Getting Started with i-Tree Eco

International i-Tree Academy Session 4

Plan for today

- i-Tree Eco model basics
- Tree variables, project options, and pilot projects
- i-Tree Eco Application orientation

-Break-

- i-Tree Eco project Set-up
- Pilot project discussion

There are many i-Tree Eco learning resources

i-Tree Tool Videos

i-Tree Eco v6

What's New in i-Tree Eco v6 - Highlights

1. Eco v6 highlights and overview - 5 min. - This YouTube video highlights new features and options available in the new i-Tree Eco v6 application.

How to convert an existing Eco v5 project to Eco v6

1. Converting Ecov5 to v6 project - 6 min. - This YouTube video describes how to update an existing Eco v5 project to use in Eco v6.

Importing inventory data into i-Tree Eco v6

1. Importing external inventory data into Eco v6 - 8 min. - YouTube video instructions for setting up an Eco v6 inventory project and importing in external data.

Creating an i-Tree Eco v6 sample project

1. Eco v6 sample project creation - 8 min. - This YouTube video demonstrates the steps to create a plot-based sample project using the new i-Tree Eco v6 application.

Creating an i-Tree Eco v6 complete inventory project

1. Eco v6 complete inventory project creation - 11 min. - This YouTube video demonstrates the steps to create a complete inventory project using the new i-Tree Eco v6 application.

Eco Plot Establishment

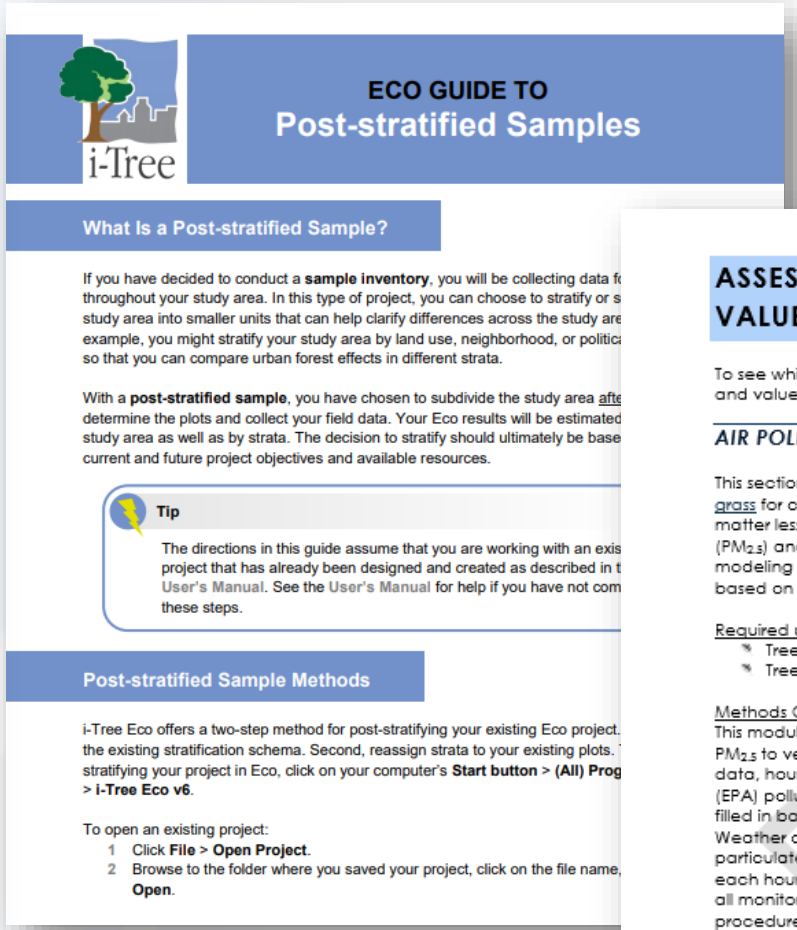
1. Basic Eco sample plot establishment - 2 min. - This video demonstrates how to lay out a simple 1/10 acre plot for an Eco sample project.
2. Eco wooded plot establishment - 3 min. - This video demonstrates how to lay out an Eco sample plot partially in a wooded area.
3. Measuring plot reference object - 2 min. - This video demonstrates how to measure a reference or permanent object from an established eco plot center.

Eco Tree Measurements

1. i-Tree Eco - Basic tree height measurements - 9 min. - This video explains how to measure total tree height, height to live top, and height to crown base measurements for an Eco project.
2. Simple tree DBH measurement - 2 min. - This video demonstrates how to measure a single stem tree (DBH) diameter at breast height.

Using the i-Tree Eco v6 Mobile Data Collection (MDC) system

1. Mobile Data Collection part 1 - How To Submit A Project To A Mobile Device - 5 min. - In this video there are instructions concerning how to submit i-Tree Eco inventory and plot based



i-Tree

ECO GUIDE TO
Post-stratified Samples

What Is a Post-stratified Sample?

If you have decided to conduct a **sample inventory**, you will be collecting data f throughout your study area. In this type of project, you can choose to stratify or s study area into smaller units that can help clarify differences across the study are example, you might stratify your study area by land use, neighborhood, or politica so that you can compare urban forest effects in different strata.

With a **post-stratified sample**, you have chosen to subdivide the study area afte determine the plots and collect your field data. Your Eco results will be estimated study area as well as by strata. The decision to stratify should ultimately be base current and future project objectives and available resources.

Tip

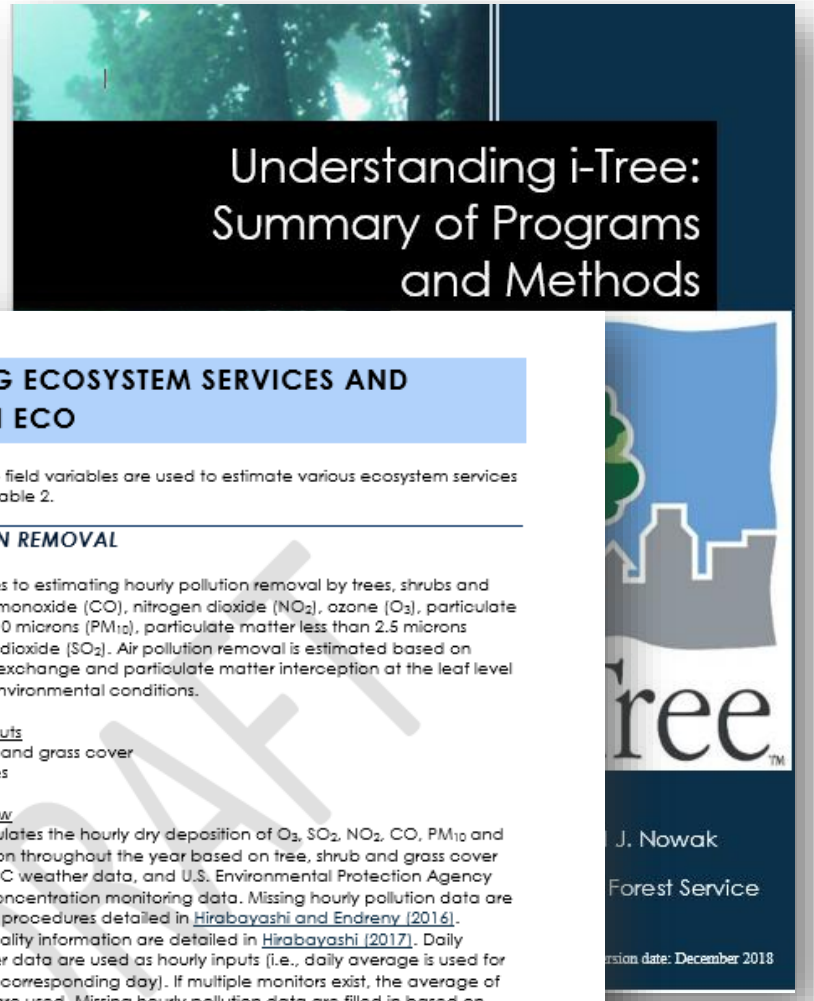
The directions in this guide assume that you are working with an exis project that has already been designed and created as described in t User's Manual. See the User's Manual for help if you have not com these steps.

