URBAN FOREST RESOURCE ANALYSIS

University of Nevada, Las Vegas

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DAVEY RESOURCE GROUP

A Division of The Davey Tree Expert Company

University of Nevada, Las Vegas
Resource Analysis

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Prepared for

University of Nevada, Las Vegas

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Executive Summary

Trees play a vital role on the University of Nevada, Las Vegas' (UNLV) campus. They provide numerous benefits both tangible and intangible, to students, faculty, visitors, and neighboring communities. In 2009, UNLV was recognized with the Cashman Good Government Award by the Nevada Taxpayers Association in recognition of maintaining consistent energy usage despite substantial campus growth since 2001. Winning this award demonstrates that sustainable practices, are valued as an important component of campus management. Trees help support these practices through their contributions to energy efficiency.

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 entities, including of the University of Nevada, Las Vegas, the City of Mesquite, North Las Vegas, Las Vegas, Boulder City, unincorporated Clark County, and the Clark County School District. 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 UNLV, this included 3,220 individual sites, representing an estimated 60% of the total campus inventory. 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.

The campus trees at UNLV are providing annual benefits of $116,035 ($3.87 per student). 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 campus.

The UNLV tree resource is reducing annual electric energy consumption by 182 megawatts (MWh) and annual natural gas consumption by 1,266 therms, for a combined value of $13,011 annually. In addition, these trees are removing 612 pounds of pollutants from the air, including ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulates ($_{PM10}$) for an overall annual air quality benefit of $5,848. Canopy from this population covers approximately 21.3 acres. This canopy reduces annual stormwater runoff by 1.3 million gallons and protects local water resources by reducing sediment and pollution loading.

The UNLV tree population is young and comprised of many small-stature trees. Therefore, the benefits provided to the university do not currently outweigh the cost of maintenance and planting. However, as existing populations of medium and large-stature trees grow in the landscape, the benefits can be expected to increase. The urban forest at UNLV is an arboretum for tree care educational programs and for demonstrating the character and value of the many unique species that can thrive in the Las Vegas region. As a result, the tree population at UNLV's is quite diverse and not exclusively focused on large-stature, greater canopy, or maximizing benefits. While a City may develop a specific planting palette focusing on benefits, UNLV values a broad pallete to increase the diversity and attractiveness of trees on the campus. The total investment in maintenance for the inventoried trees is $427,080. For every $1 invested in this resource, UNLV is receiving $0.27 in benefits.

Trees are a part of the campus infrastructure. However, unlike other public assets, with proper maintenance, trees have the potential to increase in value over time. The campus tree resource is a relatively young population in overall good condition. With more than 185 different species, UNLV is well positioned to realize a significant increase in environmental benefits as tree population continue to mature. An ongoing commitment to maximizing and maintaining the health of the urban forest will ensure that the campus continues to be a healthy, safe, and enjoyable place to live, recreate, study and learn.

Introduction

The University of Nevada, Las Vegas is located 1.5 miles east of the famous Las Vegas Strip, in Paradise, Nevada. Encompassing an area of 337-acres at an elevation of 2,057 feet above sea level, UNLV has a generally warm climate with an average annual rainfall of approximately four inches. The population is currently approximately 30,000 students. Established in 1957, the University has grown to include 200 programs of study within eleven colleges and has been recognized as a "research intensive university" by the Carnegie Foundation for the Advancement of Teaching Places.

Individual trees and a healthy urban forest play important roles in the quality of life and the sustainability of every 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 campus residents.

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 UNLV a more enjoyable place to live, recreate, study and learn. The University's 3,220 inventoried campus trees play a prominent role in the overall urban forest benefits afforded to the campus community. The UNLV students and staff rely on the University to protect and maintain this vital resource.

The University's tree resource is a relatively young population in overall good condition.

In 2012, UNLV's greenwaste recycling program diverted 1,605 cubic yards of greenwaste from the landfill.

In 2012, UNLV participated in a Nevada Division of Forestry (NDF) sponsored project to inventory their campus trees. By participating, UNLV reflects the campus appreciation, concern, and proactive stance on the management of trees. In addition, with the University's focus on an Urban Sustainability Initiative, there is ample evidence that UNLV values its trees.

The UNLV has two International Society of Arboriculture (ISA) certified arborists on staff and four ISA certified tree workers. Proper tree maintenance is important to the staff at UNLV, and the extensive training opportunities afforded to the maintenance staff is reflective of this quality. As a component of sustainable practices, greenwaste from campus tree pruning and removal is mulched

for use around campus. Material that is not used for mulch is sent to a greenwaste recycling facility for composting. Since inception of their greenwaste recycling program in 2010, the amount of recycled material has increased each year from 494 cubic yards in 2010 to over 1,600 cubic yards in 2012. This year, as of April 2013, UNLV has diverted 510 cubic yards of greenwaste from the landfill.

A team of International Society of Arboriculture certified arborists from Davey Resource Group (DRG) mapped the location and collected data on publicly 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 university 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 inventoried urban forest. This report, unique to UNLV, effectively quantifies the value of the campus trees with regard 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 inventoried campus forest, including 3,220 trees and seven 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 UNLV's campus 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

The University of Nevada, Las Vegas' urban forest resource considered 3,220 trees and seven 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 185 unique tree species identified in the inventory. The predominant tree species are *Quercus virginiana* (southern live oak, 7.1%), and *Pinus halepensis* (Aleppo pine, 6.5%).
- The age structure of the tree population is young overall, with 61% of trees measuring between 0 to 6 inches DBH (diameter at breast height, measured at 4'6" above the ground) and 77% under 12 inches DBH.
- The majority of UNLV's trees (83%) are in good condition, and 14% are in fair condition.
- To date, the campus tree population has sequestered 833 tons of carbon (CO_2), valued at approximately $12,494.
- Replacement of UNLV's 3,220 campus trees with trees of similar size, species, and condition would cost nearly $12.8 million.

Replacement of UNLV's 3,220 campus trees with trees of similar size, species, and condition would cost more than $12.8 million.

Summary of Urban Forest Benefits

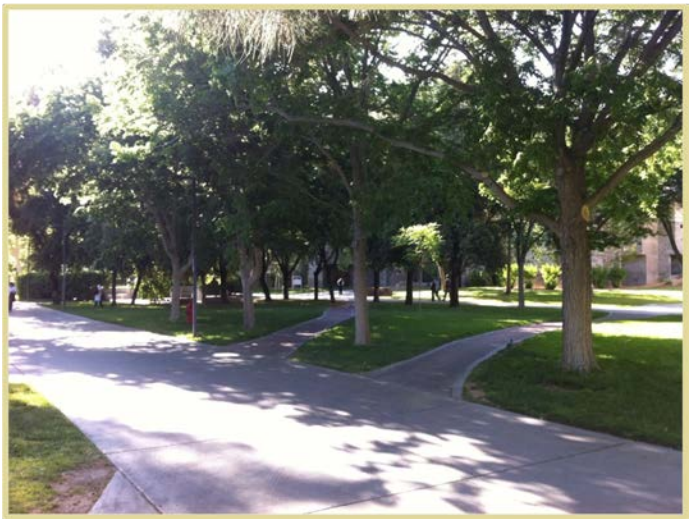
Annually, UNLV's trees provide cumulative benefits to the campus at an average value of $36.04 per tree, for a total gross value of $116,035 per year. These annual benefits include:

- Trees reduce electricity and natural gas use in their neighborhoods through shading and climate effects for an overall benefit of $13,011, an average of $4.04 per tree.
- Trees sequester 73 tons of atmospheric CO_2 per year. An additional 91 tons are avoided[1] by reducing energy generation, resulting in a net value of $2,350 and an average of $0.73 per tree.
- Net air quality improvements, including removal and avoidance of pollutants provided by the campus tree population are valued at $5,848, an average per tree benefit of $1.82.
- Campus trees intercept an estimated 1.3 million gallons of stormwater annually for a total value of $6,131, an average of $1.90 per tree.
- The benefit contributed by UNLV's campus trees to property value, aesthetics, and socioeconomics equals $88,695, an average of $27.55 per tree.
- When the university's annual investment of $116,035 for maintenance of this resource is considered, the annual net loss (benefits minus investment) to the university is -$311,045, and average of -$96.60 per tree. In other words**, for every $1 invested in campus trees, UNLV receives $0.27 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 campus tree population at UNLV is a dynamic resource that requires continued investment to maintain and realize its full benefit potential. **These campus trees are one of the few assets that have the potential to increase in value over time with 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 campus 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.



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

With the benefit of a relatively young urban forest in good condition, UNLV 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:

- Maintain an appropriate age distribution by continuing to plant new trees to improve long-term resource sustainability and greater canopy coverage. To maximize benefits, focus on medium to large-stature trees where planting sites allow. While species diversity and an arboreatum atmosphere is important to the Campus, diversity can be maintained by looking to medium and large-stature trees in their species palette.
- Maximize the condition of the existing tree resource through continuing comprehensive tree maintenance and a cyclical pruning schedule.
- Ensure young and establishing trees receive proper structural pruning early, to promote healthy structure, extend life expectancy, and reduce future investments and liability.
- Maintain and update the inventory database.

Setting an example of proper tree management, UNLV employs ISA certified arborists and tree workers on their maintenance staff

The value of UNLV's campus 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 UNLV'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. Managers can take pride in knowing that trees improve the quality of life at the University.

Chapter 2: UNLV's Urban Forest Resource

A university'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 dominate UNLV's tree population, comprising 81% 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 47% of UNLV's campus tree population, including 5% large-stature, 20% medium-stature, and 22% small-stature trees. Evergreen broadleaf trees comprise 34% of the population, including 3% large-stature, 12% medium-stature, and 19% small-stature. Large-stature conifers represent 11% of the overall population, and medium-stature conifers total 1%. Medium-statured palms make up 1% of the population, and small palms total 6%. Additional species total 1% of the population (Figure 1 and Table 1).

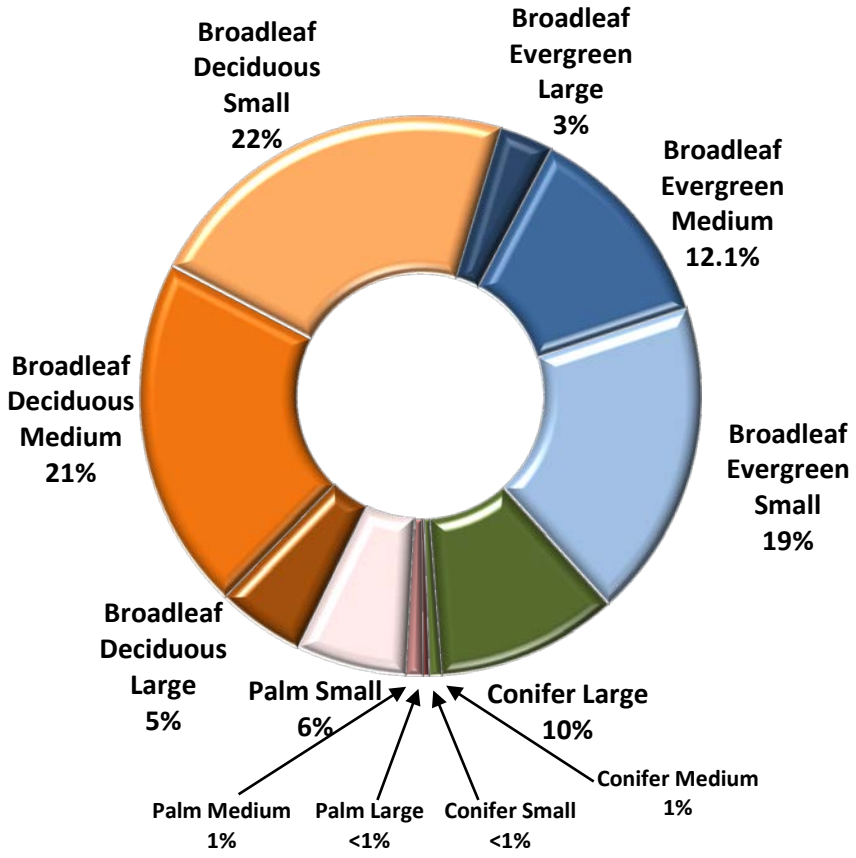


Figure 1. Overall Composition of UNLV's Tree Population

Species Richness and Composition

The campus tree population (Table 1 and Appendix C) includes a mix of 185 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 35.5% of the total population (Figure 2). The predominant tree species are *Quercus virginiana* (southern live oak, 7.1%) and *Pinus halepensis* (Aleppo pine, 6.5%).

There is a widely accepted rule that no single species should represent greater than 10% of the total population, and no single genus more than 20% (Clark Et al, 1997). In this case, no species or genus is represented by more than 10% or 20% of the population, respectively.

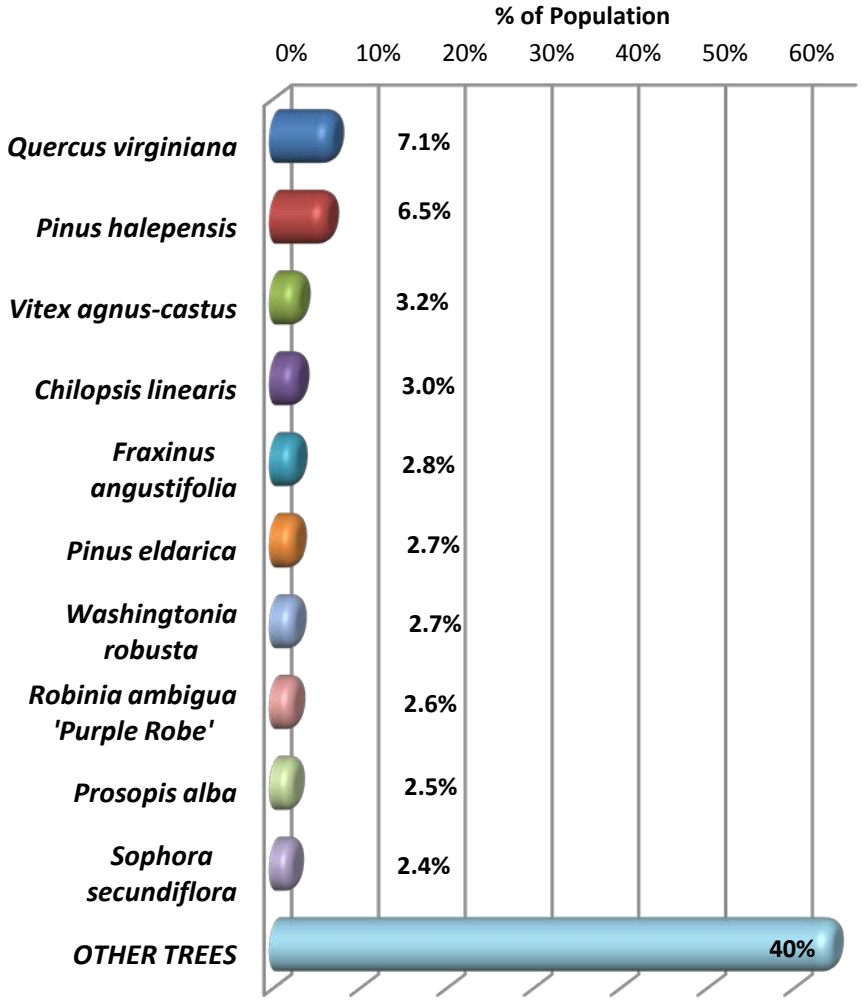


Figure 2. Frequency of Top 10 Species in UNLV's Tree Population

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 UNLV's Trees

Species	DBH Class (in)									Total	% of Pop.
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42		
Broadleaf Deciduous Large (BDL)											
Platanus x *acerfolia*	0	0	30	13	2	0	0	0	0	45	1.4
BDL OTHER	23	32	37	18	1	3	4	0	0	118	3.7
Total	**23**	**32**	**67**	**31**	**3**	**3**	**4**	**0**	**0**	**163**	**5.1**
Broadleaf Deciduous Medium (BDM)											
Fraxinus angustifolia	39	18	25	9	0	0	0	0	0	91	2.8
Robinia ambigua 'Purple Robe'	60	22	0	0	0	0	0	0	0	82	2.5
Morus alba	2	1	3	23	27	8	5	0	0	69	2.1
Fraxinus velutina 'Fan-Tex'	19	30	7	3	1	0	0	0	0	60	1.9
Pistacia chinensis	9	33	13	3	0	0	0	0	0	58	1.8
Ulmus parvifolia	4	8	13	10	0	0	0	0	0	35	1.1
Fraxinus velutina 'Glabra'	0	0	8	15	9	2	0	0	0	34	1.1
BDM OTHER	71	57	67	26	4	3	1	0	0	229	7.1
Total	**204**	**169**	**136**	**89**	**41**	**13**	**6**	**0**	**0**	**658**	**20.4**
Broadleaf Deciduous Small (BDS)											
Vitex agnus-castus	85	11	6	0	0	0	0	0	0	102	3.2
Chilopsis linearis	56	31	11	0	0	0	0	0	0	98	3.0
Prosopis torreyana	21	21	5	2	0	0	0	0	0	49	1.5
Parkinsonia x 'Desert Museum'	18	17	5	2	0	0	0	0	0	42	1.3
Eysenhardtia orthocarpa	37	2	0	0	0	0	0	0	0	39	1.2
Acacia farnesiana	6	18	6	7	1	0	0	0	0	38	1.2
Prunus mexicana	38	0	0	0	0	0	0	0	0	38	1.2
Chiltalpa tashkentensis	9	23	4	0	0	0	0	0	0	36	1.1
Cercis occidentalis 'Oklahoma'	33	1	0	0	0	0	0	0	0	34	1.1
BDS OTHER	116	59	24	22	8	1	0	0	0	230	7.1
Total	**419**	**183**	**61**	**33**	**9**	**1**	**0**	**0**	**0**	**706**	**21.9**
Broadleaf Evergreen Large (BEL)											
Quercus ilex	3	14	24	11	0	0	0	0	0	52	1.6
BEL OTHER	26	7	6	6	3	0	0	0	0	48	1.5
Total	**29**	**21**	**30**	**17**	**3**	**0**	**0**	**0**	**0**	**100**	**3.1**
Broadleaf Evergreen Medium (BEM)											
Quercus virginiana	55	121	44	7	0	0	0	0	0	227	7.0

