PlanITGeo™

Eden, North Carolina

Sample Inventory Report

June 26, 2023

TreePlotter™ INVENTORY

NORTH CAROLINA FOREST SERVICE NC

TABLE OF CONTENTS

Funding for this project was provided through a USDA Forest Service Urban & Community Forestry Grant from the North Carolina Forest Service, Department of Agriculture and Consumer Services and the USDA Forest Service. This institution is an equal opportunity employer.

Eden, NC TREE INVENTORY SUMMARY

This report summarizes tree inventory data collected in Eden, North Carolina in June 2023. The data includes **727** trees and **39** planting sites. PlanIT Geo was selected by the city of Eden to conduct a 3-6% sample tree inventory within city rights-of-ways, as well as a 3-6% inventory on public properties.

Methodology:

The sampling percentage depends on the town's population (see Table below). All sampling areas are randomly selected and evenly distributed across quadrants in each community.

Population	Sample Percentage
Below 50,000	6%
50,000 – 150,000	5%
150,000 – 250,000	4%
Above 250,000	3%

Table 1. Sample percentage according to population

Additional criteria had to be met to determine the areas of public property to be sampled: only mowed public property will be sampled and the standard error should be below 10%. According to the i-Tree manual, the standard error will be below 10% if 200 or more equal sized plots are sampled. Using a geoprocessing tool, all eligible public property was overlaid with a grid of equal sized squares. The squares, or plots, received a random integer using a built-in python function and were then sorted in ascending order according to this number. The first 200 (or more depending on the sampling percentage, see Table above) plots in this sorted list will be inventoried. To ensure an even distribution, an equal number of plots were selected in each quadrant of the city (ie. 50 or more plots per quadrant).

Selecting random street segments followed a similar workflow. All street segments received a random integer, which was then used to sort the streets in ascending order. From that sorted list, the desired number of streets (according to the sampling percentage, see Table above) are selected to be inventoried.
Note: to ensure an even distribution, an equal number of streets were selected per quadrant.

The 5% sample data was extrapolated to estimate the total number of trees and planting sites in Eden. The data displayed below this section is all estimated to be 100% of the total, within the 10% standard error.

Standard Error

According to the i-Tree manual, sampling at least 200 plots with an area of about 0.1 acres will yield a standard error of less than 10%. In Eden, 446 plots with an area of 0.099 acres were sampled. The standard deviation of trees per plot is 1.25 creating a **standard error of 6%.**

Note: Sampling public property was constrained by the parcel boundary. After overlaying a square of equal-sized grids over the parcels, the grids were clipped along the parcel border creating some plots of varying sizes along the boundary. While some of these grids were sampled, they were not included in the standard error calculation. Calculating accurate standard error requires equal-sized sampling areas.

Estimating Total Tree Numbers

To extrapolate the findings to the entire city, we utilized a multiplication factor of 16.6, assuming that the distribution and density of trees remained relatively consistent throughout the area. To come up with the multiplying factor of 16.6, we used the equation below to find the total # of trees from a 6% sample, then divided that total # of trees by the sample size of trees, which results in a multiplying factor of 16.6. By applying this method, we generated an estimate of the remaining quantity of trees present in the city, providing valuable insights for effective tree management and urban planning strategies