Post-stratified Sample Methods

i-Tree Eco offers a two-step method for post-stratifying your existing Eco project. the existing stratification schema. Second, reassign strata to your existing plots. stratifying your project in Eco, click on your computer's **Start button > (All) Prog > i-Tree Eco v6**.

To open an existing project:

1 Click **File > Open Project**.
2 Browse to the folder where you saved your project, click on the file name, **Open**.



Understanding i-Tree:
Summary of Programs
and Methods

J. Nowak
Forest Service
ersion date: December 2018

ASSESSING ECOSYSTEM SERVICES AND VALUES IN ECO

To see which tree field variables are used to estimate various ecosystem services and values, see Table 2.

AIR POLLUTION REMOVAL

This section relates to estimating hourly pollution removal by trees, shrubs and grass for carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$) and sulfur dioxide (SO_2). Air pollution removal is estimated based on modeling of gas exchange and particulate matter interception at the leaf level based on local environmental conditions.

Required user inputs
- Tree, shrub and grass cover
- Tree species

Methods Overview
This module calculates the hourly dry deposition of O_3, SO_2, NO_2, CO, PM_{10} and $PM_{2.5}$ to vegetation throughout the year based on tree, shrub and grass cover data, hourly NCDC weather data, and U.S. Environmental Protection Agency (EPA) pollution-concentration monitoring data. Missing hourly pollution data are filled in based on procedures detailed in Hirabayashi and Endreny (2016). Weather data quality information are detailed in Hirabayashi (2017). Daily particulate matter data are used as hourly inputs (i.e., daily average is used for each hour of the corresponding day). If multiple monitors exist, the average of all monitor data are used. Missing hourly pollution data are filled in based on procedures detailed in Hirabayashi and Kroll (2017).
Pollution removal or downward pollutant flux (F; in $g/m^2/s$) is calculated as the product of the deposition velocity (V_d; in m/s) and the pollutant concentration (C; in g/m^3):

$$F = V_d C$$

Deposition velocity is calculated as the inverse of the sum of the aerodynamic (R_a), quasi-laminar boundary layer (R_b) and canopy (R_c) resistances (Baldocchi et al. 1987).

$$V_d = 1/(R_a + R_b + R_c)$$

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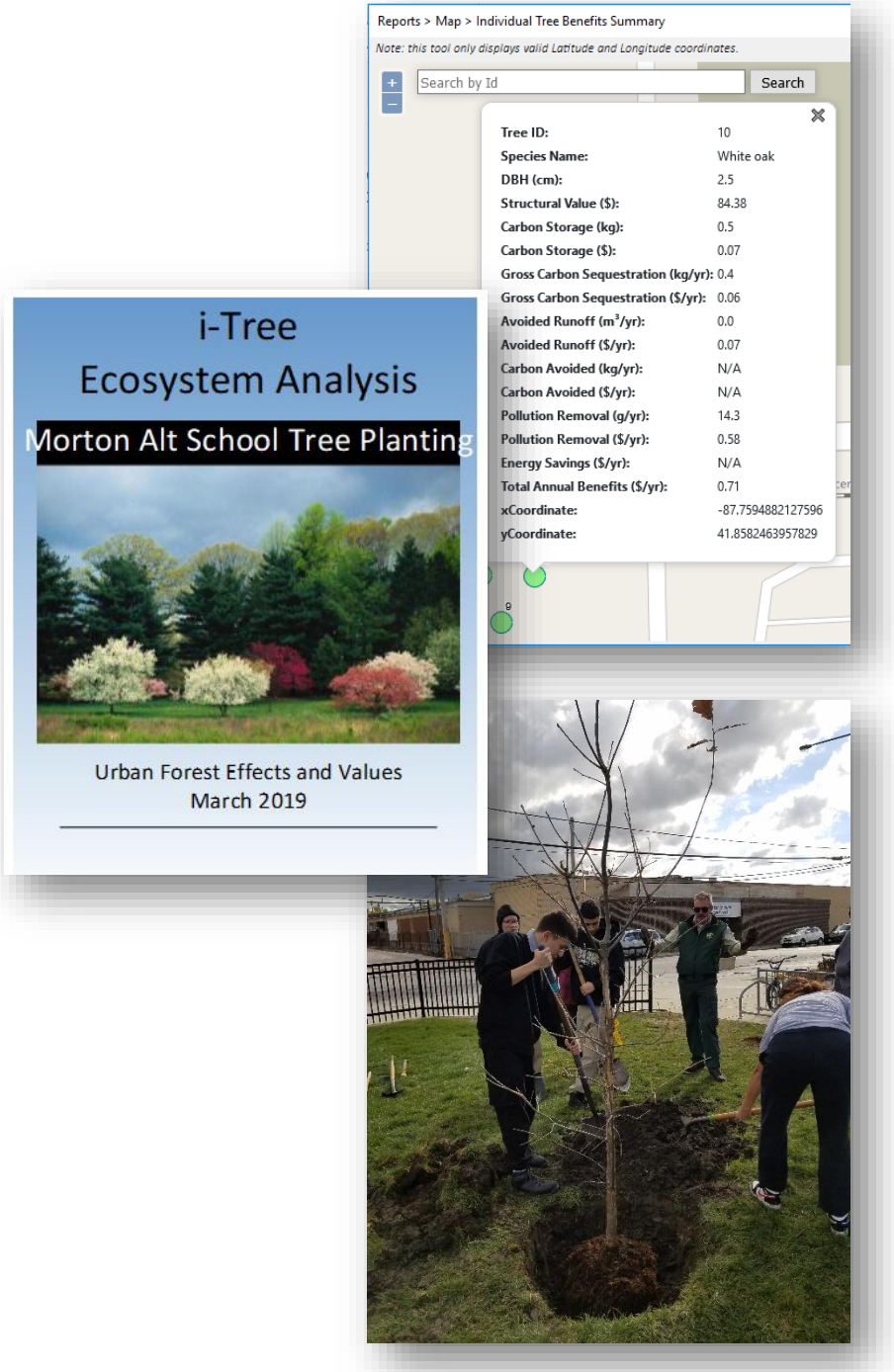
https://www.itreetools.org/support/resources-overview/i-tree-methods-and-files

