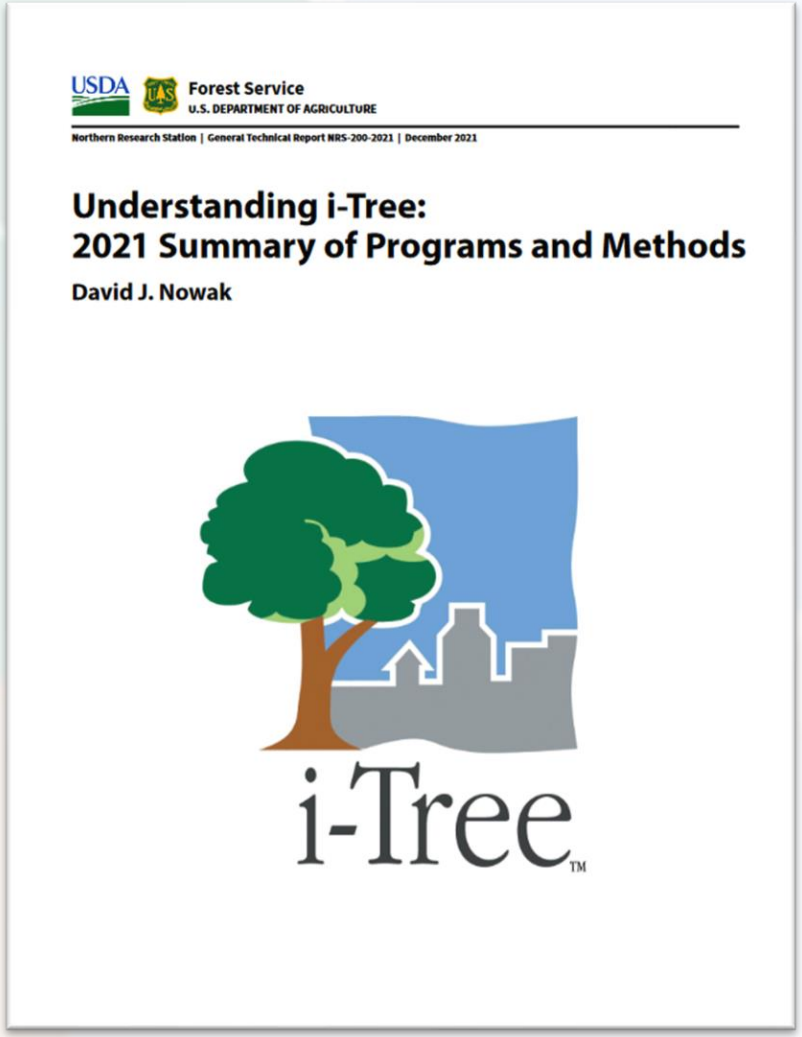
3. Total tree height
4. Height to live top
5. Height to crown base
6. Crown width (N-S)
7. Crown width (E-W)
8. % Crown missing
9. % dieback (condition)
10. Crown light exposure (CLE)
11. Land use







From field data to results



Page 22
https://www.fs.usda.gov/research/treesearch/63636

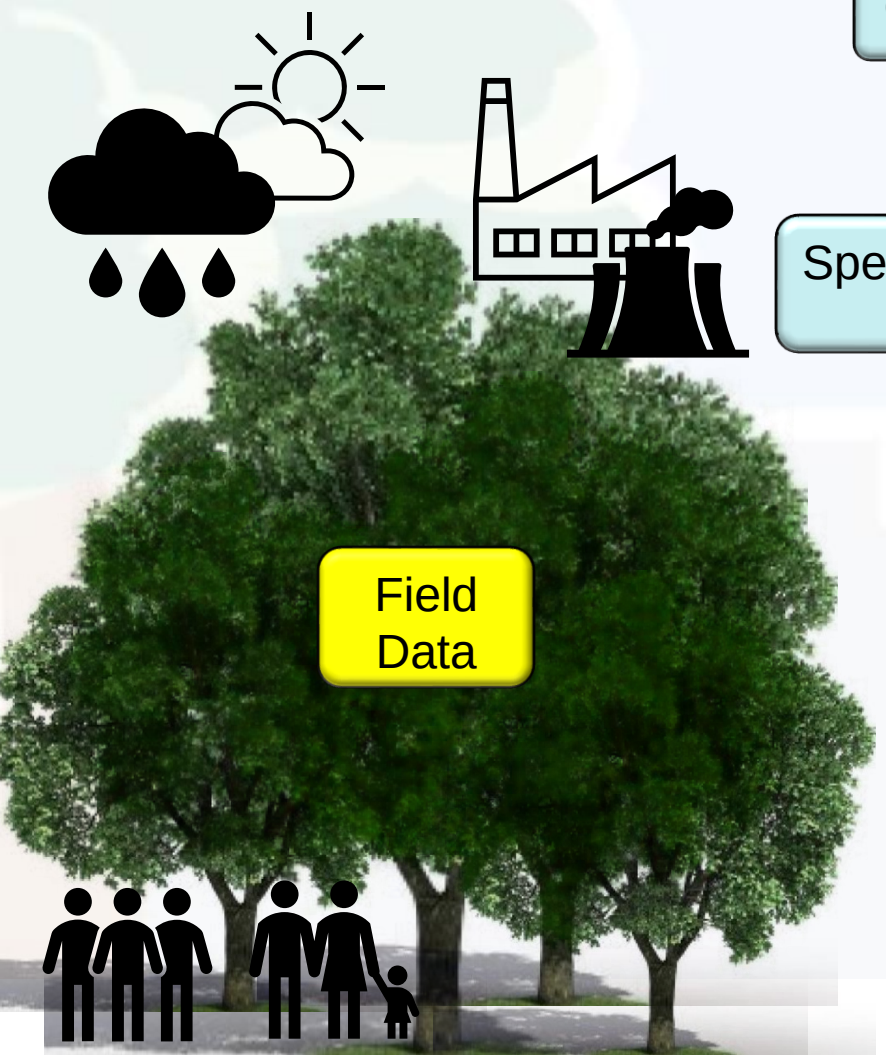
Table 2.—Summary of which directly field-measured characteristics are used to estimate derived variables and ecosystem services. D= directly used; I= indirectly used; C= conditionally used.

	DERIVED VARIABLES		ECOSYSTEM SERVICES										
DIRECT MEASURES	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
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	

Tree Data

Plot Data

i-Tree model basics: Inventory data ➡ tree benefits?



Field Data

City Data

Pollution Data

Weather Data

Species Data (*8000+*)

Location Data

i-Tree Eco

Carbon

Air Quality

Hydrology

Energy

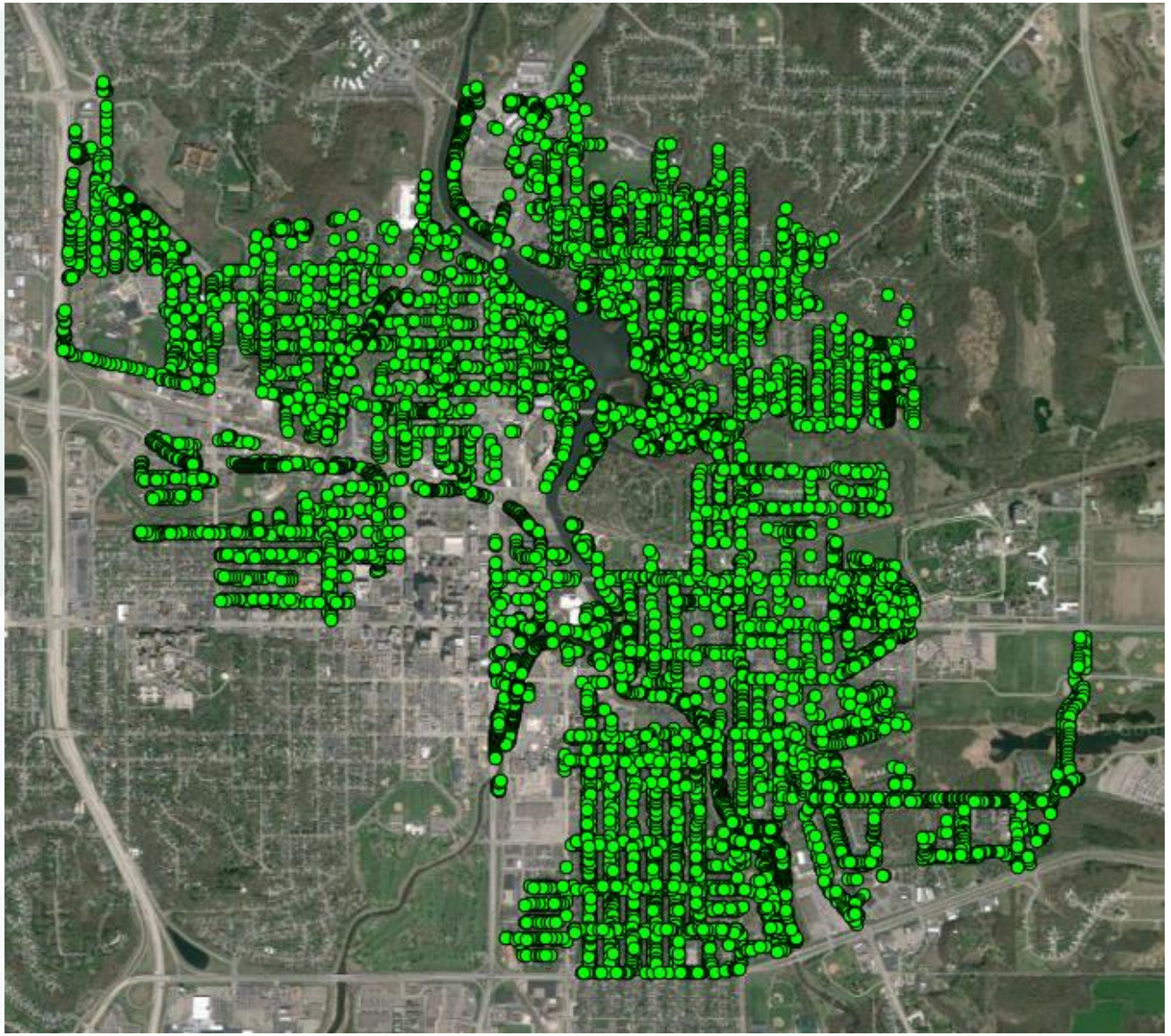
Volatile Organic Compounds

Structure

Value

Forecast

Let’s set-up an i-Tree Eco project

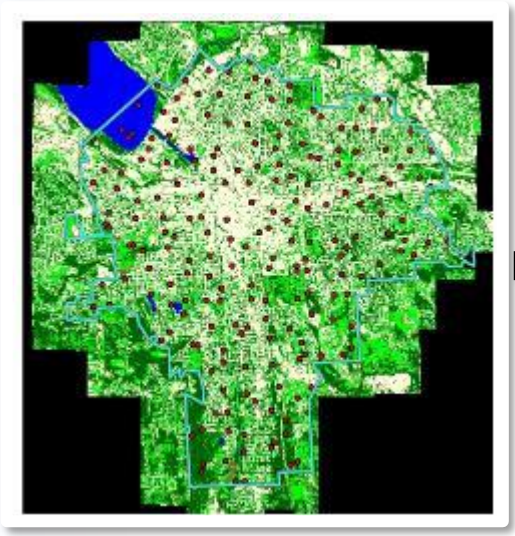


Rochester, MN
Street Tree Inventory

Key Decision 2: Sample or complete inventory?