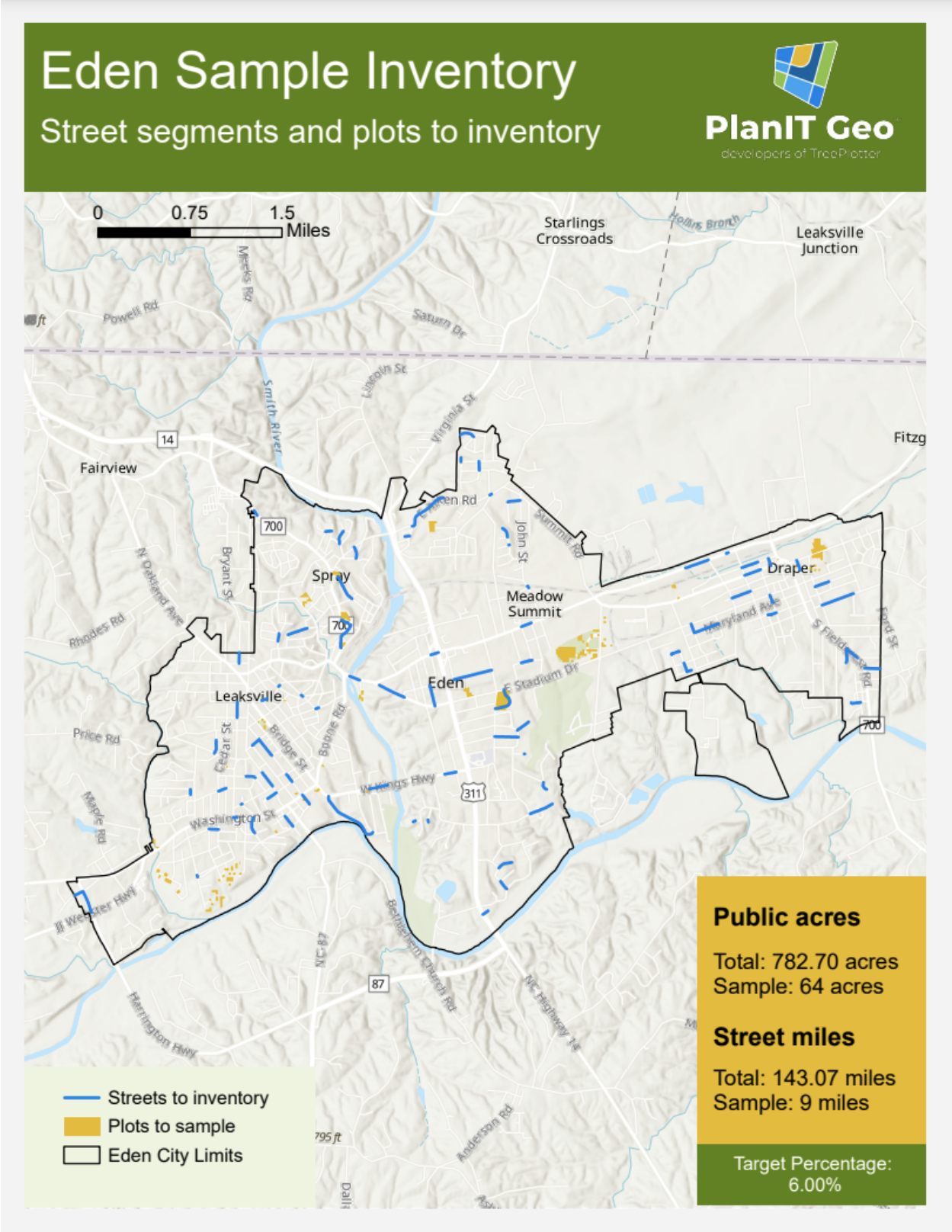
Step 1.

$$\frac{\text{Sample \# of trees}}{6} = \frac{X}{100}$$

Step 2.

