Kava Vale Master of Environmental Horticulture Candidate UW Botanic Gardens August, 2011

university of washington seattle campus forest resource analysis

University of Washington Seattle Campus
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Contents

Faculty Graduate Committee:

Dr. Kern Ewing, Committee Chair
Dr. Sarah Reichard
Dr. Soo-Hyung Kim

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Summary

Through identifying and analyzing the trees on UW's Seattle campus, this study aims to provide a picture in time of the resource's structure, function and value per the 8,775 campus trees that were inventoried from 2006-2008. The monetary value of the resource was estimated using i-Tree Streets software, a modeling approach designed by the USFS Center for Urban Forest Research. The results indicated that as of 2008, the total annual benefit produced by UW's trees was $736,385. Net quantifiable benefits of the trees outweighed their management costs by approximately half of a million dollars ($480,285) annually, for a net benefit of $54.73 per campus tree. The total campus population was assumed to be 64,884 in 2011. This translated to an annual net benefit of $7.40 per staff, faculty and student.

Resource Structure

UW Seattle's central campus consists of 643 acres nestled between Lake Washington's Union Bay to the East and the University District to the West. There were 4,335 street trees, defined in this study as trees located within a 50 foot buffer from the centerline of major roads and pathways, and 4,440 non-street trees located outside of this buffer. The following points summarize the structure of the resource, including characteristics such as age distribution, canopy coverage, replacement value, species and diversity levels. Condition information was not available.

- Broadleaf deciduous trees made up more than half of the total population, numbering 5,764 trees or 65.7%. Of these, 43% were categorized as large stature trees, 27.5% were of medium size and 29.4% were small size.
- Total campus canopy cover was estimated at 107 acres or 16.63% of total land area. Street trees accounted for 53.1% (57 acres) and non-street trees accounted for 46.9% (50 acres) of the total canopy cover.
- *Pseudotsuga menziesii* was the most commonly occurring species on campus, numbering 422 trees and 7.7% of the canopy cover. *Acer macrophyllum* was the second most common species, occurring at 380 trees and 8.6% of the entire canopy cover.
- The majority of the trees on campus were in the 6-12" DBH class, which suggests that there might not be adequate numbers of younger trees to replace aging trees if only one replacement tree is planted per removal.

- Trees greater than 24" DBH made up about 11% of the population, and consisted mainly of *Acer macrophyllum* (12.63%). Because this species is important in terms of leaf surface area and total benefits, the proportion of aging trees is not ideal in the case of catastrophic loss.
- It would cost approximately $38,865,369 to replace the 2008 tree inventory with trees of similar size and species.

Resource Function and Value

The trees on UW Seattle campus provide a host of educational, environmental and social benefits, such as interception of rainfall, reduction of energy use, aesthetic value, quality of life improvement and reduction in carbon dioxide levels. Overall, the benefit-cost ratio of the trees on UW Seattle campus was 2.9:1, which means for every dollar spent on their management, trees produced $2.90 in benefits.

- The effects of electricity and natural gas savings increase with proximity to infrastructure such as buildings, sidewalks and roads. Therefore, only the energy benefits from the trees categorized as street trees in this study were estimated. These trees saved approximately $14,392 annually, at an average of $3.32 per tree.
- The amount of carbon sequestered and avoided less the amount released during maintenance and decomposition was equal to 2,223,849 lbs. This was valued at an average $0.72 per tree annually, or $6,347 annually for all campus trees.
- Net air quality improvement was estimated to provide a benefit of $8,878 annually to the campus community. Trees with the greatest leaf surface area provided the greatest benefit (*Acer macrophyllum* and *Platanus x acerifolia*) at an average of $3.32 and $3.88 per tree, respectively.
- Total rainfall interception was valued at approximately $220,448 annually for 7,957,858 gallons of stormwater per year. Per tree, the average value of stormwater intercepted was $25.12.
- As outlined in the USFS regional Community Tree Guide for Western Washington and Oregon, the aesthetic value of public trees is estimated slightly higher than privately owned trees, which may be located on or adjacent to inaccessible land. Therefore, the aesthetic value of trees on campus as of 2008 was estimated at $486,320 ($55.42 per tree).

Resource Management

Sustainable management practices will help ensure that the net benefits of UW's trees are both preserved and increased throughout time and space. For optimal resource health and longevity, the following principles of sustainable urban forestry should be practiced.

- Tree maintenance must provide for general care such as cyclical pruning, mulching, IPM and new tree establishment. Comprehensive management must also cover removal of senescing and hazardous trees.
- Since the goal of sustainable management is to maintain net benefits over time, UW must actively intervene to establish an equal proportion of age class diversity amongst the campus inventory (Clark et al, 1997). Since mature trees tend to provide the greatest ecosystem services, it is imperative that new trees exist to replace the aging population.
- Maintaining species diversity so that no single species comprises more than 10% of the entire inventory is needed to guard against catastrophic losses caused by pests, diseases or unusual weather. Although weather would have a more general impact, certain species may be more prone to failure in various conditions such as strong wind or extreme temperatures.
- Community awareness and consensus among institutions, policy makers, managers and tree care professionals is needed to ensure that adequate levels of funding are supplied to proactively manage the resource. This includes funding for periodic assessment of the urban forest inventory in order to prioritize goals.

Introduction

Acer macrophyllum as a street tree outside Parrington Hall on Memorial Way

Founded in 1861 and moved to its present site in 1895, the University of Washington Seattle campus encompasses 643 acres, not including trees in the Union Bay Natural Area, Center for Urban Horticulture and the Washington Park Arboretum. As defined by the City of Seattle, the land use category of the campus is designated as 'Institutional'. This is a category that includes hospitals and public schools, and constitutes 1,103 acres or 2.1% of the City's land base, of which the UW campus makes up more than half (City of Seattle, 2007). Central campus is composed of a mixture of remnant native forest and planted tree species, many of which are historic landmark trees.

Trees go hand in hand with the academic function of the campus by providing educational, recreational and aesthetic benefits to the community. For example, in recent years students created and updated information for a historic 'Brockman Tree Tour' that highlights more than 70 of UW's landmark trees (www.washington.edu/home/treetour/). Other projects recently included a native tree tour and an interactive map of campus trees. In addition to this academic value, trees provide unseen benefits such as carbon sequestration, air quality improvements, stormwater mitigation and energy savings. In multiple ways, trees are essential elements of UW's culture and history, providing both tangible and intangible benefits to the campus community at a relatively low cost to administration.

In order to sustain the value of this dynamic resource, a comprehensive tree program must be practiced that addresses both current and future needs, taking into account input from institutional, professional and community stakeholders. Many barriers to achieving this exist, including a generalized lack of awareness regarding the benefits of trees, limited space for tree-planting that is also over-used, and poor growing conditions. By far, the most limiting factor is securing adequate long-term levels of funding to plant and care for new trees, conduct needed tree inventories and create sustainable tree management plans. Increasingly, managers are challenged with the task of maintaining a viable and sustainable resource with minimal support. Needless to say, urban forest resource professionals often view maintaining sufficient levels of funding as the most important aspect of tree management (Wolf and Kruger, 2010).

This study encompasses three broad elements of sustainable urban forestry as described by Clark, et al, which include the forest resource itself, along with both management and community frameworks (1997). Therefore, the purpose of this assessment is threefold:

- To help protect and preserve UW's urban forest by allowing managers to periodically assess the resource and justify levels of spending.
- To provide baseline data for the creation of a long-term forest management plan that will facilitate the UW's goal of providing a safe, educational, functional and sustainable canopy cover for the campus community and the public.

- To increase awareness and educational opportunities surrounding the benefits of trees on campus and suggest ways to involve the community in designing, managing and monitoring the tree program.

Methods

i-Tree Tools is a suite of state of the art, peer-reviewed software that was developed by the US Forest Service in collaboration with the Davey Tree Expert Co., National Arbor Day Foundation, Society of Municipal Arborists, International Society of Arboriculture and Casey Trees. The software is primarily used to quantify the benefits and costs associated with the urban forest. This study applied benefit estimations calculated by the i-Tree Streets application (formerly STRATUM), which is useful for gaining relevant approximations of dollar values for the tangible benefits that trees provide. A detailed description of how the benefit prices were assigned is explained in the *Western Washington and Oregon Community Tree Guide* produced by the U.S. Forest Service Center for Urban Forest Research (2002).

The estimations in this study are typically only applicable for street trees, however on a university campus setting, the landscape is interspersed with walking paths that resemble streets and buildings that are often located along similar trajectories. As well, aesthetic value is an important factor of campus settings, as evidenced by impeccably maintained central areas with high visibility. For the purposes of this study, it is acceptable that there is a degree of uncertainty that nevertheless provides a starting point from which management decisions can be derived (Maco and McPherson, 2003).

However, for comparison's sake the tree inventory was divided into two zones. The reports for the entire i-Tree study are located in the Appendix. Zone 1 contained all of the trees (4,335) within a 50 foot buffer from the centerline of UW's major streets and paths, a total of 18.17 linear miles. Zone 2 contained all of the campus trees (4,440) that were located outside of this area. This affected three out of five benefit categories in i-Tree Streets. Firstly, energy benefits were not accounted for in non-street trees, because trees affect energy savings the most when located in close proximity to buildings and other infrastructure. In turn this affected CO_2 benefits in Zone 2; the total net benefits were reduced by the amount of CO_2 avoided due to energy benefits. This also affected avoided pounds of gaseous pollutants when considering air quality benefits; again, Zone 2 tree benefits were removed in order to compensate.

The UW campus tree inventory used in this study was completed over the span of two years from 2006-2008 by UW Grounds Department personnel. ArcGIS was used to calculate several items needed to run the i-Tree Streets software, including the number of linear miles of major streets and pathways on campus, as shown (Figure 1) in pink. Only streets and pathways adjacent to trees were used. ArcGIS was also used to calculate the average width of streets and sidewalks in feet. In order to separate the trees into the two management zones, a 50 foot buffer from the centerline of streets was calculated, shown in blue.

Figure 1: ArcGIS map of campus trees

For a complete explanation of the i-Tree Streets modeling software and the benefit prices used in this study, please refer to the *Western Washington and Oregon Community Tree Guide* (McPherson and others, 2002) and visit the i-Tree website at itreetools.org.

UW's Tree Resource

Trees in the medicinal herb garden

The following section outlines the structure of UW's urban forest in terms of tree numbers, species richness and composition, species importance values, stocking level, relative age distribution, replacement value and canopy cover. Base UW campus information from fiscal year 2009 was used as below:

UW Campus Information

Total UW Annual Budget	3,292,790,000
Total UW Population	64,884
Total Area (sq miles)	1.0047
Avg Sidewalk Width (ft)	4.71
Total Street Length (mi)	18.17
Avg Street Width (ft)	29.86

Tree Numbers

Broadleaf deciduous trees formed the backbone of trees on campus, at 65.7% of the total population. Of these, 2,487 were large stature trees. These trees provide essential shading in the summer that allows for increased comfort and recreational opportunities for pedestrians while also helping to cool interior spaces. Deciduous trees are especially valuable in the Pacific Northwest climate of cool, extended winters with very little sunlight. It may be argued that the small amount of extra light permitted through the branches of deciduous trees matters little due to the overcast nature of Seattle. However, solar access in the winter, particularly to the south, can account for up to one third of a building's heat source (Heisler, 1986).

Coniferous trees accounted for 30.5% of the population; almost all of them (2,047 trees) were large stature trees. The ratio of large stature coniferous trees to large stature broadleaf deciduous trees was nearly equal. Half of all trees on campus were of large stature, while trees of small and medium stature accounted for 23.5% and 23.8% respectively. Because larger trees are associated with higher benefits, one future management goal may be to increase the overall percentage of large stature trees on campus.

Table 1: Tree Type and DBH Class Diversity on UW Campus

	DBH Class			
Tree Type	Small	Medium	Large	% of total
Broadleaf deciduous	1692	1585	2487	65.7
Broadleaf evergreen	86	155	87	3.7
Coniferous	283	350	2047	30.5
Palm	1	2	0	0.0
% of total	23.5	23.8	52.7	100.0

Species Richness and Composition

Overall tree diversity on campus was extremely high; there were 370 distinct species and cultivars. This is notable considering that the average number of street tree species across 22 American cities was found to be only 53 in 1989 (McPherson and Rowntree). In 2008 the UW Seattle campus tree population was dominated by *Pseudotsuga menziesii* and *Acer macrophyllum*, at 4.8% and 4.3% respectively. The replacement cost of these trees was estimated at roughly 3.6 million and 3.8 million US dollars.

The top 15 occurring tree species comprised only 37.6% of the total population; in fact, no single species accounted for greater than 5% (see Figure 10). This representation is excellent in light of the commonly accepted ideal that no single species should make up more than 10% of a population (Clark et al, 1997). No single genus made up over 20% of the total. The genus *Acer* accounted for 12.2%, followed by *Pinus* at 5.6% and *Quercus* at 3.6%. These low percentages are good indicators of urban forest health. A large part of urban forest best management practices should include measures to limit over-dependence on any single species or genus, native or non-native, due to the risk of catastrophic loss caused by pests and/or disease.

However, because the UW campus is a small community contained within the larger context of Greater Seattle, it is also worthwhile to compare its tree structure with Seattle's. As a whole, Seattle may be concerned about the dominance of the genera *Prunus* and *Acer*, at 24% and 18% respectively (City of Seattle, 2007). UW's inventory shows the greatest reliance on the genus *Acer*, at 12%. Because Maples tend to have large canopies they also provide considerable benefits. New plantings should replace aging Maples but also take into account the need for protection against over reliance on any single genus.

Table 2: Diversity of Genera in Seattle vs. on UW Campus

Seattle Street Tree Genera- 2006

Genera	Common Name	Percent
Prunus	Cherry	24%
Acer	Maple	18%
Crataegus	Hawthorn	7%
Malus	Apple	6%
Quercus	Oak	4%
Fraxinus	Ash	4%
Tilia	Linden	4%

UW Campus Tree Genera- 2008

Genera	Common Name	Percent
Acer	Maple	12%
Pinus	Pine	6%
Quercus	Oak	4%
Platanus	Sycamore	2%
Ulmus	Elm	1%
Prunus	Cherry	1%

Street trees were dominated by *Acer macrophyllum* (4.5%), followed by *Pseudotsuga menziesii* (3.3%), while the reverse was true for non-street trees, which were dominated by *Pseudotsuga menziesii* (6.2%) followed by *Acer macrophyllum* (4.2%). Big leaf maple is not usually selected for use as a street tree, both because of its shorter life expectancy as well as its sprawling nature, so the ones used as street trees were most likely remnant forest. In this study, data were not available on location of sidewalk heaving and other infrastructural damage, but would be useful to look at in future studies. Tree condition ratings were also unavailable.

Species Importance Values

The significance of any given species is often measured by assigning importance values (IVs) that (theoretically) rate trees from 0 to 100 based on their functional capacities to provide benefits. The i-Tree Streets software derives IVs from three percentages for each species, each indicating a distinct value or benefit. These three factors are percent total population, percent total leaf area and percent total canopy cover. However, IVs should only be used as guidelines because they do not take into account other factors which may also be significant; for example, adaptive traits and invasive potential.

Table 3: Importance values for 15 Most Abundant Trees

Ideally, importance values should be evenly distributed, especially among the 15 most abundant species. The 2008 inventory suggests that over reliance may occur in the top two species: *Pseudotsuga menziesii* (IV 7.0) and *Acer macrophyllum* (IV 7.5). These two species have IVs that are over two points higher than their population numbers. This suggests that their importance as a whole is more significant than their population numbers. Other species that have higher IV's than population numbers include *Chamaecyparis lawsoniana* (IV 3.3), *Thuja plicata* (IV 3.4), *Quercus rubra* (IV 3.3), *Cedrus deodara* (IV 3.8), and *Platanus x acerifolia* (IV 3.4). In

general, large stature broadleaf deciduous trees have the greatest IVs because they have the most leaf surface area and the largest canopies. In this analysis we see that several large stature coniferous trees also have high IVs. *Cedrus deodara* has an IV more than double its population numbers. The impact of removing any of these trees from the landscape would be severe, and new plantings must balance the need for high IV with the need for both species diversity and age class diversity.

Stocking Level

Stocking level is determined by adding all of the vacant sites available for planting and calculating how many trees could theoretically fit into the space. Although the information on availability of planting sites does not exist yet for UW campus, estimations can still be made based on number of street trees per linear mile and total number of trees per capita.

Assuming there is room for one street tree every 50 feet along both sides of a street, theoretically 211 street trees could occupy one linear mile. In this study, only major roads and pathways were measured for a total of 18.17 linear miles, or approximately 239 trees per linear mile based on the count of 4,335 street trees. This number included all trees within the 50 foot buffer from the street centerline, regardless of how much of the tree's diameter was within the boundary. Since the average street width was approximately 30 feet, this number would typically include trees 35 feet out from both sides of the street edge. This indicates that there may be some additional space left to plant trees along streets, but the stocking level of street trees on campus was over 100%. If major pathways were removed such as the Burke-Gilman trail, which is densely surrounded by trees, this percentage may drop considerably.

With a combined total of 64,884 students, staff and faculty, there was one tree for approximately every seven people typically on campus. This was well below the national average of 2.7 trees per capita for 22 U.S. cities as described by McPherson and Rowntree (1989). An additional 24,000 trees would need to be planted on campus in order to reach this average.

Relative Age Distribution

In order to maintain a tree resource that provides continuous benefits over time and space, it has been recommended that age distribution be weighted more heavily in the younger classes with decreasing numbers in aging classes regardless of tree species/stature (Richards, 1982/83). This distribution helps offset high mortality rates of younger trees and balance higher maintenance costs of aging trees. More recent recommendations focus on species-specific "relative dbh" values. Relative dbh is the "ratio between a tree's measured dbh and the maximum dbh for its species" (Kenney et al. 2011). The i-Tree Streets software does not yet account for this new recommendation.

Over the entire campus, 32% of trees were within the young class, 30% were established, 27% were mature, and 11% were aging. Because 30% of trees on campus were within the 6-12 inch dbh class, this suggests a transition away from dominance in the young class towards the mature and aging classes. The expected shortage in younger trees should be addressed with new plantings now, especially for trees with high IVs, in order to offset age-related mortality and reduce overall maintenance costs. Of the top ten occurring species of trees with high importance values, five species had inadequate numbers in the 0-6 inch DBH class: *Pseudotsuga menziesii* (18%), *Acer macrophyllum* (6%), *Chamaecyparis lawsoniana* (18%), *Thuja plicata* (18%), and *Quercus rubra* (19%). Of the remaining most abundant species, *Pinus sylvestris* (14%) and *Gleditsia triacanthos* (13%) had low representation.

Zone 1 (street trees) and Zone 2 (other campus trees) had similar breakdowns. Street trees slightly outnumbered other campus trees in both the mature and aging DBH classes. However, in the 0-6 inch DBH class, the reverse was true. This could be because there are fewer plantable spaces along streets. Also, street trees included species with high importance values that had inadequate representation in the smaller DBH classes, such as *Cedrus deodara* (1.62%), *Quercus palustris* (10.4%), *Plantanus x acerifolia* (5.83%) and *Pseudotsuga menziesii* (4.14%). Again, this should be addressed now before a large population of aging trees becomes a burden.

Table 4: Relative Age Distribution of Top 10 Tree Species and DBH Classes (%)

	% DBH Class (in)			
Species	0-6	6-12	12-24	24+
Pseudotsuga menziesii	18.25	12.09	42.66	27
Acer macrophyllum	6.31	20.53	39.47	33.69
Chamaecyparis lawsoniana	17.54	35.09	41.4	5.96
Thuja plicata	18.45	33.95	36.9	10.7
Acer circinatum	59.39	28.74	11.11	0.77
Pinus sylvestris	14.36	51.98	32.67	0.99
Liriodendron tulipifera	34.01	44.16	19.8	2.04
Carpinus betula 'Fastigata'	36.63	30.81	23.84	8.72
Quercus rubra	18.6	36.05	29.66	15.69
Gleditsia triacanthos	13.94	58.18	27.88	0
Campus total	32.1	29.75	26.74	11.41
"Ideal" distribution	40	25	25	10
Difference	7.9	4.75	1.74	1.41

Figure 2: Relative Age Distribution of Top 10 Tree Species (%)

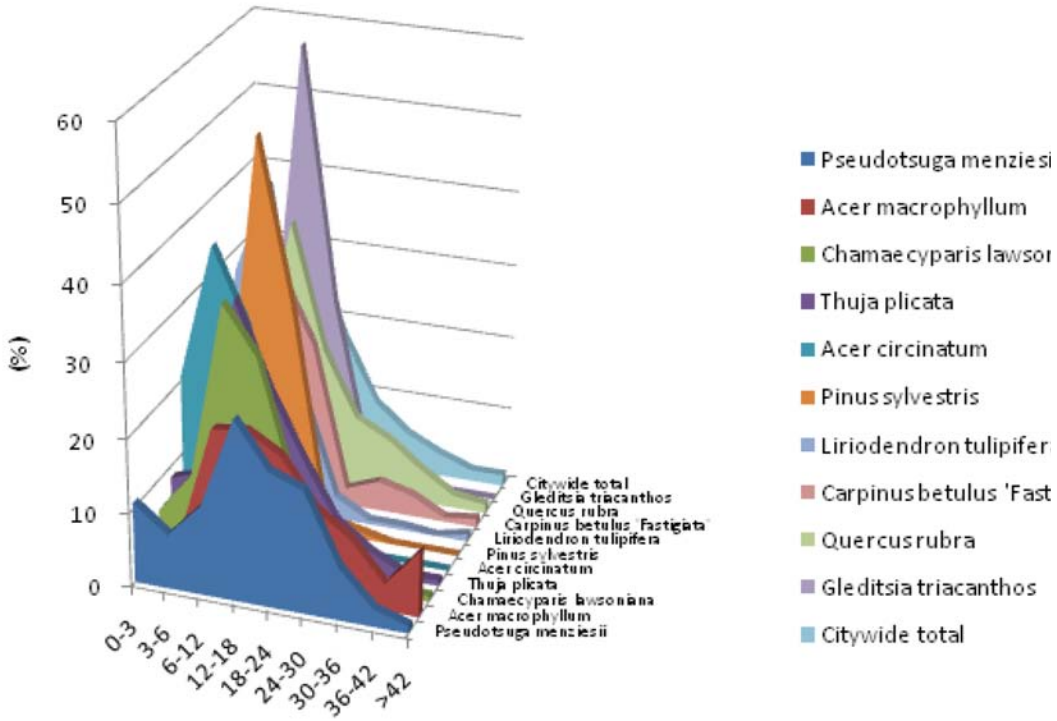


Figure 3: Relative Age Distribution for All Zones (%)

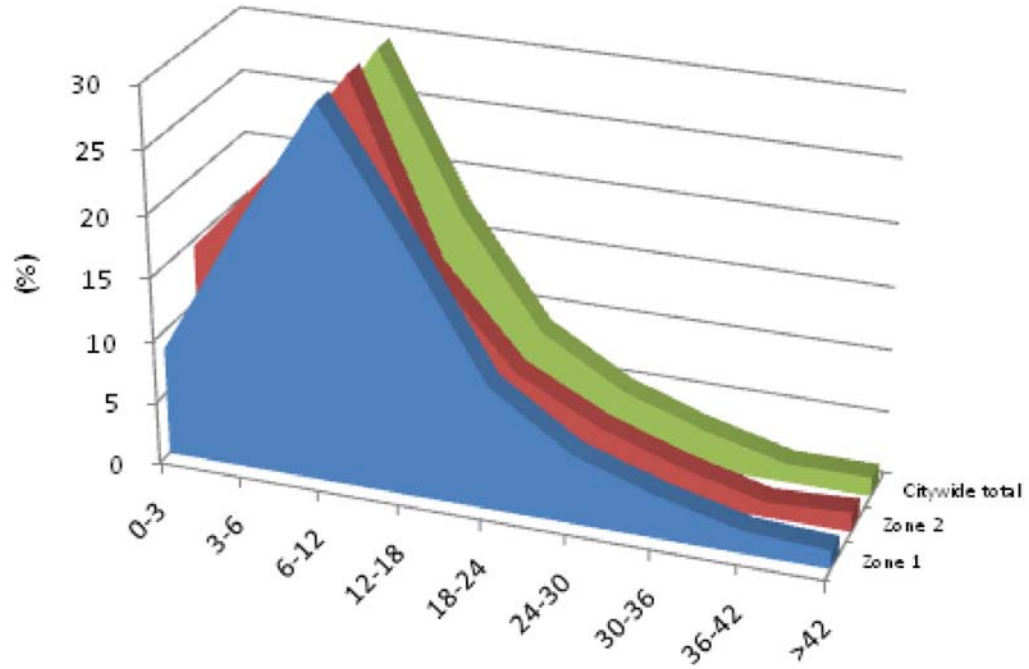


Figure 4: Relative Age Distribution for Zone 1 (Street Trees) (%)

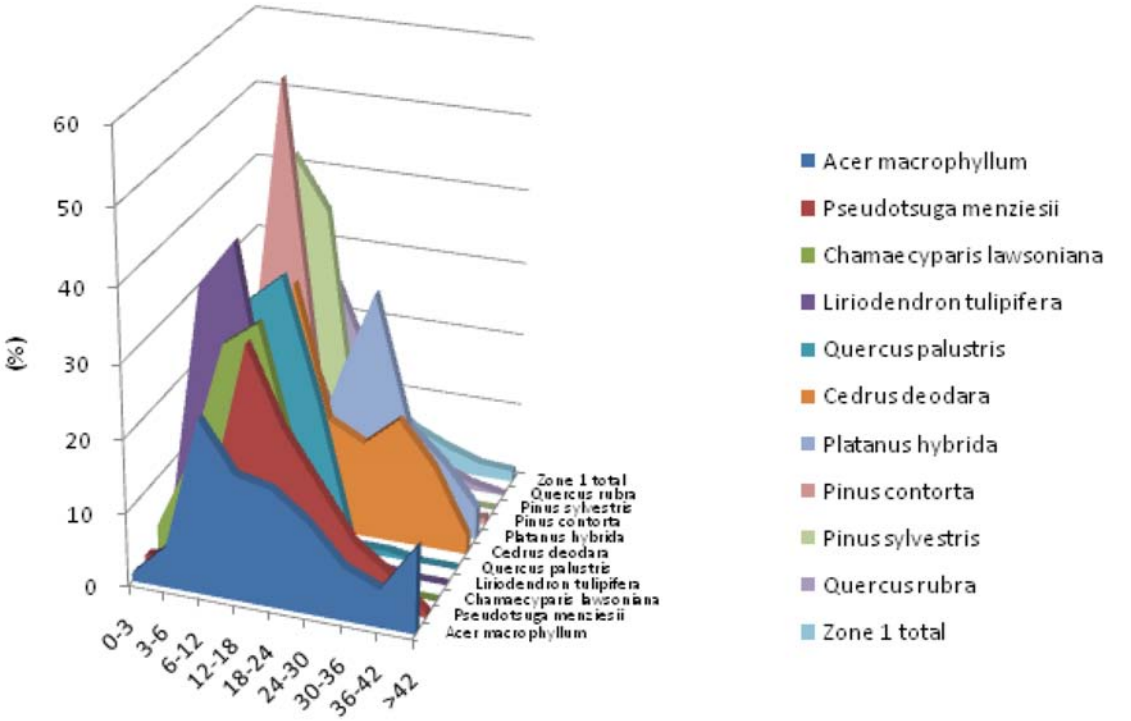
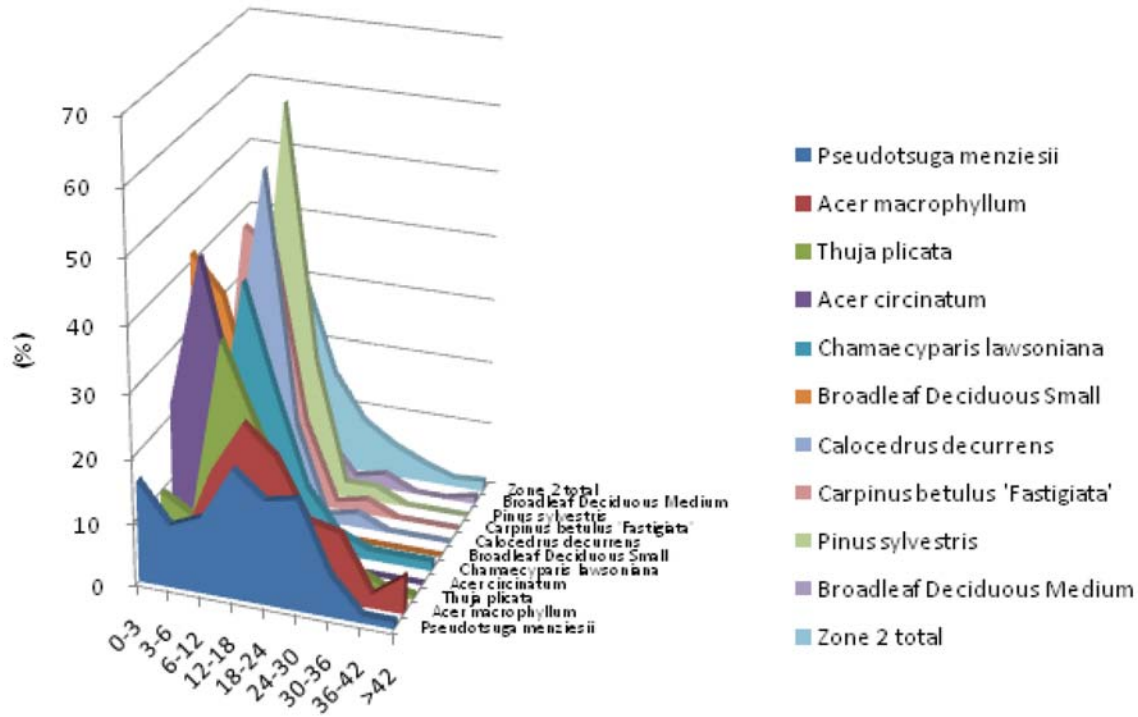


