A Practical Approach to Assessing Structure, Function, and Value of Street Tree Populations in Small Communities

by

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ABSTRACT

APRACTICAL APPROACH TO ASSESSING STRUCTURE, FUNCTION, AND VALUE OF STREET TREE POPULATIONS IN SMALL COMMUNITIES

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This study demonstrates an approach to quantify the structure, benefits, and costs of street tree populations in resource-limited communities without tree inventories. Using the city of Davis, CA as a model, existing data on the benefits and costs of municipal trees were applied to the results of a sample inventory of the city's public and private street trees. Results indicate that Davis maintains nearly 24,000 public street trees that provide $1.2 million in net annual environmental and property value benefits, with a benefit-cost ratio of 3.8. The city can improve long-term stability of this resource by managing diversity, canopy cover, and maintenance on a city zone basis.

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Chapter 1

INTRODUCTION

Street trees have been valued as an important element of the urban forest since the time of the Renaissance (Lawrence, 1995). From the sixteenth century promenades of Antwerp, Belgium to the boulevards of nineteenth century France, trees have been planted and maintained for the benefit of the people who live, work, and recreate in cities. Today, nearly every city—in every country, first or third world—has a formal street tree planting program. City managers and residents alike appreciate that urban forests not only make communities more attractive, they also provide environmental, economic, and social benefits. Despite these benefits, justifying the expense of public tree plantings and maintenance is still the burden faced by those who manage this resource.

The continuing decline in tree program budgets in California, and nationwide, underscore the need to quantify the function urban trees provide to their communities (Bernhardt and Swiecki, 1993; Tschantz and Sacamano, 1994). And while only the surface has been scratched, recent years have begun to show promise that urban forest functions are concrete and quantifiable. The values urban forests provide are tied to climate control and energy savings, improvement of air, soil, and water quality, mitigation of storm water runoff, reduction of the greenhouse gas carbon dioxide (CO_2), providing wildlife habitat and corridors, as well as aesthetics, increased real-estate value, and community vitality and well being. Identifying and describing these benefits is considered the first step to increasing public awareness and support for tree programs (Dwyer and Miller, 1999).

Long-term management, reducing tree program costs, and increasing street trees' ability to maintain benefits produced through the foreseeable future depends on sound understanding of the population's structure. Species composition, age complexity, canopy cover, condition, and plantable spaces are telltale indices of urban forest health, stature, management needs, and conflicts. Only by thorough analysis of structure can we begin to value the environmental functions urban trees provide and begin to understand how we, as stewards, can maximize those benefits while reducing costs.

Cities such as Chicago, IL and Sacramento and Modesto, CA have undertaken benefit-cost (B-C) analyses to the great benefit of their municipal tree programs and the residents of their communities. By analyzing the structure of their city trees and applying values to the functions their city trees provide, they have not only proven their trees' public benefits outweigh program costs, but have demonstrated how urban forest analyses lead to better tree programs with fewer costs and more public and environmental benefits.
Large cities, however, possess what many cities (i.e., small cities or communities) do not: the means and resources to conduct the research. Small communities, with small budgets, usually do not have the resources—whether monetary or technical—to conduct a comprehensive municipal tree analysis.

By demonstrating techniques that enable these communities to manage their forests for long-term sustainability, immediate and direct benefits will be realized. For example, increased understanding of street tree populations in small communities will help managers mitigate urban heat islands, conserve water and reduce flooding, reduce air and water pollution, identify hazardous tree species, reduce sidewalk repair costs, preserve landmark trees, and protect critical wildlife habitats. These benefits can help make cities more enjoyable places to work and play. Well-managed community forests create settings that help attract new businesses and residents.

Using the city of Davis as a model, this project develops an expedient and low-cost approach for analyzing street tree populations in small communities. This model produces four types of information:

1. Resource structure (species composition, diversity, age distribution, condition, etc.).
2. Resource management needs (sustainability, canopy cover, pruning and young tree care).
3. Resource function (magnitude of environmental and aesthetic benefits).
4. Resource value (dollar value of benefits realized).

The result of this project is that Davis, or any community that follows suit, has a baseline analysis of their municipal urban forest that the city, tree commission, and other stakeholders can use to develop a long-term Urban Forest Management Plan. This information can be used to foster community participation and support for such a plan. By demonstrating a practical, adaptive approach to urban forest analysis this study has regional, statewide, and national significance.

This research was conducted at the request of Davis's Tree Commission with funding from the California Department of Forestry and Fire Protection and the city of Davis. Technical support and field assistance was provided by the US Forest Service's Center for Urban Forest Research (CUFR) and the Department of Environmental Horticulture at UC Davis.

Chapter 2

BACKGROUND

PROBLEMS OF INADEQUATE FUNDING

The number of publicly owned trees in a community is dependent on neither population size, climate, nor geographical region, but primarily on resources allocated through cities' general funds (Tschantz and Sacamano, 1994). Tree management programs depend on monetary allocations of their city's budget for nearly all aspects of a public tree program: skilled labor, appropriate equipment, and effective management and planning techniques (Tschantz and Sacamano, 1994). But when resources are scarce, public safety services such as police and fire departments and public works such as waste, street, and water departments compete—and invariably win—when cities' budgets are tightened (Bartenstein, 1981). As municipal budgets are stressed, and cities are forced to streamline operations, urban forest budgets are and will continue to decline.

From Geneva, Switzerland (Beer, 1996) to the whole of the US, tree budgets have not kept pace with municipal growth (Dwyer, 1995). Nationwide, Tschantz and Sacamano (1994) reported that the average municipal tree budget (adjusted for inflation) has decreased approximately 40% in eight years—from $4.14 per capita in 1986 to $2.49 per capita in 1994. Further, Bernhardt and Swiecki (1988; 1992) define resource and budget limitations as the root cause of municipal tree program downsizing in California.

With tree programs receiving an average of 70% of their total support from the taxpayer-supported general fund, the resulting uncertainty in funding caused by cyclical economies (Thompson and Ahern, 2000) are forcing communities to ask if trees are worth the price to plant and care for over the long term, thus requiring urban forestry programs to demonstrate their cost-effectiveness (McPherson, 1995). If trees are proven to benefit communities, then monetary commitment to tree programs will be justified.

Benefit-Cost Analyses

While an unfamiliar idea at the time, Bartenstein (1981) touted B-C ratios (BCRs) as a strategic priority for evaluating urban tree programs' cost-effectiveness. Hudson (1983) found that B-C analyses not only quantified the benefits attained through municipal trees, but forced urban forest managers to identify all program costs—a procedure that is prerequisite to the development of an economically viable program. In the early nineties, McPherson (1992) found that B-C analysis—by showing the rate of return on urban forest investments—could be used as a strategic method to procure and secure funding. And with the understanding that the applications of B-C analyses are not absolute, but rather to be used as a tool that can help managers direct their course of action, Freeman (1993) acknowledged the true utility of B-C analysis:

> "If the objective of management is to maximize the net economic values associated with the use of environmental and natural resources, then benefit-cost analysis becomes, in effect, a set of rules for optimum management and a set of definitions and procedures for measuring benefits and costs."

With respect to urban street trees, there have been many recommendations as to what has been, should, and possibly could, be quantified in monetary terms (Dwyer, 1991; Dwyer et al., 1992; Gobster, 1991; Hull and Ulrich, 1991; Macie, 1994; McPherson, 1991; Schroeder and Lewis, 1991), but actual quantification has been forthcoming slower than suggestions. And putting the quantified components into a full-scale B-C analysis have been fewer still.

When asked, community residents can identify numerous and diverse values associated with the urban forest—from increased privacy to those encountered when trees elicit personal memories (Hull, 1992). Contingent valuation (Dwyer et al. 1989; Simon, 1994; Tyrvainen and Vaananen, 1998), the travel cost method (Dwyer et al., 1983), and hedonic pricing (Morales et al., 1983; Anderson and Cordell, 1985) are methods for valuing urban forest amenities. While not trivial and no less important, benefits quantified using the methods above must be excluded from a B-C analysis—as a decision making tool—due to the fact that they derive single values that only indirectly reflect benefits and/or costs (McPherson, 1992). For example, the contingent valuation method asks what people are *willing* to pay but doesn't base values on what they *are* paying now. Similarly, these methods do not effectively differentiate benefits provided to disparate municipal management divisions. Therefore, in an effort to provide maximum use to community officials, dollar values should be unambiguously assigned to each benefit and cost using direct estimation and implied valuation (McPherson, 1992). In this fashion, planning and management recommendations inferred from the results will stem only from directly quantifiable values.

Establishing criteria used to quantify urban tree functions provoked the need for application. In Tucson, Arizona, McPherson (1991) applied an approach to modeling the benefits and costs of a large urban tree-planting project by connecting changes in spatial and temporal vegetation structure—tree numbers and leaf area per stem—with the functional benefits and costs the trees incurred. With illustrative success, he showed that over a "40-year planning horizon," monetary net benefits to the community would be realized; however, the simplified model was limited by assuming the mixed planting accrued benefits and costs at the same rate as a single mesquite tree (*Prosopis velutina*).

Use of B-C analysis advanced as a component of the Chicago Urban Forest Climate Project (CUFCP), which used B-C analysis to answer a fundamental question regarding a planting of 95,000 new trees in Chicago: "are trees worth it (McPherson et al., 1994)?" Using methods similar to those used in Arizona (McPherson, 1991), above, the authors' use of the Cost-Benefit Analysis of Trees (C-BAT) model refined differences in trees' growth amongst locations and the change in net benefits over time, showing accrued energy savings, air quality improvements, CO_2 sequestered and avoided, hydrological benefits, and other benefits could outweigh urban tree planting and maintenance costs over a period of 30 years.

In Modesto, CA—building off the methods developed for the CUFCP—McPherson et al. (1999) conducted a complete and comprehensive B-C analysis of Modesto's municipal forest. Intending, specifically, to justify annual program expenditures, this analysis differed from previous works by estimating benefits and costs of the resource based on more than simply the growth of a single species. Benefits of trees were directly connected to tree variables such as DBH (diameter at breast height) and leaf surface area (LSA) of 22 of the city's most important species. This analysis showed potential to put a value on urban forests in a variety of communities if appropriately applied.

Prices were assigned to each benefit through direct estimation and implied valuation of benefits as externalities and annual estimates of CO_2, stormwater, energy, air quality, and property value benefits were calculated for each tree. The results allowed comparison between species and amongst different tree ages, thereby realizing the utility of B-C analysis as the decision making tool.

Communities with climates similar to Modesto could use data from this study to help manage their own urban forest resource. Where climate and street tree taxa are similar, combining street tree growth data from the Modesto analysis with tree inventory information from regional cities provides the basis for calculating annual benefits. To translate these benefits into dollar values, adjustments can be applied that account for local market variations. For example, the $0.079 per kWh of electricity Modesto residents paid can be adjusted to $0.12 per kWh, reflecting current, local prices for electricity and higher estimated dollar value of benefits obtained through air conditioning savings. In this fashion, benefit and cost data from Modesto can be reliably extended to trees in communities such as Davis. However, prerequisite to quantifying function and value is understanding urban forest structure (McPherson, 1998).

Necessity of Defining Population Structure

"The vegetation resource is the engine that drives urban forests", stated Clark et al. (1997). Furthermore, its structure—composition, extent, distribution, and health—define the effective benefits provided and costs accrued (Dwyer et al., 1992; Clark et al., 1997). Like any resource, management of urban forest resources begins with an inventory of the resource (Miller, 1997).

Tree inventory databases, which are varied in complexity and cost—ranging from a single arborist with a desk full of files to complex computer-based programs—can provide accurate information when managed properly. However, the expense and requisite updating needed to maintain accuracy often make complete inventories beyond the scope of typical urban tree programs (Tschantz and Sacamano, 1994; Jaenson et al., 1992).

Requiring fewer resources, sampling techniques are an alternative to full-scale inventories (Bernhardt and Swiecki, 1999). Based on the principle of stratified random sampling, Jaenson et al. (1992) outlined a sample tree inventory method requiring no level of pre-existing information, such as knowing the total number of existing street trees in the city. With their method, street tree information, including species composition, DBH, health, total number of trees, and vacant planting spaces can be affordably and reliably collected and analyzed, providing a database that will yield accurate baseline information—to which a benefits-cost analysis can be applied—detailing specific information pertaining to the function and structure of the vegetation resource.

SUMMARY

There is a need for an assembled, systematic practical approach that communities with few resources can utilize to promote awareness, stewardship, and investment in urban forest care and management. An approach that conducts the sample inventory technique described by Jaenson et al. (1992) and applies the benefits estimated for specific trees of Modesto's urban forest fulfills this need and is described in the remainder of this thesis.

Chapter 3

METHODOLOGY AND PROCEDURES

STUDY AREA

The city of Davis, CA is located at the southern end of the Sacramento Valley, approximately 21 km (13 mi) west of California's capitol city, Sacramento (Figure 1), and 143 km (89 mi) north of the city of Modesto. The greater Central Valley region—bounded by the Sierra Nevada mountains to the east and the coastal range to the west—exhibits a Mediterranean climate characterized by hot, dry summers and cool, wet winters. At an average city elevation of 15 m (50 ft), the annual average temperature in Davis ranges from 10°C (50°F) to 17°C (62°F) and the maximum temperature, occurring July-August, averages 35°C (95°F) to 37°C (98°F) (Wells, 1972). Defined by 0°C (32°F), the average growing season is 258 days per year, where the average frost-free period begins in early February.

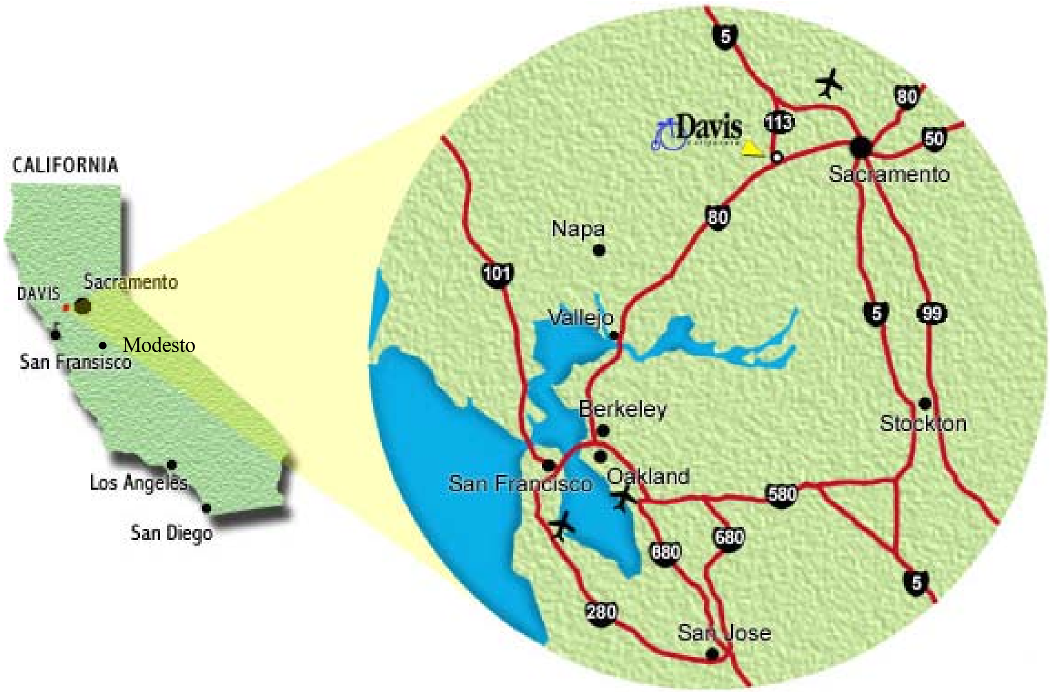
Precipitation for the year averages 420 mm (16.5 in) with 90% of this falling between November and April. The annual precipitation is less than 254 mm (10 in) one year in ten and less than 315 mm (12.4 in) one year in four; a total of nearly 508 mm (20 in) is experienced one out of every four years (Univ. of California, 1971). May 31st is the average date when the stored soil moisture supply is exhausted.

Soils in the Davis area are classified as belonging to the Yolo-Brentwood, Rincon-Marvin-Tehama, and the Capay-Clear Lake associations (Wells, 1972). These soils are typically well drained, nearly level, and vary between silty loams, silty clay loams, and clayey loams. All three soil associations are greater than 1.5 m (5 ft) in depth.

Incorporated in 1917, Davis currently has a population of approximately 58,600 (DOF, 2001), is approximately 24.5 km^2 (8.6 mi^2) in area, and there are 155 miles of public streets (City of Davis, 2001). The city is regionalized into five areas (Diemer, 2000):

1. South Davis: south of Interstate 80
2. North Davis: north of Covell Boulevard
3. West Davis: west of California Highway 113
4. East Davis: east of the Union Pacific Branch railroad line
5. Central Davis: the remaining areas including the entire downtown

Figure 1. The city of Davis, located in California's Central Valley (City of Davis, 2001).



SAMPLE TREE INVENTORY

Utilizing the rapid, stratified sampling technique proposed by Jaenson et al. (1992) 2,300 municipal street trees and any additional private street trees located in the public right-of-way (ROW) were targeted for inventory in Davis, CA during the summer of 2000. The purpose of the inventory was to estimate the structural characteristics of Davis's municipal and private street tree population with enough accuracy to confidently describe the forest's attributes to which the benefits trees provided were linked.

The methodology described by Jaenson et al. (1992) was used for this study because it was based on an accepted and valid method to conduct simple, random stratified samples of large street tree populations. Their methodology is summarized below along with deviations and adaptations appropriate for conducting this study in the city of Davis.

City zonation

The first step was to stratify the city into regions of similar land-use, demographic character, and street layout. Because Davis did not have areas of Rectilinear Residential zone type—those consisting of uniform rectangular blocks—only two zone types were used in this research, Curvilinear Residential and Downtown:

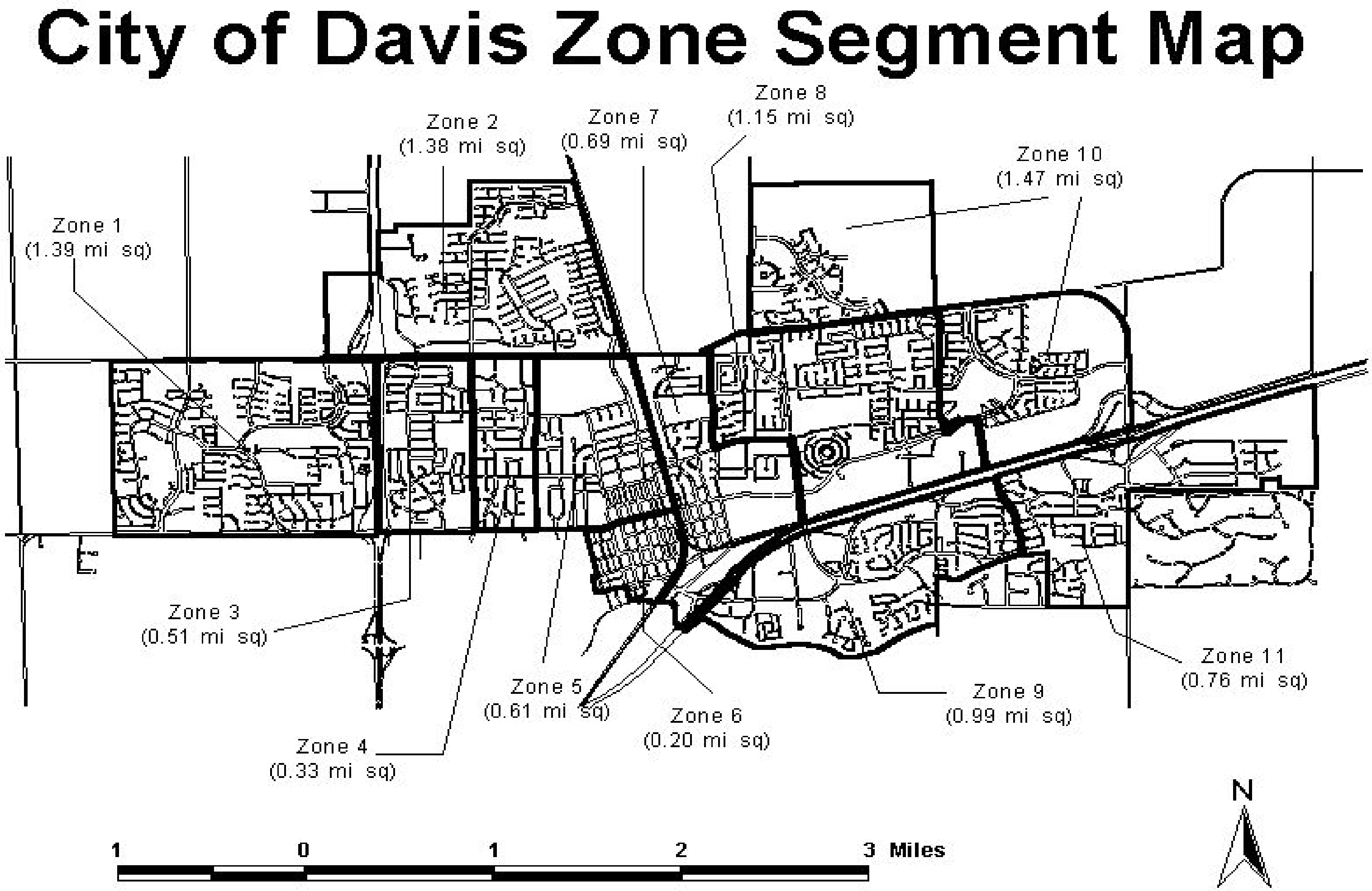
- The Downtown (DT) zone type is the central business district that is characterized by unique planting regimes and a grid-like street pattern with blocks of similar size.

- Curvilinear Residential (CR) neighborhoods are those areas that are typically newer subdivisions where streets are not grid-like, but consist of courts, places, circles, avenues, drives, boulevards, and lanes and are non-linear in character.

Using a city of Davis street map with a scale of 1:7200 (1 in equals 600 ft), the city was stratified into the zone types DT and CR. As Jaenson et al. specify, the zone types were then delineated into zone segments.

Zone segments were defined as a “contiguous region of a single zone type containing between 20 and 500 sampling units” with similar land-use, demographic character, and street layout. The city’s District Boundary & Assessment Diagram (City of Davis, 1996), 1990 census tracts (US Census Bureau, 2000), and on-site visual assessments made from an automotive tour aided in delineation. The character of Davis dictated stratifying the city into eleven zone segments: one DT zone and 10 CR zones (Figure 2).

Figure 2. Zone segment and city area map.



Establishment of uniform sampling units

The second step of the inventory procedure was to divide each zone segment into uniform sampling units: street units and street segments. A street unit was defined as "the inside perimeter of a block in the DT zone type." However, CR zones were not defined by a grid-like pattern of blocks and could not be used in CR zones. Therefore, the sampling unit used in CR zones was called a street segment, defined as "the estimated average perimeter of a DT zone block (A) divided by two." Inventorying trees on both sides of the street segment established an equivalent length of sampling units in DT and CR zones.

To find A, each block in the DT zone was first given a number; thirty-eight blocks were counted and denoted on the city map. Using Microsoft Excel, discrete random numbers were generated for 20% (to the nearest integer) of the total number of blocks, resulting in 8 random numbers within a range of 1 to 38. These randomly selected blocks were marked on the map in the DT zone. The perimeters of each selected block were then measured, summed in their entirety, and divided by the number of observations made (Table 1).

Table 1. Calculation of *A* based on average block perimeter of eight random blocks in zone segment 6.

Random block #	Measured perimeter (ft)
20	1248
7	1248
18	1248
10	1248
16	1452
12	1248
36	960
25	1296
A (average block perimeter) = 9948/8 = 1244 ft	

Dividing *A* by 2 defined the CR street segment as equal to 622 ft. On the city map, each of the 10 CR zone segments were then delineated into street segments of 622 ft and were numbered sequentially beginning with the number 1 for each of the 10 distinct CR zone segments. Sections of street remaining at intersections, cul de sacs, and edges of street segments were combined with the adjoining street segment if they were less than 311 ft (one half of the CR street segment length), but were left as discrete segments if less than 622 ft and greater than 311 ft. Where zone segment borders were delineated as street segments for inventorying on arterial streets, distance *A* (1244 ft.) was used and only the one side of the street that fell inside the zone was inventoried. Table 2 illustrates sampling unit totals achieved by the zone segment delineation process.

Table 2. Sum of zone segments and their respective number of delineated sampling units.

Zone segment (DT or CR)	Number of sampling units
1 (CR)	203
2 (CR)	172
3 (CR)	70
4 (CR)	54
5 (CR)	84
6 (DT)	38
7 (CR)	84
8 (CR)	163
9 (CR)	115
10 (CR)	175
11 (CR)	105
Total # of zone segments: 11	Total # of sampling units: 1,263

Determining number of trees sampled per zone segment

In order to distribute the sample across the city according to percentage of street trees per zone segment—weighting the zone segments—a pre-sample was conducted to estimate the number of street trees for each of the eleven zones. Discrete random numbers were generated with Microsoft Excel for each zone: a number equal to 20% (rounded to the nearest integer) of sampling units per zone segment where number of sampling units was less than 50; 10 discrete random numbers were generated for zone segments having more than 50 sampling units. Therefore, CR zone segments 1-5 and 7-11 had 10 random numbers generated for each zone, while the DT zone segment (6) had only 8.

Using a "windshield" survey method, each of the randomly chosen sampling units in each zone segment were inventoried for total number of city trees (see *Inventory Protocols* below) present. As was the case in all subsequent inventorying, only the trees on the inside perimeter of blocks in the DT zone were counted, while the trees on both sides of the street segments were counted in CR zones.

To estimate the average number of city trees per sampling unit in each zone segment, the total number of trees counted in the pre-sample were summed for each zone (Equation 1). This number was then divided by the number of sampling units pre-sampled and multiplied by the total number of sampling units in the respective zone segments to estimate the number of trees per zone segment (Equation 2):

Equation 1

$$\text{Estd. avg. \# of trees per sampling unit} = \left(\frac{\text{Total \# of trees counted per sampling unit}}{\text{\# of street units pre-sampled}} \right)$$

Equation 2

$$\text{Estd. \# of trees per zone segment} = \left(\begin{matrix} \text{Estd. avg. \# of trees} \\ \text{per sampling unit} \end{matrix} \right) * \left(\begin{matrix} \text{Actual \# of sampling} \\ \text{units per zone segment} \end{matrix} \right)$$

The total number of city street trees in Davis was then estimated for this procedure by summing the previous zone segment totals (Equation 3):

Equation 3

$$\text{Estd. total number of city street trees citywide} = \sum \text{Estd. \# of trees per zone segment}$$

Equation 4 was then used to estimate the percentage of the total city street tree population located in each zone segment:

Equation 4

$$\text{\% of total tree population in ech zone segment} = \left(\frac{\begin{matrix}\text{Estd. \# of trees} \\ \text{per zone segment}\end{matrix}}{\begin{matrix}\text{Estd. total \# of city} \\ \text{street trees citywide}\end{matrix}} \right)$$

Lastly, the desired number of trees and sampling units to be inventoried per zone segment was determined by equations 5 and 6:

Equation 5

$$\text{Target \# of trees to sample per zone segment} = (2{,}300) * \left(\begin{matrix}\text{\% of total tree pop.} \\ \text{in each zone segment}\end{matrix} \right)$$

Equation 6

$$\text{\# of sampling units to be inventoried} = \left(\frac{\begin{matrix}\text{Target \# of trees} \\ \text{per zone segment}\end{matrix}}{\begin{matrix}\text{Estd. avg. \# of trees} \\ \text{per sampling unit}\end{matrix}} \right)$$

Discrete random numbers were generated for the number of sampling units to be inventoried per zone segment (Table 3). Street segments and units were then identified and marked on the city map in preparation for the sample tree inventory.

Table 3. Results of equations 5 and 6 as applied in Davis and are the basis for the sample inventory.

Zone segment	Targeted # of city trees for sample inventory	# of sampling units sampled
1	335.6	18
2	270.3	16
3	155.8	8
4	97.1	6
5	157.2	8
6	113.9	5
7	138.1	8
8	250.3	15
9	191.2	10
10	472.2	23
11	118.3	10
Citywide	2,300.0	127

Inventory protocols

After determining the number of sampling units to be inventoried per zone segment, all trees in the city ROW within each unit were sampled according to the following protocols. Two-person teams (a measurer and a recorder) were used to record data using the field inventory sheet (Appendix A), later entered into a Microsoft Excel spreadsheet for data analysis. Equipment used during the inventory included a Brunton® compass for orientation measurements, a Suunto® clinometer for measuring tree height, a Forestry Suppliers, Inc. dbh-tape to measure tree diameter, and a Spencer Products Co. 'ProTape-S' for measuring distances. The city of Davis *Street Tree Inventory* (City of Davis, 2000) was used to help identify city trees.