$$\frac{\text{Total \# of trees calculated}}{\text{Sample \# of trees}} = 16.6$$

Figure 1. Summary of municipality area and sample size

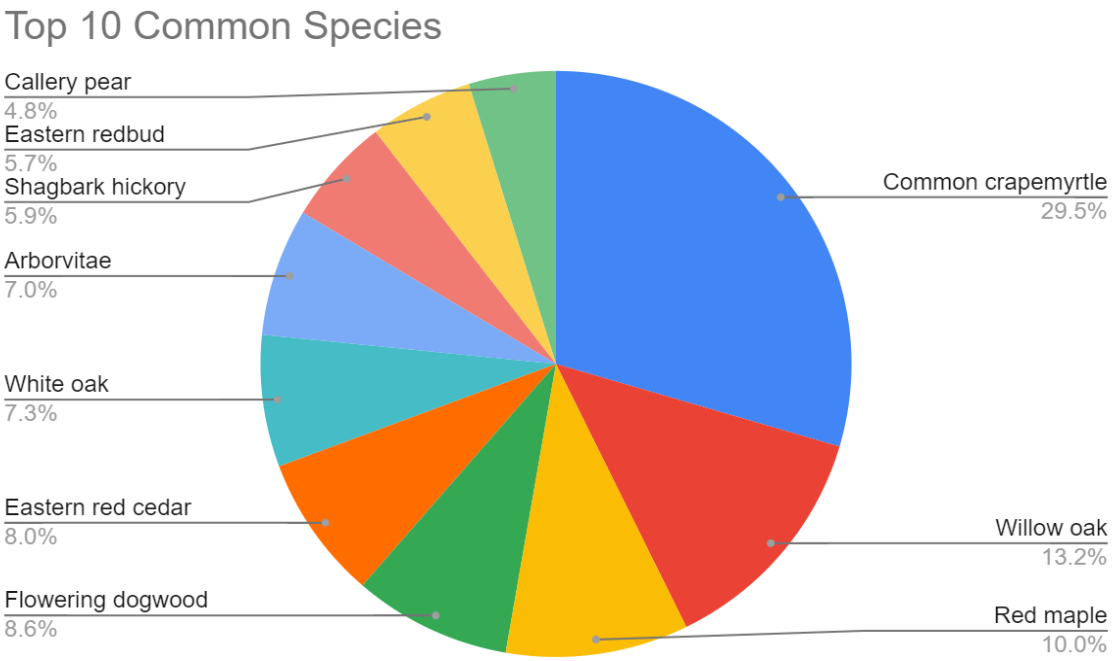


Number of Trees and Planting Sites

	Estimated	Data Collected
•	**12,068 trees**	**727 trees**
•	**647.4 planting sites**	**39 planting sites**

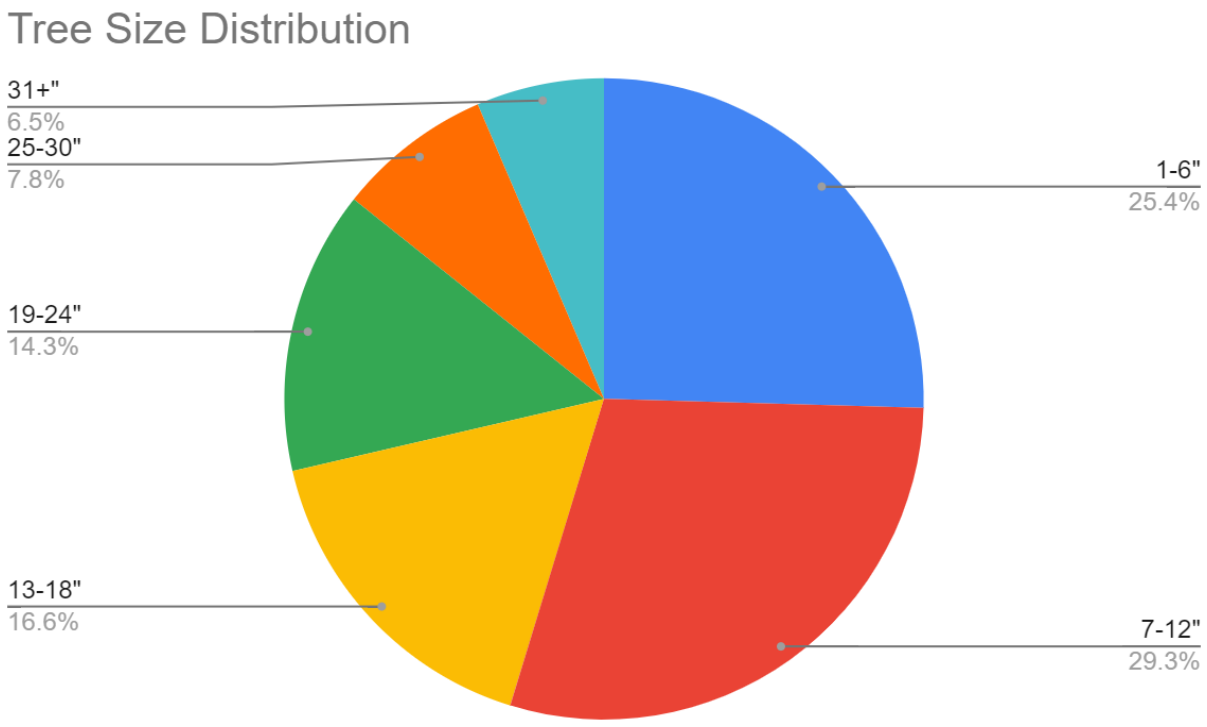
Species Diversity

Common Name	Sample Count	Estimated Total Count	Percent
Common crapemyrtle	130	2158	17.88%
Willow oak	58	962.8	7.98%
Red maple	44	730.4	6.05%
Flowering dogwood	38	630.8	5.23%
Eastern red cedar	35	581	4.81%
White oak	32	531.2	4.40%
Arborvitae	31	514.6	4.26%
Shagbark hickory	26	431.6	3.58%
Eastern redbud	25	415	3.44%
Callery pear	21	348.6	2.89%