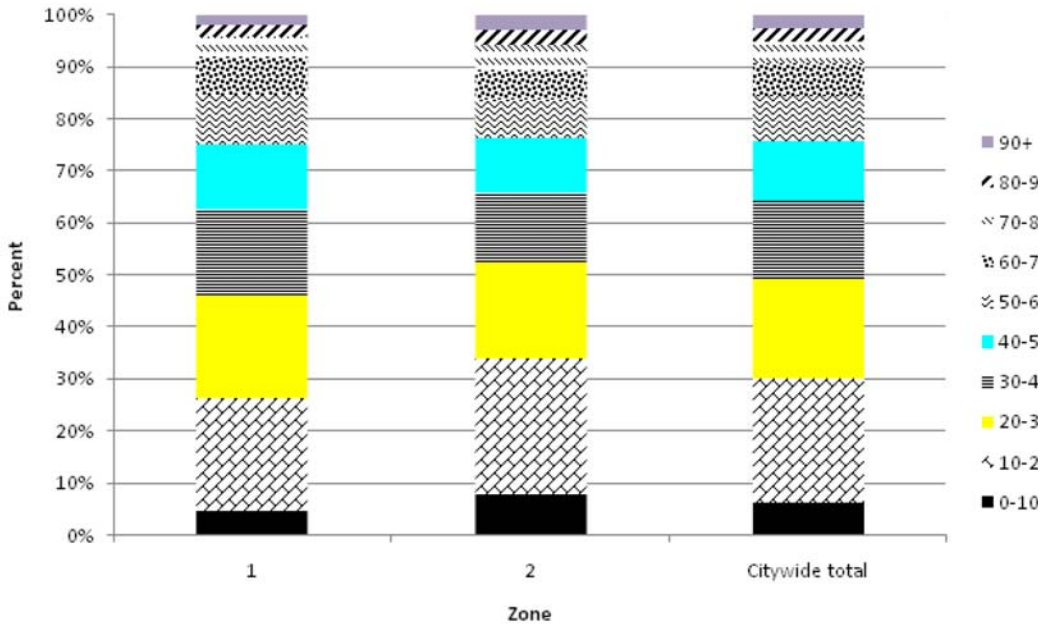
Figure 5: Relative Age Distribution for Zone 2 (Non-Street Trees) (%)



Height Class

Height class was an optional input for i-Tree Streets; seen here, it roughly mirrors the relative age distribution across campus.

Figure 6: Tree Height Class for All Zones (%)



Height Class for UW Campus Trees by Zone (%)

Zone	0-20'	20-40'	40-60'	60-80'	80-100'
Zone 1	26.4	36.2	22.2	11.0	4.1
Zone 2	34.0	31.8	18.0	10.3	5.9
Campus Total	30.2	34.0	20.1	10.7	5.0

Replacement Value

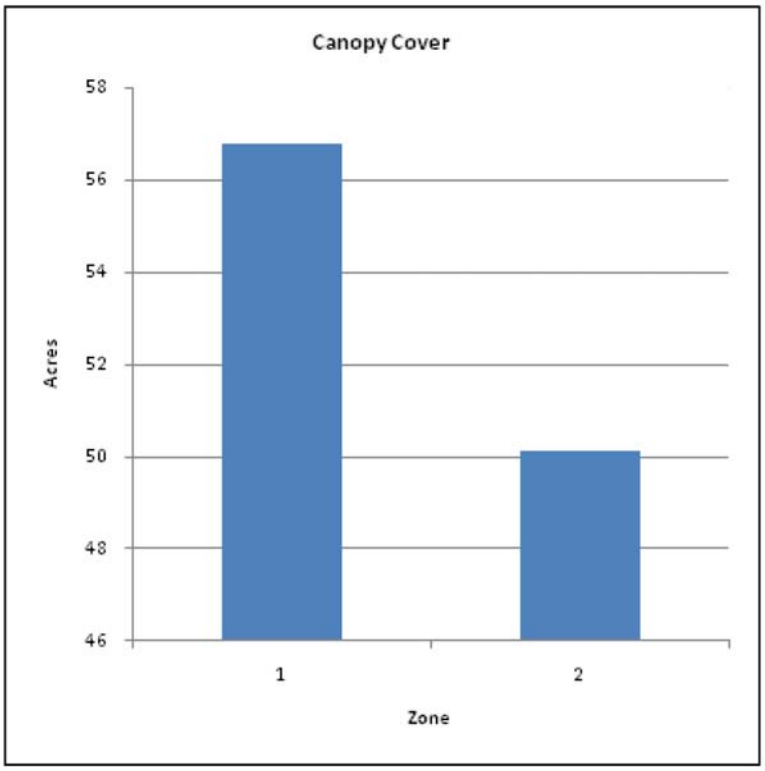
The i-Tree Streets software uses the cost approach to estimate the value of a tree, which assumes that a tree will be replaced with another tree in the same condition (Cullen, 2002). In 2008, UW Seattle campus trees were an asset that would cost approximately $39 million to replace with trees of similar species and size. The replacement value of street trees was $21 million and non-street trees was $18 million. *Pseudotsuga menziesii* and *Acer macrophyllum* alone accounted for nearly 20% of this value. *Cedrus deodara*, *Platanus x acerifolia*, *Thuja plicata* and *Chamaecyparis lawsoniana* combined accounted for 18.25% of the total value. Replacement value generally increases over time, assuming that proper care and maintenance of trees is practiced.

Canopy Cover

Canopy coverage in urban areas is especially important for reducing urban heat islands, saving energy spent on summer air conditioning, reducing maintenance of impervious surfaces by intercepting solar radiation, filtering pollutants and mitigating stormwater. The UW campus had an estimated total of 107 acres of canopy cover in 2008. Of that, street trees covered 57 acres and the remaining trees covered 50 acres. Assuming that the total street and sidewalk area covered 87 acres, the percentage of streets and sidewalks with tree canopy coverage was estimated at 65.5%. The remaining 557 acres, however, only received 9% canopy coverage. This underscores the need for more trees on campus.

The City of Seattle currently enjoys canopy coverage of 23%. Based on its Urban Forest Management Plan of 2007, its 30 year goal is to increase the canopy cover by 7%. This would entail increasing the amount of canopy cover on 'Institutional' land designations from 15% to 20% by planting an additional 5,000 trees. Currently, data do not exist for what percent of UW campus is available for planting. The i-Tree Streets software estimated the UW's total canopy cover at 16.63%, so increasing the coverage to 20% would entail a 3.37% increase by the year 2037, or planting 2,957 new trees. If UW campus has more usable planting spaces and aims to raise the canopy cover to 30%, 11,732 new trees would need to be planted. These estimates do not take into account trees that will die and need replacements.

Figure 7: Canopy Cover of UW Trees (acres)



Zone	Acres	% of Total Canopy Cover
1	57	53.1
2	50	46.9
Campuswide total	107	100.0

	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Campuswide total	643	87	107	16.63	123.61

Cost of Managing UW's Urban Forest

Seedling planted by UW Restoration Ecology Network student volunteers in Whitman Court

As previously mentioned, budget issues are perceived as the greatest threat to realizing healthy, sustainable urban forests. The following section will discuss UW's investment in its tree resource for the fiscal year of 2009, as well as compare it to 9 other benchmark universities and schools (see Table 5). These benchmark communities were chosen based on participation in the National Arbor Day Foundation's Tree Campus USA program, as well as for diversity in size and location. While information was not available for number of existing trees on each campus, the amount of spending per full-time student was calculated, along with total amount spent on trees as dollar value and percent of total operating budget. Similarly, a comparison will be drawn from the City of Seattle tree care budget, based on Seattle's 2010 Tree City USA budget information.

For fiscal year 2009, the UW spent a total of $256,100 on its tree program, or eight thousandths of one percent (0.008%) of the entire University operating budget of 3.29 billion dollars. For each of its 42,907 full-time students, this equaled $5.97 per capita, or $3.94 including 21,977 faculty and staff. Similarly, for each of its 8,775 trees, this equaled $29.19 per tree. Out of all nine benchmark schools and Universities, UW ranked the second lowest for spending per capita; only the University of Michigan spent less. This number included two schools with annual operating budgets of only 20 million (Columbia Basin College) and 275 million (Georgia Tech). This analysis reveals that the UW substantially lagged behind its peers in a number of categories. The three areas that spending on tree care usually fall into are tree planting and establishment, tree maintenance and tree administration. These costs will be looked at more closely below.

Additionally, UW lagged behind the City of Seattle in terms of its tree care investment. Seattle's budget for tree care was 12 hundredths of one percent (0.12%) of the total 2010 operating budget of 3.9 billion, nearly double UW's investment. Instead of $3.94 per capita, Seattle spent $7.86 per capita on tree care. If UW doubled its tree care budget to $512,000 annually, per capita spending would increase to $7.89. That being said, per tree spending tells a different story. While the UW invested $29.18 per tree, the City of Seattle only spent $3.47 per tree. This reflects UW's lower canopy cover (16.63%) relative to its size. Only the campus Grounds department had a tree budget at the University; in contrast, the City of Seattle's tree care budget was spread out between five different departments: Parks and Recreation, City Light, Department of Transportation, Office of Sustainability and Department of Neighborhoods.

Tree Planting and Establishment

Funding for tree purchase, planting and establishment is critical to maintain adequate numbers of trees to replace aging and dying trees, yet in fiscal year 2009 the UW only invested $12,000 for this purpose. According to the 2009 Council of Landscape Tree Appraisal handbook, the trunk formula method indicates that it costs approximately $500 to purchase, plant and provide care for one tree until establishment. Following this method suggests that 24 trees

could have been planted with $12,000; however, it was reported that only 15 trees were planted in response to 15 tree removals (UW, 2009). Planting only one tree per tree removal is inadequate because of high mortality rates associated with young trees. Moreover, new tree plantings should be regularly undertaken as part of a strategic plan to increase and essentially restore canopy cover on campus (on a space-available basis).

Volunteers play a significant role in tree planting at UW. For example, under the oversight of the UW Landscape Architect, students involved with the Society for Ecological Restoration regularly remove invasive species and plant donated native tree species to replace them in a selected area of Whitman Court (Wick, 2011). However, these trees have high mortality rates because there is no budget to care for them after they are planted until they are established. If the UW supported these trees at the minimum level by providing water for the trees, it would save time and money in the long run on top of the extra benefits the trees would provide.

Another example of community participation is from the fall of 2009, when a wide mixture of students, staff and faculty from varying departments volunteered in a planting effort in recognition of the UW's Tree Campus USA designation. The trees for this event were donated by Toyota. Volunteers were also utilized after the event to assist with tree establishment, for example by administering light pruning and dry water treatments. In total, volunteers donated $8,100 of their time in fiscal year 2009.

Tree Maintenance

In general, most maintenance costs involved in a tree care program typically revolve around cyclical pruning and tree removals. However, it was difficult to capture the cost of these activities accurately in the higher educational institutions examined here, as reflected in the budget comparisons of nine benchmark schools. Only three schools allocated funds to maintenance and removal. All of those schools had correspondingly smaller program administration costs. Out of all nine schools, only the University of Michigan did not have a budget for tree care staff. UW was one of three other schools that had a budget for contract work. Contract work usually includes removals and costs associated with litigation or infrastructure repair.

Tree Administration

Costs of administering UW's campus trees are the highest in its tree program, but also include equipment and supplies. Combined, this equaled $224,000 for UW in fiscal year 2009, or 87.5% of the total tree budget, minus maintenance and removal costs. The number of staff per school was not available, but would be useful to look at in further studies; specifically, the composition and allocation of salaries could be considered. In future budgeting, the University should examine this category more thoroughly in order to determine and record where money is actually spent.

Additional Tree-Related Expenditures

In this study, additional tree-related expenditures mainly refer to scheduled costs such as inventory and analysis, tree planting and establishment, events and memberships. Normally this category would also include expenditures such as litigation costs and infrastructure repair, but those are categorized here under maintenance costs. The UW was one of four other schools with no budget allocated for this category. Establishing a budget for this should be considered extremely important for the vision and future of trees on UW campus. At the very least, a budget for needed tree inventory and analysis should be added; without this, there is no effective way to strategically manage the urban forest.

Table 5

Tree Campus USA Budget Comparison: Fiscal Year 2009

Sorted by Total University Operating Budget

School Name	Tree Purchase	Equipment	Supplies	Maintenance & Removal	Staff & Admin	Contract Work	Volunteers ($18/hr)	Other Costs	Total Annual Tree Budget	Number of FT Students	$ per Student	Total University Operating Budget	% Total Budget	Square Miles
Columbia Basin College	$10,000	$42,980			$131,500		$18,000	$2,200	$204,680	$6,000	$34.11	$20,000,000	1.023%	0.23
Georgia Tech	$19,000	$195,481	$7,500		$138,518	$18,590	$27,000	$37,500	$443,589	$20,291	$21.86	$275,000,000	0.161%	0.63
University of Michigan	$20,000	$10,000	$10,000			$10,000			$50,000	$41,674	$1.20	$1,347,661,268	0.004%	4.96
University of Iowa	$25,000	$32,332			$232,973	$13,431	$1,728		$305,464	$30,328	$10.07	$2,466,082,688	0.012%	2.96
University of CA San Diego	$3,333	$3,333	$3,333	$138,217	$138,217		$1,080	$138,217	$425,730	$28,000	$15.20	$2,500,000,000	0.017%	1.87
Indiana University	$16,921	$16,921			$219,049			$16,921	$269,812	$42,347	$6.37	$2,917,579,328	0.009%	3.02
Cornell University	$12,667	$12,666	$12,666	$39,667	$39,667		$10,080	$39,667	$167,080	$19,639	$8.51	$2,944,000,000	0.006%	1.16
University of CA Davis	$32,000				$225,000				$257,000	$32,153	$7.99	$3,000,000,000	0.009%	8.28
University of Washington	$12,000	$12,000	$12,000		$200,000	$12,000	$8,100		$256,100	$42,907	$5.97	$3,292,790,000	0.008%	1.00
University of Pennsylvania	$41,100	$41,100	$41,100	$65,000	$65,000			$65,000	$318,300	$20,128	$15.81	$3,900,000,000	0.008%	1.55

Benefit Information

Quercus palustris, UW's most "aesthetically valuable" tree (See Appendix pg. 1)

Energy

Trees are associated with modifying climate and conserving energy in three ways:

- Trees cool interior spaces in the summer by shading, and protect other built surfaces by reducing the amount of direct solar energy stored and absorbed (McPherson and others, 2002).
- The solar energy that trees use in transpiration converts moisture to water vapor, thus cooling the surrounding air. In the built environment, trees and other vegetation may cool the air as much as 8 degrees F as compared to areas with little to no canopy (Akbari, 1992).
- Trees conserve an average of 40% indoor heat in the winter by reducing air speed and resulting infiltration through cracks and windows (Heisler, 1986).

In total, the Energy benefits from UW campus street trees alone provided $14,392 in retail savings annually as a result of both shading and climate effects. The savings per tree was $3.32 and per capita was $0.22. Overall, regardless of zone, trees with the greatest leaf surface area provided the greatest per tree energy benefits. The top species that saved the most energy in this study are in the table below. All of these trees made up more than 2% of the street tree population in Zone 1 (street trees), except for *Populus sp.*, which was 1.5%.

Table 6: Top Energy Saving Tree Species (Partially Adjusted for Zone)

CO_2

Trees reduce atmospheric carbon dioxide (CO_2) by sequestering carbon in their stems and leaves as they are growing. The amount of carbon sequestered varies greatly by species (size at maturity, life span and growth rate) (Nowak et al, 2002) . Trees also help conserve the use of carbon by offsetting heating and cooling needs. However, when trees die and decompose or their limbs are removed during maintenance activities, CO_2 is released back into the atmosphere. Also, whenever gas-powered equipment is used to manage trees CO_2 is released.

UW campus trees directly sequestered 1.8 million pounds of carbon annually and indirectly reduced carbon emissions by a total of 341,390 pounds. This is equal to driving a car that gets 20 miles per gallon at 60 miles per hour for 36,794 hours, or 632 cars driving for one hour (EPA, 2005). In this analysis, the total annual CO_2 benefits of all campus trees equaled $6,347. This total accounts for the amount of CO_2 avoided in Zone 2 by taking the estimated benefit of it ($992) out of the equation. Overall, the top five species that contributed the most to CO_2 benefits on campus, not taking into account any difference in Zone 2, were (in descending order):

- *Acer macrophyllum* ($619 per tree)
- *Pseudotsuga menziesii* ($389 per tree)
- *Cedrus deodara* ($294 per tree)
- *Platanus x acerifolia* ($275 per tree)
- *Quercus rubra* ($247 per tree)

Table 7: Annual Net CO_2 Reductions of UW Campus Trees by Zone

Zone	Sequestered	Total Released	Avoided	Total	% Total	Avg $/Tree
Zone 1	$3,088	-$333	$1,127	$3,881	49.40%	$0.90
Zone 2	$2,761	-$295	N/A	$2,466	50.60%	$0.56
Campus Total	$5,849	-$628	$1,127	$6,347	100%	$0.72

Stormwater

In the Pacific Northwest, urban stormwater runoff is a major concern for endangered populations of salmon. Trees mitigate the amounts of pollutants and runoff entering riparian areas through intercepting rainfall in their leaves and branches, which also acts to reduce soil erosion, and by absorbing rainfall through their roots.

UW campus trees intercepted approximately 8 million gallons of stormwater annually for an average of 906 gallons per tree. This translated to a total value to the UW campus community of $220,448 annually or $25.12 per tree. *Pseudotsuga menziesii* accounted for 10.5% of the total benefit, followed closely by *Acer macrophyllum* (8.0%), and *Cedrus deodara* (6.3%). On a per tree basis, *Cedrus deodara* was the top performer at $88.03/tree. In the case of stormwater interception, coniferous trees may provide greater benefits in the Pacific Northwest because they retain more above ground biomass during our wet winters than broadleaf deciduous trees.

Table 8: Annual Stormwater Reduction Benefits of UW Campus Trees by Zone

Zone	Total (Gal)	Total ($)	% Total Trees	Avg $/Tree
Zone 1	4,198,981	116,320	49.4	26.83
Zone 2	3,758,876	104,128	50.6	23.45
Campus Total	7,957,858	220,448	100	25.12

Aesthetics and Other Benefits

Aesthetic value provides the greatest dollar value of trees because beauty is associated with a significant rise in property value; in addition, having a diverse array of well cared for trees on campus is critical to the academic function of the University in maintaining a high public profile. For this reason, all of the trees in this study are accounted for in calculating the aesthetic value on campus.

Besides aesthetics, trees provide other benefits that a dollar value is not as easily attributed to. These other benefits range from social and psychological benefits, to improvements in human health, reduction of noise levels, job opportunities and wildlife habitat. Trees on campus act as buffers from surrounding urban areas. They allow opportunities for recreation and relaxation while also improving job satisfaction for UW employees and lessening mental fatigue of students (Kaplan & Kaplan, 1989). Trees also provide educational opportunities for students across a broad variety of departments ranging from social science to engineering.

In sum, UW campus trees provided $486,320 in annual benefits, or an average of $55.42 per tree. The tree with the highest value of $138.99 per tree was *Quercus palustris*, followed by *Quercus rubra* ($122.20 per tree) and *Cedrus deodara* ($91.01 per tree). In general, aesthetic value increases with leaf surface area per annum.

Table 9: Annual Aesthetic/Other Benefits of UW Campus Trees

Species	Total ($)	% Total Trees	Avg $/Tree
Quercus palustris	19,875	1.6	138.99
Quercus rubra	21,018	2.0	122.20
Cedrus deodara	14,289	1.8	91.01
Platanus x acerifolia	11,884	1.7	79.76
Pseudotsuga menziesii	33,230	4.8	78.74
Populus sp.	7,101	1.1	73.96
Acer macrophyllum	27,936	4.8	78.74
Thuja plicata	19,186	3.1	70.80
Chamaecyparis lawsoniana	20,049	3.3	70.35
Acer platanoides	7,354	1.2	70.04
Campus Total	486,320	100.0	55.42

Air Quality

According to the American Lung Association's annual *State of the Air* report for 2011, Seattle ranked 18th most polluted U.S. city for short-term particle pollution, which has been linked to illness, hospitalization and premature death in both adults and children (American Lung Association, 2011). Trees on campus intercepted approximately 1,119 pounds of particulate matter in 2008. Trees on campus also absorbed other gaseous pollutants, including nitrous

oxide, volatile organic compounds and sulfur dioxide, for a total dollar benefit of $4,752. *Pseudotsuga menziesii*, *Acer macrophyllum* and *Cedrus deodara* alone intercepted nearly half a ton of particulate matter annually. In all, campus trees intercepted or absorbed approximately two tons of particulate matter and gaseous pollutants per year.

Returning to energy savings, the trees in Zone 1 (street trees) also helped reduce the amount of air pollutant emissions released through the avoided use of heating and cooling. This amounted to 2.9 tons of particulate matter and gaseous pollutants that were not released into the atmosphere, for a dollar value of $6,197 annually.

Less significantly, trees on campus had a detrimental effect by releasing biogenic volatile compounds (BVOCs). BVOCs are composed of isoprene and monoterpenes that indirectly contribute to climate change and ozone formation in the troposphere (Owen et al., 2003). In Zones 1 and 2, the total BVOC dollar value released by trees was -$2,072. The top four heaviest emitters were *Pseudotsuga menziesii* (896.2 lbs), *Cedrus deodara* (546.6 lbs), *Thuja plicata* (375 lbs) and *Chamaecyparis lawsoniana* (350.1 lbs). Per tree, BVOC emissions totaled -$0.24 or 0.67 pounds annually.

Net air quality improvements equaled approximately $8,878 dollars per year or $1.01 per tree. This figure subtracts the value of avoided emissions from trees in Zone 2. Per tree, the top three producers of net air quality benefits were *Platanus x acerifolia* ($3.88), *Cedrus deodara* ($3.74) and *Acer macrophyllum* ($3.32).

Table 10: Annual Air Quality Benefits of UW Campus Trees by Zone

Zone	Total Absorbed	Total Avoided	Total BVOC	Total	Avg $/Tree
Zone 1	$2,497	$6,197	-$1,067	$7,627	$1.76
Zone 2	$2,255	N/A	-$1,004	$1,251	$0.28
Campus Total	$4,752	$6,197	-$2,072	$8,878	$1.01

Net Benefits and Benefit-Cost Ratio (BCR)

UW received $736,385 in total annual benefits from its campus trees. Of this amount, 34.5% were environmental benefits and 65.5% were aesthetic and other intangible benefits. On the other hand, the cost to manage UW's trees was $256,100 per year in 2009. Therefore, the annual net benefit of UW's trees was $480,285. The benefit-cost ratio of UW's tree resource, expressed in monetary value, was 2.9:1, meaning that for every $1 UW spent on its tree resource, the trees returned $2.90 in benefits to the UW campus community. Because the total campus population including staff, faculty and students was 64,884 in 2011, trees accordingly produced $7.40 in benefits per person.

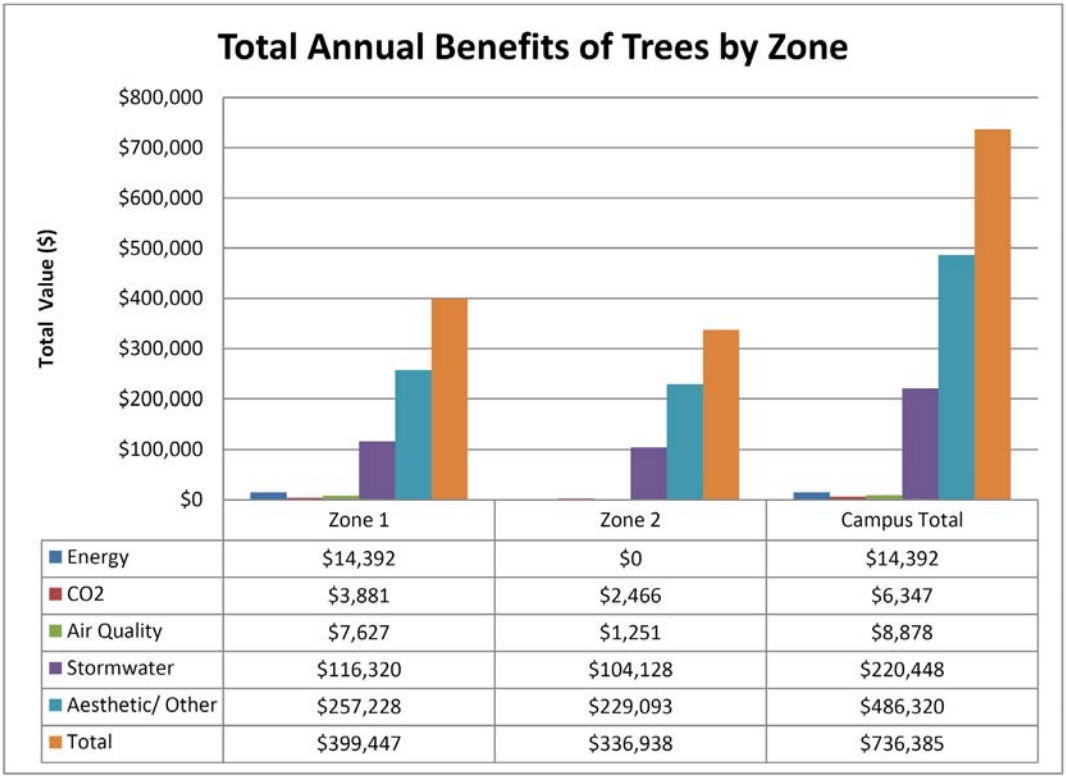
Table 11: Benefit-Cost Summary of UW Campus Trees (Adjusted)

Benefits	Total ($)	$/Tree	$/Capita
Energy	14,392	3.32	0.22
CO2	6,347	0.72	0.10
Air Quality	8,878	1.01	0.14
Stormwater	220,448	25.12	3.40
Aesthetic/Other	486,320	55.42	7.50
Total Benefits	736,385	83.92	11.35
Total Costs	256,100	29.19	3.95
Net Benefits	480,285	54.73	7.40
Benefit-Cost Ratio	2.9:1		

Total Annual and Average Annual Benefits

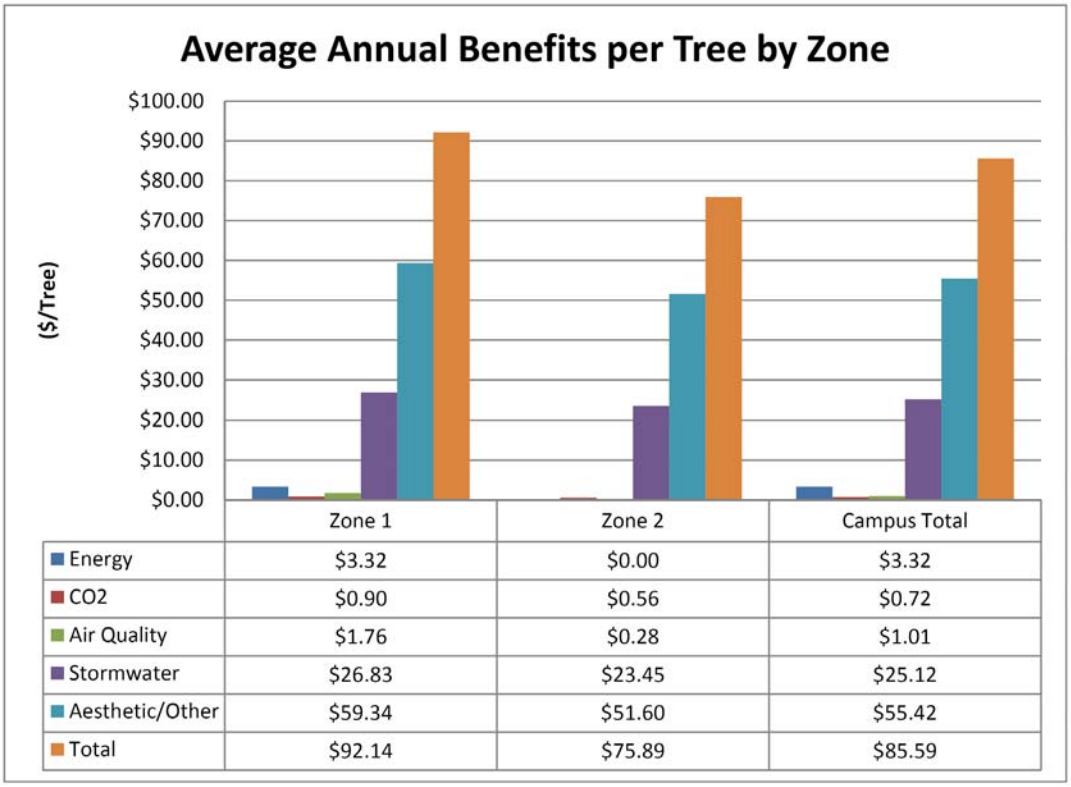
The figures below outline the calculation changes made to the i-Tree reports to account for the supposed difference in Zone 2 tree benefits. The original reports are located in the Appendix. The table below shows the top ten trees on campus that produced the overall highest benefit levels annually.