The following was recorded for each inventoried sampling unit:

- Beginning address
- Ending address
- Zone number
- Date
- Names of person(s) who conducted the inventory

The following was recorded for each tree:

Species Code – where the first two letters of the tree's genus were followed by the first two letters of the species's epithet. For example, a Chinese hackberry (*Celtis sinensis*) was coded as CESI. VOID was entered for a vacant planting area within the right-of-way, where a linear measurement of 80 ft. or more was plantable space and void of trees (Cordrey, 2000; Nunes, 2000). A species code reference list is attached (Appendix B).

City Tree – trees were considered city owned (1=Yes) if they were within the 10 ft city right-of-way and listed in the city inventory, were median trees, or were within the city right-of-way and were not privately owned and cared for. All other trees were considered private (0=No). Determination of private trees was often identified by evaluating the landscaped area for thematic species selection and grouping by the property owner. Likewise, incongruous trees located within the right-of-way and not listed in the city inventory were considered private trees. For example, if a street unit's city street trees consisted of a relatively uniform distribution of Chinese tallow (*Sapium sebiferum*), a single Mexican fan palm (*Washingtonia robusta*) would be considered a private tree if it was not listed in the city inventory and matched the landscape of the property beyond the city right-of-way.

Year Planted – if a public tree was listed in the city inventory and had a planting date noted, the year of planting was recorded. "NA" was entered where information was not available.

Land-use – where a number (1-4) was entered to correspond with the type of neighborhood or environment adjacent to the inventoried tree:

1 = Single home residential

2 = Multi-home residential

3 = Commercial/ industrial

4 = Other (vacant, institutional, agricultural, park, etc.)

Tree Location – a number (1-5) was entered that corresponds to the description of the inventoried trees planting location:

1 = Front yard

2 = Planting strip

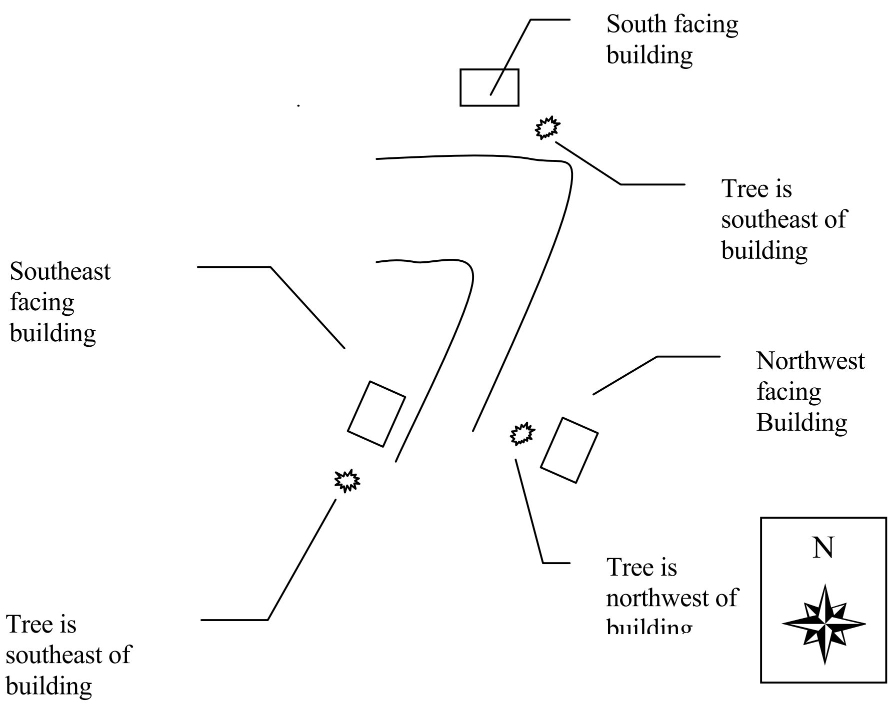
3 = Cutout

4 = Median

5 = Other

Front Orientation of Adjacent House, Building, or Air-conditioned Space – where the orientation of the inventoried building was entered in reference to its cardinal or intercardinal position (Figure 3).

Figure 3. Example of tree and building distribution.



Entries were recorded as follows:

N = North (337.5-22.5°)

NE = Northeast (22.5-67.5°)

E = East (67.5-112.5°)

SE = Southeast (112.5-157.5°)

S = South (157.5-202.5°)

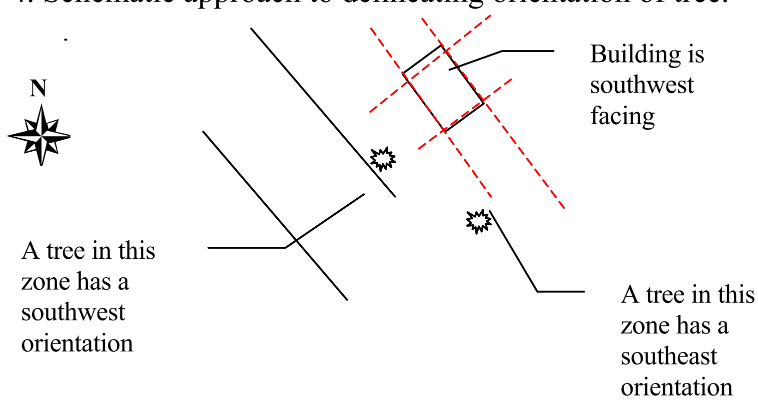
SW = Southwest (202.5-247.5°)

W = West (247.5-292.5°)

NW = Northwest (292.5-337.5°)

Orientation of Tree – using the above entries, orientation of inventoried trees with respect to the front orientation of house, building, or air-conditioned space was recorded (Figure 3). Because tree orientation needed to agree with front orientation, it was useful to visualize "imaginary lines" as defined by the building walls (Figure 4).

Figure 4. Schematic approach to delineating orientation of tree.



Setback Distance – distance from tree trunk to the nearest air-conditioned space of a house or building was recorded by distance classes:

1 = 0 – 8 m

2 = 8 – 12 m

3 = 12 – 18 m

0 = >18 m

Diameter at Breast Height (DBH) – a DBH measuring tape was used to measure bole diameter using standard methods of forestry mensuration (Brouilett, 1985). Diameter measurement (cm) was recorded to the nearest 0.1 cm.

Tree Height – using a clinometer, tree height was recorded by height class:

1 = 0 – 3 m

2 = 3 – 6 m

3 = 6 – 9 m

4 = 9 – 12 m

5 = 12 – 18 m

6 = >18 m

Crown Diameter – using a measuring tape, crown diameter was measured by averaging the widest crown radius and the narrowest crown radius measurement and multiplying by 2. Measurements of crown diameter were recorded to the nearest 0.5 m.

Condition – the condition (1-4) of each inventoried tree was recorded as a number that corresponds with the following condition classes:

1 = Good = Healthy vigorous tree. No signs of insect, disease, or mechanical injury. Little or no corrective work required. Form representative of species.

2 = Fair = Average condition and vigor for area. May need corrective pruning or repair. May lack desirable form characteristic of species. May show minor insect injury, disease, or physiological problem.

3 = Poor = General state of decline. May show severe mechanical, insect, or disease damage, but death not imminent. May require major repair or renovation.

4 = Dead or Dying = Dead or death imminent from disease or other causes.

Needs Pruning – adequacy of pruning was determined by visually estimating whether or not pruning was needed. “Yes” (1) was recorded for each tree that had dead-wood present in diameters >2 cm, needed crown cleaning, thinning, reduction, raising, or restoration. “No” (0) was entered if the tree did not exhibit or require the above conditions.

Immediate Pruning Required? – if a tree's pruning need represented a public safety liability, there was a high infestation of mistletoe (>25% canopy) or a high probability that lack of immediate pruning would lead to reduced tree longevity or decline, "Yes" (1) was recorded. "No" (0) was recorded where the above criteria were not met.

Conflicts Present? – "Yes" (1) was recorded where the following conflicts were present or exacerbated by the inventoried tree; "No" (0) was recorded where the conflicts were not present:

Sidewalk – tree roots caused adjacent sidewalk heave >.75 in.

Hazard – a tree was considered to possess hazardous characteristics if it was structurally unsound and there was a possible target (structures, vehicles, people) (Harris, 1992). Significant weak structures, decay of trunk and/or branches, cankers, rot, and root loss and decay were all indicative of hazardous trees. However, if targets—structures, people, or vehicles—were not present, no hazard existed (Harris, 1992).

Intersection/Visibility/Lighting – these were considered conflicts when clear views of street signs or intersections were obstructed by the tree. Additionally, public street lamps or lighting that were obstructed constituted a conflict.

Spacing – a tree was spaced too closely to other public or private trees or structures. These conflicts were present when the full, potential size and form of the tree was determined to be compromised or inhibited by the trees limited growing space.

Overhead Lines – trees obstructed or interfered with overhead utility lines.

Car Shaded – if any portion of an automotive vehicle was present within the tree's dripline then a car was shaded and a "1" (Yes) was entered. If, at the time of inventory, no car was present within the dripline, then "0" (No) was entered.

Other Needs/Comments – additional notes not included or pertaining to the above fields were noted where applicable.

Calculation of the results

The pre-sampling procedure was used to initially determine the proportion of individual trees in each DT and CR zone, and subsequently the sampling intensity targeted for each zone. The result was a proportional allocation of the number of sampling units sampled per zone segment (Equation 6). This stratification process yielded a self-weighting sample that simplified subsequent calculations of population estimates (Cochran, 1977).

Application of the weighting procedure described by Jaenson et al. (step 12) was found to be an unnecessary step due to the proportional sampling fraction in all strata (zone segment). Therefore, equations 7-9, below, were used in lieu of step 12 to simplify and speed calculations. Final, citywide, tree counts of public and private trees and their attributes were calculated based on the proportions of trees counted in the actual sample inventory—not the pre-sample.

Estimated total numbers of individual tree species (*X*) per zone segment were calculated using the model for stratified random sampling with proportional allocation (Cochran, 1977):

Equation 7

$$\bar{y} = \frac{\sum_{h=1}^{L} n_h \bar{y}_h}{n} \quad \text{where,}$$

$$y_h = \frac{\sum_{i=1}^{n_h} y_{hi}}{n_h}$$

$L =$ number of strata

$n_h =$ number of units in sample

$y_{hi} =$ value obtained for the *i*th unit

From equation 7, zone segment totals for each inventoried species were calculated using equation 8, and citywide totals for each species were calculated using equation 9:

Equation 8

$$\text{Estd. \# of species } X \text{ per zone segment} = \left(\begin{matrix}\text{Actual \# of sampling}\\ \text{units per zone segment}\end{matrix}\right) * \left(\frac{\text{Total \# of species } X \text{ counted in zone segment}}{\text{\# of sampling units sampled in zone segment}}\right)$$

Equation 9

$$\text{Estd. \# of each species } X \text{ citywide} = \sum \text{Estd. \# of species } X \text{ per zone segment}$$

Estimating the percentage of the citywide population represented by species *X* was calculated with equation 10:

Equation 10

$$\text{Species } X \text{ as percentage of population} = \left(\frac{\text{Estd. number of species } X}{\sum \text{Estd. number of all city trees}}\right)$$

Standard Error

Jaenson et al. (1992) purported results obtained using their statistical methodology for street tree sampling to be accurate within 10% of actual population totals. This error was determined through comparison of the sampling method coupled with known populations in four cities. Because the city of Davis does not have an accurate inventory for *all* public trees, standard error (se) was calculated to confirm sampling accuracy and provide the reader with an idea of variance for street tree population totals. The results of this analysis are reported in Chapter 4 and were calculated within zone segments (Equation 11) and as citywide totals (Equation 12) (Cochran, 1977):

Equation 11

$$\mathrm{se}_{\mathrm{citywide}} = \sqrt{\sum_{i=1}^{n} \left(\mathrm{se}_{\mathrm{zone}}\right)_i^2}$$

Equation 12

$$\mathrm{se}_{\mathrm{zone}} = \sqrt{V(\bar{y})} \quad \text{where,}$$

$$\bar{y} = \frac{\sum_{i=1}^{n_h} y_{hi}}{n_h}$$

$$V(\bar{y}) = \frac{1-f}{n} \sum W_h S_h^2$$

$$S_h^2 = \frac{\sum_{i=1}^{N_h} \left(y_{hi} - \bar{Y}_h\right)^2}{N_h - 1}$$

$$Y_h = \frac{\sum_{i=1}^{N_h} y_{hi}}{N_h}$$

$$W_h = \frac{N_h}{N}$$

$$f_h = \frac{n_h}{N_h}$$

N_h = total number of units in zone segment

n_h = number of units sampled in zone

y_{hi} = number of individual trees counted for the ith unit

STRUCTURAL ANALYSIS

Utilizing the data collected during the sample inventory, structural components of Davis's municipal forest were analyzed to identify specific management needs that will improve forest health and sustainability, and indicate how investment in a management program will impact benefits and costs of maintaining the urban forest.

Calculations of species composition by zone segment and citywide have been described above (Equations 4, 7-9). By substituting species X for different recorded tree attributes (DBH, condition class, pruning needs, etc.), these four equations were used to calculate structural characteristics presented in Chapter 4 unless otherwise noted. Data summaries in figures and tables were constructed using computer software programs Microsoft Excel and Statistical Package for the Social Sciences (SPSS).

Importance values

Importance refers to the relative contribution of a particular species to the entire community (Barbour et al., 1987). While this holds true in an urban forest setting as well as natural communities, it may also be stated that an importance value (IV) provides meaningful interpretation with respect to the degree a city might depend on particular urban trees insofar as their environmental benefits are concerned.

A traditional ecological calculation of importance is defined as the sum of relative density, frequency, and dominance (basal area) (Krebs, 1978). Widely used in forestry, this calculation can be altered to better describe importance of urban trees where canopy cover is a better descriptor of dominance than basal area (Miller and Winer, 1984). Therefore, three elements were summed to obtain an importance value (IV) for each public street tree species (Equations 13-16):

Equation 13

$$\text{IV of species } X = \text{Relative density} + \text{Relative frequency} + \text{Relative dominance}$$

where,

Equation 14

$$\text{Relative density} = \frac{\#\text{ of individuals of species } X}{\text{Total individuals of all species}} \times 100$$

Equation 15

$$\text{Relative frequency} = \frac{\text{Frequency of species } X}{\sum \text{frequency values for all species}} \times 100$$

Equation 16

$$\text{Relative dominance} = \frac{\text{Canopy cover of species } X}{\text{Total canopy cover of all species}} \times 100$$

Canopy cover

The environmental benefits of trees are related to the amount of canopy cover (CC) they provide. But defining ideal CC in any given community is a difficult task dependent upon climate, land use, and location. And while it is generally considered that more is better, an optimal degree of CC can be determined for every city (Clark et al. 1997). Periodic CC analysis can help communities assess adequacy and effectiveness of ordinances and management methods directed to increasing CC (Bernhardt and Swiecki, 1999).

The use of photogrammetry and remote sensing are two expensive ways cities can analyze urban forest CC. Calculated by ground survey or through aerial photograph examination, an alternative proposed by Bernhardt and Swiecki (1999) uses an index based on canopy cover at the edge of pavement (CCEP). While useful for comparison over time, CCEP is not a true measurement of canopy cover and cannot be used to estimate benefits that are directly related to area of canopy coverage.

To calculate benefits associated with extending pavement longevity, McPherson et al. (1999) assumed a standard estimation by which 50% of street tree canopy provided direct shade over street pavement. However, a more accurate estimation can be made with simple trigonometry using data collected in a sample inventory: planting location and average setback distance. This method measures not only actual total canopy cover, but the amount of CC over pavement and sidewalks, yielding results applicable to quantifying benefits as well as providing a measure of management success and comparison with other communities.

Canopy cover of public and private trees was estimated as total CC, CC over pavement, and CC over pavement and sidewalks. Total CC was directly estimated from tree canopy diameter. But because there were five possible tree locations, nine equations were needed to take into account the two remaining coverage regimes. All cases were dependent on some or all of the following Davis specific parameters (Cordrey, 2001b):

average median width = 3.7 m (12 ft)
average street width = 10.67 m (35 ft)
average sidewalk width = 1.22 m (4 ft)
average cutout area = 1.22 m^2 (16 ft^2)
average planting strip width = 1.22 m (4 ft)

Average tree setback from back edge of the sidewalk was assumed to be 2.3 m (7.5 ft) in both "front yard" and "other" locations, and planting cutouts are setback 0.61 m (2 ft) from curbside. All trees were assumed planted on-center in cutout, planting strip and median locations. Because median trees were typically only found on large arterial streets where crowns did not intercept sidewalks, they were assumed to not provide sidewalk coverage. Front yard and "other" tree locations were treated the same in CC calculations. The nine equations were as follows:

Equation 17

$$\text{CC m}^2 \text{ (Front yard trees over street)} \;= \frac{r^2}{2}\left(\frac{\pi\theta}{180} - \sin\theta\right)$$

$$\text{where } \theta = 2\left(\arccos\left(\frac{3.5052 \text{ m}}{r}\right)\right),\; r = \text{crown radius} \geq 3.75 \text{ m}$$

Equation 18

$$\text{CC m}^2 \text{ (Front yard trees over street \& sidewalk)} \;= \frac{r^2}{2}\left(\frac{\pi\theta}{180} - \sin\theta\right)$$

$$\text{where } \theta = 2\left(\arccos\left(\frac{2.286 \text{ m}}{r}\right)\right),\; r = \text{crown radius} \geq 2.5 \text{ m}$$

Equation 19

$$\text{CC m}^2 \text{ (median trees over street)} = 2\left(\frac{r^2}{2}\left(\frac{\pi\theta}{180} - \sin\theta\right)\right)$$

$$\text{where } \theta = 2\left(\arccos\left(\frac{1.829 \text{ m}}{r}\right)\right), \; r = \text{crown radius} \geq 2 \text{ m}$$

Equation 20

$$\text{CC m}^2 \text{ (cutout trees over street)} = \frac{r^2}{2}\left(\frac{\pi\theta}{180} - \sin\theta\right)$$

$$\text{where } \theta = 2\left(\arccos\left(\frac{1.219 \text{ m}}{r}\right)\right), \; r = \text{crown radius} \geq 1.25 \text{ m}$$

Equation 21

$$\text{CC m}^2 \text{ (cutout trees over imperious)} = \left(\pi \text{ r}^2 - 1.486 \text{ m}^2\right) - \frac{r^2}{2}\left(\frac{\pi\theta}{180} - \sin\theta\right)$$

$$\text{where } \theta = 2\left(\arccos\left(\frac{1.219 \text{ m}}{r}\right)\right), \; r = \text{crown radius} \geq 1.25 \text{ m}$$

Equation 22

$$\text{CC m}^2 \text{ (cutout trees over imperious)} = \pi \text{r}^2 - 1.486 \text{ m}^2$$

$$\text{where } r = \text{crown radius} = 1 \text{ m}$$

Equation 23

$$\text{CC m}^2 \text{ (cutout trees over imperious)} = 4 * \frac{r^2}{2}\left(\frac{\pi\theta}{180} - \sin\theta\right)$$

$$\text{where } \theta = 2\left(\arccos\left(\frac{0.6096 \text{ m}}{r}\right)\right), \; r = \text{crown radius} = 0.75 \text{ m}$$

Equation 24

$$\text{CC m}^2 \text{ (planting strip trees over street)} = \frac{r^2}{2}\left(\frac{\pi\theta}{180} - \sin\theta\right)$$

$$\text{where } \theta = 2\left(\arccos\left(\frac{0.6096 \text{ m}}{r}\right)\right), \; r = \text{crown radius} \geq 0.75 \text{ m}$$

Equation 25

$$\text{CC m}^2\text{ (planting strip trees over street \& sidewalk)} = C - \left(\left(C - (2A)\right) + B\right)$$

$$\text{where, } A = \frac{r^2}{2}\left(\frac{\pi\theta}{180} - \sin\theta\right) \text{ and } \theta = 2\left(\arccos\left(\frac{0.6096\text{ m}}{r}\right)\right),\ r = \text{crown radius} \geq 0.75\text{ m}$$

$$B = \frac{r^2}{2}\left(\frac{\pi\theta}{180} - \sin\theta\right) \text{ and } \theta = 2\left(\arccos\left(\frac{1.8288\text{ m}}{r}\right)\right),\ r = \text{crown radius} \geq 2\text{ m}$$

$$C = \pi r^2$$

Where crown radii fell below specified *r*-values, $\text{CCm}^2 = 0$, for all equations.

Total estimated CC for all species within each of the three coverage regimes was determined by multiplying total CC from the above nine equations by each zone segment's respective estimation factor determined by equation 7, where only one individual of species *X* was sampled during the inventory. The result was the estimated number of identical individuals that could be expected in that zone. Therefore, multiplying actual sample numbers by this unique zone estimation factor yielded accurate zonewide totals based on each tree's actual CC coverage.

Diversity

Species diversity is a combination of species richness (the total number of species) and species evenness (the distribution of individuals among the species), where species richness is weighted by species evenness (Barbour et al., 1987). Richness and diversity, though often positively correlated, are disparate measures; for example, a community with five species but uneven numbers of individuals in each species has a lower diversity than a community of four species that have a very similar number of individuals in each (Barbour et al., 1987).

Species diversity indices—a simplified calculation resulting in a single index number—are varied, depending on units and quantities expressed as well as weight given to evenness versus richness of the population. In urban forests, species diversity is typically high in mild climates (McPherson and Rowntree, 1989). This however could be deemed relatively unimportant with regard to management of the urban forest where many rare species can drive up an index and therefore be misleading when only a few individuals dominate a community. Therefore, a diversity index that is more relative to abundance rather than richness would be a more appropriate index for urban forests.

One of the best indicators to show the diversity of a population is Simpson's diversity index (Simpson, 1949; Barbour et al., 1987; Sun, 1992). Simpson's index (Simpson, 1949) reflects dominance which is an advantage where rare species are more likely to vary place to place rather than common ones (street tree populations), yielding less variance between samples—that is, it weights the most abundant species more heavily than the rare species (Barbour et al., 1987). The formula is calculated using equation 26:

Equation 26

$$C = \sum_{i=1}^{s} (p_i)^2 \text{ where,}$$

C is the index number, s is the total number of species in the sample, and p_i is the proportion of all individuals in the sample that belong to species i. The index number denotes the probability that two trees, chosen at random, will be of the same species; the lower the number, the more diverse the population.

BENEFIT-COST ANALYSIS

McPherson et al. (1999), in *Benefit-cost Analysis of Modesto's Municipal Urban Forest*, described methods used to estimate the environmental benefits Modesto's urban trees provided. A brief summary of their methods, along with the techniques used to extend their findings to Davis follows.

The Modesto approach

Twenty-two of Modesto's most abundant species were inventoried in a two-strata random sample of young and old trees. Data collected on tree age, size, leaf area, and biomass were used to estimate growth rates for each of the species. Crown volume and leaf-surface area (LSA) were estimated using methods of digital image processing described by Peper and McPherson (1998). Non-linear regression was used to fit a predictive model for DBH as a function of age for each species. Predictions of LSA, crown diameter, and tree height were modeled as a function of DBH using the same model as DBH vs. age.

To infer from the 22 sampled species to the remaining species, called “Other Street Trees”, each tree was categorized based on tree type (one of three life forms and three mature sizes):

- Broadleaf deciduous—large (>15 m [50 ft]) (BDL), medium 8-15 m [25-50 ft] (BDM), and small (<8 m [25 ft]) (BDS).
- Broadleaf evergreen—large (BEL), medium (BEM), and small (BES).
- Conifer—large (CL), medium (CM), and small (CS).

A typical tree was chosen for each of the above 9 categories to obtain growth curves for “other” trees falling into each of the categories.

Energy and natural gas savings

Changes in building energy use from tree shade were based on computer simulations outlined by McPherson and Simpson (1999). The models incorporated differences in building structure, climate, and effects of shading. Building characteristics were differentiated by age of construction (pre-1950, 1950-1980, and post-1980) and took into account number of stories, floor area, window area, insulation, *etc*. Typical meteorological year (TMY) weather data for Fresno, CA were used. Shading effects for deciduous and evergreen large, medium, and small trees were calculated at 5 ages (5, 15, 25, and 35 years after planting) for 3 different tree-building distances (3-6 m [10-20 ft], 6-12 m [20-40 ft], and 12-18 m [40-60 ft]) at 8 different azimuths (0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315°).

From the results of these simulations an algorithm was developed, predicting energy savings for a tree at each possible location (distance and direction from building) with each leaf pattern and size. Using aerial photos, distribution of street tree location—with respect to buildings—of Modesto's trees were determined to calculate average energy savings per tree at each location as dictated by the algorithm. Average annual savings were summed over type and age for all trees to derive citywide totals.

In addition to shading effects, climatic effects of lowered air temperature and wind speeds from increased neighborhood canopy cover were calculated using the estimate of 8% canopy coverage from street trees alone, where each percentage of canopy cover coincided with an ambient air temperature reduction of 0.1°C (0.2°F).

Cooling and heating effects were adjusted based on the typical type and saturation of air-conditioning (i.e., central heat/air pump, evaporative cooler, wall/window unit or none) or heating (i.e., natural gas, electric resistance, heat pump, or fuel oil, or other) equipment used in each typical housing vintage. Shading values were increased by 15% to account for the shading on adjacent structures (e.g., neighboring homes).

Dollar values of electrical energy savings and natural gas savings were based on marginal prices of $0.079/kWh and $0.81/therm, respectively.

Atmospheric carbon dioxide reductions

Net CO_2 reductions were calculated based on avoided emissions as the product of energy use and what is directly sequestered and released through tree growth, removal, and maintenance. As a byproduct of electricity generation, CO_2 reductions were based on Modesto's local utility emission factor of 0.18 kg per kWh (0.40 lbs/kWh). Summing the storage of CO_2 in above and below-ground biomass calculated sequestration over the course of one season for representative species of the nine tree type categories. Carbon dioxide release was based on the estimation that 80% of trees' carbon was released to the atmosphere the same year as death occurs through the process of chipping and the resultant decomposition of the trees' biomass as mulch. Tree mortality was calculated based on the percentage of the age class removed due to tree death in Modesto as reported over a period of one year. Released CO_2 as a result of tree maintenance was estimated to be 0.136 kg CO_2/cm DBH based on annual consumption of gasoline and diesel fuels by the city's Urban Forestry Division. Dollar values of CO_2 reductions ($33/metric tonne [$30/short ton]) were based on control costs recommended by the California Energy Commission (1994).

Air quality improvement

Reductions in building energy use due to shading lead to reduced power plant emissions of criteria air pollutants as well as CO_2. Changes in volatile organic compounds (VOCs), nitrogen dioxide (NO_2), as well as particulate matter of <10 micron diameter (PM_{10}) were calculated as emission offsets with the same method as for CO_2, using utility-specific emission factors.

The direct removal of pollutants from the atmosphere was expressed as the product of dry deposition velocity: $v_d=1/(R_a+R_b+R_c)$, a pollutant concentration C, a canopy projection area PC, and a time step. Hourly deposition velocities for NO_2, ozone (O_3), and PM_{10} were calculated using methods described by Scott et al. (1998) to estimate resistances (R_a, R_b, and R_c) on an hourly basis throughout a "base year". A 9-month in-leaf season was assumed for all trees and NO_2 was substituted for O_3 since ozone production is primarily NO_2 limited in the Central Valley.

Dollar values for resource units were applied using the market value of pollution emission credits traded on the open market within the San Joaquin Valley Unified Air Quality Management District. Weighted averages of all transactions ($/ton) during the years 1994 through 1997 were used to calculate the 1998 values: NO_2=$11.03/kg; PM_{10}=$6.98/kg; and VOC=$6.13/kg.

Stormwater runoff reductions

A numerical simulation was used to estimate annual rainfall interception and storage of urban trees (Xiao et al., 1998). The model incorporated tree species, leaf area, crown density, and height, and used hourly meteorological and rainfall data from 1995 in Modesto, where annual precipitation was 315 mm (12.3 in). Implied value of the intercepted rainfall ($/$m^3$) was based on annual expenditures for Modesto's urban stormwater quality program and Fresno's flood control program. The total annual benefit of intercepted rainfall totaled $2.07/m^3$ ($0.008/gal).

Property values and other benefits

Anderson and Cordell (1988) found that a single large front yard tree was associated with a $336 increase in sales prices of single-family homes in Athens, Georgia. This price was adjusted with the Consumer Price Index to put a value of $508, in 1998 dollars, based on a typical large tree in Modesto: Chinese hackberry (*Celtis sinenesis*) at 15 m tall (49 ft), 57 cm (22 in) DBH, and 250 m^2 (2,691 ft^2) of LSA. This price was used as an indicator of the additional value a Modesto resident would gain from sale of residential property with a large street tree in front of their home. The $508 was annualized over the life of the tree depending on the increased percentage of LSA incurred over a single year for street trees. It was assumed that 5% of all street trees had no increase in property value, due to planting locations with little resale value. Incorporating this reduction, the price per m^2 LSA was $1.93 ($0.18 ft^2).

The Davis approach

Estimating the environmental benefits and costs produced by street trees in Davis required two procedures: 1) estimating the resource unit values per tree based on the 1999 benefit-cost analysis of Modesto's municipal urban forest (McPherson et al, 1999) (see above); and 2) altering the price of the resource unit to reflect local, Davis-specific, prices ($/unit).

