# 2016 STATE OF THE DENTON URBAN FOREST

## *City Council Work Session*

Tuesday December 6th, 2016
Denton, Texas


Micah Pace
Consulting Urban Forester
Preservation Tree Service
micahp@preservationtree.com

Lauren Barker
Program Manager
Keep Denton Beautiful
lauren.barker@cityofdenton.com


Preservation Tree

plan-it GEO

CITY OF DENTON

kdb Keep Denton Beautiful

Texas Trees Foundation
CREATING HEALTHY COMMUNITIES

# AGENDA

- Background and Overview
- Project Details
  - iTree Eco Study
  - Urban Tree Canopy Analysis
- Key Findings
- Recommendations
- Q/A

# OVERVIEW – THE BASICS

**A combination of two methodologies to complete Denton's first comprehensive urban tree resource assessment/study:**

- **On the ground –** i-Tree Eco Assessment of trees on randomly sampled plots to quantify population, species composition, condition, and distribution.
- **From the sky –** Urban Tree Canopy Analysis of detailed land cover data from hi-res aerial imagery, to determine overall tree canopy, distribution, and opportunities for planting and preservation.

# OVERVIEW - GOALS

1. Establish a baseline of data for Denton's urban forest
2. Obtain a comprehensive picture of the structure of Denton's urban forest (tree diversity, age distribution, locations, and condition), as well as the functional value (services/benefits).
3. Assist in future policy and management decisions.
4. Allow for more strategic, targeted plantings/distribution of trees.

# Project Details

Preservation Tree

plan-it GEO

CITY OF DENTON

kdb Keep Denton Beautiful

Texas Trees Foundation
CREATING HEALTHY COMMUNITIES

# PROJECT DETAILS

## i-Tree Eco Resource assessment

- Used advanced "i-Tree Eco" software to assess both the structure and function of Denton's urban forest.
- A random sample of study plots (251) within the city limits was surveyed for individual tree parameters and extrapolated out to represent the entire urban forest (public and private).
- Estimation of the benefits/services provided by Denton's trees, and their associated monetary values.

## Urban Tree Canopy (UTC) Analysis

- Used aerial imaging to obtain a map of the urban forest within the city limits and ETJ.
- Statistical and spatial analysis to gauge health, distribution, planting opportunity, and canopy cover across 12 land use classes and 5 select geographic scales within the city limits.

# Examples of Environmental Services

- AIR QUALITY IMPROVEMENT
- CARBON SEQUESTRATION AND STORAGE
- STORM WATER RETENTION
- ENERGY SAVINGS

# Examples of Social Benefits

- AESTHETICS
- LOWER CRIME RATES
- INCREASED HEALTH AND MEDICAL RECOVERY
- INCREASED PROPERTY VALUE
- INCREASED RETAIL SALES

# i-Tree ECO Assessment

Preservation Tree

plan-it GEO

CITY OF DENTON

kdb Keep Denton Beautiful

Texas Trees Foundation
CREATING HEALTHY COMMUNITIES

# i-Tree ECO ASSESSMENT

## Overview & Process

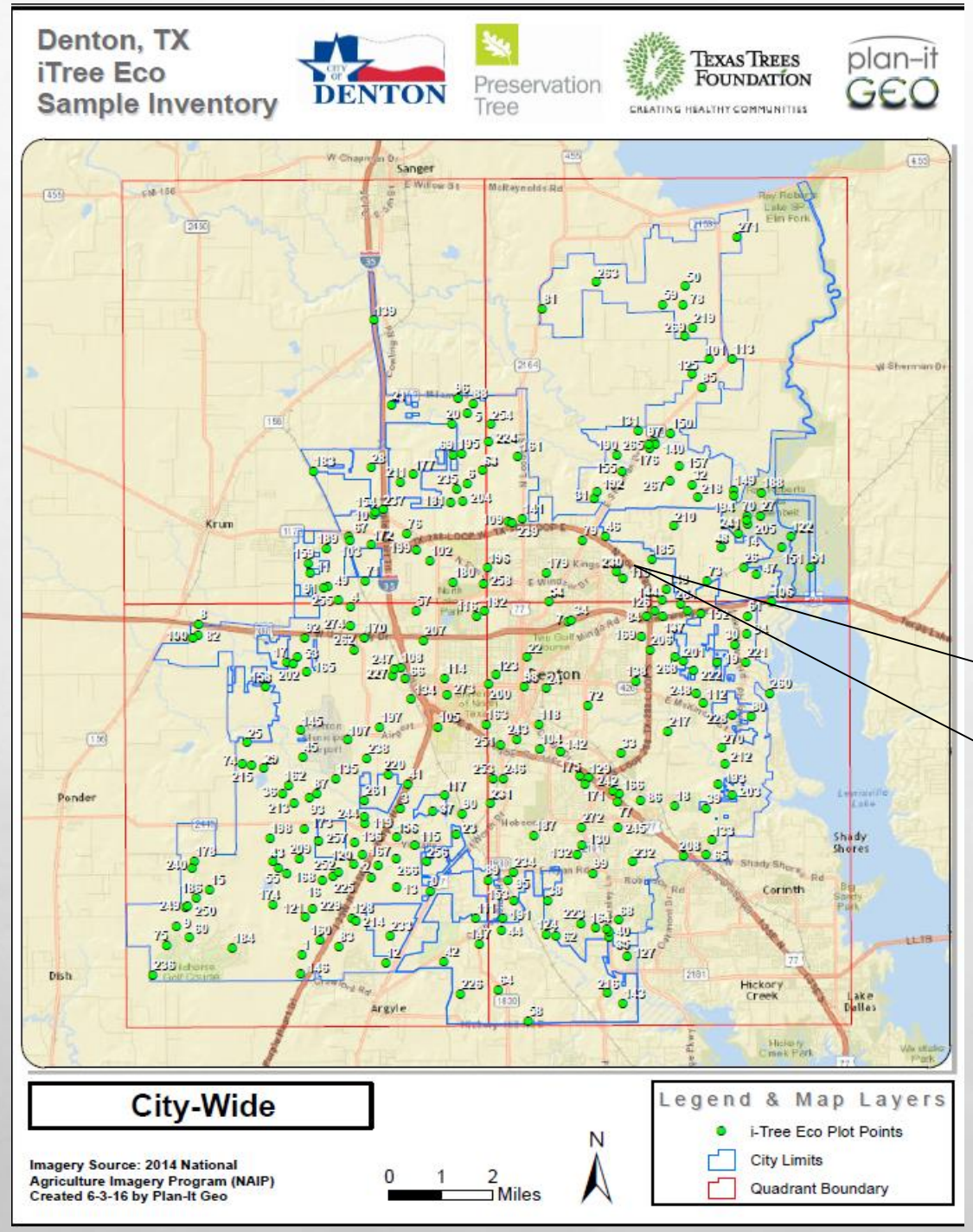
i-Tree is a suite of urban forestry assessment software tools/applications designed to help communities understand more about the structural and functional value of urban trees.