Species	DBH Class (in)									Total	% of Pop.
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42		
Prosopis alba	8	45	25	2	0	0	0	0	0	80	2.5
Brachychiton populneum	16	27	3	0	0	0	0	0	0	46	1.4
BEM OTHER	19	14	4	1	0	0	0	0	0	38	1.2
Total	**98**	**207**	**76**	**10**	**0**	**0**	**0**	**0**	**0**	**391**	**12.1**
Broadleaf Evergreen Small (BES)											
Sophora secundiflora	76	1	0	0	0	0	0	0	0	77	2.4
Acacia stenophylla	9	38	19	4	0	0	0	0	0	70	2.2
Olea europaea	1	6	31	20	2	0	0	0	0	60	1.9
Caesalpinia mexicana	44	6	1	0	0	0	0	0	0	51	1.6
Chamaerops humilis	2	49	0	0	0	0	0	0	0	51	1.6
Podocarpus macrophyllus	29	19	0	0	0	0	0	0	0	48	1.5
Arbutus unedo	35	5	1	0	0	0	0	0	0	41	1.3
BES OTHER	98	75	18	5	0	0	0	0	0	196	6.1
Total	**294**	**199**	**70**	**29**	**2**	**0**	**0**	**0**	**0**	**594**	**18.4**
Conifer Evergreen Large (CEL)											
Pinus halepensis	4	4	15	91	79	10	5	0	0	208	6.5
Pinus eldarica	15	11	6	27	28	1	0	0	0	88	2.7
CEL OTHER	8	1	19	10	2	0	0	0	0	40	1.2
Total	**27**	**16**	**40**	**128**	**109**	**11**	**5**	**0**	**0**	**336**	**10.4**
Conifer Evergreen Medium (CEM)											
CEM OTHER	1	7	1	2	11	0	0	1	0	23	0.7
Total	**1**	**7**	**1**	**2**	**11**	**0**	**0**	**1**	**0**	**23**	**0.7**
Conifer Evergreen Small (CES)											
CES OTHER	0	1	0	0	0	0	0	0	0	1	0.0
Total	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0.0**
Palm Evergreen Large (PEL)											
PEL OTHER	1	1	6	2	1	0	0	0	0	11	0.3
Total	**1**	**1**	**6**	**2**	**1**	**0**	**0**	**0**	**0**	**11**	**0.3**
Palm Evergreen Medium (PEM)											
PEM OTHER	0	2	0	30	0	0	0	0	0	32	1.0
Total	**0**	**2**	**0**	**30**	**0**	**0**	**0**	**0**	**0**	**32**	**1.0**
Palm Evergreen Small (PES)											
Washingtonia robusta	1	0	50	36	0	0	0	0	0	87	2.7
Washingtonia filifera	0	0	0	13	63	1	0	0	0	77	2.4
PES OTHER	1	14	7	19	0	0	0	0	0	41	1.3
Total	**2**	**14**	**57**	**68**	**63**	**1**	**0**	**0**	**0**	**205**	**6.4**
All Trees	**1,098**	**852**	**544**	**439**	**242**	**29**	**15**	**1**	**0**	**3,220**	**100%**

Species Importance

To quantify the significance of any one particular species to UNLV's urban forest, an *importance value* (IV) is derived for each of the most common species. 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 university'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 32 most abundant species each represent greater than 1% of the total population. Together, these 32 species represent 69% of the total population, 73% of the total leaf area, and 72% of the total canopy cover for a combined importance value of 71 (Table 2). Of these species, UNLV relies most on *Pinus halepensis* (Aleppo pine, IV=17.6) and *Morus alba* (white mulberry, IV=6.3).

Due to their large stature and high leaf surface area, some species provide more impact than their population numbers alone would suggest. For example, UNLV's *Platanus x acerifolia* (London planetree, IV=2.5) represents just 1.4% of the tree population but is providing 2.7% of the canopy cover. *Ulmus parvifolia* (Chinese elm, IV=2.6) represents just 1.17% of the population while providing 4.0% of the canopy. Both of these species are large-stature deciduous hardwoods that grow vigorously and often have higher maintenance needs. Their maintenance needs may be justified, however, considering the benefits provided by these trees are relatively high.

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 chaste tree (*Vitex agnus-castus*) represent 3.0% and 3.2% of the population, but because of their small-stature, their importance values are just 1.52 and 1.51 respectively (Table 2).

Table 2. Importance Value (IV) of UNLV'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
Quercus virginiana	227	7.05	103,874	3.57	46,222	4.98	**5.20**
Pinus halepensis	208	6.46	783,091	26.92	180,185	19.43	**17.60**
Vitex agnus-castus	102	3.17	13,043	0.45	8,489	0.92	**1.51**
Chilopsis linearis	98	3.04	16,747	0.58	8,599	0.93	**1.52**
Fraxinus angustifolia	91	2.83	66,878	2.30	29,492	3.18	**2.77**
Pinus eldarica	88	2.73	160,178	5.51	46,820	5.05	**4.43**
Washingtonia robusta	87	2.70	22,313	077	6,234	0.67	**1.38**
Robinia ambigua 'Purple Robe'	82	2.55	15,089	0.52	6,358	0.69	**1.25**
Prosopis alba	80	2.48	33,935	1.17	7,946	0.86	**1.50**
Sophora secundiflora	77	2.39	8,935	0.31	2,885	0.31	**1.00**
Washingtonia filifera	77	2.39	23,154	0.80	2,232	0.24	**1.14**
Acacia stenophylla	70	2.17	37,431	1.29	14,975	1.61	**1.69**
Morus alba	69	2.14	237,241	8.16	79,125	8.53	**6.28**
Fraxinus velutina 'Fan-Tex'	60	1.86	36,404	1.25	15,966	1.72	**1.61**
Olea europaea	60	1.86	41,141	1.41	17,747	1.91	**1.73**
Pistacia chinensis	58	1.80	33,446	1.15	14,719	1.59	**1.51**
Quercus ilex	52	1.61	72,410	2.49	20,823	2.25	**2.12**
Caesalpinia mexicana	51	1.58	8,017	0.28	2,756	0.30	**0.72**
Chamaerops humilis	51	1.58	18,369	0.63	6,674	0.72	**0.98**
Prosopis torreyana	49	1.52	13,435	0.46	7,443	0.80	**0.93**
Podocarpus macrophyllus	48	1.49	10,303	0.35	3,609	0.39	**0.74**
Brachychiton populneum	46	1.43	9,607	0.33	2,244	0.24	**0.67**
Platanus x acerfolia	45	1.40	99,170	3.41	25,175	2.71	**2.51**
Parkinsonia x 'Desert Museum'	42	1.30	12,165	0.42	6,650	0.72	**0.81**
Arbutus unedo	41	1.27	6,633	0.23	2,295	0.25	**0.58**
Eysenhardtia orthocarpa	39	1.21	3,153	0.11	2,326	0.25	**0.52**
Acacia farnesiana	38	1.18	21,174	0.73	10,156	1.10	**1.00**
Prunus mexicana	38	1.18	2,695	0.09	2,065	0.22	**0.50**
Chiltalpa tashkentensis	36	1.12	9,459	0.33	5,534	0.60	**0.68**
Ulmus parvifolia	35	1.09	82,313	2.83	37,203	4.01	**2.64**
Cercis occidentalis 'Oklahoma'	34	1.06	2,605	0.09	1,951	0.21	**0.45**
Fraxinus velutina 'Glabra'	34	1.06	113,990	3.92	39,844	4.30	**3.09**
Other Trees	1,007	31.27	790,040	27.16	262,661	28.32	**28.92**
All Trees	**3,220**	**100%**	**2,908,437**	**100%**	**927,405**	**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 provide 21 acres of tree canopy cover. *Pinus halepensis* (Aleppo pine) and *Morus alba* (white mulberry) provide the largest proportion of canopy, accounting for 19.4% and 8.5% 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 UNLV's urban forest is weighted in young trees (Figure 3), with 61% of the population consisting of trees with a DBH of six inches or smaller. Established trees (6-18 inches DBH) comprise 31%, and mature trees (>18 inches DBH) make up less than 9% of the overall population. With continued, proactive management of this young urban forest, UNLV can expect increasing benefits as this resource matures. There are 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.

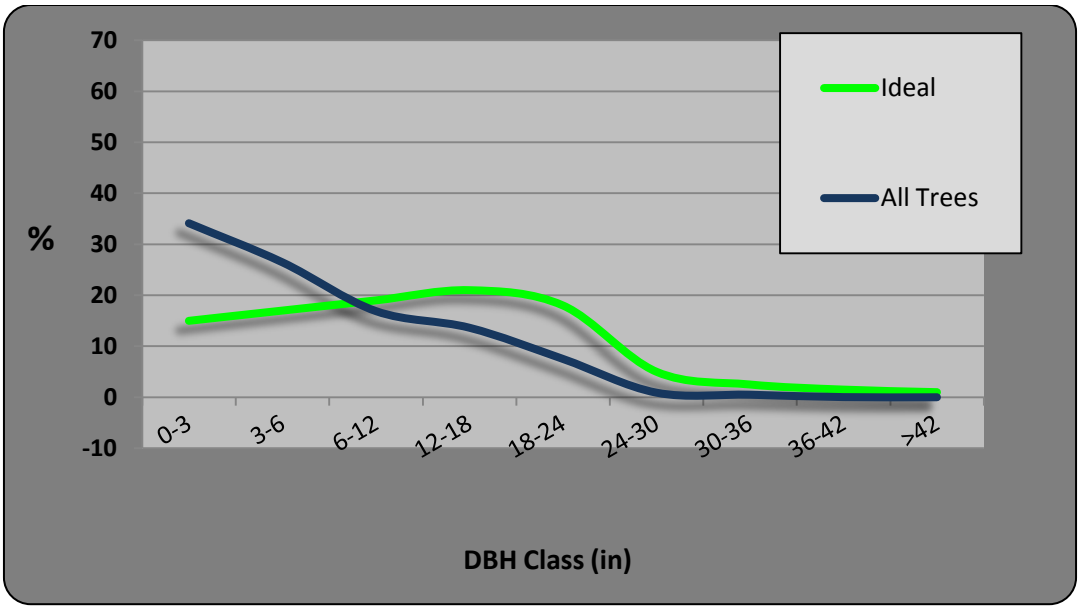


Figure 3. Overall Relative Age Distribution of UNLV's Trees

Of UNLV's top nine campus tree species (Figure 4), the youngest populations are likely *Robiniana ambigua 'Purple Robe'* ('Purble Robe' locust, 100% under 6" DBH), and *Sophora secundiflora* (mescal bean, 100% under 6" DBH).

Quercus virginiana (southern live oak, 78% 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.

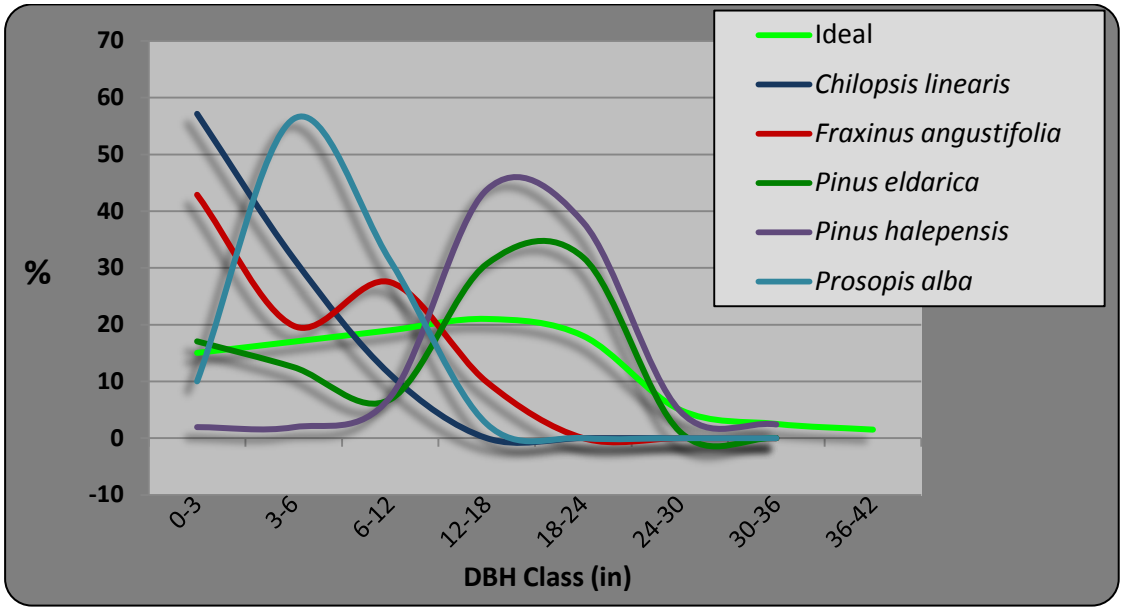
Three of the nine most common species are small-stature trees with significant representation in the small DBH classes. Because these species are smaller at maturity, this is not necessarily an indication of young age. *Vitex agnus-castus* (chaste tree, 94.1% under 6" DBH), *Chilopsis linearis* (desert willow, 88.8% under 6" DBH), and *Sophora secundiflora* (mescal bean, 100% under 6" DBH) are small-stature populations that are likely to continue to provide benefits at a flat or declining rate over time.

Pinus eldarica (Mondale pine) and *Pinus halepensis* (Aleppo pine) are the only established populations of large-stature trees. These 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, UNLV can expect greater benefits as large-stature trees mature. For the greatest environmental benefits, new installations should focus on medium and large-statured species. However, recognizing the educational and demonstration benefits of the UNLV arboretum, maximizing environmental benefits should not be the primary focus. Increasing diversity and exploring the suitability and desert adaptations of a variety of species is the greatest service to the community and the region.

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 UNLV's urban forest remains healthy and well-structured, thereby maximizing environmental services to the campus, reducing risk, and promoting a consistent flow of benefits for many generations to come.



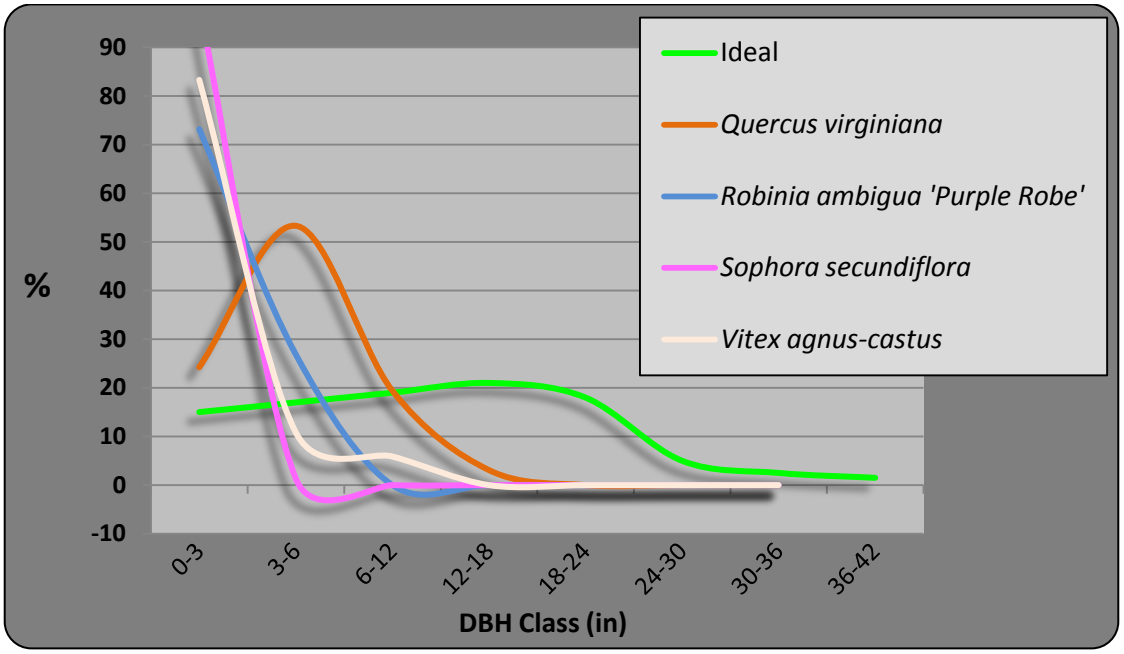


Figure 4. Relative Age Distribution of UNLV's Top Nine Tree Species

Campus 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 83.2% of UNLV's in good condition and 13.5% of in fair condition. Only 2.6% of the population was found to be in poor condition. Removal or mitigation of failing trees is recommended as soon as possible to reduce liability exposure.

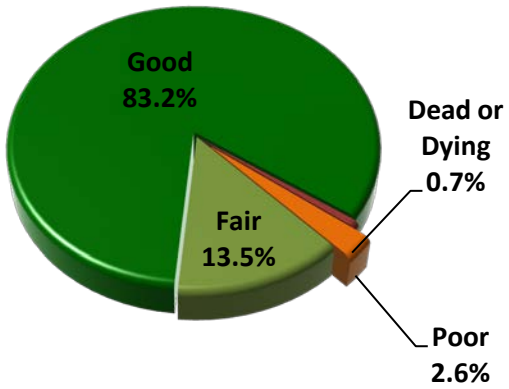


Figure 5. Condition of UNLV's Trees

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 32 most common species collected by the inventory, all 23 have an RPI of 1.0 or greater (Table 3). Of these, *Quercus virginiana* (southern live oak), *Vitex agnus-castus* (chaste tree), *Washingtonia robusta* (Mexican fan palm), *Chamaerops humilis* (Mediterranean fan palm), and *Eysenhardtia orthocarpa* (kidneywood) all share the highest RPI of 1.06, while *Platanus x acerifolia (London planetree,* RPI=0.70*)* has the lowest (Table 3).

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.