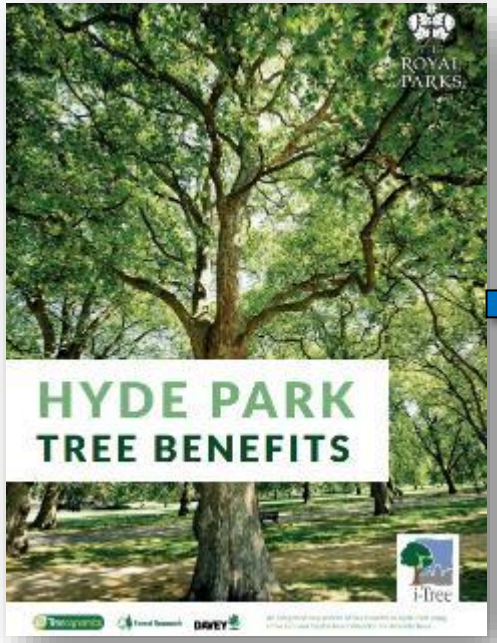
Random sample of plots

- City
- County
- Regional or watershed
- Large scale or forested areas



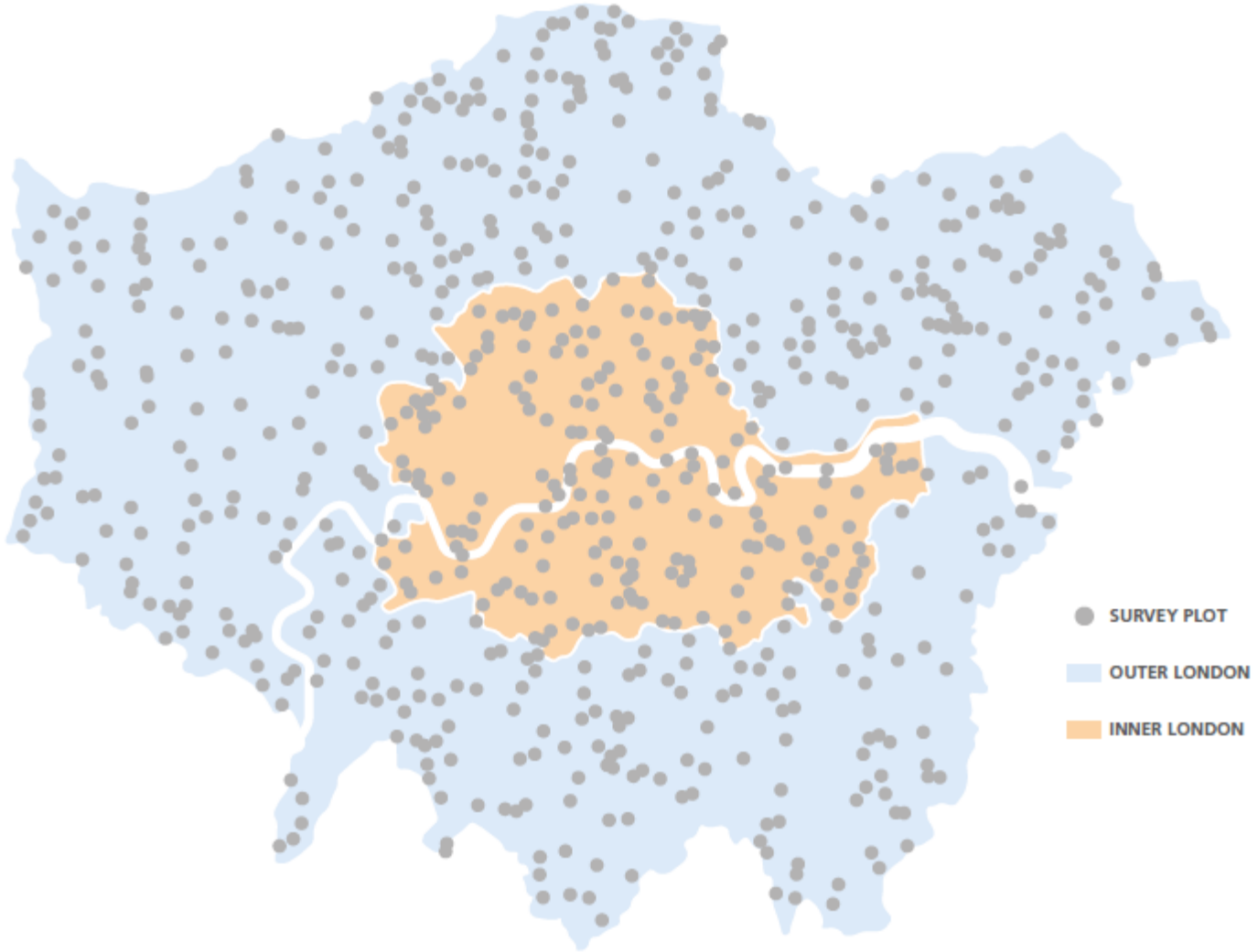
Complete inventory

- Parks
- Campuses
- Residential properties
- Specimen or single trees
- Only trees of interest



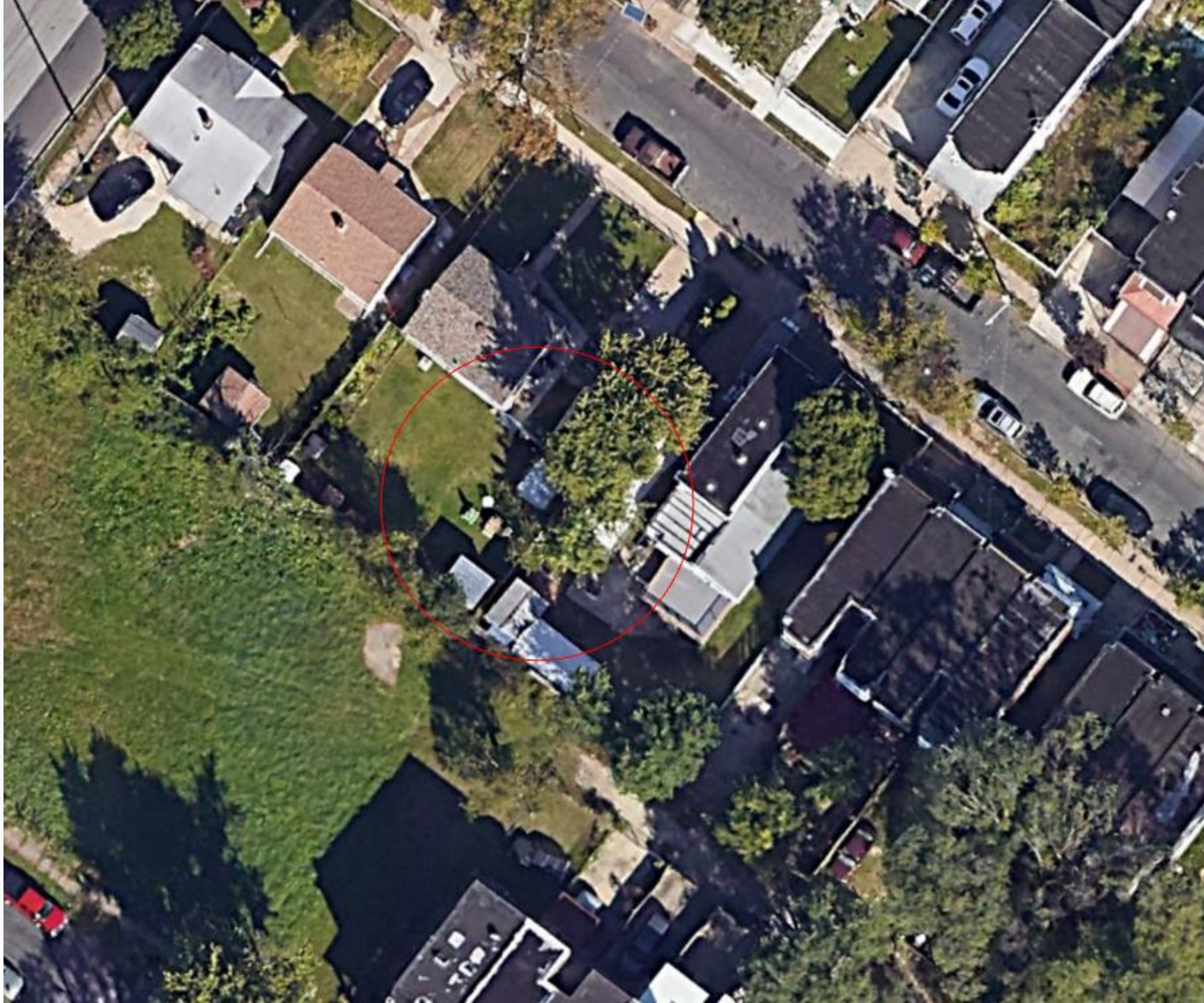
What is a sample and why would you do it?

- A small subset of the items you are interested in
- Easier than measuring the whole thing
- For statistical reasons must be random
- We can estimate how well our sample represents the whole population
- This is how London measures 8.5 million trees



What is a plot?

- By default 37.2 ft in radius, 1/10th acre in area.
- Plot size can be changed
- Tradeoffs between plot size and the number you can measure



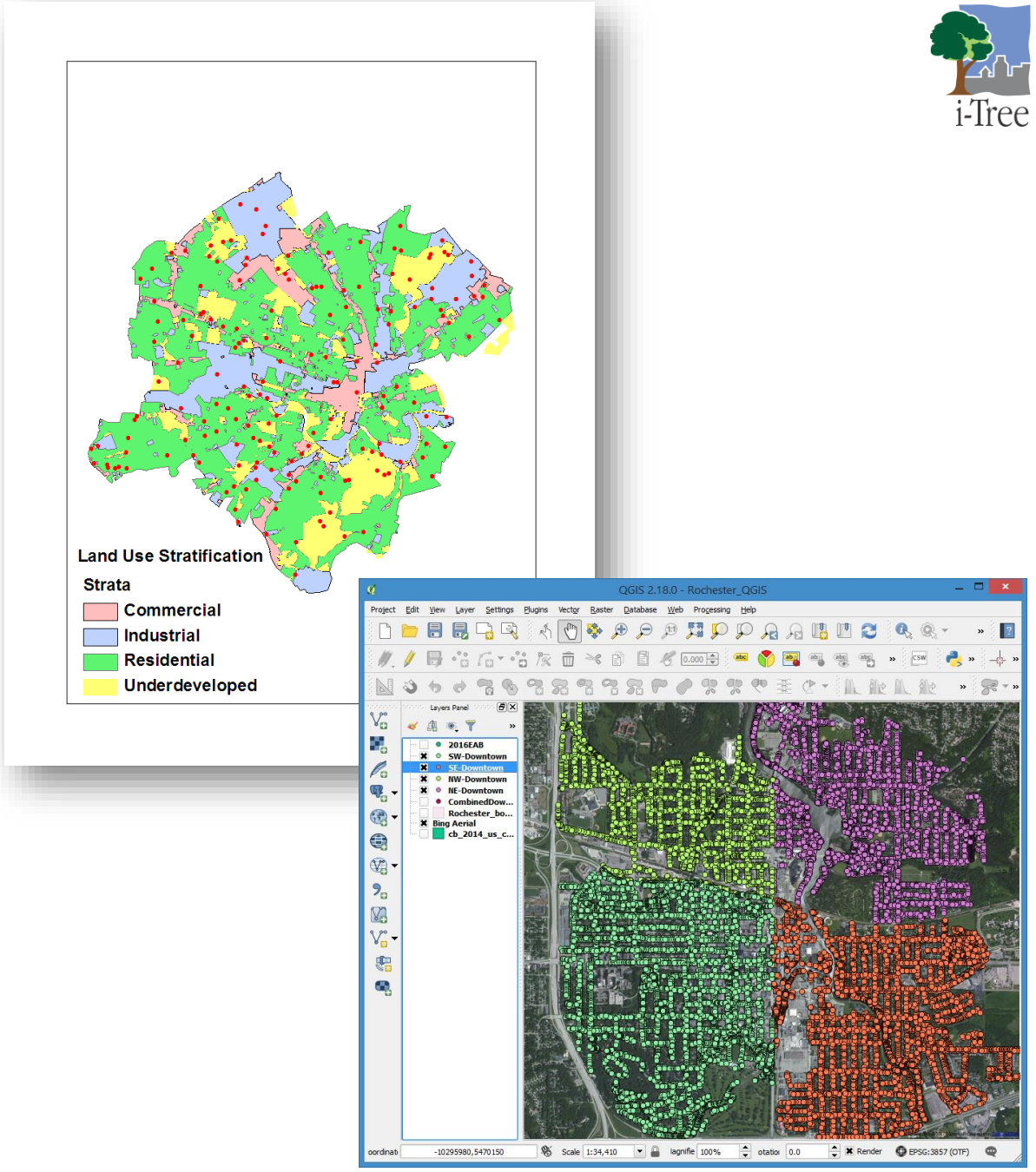
Sample Plots vs. Complete Inventory

Characteristic	Sample	Complete
Recommended area	City or larger	Any
Number of plots	200 or more	not applicable
Typical number of trees	>500	Any
Access	Numerous permissions usually required	Often no permission required
Accuracy	Some loss of accuracy due to sampling error	No sampling error, all trees of interest measured
Results	Estimates expanded to whole area of interest	Estimates only for measured trees

Key Decision 3: Will you stratify?