General assumptions

The premise behind the extension of Modesto's cost-benefit analysis to Davis was the assumption that street trees' growth response to any area climatic, pedologic, and human influences (e.g., pruning) was similar in both cities. For example, this assumption implies that a tree of species *X* in Modesto at 15 years of age and 17 cm DBH will possess the same crown and leaf area measurements of a tree of species *X* with a DBH of 17 cm in Davis; species *X* in both cities was therefore assumed to have similar allometric growth with respect to DBH. This was an important assumption that limits further extension of the Modesto specific analysis to cities that may differ in species and their allometric response to factors affecting growth.

Tree distribution—orientation and distance from air-conditioned space—is another factor that affects the potential amount of building energy savings trees provide. Factors that affect tree distribution include average lot size, building setback from curb, street layout (i.e. grid vs. curvilinear block pattern), homeowner placement preference, and city planting practices. Though these data were collected in the sample inventory, in effort to make this analysis reasonable with regard to the amount of data a city is expected to collect and analyze, Modesto's street tree distribution was assumed for the city of Davis.

Estimating resource unit values

As mentioned earlier, McPherson et al. (1999) used non-linear regression to fit a sigmoid-shaped predictive model for DBH as a function of age for each species. The DBH values for each of the published 6 age classes (5, 15, 25, 35, 45, and 55 years after planting) were obtained from the authors for each of the 22 species sampled in Modesto.

Lack of data for all 22 species in all age classes dictated minor adjustments before inferences could be extended to Davis's trees. Flowering plum (*Prunus cersifera*) was excluded due to lack of data spanning multiple age classes. All ash (*Fraxinus*) species, save *F. excelsior*, lacked enough data to not have confidence in DBH values for the 5-yr age class. Therefore, all DBH values for ash species at 5 years old were based on *F. excelsior.* A dearth of data for Chinese hackberry (*Celtis sinensis*) and London plane (*Platanus acerifolia*) required a substitution of DBH values at 5 and 15-years. These data were taken from growth models of plane trees in Claremont, CA, derived using methods as described for Modesto (McPherson et al., 2001). Additionally, values for Japanese black pine (*Pinus thunbergii*) were substituted with DBH for Chinese Pistache (*Pistache chinensis*) at 5 and 15 years.

Of the 21 trees remaining, no trees fell into the BES, CM, and CS tree type classes. Therefore, 3 additional "trees" were added so all 9 classes would be represented: 'BES Other' was scaled at one-third of the DBH values for holly oak (*Quercus ilex*); 'CM Other' and 'CS Other' were scaled at two-thirds and one-third, respectively, of black pine. Table

4 shows DBH values for the 21 Modesto species along with the 3 remaining tree type substitutes.

Table 4. Predicted DBH of 24 "trees" from Modesto by tree and age class.

Species	Class	DBH (cm) by age class (yrs)						
		0	**5**	**15**	**25**	**35**	**45**	**55**
Acer saccharinum L.	DL	0	6.0	27.5	48.3	67.5	85.1	101.4
Betula pendula Roth.	DM	0	7.6	17.8	24.3	29.3	33.3	36.7
Celtis sinensis Pers.	DL	0	12.2	28.3	45.3	52.6	58.4	63.2
Cinnamomum camphora L.	BEM	0	7.6	25.1	38.9	50.4	60.4	69.2
Fraxinus excelsior 'Hessii' L.	DM	0	9.8	24.2	33.8	41.2	47.2	52.4
F. holotricha 'Morraine' Koehne.	DM	0	9.8	33.8	50.5	64.0	75.4	85.4
F. oxycarpa 'Raywood' Willd.	DM	0	9.8	33.1	44.2	52.5	59.1	64.7
F. pennsylvanica 'Marshall' Marsh.	DM	0	9.8	24.2	28.1	30.7	32.6	34.2
F. velutina 'Modesto' Torr.	DL	0	9.8	38.5	48.5	55.6	61.1	65.6
Ginkgo biloba L.	DM	0	1.3	11.6	26.1	42.0	58.6	75.3
Gleditsia triacanthos L.	DM	0	5.6	22.2	37.0	50.0	61.6	72.3
Koelreutaria paniculata Laxm.	DM	0	6.4	19.7	29.7	37.9	44.9	51.0
Lagerstroemia indica L.	DS	0	3.4	9.1	13.1	16.2	18.8	21.1
Liquidambar styraciflua L.	DL	0	3.9	18.1	31.9	44.6	56.2	67.0
Magnolia grandiflora L.	BEM	0	4.8	14.9	22.6	29.0	34.5	39.3
Pistacia chinensis Bunge.	DM	0	9.1	21.9	30.2	36.5	41.6	46.0
Pinus thunbergiana Parl.	CL	0	9.1	21.9	33.2	37.1	40.0	42.4
Platanus x acerifolia Willd.	DL	0	12.2	28.3	40.3	46.2	50.8	54.6
Pyrus calleryana 'Bradford' Decne.	DM	0	11.7	24.8	32.7	38.5	43.1	47.0
Quercus ilex L.	BEL	0	9.8	27.3	39.8	49.8	58.1	65.4
Zelkova serrata (Thung.) Mak.	DM	0	9.9	26.9	39.0	48.5	56.4	63.3
BES Other	BES	0	3.3	9.1	13.3	16.6	19.4	21.8
CM Other	CM	0	6.1	14.6	22.1	24.7	26.7	28.3
CS Other	CS	0	3.0	7.3	11.1	12.4	13.3	14.1

With the DBH values presented in table 4 and the known resource unit values for each benefit of each tree at each age class, data were in place to infer resource unit values to Davis' trees. The first step in accomplishing this task involved categorizing the estimated total number of Davis's public trees by DBH class, both citywide and by zone segments using the following 7 classes:

0-7.5 cm (0-3 in)

7.6-15.1 cm (3-6 in)

15.2-30.4 cm (6-12 in)

30.5-45.6 cm (12-18 in)

45.7-60.9 cm (18-24 in)

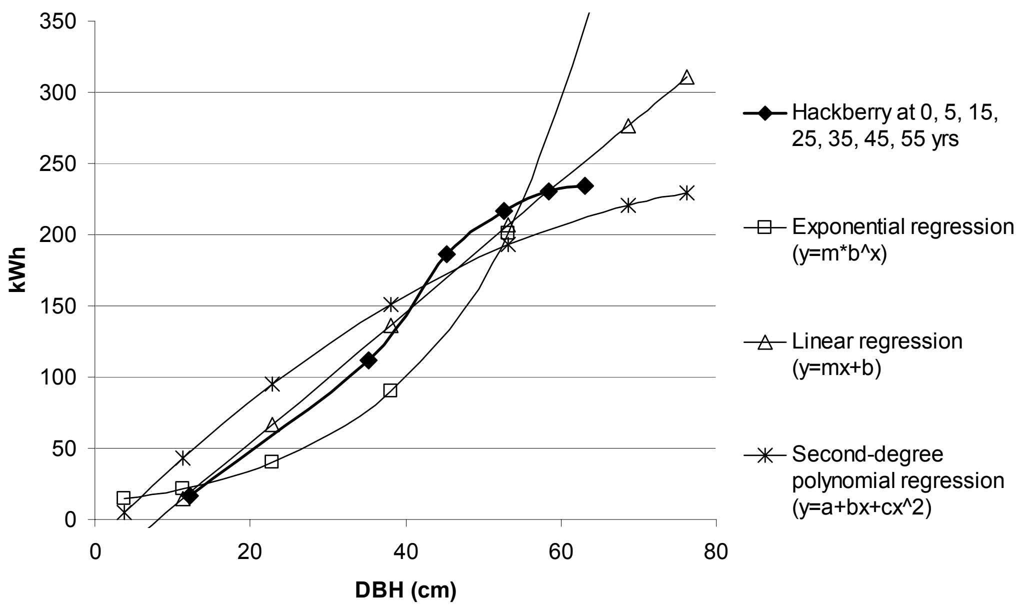
61.0-76.2 cm (24-30 in)

>76.2 cm (>30 in)

These classes served as a surrogate for evaluation of benefits in lieu of the age classes used in the Modesto analysis. But because DBH classes represented a range, the median value for each DBH class was determined and subsequently utilized to serve as single value representing all trees encompassed in each class.

Regression analysis was attempted to estimate resource unit values for median DBH class values as a function of DBH (independent variable) and resource unit value (dependent variable [e.g., kWh]). Multiple equations were explored, but no one model satisfactorily fit the growth curves of Modesto's trees by DBH. Figure 5 shows one example of the poor match achieved when using regression equations to modeling electricity benefit resource unit values (kWh) as a function of DBH in Chinese hackberry.

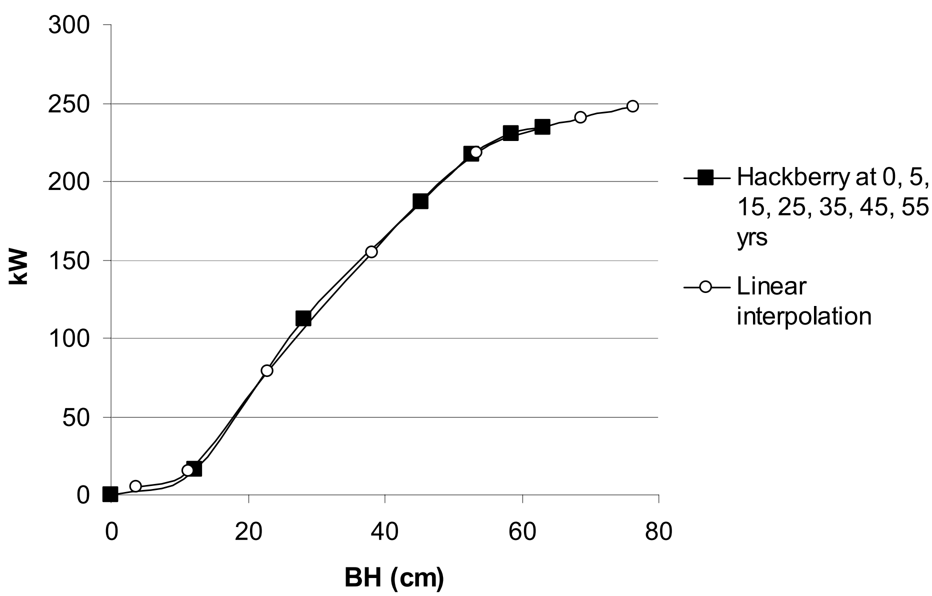
Figure 5. Multiple attempts to fit regression equations for the electricity resource unit values for DBH class midpoints based on known kWh values for Chinese hackberry growth intervals 0 to 55 years.



In all cases variation in the dependent variable—the resource unit value—proved to be unacceptable, though at different points in the trees life. Linear regression had typically high r^2 values, but appeared inaccurate in extrapolating resource values outside the known data range: under 5 years and above 55 years of age. In other words this model could only be used with confidence if trees in Davis fell within the limited DBH range found between 5 and 55 years (e.g., 12.2 cm [4.8 in] and 63.2 cm [24.9 in] for hackberry). Because significant numbers of Davis's hackberry trees fell into both the smallest and the largest of the 7 DBH classes (both outside the known data range) a better predictive measure was sought, as this example held true for several species.

Where the rate of change is assumed constant, the process of predicting intermediate locations between two XY-coordinates is termed linear interpolation. Simply put, this method creates a new Y-value for a desired X-value along a straight line between the two known coordinate pairs. And rather than rely on a model to predict beyond the known data set, linear interpolation extrapolates the desired Y-value based on the slope of the line between the two closest points. Linearly interpolated resource unit values for midpoint DBH class values were found to closely match curves based on known species values. In keeping with the previous regression example, Figure 6 displays linearly interpolated kWh values for hackberry and the resulting curve that closely matched the known growth curve.

Figure 6. Graphic example showing linearly interpolated kWh values for DBH class midpoints based on known resource values of kWh for Chinese hackberry growth intervals 0 to 55 years.



rovided reduced variability in predicting y-values that fell along the tree’s growth curve inside and outside the data range. In this fashion, Corel Quattro Pro v.8, was employed to predict resource value predictions for each of the twenty-one Modesto species for the 7 midpoints corresponding to each of the DBH classes assigned to Davis's street trees.

To infer from the 21 Modesto species to Davis's public street tree population, each species representing over one percent of the population citywide, and by zone, were matched directly with corresponding Modesto species or, where there was no corresponding tree, the best match was determined by identifying which of the 21 species was most similar in size, leaf shape/type, habit, and tree type. For example, the sample contained 98 public street tree species of which only 28 represented 1% or more of the total population. Of these 28 species, 14 corresponded directly with the taxa sampled in Modesto. The 14 remaining species were matched with the next closest species (e.g., Davis's *Pyrus calleryana* 'Aristocrat' with Modesto's *P. calleryana* 'Bradford'; Davis's *Fraxinus velutina* with Modesto's *F. velutina* 'Modesto'; Davis's *Quercus suber* with Modesto's *Q. ilex*; etc).

The 70 species that were less than 1% of the population were labeled "other" and were categorized according to McPherson et al.'s (1999) tree type classes (see above). To obtain resource values for these 9-other categories, a typical species was selected from Table 4 to represent Davis trees falling into each category:

DL Other = *P. acerifolia*
DM Other = *Pistacia chinensis*
DS Other = *Lagerstromia indica*
BEL Other = *Q. ilex*
BEM Other = *Cinnamomum camphora*
BES Other = BES Other
CL Other = *Pinus thunbergii*
CM Other = CM Other
CS Other = CS Other

Environmental benefit price adjustments

The methods used to derive resource units of environmental benefits were unaltered with respect to the Modesto analysis. Described below are the methods used to derive resource unit prices specific to the city of Davis.

Energy and natural gas

Lacking empirical data regarding the percentage of electricity and natural gas use above baseline levels in Davis, dollar values per unit were not based on marginal prices, but on conservative baseline prices. Electricity and natural gas were priced based on average Pacific Gas & Electric (PG & E) prices over the span matching Davis's fiscal year preceding the sample inventory: July 1, 1999 through June 30, 2000. Electricity savings were valued at $0.11589/kWh and natural gas at $0.6398/therm (PG&E, 2001).

Atmospheric carbon dioxide reduction

Reductions in CO_2 as a by-product of electricity generation were assumed the same in Davis as in Modesto. This assumption is likely an underestimation of the net avoided CO_2 emissions because PG & E relies more heavily on fossil fuels for generating capacity than Modesto's local utility. But because PG & E purchases a significant portion of their electricity from non-specific suppliers, specific emissions rates were difficult to estimate and thus deferred to known Modesto values. As in Modesto, CO_2 was valued using control costs recommended by the California Energy Commission (1994) at $0.033/kg ($0.015/lb).

Air quality improvement

Values for resource units were applied using criteria pollution emission reduction credit (ERCs) transaction costs specific to the Yolo-Solano Air Quality Management District (California EPA, 2000; Ehrhardt, 2001). Control cost values were obtained by using the weighted average (tons sold per unit price) for all transactions made during the two-year span 1999-2000: NO_2=$8.48/kg ($3.85/lb); PM_{10}=$9.84/kg ($4.47/lb); and VOCs=$3.32/kg ($1.51/lb).

Stormwater runoff reductions

Total capital investments associated with stormwater management in Davis totaled approximately $50 million and included all system infrastructure: drainage/transit pipes and channels, detention basins, settling ponds, and pump stations (Jue, 2001). Annualized over 40 years.—the time estimated for complete reinvestment—this amount resulted in an annual average capital expenditure of ~$1,252,000. Operations and management (including administrative salaries) of this infrastructure in FY 1999-2000 was $514,000. The combined yearly expenditure is therefore estimated at $1,766,000.

As shown in Table 5, an essential component in understanding runoff of stormwater is the evaluation of each type of land area and their effectiveness in producing runoff. Lacking complete data for Davis, total land area was classified using estimations comparable to Olympia, WA. Classified below, both percent land area and effective runoff was determined based on the final results of Olympia's *Impervious Surface Reduction Study* (City of Olympia, 1995).

Table 5. Davis land area classified to determine the citywide effective runoff coefficient of 0.33.

Landuse	Total Area (ha)	% of Total Area	Effective runoff coefficient	Weighted Average (% of tot. x runoff coefficient)
Low density residential*	81027	33	0.04	0.013
High density residential**	95759	39	0.26	0.101
Multifamily residential***	19643	8	0.49	0.037
Commercial/industrial	51563	21	0.87	0.180
Total	247992	100	1.66	0.331

*Estimate of all city areas that have less than 1 dwelling/unit per acre and includes parks, open space, green belts, agricultural land, golf courses, etc.
**Estimate of typical single-family suburban residential area (3-7 units/acre).
***Estimate of land area occupied by multi-family residential housing (7-30 units/acre).

Using equation 27, total stormwater runoff was estimated at 3,533,921 m^3 (933,526,909 gal) per year.

Equation 27

$$R_D = A \times E_{is} \times P$$

where

R_D = Total stormwater runoff in Davis

A = Total land area (2455.37 ha)

E_{is} = Total effective impervious surface (33.1 %)

P = Average annual precipitation (436.14 mm)

Dividing total annual expenditures by total stormwater runoff implies that the city spent \$0.499/m^3 (\$0.0019/gal) of stormwater managed.

Effective interception is the proportion of precipitation intercepted by a tree that would otherwise result in direct surface runoff—a factor that must be accounted for in valuing effectiveness in reducing stormwater management costs. Because the Modesto data relies on total interception to calculate benefits of stormwater, a price adjustment factor of 0.91 is used to calculate effective interception from total interception as reported in the Modesto analysis. This factor assumes an initial abstraction of 2 mm (0.078 in) for the average city ROW based on computations of runoff curves for land area as described in the Natural Resources Conservation's Technical Release-55 (NRCS, 1986) (Xiao, 2001). In other words, small rainfall events of less than 2 mm (0.078 in) are not likely to produce direct runoff and are therefore excluded in valuing stormwater reduction benefits. Therefore, it can be stated that the value of rainfall intercepted by street trees was \$0.455/m^3 (\$0.0017/gal) (\$0.499/m^3 x 0.91 = \$0.455/m^3).

Property value

A typical large tree in Davis was calculated at a slightly larger size than a large tree in Modesto. The average (weighted) LSA of mature medium-sized trees—Davis's most prevalent street tree type—was approximately 332 m^2 (3,574 ft^2), well above the Chinese hackberry with 250 m^2 (2,691 ft^2) of LSA used in Modesto. In order to represent trees classified as large in mature stature and deciduous, the higher LSA value of 400 m^2 (4,306 ft^2) was chosen as representative of the typical maturing large deciduous tree at approximately 45 cm (18 in) DBH.

The average annual change in LSA (m^2) for trees within each DBH class is used as a resource unit. To reflect regional differences in real-estate prices between Anderson and Cordell's (1988) study in Athens, GA, and those of Davis homes, the increase in average residential home sales prices was used in lieu of actual tree values as described above in the *Modesto Approach*. Therefore, assuming the 0.88% increase in average home sales prices that Anderson and Cordell (1988) found associated with each large tree held true for Davis, each large tree would be worth $2,412 based on the average single-family home resale prices in Davis averaged for the months beginning July 1999 and ending June 2000 of $273,518 (Yolo County Association of Realtors, 2001). However, not all trees are as effective as front yard residential trees in increasing property values. For example, trees adjacent to multifamily housing units will not increase the property value at the same rate as trees in front of a single-family home. Therefore, a citywide reduction factor (0.92) was applied to prorate trees' value based on their effectiveness in adding to property value (McPherson et al., 2001) (Table 6).

Table 6. Distribution of street trees in Davis by land-use and their respective effectiveness in adding annual increased property value.

Land Use Type	% of Citywide Tree Population	Property Value Reduction Factor	Weighted Effectiveness
Single home residential	79%	100%	79%
Multi-home residential	6%	75%	4%
Commercial/industrial	6%	67%	4%
Other (vacant, institutional, agricultural, etc.)	10%	50%	5%
Weighted citywide reduction factor			92%

Given these assumptions, a typical large tree was estimated to increase property values by \$5.53 per m^2 (\$0.51 ft^2) of LSA. For example it was estimated that a single Chinese pistache adds about 2.16 m^2 of LSA per year (Appendix E) when growing in the DBH range of 30.5-45.6 cm (12-18 in). During this period of growth, therefore, pistache trees effectively added \$10.92, annually, to the value of a home, condominium, or business property (2.16m^2 x \$5.53/m^2 x 92% = \$10.92).

Calculating total benefits

To assess the total value of annual benefits (*B*) for each street tree (*i*) in each zone segment (*j*) benefits were summed (Equation 28):

Equation 28

$$B = \sum_{1}^{n} j\left(\sum_{1}^{n} i\left(e_{ij} + a_{ij} + c_{ij} + h_{ij} + p_{ij}\right)\right)$$

where

e = price of net annual energy savings = annual natural gas savings + annual electricity savings

a = price of annual net air quality improvement = PM_{10} interception + NO_2 absorption + O_3 absorption

c = price of annual carbon dioxide reductions = CO_2 sequestered less releases + CO_2 avoided from reduced energy use

h = price of annual stormwater runoff reductions = Effective H_20 interception

p = price of aesthetics = annual increase in property value

Calculating total costs

Total costs associated with the management of Davis's public street trees were difficult to assess due to the lack of record keeping outside the Parks and Open Space Management Division. The Public Works Department does not currently keep records regarding specific costs of infrastructure repair expenditures attributed to city street trees (Hedberg, 2001). Likewise, the City Managers Office reported having no available records of liability costs associated with city managed street trees (Davis, 2001). Leaf litter from city street trees was collected as part of the city's green waste contract with Davis Waste Removal (DWR) and no discernable itemization in the contract was made between private yard waste and city owned trees.

Internal costs for all expenditures for FY 1999-2000 were identified through a survey completed by the Senior Park Supervisor and are identified in Chapter 5 (Table 16). Due to the unavailable cost data from city sources, two external expenditures—those outside the division—related to annual liability and infrastructure repair, were inferred from 1996 figures reported in McPherson's (2000) survey of 18 California cities' expenditures on tree-related damage. In Table 7, dollar values for FY 1999-2000 were adjusted for inflation using the consumer price index (CPI) at 12.3%. Legal cost information was not reported by Davis in the survey and was therefore inferred from the mean per capita cost of all reporting cities. Litter removal/disposal costs were assumed to be $6,317, based on 40% of 385 tons ($41.02/ton) of litter removed during the autumn leaf-drop period for DWR's FY 2000 (Geisler, 2001).

Table 7. Estimated external street tree related costs.

Expenditures	1996 costs ($)	FY 99-00 Cost ($)
Infrastructure repair	22,100	24,818
Liability/claims*	19,988	22,447
Litter clean-up**	NA	6,317
Total	42,088	47,265

* Not Davis specific, but inferred from mean reported values for 18 California cities.
** 40% of street sweeping costs during the autumn leaf-drop period.

Total net expenditures were calculated based on all identifiable internal and external costs associated with the annual management of Davis's street trees citywide. Annual costs for public street trees (*C*) were summed (Equation 29):

Equation 29

$$C = p + t + r + d + e + s + c + l + a + q$$

where,

p = annual planting expenditure

t = annual pruning expenditure

r = annual tree and stump removal and disposal expenditure

d = annual pest and disease control expenditures

e = annual establishment / irrigation expenditure

s = annual price of repair / mitigation of infrastructure damage

c = annual price of litter / storm clean - up

l = average annual litigation and settlements expenditures due to tree - related claims

a = annual expenditure for program administration

q = annual expenditures for inspection / answer service requests

Calculating the benefit-cost ratio

Total citywide annual net benefits (Equation 30) as well as the benefit–cost ratio (BCR) (Equation 31) were calculated using the sums of equations 28 and 29:

Equation 30

$$\text{Citywide Net Benefits} = B\text{-}C$$

Equation 31

$$\text{BCR} = {}^{B}\!/_{C}$$

Chapter 4

RESULTS—STRUCTURE ANALYSES

The completed sample inventory included 127 sampling units, 2,393 public trees, and an additional 696 private trees located within the city's ROW. This sample represented approximately 10% of the estimated citywide population of street trees.

TREE NUMBERS

Estimated numbers and proportions of trees found citywide and by zone segment are shown in Table 8. The estimated citywide population of city street trees totaled 23,810 (±1,396). The public tree population combined with the private tree population within the city ROW put the total number of street trees at over 31,000 (±1,476). Population totals varied by zones, however. For example, nearly 20% of all city trees were found in west Davis (zone segment 1) while the downtown core area represented less than 4% of the population. This geographical distribution of the tree population is important to understand how resources should be allocated amongst zones, but it is important to note that the zone segments were not of equal area. Direct comparison between zones, therefore, can only be made when relating the population proportions to the size of zone segments.

The percentage of population composed of private trees appeared to be related to both land-use and age of zone. Established residential areas typically have 20-30 % of their street trees in private care, while the downtown area (zone segment 6) and newly developed neighborhoods (zone segment 10) have far fewer private trees. Citywide, nearly a quarter of Davis's street tree population consisted of private trees.

Table 8. Public and private street tree population estimates (se in parentheses).

	Estd. # of city trees	Estd. # of private trees	Estd. total # of trees (city and private)	Estd. % of city tree population	Estd. % of private tree population	Estd. % of total population is private trees
Zone segment 1	4,579 (828)	1,500 (222)	6,079 (854)	19.2	20.7	24.7
Zone segment 2	2,999 (545)	1,602 (295)	4,601 (615)	12.6	22.1	34.8
Zone segment 3	1,234 (198)	333 (87)	1,566 (212)	5.2	4.6	21.2
Zone segment 4	846 (198)	315 (65)	1,161 (213)	3.6	4.3	27.1
Zone segment 5	1,775 (324)	483 (87)	2,258 (338)	7.5	6.7	21.4
Zone segment 6	882 (212)	53 (25)	935 (212)	3.7	0.7	5.7
Zone segment 7	1,502 (334)	399 (88)	1,901 (349)	6.3	5.5	21.0
Zone segment 8	3,140 (477)	1,434 (225)	4,575 (531)	13.2	19.8	31.0
Zone segment 9	2,128 (445)	460 (91)	2,588 (457)	8.9	6.3	17.8
Zone segment 10	3,340 (381)	373 (80)	3,713 (386)	14.0	5.1	10.0
Zone segment 11	1,386 (229)	305 (72)	1,691 (244)	5.8	4.2	18.0
Citywide Totals	23,810 (1,396)	7,256 (484)	31,066 (1,476)	100	100	23.4

Statistical analysis of se in Table 8 shows that the se of the zone segment populations varied, were typically within 15-20% of the estimated number. Error in citywide population totals surpassed Jaenson et al.'s (1992) finding that error of citywide totals did not exceed 10%; all estimated totals for Davis had se between 5% and 7%.

Deciduous trees were the most prevalent tree type (Table 9); nearly 45% of public trees were broadleaf deciduous trees of medium stature, and another 32% were large-stature deciduous trees. Those not classified as deciduous only accounted for approximately 15% of the population.

Table 9. Citywide public street tree numbers by mature size class and tree type.

Life Form	Large	Medium	Small	Total
Broadleaf Deciduous	7,522	10,509	2,324	20,356
Broadleaf Evergreen	949	688	348	1,985
Conifer/Palm	1,451	0	18	1,469
Total	9,922	11,197	2,690	23,810

STREET TREES PER CAPITA

Calculations of trees per capita are important in determining how well forested a city is. The more residents and dense housing a city possesses, the more need for trees to provide benefits. Citywide, Davis averaged 0.41 street trees per capita, assuming a population of 58,600 residents. Compared with 22 other cities across the US, with a mean of 0.37 (McPherson and Rowntree, 1989), Davis was slightly better than average. Regionally, Davis had over 33% more street trees per capita than its neighbor Sacramento, which was recently reported to average 0.3 per capita (McPherson, 1998), but was equal with the mean ratio of Modesto (0.41) (McPherson et al., 1999). Throughout California, however, Davis maintained far more trees than the statewide city average of 0.24 trees per person (Bernhardt and Swiecki, 1993); though the tendency of lower planting numbers tends to increase with increasing city size (Wray and Prestemon, 1983).

STOCKING LEVEL

The adequacy of a given street tree density must include all streetside tree plantings—both private and public (Richards, 1992). Therefore, the following assessment of stocking level included all public and private street trees with a 100% stocking rate defined as 15 m (~50 ft) between stems (Wray and Prestemon, 1983; McPherson and Rowntree, 1989). Table 10 shows Davis's citywide stocking rate was nearly full—a statistic that has been rarely matched in the literature, where stocking rates have been assessed to average between approximately 40% and 60% of full stocking (Wray and Prestemon, 1983; McPherson and Rowntree, 1989).

Table 10. Stocking Level for Public & Private Street trees at 15 m spacing.