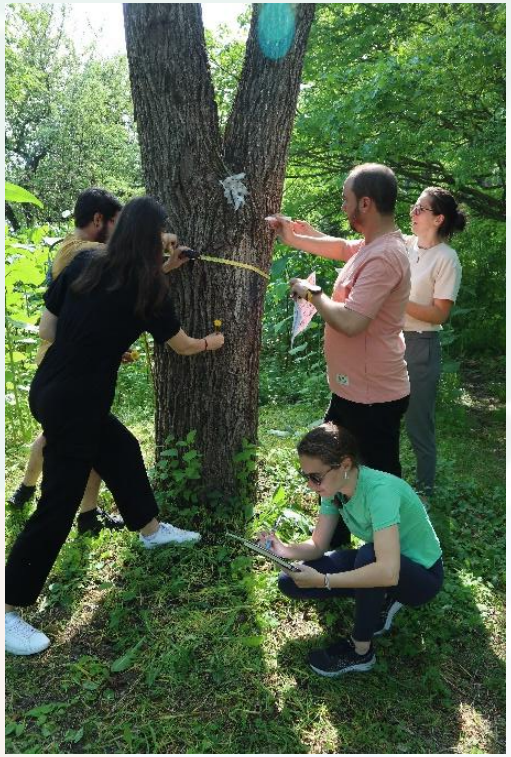
Setting up for success

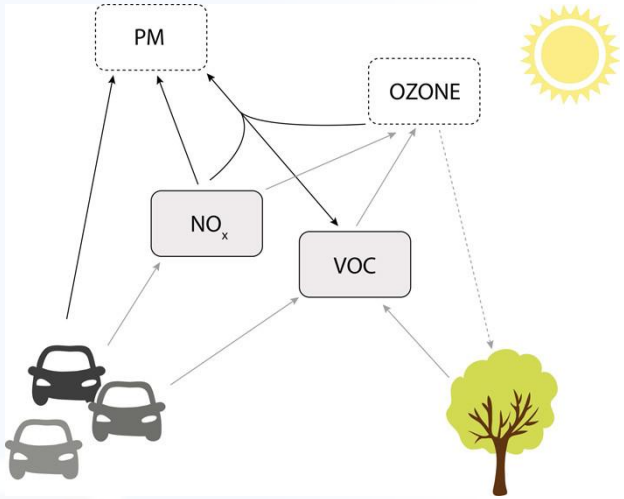
- Take time for a pilot project
- Determine your goals
- What resources do you have, or can you get? (time, equipment, staff…)
- Where will you conduct your project? What are the boundaries or limits?
- What are my end products?
- Who can I partner with to access greater resources and make more of an impact?



The i-Tree Framework

Structure → Function → Value

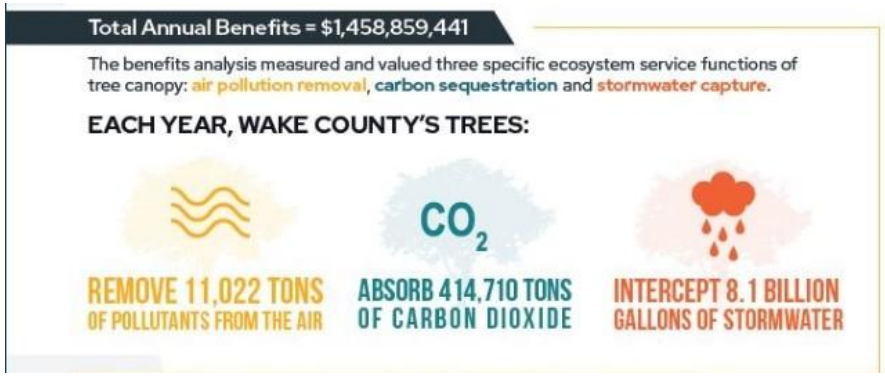




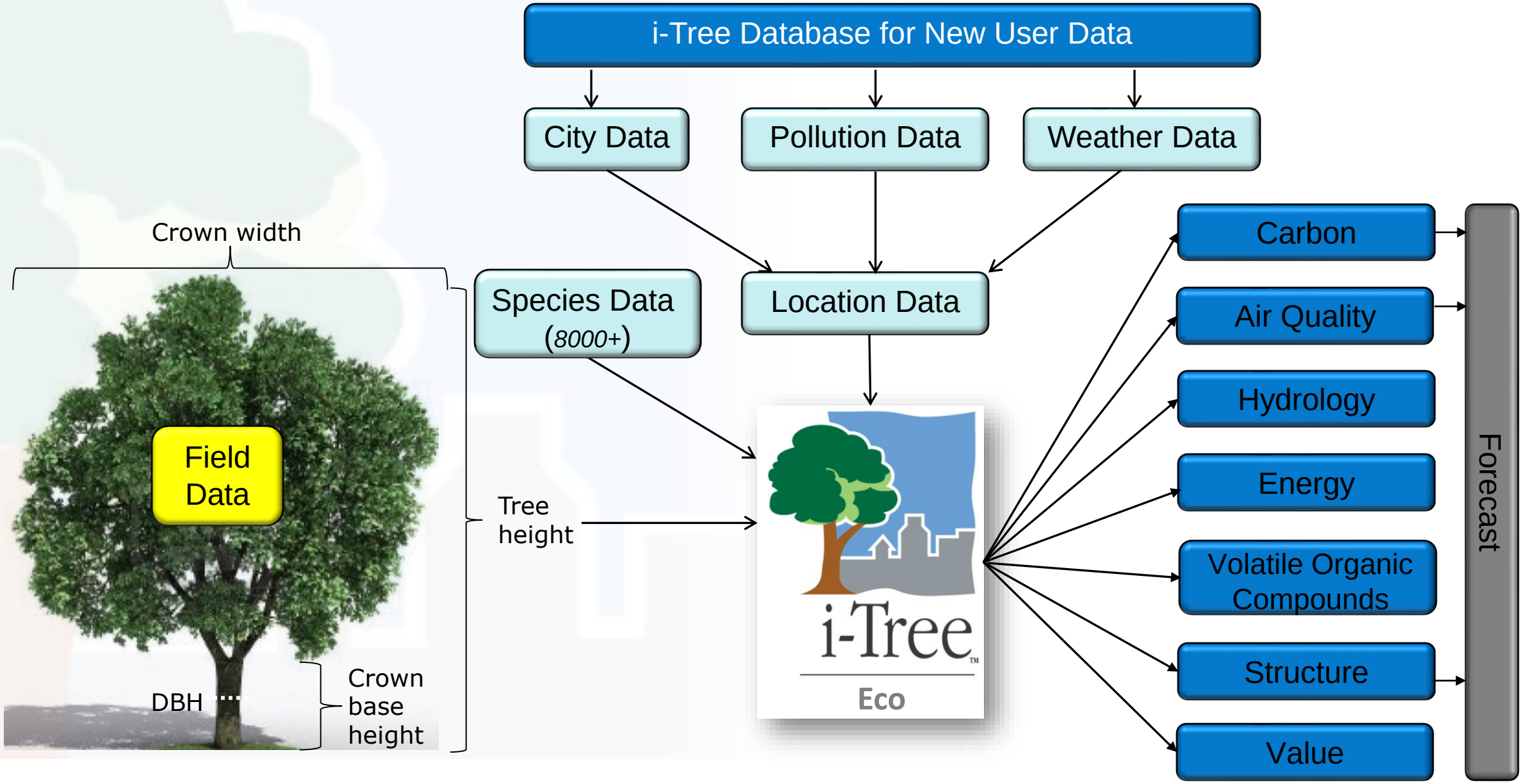
Annual Tree Benefits for Baltimore, MD

Sequestering carbon as wood in trees counteracts the CO_2 emissions of 7,387 gasoline powered passenger cars.