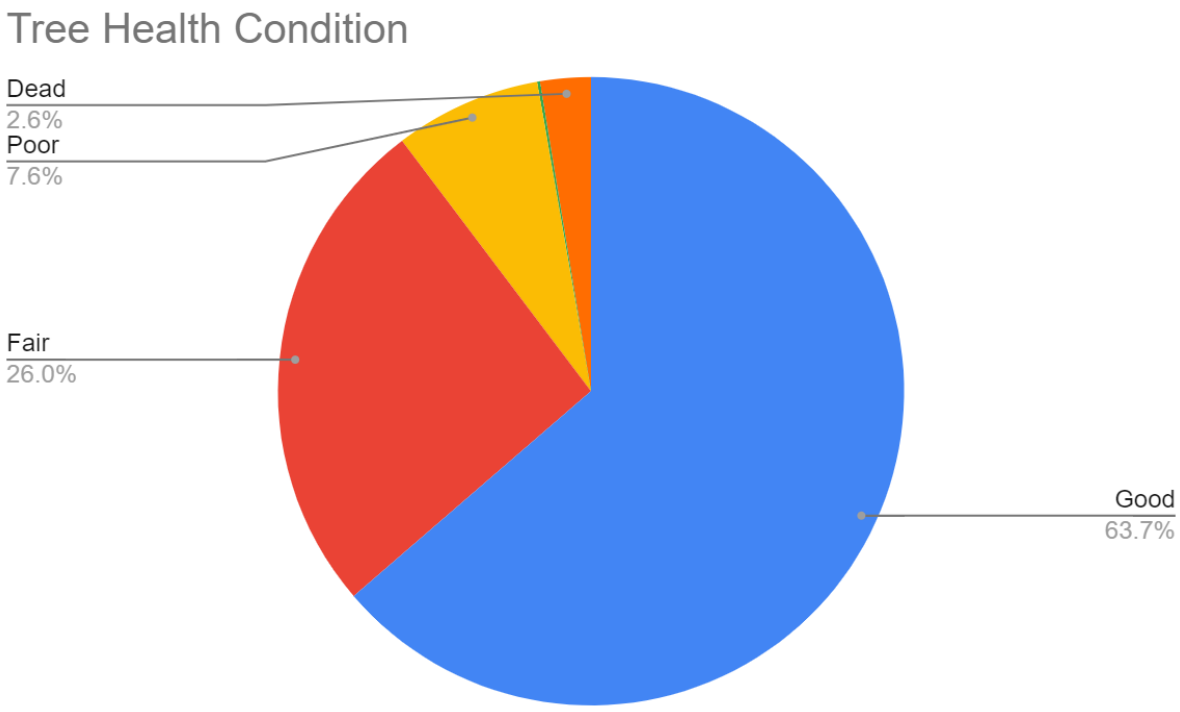
Age/Size Distribution

DBH Range	Sample Count	Estimated Total Count	Percent %
1-6"	185	3071	25.40%
7-12"	213	3535.8	29.30%
13-18"	121	2008.6	16.60%
19-24"	104	1726.4	14.30%
25-30"	57	946.2	7.80%
31+"	47	780.2	6.50%