Figure 8: Total Annual Benefits of UW Trees by Zone



	Zone 1	Zone 2	Campus Total
Energy	$14,392	$0	$14,392
CO2	$3,881	$2,466	$6,347
Air Quality	$7,627	$1,251	$8,878
Stormwater	$116,320	$104,128	$220,448
Aesthetic/ Other	$257,228	$229,093	$486,320
Total	$399,447	$336,938	$736,385

Figure 9: Average Annual Benefits of UW Trees by Zone ($/Tree)



	Zone 1	Zone 2	Campus Total
Energy	$3.32	$0.00	$3.32
CO2	$0.90	$0.56	$0.72
Air Quality	$1.76	$0.28	$1.01
Stormwater	$26.83	$23.45	$25.12
Aesthetic/Other	$59.34	$51.60	$55.42
Total	$92.14	$75.89	$85.59

Table 12: Total Annual Benefits of Top Ten UW Trees by Species (Unadjusted for Zone)

Hypothetical Trees

Assuming the cost of purchasing, planting and caring for one tree until establishment is $500, a one-time cost of $1.5 million is needed in order to increase the canopy to meet the City of Seattle's goal for institutional land categories (20%) by the year 2037, not accounting for inflation.

The benefits of planting the approximately 3,000 new trees needed to reach the City's canopy cover goal would eventually outweigh this cost. A mixture of tree types and statures, weighted more heavily towards large stature trees, were used to model this growth in benefits as the trees gained dbh from 3 inches to 24 inches (see Table 11). Broadleaf deciduous trees were modeled at 60% of the total, followed by broadleaf evergreen trees and coniferous trees each at 20% of the total. Similarly, large stature trees were modeled at 60% of the total, followed by medium and small stature trees each at 20% of the total. At this ratio, 3,000 new trees of 3 inch dbh would provide approximately $89,875 in tangible benefits annually. According to this estimate, the investment would pay for itself in about 17 years. However, from the table below we can see how the growth in trees adds value exponentially. It is probable that the investment would pay for itself in a much shorter time, assuming all 3,000 trees were planted within a few years of each other.

Table 13: Annual and Projected Benefits of 3,000 Hypothetical Trees

Class	Type	# Planted	% Total	3" DBH	6" DBH	12" DBH	24" DBH
Large	BDL	1080	60%	$35,100	$76,874	$124,016	$195,318
Large	BEL	360	20%	$16,326	$23,317	$31,306	$47,635
Large	CEL	360	20%	$15,761	$29,207	$46,494	$78,260
			60%				
Medium	BDM	360	60%	$10,541	$25,488	$42,898	$60,390
Medium	BEM	120	20%	$432	$1,616	$4,640	$4,722
Medium	CEM	120	20%	$611	$1,788	$3,304	$1,121
			20%				
Small	BDS	360	60%	$4,237	$11,380	$23,141	$50,864
Small	BES	120	20%	$3,721	$5,389	$8,203	$14,304
Small	CES	120	20%	$3,146	$5,387	$5,908	$3,588
			20%				
Totals		3000	100%	$89,875	$180,446	$289,909	$456,203
26-Year Benefit				$2,336,750	$4,691,596	$7,537,634	$11,861,278

Management Considerations

A single row of Quercus shumardii in Red Square provides shade on the brick "lawn"

As this study demonstrates, the proper care, maintenance and strategic planting of trees have been characteristically underfunded across many different colleges and universities, despite all evidence indicating more financial investment is needed. Trees have been planted and saved for beauty, shade, recreation, wildlife habitat and educational value throughout the UW's 150 year lifespan. In fact, UW has dedicated nearly a fifth of the total campus land base to this dynamic and valuable resource. This study has shown that trees provide value in a number of tangible ways that are not typically attributed to trees; accordingly, the university should adapt its approach to managing the resource in order to maximize return on investment.

Although this study lacks areas of data, including tree condition ratings and total stocking level information, it provides critical insight into the campus community as a whole, and an opportunity to step back, evaluate and design a comprehensive tree care plan. With both inventory and benefits estimations in hand, the first starting point for protecting the existing canopy and restoring it to increased functional capacity is to identify areas that warrant further consideration. Some areas that stand out for discussion are below. Ultimately, funding for trees must be more than merely adequate; it must allow for managers to make decisions, based on current inventory data, which will ensure benefits will be preserved and increased over time. Only this level of financial dedication will result in a diverse, safe and educational canopy cover.

Stocking Level and Canopy Cover

This study notes that UW campus lags behind national averages for trees per capita by over 4 percentage points. As well, stocking level estimates for non-street trees indicate that there is potentially substantial room for new trees (approximately 503 acres). It should be a priority to determine what percentage of this space is occupied by buildings and other gray infrastructure in order to accurately plan for more trees. In addition, underground utilities and overhead obstructions should be taken into account. A proper tree planting plan should be created utilizing the full extent of logistical space demands beforehand.

With only 9% canopy cover in the non-street areas of campus, trees are not equitably distributed throughout the grounds. Therefore, not all areas receive the same level of benefits. However, the campus also includes many large grassy open areas without any trees, which are considered valuable for the contrast, vistas and gathering spaces they provide. In addition, grasses along with small and medium sized shrubs and understory vegetation are important for wildlife and hydrology. When considering adding more trees on campus, a balance between different vegetation types should be taken into account as well.

Regardless of Zone, UW should set realistic goals for increasing the canopy cover. Since the City of Seattle already has a goal for the year 2037, it makes sense to emulate their goal if not surpass it. Seattle's goal for "Institutional" land categories is 20%; for UW this would require a

3.37% increase. In order to reach this goal, approximately 3,000 new trees would need to be successfully installed. To achieve this with the current level of funding would be difficult and might cost the UW more in the long run due to stretching already thin resources. To remedy the problems of acquiring needed funds in the current economic situation, lower-cost solutions should be explored. For example, volunteers could be more aggressively recruited and utilized. Moreover, UW students could continue to fill more internship and post-graduate opportunities. Grant writing could be accelerated using metrics from this study, as well as new avenues for funding explored. Realizing that all of these methods require significant time and effort, if feasible the Grounds department should consider adding a Volunteer and/or Development Coordinator to its staff. This person would free up the campus Arborist to focus more on tree care while also helping to recruit, train and organize volunteers, research funding opportunities and manage grant proposals, as well as coordinate educational outreach initiatives.

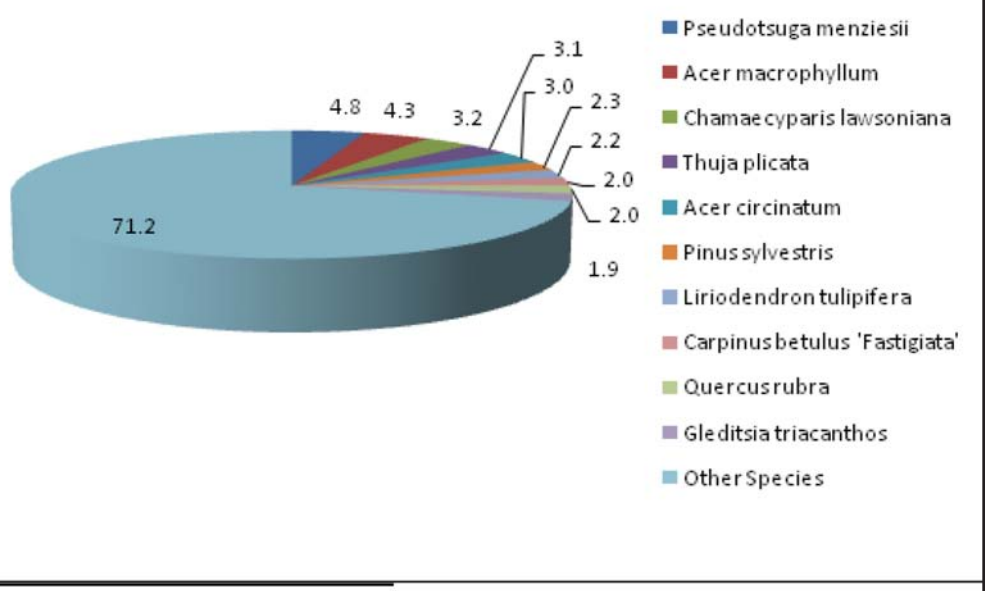
Species Distribution

At the time of this study, the campus enjoyed a wide mixture of over 350 distinct tree species and cultivars. However, species diversity should not be valued solely for its own sake. This is because a successful tree population relies on a multiplicity of factors; instead, species should be selected primarily based on their relative performance and suitability to the site (Richards, 1982/83). One way to measure the appropriateness of the species mix on campus is to calculate the percentage of species that are adapted to the local conditions. By this method an ideal goal to strive for would be if 75-100% of the species present were considered suitable (Kenney, et al. 2011).

The top ten species comprised 28.8% of the entire resource. It is unclear what percent of these trees may have belonged to remnant forest; perhaps the dominance of *Pseudotsuga menziesii* and *Acer macrophyllum* was a by-product of UW's location. In any case, future plantings in excess of replacement should be mindful of the use of these two species in order to guard against catastrophic loss due to pests, disease or extreme weather. The genus *Acer*, which comprises 18% of Seattle's urban forest and 12% of UW's urban forest, should also be used with discretion for the same reasons.

UW should concentrate on planting under-represented species with high performance indexes wherever possible. Identifying which species perform best would require UW to conduct regular tree inventories that capture condition ratings. In lieu of this direct information, McPherson and others compiled a reference list of trees that are suitable for Pacific Northwest urban areas; this list is included in the *Western Washington and Oregon Community Tree Guide* (2002).

Figure 10: Species Distribution of UW Campus Trees



Species	Percent
Pseudotsuga menziesii	4.8
Acer macrophyllum	4.3
Chamaecyparis lawsoniana	3.2
Thuja plicata	3.1
Acer circinatum	3.0
Pinus sylvestris	2.3
Liriodendron tulipifera	2.2
Carpinus betulus 'Fastigiata'	2.0
Quercus rubra	2.0
Gleditsia triacanthos	1.9
Other Species	71.2
Total	100.0

Large-Stature Trees vs. Small-Stature Trees

Identifying which species to plant ultimately relies on a host of factors other than relative performance; most importantly, these include soil characteristics, microclimate, site design and infrastructure locations. In recent decades, cities have begun to "downsize" their urban forests by planting smaller stature species to fit with existing infrastructure such as sidewalks and overhead powerlines (McPherson and others, 2002). UW campus has the advantage of (mostly) only having to locate and plan around underground utilities. Because large stature trees have greater leaf surface area, they provide greater benefits than small and medium stature trees. As canopy cover is the ultimate driving force behind benefits, large stature trees should be used wherever possible.

Relative Age Distribution

In 2008, only 32.1% of trees on campus were less than 6 inches dbh. The next largest dbh class was 6-12" dbh, which suggests that with no new plantings trees were moving towards maturity more quickly than they were being replenished. New trees must be planted annually in order to maintain the benefits of the urban forest resource over time and space. Consideration should be given to those species with fewer numbers in the smaller dbh classes, especially for proven large stature tree species.

Inventory

A priority for funding should include budgeting for periodic tree inventory of all campus trees. This will allow managers to more effectively track success and failure of new plantings, as well as maintenance needs. Moreover, it will facilitate the knowledge and awareness necessary to effectively respond to the dynamic nature of trees in an organized manner. Continued investment will only come about through periodic assessment and evaluation, which in turn will lead to more education and stewardship.

Conclusion

Cedrus deodara stands gracefully next to a bus stop on Steven's Way

This study utilized i-Tree Streets (STRATUM) software to provide a snapshot in time picture of UW's urban forest structure, function and value based on inventory information from 2006-2008. The inventory's structural information was used to model the benefits that UW's campus trees provided to the community, as well as how those benefits might theoretically increase over time. It is not intended to serve as a final authority, but rather as a useful and informative guide that can help shape future management. As well, it is a historical document that can be referred to for information that is lost over time and through changes in Grounds Department personnel. Thus, the power of the forest resource assessment lies as much in the information itself as in the interpretation.

Below is a summary of recommendations derived from this analysis:

Forest Resource

- Set a goal to increase the percentage of large-stature trees on campus from 52% to 60% to increase functional capacity of trees
- Begin a comprehensive annual tree planting effort to replace aging trees with more appropriate species (Zone 1) and distribute trees more equitably throughout the campus (Zone 2)
- Aim to reach Seattle's canopy cover goal for 'Institutional' land categories of 20% by the year 2037 by planting approximately 3,000 new trees on campus within ten years (300 trees/year) if fiscally and spatially feasible
- Be mindful of over-reliance on top 2 species (*Pseudotsuga menziesii* and *Acer macrophyllum*) and the genus *Acer* (but continue to plant equal proportions of replacement trees)

Management

- Secure funding levels to proactively manage the resource for increased benefits, including routine inventories and scheduled maintenance
- Continue cyclical pruning, IPM practices and hazard tree mitigation to minimize damage and increase safety

Community

- Recruit more volunteers (students, staff and faculty) to participate in tree planting and establishment
- Create incentive for more trees through increased education efforts across campus to heighten awareness regarding the benefits of trees
- To achieve the above, consider adding a Volunteer/Development Coordinator position to the Grounds staff

Appendix

Additional i-Tree Reports

Contents

Seattle- University of Washington Campus

Annual Aesthetic/Other Benefits of Trees by Species

4/12/2011

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Pseudotsuga menziesii	33,230	(N/A)	4.8	6.8	78.74
Acer macrophyllum	27,936	(N/A)	4.3	5.7	73.52
Chamaecyparis lawsoniana	20,049	(N/A)	3.3	4.1	70.35
Thuja plicata	19,186	(N/A)	3.1	4.0	70.80
Acer circinatum	15,740	(N/A)	3.0	3.2	60.31
Pinus sylvestris	13,466	(N/A)	2.3	2.8	66.66
Liriodendron tulipifera	10,396	(N/A)	2.3	2.1	52.77
Carpinus betulus 'Fastigiata'	9,179	(N/A)	2.0	1.9	53.37
Quercus rubra	21,018	(N/A)	2.0	4.3	122.20
Gleditsia triacanthos	9,997	(N/A)	1.9	2.1	60.59
Pinus contorta	4,149	(N/A)	1.9	0.9	25.61
Calocedrus decurrens	1,869	(N/A)	1.8	0.4	11.68
Cedrus deodara	14,289	(N/A)	1.8	2.9	91.01
Platanus hybrida	11,884	(N/A)	1.7	2.4	79.76
Malus species	5,141	(N/A)	1.7	1.1	35.21
Broadleaf Deciduous Small	1,669	(N/A)	1.6	0.3	11.67
Quercus palustris	19,875	(N/A)	1.6	4.1	138.99
Broadleaf Deciduous Medium	5,552	(N/A)	1.5	1.1	41.43
Pinus species	9,485	(N/A)	1.5	2.0	70.78
Ulmus species	7,367	(N/A)	1.4	1.5	59.90
Arbutus menziesii	1,094	(N/A)	1.4	0.2	9.12
Acer palmatum	7,318	(N/A)	1.3	1.5	62.02
Betula pendula	6,311	(N/A)	1.3	1.3	53.94
Prunus species	3,136	(N/A)	1.3	0.6	27.27
Acer species	7,508	(N/A)	1.2	1.5	70.16
Acer rubrum	6,210	(N/A)	1.2	1.3	58.58
Acer platanoides	7,354	(N/A)	1.2	1.5	70.04
Populus species	7,101	(N/A)	1.1	1.5	73.96
Rhus hirta	1,084	(N/A)	1.1	0.2	11.53
Other street trees	177,728	(N/A)	43.5	36.6	46.54
Campuswide total	486,320	(N/A)	100.0	100.0	55.42

Seattle- University of Washington Campus

Annual Aesthetic/Other Benefits of Trees by Zone

4/12/2011

Zone	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
1	257,228	(N/A)	49.4	52.9	59.34
2	229,093	(N/A)	50.6	47.1	51.60
Campuswide total	486,320	(N/A)	100.0	100.0	55.42

Seattle- University of Washington Campus

Annual Air Quality Benefits of Trees by Species

4/12/2011

Species	Deposition (lb)				Total Depos. ($)	Avoided (lb)				Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
	O_3	NO_2	PM_{10}	SO_2		NO_2	PM_{10}	VOC	SO_2								
Pseudotsuga menziesii	196.5	62.4	127.9	18.4	492	723.1	18.8	17.7	113.1	930	-896.2	-314	381.7	1,108	(N/A)	4.8	2.63
Acer macrophyllum	155.0	51.1	70.3	12.0	333	760.8	19.9	18.7	118.5	978	-146.6	-51	1,059.5	1,260	(N/A)	4.3	3.32
Chamaecyparis lawsoniana	83.8	26.6	54.5	7.8	210	328.8	8.5	8.0	51.5	423	-350.1	-123	219.6	510	(N/A)	3.2	1.79
Thuja plicata	87.3	27.7	56.8	8.2	218	334.7	8.7	8.2	52.4	430	-375.0	-131	208.9	517	(N/A)	3.1	1.91
Acer circinatum	28.5	9.4	12.9	2.2	61	144.4	3.8	3.6	22.4	185	-23.0	-8	204.0	239	(N/A)	3.0	0.91
Pinus sylvestris	43.7	13.9	28.5	4.1	109	180.5	4.7	4.4	28.3	232	-168.7	-59	139.4	283	(N/A)	2.3	1.40
Liriodendron tulipifera	24.7	8.1	11.2	1.9	53	137.1	3.6	3.4	21.3	176	-19.9	-7	191.5	222	(N/A)	2.2	1.13
Carpinus betulus 'Fastigiata'	12.1	4.0	5.4	0.9	26	73.9	1.9	1.8	11.5	95	-22.1	-8	89.5	113	(N/A)	2.0	0.66
Quercus rubra	74.2	23.6	39.4	6.0	169	326.4	8.5	8.0	50.9	419	-158.6	-55	378.3	533	(N/A)	2.0	3.10
Gleditsia triacanthos	22.8	7.5	10.4	1.8	49	129.9	3.4	3.2	20.2	167	-18.0	-6	181.1	210	(N/A)	1.9	1.27
Pinus contorta	20.9	6.6	13.6	2.0	52	75.8	2.0	1.8	11.9	97	-75.6	-26	58.9	123	(N/A)	1.8	0.76
Calocedrus decurrens	3.1	1.0	2.0	0.3	8	15.8	0.4	0.4	2.5	20	-5.1	-2	20.4	26	(N/A)	1.8	0.17
Cedrus deodara	110.8	35.2	72.1	10.4	277	390.2	10.1	9.5	61.0	502	-546.6	-191	152.8	588	(N/A)	1.8	3.74
Platanus hybrida	71.9	23.7	32.6	5.6	155	347.6	9.1	8.5	54.1	447	-68.9	-24	484.3	577	(N/A)	1.7	3.88
Malus species	21.4	7.0	9.6	1.6	46	106.3	2.8	2.6	16.6	137	-0.5	0	167.4	182	(N/A)	1.7	1.25
Broadleaf Deciduous Small	5.5	1.8	2.5	0.4	12	27.5	0.7	0.7	4.3	35	-0.1	0	43.3	47	(N/A)	1.6	0.33
Quercus palustris	58.6	18.6	31.1	4.7	133	273.5	7.2	6.7	42.6	351	-116.5	-41	326.5	444	(N/A)	1.6	3.10
Broadleaf Deciduous Medium	16.0	5.3	7.2	1.2	34	83.0	2.2	2.0	12.9	107	-127.7	-45	2.0	96	(N/A)	1.5	0.72
Pinus species	43.8	13.9	28.5	4.1	109	168.4	4.4	4.1	26.4	217	-188.5	-66	105.0	260	(N/A)	1.5	1.94
Ulmus species	27.8	9.2	12.6	2.1	60	142.6	3.7	3.5	22.2	183	-24.9	-9	198.9	234	(N/A)	1.4	1.91
Arbutus menziesii	23.8	7.6	15.5	2.2	60	89.3	2.3	2.2	14.0	115	0.0	0	156.8	174	(N/A)	1.4	1.45
Acer palmatum	22.6	7.5	10.3	1.7	49	105.0	2.8	2.6	16.3	135	-17.1	-6	151.7	178	(N/A)	1.3	1.51
Betula pendula	17.8	5.9	8.1	1.4	38	98.8	2.6	2.4	15.4	127	-1.6	-1	150.7	165	(N/A)	1.3	1.41
Prunus species	12.0	3.9	5.4	0.9	26	60.1	1.6	1.5	9.4	77	-0.2	0	94.5	103	(N/A)	1.3	0.89
Acer species	21.3	7.0	9.7	1.6	46	106.4	2.8	2.6	16.5	137	-16.3	-6	151.7	177	(N/A)	1.2	1.65
Acer rubrum	16.8	5.5	7.6	1.3	36	86.4	2.3	2.1	13.4	111	-11.5	-4	124.0	143	(N/A)	1.2	1.35
Acer platanoides	19.2	6.3	8.7	1.5	41	95.5	2.5	2.3	14.8	123	-15.0	-5	135.9	159	(N/A)	1.2	1.51
Populus species	35.3	11.6	16.0	2.7	76	175.5	4.6	4.3	27.3	226	-32.9	-12	244.4	290	(N/A)	1.1	3.02
Rhus hirta	3.5	1.1	1.6	0.3	7	17.1	0.4	0.4	2.7	22	-0.1	0	27.0	29	(N/A)	1.1	0.31
Other street trees	774.4	251.5	407.6	64.1	1,765	3,458.9	90.3	84.7	539.7	4,446	-2,491.7	-872	3,179.4	5,340	(N/A)	43.5	1.40
Campuswide total	2,055.4	664.6	1,119.3	173.3	4,752	9,062.8	236.4	222.0	1,414.3	11,650	-5,918.9	-2,072	9,029.3	14,331	(N/A)	100.0	1.63

Seattle- University of Washington Campus

Annual Air Quality Benefits of Trees by Zone

4/12/2011

Zone	Deposition (lb) O_3	NO_2	PM_{10}	SO_2	Total Depos. ($)	Avoided (lb) NO_2	PM_{10}	VOC	SO_2	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
1	1,083.0	350.3	585.9	91.0	2,497	4,820.7	125.8	118.1	752.2	6,197	-3,049.0	-1,067	4,878.0	7,627	(N/A)	49.4	1.76
2	972.4	314.3	533.4	82.4	2,255	4,242.1	110.6	103.9	662.1	5,453	-2,869.9	-1,004	4,151.3	6,704	(N/A)	50.6	1.51
Campuswide total	2,055.4	664.6	1,119.3	173.3	4,752	9,062.8	236.4	222.0	1,414.3	11,650	-5,918.9	-2,072	9,029.3	14,331	(N/A)	100.0	1.63

Seattle- University of Washington Campus

Total Annual Benefits, Net Benefits, and Costs for Trees

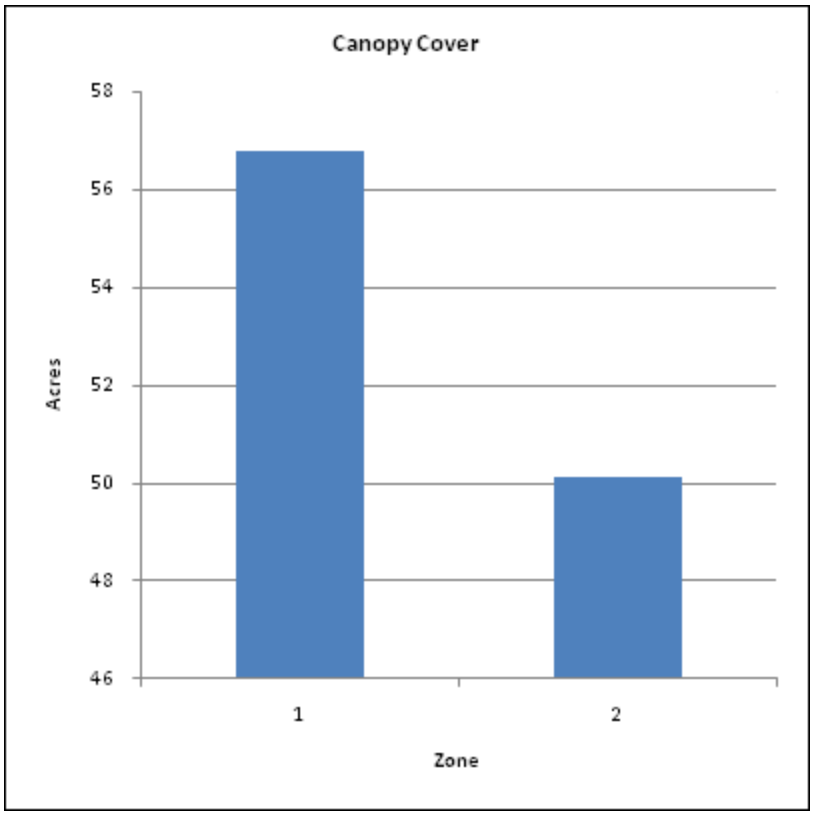
7/25/2011

Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	26,936	(N/A)	3.07	(N/A)	0.42	(N/A)
CO2	7,339	(N/A)	0.84	(N/A)	0.11	(N/A)
Air Quality	14,331	(N/A)	1.63	(N/A)	0.22	(N/A)
Stormwater	220,448	(N/A)	25.12	(N/A)	3.40	(N/A)
Aesthetic/Other	486,320	(N/A)	55.42	(N/A)	7.50	(N/A)
Total Benefits	755,374	(N/A)	86.08	(N/A)	11.64	(N/A)
Costs						
Planting	12,000		1.37		0.18	
Contract Pruning	0		0.00		0.00	
Pest Management	0		0.00		0.00	
Irrigation	0		0.00		0.00	
Removal	0		0.00		0.00	
Administration	200,000		22.79		3.08	
Inspection/Service	0		0.00		0.00	
Infrastructure Repairs	0		0.00		0.00	
Litter Clean-up	0		0.00		0.00	
Liability/Claims	0		0.00		0.00	
Other Costs	44,100		5.03		0.68	
Total Costs	256,100		29.19		3.95	
Net Benefits	499,274	(N/A)	56.90	(N/A)	7.69	(N/A)
Benefit-cost ratio	2.95	(N/A)				