Dividing area of interest into categories

- Can be performed by any categories of interest (land use, ownership, political, watershed, etc.)
- Summaries generated by categories of interest
- Perform pre- or post- measurement (sample must be random)
- Can improve statistical accuracy
- Plots or complete inventory



Key Decision 4: How will you enter data? manual, mobile, or import

i-Tree Eco v6 sample plot data sheet

☐ Check when plot is completed

Sheet _____of_____ Initials : _____

Plot Information

Plot ID:	Strata:	GPS Coordinates Lat. Long.	Date:	Crew:	Plot Size:

Plot Address:

_____

Plot Contact Name: _____Contact Type or Title: _____

Phone #: _____ Email: _____

Plot or Access Notes: _____

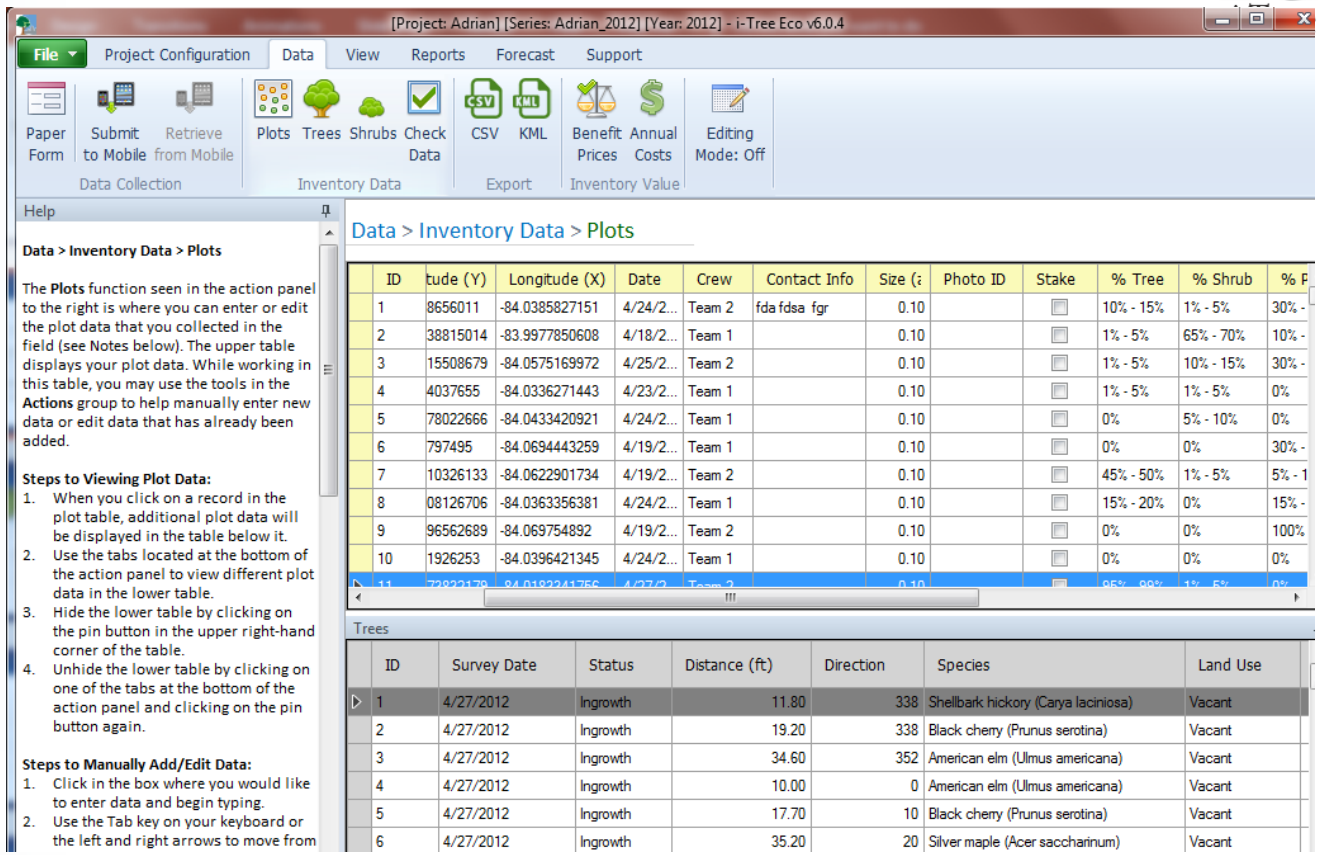
_____

_____

Plot Tree Cover (%)	Shrub Cover (%)	Plantable Space (%)	Percent of Plot Measured (%):

Did this Plot have any Trees? (Y/N):_____ Permanent stake used? (Y/N)_____

Photo ID(s):

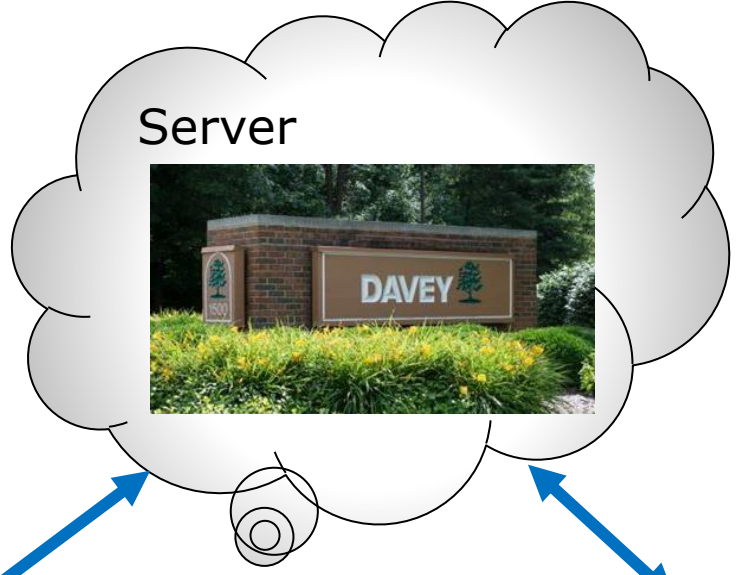


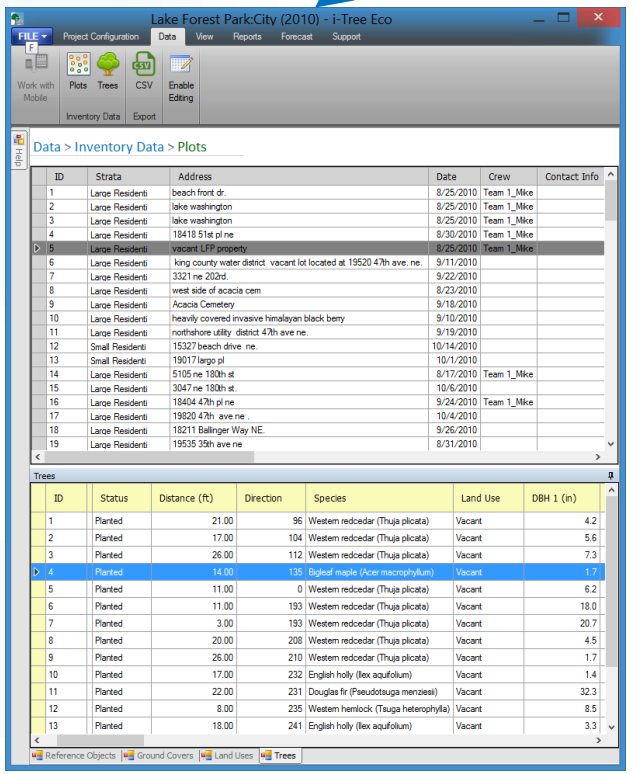
Manual data entry:
Collect on paper then directly enter in the i-Tree Eco interface

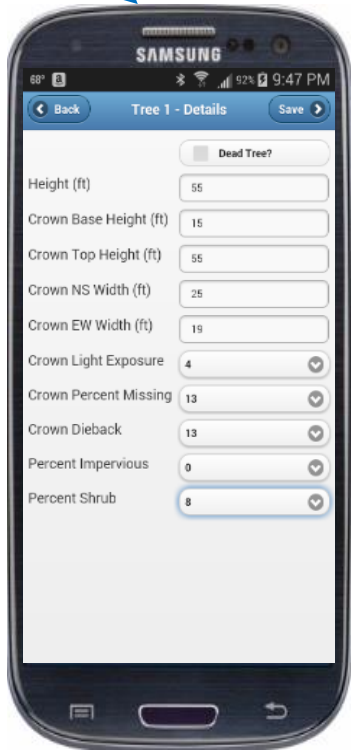
Data entry: mobile

Web-enabled mobile device

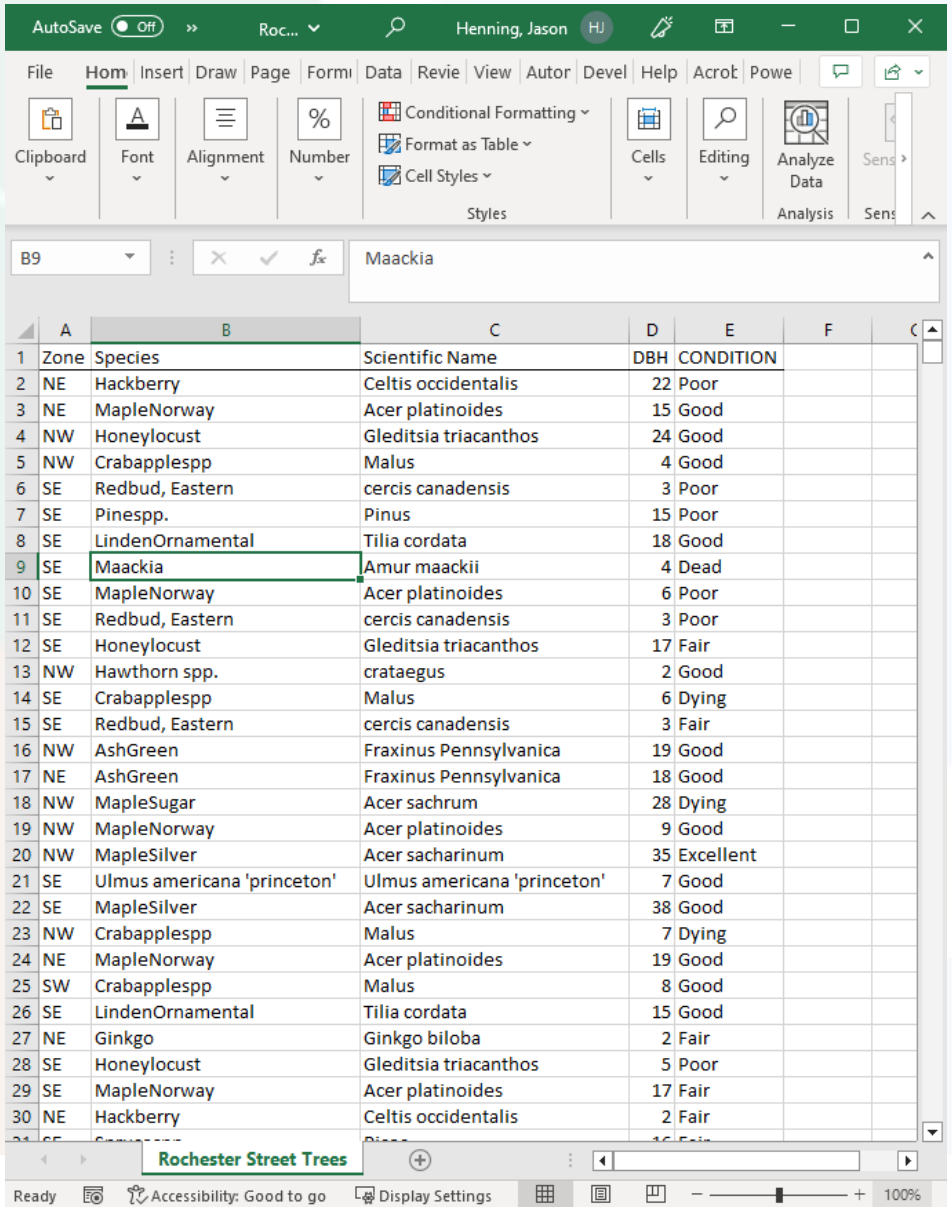
1. Measure and enter your selected field variables
2. Regularly submit data to Davey servers
3. Retrieve data into your i-Tree Eco Project



