URBAN FOREST RESOURCE ANALYSIS

CCSD | Clark County School District

Clark County School District, Nevada

June 2013

DAVEY RESOURCE GROUP
A Division of The Davey Tree Expert Company

Clark County School District, Nevada
Resource Analysis

June 2013

Prepared for

Clark County School District

Alan Paulson

Operations Manager

5100 West Sahara

Las Vegas, NV 89146

702-799-1158

Prepared by

Davey Resource Group

A Division of The Davey Tree Expert Company

7627 Morro Rd.

Atascadero, California 93422

Phone: 805-461-7500

Toll Free: 800-966-2021

Fax: 805-461-8501

www.davey.com/drg

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While the specific reports and recommendations can be attributed to this study, the basis for its structure and written content comes from the entire series of Municipal Forest Resource Analysis reports prepared and published by the USDA Forest Service, Pacific Southwest Research Station, Center for Urban Forest Research, and credit should be given to those authors. . The Municipal Forest Resource Analysis Reports are companions to the regional Tree Guides and i-Tree's STRATUM application developed by the USDA Forest Service, Pacific Southwest Research Station, Center for Urban Forest Research.

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Executive Summary

Trees play a vital role on the campuses of the Clark County School District (CCSD). They provide numerous benefits both tangible and intangible, to residents, visitors, and neighboring communities. Dedicated to maintaining 30,487 trees in the School District, Clark County School District has demonstrated that campus trees are a valued community resource, an important component of the urban infrastructure, and a part of the district's identity.

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The Nevada Division of Forestry (NDF) has an interest in supporting urban forest management across the state. In 2012, NDF contracted with Davey Resource Group (DRG) to collect an inventory of public trees within an area designated as the Clark County Area of Interest (AOI). The AOI encompassed multiple entities, including the Clark County School District, the City of Las Vegas, North Las Vegas, Mesquite, Boulder City, unincorporated Clark County, and the University of Nevada, Las Vegas (UNLV). During the inventory, a certified arborist briefly inspected each tree and recorded information including species, size, condition, geographic location, and current maintenance needs. Arborists collected this information for nearly 100,000 individual tree sites across the AOI. For CCSD, this included 30,487 trees. This inventory represents approximately 100% of the total District-managed urban forest. Upon completion of the inventory for each entity, DRG performed a detailed and quantified analysis of the current structure, function, and value of this tree resource using the inventory data in conjunction with i-Tree benefit-cost modeling software.

Clark County School District's trees are providing annual benefits of $936,202 ($0.48 per capita). These benefits include energy savings, air quality improvements, stormwater interception, atmospheric CO_2 reduction, and aesthetic contributions to the social and economic health of the campuses.

Clark County School District's tree resource is reducing annual electric energy consumption by 1,386 megawatts (MWh) and annual natural gas consumption by 10,059 therms, for a combined value of $99,468 annually. In addition, these trees are removing 1.8 tons of pollutants from the air, including ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulates ($_{PM10}$) for an overall annual air quality benefit of $41,184. Canopy from this population covers approximately 157.2 acres. This canopy reduces annual stormwater runoff by 8.2 million gallons and protects local water resources by reducing sediment and pollution loading.

The analysis determined that CCSD's tree population is a cost-effective resource that **provides annual benefits of $936,202 ($0.48 per capita).** These benefits include energy savings, air quality improvements, stormwater interception, atmospheric CO_2 reduction, and aesthetic contributions to the social and economic health of the community. Considering the annual investment of $750,000 ($0.38 per capita) to provide care for this resource, the district realizes an overall net benefit of $186,202. **The bottom line is that for every $1 spent on public trees, Clark County School District receives $1.25 in benefits.**

Trees are a part of the community infrastructure. However, unlike other public assets, with proper maintenance, trees have the potential to increase in value over time. Clark County School District's tree resource is a relatively young population and in fair to good condition. With more than 128 different species, CCSD is well positioned to realize a significant increase in environmental benefits as tree populations continue to mature. An ongoing commitment to maximizing and maintaining the health of the urban forest will ensure that the community continues to be a healthy, safe, and enjoyable place to live.

Introduction

The Clark County School District is located in Southern Nevada, with an estimated student population of 308,237. Clark County School District's arid climate makes it one of the driest places in the country. Despite the challenges imposed by climate, the district has invested in planting and maintaining over 30,487 trees within the district. These trees make up CCSD's urban forest.

Individual trees and a healthy urban forest play important roles in the quality of life and the sustainability of a community. Research demonstrates that healthy urban trees can improve the local environment and diminish the impact resulting from urbanization and industry (Center for Urban Forest Research). Trees improve air quality by manufacturing oxygen and absorbing carbon dioxide (CO_2), 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). Trees slow and reduce stormwater runoff, helping to protect critical waterways from excess pollutants and particulates. In addition, urban trees provide critical habitat for wildlife and promote a connection to the natural world for district residents.

The District's urban tree resource is a relatively young population in overall fair to good condition.

In addition to these direct improvements, healthy urban trees provide health and educational benefits to students. Attention Deficit Disorder (ADD) symptoms in children are relieved after spending time in nature. The greener the setting, the more the relief (Faber Taylor, 2001). 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, making Clark County School District a more enjoyable place to recreate, study, and learn. The District's 30,487 trees play a prominent role in the urban forest benefits afforded to the community. Residents rely on CCSD to protect and maintain this vital resource.

The Clark County School District participated in a Nevada Division of Forestry (NDF) sponsored project in 2012 to inventory their campus trees. By participating, CCSD reflects the community's appreciation, concern, and a proactive stance on the management of trees.

A team of International Society of Arboriculture certified arborists from Davey Resource Group (DRG) mapped the location and collected data on district owned trees using global positioning system technology. In addition to location, the arborists collected information about the species, size, condition, and current maintenance needs of each tree. An urban forest is a dynamic resource, constantly changing and growing in response to environment and care. It is critical for the district to update the inventory data, using asset management software, as maintenance needs are addressed and trees mature.

The inventory data was analyzed with i-Tree's *Streets*, a STRATUM Analysis Tool (*Streets* v5.0.1; i-Tree v5.0.6), to develop a resource analysis and report of the current condition of the urban forest. This report, unique to CCSD, effectively quantifies the value of the community's trees in regards to actual benefits derived from the tree resource. In addition, the report provides baseline values that can be used to develop and update an urban forest management plan. Management plans help

communities determine where to focus available resources and set benchmarks for measuring progress.

This analysis describes the structure, function, and value of the urban forest, including 30,487 trees and 451 vacant sites. With this information, managers and citizens can make informed decisions about tree management strategies. This report provides the following information:

- A description of the current structure of CCSD's tree resource and an established benchmark for future management decisions.
- The economic value of the benefits from the urban forest, illustrating the relevance and relationship of trees 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 for developing a long-term urban forest management plan.
- Inventory the remaining trees on campus and continue to update the inventory as trees are planted or other work is completed.

Chapter 1: Urban Forest Resource Summary

Summary of Urban Forest Resource Structure

Clark County School District's urban forest resource considered 30,487 trees and 451 available planting sites.

A structural analysis is the first step towards understanding the benefits provided by these trees as well as their management needs. Considering species composition, diversity, age distribution, condition, canopy coverage, and replacement value, DRG determined that the following information characterizes this urban forest resource:

- There were 128 unique tree species identified in the inventory. The predominant tree species are *Pinus eldarica* (Mondale pine, 15.3%), *Fraxinus velutina (Arizona ash, 6.9%),* and *Quercus virginiana* (southern live oak, 6.8%).
- The age structure of the tree population is very young, with 64% of trees measuring between 0 to 6 inches DBH (diameter at breast height, measured at 4'6" above the ground) and 87% measuring less than12 inches DBH.
- Approximately half of the trees (47.8%) are in good condition and 47% are in fair condition.
- To date, the tree population has sequestered 4,811 tons of carbon (CO_2), valued at approximately $72,163.
- Replacement of CCSD's 30,487 trees with trees of similar size, species, and condition would cost nearly $71.3 million.

Replacement of CCSD's 30,487 public trees with trees of similar size, species, and condition would cost more than $71.3 million.

Summary of Urban Forest Benefits

Annually, Clark County School District's trees provide cumulative benefits to the community at an average value of $30.71 per tree, for a total gross value of $936,202 per year. These annual benefits include:

- Trees reduce electricity and natural gas use in their neighborhoods through shading and climate effects for an overall benefit of $99,468, an average of $3.26 per tree.
- Trees sequester 506 tons of atmospheric CO_2 per year. An additional 692 tons are avoided[1] by reducing energy generation, resulting in a net value of $17,293 and an average of $0.57 per tree.
- Net air quality improvements, including removal and avoidance[2] of pollutants, provided by the district tree population are valued at $41,184, an average per tree benefit of $1.35.
- Clark County School District's trees intercept an estimated 8.2 million gallons of stormwater annually for a total value of $39,531 per year, an average of $1.30 per tree.
- The benefit contributed by CCSD's trees to property value increases, aesthetics, and socioeconomics equals $675,690, an average of $22.16 per tree.
- When the district's annual investment of $750,000 for maintenance of this resource is considered, the annual net benefit (benefits minus investment) to the district is $186,202, an average of $6.11 per tree. In other words**, for every $1 invested in district trees, CCSD receives $1.25 in benefits.**

[1] Avoided pollution is a result of reducing energy consumption. The avoided value represents pollution that would have resulted from the generation of additional energy.

Urban Forest Resource Management

The value of Clark County School District's tree resource should continue to increase as existing trees mature and new trees are planted.

Clark County School District's tree population is a dynamic resource that requires continued investment to maintain and realize its full benefit potential. **These community trees are one of the few assets that have the potential to increase in value with time and proper management.** Appropriate and timely tree care can substantially increase lifespan. When trees live longer, they provide greater benefits. As individual trees continue to mature and aging trees are replaced, the overall value of the community forest and the amount of benefits provided grow as well. This vital, living resource is, however, vulnerable to a host of stressors and requires ecologically sound and sustainable best management practices to ensure a continued flow of benefits for future generations.

Clark County School District's has the benefit of a relatively young urban forest in good condition. The district should focus resources on maximizing the flow of benefits from the current tree population and maintaining a forward-thinking approach. Based on the resource analysis, DRG recommends the following:

- Work toward developing an appropriate age distribution. Clark County School District's tree population is heavily weighted toward small, young trees. Clark County School District should work to offset this by continuing to plant new trees in order to improve long-term resource sustainability and greater canopy coverage. To maximize benefits, focus on medium to large-stature trees where planting sites allow.
- Maximize the benefits of the existing tree resource through continuing comprehensive tree maintenance and a cyclical pruning schedule.
- Continue annual tree planting efforts with the goal of achieving a 100% stocking rate, utilizing available planting sites identified by the inventory.
- Implement a structural pruning program for young and establishing trees to promote healthy structure, extend life expectancy, and reduce future investments and liability. This is especially important in the case of CCSD with such a large population of young.
- Continue to develop species diversity. While CCSD only has one species comprising greater than 10% of the overall population (*Pinus eldarica*, Mondale pine, 15.3%), there are under-represented species and genera that CCSD could focus on planting to improve overall diversity among its tree population.
- Maintain and update the inventory database.

The value of Clark County School District's tree resource will continue to increase as existing trees mature and new trees are planted. As the resource grows, investment in management is critical to ensuring that residents will continue receiving a high return on the investment in the future. It is not as simple as planting more trees to increase canopy cover and 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 CCSD'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. With the district's relatively young tree population, the benefits received from the more mature trees are even more pronounced. Managers can take pride in knowing that trees improve the quality of life in the district.

Chapter 2: Clark County School District's Urban Forest Resource

The district's urban forest resource is more thoroughly understood through examination of composition and species richness (diversity). Inferences based on this data can help managers understand the importance of individual tree species to the overall forest as it exists today. Consideration of stocking level (trees per available space), canopy cover, age distribution, condition, and performance helps to project the potential of the forest resource.

Population Composition

Broadleaf species are the most common among CCSD's tree population, comprising 77.1% of the total inventory. Broadleaf trees typically have larger canopies than coniferous trees of the same size diameter. Since many of the measurable benefits derived from trees are directly related to leaf surface area, broadleaf trees generally provide the highest level of benefits to a community. Larger-statured broadleaf tree species provide greater benefits than smaller-statured trees, independent of diameter. Deciduous broadleaf species make up 54% of CCSD's tree population, including 1% large-stature, 32% medium-stature, and 21% small-stature trees. Evergreen broadleaf trees comprise 23.1% of the population, including 2% large-stature, 12.1% medium-stature, and 9% small-stature trees. Large-stature conifers represent 17% of the overall population, and small-stature conifers total less than 1%. Medium-statured palms make up 1% of the population, small palms total 7%, and large-statured palms less than 1%. Additional species total 1% of the population (Figure 1).

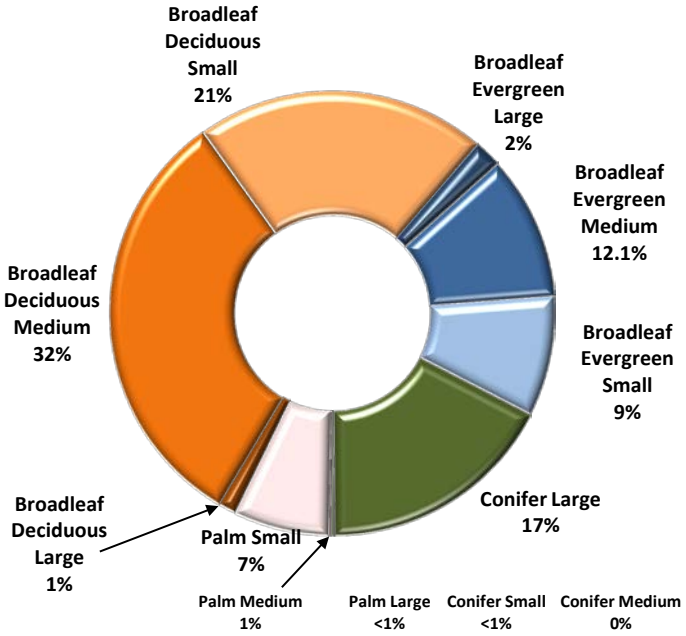


Figure 1. Overall Composition of CCSD's Tree Population

Species Richness and Composition

Clark County School District's tree population (Table 1 and Appendix C) includes a mix of 128 unique species, significantly more than that of the mean of 53 species reported by McPherson and Rowntree (1989) in their nationwide survey of street tree populations in 22 U.S. cities. The top 10 species represent 65% of the total population (Figure 2). The predominant tree species are *Pinus eldarica* (Mondale pine, 15.3%), *Fraxinus velutina* (Arizona ash, 6.9%), *Quercus virginiana* (southern live oak, 6.8%), and *Fraxinus velutina 'Fan-Tex'* (shamel ash, 6.7%).

There is a widely accepted rule that no single species should represent greater than 10% of the total population, while no single genus more than 20% (Clark et al, 1997). Three genera represent 45.3% of the population, comprised of *Fraxinus* (19.0%), *Pinus* (17.1%), and *Quercus* (9.2%). While no genus is represented by more than 20% of the population, *Fraxinus* comes close, at 19.0%, and *Pinus eldarica*, at 15.3% exceeds the 10% species rule. New plantings in the immediate future should limit these species to reduce overreliance.

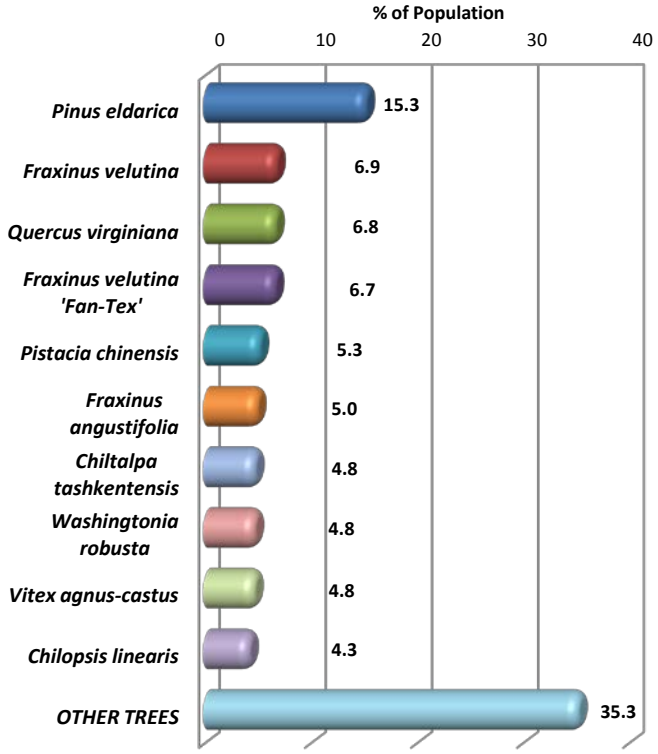


Figure 2. Frequency of Top 10 Species in CCSD's Tree Population

It is important to maintain a diverse population within an urban forest. Dominance of any single species or genus can have detrimental consequences in the event of storms, drought, disease, pests, or other stressors that can severely affect an urban forest and the flow of benefits and costs over time. Catastrophic pathogens, such as Dutch Elm Disease (*Ophiostoma ulmi)*, Emerald Ash Borer (*Agrilus planipennis*), Asian Longhorned Beetle (*Anoplophora glabripennis*), and Sudden Oak Death (SOD) (*Phytophthora ramorum*) are some examples of unexpected, devastating, and costly pests and pathogens that highlight the importance of diversity and the balanced distribution of species and genera.