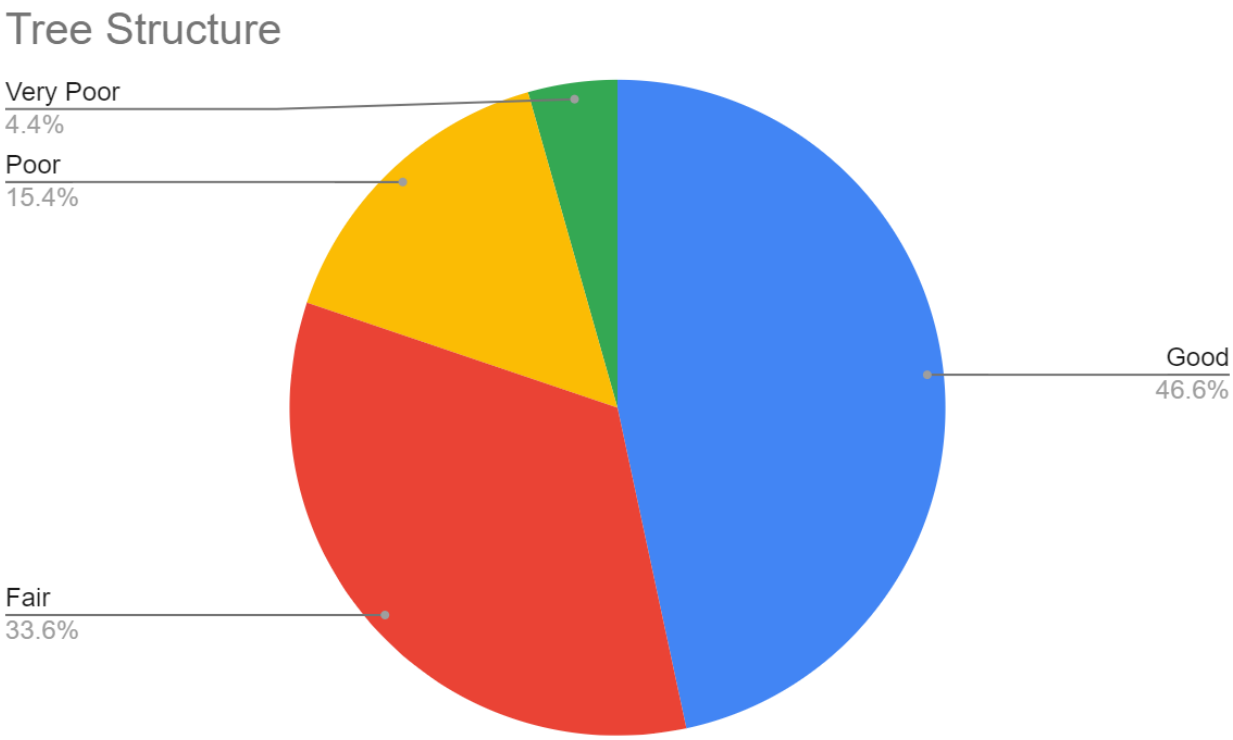
Tree Health

Tree Condition	Sample Count	Estimated Total Count	Percent
Good	463	7685.8	63.69%
Fair	189	3137.4	26%
Poor	55	913	7.57%
Very Poor	1	16.6	0.14%
Dead	19	315.4	2.61%