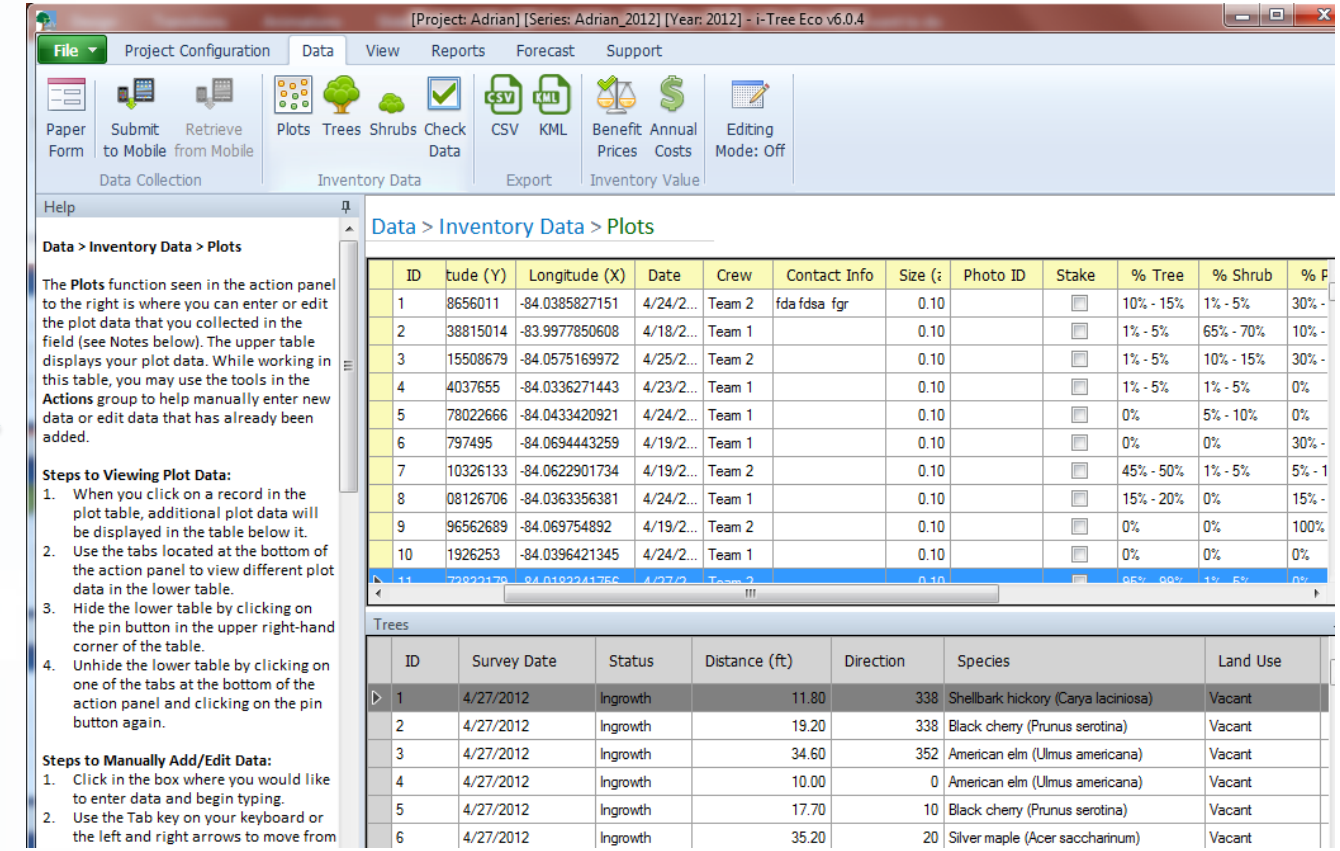




Data import



	A	B	C	D	E	F
1	Zone	Species	Scientific Name	DBH	CONDITION	
2	NE	Hackberry	Celtis occidentalis	22	Poor	
3	NE	MapleNorway	Acer platinoides	15	Good	
4	NW	Honeylocust	Gleditsia triacanthos	24	Good	
5	NW	Crabapplespp	Malus	4	Good	
6	SE	Redbud, Eastern	cercis canadensis	3	Poor	
7	SE	Pinespp.	Pinus	15	Poor	
8	SE	LindenOrnamental	Tilia cordata	18	Good	
9	SE	Maackia	Amur maackii	4	Dead	
10	SE	MapleNorway	Acer platinoides	6	Poor	
11	SE	Redbud, Eastern	cercis canadensis	3	Poor	
12	SE	Honeylocust	Gleditsia triacanthos	17	Fair	
13	NW	Hawthorn spp.	crataegus	2	Good	
14	SE	Crabapplespp	Malus	6	Dying	
15	SE	Redbud, Eastern	cercis canadensis	3	Fair	
16	NW	AshGreen	Fraxinus Pennsylvanica	19	Good	
17	NE	AshGreen	Fraxinus Pennsylvanica	18	Good	
18	NW	MapleSugar	Acer sachrum	28	Dying	
19	NW	MapleNorway	Acer platinoides	9	Good	
20	NW	MapleSilver	Acer sacharinum	35	Excellent	
21	SE	Ulmus americana 'princeton'	Ulmus americana 'princeton'	7	Good	
22	SE	MapleSilver	Acer sacharinum	38	Good	
23	NW	Crabapplespp	Malus	7	Dying	
24	NE	MapleNorway	Acer platinoides	19	Good	
25	SW	Crabapplespp	Malus	8	Good	
26	SE	LindenOrnamental	Tilia cordata	15	Good	
27	NE	Ginkgo	Ginkgo biloba	2	Fair	
28	SE	Honeylocust	Gleditsia triacanthos	5	Poor	
29	SE	MapleNorway	Acer platinoides	17	Fair	
30	NE	Hackberry	Celtis occidentalis	2	Fair	



Data entry: mobile, manual, or import

Mobile

- Useful for citizen science
- Multiple people can do data entry
- Need device, safety, battery
- Tedious for plots with lots of trees

Manual

- Use paper for permanent record
- Fewer potential issues
- Single user
- Slow

Import

- Ultimate flexibility
- Add value to existing inventories
- Quick
- Now works for samples or complete inventory