Table 1. Population Distribution of CCSD's Trees

Species	DBH Class (in)										% of Pop.
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	
Broadleaf Deciduous Large (BDL)											
BDL OTHER	88	125	96	68	18	2	4	0	0	401	1.3
Total	**88**	**125**	**96**	**68**	**18**	**2**	**4**	**0**	**0**	**401**	**1.3**
Broadleaf Deciduous Medium (BDM)											
Fraxinus velutina	426	992	502	134	24	3	3	1	6	2,091	6.9
Fraxinus velutina 'Fan-Tex'	536	1,170	299	46	0	0	0	0	0	2,051	6.7
Pistacia chinensis	274	1,187	141	11	0	0	0	0	0	1,613	5.3
Fraxinus angustifolia	250	1,126	135	25	0	0	0	0	0	1,536	5.0
Morus alba	8	5	96	336	155	64	22	11	5	702	2.3
Ulmus parvifolia	210	433	46	4	0	0	0	0	0	693	2.3
BDM OTHER	247	369	264	40	12	0	0	0	0	932	3.1
Total	**1,951**	**5,282**	**1,483**	**596**	**191**	**67**	**25**	**12**	**11**	**9,618**	**31.5**
Broadleaf Deciduous Small (BDS)											
Chiltalpa tashkentensis	150	859	455	10	1	0	0	0	0	1,475	4.8
Vitex agnus-castus	954	472	25	4	0	0	0	0	0	1,455	4.8
Chilopsis linearis	679	534	92	9	0	0	0	0	0	1,314	4.3
Parkinsonia x 'Desert Museum'	231	514	167	6	0	0	0	0	0	918	3.0
Prosopis velutina	42	155	187	42	2	0	0	0	0	428	1.4
BDS OTHER	350	344	139	29	6	0	0	0	0	868	2.8
Total	**2,406**	**2,878**	**1,065**	**100**	**9**	**0**	**0**	**0**	**0**	**6,458**	**21.2**
Broadleaf Evergreen Large (BEL)											
Quercus ilex	237	307	19	2	0	0	0	0	0	565	1.9
BEL OTHER	3	8	18	9	6	2	0	0	0	46	0.2
Total	**240**	**315**	**37**	**11**	**6**	**2**	**0**	**0**	**0**	**611**	**2.0**
Broadleaf Evergreen Medium (BEM)											
Quercus virginiana	283	1,436	331	9	2	0	0	0	0	2,061	6.8
Prosopis alba	356	281	202	60	12	1	0	0	0	912	3.0
BEM OTHER	90	106	26	2	1	1	0	0	0	226	0.7
Total	**729**	**1,823**	**559**	**71**	**15**	**2**	**0**	**0**	**0**	**3,199**	**10.5**
Broadleaf Evergreen Small (BES)											
Acacia stenophylla	56	514	342	58	5	0	0	0	0	975	3.2
Olea europaea	150	154	31	9	4	1	0	0	0	349	1.1

Species	DBH Class (in)										% of Pop.
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	
BES OTHER	611	593	149	7	2	0	0	0	0	1,362	4.5
Total	**817**	**1,261**	**522**	**74**	**11**	**1**	**0**	**0**	**0**	**2,686**	**8.8**
Conifer Evergreen Large (CEL)											
Pinus eldarica	138	1,327	2,454	608	103	24	6	3	0	4,663	15.3
Pinus halepensis	5	24	160	200	43	12	4	1	0	449	1.5
CEL OTHER	13	54	57	13	7	5	0	1	0	150	0.5
Total	**156**	**1,405**	**2,671**	**821**	**153**	**41**	**10**	**5**	**0**	**5,262**	**17.3**
Conifer Evergreen Medium (CEM)											
CEM OTHER	4	7	3	15	0	0	0	0	0	29	0.1
Total	**4**	**7**	**3**	**15**	**0**	**0**	**0**	**0**	**0**	**29**	**0.1**
Conifer Evergreen Small (CES)											
CES OTHER	4	18	20	6	0	0	0	0	0	48	0.2
Total	**4**	**18**	**20**	**6**	**0**	**0**	**0**	**0**	**0**	**48**	**0.2**
Palm Evergreen Large (PEL)											
PEL OTHER	0	1	0	3	1	3	3	1	2	14	0.0
Total	**0**	**1**	**0**	**3**	**1**	**3**	**3**	**1**	**2**	**14**	**0.0**
Palm Evergreen Medium (PEM)											
PEM OTHER	0	3	13	30	6	0	0	0	0	52	0.2
Total	**0**	**3**	**13**	**30**	**6**	**0**	**0**	**0**	**0**	**52**	**0.2**
Palm Evergreen Small (PES)											
Washingtonia robusta	12	30	510	689	144	46	28	5	1	1,465	4.8
Washingtonia filifera	2	3	17	121	309	59	24	17	16	568	1.9
PES OTHER	3	62	11	0	0	0	0	0	0	76	0.2
Total	**17**	**95**	**538**	**810**	**453**		**52**	**22**	**17**	**2,109**	**6.9**
All Trees	**6,412**	**13,213**	**7,007**	**2,605**	**863**		**94**	**40**	**30**	**30,487**	**100%**

Species Importance

To quantify the significance of any one particular species to CCSD's urban forest, an *importance value* (IV) is derived for each of the most common species in the inventory. Importance values are particularly meaningful to urban forest managers because they indicate a community's reliance on the functional capacity of a particular species. **i-Tree *Streets* calculates importance value based on the mean of three values: percentage of total population, percentage of total leaf area, and percentage of total canopy cover.** Importance value goes beyond tree numbers alone to suggest reliance on specific species based on the benefits they provide. The importance value can range from zero (which implies no reliance) to 100 (suggesting total reliance).

No single species should dominate the composition in the district's urban forest population. Since importance value goes beyond population numbers alone, it can help managers to better comprehend the resulting loss of benefits from a catastrophic loss of any one species. When importance values are comparatively equal among the 10 to 15 most abundant species, the risk of major reductions to benefits is significantly reduced. Of course, suitability of the dominant species is

another important consideration. Planting short-lived or poorly adapted species can result in shorter lifespans and increased long-term management investments.

The 20 most abundant species each represent greater than 1% of the total population. Together, these 20 species represent 86% of the total population 87% of the total leaf area, and 87% of the total canopy cover for a combined importance value of 86 (Table 2). Of these species, CCSD relies most on Pinus eldarica (Mondale pine, IV=17.9) and Fraxinus velutina (Arizona ash, IV=8.1).

Due to their large stature and high leaf surface area, some species provide more impact than their population numbers alone might suggest. For example, CCSD's white mulberry (*Morus alba*, IV=8.33) represent just 2.3% of the tree population but provide 10.8% of the canopy cover. Mondale pine (*Pinus eldarica*, IV=17.91) represent 15.3% of the population but provide18.2% of the canopy. Both are medium to large-stature deciduous hardwoods with dense canopies.

The low importance value of some species is a function of tree type. Immature and small-stature populations tend to have lower importance values than their percentage in the overall population might suggest. This is due to their relatively small leaf area and canopy coverage. For instance, *Chilopsis linearis* (desert willow) and *Vitex agnus-castus* (chaste tree) represent 4.3% and 4.8% of the population, but because of their small-stature, their importance values are just 2.4 and 2.7 respectively (Table 2).

Table 2. Importance Value (IV) of CCSD's Most Abundant Tree Species

Species	Number of Trees	% of Pop.	Leaf Area (ft^2)	% of Total Leaf Area	Canopy Cover (ft^2)	% of Total Canopy Cover	Importance Value
Pinus eldarica	4,663	15.3	3,696,769	20.2	1,245,263	18.2	**17.91**
Fraxinus velutina	2,091	6.9	1,741,417	9.5	542,758	7.9	**8.11**
Quercus virginiana	2,061	6.8	860,010	4.7	384,932	5.6	**5.70**
Fraxinus velutina 'Fan-Tex'	2,051	6.7	1,031,368	5.6	491,440	7.2	**6.52**
Pistacia chinensis	1,613	5.3	568,367	3.1	257,795	3.8	**4.06**
Fraxinus angustifolia	1,536	5.0	728,102	4.0	354,969	5.2	**4.74**
Chiltalpa tashkentensis	1,475	4.8	565,495	3.1	312,146	4.6	**4.16**
Washingtonia robusta	1,465	4.8	425,990	2.3	116,601	1.7	**2.95**
Vitex agnus-castus	1,455	4.8	215,545	1.2	137,482	2.0	**2.65**
Chilopsis linearis	1,314	4.3	227,041	1.2	114,747	1.7	**2.41**
Acacia stenophylla	975	3.2	589,095	3.2	238,016	3.5	**3.30**
Parkinsonia x 'Desert Museum'	918	3.0	275,508	1.5	156,601	2.3	**2.27**
Prosopis alba	912	3.0	395,733	2.2	97,110	1.4	**2.19**
Morus alba	702	2.3	2,170,716	11.9	740,382	10.8	**8.33**
Ulmus parvifolia	693	2.3	369,887	2.0	199,208	2.9	**2.40**
Washingtonia filifera	568	1.9	170,369	0.9	16,416	0.2	**1.01**
Quercus ilex	565	1.9	193,563	1.1	47,089	0.7	**1.20**
Pinus halepensis	449	1.5	1,069,344	5.9	249,230	3.6	**3.66**
Prosopis velutina	428	1.4	422,871	2.3	193,445	2.8	**2.18**
Olea europaea	349	1.1	84,397	0.5	31,388	0.5	**0.69**
Other Trees	4,204	13.8	2,458,254	13.5	921,141	13.5	**13.57**
All Trees	**30,487**	**100%**	**18,259,840**	**100%**	**6,848,157**	**100%**	**100%**

Canopy Cover

The amount and distribution of leaf surface area is the driving force behind the urban forest's ability to produce benefits for the community (Clark, 1997). As canopy cover increases, so do the benefits afforded by leaf area. Overall, the inventoried trees provided 157 acres of tree canopy cover. Mondale pine (*Pinus eldarica*) and white mulberry (*Morus alba*) provide the largest proportion of canopy, accounting for 18.2% and 10.8% of the total canopy respectively.

Relative Age Distribution

Age distribution can be approximated by considering the DBH range of the overall population and of individual species. Trees with smaller diameters tend to be younger. It is important to note that palms do not increase in DBH over time, so they are not considered in this analysis. In palms, height more accurately correlates to age.

An unevenly aged tree population assures continuity in overall tree canopy coverage and associated benefits.

The distribution of individual tree ages within a tree population influences present and future costs as well as the flow of benefits. An ideally aged population allows managers to allocate annual maintenance costs uniformly over many years and assures continuity in overall tree canopy coverage and associated benefits. A desirable distribution has a high proportion of young trees to offset establishment and age related mortality as the percentage of older trees declines over time (Richards, 1982/83). This ideal, albeit uneven, distribution suggests a large fraction of trees (~40%) should be young with DBH less than eight inches, while only 10% should be in the large diameter classes (>24 inches).

Overall, the age distribution of Clark County School District's urban forest is weighted toward young trees, with 64% of the population consisting of trees with a DBH (diameter at breast height) of six inches or smaller. Established trees (6-18 inches DBH) comprise 32%, and mature trees (>18 inches DBH) make up 4% of the overall population (Figure 3). With continued, proactive management of this young urban forest, CCSD can expect increasing benefits as this resource matures. Clark County School District has very few trees in the large diameter classes (>24"). This may be, at least in part, a result of the arid environment rather than the overall age of the tree population. Trees in the older age classes provide greater benefits due to their high leaf surface area. Emphasis should be placed on preserving older trees.

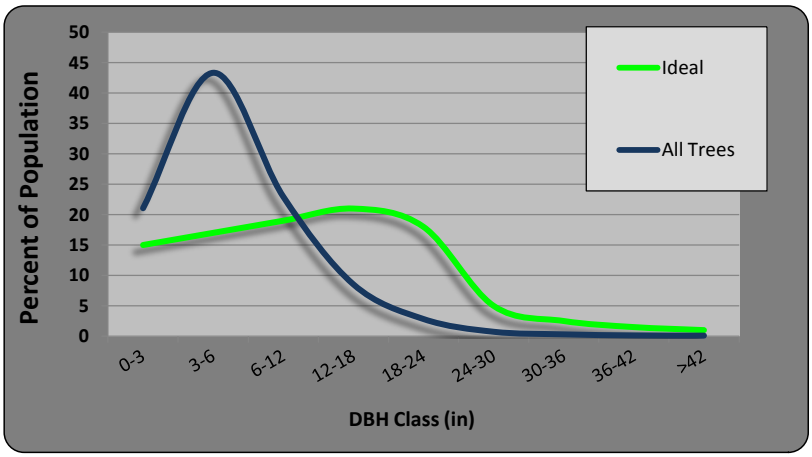


Figure 3. Overall Relative Age Distribution of CCSD's Tree Inventory

Of Clark County School District's top nine most common species (Figure 4), the youngest population is likely *Vitex agnus-castus* (chaste tree, 98% under 6" DBH).

Quercus virginiana (southern live oak, 83% under 6" DBH) is a medium-stature tree well represented in the young age classes. This species has considerable potential to increase in value and benefit with appropriate maintenance.

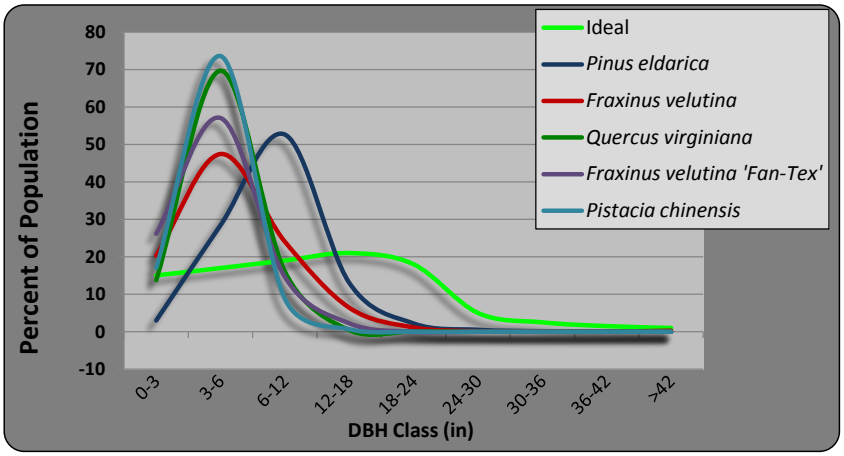
Three of the nine most common species are small-stature trees with significant representation in the small DBH classes. Because these trees are smaller at maturity, this is not necessarily an indication of young age. *Chiltalpa tashkentensis* (pink dawn),*Vitex agnus-castus* (chaste tree), and *Chilopsis linearis* (desert willow) are small-stature populations that are likely to continue to provide benefits at a flat or declining rate over time.

Pinus eldarica (Mondale pine) is the only established population of a large-stature tree. This species will continue to provide increased benefits over time.

As young populations mature and eventually grow old, their maintenance needs are likely to increase. Future plantings should adequately represent long-standing and high-performing species. Sufficient replacements should be planted to ensure the functional capacity and benefit streams from these populations, even as individuals begin to decline.

With a relatively young urban forest and proactive management, CCSD can expect greater benefits as large-stature trees mature. New installations should carefully consider species selection, increasing the use of underused and well-performing species, and focusing on medium and large-statured species.

In addition to planting, it is critical to dedicate resources to ensuring proper maintenance as trees mature. A long-term, sustainable management plan, including regular inspection and pruning cycles, can ensure CCSD's urban forest remains healthy and well-structured, thereby maximizing environmental services to the community, reducing risk, and promoting a consistent flow of benefits for many generations to come.



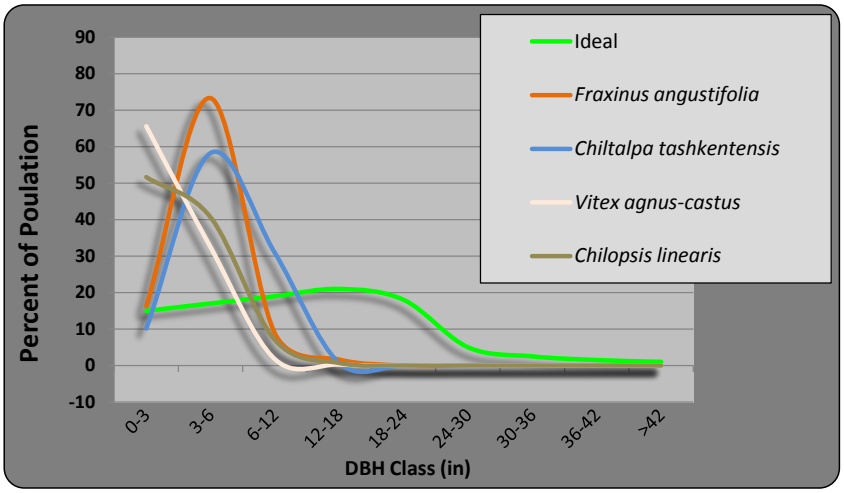


Figure 4. Relative Age Distribution of CCSD's Top Nine Tree Species

Urban Forest Condition and Relative Performance

Tree condition is an indication of how well trees are managed and how well they are performing in a given site-specific environment (e.g., street median, parking lot, etc.). Each tree was rated for overall condition, including consideration for structure, foliage, and the root collar. When trees are performing at their peak, the benefits they provide are maximized.