Seattle- University of Washington Campus

Canopy Cover of Trees (Acres)

4/12/2011



Zone	Acres	% of Total Canopy Cover
1	57	53.1
2	50	46.9
Campuswide total	107	100.0

	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Campuswide total	643	87	107	16.63	123.61

Seattle- University of Washington Campus

Annual CO_2 Benefits of Trees by Species

4/12/2011

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($) Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Pseudotsuga menziesii	78,145	258	-5,881	-5,669	-38	51,344	169	117,938	389 (N/A)	4.8	5.3	0.92
Acer macrophyllum	156,631	517	-16,737	-6,091	-75	53,778	177	187,580	619 (N/A)	4.3	8.4	1.63
Chamaecyparis lawsoniana	34,583	114	-1,773	-2,801	-15	23,393	77	53,401	176 (N/A)	3.3	2.4	0.62
Thuja plicata	35,606	117	-2,088	-2,806	-16	23,798	79	54,510	180 (N/A)	3.1	2.5	0.66
Acer circinatum	31,700	105	-1,062	-1,340	-8	10,178	34	39,476	130 (N/A)	3.0	1.8	0.50
Pinus sylvestris	18,866	62	-604	-1,658	-7	12,869	42	29,473	97 (N/A)	2.3	1.3	0.48
Liriodendron tulipifera	35,183	116	-1,602	-1,436	-10	9,684	32	41,829	138 (N/A)	2.3	1.9	0.70
Carpinus betulus 'Fastigiata'	10,685	35	-358	-201	-2	5,225	17	15,351	51 (N/A)	2.0	0.7	0.29
Quercus rubra	57,592	190	-3,930	-1,867	-19	23,080	76	74,874	247 (N/A)	2.0	3.4	1.44
Gleditsia triacanthos	33,929	112	-1,273	-1,319	-9	9,174	30	40,512	134 (N/A)	1.9	1.8	0.81
Pinus contorta	3,973	13	-207	-190	-1	5,385	18	8,962	30 (N/A)	1.9	0.4	0.18
Calocedrus decurrens	12,260	40	-353	-187	-2	1,141	4	12,861	42 (N/A)	1.8	0.6	0.27
Cedrus deodara	41,438	137	-4,236	-3,004	-24	27,690	91	61,888	204 (N/A)	1.8	2.8	1.30
Platanus hybrida	75,211	248	-7,919	-2,673	-35	24,567	81	89,186	294 (N/A)	1.7	4.0	1.98
Malus species	80,204	265	-3,063	-1,363	-15	7,532	25	83,310	275 (N/A)	1.7	3.8	1.88
Broadleaf Deciduous Small	13,704	45	-316	-545	-3	1,941	6	14,783	49 (N/A)	1.6	0.7	0.34
Quercus palustris	51,845	171	-2,343	-1,535	-13	19,317	64	67,284	222 (N/A)	1.6	3.0	1.55
Broadleaf Deciduous Medium	10,955	36	-653	-808	-5	5,866	19	15,359	51 (N/A)	1.5	0.7	0.38
Pinus species	17,590	58	-1,055	-1,405	-8	11,971	40	27,101	89 (N/A)	1.5	1.2	0.67
Ulmus species	32,855	108	-2,555	-1,264	-13	10,076	33	39,111	129 (N/A)	1.4	1.8	1.05
Arbutus menziesii	11,089	37	-1,046	-969	-7	6,352	21	15,426	51 (N/A)	1.4	0.7	0.42
Acer palmatum	21,395	71	-1,370	-834	-7	7,416	24	26,606	88 (N/A)	1.3	1.2	0.74
Betula pendula	9,245	31	-521	-137	-2	6,981	23	15,568	51 (N/A)	1.3	0.7	0.44
Prunus species	38,080	126	-1,180	-868	-7	4,253	14	40,285	133 (N/A)	1.3	1.8	1.16
Acer species	20,969	69	-929	-812	-6	7,508	25	26,736	88 (N/A)	1.2	1.2	0.82
Acer rubrum	10,911	36	-378	-663	-3	6,088	20	15,958	53 (N/A)	1.2	0.7	0.50
Acer platanoides	19,555	65	-874	-773	-5	6,739	22	24,646	81 (N/A)	1.2	1.1	0.77
Populus species	38,632	127	-3,641	-1,412	-17	12,407	41	45,985	152 (N/A)	1.1	2.1	1.58
Rhus hirta	8,306	27	-178	-360	-2	1,208	4	8,975	30 (N/A)	1.1	0.4	0.32
Other street trees	761,179	2,512	-47,123	-30,105	-255	244,923	808	928,874	3,065 (N/A)	43.5	41.8	0.80
Campuswide total	1,772,316	5,849	-115,254	-75,096	-628	641,882	2,118	2,223,849	7,339 (N/A)	100.0	100.0	0.84

Seattle- Universtity of Washington Campus

Annual CO_2 Benefits of Trees by Zone

4/12/2011

Zone	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
1	935,670	3,088	-61,705	-39,234	-333	341,390	1,127	1,176,121	3,881	(N/A)	49.4	52.9	0.90
2	836,646	2,761	-53,549	-35,862	-295	300,492	992	1,047,728	3,458	(N/A)	50.6	47.1	0.78
Campuswide total	1,772,316	5,849	-115,254	-75,096	-628	641,882	2,118	2,223,849	7,339	(N/A)	100.0	100.0	0.84

Seattle- University of Washington Campus

Annual Energy Benefits of Trees By Species

4/12/2011

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Pseudotsuga menziesii	25.4	1,302	561.7	644	1,946	(N/A)	4.8	7.2	4.61
Acer macrophyllum	26.6	1,364	922.0	1,057	2,421	(N/A)	4.3	9.0	6.37
Chamaecyparis lawsoniana	11.6	593	193.3	222	815	(N/A)	3.3	3.0	2.86
Thuja plicata	11.8	604	214.5	246	849	(N/A)	3.1	3.2	3.13
Acer circinatum	5.0	258	210.8	242	500	(N/A)	3.0	1.9	1.91
Pinus sylvestris	6.4	326	73.7	85	411	(N/A)	2.3	1.5	2.03
Liriodendron tulipifera	4.8	246	174.0	199	445	(N/A)	2.3	1.7	2.26
Carpinus betulus 'Fastigiata'	2.6	133	82.9	95	228	(N/A)	2.0	0.8	1.32
Quercus rubra	11.4	585	384.7	441	1,026	(N/A)	2.0	3.8	5.97
Gleditsia triacanthos	4.5	233	165.1	189	422	(N/A)	1.9	1.6	2.56
Pinus contorta	2.7	137	53.2	61	198	(N/A)	1.9	0.7	1.22
Calocedrus decurrens	0.6	29	-16.6	-19	10	(N/A)	1.8	0.0	0.06
Cedrus deodara	13.7	702	325.9	373	1,076	(N/A)	1.8	4.0	6.85
Platanus hybrida	12.2	623	423.4	485	1,108	(N/A)	1.7	4.1	7.44
Malus species	3.7	191	107.3	123	314	(N/A)	1.7	1.2	2.15
Broadleaf Deciduous Small	1.0	49	35.9	41	90	(N/A)	1.6	0.3	0.63
Quercus palustris	9.6	490	351.8	403	893	(N/A)	1.6	3.3	6.25
Broadleaf Deciduous Medium	2.9	149	102.9	118	267	(N/A)	1.5	1.0	1.99
Pinus species	5.9	304	109.8	126	429	(N/A)	1.5	1.6	3.21
Ulmus species	5.0	256	177.1	203	458	(N/A)	1.4	1.7	3.73
Arbutus menziesii	3.1	161	51.1	59	220	(N/A)	1.4	0.8	1.83
Acer palmatum	3.7	188	135.9	156	344	(N/A)	1.3	1.3	2.91
Betula pendula	3.5	177	119.6	137	314	(N/A)	1.3	1.2	2.68
Prunus species	2.1	108	67.7	78	185	(N/A)	1.3	0.7	1.61
Acer species	3.7	190	144.9	166	357	(N/A)	1.2	1.3	3.33
Acer rubrum	3.0	154	131.5	151	305	(N/A)	1.2	1.1	2.88
Acer platanoides	3.3	171	131.0	150	321	(N/A)	1.2	1.2	3.06
Populus species	6.1	315	214.6	246	561	(N/A)	1.1	2.1	5.84
Rhus hirta	0.6	31	22.8	26	57	(N/A)	1.1	0.2	0.60
Other street trees	121.3	6,212	3,626.1	4,155	10,367	(N/A)	43.5	38.5	2.71
Campuswide total	318.0	16,279	9,298.8	10,656	26,936	(N/A)	100.0	100.0	3.07

Seattle- University of Washington Campus

Annual Energy Benefits of Trees By Zone

4/12/2011

Zone	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
1	169.1	8,658	5,003.2	5,734	14,392	(N/A)	49.4	53.4	3.32
2	148.9	7,621	4,295.6	4,923	12,544	(N/A)	50.6	46.6	2.83
Campuswide total	318.0	16,279	9,298.8	10,656	26,936	(N/A)	100.0	100.0	3.07

Seattle- University of Washington Campus

Height Class for Most Abundant Trees by Species (%)

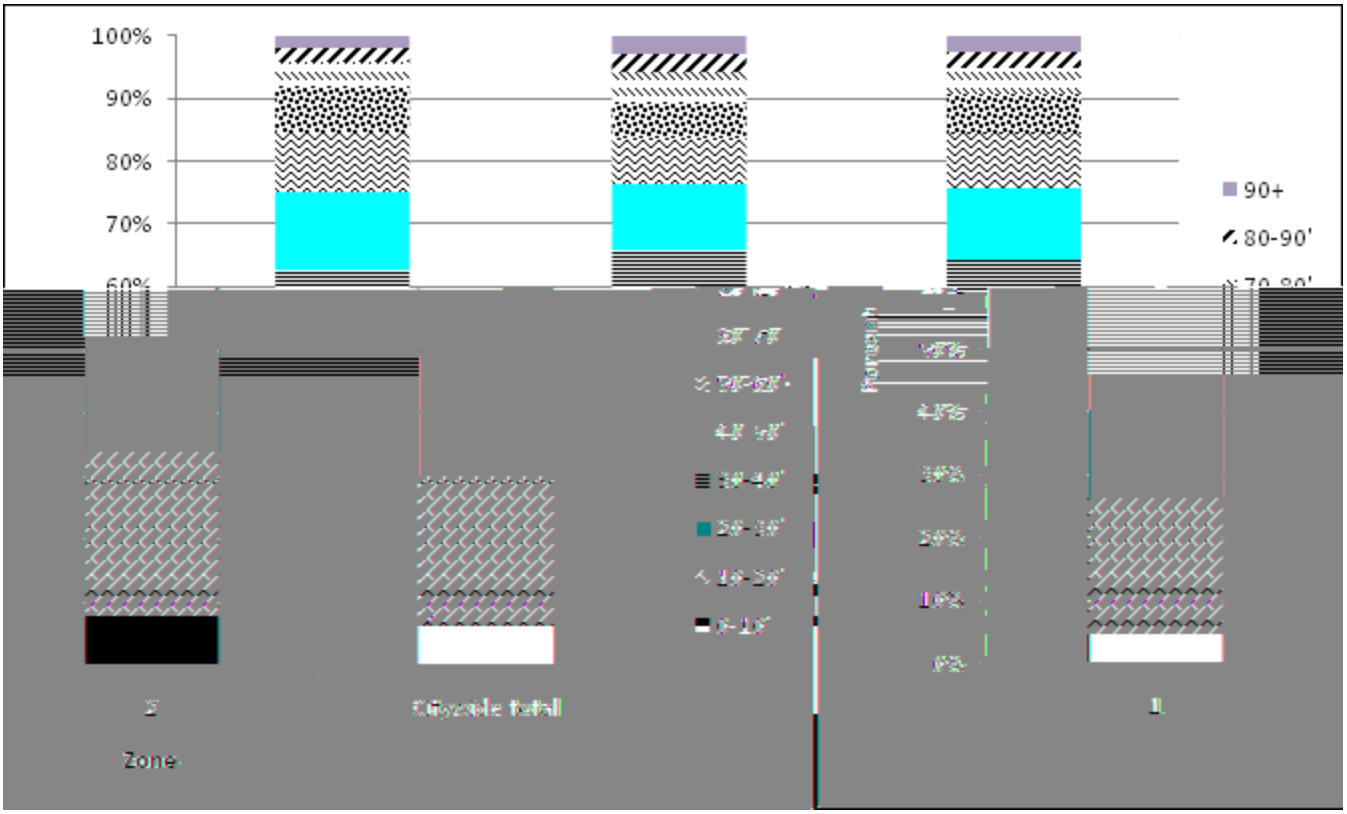
4/12/2011

Species	0-10'	10-20'	20-30'	30-40'	40-50'	50-60'	60-70'	70-80'	80-90'	90+
Pseudotsuga menziesii	9.0	6.2	4.5	5.7	8.8	7.3	13.7	17.3	12.3	15.2
Acer macrophyllum	1.1	2.9	5.3	11.3	15.5	23.2	18.7	12.6	7.4	2.1
Chamaecyparis lawsonian	4.6	6.7	10.9	19.3	16.1	18.2	17.5	4.9	0.7	1.1
Thuja plicata	7.0	9.2	12.2	16.2	17.7	14.8	8.9	7.0	4.4	2.6
Acer circinatum	14.9	66.3	17.2	1.1	0.0	0.0	0.4	0.0	0.0	0.0
Pinus sylvestris	2.5	10.9	21.8	26.2	15.3	14.9	5.0	2.5	1.0	0.0
Liriodendron tulipifera	1.0	15.2	25.4	23.9	23.4	8.1	1.5	0.5	1.0	0.0
Carpinus betulus 'Fastigiat	0.6	17.4	32.6	30.2	15.1	4.1	0.0	0.0	0.0	0.0
Quercus rubra	1.2	9.3	20.3	18.6	18.6	12.2	4.7	2.9	2.9	9.3
Gleditsia triacanthos	0.0	21.2	26.7	38.2	12.7	1.2	0.0	0.0	0.0	0.0
Pinus contorta	5.6	22.2	27.8	27.2	14.8	1.2	0.0	0.6	0.0	0.6
Calocedrus decurrens	5.6	41.3	10.6	20.0	16.9	3.8	0.0	1.3	0.6	0.0
Cedrus deodara	0.6	0.6	2.5	3.8	15.3	21.7	20.4	15.9	14.6	4.5
Platanus hybrida	0.7	2.0	10.1	7.4	6.7	20.1	32.9	13.4	4.0	2.7
Malus species	7.5	55.5	29.5	5.5	1.4	0.7	0.0	0.0	0.0	0.0
Broadleaf Deciduous Sma	21.7	70.6	4.2	3.5	0.0	0.0	0.0	0.0	0.0	0.0
Quercus palustris	1.4	2.8	15.4	25.2	15.4	16.8	17.5	4.2	0.7	0.7
Broadleaf Deciduous Medium	3.7	20.1	44.0	32.1	0.0	0.0	0.0	0.0	0.0	0.0
Pinus species	11.9	12.7	17.2	8.2	17.9	17.9	8.2	3.7	0.0	2.2
Ulmus species	0.0	7.3	12.2	20.3	26.0	18.7	7.3	2.4	2.4	3.3
Arbutus menziesii	5.0	23.3	25.0	15.8	12.5	10.8	5.8	0.8	0.8	0.0
Acer palmatum	10.2	54.2	22.0	12.7	0.8	0.0	0.0	0.0	0.0	0.0
Betula pendula	0.0	4.3	18.8	20.5	32.5	15.4	6.8	1.7	0.0	0.0
Prunus species	7.0	20.9	32.2	23.5	10.4	1.7	3.5	0.0	0.9	0.0
Acer species	0.9	26.2	26.2	25.2	12.1	2.8	4.7	0.9	0.0	0.9
Acer rubrum	0.0	24.5	24.5	21.7	17.0	7.5	3.8	0.9	0.0	0.0
Acer platanoides	0.0	7.6	29.5	30.5	19.0	10.5	1.9	0.0	1.0	0.0
Populus species	0.0	4.2	9.4	4.2	14.6	16.7	19.8	6.3	9.4	15.6
Rhus hirta	14.9	68.1	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other trees	7.6	29.7	21.3	13.3	9.5	6.7	4.3	3.6	2.0	2.0
Total	6.1	24.1	19.0	15.0	11.5	8.6	6.4	4.3	2.6	2.4

Seattle- University of Washington Campus

Height Class for Trees by Zone (%)

4/12/2011



Zone	0-10'	10-20'	20-30'	30-40'	40-50'	50-60'	60-70'	70-80'	80-90'	90+
1	4.5	21.9	19.6	16.6	12.3	9.9	7.1	3.9	2.1	2.0
2	7.7	26.3	18.4	13.4	10.6	7.4	5.7	4.6	3.1	2.8
Campuswide total	6.1	24.1	19.0	15.0	11.5	8.6	6.4	4.3	2.6	2.4

Seattle- University of Washington Campus

Importance Values for Most Abundant Trees

4/12/2011

Species	Number of Trees	% of Total Trees	Leaf Area (ft²)	% of Total Leaf Area	Canopy Cover (ft²)	% of Total Canopy Cover	Importance Value
Pseudotsuga menziesii	422	4.8	2,221,537	8.6	359,402	7.7	7.0
Acer macrophyllum	380	4.3	2,443,996	9.5	402,668	8.6	7.5
Chamaecyparis lawsoniana	285	3.2	867,838	3.4	153,266	3.3	3.3
Thuja plicata	271	3.1	929,562	3.6	159,557	3.4	3.4
Acer circinatum	261	3.0	425,963	1.7	73,959	1.6	2.1
Pinus sylvestris	202	2.3	418,203	1.6	79,986	1.7	1.9
Liriodendron tulipifera	197	2.2	331,377	1.3	64,263	1.4	1.6
Carpinus betulus 'Fastigiata'	172	2.0	246,039	1.0	32,145	0.7	1.2
Quercus rubra	172	2.0	1,022,770	4.0	189,117	4.1	3.3
Gleditsia triacanthos	165	1.9	300,143	1.2	59,323	1.3	1.4
Pinus contorta	162	1.8	174,383	0.7	38,229	0.8	1.1
Calocedrus decurrens	160	1.8	51,588	0.2	5,749	0.1	0.7
Cedrus deodara	157	1.8	1,355,001	5.3	202,674	4.4	3.8
Platanus hybrida	149	1.7	1,148,592	4.5	186,954	4.0	3.4
Malus species	146	1.7	173,070	0.7	56,538	1.2	1.2
Broadleaf Deciduous Small	143	1.6	32,978	0.1	14,657	0.3	0.7
Quercus palustris	143	1.6	751,189	2.9	149,387	3.2	2.6
Broadleaf Deciduous Medium	134	1.5	226,693	0.9	42,254	0.9	1.1
Pinus species	134	1.5	467,236	1.8	80,046	1.7	1.7
Ulmus species	123	1.4	416,070	1.6	72,361	1.6	1.5
Arbutus menziesii	120	1.4	64,775	0.3	43,525	0.9	0.9
Acer palmatum	118	1.3	315,907	1.2	58,854	1.3	1.3
Betula pendula	117	1.3	273,675	1.1	46,322	1.0	1.1
Prunus species	115	1.3	85,861	0.3	31,743	0.7	0.8
Acer species	107	1.2	301,369	1.2	55,392	1.2	1.2
Acer rubrum	106	1.2	192,104	0.7	43,760	0.9	1.0
Acer platanoides	105	1.2	278,208	1.1	49,997	1.1	1.1
Populus species	96	1.1	549,263	2.1	91,635	2.0	1.7
Rhus hirta	94	1.1	20,078	0.1	9,207	0.2	0.4
Other trees	3,819	43.5	9,706,997	37.6	1,805,131	38.8	40.0
Total	8,775	100.0	25,792,466	100.0	4,658,102	100.0	100.0

Seattle- University of Washington Campus

Annual Management Costs of Trees

7/25/2011

Expenditures	Total ($)	$/Tree	$/Capita
Purchasing Trees and Planting	12,000	1.37	0.18
Contract Pruning	0	0.00	0.00
Pest Management	0	0.00	0.00
Irrigation	0	0.00	0.00
Removal	0	0.00	0.00
Administration	200,000	22.79	3.08
Inspection/Service	0	0.00	0.00
Infrastructure Repairs	0	0.00	0.00
Litter Clean-up	0	0.00	0.00
Liability/Claim	0	0.00	0.00
Other Cost	44,100	5.03	0.68
Total Expenditures	256,100	29.19	3.95

Seattle- University of Washington Campus

Population Summary of Trees

4/12/2011

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error
Broadleaf Deciduous Large (BDL)											
Acer macrophyllum	4	20	78	80	70	46	34	14	34	380	
Liriodendron tulipifera	3	64	87	33	6	1	1	0	2	197	
Quercus rubra	8	24	62	33	18	14	8	3	2	172	
Gleditsia triacanthos	1	22	96	40	6	0	0	0	0	165	
Platanus hybrida	1	9	22	11	28	43	18	12	5	149	
Quercus palustris	3	13	41	50	32	3	1	0	0	143	
BDL OTHER	67	68	105	91	45	48	27	16	17	484	
Total	**87**	**220**	**491**	**338**	**205**	**155**	**89**	**45**	**60**	**1,690 (±NaN)**	
Broadleaf Deciduous Medium (BDM)											
Carpinus betulus 'Fastigiata'	1	62	53	37	4	7	5	1	2	172	
Broadleaf Deciduous Mediu	26	37	53	11	2	3	0	0	2	134	
Betula pendula	3	26	51	30	6	1	0	0	0	117	
Acer species	17	17	36	27	10	0	0	0	0	107	
Acer rubrum	9	36	42	17	2	0	0	0	0	106	
Acer platanoides	3	34	41	22	2	1	2	0	0	105	
BDM OTHER	73	180	132	79	41	23	23	11	7	569	
Total	**132**	**392**	**408**	**223**	**67**	**35**	**30**	**12**	**11**	**1,310 (±NaN)**	
Broadleaf Deciduous Small (BDS)											
Acer circinatum	54	101	75	26	3	2	0	0	0	261	
Broadleaf Deciduous Small	56	48	31	8	0	0	0	0	0	143	
Acer palmatum	24	33	37	8	7	4	3	2	0	118	
Rhus hirta	29	41	21	3	0	0	0	0	0	94	
BDS OTHER	50	120	125	56	15	4	2	2	0	374	
Total	**213**	**343**	**289**	**101**	**25**	**10**	**5**	**4**	**0**	**990 (±NaN)**	
Broadleaf Evergreen Large (BEL)											
BEL OTHER	2	1	13	2	9	5	0	1	1	34	
Total	**2**	**1**	**13**	**2**	**9**	**5**	**0**	**1**	**1**	**34 (±NaN)**	
Broadleaf Evergreen Medium (BEM)											
BEM OTHER	0	0	0	0	0	0	0	0	0	0	
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±NaN)**	
Broadleaf Evergreen Small (BES)											
BES OTHER	13	21	25	8	4	1	0	0	0	72	
Total	**13**	**21**	**25**	**8**	**4**	**1**	**0**	**0**	**0**	**72 (±NaN)**	
Conifer Evergreen Large (CEL)											
Pseudotsuga menziesii	46	31	51	103	77	70	30	10	4	422	
Chamaecyparis lawsoniana	17	33	100	82	36	10	3	2	2	285	
Thuja plicata	23	27	92	62	38	17	8	2	2	271	
Pinus sylvestris	6	23	105	62	4	2	0	0	0	202	
Cedrus deodara	2	1	9	42	24	24	30	20	5	157	
CEL OTHER	56	34	89	55	39	29	26	13	27	368	
Total	**150**	**149**	**446**	**406**	**218**	**152**	**97**	**47**	**40**	**1,705 (±NaN)**	
Conifer Evergreen Medium (CEM)											
Calocedrus decurrens	9	29	82	24	9	3	4	0	0	160	
CEM OTHER	5	13	10	4	1	1	1	0	0	35	
Total	**14**	**42**	**92**	**28**	**10**	**4**	**5**	**0**	**0**	**195 (±NaN)**	
Conifer Evergreen Small (CES)											
Pinus contorta	7	30	87	30	6	0	1	0	1	162	
CES OTHER	32	29	22	5	2	0	0	0	0	90	
Total	**39**	**59**	**109**	**35**	**8**	**0**	**1**	**0**	**1**	**252 (±NaN)**	
Palm Evergreen Large (PEL)											
PEL OTHER	0	0	0	0	0	0	0	0	0	0	

Seattle- University of Washington Campus

Population Summary of Trees

4/12/2011

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**(±NaN)**
Palm Evergreen Medium (PEM)											
PEM OTHER	0	0	2	0	0	0	0	0	0	2	
Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**(±NaN)**
Palm Evergreen Small (PES)											
PES OTHER	0	0	0	0	0	0	1	0	0	1	
Total	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**(±NaN)**
Grand Total	**650**	**1,227**	**1,875**	**1,141**	**546**	**362**	**228**	**109**	**113**	**6,251**	**(±0)**

Seattle- University of Washington Campus

Complete Population of Trees

4/12/2011

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error
Broadleaf Deciduous Large (BDL)											
Acer macrophyllum	4	20	78	80	70	46	34	14	34	380	
Liriodendron tulipifera	3	64	87	33	6	1	1	0	2	197	
Quercus rubra	8	24	62	33	18	14	8	3	2	172	
Gleditsia triacanthos	1	22	96	40	6	0	0	0	0	165	
Platanus hybrida	1	9	22	11	28	43	18	12	5	149	
Quercus palustris	3	13	41	50	32	3	1	0	0	143	
Broadleaf Deciduous Large	3	5	15	22	8	5	3	1	6	68	
Acer saccharum	9	20	18	6	0	3	0	1	0	57	
Aesculus hippocastanum	1	0	3	6	9	13	8	9	4	53	
Fraxinus latifolia	5	8	20	13	1	2	0	0	0	49	
Acer saccharinum	2	3	18	13	4	4	3	1	0	48	
Ulmus americana	4	5	4	12	3	5	3	1	5	42	
Populus balsamifera ssp. tric	0	5	10	4	7	6	4	0	2	38	
Quercus coccinea	15	11	1	3	3	3	0	0	0	36	
Fagus sylvatica	5	6	4	5	1	5	4	0	0	30	
Ginkgo biloba	17	1	3	1	0	0	0	0	0	22	
Acer negundo	1	0	5	4	1	0	0	0	0	11	
Populus nigra	0	0	1	0	5	2	1	2	0	11	
Populus alba	3	3	1	0	0	0	0	0	0	7	
Catalpa speciosa	1	1	0	1	1	0	0	1	0	5	
Taxodium distichum	0	0	2	1	1	0	0	0	0	4	
Quercus macrocarpa	1	0	0	0	0	0	1	0	0	2	
Quercus alba	0	0	0	0	1	0	0	0	0	1	
Total	**87**	**220**	**491**	**338**	**205**	**155**	**89**	**45**	**60**	**1,690 (±NaN)**	
Broadleaf Deciduous Medium (BDM)											
Carpinus betulus 'Fastigiata'	1	62	53	37	4	7	5	1	2	172	
Broadleaf Deciduous Mediu	26	37	53	11	2	3	0	0	2	134	
Betula pendula	3	26	51	30	6	1	0	0	0	117	
Acer species	17	17	36	27	10	0	0	0	0	107	
Acer rubrum	9	36	42	17	2	0	0	0	0	106	
Acer platanoides	3	34	41	22	2	1	2	0	0	105	
Liquidambar styraciflua	5	18	28	18	8	1	0	0	0	78	
Tilia cordata	19	35	7	4	0	2	0	1	0	68	
Prunus yedoensis	1	9	6	4	12	9	9	3	3	56	
Populus tremuloides	8	22	18	4	0	0	0	0	0	52	
Cornus nuttallii	7	15	19	6	1	1	1	0	0	50	
Betula nigra	15	25	3	0	0	1	0	0	0	44	
Fraxinus oxycarpa	10	25	5	0	0	0	0	0	0	40	
Ailanthus altissima	0	8	9	9	4	2	0	0	0	32	
Robinia pseudoacacia	0	3	4	9	6	3	5	1	1	32	
Cercidiphyllum japonicum	4	10	2	5	3	0	0	0	0	24	
Ulmus procera	0	0	0	1	2	3	7	4	2	19	
Larix decidua	2	2	5	4	2	0	0	0	0	15	
Parrotia persica	1	3	2	4	1	1	1	1	1	15	
Alnus rubra	0	0	8	3	2	0	0	1	0	14	
Paulownia tomentosa	0	1	6	2	0	0	0	0	0	9	
Acer pseudoplatanus	1	1	4	1	0	0	0	0	0	7	
Prunus avium	0	1	4	1	0	0	0	0	0	6	
Salix matsudana	0	1	1	2	0	0	0	0	0	4	
Albizia julibrissin	0	0	1	1	0	0	0	0	0	2	
Celtis sinensis	0	0	0	1	0	0	0	0	0	1	
Koelreuteria paniculata	0	1	0	0	0	0	0	0	0	1	
Total	**132**	**392**	**408**	**223**	**67**	**35**	**30**	**12**	**11**	**1,310 (±NaN)**	
Broadleaf Deciduous Small (BDS)											
Acer circinatum	54	101	75	26	3	2	0	0	0	261	
Broadleaf Deciduous Small	56	48	31	8	0	0	0	0	0	143	
Acer palmatum	24	33	37	8	7	4	3	2	0	118	

