

# *Burlingame, California*

## *Urban Forest Resource Analysis*

*May 2011*



## Executive Summary

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Recognized by the Arbor Day Foundation as a Tree City, USA for more than 31 years, trees are an important part of the history and character of Burlingame, California. Often referred to as the City of Trees, the community has an active street tree program and a tree protection ordinance (11.04.035) that prohibits the destruction, injury, or removal of public trees without a permit.

As a continuation of their long-standing, proactive approach to managing the urban forest, the City of Burlingame contracted with Davey Resource Group (DRG) in 2011 to inventory publicly owned trees on streets and right-of-ways, in parks, and at City facilities. The inventory, conducted by a team of arborists, included a brief inspection of each tree. In addition to the geographic location, the arborist also recorded the species, size, condition, and current maintenance needs of each tree. The inventory identified 14,783 trees and 911 available planting sites. Using the collected information in conjunction with i-Tree benefit-cost modeling software, DRG developed a detailed and quantified analysis of the current structure, function, and value of this public tree resource.

The analysis determined that Burlingame's public urban forest is a cost-effective resource that provides annual benefits of \$2,275,915 (\$153 per tree). These benefits include energy savings, air quality improvements, stormwater interception, atmospheric CO<sub>2</sub> reduction, and aesthetic contributions to the social and economic health of the community. Considering the annual investment of \$954,000 (\$33.88 per capita) to provide care for this resource, the community realizes an overall net benefit of \$1,321,915. **The bottom line is that for every \$1 spent on public trees, the community of Burlingame receives \$2.39 in benefits.**

Each year, public trees reduce electrical energy consumption by 1,805 megawatt hours (MWh) and annual natural gas consumption by 36,555 therms, for a combined value of \$366,259. In addition, canopy from this population annually reduces stormwater runoff by 22.8 million gallons, protecting local water resources, including the Bay, by preventing the introduction of sediment and pollution. Because the public tree inventory currently includes a large percentage of species that naturally emit higher amounts of biogenic volatile organic compounds (BVOCs), the air quality benefits provided by the overall population are negative. However, the population is removing, through deposition and interception, 3.7 tons of nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), ozone (O<sub>3</sub>), and small particulate matter (PM<sub>10</sub>) from the atmosphere each year.

Through continued growth, greater tree canopy coverage, improved overall health, species selection, and increased lifespan, the urban forest is one community asset that has the potential to increase in value and provided benefits over time. Burlingame has a nearly ideal age distribution, with a good number of young trees establishing and poised to replace older, declining populations. Many of these young trees produce positive air quality benefits and although it is critical to maintain an adequate level of resources to protect and nurture this investment, the City is well positioned to realize an increase in environmental benefits over time. Burlingame's ongoing commitment to maintaining and conserving the urban forest will continue to ensure that the community will always be a great place to live.

## Introduction

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Often referred to as the City of Trees, Burlingame, California is located on the San Francisco peninsula, in San Mateo County. Incorporated in 1908, the City encompasses an area of 5.5 square miles and has a current population estimated at 28,158. With significant shoreline on San Francisco Bay, residents and visitors enjoy a temperate climate and a high quality of life.

Determined to become a more sustainable community, the City's [Climate Action Plan](#) encourages green practices and reduced carbon emissions. While trees are not specifically mentioned as a solution, their contribution cannot be discounted. Individual trees and a healthy urban forest play important roles in the quality of life and the sustainability of Burlingame. Research has demonstrated that healthy urban trees can improve the local environment and lessen the impact resulting from urbanization and industry (CUFR). Trees improve air quality by manufacturing oxygen and absorbing carbon dioxide (CO<sub>2</sub>), as well as filtering and reducing airborne particulate matter such as smoke and dust. Urban trees reduce energy consumption by shading structures from solar energy and reducing the overall rise in temperature created through urban heat island effects (EPA). Urban trees slow and reduce stormwater runoff, helping to protect critical waterways, including the Bay, from excess pollutants and particulates and urban trees provide critical habitat for wildlife and promote a connection to the natural world.

In addition to these direct improvements, healthy urban trees increase the overall attractiveness of a community and have been proven to increase the value of local real estate by 7 to 10%, as well as promoting shopping, retail sales, and tourism (Wolf, 2007). Trees support a more livable community, fostering psychological health and providing residents with a greater sense of place (Ulrich, 1986; Kaplan, 1989). Community trees, both public and private, soften the urban hardscape by providing a green sanctuary and making Burlingame a more enjoyable place to live, work, and play. The City's 14,783 public trees play a prominent role in the urban forest benefits afforded to the community and the citizens rely on the City of Burlingame to protect and maintain this vital resource.

Acknowledged by the Arbor Day Foundation as a Tree City USA for more than 31 years, there is ample evidence that Burlingame values its trees. The City has an active [Street Tree](#) program along with an ordinance (11.04.035) that protects street trees and other public trees from being improperly pruned, injured, or destroyed. Reflecting further appreciation and a proactive stance on the management of the community's urban forest resource, the City contracted with Davey Resource Group (DRG) in 2011 to conduct an inventory of public trees on streets, in parks, and at city facilities. A team of ISA Certified Arborists mapped and geo-coded the location of publicly owned trees using global positioning system (GPS) technology. The inventory data is maintained by the City's urban forest staff using TreeKeeper<sup>®</sup> 7.7, a software management system developed by Davey to provide accurate and dependable inventory data specific to tree characteristics, health, and performed maintenance.

In addition to geo-coding the location, DRG arborists collected information about the species, size, condition, and current maintenance needs of each tree. The collected data was used in conjunction with *i-Tree's Streets*, a STRATUM Analysis Tool (*Streets* v4.0.0; *i-Tree* v4.0.1), to develop a resource analysis and report of the current condition of the urban forest. This report, unique to Burlingame, effectively quantifies the value of the community's public



trees in regards to actual benefits derived from the tree resource. In addition, the report provides baseline values that can be used when developing and updating an urban forest management plan. This helps in determining where to focus available resources and setting benchmarks for measuring progress.

The purpose of the urban forest resource analysis and report is to provide information on the structure, function, and value of the public tree resource. From this information, managers and citizens alike can make informed decisions about budgetary support and management priorities. This report provides the following information:

- A description of the current structure of Burlingame's public tree resource.
- Current, detailed management expenditures for Burlingame's publicly managed trees and critical baseline information for evaluating program efficiency.
- A quantified value of the environmental benefits provided by Burlingame's public trees. This also illustrates the relevance and relationship of the resource to local quality of life issues such as air quality, environmental health, economic development, and psychological health.
- Data that may be used by resource managers in the pursuit of alternative funding sources and collaborative relationships with utility purveyors, non-governmental organizations, air quality districts, federal and state agencies, legislative initiatives, or local assessment fees.
- Benchmark data, useful in the development of a urban forest management goals and for measuring the success of long-term strategies.

Burlingame's urban forest inventory included all publicly managed trees in streets, city facilities, and parks.