The inventory found 48% of CCSD's trees in good condition and 47.0% in fair condition. Nearly 5% of the population was determined to be in poor. Removal or mitigation of dead and failing trees is recommended as soon as possible to reduce liability exposure.

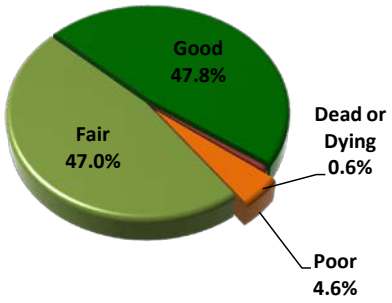


Figure 5. Condition of CCSD's Trees

The *relative performance index* (RPI) is one way to further analyze the condition and suitability of specific tree species. The RPI provides an urban forest manager with a detailed perspective on how one species' performance compares to that of another. The index compares the condition ratings of each tree species with the condition ratings of every other tree species within a given urban forest population. An RPI value of 1.0 or better indicates that the species is performing as well or better than average when compared to other species. An RPI value below 1.0 indicates that the species is not performing as well in comparison to the rest of the population.

Among the 20 most common species collected by the inventory, nine have an RPI of 1.0 or greater (Table 3). Of these, *Washingtonia filifera* (California fan palm, RPI=1.18) and *Washingtonia robusta* (Mexican fan palm, RPI=1.11) have the highest RPI, while *Chitalpa tashkentensis* (pink dawn, RPI=0.82) has the lowest.

Table 3. Relative Performance Index (RPI) for CCSD's Trees

Species	Dead or Dying	Poor	Fair	Good	RPI	# of Trees	% of Pop.
Pinus eldarica	0.7	1.5	23.4	74.4	**1.10**	4,663	15.3
Fraxinus velutina	0.9	4.3	66.2	28.6	**0.93**	2,091	6.9
Quercus virginiana	0.5	2.8	52.3	44.4	**1.00**	2,061	6.8
Fraxinus velutina 'Fan-Tex'	0.4	4.2	51.8	43.5	**0.99**	2,051	6.7
Pistacia chinensis	0.0	1.1	37.1	61.8	**1.07**	1,613	5.3
Fraxinus angustifolia	1.9	16.0	61.0	21.1	**0.86**	1,536	5.0
Chiltalpa tashkentensis	0.9	20.8	63.0	15.3	**0.82**	1,475	4.8
Washingtonia robusta	0.2	1.6	24.4	73.8	**1.11**	1,465	4.8
Vitex agnus-castus	0.2	0.7	57.7	41.4	**0.99**	1,455	4.8
Chilopsis linearis	0.1	4.0	57.5	38.4	**0.97**	1,314	4.3
Acacia stenophylla	0.3	1.3	34.3	64.1	**1.07**	975	3.2
Parkinsonia x 'Desert Museum'	0.0	1.7	60.5	37.8	**0.98**	918	3.0
Prosopis alba	0.2	1.9	67.7	30.3	**0.95**	912	3.0
Morus alba	1.0	10.1	59.0	29.9	**0.91**	702	2.3
Ulmus parvifolia	0.4	3.5	41.7	54.4	**1.03**	693	2.3
Washingtonia filifera	0.2	0.0	5.8	94.0	**1.18**	568	1.9
Quercus ilex	1.4	13.1	59.8	25.7	**0.89**	565	1.9
Pinus halepensis	0.2	2.0	31.4	66.4	**1.08**	449	1.5
Prosopis velutina	0.9	3.5	47.4	48.1	**1.00**	428	1.4
Olea europaea	0.3	0.6	77.9	21.2	**0.92**	349	1.1
Other Trees	1.0	4.8	49.6	44.6	**1.00**	4,204	13.8
All Trees	**0.6**	**4.6**	**47.0**	**47.8**	**1.00**	**30,487**	**100%**

The RPI can be a useful tool for urban forest managers. For example, if a community has been planting two or more new species, the RPI can be used to compare their relative performance. If the RPI indicates that one is performing relatively poorly, managers may decide to reduce or even stop planting that species and subsequently save money on both planting stock and replacement costs. The RPI enables managers to look at the performance of long-standing species as well. Established species with an RPI of 1.00 or greater have performed well when compared to the population as a whole. These top performers should be retained, and planted, as a healthy proportion of the overall population. It is important to keep in mind that, because RPI is based on condition at the time of the inventory, it may not reflect cosmetic or nuisance issues, especially seasonal issues that are not threatening the health or structure of the trees.

An RPI value less than 1.00 may be indicative of a species that is not well adapted to local conditions. Poorly adapted species are more likely to present increased safety and maintenance issues. Species with an RPI less than 1.00 should receive careful consideration before being selected for future planting choices. Prior to selecting or deselecting trees based on RPI alone, managers are encouraged to take into account the age distribution of the species, among other factors. A species that has a RPI of less than 1.00, but has a significant number of trees in larger DBH classes, may simply be exhibiting signs of population senescence. The individuals of this species may have produced substantial benefits over the years and the species should continue to be considered when making determinations for future planting. A complete table, with RPI values for all species, is included in Appendix C.

The RPI value can also help to identify underused species that are demonstrating good performance. Trees with an RPI value greater than 1.00 and an established age distribution may be indicating their

suitability in the local environment and should receive consideration for additional planting (Table 4). When considering new species, it helps to base the decision on established populations. The greater number of trees of a particular species, the more relevant the RPI becomes. The following species appear to be performing well and should be considered for future tree plantings.

Table 4. Tree Species Which May be Underused, Based on RPI

Species	RPI	# of Trees	% of Pop.
Pistacia x atlantica	**1.19**	88	0.29
Chamaerops humilis	**1.09**	210	0.69
Sophora secundiflora	**1.08**	296	0.97
Pyrus kawakamii	**1.05**	114	0.37
Rhus lancea	**1.04**	281	0.92

Replacement Value

The current value of CCSD's tree resource is approximately $71.3 million. The community forest is a public asset that, when properly cared for, has the potential to appreciate in value as the trees mature over time. Replacement value accounts for the historical investment in trees over their lifetime. Replacement value is also a way of describing the value of a tree population (and/or average value per tree) at a given time. The replacement value reflects current population numbers, stature, placement, and condition. There are several methods available for obtaining a fair and reasonable perception of a tree's value (CTLA, 1992; Watson, 2002). The cost approach, trunk formula method used in this analysis assumes the value of a tree is equal to the cost of replacing the tree in its current state (Cullen, 2002).

Mondale pine accounts for 27.7 % of the total estimated replacement value.

To replace CCSD's current tree population of 30,487 trees with trees of similar size, species, and condition would cost nearly $71.3 million (Table 5). The average replacement value per tree is $2,339. *Pinus eldarica* (Mondale pine), *Pinus halepensis* (Aleppo pine), and *Morus alba* (white mulberry) are the most valuable populations, representing $29.5 million and 41.3% of the overall replacement value, but just 19.1% of the inventoried population. A complete table, listing replacement value for all species, is included in Appendix C.

Replacement of the Mondale pine population in CCSD's public inventory would cost $19.7 million.

On a per-tree basis, *Pinus halepensis* (Aleppo pine, $11,489/tree) and *Morus alba* (white mulberry, $6,529/tree) have the highest average replacement values. The high value of each of these species reinforces their importance to the district. Many of the highest valued species are large and medium-stature trees with large canopies and are therefore likely to have high importance values as well. Conversely, smaller statured trees have average values of around $300 per tree, including *Sophora Secundiflora* (mescal bean, $276/tree) and *Washingtonia robusta* (Mexican fan palm, $280/tree).

Clark County School District's trees represent a vital component of the district's infrastructure and an asset valued at approximately $71.3 million - an asset that, with proper care and maintenance, will increase in value over time. Distinguishing replacement value from the value of annual benefits produced by CCSD's trees is very important. Annual benefits are examined in Chapter 3.

Table 5. Replacement Value of CCSD's Trees

	DBH Class (in)											
Species	**0-3**	**3-7**	**7-13**	**13-19**	**19-25**	**25-31**	**31-37**	**37-42**	**>42**	**Total $**	**% of Total**	**% of Pop.**
Pinus eldarica	25,420	1,328,871	9,521,448	5,976,704	1,853,771	647,084	238,230	132,959	0	**19,724,486**	27.7	15.3
Fraxinus velutina	61,779	704,273	1,365,643	858,334	262,857	52,141	76,749	34,496	235,047	**3,651,320**	5.1	6.9
Quercus virginiana	53,806	1,823,821	1,661,253	99,598	38,132	0	0	0	0	**3,676,612**	5.2	6.8
Fraxinus velutina 'Fan-Tex'	111,263	1,430,734	1,531,149	622,068	0	0	0	0	0	**3,695,213**	5.2	6.7
Pistacia chinensis	65,428	2,017,380	942,979	175,359	0	0	0	0	0	**3,201,147**	4.5	5.3
Fraxinus angustifolia	40,237	1,250,830	630,788	299,639	0	0	0	0	0	**2,221,494**	3.1	5.0
Chiltalpa tashkentensis	23,806	909,987	1,816,776	109,727	19,066	0	0	0	0	**2,879,363**	4.0	4.8
Washingtonia robusta	1,704	5,561	124,230	197,816	47,530	17,711	12,060	2,440	572	**409,624**	0.6	4.8
Vitex agnus-castus	201,399	597,951	127,094	53,175	0	0	0	0	0	**979,620**	1.4	4.8
Chilopsis linearis	139,930	656,458	437,806	116,479	0	0	0	0	0	**1,350,673**	1.9	4.3
Acacia stenophylla	11,085	686,337	1,803,063	760,493	111,219	0	0	0	0	**3,372,198**	4.7	3.2
Parkinsonia x 'Desert Museum'	44,402	631,409	865,912	77,653	0	0	0	0	0	**1,619,376**	2.3	3.0
Prosopis alba	61,066	271,399	647,377	505,714	163,820	22,052	0	0	0	**1,671,427**	2.3	3.0
Morus alba	1,025	2,673	173,613	1,617,901	1,157,752	790,421	428,677	271,407	140,074	**4,583,543**	6.4	2.3
Ulmus parvifolia	49,051	549,821	208,033	53,175	0	0	0	0	0	**860,081**	1.2	2.3
Washingtonia filifera	514	860	8,339	74,093	231,325	52,101	24,321	18,012	18,217	**427,782**	0.6	1.9
Quercus ilex	40,646	372,154	91,307	28,698	0	0	0	0	0	**532,805**	0.7	1.9
Pinus halepensis	1,212	30,237	834,473	2,559,171	1,050,228	421,290	200,554	61,255	0	**5,158,420**	7.2	1.5
Prosopis velutina	8,996	233,971	1,202,331	691,693	48,961	0	0	0	0	**2,185,952**	3.1	1.4
Olea europaea	31,552	227,684	193,125	127,731	108,123	39,601	0	0	0	**727,815**	1.0	1.1
Other Trees	278,104	1,800,864	3,300,659	1,825,961	770,895	248,350	65,725	91,427	9,298	**8,391,283**	11.8	13.8
All Trees	**$1,252,428**	**$15,533,275**	**$27,487,397**	**$16,831,184**	**$5,863,681**	**$2,290,749**	**$1,046,315**	**$611,996**	**$403,208**	**$71,320,233**	**100%**	**100%**

Chapter 3: Urban Forest Resource Benefits

Trees are important to CCSD. Environmentally, they help conserve and reduce energy use, reduce global carbon dioxide (CO_2) levels, improve air quality, and mitigate stormwater runoff. Additionally, trees provide a wealth of well-documented psychological, social, and economic benefits related primarily to their aesthetic effects. Environmentally, trees make good sense, working ceaselessly to provide benefits back to the community. However, the question remains, are the collective benefits worth the cost of management? In other words, are trees a good investment for CCSD? To answer this question, the benefits must be quantified in financial terms.

Trees and other vegetation within an urbanized environment help reduce the urban heat island effect.

The i-Tree *Streets* analysis model allows benefits to be quantified based on regional reference cities and local community attributes, such as median home values and local energy prices. This analysis provides a snapshot of the annual benefits (along with the value of those benefits) produced by CCSD's urban forest. While the annual benefits produced by the urban forest can be substantial, it is important to recognize that the greatest benefits from the urban forest are derived from the benefit stream that results over time, from a mature forest where trees are well managed, healthy, and long-lived.

This analysis used CCSD's current inventory data and i-Tree's *Streets* software to assess and quantify the beneficial functions of this resource and to place a dollar value on the annual environmental benefits these trees provide. The benefits calculated by i-Tree *Streets* are estimations based on the best available and current scientific research with an accepted degree of uncertainty. The data returned from i-Tree *Streets* can provide a platform from which informed management decisions can be made (Maco and McPherson, 2003). A discussion on the methods used to calculate and assign a monetary value to these benefits is included in Appendix A.

Energy Savings

Trees modify climate and conserve energy in three principal ways:

- Shading reduces the amount of radiant energy absorbed and stored by hardscape surfaces, thereby reducing the heat island effect.
- Transpiration converts moisture to water vapor, thereby cooling the air by using solar energy that would otherwise result in heating of the air.
- Reduction of wind speed and the movement of outside air into interior spaces, and conductive heat loss where thermal conductivity is relatively high (e.g., glass windows) (Simpson, 1998).

The *heat island effect* describes the increase in urban temperatures in relation to surrounding suburban and rural areas. Heat islands are associated with an increase in hardscape and impervious surfaces. Trees and other vegetation within an urbanized environment help reduce the heat island effect by lowering air temperatures 5°F (3°C) compared with outside the green space (Chandler, 1965). On a larger citywide scale, temperature differences of more than 9°F (5°C) have been observed between city centers without adequate canopy coverage and more vegetated suburban areas (Akbari and others, 1992). The relative importance of these effects depends upon the size and configuration of trees and other landscape elements (McPherson, 1993). Tree spacing, crown spread, and vertical distribution of leaf area each influence the transport of warm air and pollutants along streets and out of urban canyons.

Trees reduce conductive heat loss from buildings by reducing air movement into buildings and against conductive surfaces (e.g., glass, metal siding). Trees can reduce wind speed and the resulting air infiltration by up to 50%, translating into potential annual heating savings of 25% (Heisler, 1986).

Electricity and Natural Gas Reduction

Electricity and natural gas saved annually at Clark County School District from both the shading and climate effects of trees is equal to 1,386 MWh (valued at $92,975) and 10,059 therms ($6,493), for a total retail savings of approximately $99,468, and an average of $3.26 per tree (Table 6). *Morus alba* (white mulberry), which represents 2.3% of the population, is providing 9.2% of the energy benefits and the highest per-tree benefit ($13.10/tree). Similarly, *Pinus halepensis* (Aleppo pine), which represents just 1.5% of the population, is providing 3.6% of the total energy benefits and the next highest per-tree benefit of $7.92. Together, the populations of *Morus alba* (white mulberry) and *Pinus halepensis* (Aleppo pine) are providing 12.8% of the overall energy benefits while comprising just 3.8% of the population.

Small stature trees are less able to provide electricity and natural gas reductions. On a per-tree basis, *Chilopsis linearis* (desert willow, $1.18/tree) and *Washingtonia robusta* (Mexican fan palm, $1.14/tree) provide the lowest benefits. Although these two species account for 9.1% of the urban forest, they are providing only 3.2% of the overall energy benefits.

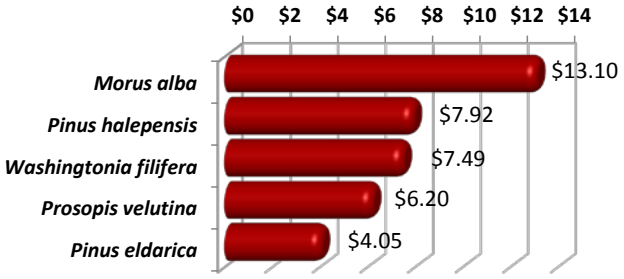


Figure 6. Annual Electricity and Natural Gas Benefits - Top Five Species

Table 6. Annual Electric and Natural Gas Benefits from CCSD's Trees

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	% of Pop.	% of Total $	Avg. $/tree
Pinus eldarica	265.6	17,823	1,672.9	1,079.83	**18,903**	15.3	19.0	4.05
Fraxinus velutina	106.8	7,169	788.6	509.05	**7,678**	6.9	7.7	3.67
Quercus virginiana	76.0	5,098	560.9	362.06	**5,460**	6.8	5.5	2.65
Fraxinus velutina 'Fan-Tex'	92.4	6,201	710.2	458.42	**6,659**	6.7	6.7	3.25
Pistacia chinensis	49.9	3,346	395.1	255.02	**3,601**	5.3	3.6	2.23
Fraxinus angustifolia	66.3	4,446	524.4	338.48	**4,784**	5.0	4.8	3.11
Chiltalpa tashkentensis	59.7	4,009	469.0	302.74	**4,312**	4.8	4.3	2.92
Washingtonia robusta	23.0	1,541	191.5	123.62	**1,665**	4.8	1.7	1.14
Vitex agnus-castus	25.1	1,687	220.1	142.08	**1,829**	4.8	1.8	1.26
Chilopsis linearis	21.4	1,437	183.0	118.13	**1,555**	4.3	1.6	1.18
Acacia stenophylla	45.5	3,051	344.4	222.32	**3,273**	3.2	3.3	3.36
Parkinsonia x 'Desert Museum'	29.7	1,993	238.8	154.12	**2,147**	3.0	2.2	2.34
Prosopis alba	20.3	1,363	137.4	88.70	**1,452**	3.0	1.5	1.59
Morus alba	128.4	8,615	895.1	577.76	**9,193**	2.3	9.2	13.10
Ulmus parvifolia	38.2	2,564	283.5	183.02	**2,747**	2.3	2.8	3.96
Washingtonia filifera	58.8	3,944	479.5	309.53	**4,254**	1.9	4.3	7.49
Quercus ilex	10.5	707	67.3	43.44	**751**	1.9	0.8	1.33
Pinus halepensis	50.1	3,362	304.1	196.31	**3,558**	1.5	3.6	7.92
Prosopis velutina	37.0	2,486	259.9	167.78	**2,653**	1.4	2.7	6.20
Olea europaea	5.9	393	48.5	31.28	**424**	1.1	0.4	1.22
Other Trees	175.0	11,742	1,284.6	829.21	**12,571**	13.8	12.6	2.99
All Trees	**1,386**	**$92,975**	**10,059**	**$6,493**	**$99,468**	**100%**	**100%**	**$3.26**

Atmospheric Carbon Dioxide Reduction

As environmental awareness continues to increase, governments are paying particular attention to global warming and the effects of greenhouse gas emissions. Two national policy options are currently under debate, the establishment of a carbon tax, and a greenhouse gas cap-and-trade system, aimed at the reduction of atmospheric carbon dioxide (CO_2) and other greenhouse gases. A carbon tax would place a tax burden on each unit of greenhouse gas emission and would require regulated entities to pay for their level of emissions. Alternatively, in a cap-and-trade system, an upper limit (or cap) is placed on global (federal, regional, or other jurisdiction) levels of greenhouse gas emissions and the regulated entities would be required to either reduce emissions to required limits or purchase emissions allowances in order to meet the cap (Williams, 2007).