## How does it work?

Uses field data to calculate structure from a statistical sample
Uses structure data to calculate function
Uses function data to calculate value
Uses value results to draw conclusions and make management recommendations

## Everything hinges on the collected field data

How and where do we get these data?




City was divided into 4 quadrants.

275 randomly located study plots established across the city limits.

251 plots ultimately sampled.

Plots covered wide range of land use classes.

Data Collection between June 2016 and August 2016

Plot: 14 - ( )
Coordinates: 33.25704

Denton, TX iEco Study

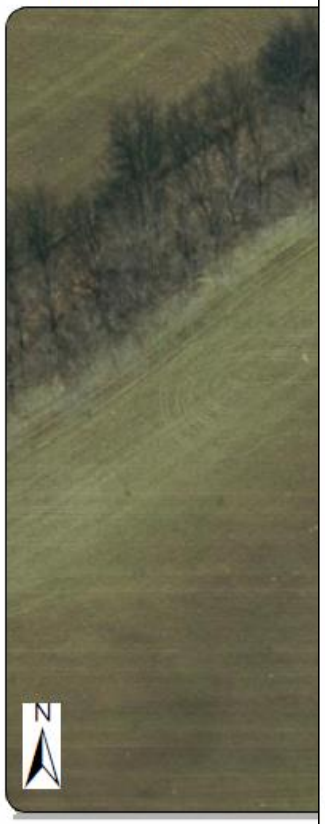
- i-Tree Eco Plot Points
- Quadrant Boundary
- City Limits
- Parcels

Preservation Tree | Texas Trees Foundation | Denton

0 50 100 Feet

Imagery Source: 2015 Orthos, City of Denton
Created 6-7-16 by Plan-It Geo

Plot: 48 - ( Croplar
Coordinates: 33.2




Denton, TX iEco St

- i-Tree Eco Plot Points
- Quadrant Boundary
- City Limits
- Parcels

Preservation Tree | Texas Trees Foundation

0 50 100 Fe

Imagery Source: 2015 Orthos, City of Denton
Created 6-7-16 by Plan-It Geo

Plot: 85 - ( )
Coordinates: 33.299

Denton, TX iEco Stud

- i-Tree Eco Plot Points
- Quadrant Boundary
- City Limits
- Parcels

Preservation Tree | Texas Trees Foundation | DEN

0 50 100 Feet

Imagery Source: 2015 Orthos, City of Denton
Created 6-7-16 by Plan-It Geo

Plot: 144 - 2616 SIRIUS
Coordinates: 33.23850

Denton, TX iEco Study

- i-Tree Eco Plot Points
- Quadrant Boundary
- City Limits
- Parcels

Preservation Tree | Texas Trees Foundation | DENT

0 50 100 Feet

Imagery Source: 2015 Orthos, City of Denton
Created 6-7-16 by Plan-It Geo

Plot: 230 - 2404 GREEN OAKS ST ( Resident Lot )
Coordinates: 33.246793, -97.100716

