

---

Reimagining  
the Civic Commons

---

# How to use the Tree Benefits Analysis Tool

---

---

## Tree Benefits Analysis Tool

---

The Tree Benefits Analysis Tool provides a framework for tracking and analyzing the impact of individual tree plantings on the local environment. The tool is designed to work in conjunction with the [i-Tree software suite](#), a free peer-reviewed tool from the USDA Forest Service that allows communities to quantify the benefits and value of trees. The tool provides data on tree canopy, tree count, carbon dioxide sequestered annually, and stormwater management benefits.

**You can customize the [Tree Benefits Analysis Tool](#) for your site, using these instructions as a guide to help you refine your analysis.**

# Instructions

To collect and analyze data, you will use the worksheets included in this toolkit and the USDA Forest Service's [i-Tree Design](#) tool. The i-Tree Design tool will allow you to obtain metrics on the environmental benefits of trees within your site. More detail about i-Tree Design can be found on i-Tree's [methodology page](#). It may be helpful to have a trained arborist or other landscape professional help with this assessment. They can identify different tree species and assess the condition of each tree.

The analysis quantifies the benefits of existing trees in a site and the impact of new tree plantings or removals in a future year of your choosing (ideally after a significant improvement has occurred, such as a park renovation, volunteer tree planting effort, etc.).

*Note: Since this process involves inventorying data on each individual tree in a site, it may not be appropriate or realistic to perform in large sites with a large number of trees.*

---

## Tree Benefits Analysis Tool

---

### Step 1: Field Survey

Perform a field survey of all existing trees in your site, noting their location in the “**TREE ID MAP**” and creating a unique code to identify each tree. Here’s how:

On the Analysis tab, enter the name of your site and its approximate size in acres.

1. Overlay a reference map of the site into the [Tree ID Map worksheet](#). Since the purpose of the map is to give you a rough idea of where each tree is planted on the site, an aerial or hand-drawn site plan showing your study area boundaries and the primary features of the site (e.g. pathways, landmarks, and significant natural features) will be sufficient.
2. For each tree, draw a circle indicating its approximate location, and then write an alphanumeric code inside the circle – for example, 1.A, 2.A, 3.A, etc. In this code, the number refers to the individual tree, and the letter refers to the analysis period, indicating whether that tree is from the baseline inventory or is a tree planted after baseline. This code will be used to link the location of each tree to its corresponding characteristics in the “**BASELINE SHEET**” tab.
3. You will also record a few characteristics of each tree and enter them into the “**BASELINE SHEET**” tab in Step 2. We have included a shortened PDF version of this worksheet that you can use to record data in the field. These characteristics, which are listed in the Baseline Inventory Worksheet, include:
  - **Species (common name)**. To make it easier to plug this information into i-Tree, we have prepopulated this field with a drop-down list of over 1,000 species covering all ecological regions in the United States.
  - **Circumference or Diameter** of the tree trunk (measured approximately 4.5 feet above the ground).
  - **Tree Condition** (Excellent, Good, Fair, Poor, Dead or Dying).
  - **Exposure to Sunlight** throughout the day (Full Sun, Partial Sun, Full Shade).

Depending on your ability to identify these characteristics in the field, it may be helpful to enlist the help of a trained arborist or other landscape professional to assist with this step.

4. Once you have completed this field survey, mapped each tree using the “**TREE ID MAP**,” and entered each tree’s characteristics in the Baseline Inventory Worksheet, you will have all the information needed to perform a baseline analysis.