The idea that carbon credits are a commodity that can be exchanged for financial gain is based on the growth of emerging carbon markets. The Center for Urban Forest Research recently led the development of Urban Forest Project Reporting Protocol. The protocol, which incorporates methods of the Kyoto Protocol and Voluntary Carbon Standard (VCS), establishes methods for calculating reductions, provides guidance for accounting and reporting, and guides urban forest managers in developing tree planting and stewardship projects that could be registered for greenhouse gas (GHG) reduction credits (offsets). The protocol can be applied to urban tree planting projects within municipalities, campuses, and utility service areas anywhere in the United States.

While CCSD's urban forest resource may or may not qualify for carbon-offset credits or be traded in the open market, the district's inventoried trees are nonetheless providing a significant reduction in atmospheric carbon dioxide (CO_2) for a positive environmental and financial benefit to the community.

Urban trees reduce atmospheric CO_2 in two ways:

- Directly, through growth and the sequestration of CO_2 in wood, foliar biomass, and soil.
- Indirectly, by lowering the demand for heating and air conditioning, thereby reducing the emissions associated with electric power generation and natural gas consumption.

At the same time, vehicles and other combustion engines used to plant and care for trees release CO_2 during operation. Additionally, when a tree dies, most of the CO_2 that accumulated as woody biomass is released back into the atmosphere during decomposition, except in cases where the wood is recycled. Each of these factors must be considered when calculating the net CO_2 benefits of trees.

Sequestered Carbon Dioxide

To date, CCSD's urban forest has sequestered a total of 4,811 tons of carbon dioxide (CO_2), valued at $72,163[3]. Annually, this tree resource directly sequesters 506 tons of CO_2, valued at $7,596, into woody and foliar biomass. Accounting for estimated CO_2 emissions from tree decomposition (-38.5 tons), tree related maintenance activity (-7.5 tons), and avoided CO_2 (692.5 tons), CCSD's trees provide an annual net reduction in atmospheric CO_2 of 1,152.8 tons, valued at $17,293 with an average of $0.57 per tree, reflected by the negative numbers in decomposition release and maintenance release in Table 7.

Morus alba (white mulberry, $2.01/tree) and *Pinus halepensis* (Aleppo pine, $1.49/tree) are currently providing the highest per tree benefit (Figure 7). *Pinus eldarica* (Mondale pine) are providing the greatest percentage of overall benefits at 17.1% due to their larger size and prevalence in the population (15.3%).

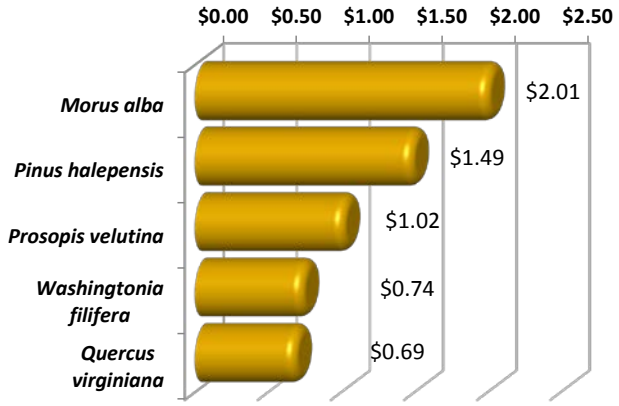


Figure 7. Annual Reduction of CO_2 - Top Five Species

[3] *Based on i-Tree Streets default value of $15 per ton. Market value may vary.*

Table 7. Annual CO_2 Reduction Benefits Provided by CCSD's Trees

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Release ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)	% of Pop.	% of Total $	Avg. $/tree
Pinus eldarica	145,301	1,089.75	- 13,508	- 3,154.7	- 124.97	265,486	1,991.15	394,124	**2,955.93**	15.3	17.1	0.63
Fraxinus velutina	81,222	609.17	- 5,153	- 983.6	- 46.02	106,780	800.85	181,866	**1,364.00**	6.9	7.9	0.65
Quercus virginiana	120,033	900.25	- 4,598	- 787.3	- 40.39	75,934	569.51	190,582	**1,429.36**	6.8	8.3	0.69
Fraxinus velutina 'Fan-Tex'	62,311	467.33	- 1,963	- 740.8	- 20.28	92,364	692.73	151,971	**1,139.78**	6.7	6.6	0.56
Pistacia chinensis	26,476	198.57	- 931	- 563.4	- 11.21	49,841	373.81	74,823	**561.17**	5.3	3.3	0.35
Fraxinus angustifolia	45,744	343.08	- 1,244	- 551.3	- 13.46	66,220	496.65	110,170	**826.27**	5.0	4.8	0.54
Chiltalpa tashkentensis	70,971	532.28	- 3,857	- 654.6	- 33.83	59,714	447.86	126,174	**946.30**	4.8	5.5	0.64
Washingtonia robusta	34,908	261.81	- 8,222	- 1,445.5	- 72.50	22,956	172.17	48,198	**361.48**	4.8	2.1	0.25
Vitex agnus-castus	25,766	193.24	- 819	- 301.0	- 8.40	25,135	188.51	49,781	**373.35**	4.8	2.2	0.26
Chilopsis linearis	10,922	81.92	- 54	- 343.7	- 2.98	21,401	160.51	31,926	**239.45**	4.3	1.4	0.18
Acacia stenophylla	17,462	130.96	- 997	- 505.7	- 11.27	45,440	340.80	61,400	**460.50**	3.2	2.7	0.47
Parkinsonia x 'Desert Museum'	34,239	256.79	- 1,686	- 333.4	- 15.14	29,682	222.61	61,901	**464.26**	3.0	2.7	0.51
Prosopis alba	21,227	159.21	- 2,248	- 375.9	- 19.68	20,309	152.31	38,912	**291.84**	3.0	1.7	0.32
Morus alba	75,580	566.85	- 15,015	- 963.3	- 119.83	128,328	962.46	187,929	**1,409.47**	2.3	8.2	2.01
Ulmus parvifolia	16,238	121.78	- 568	- 214.6	- 5.87	38,188	286.41	53,643	**402.32**	2.3	2.3	0.58
Washingtonia filifera	72	0.54	- 2,451	- 398.5	- 21.37	58,751	440.63	55,973	**419.80**	1.9	2.4	0.74
Quercus ilex	22,491	168.68	- 438	- 151.9	- 4.42	10,535	79.01	32,436	**243.27**	1.9	1.4	0.43
Pinus halepensis	42,940	322.05	- 3,510	- 466.7	- 29.82	50,077	375.58	89,041	**667.80**	1.5	3.9	1.49
Prosopis velutina	22,443	168.32	- 1,089	- 244.2	- 10.00	37,026	277.69	58,135	**436.01**	1.4	2.5	1.02
Olea europaea	4,277	32.08	- 272	- 113.1	- 2.89	5,856	43.92	9,748	**73.11**	1.1	0.4	0.21
Other Trees	132,189	991.42	- 8,353	- 1,701.9	- 75.41	174,896	1,311.72	297,030	**2,227.73**	13.8	12.9	0.53
All Trees	**1,012,811**	**$7,596**	**- 76,974**	**- 14,995**	**- $689.77**	**1,384,921**	**$10,387**	**2,305,762**	**$17,293**	**100%**	**100%**	**$0.57**

Air Quality Improvement

Urban trees improve air quality in five fundamental ways:

- Absorption of gaseous pollutants such as ozone (O_3) and nitrogen dioxide (NO_2) through leaf surfaces
- Interception of particulate matter ($_{PM10}$), such as dust, ash, dirt, pollen, and smoke
- Reduction of emissions from power generation by reducing energy consumption
- Increase of oxygen levels through photosynthesis
- Transpiration of water and shade provision, resulting in lower local air temperatures, thereby reducing ozone (0_3) levels

The Clark County Department of Air Quality (CCDAQ) measures air pollution and provides data on the number of days per year that federal pollution standards are exceeded.

$_{PM10}$ is particulate matter in the air that measures less than 10 micrometers, smaller than the width of a single human hair. $_{PM10}$ pollution can cause respiratory problems for local residents. CCDAQ reports that air quality in Clark County exceeded the state 8-hour $_{PM10}$ standard of 150 µg/m^3 for only 1 day in 2012.

Table 8. Number of Days Exceeding Federal Ground-Level Ozone

Year	Ozone > Federal 2012 8-hour Standard
2012	19
2011	9
2010	1
2009	5
2008	10
2007	17
2006	8
2005	8
2004	4
2003	10
Average	**9.1**

Ozone (O_3) is another air pollutant that is harmful to human health. Between 2003 and 2012, the Federal 8-hour standard (0.075 ppm) for ground level (O_3) was exceeded 91 days, an average of 9.1 days per year (Table 8) (CCDAQ, 2013).

In the absence of cooling effects provided by trees, higher temperatures contribute to ozone (O_3) formation. Additionally, short-term increases in ozone concentrations are statistically associated with increased tree mortality for 95 large US cities (Bell and others, 2004). However, it should be noted that while trees do a great deal to absorb air pollutants (especially ozone and particulate matter); they also negatively contribute to air pollution. Trees emit various biogenic volatile organic compounds (BVOCs), such as isoprene's and monoterpenes, which also contribute to ozone formation. i-Tree *Streets* analysis accounts for these BVOC emissions in the air quality net benefit.

Deposition and Interception

Each year, approximately 1.8 tons of nitrogen dioxide (NO_2), sulfur dioxide (SO_2), small particulate matter ($_{PM10}$), and ozone (O_3) are intercepted or absorbed by the trees at CCSD, for a value of $19,187 (Table 9). As a population, *Pinus eldarica* (Mondale pine, 904 lbs.), *Morus alba* (white mulberry, 515.98 lbs.), *Fraxinus velutina (*Arizona ash, 225.65 lbs), and *Chitalpa tashkentensis* (pink dawn, 214.31 lbs) are the greatest contributors to pollutant deposition and interception, accounting for over half (51%) of the benefits.

Avoided Pollutants

The energy savings provided by trees have the additional indirect benefit of reducing air pollutant emissions (NO_2, $_{PM10}$, SO_2, and VOCs) that result from energy production. Altogether, 2.4 tons of pollutants, valued at $43,972, are avoided annually through the shading effects of CCSD's trees.

BVOC Emissions

Biogenic volatile organic compound (BVOC) emissions from trees, which negatively affect air quality, must also be considered. Approximately 2.7 tons of BVOCs are emitted annually from CCSD's trees, offsetting the total air quality benefit by -$21,975. *Quercus virginiana* (southern live oak*)* are the heaviest per tree emitters of BVOCs (-0.87 lbs./tree), accounting for 0.02% of the total BVOC emissions, while comprising just 6.8% of the total population. Ultimately, for *Quercus virginiana,* the benefits from interception, deposition, and avoidance of air pollutants (NO_2, $_{PM10}$, SO_2, and VOCs) are not enough to offset their BVOC emissions, and their per tree net impact on air quality is negative.

Net Air Quality Improvement

The net value of air pollutants removed, avoided, and released by CCSD's tree population is $41,184 annually. The average net benefit per tree is $1.35. Trees vary dramatically in their ability to produce air quality benefits. Typically, large-canopied trees with large leaf surface areas that are not high emitters of BVOCs produce the greatest benefits. On a per-tree basis, *Morus alba* (white mulberry*,* $7.22/tree) and *Pinus halepensis* (Aleppo pine, $3.58/tree) currently produce the greatest per tree net air quality improvements (Figure 8). However, due to its established age distribution and high prevalence in the population (15.3%), *Pinus eldarica* (Mondale pine) account for the greatest air quality improvements (48%) in terms of total benefits by species, collectively removing 1,411 pounds of pollutants at a net value of $11,627.

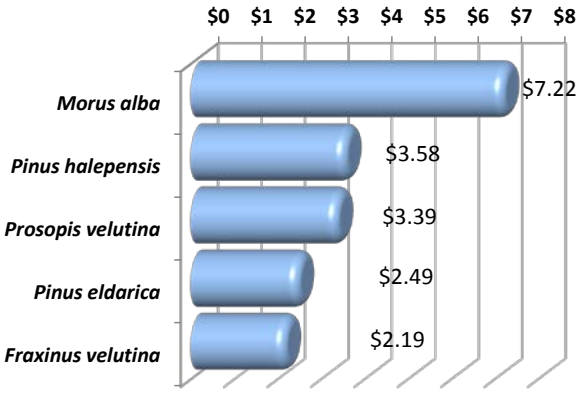


Figure 8. Annual Improvement to Air Quality - Top Five Species

Table 9. Annual Air Quality Improvements Provided by CCSD's Trees

Species	Deposition O_3 (lb)	Deposition NO_2 (lb)	Deposition $PM10$ (lb)	Deposition SO_2 (lb)	Total Deposition ($)	Avoided NO_2 (lb)	Avoided $PM10$ (lb)	Avoided VOC (lb)	Avoided SO_2 (lb)	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	% of Pop.	Avg. $/tree
Pinus eldarica	333.6	182.0	351.8	36.7	4,748.98	479.1	24.4	4.3	410.3	8,522	- 411.1	- 1,644.38	1,411.1	**11,627**	15.3	2.49
Fraxinus velutina	92.7	35.9	89.6	7.4	1,168.89	192.1	9.8	1.7	164.0	3,409	0	0	593.3	**4,578**	6.9	2.19
Quercus virginiana	32.6	17.8	49.4	3.6	554.18	136.6	7.0	1.2	116.7	2,426	- 1,788.3	- 7,153.17	- 1,423.4	**- 4,173**	6.8	- 2.02
Fraxinus velutina 'Fan-Tex'	62.2	29.9	74.8	6.2	915.08	165.3	8.4	1.5	141.1	2,933	- 146.3	- 585.21	343.2	**3,263**	6.7	1.59
Pistacia chinensis	35.7	13.8	36.8	2.9	463.76	89.7	4.6	0.8	76.5	1,590	- 522.2	- 2,088.73	- 261.5	**- 35**	5.3	- 0.02
Fraxinus angustifolia	37.7	18.1	48.2	3.8	571.43	118.5	6.1	1.1	101.1	2,102	- 103.3	- 413.14	231.2	**2,260**	5.0	1.47
Chiltalpa tashkentensis	84.0	40.4	81.6	8.4	1,118.11	107.2	5.5	1.0	91.5	1,901	- 234.5	- 937.82	185.0	**2,082**	4.8	1.41
Washingtonia robusta	63.6	34.7	59.9	7.0	862.79	41.3	2.1	0.4	35.2	733	- 440.2	- 1,760.83	- 195.9	**- 166**	4.8	- 0.11
Vitex agnus-castus	19.3	9.3	22.5	1.9	278.94	45.0	2.3	0.4	38.4	798	- 89.4	- 357.46	49.7	**720**	4.8	0.49
Chilopsis linearis	10.2	2.8	10.1	0.6	122.19	38.4	2.0	0.4	32.7	681	- 151.2	- 604.87	- 54.1	**198**	4.3	0.15
Acacia stenophylla	45.0	24.5	51.6	4.9	665.33	81.3	4.2	0.7	69.4	1,443	0	0	281.7	**2,108**	3.2	2.16
Parkinsonia x 'Desert Museum'	37.0	17.8	37.1	3.7	499.71	53.3	2.7	0.5	45.4	945	- 114.2	- 456.90	83.3	**987**	3.0	1.08
Prosopis alba	20.7	11.3	23.0	2.3	301.92	36.6	1.9	0.3	31.3	651	- 111.1	- 444.42	16.3	**508**	3.0	0.56
Morus alba	259.5	70.8	169.8	15.8	2,588.17	224.6	11.5	2.0	191.8	3,987	- 376.9	- 1,507.78	569.0	**5,068**	2.3	7.22
Ulmus parvifolia	17.9	6.9	21.7	1.4	252.14	68.5	3.5	0.6	58.5	1,216	0	0	179.1	**1,468**	2.3	2.12
Washingtonia filifera	10.0	5.5	9.3	1.1	135.34	101.6	5.2	0.9	86.6	1,800	- 176.6	- 706.23	43.7	**1,229**	1.9	2.16
Quercus ilex	2.8	1.5	4.9	0.3	51.60	19.1	1.0	0.2	16.4	341	- 122.0	- 488.08	- 75.8	**- 96**	1.9	- 0.17
Pinus halepensis	36.6	20.0	45.3	4.0	561.16	89.3	4.5	0.8	76.5	1,588	- 135.3	- 541.19	141.6	**1,608**	1.5	3.58
Prosopis velutina	37.3	17.9	39.5	3.7	516.32	66.2	3.4	0.6	56.6	1,176	- 60.0	- 239.94	165.3	**1,452**	1.4	3.39
Olea europaea	5.5	3.0	6.4	0.6	82.07	10.5	0.5	0.1	8.9	186	- 5.3	- 21.26	30.2	**246**	1.1	0.71
Other Trees	198.3	97.3	206.0	19.8	2,729.12	312.4	15.9	2.8	266.8	5,546	- 506.0	- 2,024.08	613.4	**6,251**	13.8	1.49
All Trees	**1,442.37**	**661.12**	**1,439.32**	**136.13**	**$19,187**	**2,476.72**	**126.40**	**22.35**	**2,115.74**	**$43,972**	**- 5,493.87**	**-$21,975**	**2,926.29**	**$41,184**	**100%**	**$1.35**

Stormwater Runoff Reductions

Rainfall interception by trees reduces the amount of stormwater that enters collection and treatment facilities during large storm events. Trees intercept rainfall in their canopy, acting as mini-reservoirs, controlling runoff at the source. Healthy urban trees reduce the amount of runoff and pollutant loading in receiving waters in three primary ways:

- Leaves and branch surfaces intercept and store rainfall, thereby reducing runoff volumes and delaying the onset of peak flows.
- Root growth and decomposition increase the capacity and rate of soil infiltration by rainfall and reduce overland flow.
- Tree canopies reduce soil erosion and surface flows by diminishing the impact of raindrops on bare soil.