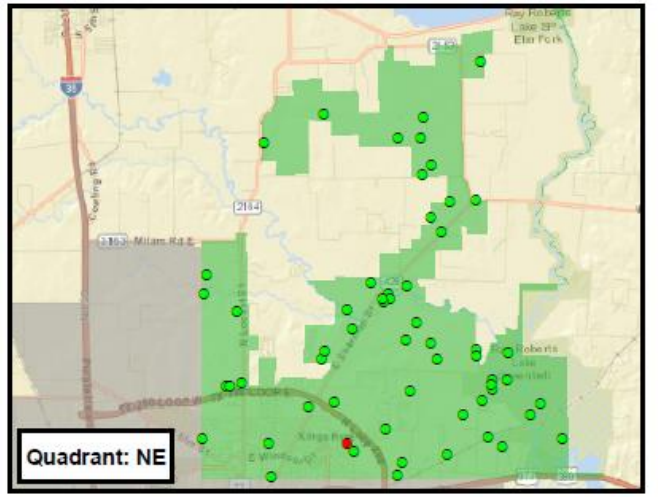
Denton, TX iEco Study

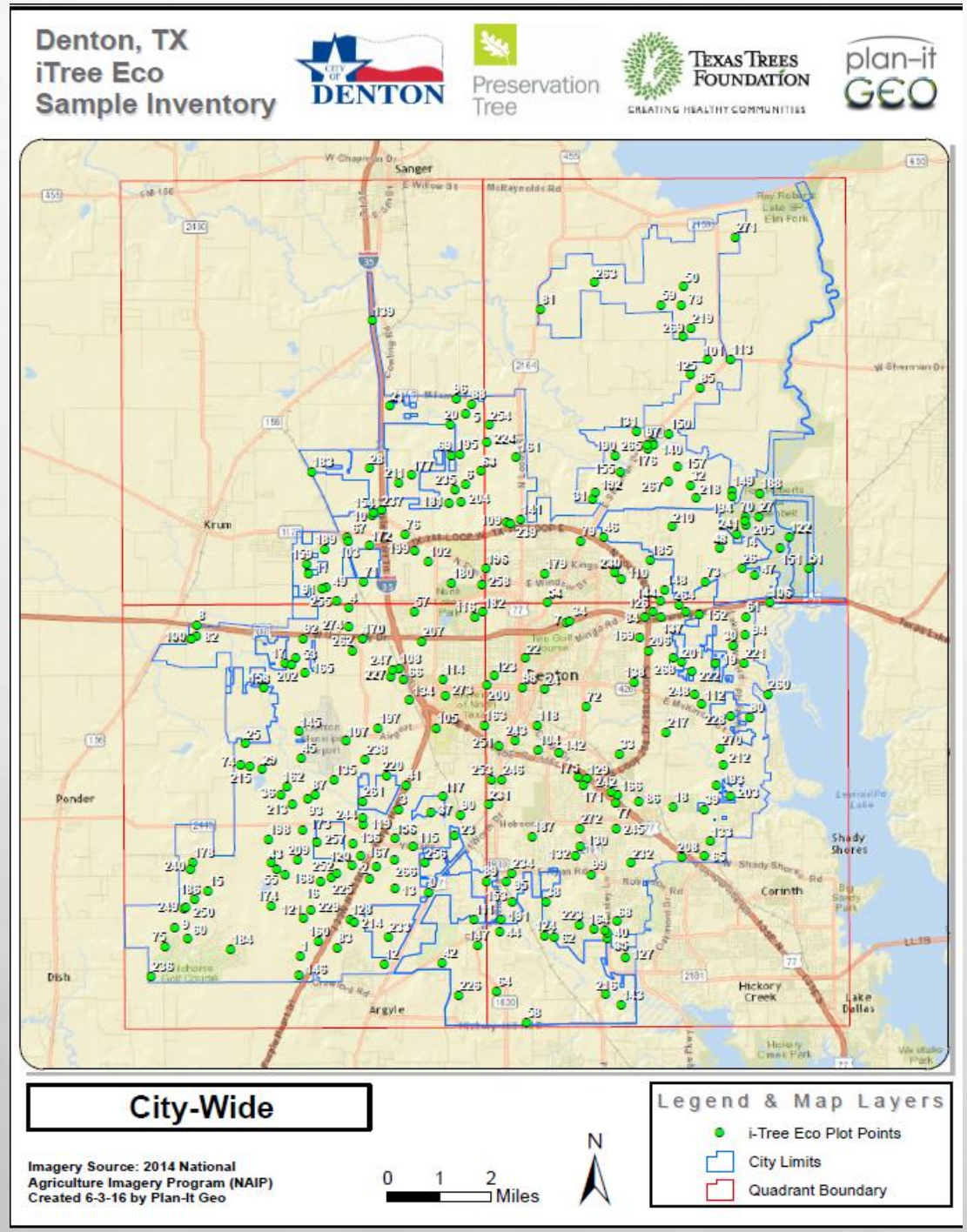
- i-Tree Eco Plot Points
- Quadrant Boundary
- City Limits
- Parcels

Preservation Tree | Texas Trees Foundation | Denton

0 50 100 Feet

Imagery Source: 2015 Orthos, City of Denton
Created 6-7-16 by Plan-It Geo






- Only 1 of 6 Texas Communities to conduct such a project.
- Only 773 communities in the nation have completed an iEco study.
- Only 827 Eco projects registered around the world