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

Species	Dead or Dying	Poor	Fair	Good	RPI	# of Trees	% of Pop.
Quercus virginiana	0.00	0.00	1.76	98.24	**1.06**	227	7.05
Pinus halepensis	0.00	0.48	15.87	83.65	**1.01**	208	6.46
Vitex agnus-castus	0.00	0.00	2.94	97.06	**1.06**	102	3.17
Chilopsis linearis	0.00	2.04	6.12	91.84	**1.03**	98	3.04
Fraxinus angustifolia	2.20	9.89	30.77	57.14	**0.89**	91	2.83
Pinus eldarica	0.00	0.00	5.68	94.32	**1.05**	88	2.73
Washingtonia robusta	0.00	0.00	2.30	97.70	**1.06**	87	2.70
Robinia ambigua 'Purple Robe'	6.10	0.00	36.59	57.32	**0.89**	82	2.55
Prosopis alba	0.00	0.00	13.75	86.25	**1.02**	80	2.48
Washingtonia filifera	0.00	1.30	3.90	94.81	**1.04**	77	2.39
Sophora secundiflora	1.30	0.00	1.30	97.40	**1.05**	77	2.39
Acacia stenophylla	0.00	0.00	5.71	94.29	**1.05**	70	2.17
Morus alba	0.00	2.90	18.84	78.26	**0.99**	69	2.14
Olea europaea	0.00	0.00	15.00	85.00	**1.02**	60	1.86
Fraxinus velutina 'Fan-Tex'	0.00	0.00	6.67	93.33	**1.04**	60	1.86
Pistacia chinensis	0.00	1.72	3.45	94.83	**1.04**	58	1.80
Quercus ilex	1.92	1.92	9.62	86.54	**1.00**	52	1.61
Chamaerops humilis	0.00	0.00	0.00	100.00	**1.06**	51	1.58
Caesalpinia mexicana	0.00	0.00	3.92	96.08	**1.05**	51	1.58
Prosopis torreyana	2.04	2.04	4.08	91.84	**1.02**	49	1.52
Podocarpus macrophyllus	0.00	0.00	4.17	95.83	**1.05**	48	1.49
Brachychiton populneum	0.00	0.00	13.04	86.96	**1.02**	46	1.43
Platanus x acerfolia	0.00	15.56	84.44	0.00	**0.70**	45	1.40
Parkinsonia x 'Desert Museum'	0.00	4.76	14.29	80.95	**0.99**	42	1.30
Arbutus unedo	2.44	2.44	17.07	78.05	**0.97**	41	1.27
Eysenhardtia orthocarpa	0.00	0.00	0.00	100.00	**1.06**	39	1.21
Acacia farnesiana	0.00	0.00	13.16	86.84	**1.02**	38	1.18
Prunus mexicana	5.26	2.63	2.63	89.47	**0.99**	38	1.18
Chiltalpa tashkentensis	0.00	5.56	94.44	0.00	**0.73**	36	1.12
Ulmus parvifolia	0.00	5.71	8.57	85.71	**1.00**	35	1.09
Cercis occidentalis 'Oklahoma'	0.00	2.94	0.00	97.06	**1.05**	34	1.06
Fraxinus velutina 'Glabra'	0.00	5.88	52.94	41.18	**0.86**	34	1.06
Other Trees	0.89	4.77	14.60	79.74	**97.74**	1,007	31.27
All Trees	**0.68**	**2.61**	**13.48**	**83.23**	**1.00**	**3,220**	**100%**

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.
Phoenix dactylifera	**1.06**	30	0.93
Fraxinus velutina	**0.96**	30	0.93
Celtis occidentalis	**1.05**	29	0.90
Olea europaea 'Swan Hill'	**1.04**	26	0.81
Prosopis chilensis	**0.99**	26	0.81

Replacement Value

The current value of UNLV's campus tree resource is approximately $12.8 million. The campus forest is an 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).

To replace UNLV's current campus tree population of 3,220 trees with trees of similar size, species, and condition would cost nearly $12.8 million (Table 5). The average replacement value per tree is $3,986. *Pinus halepensis* (Aleppo pine) and *Pinus eldarica* (Mondale pine) are the most valuable populations, representing $5 million and 39% of the overall replacement value, but just 9% of the population. A complete table, listing replacement value for all species, is included in Appendix C.

On a per-tree basis, *Pinus halepensis* (Aleppo pine, $19,595.68/tree) and *Fraxinus velutina 'Glabra'* (Arizona ash, $14,339.07) have the highest average replacement values. The high value of each of these species reinforces their importance to the university. 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 *Washingtonia robusta* (Mexican fan palm, $281/tree) and *Prunus mexicana* (Mexican plum, $209/tree).

The urban forest at UNLV is a vital component of the University's infrastructure and an asset valued at approximately $12.8 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 UNLV's campus trees is very important. Annual benefits are examined in Chapter 3.

Replacement of the Aleppo pine population in UNLV's public inventory would cost $4.1 million.

Table 5. Replacement Value of UNLV's Trees

Species	DBH Class (in)							Total $	% of Total	% of Pop.
	0-3	3-7	7-13	13-19	19-25	25-31	31-37			
Quercus virginiana	14,160	184,019	243,485	100,442	0	0	0	**542,107**	4.22	7.05
Pinus halepensis	954	5,189	76,925	1,246,668	2,070,269	411,014	264,882	**4,075,901**	31.76	6.46
Vitex agnus-castus	21,656	16,729	34,115	0	0	0	0	**72,500**	0.56	3.17
Chilopsis linearis	14,190	44,909	59,199	0	0	0	0	**118,298**	0.92	3.04
Fraxinus angustifolia	7,527	23,349	138,800	116,479	0	0	0	**286,155**	2.23	2.83
Pinus eldarica	3,207	12,071	23,620	277,872	536,224	31,610	0	**884,606**	6.89	2.73
Washingtonia robusta	188	0	13,184	11,100	0	0	0	**24,472**	0.19	2.70
Robinia ambigua 'Purple Robe'	13,024	33,011	0	0	0	0	0	**46,035**	0.36	2.55
Prosopis alba	1,777	48,321	101,492	17,564	0	0	0	**169,155**	1.32	2.48
Sophora secundiflora	17,420	1,133	0	0	0	0	0	**18,553**	0.14	2.39
Washingtonia filifera	0	0	0	7,751	47,113	892	0	**55,756**	0.43	2.39
Acacia stenophylla	2,317	57,791	103,013	53,175	0	0	0	**216,297**	1.69	2.17
Morus alba	327	699	5,722	124,295	279,302	141,072	106,788	**658,205**	5.13	2.14
Fraxinus velutina 'Fan-Tex'	4,816	44,730	38,128	43,047	27,010	0	0	**157,731**	1.23	1.86
Olea europaea	284	11,452	216,625	346,388	59,162	0	0	**633,910**	4.94	1.86
Pistacia chinensis	2,475	62,983	92,290	44,381	0	0	0	**202,129**	1.57	1.80
Quercus ilex	727	19,950	129,770	157,838	0	0	0	**308,284**	2.40	1.61
Caesalpinia mexicana	8,573	4,881	2,844	0	0	0	0	**16,298**	0.13	1.58
Chamaerops humilis	405	11,291	0	0	0	0	0	**11,696**	0.09	1.58
Prosopis torreyana	5,210	31,043	28,429	28,698	0	0	0	**93,379**	0.73	1.52
Podocarpus macrophyllus	6,212	17,341	0	0	0	0	0	**23,553**	0.18	1.49
Brachychiton populneum	4,043	38,826	17,057	0	0	0	0	**59,926**	0.47	1.43
Platanus x acerfolia	0	0	54,605	64,974	18,712	0	0	**138,291**	1.08	1.40
Parkinsonia x 'Desert Museum'	4,483	24,065	25,084	20,257	0	0	0	**73,889**	0.58	1.30
Arbutus unedo	8,359	7,157	5,686	0	0	0	0	**21,202**	0.17	1.27
Eysenhardtia orthocarpa	8,007	1,854	0	0	0	0	0	**9,861**	0.08	1.21
Acacia farnesiana	1,706	32,109	43,581	123,401	34,681	0	0	**235,478**	1.83	1.18
Prunus mexicana	7,956	0	0	0	0	0	0	**7,956**	0.06	1.18
Chiltalpa tashkentensis	1,636	23,796	16,054	0	0	0	0	**41,486**	0.32	1.12
Ulmus parvifolia	878	11,719	72,243	130,828	0	0	0	**215,669**	1.68	1.09
Cercis occidentalis 'Oklahoma'	6,786	825	0	0	0	0	0	**7,612**	0.06	1.06
Fraxinus velutina 'Glabra'	0	0	35,453	177,251	187,484	87,341	0	**487,528**	3.80	1.06
Other Trees	82,830	311,294	772,767	976,088	523,108	107,364	84,959	**2,921,195**	22.76	31.27
All Trees	**$252,131**	**$1,082,537**	**$2,350,173**	**$4,068,497**	**$3,783,065**	**$779,293**	**$456,629**	**$12,835,111**	**100%**	**100%**

Chapter 3: Campus Forest Resource Benefits

Trees are important to the University of Nevada, Las Vegas. 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 campus community. However, the question remains, are the collective benefits worth the costs of management? In other words, are trees a good investment for UNLV? 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 UNLV'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 UNLV's current campus tree 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 management decisions can be made (Maco and McPherson, 2003). A discussion on the methods used to calculate and assign monetary value to these benefits can be found 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 UNLV from both the shading and climate effects of campus trees is equal to 182 MWh (valued at $12,193) and 1,266 therms ($817.41), for a total retail savings of approximately $13,011 and an average of $4.04 per tree (Table 6). *Fraxinus velutina 'Glabra'* (Arizona ash), which represents 1.1% of the population, is providing 3.9% of the total energy benefits and is the highest per-tree benefit of $14.81/tree. Similarly, *Ulmus parvifolia* (Chinese elm), which represents just 1.1% of the population, is providing 3.8% of the total energy bvenefits and the next highest per-tree benefit of $14.19. Together, the populations of *Morus alba* (white mulberry) and *Pinus halepensis* (Aleppo pine) are providing 26% of the overall energy benefits while comprising just 8.6% of the population.

Small stature trees are less able to provide electricity and natural gas reductions. On a per-tree basis, *Sophora secundiflora* (mescal bean, $0.48) and *Prunus mexicana* (Mexican plum, $0.69) provide the lowest benefits. Although these two species account for 3.6% of the urban forest, they are providing only 0.48% of the overall energy benefits.

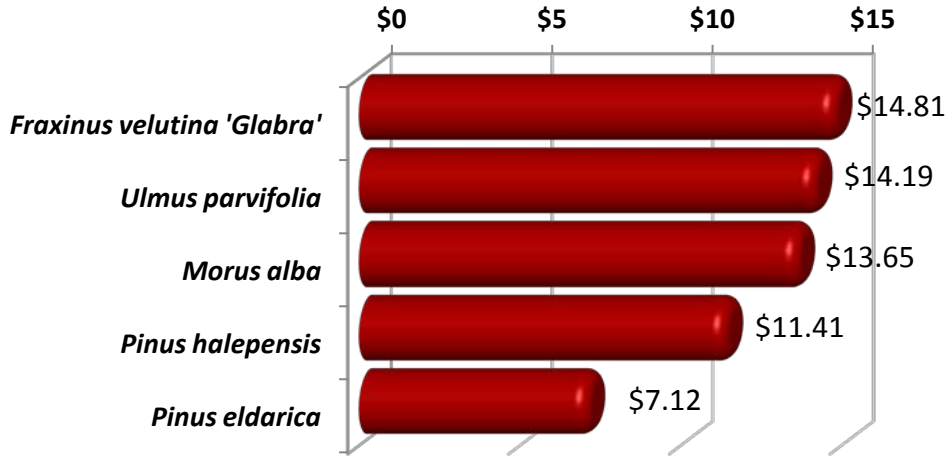


Figure 6. Annual Electricity and Natural Gas Benefits - Top Five Species

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

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	% of Pop.	% of Total $	Avg. $/tree
Quercus virginiana	9.12	611.67	65.68	42.40	**654.07**	7.05	5.03	2.88
Pinus halepensis	33.41	2,241.65	204.70	132.13	**2,373.78**	6.46	18.24	11.41
Vitex agnus-castus	1.54	103.40	13.65	8.81	**112.21**	3.17	0.86	1.10
Chilopsis linearis	1.61	107.82	13.77	8.89	**116.71**	3.04	0.90	1.19
Fraxinus angustifolia	5.66	380.12	39.39	25.42	**405.54**	2.83	3.12	4.46
Pinus eldarica	8.78	589.28	57.33	37.00	**626.29**	2.73	4.81	7.12
Washingtonia robusta	1.27	85.48	10.22	6.60	**92.08**	2.70	0.71	1.06
Robinia ambigua 'Purple Robe'	1.14	76.55	10.13	6.54	**83.09**	2.55	0.64	1.01
Prosopis alba	1.71	114.84	11.64	7.52	**122.35**	2.48	0.94	1.53
Sophora secundiflora	0.50	33.77	4.53	2.93	**36.70**	2.39	0.28	0.48
Washingtonia filifera	7.50	503.33	65.08	42.01	**545.34**	2.39	4.19	7.08
Acacia stenophylla	2.86	192.18	21.81	14.08	**206.26**	2.17	1.59	2.95
Morus alba	13.14	881.47	93.40	60.29	**941.76**	2.14	7.24	13.65
Fraxinus velutina 'Fan-Tex'	2.95	197.88	21.97	14.18	**212.06**	1.86	1.63	3.53
Olea europaea	3.51	235.46	25.44	16.42	**251.89**	1.86	1.94	4.20
Pistacia chinensis	2.86	191.82	21.19	13.68	**205.49**	1.80	1.58	3.54
Quercus ilex	4.42	296.62	27.72	17.90	**314.51**	1.61	2.42	6.05
Caesalpinia mexicana	0.50	33.25	4.27	2.75	**36.01**	1.58	0.28	0.71
Chamaerops humilis	1.24	82.94	10.32	6.66	**89.60**	1.58	0.69	1.76
Prosopis torreyana	1.40	94.25	11.32	7.31	**101.56**	1.52	0.78	2.07
Podocarpus macrophyllus	0.66	44.08	5.61	3.62	**47.70**	1.49	0.37	0.99
Brachychiton populneum	0.47	31.59	3.42	2.20	**33.80**	1.43	0.26	0.73
Platanus x acerifolia	5.00	335.39	34.36	22.18	**357.56**	1.40	2.75	7.95
Parkinsonia x 'Desert Museum'	1.26	84.42	10.07	6.50	**90.91**	1.30	0.70	2.16
Arbutus unedo	0.41	27.77	3.55	2.29	**30.06**	1.27	0.23	0.73
Eysenhardtia orthocarpa	0.41	27.30	3.91	2.52	**29.82**	1.21	0.23	0.76
Acacia farnesiana	1.96	131.40	14.65	9.46	**140.86**	1.18	1.08	3.71
Prunus mexicana	0.36	23.96	3.51	2.26	**26.23**	1.18	0.20	0.69
Chiltalpa tashkentensis	1.04	69.99	8.54	5.51	**75.51**	1.12	0.58	2.10
Ulmus parvifolia	7.01	470.68	40.47	26.12	**496.80**	1.09	3.82	14.19
Cercis occidentalis 'Oklahoma'	0.34	22.79	3.29	2.12	**24.92**	1.06	0.19	0.73
Fraxinus velutina 'Glabra'	7.07	474.44	44.86	28.96	**503.40**	1.06	3.87	14.81
Other Trees	50.60	3,395.59	356.55	230.15	**3,625.74**	31.27	27.87	3.60
All Trees	**181.72**	**$12,193**	**1,266.33**	**$817.41**	**$13,011**	**100%**	**100%**	**$4.04**

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).

UNLV's trees provide air quality improvements and a significant reduction in atmospheric carbon dioxide.

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

Urban trees reduce atmospheric carbon dioxide (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, UNLV's urban forest has sequestered a total of 833 tons of carbon dioxide (CO_2) valued at $12,494[2]. Annually, this tree resource directly sequesters 73 tons of CO_2, valued at $1,101, into woody and foliar biomass. Accounting for estimated CO_2 emissions from tree decomposition (-6.7 tons), tree related maintenance activity (-1,742 lbs), and avoided CO_2 (90.8 tons), UNLV's trees provide an annual net reduction in atmospheric CO_2 of 156.7 tons, valued at $2,350, with an average of $0.73 per tree, reflected by th negative numbers in decomposition release and maintenance release in Table 7.

Fraxinus velutina 'Glabra' (Arizona ash, $2.40) and *Pinus halepensis* (Aleppo pine, $2.11) are currently providing the highest per tree benefit (Figure 7). *Pinus halepensis* (Aleppo pine) are providing the greatest percentage of overall benefits at 18.7% due to their larger size and prevalence in the population (6.5%).