## Chapter 1: Urban Forest Resource Summary

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### Summary of Urban Forest Resource Structure

The City of Burlingame's urban forest resource currently includes 14,783 publicly managed trees and 911 available planting sites. A structural analysis is the first step towards understanding the benefits provided by these trees as well as their management needs. Upon examination of species composition, diversity, age distribution, condition, canopy coverage, and replacement value, DRG determined that the following information characterizes Burlingame's public tree resource:

- The inventory includes more than 200 distinct tree species. The predominant tree species are London planetree (*Platanus X acerifolia*, 12.6%), blue gum (*Eucalyptus globulus*, 11%), and southern magnolia (*Magnolia grandiflora*, 8.7%).
- The age structure of Burlingame's public tree population is nearly ideal, with 41.2% of trees measuring less than 8 inches DBH (diameter at breast height, measured at 4'6" above the ground) and 16.8% measuring greater than 24 inches DBH.
- Burlingame's tree resource is in relatively good condition overall, with 44.5% of trees rated good or better and 49% rated fair. Maintaining the condition of existing trees for as long as possible will increase their useful lifespan and promote a steady flow of benefits to the community.
- Burlingame's public tree canopy cover is estimated at 274 acres, or 7.8% of the total land area and 71% of the total street and sidewalk area within the City.
- Burlingame's public tree population has sequestered 34,749 tons of carbon (CO<sub>2</sub>) to date, valued at \$521,228.
- Replacement of Burlingame's 14,783 public trees with trees of similar size, species, and condition would cost more than \$41.7 million.
- Burlingame's current stocking level for public trees is estimated to be 94.2%, based on a total 15,694 inventoried planting sites, including 14,873 trees, 844 vacant sites, and 67 sites requiring stump removal prior to replanting.

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### Summary of Urban Forest Benefits

Annually, Burlingame's public trees provide cumulative benefits to the community at an average value of \$153.95 per tree, for a total gross value of \$2,275,915 per year. The City's public trees are providing the following substantial annual benefits:

- Public trees reduce electricity and natural gas use in Burlingame through shading and climate effects, totaling \$366,259, an average of \$24.78 per tree.

- The public trees in Burlingame currently sequester 1,843.9 tons of atmospheric CO<sub>2</sub> per year. An additional 758.4 tons is avoided through decreased energy use, resulting in a net value of \$34,003 and an average of \$2.30 per tree.
- Burlingame's public trees intercept an estimated 22.8 million gallons of stormwater annually for a total value of \$91,179 per year, an average of \$6.17 per tree.
- The total annual benefits contributed by Burlingame's public trees to property value increases, aesthetics, and socioeconomic value are nearly \$2.1 million, an average of \$140.08 per tree.
- While many species in this inventory are providing positive air quality benefits, the prevalence of species that emit high levels of biogenic volatile organic compound (BVOCs) is resulting in an air quality deficit of -\$286,390 annually.
- When the City's annual investment of \$954,000 for maintenance of this urban forest resource is considered, the annual net benefit (benefits minus investment) to the City is \$1,321,915. The average net benefit for an individual public tree in Burlingame is \$89.42 per year. **Burlingame receives \$2.39 in benefits for every \$1 spent on the public tree population.**

***For every \$1  
invested  
in public trees,  
Burlingame  
receives  
\$2.39  
in benefits***

## ***Urban Forest Resource Management***

Burlingame's public tree population is a dynamic resource that is worth continued investment to maintain and extend its full benefit potential. **The community forest is one of the few assets that has the potential to increase in value with time and proper management.** Appropriate and timely tree care can substantially increase lifespan, preserving the higher benefit stream that results from a mature community forest. As individual trees continue to mature, aging trees are replaced, and stocking levels increase, the overall value of the community forest and the amount of benefits provided also increases. This vital, living resource is, however, vulnerable to a host of stressors, requiring ecologically sound and sustainable best management practices to ensure a continued flow of benefits for future generations.

Burlingame's urban forest has a nearly ideal relative age distribution, with a good portion of young trees establishing to provide replacement for older trees as their senescence necessitates removal. While the overall population is in relatively good condition, the inventory identified 306 trees in need of priority pruning to mitigate defects and/or improve structure. An additional 252 trees were recommended for removal. Once these priority tasks are completed, Burlingame can focus resources on maximizing the overall flow of benefits by planting additional trees to replace removals and increase the overall stocking level (currently 94.3%). Based on the resource analysis, Davey Resource Group recommends the following:

- *Continue annual tree planting efforts with the goal of achieving a 100% stocking rate, utilizing available planting sites identified by the inventory*
- *Increase reliance on species that provide positive air quality benefits*

- *Reduce the prevalence of species that emit high levels of BVOCs. As these populations age, install replacement species that provide positive air quality benefits*
- *Promote the health and longevity of the existing tree resource through comprehensive tree maintenance and a cyclical pruning schedule*
- *Dedicate resources towards a structural pruning program for young and establishing trees to promote healthy structure, extend life expectancy, and reduce future costs and liability*
- *Maintain a stable age distribution to ensure long-term resource sustainability and optimal canopy coverage. Where possible, establish replacement trees for the City's most mature trees (and top benefit producers) with trees of similar stature before they must be removed, thereby ensuring a consistent flow of benefits. Focus on planting large-stature trees, where space allows, to maximize benefits*

Planning and funding for tree care and tree management must complement planting efforts in order to ensure the long-term success and health of Burlingame's urban forest. Existing mature trees should be maintained and protected whenever possible, since the greatest benefits accrue from the continued growth and longevity of the existing canopy. Burlingame can take pride in knowing that public trees improve the quality of life in the city and that trees are well worth the investment.

This urban forest resource analysis and report, based on the current inventory status, defines the population and structure of Burlingame's public urban forest and quantifies the benefits of that resource. The analysis focuses solely on publicly owned, city-managed trees. The analysis utilizes *i-Tree Streets*, a STRATUM Analysis Tool (*Streets* v4.0.0; *i-Tree* v4.0.1), in order to establish baseline information on the value to the community. This report and the included analysis, which is unique to Burlingame, effectively estimates and quantifies the value of the public tree asset in regards to actual benefits derived from this resource. In addition, the report provides a baseline analysis that can be used when creating, implementing, and updating an urban forest management plan, determining where best to focus available resources, and setting benchmarks for measuring progress. An urban forest resource analysis provides information on the structure, function, and value of the urban forest and its assets so that forest managers and citizens alike can make informed decisions about budgetary support and management priorities.