	Estd. # of all trees per zone segment	Estd. linear meters of plantable space (linear feet)	Estd. optimum stocking level (# of trees)	Estd. % stocking level
Zone segment 1	6,079	76,971 (252,532)	5,131	118
Zone segment 2	4,601	65,217 (213,968)	4,348	106
Zone segment 3	1,566	26,542 (87,080)	1,769	89
Zone segment 4	1,161	20,475 (67,176)	1,365	85
Zone segment 5	2,258	31,850 (104,496)	2,123	106
Zone segment 6	935	14,409 (47,272)	961	97
Zone segment 7	1,901	31,850 (104,496)	2,123	89
Zone segment 8	4,575	61,805 (202,772)	4,120	111
Zone segment 9	2,588	43,605 (143,060)	2,907	89
Zone segment 10	3,713	66,355 (217,700)	4,424	84
Zone segment 11	1,691	39,813 (130,620)	2,654	64
Citywide Totals	31,066	478,893 (1,571,172)	31,926	97

Of course the concept of stocking involves more than tree density alone. Available planting space, size of existing trees, and site conditions all have a role. Therefore, to better evaluate the actual number of available planting spaces, the city's targeted level of 1 street tree per resident lot—where a residential lot averages 80 ft. citywide (Cordrey, 2000)—was observed for "void" spaces (Table 11). By this measurement, almost 8% of

Davis's planting sites were void of trees. Only the downtown center (zone segment 6) was observed to be completely planted. Newer neighborhoods such as zones 10 and 11 exhibited the most available planting spaces.

Table 11. Available planting spaces based on observed void space.

	Estd. total # of plantable spaces	% of zone unplanted
Zone segment 1	305	4.8
Zone segment 2	269	5.5
Zone segment 3	79	4.8
Zone segment 4	45	3.7
Zone segment 5	11	0.5
Zone segment 6	0	0
Zone segment 7	200	9.5
Zone segment 8	369	7.5
Zone segment 9	92	3.4
Zone segment 10	708	16
Zone segment 11	452	21
Citywide Totals	2381	7.9

Species Richness

Including private trees found within the ROW, a total of 127 different street tree species and cultivars were found throughout the city. Considered alone, city-managed trees included 98 different taxa—a rich composition compared to other cities; McPherson and Rowntree (1989) reported a mean of 53 species in their survey of 22 US cities. This richness could be accounted for by the relatively mild climate, homeowner preference, and/or management forethought. However, when compared with only California communities, Davis's assemblage appeared on par given the variability amongst different cities. For example, Modesto was reported to have 184 species in their tree inventory

(McPherson et al., 1999), while both Los Angeles and La Canada Flintridge had 77 (McPherson and Rowntree, 1989).

Species richness varied, however, by zone segment, ranging from 24 public species in zone segment 6 to 49 in zone segment 10 (Table 12). Overall, species richness by zone did not appear correlated with the size of zone segments (r^2=0.52), suggesting that species richness had more to do with neighborhood age and land-use than extent of land area covered.

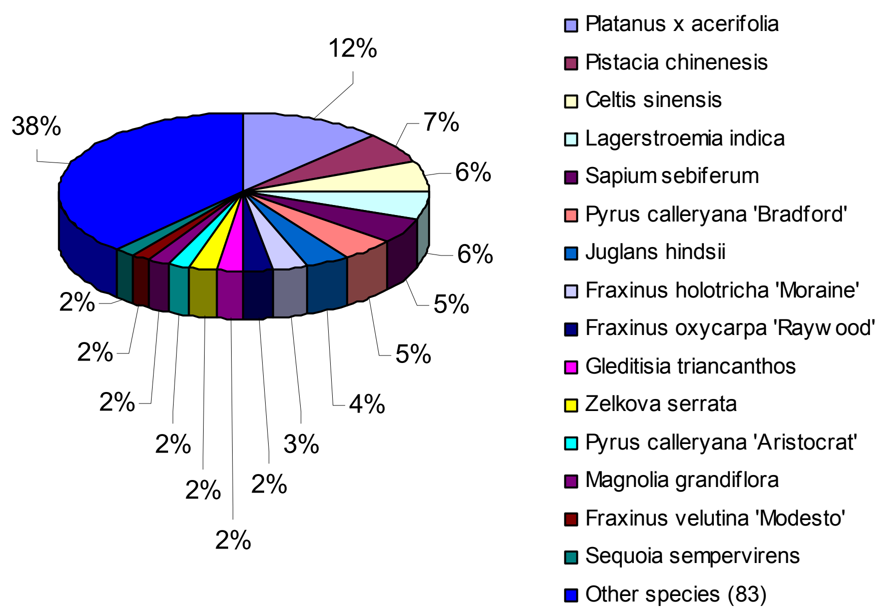
Table 12. Species richness and percent land area by zone segment.

Zone Segment	# of public species	# of private species	% of total land area
1	44	41	15%
2	34	44	15%
3	38	22	5%
4	21	15	5%
5	30	27	6%
6	24	5	2%
7	29	24	7%
8	45	45	12%
9	25	18	10%
10	49	21	16%
11	33	17	8%
Citywide	98	96	100%

SPECIES COMPOSITION

London plane was the most widely planted city street tree in Davis. Approximately 2,900 existed throughout the city, accounting for over 12% of the total public street tree population. Four other species individually represented over 5% of the total population: Chinese pistache, Chinese hackberry, crape myrtle (*Lagerstroemia indica*), and Chinese tallow (*Sapium sebiferum*). The ornamental pear—*Pyrus calleryana*—was nearly 7% of the population but was comprised of two cultivars, 'Bradford' and 'Aristocrat', which individually were less than 5% of the total public tree population. There were 25 additional public trees that each comprised 1% or more of the entire population.

Figure 7. Citywide public street tree composition.



Crape myrtle, weeping birch (*Betula pendula*), and coastal redwood (*Sequoia sempervirens*) were the three most commonly planted street trees by private parties. Together they represented nearly 25%, or about 1,800, of all privately planted street trees. There were 25 other taxa that each represented over 1% of the private tree population. Private trees combined with the city trees changed the overall composition very little. The top 5 species remained the same, however crape myrtle replaced Chinese pistache as the second most widely planted species.

Citywide, the species composition appeared not to be overrepresented by too few individual species. Only London plane exceeded the commonly held standard that no single species should represent over 10% of the total population (Clark et al., 1997). However, examination of zone segments belied this interpretation.

In every zone segment two or more species contributed 20% to over 50% of the zone's population. In several cases, a single species contributed 25-40% of the population: plane in zones 9 and 6; Chinese hackberry in zone 7; and the Japanese pagoda tree (*Saphora japonica*) in zone 4. These numbers suggest species composition becomes a problem of scale in Davis and city managers must decide how their management of zones ultimately affects forest stability.

DIVERSITY

The index number (*C*) denotes the probability that two trees, chosen at random, will be of the same species; the lower the number, the more diverse the population. For example, *C*=0.10 can be interpreted as having the equivalent of 10 species evenly distributed. Twenty species evenly distributed would have an index value of 0.05, equivalent to each species representing about 5% of the population.

Table 13. Simpson's diversity index by zone (*C*)

Zone	Public Trees	Private Trees	Public & Private Trees
1	0.08	0.06	0.06
2	0.12	0.05	0.07
3	0.05	0.09	0.05
4	0.16	0.12	0.10
5	0.09	0.05	0.06
6	0.14	0.22	0.12
7	0.17	0.06	0.12
8	0.05	0.05	0.04
9	0.19	0.10	0.14
10	0.07	0.07	0.06
11	0.07	0.11	0.05
Citywide	0.04	0.03	0.03

Table 13 shows that citywide the street tree population was diverse. However, a complete understanding of street tree diversity must reflect concern for local vulnerability of zone segments (Sanders, 1981). Considering only public trees, 5 zones had indices over 0.10 and are potential subjects of concern. These 5 zones accounted for approximately 35% of the total city tree population. The addition of privately planted and managed trees improved the indices in all zones and citywide. In this respect, private trees may be an asset by reducing chances of catastrophic losses of street side plantings.

SPECIES IMPORTANCE

Importance values are particularly meaningful to managers because they suggest a community's reliance on the functional capacity of particular species. This evaluation takes into account not only total numbers, but their canopy cover and spatial distribution, providing a useful comparison to the total population distribution.

As a sum of three relative values, importance values, in theory can range between 0 and 300; where an IV of 300 suggests total reliance on one species and an IV of 0 suggests no reliance. Values for public trees in Davis ranged between 69 (i.e., London plane) and 1 (e.g., American hornbeam [*Carpinus carolina*]), meaning no one tree species is relied upon completely (Table 14).

Similar to total population distribution, plane trees were on top. However, many other trees changed position. Chinese hackberry was more important than pistache despite total numbers. The top 6 species in population distribution, however, remained the top 6 in importance as well.

Another advantage of using IVs is that it provides a check that uncovers "relics" from the sampling method by introducing the spatial component that frequency calculations provide. For example, the discrete random sampling procedure dictated that we sample from two adjacent sampling units along Russell Boulevard in zone segment 1. While a few isolated individuals did exist in other zones, this street was the only place in Davis where California black walnut was densely planted. Due to this anomaly, extrapolating zone segment 1 data on walnuts to the citywide population totals may be a misinterpretation as suggested by black walnut's IV of 16; a drop in rank from 7th (Figure 7) to 14th overall as indexed by importance. This was probably a more accurate estimate of the community's true reliance on this species.

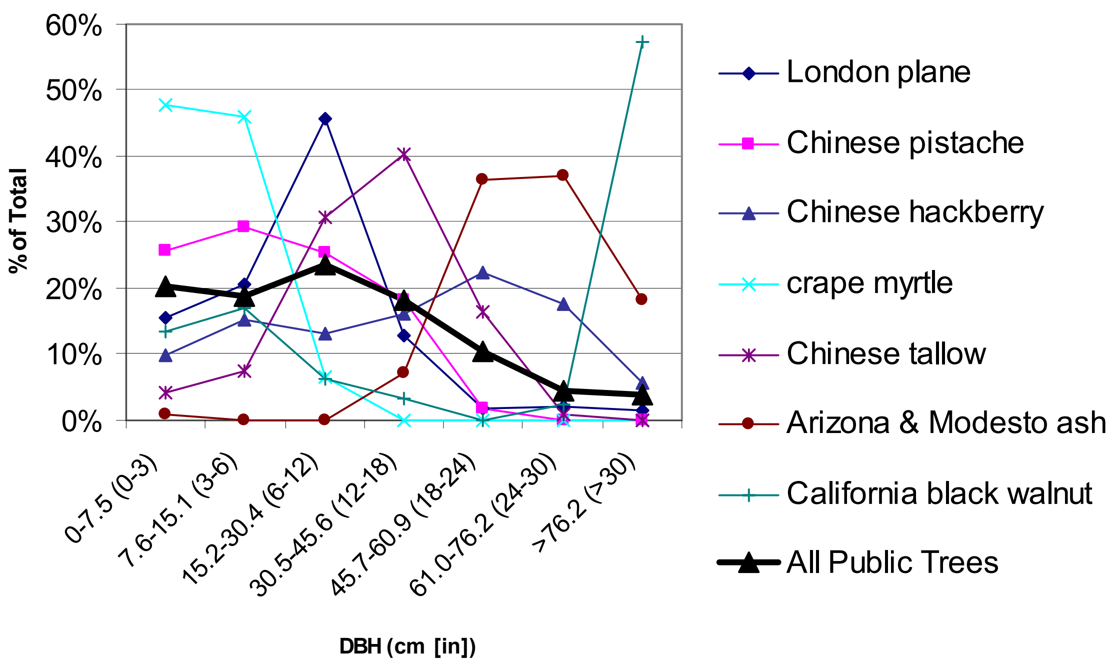
Table 14. Importance Values for all public street trees.

Species	Importance Value	Species	Importance Value
Platanus acerifolia	69	*Eucalyptus spp.*	4
Celtis sinensis	54	*Cedrus deodara*	4
Pistacia chinensis	48	*Ulmus parvifolia*	4
Lagerstroemia indica	33	*Alnus cordata*	4
Sapium sebiferum	30	*Prunus amygdalus*	4
Pyrus calleryana 'Bradford'	27	*Tilia cordata*	3
Fraxinus holotricha 'Moraine'	26	*Pinus pinea*	3
Zelkova serrata	22	*Fraxinus spp.*	3
Pyrus calleryana 'Aristocrat'	22	*Celtis occidentalis*	3
Fraxinus oxycarpa 'Raywood'	20	*Ulmus*	3
Celtis australis	20	*Eucalyptus polyanthemos*	3
Gleditisia triancanthos	19	*Quercus palustris*	3
Sequoia sempervirens	18	*Quercus coccinea*	3
Juglans hindsii	16	*Maytenus boaria*	2
Fraxinus velutina 'Modesto'	16	*Laurus nobilis*	2
Malus floribunda	15	*Salix babylonica*	2
Pyrus calleryana	13	*Ligustrum lucidum*	2
Pinus canariensis	13	*Ceratonia siliqua*	2
Magnolia grandiflora	13	*Acer negundo*	2
Prunus cerasifera	13	*Pinus brutia*	2
Ginkgo biloba	13	*Eucalyptus sideroxylon 'Rosea'*	2
Alnus rhombifolia	12	*Cercis canadensis*	2
Rhus lancea	12	*Catalpa speciosa*	2
Quercus lobata	12	*Juniperus species*	2
Melia azedarach	11	*Schinus molle*	2
Quercus suber	10	*Tilia x euchlora*	1
Acer rubrum	9	*Acer pseudoplatanus*	1
Quercus virginiana	9	*Carpinus betulus 'Fastigiata'*	1
Acer saccharinum	9	*Prunus spp*	1
Koelreuteria paniculata	9	*Melia azedarach*	1
Fraxinus velutina	9	*Quercus robur*	1
Quercus agrifolia	8	*Pinus radiata*	1
Morus alba	8	*Pterocarya stenoptera*	1
Betula pendula	7	*Ailanthus altissima*	1
Robinia ambigua	7	*Picea pungens*	1
Acer buergerianum	6	*Umbellularia californica*	1
Albizia julibrissin	6	*Arbutus unedo*	1
Pinus halapensis	5	*Crateagus spp*	1
Liriodendron tulipifera	5	*Calocedrus decurrens*	1
Sophora japonica	5	*Pinus ponderosa*	1
Liquidambar styraciflua	5	*Celtis spp*	1
Quercus ilex	5	*Cedrus atlantica*	1
Juglans regia	5	*Tilia americana*	1
Cercis occidentalis	4	*Quercus spp*	1
Quercus wislizenii	4	*Carpinus carolina*	1
Platanus racemosa	4	*Acer campestre*	1
Casurina cunninghamia	4	*Olea europaea*	1
Fraxinus uhdei	4	*Prunus avium*	1
Carpinus betulus	4	*Pyrus spp*	1

RELATIVE AGE DISTRIBUTION

Inferring from measurements of DBH, Figure 8 represents the relative age distribution of Davis's publicly managed street trees as well as selected species representing large percentages of the total population.

Figure 8. Relative age distribution of selected tree species and total public tree population.



Age, or DBH size class, is important in determining current management needs as well as how the needs will change depending on total numbers and aging of individual species. Arizona (*Fraxinus velutina*) and Modesto ash (*F. velutina* 'Modesto') along with Chinese hackberry were represented by an aged population with few young individuals to replace their aging predecessors. Black walnut was limited to very young and very old individuals, with recent plantings intended to replace the senescing population. Plane and tallow trees were of middle age, in a size class that typically represents high functional value (Richards, 1982/83). Crape myrtle, on the other-hand, was represented by only small size classes; and while abundant, trees of this profile are relatively unimportant when considering the functionality of the forest (McPherson et al., 1999).

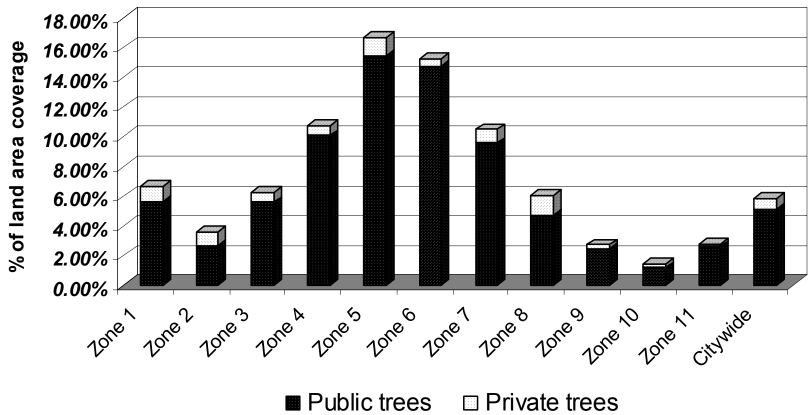
This representation of tree age suggested that individual species were heavily planted over a relatively short period of time and then subsequently abandoned for alternative species. Relative age, overall, was well distributed, having the majority of trees in smaller size classes poised to replace trees as their functionality wanes (Richards, 1982/3; McPherson and Rowntree, 1989). Problems, however, arose when approached from a zone segment scale. Different zones depended heavily on particular species of unvarying age (Appendix C). Though these populations were functional, mature, healthy, and required little maintenance at the time of inventory, these attributes are likely to fail over a relatively short period of time as the trees mature. It is these forested areas that will suffer deficiencies in value and sustainability as the functional trees age and decline as a group.

CANOPY COVER

Canopy cover over land area and impervious surfaces is dependent on tree distribution, age, and location. Calculations that take these factors into account suggested that city maintained street trees provided approximately 5% coverage over the city's 24.55 km^2

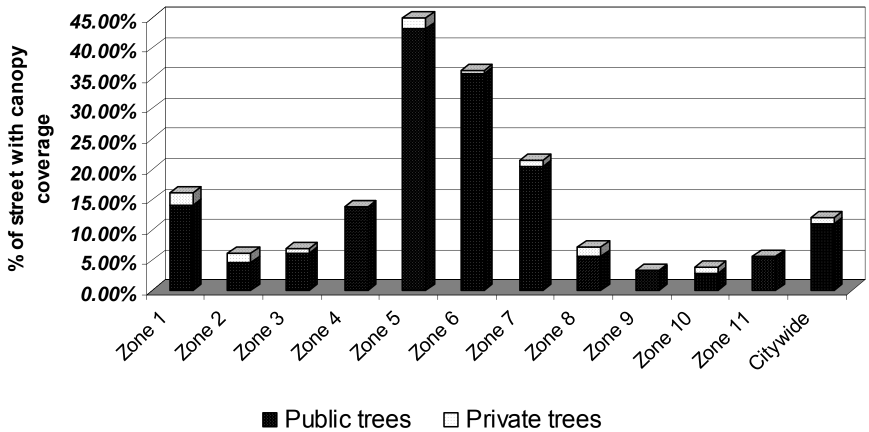
($9.48\ mi^2$) land area. The addition of private trees brought the total street tree canopy coverage to nearly 6% of the city's area (Figure 9).

Figure 9. Street tree canopy cover as a percent of zone segment land area.



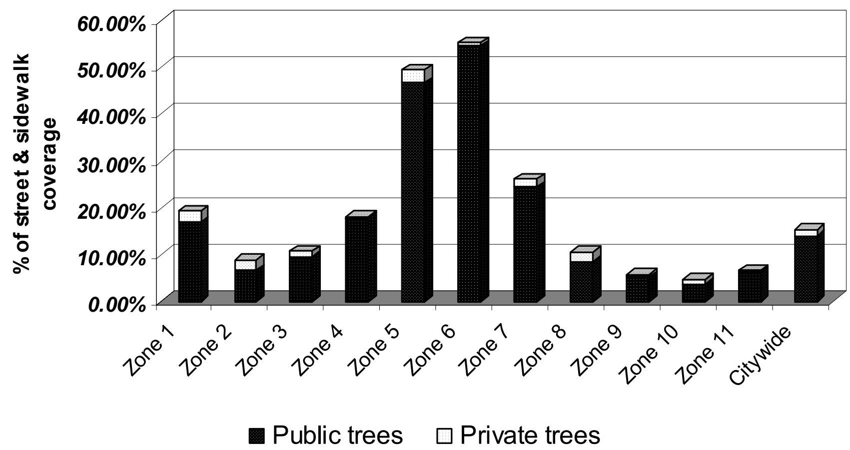
Total city street length was estimated to be 240 km (148.9 mi) at an average of 10.7 m (35 ft) in width. Therefore, street area was 256 ha (634 ac) or 10.4% of the city's land area. Taking into account planting location, it was estimated that 23% of all public street tree canopy cover was directly over city streets, while private trees—due to their typically smaller stature and front yard locations—averaged only 21%. As a result, canopy cover from public trees averaged 11% cover over street area, but was over 40% in older, city center neighborhoods. Adding private trees brought the total to 12% citywide (Figure 10).

Figure 10. Street tree canopy cover as a percentage of public street area.



City sidewalks were typically 1.2 m (4 ft) in width and increased the publicly maintained impervious surfaces by about 58 ha (140 ac) citywide or an additional 2.4% of total land area. Public street trees did a much better job of providing coverage over sidewalks than streets: 24% of all sidewalks, citywide, had direct coverage thanks to public trees, and the average canopy projected 34% of its coverage over streets and sidewalks. Private trees—again, due to their smaller stature and location—averaged only 25% of their canopy over streets and sidewalks. Zone segments with young populations had accordingly low sidewalk coverage (7% in zone segment 10), while older city center neighborhoods averaged 60% (zone segment 5) to 100% (zone segment 6) sidewalk coverage. Figure 11 represents the percentage of canopy coverage of publicly maintained impervious surfaces. Public trees provided nearly 14% coverage while private trees averaged 1.5%.

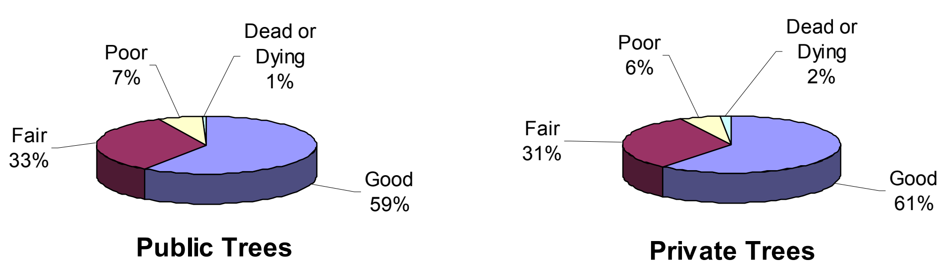
Figure 11. Street tree canopy cover as a percentage of public street and sidewalk coverage.



TREE CONDITION

Tree condition indicates both how well trees are managed and their relative performance given site-specific conditions. Because of neglect and inconsistent management, street trees privately cared for are typically in poorer condition relative to those publicly managed (Bernstein, 1981). In Davis, however, there was little difference between the citywide condition of public and private trees (Figure 12). Trees in "good" condition accounted for approximately 60% of the population, 32% were fair, and 8% poor or dead.

Figure 12. Citywide distribution of public and private trees by condition class.



Overall condition of trees varied by zone segment. Over half of the public street trees in zones 2 and 6 were in fair or worse condition, while zones 9 and 11 exhibited a greater percentage of trees in good condition (Table 15).

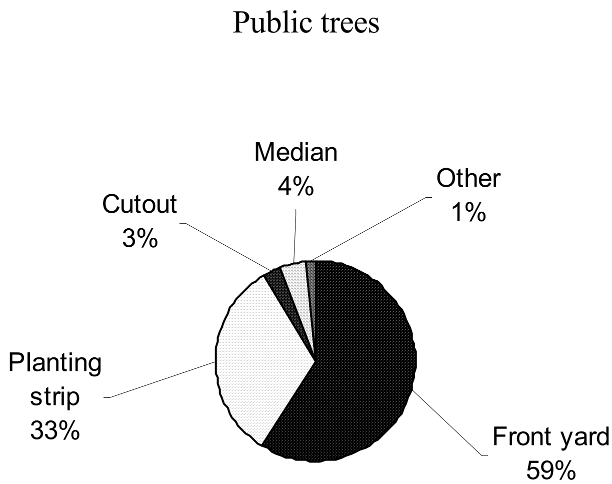
Table 15. Condition of public street tree population by zone.

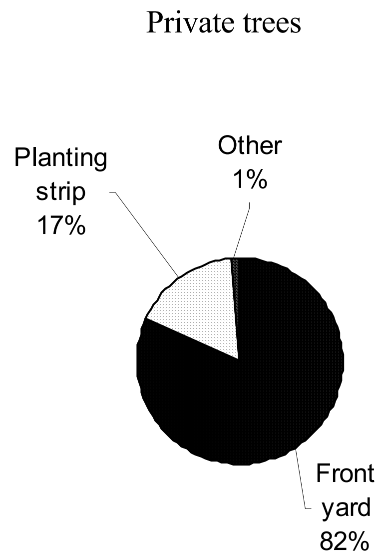
Zone Segment	Good	Fair	Poor	Dead or Dying
1	55%	32%	12%	1%
2	42%	53%	5%	0%
3	60%	30%	9%	0%
4	55%	36%	6%	2%
5	53%	40%	7%	1%
6	47%	46%	8%	0%
7	59%	34%	8%	0%
8	69%	22%	9%	1%
9	71%	28%	1%	0%
10	65%	31%	3%	1%
11	77%	20%	2%	1%

Street Tree Population by Location & Land-use

The majority of street trees in Davis were located in front yard planting spaces (Figure 13). As one would expect, diversity in location was greater amongst public trees, represented by greater numbers in planting strips, cutouts, and medians. Citywide, it was estimated that 950 city trees were located in medians, over 700 in cutouts, and nearly 7,900 in planting strips. The remainder, approximately 14,000 trees, were in front yards.

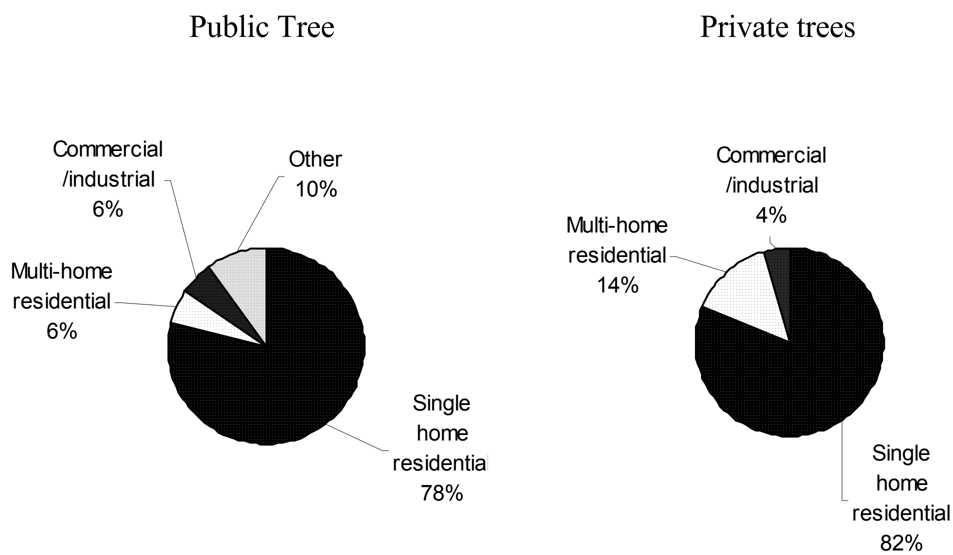
Figure 13. Planting location of street trees.





Distribution of street trees by land-use followed the basic composition of the city, having the vast majority of the city's land area in single home residential neighborhoods (Figure 14). No private trees were found to be associated with vacant lots, agricultural, or institutional areas. However, there was a greater percentage of the private street tree population adjacent to multi-home residential places, reflecting the city's requirement that owners of apartment or condominium complexes were responsible for planting and maintaining street trees adjacent to such properties (Cordrey, 2000).

Figure 14. Distribution of street trees by land-use.

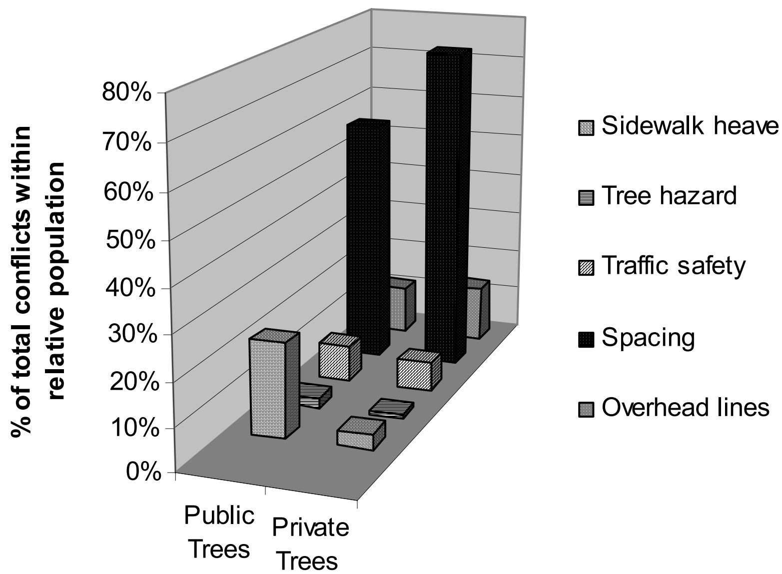


STREET TREE CONFLICTS

Assessing condition is one method of evaluating tree suitability. Another method includes assessing problems associated with street trees that lead to increased liability and infrastructure expenditures. By assessing the problems associated with street tree conflicts, managers will be better prepared to decrease the instances of future conflicts in new plantings, while targeting specific areas and species to abate current problems.