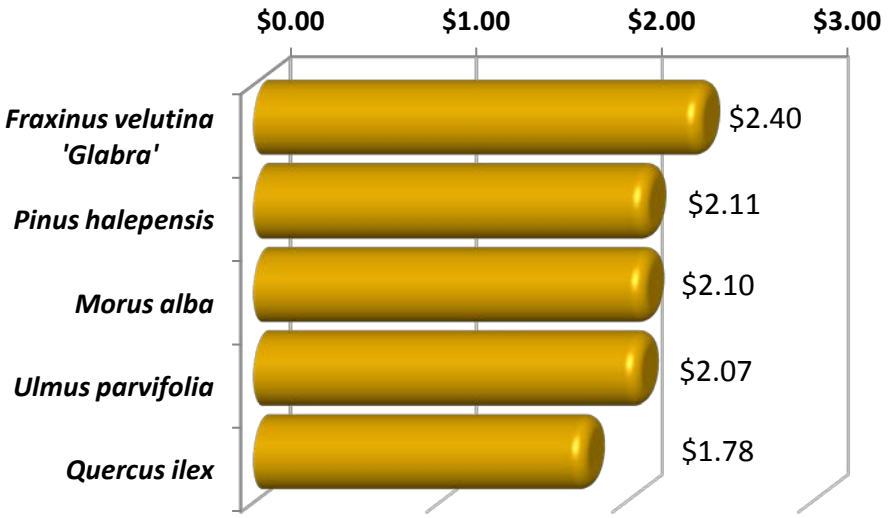


Figure 7. Annual Reduction of CO_2 - Top Five Species

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

Table 7. Annual CO_2 Reduction Benefits Provided by UNLV'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
Quercus virginiana	14,806	111.05	- 620.19	- 88.43	- 5.31	9,111	68.33	23,209	**174.07**	7.05	7.41	0.77
Pinus halepensis	28,495	213.72	- 2,997.37	- 283.64	- 24.61	33,391	250.43	58,605	**439.54**	6.46	18.71	2.11
Vitex agnus-castus	1,577	11.83	- 54.17	- 18.11	- 0.54	1,540	11.55	3,045	**22.84**	3.17	0.97	0.22
Chilopsis linearis	807	6.06	- 4.10	- 25.28	- 0.22	1,606	12.05	2,384	**17.88**	3.04	0.76	0.18
Fraxinus angustifolia	3,513	26.35	- 172.77	- 39.16	- 1.59	5,662	42.47	8,963	**67.23**	2.83	2.86	0.74
Pinus eldarica	4,585	34.39	- 826.59	- 89.37	- 6.87	8,778	65.83	12,447	**93.35**	2.73	3.97	1.06
Washingtonia robusta	2,244	16.83	- 438.74	- 77.73	- 3.87	1,273	9.55	3,000	**22.50**	2.70	0.96	0.26
Robinia ambigua 'Purple Robe'	1,039	7.79	- 13.28	- 14.82	- 0.21	1,140	8.55	2,151	**16.14**	2.55	0.69	0.20
Prosopis alba	2,260	16.95	- 152.44	- 36.81	- 1.42	1,711	12.83	3,782	**28.36**	2.48	1.21	0.35
Sophora secundiflora	131	0.98	- 1.50	- 9.29	- 0.08	503	3.77	623	**4.67**	2.39	0.20	0.06
Washingtonia filifera	0	0.00	- 324.74	- 54.33	- 2.84	7,497	56.23	7,119	**53.39**	2.39	2.27	0.69
Acacia stenophylla	1,088	8.16	- 58.46	- 32.57	- 0.68	2,863	21.47	3,860	**28.95**	2.17	1.23	0.41
Morus alba	8,033	60.25	- 1,772.63	- 104.07	- 14.08	13,130	98.48	19,287	**144.65**	2.14	6.16	2.10
Fraxinus velutina 'Fan-Tex'	1,980	14.85	- 88.06	- 22.93	- 0.83	2,948	22.11	4,816	**36.12**	1.86	1.54	0.60
Olea europaea	2,115	15.86	- 240.93	- 50.92	- 2.19	3,507	26.31	5,330	**39.98**	1.86	1.70	0.67
Pistacia chinensis	1,321	9.91	- 77.37	- 25.40	- 0.77	2,857	21.43	4,075	**30.57**	1.80	1.30	0.53
Quercus ilex	8,349	62.62	- 374.22	- 35.16	- 3.07	4,418	33.14	12,358	**92.69**	1.61	3.94	1.78
Caesalpinia mexicana	153	1.15	- 3.62	- 8.00	- 0.09	495	3.71	637	**4.78**	1.58	0.20	0.09
Chamaerops humilis	468	3.51	- 11.91	- 17.52	- 0.22	1,235	9.27	1,674	**12.55**	1.58	0.53	0.25
Prosopis torreyana	1,647	12.35	- 94.80	- 15.76	- 0.83	1,404	10.53	2,940	**22.05**	1.52	0.94	0.45
Podocarpus macrophyllus	226	1.70	- 5.09	- 10.11	- 0.11	657	4.92	868	**6.51**	1.49	0.28	0.14
Brachychiton populneum	681	5.10	- 29.50	- 13.52	- 0.32	471	3.53	1,108	**8.31**	1.43	0.35	0.18
Platanus x acerifolia	4,757	35.68	- 318.38	- 39.75	- 2.69	4,996	37.47	9,394	**70.46**	1.40	3.00	1.57
Parkinsonia x 'Desert Museum'	1,495	11.21	- 90.20	- 13.99	- 0.78	1,257	9.43	2,648	**19.86**	1.30	0.85	0.47
Arbutus unedo	129	0.97	- 3.23	- 6.59	- 0.07	414	3.10	533	**4.00**	1.27	0.17	0.10
Eysenhardtia orthocarpa	365	2.74	- 5.13	- 5.06	- 0.08	407	3.05	761	**5.71**	1.21	0.24	0.15
Acacia farnesiana	2,419	18.14	- 218.49	- 20.70	- 1.79	1,957	14.68	4,137	**31.03**	1.18	1.32	0.82
Prunus mexicana	309	2.32	- 3.03	- 4.47	- 0.06	357	2.68	659	**4.94**	1.18	0.21	0.13
Chiltalpa tashkentensis	1,163	8.73	- 49.36	- 11.99	- 0.46	1,043	7.82	2,145	**16.08**	1.12	0.68	0.45
Ulmus parvifolia	2,895	21.71	- 213.35	- 24.22	- 1.78	7,011	52.58	9,668	**72.51**	1.09	3.09	2.07
Cercis occidentalis 'Oklahoma'	300	2.25	- 3.72	- 4.23	- 0.06	340	2.55	632	**4.74**	1.06	0.20	0.14
Fraxinus velutina 'Glabra'	4,292	32.19	- 442.06	- 42.33	- 3.63	7,067	53.00	10,875	**81.56**	1.06	3.47	2.40
Other Trees	43,104	323.28	- 3,617.33	- 495.31	- 30.84	50,579	379.34	89,570	**671.78**	31.27	28.59	0.67
All Trees	**146,747**	**$1,101**	**- 13,327**	**- 1,742**	**-$113.01**	**181,624**	**$1,362**	**313,303**	**$2,350**	**100%**	**100%**	**$0.73**

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.

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).

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**

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 613 pounds of nitrogen dioxide (NO_2), sulfur dioxide (SO_2), small particulate matter ($_{PM10}$), and ozone (O_3) are intercepted or absorbed by the campus trees at UNLV, for a value of $3,190 (Table 9). As a population, *Pinus halepensis* (Aleppo pine, 95 lbs.), is the greatest contributor to pollutant deposition and interception, accounting for approximately 16% 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, 1.8 tons of pollutants, valued at $33,885, are avoided annually through the shading effects of UNLV's campus trees.

BVOC Emissions

Biogenic volatile organic compound (BVOC) emissions from trees, which negatively affect air quality, must also be considered. Approximately 762 lbs of BVOCs are emitted annually from UNLV's campus trees, offsetting the total air quality benefit by -$3,049. *Quercus virginiana* (southern live oak*)* are the heaviest per tree emitters of BVOCs (-0.95 lbs/tree), accounting for 0.12% of BVOC emissions, while comprising just 7.1% of the population. The benefits from interception, deposition, and avoidance of air pollutants (NO_2, $_{PM10}$, SO_2, and VOCs) of *Quercus virginiana* (southern live oak) 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 UNLV's campus tree population are valued at $5,848 annually. The average net benefit per tree is $1.82. Trees vary dramatically in their ability to produce net 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, *Fraxinus velutina 'Glabra'* (Arizona ash*,* $10.43/tree) and *Ulmus parvifolia* (Chinese elm, $9.91/tree) currently produce the greatest per tree net air quality improvements (Figure 8). However, due to its established age distribution and prevalence in the population (6.5%), *Pinus halepensis* (Aleppo pine) account for the greatest air quality improvements (23%) in terms of total benefits by species, collectively removing 107 lbs of pollutants at a net value of $1,140.

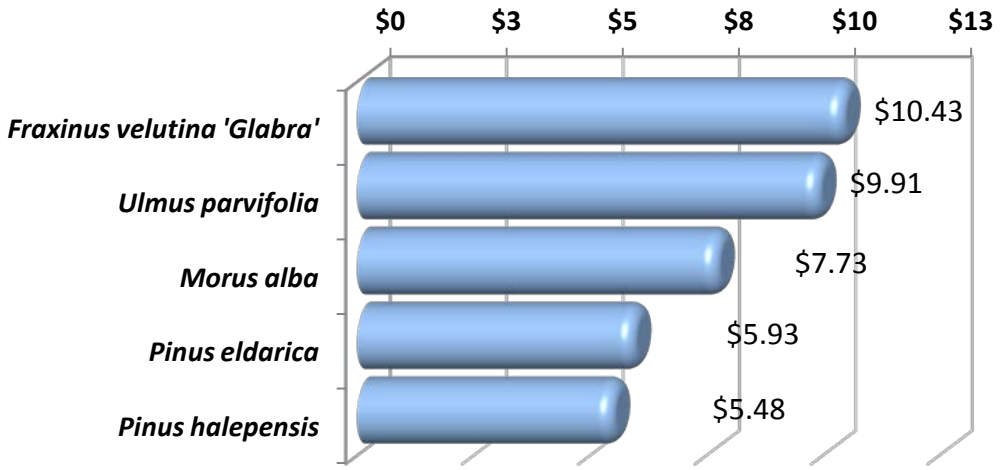


Figure 8. Annual Improvement to Air Quality - Top Five Species

Table 9. Annual Air Quality Improvements Provided by UNLV'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
Quercus virginiana	5.20	2.84	7.04	0.57	83.41	16.39	0.84	0.15	14.01	291.04	- 215.99	- 863.97	- 168.96	**- 489.52**	7.05	- 2.16
Pinus halepensis	33.75	18.40	38.99	3.71	500.76	58.20	2.97	0.52	49.85	1,035.31	- 99.08	- 396.32	107.31	**1,139.76**	6.46	5.48
Vitex agnus-castus	1.29	0.62	1.45	0.13	18.37	2.76	0.14	0.03	2.35	48.89	- 5.41	- 21.63	3.36	**45.63**	3.17	0.45
Chilopsis linearis	0.73	0.20	0.74	0.04	8.88	2.88	0.15	0.03	2.45	51.05	- 11.15	- 44.62	- 3.92	**15.32**	3.04	0.16
Fraxinus angustifolia	5.96	2.87	6.22	0.59	81.93	10.14	0.52	0.09	8.66	180.03	- 9.49	- 37.95	25.56	**224.01**	2.83	2.46
Pinus eldarica	23.64	12.89	22.45	2.60	321.61	15.29	0.78	0.14	13.09	271.83	- 17.81	- 71.25	73.05	**522.19**	2.73	5.93
Washingtonia robusta	3.09	1.69	2.94	0.34	42.07	2.31	0.12	0.02	1.97	41.03	- 23.06	- 92.23	- 10.58	**- 9.13**	2.70	- 0.10
Robinia ambigua 'Purple Robe'	0.31	0.15	0.57	0.03	5.75	2.04	0.10	0.02	1.74	36.13	- 2.14	- 8.56	2.82	**33.32**	2.55	0.41
Prosopis alba	0.86	0.47	1.18	0.10	13.93	3.11	0.16	0.03	2.66	55.27	- 9.53	- 38.11	- 0.96	**31.09**	2.48	0.39
Sophora secundiflora	0.06	0.03	0.21	0.01	1.73	0.90	0.05	0.01	0.77	15.95	0.00	0.00	2.03	**17.68**	2.39	0.23
Washingtonia filifera	1.36	0.74	1.27	0.15	18.41	12.67	0.65	0.12	10.78	224.30	- 24.00	- 95.98	3.75	**146.73**	2.39	1.91
Acacia stenophylla	2.65	1.44	3.09	0.29	39.48	5.13	0.26	0.05	4.38	90.99	0.00	0.00	17.29	**130.47**	2.17	1.86
Morus alba	29.80	8.13	19.22	1.81	295.48	22.68	1.16	0.21	19.36	402.50	- 41.20	- 164.79	61.17	**533.19**	2.14	7.73
Fraxinus velutina 'Fan-Tex'	2.93	1.41	3.12	0.29	40.68	5.24	0.27	0.05	4.47	93.00	- 5.16	- 20.66	12.62	**113.03**	1.86	1.88
Olea europaea	4.95	2.70	5.16	0.54	70.14	6.29	0.32	0.06	5.37	111.69	- 2.59	- 10.36	22.81	**171.46**	1.86	2.86
Pistacia chinensis	3.98	1.54	3.43	0.32	47.68	5.14	0.26	0.05	4.38	91.12	- 30.73	- 122.91	- 11.63	**15.89**	1.80	0.27
Quercus ilex	3.94	2.15	4.53	0.43	58.37	7.99	0.41	0.07	6.84	142.09	- 45.65	- 182.59	- 19.28	**17.87**	1.61	0.34
Caesalpinia mexicana	0.15	0.08	0.28	0.02	2.91	0.89	0.05	0.01	0.75	15.70	0.00	0.00	2.23	**18.62**	1.58	0.37
Chamaerops humilis	0.47	0.26	0.77	0.05	8.37	2.21	0.11	0.02	1.88	39.11	0.00	0.00	5.77	**47.47**	1.58	0.93
Prosopis torreyana	1.97	0.95	1.92	0.20	26.25	2.52	0.13	0.02	2.15	44.67	- 5.57	- 22.28	4.28	**48.64**	1.52	0.99
Podocarpus macrophyllus	0.20	0.11	0.37	0.02	3.82	1.17	0.06	0.01	1.00	20.79	0.00	0.00	2.95	**24.62**	1.49	0.51
Brachychiton populneum	0.11	0.06	0.22	0.01	2.21	0.86	0.04	0.01	0.73	15.22	- 2.70	- 10.79	- 0.65	**6.65**	1.43	0.14
Platanus x acerifolia	6.30	2.76	5.91	0.54	80.22	8.95	0.46	0.08	7.65	158.99	0.00	0.00	32.65	**239.21**	1.40	5.32
Parkinsonia x 'Desert Museum'	1.86	0.89	1.80	0.18	24.67	2.26	0.12	0.02	1.92	40.01	- 5.04	- 20.17	4.00	**44.51**	1.30	1.06
Arbutus unedo	0.14	0.08	0.24	0.02	2.56	0.74	0.04	0.01	0.63	13.12	0.00	0.00	1.89	**15.68**	1.27	0.38
Eysenhardtia orthocarpa	0.16	0.08	0.25	0.02	2.68	0.73	0.04	0.01	0.62	12.88	- 1.31	- 5.23	0.58	**10.33**	1.21	0.26
Acacia farnesiana	4.20	2.02	3.80	0.42	54.20	3.52	0.18	0.03	3.00	62.42	- 8.78	- 35.12	8.39	**81.51**	1.18	2.14
Prunus mexicana	0.11	0.05	0.20	0.01	2.02	0.64	0.03	0.01	0.54	11.30	- 1.12	- 4.47	0.48	**8.85**	1.18	0.23
Chiltalpa tashkentensis	1.11	0.53	1.16	0.11	15.28	1.87	0.10	0.02	1.59	33.16	- 3.92	- 15.69	2.57	**32.76**	1.12	0.91
Ulmus parvifolia	10.47	4.05	8.86	0.84	124.40	12.51	0.64	0.11	10.71	222.53	0.00	0.00	48.19	**346.93**	1.09	9.91
Cercis occidentalis 'Oklahoma'	0.12	0.06	0.20	0.01	2.11	0.61	0.03	0.01	0.52	10.75	- 1.08	- 4.32	0.47	**8.54**	1.06	0.25
Fraxinus velutina 'Glabra'	15.47	7.44	14.06	1.54	200.13	12.33	0.63	0.11	10.55	219.17	- 16.17	- 64.68	45.96	**354.63**	1.06	10.43
Other Trees	74.46	36.01	72.05	7.33	989.27	90.41	4.61	0.81	77.26	1,605.51	- 173.56	- 694.26	189.38	**1,900.52**	31.27	1.89
All Trees	**241.82**	**113.70**	**233.70**	**23.28**	**$3,190**	**321.36**	**16.40**	**2.89**	**274.66**	**$5,708**	**- 762.23**	**-$3,049**	**465.59**	**$5,848**	**100%**	**$1.82**

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.

The campus trees at UNLV intercept 1,277,149 million gallons of stormwater annually for an average of 397 gallons per tree (Table 10). The total annual value of this benefit to the University is $6,130, an average of $1.90 per tree. *Pinus halepensis* (Aleppo pine) are currently providing the greatest per tree benefit of $8.19 and the highest percentage of overall stormwater benefits of 27.8% (Figure 9).

As trees grow, their stormwater benefits often improve, but some species will realize more substantial benefits than others will. Many of the species currently demonstrating very low benefits, including *Prunus mexicana* (Mexican plum, $0.23/tree), *Cercis occidentalis 'Oklahoma'* (Oklahoma redbud, $0.25/tree), and *Chilopsis linearis* (desert willow, $0.25/tree) are small-stature trees. As such, their benefits will not increase much over time. However, other trees with currently lower benefits, such as *Quercus virginiana* (southern live oak, $1.28/tree) and *Robiniana ambigua 'Purple Robe'* ('Purple Robe' locust, $0.43/tree), young populations of medium-stature species, will realize increasing benefits as their canopies mature.

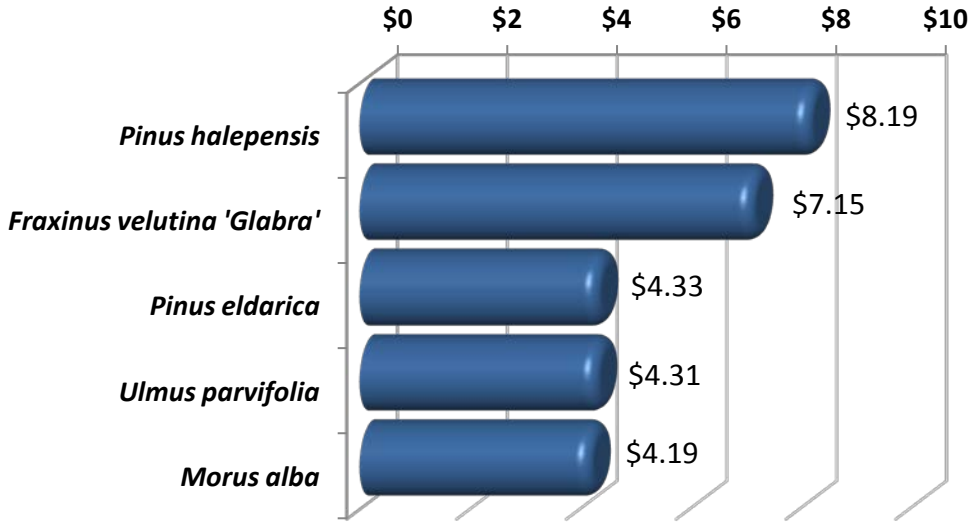


Figure 9. Annual Reduction in Stormwater Runoff - Top Five Species

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

Species	Total Rainfall Interception (Gal)	Total ($)	% of Pop.	% of Total $	Avg. $/tree
Quercus virginiana	60,628	**291.03**	7.05	4.75	1.28
Pinus halepensis	354,712	**1,702.74**	6.46	27.77	8.19
Vitex agnus-castus	8,036	**38.58**	3.17	0.63	0.38
Chilopsis linearis	5,012	**24.06**	3.04	0.39	0.25
Fraxinus angustifolia	33,394	**160.30**	2.83	2.61	1.76
Pinus eldarica	79,324	**380.78**	2.73	6.21	4.33
Washingtonia robusta	10,624	**51.00**	2.70	0.83	0.59
Robinia ambigua 'Purple Robe'	7,321	**35.14**	2.55	0.57	0.43
Prosopis alba	15,219	**73.06**	2.48	1.19	0.91
Sophora secundiflora	4,538	**21.78**	2.39	0.36	0.28
Washingtonia filifera	5,404	**25.94**	2.39	0.42	0.34
Acacia stenophylla	20,792	**99.81**	2.17	1.63	1.43
Morus alba	60,223	**289.09**	2.14	4.72	4.19
Fraxinus velutina 'Fan-Tex'	18,118	**86.97**	1.86	1.42	1.45
Olea europaea	23,482	**112.72**	1.86	1.84	1.88
Pistacia chinensis	12,429	**59.66**	1.80	0.97	1.03
Quercus ilex	34,929	**167.67**	1.61	2.73	3.22
Caesalpinia mexicana	4,175	**20.04**	1.58	0.33	0.39
Chamaerops humilis	9,791	**47.00**	1.58	0.77	0.92
Prosopis torreyana	7,571	**36.34**	1.52	0.59	0.74
Podocarpus macrophyllus	5,408	**25.96**	1.49	0.42	0.54
Brachychiton populneum	4,301	**20.65**	1.43	0.34	0.45
Platanus x acerifolia	35,142	**168.70**	1.40	2.75	3.75
Parkinsonia x 'Desert Museum'	6,805	**32.67**	1.30	0.53	0.78
Arbutus unedo	3,464	**16.63**	1.27	0.27	0.41
Eysenhardtia orthocarpa	2,089	**10.03**	1.21	0.16	0.26
Acacia farnesiana	11,046	**53.02**	1.18	0.86	1.40
Prunus mexicana	1,826	**8.76**	1.18	0.14	0.23
Chiltalpa tashkentensis	5,503	**26.42**	1.12	0.43	0.73
Ulmus parvifolia	31,457	**151.01**	1.09	2.46	4.31
Cercis occidentalis 'Oklahoma'	1,741	**8.36**	1.06	0.14	0.25
Fraxinus velutina 'Glabra'	50,656	**243.17**	1.06	3.97	7.15
Other Trees	341,990	**1,641.67**	31.27	26.78	1.63
All Trees	**1,277,149**	**$6,131**	**100%**	**100%**	**$1.90**

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 may be 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 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 $88,695, an average of $27.55 per tree (Table 11). Tree species that produced the highest average per tree aesthetic benefits are *Pinus halepensis* (Aleppo pine, $76.26), followed by *Ulmus parvifolia* (Chinese elm, $75.28) and *Fraxinus velutina* 'Glabra' (Arizona ash, $74.84).