The filtration and removal of air pollution by the leaves of trees is estimated to reduce acute respiratory symptoms and exacerbated asthma by 1009 incidents. This also prevents the loss of 124 school day(s) and 20 work day(s).



i-Tree Eco Model Basics

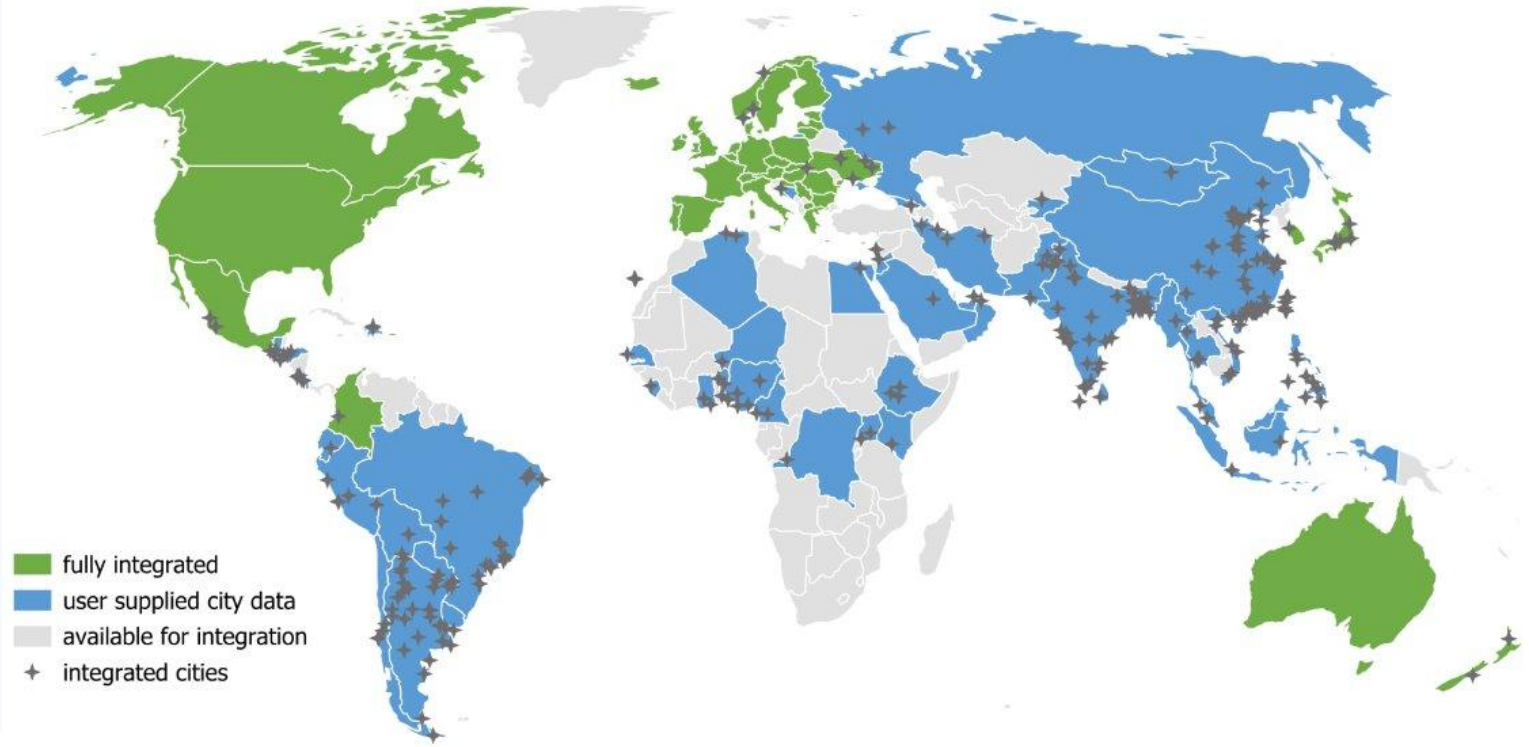


https://www.itreetools.org/support/resources-overview/i-tree-methods-and-files

International considerations

Are the models accurate?

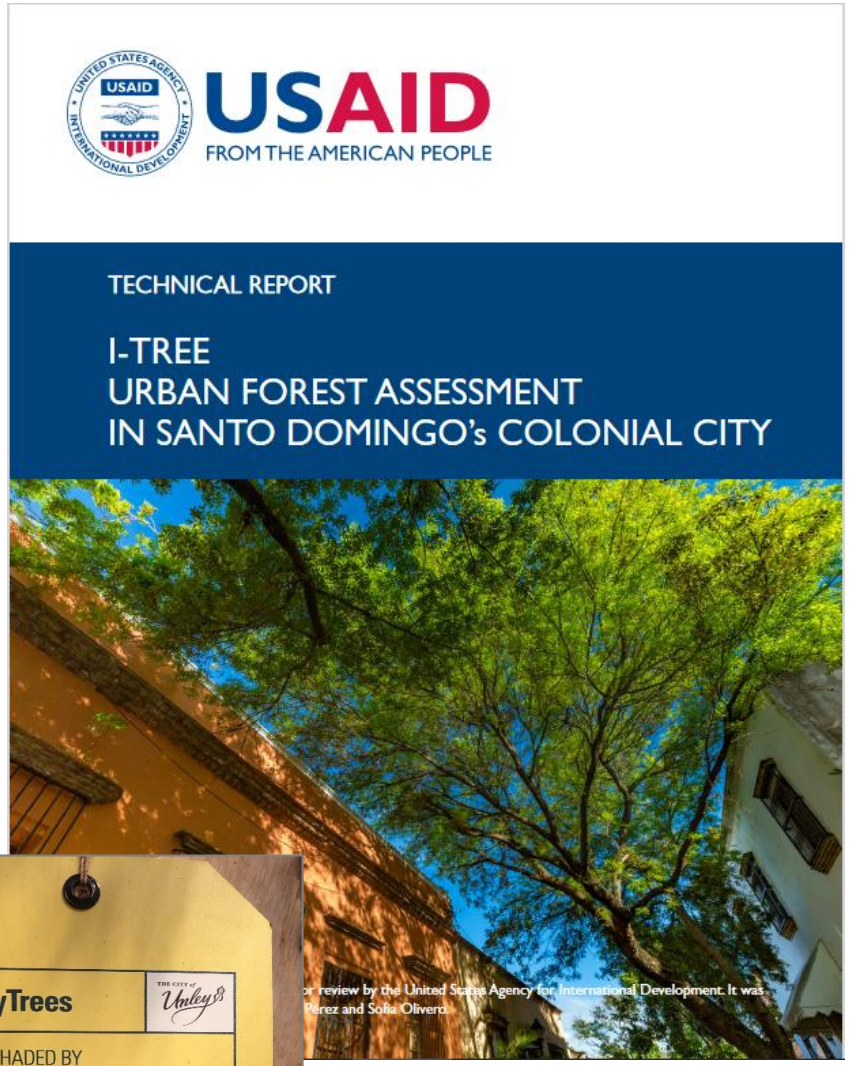
- Tree structure assessments applicable everywhere
- Ecosystem services
  - Carbon – species specific equations
  - Precipitation and pollution – depends on completeness of available data
  - Energy – based on US building types and energy production
- Monetary values
  - Can convert to local currency
  - Mostly relies on US models



Key decision points with i-Tree Eco

- Complete inventory or plot sampling project?
- What data fields will I collect (simple to complex)?
- Will I stratify?
- How will I collect data?
- Do I need to use i-Tree Database?