Citywide, an estimated 3,502 public street trees, or ~14% of the population, were associated with public safety and spacing conflicts. Within the private tree population, an additional 2,012 trees, or 26% of the population, were estimated to have one or more conflicts. The distribution of these trees by conflict type can be seen in Figure 15.

Figure 15. Distribution of private and public trees by conflict type.

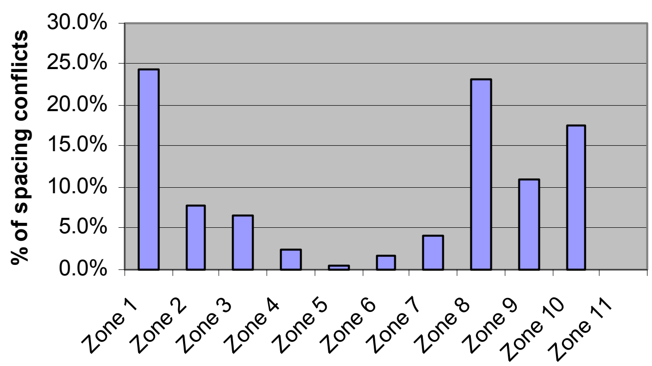


Amongst the two populations, private trees were causing a higher percentage of conflicts relative to their numbers. The distribution, however, differed slightly, and will be discussed below.

Spacing

Most notable amongst conflicts were those associated with spacing, where the total estimated number of public trees and private trees was nearly equivalent: each contributing approximately 1,500 trees to the problem. Streetside private plantings were not negligible and tended to be planted too closely with more frequency than publicly managed trees. Because these trees fell within the ROW, and affected growth, and health, of city managed trees, they should be of concern to city managers. Incidence of spacing problems amongst public trees appeared more severe as one moves away from the city center (Figure 16).

Figure 16. Distribution of spacing conflicts within the public tree population.



Sidewalk heave

Sidewalk heave is a conflict that typically concerns street tree managers due to the large costs associated with infrastructure repair as well as the potential legal costs associated with trip and fall incidents. There were an estimated 1,114 incidences of heave over ¾ in. in height throughout Davis. Considering the average tree related sidewalk repair in California costs $480 per incident (McPherson, 2000), these conflicts in Davis represented a potential $535,000 problem.

Out of five possible tree locations, heave was found in only three: cutouts, planting strips, and front yards. Cutouts accounted for 7% of all heave problems, a two-fold increase relative to the distribution of trees by location. Trees growing in planting strips and front yards accounted for 38% and 55%, respectively. Excluding cutouts, this distribution was similar to the distribution of all public trees by location (Figure 13) and therefore, the conflicts could not be attributed to location as much as to prevailing species.

Figure 17 shows that relatively few species caused the majority of sidewalk heave problems. Zone segments afflicted by sidewalk heave (Figure 18) were the same segments where the above species were found to be a large proportion of the segment population and in larger DBH class sizes (Appendix D).

Figure 17. Percentage of sidewalk heave caused by public tree species.

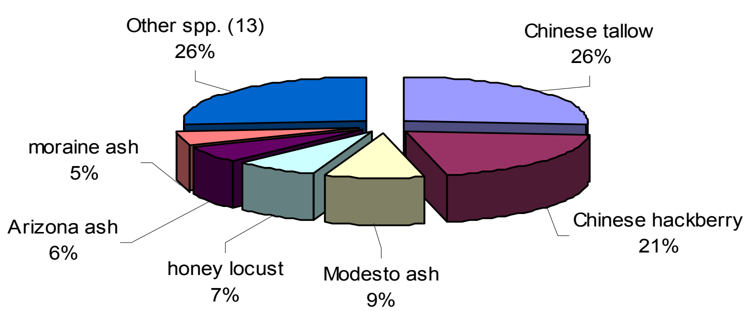
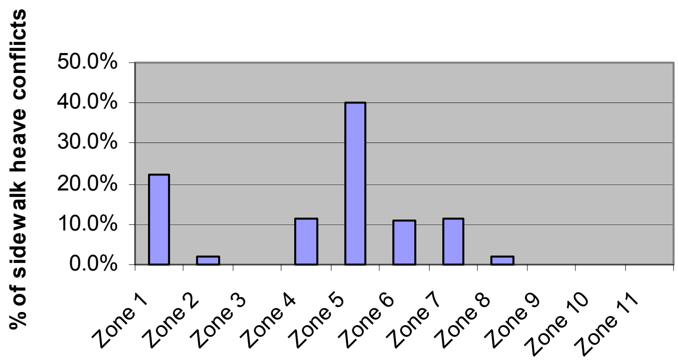


Figure 18. Distribution of sidewalk heave within the public tree population.

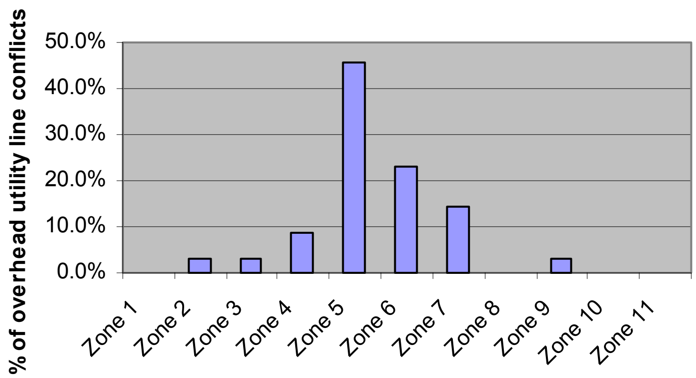


Heave in zone segment 1 was attributed to the Chinese tallow, which represents 14% of the population. Zone segments 2, 4, 6, 7, and 8 all had moderate proportions of their populations consisting of a combination of the above species, while zone segment 5 had 60% of its population represented by the 6 species noted as causing the majority of heave conflicts.

Overhead utility lines

Utility lines are a great source of conflict for tree managers. Forethought can limit these conflicts by planting small-stature trees, though these trees are limited not only in size attained, but the amount of benefits they can provide. A combination of choosing the right tree and pruning existing large trees has limited these conflicts in Davis to an estimated 1.5% of the public tree population. Trees in private care were estimated to be contributing to these conflicts at over double the rate as public trees, suggesting that less planning and care amongst private property owners contributed greatly to these conflicts. The estimated number of conflict citywide, by all trees, was 603—mostly limited to central Davis areas (Figure 19).

Figure 19. Distribution of conflicts between trees and overhead utility lines within the street tree population.

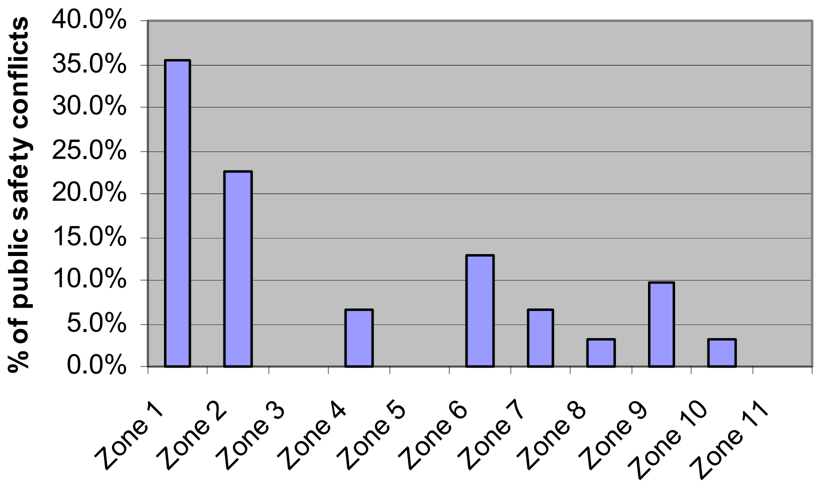


Public safety

Other conflicts associated with public safety are those that obstruct visibility to streetside signage or traffic at intersections. There were approximately 443 of these conflicts citywide, with public trees responsible for 308 of the total number. Again, however, private trees were responsible for a disproportionate number of these incidences.

Zone segments that have recently gone through the cities pruning cycle would intuitively seem to have fewer numbers of these conflicts, but it appeared that these conflicts were more a function of total number of trees in the zones. That is, a higher frequency of these conflicts were found where zone population numbers were proportionately higher. But population age, frequency of signage, and place within the pruning cycle probably all played a role in the distribution. For example, the downtown zone segment (6) had less than 4% of the total public street tree population, but represented about 13% of all the public safety conflicts (Figure 20). The lack of conflicts in zones 3 and 5 could be attributed to well-pruned trees and better placement.

Figure 20. Distribution of public safety conflict within the public tree population.



Hazardous trees

Street trees with hazardous characteristics were an infrequent occurrence in Davis. There were only 121 trees in this category citywide; public trees accounted for approximately 100 of the 121. Of these, 60% were California walnut and 20% were Japanese pagoda. The aging walnuts being found in zone segment 1 along Russell Blvd., and pagoda trees limited to zone segment 4, where this species accounted for 34% of the zone population.

PRUNING NEEDS

Understanding species distribution, age structure, and tree condition may aid in determining proper pruning cycle length, but it is important to understand the actual pruning needs of the city trees. Not only will this provide clues to whether or not the pruning cycle is adequate, but what level of risk and liability is associated with the city's street tree population.

Figure 21. Percentage of public street trees with pruning needs.

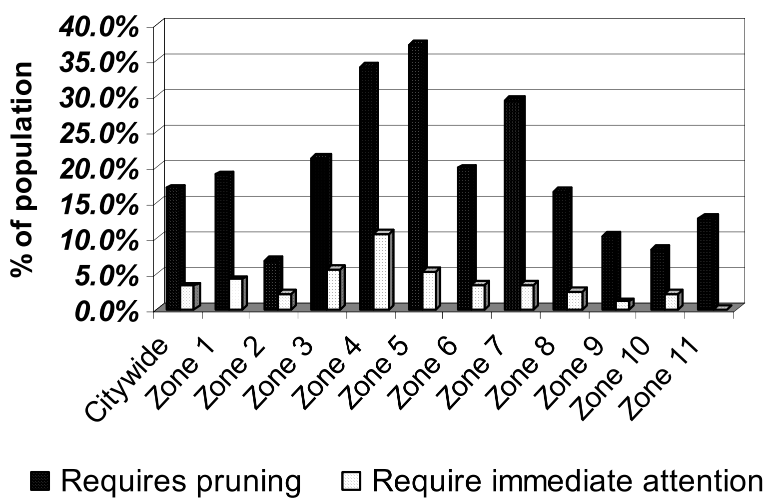


Figure 21, above, displays the significant level of pruning needed by Davis' public trees. Overall, 17% of the trees needed maintenance in the form of pruning and over 3% needed immediate attention. By zone segment however, these percentages were sometimes much higher. Zone segments 2 and 10 were both pruned in 1999 and accordingly have lower pruning needs than other zones. Interestingly, west Davis (zone segment 1) was pruned the winter and spring of 2000—before the sample inventory was conducted—but 19% of the public trees still required pruning—a level that exceeded the city average. This may reflect the quality, or lack thereof, of the pruning contracted for that year. However, it should be noted that nearly 60% of the trees which needed pruning in this zone were limited to the California walnuts on Russell Blvd. If these were not pruned with the rest of the zone, the total was a more reasonable 7% of the population—in-line with the other zones recently pruned.

YOUNG TREE CARE

The sample inventory conducted for this project did not specifically address young tree care, *per se*, but adequacy of care could be inferred from the data collected as comments on the inventory sheet. The most frequent comments were noted as “remove stake” or “stakes too tight”. Meaning that nursery or establishment stakes had outlived their utility and were now inhibiting proper tree growth, structure, or form.

Citywide it was estimated that approximately 4% of all public trees possessed stakes that were damaging to the tree and therefore required removal. If one considers that about 20% of all public trees fell into the young tree DBH class size (0-6 in), and the vast majority of stakes were found on these trees, then 20% of these trees had problems associated with staking, suggesting that care of young trees was not adequate in this respect. Either resources may not have been available to attend to all newly out-planted trees on a yearly basis or techniques employed may have been improper.

RESULTS—BENEFIT-COST ANALYSIS

COSTS OF MANAGING DAVIS'S STREET TREES

Public street trees in Davis are managed through the Parks and Open Space Management Division of the city's Parks & Community Services Department. In fiscal year (FY) 1999-2000, the city's street tree program was allocated approximately 14% of the department's budget, an estimated $396,000 program budget (Cordrey, 2001a) (Table 16). This amount represented 0.5% of the city's budget for the same fiscal year.

Assuming a population of 58,600 residents and an estimated public street population of 23,810, the city spent approximately $6.75 per capita and $16.62 per tree in direct costs through the allocated budget. The addition of external expenditures brought the total annual cost of managing Davis's street trees to nearly $450,000: $7.67 per capita and $18.87 per tree managed. Adjusted with the CPI, values from a 1996 survey—reported in *Expenditures associated with conflicts between street tree root growth and hardscape in California, US* (McPherson, 2000)—suggest Davis spent approximately the same on a per capita basis ($6.74), but considerably less on a per tree basis ($22.70) than the average California city.

Table 16. Total estimated street tree related expenditures for fiscal year 1999-2000.

Program Expenditures	
Contract Pruning	100,000
In-house pruning	41,184
Tree & stump removal	35,640
Summer Irrigation	792
Pest management*	91,080
Salvage & disposal	15,840
Inspection/service requests	26,136
Purchasing trees	5,940
Administration	79,200
Total Program Expenditures	395,812
External Expenditures	
Infrastructure repair	24,818
Litter clean-up	6,317
Liability/claims	22,447
Total External Expenditure	53,582
Net Expenditure	449,393

*$90,000 contracted for mistletoe eradication

BENEFITS PRODUCED BY DAVIS'S STREET TREES

Energy savings

As a result of both direct shading and climate effects, Davis's city street trees saved 2,250 MWh of electricity and 2,097 MBtu of natural gas annually (Table 17). Private trees in the city's ROW saved an additional 531 MWh of electricity and 522 MBtu of natural gas. Total annual energy saving due to city trees was over $274,000 while private trees provided an additional $65,000. Average per tree savings varied by zone segment as a result of species composition and age, ranging from about $4 to $21 for public trees, with a citywide average of approximately $13. This disparity was most evident in zone segments with older tree populations (e.g., zone segment 7) versus those with young populations (e.g., zone segment 10), where the percentage of total tree population was not proportional to savings produced.

Table 17. Net annual energy savings produced by public trees by zone segment and private trees citywide.

	Total Electricity (MWh)	Total Natural Gas (MBtu)	Total ($)	% of Citywide Population	% of Total ($)	Avg. $/tree
Zone segment 1	506.7	471	61,735	19%	23%	13.48
Zone segment 2	243.2	239	29,708	13%	11%	9.91
Zone segment 3	137.2	121	16,676	5%	6%	13.51
Zone segment 4	116.1	105	14,129	4%	5%	16.70
Zone segment 5	231.7	211	28,206	7%	10%	15.89
Zone segment 6	119.3	112	14,536	4%	5%	16.48
Zone segment 7	259.4	234	31,558	6%	12%	21.01
Zone segment 8	281.5	257	34,268	13%	12%	10.91
Zone segment 9	148.9	149	18,207	9%	7%	8.56
Zone segment 10	110.6	108	13,509	14%	5%	4.04
Zone segment 11	95.5	90	11,644	6%	4%	8.40
Public trees citywide	2,250	2,097	274,176	100%	100%	11.52
Private trees citywide	531	522	64,837	100%	100%	8.94
All trees Citywide	2,781	2,619	339,014	100%	100%	10.92

Examining energy savings at the species level revealed the overall ability of a specific tree to provide energy saving throughout their life. Though limited by the age distribution found in Davis, Table 18 shows that an average small tree, such as crape myrtle, will save a homeowner less than $5 per year, while larger trees (e.g., Chinese tallow or hackberry), can average over four times those savings. Values for all Davis street trees can be found in appendix E.

Table 18. Net annual energy benefits and weighted averages of selected public species.

Species	Total ($)	% of Citywide Population	% of Total ($)	Avg. $/tree
London plane	26,748	12.2%	9.7%	9.22
Chinese pistache	12,501	7.6%	4.6%	6.94
Chinese hackberry	25,848	6.2%	9.4%	17.43
crape myrtle	6,317	5.7%	2.3%	4.66
Chinese tallow	25,621	5.3%	9.3%	20.32
Bradford pear	8,338	4.7%	3.0%	7.49
moraine ash	16,543	3.2%	6.0%	21.77
southern magnolia	2,608	1.9%	1.0%	5.91
coast redwood	3,286	1.6%	1.2%	8.78
Modesto ash	5,773	1.6%	2.1%	14.80
Other street trees	140,806	50%	51.3%	11.83
All public street trees	274,388	100%	100.0%	11.52

Atmospheric carbon dioxide reductions

Carbon dioxide reductions by trees are dependent on individual sequestration rates, emission offsets from energy saving, mortality, and the amount of maintenance the trees are provided. As table 19 shows, the amount of CO_2 benefits produced was dependent on species present and their age. Citywide, public trees reduced energy plant CO_2 emissions by approximately 1,366 metric tons (1,506 short tons). And through net sequestration, the same trees produced savings of an additional 1,733 metric tons (1,909 short tons). The combination of these savings is valued at $102,485 annually. Private trees produced a total savings worth $20,598.

Table 19. Net CO_2 reductions of public trees by zone segment and private trees citywide.

	Total CO_2 sequestered less releases (kg)	Total CO_2 emissions avoided (kg)	Total ($)	% of Citywide Population	% of Total ($)	Avg. $/tree
Zone segment 1	269,401	298,074	18,766	19%	18%	4.10
Zone segment 2	212,848	141,979	11,734	13%	11%	3.91
Zone segment 3	148,223	82,549	7,631	5%	7%	6.18
Zone segment 4	61,976	66,648	4,253	4%	4%	5.03
Zone segment 5	212,752	172,294	12,733	7%	12%	7.17
Zone segment 6	115,785	68,689	6,100	4%	6%	6.92
Zone segment 7	175,462	161,028	11,127	6%	11%	7.41
Zone segment 8	199,230	165,512	12,062	13%	12%	3.84
Zone segment 9	181,081	88,455	8,913	9%	9%	4.19
Zone segment 10	91,668	64,959	5,180	14%	5%	1.55
Zone segment 11	64,173	56,352	3,986	6%	4%	2.88
Public trees citywide	1,732,598	1,366,539	102,485	100%	100%	4.30
Private trees citywide	301,801	321,082	20,598	100%	100%	2.84
All trees Citywide	2,034,400	1,687,621	123,083	100%	100%	3.97

Table 20 is representative of the capacity certain trees maintain with respect to their ability to produce CO_2 benefits in Davis. The average annual benefit was $4.30, but values varied by species and were therefore not proportional to population. For example, crape myrtles, despite their relatively large numbers, yielded few benefits. Others, such as moraine ash were responsible for nearly 10% of the total CO_2 benefit even though they represented a mere 3% of the total population. Contributing to these elevated benefit rates were fast growth rates—resulting in high sequestration rates—as well as reductions in emissions from electrical power generation stemming from moraine ashes' high level of energy savings. Values for all Davis street trees can be found in appendix E.

Table 20. Total value of net annual CO_2 reductions for selected public street tree species.

Species	Total ($)	% of Citywide Population	% of Total ($)	Avg. $/tree
London plane	14,641	12.2%	14.3%	5.05
Chinese pistache	3,937	7.6%	3.9%	2.19
Chinese hackberry	8,472	6.2%	8.3%	5.71
crape myrtle	1,218	5.7%	1.2%	0.90
Chinese tallow	8,550	5.3%	8.4%	6.78
Bradford pear	2,758	4.7%	2.7%	2.48
moraine ash	9,559	3.2%	9.4%	12.58
southern magnolia	559	1.9%	0.5%	1.27
coast redwood	970	1.6%	0.9%	2.59
Modesto ash	2,977	1.6%	2.9%	7.63
Other street trees	48,443	50%	47%	4.06
All public street trees	102,083	100%	100%	4.30

Air quality improvement

The offset of criteria air pollutants as a result of energy savings from the city's street trees was small, averaging only $0.07 per public tree (Table 21). This value, however, was as high as $0.14 for the average tree in zone segment 7, but as low as $0.02 for the average zone 10 tree. Reduction of NO_2 was the largest factor of this benefit. Total avoided PM_{10} and VOCs were relatively insignificant.

Table 21. Total annual avoided pollutant emissions of public trees by zone segment and private trees citywide.

	Total NO_2 (kg)	Total PM_{10} (kg)	Total VOCs (kg)	Total ($)	% of Citywide Population	% of Total ($)	Avg. $/tree
Zone segment 1	39	2.3	1.7	357	19%	22%	0.08
Zone segment 2	18	0.9	0.8	168	13%	10%	0.06
Zone segment 3	11	0.6	0.5	100	5%	6%	0.08
Zone segment 4	8	0.5	0.4	77	4%	5%	0.09
Zone segment 5	21	1.2	0.9	190	7%	12%	0.11
Zone segment 6	8	0.5	0.4	78	4%	5%	0.09
Zone segment 7	24	1.3	1.0	216	6%	13%	0.14
Zone segment 8	22	1.2	1.0	201	13%	12%	0.06
Zone segment 9	12	0.3	0.5	108	9%	7%	0.05
Zone segment 10	9	0.3	0.4	78	14%	5%	0.02
Zone segment 11	7	0.4	0.3	67	6%	4%	0.05
Public trees citywide	179	10	8	1,638	100%	100%	0.07
Private trees citywide	49	2.7	2.2	449	100%	100%	0.06
All trees Citywide	228	12.4	10.1	2,087	100%	100%	0.07

Pollutant uptake by the city's street trees was significant, totaling over a $273, 000 a year for the combined uptake of O_3, NO_2 and PM_{10} (Table 22). The combination of pollutant deposition and interception resulted in approximately 30.5 metric tons (33.6 short tons) of pollutants directly removed from the city's air. The trees in zone segments 1, 5, and 7 produced 60% of this benefit.

Table 22. Total annual pollutant uptake of public trees by zone segment and private trees citywide.

	Total O_3 (kg)	Total NO_2 (kg)	Total PM_{10} (kg)	Total ($)	% of Citywide Population	% of Total ($)	Avg. $/tree
Zone segment 1	3,437	1,261	2,560	65,021	19%	24%	14.20
Zone segment 2	1,071	398	835	20,666	13%	8%	6.89
Zone segment 3	671	258	535	13,137	5%	5%	10.65
Zone segment 4	795	290	588	14,989	4%	5%	17.72
Zone segment 5	2,599	957	1,930	49,145	7%	18%	27.69
Zone segment 6	755	279	575	14,420	4%	5%	16.35
Zone segment 7	2,016	781	1,582	39,279	6%	14%	26.15
Zone segment 8	1,296	484	1,005	24,985	13%	9%	7.95
Zone segment 9	734	270	570	14,125	9%	5%	6.64
Zone segment 10	297	110	240	5,806	14%	2%	1.74
Zone segment 11	611	222	454	11,533	6%	4%	8.32
Public trees citywide	14,282	5,309	10,875	273,107	100%	100%	11.47
Private trees citywide	2,205	889	1,828	44,221	100%	100%	6.09
All trees Citywide	16,487	6,198	12,703	317,327	100%	100%	10.23

Net air quality benefits, as shown above, were primarily due to pollutant uptake rather than avoided emissions. Average per tree values varied dramatically when it came to air pollutant benefits in Davis, ranging from annual savings of nearly $55 for the average Modesto ash to less than $1 for the average crape myrtle (Table 23). Citywide, public trees averaged $11.54 and produced a grand total of nearly $280,000 in annual air quality benefits. Values for all Davis street trees can be found in appendix E.

Table 23. Net annual criteria pollutant benefits of selected public tree species.

Species	Total ($)	% of Citywide Population	% of Total ($)	Avg. $/tree
London plane	25,384	12.2%	9.1%	8.75
Chinese pistache	10,051	7.6%	3.6%	5.58
Chinese hackberry	35,400	6.2%	12.7%	23.87
crape myrtle	1,054	5.7%	0.4%	0.78
Chinese tallow	16,596	5.3%	5.9%	13.16
Bradford pear	6,022	4.7%	2.2%	5.41
moraine ash	12,187	3.2%	4.4%	16.04
southern magnolia	775	1.9%	0.3%	1.76
coast redwood	1,907	1.6%	0.7%	5.10
Modesto ash	21,343	1.6%	7.6%	54.73
Other street trees	148,553	50%	53%	12.48
All public street trees	279,273	100%	100%	11.54

Stormwater runoff reduction

The ability of Davis's city street trees to intercept rain was estimated at 53,473 m^3 (14,126,069 gal) annually. The total value of this benefit to the city was $24,342 annually or $1.02 for the average public tree (Table 24), a relatively small value due to the predominance of a deciduous tree population and a winter rainfall pattern. Average per tree values varied by zone, however. The more mature trees of central Davis averaged $2 or more annually, while the small trees of new developments (i.e, zone segment 10) averaged only $0.28.

Table 24. Total annual stormwater reduction benefits of public trees by zone segment and private trees citywide.

	Total rainfall interception (m^3)	Total ($)*	% of Citywide Population	% of Total ($)	Avg. $/tree
Zone segment 1	12,457	5,671	19%	23%	1.24
Zone segment 2	4,537	2,065	13%	8%	0.69
Zone segment 3	3,708	1,688	5%	7%	1.37
Zone segment 4	2,563	1,167	4%	5%	1.38
Zone segment 5	7,507	3,417	7%	14%	1.93
Zone segment 6	2,667	1,214	4%	5%	1.38
Zone segment 7	6,838	3,113	6%	13%	2.07
Zone segment 8	5,234	2,383	13%	10%	0.76
Zone segment 9	3,362	1,530	9%	6%	0.72
Zone segment 10	2,081	947	14%	4%	0.28
Zone segment 11	2,519	1,147	6%	5%	0.83
Public trees citywide	53,473	24,342	100%	100%	1.02
Private trees citywide	11,953	5,441	100%	100%	0.75
All trees Citywide	65,426	29,783	100%	100%	0.96

*Factored using the effective interception adjustment of 0.91

When averaged throughout the population, certain species were much better at reducing stormwater runoff than others (Table 25). Leaf type and area, branching pattern and bark, as well as tree size and shape all affected the amount of precipitation trees can intercept and hold to avoid direct runoff. Trees such as Chinese hackberry and Modesto ash performed this function well, while Chinese pistache and ornamental pears were among the worst performers. Values for all Davis street trees can be found in appendix E.

Table 25. Annual stormwater reduction benefits of selected public species.

Species	Total ($)	% of Citywide Population	% of Total ($)	Avg. $/tree
London plane	2,435	12.2%	9.9%	0.84
Chinese pistache	871	7.6%	3.6%	0.48
Chinese hackberry	2,902	6.2%	11.8%	1.96
crape myrtle	113	5.7%	0.5%	0.08
Chinese tallow	1,481	5.3%	6.0%	1.17
Bradford pear	533	4.7%	2.2%	0.48
moraine ash	1,134	3.2%	4.6%	1.49
southern magnolia	166	1.9%	0.7%	0.38
coast redwood	312	1.6%	1.3%	0.83
Modesto ash	952	1.6%	3.9%	2.44
Other street trees	13,617	50%	56%	1.14
All public street trees	24,515	100%	100%	1.02

Property value increases

At over $273,000, the average home resale prices in Davis were high between July 1, 1999 and June 30, 2000. As a result, associated annual increases in property values were high, and accounted for nearly 60% of the total benefits street trees produced. The annual citywide increase in property value from trees was estimated at approximately $1 million, with individual trees increasing adjacent property value by an average of almost $43/year (Table 26). Interestingly, this value did not change dramatically between very old and young populations. Rather, populations in their early functional stage produced the largest benefits, where growth, and subsequent annual increase in LSA, was rapid. Zone segments 3 and 9 were examples that fit this profile.

Table 26. Total annual increases in property value for public trees by zone segment and private trees citywide.

	Total ($)	% of Citywide Tree Population	% of Total ($)	Avg. $/tree
Zone segment 1	186,063	19%	18%	40.63
Zone segment 2	135,690	13%	13%	45.25
Zone segment 3	70,359	5%	7%	57.02
Zone segment 4	25,065	4%	2%	29.63
Zone segment 5	78,740	7%	8%	44.36
Zone segment 6	41,192	4%	4%	46.70
Zone segment 7	64,994	6%	6%	43.27
Zone segment 8	122,861	13%	12%	39.12
Zone segment 9	114,895	9%	11%	53.99
Zone segment 10	123,677	14%	12%	37.03
Zone segment 11	54,001	6%	5%	38.96
Public trees citywide	1,017,538	100%	100%	42.74
Private trees citywide	219,399	100%	100%	30.24
All trees Citywide	1,236,937	100%	100%	39.86

Removing population diversity from the equation showed dramatic differences in street trees that were performing this function. As seen in table 27, large-stature trees continued to grow even in mature stands (discrete subpopulations of larger zonewide populations). Therefore, areas with stands of moraine ash or London plane were provided with property values increasing at nearly $80 or more annually. Small-stature trees produced average benefits that were accordingly small in comparison, similar to very old trees with most of their growth in the past (e.g., Modesto ash). Values for all Davis street trees can be found in appendix E.