Seattle- University of Washington Campus

Complete Population of Trees

4/12/2011

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error
Rhus hirta	29	41	21	3	0	0	0	0	0	94	
Prunus serrulata	2	4	36	37	5	0	0	2	0	86	
Syringa reticulata	10	26	25	3	0	0	0	0	0	64	
Sorbus aucuparia	7	28	20	2	3	1	1	0	0	62	
Cornus florida	8	11	22	7	1	0	1	0	0	50	
Crataegus phaenopyrum	0	22	1	1	0	0	0	0	0	24	
Rhus glabra	5	7	3	0	0	0	0	0	0	15	
Laburnum anagyroides	2	9	2	0	1	0	0	0	0	14	
Crataegus laevigata	0	0	10	3	0	0	0	0	0	13	
Crataegus douglasii	5	6	0	1	0	0	0	0	0	12	
Magnolia x soulangiana	8	3	0	0	0	0	0	0	0	11	
Prunus subhirtella	2	2	1	1	4	1	0	0	0	11	
Prunus cerasifera	0	0	2	1	1	2	0	0	0	6	
Syringa vulgaris	1	1	1	0	0	0	0	0	0	3	
Malus floribunda	0	1	1	0	0	0	0	0	0	2	
Acer buergerianum	0	0	1	0	0	0	0	0	0	1	
Total	**213**	**343**	**289**	**101**	**25**	**10**	**5**	**4**	**0**	**990 (±NaN)**	
Broadleaf Evergreen Large (BEL)											
Broadleaf Evergreen Large	2	1	13	2	8	5	0	1	1	33	
Quercus agrifolia	0	0	0	0	1	0	0	0	0	1	
Total	**2**	**1**	**13**	**2**	**9**	**5**	**0**	**1**	**1**	**34 (±NaN)**	
Broadleaf Evergreen Medium (BEM)											
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±NaN)**	
Broadleaf Evergreen Small (BES)											
Ilex aquifolium	3	12	11	2	3	0	0	0	0	31	
Prunus laurocerasus	0	8	8	2	0	1	0	0	0	19	
Broadleaf Evergreen Small	9	1	2	1	1	0	0	0	0	14	
Magnolia grandiflora	1	0	4	3	0	0	0	0	0	8	
Total	**13**	**21**	**25**	**8**	**4**	**1**	**0**	**0**	**0**	**72 (±NaN)**	
Conifer Evergreen Large (CEL)											
Pseudotsuga menziesii	46	31	51	103	77	70	30	10	4	422	
Chamaecyparis lawsoniana	17	33	100	82	36	10	3	2	2	285	
Thuja plicata	23	27	92	62	38	17	8	2	2	271	
Pinus sylvestris	6	23	105	62	4	2	0	0	0	202	
Cedrus deodara	2	1	9	42	24	24	30	20	5	157	
Cedrus atlantica	6	1	7	7	13	8	13	5	9	69	
Sequoia sempervirens	3	2	12	4	2	3	5	5	9	45	
Pinus ponderosa	9	2	4	8	9	7	4	0	0	43	
Conifer Evergreen Large	1	2	13	12	7	1	2	1	2	41	
Tsuga heterophylla	17	9	4	1	1	2	0	0	0	34	
Thuja occidentalis	6	11	10	0	0	0	0	0	0	27	
Picea abies	0	0	10	9	4	3	0	0	0	26	
Pinus thunbergiana	2	0	12	5	0	2	0	0	0	21	
Pinus densiflora	1	1	12	4	0	0	0	0	0	18	
Sequoiadendron giganteum	3	0	1	1	1	3	0	2	7	18	
Abies grandis	7	1	2	1	1	0	0	0	0	12	
Picea pungens	0	1	0	2	1	0	1	0	0	5	
Sciadopitys verticillata	0	3	0	1	0	0	0	0	0	4	
Chamaecyparis nootkatensis	0	1	2	0	0	0	0	0	0	3	
Abies procera	1	0	0	0	0	0	0	0	0	1	
Picea sitchensis	0	0	0	0	0	0	1	0	0	1	
Total	**150**	**149**	**446**	**406**	**218**	**152**	**97**	**47**	**40**	**1,705 (±NaN)**	
Conifer Evergreen Medium (CEM)											
Calocedrus decurrens	9	29	82	24	9	3	4	0	0	160	
Conifer Evergreen Medium	1	8	5	0	0	0	0	0	0	14	
Cunninghamia lanceolata	0	1	4	3	1	1	1	0	0	11	

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Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error
Pinus mugo	0	4	1	1	0	0	0	0	0	6	
Pinus pinea	4	0	0	0	0	0	0	0	0	4	
Total	**14**	**42**	**92**	**28**	**10**	**4**	**5**	**0**	**0**	**195**	**(±NaN)**
Conifer Evergreen Small (CES)											
Pinus contorta	7	30	87	30	6	0	1	0	1	162	
Chamaecyparis obtusa	4	13	0	0	0	0	0	0	0	17	
Pinus aristata	4	9	4	0	0	0	0	0	0	17	
Taxus baccata	5	2	6	1	1	0	0	0	0	15	
Conifer Evergreen Small	9	2	1	0	0	0	0	0	0	12	
Chamaecyparis pisifera	1	0	7	4	0	0	0	0	0	12	
Tsuga mertensiana	7	2	0	0	0	0	0	0	0	9	
Juniperus chinensis	2	0	3	0	1	0	0	0	0	6	
Abies pinsapo	0	1	1	0	0	0	0	0	0	2	
Total	**39**	**59**	**109**	**35**	**8**	**0**	**1**	**0**	**1**	**252**	**(±NaN)**
Palm Evergreen Large (PEL)											
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**(±NaN)**
Palm Evergreen Medium (PEM)											
Palm Evergreen Medium	0	0	2	0	0	0	0	0	0	2	
Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**(±NaN)**
Palm Evergreen Small (PES)											
Palm Evergreen Small	0	0	0	0	0	0	1	0	0	1	
Total	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**(±NaN)**
Grand Total	**650**	**1,227**	**1,875**	**1,141**	**546**	**362**	**228**	**109**	**113**	**6,251**	**(±0)**

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Complete Population of Trees for Zone 1

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Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total Standard Error
Broadleaf Deciduous Large (BDL)										
Acer macrophyllum	2	11	46	33	31	24	14	10	23	194 (±0)
Liriodendron tulipifera	2	46	54	20	6	1	1	0	0	130 (±0)
Quercus palustris	3	10	40	45	25	1	1	0	0	125 (±0)
Platanus hybrida	0	7	10	7	24	38	17	12	5	120 (±0)
Quercus rubra	1	13	37	28	16	8	3	1	0	107 (±0)
Gleditsia triacanthos	0	9	47	31	4	0	0	0	0	91 (±0)
Fraxinus latifolia	3	5	18	10	0	1	0	0	0	37 (±0)
Acer saccharinum	0	2	10	11	3	4	3	1	0	34 (±0)
Ulmus americana	0	0	4	12	3	2	1	1	2	25 (±0)
Aesculus hippocastanum	0	0	1	1	5	5	5	6	1	24 (±0)
Acer saccharum	7	6	8	1	0	1	0	0	0	23 (±0)
Populus balsamifera ssp. tric	0	3	6	3	3	3	3	0	1	22 (±0)
Quercus coccinea	3	10	1	1	3	1	0	0	0	19 (±0)
Broadleaf Deciduous Large	0	1	5	4	0	1	1	1	0	13 (±0)
Ginkgo biloba	13	0	0	0	0	0	0	0	0	13 (±0)
Acer negundo	0	0	4	4	0	0	0	0	0	8 (±0)
Fagus sylvatica	4	0	1	0	0	3	0	0	0	8 (±0)
Populus alba	3	3	1	0	0	0	0	0	0	7 (±0)
Catalpa speciosa	0	0	0	1	0	0	0	0	0	1 (±0)
Populus nigra	0	0	1	0	0	0	0	0	0	1 (±0)
Quercus macrocarpa	1	0	0	0	0	0	0	0	0	1 (±0)
Taxodium distichum	0	0	0	0	1	0	0	0	0	1 (±0)
Total	**42**	**126**	**294**	**212**	**124**	**93**	**49**	**32**	**32**	**1,004 (±0)**
Broadleaf Deciduous Medium (BDM)										
Carpinus betulus 'Fastigiata'	0	23	17	25	3	5	5	1	2	81 (±0)
Acer platanoides	3	22	30	13	0	1	0	0	0	69 (±0)
Betula pendula	2	19	24	12	2	1	0	0	0	60 (±0)
Tilia cordata	16	33	1	2	0	0	0	1	0	53 (±0)
Acer species	6	7	19	17	2	0	0	0	0	51 (±0)
Acer rubrum	3	15	21	10	1	0	0	0	0	50 (±0)
Prunus yedoensis	1	8	5	4	10	7	9	3	3	50 (±0)
Broadleaf Deciduous Mediu	11	10	17	5	1	1	0	0	1	46 (±0)
Liquidambar styraciflua	5	16	14	7	2	1	0	0	0	45 (±0)
Populus tremuloides	3	18	16	4	0	0	0	0	0	41 (±0)
Fraxinus oxycarpa	8	13	4	0	0	0	0	0	0	25 (±0)
Cornus nuttallii	1	7	10	4	1	0	0	0	0	23 (±0)
Betula nigra	5	16	1	0	0	0	0	0	0	22 (±0)
Ailanthus altissima	0	7	2	3	0	1	0	0	0	13 (±0)
Alnus rubra	0	0	8	2	2	0	0	0	0	12 (±0)
Robinia pseudoacacia	0	0	0	3	3	1	2	1	1	11 (±0)
Cercidiphyllum japonicum	1	1	0	4	2	0	0	0	0	8 (±0)
Larix decidua	2	1	3	0	0	0	0	0	0	6 (±0)
Paulownia tomentosa	0	1	4	0	0	0	0	0	0	5 (±0)
Ulmus procera	0	0	0	0	1	1	2	0	1	5 (±0)
Acer pseudoplatanus	0	1	2	0	0	0	0	0	0	3 (±0)
Salix matsudana	0	0	1	1	0	0	0	0	0	2 (±0)
Celtis sinensis	0	0	0	1	0	0	0	0	0	1 (±0)
Parrotia persica	0	0	0	0	0	0	0	0	1	1 (±0)
Prunus avium	0	0	1	0	0	0	0	0	0	1 (±0)
Total	**67**	**218**	**200**	**117**	**30**	**19**	**18**	**6**	**9**	**684 (±0)**
Broadleaf Deciduous Small (BDS)										
Acer circinatum	16	23	31	14	2	2	0	0	0	88 (±0)
Prunus serrulata	1	1	9	28	2	0	0	1	0	42 (±0)
Broadleaf Deciduous Small	13	11	12	3	0	0	0	0	0	39 (±0)
Acer palmatum	12	8	6	2	2	1	1	1	0	33 (±0)
Rhus hirta	3	14	12	0	0	0	0	0	0	29 (±0)
Cornus florida	2	5	15	3	1	0	1	0	0	27 (±0)

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Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total Standard Error
Sorbus aucuparia	6	13	2	2	0	0	0	0	0	23 (±0)
Syringa reticulata	1	6	5	1	0	0	0	0	0	13 (±0)
Crataegus douglasii	5	3	0	1	0	0	0	0	0	9 (±0)
Prunus subhirtella	1	1	1	0	4	1	0	0	0	8 (±0)
Crataegus phaenopyrum	0	5	0	1	0	0	0	0	0	6 (±0)
Rhus glabra	0	3	3	0	0	0	0	0	0	6 (±0)
Laburnum anagyroides	0	4	0	0	1	0	0	0	0	5 (±0)
Magnolia x soulangiana	0	2	0	0	0	0	0	0	0	2 (±0)
Prunus cerasifera	0	0	0	0	0	2	0	0	0	2 (±0)
Crataegus laevigata	0	0	0	1	0	0	0	0	0	1 (±0)
Malus floribunda	0	1	0	0	0	0	0	0	0	1 (±0)
Total	**60**	**100**	**96**	**56**	**12**	**6**	**2**	**2**	**0**	**334 (±0)**
Broadleaf Evergreen Large (BEL)										
Broadleaf Evergreen Large	2	0	10	0	3	1	0	1	0	17 (±0)
Total	**2**	**0**	**10**	**0**	**3**	**1**	**0**	**1**	**0**	**17 (±0)**
Broadleaf Evergreen Medium (BEM)										
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±0)**
Broadleaf Evergreen Small (BES)										
Ilex aquifolium	2	2	5	1	2	0	0	0	0	12 (±0)
Prunus laurocerasus	0	3	4	0	0	1	0	0	0	8 (±0)
Magnolia grandiflora	0	0	3	1	0	0	0	0	0	4 (±0)
Broadleaf Evergreen Small	1	0	1	1	0	0	0	0	0	3 (±0)
Total	**3**	**5**	**13**	**3**	**2**	**1**	**0**	**0**	**0**	**27 (±0)**
Conifer Evergreen Large (CEL)										
Pseudotsuga menziesii	2	4	18	47	32	22	12	7	1	145 (±0)
Chamaecyparis lawsoniana	5	19	42	47	22	5	1	0	0	141 (±0)
Cedrus deodara	1	1	7	41	19	16	21	14	3	123 (±0)
Pinus sylvestris	5	12	51	43	2	0	0	0	0	113 (±0)
Thuja plicata	6	15	31	21	15	6	2	0	1	97 (±0)
Cedrus atlantica	4	1	3	5	9	5	6	4	0	37 (±0)
Picea abies	0	0	8	7	1	0	0	0	0	16 (±0)
Pinus ponderosa	3	2	0	1	2	5	3	0	0	16 (±0)
Conifer Evergreen Large	0	2	3	5	1	0	1	0	2	14 (±0)
Sequoia sempervirens	1	1	1	2	0	1	4	1	2	13 (±0)
Pinus thunbergiana	2	0	6	1	0	2	0	0	0	11 (±0)
Sequoiadendron giganteum	0	0	1	0	1	3	0	0	4	9 (±0)
Tsuga heterophylla	0	2	1	1	0	1	0	0	0	5 (±0)
Abies grandis	1	0	2	0	1	0	0	0	0	4 (±0)
Pinus densiflora	1	1	0	2	0	0	0	0	0	4 (±0)
Thuja occidentalis	0	2	2	0	0	0	0	0	0	4 (±0)
Picea pungens	0	1	0	2	0	0	0	0	0	3 (±0)
Sciadopitys verticillata	0	0	0	1	0	0	0	0	0	1 (±0)
Total	**31**	**63**	**176**	**226**	**105**	**66**	**50**	**26**	**13**	**756 (±0)**
Conifer Evergreen Medium (CEM)										
Calocedrus decurrens	3	9	32	10	8	1	4	0	0	67 (±0)
Conifer Evergreen Medium	0	1	2	0	0	0	0	0	0	3 (±0)
Cunninghamia lanceolata	0	0	1	0	0	0	0	0	0	1 (±0)
Pinus mugo	0	0	0	1	0	0	0	0	0	1 (±0)
Total	**3**	**10**	**35**	**11**	**8**	**1**	**4**	**0**	**0**	**72 (±0)**
Conifer Evergreen Small (CES)										
Pinus contorta	4	18	65	20	6	0	1	0	1	115 (±0)
Pinus aristata	2	4	3	0	0	0	0	0	0	9 (±0)
Chamaecyparis pisifera	1	0	5	2	0	0	0	0	0	8 (±0)
Conifer Evergreen Small	7	0	0	0	0	0	0	0	0	7 (±0)
Chamaecyparis obtusa	1	4	0	0	0	0	0	0	0	5 (±0)
Taxus baccata	1	1	1	0	0	0	0	0	0	3 (±0)

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Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total Standard Error
Juniperus chinensis	1	0	1	0	0	0	0	0	0	2 (±0)
Tsuga mertensiana	2	0	0	0	0	0	0	0	0	2 (±0)
Abies pinsapo	0	1	0	0	0	0	0	0	0	1 (±0)
Total	**19**	**28**	**75**	**22**	**6**	**0**	**1**	**0**	**1**	**152 (±0)**
Palm Evergreen Large (PEL)										
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±0)**
Palm Evergreen Medium (PEM)										
Palm Evergreen Medium	0	0	2	0	0	0	0	0	0	2 (±0)
Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2 (±0)**
Palm Evergreen Small (PES)										
Palm Evergreen Small	0	0	0	0	0	0	1	0	0	1 (±0)
Total	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1 (±0)**
Grand Total	**227**	**550**	**901**	**647**	**290**	**187**	**125**	**67**	**55**	**3,049 (±0)**

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Complete Population of Trees for Zone 2

4/12/2011

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total Standard Error
Broadleaf Deciduous Large (BDL)										
Acer macrophyllum	2	9	32	47	39	22	20	4	11	186 (±0)
Gleditsia triacanthos	1	13	49	9	2	0	0	0	0	74 (±0)
Liriodendron tulipifera	1	18	33	13	0	0	0	0	2	67 (±0)
Quercus rubra	7	11	25	5	2	6	5	2	2	65 (±0)
Broadleaf Deciduous Large	3	4	10	18	8	4	2	0	6	55 (±0)
Acer saccharum	2	14	10	5	0	2	0	1	0	34 (±0)
Aesculus hippocastanum	1	0	2	5	4	8	3	3	3	29 (±0)
Platanus hybrida	1	2	12	4	4	5	1	0	0	29 (±0)
Fagus sylvatica	1	6	3	5	1	2	4	0	0	22 (±0)
Quercus palustris	0	3	1	5	7	2	0	0	0	18 (±0)
Quercus coccinea	12	1	0	2	0	2	0	0	0	17 (±0)
Ulmus americana	4	5	0	0	0	3	2	0	3	17 (±0)
Populus balsamifera ssp. tric	0	2	4	1	4	3	1	0	1	16 (±0)
Acer saccharinum	2	1	8	2	1	0	0	0	0	14 (±0)
Fraxinus latifolia	2	3	2	3	1	1	0	0	0	12 (±0)
Populus nigra	0	0	0	0	5	2	1	2	0	10 (±0)
Ginkgo biloba	4	1	3	1	0	0	0	0	0	9 (±0)
Catalpa speciosa	1	1	0	0	1	0	0	1	0	4 (±0)
Acer negundo	1	0	1	0	1	0	0	0	0	3 (±0)
Taxodium distichum	0	0	2	1	0	0	0	0	0	3 (±0)
Quercus alba	0	0	0	0	1	0	0	0	0	1 (±0)
Quercus macrocarpa	0	0	0	0	0	0	1	0	0	1 (±0)
Total	**45**	**94**	**197**	**126**	**81**	**62**	**40**	**13**	**28**	**686 (±0)**
Broadleaf Deciduous Medium (BDM)										
Carpinus betulus 'Fastigiata'	1	39	36	12	1	2	0	0	0	91 (±0)
Broadleaf Deciduous Mediu	15	27	36	6	1	2	0	0	1	88 (±0)
Betula pendula	1	7	27	18	4	0	0	0	0	57 (±0)
Acer species	11	10	17	10	8	0	0	0	0	56 (±0)
Acer rubrum	6	21	21	7	1	0	0	0	0	56 (±0)
Acer platanoides	0	12	11	9	2	0	2	0	0	36 (±0)
Liquidambar styraciflua	0	2	14	11	6	0	0	0	0	33 (±0)
Cornus nuttallii	6	8	9	2	0	1	1	0	0	27 (±0)
Betula nigra	10	9	2	0	0	1	0	0	0	22 (±0)
Robinia pseudoacacia	0	3	4	6	3	2	3	0	0	21 (±0)
Ailanthus altissima	0	1	7	6	4	1	0	0	0	19 (±0)
Cercidiphyllum japonicum	3	9	2	1	1	0	0	0	0	16 (±0)
Fraxinus oxycarpa	2	12	1	0	0	0	0	0	0	15 (±0)
Tilia cordata	3	2	6	2	0	2	0	0	0	15 (±0)
Parrotia persica	1	3	2	4	1	1	1	1	0	14 (±0)
Ulmus procera	0	0	0	1	1	2	5	4	1	14 (±0)
Populus tremuloides	5	4	2	0	0	0	0	0	0	11 (±0)
Larix decidua	0	1	2	4	2	0	0	0	0	9 (±0)
Prunus yedoensis	0	1	1	0	2	2	0	0	0	6 (±0)
Prunus avium	0	1	3	1	0	0	0	0	0	5 (±0)
Acer pseudoplatanus	1	0	2	1	0	0	0	0	0	4 (±0)
Paulownia tomentosa	0	0	2	2	0	0	0	0	0	4 (±0)
Albizia julibrissin	0	0	1	1	0	0	0	0	0	2 (±0)
Alnus rubra	0	0	0	1	0	0	0	1	0	2 (±0)
Salix matsudana	0	1	0	1	0	0	0	0	0	2 (±0)
Koelreuteria paniculata	0	1	0	0	0	0	0	0	0	1 (±0)
Total	**65**	**174**	**208**	**106**	**37**	**16**	**12**	**6**	**2**	**626 (±0)**
Broadleaf Deciduous Small (BDS)										
Acer circinatum	38	78	44	12	1	0	0	0	0	173 (±0)
Broadleaf Deciduous Small	43	37	19	5	0	0	0	0	0	104 (±0)
Acer palmatum	12	25	31	6	5	3	2	1	0	85 (±0)
Rhus hirta	26	27	9	3	0	0	0	0	0	65 (±0)
Syringa reticulata	9	20	20	2	0	0	0	0	0	51 (±0)

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Complete Population of Trees for Zone 2

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Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total Standard Error
Prunus serrulata	1	3	27	9	3	0	0	1	0	44 (±0)
Sorbus aucuparia	1	15	18	0	3	1	1	0	0	39 (±0)
Cornus florida	6	6	7	4	0	0	0	0	0	23 (±0)
Crataegus phaenopyrum	0	17	1	0	0	0	0	0	0	18 (±0)
Crataegus laevigata	0	0	10	2	0	0	0	0	0	12 (±0)
Laburnum anagyroides	2	5	2	0	0	0	0	0	0	9 (±0)
Magnolia x soulangiana	8	1	0	0	0	0	0	0	0	9 (±0)
Rhus glabra	5	4	0	0	0	0	0	0	0	9 (±0)
Prunus cerasifera	0	0	2	1	1	0	0	0	0	4 (±0)
Crataegus douglasii	0	3	0	0	0	0	0	0	0	3 (±0)
Prunus subhirtella	1	1	0	1	0	0	0	0	0	3 (±0)
Syringa vulgaris	1	1	1	0	0	0	0	0	0	3 (±0)
Acer buergerianum	0	0	1	0	0	0	0	0	0	1 (±0)
Malus floribunda	0	0	1	0	0	0	0	0	0	1 (±0)
Total	**153**	**243**	**193**	**45**	**13**	**4**	**3**	**2**	**0**	**656 (±0)**
Broadleaf Evergreen Large (BEL)										
Broadleaf Evergreen Large	0	1	3	2	5	4	0	0	1	16 (±0)
Quercus agrifolia	0	0	0	0	1	0	0	0	0	1 (±0)
Total	**0**	**1**	**3**	**2**	**6**	**4**	**0**	**0**	**1**	**17 (±0)**
Broadleaf Evergreen Medium (BEM)										
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±0)**
Broadleaf Evergreen Small (BES)										
Ilex aquifolium	1	10	6	1	1	0	0	0	0	19 (±0)
Broadleaf Evergreen Small	8	1	1	0	1	0	0	0	0	11 (±0)
Prunus laurocerasus	0	5	4	2	0	0	0	0	0	11 (±0)
Magnolia grandiflora	1	0	1	2	0	0	0	0	0	4 (±0)
Total	**10**	**16**	**12**	**5**	**2**	**0**	**0**	**0**	**0**	**45 (±0)**
Conifer Evergreen Large (CEL)										
Pseudotsuga menziesii	44	27	33	56	45	48	18	3	3	277 (±0)
Thuja plicata	17	12	61	41	23	11	6	2	1	174 (±0)
Chamaecyparis lawsoniana	12	14	58	35	14	5	2	2	2	144 (±0)
Pinus sylvestris	1	11	54	19	2	2	0	0	0	89 (±0)
Cedrus deodara	1	0	2	1	5	8	9	6	2	34 (±0)
Cedrus atlantica	2	0	4	2	4	3	7	1	9	32 (±0)
Sequoia sempervirens	2	1	11	2	2	2	1	4	7	32 (±0)
Tsuga heterophylla	17	7	3	0	1	1	0	0	0	29 (±0)
Conifer Evergreen Large	1	0	10	7	6	1	1	1	0	27 (±0)
Pinus ponderosa	6	0	4	7	7	2	1	0	0	27 (±0)
Thuja occidentalis	6	9	8	0	0	0	0	0	0	23 (±0)
Pinus densiflora	0	0	12	2	0	0	0	0	0	14 (±0)
Picea abies	0	0	2	2	3	3	0	0	0	10 (±0)
Pinus thunbergiana	0	0	6	4	0	0	0	0	0	10 (±0)
Sequoiadendron giganteum	3	0	0	1	0	0	0	2	3	9 (±0)
Abies grandis	6	1	0	1	0	0	0	0	0	8 (±0)
Chamaecyparis nootkatensis	0	1	2	0	0	0	0	0	0	3 (±0)
Sciadopitys verticillata	0	3	0	0	0	0	0	0	0	3 (±0)
Picea pungens	0	0	0	0	1	0	1	0	0	2 (±0)
Abies procera	1	0	0	0	0	0	0	0	0	1 (±0)
Picea sitchensis	0	0	0	0	0	0	1	0	0	1 (±0)
Total	**119**	**86**	**270**	**180**	**113**	**86**	**47**	**21**	**27**	**949 (±0)**
Conifer Evergreen Medium (CEM)										
Calocedrus decurrens	6	20	50	14	1	2	0	0	0	93 (±0)
Conifer Evergreen Medium	1	7	3	0	0	0	0	0	0	11 (±0)
Cunninghamia lanceolata	0	1	3	3	1	1	1	0	0	10 (±0)
Pinus mugo	0	4	1	0	0	0	0	0	0	5 (±0)
Pinus pinea	4	0	0	0	0	0	0	0	0	4 (±0)