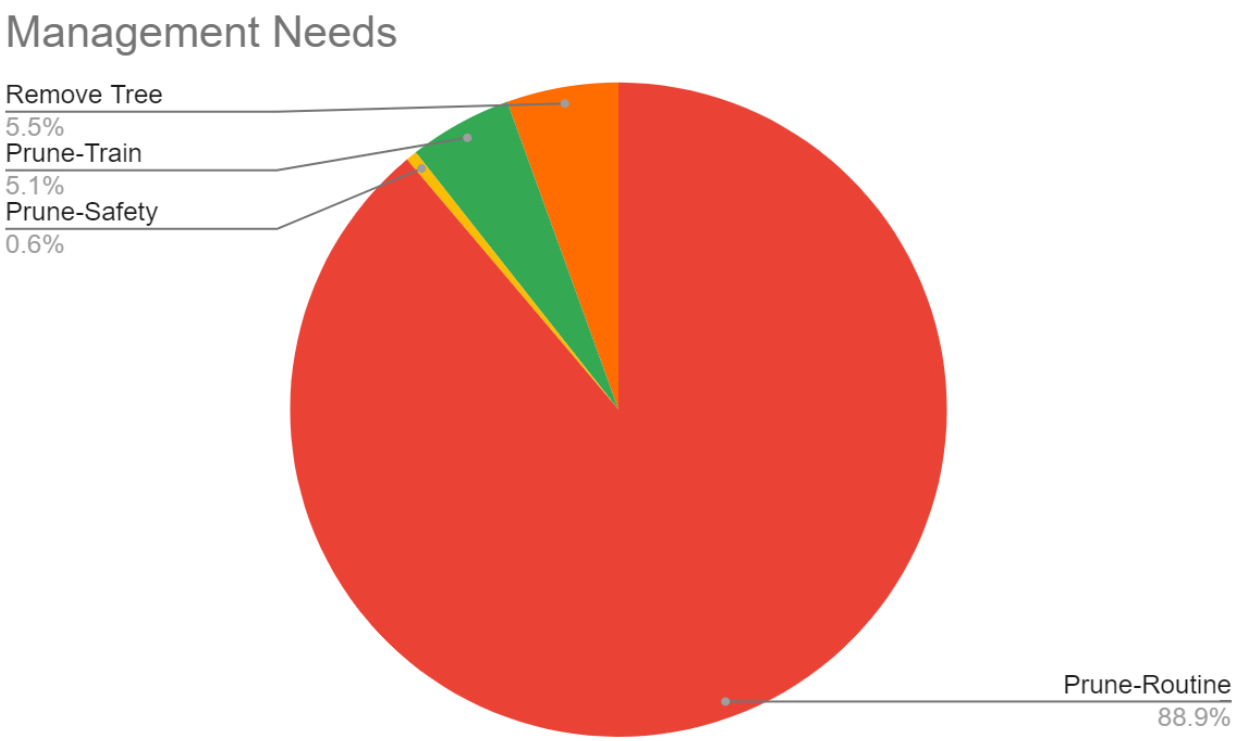
Tree Structure

Tree Structure	Sample Count	Estimated Total Count	Percent
Good	339	5627.4	46.60%
Fair	244	4050.4	33.60%
Poor	112	1859.2	15.40%
Very Poor	32	531.2	4.40%



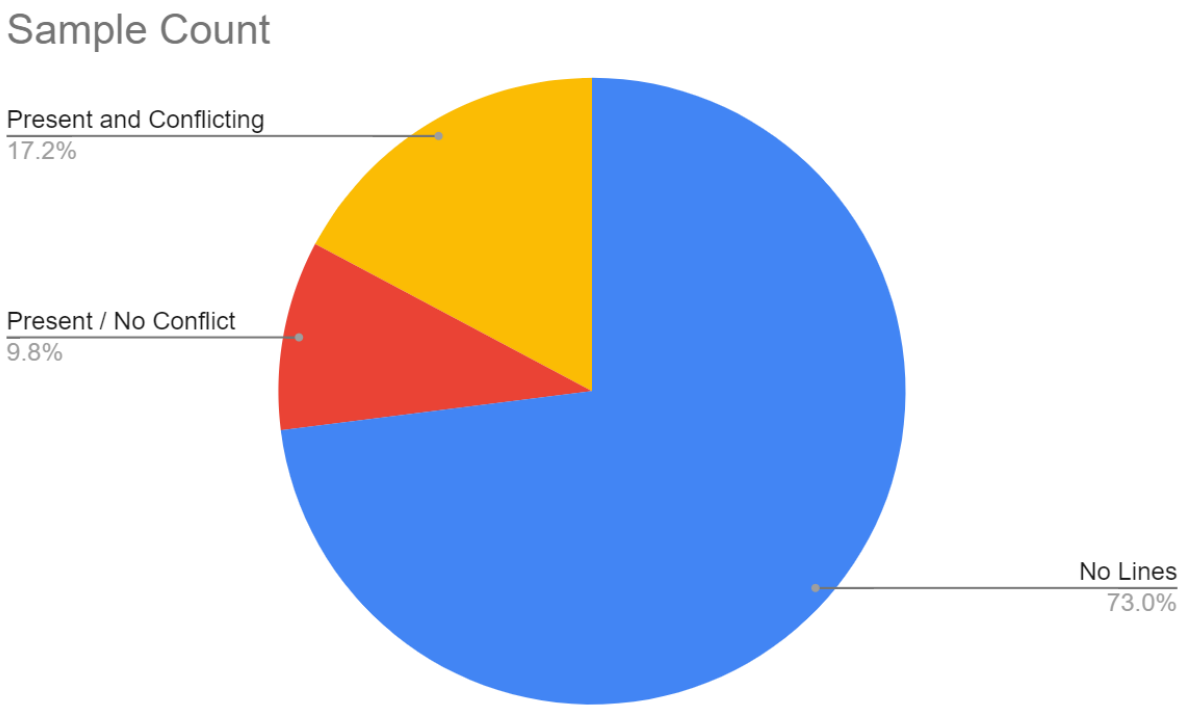
Management Needs

Management Need	Sample Count	Estimated Total Count	Percent
Prune-Reduction	0	0	0
Prune-Routine	646	10723.6	88.90%
Prune-Safety	4	66.4	0.60%
Prune-Train	37	614.2	5.10%
Remove Tree	40	664	5.50%