Clark County School District's trees intercept 8,234,954 million gallons of stormwater annually for an average of 270 gallons per tree (Table 10). The total value of this benefit to the district is $39,531, an average of $1.30 per tree. *Pinus halepensis* (Aleppo pine) are currently providing the greatest per tree benefit of $5.20, while *Pinus eldarica* (Mondale pine), due in part to their prevalence in the population (15.3%), are providing the largest portion of overall benefits at 23%.

As trees grow, their stormwater benefits often improve, but some species will realize more substantial benefits than others will. Many of the tree species currently demonstrating very low benefits, including *Chilopsis linearis* (desert willow, $0.25/tree) and *Vitex agnus-castus* (chaste tree, $0.43/tree) are small-stature trees. As such, their benefits will not increase much over time. However, other trees with currently lower benefits, such as *Prosopis alba* (Algarrobo blanco, $0.95/tree) and *Pistacia chinensis* (Chinese pistache, $0.64/tree), young populations of medium-stature species, will realize increasing benefits as their canopies mature.

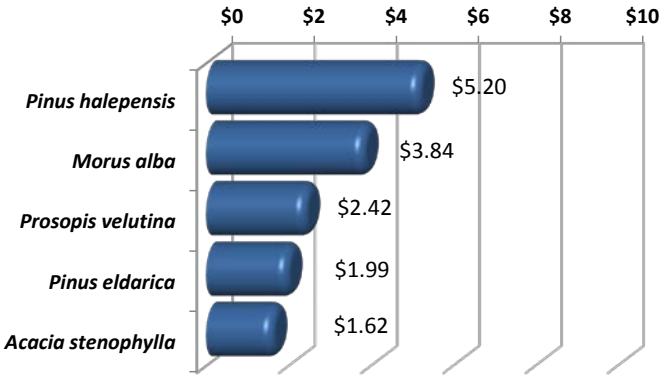


Figure 9. Annual Reduction in Stormwater Runoff - Top Five Species

Table 10. Annual Stormwater Runoff Reduction Benefits Provided by CCSD's Trees

Species	Total Rainfall Interception (Gal)	Total ($)	% of Pop.	% of Total $	Avg. $/tree
Pinus eldarica	1,934,413	**9,286**	15.3	23.5	1.99
Fraxinus velutina	514,684	**2,471**	6.9	6.3	1.18
Quercus virginiana	503,269	**2,416**	6.8	6.1	1.17
Fraxinus velutina 'Fan-Tex'	536,267	**2,574**	6.7	6.5	1.26
Pistacia chinensis	215,108	**1,033**	5.3	2.6	0.64
Fraxinus angustifolia	383,312	**1,840**	5.0	4.7	1.20
Chiltalpa tashkentensis	318,600	**1,529**	4.8	3.9	1.04
Washingtonia robusta	200,817	**964**	4.8	2.4	0.66
Vitex agnus-castus	131,424	**631**	4.8	1.6	0.43
Chilopsis linearis	67,309	**323**	4.3	0.8	0.25
Acacia stenophylla	328,670	**1,578**	3.2	4.0	1.62
Parkinsonia x 'Desert Museum'	157,690	**757**	3.0	1.9	0.82
Prosopis alba	180,950	**869**	3.0	2.2	0.95
Morus alba	561,663	**2,696**	2.3	6.8	3.84
Ulmus parvifolia	157,895	**758**	2.3	1.9	1.09
Washingtonia filifera	39,750	**191**	1.9	0.5	0.34
Quercus ilex	84,255	**404**	1.9	1.0	0.72
Pinus halepensis	486,766	**2,337**	1.5	5.9	5.20
Prosopis velutina	215,349	**1,034**	1.4	2.6	2.42
Olea europaea	44,716	**215**	1.1	0.5	0.62
Other Trees	1,172,044	**5,626**	13.8	14.2	1.34
All Trees	**8,234,954**	**$39,531**	**100%**	**100%**	**$1.30**

Aesthetic, Property Value and Socioeconomic Benefits

Trees provide beauty in the urban landscape.

Trees provide beauty in the urban landscape, privacy to homeowners, improved human health, a sense of comfort and place, and habitat for urban wildlife. There is documented evidence regarding children coping with attention deficit disorder (ADD) that "children function better than usual after activities in green settings and that the "greener" a child's play area, the less severe his or her attention deficit symptoms (Faber Taylor, 2001)." Thus, contact with nature may support children suffering with ADD. Some of these benefits are captured as a percentage of the value of the property on which a tree stands. To determine the value of these less tangible benefits, i-Tree *Streets* uses research that compares differences in sales prices of homes to estimate the contribution associated with trees. Differences in housing prices in relation to the presence (or lack) of a street tree can help define the aesthetic value of street trees in the urban environment.

The calculation of annual aesthetic and other benefits corresponds with a tree's annual increase in leaf area. When a tree is actively growing, leaf area may increase dramatically. Once a tree is mature, there may be little or no net increase in leaf area from one year to the next; thus, there is little or no incremental annual aesthetic benefit for that year, although the cumulative benefit over the course of the entire life of the tree may be large. Since this report represents a one-year sample snapshot of the inventoried tree population, **aesthetic benefits reflect the increase in leaf area for each species population over the course of a single year.**

Children function better after activities in green settings. (Faber Taylor, 2001).

The total annual benefit associated with property value increases and other less tangible benefits is $675,690, an average of $22.16 per tree (Table 11). Tree species that produced the highest average per tree aesthetic benefits are *Pinus halepensis* (Aleppo pine, $65.02), followed by *Prosopis velutina* (velvet mesquite, $45.59), and *Quercus ilex* (holly oak, $39.48).

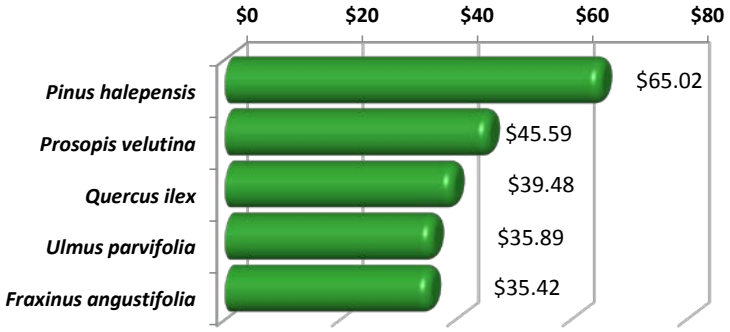


Figure 10. Annual Increase in Property and Socioeconomic Values - Top Five Species

Table 11. Annual Property Value, Aesthetic, and Socioeconomic Benefits Provided by CCSD's Trees

Species	Total ($)	% of Pop.	% of Total $	Avg. $/tree
Pinus eldarica	**85,101**	15.3	12.6	18.25
Fraxinus velutina	**53,453**	6.9	7.9	25.56
Quercus virginiana	**45,687**	6.8	6.8	22.17
Fraxinus velutina 'Fan-Tex'	**72,557**	6.7	10.7	35.38
Pistacia chinensis	**36,334**	5.3	5.4	22.53
Fraxinus angustifolia	**54,401**	5.0	8.1	35.42
Chiltalpa tashkentensis	**20,231**	4.8	3.0	13.72
Washingtonia robusta	**11,508**	4.8	1.7	7.86
Vitex agnus-castus	**14,771**	4.8	2.2	10.15
Chilopsis linearis	**11,644**	4.3	1.7	8.86
Acacia stenophylla	**18,881**	3.2	2.8	19.37
Parkinsonia x 'Desert Museum'	**11,474**	3.0	1.7	12.50
Prosopis alba	**12,129**	3.0	1.8	13.30
Morus alba	**20,144**	2.3	3.0	28.69
Ulmus parvifolia	**24,874**	2.3	3.7	35.89
Washingtonia filifera	**46**	1.9	0.0	0.08
Quercus ilex	**22,309**	1.9	3.3	39.48
Pinus halepensis	**29,194**	1.5	4.3	65.02
Prosopis velutina	**19,513**	1.4	2.9	45.59
Olea europaea	**4,867**	1.1	0.7	13.94
Other Trees	**106,573**	13.8	15.8	25.35
All Trees	**$675,690**	**100%**	**100%**	**$22.16**

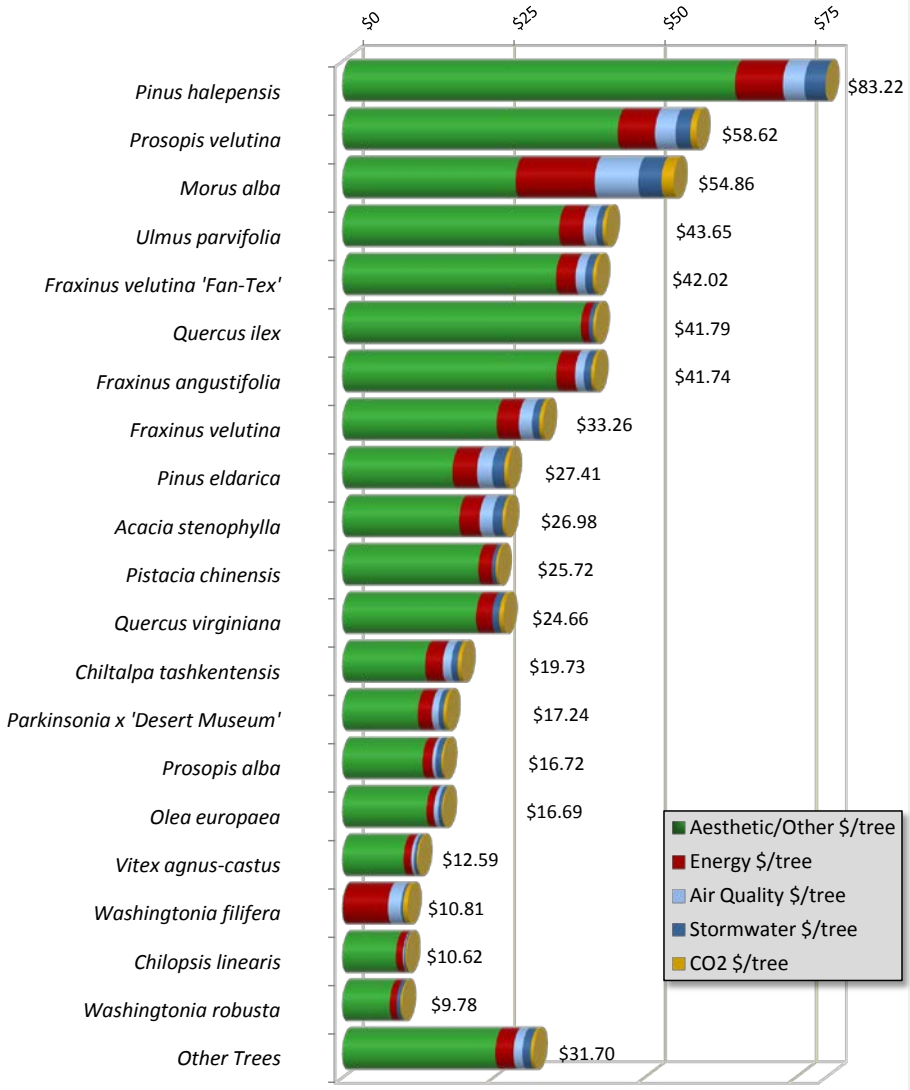


Figure 11. Summary of Annual per Tree Benefits

Table 12. Summary of Current Annual Average per Tree Benefits ($/Tree/yr.) from CCSD's Tree Resource

Species	Energy $/tree	CO_2 $/tree	Air Quality $/tree	Stormwater $/tree	Aesthetic/Other $/tree	% of Pop.	Total $/tree
Pinus halepensis	7.92	1.49	3.58	5.20	65.02	1.5	**83.22**
Prosopis velutina	6.20	1.02	3.39	2.42	45.59	1.4	**58.62**
Morus alba	13.10	2.01	7.22	3.84	28.69	2.3	**54.86**
Ulmus parvifolia	3.96	0.58	2.12	1.09	35.89	2.3	**43.65**
Fraxinus velutina 'Fan-Tex'	3.25	0.56	1.59	1.26	35.38	6.7	**42.02**
Quercus ilex	1.33	0.43	- 0.17	0.72	39.48	1.9	**41.79**
Fraxinus angustifolia	3.11	0.54	1.47	1.20	35.42	5.0	**41.74**
Fraxinus velutina	3.67	0.65	2.19	1.18	25.56	6.9	**33.26**
Pinus eldarica	4.05	0.63	2.49	1.99	18.25	15.3	**27.42**
Acacia stenophylla	3.36	0.47	2.16	1.62	19.37	3.2	**26.98**
Pistacia chinensis	2.23	0.35	- 0.02	0.64	22.53	5.3	**25.72**
Quercus virginiana	2.65	0.69	- 2.02	1.17	22.17	6.8	**24.66**
Chiltalpa tashkentensis	2.92	0.64	1.41	1.04	13.72	4.8	**19.73**
Parkinsonia x 'Desert Museum'	2.34	0.51	1.08	0.82	12.50	3.0	**17.24**
Prosopis alba	1.59	0.32	0.56	0.95	13.30	3.0	**16.72**
Olea europaea	1.22	0.21	0.71	0.62	13.94	1.1	**16.69**
Vitex agnus-castus	1.26	0.26	0.49	0.43	10.15	4.8	**12.59**
Washingtonia filifera	7.49	0.74	2.16	0.34	0.08	1.9	**10.81**
Chilopsis linearis	1.18	0.18	0.15	0.25	8.86	4.3	**10.62**
Washingtonia robusta	1.14	0.25	- 0.11	0.66	7.86	4.8	**9.78**
Other Trees	2.99	0.53	1.49	1.34	25.35	13.8	**31.70**
All Trees	**$3.31**	**$0.55**	**$1.31**	**$1.11**	**$20.45**	**100%**	**$34.73**

Net Benefits and Benefit-Investment Ratio (BIR)

Clark County School District receives substantial benefits from their campus trees; however, the District must also consider their investments in maintaining this resource. Applying a *benefit-investment ratio* (BIR) is a useful way to evaluate the investment in the community tree population. A BIR is an indicator used to summarize the overall value compared to the investments of a given project. Specifically, in this analysis, BIR is the ratio of the total benefits provided by the district's trees compared to the cost (investment) associated with their management.

Clark County School District's trees have beneficial effects on the environment. Approximately 22.5% ($196,476) of the total annual benefits ($936,202) quantified in this study are environmental services (Table 13). Energy savings ($99,468) account for 50.6% of the annual environmental benefits and 11.4% of all benefits. The trees provide $41,184 in air quality benefits, accounting for 21.0% of environmental benefits and 4.7% of all benefits. Stormwater benefits ($39,531) account for 20.1% of environmental benefits and 4.5% of all benefits. Carbon reduction, valued at $17,293, accounts for 8.8% of environmental benefits and 2.0% of all benefits. Annual increases to property value, socioeconomic, and other aesthetic benefits are substantial benefits, accounting for the remaining 76% ($710,494) of all benefits.