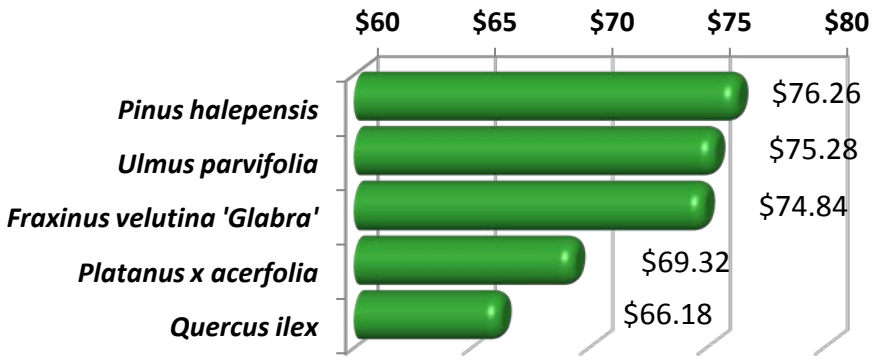


Figure 10. Annual Increase in Property and Socioeconomic Values - Top Five Species

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

Species	Total ($)	% of Pop.	% of Total $	Avg. $/tree
Quercus virginiana	**5,309.98**	7.05	5.99	23.39
Pinus halepensis	**15,861.17**	6.46	17.88	76.26
Vitex agnus-castus	**994.45**	3.17	1.12	9.75
Chilopsis linearis	**863.80**	3.04	0.97	8.81
Fraxinus angustifolia	**3,489.72**	2.83	3.93	38.35
Pinus eldarica	**2,433.36**	2.73	2.74	27.65
Washingtonia robusta	**792.60**	2.70	0.89	9.11
Robinia ambigua 'Purple Robe'	**2,131.51**	2.55	2.40	25.99
Prosopis alba	**1,250.07**	2.48	1.41	15.63
Sophora secundiflora	**1,186.26**	2.39	1.34	15.41
Washingtonia filifera	**0.30**	2.39	0.00	0.00
Acacia stenophylla	**1,320.62**	2.17	1.49	18.87
Morus alba	**1,871.06**	2.14	2.11	27.12
Fraxinus velutina 'Fan-Tex'	**2,168.52**	1.86	2.44	36.14
Olea europaea	**652.06**	1.86	0.74	10.87
Pistacia chinensis	**1,446.47**	1.80	1.63	24.94
Quercus ilex	**3,441.48**	1.61	3.88	66.18
Caesalpinia mexicana	**805.16**	1.58	0.91	15.79
Chamaerops humilis	**910.48**	1.58	1.03	17.85
Prosopis torreyana	**582.81**	1.52	0.66	11.89
Podocarpus macrophyllus	**786.92**	1.49	0.89	16.39
Brachychiton populneum	**560.85**	1.43	0.63	12.19
Platanus x acerifolia	**3,119.39**	1.40	3.52	69.32
Parkinsonia x 'Desert Museum'	**507.29**	1.30	0.57	12.08
Arbutus unedo	**648.86**	1.27	0.73	15.83
Eysenhardtia orthocarpa	**352.04**	1.21	0.40	9.03
Acacia farnesiana	**557.29**	1.18	0.63	14.67
Prunus mexicana	**336.42**	1.18	0.38	8.85
Chiltalpa tashkentensis	**432.72**	1.12	0.49	12.02
Ulmus parvifolia	**2,634.83**	1.09	2.97	75.28
Cercis occidentalis 'Oklahoma'	**304.39**	1.06	0.34	8.95
Fraxinus velutina 'Glabra'	**2,544.70**	1.06	2.87	74.84
Other Trees	**28,397.51**	31.27	32.02	28.20
All Trees	**$88,695**	**100%**	**100%**	**$27.55**

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

Species	Energy $/tree	CO_2 $/tree	Air Quality $/tree	Stormwater $/tree	Aesthetic/Other $/tree	% of Pop.	Total $
Fraxinus velutina 'Glabra'	14.81	2.40	10.43	7.15	74.84	1.06	**109.63**
Ulmus parvifolia	14.19	2.07	9.91	4.31	75.28	1.09	**105.77**
Pinus halepensis	11.41	2.11	5.48	8.19	76.26	6.46	**103.45**
Platanus x acerifolia	7.95	1.57	5.32	3.75	69.32	1.40	**87.90**
Quercus ilex	6.05	1.78	0.34	3.22	66.18	1.61	**77.58**
Morus alba	13.65	2.10	7.73	4.19	27.12	2.14	**54.78**
Fraxinus angustifolia	4.46	0.74	2.46	1.76	38.35	2.83	**47.77**
Pinus eldarica	7.12	1.06	5.93	4.33	27.65	2.73	**46.09**
Fraxinus velutina 'Fan-Tex'	3.53	0.60	1.88	1.45	36.14	1.86	**43.61**
Pistacia chinensis	3.54	0.53	0.27	1.03	24.94	1.80	**30.31**
Robinia ambigua 'Purple Robe'	1.01	0.20	0.41	0.43	25.99	2.55	**28.04**
Quercus virginiana	2.88	0.77	- 2.16	1.28	23.39	7.05	**26.17**
Acacia stenophylla	2.95	0.41	1.86	1.43	18.87	2.17	**25.52**
Acacia farnesiana	3.71	0.82	2.14	1.40	14.67	1.18	**22.73**
Chamaerops humilis	1.76	0.25	0.93	0.92	17.85	1.58	**21.71**
Olea europaea	4.20	0.67	2.86	1.88	10.87	1.86	**20.47**
Prosopis alba	1.53	0.35	0.39	0.91	15.63	2.48	**18.81**
Podocarpus macrophyllus	0.99	0.14	0.51	0.54	16.39	1.49	**18.58**
Arbutus unedo	0.73	0.10	0.38	0.41	15.83	1.27	**17.44**
Caesalpinia mexicana	0.71	0.09	0.37	0.39	15.79	1.58	**17.35**
Parkinsonia x 'Desert Museum'	2.16	0.47	1.06	0.78	12.08	1.30	**16.55**
Sophora secundiflora	0.48	0.06	0.23	0.28	15.41	2.39	**16.46**
Chiltalpa tashkentensis	2.10	0.45	0.91	0.73	12.02	1.12	**16.21**
Prosopis torreyana	2.07	0.45	0.99	0.74	11.89	1.52	**16.15**
Brachychiton populneum	0.73	0.18	0.14	0.45	12.19	1.43	**13.70**
Vitex agnus-castus	1.10	0.22	0.45	0.38	9.75	3.17	**11.90**
Washingtonia robusta	1.06	0.26	- 0.10	0.59	9.11	2.70	**10.91**
Chilopsis linearis	1.19	0.18	0.16	0.25	8.81	3.04	**10.59**
Eysenhardtia orthocarpa	0.76	0.15	0.26	0.26	9.03	1.21	**10.46**
Cercis occidentalis 'Oklahoma'	0.73	0.14	0.25	0.25	8.95	1.06	**10.32**
Prunus mexicana	0.69	0.13	0.23	0.23	8.85	1.18	**10.14**
Washingtonia filifera	7.08	0.69	1.91	0.34	0.00	2.39	**10.02**
Other Trees	3.60	0.67	1.89	1.63	28.20	31.27	**35.99**
All Trees	**$3.97**	**$0.69**	**$2.00**	**$1.69**	**$25.38**	**100%**	**$33.73**

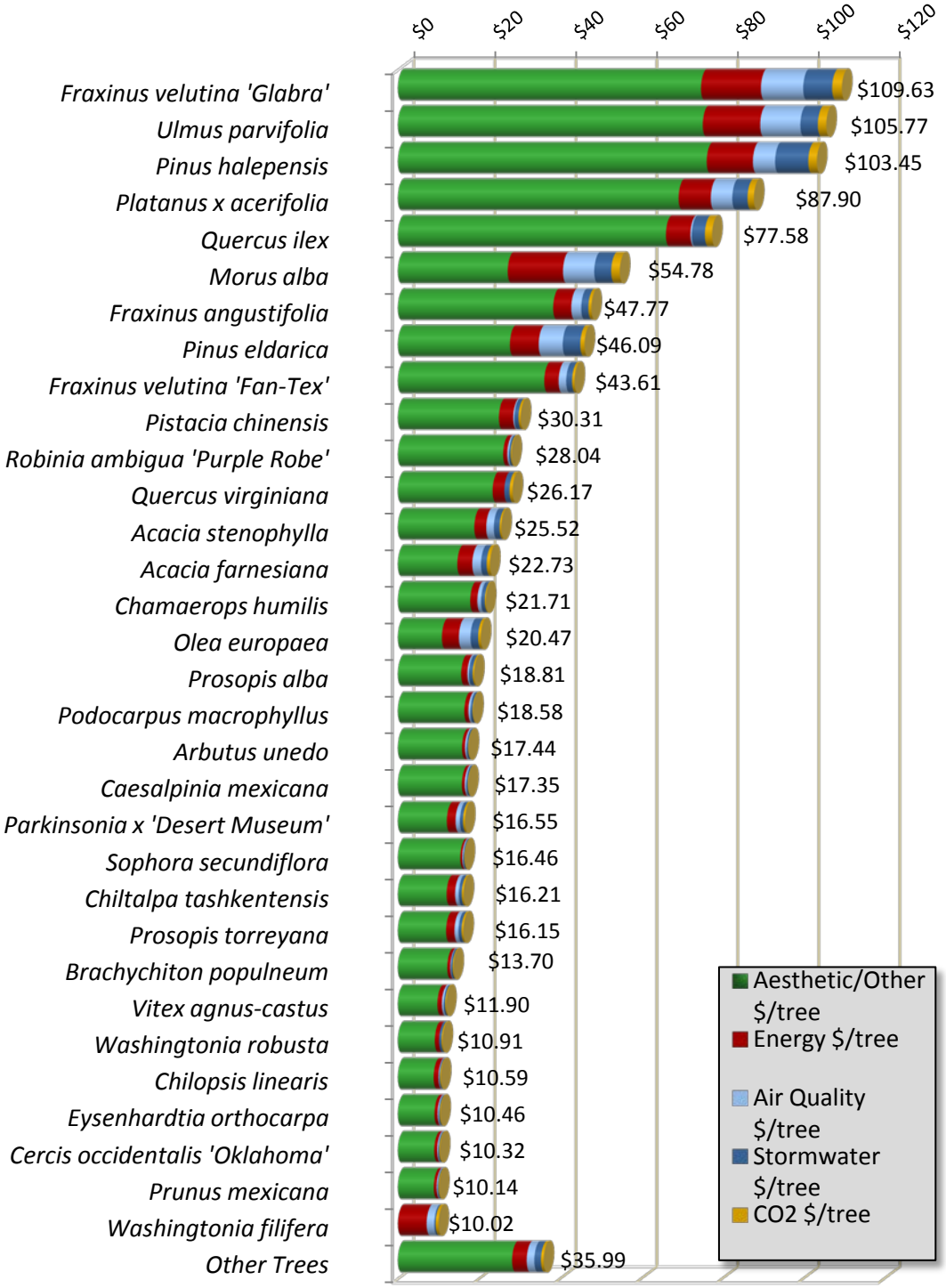


Figure 11. Summary of Annual per Tree Benefits

Net Benefits and Benefit-Investment Ratio (BIR)

There are substantial benefits from received from the UNLV campus trees; however, the University must also consider their investments in maintaining this resource. Applying a *benefit-investment ratio* (BIR) is a useful way to evaluate the public investment in the community tree population. A BIR is an indicator used to summarize the overall value compared to the investments of a given resource. Specifically, in this analysis, BIR is the ratio of the total benefits provided by the University's trees compared to the costs (investment) associated with their management.

The trees at UNLV have beneficial effects on the environment. Approximately 23.6% ($27,340) of the total annual benefits ($116,035) quantified in this study are environmental services (Table 13). Energy savings ($13,011) account for nearly 47.6% of the annual environmental benefits and 11.2% of all benefits. The trees provide $5,848 in air quality benefits, accounting for 21.4% of environmental benefits and 5.0% of all benefits. Stormwater benefits ($6,131) account for 22.4% of the environmental benefits and 5.3% of all benefits. Carbon reduction, valued at $2,350, accounts for 8.6% 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 76.4% ($88,695) of all benefits.

The total estimated benefits provided by UNLV's campus tree resource is $116,035, a value of $36.04 per tree and $3.87 per student. 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 University, 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 from UNLV's inventoried trees is $116,035. It is important to note that only approximately 60% of the campus was inventoried and the benefits should be considered an incomplete analysis. When the university's annual tree related expenditure (or investment) of $427,080 in this resource is considered, the net annual benefit (benefits minus investment) to the university is a loss of -$311,045. The average net loss for an individual tree on the UNLV campus is -$96.60 and the per student net loss is -$10.37 Based on the inventory of 3,220 trees, **UNLV is currently receiving $0.27 in benefits for every $1 invested in its urban forest resource** (Table 13).

Considering the relatively young age of UNLV's urban forest a loss is not unreasonable. As existing trees mature and vacant planting sites are filled, the benefits from this resource will increase and annual planting costs can be reduced. Over time, with proactive and timely management, UNLV's urban forest can contribute positive net benefits to the campus. Furthermore, considering the vital importance of trees to the quality of life on the UNLV campus, the true value of UNLV's urban forest is incalculable.

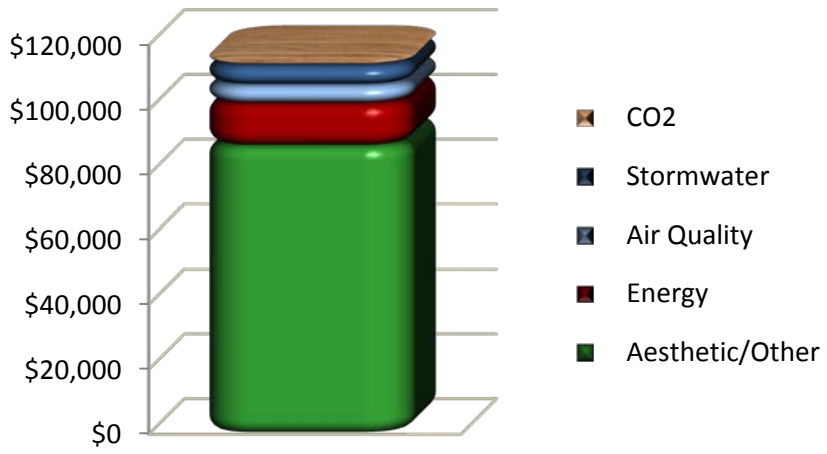


Figure 12. Total Annual Benefits from UNLV's Trees

Total Annual Benefits: $116,035
Average Annual per Tree Benefits: $36.04
Annual Value of Benefits per Student: $3.87

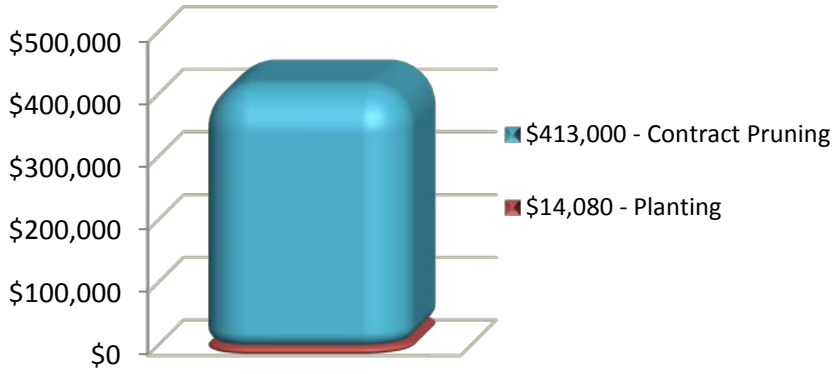


Figure 13. Total Annual Investment to Maintain UNLV's Trees

Total Annual Investment: $427,080
Average Annual per Tree Investment: $132.63
Annual Investment per Student: $14.24

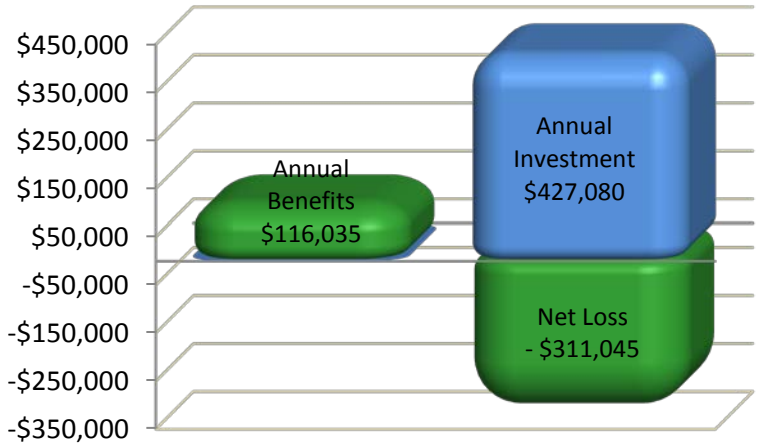


Figure 14. Benefit versus Investment Ratio

Annual Net Loss of UNLV's Tree Resource: -$311,045
For EVERY $1 Invested in public trees, UNLV receives $0.27 in Benefits.

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

Benefits	Total ($)	$/tree	$/student
Energy	13,011	4.04	0.43
CO_2	2,350	0.73	0.08
Air Quality	5,848	1.82	0.19
Stormwater	6,131	1.90	0.20
Aesthetic/Other	88,695	27.55	2.96
Total Benefits	**$116,035**	**$36.04**	**$3.87**
Investment			
Planting	14,080	4.37	0.47
Contract Pruning	413,000	128.26	13.77
Total Investment	**$427,080**	**$132.63**	**$14.24**
Net Loss	**-$311,045**	**-$96.60**	**-$10.37**
Benefit-Investment ratio	**$0.27**		

Conclusion

This analysis describes the current structural characteristics of UNLV'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.