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Complete Population of Trees for Zone 2

4/12/2011

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total Standard Error
Total	**11**	**32**	**57**	**17**	**2**	**3**	**1**	**0**	**0**	**123 (±0)**
Conifer Evergreen Small (CES)										
Pinus contorta	3	12	22	10	0	0	0	0	0	47 (±0)
Chamaecyparis obtusa	3	9	0	0	0	0	0	0	0	12 (±0)
Taxus baccata	4	1	5	1	1	0	0	0	0	12 (±0)
Pinus aristata	2	5	1	0	0	0	0	0	0	8 (±0)
Tsuga mertensiana	5	2	0	0	0	0	0	0	0	7 (±0)
Conifer Evergreen Small	2	2	1	0	0	0	0	0	0	5 (±0)
Chamaecyparis pisifera	0	0	2	2	0	0	0	0	0	4 (±0)
Juniperus chinensis	1	0	2	0	1	0	0	0	0	4 (±0)
Abies pinsapo	0	0	1	0	0	0	0	0	0	1 (±0)
Total	**20**	**31**	**34**	**13**	**2**	**0**	**0**	**0**	**0**	**100 (±0)**
Palm Evergreen Large (PEL)										
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±0)**
Palm Evergreen Medium (PEM)										
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±0)**
Palm Evergreen Small (PES)										
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±0)**
Grand Total	**423**	**677**	**974**	**494**	**256**	**175**	**103**	**42**	**58**	**3,202 (±0)**

Seattle- University of Washington Campus

Population Summary of Trees for Zone 1

4/12/2011

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total Standard Error
Broadleaf Deciduous Large (BDL)										
Acer macrophyllum	2	11	46	33	31	24	14	10	23	194 (±0)
Liriodendron tulipifera	2	46	54	20	6	1	1	0	0	130 (±0)
Quercus palustris	3	10	40	45	25	1	1	0	0	125 (±0)
Platanus hybrida	0	7	10	7	24	38	17	12	5	120 (±0)
Quercus rubra	1	13	37	28	16	8	3	1	0	107 (±0)
Gleditsia triacanthos	0	9	47	31	4	0	0	0	0	91 (±0)
BDL OTHER	34	30	60	48	18	21	13	9	4	237 (±0)
Total	**42**	**126**	**294**	**212**	**124**	**93**	**49**	**32**	**32**	**1,004 (±0)**
Broadleaf Deciduous Medium (BDM)										
Carpinus betulus 'Fastigiata'	0	23	17	25	3	5	5	1	2	81 (±0)
Acer platanoides	3	22	30	13	0	1	0	0	0	69 (±0)
Betula pendula	2	19	24	12	2	1	0	0	0	60 (±0)
Tilia cordata	16	33	1	2	0	0	0	1	0	53 (±0)
Acer species	6	7	19	17	2	0	0	0	0	51 (±0)
Acer rubrum	3	15	21	10	1	0	0	0	0	50 (±0)
Prunus yedoensis	1	8	5	4	10	7	9	3	3	50 (±0)
Broadleaf Deciduous Mediu	11	10	17	5	1	1	0	0	1	46 (±0)
Liquidambar styraciflua	5	16	14	7	2	1	0	0	0	45 (±0)
BDM OTHER	20	65	52	22	9	3	4	1	3	179 (±0)
Total	**67**	**218**	**200**	**117**	**30**	**19**	**18**	**6**	**9**	**684 (±0)**
Broadleaf Deciduous Small (BDS)										
Acer circinatum	16	23	31	14	2	2	0	0	0	88 (±0)
BDS OTHER	44	77	65	42	10	4	2	2	0	246 (±0)
Total	**60**	**100**	**96**	**56**	**12**	**6**	**2**	**2**	**0**	**334 (±0)**
Broadleaf Evergreen Large (BEL)										
BEL OTHER	2	0	10	0	3	1	0	1	0	17 (±0)
Total	**2**	**0**	**10**	**0**	**3**	**1**	**0**	**1**	**0**	**17 (±0)**
Broadleaf Evergreen Medium (BEM)										
BEM OTHER	0	0	0	0	0	0	0	0	0	0 (±0)
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±0)**
Broadleaf Evergreen Small (BES)										
BES OTHER	3	5	13	3	2	1	0	0	0	27 (±0)
Total	**3**	**5**	**13**	**3**	**2**	**1**	**0**	**0**	**0**	**27 (±0)**
Conifer Evergreen Large (CEL)										
Pseudotsuga menziesii	2	4	18	47	32	22	12	7	1	145 (±0)
Chamaecyparis lawsoniana	5	19	42	47	22	5	1	0	0	141 (±0)
Cedrus deodara	1	1	7	41	19	16	21	14	3	123 (±0)
Pinus sylvestris	5	12	51	43	2	0	0	0	0	113 (±0)
Thuja plicata	6	15	31	21	15	6	2	0	1	97 (±0)
CEL OTHER	12	12	27	27	15	17	14	5	8	137 (±0)
Total	**31**	**63**	**176**	**226**	**105**	**66**	**50**	**26**	**13**	**756 (±0)**
Conifer Evergreen Medium (CEM)										
Calocedrus decurrens	3	9	32	10	8	1	4	0	0	67 (±0)
CEM OTHER	0	1	3	1	0	0	0	0	0	5 (±0)
Total	**3**	**10**	**35**	**11**	**8**	**1**	**4**	**0**	**0**	**72 (±0)**
Conifer Evergreen Small (CES)										
Pinus contorta	4	18	65	20	6	0	1	0	1	115 (±0)
CES OTHER	15	10	10	2	0	0	0	0	0	37 (±0)
Total	**19**	**28**	**75**	**22**	**6**	**0**	**1**	**0**	**1**	**152 (±0)**
Palm Evergreen Large (PEL)										
PEL OTHER	0	0	0	0	0	0	0	0	0	0 (±0)

Seattle- University of Washington Campus

Population Summary of Trees for Zone 1

4/12/2011

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total Standard Error
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±0)**
Palm Evergreen Medium (PEM)										
PEM OTHER	0	0	2	0	0	0	0	0	0	2 (±0)
Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2 (±0)**
Palm Evergreen Small (PES)										
PES OTHER	0	0	0	0	0	0	1	0	0	1 (±0)
Total	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1 (±0)**
Grand Total	**227**	**550**	**901**	**647**	**290**	**187**	**125**	**67**	**55**	**3,049 (±0)**

Seattle- University of Washington Campus

Population Summary of Trees for Zone 2

4/12/2011

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total Standard Error
Broadleaf Deciduous Large (BDL)										
Acer macrophyllum	2	9	32	47	39	22	20	4	11	186 (±0)
Gleditsia triacanthos	1	13	49	9	2	0	0	0	0	74 (±0)
Liriodendron tulipifera	1	18	33	13	0	0	0	0	2	67 (±0)
Quercus rubra	7	11	25	5	2	6	5	2	2	65 (±0)
Broadleaf Deciduous Large	3	4	10	18	8	4	2	0	6	55 (±0)
BDL OTHER	31	39	48	34	30	30	13	7	7	239 (±0)
Total	**45**	**94**	**197**	**126**	**81**	**62**	**40**	**13**	**28**	**686 (±0)**
Broadleaf Deciduous Medium (BDM)										
Carpinus betulus 'Fastigiata'	1	39	36	12	1	2	0	0	0	91 (±0)
Broadleaf Deciduous Mediu	15	27	36	6	1	2	0	0	1	88 (±0)
Betula pendula	1	7	27	18	4	0	0	0	0	57 (±0)
Acer species	11	10	17	10	8	0	0	0	0	56 (±0)
Acer rubrum	6	21	21	7	1	0	0	0	0	56 (±0)
BDM OTHER	31	70	71	53	22	12	12	6	1	278 (±0)
Total	**65**	**174**	**208**	**106**	**37**	**16**	**12**	**6**	**2**	**626 (±0)**
Broadleaf Deciduous Small (BDS)										
Acer circinatum	38	78	44	12	1	0	0	0	0	173 (±0)
Broadleaf Deciduous Small	43	37	19	5	0	0	0	0	0	104 (±0)
Acer palmatum	12	25	31	6	5	3	2	1	0	85 (±0)
Rhus hirta	26	27	9	3	0	0	0	0	0	65 (±0)
Syringa reticulata	9	20	20	2	0	0	0	0	0	51 (±0)
BDS OTHER	25	56	70	17	7	1	1	1	0	178 (±0)
Total	**153**	**243**	**193**	**45**	**13**	**4**	**3**	**2**	**0**	**656 (±0)**
Broadleaf Evergreen Large (BEL)										
BEL OTHER	0	1	3	2	6	4	0	0	1	17 (±0)
Total	**0**	**1**	**3**	**2**	**6**	**4**	**0**	**0**	**1**	**17 (±0)**
Broadleaf Evergreen Medium (BEM)										
BEM OTHER	0	0	0	0	0	0	0	0	0	0 (±0)
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±0)**
Broadleaf Evergreen Small (BES)										
BES OTHER	10	16	12	5	2	0	0	0	0	45 (±0)
Total	**10**	**16**	**12**	**5**	**2**	**0**	**0**	**0**	**0**	**45 (±0)**
Conifer Evergreen Large (CEL)										
Pseudotsuga menziesii	44	27	33	56	45	48	18	3	3	277 (±0)
Thuja plicata	17	12	61	41	23	11	6	2	1	174 (±0)
Chamaecyparis lawsoniana	12	14	58	35	14	5	2	2	2	144 (±0)
Pinus sylvestris	1	11	54	19	2	2	0	0	0	89 (±0)
CEL OTHER	45	22	64	29	29	20	21	14	21	265 (±0)
Total	**119**	**86**	**270**	**180**	**113**	**86**	**47**	**21**	**27**	**949 (±0)**
Conifer Evergreen Medium (CEM)										
Calocedrus decurrens	6	20	50	14	1	2	0	0	0	93 (±0)
CEM OTHER	5	12	7	3	1	1	1	0	0	30 (±0)
Total	**11**	**32**	**57**	**17**	**2**	**3**	**1**	**0**	**0**	**123 (±0)**
Conifer Evergreen Small (CES)										
Pinus contorta	3	12	22	10	0	0	0	0	0	47 (±0)
CES OTHER	17	19	12	3	2	0	0	0	0	53 (±0)
Total	**20**	**31**	**34**	**13**	**2**	**0**	**0**	**0**	**0**	**100 (±0)**
Palm Evergreen Large (PEL)										
PEL OTHER	0	0	0	0	0	0	0	0	0	0 (±0)
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±0)**
Palm Evergreen Medium (PEM)										

Seattle- University of Washington Campus

Population Summary of Trees for Zone 2

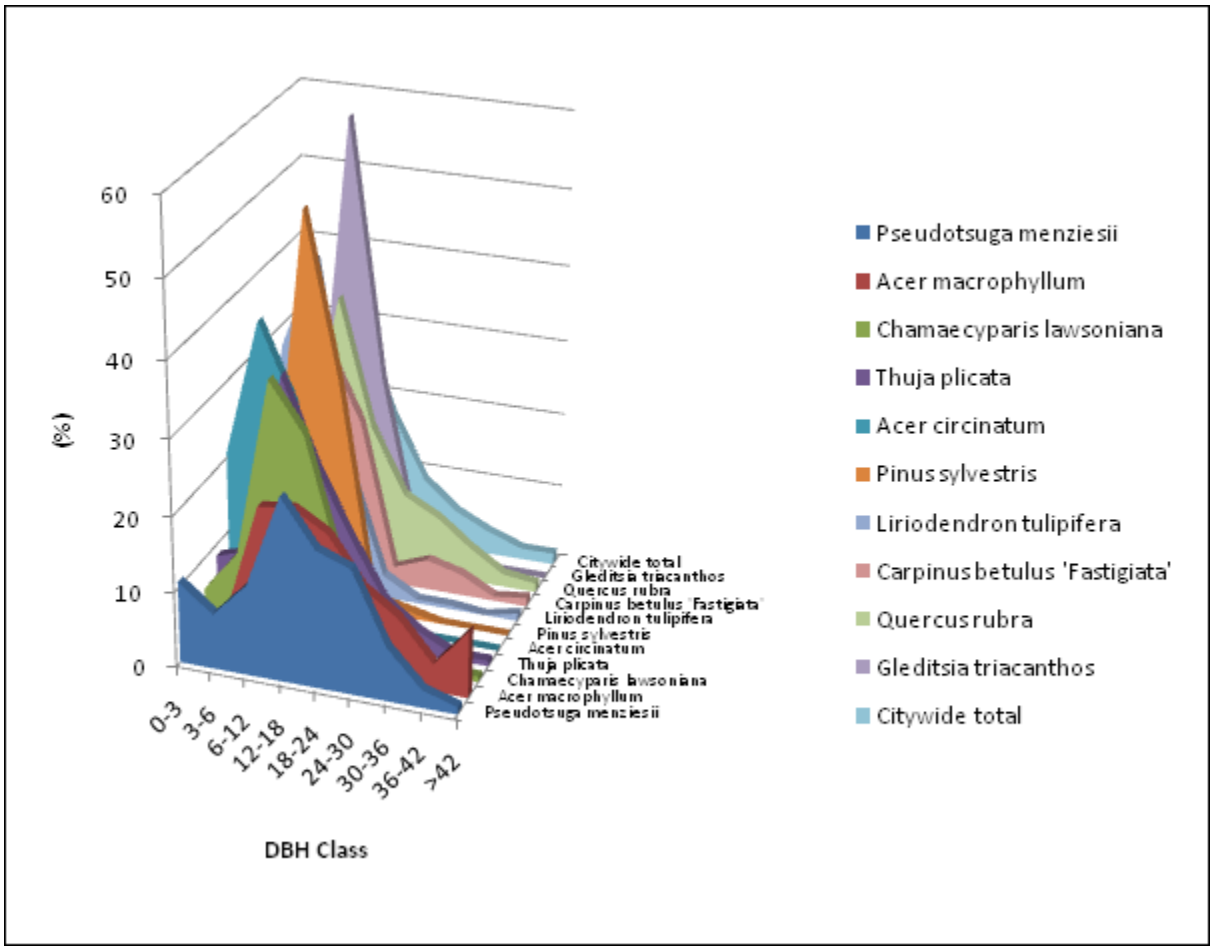
4/12/2011

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total Standard Error
PEM OTHER	0	0	0	0	0	0	0	0	0	0 (±0)
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±0)**
Palm Evergreen Small (PES)										
PES OTHER	0	0	0	0	0	0	0	0	0	0 (±0)
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0 (±0)**
Grand Total	**423**	**677**	**974**	**494**	**256**	**175**	**103**	**42**	**58**	**3,202 (±0)**

Seattle- University of Washington Campus

Relative Age Distribution of Top Tree Species (%)

4/12/2011



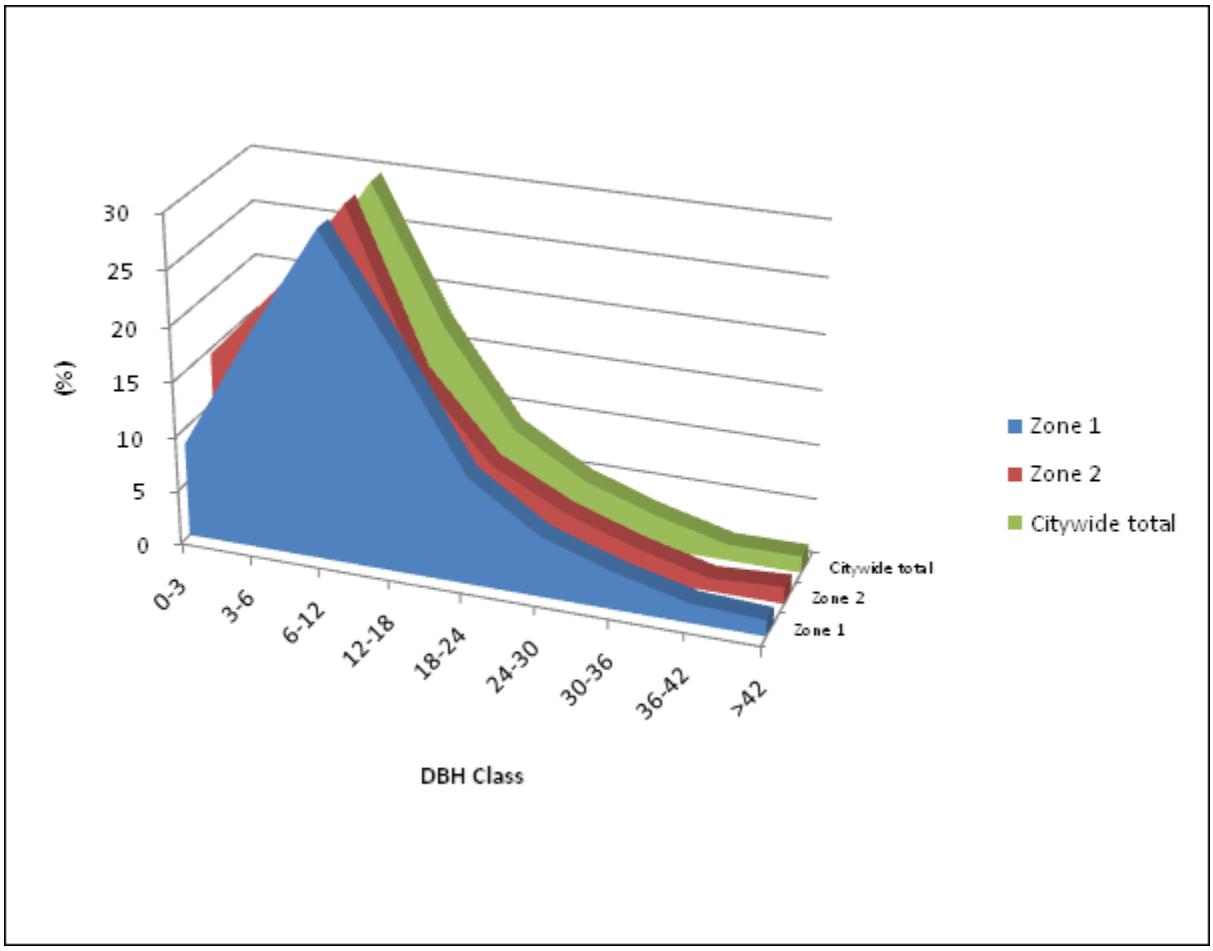
DBH class (in)

Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Pseudotsuga menziesii	10.90	7.35	12.09	24.41	18.25	16.59	7.11	2.37	0.95
Acer macrophyllum	1.05	5.26	20.53	21.05	18.42	12.11	8.95	3.68	8.95
Chamaecyparis lawsonia	5.96	11.58	35.09	28.77	12.63	3.51	1.05	0.70	0.70
Thuja plicata	8.49	9.96	33.95	22.88	14.02	6.27	2.95	0.74	0.74
Acer circinatum	20.69	38.70	28.74	9.96	1.15	0.77	0.00	0.00	0.00
Pinus sylvestris	2.97	11.39	51.98	30.69	1.98	0.99	0.00	0.00	0.00
Liriodendron tulipifera	1.52	32.49	44.16	16.75	3.05	0.51	0.51	0.00	1.02
Carpinus betulus 'Fastigiata'	0.58	36.05	30.81	21.51	2.33	4.07	2.91	0.58	1.16
Quercus rubra	4.65	13.95	36.05	19.19	10.47	8.14	4.65	1.74	1.16
Gleditsia triacanthos	0.61	13.33	58.18	24.24	3.64	0.00	0.00	0.00	0.00
Campuswide total	11.61	20.49	29.75	17.70	9.04	5.28	3.11	1.49	1.53

Seattle- University of Washington Campus

Relative Age Distribution of Tree Species for All Zones (%)

4/12/2011



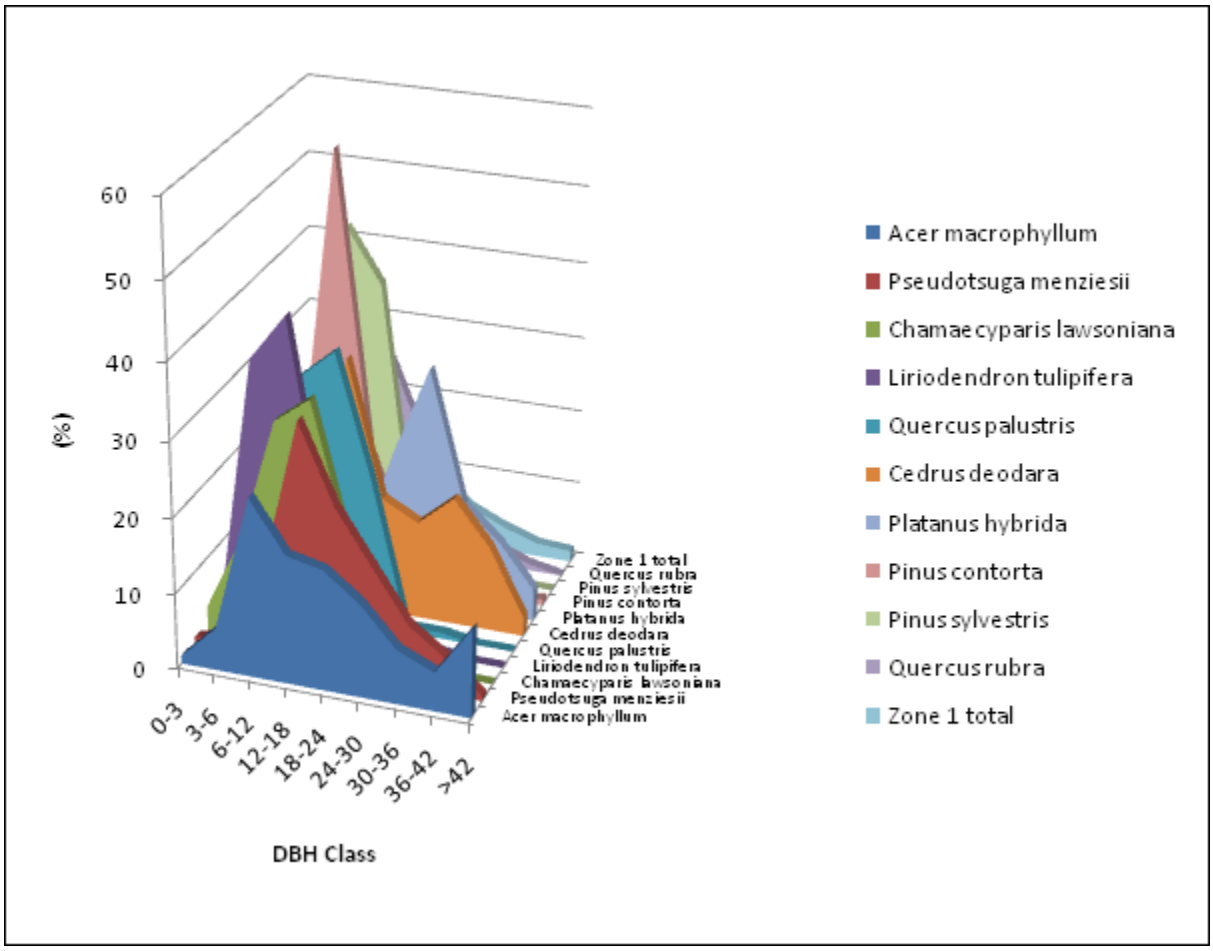
DBH class (in)

Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Zone 1	8.63	19.61	29.71	20.07	9.80	5.51	3.39	1.80	1.48
Zone 2	14.53	21.35	29.80	15.38	8.29	5.05	2.84	1.19	1.58
Campuswide total	11.61	20.49	29.75	17.70	9.04	5.28	3.11	1.49	1.53

Seattle- University of Washington Campus

Relative Age Distribution of Top 10 Tree Species for Zone 1 (%)

4/12/2011



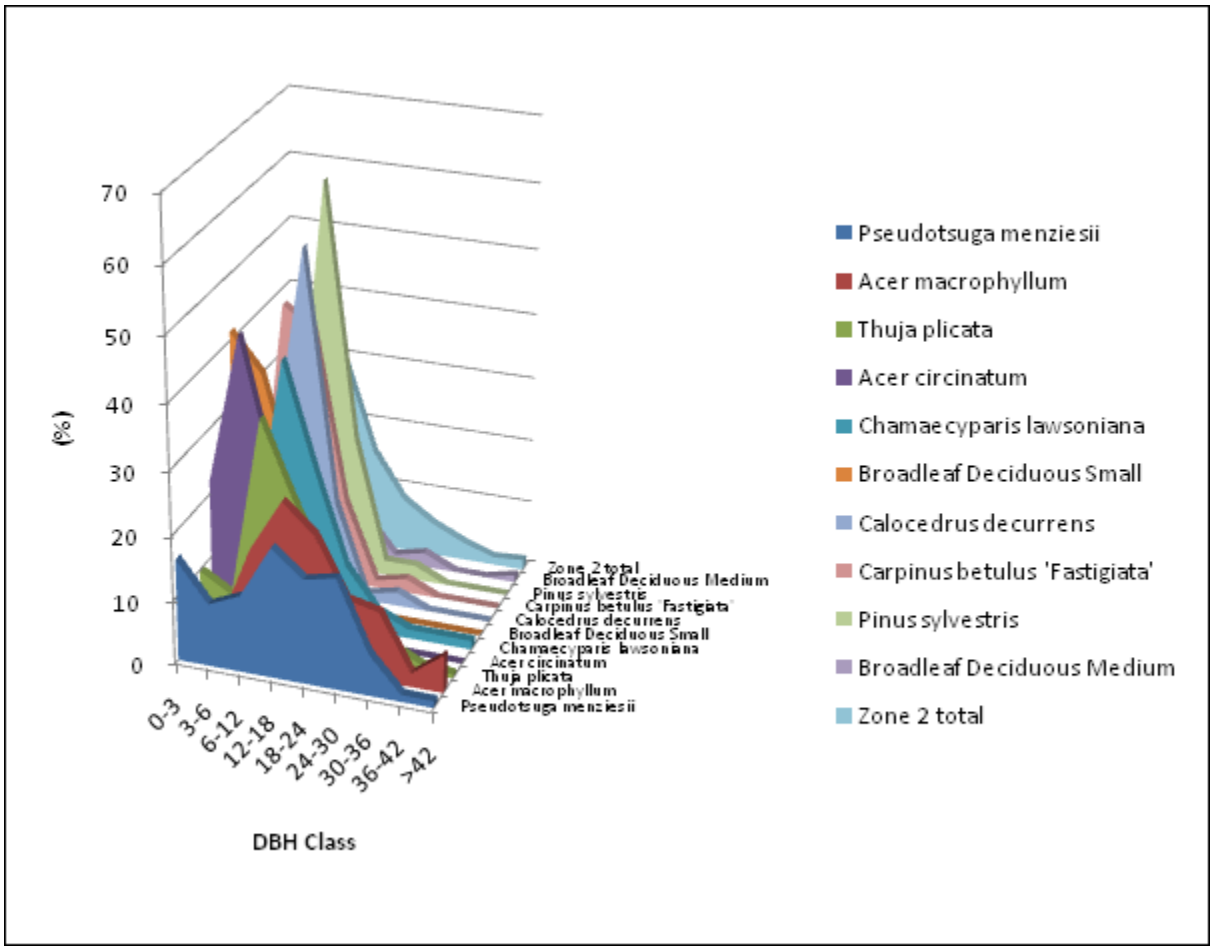
DBH class (in)

Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Acer macrophyllum	1.03	5.67	23.71	17.01	15.98	12.37	7.22	5.15	11.86
Pseudotsuga menziesii	1.38	2.76	12.41	32.41	22.07	15.17	8.28	4.83	0.69
Chamaecyparis lawsoniana	3.55	13.48	29.79	33.33	15.60	3.55	0.71	0.00	0.00
Liriodendron tulipifera	1.54	35.38	41.54	15.38	4.62	0.77	0.77	0.00	0.00
Quercus palustris	2.40	8.00	32.00	36.00	20.00	0.80	0.80	0.00	0.00
Cedrus deodara	0.81	0.81	5.69	33.33	15.45	13.01	17.07	11.38	2.44
Platanus hybrida	0.00	5.83	8.33	5.83	20.00	31.67	14.17	10.00	4.17
Pinus contorta	3.48	15.65	56.52	17.39	5.22	0.00	0.87	0.00	0.87
Pinus sylvestris	4.42	10.62	45.13	38.05	1.77	0.00	0.00	0.00	0.00
Quercus rubra	0.93	12.15	34.58	26.17	14.95	7.48	2.80	0.93	0.00
Zone 1 total	8.63	19.61	29.71	20.07	9.80	5.51	3.39	1.80	1.48