# City of Burlingame

## Inventory Report

Presented by Dana Karcher  
Davey Resource Group  
July 18, 2011



# What is the Value of Trees to Burlingame?

- Interception of Stormwater
- Aesthetics
- Energy Conservation
- Air Quality
- CO2 Reductions

# The Inventory

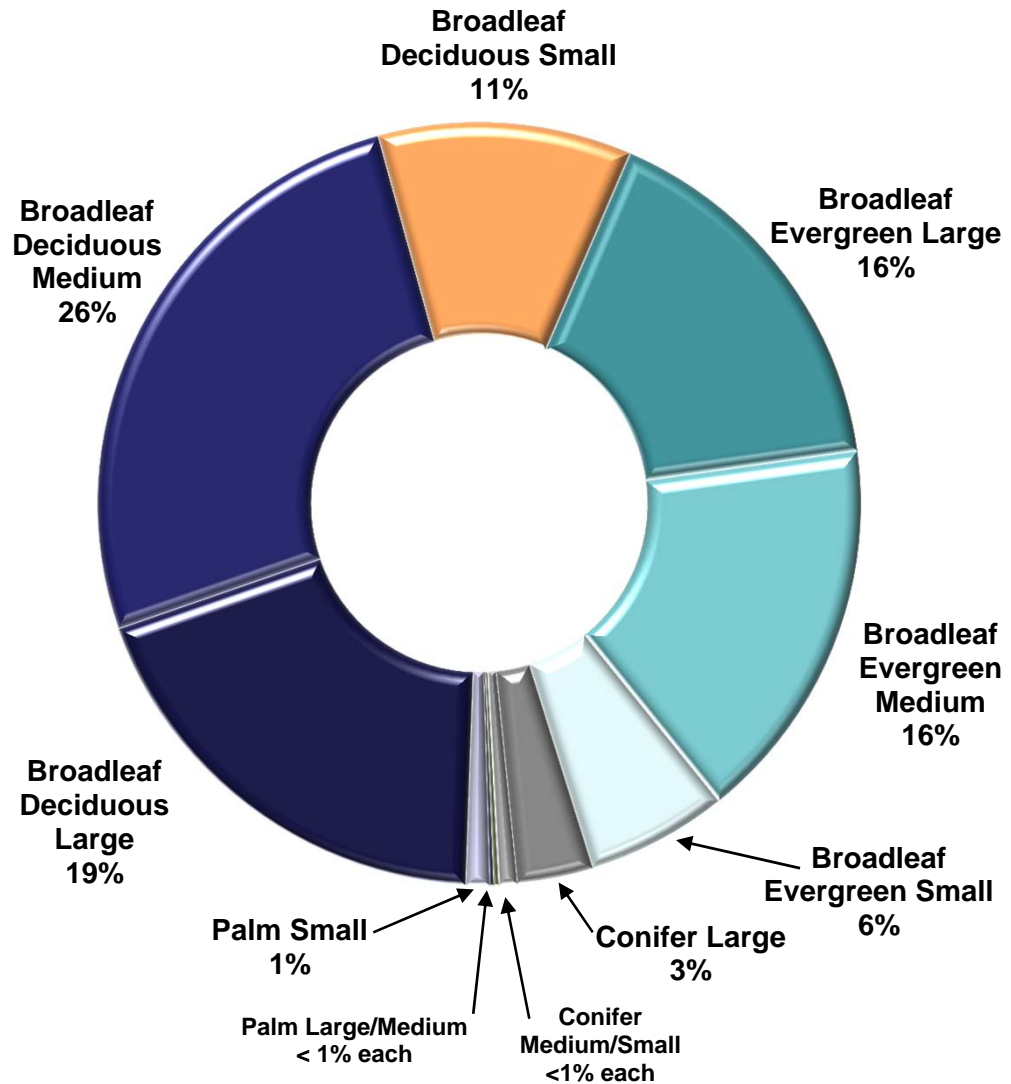
- CalFire Grant
  - ABAG Funding
  - In-Kind
- Personnel
- Equipment
- Collection Attributes

## Findings

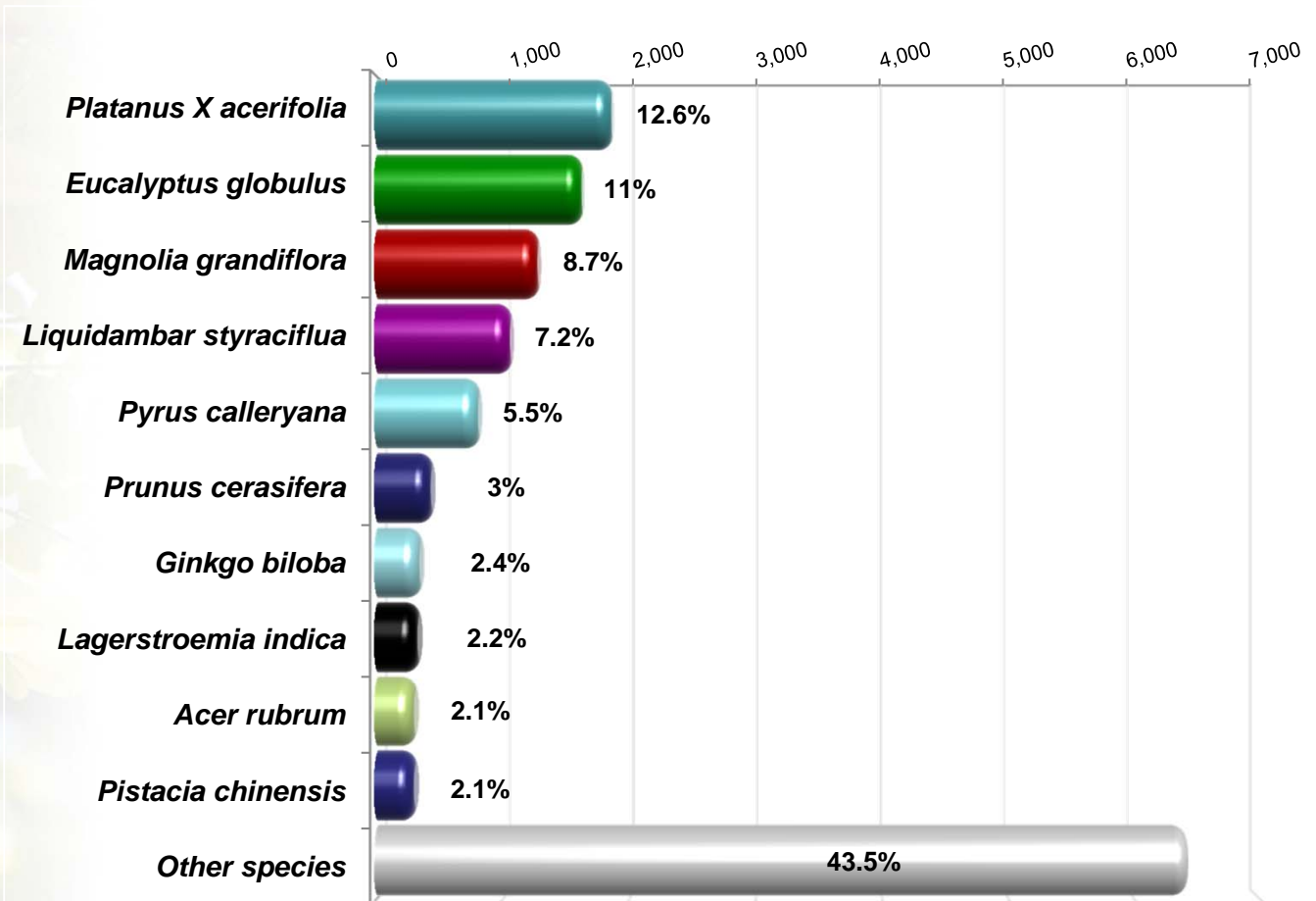
- 14,848 Trees
  - #1 Tree: London planetree
  - #2 Tree: Blue gum eucalyptus
  - #3 Tree: Magnolia
- Over 250 Species
- 94% Stocking level
  - 911 Planting Sites
- Replacement Value