The total estimated benefits provided by CCSD's campus tree resource is $936,202, a value of $30.71 per tree and $0.48 per capita. These benefits are realized on an annual basis. It is important to acknowledge that this is not a full accounting of the benefits provided by this resource, as some benefits are intangible and/or difficult to quantify, such as impacts on psychological health, crime, and violence. Empirical evidence of these benefits does exist (Wolf, 2007; Kaplan, 1989; Ulrich, 1986), but there is limited knowledge about the physical processes at work and the complex nature of interactions make quantification imprecise. Tree growth and mortality rates are highly variable. A true and full accounting of benefits and investments must consider variability among sites (e.g., tree species, growing conditions, maintenance practices) throughout the district, as well as variability in tree growth. In other words, **trees are worth far more than what one can ever quantify!**

The total annual quantifiable benefit that campus trees provide to the Clark County School District is $936,202. When the district's annual tree related expenditures (or investment) of $750,000 in this resource are considered, the net annual benefit (benefits minus investment) to the district is $186,202. The average net benefit for an individual tree in the CCSD is $6.11 and the per capita net benefit is $0.09. Based on the inventory of 30,487 trees, **CCSD is currently receiving $1.25 in benefits for every $1 invested in its urban forest resource** (Table 13).

Considering the relatively young age of CCSD's urban forest, CCSD receives a great return on its investment. Additionally, as existing trees mature and vacant planting sites are filled, the benefits from this resource will increase. Furthermore, considering the vital importance of trees to the quality of life on the Clark County School District's campuses, the true value of CCSD's urban forest is incalculable.

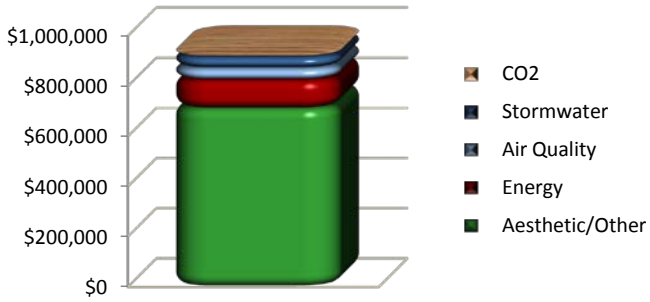


Figure 12. Total Annual Benefits from CCSD's Trees

Total Annual Benefits: $936,202
Average Annual per Tree Benefits: $30.71
Annual Value of Benefits per Capita: $0.48

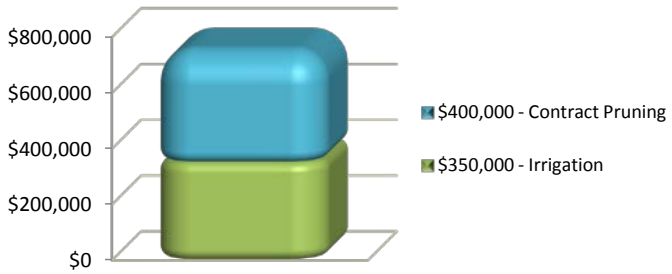


Figure 13. Total Annual Investment to Maintain CCSD's Trees

Total Annual Investment: $750,000
Average Annual per Tree Investment: $24.60
Annual Investment per Capita: $0.38

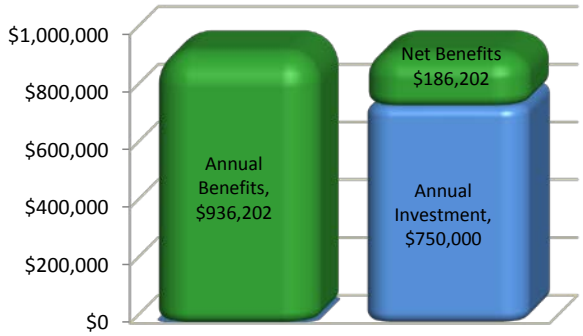


Figure 14. Benefit versus Investment Ratio

Annual Net Benefits of CCSD's Tree Resource: $186,202
For EVERY $1 Invested in district trees, CCSD receives $1.25 in Benefits.

Table 13. Annual Benefit versus Investment Summary for CCSD's Tree Resource

Benefits	Total ($)	$/tree	$/capita
Energy	112,123	3.68	0.06
CO_2	19,565	0.64	0.01
Air Quality	48,672	1.60	0.02
Stormwater	45,348	1.49	0.02
Aesthetic/Other	710,494	23.31	0.36
Total Benefits	**$936,202**	**$30.71**	**$0.48**
Investment			
Contract Pruning	400,000	13.12	0.20
Irrigation	350,000	11.48	0.18
Total Investments	**$750,000**	**$24.60**	**$0.38**
Net Benefits	**$186,202**	**$6.11**	**$0.09**
Benefit-Investment ratio	**$1.25**		

Conclusion

This analysis describes the current structural characteristics of Clark County School District's tree resource using established tree sampling, numerical modeling, and statistical methods to provide a general accounting of the benefits. The analysis provides a "snapshot" of this resource at its current population, structure, and condition. Rather than examining each individual tree, as an inventory does, the resource analysis examines trends and performance measures over the entire urban forest and each of the major species populations within.

Clark County School District's trees are providing quantifiable benefits, including energy savings, stormwater runoff reduction, reduction in atmospheric CO_2, and aesthetic benefits. The district's 30,487 trees are providing $936,202 in annual gross benefits. That is an average value of $30.71 per tree and $0.48 per capita.

Clark County School District's urban forest is relatively young and in fair to good condition with 128 different species. Although it is critical to maintain an adequate level of resources to protect and nurture this resource, CCSD's trees can be expected to provide even greater benefits in the future and for many generations to come. The district can focus resources on maximizing the flow of benefits from the current tree population and maintaining a forward-thinking approach. Based on the resource analysis, Davey Resource Group recommends the following:

- Work toward developing an appropriate age distribution. CCSD's tree population is heavily weighted toward small, young trees. CCSD should work to offset this by continuing to plant new trees in order to improve long-term resource sustainability and greater canopy coverage. To maximize benefits, focus on medium to large-stature trees where conditions are sustainable
- Maximize the benefits of the existing tree resource through comprehensive tree maintenance and a cyclical pruning schedule
- Continue annual tree planting efforts with the goal of achieving a 100% stocking rate, utilizing available planting sites identified by the inventory
- Implement a structural pruning program for young and establishing trees to promote healthy structure, extend life expectancy, and reduce future investments and liability. This is especially important in the case of CCSD with such a large population of young trees
- Continue to develop species diversity. While CCSD only has one species comprising greater than 10% of the overall population (*Pinus eldarica*, Mondale pine, 15.3%), there are under-represented species and genera that CCSD could focus on planting to improve overall diversity among its tree population
- Maintain and update the inventory database

Urban forest managers can better anticipate future trends with an understanding of the current status of the district's tree population. Managers can also anticipate challenges and devise plans to increase the current level of benefits. Performance data from the analysis can be used to make determinations regarding species selection, distribution, and maintenance policies. Documenting current structure is necessary for establishing goals and performance objectives and can serve as a benchmark for measuring future success. Information from the urban forest resource analysis can be referenced in development of an urban forest management or master plan. An urban forest master plan is a critical tool for successful urban forest management, inspiring commitment and providing vision for communication with key decision-makers both inside and outside the organization.

Clark County School District's trees are of vital importance to the environmental, social, and economic well-being of the community, from the students and staff at the schools of Clark County School District to the residents and visitors of the surrounding area. The district has demonstrated

that trees are a valued community resource, a vital component of the urban infrastructure, and an important part of the district's history and identity. Clark County School District may use this inventory to take a proactive and forward-looking approach to caring for the community's trees in the future. Updates should be incorporated into the inventory as work is performed. Current and complete inventory data will help staff to more efficiently track maintenance activities and tree health and will provide a strong basis for making informed management decisions. With additional tree planting and proactive management, CCSD's urban forest can be expected to produce an even greater flow of benefits as this resource continues to mature. By maintaining a commitment to planting, maintaining, and preserving these trees, the community will continue to be a healthy, safe, and enjoyable place to live, recreate, study, and learn.

Appendix A: Methods and Procedures

Certified Arborists collected CCSD's tree inventory using ArcPad software to assist the inventory arborist in locating the sample plots on the ground and inputting tree attributes (details about each tree's species, size, and condition). The data was formatted for use in i-Tree's public tree population assessment tool, i-Tree *Streets*, a STRATUM Analysis Tool (Streets v 5.0.1; i-Tree v 5.0.6). i-Tree *Streets* assesses tree population structure and the function of those trees, such as their role in building energy use, air pollution removal, stormwater interception, carbon dioxide removal, and property value increases. In order to analyze the economic benefits of CCSD's trees, i-Tree *Streets* calculates the dollar value of annual resource functionality. This analysis combines the results of the district's tree inventory with benefit modeling data to produce information regarding resource structure, function, and value for use in determining management recommendations. i-Tree *Streets* regionalizes the calculations of its output by incorporating detailed reference district project information for 17 climate zones across the United States (CCSD is located in the Southwest Desert Climate Zone).

An annual resource unit was determined on a per tree basis for each of the modeled benefits. Resource units are measured as MWh of electricity saved per tree; MBtu of natural gas conserved per tree; pounds of atmospheric CO_2 reduced per tree; pounds of NO_2,SO_2, O_3, $_{PM10}$, and VOCs reduced per tree; cubic feet of stormwater runoff reduced per tree; and square feet of leaf area added per tree to increase property values.

Price values assigned to each resource unit (tree) were generated based on economic indicators of society's willingness to pay for the environmental benefits trees provide. The district provided the investment values for pruning and irrigation.

Estimates of benefits are initial approximations as some benefits are difficult to quantify (e.g., impacts on psychological health, crime, and violence). In addition, limited knowledge about the physical processes at work and their interactions makes estimates imprecise (e.g., fate of air pollutants trapped by trees and then washed to the ground by rainfall). Therefore, this method of quantification provides first-order approximations based on current research. It is intended to be a general accounting of the benefits produced by urban trees.

Table 14. CCSD Benefit Prices Used In This Analysis

Benefits	Price	Unit	Source
Electricity	$0.0671	$/Kwh	Residential rates from NV Energy
Natural Gas	$0.6455	$/Therm	Residential rates from NV Energy
CO_2	$0.0075	$/lb	*Streets* default – Southwest Desert
PM10	$6	$/lb	*Streets* default – Southwest Desert
NO_2	$4	$/lb	*Streets* default – Southwest Desert
SO_2	$15.70	$/lb	*Streets* default – Southwest Desert
VOC	$4	$/lb	*Streets* default – Southwest Desert
Stormwater Interception	$0.0048	$/gallon	*Streets* default – Southwest Desert
Median Home Value	$125,000	$	City-data.com

i-Tree *Streets* default values (Table 14) from the Southwest Desert Climate Zone were used for all benefit prices except for median home values and electric and natural gas rates. Electric rates, natural gas rates are residential rates from NV Energy. Median home value for Clark County was estimated to be $125,000 in February, 2013, based on the value reported at citydata.com. Using these rates, the magnitude of the benefits provided by the tree resource was calculated using i-Tree *Streets*. Program budget values used in benefit versus investment ratio calculations were supplied by the District.

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Appendix C: Reports

Clark County Schools Complete Population of Trees

Species	DBH Class (in)										% of Pop.
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	
Broadleaf Deciduous Large (BDL)											
Gleditsia triacanthos	50	50	20	8	2	0	0	0	0	130	0.4
Ulmus pumila	31	27	7	10	4	1	0	0	0	80	0.3
Plantanus occidentalis	0	3	20	19	0	0	0	0	0	42	0.1
Fraxinus uhdei	2	8	30	1	0	0	0	0	0	41	0.1
Populus fremontii	0	0	5	17	8	1	2	0	0	33	0.1
Populus species	0	1	10	11	4	0	2	0	0	28	0.1
Quercus lobata	0	11	0	1	0	0	0	0	0	12	0.0
Platanus wrightii	0	11	0	0	0	0	0	0	0	11	0.0
Quercus muehlenbergii	1	8	1	0	0	0	0	0	0	10	0.0
Celtis sinensis	1	1	3	0	0	0	0	0	0	5	0.0
Quecus shumardii	1	4	0	0	0	0	0	0	0	5	0.0
Carya illinoinensis	2	0	0	0	0	0	0	0	0	2	0.0
Platanus racemosa	0	0	0	1	0	0	0	0	0	1	0.0
Zelkova serrata	0	1	0	0	0	0	0	0	0	1	0.0
Total	**88**	**125**	**96**	**68**	**18**	**2**	**4**	**0**	**0**	**401**	**1.3**
Broadleaf Deciduous Medium (BDM)											
Fraxinus velutina	426	992	502	134	24	3	3	1	6	2,091	6.9
Fraxinus velutina 'Fan-Tex'	536	1,170	299	46	0	0	0	0	0	2,051	6.7
Pistacia chinensis	274	1,187	141	11	0	0	0	0	0	1,613	5.3
Fraxinus angustifolia	250	1,126	135	25	0	0	0	0	0	1,536	5.0
Morus alba	8	5	96	336	155	64	22	11	5	702	2.3
Ulmus parvifolia	210	433	46	4	0	0	0	0	0	693	2.3
Parkinsonia florida	132	69	82	11	0	0	0	0	0	294	1.0
Prosopis chilensis	45	113	42	12	6	0	0	0	0	218	0.7
Robinia pseudoacacia	16	58	24	1	0	0	0	0	0	99	0.3
Pistacia X atlantica	5	14	69	0	0	0	0	0	0	88	0.3
Parkinsonia aculeata	23	19	24	6	5	0	0	0	0	77	0.3
Robinia ambigua 'Purple Robe'	12	36	0	0	0	0	0	0	0	48	0.2
Celtis occidentalis	0	39	1	0	0	0	0	0	0	40	0.1
Fraxinus velutina 'Glabra'	2	3	16	9	1	0	0	0	0	31	0.1
Celtis reticulata	0	10	0	0	0	0	0	0	0	10	0.0
Albizia julibrissin	3	4	1	0	0	0	0	0	0	8	0.0
Melia azedarach	3	2	2	0	0	0	0	0	0	7	0.0
Pyrus communis	3	1	0	0	0	0	0	0	0	4	0.0
Koelreuteria paniculata	2	0	1	0	0	0	0	0	0	3	0.0
Geoffroea decorticans	0	0	1	1	0	0	0	0	0	2	0.0
Salix gooddingii	0	1	1	0	0	0	0	0	0	2	0.0

Species	DBH Class (in)										% of Pop.
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	
Acer ginnala	1	0	0	0	0	0	0	0	0	1	0.0
Total	**1,951**	**5,282**	**1,483**	**596**	**191**	**67**	**25**	**12**	**11**	**9,618**	**31.6**
Broadleaf Deciduous Small (BDS)											
Chiltalpa tashkentensis	150	859	455	10	1	0	0	0	0	1,475	4.8
Vitex agnus-castus	954	472	25	4	0	0	0	0	0	1,455	4.8
Chilopsis linearis	679	534	92	9	0	0	0	0	0	1,314	4.3
Parkinsonia x 'Desert Museum'	231	514	167	6	0	0	0	0	0	918	3.0
Prosopis velutina	42	155	187	42	2	0	0	0	0	428	1.4
Pyrus calleryana	42	113	13	1	4	0	0	0	0	173	0.6
Prosopis glandulosa	50	60	40	0	0	0	0	0	0	150	0.5
Acacia farnesiana	40	38	31	15	2	0	0	0	0	126	0.4
Prunus cerasifera	70	32	6	0	0	0	0	0	0	108	0.4
Cercis canadensis	55	1	0	0	0	0	0	0	0	56	0.2
Parkinsonia microphylla	18	17	18	0	0	0	0	0	0	53	0.2
Prosopis juliflora	4	11	15	8	0	0	0	0	0	38	0.1
Elaeocarpus decipiens	8	27	1	0	0	0	0	0	0	36	0.1
Prosopis torreyana	2	13	9	2	0	0	0	0	0	26	0.1
Fraxinus sieboldiana	4	13	0	0	0	0	0	0	0	17	0.1
Fraxinus anomala	7	8	0	0	0	0	0	0	0	15	0.0
Prunus persica	11	1	1	0	0	0	0	0	0	13	0.0
Punica granatum	7	3	0	0	0	0	0	0	0	10	0.0
Malus spp.	8	1	0	0	0	0	0	0	0	9	0.0
Prosopis pubescens	6	3	0	0	0	0	0	0	0	9	0.0
Tamarix chinensis	7	0	0	0	0	0	0	0	0	7	0.0
Prunus dulcis	2	2	1	1	0	0	0	0	0	6	0.0
Cercidium praecox	0	0	2	2	0	0	0	0	0	4	0.0
Lagerstroemia indica	2	1	1	0	0	0	0	0	0	4	0.0
Ficus carica	2	0	1	0	0	0	0	0	0	3	0.0
Prunus armeniaca	3	0	0	0	0	0	0	0	0	3	0.0
Eysenhardtia orthocarpa	1	0	0	0	0	0	0	0	0	1	0.0
Salix laevigata	1	0	0	0	0	0	0	0	0	1	0.0
Total	**2,406**	**2,878**	**1,065**	**100**	**9**	**0**	**0**	**0**	**0**	**6,458**	**21.2**
Broadleaf Evergreen Large (BEL)											
Quercus ilex	237	307	19	2	0	0	0	0	0	565	1.9
Eucalyptus camaldulensis	0	3	8	7	6	1	0	0	0	25	0.1
Eucalyptus rudis	3	0	4	1	0	0	0	0	0	8	0.0
Eucalyptus polyanthemos	0	1	3	0	0	1	0	0	0	5	0.0
Quercus agrifolia	0	4	0	0	0	0	0	0	0	4	0.0
Eucalyptus microtheca	0	0	2	0	0	0	0	0	0	2	0.0
Eucalyptus sideroxylon	0	0	1	1	0	0	0	0	0	2	0.0
Total	**240**	**315**	**37**	**11**	**6**	**2**	**0**	**0**	**0**	**611**	**2.0**