# URBAN TREE CANOPY (UTC) ANALYSIS

Preservation Tree

plan-it GEO

CITY OF DENTON

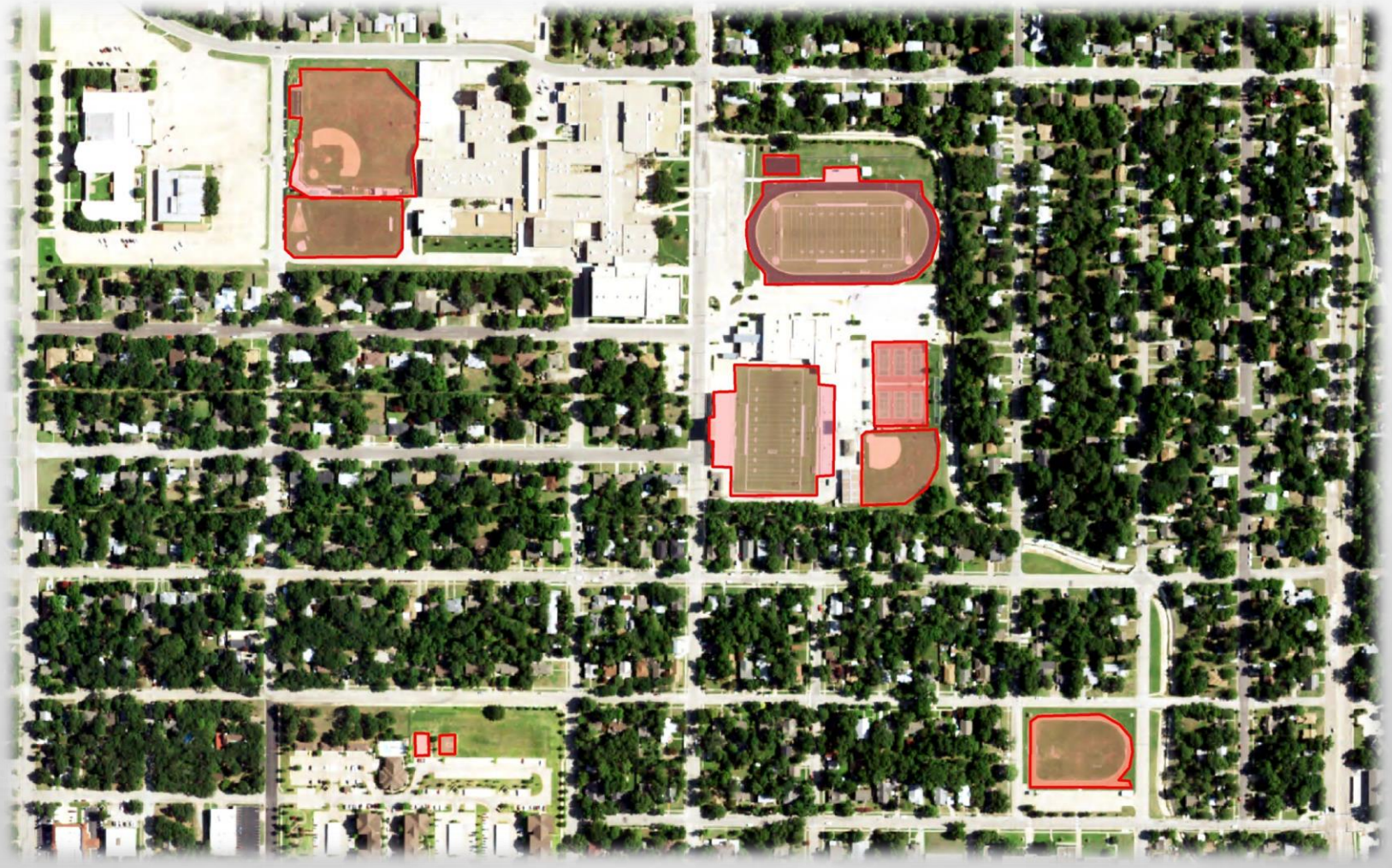
kdb Keep Denton Beautiful

Texas Trees Foundation
CREATING HEALTHY COMMUNITIES

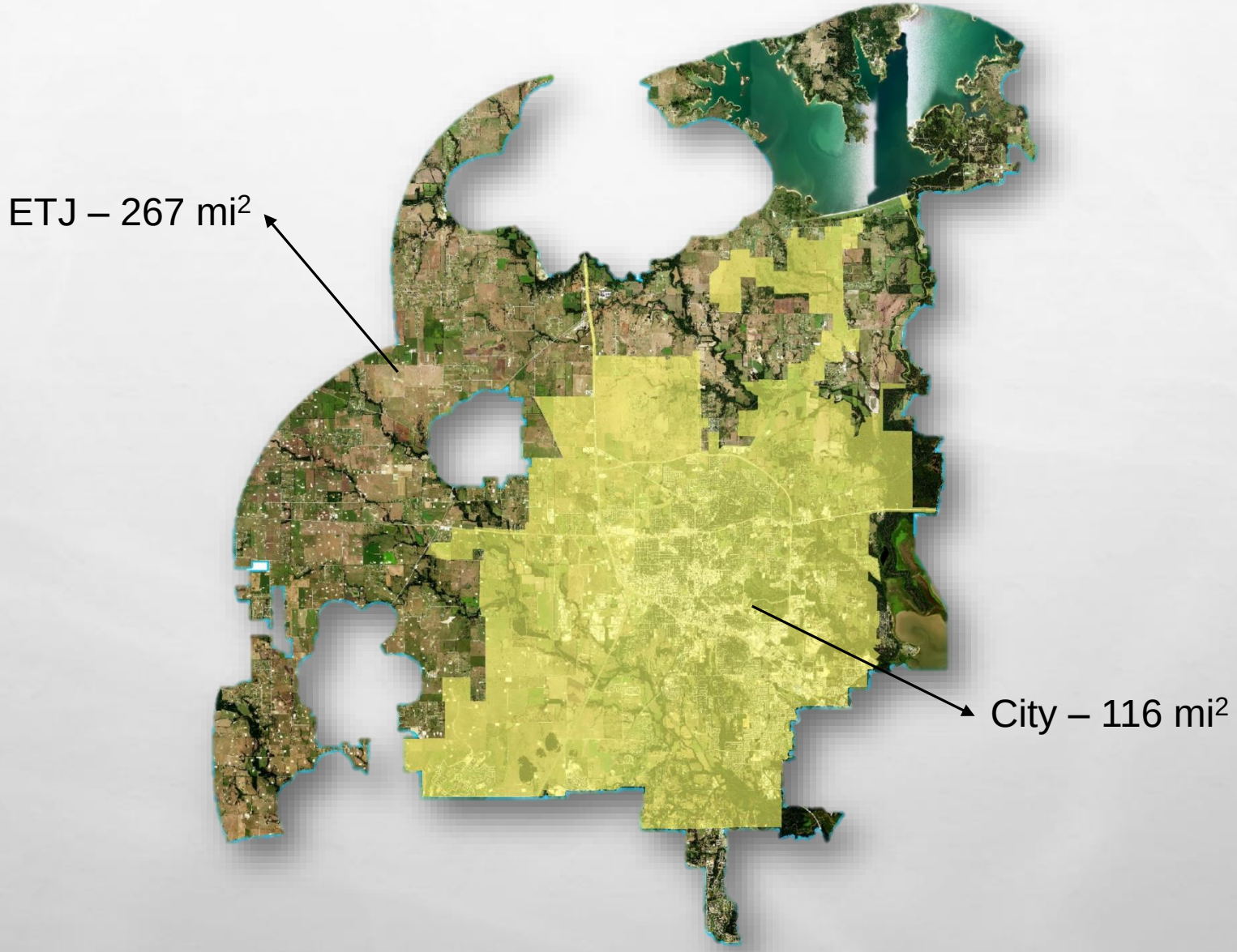
# ANALYSES PERFORMED

- Remote sensing classification of canopy cover and land cover using LiDAR (2015) and NAIP (2014)
- Manual review (QA/QC) to 94% overall accuracy and 96% accuracy for canopy
- Perform canopy change analysis from 2008 to 2014
- Possible Planting Areas (PPA)
- Land Cover data metrics using 5 target geographies (Land Use, Census Blocks, Zip Codes, Voting Districts, and Parcels)
- Deliverables: maps, GIS data, spreadsheet, report, Canopy Planner GIS Tool