Let’s get some data into i-Tree Eco

Let’s get some data into i-Tree Eco

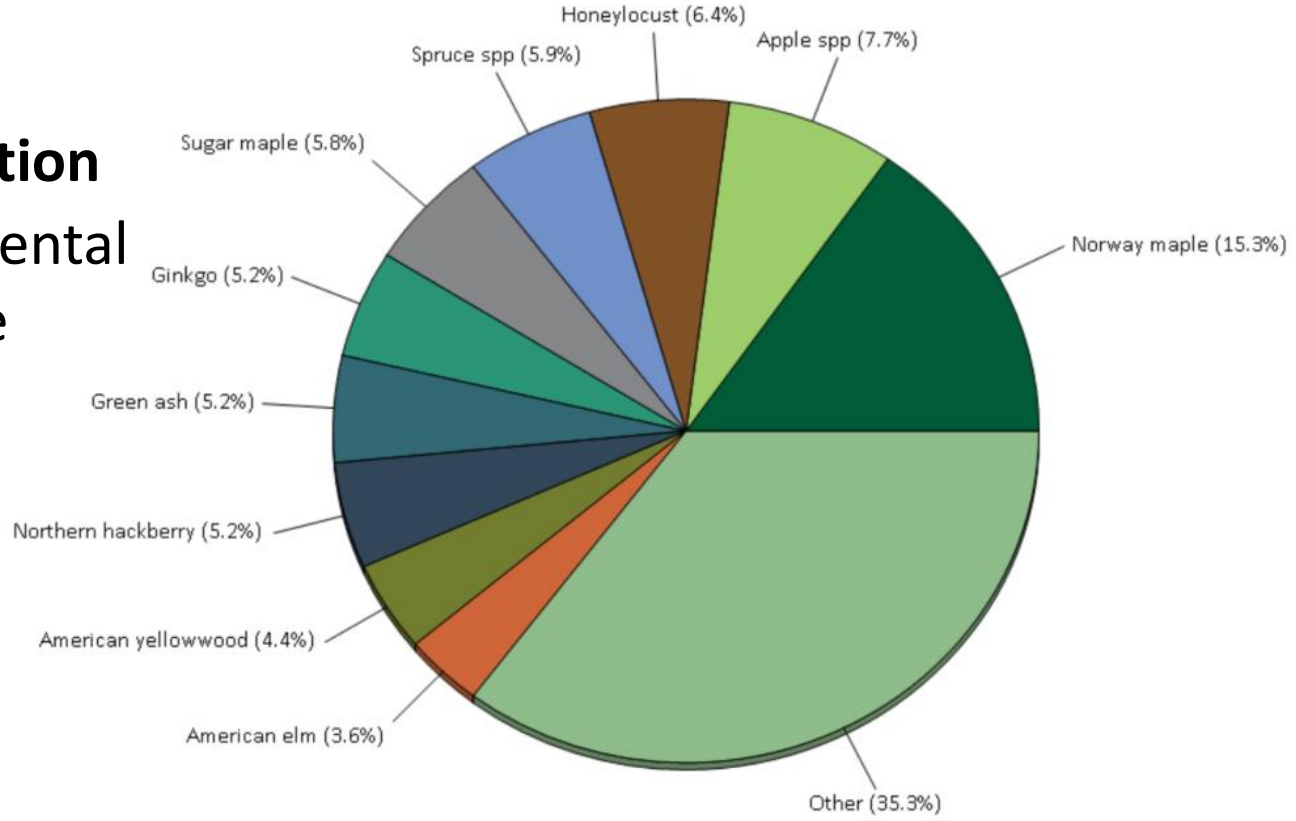
Mobile data entry

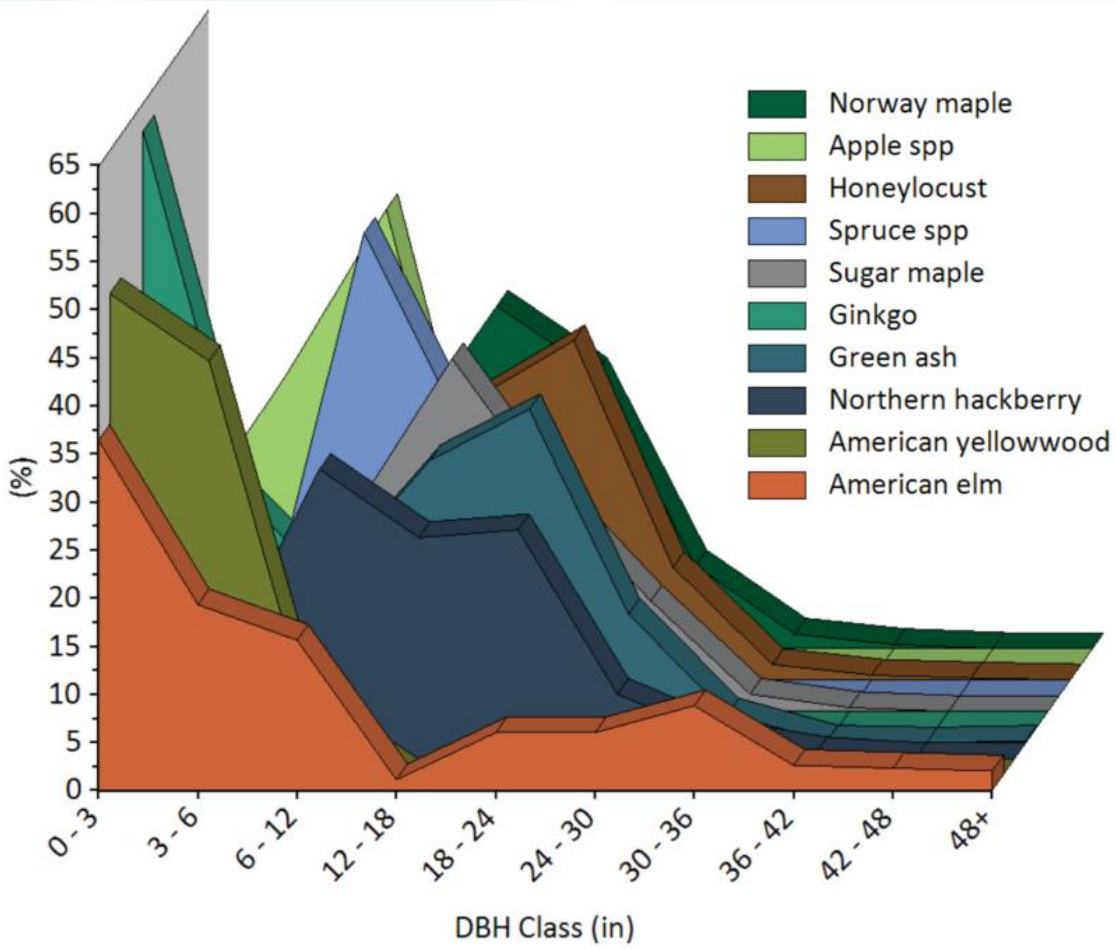
https://bit.ly/i-TreeSummer

i-Tree Eco structure results

Species Diversity/Composition

Diversity reduces environmental threats, increases resilience





Size/Age Class Distribution

Distribution of age informs sustainability

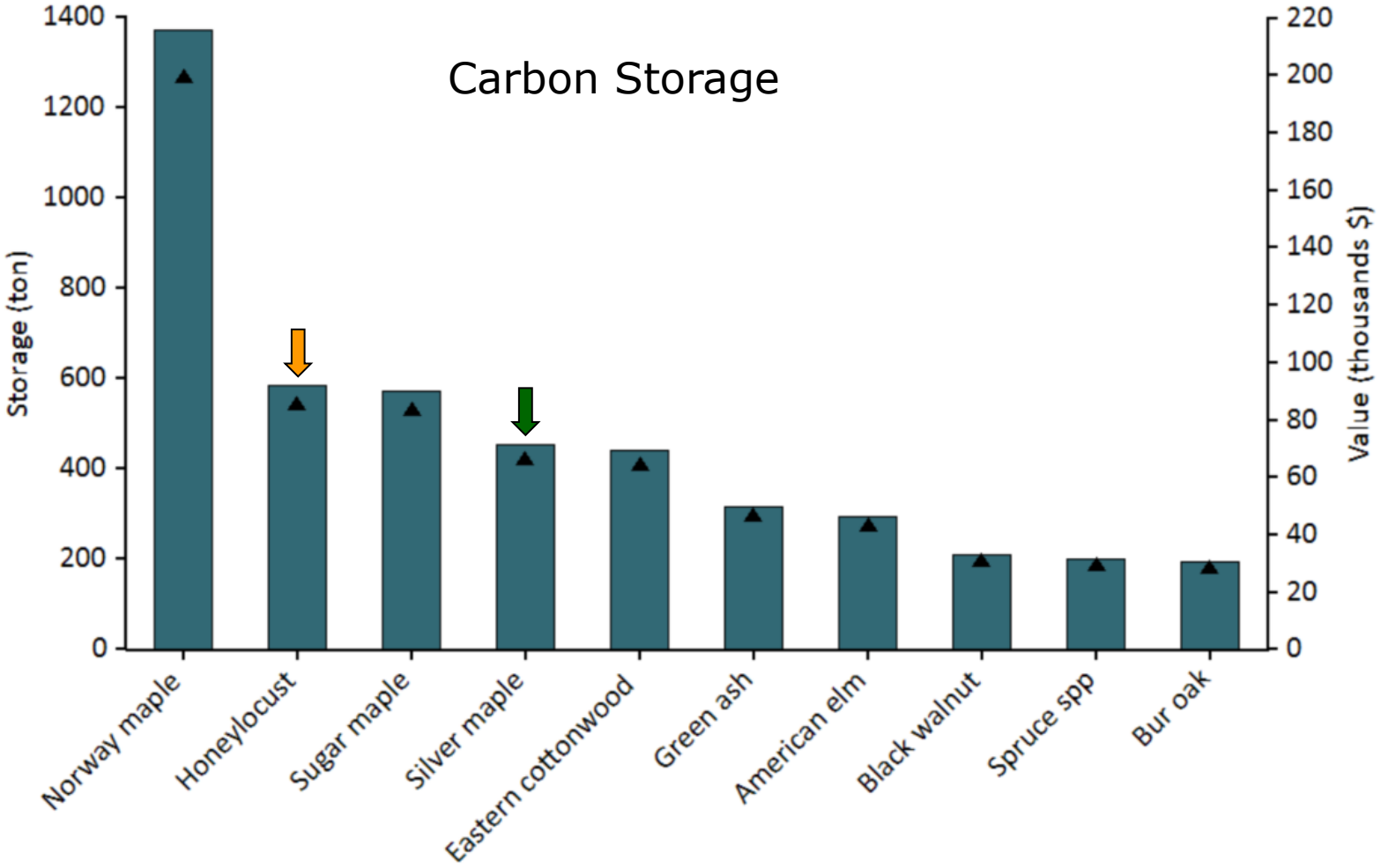
i-Tree Eco management focused results

Appendix VI. Potential Risk of Pests

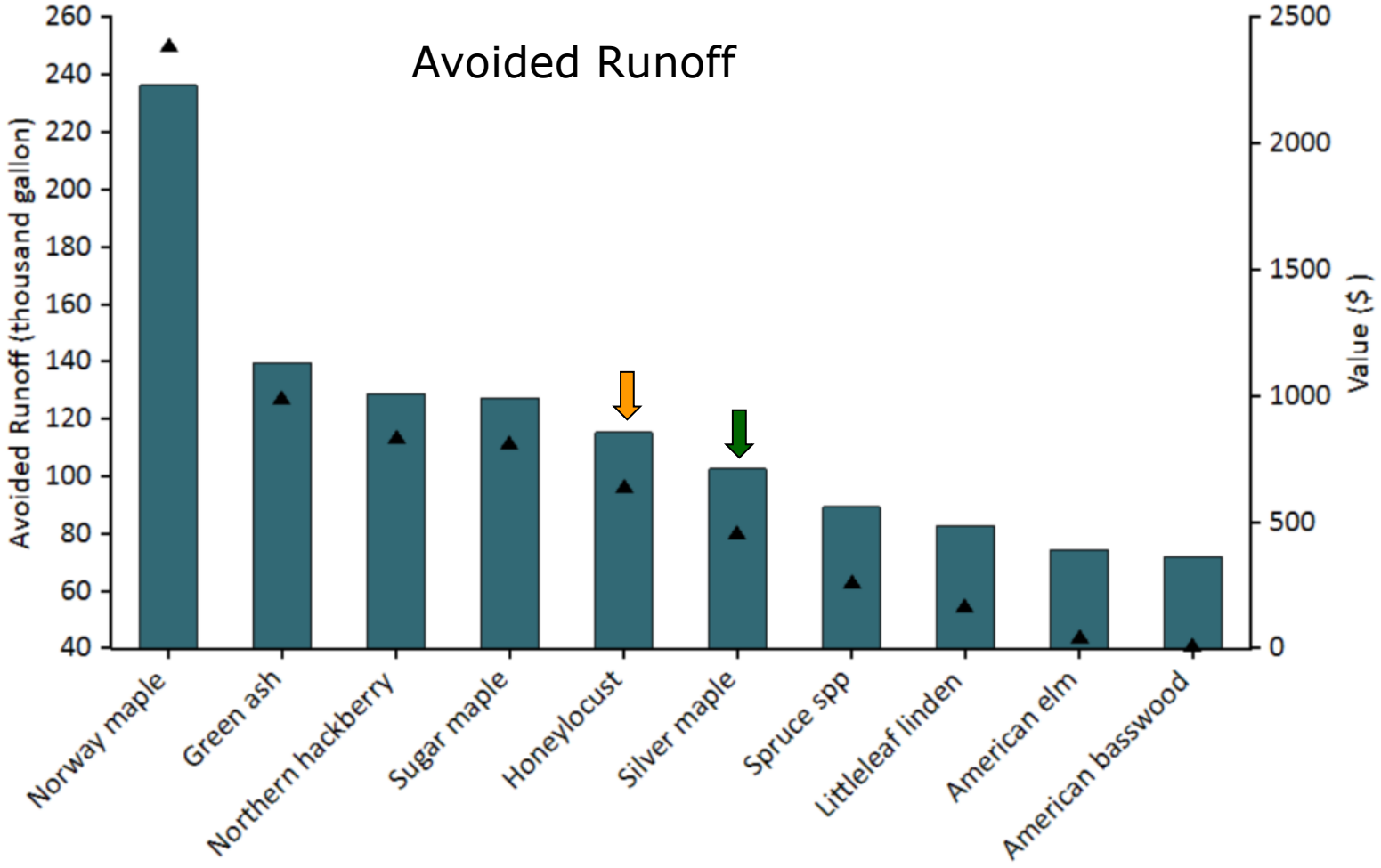
Fifty-three insects and diseases were analyzed to quantify their potential impact on the urban forest.

Code	Scientific Name	Common Name	Trees at Risk (#)	Value ($ thousands)
AL	Phyllocnistis populiella	Aspen Leafminer	30	8.94
ALB	Anoplophora glabripennis	Asian Longhorned Beetle	5,080	6,037.13
ARCA	Neodothiora populina	Aspen Running Canker	0	0.00
ARD	Armillaria spp.	Armillaria Root Disease	4	2.86
BBD	Neonectria faginata	Beech Bark Disease	0	0.00
BC	Sirococcus clavigignenti juglandacearum	Butternut Canker	145	273.64
BLD	Litylenchus crenatae mccannii	Beech Leaf Disease	0	0.00
BM	Euproctis chrysorrhoea	Browntail Moth	891	335.73
BOB	Tubakia iowensis	Bur Oak Blight	105	291.08
BSRD	Leptographium wageneri	Black Stain Root Disease	4	2.86
BWA	Adelges piceae	Balsam Woolly Adelgid	1	0.25
CB	Cryphonectria parasitica	Chestnut Blight	0	0.00
DA	Discula destructiva	Dogwood Anthracnose	0	0.00