**\$41.7 million**

# Species Distribution

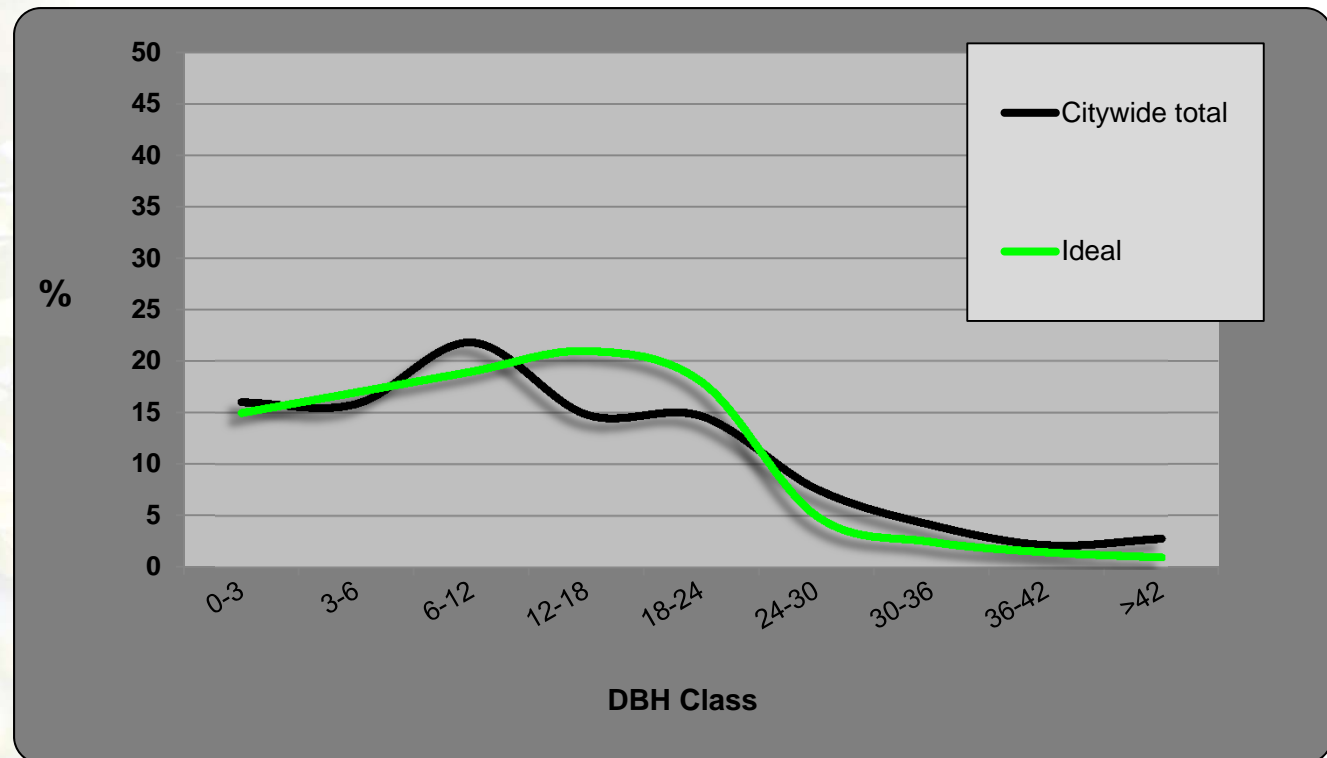


# Species Distribution

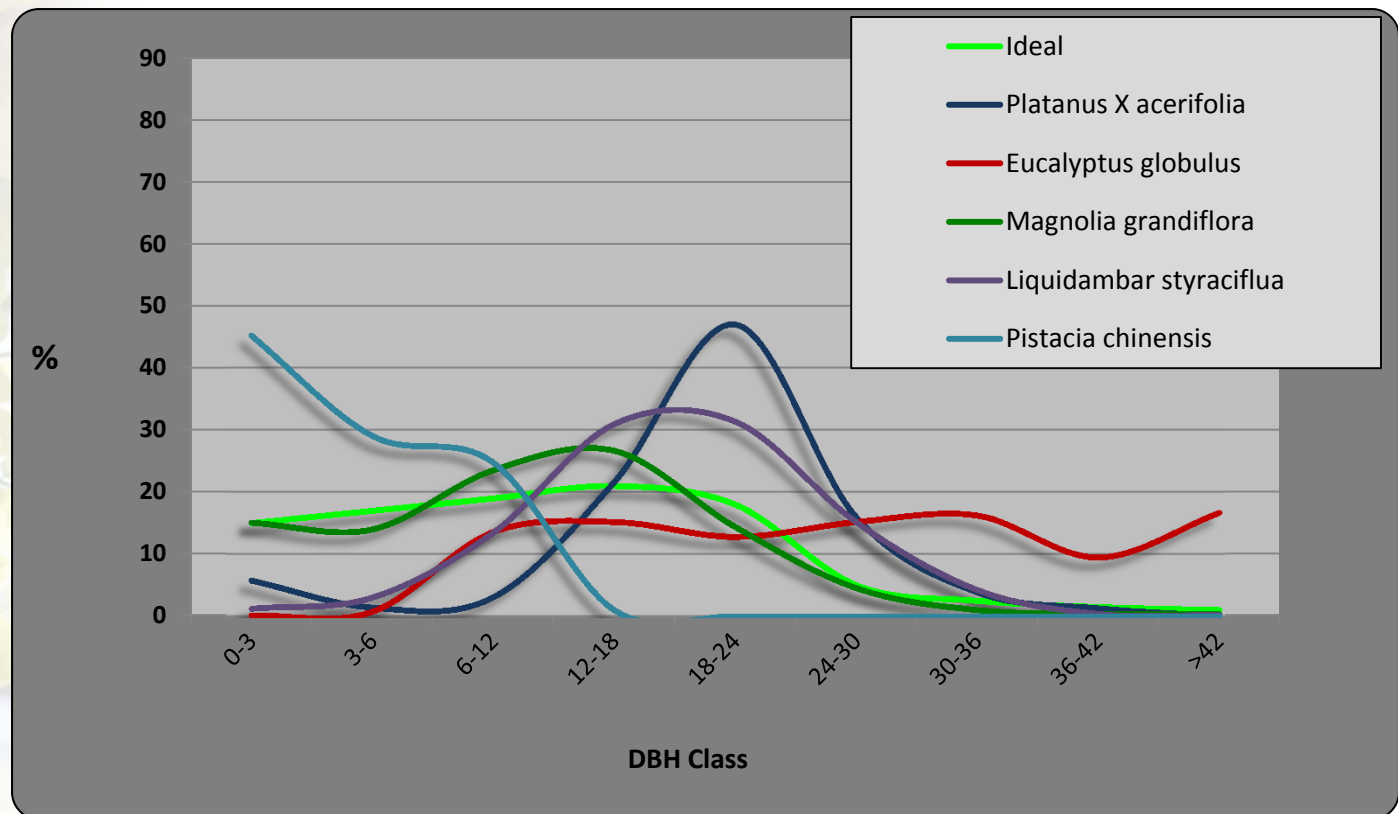




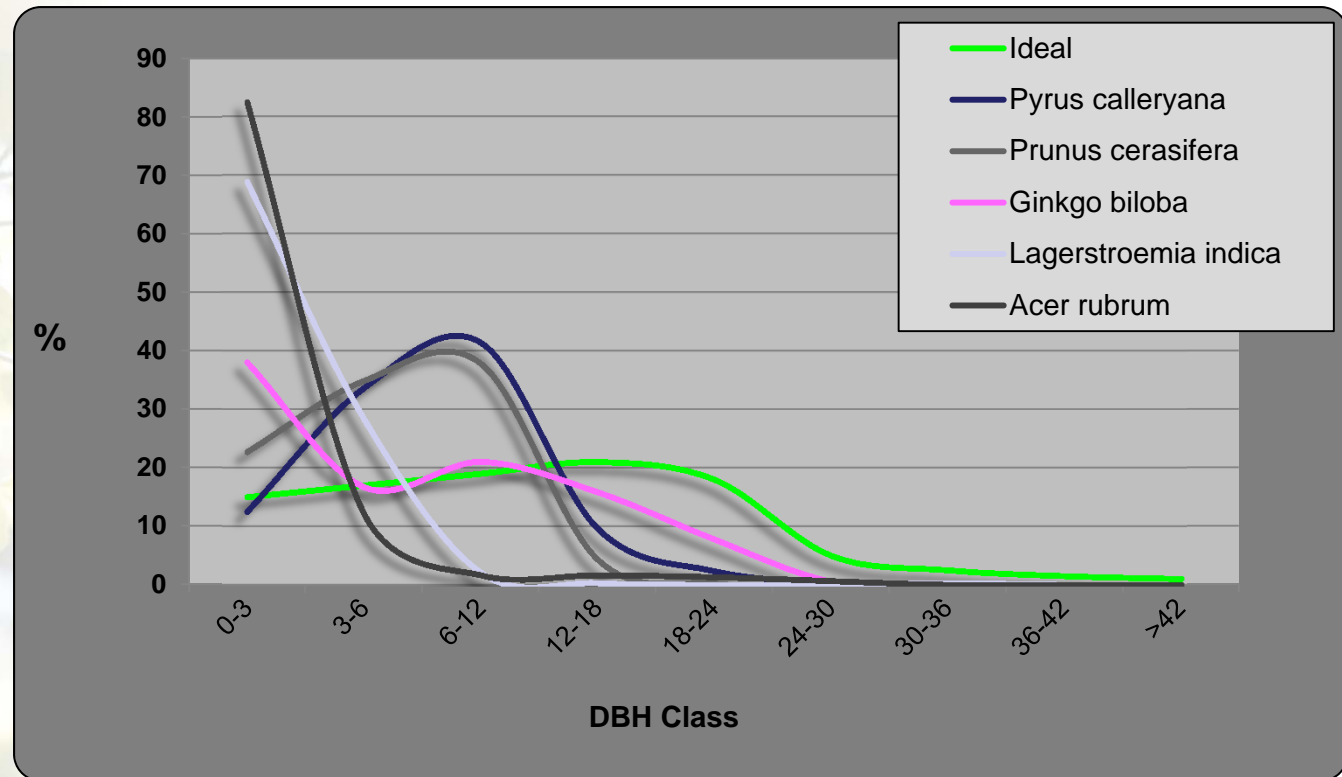