# UNSUITABLE PLANTING AREAS

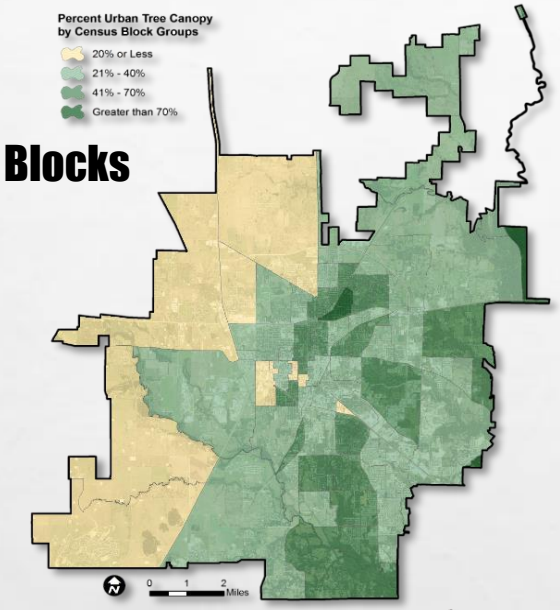


# CITY VS. ETJ BOUNDARIES

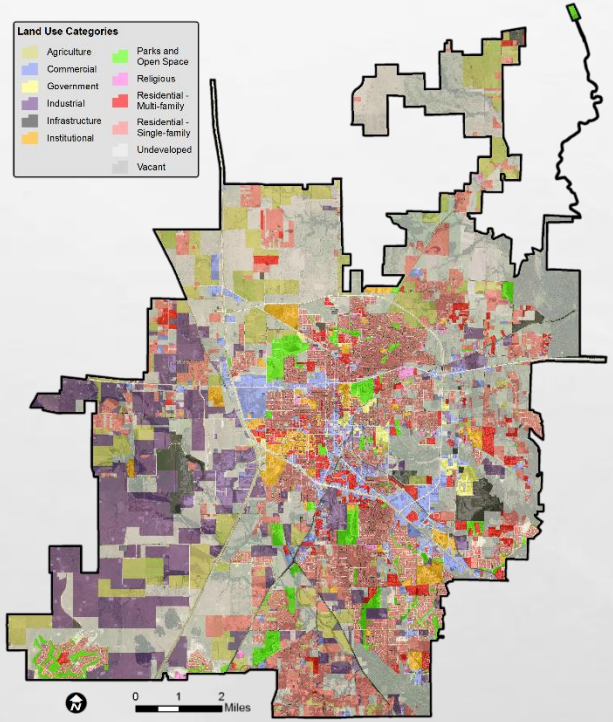


# TARGET GEOGRAPHIES

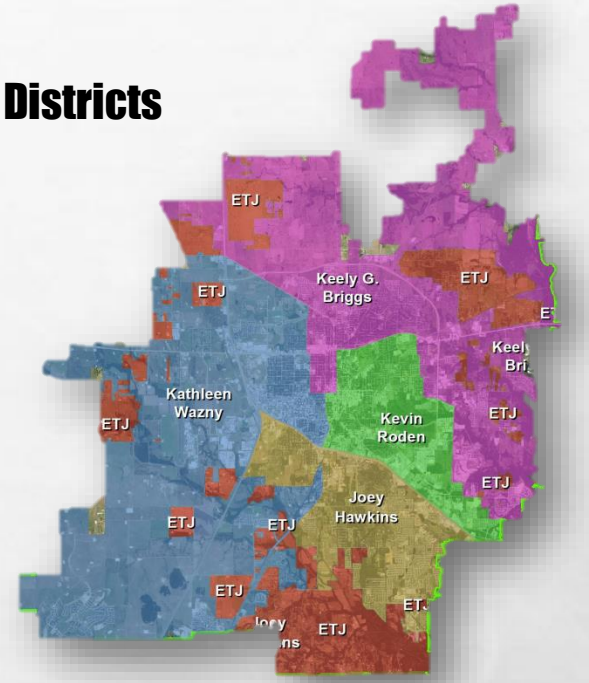
## Census Blocks



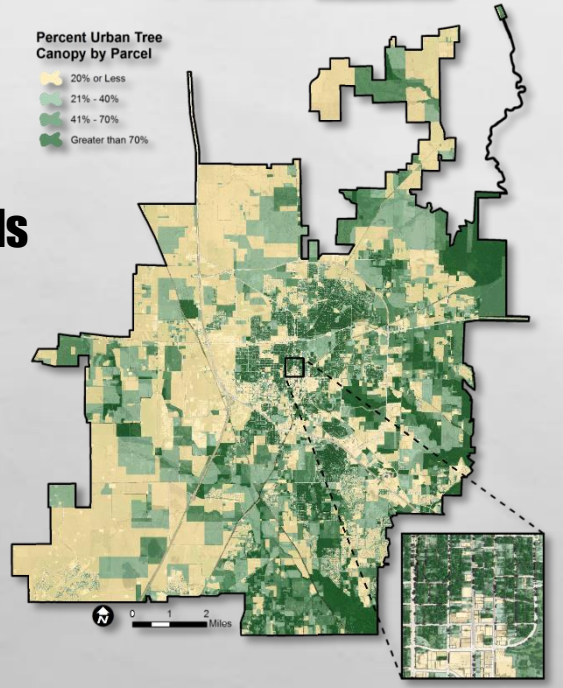

## Land Use



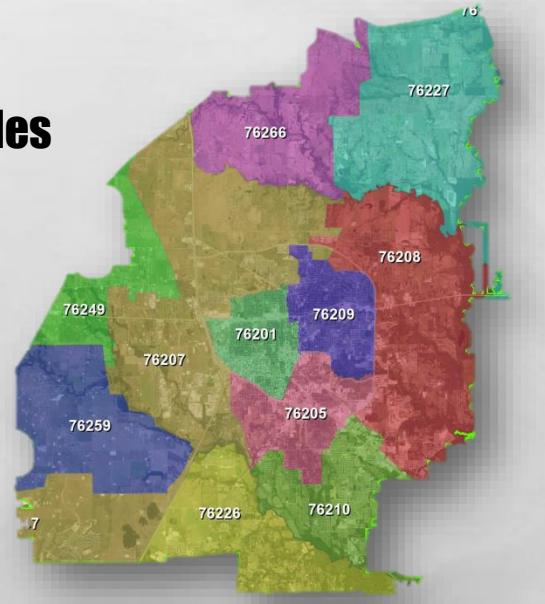

## Voter Districts



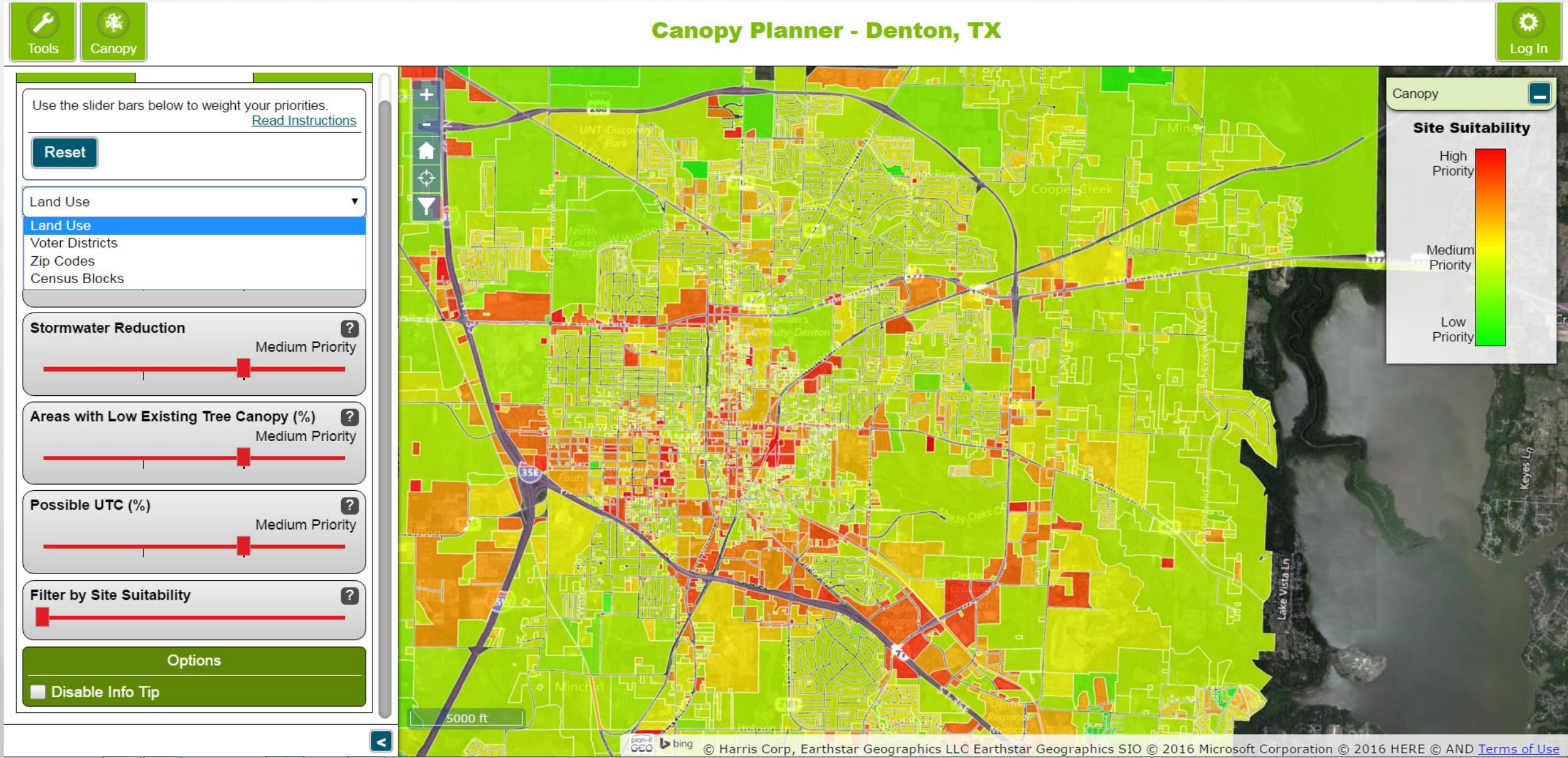