i-Tree Eco tree function



i-Tree Eco tree function



Rochester Inventory Data

Silver maples

Tree count: 247

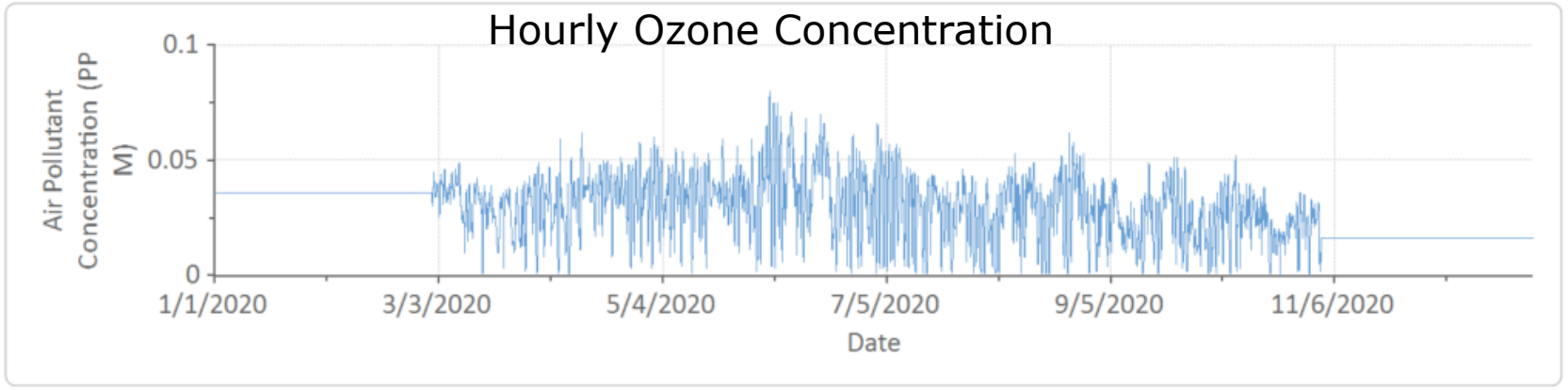
Leaf area: 33 acres

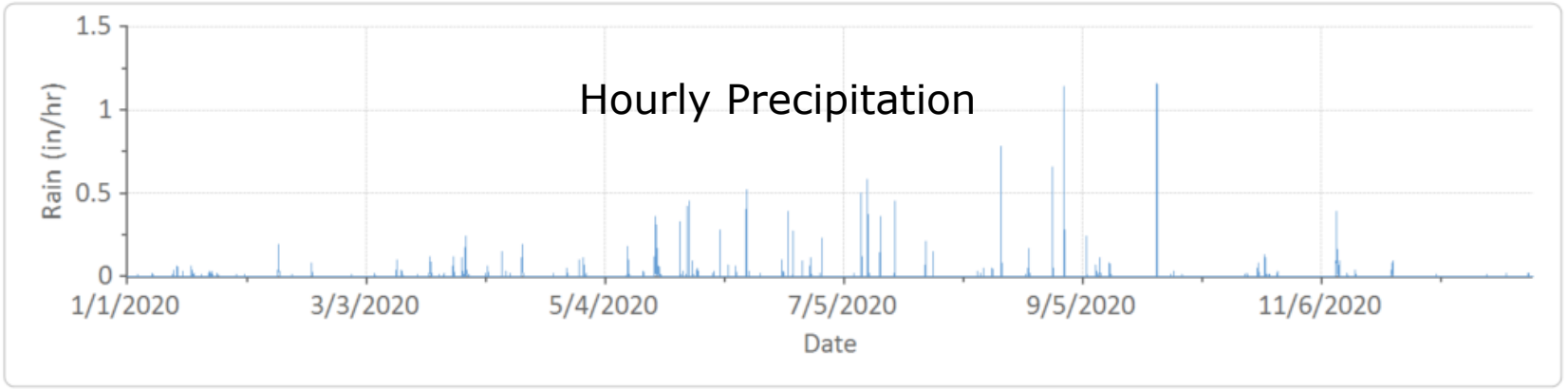
Honeylocusts

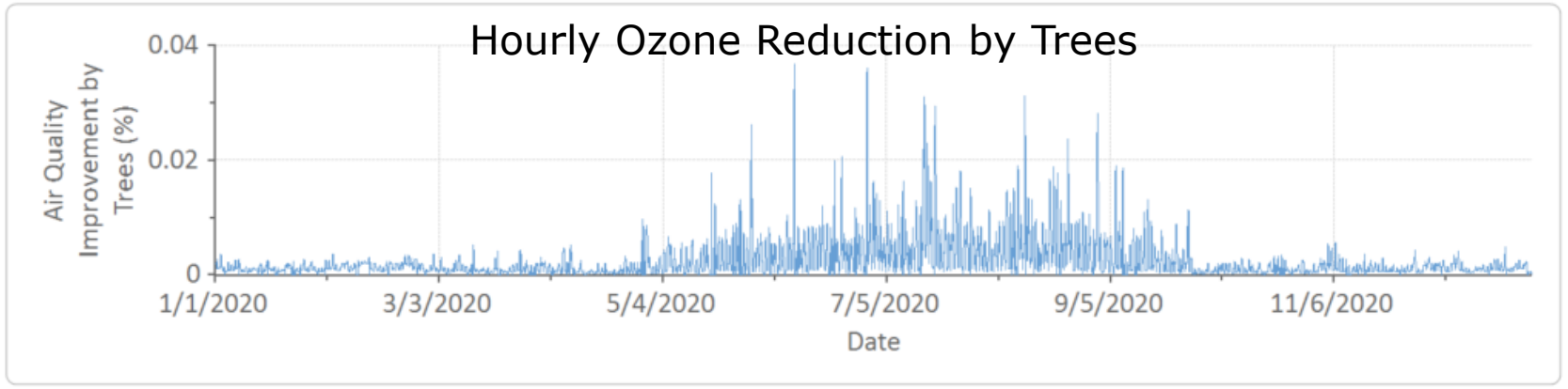
Tree count: 623

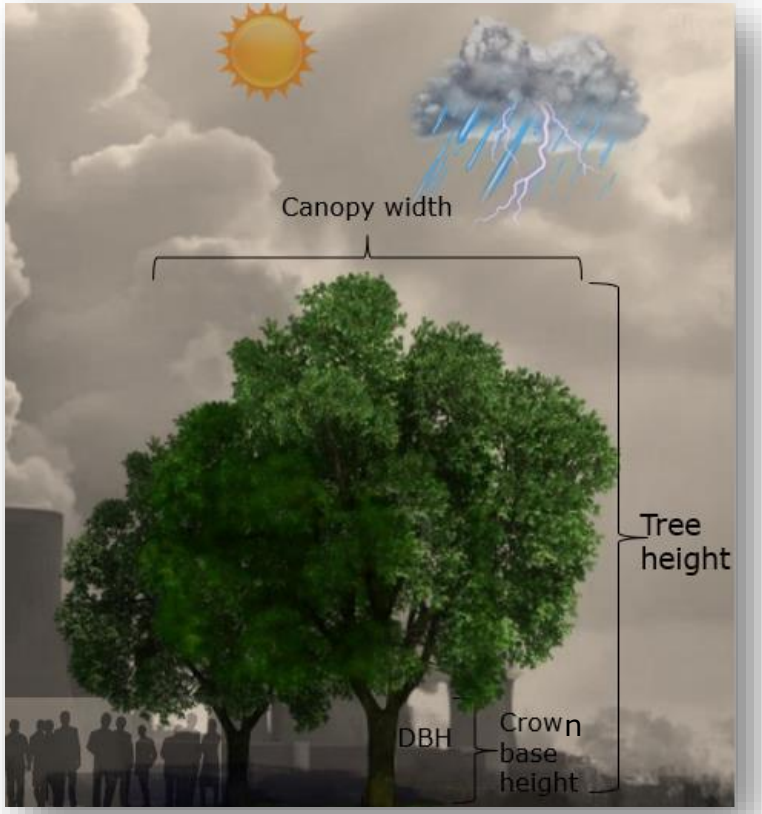
Leaf area: 40 acres

i-Tree Eco detailed results









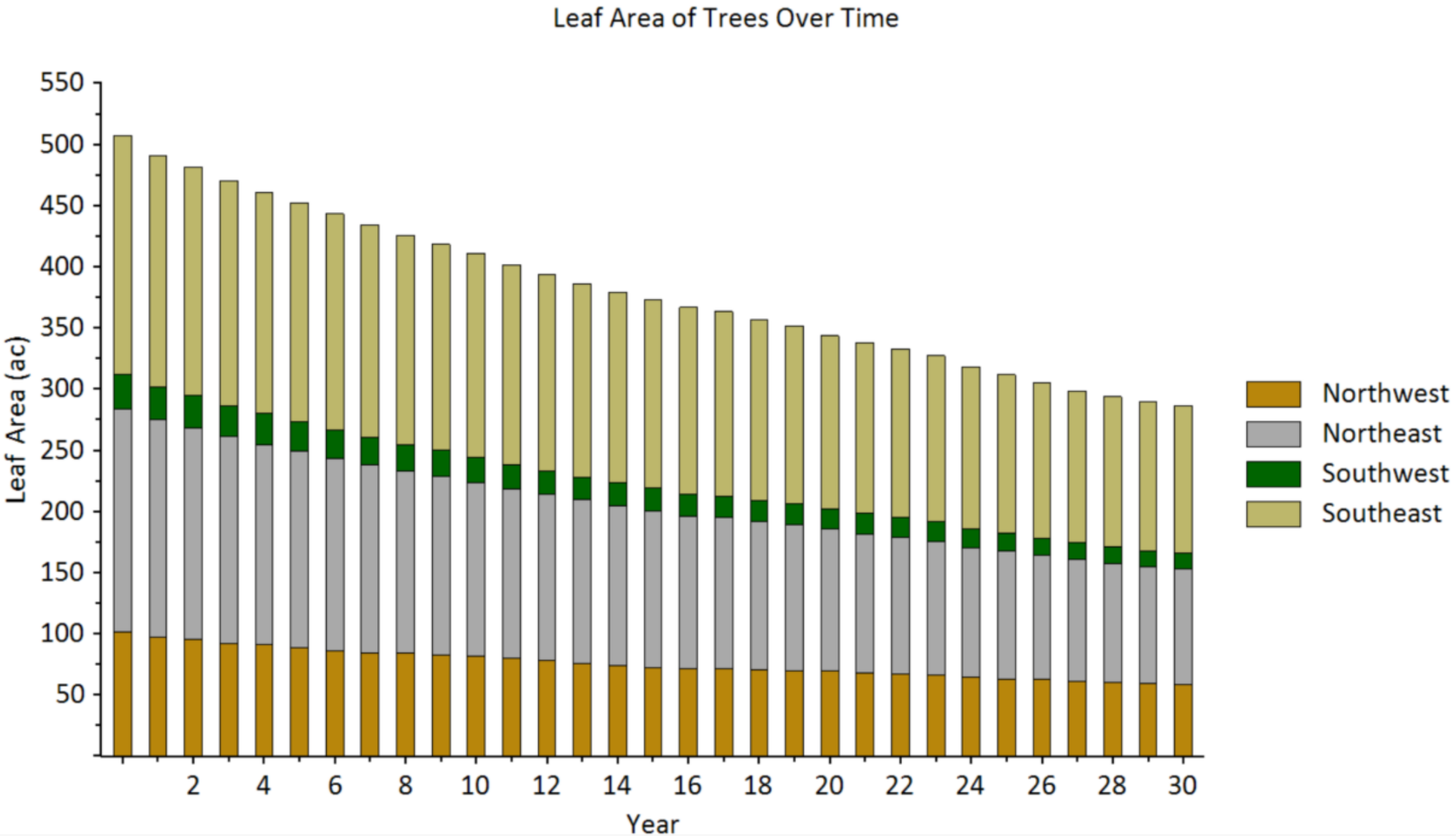
i-Tree Eco health

Air Quality Health Impacts and Values by Trees

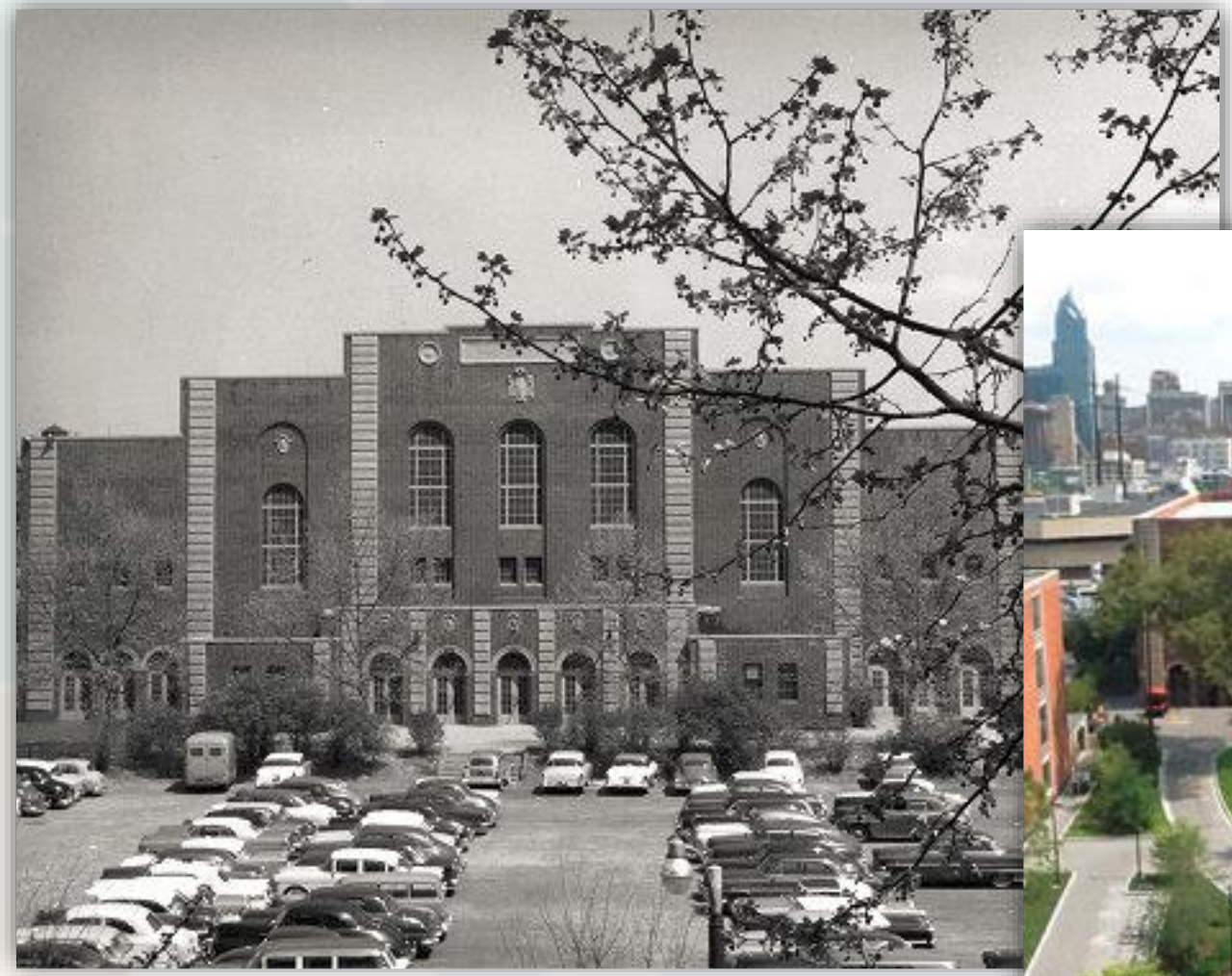
Location: Rochester, Olmsted, Minnesota, United States of America
Project: Rochester Street Trees, Series: 1, Year: 2023
Generated: 4/18/2023