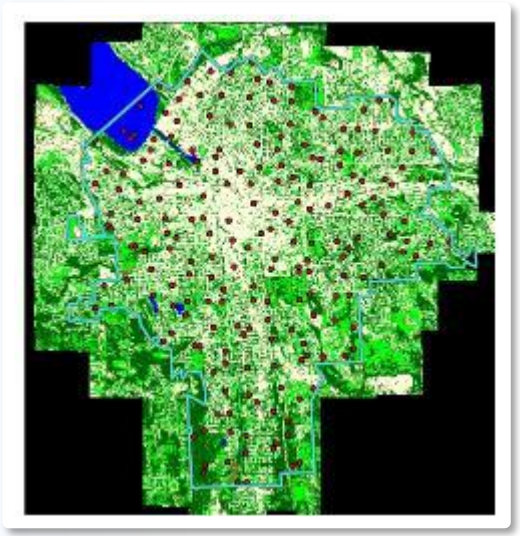
How will you use your i-Tree Eco results?

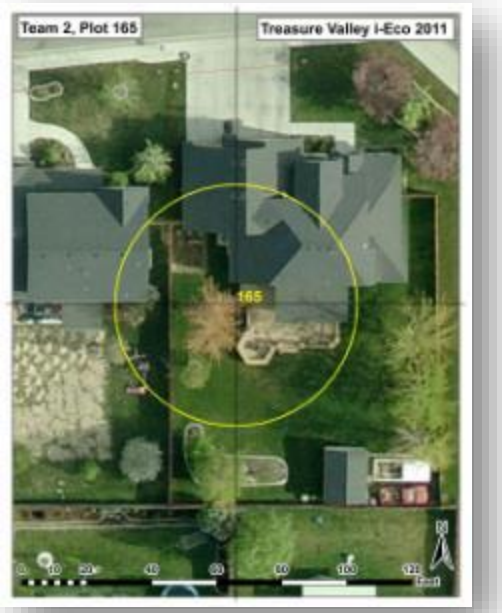


Key decisions: sample or complete inventory

Sample plots (0.0405ha or 11.4m radius)

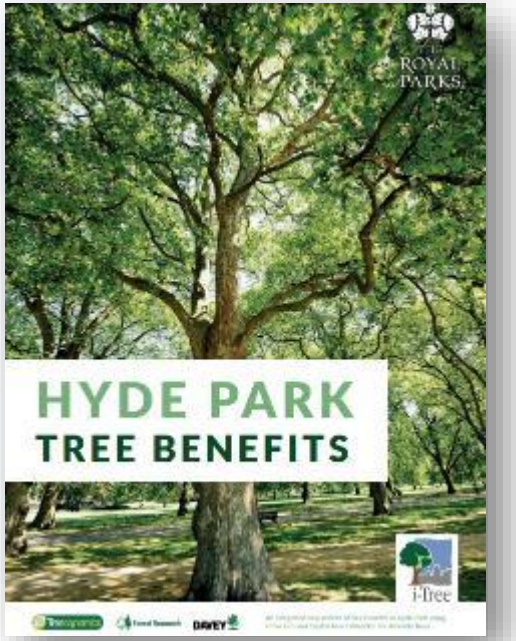
- City
- Region or watershed
- Large scale





Complete inventory

- Parks
- Campuses
- Residential properties
- Specimen or single trees
- Can import other tree data into Eco for analysis



Sample Plots vs. Complete Inventory

Characteristic	Sample	Complete
Recommended area	City or larger	Any
Number of plots	200 or more	none
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 associated with each tree

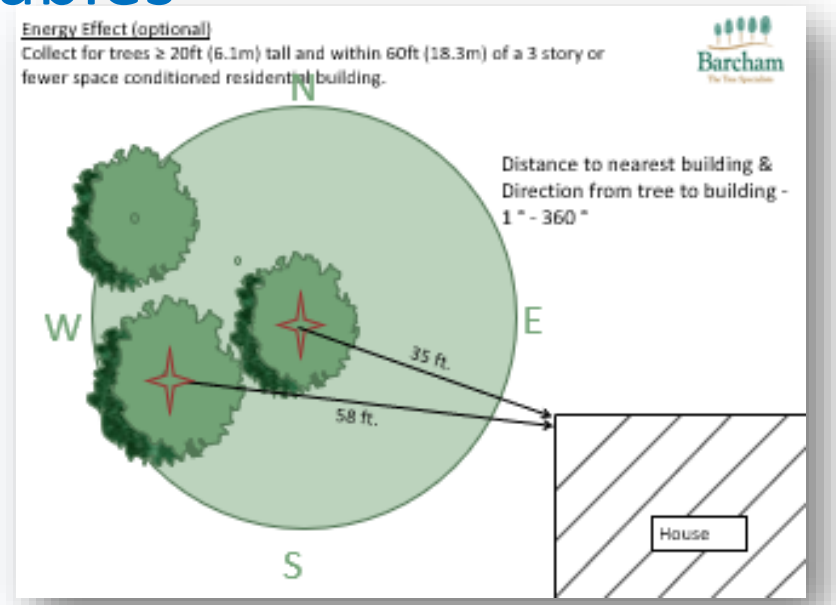
Key Decision: Eco tree data variables

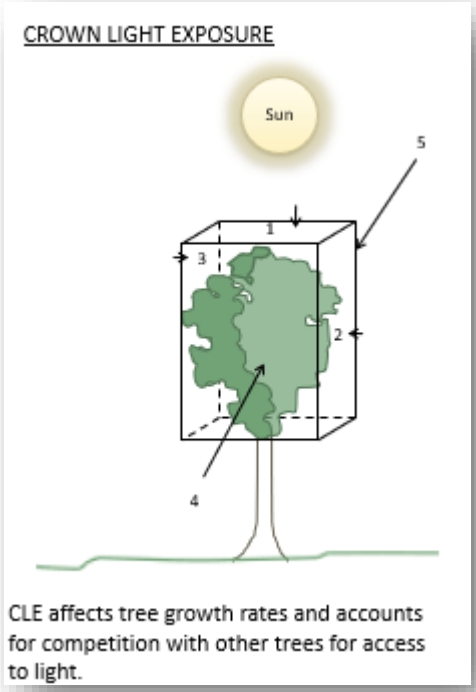
Minimum Required Tree Data

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 & E-W)
7. % Crown missing
8. % dieback (condition)
9. Crown light exposure (CLE)
10. Direction to building (Energy effect)
11. Distance to building (Energy effect)
12. Land use