# Age Structure



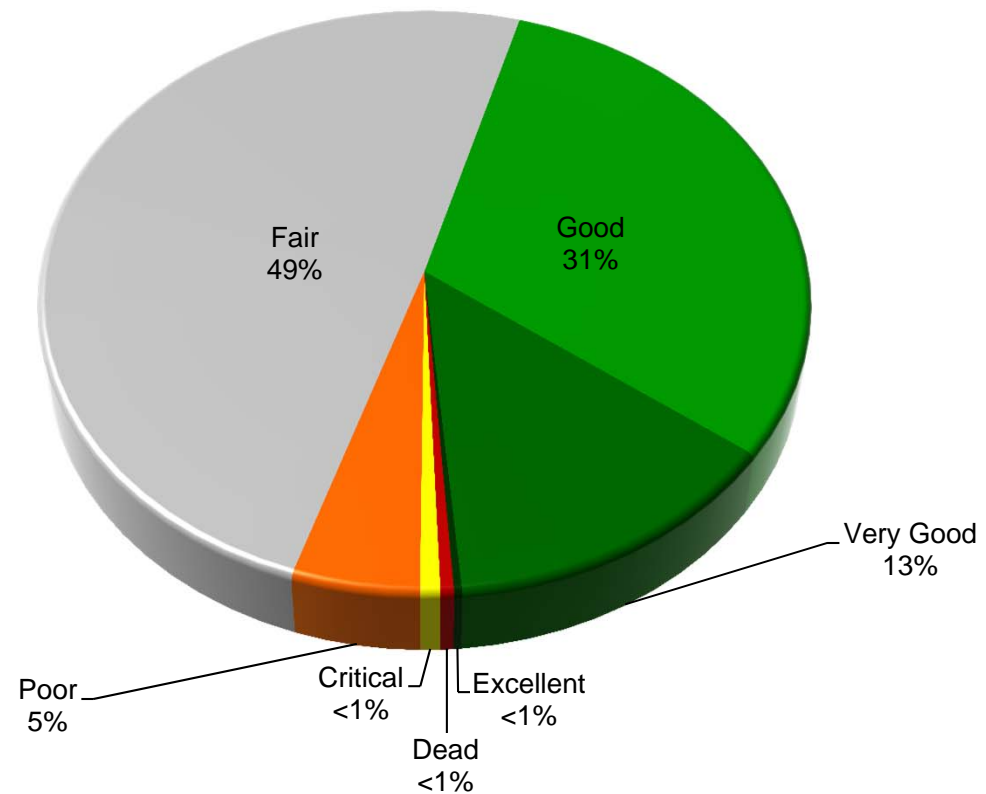
# Age Structure



# Age Structure

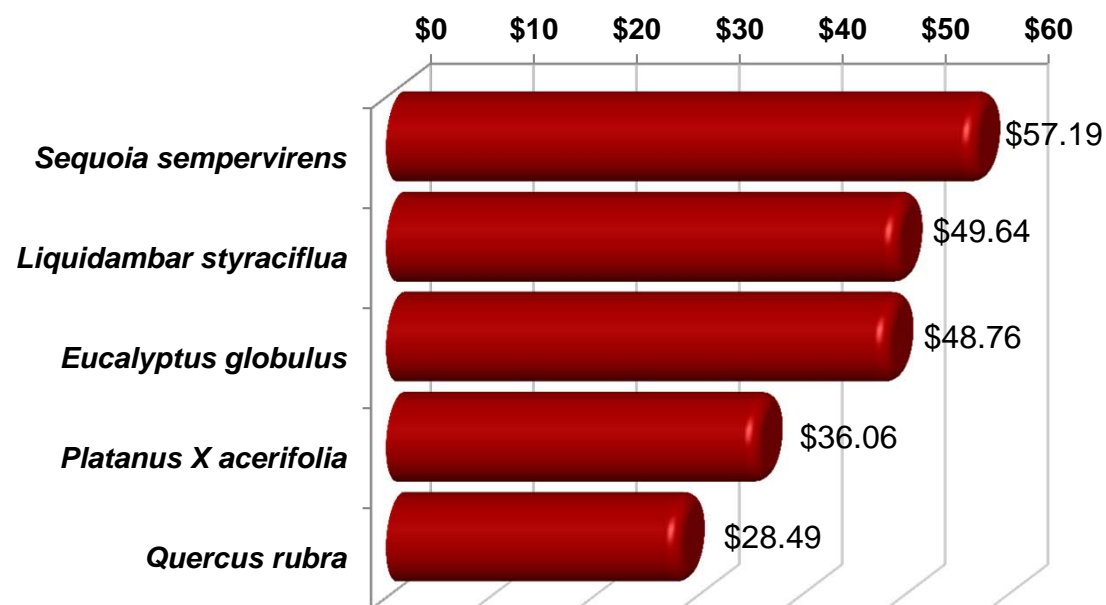


# Urban Forest Condition





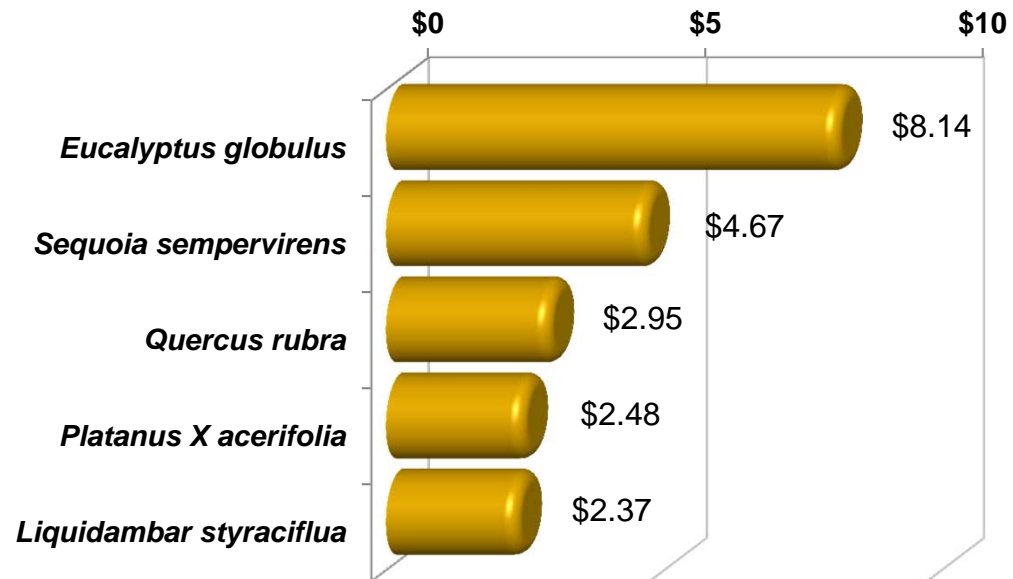