The campus trees at UNLV provide quantifiable benefits including energy savings, stormwater runoff reduction, reduction in atmospheric CO_2, and aesthetic benefits. The University's 3,220 trees are providing $116,035 in annual gross benefits. That is an average of $36.04 per tree and $3.87 per student.

The trees in this project are relatively young and in good condition with more than 185 different species. Although it is critical to maintain an adequate level of resources to protect and nurture this resource, UNLV's campus trees can be expected to provide even greater benefits in the future and for many generations to come. The university 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:

- Maintain an appropriate age distribution by continuing to plant new trees to improve long-term resource sustainability and greater canopy coverage. To maximize benefits, focus on medium to large-stature trees where conditions are sustainable. While species diversity and an arboreatum atmosphere is important to the Campus, diversity can be maintained by looking to medium and large-stature trees in their species palette.

- Maximize the condition of the existing tree resource through continuing comprehensive tree maintenance and a cyclical pruning schedule.

- Ensure youung and establishing trees receive proper structural pruning early, to promote healthy structure, extend life expectancy, and reduce future investments and liability.

- Maintain and update the inventory database.

Urban forest managers can better anticipate future trends with an understanding of the current status of the university'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.

The trees at UNLV are of vital importance to the environmental, social, and economic well-being of the community, from the students and staff of the University – to residents and visitors of the surrounding area. UNLV has demonstrated that trees are a valued campus resource, a vital component of the urban infrastructure, and an important part of the university's history and

As an example of proper tree management, UNLV employs ISA certified arborists and tree workers on their maintenance staff

identity. The university may use this inventory to take a proactive and forward-looking approach to caring for the campus' 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, UNLV's campus 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 campus will continue to be a healthy, safe and enjoyable place to live, recreate, study, and learn.

Appendix A: Methods and Procedures

Certified Arborists collected UNLV'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 UNLV's trees, i-Tree *Streets* calculates the dollar value of annual resource functionality. This analysis combines the results of the university'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 University project information for 17 climate zones across the United States (UNLV 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 university provided the investment of planting and contract pruning.

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. UNLV 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 and natural gas rates are residential rates from Nevada Energy (NVEnergy). Median home value for the area around UNLV was estimated to be $125,000, using City-data.com. Using these rates, the magnitude of the benefits provided by the campus tree resource was calculated using i-Tree *Streets*. Program budget values used in benefit versus investment ratio calculations were supplied by UNLV.

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Appendix C: Reports

UNLV Complete Population of Campus Trees

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	% of Pop.
Broadleaf Deciduous Large (BDL)											
Platanus x acerfolia	0	0	30	13	2	0	0	0	0	45	1.4
Fraxinus uhdei	3	7	4	2	0	0	0	0	0	16	0.5
Celtis sinensis	4	8	0	0	0	0	0	0	0	12	0.4
Platanus racemosa	0	0	4	7	0	0	0	0	0	11	0.3
Populus fremontii	2	1	0	0	1	3	4	0	0	11	0.3
Zelkova serrata	0	0	10	1	0	0	0	0	0	11	0.3
Quercus muehlenbergii	3	2	5	0	0	0	0	0	0	10	0.3
Quercus lobata	3	2	1	2	0	0	0	0	0	8	0.2
Quecus shumardii	0	4	4	0	0	0	0	0	0	8	0.2
Quercus texana	3	2	3	0	0	0	0	0	0	8	0.2
Platanus wrightii	0	0	1	4	0	0	0	0	0	5	0.2
Quercus macrocarpa	0	4	1	0	0	0	0	0	0	5	0.2
Platanus mexicana	0	1	1	2	0	0	0	0	0	4	0.1
Quercus palustris	3	0	0	0	0	0	0	0	0	3	0.1
Quercus rubra	2	0	0	0	0	0	0	0	0	2	0.1
Ulmus crassifolia	0	1	1	0	0	0	0	0	0	2	0.1
Plantanus occidentalis	0	0	1	0	0	0	0	0	0	1	0.0
Ulmus glabra 'Camperdownii'	0	0	1	0	0	0	0	0	0	1	0.0
Total	**23**	**32**	**67**	**31**	**3**	**3**	**4**	**0**	**0**	**163**	**5.1**
Broadleaf Deciduous Medium (BDM)											
Fraxinus angustifolia	39	18	25	9	0	0	0	0	0	91	2.8
Robinia ambigua 'Purple Robe'	60	22	0	0	0	0	0	0	0	82	2.5
Morus alba	2	1	3	23	27	8	5	0	0	69	2.1
Fraxinus velutina 'Fan-Tex'	19	30	7	3	1	0	0	0	0	60	1.9
Pistacia chinensis	9	33	13	3	0	0	0	0	0	58	1.8
Ulmus parvifolia	4	8	13	10	0	0	0	0	0	35	1.1
Fraxinus velutina 'Glabra'	0	0	8	15	9	2	0	0	0	34	1.1
Fraxinus velutina	5	9	6	5	2	2	1	0	0	30	0.9
Celtis occidentalis	3	0	23	3	0	0	0	0	0	29	0.9
Prosopis chilensis	2	7	9	7	0	1	0	0	0	26	0.8
Parkinsonia aculeata	6	12	4	1	0	0	0	0	0	23	0.7
Parkinsonia florida	0	6	8	4	0	0	0	0	0	18	0.6
Albizia julibrissin	9	4	2	0	0	0	0	0	0	15	0.5
Koelreuteria paniculata	10	2	2	0	0	0	0	0	0	14	0.4
Koelreuteria bipinnata	6	7	0	0	0	0	0	0	0	13	0.4
Celtis reticulata	3	3	2	1	0	0	0	0	0	9	0.3
Pistacia X *atlantica* 'Red	0	3	5	1	0	0	0	0	0	9	0.3

Species	DBH Class (in)									Total	% of Pop.
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42		
Push'											
Ungnadia speciosa	7	0	0	0	0	0	0	0	0	7	0.2
Acer negundo 'Flamingo'	4	2	0	0	0	0	0	0	0	6	0.2
Quercus douglasii	5	0	0	0	0	0	0	0	0	5	0.2
Melia azedarach	1	0	1	2	0	0	0	0	0	4	0.1
Salix gooddingii	1	0	0	1	2	0	0	0	0	4	0.1
Gleditsia triacanthos v. inermis	0	0	2	1	0	0	0	0	0	3	0.1
Acacia willardiana	2	0	0	0	0	0	0	0	0	2	0.1
Ginkgo biloba 'Autumn Gold'	1	1	0	0	0	0	0	0	0	2	0.1
Robinia pseudoacacia	0	1	1	0	0	0	0	0	0	2	0.1
Sambucus nigra ssp. *Cerulea*	2	0	0	0	0	0	0	0	0	2	0.1
Acer ginnala	1	0	0	0	0	0	0	0	0	1	0.0
Fraxinus angustifolia ssp. *Oxycarpa*	1	0	0	0	0	0	0	0	0	1	0.0
Fraxinus velutina 'Bonita'	0	0	1	0	0	0	0	0	0	1	0.0
Juglans major	1	0	0	0	0	0	0	0	0	1	0.0
Maclura pomifera	1	0	0	0	0	0	0	0	0	1	0.0
Salix matsudana 'Tortuosa'	0	0	1	0	0	0	0	0	0	1	0.0
Total	**204**	**169**	**136**	**89**	**41**	**13**	**6**	**0**	**0**	**658**	**20.4**
Broadleaf Deciduous Small (BDS)											
Vitex agnus-castus	85	11	6	0	0	0	0	0	0	102	3.2
Chilopsis linearis	56	31	11	0	0	0	0	0	0	98	3.0
Prosopis torreyana	21	21	5	2	0	0	0	0	0	49	1.5
Parkinsonia x 'Desert Museum'	18	17	5	2	0	0	0	0	0	42	1.3
Eysenhardtia orthocarpa	37	2	0	0	0	0	0	0	0	39	1.2
Acacia farnesiana	6	18	6	7	1	0	0	0	0	38	1.2
Prunus mexicana	38	0	0	0	0	0	0	0	0	38	1.2
Chiltalpa tashkentensis	9	23	4	0	0	0	0	0	0	36	1.1
Cercis occidentalis 'Oklahoma'	33	1	0	0	0	0	0	0	0	34	1.1
Morus alba 'Chaparral'	0	1	4	12	7	1	0	0	0	25	0.8
Prosopis glandulosa	10	13	1	0	0	0	0	0	0	24	0.7
Elaeocarpus decipiens	10	9	3	0	0	0	0	0	0	22	0.7
Lagerstroemia indica	15	7	0	0	0	0	0	0	0	22	0.7
Cercis occidentalis	12	6	1	0	0	0	0	0	0	19	0.6
Punica granatum	18	1	0	0	0	0	0	0	0	19	0.6
Prosopis juliflora	0	1	3	7	1	0	0	0	0	12	0.4
Parkinsonia microphylla	4	4	1	0	0	0	0	0	0	9	0.3
Prunus dulcis	4	2	1	1	0	0	0	0	0	8	0.2
Forestiera pubescens	7	0	0	0	0	0	0	0	0	7	0.2
Prosopis pubescens	3	1	3	0	0	0	0	0	0	7	0.2

Species	DBH Class (in)									Total	% of Pop.
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42		
Pyrus calleryana	1	5	0	0	0	0	0	0	0	6	0.2
Prunus cerasifera	4	1	0	0	0	0	0	0	0	5	0.2
Cercis canadensis	2	2	0	0	0	0	0	0	0	4	0.1
Cercidium praecox	1	3	0	0	0	0	0	0	0	4	0.1
Prunus armeniaca	3	0	1	0	0	0	0	0	0	4	0.1
Rhus lanceolata	4	0	0	0	0	0	0	0	0	4	0.1
Bauhinia lunarioides	3	0	0	0	0	0	0	0	0	3	0.1
Parkinsonia x 'Sonoran Emerald'	0	0	3	0	0	0	0	0	0	3	0.1
Prosopis velutina	0	1	0	2	0	0	0	0	0	3	0.1
Ziziphus jujuba	2	1	0	0	0	0	0	0	0	3	0.1
Caesalpinia palmeri	2	0	0	0	0	0	0	0	0	2	0.1
Cotinus coggygria	2	0	0	0	0	0	0	0	0	2	0.1
Prunus persica	2	0	0	0	0	0	0	0	0	2	0.1
Quercus gambelii	2	0	0	0	0	0	0	0	0	2	0.1
Chionanthus retusus	0	0	1	0	0	0	0	0	0	1	0.0
Ficus carica	0	0	1	0	0	0	0	0	0	1	0.0
Havardia mexicana	0	0	1	0	0	0	0	0	0	1	0.0
Malus spp.	1	0	0	0	0	0	0	0	0	1	0.0
Mimosa dysocarpa	1	0	0	0	0	0	0	0	0	1	0.0
Prunus spp.	0	1	0	0	0	0	0	0	0	1	0.0
Prosopis spp.	1	0	0	0	0	0	0	0	0	1	0.0
Syringa vulgaris	1	0	0	0	0	0	0	0	0	1	0.0
Tamarix chinensis	1	0	0	0	0	0	0	0	0	1	0.0
Total	**419**	**183**	**61**	**33**	**9**	**1**	**0**	**0**	**0**	**706**	**21.9**
Broadleaf Evergreen Large (BEL)											
Quercus ilex	3	14	24	11	0	0	0	0	0	52	1.6
Eucalyptus microtheca	14	3	2	3	3	0	0	0	0	25	0.8
Eucalyptus camaldulensis	9	0	0	0	0	0	0	0	0	9	0.3
Quercus suber	2	3	1	0	0	0	0	0	0	6	0.2
Eucalyptus sideroxylon	1	0	2	2	0	0	0	0	0	5	0.2
Dalbergia sissoo	0	0	1	1	0	0	0	0	0	2	0.1
Quercus polymorpha	0	1	0	0	0	0	0	0	0	1	0.0
Total	**29**	**21**	**30**	**17**	**3**	**0**	**0**	**0**	**0**	**100**	**3.1**
Broadleaf Evergreen Medium (BEM)											
Quercus virginiana	55	121	44	7	0	0	0	0	0	227	7.0
Prosopis alba	8	45	25	2	0	0	0	0	0	80	2.5
Brachychiton populneum	16	27	3	0	0	0	0	0	0	46	1.4
Laurus nobillis	7	2	0	0	0	0	0	0	0	9	0.3
Ceratonia siliqua	4	0	2	1	0	0	0	0	0	7	0.2
Cocculus laurifolius	0	5	1	0	0	0	0	0	0	6	0.2
Acacia gerrardii	0	2	1	0	0	0	0	0	0	3	0.1
Eriobotyra deflexa	1	2	0	0	0	0	0	0	0	3	0.1
Magnolia grandiflora	2	1	0	0	0	0	0	0	0	3	0.1

Species	DBH Class (in)									Total	% of Pop.
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42		
Acacia estrophiolata	2	0	0	0	0	0	0	0	0	2	0.1
Acacia brachystachya	1	0	0	0	0	0	0	0	0	1	0.0
Acacia erioloba	1	0	0	0	0	0	0	0	0	1	0.0
Acacia karroo	0	1	0	0	0	0	0	0	0	1	0.0
Quercus engelmannii	1	0	0	0	0	0	0	0	0	1	0.0
Schinus molle	0	1	0	0	0	0	0	0	0	1	0.0
Total	**98**	**207**	**76**	**10**	**0**	**0**	**0**	**0**	**0**	**391**	**12.1**
Broadleaf Evergreen Small (BES)											
Sophora secundiflora	76	1	0	0	0	0	0	0	0	77	2.4
Acacia stenophylla	9	38	19	4	0	0	0	0	0	70	2.2
Olea europaea	1	6	31	20	2	0	0	0	0	60	1.9
Caesalpinia mexicana	44	6	1	0	0	0	0	0	0	51	1.6
Chamaerops humilis	2	49	0	0	0	0	0	0	0	51	1.6
Podocarpus macrophyllus	29	19	0	0	0	0	0	0	0	48	1.5
Arbutus unedo	35	5	1	0	0	0	0	0	0	41	1.3
Olea europaea 'Swan Hill'	3	22	1	0	0	0	0	0	0	26	0.8
Xylosma congestum	14	6	0	0	0	0	0	0	0	20	0.6
Ligustrum lucidum	7	11	0	0	0	0	0	0	0	18	0.6
Rhus lancea	2	7	5	4	0	0	0	0	0	18	0.6
Acacia aneura	8	4	1	0	0	0	0	0	0	13	0.4
Cordia boissieri	11	1	1	0	0	0	0	0	0	13	0.4
Pittosporum angustifolium	1	7	3	0	0	0	0	0	0	11	0.3
Acacia rigidula	7	2	0	0	0	0	0	0	0	9	0.3
Acacia greggii	5	0	1	0	0	0	0	0	0	6	0.2
Myrtus communis	6	0	0	0	0	0	0	0	0	6	0.2
Olea europaea 'Wilson'	1	5	0	0	0	0	0	0	0	6	0.2
Prunus caroliniana	2	2	2	0	0	0	0	0	0	6	0.2
Celtis pallida	4	0	0	0	0	0	0	0	0	4	0.1
Acacia jennerae	2	1	0	0	0	0	0	0	0	3	0.1
Acacia schaffneri	1	1	1	0	0	0	0	0	0	3	0.1
Eucalyptus latens 'Moon Lagoon'	3	0	0	0	0	0	0	0	0	3	0.1
Ilex altaclarensis 'Wilsonii'	3	0	0	0	0	0	0	0	0	3	0.1
Ligustrum japonicum	2	1	0	0	0	0	0	0	0	3	0.1
Acacia pendula	0	1	1	0	0	0	0	0	0	2	0.1
Citrus species	2	0	0	0	0	0	0	0	0	2	0.1
Ebenopsis ebano	2	0	0	0	0	0	0	0	0	2	0.1
Eucalyptus spathulata	0	1	0	1	0	0	0	0	0	2	0.1
Leucaena retusa	2	0	0	0	0	0	0	0	0	2	0.1
Quercus wislizenii	2	0	0	0	0	0	0	0	0	2	0.1
Schinus terebinthifolius	1	1	0	0	0	0	0	0	0	2	0.1
Acacia coriacea	0	0	1	0	0	0	0	0	0	1	0.0
Acacia constricta var. *paucispina*	1	0	0	0	0	0	0	0	0	1	0.0

Species	DBH Class (in)									Total	% of Pop.
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42		
Acacia papyrocarpa	0	1	0	0	0	0	0	0	0	1	0.0
Acacia saligna	0	1	0	0	0	0	0	0	0	1	0.0
Acacia tetragonophylla	1	0	0	0	0	0	0	0	0	1	0.0
Condalia hookeri	1	0	0	0	0	0	0	0	0	1	0.0
Eucalyptus formannii	0	0	1	0	0	0	0	0	0	1	0.0
Fraxinus greggii	1	0	0	0	0	0	0	0	0	1	0.0
Havardia pallens tenaza	1	0	0	0	0	0	0	0	0	1	0.0
Ilex vomitoria	1	0	0	0	0	0	0	0	0	1	0.0
Lysiloma microphyllum	1	0	0	0	0	0	0	0	0	1	0.0
Total	**294**	**199**	**70**	**29**	**2**	**0**	**0**	**0**	**0**	**594**	**18.4**
Conifer Evergreen Large (CEL)											
Pinus halepensis	4	4	15	91	79	10	5	0	0	208	6.5
Pinus eldarica	15	11	6	27	28	1	0	0	0	88	2.7
Pinus pinea	1	0	16	7	0	0	0	0	0	24	0.7
Cupressus sempervirens	6	0	2	0	0	0	0	0	0	8	0.2
Pinus roxburghii	0	0	0	3	2	0	0	0	0	5	0.2
Cedrus deodara	1	1	0	0	0	0	0	0	0	2	0.1
Casuarina equisetifolia	0	0	1	0	0	0	0	0	0	1	0.0
Total	**27**	**16**	**40**	**128**	**109**	**11**	**5**	**0**	**0**	**336**	**10.4**
Conifer Evergreen Medium (CEM)											
Pinus brutia	0	0	1	2	11	0	0	1	0	15	0.5
Thuja occidentalis	1	5	0	0	0	0	0	0	0	6	0.2
Cupressus glabra	0	1	0	0	0	0	0	0	0	1	0.0
Thuja occidentalis var. *filiform*	0	1	0	0	0	0	0	0	0	1	0.0
Total	**1**	**7**	**1**	**2**	**11**	**0**	**0**	**1**	**0**	**23**	**0.7**
Conifer Evergreen Small (CES)											
Juniperus spp.	0	1	0	0	0	0	0	0	0	1	0.0
Total	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0.0**
Palm Evergreen Large (PEL)											
Phoenix sylvestris	0	0	4	1	0	0	0	0	0	5	0.2
Sabal palmetto	0	0	2	1	0	0	0	0	0	3	0.1
Trachycarpus fortunei	1	1	0	0	0	0	0	0	0	2	0.1
Phoenix canariensis	0	0	0	0	1	0	0	0	0	1	0.0
Total	**1**	**1**	**6**	**2**	**1**	**0**	**0**	**0**	**0**	**11**	**0.3**
Palm Evergreen Medium (PEM)											
Phoenix dactylifera	0	0	0	30	0	0	0	0	0	30	0.9
Nannorrhops ritchiana	0	2	0	0	0	0	0	0	0	2	0.1
Total	**0**	**2**	**0**	**30**	**0**	**0**	**0**	**0**	**0**	**32**	**1.0**
Palm Evergreen Small (PES)											