---

## Tree Benefits Analysis Tool

---

### Step 2: Baseline Inventory

1. First, in the **“ANALYSIS SHEET”** tab, enter the name of your site and its approximate size in acres.
2. Next, in the **“BASELINE SHEET”** tab, enter the data you collected in Step 1 during the **Field Survey**.
3. In the first column, enter the Tree ID code for each tree that you mapped during the **Field Survey**.
4. Next, enter the data you collected for each tree during the Field Survey, including species, trunk size, condition, and exposure to sunlight.
5. Lastly, in the “Tree Spread at Maturity” column, look up and enter the average tree spread (diameter) of your tree species’ canopy at maturity. This will allow you to automatically calculate a canopy estimate for the site. To find the average tree spread, consult a trained arborist or landscape professional, or use free websites such as the Arbor Day Foundation’s [Tree Database](#). If a range is given for average tree canopy, such as 40-60 feet, use the average of the high and low number. The formula prepopulated in the next column will automatically calculate the estimated square footage of the tree canopy at maturity.

### Step 3: Calculate Tree Benefits in i-Tree Design

1. Visit the [i-Tree Design](#) website to get started. Enter the address of your site and click “Go!” to zoom to your geography on the map.
2. On the next page, enter data about each of the trees from your survey. The first option allows you to draw structures. The purpose of this option is to calculate the impact of trees on utility bills. For the purposes of this analysis, you can skip this step, but you are free to use this feature if useful.
3. Next, using data from your tree survey, describe the tree and its conditions and place each tree at the approximate location where it is planted on the aerial. Select “2. Place Trees” from the menu on the left. Fill in the information boxes and follow the instructions to place your trees.
4. Finally, you will be given the option to project the future benefits of your trees at a later year. For this analysis, we have used a 10-year projection. Projections are important for estimating the environmental benefits of newly planted trees that have not yet grown to their full potential. The i-Tree software will always automatically calculate the present benefits of your trees as a default.
5. Select “3. Estimate Benefits” from the menu on the left. Enter 10 into the box and press the calculate button to return your results.
6. From your results, navigate to the tabs for gallons of stormwater intercepted and amount of carbon dioxide sequestered for both the present year and 10-year projection. Copy these data points directly into the “Baseline Metrics” column on the **“ANALYSIS SHEET”** tab.
7. Lastly, we highly recommend saving your work in i-Tree Design. This will allow you to return to an existing project at a later date to add new trees or delete removed trees, as appropriate. To do so, click the “Save Progress” link at the top right of the i-Tree Design data entry page.

---

## Tree Benefits Analysis Tool

---

### Step 4: Measuring Change Over Time

The Tree Benefits Analysis Tool is designed to allow you to measure change over time to your site's tree canopy and to quantify the environmental impacts of new plantings and removals. We recommend performing this step in a future year of your choosing in order to show the impact of a park renovation, volunteer tree planting initiative, or other significant change to the canopy. Most of the instructions for measuring change over time involve repeating steps from the baseline year, with a few variations.

To perform your analysis of the comparison year and change over time, perform the following:

1. First, repeat Steps 1-2 above with the following deviations from the original instructions:
  - Any trees planted after the baseline year should be recorded in the **"COMPARISON YEAR SHEET"** tab.
  - Any trees removed after the baseline year should be cut and pasted from the **"BASELINE SHEET"** into the **"TREES REMOVED SHEET."** This is to account for the removal of any trees, often due to design changes, trees being in poor health, trees that fell during storms, etc.
  - Both sheets include one additional column to record the approximate month and year of planting or removal. This is included just for administrative purposes and does not impact the calculations in the **"ANALYSIS SHEET."**
  - Lastly, it may not be necessary to perform a second field survey if you have a site plan showing new trees planted and existing trees removed. A typical park renovation should include this information on the site plan.
2. Next, reopen your i-Tree project from the baseline year in i-Tree Design, and repeat Step 3, adding new plantings and deleting any trees that were removed. Enter the results from i-Tree Design into the **"Comparison Year Metrics"** column in the **"ANALYSIS SHEET"** tab.
3. The **"Change from Baseline to Comparison Year"** columns will calculate the change from the baseline year to comparison year, allowing you to report the following changes as a result of new trees added, including:
  - Percentage increase in tree canopy
  - Total increase in number of trees on site
  - Percentage change and total pounds of CO<sub>2</sub> sequestered
  - Percentage change and total number of additional gallons of stormwater intercepted
4. You can see an example of data entry and analysis in the [Tree Benefits Example](#)

# A Summary Of Fields Included In The Tool

## Tree Survey Tab Field Descriptions

### TREE ID

A unique identifier used for mapping each tree, critical for entering each tree into i-Tree Design.