Table 27. Annual property value increases produced by selected public trees.

Species	Total ($)	% of Citywide Population	% of Total ($)	Avg. $/tree
London plane	225,023	12.2%	22.2%	77.57
Chinese pistache	62,413	7.6%	6.2%	34.64
Chinese hackberry	82,184	6.2%	8.1%	55.42
crape myrtle	8,913	5.7%	0.9%	6.58
Chinese tallow	76,289	5.3%	7.5%	60.50
Bradford pear	35,273	4.7%	3.5%	31.69
moraine ash	62,577	3.2%	6.2%	82.34
southern magnolia	5,394	1.9%	0.5%	12.23
coast redwood	12,417	1.6%	1.2%	33.20
Modesto ash	6,251	1.6%	0.6%	16.03
Other street trees	434,874	50%	43%	36.53
All public street trees	1,011,608	100%	100%	42.74

TOTAL ANNUAL NET BENEFITS AND BENEFIT-COST RATIO

During the 1999-2000 fiscal year, publicly maintained street trees produced nearly $1.7 million in tangible benefits for the residents of Davis (Table 28); less net expenditures of $449,353, net benefits were $1,248,464, annually. This amounted to an average of $52.43 per publicly maintained tree or approximately $21.30 for every resident. Total annual benefits divided by total annual costs yielded a B-C ratio (BCR) of 3.78. Therefore, the city's street trees returned $3.78 to the community for every $1 spent on their management.

The BCR was favorably high in Davis. Forty percent of the annual benefits were attributed to environmental values. Of this, energy savings and improved air quality—benefits that are locally realized—were the majority of this value. Though functionally of lesser proportion, reductions in CO_2 and stormwater runoff were significant. Annual increases in property value were the largest benefits produced by street trees in Davis, accounting for 60% of the total for an annual value of over $1 million.

On average, privately maintained trees along the streets of Davis did not perform as well as publicly cared for trees, providing less than 70% of the net benefits on a per tree basis. The proportionately larger trees in the public tree population accounted for the increased level of benefits.

Table 28. Total annual benefits produced by public and private street trees in Davis (weighted averages).

Benefit	Total ($)	% of Total Benefit	Average $/tree
Public Street Trees			
Environmental			
Energy	274,176	16%	11.52
CO_2	102,485	6%	4.30
Air Quality	279,273	16%	11.54
Stormwater	24,342	1%	1.02
Environmental Subtotal	680,277	40%	28.38
Property Increase	1,017,538	60%	42.74
Public Tree Total	1,697,815	83%	71.12
Private Street Trees			
Environmental			
Energy	64,837	18%	8.94
CO_2	20,598	6%	2.84
Air Quality	44,670	13%	6.16
Stormwater	5,441	2%	0.75
Environmental Subtotal	135,546	38%	18.68
Property Increase	219,399	62%	30.24
Private Tree Total	354,945	17%	48.92
Total Benefit	2,052,760	100%	66.41

Compared to Modesto, Davis's street trees produced much larger net benefits (Table 29). The increase was due to property value increases, as total environmental benefits (on a per tree basis) were less in Davis than in Modesto. It is important to remember, however, the value of some benefits were calculated differently and may account for large differences (e.g., stormwater and property value).

Table 29. Comparison of street tree benefits and costs in Modesto and Davis.

Benefit Category	Modesto $/tree	Davis $/tree
Environmental		
Energy	10.83	11.52
CO_2	4.86	4.30
Air Quality	14.53	11.54
Stormwater	5.55	1.02
Environmental Subtotal	35.77	28.38
Property Increase	18.11	42.74
Total Benefits	53.88	71.12
Program Costs*	24.29	18.87
Net Benefits	29.59	52.25

*Costs in Modesto were based on both street and park trees

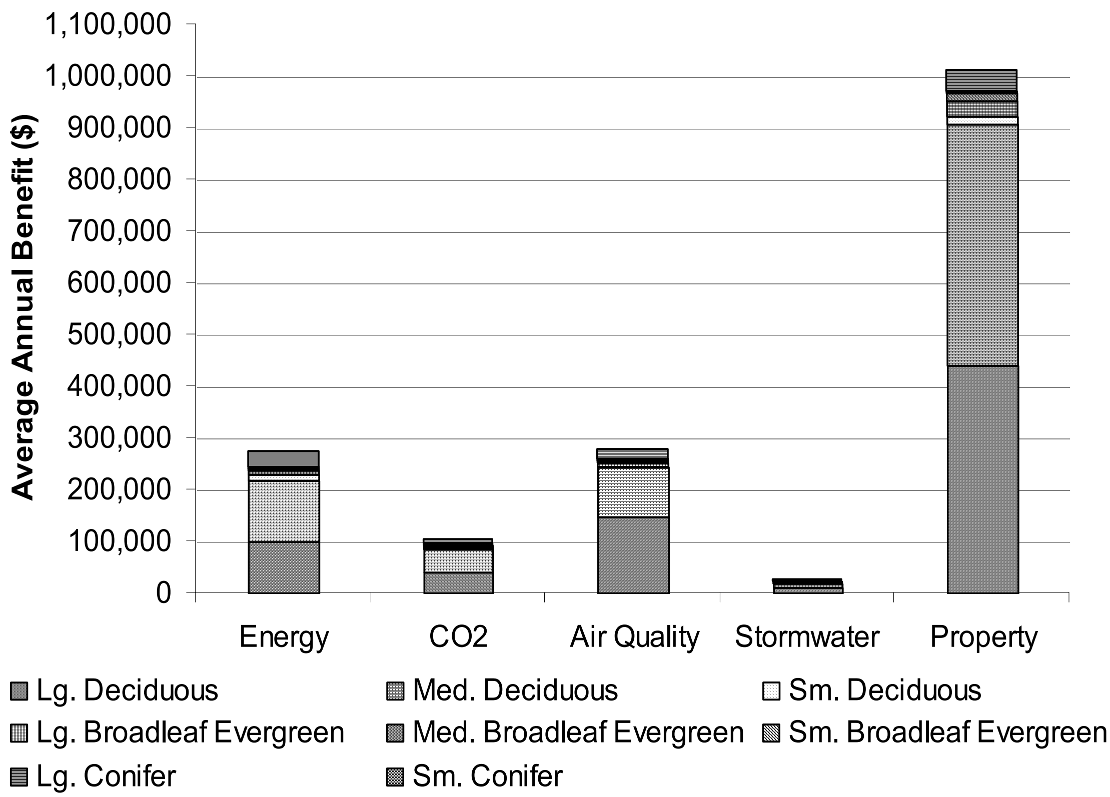
While species varied in their ability to produce benefits, common characteristics of trees within tree type classes aided in identifying the most beneficial street trees in Davis (Table 30). Comparatively, large trees produced the most benefits, but the average large deciduous tree produced nearly 30% more than a large conifer, and almost 50% more than a large broadleaf evergreen. Comparisons within tree types were more striking; even the youngest of the large-stature deciduous trees produced more annual benefits than mature small-stature trees of the same type. Medium deciduous trees out-performed large broadleaf evergreens and rival the benefit produced by the average large conifer.

Table 30. Average (weighted) annual benefits ($) produced by tree types as a function of DBH class (NP = No public trees present in age class).

Species	DBH class (cm [in])							Total Avg.
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	
Lg. Deciduous	26.55	78.22	124.70	125.48	104.95	98.57	113.28	98.05
Med. Deciduous	21.68	52.81	81.66	87.32	104.29	81.26	93.41	70.00
Sm. Deciduous	9.07	16.82	14.84	17.76	20.67	NP	NP	12.96
Lg. Broadleaf Evergreen	7.04	22.12	49.53	97.48	123.89	116.28	109.92	54.42
Med. Broadleaf Evergreen	10.55	27.38	51.98	75.83	69.02	107.31	NP	29.90
Sm. Broadleaf Evergreen	13.68	28.82	41.08	41.08	41.08	NP	41.08	39.59
Lg. Conifer	16.81	48.14	82.69	77.36	79.70	96.48	104.81	70.61
Med. Conifer	NP	NP	NP	NP	NP	NP	NP	NP
Sm. Conifer	9.37	NP	NP	NP	9.75	NP	NP	9.59
All public trees	18.28	49.17	92.47	92.20	101.42	97.18	111.65	71.12

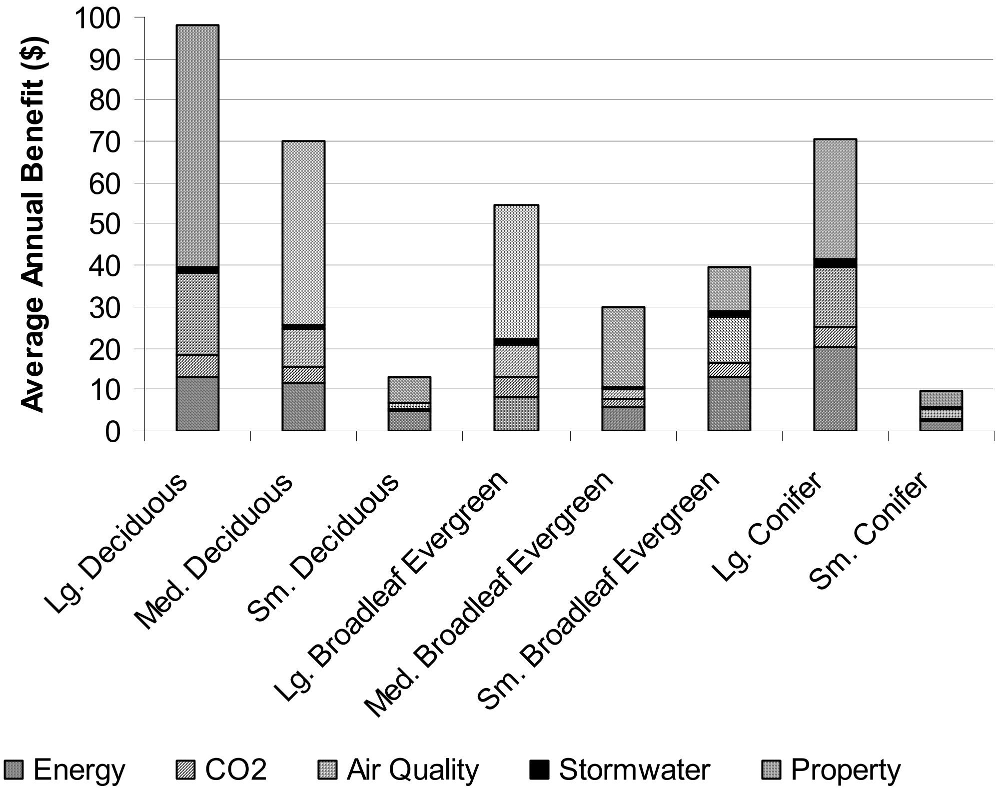
The two most important types of street trees in Davis are large- and medium-stature deciduous trees. Figure 22 shows, that while other tree types can and do produce benefits, deciduous trees of large and medium forms produced the greatest benefits.

Figure 22. Average annual benefits produced by tree types that comprise the city's public street tree population.



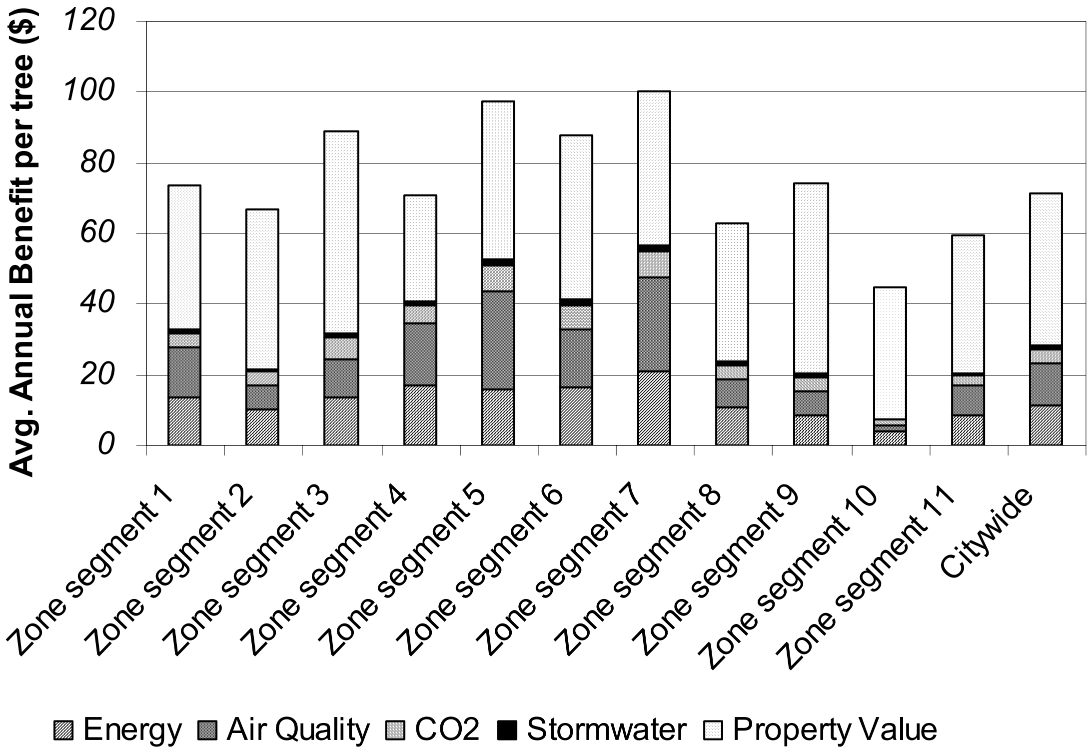
Another way to examine street trees in Davis was by their functionality in producing different benefits (Figure 23). For example, large coniferous trees produced more energy savings than large deciduous trees, but significantly less for property value increases. Another example was the differences between large and medium deciduous trees. If a tree manager was choosing between the two, s/he could evaluate the decision by future benefits gained or lost. Choosing the medium-stature tree would be giving up little in terms of energy and CO_2 reductions, as well as property value, but air quality improvement would be decreased by approximately half the value. In this fashion, tree managers of Davis can use this method to distribute trees in an equitable fashion and according to area needs, although site conditions and space available also limit selection.

Figure 23. Average annual environmental benefits of a single public tree by tree type.



The values represented in Figure 24, below, reflect the presence of specific tree types. Due to the prevailing mature large-stature deciduous trees in zone segments 5 and 7, total average annual benefits were high, with even distribution between environmental and aesthetic benefits. On the other hand, zone segments with young tree populations provided relatively few environmental benefits compared to increased property values.

Figure 24. Average annual benefits by zone segment.



Chapter 5

MANAGEMENT IMPLICATIONS

Developing a good street tree management plan is an integral component of any larger "urban forest" management strategy. Miller (1997) suggested a planning process consisting of three questions:

1. What do you have?
2. What do you want?
3. How do you get what you want?

The bulk of this thesis has been aimed at answering Miller's first question: an assessment of the existing tree resource. Not only did this analysis provide information that uncovers management priorities that will aid the community in reaching its goals, but it can be used as a baseline against which change can be measured (Bernhardt and Swiecki, 1999). To complete this assessment, however, Bernhardt and Swiecki (1999) stressed the need for cities to review and identify all management practices pertaining to the vegetation resource. While not included in this analysis, it would behoove the city of Davis to supplement this street tree analysis with a thorough audit of tree care practices, ordinances, and their enforcement, tree planting and planning guidelines, the state of their street tree inventory, and activities of municipal departments affecting trees (e.g., public works).

Neither detailed nor refined, the framework to answer Miller's second question comes from the city itself. With respect to public street trees, the city of Davis's 2000-2001 strategic plan outlines goals that any city would be proud to achieve:

> "City street trees and trees within public facilities are maintained in a healthy, vigorous condition to provide numerous benefits including shade, wind barriers, improved air quality and visual relief. The city's comprehensive urban tree management plan provides ecologically and horticulturally sound plant, pest and disease control; a high standard of pruning; proper planting and establishment methods, and timely response to complaints and safety concerns…"

In other words, the city seeks to maintain a functional municipal forest that is both healthy and safe: a street tree population that yields numerous benefits without compromising environmental quality or the well-being of the people who live, work, and recreate in Davis. Regardless of the city's current street tree management plan status, this analysis has provided accurate data on which management decisions can be made to achieve the goals set forth above. Therefore, this final discussion is dedicated to helping the city answer Miller's third and final question: how does Davis get what it wants?

CITYWIDE LONG-TERM MANAGEMENT GOALS

Achieving resource sustainability will produce long-term net benefits to the community while reducing the associated costs incurred with managing the resource. Structural features of a sustainable urban tree population include adequate species and age diversity, well-adapted healthy trees, and climate appropriate canopy cover (Clark et al. 1997;

McPherson, 1998). To this end, focusing on these components refines the broader street tree management goals as defined by the city (above). Long-term street tree management in Davis with respect to these three components is discussed below.

Population diversity

Richards (1982/83) defined stability of a street tree population as having a low probability that the number of functional trees will decline over the foreseeable future to the point of disrupting both the functional values trees provided and the management allocations needed for managing the population: a condition dependent on species being adapted for long-term success and on the age distribution of those species to assure the continuation of the population.

The process of biological simplification in street tree populations increases their vulnerability to certain species-specific attacks, thereby decreasing the level of benefits afforded to the community when tree stands are devastated (Sanders, 1981). To avoid this pitfall, the city of Davis needs to make species-specific planting decisions a priority. However, simply focusing on maximizing diversity to prevent catastrophe is not the solution.

Attempting too much diversity in cities where a limited pallet of species adapted to the local urban environment occurs may create problems (Miller, 1997). Not only does it make reaching the hackneyed 5-10% level that no single species should extend beyond difficult to achieve, but as Richards (1982/83) pointed out, stability is further threatened where ill-adapted species are relied upon too heavily. Though valuable as guidelines, planting decisions might be better served through common sense and good judgment, rather than blanket numerical limits suggested by others.

In reference to species composition, diversity cannot be used as an effective management tool without integrating diversity in age as well (Dorney et al., 1983). This is especially true amongst street tree populations where an even-flow of benefits is desired. Complex age structure throughout the street tree population will insure a continuation of a sustained level of benefits to the community.

Bolstering stability through managed age diversity is dependent on tree losses related to establishment, senescence, and those that are age-independent (Richards, 1979). In a case study of Syracuse, NY, Richards (1982/38) found that a good age distribution that promoted stability through continued replacement of these losses was 40% young trees under 20 cm (8 in) DBH, 30% early functional trees (20-40 cm [8-16 in]), 20% functionally mature trees (40-60 cm [16-24]), and 10% older trees with most of their functional life past. Richard's distribution is a useful guideline with which cities can compare and assess the age diversity of their own street tree populations (Richards, 1982/83; McPherson, 1998).

Complexity in species and structure, however, must be weighed according to specific needs of management zones; and on a smaller scale, to meet the needs of individual blocks and streets. Utilizing the diversity index, importance values, condition values, and age distribution tables provided above are all requisite to understanding which species are too heavily relied upon, ill-adapted, or lacking in age complexity.

In order to meet the long-term goals of diversity as outlined above, the results of the analysis suggest the city set three management goals: 1) plant species that are well-adapted and long-lived, 2) reduce over reliance on too few species within zone segments, and 3) focus rejuvenation planting efforts in areas where even, old-aged stands predominate.

Canopy cover

Canopy cover, or more precisely the amount and distribution of leaf surface area, is the driving force behind the urban forest's ability to produce benefits for the community. As canopy cover increases, so too do the benefits afforded by leaf area. It is important to remember that street trees throughout the US—and those of Davis—likely represent less than 10% of the entire urban forest (Moll and Kollin, 1993). In other words, the benefits Davis residents realize from all urban vegetation is far greater than the values found through this analysis. But unlike vegetation found on private lands, residents pay the city to manage street trees for the benefit of the community. Maximizing the return on this investment is contingent upon maximizing and maintaining the canopy cover of these trees.

The city of Davis did not have a street tree ordinance that specifies percentage canopy cover over streets as they did for parking lots: 50% coverage, 15 years after planting. Unlike parking lots however, attaining appropriate coverage on the city's sidewalks and streets must take into account varied land-use, planting locations, and population age complexity as discussed above. Because coverage within a stable street tree population will not be uniform over all areas, the ideal canopy cover is somewhat less than that determined for parking lots, but certainly greater than current levels.

Zone segments with relatively high percentages of canopy cover were those in the downtown and central Davis neighborhoods (i.e., zone segments 4,5, 6, and 7). These segments were also areas that have greater numbers of mature trees, suggesting what are maximum levels of attainment for the community. With 54% coverage of public impervious surfaces, downtown trees (zone segment 6) had the highest level of coverage. But being unique in Davis with respect to the atypical land-use regime as well as tree planting location (i.e., commercial land-use and planting strip/cutout planting locations), this zone should not be the basis for the ideal coverage for the rest of the city. Zone segment 5, however, was similarly high in canopy cover as a percentage of street and sidewalk area (46%) and was more representative of the remaining 8 zone segments with respect to land-use and planting locations of trees. Therefore, this zone may present a more accurate model of canopy cover for the city to strive for.

As discussed earlier, however, ideal canopy cover should be based on more than simply land-use and tree location; age distribution is a factor that cannot be ignored and must be part of the calculation. Comparison of Richards's (1982/83) ideal age distribution with the distribution of trees in zone 5 (see *Management priorities*, below) revealed a senescing tree population which may indicate reduced canopy cover from repeated pruning, disease, or dieback. But taking into account the dearth of young trees, it would be reasonable to suggest that the level of coverage during the sample inventory, ~46% for public trees only, was elevated.

Accounting for the average setback, a typical young city street tree less than 20 cm (8 in) in DBH had a crown diameter of 3.16 m (~10 ft) and did not intercept paved city surfaces; trees that fell into Richard's early functional, functionally mature, and older tree classes averaged coverages of approximately 10 m^2 (108 ft^2), 26 m^2 (280 ft^2), and 50 m^2 (538 ft^2), respectively. Adjusting the proportion of trees in zone segment 5 to reflect Richard's preferred age distribution, and weighting the trees average coverage based on the above values, dropped the coverage to 24%, or about one-half of its estimated level. This estimation suggests that when land-use, planting location, and a good age distribution are taken into account, an appropriate coverage is 25% of public street and sidewalk surface area, more than two times the city's estimated level of coverage.

Doubling the street tree canopy cover requires a multifaceted approach in Davis. Plantable spaces must be filled and use of large stature trees must be encouraged wherever feasible.

Those areas with the lowest canopy cover were the same areas where lack of utility lines and an increase in residential lot frontage allowed for large trees. The newest neighborhoods of Davis—those that fit this description—exhibited a trend contrary to those that will increase canopy cover as described here. For example, zones segments 10 and 11, where tree age was very young (see figures 46 and 48, below), already had large populations of small stature trees: Bradford pear alone was 16% of the total population in zone 11, while crape myrtle and Bradford pear together comprised nearly 17% of the zone 10 population. This trend towards heavy planting of small stature trees is not likely to increase the amount of environmental benefits produced by trees in Davis.

The city, however, can effect canopy cover improvement by reaching the city's full stocking potential. Planting 2,400 trees across the city will increase local livability and environmental benefits, while at the same time reducing the need for city expenditures on services such as stormwater management.

Pruning & maintenance

Unfortunately, budget constraints of municipal tree programs often dictate the length of pruning cycles and maintenance regimes rather than the needs of the urban forest and its constituent components. In fact, many cities do not have a programmed pruning plan, but maintain trees under "request" and "crisis" mode, finding them further and further behind every year. Programmed pruning, under a reasonable timeline, can improve public safety by eliminating conflicts, reduce costs by improving program efficiency, and increase benefits by improving tree health and condition. Any short-term dollar savings realized by cities deferring pruning only do so at a loss in tree value (Miller and Sylvester, 1981).

Managed programmed pruning by zone is recommended on a 3-6 yr cycle in residential areas; annual maintenance is suggested for commercial zones segments (Miller, 1997). Though Davis employed a management by zone approach, it had increased the maintenance rotation to 8 years. This regime may have been a calculated management decision, but was more likely determined out of necessity, as city pruning cycles depend primarily on the number of trees in the community and the funds available for maintenance (Miller, 1997). Whether or not the 8-year cycle was adequate was determined by assessing pruning needs with the number of years since the trees were last pruned (Table 31).

Table 31. Citywide and zone segment pruning needs.

Zone Segment	% of population needing pruning	% of population requiring immediate pruning	Estd. # requiring pruning	# of years since last pruning
1	19%	4%	868	0
2	7%	2%	204	1
3	21%	6%	263	4
4	34%	11%	288	5
5	37%	5%	662	6*
6	20%	3%	175	4
7	29%	3%	441	3
8	17%	2%	522	2
9	10%	1%	219	7
10	8%	2%	282	1
11	13%	0%	179	7**
Citywide	17%	3%	4,050	--

*Limited pruning conducted the same year as sample inventory.
**Zone contains new developments less than 7 yrs old.

In Table 30 all zone segments showing that 20% or more of their population required pruning had not been pruned within the last 4 years. This cut-off point is in-line with Miller and Sylvester's (1981) findings—in their study of Milwaukee—where extending pruning cycles beyond 4 or 5 years resulted in a loss of tree value that exceeded any savings accrued by deferring maintenance. In order to maintain consistency and maximize urban forest benefits while reducing city liabilities and public safety conflicts, the city of Modesto, CA had also found 4 years to be the ideal pruning cycle for their municipal forest (Gilstrap, 1983). Furthermore, Anderson and Eaton (1986) suggested that an adequate and systematic pruning and inspection program was the first step to avoiding liability stemming from trees.

In zone segments 4 and 5, where area pruning had not been conducted for 5 or more years, a full one-third of the trees needed pruning and 5-10% were in jeopardy of reduced longevity, onset of decline, or represented a public safety liability. Those conditions, at such high levels, bolster the argument that 4 years should be the desired cycle.

Results of the sample inventory also suggested that certain tree species may contribute an unproportionately large percentage of trees that require pruning. While not ideal, utilizing "species pruning" to target specific tree species could potentially reduce the total number of trees needing pruning over the short-term until adequate resources are established to allow for the establishment of the ideal pruning cycle. For example, in zone segment 5, the pruning of Arizona and Modesto ash along with honey locust would reduce the number of trees needing pruning to 20% of estimated levels. Further zone specific data regarding species needing pruning is discussed below on a zone segment by zone segment basis.

The city had estimated their current street tree population at approximately 15,000 trees. This analysis suggests that this was a gross underestimate. The city's estimated number of street trees, as reported here, is nearly 60% higher than the city's estimate, not including the private trees planted in the ROW that managers must contend with. The city must now decide how resources needed to maintain the current population require bolstering and reallocation amongst planting, pruning, and disease management.

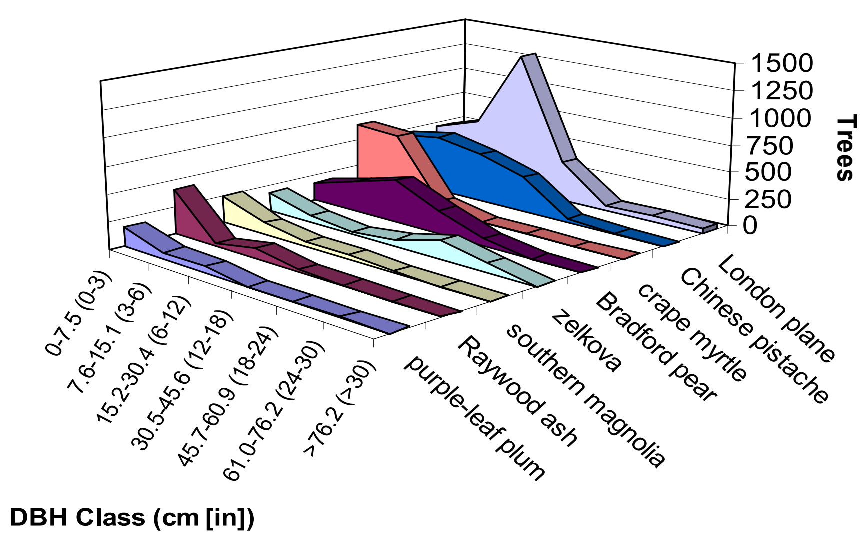
The city's first priority should be young tree care, as trees trained well when young will demand far less pruning when old (Miller, 1997). Considering 20% of all young trees were in need of stake removal alone, the city is poised to accept an unnecessary burden of maintenance problems as these trees mature. The second priority should be improving health and condition of existing populations in later stages of their lifecycle. Four out of every ten street trees were in conditions less than "good", and about 1 in every 6 trees required maintenance. By improving the health of these trees, the public will gain through increased benefits and the city will reduce liability and long-term costs. If there are not enough resources to maintain the existing population, adding new tree plantings will only compound management problems (Miller, 1997). Therefore, new tree plantings should be given last priority.