Health Outcome	NO2 ($/yr)	O3 ($/yr)	PM2.5 ($/yr)	SO2 ($/yr)	All ($/yr)
Acute Bronchitis			0.05		0.05
Acute Myocardial			13.31		13.31
Acute Respiratory	0.99	77.97	28.87	0.17	108
Asthma Exacerbation	39.16		19.05	3.69	61.9
Chronic Bronchitis			72.41		72.41
Emergency Room Visits	0.10	0.13	0.10	0.05	0.38
Hospital Admissions	21.86	31.31		4.49	57.66
Hospital Admissions,			3.16		3.16
Hospital Admissions,			2.24		2.24
Lower Respiratory			0.34		0.34
Mortality		3153.14	5791.25		8944.39
School Loss Days		38.07			38.07
Upper Respiratory			0.25		0.25
Work Loss Days			8.95		8.95
Total	**62.10**	**3300.62**	**5939.98**	**8.41**	**9311.11**

i-Tree Eco Forecast



Results: Telling a story with data



"These six trees store 14,291 lbs of carbon and continue to sequester 470 lbs of carbon each year. For comparison, the 1,316 small trees between 1-4 inches DBH in this study store a combined total of 16,567 lbs of carbon"

From Corey Bassett, https://www.itreetools.org/documents/352/UPenn_iTreeEcoInventory.pdf

i-Tree Eco: Power of stratification

City owned parkland is **9%** of the city

Trees on city owned parkland account for **40%** of carbon storage and sequestration

Feature	Estimate
Number of trees	1,100,000
Tree Cover	64%
Carbon Storage	273,000 tons ($19.4 million)
Pollution Removal	179 tons/yr ($6.6 million/yr)

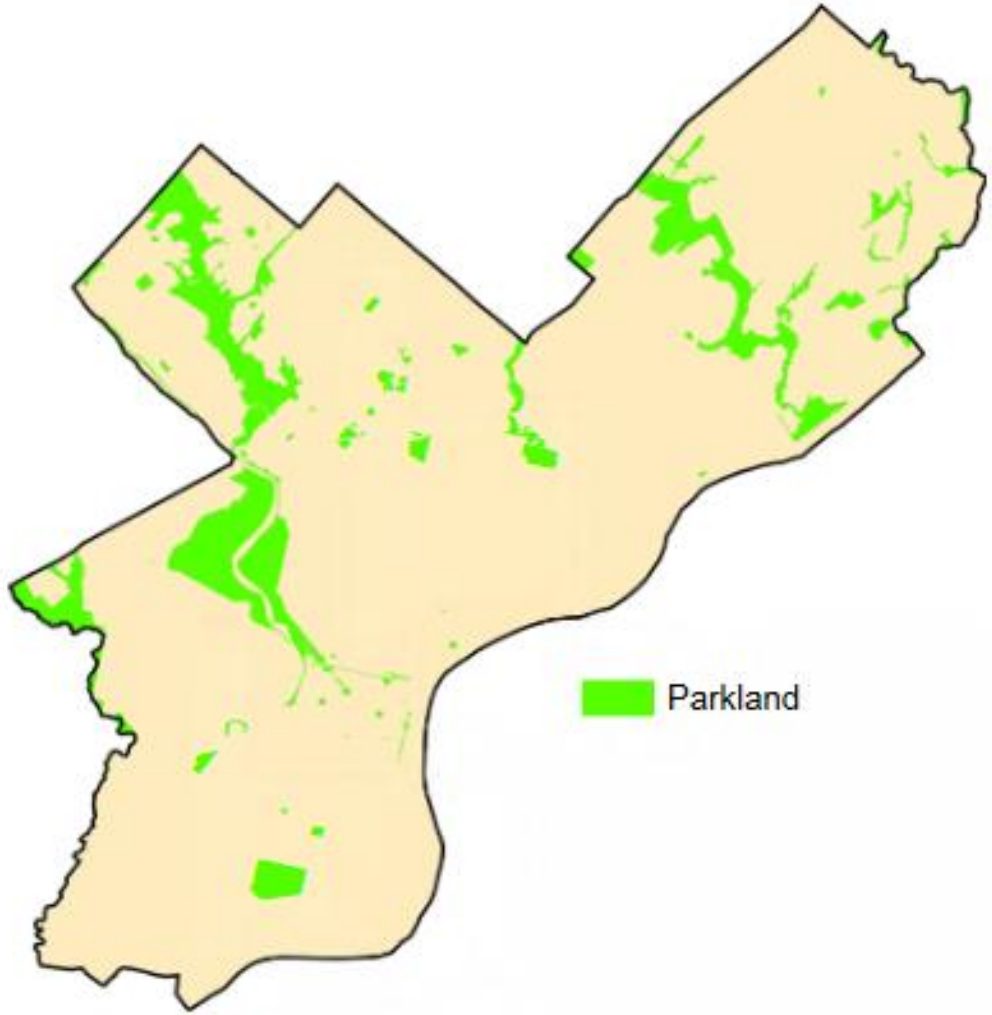
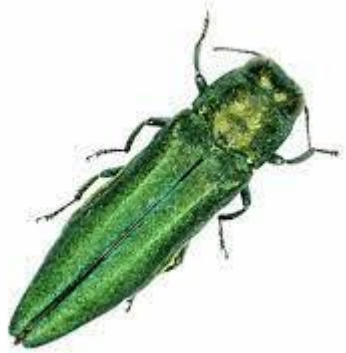


Figure 1.—Philadelphia city boundaries and designated parkland areas, 2012.

i-Tree Eco Example: Large project with targeted results

Ash Trees:
City stands to lose 7.1% of its forest and millions in benefits to emerald ash borer



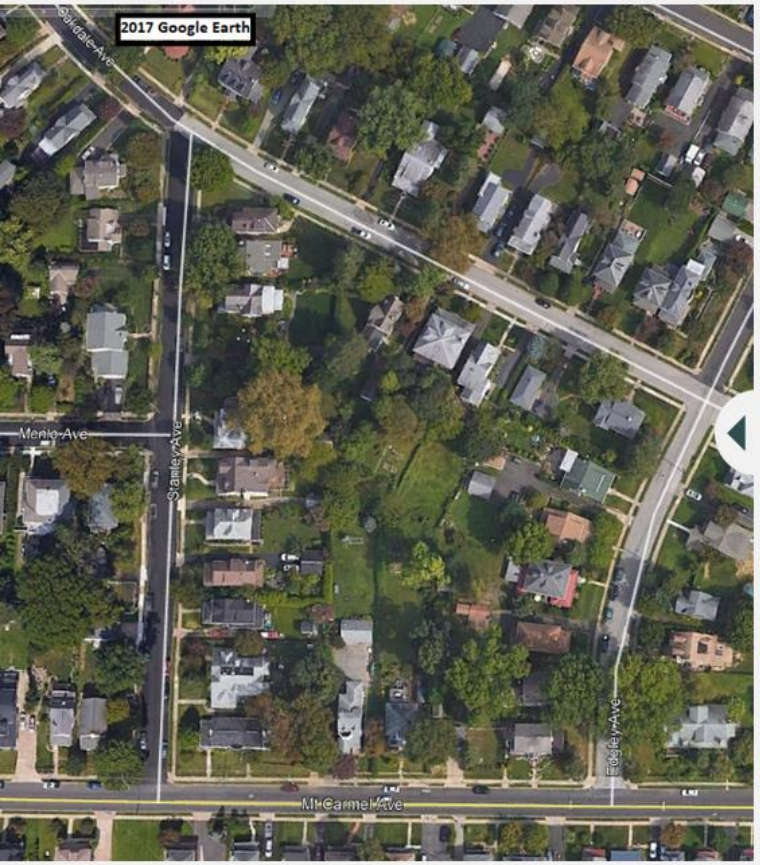
Parameter	Estimate	Units	% of Total City	Species Group Rank
Population	206,996	number	7.1	3
Density	2.3	trees/acre		3
Carbon stored	35,742	tons	5.1	7
Carbon sequestered	1,025	tons/year	3.8	11
Net carbon sequestered	935	tons/year	4.0	10
Leaf area	4,818	acres	5.2	7
Leaf biomass	1,936	tons	6.3	3
Trees, diameter 1-3 in.	111,777	number	54.0[a]	2
Trees, diameter >18 in.	10,557	number	5.1[a]	12

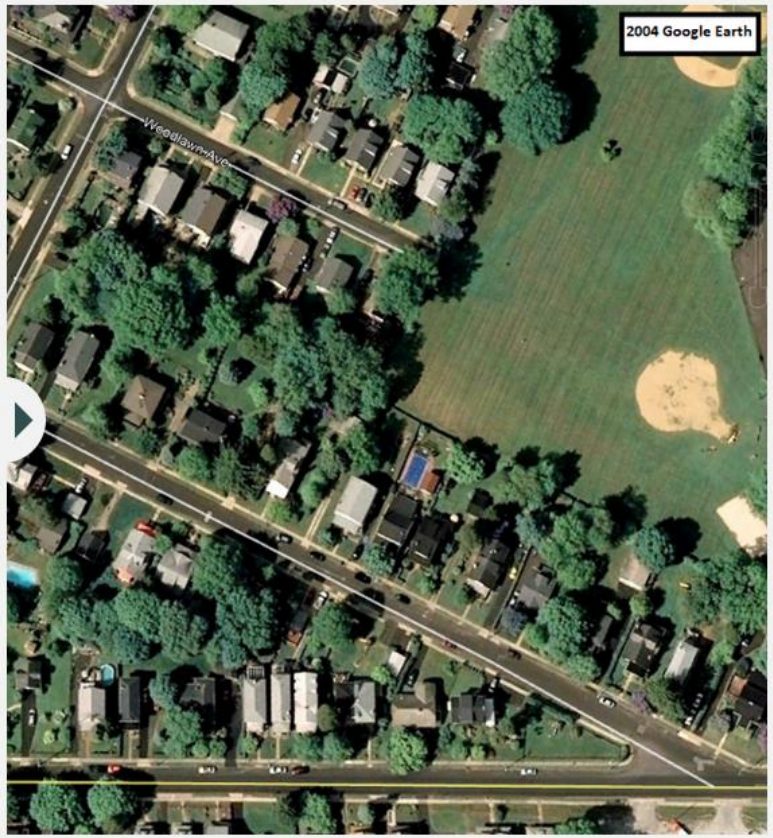
[a] Percent of all ash trees

i-Tree Eco: Small project with big value

Abington Township Montgomery County, PA

Introduction | Master Tree Action Plan | Abington's Urban Tree Canopy | A Closer Look | Tree Canopy Cover by Populatio... | Selected Land Uses | Summ →





Tree Size Matters. The neighborhood's large, mature shade trees have the most leaf area and provide the greatest benefits. **While trees 30" or greater in diameter make up only 8% of the population - their canopies make up 27% of the neighborhood's leaf area.** A comparison of the benefits of an 11" diameter Dogwood tree and a 30" diameter Maple tree growing in the neighborhood shows that the Maple provides nearly 8 times the ecosystem benefits as the Dogwood.