Seattle- University of Washington Campus

Relative Age Distribution of Top 10 Tree Species for Zone 2 (%)

4/12/2011



DBH class (in)

Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Pseudotsuga menziesii	15.88	9.75	11.91	20.22	16.25	17.33	6.50	1.08	1.08
Acer macrophyllum	1.08	4.84	17.20	25.27	20.97	11.83	10.75	2.15	5.91
Thuja plicata	9.77	6.90	35.06	23.56	13.22	6.32	3.45	1.15	0.57
Acer circinatum	21.97	45.09	25.43	6.94	0.58	0.00	0.00	0.00	0.00
Chamaecyparis lawsonia	8.33	9.72	40.28	24.31	9.72	3.47	1.39	1.39	1.39
Broadleaf Deciduous Sm	41.35	35.58	18.27	4.81	0.00	0.00	0.00	0.00	0.00
Calocedrus decurrens	6.45	21.51	53.76	15.05	1.08	2.15	0.00	0.00	0.00
Carpinus betulus 'Fastigi	1.10	42.86	39.56	13.19	1.10	2.20	0.00	0.00	0.00
Pinus sylvestris	1.12	12.36	60.67	21.35	2.25	2.25	0.00	0.00	0.00
Broadleaf Deciduous Medium	17.05	30.68	40.91	6.82	1.14	2.27	0.00	0.00	1.14
Zone 2 total	14.53	21.35	29.80	15.38	8.29	5.05	2.84	1.19	1.58

Seattle- University of Washington Campus

Replacement Value for Trees by Species ($)

4/12/2011

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error	% of Total
Pseudotsuga menziesii	5,246	15,576	92,482	506,836	737,796	1,105,754	691,722	304,729	136,253	3,596,393	(±0)	9.25
Acer macrophyllum	525	9,478	127,186	349,790	593,954	642,557	691,673	376,857	1,022,933	3,814,953	(±0)	9.82
Chamaecyparis lawsonia	2,434	14,979	150,264	327,059	277,825	126,891	55,407	48,860	54,605	1,058,325	(±0)	2.72
Thuja plicata	2,505	13,798	171,876	315,285	376,610	277,862	190,596	63,078	70,512	1,482,122	(±0)	3.81
Acer circinatum	8,934	42,095	94,877	85,167	18,875	20,626	0	0	0	270,574	(±0)	0.70
Pinus sylvestris	890	10,243	152,020	237,089	29,553	24,282	0	0	0	454,077	(±0)	1.17
Liriodendron tulipifera	342	32,158	157,764	162,384	57,491	15,796	23,021	0	68,126	517,082	(±0)	1.33
Carpinus betulus 'Fastigia	105	32,038	100,953	192,212	40,521	116,973	121,800	32,250	72,103	708,955	(±0)	1.82
Quercus rubra	981	11,716	106,763	153,336	162,601	208,356	173,458	86,087	64,149	967,448	(±0)	2.49
Gleditsia triacanthos	140	10,112	147,763	163,928	47,620	0	0	0	0	369,563	(±0)	0.95
Pinus contorta	978	13,789	133,910	122,946	47,620	0	19,004	0	28,098	366,346	(±0)	0.94
Calocedrus decurrens	1,026	14,571	148,697	118,098	86,236	47,389	92,085	0	0	508,102	(±0)	1.31
Cedrus deodara	228	502	16,320	206,671	229,962	379,116	690,634	609,457	170,316	2,303,207	(±0)	5.93
Platanus hybrida	95	4,805	44,318	60,763	302,068	765,706	468,630	412,594	192,188	2,251,167	(±0)	5.79
Malus species	2,316	11,253	59,456	88,443	132,124	41,252	14,988	79,238	22,133	451,202	(±0)	1.16
Broadleaf Deciduous Sm	9,265	20,006	39,216	26,205	0	0	0	0	0	94,692	(±0)	0.24
Quercus palustris	368	6,346	70,601	232,328	289,069	44,648	21,682	0	0	665,043	(±0)	1.71
Broadleaf Deciduous Medium	3,054	18,380	94,172	52,922	18,725	46,293	0	0	66,536	300,080	(±0)	0.77
Pinus species	1,140	9,547	63,468	172,226	229,962	94,779	23,021	60,946	68,126	723,216	(±0)	1.86
Ulmus species	787	12,321	70,115	74,330	118,791	97,780	101,717	53,837	90,259	619,938	(±0)	1.60
Arbutus menziesii	2,480	9,821	23,135	24,415	26,984	23,492	16,846	7,369	16,427	150,970	(±0)	0.39
Acer palmatum	2,737	16,581	67,095	39,366	67,072	63,186	69,063	60,946	0	386,047	(±0)	0.99
Betula pendula	455	11,430	71,974	111,430	43,014	11,775	0	0	0	250,079	(±0)	0.64
Prunus species	1,324	11,670	63,251	58,962	50,333	20,626	14,988	0	0	221,153	(±0)	0.57
Acer species	2,376	7,814	55,411	110,651	79,367	0	0	0	0	255,619	(±0)	0.66
Acer rubrum	980	18,397	78,465	86,449	19,822	0	0	0	0	204,113	(±0)	0.53
Acer platanoides	378	16,404	69,103	99,811	17,628	14,517	42,293	0	0	260,135	(±0)	0.67
Populus species	262	3,317	29,351	113,682	152,731	97,780	183,090	161,510	90,259	831,982	(±0)	2.14
Rhus hirta	4,798	17,088	26,565	9,827	0	0	0	0	0	58,279	(±0)	0.15
Prunus serrulata	331	1,667	45,541	121,200	31,458	0	0	39,619	0	239,815	(±0)	0.62
Liquidambar styraciflua	716	8,170	42,074	71,794	61,739	12,689	0	0	0	197,182	(±0)	0.51
Crataegus species	2,482	3,751	30,361	45,859	37,750	61,877	44,963	0	0	227,043	(±0)	0.58
Zelkova species	394	13,269	65,224	26,234	0	0	0	0	0	105,121	(±0)	0.27
Betula species	882	11,097	45,507	45,369	35,256	58,068	0	0	0	196,179	(±0)	0.50
Quercus species	1,049	2,370	30,981	65,586	144,246	83,812	40,687	26,918	30,086	425,735	(±0)	1.10
Cedrus atlantica	736	488	12,054	32,526	117,434	119,060	282,381	143,478	288,672	996,830	(±0)	2.56

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error	% of Total
Broadleaf Deciduous Lar	394	2,370	24,459	96,192	67,880	69,843	61,030	26,918	180,518	529,604	(±0)	1.36
Tilia cordata	2,232	17,386	12,438	19,244	0	30,862	0	29,762	0	111,924	(±0)	0.29
Syringa reticulata	1,226	12,693	43,050	13,940	0	0	0	0	0	70,908	(±0)	0.18
Sorbus aucuparia	978	12,869	30,784	8,196	23,810	13,055	19,004	0	0	108,697	(±0)	0.28
Pyrus calleryana	3,877	8,445	14,215	4,811	0	15,431	0	0	0	46,778	(±0)	0.12
Pinus strobus	0	3,517	18,134	59,049	239,544	47,389	46,042	0	0	413,676	(±0)	1.06
Acer saccharum	1,520	8,221	22,112	18,996	0	29,842	0	19,098	0	99,790	(±0)	0.26
Prunus yedoensis	148	4,008	8,687	15,296	88,660	109,267	158,990	70,092	78,328	533,476	(±0)	1.37
Aesculus hippocastanum	117	0	5,330	28,866	84,262	200,602	179,885	267,858	133,071	899,991	(±0)	2.32
Pinus nigra	228	2,512	45,334	63,970	28,745	63,186	0	0	0	203,976	(±0)	0.52
Populus tremuloides	1,392	8,855	21,125	12,006	0	0	0	0	0	43,378	(±0)	0.11
Cornus florida	1,187	4,899	31,852	26,768	7,388	0	17,666	0	0	89,759	(±0)	0.23
Cornus nuttallii	882	7,237	32,023	27,221	8,814	14,517	21,147	0	0	111,841	(±0)	0.29
Metasequoia glyptostrob	131	9,478	35,873	26,234	0	0	0	26,918	0	98,635	(±0)	0.25
Fraxinus latifolia	673	3,746	31,881	55,415	8,266	27,206	0	0	0	127,186	(±0)	0.33
Acer saccharinum	279	1,379	27,706	53,277	31,747	52,219	57,013	25,141	0	248,761	(±0)	0.64
Betula papyrifera	394	7,582	22,828	34,979	50,910	0	0	0	0	116,694	(±0)	0.30
Cercis canadensis	4,136	7,085	6,325	0	0	0	0	0	0	17,547	(±0)	0.05
Sequoia sempervirens	481	851	15,838	13,761	13,241	32,584	79,326	104,379	209,930	470,391	(±0)	1.21
Betula nigra	2,225	11,134	4,343	0	0	12,141	0	0	0	29,842	(±0)	0.08
Corylus species	2,813	4,585	15,180	9,827	0	0	0	0	0	32,405	(±0)	0.08
Pinus ponderosa	980	1,022	7,473	40,682	89,197	114,414	96,424	0	0	350,192	(±0)	0.90
Ulmus americana	538	2,341	6,376	51,152	24,797	68,015	59,423	26,207	146,454	385,306	(±0)	0.99
Conifer Evergreen Large	114	1,005	23,574	59,049	67,072	15,796	46,042	30,473	68,126	311,252	(±0)	0.80
Fraxinus oxycarpa	1,175	12,419	8,884	0	0	0	0	0	0	22,478	(±0)	0.06
Picea species	570	12,059	12,694	9,841	0	0	23,021	0	0	58,186	(±0)	0.15
Populus balsamifera ssp.	0	2,127	13,199	13,761	46,344	65,168	63,164	0	46,651	250,413	(±0)	0.64
Zelkova serrata	131	2,370	39,134	26,234	16,970	0	0	0	0	84,839	(±0)	0.22
Quercus coccinea	2,225	4,899	1,448	11,472	22,165	36,422	0	0	0	78,631	(±0)	0.20
Cedrus species	1,939	502	1,813	59,049	19,164	15,796	0	0	34,063	132,327	(±0)	0.34
Pinus coulteri	0	1,507	9,067	34,445	95,818	94,779	23,021	30,473	34,063	323,173	(±0)	0.83
Pinus monticola	114	1,507	9,067	68,890	76,654	15,796	23,021	0	34,063	229,114	(±0)	0.59
Pinus rigida	0	1,005	34,454	54,128	19,164	0	0	0	0	108,751	(±0)	0.28
Tsuga heterophylla	2,580	3,957	5,645	3,714	7,169	23,550	0	0	0	46,615	(±0)	0.12
Broadleaf Evergreen Large	279	460	20,010	8,196	63,494	65,273	0	25,141	28,098	210,951	(±0)	0.54
Magnolia species	1,489	4,168	12,650	9,827	6,292	0	0	0	0	34,426	(±0)	0.09
Quercus robur	394	948	16,306	43,724	33,940	41,906	0	0	30,086	167,303	(±0)	0.43
Ailanthus altissima	0	3,677	13,853	36,884	31,747	26,109	0	0	0	112,270	(±0)	0.29
Robinia pseudoacacia	0	1,447	6,742	40,832	52,884	43,551	105,733	27,985	31,279	310,454	(±0)	0.80
Tilia species	0	4,739	29,351	13,117	8,485	0	0	0	0	55,692	(±0)	0.14
Ilex aquifolium	548	4,659	11,905	5,455	15,585	0	0	0	0	38,150	(±0)	0.10

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error	% of Total
Fagus sylvatica	613	2,929	6,888	23,233	9,033	74,413	86,729	0	0	203,838	(±0)	0.52
Fraxinus species	131	9,004	9,784	13,117	8,485	0	0	0	0	40,521	(±0)	0.10
Cornus kousa	2,482	5,418	0	0	6,292	0	0	0	0	14,192	(±0)	0.04
Thuja occidentalis	993	4,585	12,650	0	0	0	0	0	0	18,228	(±0)	0.05
Crataegus monogyna	496	3,334	12,650	9,827	12,583	0	0	0	0	38,891	(±0)	0.10
Fagus species	656	8,056	0	8,745	8,485	13,969	0	0	0	39,911	(±0)	0.10
Picea abies	0	0	13,199	30,962	26,483	32,584	0	0	0	103,226	(±0)	0.27
Eucalyptus species	1,537	919	9,235	20,491	7,937	0	0	0	0	40,119	(±0)	0.10
Cercidiphyllum japonicu	504	4,825	3,371	22,684	26,442	0	0	0	0	57,826	(±0)	0.15
Cornus mas	662	5,001	5,060	9,827	0	0	14,988	0	0	35,538	(±0)	0.09
Crataegus phaenopyrum	0	10,112	1,539	4,098	0	0	0	0	0	15,749	(±0)	0.04
Acer campestre	0	511	29,891	20,341	19,822	0	0	0	0	70,565	(±0)	0.18
Carpinus betulus	0	965	26,967	13,611	17,628	0	0	0	0	59,171	(±0)	0.15
Ginkgo biloba	1,997	497	5,330	4,811	0	0	0	0	0	12,635	(±0)	0.03
Laurus nobilis	225	3,802	5,002	0	2,453	0	0	0	0	11,483	(±0)	0.03
Pinus thunbergiana	279	0	18,470	20,491	0	26,109	0	0	0	65,350	(±0)	0.17
Cornus species	1,324	2,084	6,325	3,276	0	10,313	0	0	0	23,321	(±0)	0.06
x Cupressocyparis leylan	0	0	23,574	29,524	9,582	0	0	0	0	62,680	(±0)	0.16
Salix species	0	0	8,153	43,724	0	41,906	0	53,837	0	147,619	(±0)	0.38
Prunus laurocerasus	0	3,448	10,851	7,100	0	11,227	0	0	0	32,626	(±0)	0.08
Ulmus procera	0	0	0	3,989	15,435	38,067	129,282	97,721	54,605	339,098	(±0)	0.87
Carpinus species	705	3,974	7,107	0	0	0	0	0	0	11,786	(±0)	0.03
Pinus densiflora	152	440	16,935	14,857	0	0	0	0	0	32,384	(±0)	0.08
Sequoiadendron giganteu	316	0	1,905	5,195	10,130	50,131	0	64,500	252,361	384,539	(±0)	0.99
Acer rubrum 'armstrong'	0	8,176	1,868	0	0	0	0	0	0	10,045	(±0)	0.03
Chamaecyparis obtusa	559	5,975	0	0	0	0	0	0	0	6,534	(±0)	0.02
Nyssa sylvatica	822	2,484	7,107	4,811	0	0	0	0	0	15,224	(±0)	0.04
Pinus aristata	490	4,394	6,888	0	0	0	0	0	0	11,772	(±0)	0.03
Cladrastis lutea	1,158	2,917	0	0	6,292	10,313	0	0	0	20,680	(±0)	0.05
Carpinus caroliniana	0	0	11,385	0	0	10,313	44,963	39,619	0	106,280	(±0)	0.27
Larix decidua	286	908	7,513	15,954	15,435	0	0	0	0	40,096	(±0)	0.10
Parrotia persica	140	1,379	3,078	16,393	7,937	13,055	19,004	25,141	28,098	114,225	(±0)	0.29
Prunus serotina	0	474	9,784	21,862	16,970	13,969	0	0	0	63,058	(±0)	0.16
Rhus glabra	613	3,417	5,166	0	0	0	0	0	0	9,196	(±0)	0.02
Taxus baccata	656	948	9,784	4,372	8,485	0	0	0	0	24,245	(±0)	0.06
Alnus rubra	0	0	12,314	12,295	15,873	0	0	25,141	0	65,623	(±0)	0.17
Broadleaf Evergreen Sma	1,258	460	3,078	4,098	7,937	0	0	0	0	16,831	(±0)	0.04
Conifer Evergreen Medium	114	4,020	9,067	0	0	0	0	0	0	13,201	(±0)	0.03
Laburnum anagyroides	321	3,828	2,640	0	6,621	0	0	0	0	13,409	(±0)	0.03
Cotinus coggygria	993	1,250	3,795	3,276	0	0	0	0	0	9,314	(±0)	0.02
Crataegus laevigata	0	0	15,026	11,966	0	0	0	0	0	26,992	(±0)	0.07

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error	% of Total
Populus nigra 'italica'	0	0	3,261	8,745	25,455	41,906	20,343	0	60,173	159,883	(±0)	0.41
Abies grandis	918	474	3,261	4,372	8,485	0	0	0	0	17,511	(±0)	0.05
Alnus species	0	0	4,618	24,589	23,810	0	0	0	0	53,017	(±0)	0.14
Conifer Evergreen Small	1,258	919	1,539	0	0	0	0	0	0	3,716	(±0)	0.01
Chamaecyparis pisifera	148	0	10,135	15,296	0	0	0	0	0	25,579	(±0)	0.07
Crataegus douglasii	784	2,586	0	3,550	0	0	0	0	0	6,921	(±0)	0.02
Fraxinus pennsylvanica	0	2,370	8,153	8,745	0	0	0	0	0	19,267	(±0)	0.05
Oxydendrum arboreum	394	2,843	4,892	0	0	0	0	0	0	8,129	(±0)	0.02
Acer griseum	1,489	417	1,265	0	0	0	0	0	0	3,171	(±0)	0.01
Acer negundo	143	0	7,513	15,954	7,717	0	0	0	0	31,328	(±0)	0.08
Cunninghamia lanceolata	0	497	7,107	14,433	9,362	15,431	22,486	0	0	69,316	(±0)	0.18
Magnolia x soulangiana	981	1,465	0	0	0	0	0	0	0	2,445	(±0)	0.01
Populus nigra	0	0	1,082	0	25,975	16,970	12,310	32,510	0	88,847	(±0)	0.23
Prunus subhirtella	355	794	1,137	2,892	22,096	9,033	0	0	0	36,306	(±0)	0.09
Quercus muehlenbergii	0	3,791	4,892	0	0	0	0	0	0	8,683	(±0)	0.02
Quercus velutina	0	0	1,631	17,490	42,425	13,969	0	0	0	75,514	(±0)	0.19
Abies species	114	1,005	1,813	19,683	19,164	0	0	0	0	41,779	(±0)	0.11
Abies concolor	0	2,010	3,627	9,841	9,582	0	0	0	0	25,060	(±0)	0.06
Amelanchier x Grandiflo	1,324	417	0	0	0	0	0	0	0	1,740	(±0)	0.00
Euonymus species	1,158	834	0	0	0	0	0	0	0	1,992	(±0)	0.01
Juniperus species	140	460	6,157	8,196	7,937	0	0	0	0	22,889	(±0)	0.06
Juniperus virginiana	1,258	0	0	0	0	0	0	0	0	1,258	(±0)	0.00
Magnolia acuminata	0	474	0	26,234	0	27,937	0	0	0	54,645	(±0)	0.14
Paulownia tomentosa	0	517	11,429	10,390	0	0	0	0	0	22,335	(±0)	0.06
Taxus species	0	1,379	3,078	8,196	7,937	13,055	0	0	0	33,645	(±0)	0.09
Tsuga canadensis	0	3,015	3,627	4,921	0	0	0	0	0	11,562	(±0)	0.03
Tsuga mertensiana	822	994	0	0	0	0	0	0	0	1,816	(±0)	0.00
Acacia melanoxylon	1,127	950	0	0	0	0	0	0	0	2,078	(±0)	0.01
Aesculus species	0	497	1,777	14,433	9,362	15,431	0	0	33,268	74,768	(±0)	0.19
Magnolia grandiflora	114	0	7,254	14,762	0	0	0	0	0	22,130	(±0)	0.06
Rhus species	165	417	3,795	0	6,292	20,626	0	0	0	31,295	(±0)	0.08
Acer pseudoplatanus	131	474	6,522	4,372	0	0	0	0	0	11,500	(±0)	0.03
Magnolia stellata	662	1,250	0	0	0	0	0	0	0	1,912	(±0)	0.00
Populus alba	558	1,148	1,046	0	0	0	0	0	0	2,751	(±0)	0.01
Quercus virginiana	0	2,758	1,539	0	0	0	0	0	0	4,297	(±0)	0.01
Ulmus carpinifolia 'hollandica'	131	474	6,522	0	0	0	20,343	0	0	27,471	(±0)	0.07
Acer x freemanii	787	0	0	0	0	0	0	0	0	787	(±0)	0.00
Acer ginnala	109	0	5,605	10,170	0	0	0	0	0	15,884	(±0)	0.04
Ilex altaclarensis	0	0	4,618	4,098	7,937	13,055	0	0	0	29,707	(±0)	0.08
Juniperus chinensis	262	0	4,892	0	8,485	0	0	0	0	13,639	(±0)	0.04
Juglans nigra	0	474	1,631	0	8,485	27,937	20,343	0	0	58,870	(±0)	0.15

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error	% of Total
Pinus mugo	0	1,838	1,539	4,098	0	0	0	0	0	7,476	(±0)	0.02
Platanus species	0	474	0	17,490	8,485	0	0	0	0	26,448	(±0)	0.07
Prunus avium	0	454	6,011	3,989	0	0	0	0	0	10,453	(±0)	0.03
Prunus cerasifera	0	0	3,554	4,811	9,362	30,862	0	0	0	48,589	(±0)	0.13
Pyrus species	165	417	1,265	3,276	0	0	0	0	44,265	49,388	(±0)	0.13
Quercus ilex	0	0	4,618	12,295	0	0	0	0	0	16,912	(±0)	0.04
Quercus shumardii	0	0	0	0	16,970	55,875	0	0	0	72,845	(±0)	0.19
Betula populifolia	0	994	5,330	0	0	0	0	0	0	6,324	(±0)	0.02
Castanea species	0	474	1,631	8,745	8,485	0	0	0	0	19,334	(±0)	0.05
Catalpa speciosa	114	502	0	4,921	9,582	0	0	30,473	0	45,592	(±0)	0.12
Crataegus mollis 'scheele	0	417	2,530	0	12,583	0	0	0	0	15,530	(±0)	0.04
Pinus attenuata	0	0	0	4,921	28,745	0	23,021	0	0	56,687	(±0)	0.15
Pinus banksiana	0	0	3,627	4,921	9,582	0	23,021	0	0	41,150	(±0)	0.11
Picea pungens	0	431	0	7,100	6,840	0	16,327	0	0	30,697	(±0)	0.08
Sassafras albidum	587	0	0	0	0	0	0	0	0	587	(±0)	0.00
Amelanchier species	496	417	0	0	0	0	0	0	0	913	(±0)	0.00
Chionanthus virginicus	662	0	0	0	0	0	0	0	0	662	(±0)	0.00
Clerodendrun trichotomu	662	0	0	0	0	0	0	0	0	662	(±0)	0.00
Ficus carica	0	417	2,530	3,276	0	0	0	0	0	6,222	(±0)	0.02
Hamamelis virginiana	496	417	0	0	0	0	0	0	0	913	(±0)	0.00
Ilex species	0	1,379	1,539	0	0	0	0	0	0	2,918	(±0)	0.01
Pinus pinea	525	0	0	0	0	0	0	0	0	525	(±0)	0.00
Populus balsamifera	0	0	0	0	16,970	27,937	0	0	0	44,907	(±0)	0.12
Salix matsudana	0	431	1,356	7,100	0	0	0	0	0	8,887	(±0)	0.02
Sciadopitys verticillata	0	1,379	0	4,098	0	0	0	0	0	5,477	(±0)	0.01
Taxodium distichum	0	0	3,261	4,372	8,485	0	0	0	0	16,119	(±0)	0.04
Thuja species	0	0	7,254	0	0	0	0	0	0	7,254	(±0)	0.02
Chamaecyparis nootkatensis	0	468	3,188	0	0	0	0	0	0	3,656	(±0)	0.01
Crataegus crus-galli	0	0	1,265	3,276	6,292	0	0	0	0	10,832	(±0)	0.03
Cupressus sempervirens	114	502	1,813	0	0	0	0	0	0	2,430	(±0)	0.01
Juglans species	117	0	0	4,811	0	15,431	0	0	0	20,359	(±0)	0.05
Larix species	0	948	0	4,372	0	0	0	0	0	5,320	(±0)	0.01
Maytenus boaria	676	0	0	0	0	0	0	0	0	676	(±0)	0.00
Ostrya virginiana	117	497	0	4,811	0	0	0	0	0	5,425	(±0)	0.01
Pinus flexilis	0	502	0	9,841	0	0	0	0	0	10,344	(±0)	0.03
Quercus suber	0	0	1,539	0	0	26,109	0	0	0	27,649	(±0)	0.07
Sorbus species	0	417	0	3,276	6,292	0	0	0	0	9,984	(±0)	0.03
Syringa vulgaris	123	488	1,722	0	0	0	0	0	0	2,333	(±0)	0.01
Ulmus campestris	0	0	3,261	0	0	0	20,343	0	0	23,605	(±0)	0.06
Abies pinsapo	0	454	1,503	0	0	0	0	0	0	1,957	(±0)	0.01
Albizia julibrissin	0	0	1,228	3,166	0	0	0	0	0	4,394	(±0)	0.01

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error	% of Total
Araucaria araucana	114	0	0	0	0	15,796	0	0	0	15,911	(±0)	0.04
Carya species	131	0	1,631	0	0	0	0	0	0	1,762	(±0)	0.00
Catalpa species	0	948	0	0	0	0	0	0	0	948	(±0)	0.00
Catalpa bignonioides	0	0	0	0	0	15,431	22,486	0	0	37,916	(±0)	0.10
Carya laciniosa	0	0	3,261	0	0	0	0	0	0	3,261	(±0)	0.01
Cercis siliquastrum	0	0	1,265	3,276	0	0	0	0	0	4,541	(±0)	0.01
Cryptomeria japonica	0	1,005	0	0	0	0	0	0	0	1,005	(±0)	0.00
Elaeagnus species	0	417	1,265	0	0	0	0	0	0	1,682	(±0)	0.00
Eucommia ulmoides	0	0	1,777	0	9,362	0	0	0	0	11,139	(±0)	0.03
Fagus sylvatica 'Purpurea'	0	0	0	8,745	0	0	0	0	0	8,745	(±0)	0.02
Fraxinus excelsior	0	497	0	0	9,362	0	0	0	0	9,859	(±0)	0.03
Fraxinus ornus	117	0	0	0	9,362	0	0	0	0	9,480	(±0)	0.02
Halesia carolina	117	0	1,777	0	0	0	0	0	0	1,894	(±0)	0.00
Halesia diptera	0	417	1,265	0	0	0	0	0	0	1,682	(±0)	0.00
Lagerstroemia indica	0	0	1,265	0	6,292	0	0	0	0	7,557	(±0)	0.02
Malus floribunda	0	345	808	0	0	0	0	0	0	1,153	(±0)	0.00
Palm Evergreen Medium	0	0	522	0	0	0	0	0	0	522	(±0)	0.00
Quercus imbricaria	0	0	0	0	0	0	40,687	0	0	40,687	(±0)	0.10
Quercus macrocarpa	123	0	0	0	0	0	21,682	0	0	21,805	(±0)	0.06
Quercus nigra	0	0	0	4,372	8,485	0	0	0	0	12,857	(±0)	0.03
Quercus prinus	0	0	0	4,647	9,033	0	0	0	0	13,680	(±0)	0.04
Rhododendron species	0	0	1,539	0	7,937	0	0	0	0	9,476	(±0)	0.02
Rhamnus species	331	0	0	0	0	0	0	0	0	331	(±0)	0.00
Umbellularia californica	225	0	625	0	0	0	0	0	0	851	(±0)	0.00
Abies fraseri	114	0	0	0	0	0	0	0	0	114	(±0)	0.00
Abies procera	160	0	0	0	0	0	0	0	0	160	(±0)	0.00
Acer buergerianum	0	0	1,631	0	0	0	0	0	0	1,631	(±0)	0.00
Acer glabrum	0	474	0	0	0	0	0	0	0	474	(±0)	0.00
Acer tataricum	0	0	0	3,276	0	0	0	0	0	3,276	(±0)	0.01
Asimina triloba	0	417	0	0	0	0	0	0	0	417	(±0)	0.00
Betula alleghaniensis	0	0	0	0	0	0	20,343	0	0	20,343	(±0)	0.05
Betula lenta	131	0	0	0	0	0	0	0	0	131	(±0)	0.00
Castanea dentata	0	0	0	0	8,485	0	0	0	0	8,485	(±0)	0.02
Carya glabra	0	0	0	0	8,485	0	0	0	0	8,485	(±0)	0.02
Celtis australis	0	0	0	4,372	0	0	0	0	0	4,372	(±0)	0.01
Celtis sinensis	0	0	0	4,811	0	0	0	0	0	4,811	(±0)	0.01
Cornus alternifolia	0	417	0	0	0	0	0	0	0	417	(±0)	0.00
Corylus americana	0	0	0	3,276	0	0	0	0	0	3,276	(±0)	0.01
Cordyline australis	0	0	1,539	0	0	0	0	0	0	1,539	(±0)	0.00
Cupressus species	0	0	1,813	0	0	0	0	0	0	1,813	(±0)	0.00
Diospyros virginiana	165	0	0	0	0	0	0	0	0	165	(±0)	0.00