SPECIFIC MANAGEMENT PRIORITIES

Citywide

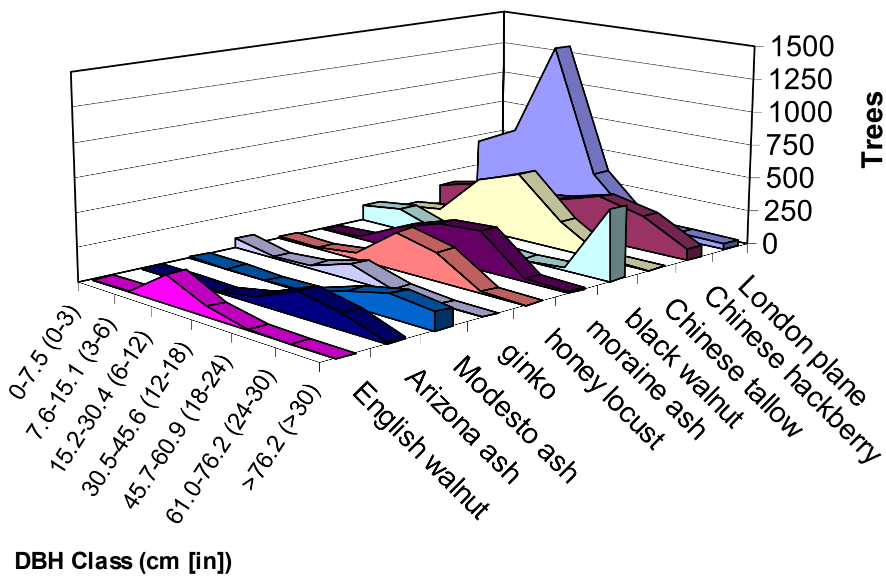
Species diversity was adequate when viewed on a citywide scale, but, as discussed above, planting for population stability requires more than simply planting "other trees" when a single species is planted beyond a set threshold (e.g., 10% of total population). Comparing Figure 25 with Figure 26, displays new and replacement planting trends with a preponderance of species that are not proven in their adaptability nor in their ability to produce benefits the community depends on. Zelkova, and perhaps London plane were the only species with individuals present in functionally large DBH classes. All other species were either untested or lack mature stature to attain functional size.

Figure 25. Top trees currently planted by numbers and DBH classes.



As evident in Figure 26, large, long-lived deciduous trees were those that reach functional age. Substantial tree numbers in large DBH classes represent proven adaptability amongst these trees. The shift towards planting small-stature and untested species has the ability to dramatically disrupt the current level of benefits afforded the community.

Figure 26. Age distribution of trees in Davis that are currently producing the largest average annual benefits on a per tree basis.



Presumably, the city ceased planting the majority of the species represented in Figure 26 due to perceived problems, whether it was infrastructure or pest related. It is important, however, to further evaluate how well they, as well as other species, are aging in comparison with each other.

Recent pruning and stand age may be factors, but condition class is likely to be an overriding indicator of selecting well-adapted and appropriate trees. Table 32 displays a condition index value based on the proportion of each public tree classified as "good" divided by the proportion of the total population that that tree represented. An index value of '1' indicates those trees that typified the citywide example of having 60% of its constituents in "good" condition. Any value higher than '1' indicated species that had proportionately more individuals classified as 'good'. Likewise, index values below '1' were street trees with below average 'good' condition ratings when compared with other Davis street trees.

Table 32. Condition index for public trees species representing over 0.5% of the total population.

Species	Condition index	Species	Condition index
Acer saccharinum	1.1	*Melia azedarach*	1.2
Albizia julibrissin	1.2	*Morus alba*	1.6
Alnus rhombifolia	0.6	*Pinus canariensis*	1.5
Betula pendula	0.4	*Pistacia chinensis*	1.3
Carpinus betulus	1.6	*Pinus halapensis*	1.4
Casurina cunninghamia	1.2	*Pinus pinea*	1.5
Celtis australis	1.4	*Platanus acerifolia*	0.8
Cercis occidentalis	1.6	*Platanus racemosa*	1.0
Celtis sinensis	1.1	*Prunus cerasifera*	0.5
Fraxinus holotricha 'Moraine'	0.8	*Pyrus calleryana*	0.5
Fraxinus oxycarpa 'Raywood'	1.0	*Pyrus calleryana 'Aristocrat'*	1.2
Fraxinus spp.	0.6	*Pyrus calleryana 'Bradford'*	0.9
Fraxinus velutina	0.1	*Quercus agrifolia*	1.3
Fraxinus velutina 'Modesto'	0.4	*Quercus ilex*	1.4
Ginkgo biloba	1.4	*Quercus lobata*	1.0
Gleditisia triancanthos	0.7	*Quercus suber*	1.4
Juglans hindsii	0.4	*Quesrcus virginiana*	1.6
Juglans regia	1.3	*Rhus lancea*	1.1
Koelreuteria paniculata	1.4	*Robinia ambigua*	1.2
Lagerstroemia indica	0.8	*Salix babylonica*	1.7
Laurus nobilis	1.1	*Sapium sebiferum*	1.0
Liquidambar styraciflua	1.2	*Sequoia sempervirens*	1.3
Liriodendron tulipifera	0.8	*Sophora japonica*	0.7
Malus floribunda	1.2	*Zelkova serrata*	1.1
Magnolia grandiflora	1.5		

While condition index values can be used to indicate trees well suited to the Davis conditions, it is important to remember that some species with low values may have represented species populations with an even age distribution that were senescing as a population. An example would be many of the ash species as well as California black walnut. Though most of these trees' functional lives were past, they had served the city well throughout their long lives and to not replant these species based on current condition of these senescing individuals would be shortsighted.

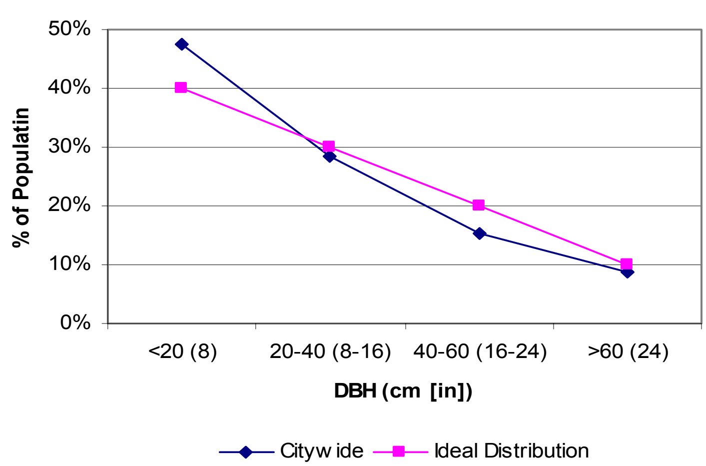
On the other hand, the fact that some of the species currently being heavily planted had values less than '1' further suggested that the city was putting faith in species unlikely to provide stability or cost effective functionality. These species—plum, Bradford pear, crape myrtle, and plane—were exhibiting relatively poor condition at young ages, suggesting that these were not trees that will age gracefully. In addition to returning reliance back to the trees presently providing high levels of benefits, evaluation of condition values and relative age (Appendix D) suggests that several species appeared to be well-adapted, long-lived, and have the potential to provide reasonable levels of benefits, deserving further consideration: zelkova, cork oak, holly oak, Chinese elm, California sycamore, and European hornbeam.

Table 33. Citywide distribution of the most prevalent public species.

Species	Estd. #	Std. Err.	% of Population
Platanus acerifolia	2,901	484	12.2%
Pistacia chinensis	1,802	371	7.6%
Celtis sinensis	1,483	291	6.2%
Lagerstroemia indica	1,355	339	5.7%
Sapium sebiferum	1,261	424	5.3%
Pyrus calleryana 'Bradford'	1,113	293	4.7%
Juglans hindsii	917	612	3.8%
Fraxinus holotricha 'Moraine'	760	252	3.2%
Other	12,219	821	34%
Total	23,810	1,396	100.0%

The citywide age distribution was inline with the ideal distribution as described above, though the numbers of young trees were elevated and the number of functional trees were slightly less than ideal (Figure 27). This distribution suggests that a strong young tree care program is needed as well as targeted maintenance for functionally mature trees. These priorities will insure that young trees will transition through their lifecycle in good health, minimizing the resources needed to maintain them, while functionally mature trees will perform at their peak to compensate for their lack in number.

Figure 27. Citywide relative age distribution of public trees.



Zone segment 1

As discussed earlier, the estimated number of California black walnuts growing in west Davis may be an over-estimation (Table 34). However, residing along Russell Blvd. many hundreds of these trees do exist. At over 100 years old, most of them were quickly losing their functional potential and contributed significantly to the degree of pruning and safety conflicts present in this zone and citywide; they represented over 60% of the pruning needs zonewide and 60% of the city's hazard trees.

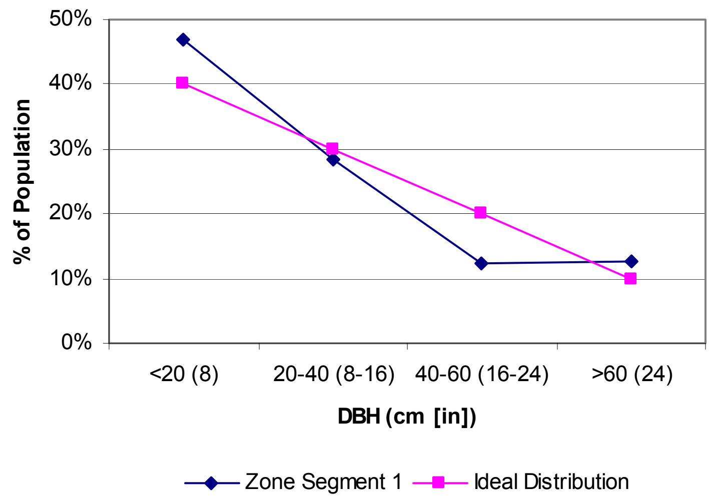
Table 34. The most prevalent public species in zone segment 1.

Species	Estd. #	Std. Err.	% of Population
Juglans hindsii	891	612	19.5%
Sapium sebiferum	643	379	14.0%
Pistacia chinensis	282	108	6.2%
Lagerstroemia indica	259	171	5.7%
Platanus acerifolia	226	91	4.9%
Robinia ambigua	226	111	4.9%
Pinus pinea	214	165	4.7%
Pinus canariensis	180	94	3.9%
Other	1,658	265	27%
Total	4,579	828	100.0%

Another tree of concern in this zone is Chinese tallow. Heavy reliance on this tree has resulted in the presence of sidewalk heave well above the city average. Additionally, this zone accounted for over one-third of all safety conflicts—in the form of street sign or intersection and lighting visibility obstructions—suggesting trees were placed too close to this infrastructure or adequate pruning to abate the problem was lacking.

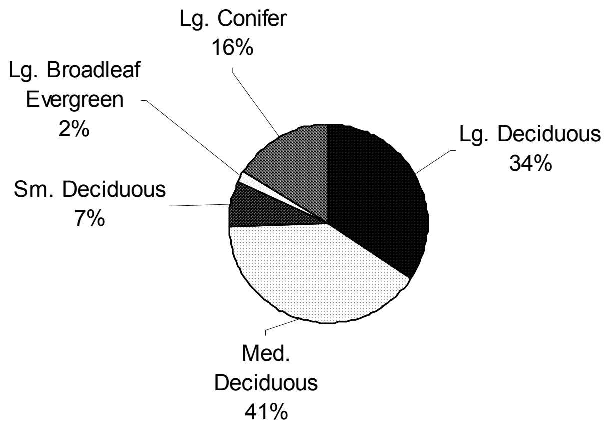
Age distribution suggests a relatively uneven-aged population, with fewer than ideal functional trees and higher than desired numbers of senescing trees (i.e., walnuts) (Figure 28). Care of young trees should be stressed as well as rejuvenating the senescing walnut population.

Figure 28. Relative age distribution of public trees in zone segment 1.



A predominance of large and medium stature deciduous and conifer trees (Figure 29) should improve average annual benefits as early functional trees begin to fill the present gap in functional tree numbers. Where site conditions permit, planting the remaining 5% of available planting sites with large deciduous trees will help to ensure that canopy cover will meet the needed doubling over the coming years.

Figure 29. Zone segment 1 public tree distribution by tree type.



Zone segment 2

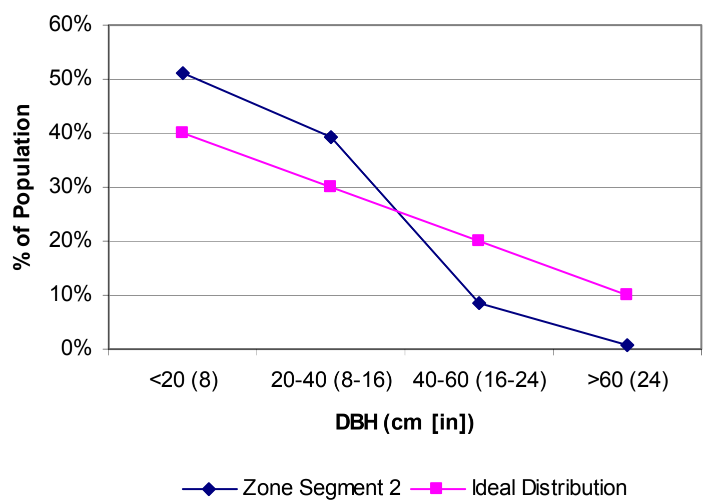
North Davis had 65% of its street trees spread among only 4 species (Table 35); and only two were trees that can be relied upon for their functionality: pistache and London plane. Compounding this problem is the fact that nearly 35% of the trees found in the ROW were private trees, contributing to a higher than desired tree density. The combination of poor performing species and close spacing were likely factors that resulted in this zone's distinction as having the fewest trees categorized as having good condition (42%). With respect to benefits, this characteristic suggests that this zone is unlikely to raise its below average yielding trees without intensive planning.

Table 35. The most prevalent public species in zone segment 2.

Species	Estd. #	Std. Err.	% of Population
Platanus acerifolia	505	301	16.8%
Pyrus calleryana 'Bradford'	505	245	16.8%
Lagerstroemia indica	473	253	15.8%
Pistacia chinensis	462	203	15.4%
Sapium sebiferum	204	123	6.8%
Fraxinus holotricha 'Moraine'	129	97	4.3%
Pyrus calleryana 'Aristocrat'	118	46	3.9%
Rhus lancea	108	75	3.6%
Other	495	92	14%
Total	2,999	545	100.0%

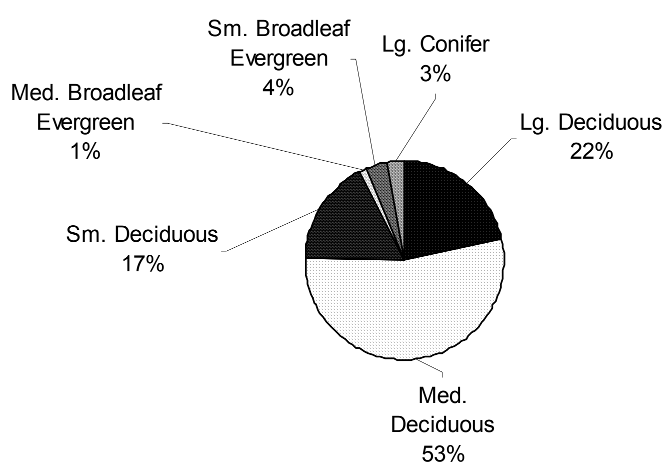
The relatively young age of the trees in this zone reflected the average neighborhood age, having few older homes or trees. The population however, appeared to have enough young trees to make the transition into a functional distribution of trees while maintaining stability (Figure 30), but examining the tree type composition provided further evidence to suggest that the population of trees that reach functional age size classes will be limited (Figure 31).

Figure 30. Relative age distribution of public trees in zone segment 2.



The few relatively large deciduous trees present in this zone (Figure 31) were limited to London plane trees and a smaller proportion of moraine ash. While these trees are likely to reach large size and provide benefits through large canopies, few other trees will do so. Therefore, priorities in this zone are increasing the level of well-adapted, large trees and providing adequate space for proper development. Monitoring the condition of trees in this zone for stress and disease is imperative.

Figure 31. Zone segment 2 public tree distribution by tree type.



Zone segment 3

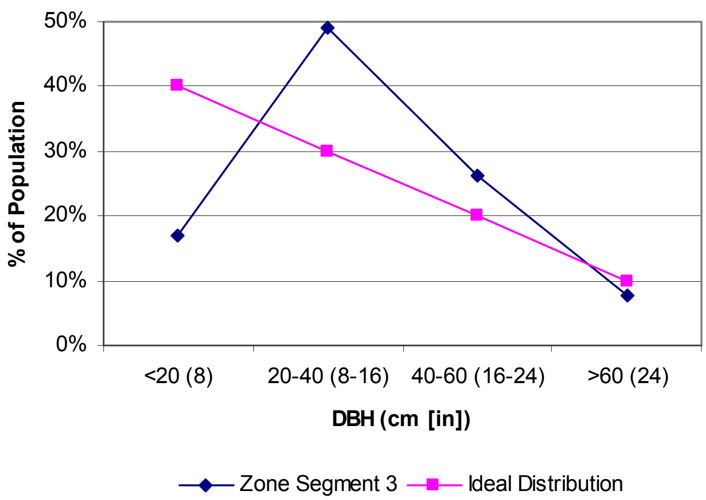
West central Davis had a relatively good mix of species (Table 36) and, according to Simpson's Diversity index, was the most diverse population in the city. Only gingko represented elevated population levels. But as mentioned earlier, this species is a well-adapted tree that consistently provided higher than average levels of annual benefits ($121). For these reasons, the present levels of ginkgo should be of little concern to city managers.

Table 36. The most prevalent public species in zone segment 3.

Species	Estd. #	Std. Err.	% of Population
Ginkgo biloba	149	74	12.1%
Liriodendron tulipifera	105	77	8.5%
Gleditisia triancanthos	96	56	7.8%
Quercus ilex	96	96	7.8%
Betula pendula	70	70	5.7%
Quercus suber	70	35	5.7%
Rhus lancea	70	37	5.7%
Celtis sinensis	53	22	4.3%
Other	525	87	30%
Total	1,234	198	100.0%

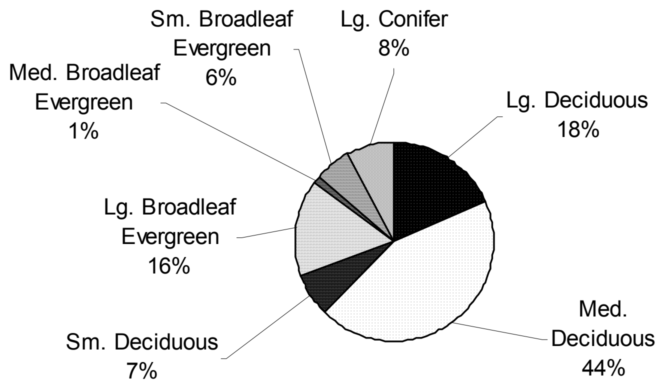
Compared to the ideal age distribution, this zone was noticeably lacking in young trees (Figure 32). Without this segment of the population, there will not be sufficient tree numbers to replace trees now moving through their early functional years.

Figure 32. Relative age distribution of public trees in zone segment 3.



Canopy cover over public streets and sidewalks was below average in this zone. While the mix of trees here are poised to sustain the benefits observed, increasing those benefits—and their below average canopy cover—will only be achieved through increasing the number of large-stature trees (Figure 33). Filling the estimated 5% of unplanted available space with such trees should be the management priority of this zone. Not only will it boost the number of young trees but will eventually help maximize benefits provided.

Figure 33. Zone segment 3 public tree distribution by tree type.



Zone segment 4

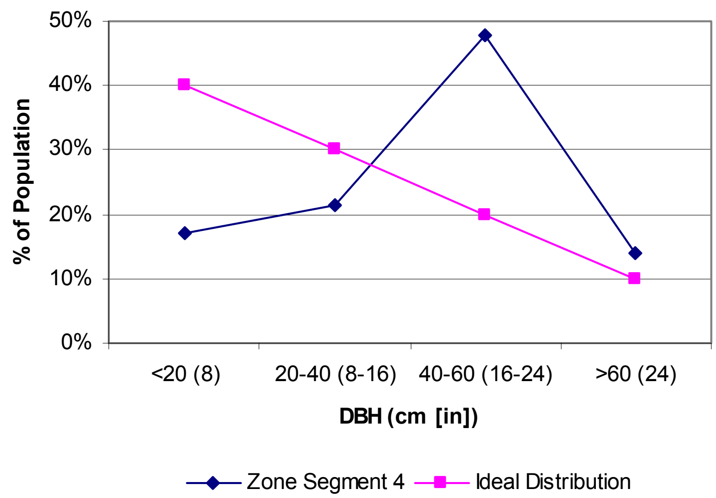
This central Davis zone was heavily planted with Japanese pagoda trees and is an ideal example of too much reliance in a single species (Table 37).

Table 37. The most prevalent public species in zone segment 4.

Species	Estd. #	Std. Err.	% of Population
Sophora japonica	288	160	34.0%
Zelkova serrata	135	92	16.0%
Pistacia chinensis	72	39	8.5%
Alnus rhombifolia	63	45	7.4%
Fraxinus holotricha 'Moraine'	45	17	5.3%
Celtis sinensis	36	18	4.3%
Morus alba	27	27	3.2%
Quercus coccinea	27	27	3.2%
Other	153	43	15%
Total	846	204	100.0%

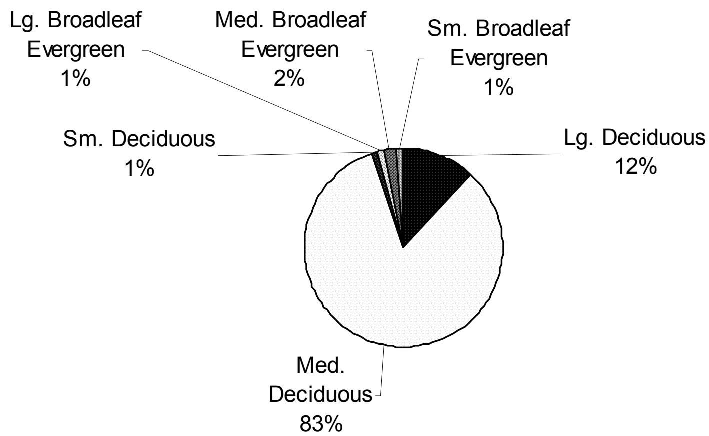
As Figure 34 shows, the pagoda trees, along with zelkova, are quickly moving into post functional years—a situation where many trees may require removal within the next 10 years. Pagoda trees represented over half of the estimated pruning needs and 70% of those required immediate attention; zelkova made up another 16% of the pruning needs. The predominance of these two aging species resulted in a population of trees where 1 out of 3 need maintenance, the second highest in the city. Additionally, at 2% of the population, this zone had the highest percentage of its population evaluated as "dead or dying".

Figure 34. Relative age distribution of public trees in zone segment 4.



Below average annual benefits produced by this zone's trees was in part due to the lack of large-stature deciduous trees (Figure 35). The below average condition of this zone's trees was likely the other contributing cause.

Figure 35. Zone segment 4 public tree distribution by tree type.



Management priorities in this zone are clear: planned rejuvenation of senescing stands are needed and targeting pruning to maintain the current stands between rotations. Replacement planting should be aimed at diversifying the population with large well-adapted varieties.

Zone segment 5

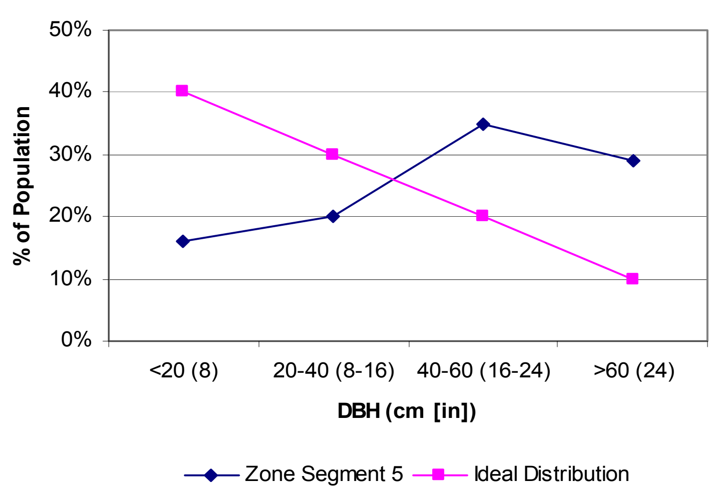
With 40% of the trees as ash varieties, diversity in this central Davis zone appeared somewhat lacking (Table 38). However, their large-stature afforded this zone the second highest level of benefits received by any population.

Table 38. The most prevalent public species in zone segment 5.

Species	Estd. #	Std. Err.	% of Population
Fraxinus velutina	305	224	17.2%
Fraxinus velutina 'Modesto'	252	114	14.2%
Celtis sinensis	242	107	13.6%
Gleditisia triancanthos	179	109	10.1%
Platanus acerifolia	158	70	8.9%
Fraxinus holotricha 'Moraine'	84	42	4.7%
Pistacia chinensis	63	52	3.6%
Quercus lobata	63	35	3.6%
Other	431	88	20%
Total	1,775	324	100.0%

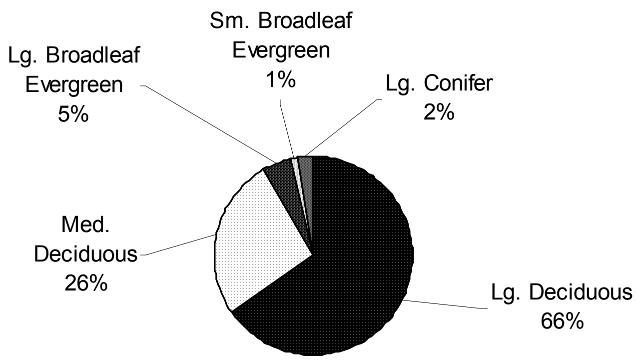
The relative age distribution shows a population of trees that was far off the stability mark as exhibited by the ideal distribution (Figure 36). The four most prevalent species—estimated at over half the total population—were moving towards the end of their lifecycle in similar time. Though this zone segment represented less than 7% of total land area in Davis, the benefits produced by the trees of this zone represented over 10% of the city total. Management must focus on rejuvenating these stands to sustain benefits not only for the neighborhoods within the zone, but for the greater population as well.

Figure 36. Relative age distribution of public trees in zone segment 5.



In addition to providing benefits, the predominance of large trees (Figure 37) provides much needed canopy cover. Over 45% of the city streets and sidewalks were shaded in this zone. However, large trees, ill-suited to site conditions may bring problems. Over 40% of all sidewalk heave was found to be associated with trees in this zone. Similarly, trees here represented nearly half of all over-head utility line conflicts.

Figure 37. Zone segment 5 public tree distribution by tree type.



To ensure public safety, maintenance of these less than average condition trees must be a priority. Almost 40% of the trees here were in need of pruning, the highest level in the city. Targeting Arizona and Modesto ash along with honey locust will alleviate 70% of the pruning needs. Abatement of infrastructure conflicts will further reduce city liability. But, like other aging stands, this zone needs an immediate rejuvenation effort. The short-term outlook resembles a population that will take more resources to maintain while returning fewer benefits.

Zone segment 6

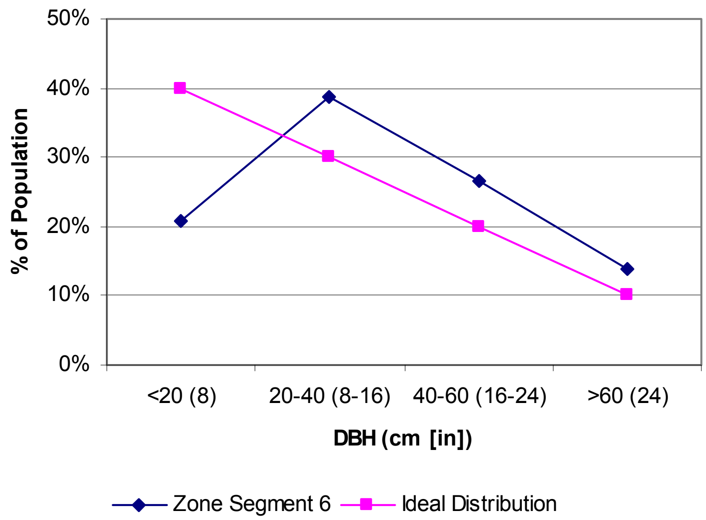
Downtown Davis had the lowest species richness and was one of the least diverse populations according to Simpson's diversity index. Nearly half the trees zonewide were one of two species: London plane or moraine ash (Table 39).

Table 39. The most prevalent public species in zone segment 6.