Species	DBH Class (in)									Total	% of Pop.
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42		
Washingtonia robusta	1	0	50	36	0	0	0	0	0	87	2.7
Washingtonia filifera	0	0	0	13	63	1	0	0	0	77	2.4
Cycas revoluta	0	14	4	0	0	0	0	0	0	18	0.6
Brahea armata	0	0	3	12	0	0	0	0	0	15	0.5
Carnegiea gigantea	0	0	0	4	0	0	0	0	0	4	0.1
Butia capitata	0	0	0	2	0	0	0	0	0	2	0.1
Bismarckia nobilis	0	0	0	1	0	0	0	0	0	1	0.0
Phoenix roebelenii	1	0	0	0	0	0	0	0	0	1	0.0
Total	**2**	**14**	**57**	**68**	**63**	**1**	**0**	**0**	**0**	**205**	**6.4**
All Trees	**1,098**	**82**	**544**	**439**	**242**	**29**	**15**	**1**	**0**	**3,220**	**100%**

Relative Performance Index (RPI) for UNLV's Campus Tree Species

Species	Dead or Dying	Poor	Fair	Good	RPI	# of Trees	% of Pop.
Quercus virginiana	0.00	0.00	1.76	98.24	**1.06**	227	7.05
Pinus halepensis	0.00	0.48	15.87	83.65	**1.01**	208	6.46
Vitex agnus-castus	0.00	0.00	2.94	97.06	**1.06**	102	3.17
Chilopsis linearis	0.00	2.04	6.12	91.84	**1.03**	98	3.04
Fraxinus angustifolia	2.20	9.89	30.77	57.14	**0.89**	91	2.83
Pinus eldarica	0.00	0.00	5.68	94.32	**1.05**	88	2.73
Washingtonia robusta	0.00	0.00	2.30	97.70	**1.06**	87	2.70
Robinia ambigua 'Purple Robe'	6.10	0.00	36.59	57.32	**0.89**	82	2.55
Prosopis alba	0.00	0.00	13.75	86.25	**1.02**	80	2.48
Washingtonia filifera	0.00	1.30	3.90	94.81	**1.04**	77	2.39
Sophora secundiflora	1.30	0.00	1.30	97.40	**1.05**	77	2.39
Acacia stenophylla	0.00	0.00	5.71	94.29	**1.05**	70	2.17
Morus alba	0.00	2.90	18.84	78.26	**0.99**	69	2.14
Olea europaea	0.00	0.00	15.00	85.00	**1.02**	60	1.86
Fraxinus velutina 'Fan-Tex'	0.00	0.00	6.67	93.33	**1.04**	60	1.86
Pistacia chinensis	0.00	1.72	3.45	94.83	**1.04**	58	1.80
Quercus ilex	1.92	1.92	9.62	86.54	**1.00**	52	1.61
Chamaerops humilis	0.00	0.00	0.00	100.00	**1.06**	51	1.58
Caesalpinia mexicana	0.00	0.00	3.92	96.08	**1.05**	51	1.58
Prosopis torreyana	2.04	2.04	4.08	91.84	**1.02**	49	1.52
Podocarpus macrophyllus	0.00	0.00	4.17	95.83	**1.05**	48	1.49
Brachychiton populneum	0.00	0.00	13.04	86.96	**1.02**	46	1.43
Platanus x acerfolia	0.00	15.56	84.44	0.00	**0.70**	45	1.40
Parkinsonia x 'Desert Museum'	0.00	4.76	14.29	80.95	**0.99**	42	1.30
Arbutus unedo	2.44	2.44	17.07	78.05	**0.97**	41	1.27
Eysenhardtia orthocarpa	0.00	0.00	0.00	100.00	**1.06**	39	1.21
Acacia farnesiana	0.00	0.00	13.16	86.84	**1.02**	38	1.18
Prunus mexicana	5.26	2.63	2.63	89.47	**0.99**	38	1.18
Chiltalpa tashkentensis	0.00	5.56	94.44	0.00	**0.73**	36	1.12
Ulmus parvifolia	0.00	5.71	8.57	85.71	**1.00**	35	1.09
Cercis occidentalis 'Oklahoma'	0.00	2.94	0.00	97.06	**1.05**	34	1.06
Fraxinus velutina 'Glabra'	0.00	5.88	52.94	41.18	**0.86**	34	1.06
Phoenix dactylifera	0.00	0.00	0.00	100.00	**1.06**	30	0.93
Fraxinus velutina	0.00	3.33	26.67	70.00	**0.96**	30	0.93
Celtis occidentalis	0.00	0.00	3.45	96.55	**1.05**	29	0.90
Olea europaea 'Swan Hill'	0.00	0.00	7.69	92.31	**1.04**	26	0.81
Prosopis chilensis	0.00	3.85	15.38	80.77	**0.99**	26	0.81
Eucalyptus microtheca	0.00	4.00	12.00	84.00	**1.00**	25	0.78
Morus alba 'Chaparral'	0.00	0.00	8.00	92.00	**1.04**	25	0.78
Pinus pinea	0.00	4.17	12.50	83.33	**1.00**	24	0.75
Prosopis glandulosa	0.00	0.00	8.33	91.67	**1.04**	24	0.75
Parkinsonia aculeata	4.35	4.35	0.00	91.30	**1.00**	23	0.71
Lagerstroemia indica	0.00	0.00	13.64	86.36	**1.02**	22	0.68
Elaeocarpus decipiens	4.55	9.09	27.27	59.09	**0.88**	22	0.68

Species	Dead or Dying	Poor	Fair	Good	RPI	# of Trees	% of Pop.
Xylosma congestum	0.00	0.00	0.00	100.00	**1.06**	20	0.62
Cercis occidentalis	0.00	5.26	10.53	84.21	**1.00**	19	0.59
Punica granatum	0.00	0.00	0.00	100.00	**1.06**	19	0.59
Rhus lancea	0.00	0.00	27.78	72.22	**0.98**	18	0.56
Parkinsonia florida	0.00	5.56	22.22	72.22	**0.96**	18	0.56
Ligustrum lucidum	0.00	16.67	61.11	22.22	**0.77**	18	0.56
Cycas revoluta	0.00	0.00	0.00	100.00	**1.06**	18	0.56
Fraxinus uhdei	6.25	18.75	12.50	62.50	**0.85**	16	0.50
Pinus brutia	0.00	0.00	6.67	93.33	**1.04**	15	0.47
Albizia julibrissin	0.00	6.67	26.67	66.67	**0.94**	15	0.47
Brahea armata	0.00	0.00	0.00	100.00	**1.06**	15	0.47
Koelreuteria paniculata	0.00	0.00	28.57	71.43	**0.98**	14	0.43
Cordia boissieri	0.00	0.00	0.00	100.00	**1.06**	13	0.40
Acacia aneura	23.08	30.77	23.08	23.08	**0.58**	13	0.40
Koelreuteria bipinnata	0.00	7.69	0.00	92.31	**1.02**	13	0.40
Celtis sinensis	0.00	16.67	25.00	58.33	**0.88**	12	0.37
Prosopis juliflora	0.00	0.00	8.33	91.67	**1.04**	12	0.37
Pittosporum angustifolium	0.00	0.00	0.00	100.00	**1.06**	11	0.34
Zelkova serrata	0.00	0.00	90.91	9.09	**0.78**	11	0.34
Platanus racemosa	0.00	90.91	9.09	0.00	**0.47**	11	0.34
Populus fremontii	0.00	0.00	54.55	45.45	**0.89**	11	0.34
Quercus muehlenbergii	0.00	0.00	10.00	90.00	**1.03**	10	0.31
Parkinsonia microphylla	0.00	0.00	33.33	66.67	**0.96**	9	0.28
Celtis reticulata	0.00	0.00	11.11	88.89	**1.03**	9	0.28
Laurus nobillis	0.00	0.00	0.00	100.00	**1.06**	9	0.28
Acacia rigidula	0.00	0.00	22.22	77.78	**1.00**	9	0.28
Pistacia X atlantica 'Red Push'	0.00	0.00	0.00	100.00	**1.06**	9	0.28
Eucalyptus camaldulensis	0.00	0.00	0.00	100.00	**1.06**	9	0.28
Quercus texana	0.00	12.50	25.00	62.50	**0.91**	8	0.25
Quercus lobata	0.00	0.00	0.00	100.00	**1.06**	8	0.25
Prunus dulcis	0.00	0.00	12.50	87.50	**1.03**	8	0.25
Cupressus sempervirens	0.00	0.00	0.00	100.00	**1.06**	8	0.25
Quecus shumardii	0.00	0.00	12.50	87.50	**1.03**	8	0.25
Prosopis pubescens	0.00	0.00	14.29	85.71	**1.02**	7	0.22
Ungnadia speciosa	0.00	0.00	0.00	100.00	**1.06**	7	0.22
Ceratonia siliqua	0.00	0.00	14.29	85.71	**1.02**	7	0.22
Forestiera pubescens	0.00	0.00	0.00	100.00	**1.06**	7	0.22
Acacia greggii	0.00	0.00	0.00	100.00	**1.06**	6	0.19
Olea europaea 'Wilson'	0.00	0.00	16.67	83.33	**1.01**	6	0.19
Cocculus laurifolius	0.00	0.00	0.00	100.00	**1.06**	6	0.19
Prunus caroliniana	0.00	0.00	33.33	66.67	**0.96**	6	0.19
Myrtus communis	0.00	0.00	0.00	100.00	**1.06**	6	0.19
Quercus suber	0.00	33.33	0.00	66.67	**0.86**	6	0.19
Acer negundo 'Flamingo'	0.00	0.00	33.33	66.67	**0.96**	6	0.19
Pyrus calleryana	0.00	16.67	0.00	83.33	**0.96**	6	0.19

Species	Dead or Dying	Poor	Fair	Good	RPI	# of Trees	% of Pop.
Thuja occidentalis	0.00	0.00	83.33	16.67	**0.80**	6	0.19
Quercus macrocarpa	0.00	20.00	60.00	20.00	**0.75**	5	0.16
Phoenix sylvestris	0.00	0.00	0.00	100.00	**1.06**	5	0.16
Pinus roxburghii	0.00	0.00	0.00	100.00	**1.06**	5	0.16
Quercus douglasii	0.00	0.00	20.00	80.00	**1.00**	5	0.16
Prunus cerasifera	0.00	0.00	20.00	80.00	**1.00**	5	0.16
Platanus wrightii	0.00	20.00	0.00	80.00	**0.94**	5	0.16
Eucalyptus sideroxylon	0.00	0.00	80.00	20.00	**0.81**	5	0.16
Prunus armeniaca	0.00	0.00	0.00	100.00	**1.06**	4	0.12
Carnegiea gigantea	0.00	0.00	0.00	100.00	**1.06**	4	0.12
Platanus mexicana	0.00	0.00	25.00	75.00	**0.99**	4	0.12
Cercis canadensis	0.00	25.00	50.00	25.00	**0.75**	4	0.12
Salix gooddingii	0.00	0.00	0.00	100.00	**1.06**	4	0.12
Celtis pallida	0.00	0.00	0.00	100.00	**1.06**	4	0.12
Rhus lanceolata	0.00	0.00	0.00	100.00	**1.06**	4	0.12
Melia azedarach	0.00	0.00	0.00	100.00	**1.06**	4	0.12
Cercidium praecox	0.00	0.00	0.00	100.00	**1.06**	4	0.12
Eriobotyra deflexa	0.00	0.00	0.00	100.00	**1.06**	3	0.09
Ziziphus jujuba	0.00	0.00	0.00	100.00	**1.06**	3	0.09
Bauhinia lunarioides	0.00	0.00	0.00	100.00	**1.06**	3	0.09
Magnolia grandiflora	0.00	33.33	33.33	33.33	**0.75**	3	0.09
Gleditsia triacanthos v. inermis	0.00	0.00	0.00	100.00	**1.06**	3	0.09
Acacia jennerae	0.00	0.00	33.33	66.67	**0.96**	3	0.09
Acacia gerrardii	0.00	0.00	33.33	66.67	**0.96**	3	0.09
Prosopis velutina	0.00	0.00	33.33	66.67	**0.96**	3	0.09
Acacia schaffneri	0.00	33.33	33.33	33.33	**0.75**	3	0.09
Quercus palustris	0.00	66.67	33.33	0.00	**0.54**	3	0.09
Ilex altaclarensis 'Wilsonii'	0.00	0.00	0.00	100.00	**1.06**	3	0.09
Eucalyptus latens moon lagoon	33.33	0.00	0.00	66.67	**0.75**	3	0.09
Ligustrum japonicum	0.00	0.00	0.00	100.00	**1.06**	3	0.09
Sabal palmetto	0.00	0.00	0.00	100.00	**1.06**	3	0.09
Parkinsonia x 'Sonoran Emerald'	0.00	0.00	66.67	33.33	**0.86**	3	0.09
Acacia pendula	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Nannorrhops ritchiana	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Dalbergia sissoo	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Sambucus nigra ssp. Cerulea	0.00	50.00	0.00	50.00	**0.75**	2	0.06
Quercus gambelii	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Ebenopsis ebano	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Leucaena retusa	0.00	0.00	50.00	50.00	**0.91**	2	0.06
Trachycarpus fortunei	50.00	0.00	0.00	50.00	**0.60**	2	0.06
Acacia willardiana	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Ginkgo biloba 'Autumn Gold'	0.00	0.00	100.00	0.00	**0.75**	2	0.06
Prunus persica	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Eucalyptus spathulata	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Butia capitata	0.00	50.00	50.00	0.00	**0.60**	2	0.06

Species	Dead or Dying	Poor	Fair	Good	RPI	# of Trees	% of Pop.
Caesalpinia palmeri	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Acacia estrophiolata	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Cedrus deodara	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Quercus rubra	0.00	50.00	50.00	0.00	**0.60**	2	0.06
Quercus wislizenii	0.00	50.00	50.00	0.00	**0.60**	2	0.06
Robinia pseudoacacia	0.00	0.00	50.00	50.00	**0.91**	2	0.06
Ulmus crassifolia	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Cotinus coggygria	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Schinus terebinthifolius	0.00	0.00	0.00	100.00	**1.06**	2	0.06
Citrus species	0.00	0.00	100.00	0.00	**0.75**	2	0.06
Maclura pomifera	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Mimosa dysocarpa	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Acacia constricta var. paucispina	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Eucalyptus formannii	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Quercus engelmannii	100.00	0.00	0.00	0.00	**0.13**	1	0.03
Acacia saligna	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Lysiloma microphyllum	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Acacia brachystachya	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Condalia hookeri	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Acacia karroo	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Acacia papyrocarpa	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Acacia tetragonophylla	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Acacia erioloba	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Havardia pallens tenaza	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Acacia coriacea	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Malus spp.	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Acer ginnala	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Fraxinus greggii	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Prunus spp.	0.00	0.00	100.00	0.00	**0.75**	1	0.03
Syringa vulgaris	0.00	0.00	100.00	0.00	**0.75**	1	0.03
Ulmus glabra 'Camperdownii'	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Salix matsudana 'Tortuosa'	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Cupressus glabra	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Chionanthus retusus	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Fraxinus velutina 'Bonita'	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Ficus carica	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Thuja occidentalis var. filiform	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Plantanus occidentalis	0.00	0.00	100.00	0.00	**0.75**	1	0.03
Ilex vomitoria	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Juglans major	0.00	0.00	100.00	0.00	**0.75**	1	0.03
Juniperus spp.	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Bismarckia nobilis	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Phoenix roebelenii	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Fraxinus angustifolia ssp. Oxycarpa	0.00	0.00	0.00	100.00	**1.06**	1	0.03

Species	Dead or Dying	Poor	Fair	Good	RPI	# of Trees	% of Pop.
Phoenix canariensis	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Casuarina equisetifolia	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Prosopis spp.	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Quercus polymorpha	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Tamarix chinensis	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Havardia mexicana	0.00	0.00	0.00	100.00	**1.06**	1	0.03
Schinus molle	0.00	0.00	0.00	100.00	**1.06**	1	0.03
All Trees	**0.68**	**2.61**	**13.48**	**83.23**	**1.00**	**3220**	**100%**

Replacement Value of UNLV's Campus 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			
Quercus virginiana	14,160	184,019	243,485	100,442	0	0	0	0	0	**542,107**	4.22	7.05
Pinus halepensis	954	5,189	76,925	1,246,668	2,070,269	411,014	264,882	0	0	**4,075,901**	31.76	6.46
Vitex agnus-castus	21,656	16,729	34,115	0	0	0	0	0	0	**72,500**	0.56	3.17
Chilopsis linearis	14,190	44,909	59,199	0	0	0	0	0	0	**118,298**	0.92	3.04
Fraxinus angustifolia	7,527	23,349	138,800	116,479	0	0	0	0	0	**286,155**	2.23	2.83
Pinus eldarica	3,207	12,071	23,620	277,872	536,224	31,610	0	0	0	**884,606**	6.89	2.73
Washingtonia robusta	188	0	13,184	11,100	0	0	0	0	0	**24,472**	0.19	2.70
Robinia ambigua 'Purple Robe'	13,024	33,011	0	0	0	0	0	0	0	**46,035**	0.36	2.55
Prosopis alba	1,777	48,321	101,492	17,564	0	0	0	0	0	**169,155**	1.32	2.48
Sophora secundiflora	17,420	1,133	0	0	0	0	0	0	0	**18,553**	0.14	2.39
Washingtonia filifera	0	0	0	7,751	47,113	892	0	0	0	**55,756**	0.43	2.39
Acacia stenophylla	2,317	57,791	103,013	53,175	0	0	0	0	0	**216,297**	1.69	2.17
Morus alba	327	699	5,722	124,295	279,302	141,072	106,788	0	0	**658,205**	5.13	2.14
Fraxinus velutina 'Fan-Tex'	4,816	44,730	38,128	43,047	27,010	0	0	0	0	**157,731**	1.23	1.86
Olea europaea	284	11,452	216,625	346,388	59,162	0	0	0	0	**633,910**	4.94	1.86
Pistacia chinensis	2,475	62,983	92,290	44,381	0	0	0	0	0	**202,129**	1.57	1.80
Quercus ilex	727	19,950	129,770	157,838	0	0	0	0	0	**308,284**	2.40	1.61
Caesalpinia mexicana	8,573	4,881	2,844	0	0	0	0	0	0	**16,298**	0.13	1.58
Chamaerops humilis	405	11,291	0	0	0	0	0	0	0	**11,696**	0.09	1.58
Prosopis torreyana	5,210	31,043	28,429	28,698	0	0	0	0	0	**93,379**	0.73	1.52
Podocarpus macrophyllus	6,212	17,341	0	0	0	0	0	0	0	**23,553**	0.18	1.49
Brachychiton populneum	4,043	38,826	17,057	0	0	0	0	0	0	**59,926**	0.47	1.43
Platanus x acerfolia	0	0	54,605	64,974	18,712	0	0	0	0	**138,291**	1.08	1.40
Parkinsonia x 'Desert Museum'	4,483	24,065	25,084	20,257	0	0	0	0	0	**73,889**	0.58	1.30
Arbutus unedo	8,359	7,157	5,686	0	0	0	0	0	0	**21,202**	0.17	1.27
Eysenhardtia orthocarpa	8,007	1,854	0	0	0	0	0	0	0	**9,861**	0.08	1.21
Acacia farnesiana	1,706	32,109	43,581	123,401	34,681	0	0	0	0	**235,478**	1.83	1.18
Prunus mexicana	7,956	0	0	0	0	0	0	0	0	**7,956**	0.06	1.18
Chiltalpa tashkentensis	1,636	23,796	16,054	0	0	0	0	0	0	**41,486**	0.32	1.12
Ulmus parvifolia	878	11,719	72,243	130,828	0	0	0	0	0	**215,669**	1.68	1.09