Species	DBH Class (in)										% of Pop.
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	
Broadleaf Evergreen Medium (BEM)											
Quercus virginiana	283	1,436	331	9	2	0	0	0	0	2,061	6.8
Prosopis alba	356	281	202	60	12	1	0	0	0	912	3.0
Quercus fusiformis	58	86	14	1	0	0	0	0	0	159	0.5
Laurus nobillis	14	7	0	0	0	0	0	0	0	21	0.1
Brachychiton populneum	1	3	9	0	0	0	0	0	0	13	0.0
Schinus molle	0	6	3	1	1	0	0	0	0	11	0.0
Magnolia grandiflora	5	3	0	0	0	0	0	0	0	8	0.0
Ilex attenuata	7	0	0	0	0	0	0	0	0	7	0.0
Acacia salicina	1	1	0	0	0	1	0	0	0	3	0.0
Ceratonia siliqua	3	0	0	0	0	0	0	0	0	3	0.0
Eriobotyra japonica	1	0	0	0	0	0	0	0	0	1	0.0
Total	**729**	**1,823**	**559**	**71**	**15**	**2**	**0**	**0**	**0**	**3,199**	**10.5**
Broadleaf Evergreen Small (BES)											
Acacia stenophylla	56	514	342	58	5	0	0	0	0	975	3.2
Olea europaea	150	154	31	9	4	1	0	0	0	349	1.1
Sophora secundiflora	273	22	1	0	0	0	0	0	0	296	1.0
Rhus lancea	65	153	59	4	0	0	0	0	0	281	0.9
Chamaerops humilis	51	131	28	0	0	0	0	0	0	210	0.7
Ligustrum lucidum	80	90	3	0	0	0	0	0	0	173	0.6
Pyrus kawakamii	0	109	5	0	0	0	0	0	0	114	0.4
Olea europaea 'Swan Hill'	14	54	31	1	0	0	0	0	0	100	0.3
Xylosma congestum	25	2	7	1	0	0	0	0	0	35	0.1
Ilex cornuta 'Burfordii'	21	7	4	0	0	0	0	0	0	32	0.1
Citrus species	24	4	3	0	0	0	0	0	0	31	0.1
Cordia boissieri	20	2	0	0	0	0	0	0	0	22	0.1
Podocarpus macrophyllus	21	1	0	0	0	0	0	0	0	22	0.1
Prunus caroliniana	3	10	0	0	0	0	0	0	0	13	0.0
Acacia greggii	5	2	4	0	0	0	0	0	0	11	0.0
Fraxinus greggii	5	0	0	0	0	0	0	0	0	5	0.0
Acacia pendula	0	3	1	0	0	0	0	0	0	4	0.0
Callistemon viminalis	3	0	0	0	0	0	0	0	0	3	0.0
Geijera parviflora	0	0	2	0	1	0	0	0	0	3	0.0
Rhaphiolepis indica	1	2	0	0	0	0	0	0	0	3	0.0
Ebenopsis ebano	0	0	1	0	0	0	0	0	0	1	0.0
Eucalyptus formannii	0	0	0	1	0	0	0	0	0	1	0.0
Myrtus communis	0	0	0	0	1	0	0	0	0	1	0.0
Yucca brevifolia	0	1	0	0	0	0	0	0	0	1	0.0
Total	**817**	**1,261**	**522**	**74**	**11**	**1**	**0**	**0**	**0**	**2,686**	**8.8**
Conifer Evergreen Large (CEL)											
Pinus eldarica	138	1,327	2,454	608	103	24	6	3	0	4,663	15.3
Pinus halepensis	5	24	160	200	43	12	4	1	0	449	1.5
Cupressus sempervirens	10	36	5	3	1	1	0	0	0	56	0.2

Species	DBH Class (in)										% of Pop.
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	
Pinus roxburghii	0	12	39	2	0	0	0	0	0	53	0.2
Pinus pinea	2	4	6	3	2	2	0	1	0	20	0.1
Pinus ponderosa var. scopulorum	0	0	7	5	4	2	0	0	0	18	0.1
Cedrus deodara	1	2	0	0	0	0	0	0	0	3	0.0
Total	**156**	**1,405**	**2,671**	**821**	**153**	**41**	**10**	**5**	**0**	**5,262**	**17.3**
Conifer Evergreen Medium (CEM)											
Pinus brutia	0	0	1	14	0	0	0	0	0	15	0.0
Cupressus glabra	4	4	1	1	0	0	0	0	0	10	0.0
Thuja occidentalis	0	3	1	0	0	0	0	0	0	4	0.0
Total	**4**	**7**	**3**	**15**	**0**	**0**	**0**	**0**	**0**	**29**	**0.1**
Conifer Evergreen Small (CES)											
Juniperus spp.	3	11	3	0	0	0	0	0	0	17	0.1
Juniperus chinensis	0	6	5	0	0	0	0	0	0	11	0.0
Platycladus orientalis	1	1	9	0	0	0	0	0	0	11	0.0
Juniperus chinensis 'Torulosa'	0	0	3	6	0	0	0	0	0	9	0.0
Total	**4**	**18**	**20**	**6**	**0**	**0**	**0**	**0**	**0**	**48**	**0.2**
Palm Evergreen Large (PEL)											
Phoenix canariensis	0	1	0	3	1	3	3	1	2	14	0.0
Total	**0**	**1**	**0**	**3**	**1**	**3**	**3**	**1**	**2**	**14**	**0.0**
Palm Evergreen Medium (PEM)											
Phoenix dactylifera	0	3	13	30	6	0	0	0	0	52	0.2
Total	**0**	**3**	**13**	**30**	**6**	**0**	**0**	**0**	**0**	**52**	**0.2**
Palm Evergreen Small (PES)											
Washingtonia robusta	12	30	510	689	144	46	28	5	1	1,465	4.8
Washingtonia filifera	2	3	17	121	309	59	24	17	16	568	1.9
Brahea armata	2	56	6	0	0	0	0	0	0	64	0.2
Cycas revoluta	1	3	2	0	0	0	0	0	0	6	0.0
Arecastrum romanzoffianum	0	1	3	0	0	0	0	0	0	4	0.0
Butia capitata	0	2	0	0	0	0	0	0	0	2	0.0
Total	**17**	**95**	**538**	**810**	**453**	**105**	**52**	**22**	**17**	**2,109**	**6.9**
All Trees	**6,412**	**13,213**	**7,007**	**2,605**	**863**	**223**	**94**	**40**	**30**	**30,487**	**100%**

Relative Performance Index (RPI) for CCSD's Tree Species

Species	Dead or Dying	Poor	Fair	Good	RPI	# of Trees	% of Pop.
Pinus eldarica	0.69	1.54	23.38	74.39	**1.10**	4,663	15.30
Fraxinus velutina	0.91	4.30	66.24	28.55	**0.93**	2,091	6.86
Quercus virginiana	0.53	2.77	52.26	44.44	**1.00**	2,061	6.76
Fraxinus velutina 'Fan-Tex'	0.44	4.24	51.83	43.49	**0.99**	2,051	6.73
Pistacia chinensis	0.00	1.12	37.07	61.81	**1.07**	1,613	5.29
Fraxinus angustifolia	1.89	16.02	61.00	21.09	**0.86**	1,536	5.04
Chiltalpa tashkentensis	0.95	20.81	62.98	15.25	**0.82**	1,475	4.84
Washingtonia robusta	0.20	1.64	24.37	73.79	**1.11**	1,465	4.81
Vitex agnus-castus	0.21	0.69	57.73	41.37	**0.99**	1,455	4.77
Chilopsis linearis	0.08	4.03	57.53	38.36	**0.97**	1,314	4.31
Acacia stenophylla	0.31	1.33	34.26	64.10	**1.07**	975	3.20
Parkinsonia x 'Desert Museum'	0.00	1.74	60.46	37.80	**0.98**	918	3.01
Prosopis alba	0.22	1.86	67.65	30.26	**0.95**	912	2.99
Morus alba	1.00	10.11	58.97	29.91	**0.91**	702	2.30
Ulmus parvifolia	0.43	3.46	41.70	54.40	**1.03**	693	2.27
Washingtonia filifera	0.18	0.00	5.81	94.01	**1.18**	568	1.86
Quercus ilex	1.42	13.10	59.82	25.66	**0.89**	565	1.85
Pinus halepensis	0.22	2.00	31.40	66.37	**1.08**	449	1.47
Prosopis velutina	0.93	3.50	47.43	48.13	**1.00**	428	1.40
Olea europaea	0.29	0.57	77.94	21.20	**0.92**	349	1.14
Sophora secundiflora	0.00	2.03	31.08	66.89	**1.08**	296	0.97
Parkinsonia florida	0.00	1.36	74.15	24.49	**0.93**	294	0.96
Rhus lancea	0.36	2.49	39.50	57.65	**1.04**	281	0.92
Prosopis chilensis	0.46	7.34	85.32	6.88	**0.85**	218	0.72
Chamaerops humilis	0.00	0.48	31.90	67.62	**1.09**	210	0.69
Pyrus calleryana	4.62	6.36	42.77	46.24	**0.96**	173	0.57
Ligustrum lucidum	2.31	7.51	46.24	43.93	**0.96**	173	0.57
Quercus fusiformis	0.63	1.26	97.48	0.63	**0.84**	159	0.52
Prosopis glandulosa	0.67	3.33	78.00	18.00	**0.90**	150	0.49
Gleditsia triacanthos	0.77	10.00	58.46	30.77	**0.92**	130	0.43
Acacia farnesiana	0.00	2.38	67.46	30.16	**0.95**	126	0.41
Pyrus kawakamii	0.00	0.00	44.74	55.26	**1.05**	114	0.37
Prunus cerasifera	4.63	9.26	62.96	23.15	**0.87**	108	0.35
Olea europaea 'Swan Hill'	0.00	3.00	20.00	77.00	**1.11**	100	0.33
Robinia pseudoacacia	1.01	19.19	44.44	35.35	**0.90**	99	0.32
Pistacia X atlantica	0.00	0.00	3.41	96.59	**1.19**	88	0.29
Ulmus pumila	2.50	11.25	76.25	10.00	**0.83**	80	0.26
Parkinsonia aculeata	1.30	6.49	62.34	29.87	**0.92**	77	0.25
Brahea armata	0.00	0.00	23.44	76.56	**1.12**	64	0.21
Cupressus sempervirens	1.79	1.79	28.57	67.86	**1.07**	56	0.18
Cercis canadensis	0.00	0.00	96.43	3.57	**0.86**	56	0.18
Parkinsonia microphylla	0.00	5.66	49.06	45.28	**0.99**	53	0.17
Pinus roxburghii	0.00	0.00	7.55	92.45	**1.18**	53	0.17
Phoenix dactylifera	0.00	1.92	5.77	92.31	**1.17**	52	0.17
Robinia ambigua 'Purple Robe'	6.25	12.50	77.08	4.17	**0.78**	48	0.16

Species	Dead or Dying	Poor	Fair	Good	RPI	# of Trees	% of Pop.
Plantanus occidentalis	0.00	4.76	45.24	50.00	**1.01**	42	0.14
Fraxinus uhdei	0.00	4.88	21.95	73.17	**1.09**	41	0.13
Celtis occidentalis	0.00	2.50	45.00	52.50	**1.03**	40	0.13
Prosopis juliflora	5.26	0.00	10.53	84.21	**1.11**	38	0.12
Elaeocarpus decipiens	8.33	11.11	55.56	25.00	**0.84**	36	0.12
Xylosma congestum	0.00	5.71	80.00	14.29	**0.88**	35	0.11
Populus fremontii	3.03	27.27	36.36	33.33	**0.85**	33	0.11
Ilex cornuta 'Burfordii'	0.00	0.00	12.50	87.50	**1.16**	32	0.10
Fraxinus velutina 'Glabra'	0.00	25.81	38.71	35.48	**0.89**	31	0.10
Citrus species	0.00	6.45	70.97	22.58	**0.91**	31	0.10
Populus species	0.00	3.57	85.71	10.71	**0.88**	28	0.09
Prosopis torreyana	0.00	7.69	34.62	57.69	**1.03**	26	0.09
Eucalyptus camaldulensis	0.00	0.00	72.00	28.00	**0.95**	25	0.08
Podocarpus macrophyllus	0.00	0.00	13.64	86.36	**1.16**	22	0.07
Cordia boissieri	0.00	0.00	4.55	95.45	**1.19**	22	0.07
Laurus nobillis	0.00	47.62	42.86	9.52	**0.72**	21	0.07
Pinus pinea	0.00	0.00	20.00	80.00	**1.14**	20	0.07
Pinus ponderosa var. scopulorum	0.00	0.00	22.22	77.78	**1.13**	18	0.06
Fraxinus sieboldiana	0.00	0.00	17.65	82.35	**1.14**	17	0.06
Juniperus spp.	5.88	0.00	82.35	11.76	**0.85**	17	0.06
Fraxinus anomala	6.67	0.00	33.33	60.00	**1.02**	15	0.05
Pinus brutia	0.00	0.00	60.00	40.00	**0.99**	15	0.05
Phoenix canariensis	0.00	0.00	7.14	92.86	**1.18**	14	0.05
Prunus persica	0.00	0.00	38.46	61.54	**1.07**	13	0.04
Brachychiton populneum	0.00	0.00	15.38	84.62	**1.15**	13	0.04
Prunus caroliniana	0.00	7.69	69.23	23.08	**0.91**	13	0.04
Quercus lobata	0.00	25.00	75.00	0.00	**0.76**	12	0.04
Schinus molle	0.00	0.00	9.09	90.91	**1.17**	11	0.04
Acacia greggii	0.00	0.00	18.18	81.82	**1.14**	11	0.04
Platycladus orientalis	0.00	0.00	9.09	90.91	**1.17**	11	0.04
Juniperus chinensis	0.00	0.00	36.36	63.64	**1.08**	11	0.04
Platanus wrightii	0.00	0.00	90.91	9.09	**0.88**	11	0.04
Punica granatum	0.00	0.00	30.00	70.00	**1.10**	10	0.03
Cupressus glabra	0.00	0.00	70.00	30.00	**0.96**	10	0.03
Quercus muehlenbergii	0.00	0.00	100.00	0.00	**0.85**	10	0.03
Celtis reticulata	0.00	0.00	60.00	40.00	**0.99**	10	0.03
Malus spp.	0.00	0.00	55.56	44.44	**1.01**	9	0.03
Prosopis pubescens	0.00	0.00	11.11	88.89	**1.17**	9	0.03
Juniperus chinensis 'Torulosa'	0.00	0.00	0.00	100.00	**1.21**	9	0.03
Albizia julibrissin	0.00	0.00	12.50	87.50	**1.16**	8	0.03
Magnolia grandiflora	0.00	37.50	25.00	37.50	**0.85**	8	0.03
Eucalyptus rudis	0.00	0.00	100.00	0.00	**0.85**	8	0.03
Tamarix chinensis	0.00	0.00	14.29	85.71	**1.16**	7	0.02
Melia azedarach	0.00	28.57	28.57	42.86	**0.90**	7	0.02
Ilex attenuata	0.00	0.00	0.00	100.00	**1.21**	7	0.02
Prunus dulcis	0.00	0.00	66.67	33.33	**0.97**	6	0.02

Species	Dead or Dying	Poor	Fair	Good	RPI	# of Trees	% of Pop.
Cycas revoluta	0.00	16.67	0.00	83.33	**1.09**	6	0.02
Eucalyptus polyanthemos	0.00	0.00	20.00	80.00	**1.14**	5	0.02
Quecus shumardii	0.00	0.00	40.00	60.00	**1.06**	5	0.02
Fraxinus greggii	20.00	0.00	60.00	20.00	**0.78**	5	0.02
Celtis sinensis	0.00	20.00	80.00	0.00	**0.78**	5	0.02
Arecastrum romanzoffianum	0.00	0.00	0.00	100.00	**1.21**	4	0.01
Cercidium praecox	0.00	0.00	25.00	75.00	**1.12**	4	0.01
Thuja occidentalis	0.00	0.00	0.00	100.00	**1.21**	4	0.01
Lagerstroemia indica	0.00	0.00	25.00	75.00	**1.12**	4	0.01
Pyrus communis	0.00	0.00	50.00	50.00	**1.03**	4	0.01
Acacia pendula	0.00	0.00	0.00	100.00	**1.21**	4	0.01
Quercus agrifolia	25.00	75.00	0.00	0.00	**0.41**	4	0.01
Geijera parviflora	0.00	33.33	0.00	66.67	**0.97**	3	0.01
Ceratonia siliqua	0.00	0.00	0.00	100.00	**1.21**	3	0.01
Prunus armeniaca	0.00	0.00	0.00	100.00	**1.21**	3	0.01
Ficus carica	0.00	0.00	33.33	66.67	**1.09**	3	0.01
Rhaphiolepis indica	0.00	0.00	100.00	0.00	**0.85**	3	0.01
Koelreuteria paniculata	0.00	66.67	0.00	33.33	**0.73**	3	0.01
Callistemon viminalis	0.00	0.00	66.67	33.33	**0.97**	3	0.01
Acacia salicina	0.00	0.00	100.00	0.00	**0.85**	3	0.01
Cedrus deodara	33.33	0.00	66.67	0.00	**0.61**	3	0.01
Carya illinoinensis	0.00	0.00	0.00	100.00	**1.21**	2	0.01
Eucalyptus microtheca	0.00	0.00	50.00	50.00	**1.03**	2	0.01
Salix gooddingii	0.00	0.00	50.00	50.00	**1.03**	2	0.01
Eucalyptus sideroxylon	0.00	0.00	0.00	100.00	**1.21**	2	0.01
Geoffroea decorticans	0.00	0.00	0.00	100.00	**1.21**	2	0.01
Butia capitata	0.00	0.00	50.00	50.00	**1.03**	2	0.01
Eucalyptus formannii	0.00	0.00	0.00	100.00	**1.21**	1	0.00
Salix laevigata	0.00	0.00	0.00	100.00	**1.21**	1	0.00
Acer ginnala	0.00	100.00	0.00	0.00	**0.50**	1	0.00
Platanus racemosa	0.00	0.00	100.00	0.00	**0.85**	1	0.00
Eysenhardtia orthocarpa	100.00	0.00	0.00	0.00	**0.14**	1	0.00
Eriobotyra japonica	0.00	0.00	0.00	100.00	**1.21**	1	0.00
Yucca brevifolia	0.00	0.00	0.00	100.00	**1.21**	1	0.00
Ebenopsis ebano	0.00	0.00	0.00	100.00	**1.21**	1	0.00
Zelkova serrata	0.00	0.00	100.00	0.00	**0.85**	1	0.00
Myrtus communis	0.00	100.00	0.00	0.00	**0.50**	1	0.00
All Trees	**0.63**	**4.61**	**46.95**	**47.81**	**1.00**	**30,487**	**100%**