### SPECIES [DROP-DOWN LIST]

The common name of each tree's species. We have prepopulated this list with common names of the more than 1,000 tree species in the United States used with i-Tree Design, current as of September 2019.

### UNIT OF MEASUREMENT [DROP-DOWN LIST]

The unit of measurement for the diameter and circumference of your tree. This unit should be consistent for all trees in your survey.

### CIRCUMFERENCE

The circumference of the tree is commonly measured by wrapping a tape measure around the trunk of a tree 54" from the ground.

### DIAMETER [PRE-FILLED CALCULATION]

The diameter is calculated by dividing the circumference by pi (3.14). Since the circumference is relatively easy to measure accurately, we have prepopulated this field with an equation that will automatically return the diameter once you've entered the circumference. However, you only need to enter one of these figures in order for i-Tree to calculate the tree's benefits.

### TREE CONDITION [DROP-DOWN LIST]

This field indicates the condition of the tree, and you will pick from five options (Excellent, Good, Fair, Poor, Dead or Dying) that are compatible with i-Tree Design.

### EXPOSURE TO SUNLIGHT [DROP-DOWN LIST]

This field indicates the approximate amount of sunlight the tree receives throughout the day. You will pick from three options (Full Sun, Partial Sun, Full Shade) that are compatible with i-Tree Design.

### TREE SPREAD AT MATURITY

This field is used to estimate the area of your tree canopy. The "spread" of a tree refers to the diameter of the canopy at maturity. This data can be obtained by consulting a trained arborist or landscape professional or by researching this information on your own. A helpful resource for researching the spread of common tree types is the Arbor Day Foundation's [Tree Database](#).

### SQFT OF CANOPY AT MATURITY [PRE-FILLED CALCULATION]

This calculation allows you to estimate the area of each tree's canopy at maturity, important for calculating the tree canopy percentage of your site on the Analysis tab. Canopy is estimated by multiplying the tree spread by pi (3.14).

### MONTH/YEAR OF PLANTING

This field is used for accurate record keeping but is not used for calculations. This field is not used in the **"BASELINE SHEET."**

# Analysis Tab Field Descriptions

## Site Info

- **Site Name:** the name of your site.
- **Site Size:** The size of your site, in acres. This figure will be used for the tree canopy calculations.

## Metrics

- **Tree Canopy (estimated at maturity):** The percent of project area covered by tree canopy.
- **Tree Count:** The number of trees in your site.
- **Co2 Sequestered Annually:** The amount of carbon dioxide sequestered annually in trees.
- **Gallons of Stormwater Intercepted:** The amount of rainfall intercepted by trees.

# Data Collection Tips

- 1. Enlist the help of a trained arborist or landscape professional.** To use this tool, you must be able to accurately identify tree species in the field or enter tree species and condition data from a landscape plan. This may be difficult for the layperson to do, so we highly recommend enlisting the assistance of a trained arborist or landscape professional to assist with this task.
- 2. Practice using i-Tree Design and the included worksheet before going out in the field.** This DIY tool is unique in that you will use both the i-Tree Design software suite and the worksheet together once you have completed your tree survey. As such, we recommend practicing with both tools before taking your full tree inventory in order to get familiar with both systems and ensure you are collecting data for your tree survey correctly.
- 3. Keep track of trees that get removed.** During the course of your analysis period, it is likely that some trees may be removed if they are in poor health or fall in a storm, for example. If this is the case, simply cut and paste those trees from the Baseline or Comparison Year tab into the Trees Removed tab. Maintain the same TREE ID as in your original records. Once these trees have been placed in the Trees Removed tab, your canopy calculations will automatically update, but you will need to reload your i-Tree project, delete the removed trees from your inventory, and rerun the benefit calculations.