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			
Cercis occidentalis 'Oklahoma'	6,786	825	0	0	0	0	0	0	0	**7,612**	0.06	1.06
Fraxinus velutina 'Glabra'	0	0	35,453	177,251	187,484	87,341	0	0	0	**487,528**	3.80	1.06
Fraxinus velutina	954	7,414	17,621	33,473	30,502	42,003	36,242	0	0	**168,209**	1.31	31.24
Phoenix dactylifera	0	0	0	29,312	0	0	0	0	0	**29,312**	0.23	0.93
Celtis occidentalis	772	0	129,101	43,047	0	0	0	0	0	**172,920**	1.35	0.93
Olea europaea 'Swan Hill'	772	32,563	5,686	0	0	0	0	0	0	**39,022**	0.30	0.90
Prosopis chilensis	393	7,598	33,348	72,072	0	22,052	0	0	0	**135,463**	1.06	0.81
Eucalyptus microtheca	3,529	3,668	11,372	38,826	73,087	0	0	0	0	**130,481**	1.02	0.81
Morus alba 'Chaparral'	0	699	9,490	70,239	70,147	17,634	0	0	0	**168,209**	1.31	0.78
Pinus pinea	257	0	84,283	96,222	0	0	0	0	0	**180,763**	1.41	0.78
Prosopis glandulosa	2,759	24,250	7,264	0	0	0	0	0	0	**34,273**	0.27	0.75
Parkinsonia aculeata	1,149	8,266	8,095	5,853	0	0	0	0	0	**23,363**	0.18	0.75
Elaeocarpus decipiens	1,626	6,700	8,569	0	0	0	0	0	0	**16,895**	0.13	0.71
Lagerstroemia indica	4,013	13,360	0	0	0	0	0	0	0	**17,373**	0.14	0.68
Xylosma congestum	3,030	5,562	0	0	0	0	0	0	0	**8,592**	0.07	0.68
Cercis occidentalis	2,328	4,710	2,856	0	0	0	0	0	0	**9,894**	0.08	0.62
Punica granatum	4,634	1,521	0	0	0	0	0	0	0	**6,155**	0.05	0.59
Parkinsonia florida	0	11,452	49,563	62,783	0	0	0	0	0	**123,797**	0.96	0.59
Cycas revoluta	0	3,226	1,050	0	0	0	0	0	0	**4,276**	0.03	0.56
Ligustrum lucidum	1,575	10,467	0	0	0	0	0	0	0	**12,042**	0.09	0.56
Rhus lancea	515	9,751	23,412	57,396	0	0	0	0	0	**91,074**	0.71	0.56
Fraxinus uhdei	406	4,483	6,978	11,706	0	0	0	0	0	**23,573**	0.18	0.56
Albizia julibrissin	1,872	4,532	4,591	0	0	0	0	0	0	**10,996**	0.09	0.50
Brahea armata	0	0	4,984	27,764	0	0	0	0	0	**32,749**	0.26	0.47
Pinus brutia	0	0	2,922	20,810	215,180	0	0	62,786	0	**301,698**	2.35	0.47
Koelreuteria paniculata	2,347	3,042	9,699	0	0	0	0	0	0	**15,088**	0.12	0.47
Acacia aneura	1,439	4,026	5,686	0	0	0	0	0	0	**11,150**	0.09	0.43
Cordia boissieri	2,380	927	3,270	0	0	0	0	0	0	**6,577**	0.05	0.40
Koelreuteria bipinnata	1,393	10,646	0	0	0	0	0	0	0	**12,039**	0.09	0.40
Celtis sinensis	878	9,930	0	0	0	0	0	0	0	**10,808**	0.08	0.40
Prosopis juliflora	0	1,521	15,385	100,442	27,010	0	0	0	0	**144,359**	1.12	0.37
Pittosporum angustifolium	209	5,778	8,569	0	0	0	0	0	0	**14,556**	0.11	0.37

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			
Platanus racemosa	0	0	3,908	18,593	0	0	0	0	0	**22,500**	0.18	0.34
Populus fremontii	361	485	0	0	4,680	25,675	48,716	0	0	**79,917**	0.62	0.34
Zelkova serrata	0	0	24,043	5,748	0	0	0	0	0	**29,791**	0.23	0.34
Quercus muehlenbergii	575	1,193	11,863	0	0	0	0	0	0	**13,630**	0.11	0.34
Acacia rigidula	1,726	2,594	0	0	0	0	0	0	0	**4,321**	0.03	0.31
Parkinsonia microphylla	1,053	6,512	7,264	0	0	0	0	0	0	**14,829**	0.12	0.28
Celtis reticulata	772	4,562	9,699	14,349	0	0	0	0	0	**29,383**	0.23	0.28
Eucalyptus camaldulensis	1,724	0	0	0	0	0	0	0	0	**1,724**	0.01	0.28
Laurus nobillis	1,802	3,042	0	0	0	0	0	0	0	**4,844**	0.04	0.28
Pistacia X atlantica 'Red Push'	0	2,476	14,281	7,080	0	0	0	0	0	**23,838**	0.19	0.28
Cupressus sempervirens	1,545	0	11,372	0	0	0	0	0	0	**12,916**	0.10	0.28
Prunus dulcis	1,137	3,817	7,264	12,990	0	0	0	0	0	**25,207**	0.20	0.25
Quercus lobata	772	3,042	5,686	28,698	0	0	0	0	0	**38,198**	0.30	0.25
Quecus shumardii	0	5,636	22,743	0	0	0	0	0	0	**28,379**	0.22	0.25
Quercus texana	621	2,147	17,057	0	0	0	0	0	0	**19,825**	0.15	0.25
Ceratonia siliqua	1,030	0	9,699	14,349	0	0	0	0	0	**25,078**	0.20	0.25
Forestiera pubescens	1,397	0	0	0	0	0	0	0	0	**1,397**	0.01	0.22
Prosopis pubescens	692	800	12,324	0	0	0	0	0	0	**13,816**	0.11	0.22
Ungnadia speciosa	1,515	0	0	0	0	0	0	0	0	**1,515**	0.01	0.22
Acacia greggii	1,287	0	5,686	0	0	0	0	0	0	**6,973**	0.05	0.22
Acer negundo 'Flamingo'	878	3,042	0	0	0	0	0	0	0	**3,920**	0.03	0.19
Cocculus laurifolius	0	4,090	2,826	0	0	0	0	0	0	**6,916**	0.05	0.19
Myrtus communis	1,545	0	0	0	0	0	0	0	0	**1,545**	0.01	0.19
Olea europaea 'Wilson'	182	7,604	0	0	0	0	0	0	0	**7,786**	0.06	0.19
Prunus caroliniana	439	2,594	11,372	0	0	0	0	0	0	**14,405**	0.11	0.19
Pyrus calleryana	106	7,604	0	0	0	0	0	0	0	**7,710**	0.06	0.19
Quercus suber	515	2,773	5,686	0	0	0	0	0	0	**8,974**	0.07	0.19
Thuja occidentalis	151	4,311	0	0	0	0	0	0	0	**4,462**	0.03	0.19
Eucalyptus sideroxylon	257	0	8,027	20,257	0	0	0	0	0	**28,542**	0.22	0.19
Phoenix sylvestris	0	0	1,431	424	0	0	0	0	0	**1,855**	0.01	0.16
Pinus roxburghii	0	0	0	24,387	30,502	0	0	0	0	**54,889**	0.43	0.16
Platanus wrightii	0	0	1,341	32,516	0	0	0	0	0	**33,857**	0.26	0.16

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			
Prunus cerasifera	855	1,133	0	0	0	0	0	0	0	**1,988**	0.02	0.16
Quercus douglasii	1,212	0	0	0	0	0	0	0	0	**1,212**	0.01	0.16
Quercus macrocarpa	0	3,847	5,686	0	0	0	0	0	0	**9,533**	0.07	0.16
Carnegiea gigantea	0	0	0	1,998	0	0	0	0	0	**1,998**	0.02	0.16
Cercis canadensis	363	2,147	0	0	0	0	0	0	0	**2,510**	0.02	0.12
Celtis pallida	1,030	0	0	0	0	0	0	0	0	**1,030**	0.01	0.12
Cercidium praecox	257	4,562	0	0	0	0	0	0	0	**4,820**	0.04	0.12
Melia azedarach	231	0	4,108	20,592	0	0	0	0	0	**24,931**	0.19	0.12
Platanus mexicana	0	583	2,856	14,161	0	0	0	0	0	**17,600**	0.14	0.12
Prunus armeniaca	853	0	7,264	0	0	0	0	0	0	**8,116**	0.06	0.12
Rhus lanceolata	1,030	0	0	0	0	0	0	0	0	**1,030**	0.01	0.12
Salix gooddingii	284	0	0	18,402	69,362	0	0	0	0	**88,048**	0.69	0.12
Acacia gerrardii	0	3,042	4,013	0	0	0	0	0	0	**7,055**	0.05	0.12
Acacia jennerae	439	1,521	0	0	0	0	0	0	0	**1,960**	0.02	0.09
Acacia schaffneri	182	626	5,686	0	0	0	0	0	0	**6,494**	0.05	0.09
Bauhinia lunarioides	772	0	0	0	0	0	0	0	0	**772**	0.01	0.09
Eriobotyra deflexa	209	1,651	0	0	0	0	0	0	0	**1,860**	0.01	0.09
Eucalyptus latens moon lagoon	727	0	0	0	0	0	0	0	0	**727**	0.01	0.09
Gleditsia triacanthos v. inermis	0	0	8,216	10,296	0	0	0	0	0	**18,512**	0.14	0.09
Ilex altaclarensis 'Wilsonii'	649	0	0	0	0	0	0	0	0	**649**	0.01	0.09
Ligustrum japonicum	515	1,521	0	0	0	0	0	0	0	**2,036**	0.02	0.09
Magnolia grandiflora	363	1,074	0	0	0	0	0	0	0	**1,437**	0.01	0.09
Parkinsonia x 'Sonoran Emerald'	0	0	13,713	0	0	0	0	0	0	**13,713**	0.11	0.09
Prosopis velutina	0	1,909	0	31,391	0	0	0	0	0	**33,300**	0.26	0.09
Quercus palustris	327	0	0	0	0	0	0	0	0	**327**	0.00	0.09
Sabal palmetto	0	0	716	424	0	0	0	0	0	**1,139**	0.01	0.09
Ziziphus jujuba	433	927	0	0	0	0	0	0	0	**1,360**	0.01	0.09
Acacia estrophiolata	515	0	0	0	0	0	0	0	0	**515**	0.00	0.09
Acacia pendula	0	1,521	5,686	0	0	0	0	0	0	**7,207**	0.06	0.06
Acacia willardiana	515	0	0	0	0	0	0	0	0	**515**	0.00	0.06
Butia capitata	0	0	0	480	0	0	0	0	0	**480**	0.00	0.06
Caesalpinia palmeri	395	0	0	0	0	0	0	0	0	**395**	0.00	0.06

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			
Cedrus deodara	203	913	0	0	0	0	0	0	0	**1,116**	0.01	0.06
Citrus species	363	0	0	0	0	0	0	0	0	**363**	0.00	0.06
Cotinus coggygria	433	0	0	0	0	0	0	0	0	**433**	0.00	0.06
Dalbergia sissoo	0	0	4,108	10,296	0	0	0	0	0	**14,404**	0.11	0.06
Ebenopsis ebano	515	0	0	0	0	0	0	0	0	**515**	0.00	0.06
Eucalyptus spathulata	0	1,909	0	18,402	0	0	0	0	0	**20,310**	0.16	0.06
Ginkgo biloba 'Autumn Gold'	139	449	0	0	0	0	0	0	0	**588**	0.00	0.06
Leucaena retusa	439	0	0	0	0	0	0	0	0	**439**	0.00	0.06
Nannorrhops ritchiana	0	781	0	0	0	0	0	0	0	**781**	0.01	0.06
Prunus persica	569	0	0	0	0	0	0	0	0	**569**	0.00	0.06
Quercus gambelii	515	0	0	0	0	0	0	0	0	**515**	0.00	0.06
Quercus rubra	288	0	0	0	0	0	0	0	0	**288**	0.00	0.06
Quercus wislizenii	288	0	0	0	0	0	0	0	0	**288**	0.00	0.06
Robinia pseudoacacia	0	1,074	5,686	0	0	0	0	0	0	**6,759**	0.05	0.06
Sambucus nigra ssp. Cerulea	401	0	0	0	0	0	0	0	0	**401**	0.00	0.06
Schinus terebinthifolius	257	1,521	0	0	0	0	0	0	0	**1,778**	0.01	0.06
Trachycarpus fortunei	229	309	0	0	0	0	0	0	0	**539**	0.00	0.06
Ulmus crassifolia	0	1,521	5,686	0	0	0	0	0	0	**7,207**	0.06	0.06
Acacia brachystachya	257	0	0	0	0	0	0	0	0	**257**	0.00	0.06
Acacia coriacea	0	0	5,686	0	0	0	0	0	0	**5,686**	0.04	0.03
Acacia constricta var. paucispina	257	0	0	0	0	0	0	0	0	**257**	0.00	0.03
Acacia erioloba	257	0	0	0	0	0	0	0	0	**257**	0.00	0.03
Acer ginnala	257	0	0	0	0	0	0	0	0	**257**	0.00	0.03
Acacia karroo	0	1,521	0	0	0	0	0	0	0	**1,521**	0.01	0.03
Acacia papyrocarpa	0	1,521	0	0	0	0	0	0	0	**1,521**	0.01	0.03
Acacia saligna	0	1,133	0	0	0	0	0	0	0	**1,133**	0.01	0.03
Acacia tetragonophylla	257	0	0	0	0	0	0	0	0	**257**	0.00	0.03
Bismarckia nobilis	0	0	0	311	0	0	0	0	0	**311**	0.00	0.03
Casuarina equisetifolia	0	0	5,686	0	0	0	0	0	0	**5,686**	0.04	0.03
Chionanthus retusus	0	0	4,157	0	0	0	0	0	0	**4,157**	0.03	0.03
Condalia hookeri	209	0	0	0	0	0	0	0	0	**209**	0.00	0.03
Cupressus glabra	0	1,521	0	0	0	0	0	0	0	**1,521**	0.01	0.03

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			
Eucalyptus formannii	0	0	5,686	0	0	0	0	0	0	**5,686**	0.04	0.03
Ficus carica	0	0	7,264	0	0	0	0	0	0	**7,264**	0.06	0.03
Fraxinus angustifolia ssp. Oxycarpa	216	0	0	0	0	0	0	0	0	**216**	0.00	0.03
Fraxinus greggii	257	0	0	0	0	0	0	0	0	**257**	0.00	0.03
Fraxinus velutina 'Bonita'	0	0	3,270	0	0	0	0	0	0	**3,270**	0.03	0.03
Havardia mexicana	0	0	3,270	0	0	0	0	0	0	**3,270**	0.03	0.03
Havardia pallens tenaza	216	0	0	0	0	0	0	0	0	**216**	0.00	0.03
Ilex vomitoria	216	0	0	0	0	0	0	0	0	**216**	0.00	0.03
Juglans major	153	0	0	0	0	0	0	0	0	**153**	0.00	0.03
Juniperus spp.	0	1,521	0	0	0	0	0	0	0	**1,521**	0.01	0.03
Lysiloma microphyllum	284	0	0	0	0	0	0	0	0	**284**	0.00	0.03
Maclura pomifera	203	0	0	0	0	0	0	0	0	**203**	0.00	0.03
Malus spp.	284	0	0	0	0	0	0	0	0	**284**	0.00	0.03
Mimosa dysocarpa	216	0	0	0	0	0	0	0	0	**216**	0.00	0.03
Phoenix canariensis	0	0	0	0	2,638	0	0	0	0	**2,638**	0.02	0.03
Phoenix roebelenii	299	0	0	0	0	0	0	0	0	**299**	0.00	0.03
Plantanus occidentalis	0	0	4,013	0	0	0	0	0	0	**4,013**	0.03	0.03
Prosopis spp.	231	0	0	0	0	0	0	0	0	**231**	0.00	0.03
Prunus spp.	0	1,347	0	0	0	0	0	0	0	**1,347**	0.01	0.03
Quercus engelmannii	212	0	0	0	0	0	0	0	0	**212**	0.00	0.03
Quercus polymorpha	0	1,128	0	0	0	0	0	0	0	**1,128**	0.01	0.03
Salix matsudana 'Tortuosa'	0	0	7,264	0	0	0	0	0	0	**7,264**	0.06	0.03
Schinus molle	0	1,521	0	0	0	0	0	0	0	**1,521**	0.01	0.03
Syringa vulgaris	153	0	0	0	0	0	0	0	0	**153**	0.00	0.03
Tamarix chinensis	284	0	0	0	0	0	0	0	0	**284**	0.00	0.03
Thuja occidentalis var. filiform	0	1,128	0	0	0	0	0	0	0	**1,128**	0.01	0.03
Ulmus glabra 'Camperdownii'	0	0	5,686	0	0	0	0	0	0	**5,686**	0.04	0.03
All Trees	**$252,131**	**$1,082,537**	**$2,350,173**	**$4,068,497**	**$3,783,065**	**$779,293**	**$456,629**	**$62,786**	**$ 0**	**$12,835,111**	**100%**	**100%**