# iTree Results: Electricity and Natural Gas Savings



- Strategic shading
- Slowing of winds
- Evapotranspiration



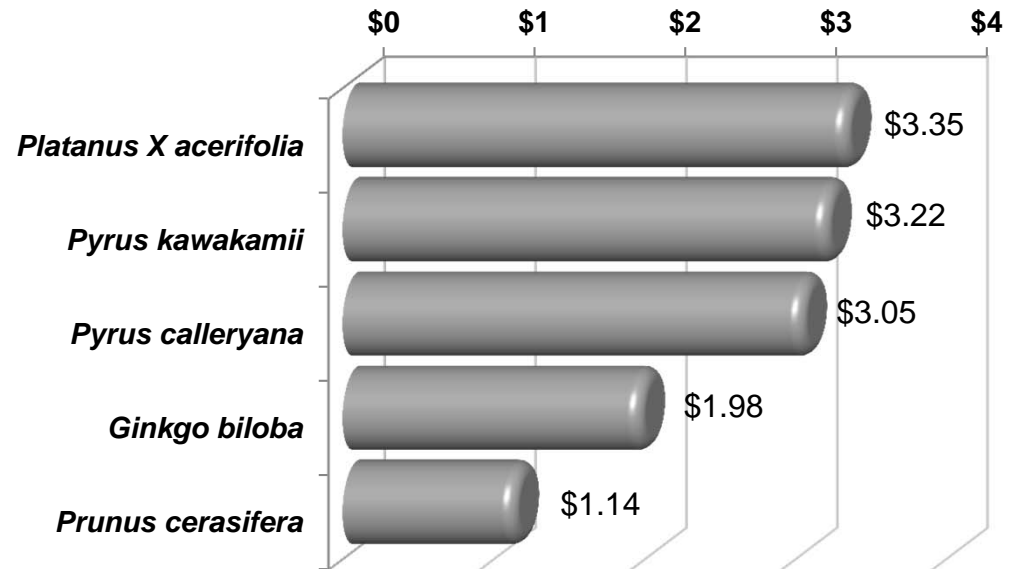
# iTree Results: Sequestered Carbon Dioxide