## Parcels




## Zip Codes



# CANOPY PLANNER – GIS ANALYSIS TOOL



# KEY FINDINGS:

# STATE OF THE DENTON URBAN FOREST

Preservation Tree

plan-it GEO

CITY OF DENTON

kdb Keep Denton Beautiful

Texas Trees Foundation
CREATING HEALTHY COMMUNITIES

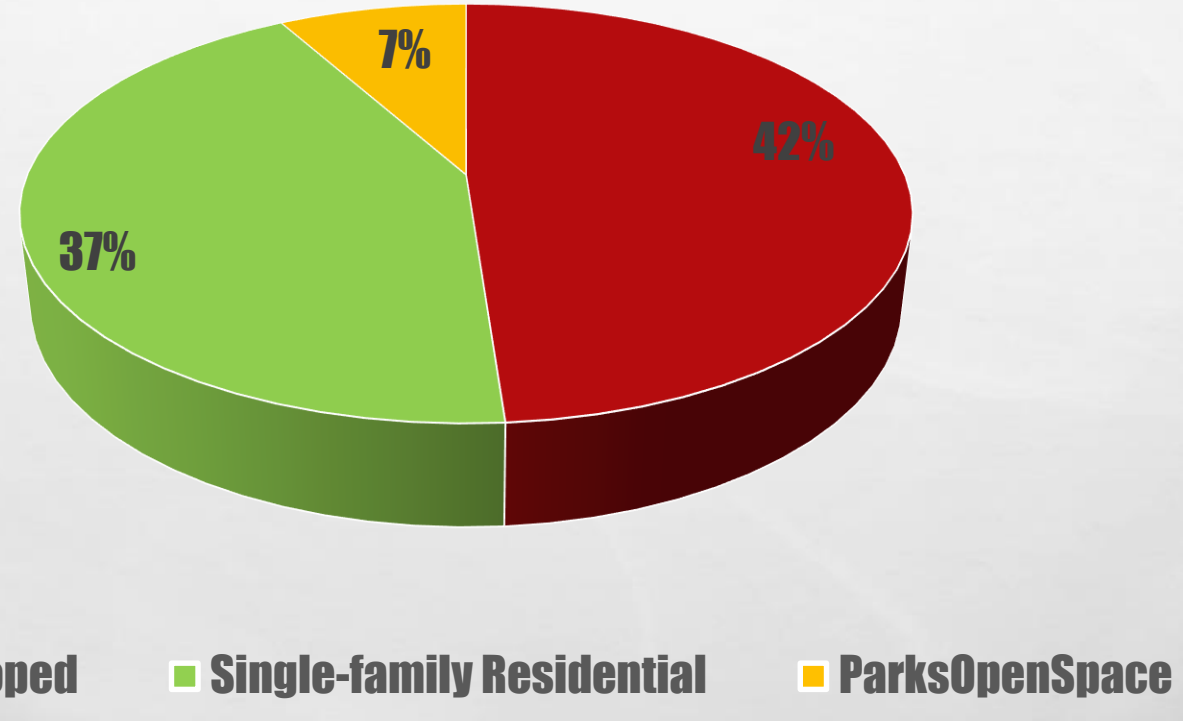
# STATE OF THE DENTON URBAN FOREST

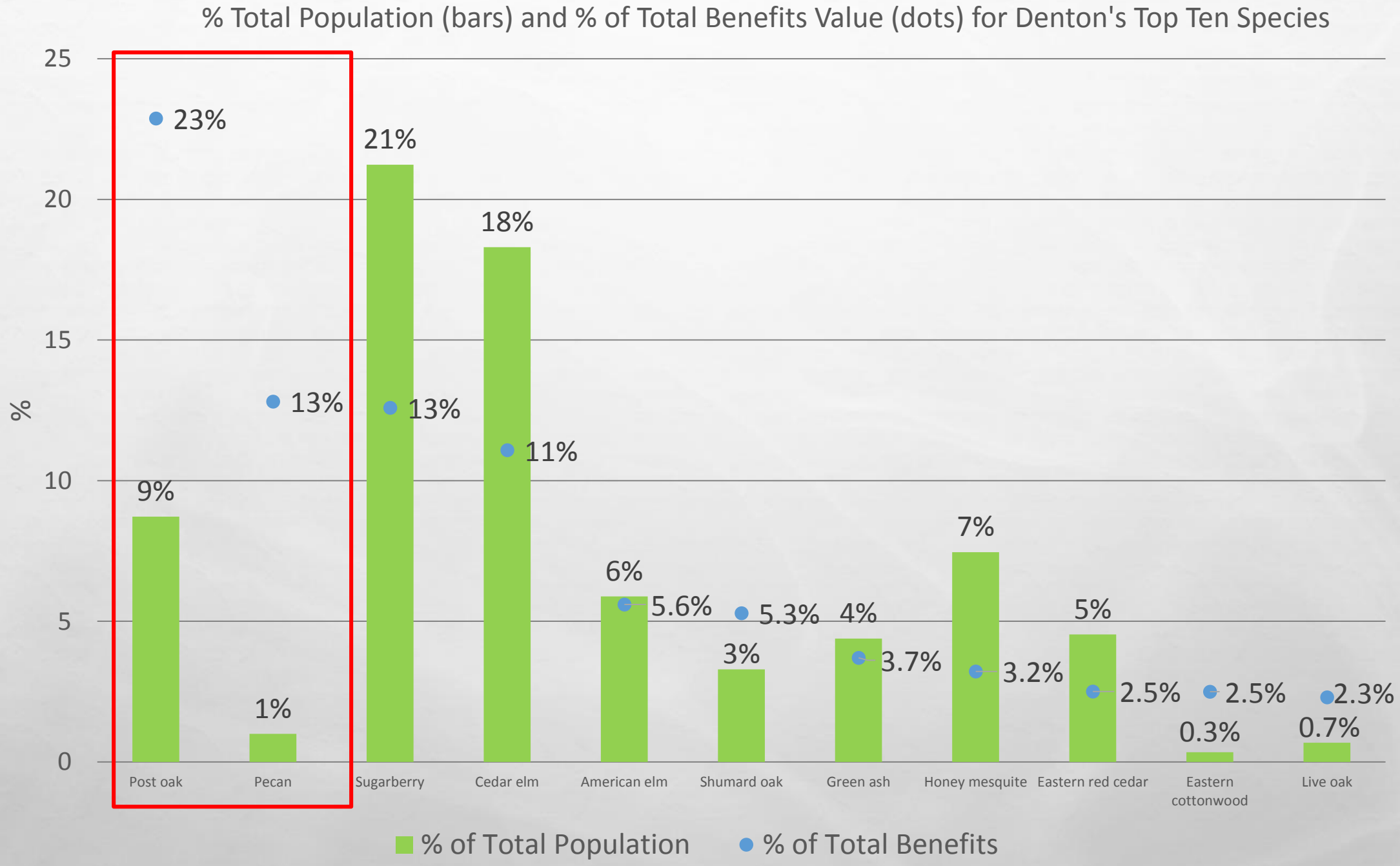
- Denton's **most common tree species were Sugarberry (a.k.a. Hackberry), Cedar Elm, and Post oak**
- Denton's 3,463,000 trees had a **structural value of $2.06 billion.**
- Denton's trees provided **$7.2 million annually in environmental services**.
- Trees cleaned the air by storing 458,000 tons of carbon valued at $61 million.
- Trees provided over 52 thousand tons of Oxygen per year.
- Trees provided **annual energy savings of $1.6 million annually.**