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error	% of Total
Juniperus scopulorum	140	0	0	0	0	0	0	0	0	140	(±0)	0.00
Koelreuteria paniculata	0	445	0	0	0	0	0	0	0	445	(±0)	0.00
Maclura pomifera	0	0	1,777	0	0	0	0	0	0	1,777	(±0)	0.00
Magnolia tripetala	0	0	0	0	6,292	0	0	0	0	6,292	(±0)	0.02
Palm Evergreen Small	0	0	0	0	0	0	818	0	0	818	(±0)	0.00
Photinia spp.	0	0	0	4,098	0	0	0	0	0	4,098	(±0)	0.01
Pinus cembroides	0	0	0	4,098	0	0	0	0	0	4,098	(±0)	0.01
Pinus radiata	0	0	0	0	0	15,796	0	0	0	15,796	(±0)	0.04
Picea sitchensis	0	0	0	0	0	0	14,988	0	0	14,988	(±0)	0.04
Pinus strobiformis	0	0	1,539	0	0	0	0	0	0	1,539	(±0)	0.00
Pinus wallichiana	0	0	0	0	9,582	0	0	0	0	9,582	(±0)	0.02
Populus deltoides	0	0	0	0	0	13,969	0	0	0	13,969	(±0)	0.04
Podocarpus macrophyllus	0	0	1,539	0	0	0	0	0	0	1,539	(±0)	0.00
Prunus virginiana	165	0	0	0	0	0	0	0	0	165	(±0)	0.00
Quercus agrifolia	0	0	0	0	7,937	0	0	0	0	7,937	(±0)	0.02
Quercus alba	0	0	0	0	7,937	0	0	0	0	7,937	(±0)	0.02
Quercus aliena	0	0	0	4,811	0	0	0	0	0	4,811	(±0)	0.01
Salix alba	0	0	0	0	0	0	20,343	0	0	20,343	(±0)	0.05
Campuswide total	144,835	829,048	4,118,672	6,724,719	6,806,516	6,746,588	5,768,551	3,647,159	4,079,281	38,865,369	(±0)	100.00

Seattle- University of Washington Campus

Replacement Value for Trees by Zone ($)

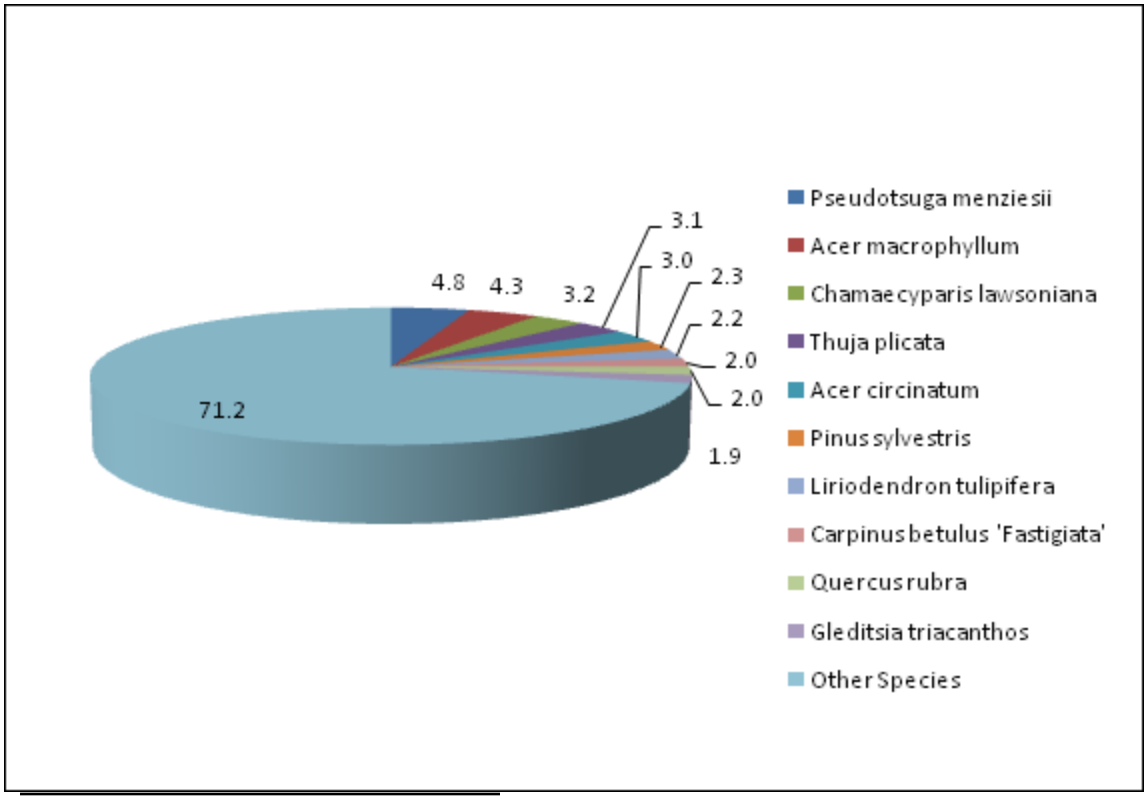
4/12/2011

	DBH Class (in)											
Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error	% of Total
1	51,359	395,899	2,031,131	3,774,741	3,680,616	3,563,328	3,148,719	2,285,177	1,968,471	20,899,441	(±0)	53.77
2	93,477	433,148	2,087,541	2,949,978	3,125,900	3,183,260	2,619,832	1,361,982	2,110,810	17,965,928	(±0)	46.23
Campuswide total	144,835	829,048	4,118,672	6,724,719	6,806,516	6,746,588	5,768,551	3,647,159	4,079,281	38,865,369	(±0)	100.00

Seattle- University of Washington Campus

Species Distribution of Trees (%)

4/12/2011



Species	Percent
Pseudotsuga menziesii	4.8
Acer macrophyllum	4.3
Chamaecyparis lawsoniana	3.2
Thuja plicata	3.1
Acer circinatum	3.0
Pinus sylvestris	2.3
Liriodendron tulipifera	2.2
Carpinus betulus 'Fastigiata'	2.0
Quercus rubra	2.0
Gleditsia triacanthos	1.9
Other Species	71.2
Total	100.0

Seattle- University of Washington Campus

Species Distribution for the Five Most Abundant Species of Trees

4/12/2011

Zone	1st (%)	2nd (%)	3rd (%)	4th (%)	5th (%)	# of Trees
1	Acer macrophyllum (4.5)	Pseudotsuga menziesi (3.3)	Chamaecyparis lawson (3.3)	Liriodendron tulipif (3)	Quercus palustris (2.9)	4,335
2	Pseudotsuga menziesi (6.2)	Acer macrophyllum (4.2)	Thuja plicata (3.9)	Acer circinatum (3.9)	Chamaecyparis lawson (3.2)	4,440
Campuswide total	Pseudotsuga menziesi (4.8)	Acer macrophyllum (4.3)	Chamaecyparis lawson (3.2)	Thuja plicata (3.1)	Acer circinatum (3)	8,775

Seattle- University of Washington Campus

Stored CO2 Benefits of Trees by Species

4/12/2011

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Pseudotsuga menziesii	1,398,957	4,617	(N/A)	4.8	5.1	10.94
Acer macrophyllum	3,984,980	13,150	(N/A)	4.3	14.5	34.61
Chamaecyparis lawsoniana	420,817	1,389	(N/A)	3.3	1.5	4.87
Thuja plicata	496,108	1,637	(N/A)	3.1	1.8	6.04
Acer circinatum	252,145	832	(N/A)	3.0	0.9	3.19
Pinus sylvestris	142,914	472	(N/A)	2.3	0.5	2.33
Liriodendron tulipifera	381,488	1,259	(N/A)	2.3	1.4	6.39
Carpinus betulus 'Fastigiata'	85,266	281	(N/A)	2.0	0.3	1.64
Quercus rubra	935,689	3,088	(N/A)	2.0	3.4	17.95
Gleditsia triacanthos	303,121	1,000	(N/A)	1.9	1.1	6.06
Pinus contorta	49,274	163	(N/A)	1.9	0.2	1.00
Calocedrus decurrens	83,955	277	(N/A)	1.8	0.3	1.73
Cedrus deodara	1,008,645	3,329	(N/A)	1.8	3.7	21.20
Platanus hybrida	1,885,516	6,222	(N/A)	1.7	6.9	41.76
Malus species	729,201	2,406	(N/A)	1.7	2.7	16.48
Broadleaf Deciduous Small	74,812	247	(N/A)	1.6	0.3	1.73
Quercus palustris	557,859	1,841	(N/A)	1.6	2.0	12.87
Broadleaf Deciduous Medium	155,295	512	(N/A)	1.5	0.6	3.82
Pinus species	250,494	827	(N/A)	1.5	0.9	6.17
Ulmus species	608,307	2,007	(N/A)	1.4	2.2	16.32
Arbutus menziesii	249,007	822	(N/A)	1.4	0.9	6.85
Acer palmatum	325,830	1,075	(N/A)	1.3	1.2	9.11
Betula pendula	124,101	410	(N/A)	1.3	0.5	3.50
Prunus species	280,949	927	(N/A)	1.3	1.0	8.06
Acer species	220,926	729	(N/A)	1.2	0.8	6.81
Acer rubrum	89,946	297	(N/A)	1.2	0.3	2.80
Acer platanoides	208,116	687	(N/A)	1.2	0.8	6.54
Populus species	866,887	2,861	(N/A)	1.1	3.2	29.80
Rhus hirta	42,199	139	(N/A)	1.1	0.2	1.48
Other street trees	5,085,350	36,997	(N/A)	43.5	40.9	9.69
Campuswide total	27,424,068	90,499	(N/A)	100.0	100.0	10.31

Seattle- University of Washington Campus

Stored CO2 Benefits of Trees by Zone

4/12/2011

Zone	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
1	14,684,483	48,459	(N/A)	49.4	53.5	11.18
2	12,739,585	42,041	(N/A)	50.6	46.5	9.47
Campuswide total	27,424,068	90,499	(N/A)	100.0	100.0	10.31

Seattle- University of Washington Campus

Annual Stormwater Benefits of Trees by Species

4/12/2011

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Pseudotsuga menziesii	834,953	23,130	(N/A)	4.8	10.5	54.81
Acer macrophyllum	636,813	17,641	(N/A)	4.3	8.0	46.42
Chamaecyparis lawsoniana	333,275	9,232	(N/A)	3.3	4.2	32.39
Thuja plicata	354,435	9,819	(N/A)	3.1	4.5	36.23
Acer circinatum	112,627	3,120	(N/A)	3.0	1.4	11.95
Pinus sylvestris	163,951	4,542	(N/A)	2.3	2.1	22.48
Liriodendron tulipifera	91,147	2,525	(N/A)	2.3	1.2	12.82
Carpinus betulus 'Fastigiata'	55,756	1,545	(N/A)	2.0	0.7	8.98
Quercus rubra	265,132	7,345	(N/A)	2.0	3.3	42.70
Gleditsia triacanthos	83,126	2,303	(N/A)	1.9	1.0	13.96
Pinus contorta	70,649	1,957	(N/A)	1.9	0.9	12.08
Calocedrus decurrens	17,442	483	(N/A)	1.8	0.2	3.02
Cedrus deodara	498,899	13,820	(N/A)	1.8	6.3	88.03
Platanus hybrida	298,207	8,261	(N/A)	1.7	3.8	55.44
Malus species	55,430	1,536	(N/A)	1.7	0.7	10.52
Broadleaf Deciduous Small	12,229	339	(N/A)	1.6	0.2	2.37
Quercus palustris	199,611	5,530	(N/A)	1.6	2.5	38.67
Broadleaf Deciduous Medium	59,179	1,639	(N/A)	1.5	0.7	12.23
Pinus species	178,009	4,931	(N/A)	1.5	2.2	36.80
Ulmus species	110,316	3,056	(N/A)	1.4	1.4	24.85
Arbutus menziesii	41,380	1,146	(N/A)	1.4	0.5	9.55
Acer palmatum	86,072	2,384	(N/A)	1.3	1.1	20.21
Betula pendula	71,585	1,983	(N/A)	1.3	0.9	16.95
Prunus species	29,117	807	(N/A)	1.3	0.4	7.01
Acer species	81,584	2,260	(N/A)	1.2	1.0	21.12
Acer rubrum	55,806	1,546	(N/A)	1.2	0.7	14.58
Acer platanoides	74,647	2,068	(N/A)	1.2	0.9	19.69
Populus species	143,691	3,981	(N/A)	1.1	1.8	41.46
Rhus hirta	7,564	210	(N/A)	1.1	0.1	2.23
Other street trees	2,935,224	81,311	(N/A)	43.5	36.9	21.29
Campuswide total	7,957,858	220,448	(N/A)	100.0	100.0	25.12

Seattle- University of Washington Campus

Annual Stormwater Benefits of Trees by Zone

4/12/2011

Zone	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
1	4,198,981	116,320	(N/A)	49.4	52.8	26.83
2	3,758,876	104,128	(N/A)	50.6	47.2	23.45
Campuswide total	7,957,858	220,448	(N/A)	100.0	100.0	25.12

Seattle- University of Washington Campus

Annual Benefits of Trees by Species ($/tree)

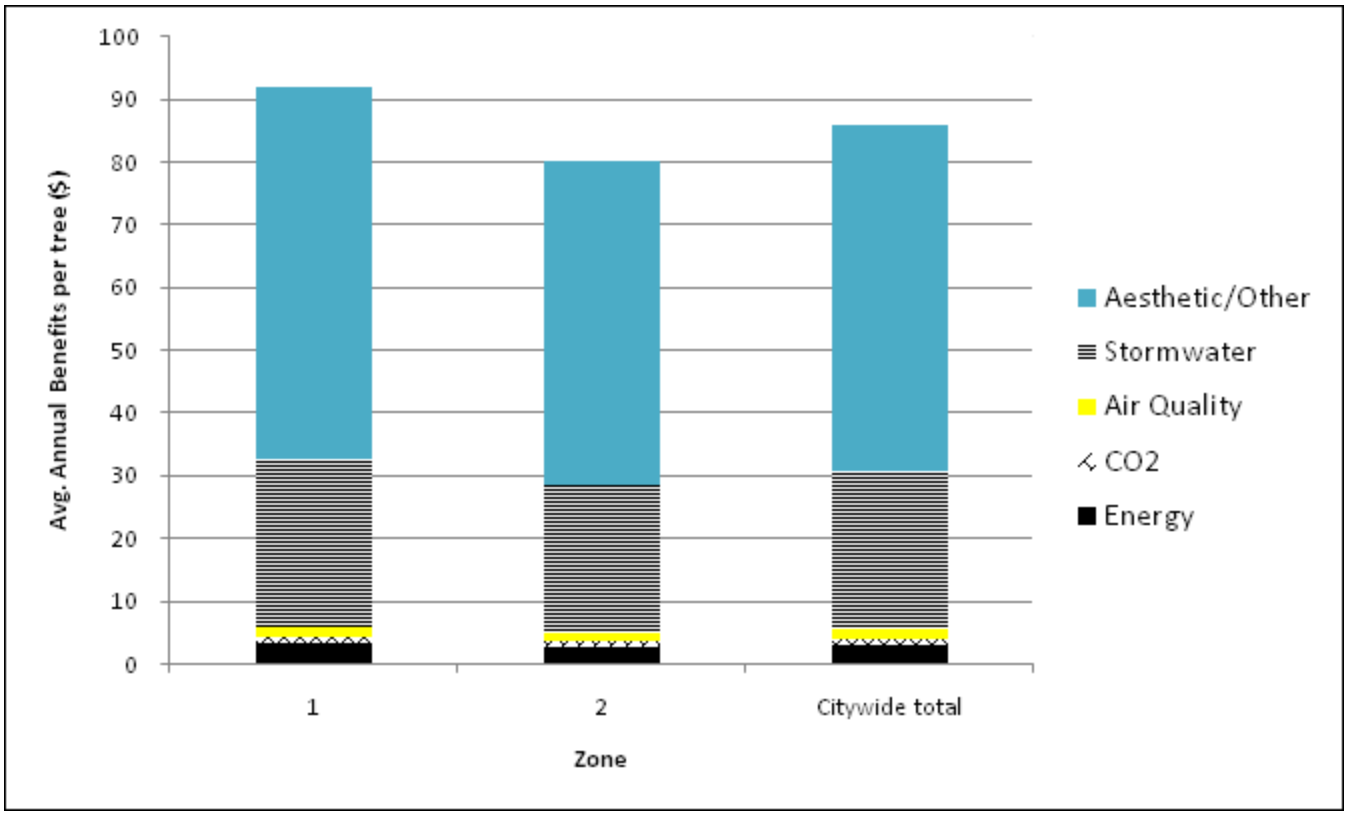
4/12/2011

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error
Pseudotsuga menziesii	4.61	0.92	2.63	54.81	78.74	141.71	(N/A)
Acer macrophyllum	6.37	1.63	3.32	46.42	73.52	131.25	(N/A)
Chamaecyparis lawsor	2.86	0.62	1.79	32.39	70.35	108.01	(N/A)
Thuja plicata	3.13	0.66	1.91	36.23	70.80	112.73	(N/A)
Acer circinatum	1.91	0.50	0.91	11.95	60.31	75.59	(N/A)
Pinus sylvestris	2.03	0.48	1.40	22.48	66.66	93.06	(N/A)
Liriodendron tulipifera	2.26	0.70	1.13	12.82	52.77	69.68	(N/A)
Carpinus betulus 'Fasti	1.32	0.29	0.66	8.98	53.37	64.62	(N/A)
Quercus rubra	5.97	1.44	3.10	42.70	122.20	175.40	(N/A)
Gleditsia triacanthos	2.56	0.81	1.27	13.96	60.59	79.18	(N/A)
Pinus contorta	1.22	0.18	0.76	12.08	25.61	39.85	(N/A)
Calocedrus decurrens	0.06	0.27	0.17	3.02	11.68	15.20	(N/A)
Cedrus deodara	6.85	1.30	3.74	88.03	91.01	190.94	(N/A)
Platanus hybrida	7.44	1.98	3.88	55.44	79.76	148.49	(N/A)
Malus species	2.15	1.88	1.25	10.52	35.21	51.01	(N/A)
Broadleaf Deciduous S	0.63	0.34	0.33	2.37	11.67	15.34	(N/A)
Quercus palustris	6.25	1.55	3.10	38.67	138.99	188.56	(N/A)
Broadleaf Deciduous Medium	1.99	0.38	0.72	12.23	41.43	56.75	(N/A)
Pinus species	3.21	0.67	1.94	36.80	70.78	113.40	(N/A)
Ulmus species	3.73	1.05	1.91	24.85	59.90	91.43	(N/A)
Arbutus menziesii	1.83	0.42	1.45	9.55	9.12	22.38	(N/A)
Acer palmatum	2.91	0.74	1.51	20.21	62.02	87.39	(N/A)
Betula pendula	2.68	0.44	1.41	16.95	53.94	75.42	(N/A)
Prunus species	1.61	1.16	0.89	7.01	27.27	37.95	(N/A)
Acer species	3.33	0.82	1.65	21.12	70.16	97.10	(N/A)
Acer rubrum	2.88	0.50	1.35	14.58	58.58	77.89	(N/A)
Acer platanoides	3.06	0.77	1.51	19.69	70.04	95.08	(N/A)
Populus species	5.84	1.58	3.02	41.46	73.96	125.87	(N/A)
Rhus hirta	0.60	0.32	0.31	2.23	11.53	14.99	(N/A)
Other street trees	2.71	0.80	1.40	21.29	46.54	72.74	(N/A)

Seattle- University of Washington Campus

Annual Benefits of Trees by Zone ($/tree)

4/12/2011



Zone	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error
1	3.32	0.90	1.76	26.83	59.34	92.14	(N/A)
2	2.83	0.78	1.51	23.45	51.60	80.16	(N/A)
Campuswide total	3.07	0.84	1.63	25.12	55.42	86.08	(N/A)

Seattle- University of Washington Campus

Total Annual Benefits of Trees by Species ($)

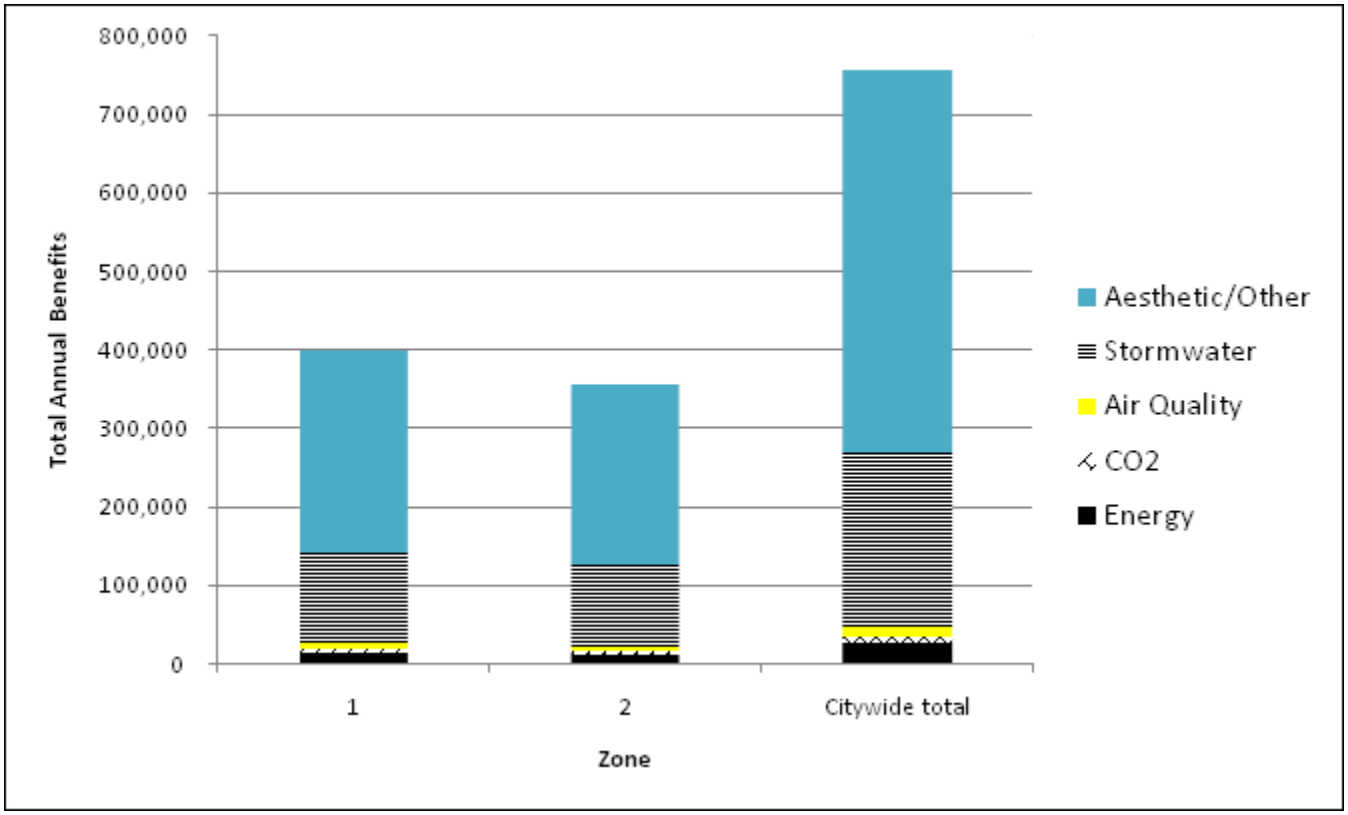
4/12/2011

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Pseudotsuga menziesii	1,946	389	1,108	23,130	33,230	59,802	(±0)	7.9
Acer macrophyllum	2,421	619	1,260	17,641	27,936	49,877	(±0)	6.6
Chamaecyparis lawsonia	815	176	510	9,232	20,049	30,783	(±0)	4.1
Thuja plicata	849	180	517	9,819	19,186	30,551	(±0)	4.0
Acer circinatum	500	130	239	3,120	15,740	19,728	(±0)	2.6
Pinus sylvestris	411	97	283	4,542	13,466	18,798	(±0)	2.5
Liriodendron tulipifera	445	138	222	2,525	10,396	13,727	(±0)	1.8
Carpinus betulus 'Fastig	228	51	113	1,545	9,179	11,115	(±0)	1.5
Quercus rubra	1,026	247	533	7,345	21,018	30,168	(±0)	4.0
Gleditsia triacanthos	422	134	210	2,303	9,997	13,065	(±0)	1.7
Pinus contorta	198	30	123	1,957	4,149	6,456	(±0)	0.9
Calocedrus decurrens	10	42	26	483	1,869	2,431	(±0)	0.3
Cedrus deodara	1,076	204	588	13,820	14,289	29,977	(±0)	4.0
Platanus hybrida	1,108	294	577	8,261	11,884	22,125	(±0)	2.9
Malus species	314	275	182	1,536	5,141	7,448	(±0)	1.0
Broadleaf Deciduous Sn	90	49	47	339	1,669	2,194	(±0)	0.3
Quercus palustris	893	222	444	5,530	19,875	26,964	(±0)	3.6
Broadleaf Deciduous Medium	267	51	96	1,639	5,552	7,605	(±0)	1.0
Pinus species	429	89	260	4,931	9,485	15,195	(±0)	2.0
Ulmus species	458	129	234	3,056	7,367	11,245	(±0)	1.5
Arbutus menziesii	220	51	174	1,146	1,094	2,685	(±0)	0.4
Acer palmatum	344	88	178	2,384	7,318	10,312	(±0)	1.4
Betula pendula	314	51	165	1,983	6,311	8,825	(±0)	1.2
Prunus species	185	133	103	807	3,136	4,364	(±0)	0.6
Acer species	357	88	177	2,260	7,508	10,389	(±0)	1.4
Acer rubrum	305	53	143	1,546	6,210	8,257	(±0)	1.1
Acer platanoides	321	81	159	2,068	7,354	9,983	(±0)	1.3
Populus species	561	152	290	3,981	7,101	12,083	(±0)	1.6
Rhus hirta	57	30	29	210	1,084	1,409	(±0)	0.2
Other street trees	10,367	3,065	5,340	81,311	177,728	277,811	(±0)	36.8
Campuswide Total	26,936	7,339	14,331	220,448	486,320	755,373	(±0)	100.0

Seattle- University of Washington Campus

Total Annual Benefits of Trees by Zone ($)

4/12/2011



Zone	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
1	14,392	3,881	7,627	116,320	257,228	399,447	(N/A)	52.9
2	12,544	3,458	6,704	104,128	229,093	355,926	(N/A)	47.1
Campuswide total	26,936	7,339	14,331	220,448	486,320	755,373	(N/A)	100.0

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