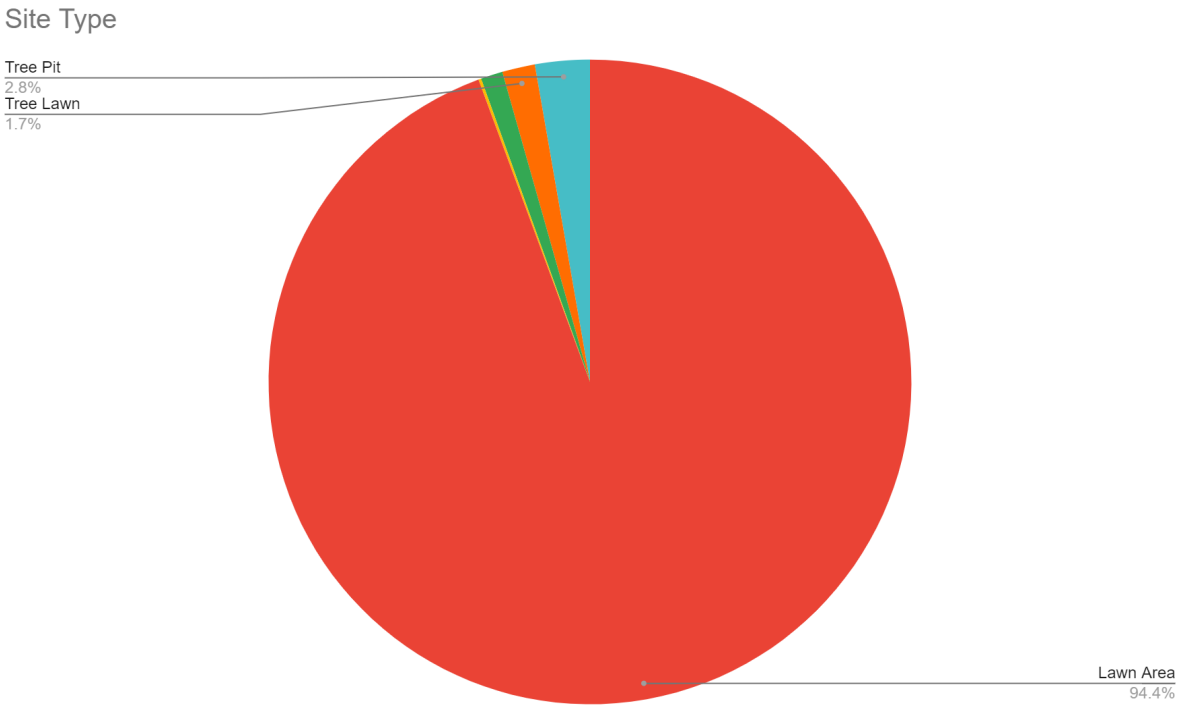
Overhead Utilities

Overhead Utilities	Sample Count	Estimated Total Count	Percent
No Lines	530	8798	73%
Present / No Conflict	71	1178.6	9.80%
Present and Conflicting	125	2075	17.20%