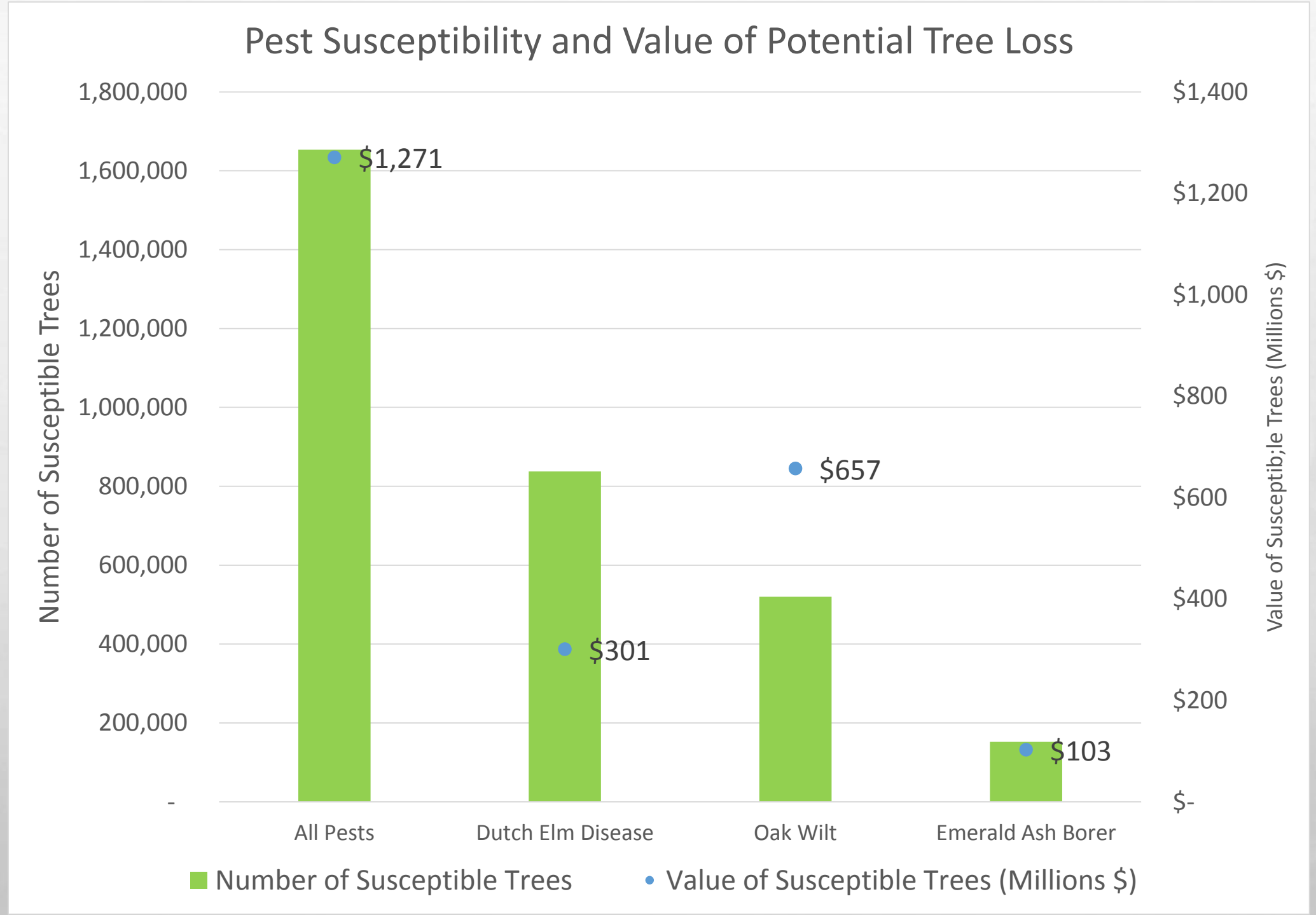
# STATE OF THE DENTON URBAN FOREST

- Denton's average **tree canopy was 30 % (*not* comparable to previous analyses)**
- **46% of Denton's urban tree canopy was located on undeveloped land.**
- Within Denton's ETJ there was an **increase in canopy of 2.2% from 2008 to 2014**.
- **14% of the surface area in Denton was covered with impervious surface** such as buildings, cement, roads and parking lots.
- **44% of the current land area were suitable for future tree planting**.

# % of Total Benefits by Land Use Class

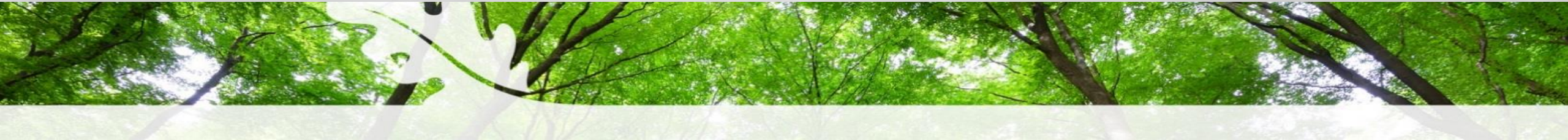



% Total Population (bars) and % of Total Benefits Value (dots) for Denton's Top Ten Species
25
20
15
10
5
0
%
23%
13%
21%
13%
18%
11%
9%
1%
6%
5.6%
5.3%
3%
4%
3.7%
7%
3.2%
5%
2.5%
0.3%
2.5%
0.7%
2.3%
Post oak
Pecan
Sugarberry
Cedar elm
American elm
Shumard oak
Green ash
Honey mesquite
Eastern red cedar
Eastern cottonwood
Live oak
% of Total Population
% of Total Benefits


Pest Susceptibility and Value of Potential Tree Loss
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
-
Number of Susceptible Trees
$1,400
$1,200
$1,000
$800
$600
$400
$200
$-
Value of Susceptib;le Trees (Millions $)
$1,271
$301
$657
$103
All Pests
Dutch Elm Disease
Oak Wilt
Emerald Ash Borer
Number of Susceptible Trees
Value of Susceptible Trees (Millions $)

## Per Tree Benefit Values for Several iTree Eco Studies in Texas

| Location | Year | Scale | # of Trees | Acres | Tree/Acre | # of Species | Canopy Cover (%) | Carbon Storage ($) | Carbon Sequestration ($/yr) | Energy Savings ($/yr) | Air Quality ($/yr) | Rainfall Interception ($/yr) | Average of All Benefits ($) | Structural / Replacement Value ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Houston | 2005 | Region (8 County) | 663,000,000 | 4,851,840 | 137 | 67 | 28 | 1.87 | 0.04 | 0.20 | 0.45 | NA | 0.64 | $ 311 |
| Arlington | 2009 | City | 2,965,000 | 65,889 | 45 | 77 | 22 | 2.87 | 0.15 | 0.99 | 0.98 | 1.44 | 1.29 | $ 927 |
| Mesquite | 2012 | City | 2,091,000 | 29,568 | 71 | 54 | 24 | 4.92 | 0.44 | 0.37 | 0.74 | 0.96 | 1.49 | $ 476 |
| El Paso | 2013 | City | 1,281,000 | 164,032 | 13 | 50 | 5 | 5.16 | 0.41 | 2.11 | 0.19 | 1.72 | 1.92 | $ 1,272 |
| Plano | 2014 | City | 1,690,000 | 46,030 | 37 | 60 | 16 | 8.99 | 0.62 | 1.1 | 1.02 | 0.26 | 2.39 | $ 947 |
| Dallas | 2014 | City | 14,700,000 | 218,240 | 67 | 80 | 29 | 9.32 | 0.56 | 0.61 | 1.03 | 0.27 | 2.36 | $ 613 |
| Denton | 2016 | City | 3,463,000 | 74,492 | 47 | 46 | 30 | 17.6 | 0.88 | 0.58 | 0.22 | 0.39 | 3.93 | $ 595 |



# RECOMMENDATIONS AND NEXT STEPS

Preservation Tree

plan-it GEO

CITY OF DENTON

kdb Keep Denton Beautiful

Texas Trees Foundation
CREATING HEALTHY COMMUNITIES

# RECOMMENDATIONS

**Recommendation 1**: Utilize assessment results to **preserve and promote urban tree canopy**, especially **in Undeveloped** and **Single-Family Residential** land use classes.

**Recommendation 2**: **Perform further UTC analyses**, especially comparing publicly and privately owned parcels in the Undeveloped land use class.

**Recommendation 3**: Utilize assessment to help **drive policy and management decisions** that both *strengthen tree protection during development* and professional care annually.

**Recommendation 4**: Utilize assessment results to **enhance current tree planting initiatives** through strategic tree and planting location selection and through development of public/private partnerships.

**Recommendation 5**: Utilize trees and other green infrastructure to **off-set the urban heat island effect and reduce impact of stormwater.**

# 2016 DENTON URBAN FOREST ASSESSMENT PROJECT

Growing the Denton Urban Forest Together!

Questions, Comments, Discussion

Preservation Tree

plan-it GEO

CITY OF DENTON

kdb Keep Denton Beautiful

Texas Trees Foundation
CREATING HEALTHY COMMUNITIES