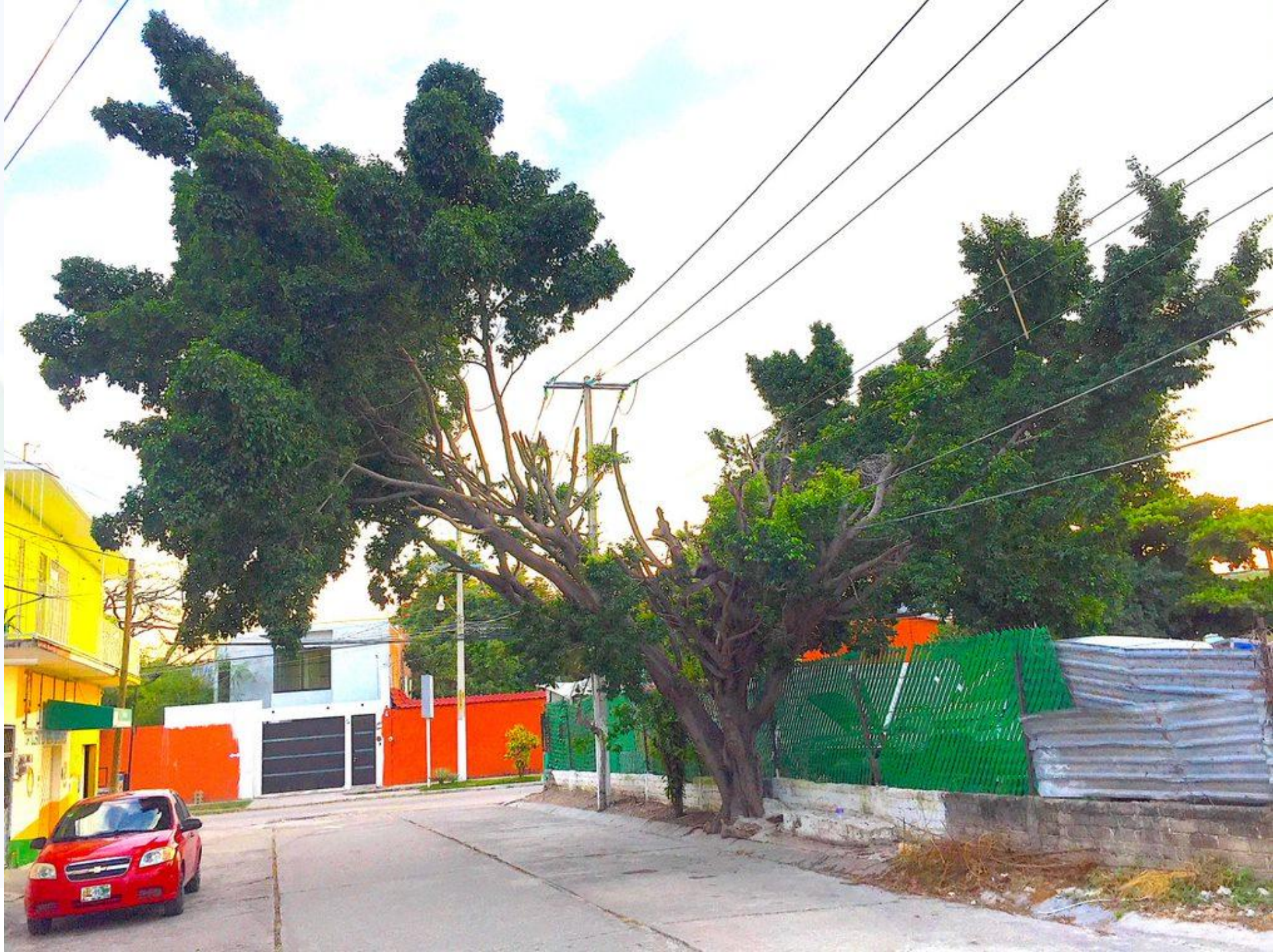
Eco defaults & methods for data not measured

A = air pollution removal; C = carbon sequestration/storage; E = energy effects; F = Forecast, R = avoided runoff; S = structural or compensatory value; V = volatile organic compound emissions; W = wildlife suitability

- Actual land use – defaults to residential (C, S, W)
- Total tree height – predicted from a regression equation (A, C, E, F, R, V, W)
- Height to live top – assumed to be the same as total height
- Height to crown base – predicted from a regression equation (A, R, V)
- Crown width – predicted from a regression equation (A, R, V)
- Percent crown missing – assumed to be 13% crown missing (A, E, R, V)
- Crown health – assumed to be 13% dieback (87% condition) (C, F, S, W)
- Crown light exposure – defaults to class 2-3 (C, F)

http://www.itreetools.org/resources/manuals/Ecov6_ManualsGuides/Ecov6Guide_DataLimitations.pdf

Trees don’t know the i-Tree Eco protocol



Eco tree data variable relationships

	DIRECT FIELD MEASURES	DERIVED VARIABLES: Leaf Area	DERIVED VARIABLES: Leaf Biomass	ECOSYSTEM SERVICES: Carbon Storage	Gross Carbon Sequestration	Net Carbon Sequestration	Energy Effects	Air Pollution Removal	Avoided Runoff	Transpiration	VOC Emissions	Compensatory Value
Tree Variables	Species	D	D	D	D	D	D	I	I	I	D	D
	Diameter at breast height (DBH)			D	D	D						D
	Total height	D	D	D	D	D	D	I	I	I	I	
	Crown base height	D	D	C				I	I	I	I	
	Crown width	D	D	C				I	I	I	I	
	Crown light exposure (CLE)			D	D	D						
	Percent crown missing	D	D	C			D	I	I	I	I	
	Condition (crown dieback)				D	D						D
Plot Variables	Field land use											D
	Distance to building						D					
	Direction to building						D					
	Percent tree cover						D	D	D			
	Percent building cover						D					

D	Directly used
I	Indirectly used
C	Conditionally used

Data Variables - Ecosystem Services Relationships descriptions
https://www.itreetools.org/eco/resources/v6/Ecov6_data_variables_ES_relationships.pdf