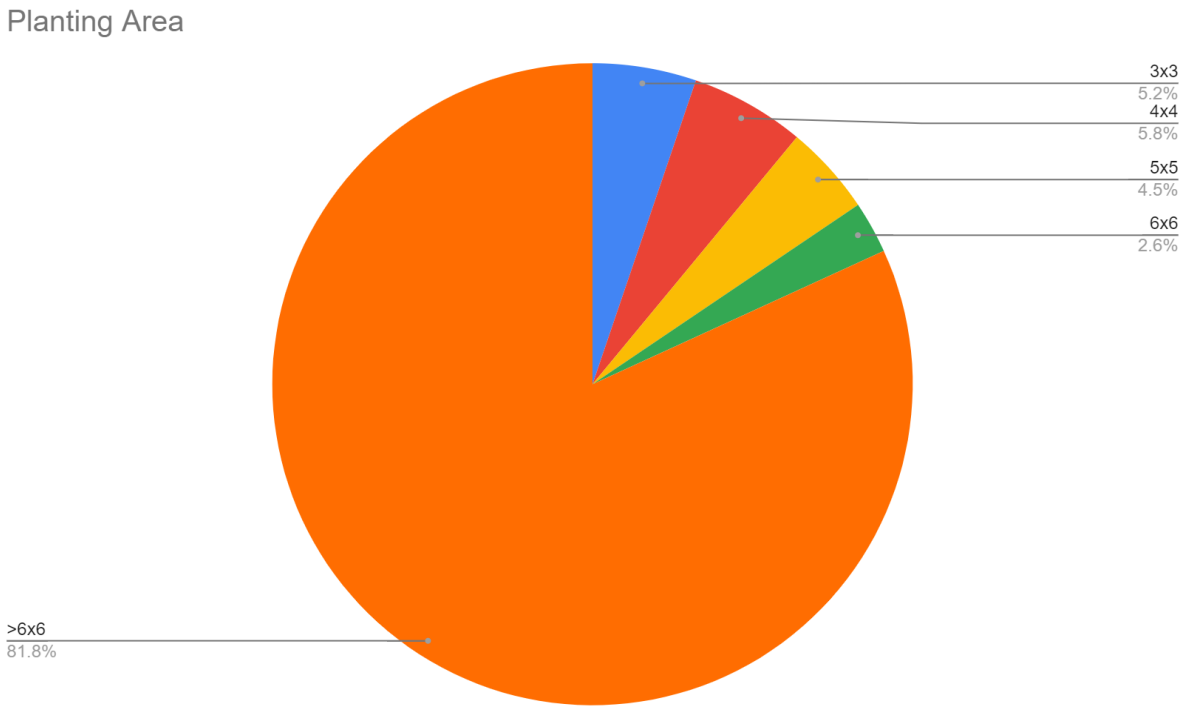
Site Type

Site Type	Sample Count	Estimated Total Count	Percent
Border Tree	0	0	
Lawn Area	686	11387.6	94.40%
Natural Area	1	16.6	0.10%
Street Median	8	132.8	1.10%
Tree Lawn	12	199.2	1.70%
Tree Pit	20	332	2.80%



Planting Area

Planting Area	Sample Count	Estimated Total Count	Percent
3x3	38	630.8	5.20%
4x4	42	697.2	5.80%
5x5	33	547.8	4.50%
6x6	19	315.4	2.60%
>6x6	594	9860.4	81.80%



Economic and ecosystem benefit analysis of Eden's Urban Forest

To identify the dollar value provided and returned to the community, the TreePlotter software application, which utilizes the latest i-Tree API to process this data, was used to quantify the benefits of the trees in the sample tree inventory. This tool in TreePlotter creates an annual benefit report that demonstrates the value public trees provide.

These quantified benefits and the reports generated are described below:

- **Carbon Monetary Benefit:** Calculates the dollar value associated with the amount of carbon stored or sequestered by trees based on calculations of the social cost of carbon.
- **Carbon Sequestered**: Presents annual reductions in atmospheric CO2 due to sequestration by trees and reduced emissions from power plants due to reductions in energy use. This is measured pounds and has been translated to tons for this report. The model accounts for CO2 released as trees die and decompose and CO2 released during the care and maintenance of trees.
- **Carbon Stored**: Tallies all of the carbon dioxide (CO2) stored in the urban forest over the life of its trees as a result of sequestration. Carbon stored is measured in pounds.
- **Air Quality**: Quantifies the air pollutants (ozone [O3], nitrogen dioxide [NO2], sulfur dioxide [SO2], particulate matter less than 10 micrometers in diameter [PM10]) deposited on tree surfaces, and reduced emissions from power plants (NO2, PM10, volatile organic compounds [VOCs], SO2) due to reduced electricity use in pounds. The potential negative effects of trees on air quality due to biogenic volatile organic compounds (BVOC) emissions is also reported.

- **Stormwater**: Presents monetary savings due to reductions in annual stormwater runoff due to rainfall interception by tree canopy, as well as the reduction in annual stormwater runoff due to rainfall interception by tree canopy.

The data collected from the sample inventory of trees completed in June 2023 were analyzed in TreePlotter for an understanding of the value and benefits of Eden's urban forest. Benefits in the tables below represent annual benefits for each category.

Annual Benefits	Total ($)	Quantity	Estimated Total ($)	Estimated Quantity
Carbon	$2,731.07	117,429.10 lbs sequestered	$45,335.76	1,949,323.06 lbs sequestered
Air Quality	$90.01	481.58 lbs of pollutants removed	$1,494.17	7,994.23 lbs of pollutants removed
Stormwater	$374.02	5,595.36 (ft^3) runoff avoided 100,787.83 ft^3 intercepted	$6,208.73	92,882.98 (ft^3) runoff avoided 1,673,077.98 ft^3 intercepted
Total Annual Benefits	**$3,195.11**		**Estimated Total Annual Benefits**	**$53,038.83**

The data was also analyzed to estimate the value of the lifetime carbon stored in the trees in the sample inventory at their current size.

Lifetime Benefits	Total ($)	Quantity	Estimated Total ($)	Estimated Quantity
Carbon	$69,643.73	816,682.5 lbs C stored 2,994,504.20 lbs CO_2 stored	$1,156,085.92	13,556,929.5 lbs C stored 49,708,769.7 lbs CO_2 stored
Total Lifetime Benefits	**$69,643.73**		**Estimated Total Lifetime Benefits**	**$1,156,085.92**