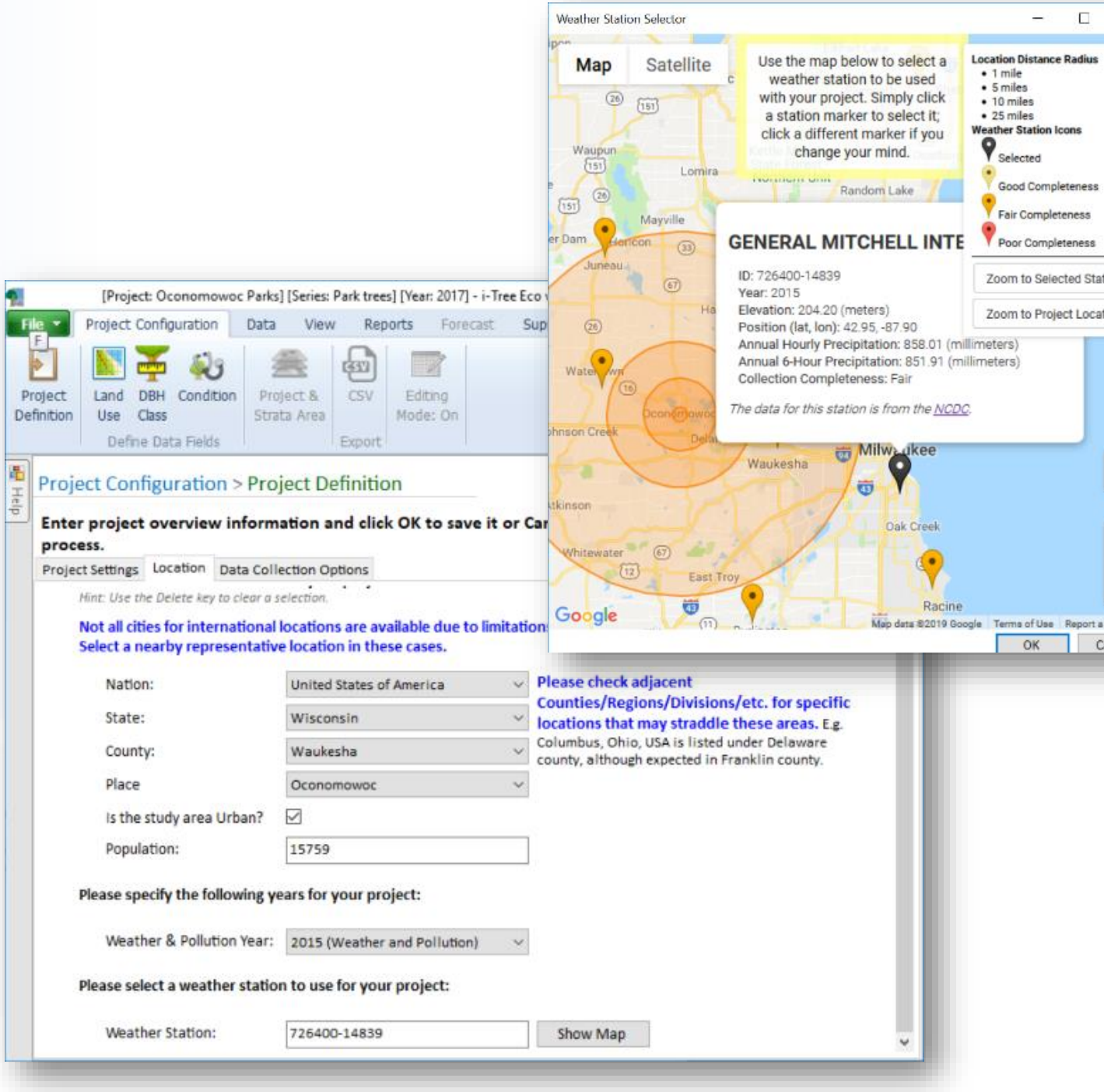
To maximize the benefits Abington's tree canopy provides - we should focus our private property efforts on preserving our existing large trees and planting species that will grow to be large shade trees to replace those we have lost or will lose in the future.

08 / 09

https://storymaps.arcgis.com/stories/ed7e547aeaed454ea5dd44c4b1be08c0

i-Tree Eco: Advantages

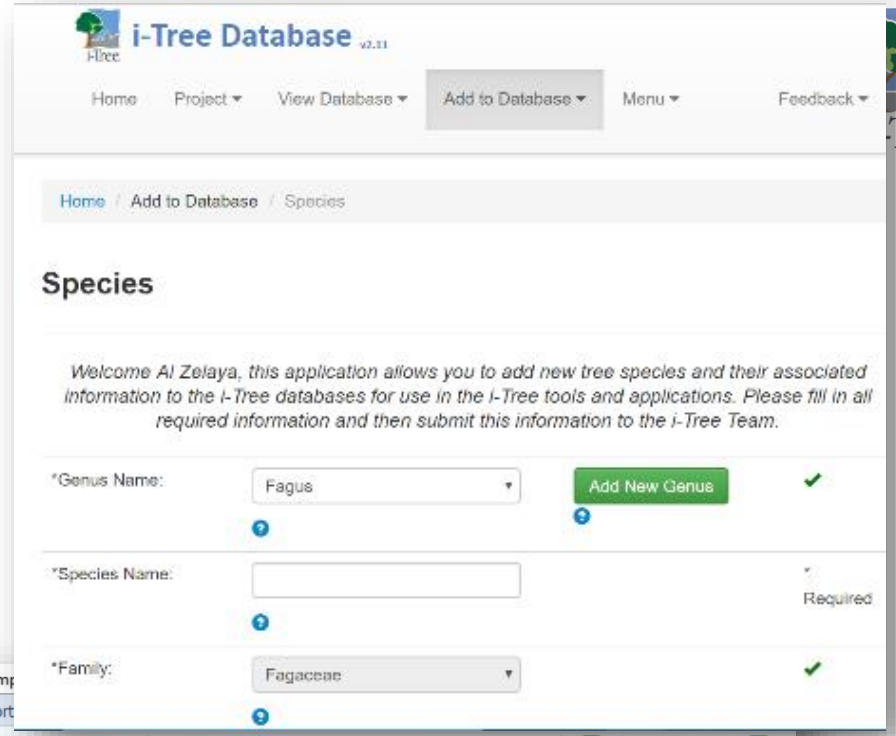
- **Local Modeling** – Eco uses available local hourly weather & pollution data and other local characteristics for modeling
- **Dynamic model** – constantly improved with new science, new international locations, new reports and functions
- **Flexible** data collection and project design maximize user base.
- The **Eco import** option is a great way to assess existing tree inventory data quickly

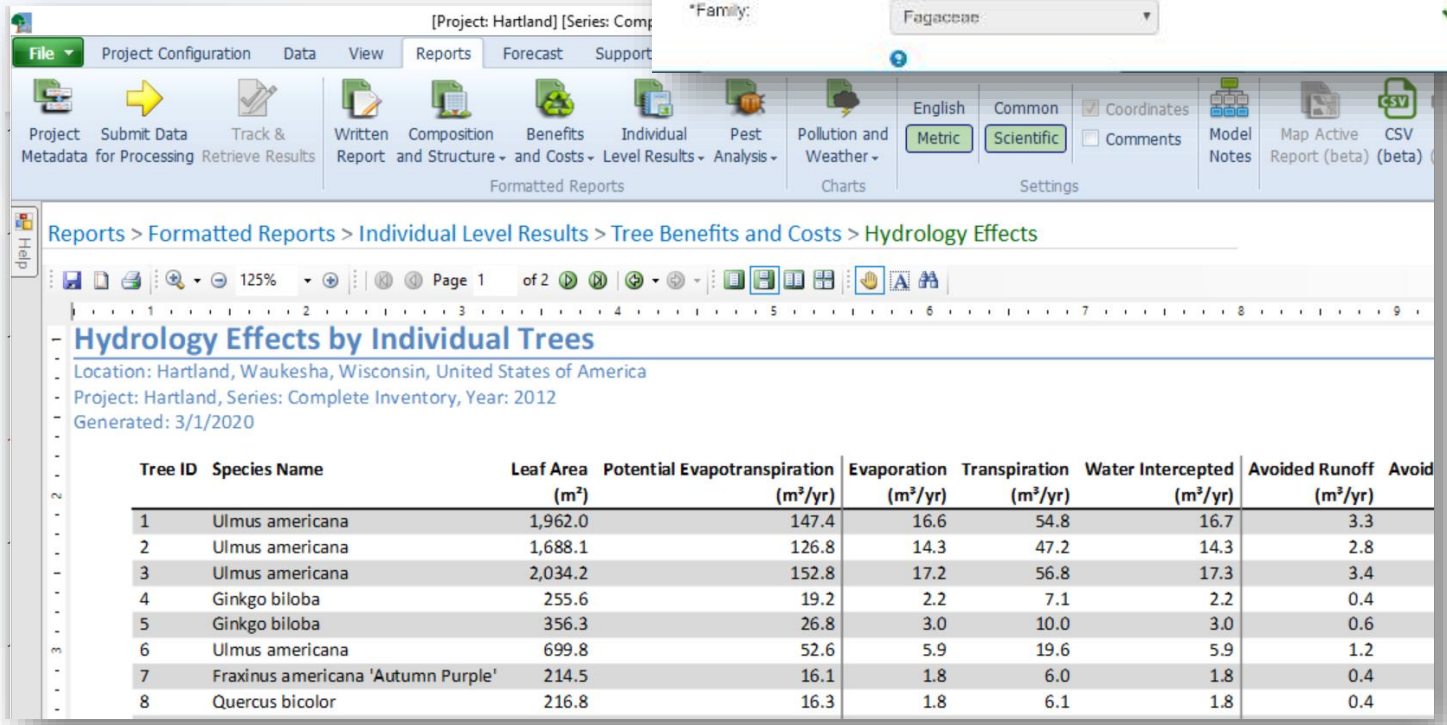


i-Tree Eco: Advantages

- **Options to improve** the model. e.g. users can submit new species, hourly rainfall data, biomass equations (i-Tree Database)

- **Flexible results** – Eco reports by species, strata, and individual tree to help with strategic decision making.





Tree ID	Species Name	Leaf Area (m²)	Potential Evapotranspiration (m³/yr)	Evaporation (m³/yr)	Transpiration (m³/yr)	Water Intercepted (m³/yr)	Avoided Runoff (m³/yr)	Avoid
1	Ulmus americana	1,962.0	147.4	16.6	54.8	16.7	3.3	
2	Ulmus americana	1,688.1	126.8	14.3	47.2	14.3	2.8	
3	Ulmus americana	2,034.2	152.8	17.2	56.8	17.3	3.4	
4	Ginkgo biloba	255.6	19.2	2.2	7.1	2.2	0.4	
5	Ginkgo biloba	356.3	26.8	3.0	10.0	3.0	0.6	
6	Ulmus americana	699.8	52.6	5.9	19.6	5.9	1.2	
7	Fraxinus americana 'Autumn Purple'	214.5	16.1	1.8	6.0	1.8	0.4	
8	Quercus bicolor	216.8	16.3	1.8	6.1	1.8	0.4	

Use i-Tree Eco …

… when you have existing data.

… when you have resources for a large-scale project.

… if you can make good use of the wealth of results.

… to support management.

… when interested in a plot-based sample.

… for centralized project management.

Try another i-Tree tool …

… when working with students or the public.

… to show that trees have benefits.

… when time is limited.

… to start conversations on trees and tree benefits.

… when you are interested in canopy cover.

… for priority planning.

i-Tree Eco is flexible

Test your decisions with a pilot project!

A pilot project is a small project designed using the set-up you are considering for a larger project.

- Test assumptions and methods
- Evaluate challenges and limitations
- Can be expanded to become your target project