**Directly**, through growth and the sequestration of CO<sub>2</sub> as wood and foliar biomass.

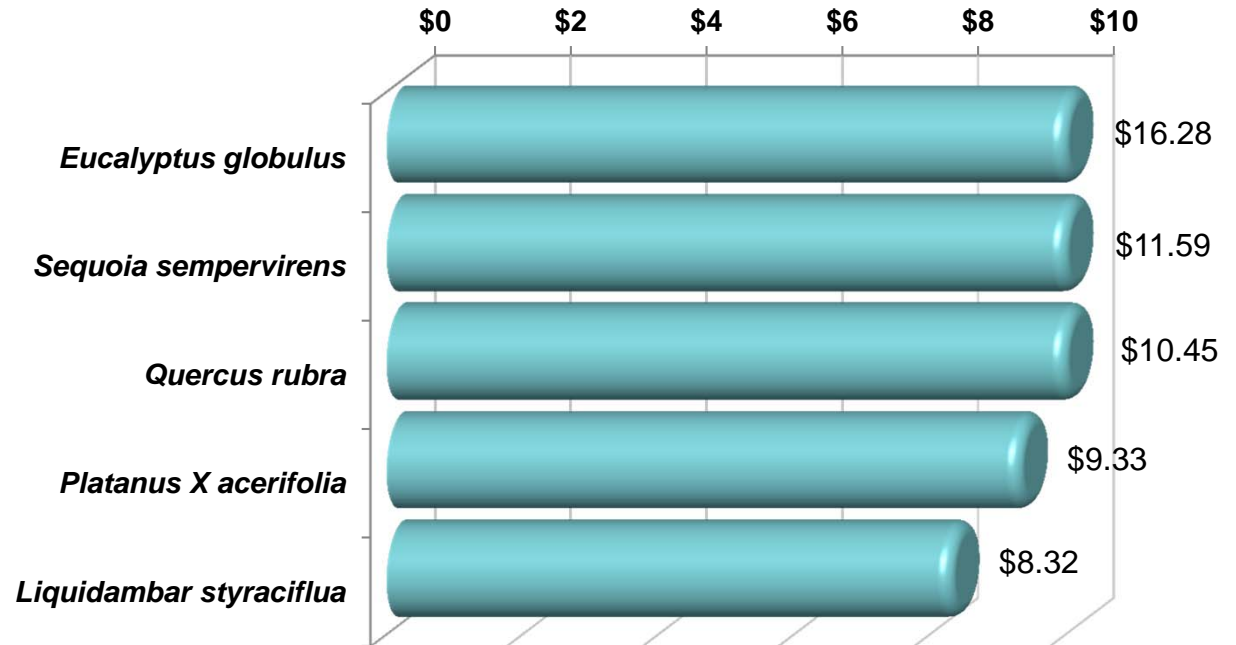
**Indirectly**, by lowering the demand for heating and air conditioning, thereby reducing the emissions associated with electric power generation and natural gas consumption.

# iTree Results: Air Quality Improvement



- Absorption of pollutants
- Interception of PM
- Reduction of emissions
- Increase in Oxygen levels
- Reduction of air temperatures