Key Decision: mobile or manual data entry

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: _____

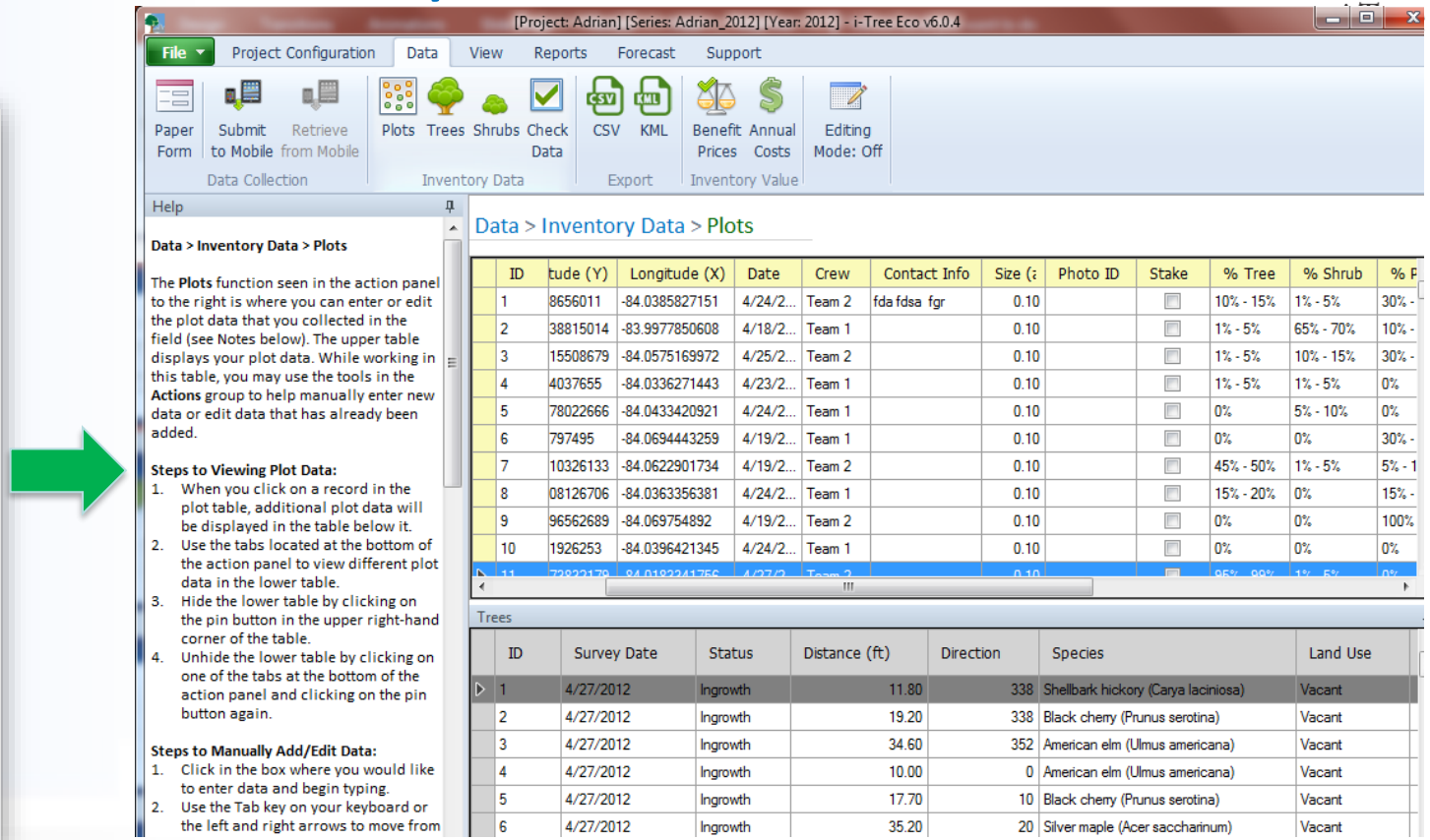
Phone #: _____ Email: _____

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) _____

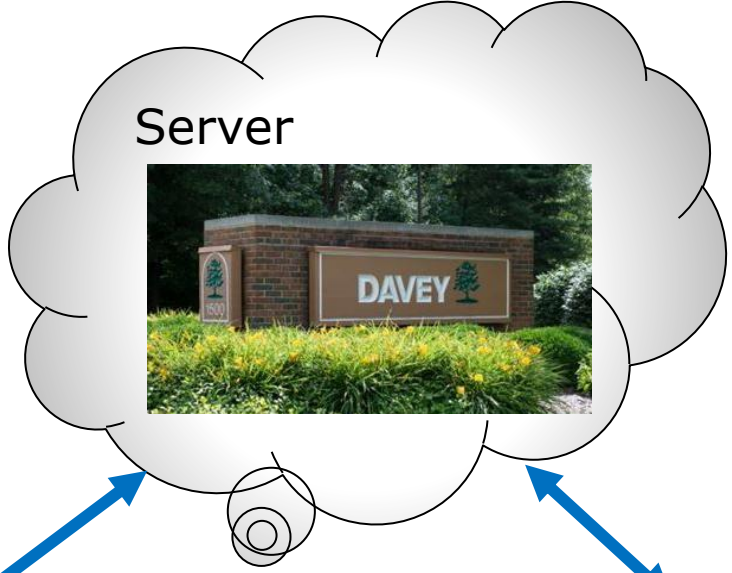
Photo ID(s):

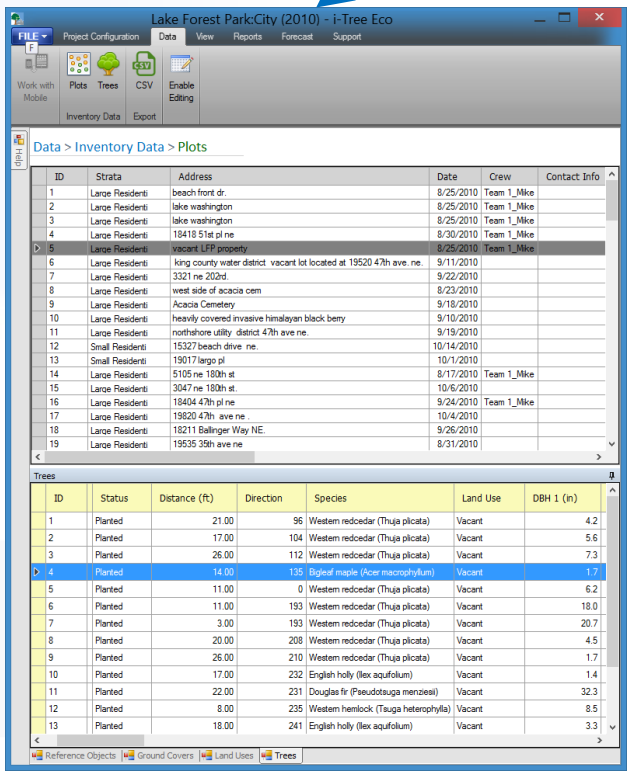


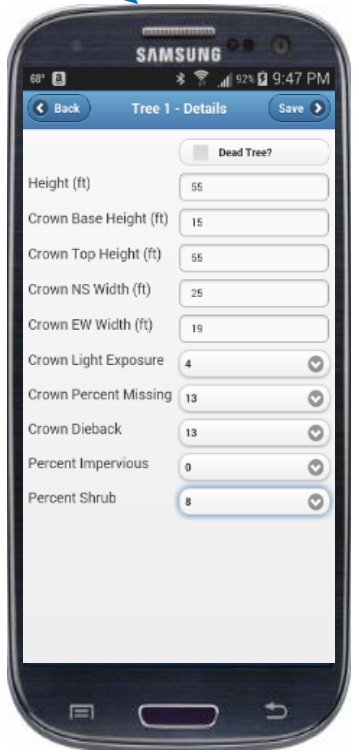
Manual data entry:
Collect on paper then directly enter in the i-Tree Eco interface

Data entry: mobile or manual

- Web-enabled mobile device or paper
- Measure required & optional variables
- Run data in model to obtain results







Data entry: mobile or manual

Mobile

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

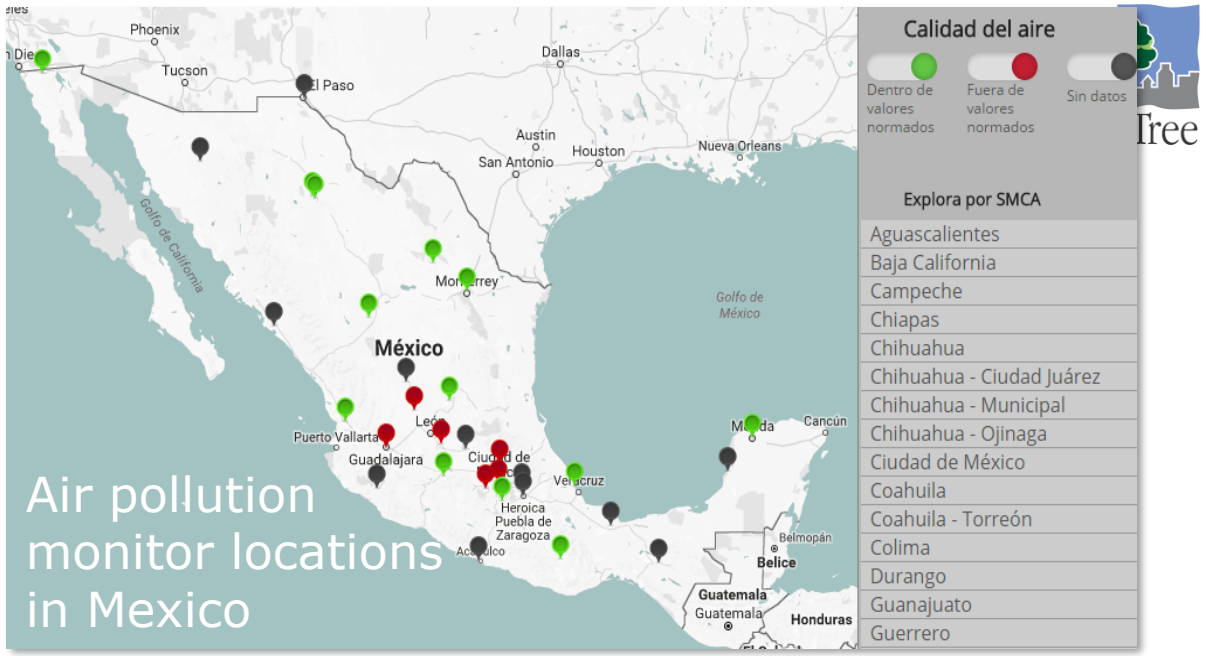
Paper

- Permanent record
- Fewer potential issues
- Transcription errors
- Can use in conjunction with mobile for distributed data entry