Replacement Value of CCSD's Tree Species

Species	DBH Class (in)									Total $	% of Total	% of Pop.
	0-3	3-7	7-13	13-19	19-25	25-31	31-37	37-42	>42			
Pinus eldarica	25,420	1,328,871	9,521,448	5,976,704	1,853,771	647,084	238,230	132,959	0	**19,724,486**	27.66	15.30
Fraxinus velutina	61,779	704,273	1,365,643	858,334	262,857	52,141	76,749	34,496	235,047	**3,651,320**	5.12	6.86
Quercus virginiana	53,806	1,823,821	1,661,253	99,598	38,132	0	0	0	0	**3,676,612**	5.16	6.76
Fraxinus velutina 'Fan-Tex'	111,263	1,430,734	1,531,149	622,068	0	0	0	0	0	**3,695,213**	5.18	6.73
Pistacia chinensis	65,428	2,017,380	942,979	175,359	0	0	0	0	0	**3,201,147**	4.49	5.29
Fraxinus angustifolia	40,237	1,250,830	630,788	299,639	0	0	0	0	0	**2,221,494**	3.11	5.04
Chiltalpa tashkentensis	23,806	909,987	1,816,776	109,727	19,066	0	0	0	0	**2,879,363**	4.04	4.84
Washingtonia robusta	1,704	5,561	124,230	197,816	47,530	17,711	12,060	2,440	572	**409,624**	0.57	4.81
Vitex agnus-castus	201,399	597,951	127,094	53,175	0	0	0	0	0	**979,620**	1.37	4.77
Chilopsis linearis	139,930	656,458	437,806	116,479	0	0	0	0	0	**1,350,673**	1.89	4.31
Acacia stenophylla	11,085	686,337	1,803,063	760,493	111,219	0	0	0	0	**3,372,198**	4.73	3.20
Parkinsonia x 'Desert Museum'	44,402	631,409	865,912	77,653	0	0	0	0	0	**1,619,376**	2.27	3.01
Prosopis alba	61,066	271,399	647,377	505,714	163,820	22,052	0	0	0	**1,671,427**	2.34	2.99
Morus alba	1,025	2,673	173,613	1,617,901	1,157,752	790,421	428,677	271,407	140,074	**4,583,543**	6.43	2.30
Ulmus parvifolia	49,051	549,821	208,033	53,175	0	0	0	0	0	**860,081**	1.21	2.27
Washingtonia filifera	514	860	8,339	74,093	231,325	52,101	24,321	18,012	18,217	**427,782**	0.60	1.86
Quercus ilex	40,646	372,154	91,307	28,698	0	0	0	0	0	**532,805**	0.75	1.85
Pinus halepensis	1,212	30,237	834,473	2,559,171	1,050,228	421,290	200,554	61,255	0	**5,158,420**	7.23	1.47
Prosopis velutina	8,996	233,971	1,202,331	691,693	48,961	0	0	0	0	**2,185,952**	3.06	1.40
Olea europaea	31,552	227,684	193,125	127,731	108,123	39,601	0	0	0	**727,815**	1.02	1.14
Sophora secundiflora	56,724	20,928	4,108	0	0	0	0	0	0	**81,760**	0.11	0.97
Parkinsonia florida	26,569	105,309	505,885	169,947	0	0	0	0	0	**807,710**	1.13	0.96
Rhus lancea	13,206	210,768	290,310	44,735	0	0	0	0	0	**559,018**	0.78	0.92
Prosopis chilensis	7,258	87,511	132,665	90,241	76,222	0	0	0	0	**393,898**	0.55	0.72
Chamaerops humilis	9,493	27,136	6,578	0	0	0	0	0	0	**43,207**	0.06	0.69
Ligustrum lucidum	15,931	116,387	15,385	0	0	0	0	0	0	**147,704**	0.21	0.57
Pyrus calleryana	8,102	145,551	63,547	14,349	108,042	0	0	0	0	**339,591**	0.48	0.57
Quercus fusiformis	10,570	91,875	56,189	10,129	0	0	0	0	0	**168,764**	0.24	0.52
Prosopis glandulosa	10,032	88,357	224,315	0	0	0	0	0	0	**322,704**	0.45	0.49
Gleditsia triacanthos	8,276	43,323	68,870	77,523	27,303	0	0	0	0	**225,294**	0.32	0.43
Acacia farnesiana	8,862	56,247	180,307	227,317	48,961	0	0	0	0	**521,695**	0.73	0.41
Pyrus kawakamii	0	107,173	18,124	0	0	0	0	0	0	**125,297**	0.18	0.37
Prunus cerasifera	12,387	26,260	17,882	0	0	0	0	0	0	**56,529**	0.08	0.35
Olea europaea 'Swan Hill'	3,301	74,520	167,898	14,349	0	0	0	0	0	**260,068**	0.36	0.33
Robinia pseudoacacia	2,378	70,494	106,358	5,908	0	0	0	0	0	**185,138**	0.26	0.32
Pistacia X atlantica	924	11,313	197,082	0	0	0	0	0	0	**209,319**	0.29	0.29
Ulmus pumila	5,709	28,090	29,767	92,846	90,564	30,826	0	0	0	**277,803**	0.39	0.26
Parkinsonia aculeata	3,639	9,993	40,891	28,233	48,266	0	0	0	0	**131,023**	0.18	0.25
Brahea armata	1,116	55,923	8,991	0	0	0	0	0	0	**66,031**	0.09	0.21
Cercis canadensis	10,146	1,074	0	0	0	0	0	0	0	**11,220**	0.02	0.18
Cupressus sempervirens	2,423	48,666	28,429	43,047	19,066	17,982	0	0	0	**159,613**	0.22	0.18
Parkinsonia microphylla	3,779	27,955	113,653	0	0	0	0	0	0	**145,387**	0.20	0.17
Pinus roxburghii	0	10,423	126,030	13,867	0	0	0	0	0	**150,320**	0.21	0.17
Phoenix dactylifera	0	1,238	10,506	29,312	6,798	0	0	0	0	**47,854**	0.07	0.17

Species	DBH Class (in)									Total $	% of Total	% of Pop.
	0-3	3-7	7-13	13-19	19-25	25-31	31-37	37-42	>42			
Robinia ambigua 'Purple Robe'	2,317	36,589	0	0	0	0	0	0	0	**38,906**	0.05	0.16
Plantanus occidentalis	0	2,326	105,354	217,766	0	0	0	0	0	**325,446**	0.46	0.14
Fraxinus uhdei	270	4,154	68,385	5,853	0	0	0	0	0	**78,662**	0.11	0.13
Celtis occidentalis	0	50,366	5,686	0	0	0	0	0	0	**56,052**	0.08	0.13
Prosopis juliflora	1,030	15,745	83,615	106,351	0	0	0	0	0	**206,740**	0.29	0.12
Elaeocarpus decipiens	1,269	16,654	2,856	0	0	0	0	0	0	**20,779**	0.03	0.12
Xylosma congestum	3,755	1,309	20,004	5,748	0	0	0	0	0	**30,815**	0.04	0.11
Populus fremontii	0	0	7,007	44,402	35,488	4,384	17,464	0	0	**108,745**	0.15	0.11
Ilex cornuta Burfordii	4,365	7,229	16,559	0	0	0	0	0	0	**28,153**	0.04	0.10
Citrus species	4,664	4,741	12,040	0	0	0	0	0	0	**21,446**	0.03	0.10
Fraxinus velutina 'Glabra'	363	2,326	80,939	70,056	19,066	0	0	0	0	**172,751**	0.24	0.10
Populus species	0	493	16,747	48,892	30,891	0	36,613	0	0	**133,636**	0.19	0.09
Prosopis torreyana	515	16,192	44,483	24,478	0	0	0	0	0	**85,668**	0.12	0.09
Eucalyptus camaldulensis	0	1,480	15,491	34,086	49,554	12,448	0	0	0	**113,059**	0.16	0.08
Cordia boissieri	4,264	1,854	0	0	0	0	0	0	0	**6,118**	0.01	0.07
Podocarpus macrophyllus	4,353	927	0	0	0	0	0	0	0	**5,280**	0.01	0.07
Laurus nobillis	2,166	6,173	0	0	0	0	0	0	0	**8,338**	0.01	0.07
Pinus pinea	515	6,083	30,770	38,826	54,021	74,496	0	86,778	0	**291,490**	0.41	0.07
Pinus ponderosa var. scopulorum	0	0	22,687	35,597	56,049	41,638	0	0	0	**155,970**	0.22	0.06
Fraxinus sieboldiana	802	11,506	0	0	0	0	0	0	0	**12,308**	0.02	0.06
Juniperus spp.	545	12,882	12,040	0	0	0	0	0	0	**25,468**	0.04	0.06
Pinus brutia	0	0	4,140	118,126	0	0	0	0	0	**122,266**	0.17	0.05
Fraxinus anomala	1,133	6,598	0	0	0	0	0	0	0	**7,731**	0.01	0.05
Phoenix canariensis	0	1,509	0	6,487	1,862	9,629	11,648	4,649	9,298	**45,082**	0.06	0.05
Brachychiton populneum	182	4,562	49,500	0	0	0	0	0	0	**54,244**	0.08	0.04
Prunus caroliniana	621	11,183	0	0	0	0	0	0	0	**11,803**	0.02	0.04
Prunus persica	2,876	1,347	5,127	0	0	0	0	0	0	**9,350**	0.01	0.04
Quercus lobata	0	10,467	0	10,129	0	0	0	0	0	**20,595**	0.03	0.04
Acacia greggii	1,287	2,147	22,743	0	0	0	0	0	0	**26,177**	0.04	0.04
Juniperus chinensis	0	7,336	28,429	0	0	0	0	0	0	**35,765**	0.05	0.04
Platanus wrightii	0	7,360	0	0	0	0	0	0	0	**7,360**	0.01	0.04
Schinus molle	0	9,125	17,057	10,129	27,010	0	0	0	0	**63,321**	0.09	0.04
Platycladus orientalis	257	1,074	51,172	0	0	0	0	0	0	**52,503**	0.07	0.04
Celtis reticulata	0	12,524	0	0	0	0	0	0	0	**12,524**	0.02	0.03
Cupressus glabra	803	4,741	4,013	14,349	0	0	0	0	0	**23,906**	0.03	0.03
Punica granatum	1,726	3,668	0	0	0	0	0	0	0	**5,394**	0.01	0.03
Quercus muehlenbergii	135	3,948	1,675	0	0	0	0	0	0	**5,758**	0.01	0.03
Juniperus chinensis 'Torulosa'	0	0	17,057	86,093	0	0	0	0	0	**103,151**	0.14	0.03
Malus spp.	1,940	1,347	0	0	0	0	0	0	0	**3,287**	0.00	0.03
Prosopis pubescens	1,316	3,399	0	0	0	0	0	0	0	**4,715**	0.01	0.03
Albizia julibrissin	692	4,199	4,108	0	0	0	0	0	0	**8,999**	0.01	0.03
Eucalyptus rudis	406	0	6,699	4,132	0	0	0	0	0	**11,236**	0.02	0.03
Magnolia grandiflora	909	3,221	0	0	0	0	0	0	0	**4,129**	0.01	0.03
Cycas revoluta	405	556	525	0	0	0	0	0	0	**1,486**	0.00	0.02
Ilex attenuata	1,515	0	0	0	0	0	0	0	0	**1,515**	0.00	0.02
Melia azedarach	421	1,933	7,008	0	0	0	0	0	0	**9,361**	0.01	0.02

Species	DBH Class (in)									Total $	% of Total	% of Pop.
	0-3	3-7	7-13	13-19	19-25	25-31	31-37	37-42	>42			
Tamarix chinensis	1,906	0	0	0	0	0	0	0	0	**1,906**	0.00	0.02
Prunus dulcis	485	2,694	7,264	12,990	0	0	0	0	0	**23,432**	0.03	0.02
Celtis sinensis	106	1,074	12,040	0	0	0	0	0	0	**13,220**	0.02	0.02
Eucalyptus polyanthemos	0	1,521	15,385	0	0	43,670	0	0	0	**60,576**	0.08	0.02
Fraxinus greggii	1,015	0	0	0	0	0	0	0	0	**1,015**	0.00	0.02
Quecus shumardii	182	5,636	0	0	0	0	0	0	0	**5,818**	0.01	0.02
Acacia pendula	0	4,562	5,686	0	0	0	0	0	0	**10,248**	0.01	0.01
Arecastrum romanzoffianum	0	315	1,253	0	0	0	0	0	0	**1,568**	0.00	0.01
Cercidium praecox	0	0	9,699	28,698	0	0	0	0	0	**38,397**	0.05	0.01
Lagerstroemia indica	485	1,909	7,264	0	0	0	0	0	0	**9,657**	0.01	0.01
Pyrus communis	624	800	0	0	0	0	0	0	0	**1,424**	0.00	0.01
Quercus agrifolia	0	3,131	0	0	0	0	0	0	0	**3,131**	0.00	0.01
Thuja occidentalis	0	3,383	4,140	0	0	0	0	0	0	**7,522**	0.01	0.01
Acacia salicina	144	526	0	0	0	13,277	0	0	0	**13,947**	0.02	0.01
Callistemon viminalis	492	0	0	0	0	0	0	0	0	**492**	0.00	0.01
Cedrus deodara	143	1,397	0	0	0	0	0	0	0	**1,540**	0.00	0.01
Ceratonia siliqua	772	0	0	0	0	0	0	0	0	**772**	0.00	0.01
Ficus carica	569	0	5,127	0	0	0	0	0	0	**5,696**	0.01	0.01
Geijera parviflora	0	0	17,826	0	60,608	0	0	0	0	**78,435**	0.11	0.01
Koelreuteria paniculata	212	0	5,686	0	0	0	0	0	0	**5,898**	0.01	0.01
Prunus armeniaca	853	0	0	0	0	0	0	0	0	**853**	0.00	0.01
Rhaphiolepis indica	182	2,147	0	0	0	0	0	0	0	**2,329**	0.00	0.01
Butia capitata	0	456	0	0	0	0	0	0	0	**456**	0.00	0.01
Carya illinoinensis	515	0	0	0	0	0	0	0	0	**515**	0.00	0.01
Eucalyptus microtheca	0	0	9,699	0	0	0	0	0	0	**9,699**	0.01	0.01
Eucalyptus sideroxylon	0	0	5,686	14,349	0	0	0	0	0	**20,035**	0.03	0.01
Geoffroea decorticans	0	0	3,270	8,143	0	0	0	0	0	**11,413**	0.02	0.01
Salix gooddingii	0	1,347	7,264	0	0	0	0	0	0	**8,611**	0.01	0.01
Acer ginnala	106	0	0	0	0	0	0	0	0	**106**	0.00	0.00
Ebenopsis ebano	0	0	5,686	0	0	0	0	0	0	**5,686**	0.01	0.00
Eriobotyra japonica	209	0	0	0	0	0	0	0	0	**209**	0.00	0.00
Eucalyptus formannii	0	0	0	14,349	0	0	0	0	0	**14,349**	0.02	0.00
Eysenhardtia orthocarpa	178	0	0	0	0	0	0	0	0	**178**	0.00	0.00
Myrtus communis	0	0	0	0	11,122	0	0	0	0	**11,122**	0.02	0.00
Platanus racemosa	0	0	0	4,132	0	0	0	0	0	**4,132**	0.01	0.00
Salix laevigata	284	0	0	0	0	0	0	0	0	**284**	0.00	0.00
Yucca brevifolia	0	1,521	0	0	0	0	0	0	0	**1,521**	0.00	0.00
Zelkova serrata	0	654	0	0	0	0	0	0	0	**654**	0.00	0.00
All Trees	**$1,252,428**	**$15,533,275**	**$27,487,397**	**$16,831,184**	**$5,863,681**	**$2,290,749**	**$1,046,315**	**$611,996**	**$403,208**	**$71,320,233**	**100%**	**100%**