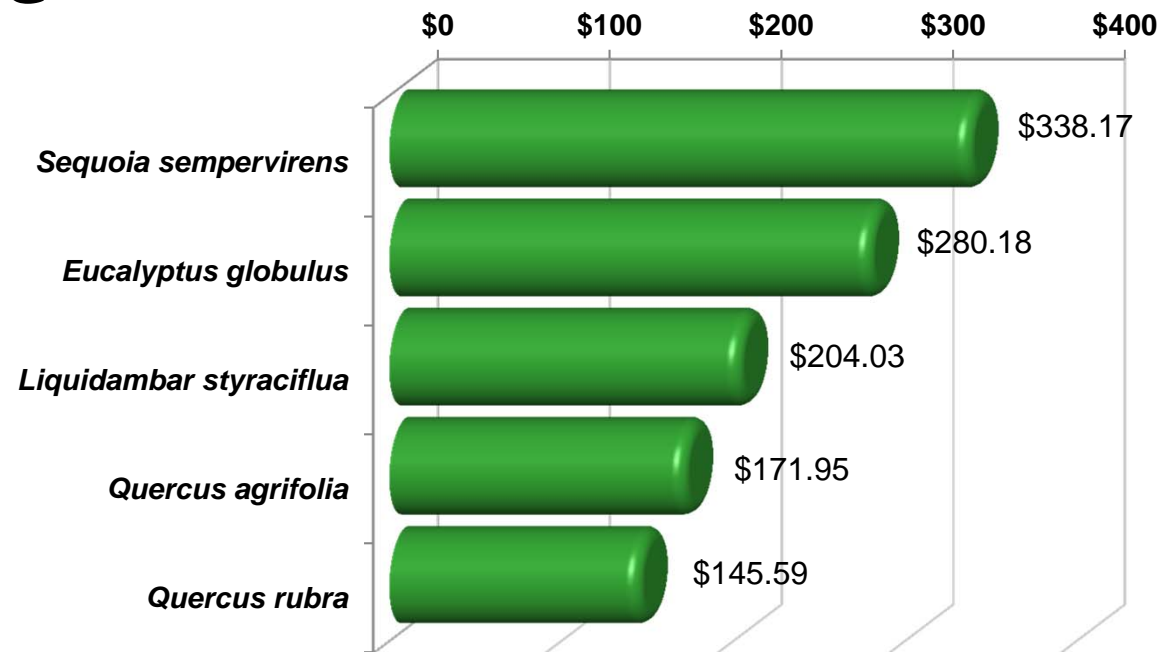
# iTree Results: Stormwater Benefits



- Leaf and Branch Surface Storage
- Root Growth and Decomposition
- Soil Erosion

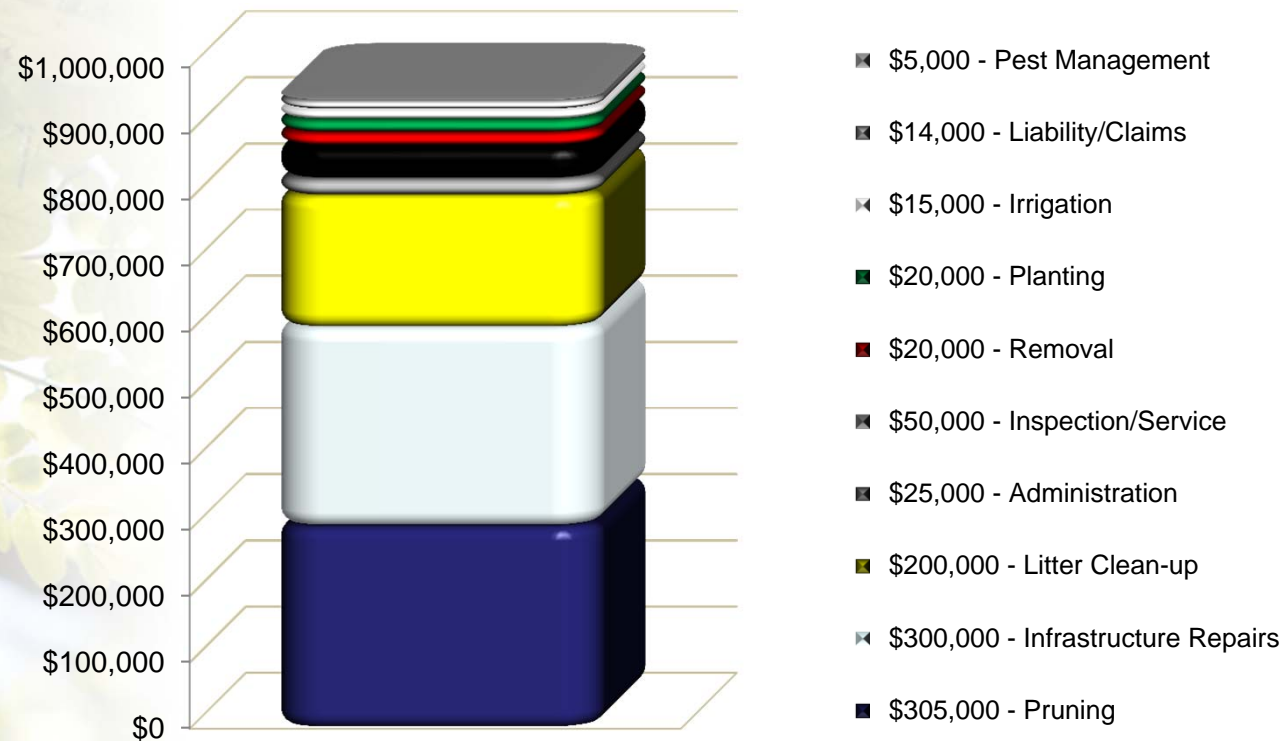


# iTree Results: Aesthetic Value



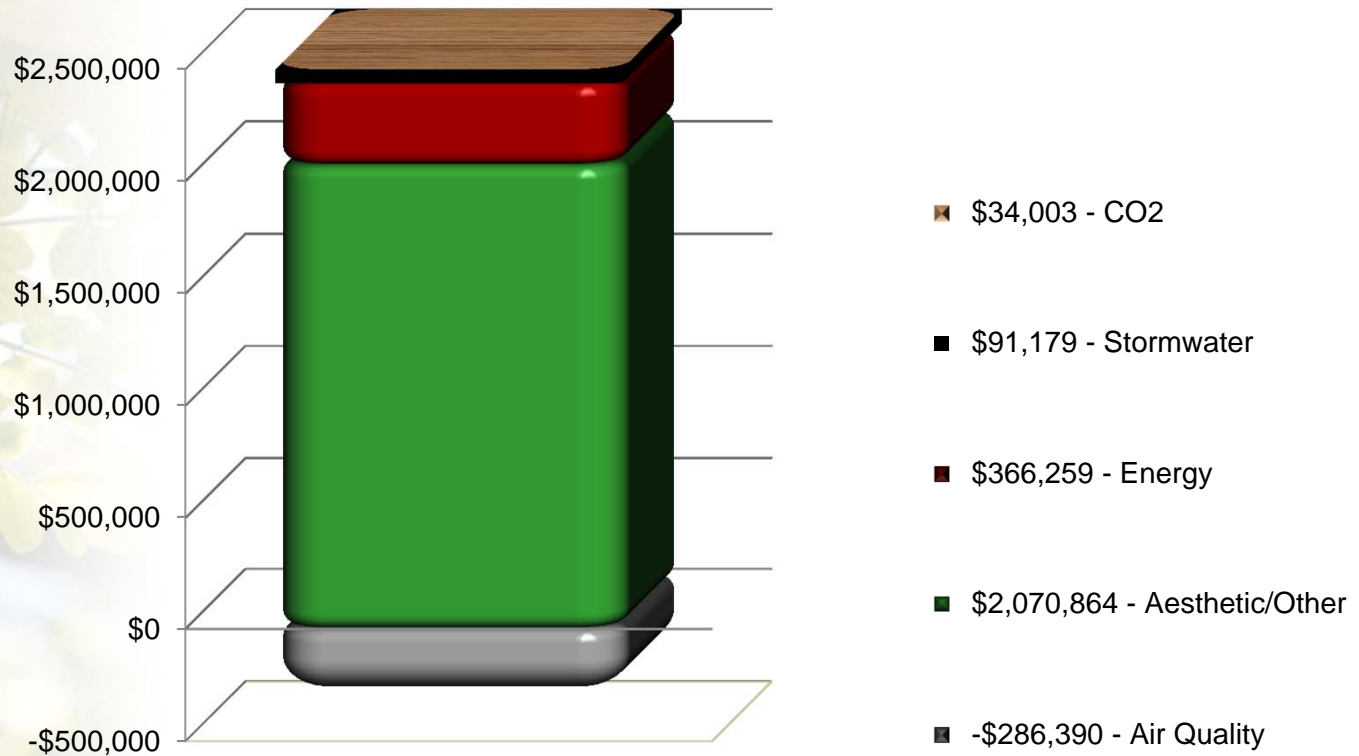
- Property Value Increase
- Economic Values

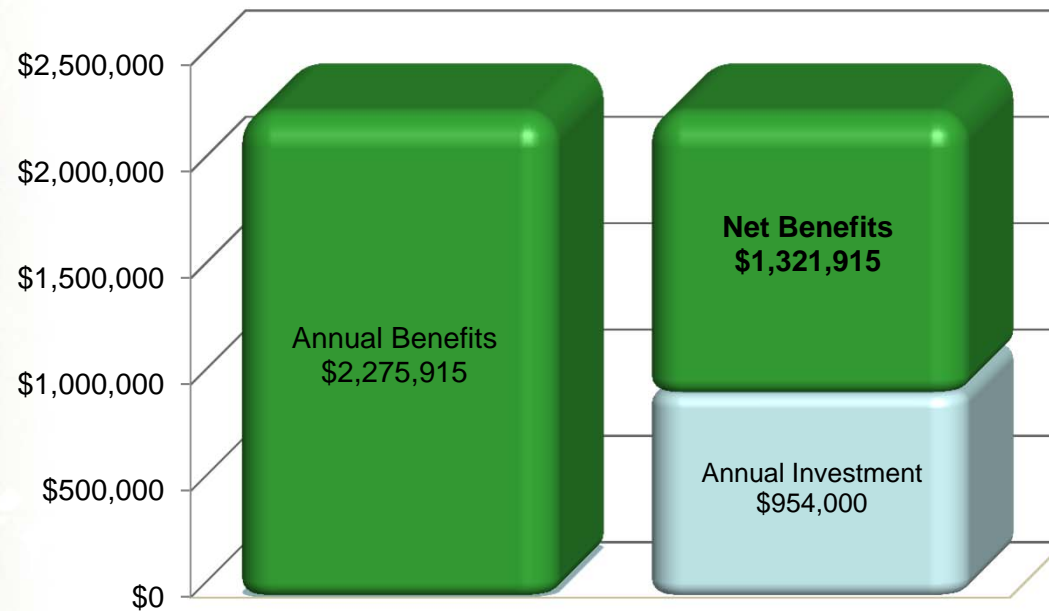
# Annual Expenditures





# Annual Benefits





- For every **\$1 invested** in Burlingame's public trees, the community receives **\$2.39 in net benefits**.

- The estimated gross benefits provided by Burlingame's public tree resource amount to \$2,275,915; a value of \$153.95 per tree and \$80.83 per capita.

## Recommendations

- Continue annual tree planting efforts
- Increase reliance on species that provide positive air quality benefits
- Reduce the prevalence of species that emit high levels of BVOCs.
- Continue to promote the health and longevity of the existing tree resource through comprehensive tree maintenance and a cyclical pruning schedule
- Dedicate resources towards a structural pruning program for young and establishing trees

# Recommendations

- **Maintain a stable age distribution to ensure long-term resource sustainability and optimal canopy coverage.**
- **Where possible, establish replacement trees for the City's most mature trees (and top benefit producers) with trees of similar stature before they must be removed**
- **Focus on planting large-stature trees, where space allows, to maximize benefits**