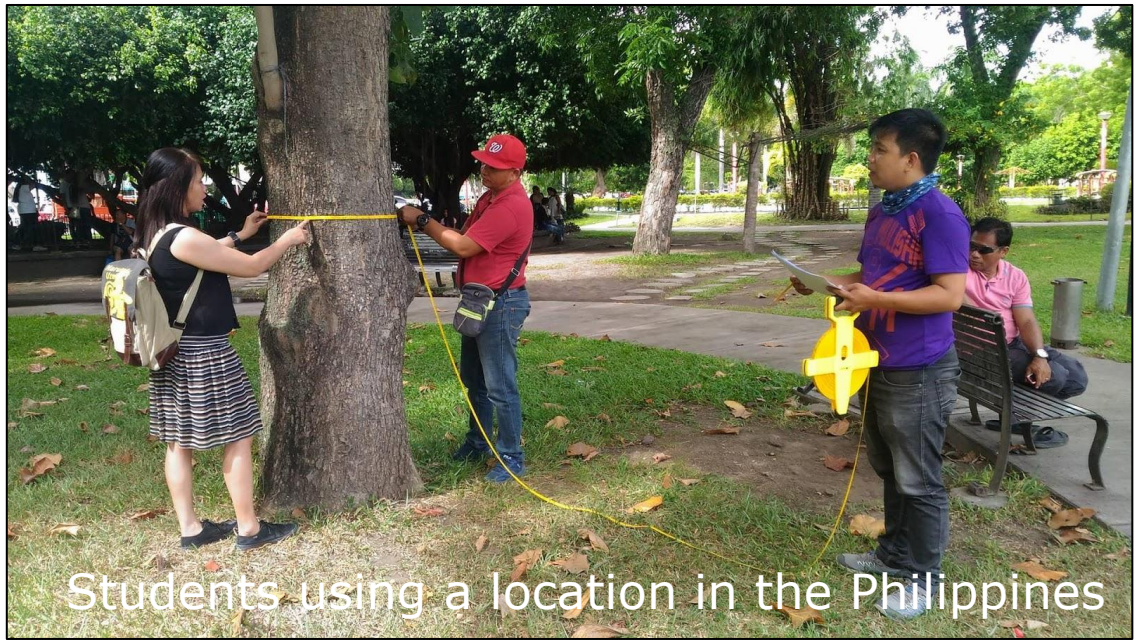
Key Decision – Do you need to use i-Tree Datbase?

Is your location in Eco?

- Fully integrated
- Supplied through i-Tree Database
  - Location only
  - Precipitation
  - Pollution
- Is there a similar location in i-Tree Eco?



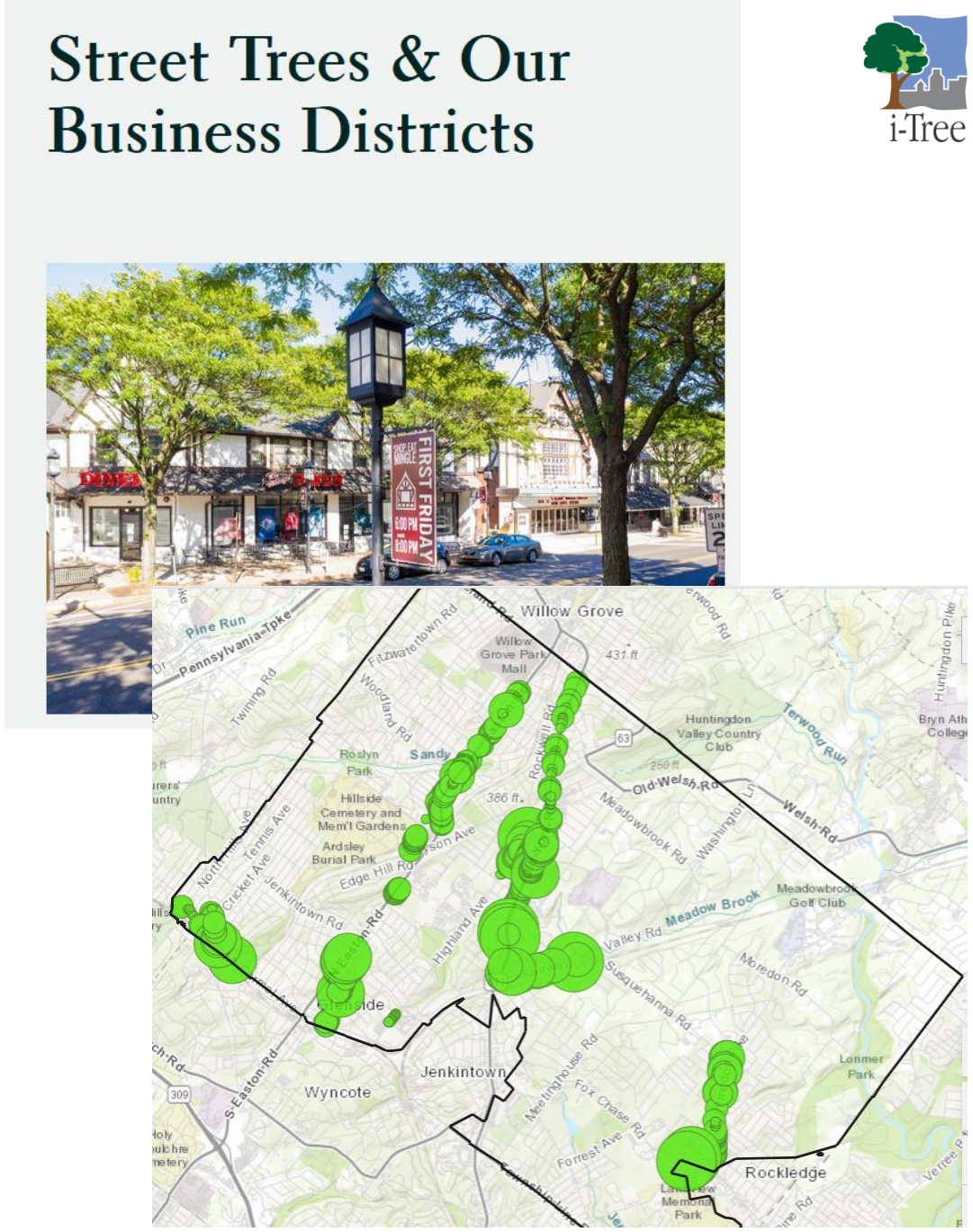
Air pollution monitor locations in Mexico


Students using a location in the Philippines

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



Let’s use the application!