Species	Estd. #	Std. Err.	% of Population
Platanus acerifolia	220	113	25.0%
Fraxinus holotricha 'Moraine'	198	135	22.4%
Lagerstroemia indica	91	74	10.3%
Laurus nobilis	46	46	5.2%
Ulmus spp.	38	38	4.3%
Celtis sinensis	30	19	3.4%
Gleditisia triancanthos	30	22	3.4%
Pyrus calleryana	30	30	3.4%
Other	198	56	18%
Total	882	212	100.0%

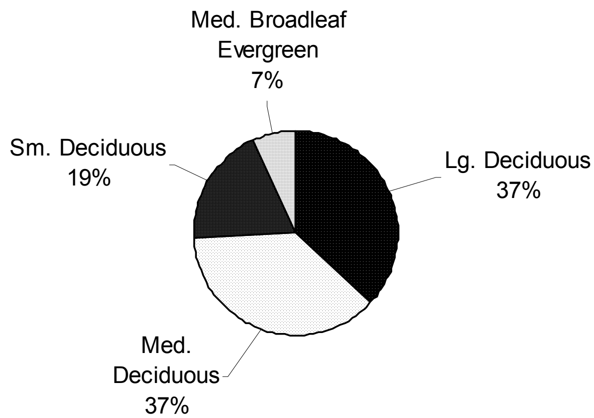
The age distribution is of little concern over the short-term, as the number of trees in early functional size classes were many and can maintain the stability through the foreseeable future (Figure 38). But, while there were estimated to be no available planting spaces, replacing the 8% of the population that was in poor condition will bolster the young tree population segment thereby increasing population stability over the long-term.

Figure 38. Relative age distribution of public trees in zone segment 6.



A good mix of large and medium deciduous tree yielded above average per tree benefits for this zone segment (Figure 39). However, the benefits attributed to these trees were not as large as the level of shade over impervious surfaces they provided would suggest. Limited growing space coupled with their lack of good health likely limited the extent of these trees. Less than 50% of the population was rated in good condition, while 20% was in need of pruning. At levels higher than citywide averages, tree maintenance is a priority. Targeting moraine ash, Bradford pear, and honey locust may eliminate 50% of the pruning needs.

Figure 39. Zone segment 6 public tree distribution by tree type.



Zone segment 7

East of the railroad tracks, the street trees of this zone segment shared characteristics and management concerns similar to the neighboring central Davis zones. Nearly 60% of the population was comprised of only 3 species, and Chinese hackberry alone represented 36% (Table 40).

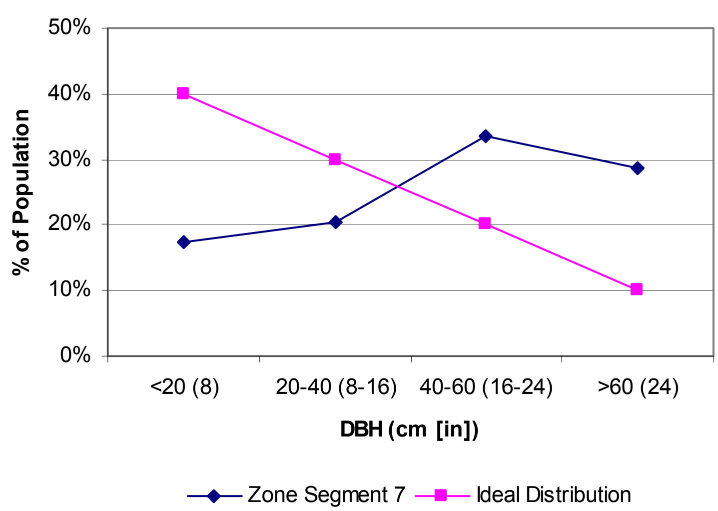
Table 40. The most prevalent public species in zone segment 7.

Species	Estd. #	Std. Err.	% of Population
Celtis sinensis	546	234	36.4%
Fraxinus holotricha 'Moraine'	179	179	11.9%
Celtis australis	137	76	9.1%
Casurina cunninghamia	74	54	4.9%
Fraxinus velutina 'Modesto'	74	74	4.9%
Pinus canariensis	53	27	3.5%
Albizia julibrissin	42	42	2.8%
Celtis occidentalis	32	32	2.1%
Other	368	87	20%
Total	1,502	334	100.0%

The relative age distribution deviated from the ideal, following senescing populations discussed previously (Figure 40). The major contributor to the functional tree size class was Chinese hackberry. These large trees were the driving force helping this zone return the highest average annual benefits per tree. Sustaining these benefits should be the primary priority in this zone.

While it appears that young trees, including European hackberry (*Celtis australis*) and cork oak, were planted to help rejuvenate the aging Chinese hackberry trees, 10% of available planting spaces remained unplanted. Filling these spaces now will help to stabilize the population for long-term returns on the city's investment in this high yielding resource.

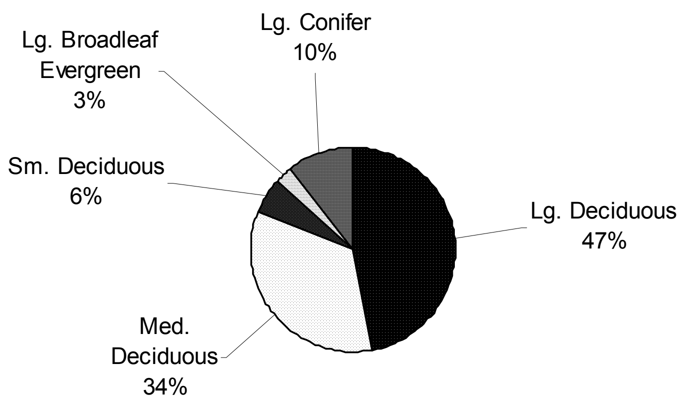
Figure 40. Relative age distribution of public trees in zone segment 7.



The distribution of trees by tree type (Figure 41) helped provide this zone segment with nearly ideal coverage of streets and sidewalks (25%). Overall condition of these trees was on par with city averages as well, but pruning needs were above average, at nearly 30%.

Infrastructure conflicts were not at the same high level as central Davis neighborhoods, but over-head utility line and sidewalk heave conflicts were significant at 15% and 10% of citywide totals, respectively; significant enough to warrant concern with managers.

Figure 41. Zone segment 7 public tree distribution by tree type.



Zone segment 8

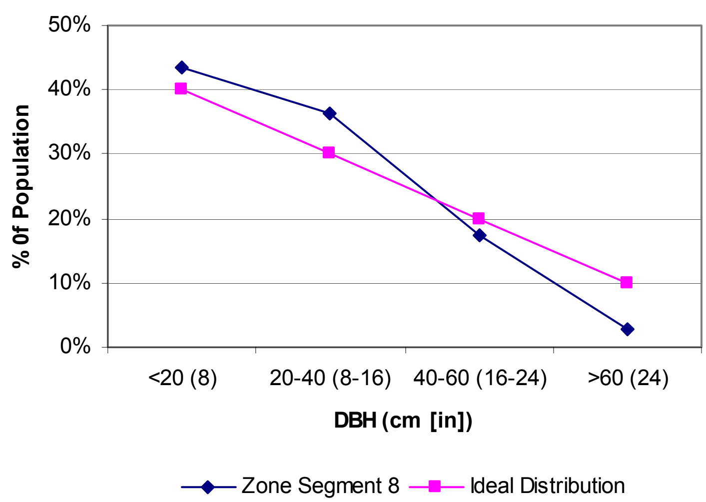
This east Davis Zone segment was adequately diverse by measure of Simpson's diversity index, approaching citywide levels of species diversification (Table 8). Only pistache and London plane approached levels that would cause caution, but the zone's even distribution of species and above average health suggest that there is no cause for alarm (Table 41).

Table 41. The most prevalent public species in zone segment 8.

Species	Estd. #	Std. Err.	% of Population
Pistacia chinensis	391	251	12.5%
Platanus acerifolia	315	148	10.0%
Carpinus betulus	206	141	6.6%
Sapium sebiferum	206	131	6.6%
Zelkova serrata	185	103	5.9%
Betula pendula	163	114	5.2%
Gleditisia triancanthos	163	163	5.2%
Lagerstroemia indica	141	91	4.5%
Other	1,369	218	30%
Total	3,140	477	100.0%

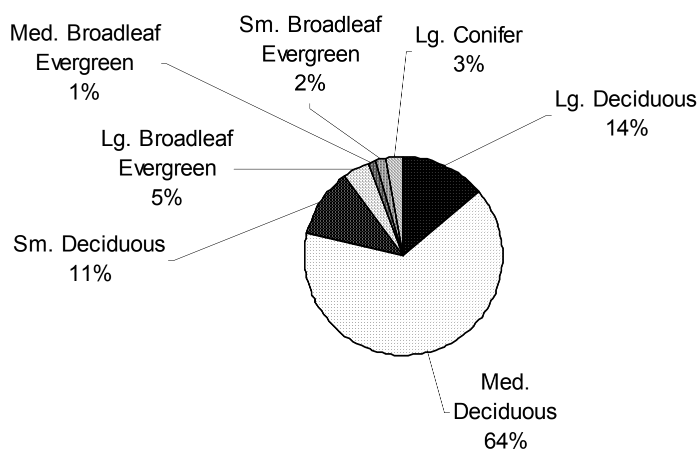
Similarly, the relative age distribution was nearest to ideal over any other zone segment (Figure 42). The slightly elevated young tree numbers will transition into their functional years compensating for the slight deficit in mature trees.

Figure 42. Relative age distribution of public trees in zone segment 8.



The majority of trees in this zone were limited to medium-stature deciduous trees (Figure 43). Tree numbers in the smallest DBH class (0-7.5 cm [<3in]) suggest that planting trends have not yet shifted to include more large-stature trees (Appendix D). Rather, medium-and small-stature trees were being planted (e.g., crab apple, crape myrtle, trident maple, pistache, and Texas umbrella). In order to raise the below average annual benefits and improve canopy coverage to adequate levels, filling the estimated 370 available planting sites with large deciduous trees is the top priority for management in this zone. New plantings must be adequately spaced. Spacing conflicts in this zone were amongst the highest citywide, as were the number of private trees present within the ROW.

Figure 43. Zone segment 8 public tree distribution by tree type.



Zone segment 9

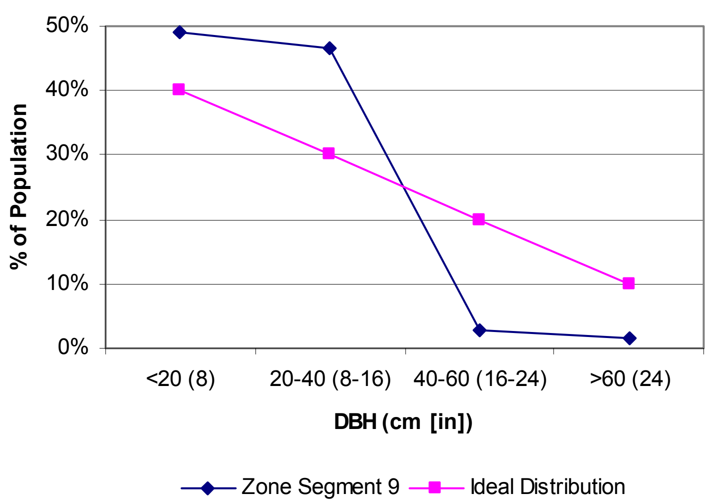
South Davis has been heavily planted with London plane and southern magnolia over the recent years. And as can be seen in Table 42, reliance on these two species came with a lack of diversity.

Table 42. The most prevalent public species in zone segment 9.

Species	Estd. #	Std. Err.	% of Population
Platanus acerifolia	840	275	39.5%
Magnolia grandiflora	288	262	13.5%
Celtis sinensis	138	76	6.5%
Laurus nobilis	127	127	5.9%
Liquidambar styraciflua	127	114	5.9%
Pistacia chinensis	81	69	3.8%
Quercus suber	58	58	2.7%
Sapium sebiferum	58	35	2.7%
Other	414	100	16%
Total	2,128	445	100.0%

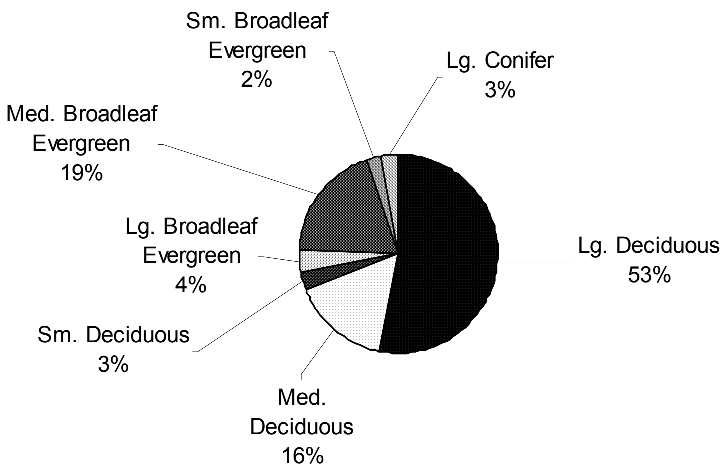
The majority of the population was still in its infancy, only beginning to move through its early functional years (Figure 44). As a result, average annual benefits were amongst the cities lowest. The benefits that were produced were mostly due to property value increases, as rapid growth adds aesthetic value before the trees fully realize their functional potential with respect to environmental benefits.

Figure 44. Relative age distribution of public trees in zone segment 9.



Over 50% of the trees were deciduous and of large-stature, which holds well for the future in terms of increasing environmental benefits and increasing canopy cover (Figure 45). And with less than 100 available planting sites, this zone was well stocked. Pruning was needed by approximately 10% of the population, evenly distributed throughout the population save Chinese hackberry which accounted for over 25% of all pruning needs. While seemingly minimal, management priorities should not be neglected: pruning is needed and reliance on London plane should be minimized through planting alternative large species where replacements and additional plantings permit.

Figure 45. Zone segment 9 public tree distribution by tree type.



Zone segment 10

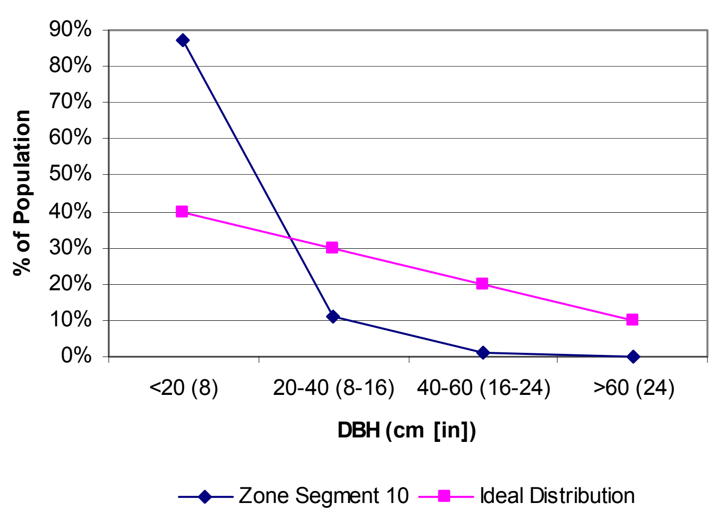
The new residential neighborhoods of Wildhorse and Mace Ranch comprised the extent of this zone segment. The vast majority of trees planted here have been done so by developers themselves via city ordinance. London plane, Raywood ash, crape myrtle and Chinese pistache appeared to be the most widely planted species (Table 43).

Table 43. The most prevalent public species in zone segment 10.

Species	Estd. #	Std. Err.	% of Population
Platanus acerifolia	434	107	13.0%
Fraxinus oxycarpa 'Raywood'	426	144	12.8%
Lagerstroemia indica	312	82	9.3%
Pistacia chinensis	297	74	8.9%
Juglans regia	251	251	7.5%
Pyrus calleryana 'Bradford'	167	75	5.0%
Acer rubrum	122	57	3.6%
Prunus cerasifera	122	59	3.6%
Other	1,210	161	27%
Total	3,340	381	100.0%

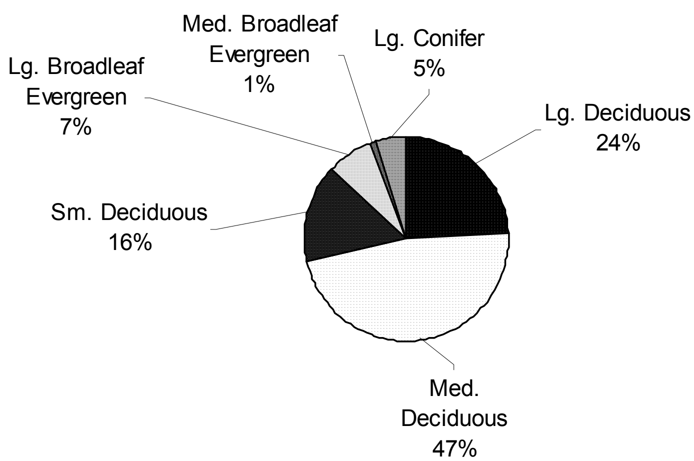
With nearly 90% of the street trees categorized as young, the relative age distribution was inline with neighborhood age (Figure 46). Commensurate with a young population, this zone provided its residents with lowest average annual benefits. Similarly, over 80% of the $45 produced by the average tree in these neighborhoods was limited to property value increases.

Figure 46. Relative age distribution of public trees in zone segment 10.



The city has managed to plant over 3,700 street trees in these new developments, but the number of available planting spaces was more than double the city's average. Filling the estimated 700 sites should be a priority. But with the percentage of small-stature trees amongst the highest in the city, care needs to be taken in planting for long-term benefits, as the trend away from large trees will not improve this zone's rank as having the lowest percentage of their streets and sidewalks shaded (Figure 47).

Figure 47. Zone segment 10 public tree distribution by tree type.



Pruning needs were modest at 10% of the population requiring attention. A full 30% of these needs could be attributed to Raywood ash alone. Other trees that needed attention include London plane, purple-leaf plum, and Bradford pear. To ensure that the trees age in good condition, proper young tree care is imperative. Fourteen percent of the entire population was in need of stake removal. Additionally, care must be taken to avoid spacing conflicts. Nearly one out of every four trees in this zone was spaced too closely. And while the aesthetic benefits of this planting regime may be more pleasing when trees are young, without eventual removal their potential to fully realize maximum benefits to the community is jeopardized in the long-term.

Zone segment 11

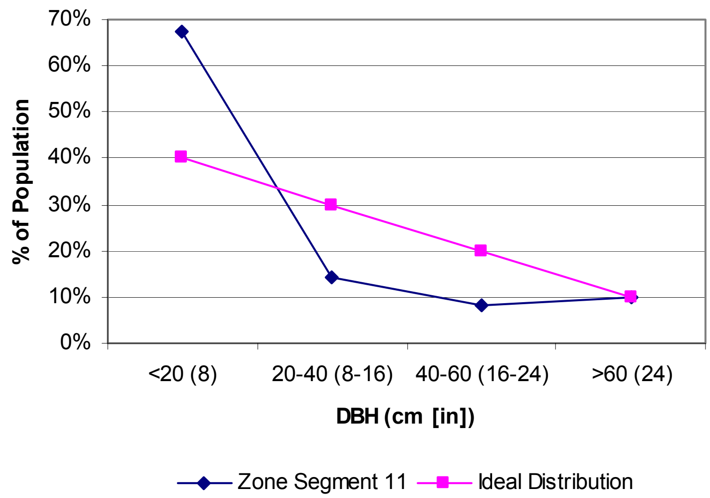
Far east Davis was characterized by a mix of new and slightly older neighborhoods. Diversity of street tree species in this zone was not of too much concern in its own right, but Bradford pear—being the most prevalent species—does not provide stability compared to other species in large numbers, as pear trees typically lack proven longevity in Davis. Excluding Bradford pear, however, Table 44 shows prevailing species were trees of known longevity and adaptability.

Table 44. The most prevalent public species in zone segment 11.

Species	Estd. #	Std. Err.	% of Population
Pyrus calleryana 'Bradford'	221	119	15.9%
Platanus acerifolia	168	92	12.1%
Pistacia chinensis	137	86	9.8%
Celtis sinensis	105	63	7.6%
Cercis occidentalis	74	74	5.3%
Zelkova serrata	63	42	4.5%
Celtis australis	42	23	3.0%
Eucalyptus spp.	42	42	3.0%
Other	536	97	28%
Total	1,386	229	100.0%

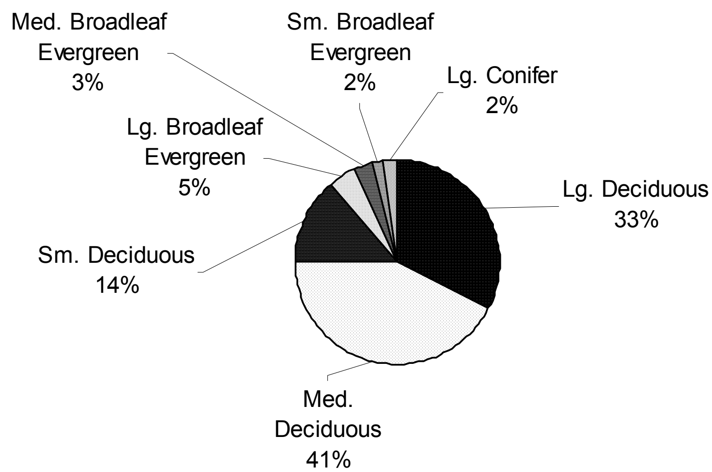
The relative age distribution was consistent with neighborhood age, having nearly 70% of the tree population characterized as young trees (Figure 48). This zone benefited from a number of older Chinese hackberry and zelkova trees that raised average benefit values beyond what bordering neighborhoods of zone segment 10 produced. The many young trees are in good position to fill the functional population gap in coming years.

Figure 48. Relative age distribution of public trees in zone segment 11.



Approximately 75% of the existing population was split between large- and medium-stature deciduous trees, a good distribution to provide benefits over the long-term (Figure 49). However, the main priority in this zone is filling vacant planting sites. With over 20% of planting sites unplanted, it had the highest new-planting potential of any zone. Bolstering the population by planting large-stature trees will help to assure maximum cover is provided as the population moves into its functional years.

Figure 49. Zone segment 11 public tree distribution by tree type.



Chapter 6

CONCLUSION

This study described structural characteristics of an urban street tree population with enough accuracy to assess the environmental benefits they provide. In addition, management goals and priorities needed to maximize these benefits were analyzed. The sample inventory technique employed was based on established statistical methods, and though the B-C analysis has been based on the most recent advancements, there was a degree of uncertainty that belied the approach used here (e.g., trees grow at the same rate in Davis as they do in Modesto). There was no doubt that an element of precision was lacking due to the degree of assumptions made, though the intent of quantifying benefits was not to account for each penny. Rather, this analysis was meant to be a general accounting of the benefits produced by street trees—an accounting with an accepted degree of uncertainty—that can nonetheless provide a platform on which decisions can be made.

Useful as a guideline for communities with few resources, this project has demonstrated how this approach can be a valid starting point for long-term urban forest management as well as describing the functional capacity of a public resource that can spur interest and investment in community tree planting and care. Any community with similar climate and tree composition can use the information contained in this report to conduct their own analysis. As the US Forest Service's Center for Urban Forest Research conducts additional analyses in other locales, communities in those regions can follow suit, enabling them to discover and realize the functional capacity of their street trees.

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Appendix A: Field Inventory Sheet

Segment Location: Zone #: ____________ Date: ____________

Beginning Address: ____________ Name: ____________

Ending Address: ____________

															Conflicts present?: 1=Yes, 0=No						
Tree #	Species Code	City Tree? 1=Yes 0=No	Year Planted (or NA)	Land-use (1-4)	Tree Location (1-5)	Front Orientation of House	Orientation of Tree	Setback Distance (0-3)	DBH (cm)	Tree Height (1-6)	Crown Diameter (m)	Condition (1-4)	Needs Pruning 1=Yes 0=No	Immediate pruning required? 1=Yes, 0=No	Sidewalk (≥3/4" heave)	Tree hazard	Intersection/ Visibility/ Lighting	Spacing	Overhead lines	Car shaded? 1=Yes 0=No	Other needs/Comments

Land Use:
1 - Single-home residential
2 - Multi-home residential
3 - Commercial/industrial
4 - Other (vacant, institutional, agriculture, etc.)

Tree Location:
1 - Front Yard
2 - Planting strip
3 - Cutout
4 - Median
5 - Other

Orientation (house & tree):
N - North
NE - Northeast
E - East
SE - Southeast
S - South
SW - Southwest
W - West
NW - Northwest

Setback Distance Classes:
1 - 0 – 8 m
2 - 8 – 12 m
3 - 12 – 18 m
0 - >18 m

Height Classes:
1 - 0 – 3 m
2 - 3 – 6 m
3 - 6 – 9 m
4 - 9 – 12 m
5 - 12 – 18 m
6 - >18 m

Condition:
1 - Good - Healthy vigorous tree. No signs of insects, disease, or mechanical injury. Little or no corrective work required. Form representative of species.
2 - Fair - Average condition and vigor for area. May need corrective pruning or repair. May lack desirable form characteristic of species. May show minor insect injury, disease, or physiological problem.
3 - Poor - General state of decline. May show severe mechanical, insect, or disease damage, but death not imminent. May require major repair or renovation.
4 - Dead or Dying - Dead or death imminent from disease or other causes.

Appendix B: Species Code Reference List

Species #	Code	Scientific Name	Common Name	Tree Type	Spp. Value Assignment
0	**VOID**	Vacant Planting Site	Vacant Planting Site	NA	NA
1	ACBU	*Acer buergerianum*	Maple, Trident	DS	LAIN
2	ACCA	*Acer campestre*	Maple, Hedge	DM	PYCA
3	ACNE	*Acer negundo*	Box Elder	DL	ACSA
4	ACPA	*Acer palmatum*	Maple, Japanese	DS	LAIN
5	ACPS	*Acer pseudoplatanus*	Maple, Sycamore	DM	FRHO M
6	ACRU	*Acer rubrum*	Maple, Red	DM	FRHO M
7	ACSA	*Acer saccharinum*	Maple, Silver	DL	ACSA
8	AECA 1	*Aesculus californica*	California Buckeye	DS	LAIN
9	AIAL	*Ailanthus altissima*	Tree Of Heaven	DM	PICH
10	ALCO	*Alnus cordata*	Alder, Italian	DM	PYCA
11	ALJU	*Albizia julibrissin*	Silk Tree	DM	GLTR
12	ALRH	*Alnus rhombifolia*	Alder, White	DM	PYCA
13	ARUN	*Arbutus unedo*	Strawberry Tree	BES	BES OTHER
14	BENI	*Betulus nigra*	Birch, River	DM	BEPE
15	BEPA	*Betula papyrifera*	Brch, Paper	DM	BEPE
16	BEPE	*Betula pendula*	Birch, White Birch	DM	BEPE
17	CABE	*Carpinus betulus*	Hornbeam, European	DM	PYCA
18	CABE F	*Carpinus betulus 'Fastigiata'*	Hornbeam, Fastigate	DM	PYCA
19	CACA	*Carpinus carolina*	Hornbeam, American	DM	PYCA
20	CACU	*Casurina cunninghamia*	Beef wood, She oak	CL	PITH
21	CADE	*Calocedrus decurrens*	Incense cedar	CL	PITH
22	CASP	*Catalpa speciosa*	Western Catalpa	DL	ACSA
23	CEAT	*Cedrus atlantica*	Cedar, Atlas	CL	PITH
24	CEAU	*Celtis Australis*	Hackberry, European	DM	ZESE
25	CECA	*Cercis canadensis*	Redbud, Eastern	DS	LAIN
26	CEDE	*Cedrus deodara*	Cedar, Deodar	CL	PITH
27	CEOC	*Cercis occidentalis*	Redbud, Western	DS	LAIN
28	CEOC1	*Celtis occidentalis*	Hackberry, Common	DL	CESI
29	CESI	*Celtis sinensis*	Hackberry, Chinese	DL	CESI
30	CESI 1	*Ceratonia siliqua*	Carob	BEM	CICA
31	CESP	*Celtis spp*	Hackberry	DL	CESI
32	CICA	*Cinnamomum camphora*	Camphor	BEM	CICA
33	CISP	*Citrus spp.*	Lemon,orange,lime	BES	BES OTHER
34	CRSP	*Crateagus spp*	Hawthorn Spp	DS	LAIN
35	CYRE	*Cycas revoluta*	Cycad	CS	CS OTHER
36	DIKA	*Diospyros kaki*	Persimmon	DM	PYCA
37	ERDE	*Eriobotrya deflexa*	Loquat, Bronze	BES	BES OTHER
38	EUPO	*Eucalyptus polyanthemos*	Eucalyptus,silver Dollar	BEL	QUIL
39	EUSI R	*Eucalyptus sideroxylon 'Rosea'*	Eucalyptus,red Ironbark	BEL	QUIL
40	EUSP	*Eucalyptus*	Eucalyptus Spp	BEL	QUIL
41	FICA	*Ficus carica*	Fig, Edible	DS	LAIN
42	FRHO M	*Fraxinus holotricha 'Moraine'*	Ash, Moraine	DM	FRHO M
43	FROX R	*Fraxinus oxycarpa 'Raywood'*	Ash, Raywood	DM	FROX R
44	FRSP	*Fraxinus spp.*	Ash spp.	DM	FRPE M
45	FRUH	*Fraxinus uhdei*	Ash, Shamel	DL	FRPE M
46	FRVE	*Fraxinus velutina*	Ash, Arizona	DL	FRVE G
47	FRVE G	*Fraxinus velutina 'Modesto'*	Ash, Modesto	DL	FRVE G
48	GIBI	*Ginkgo biloba*	Ginkgo, Female	DM	GIBI
49	GLTR	*Gleditisia triancanthos*	Locust, Honey	DM	GLTR
50	JUHI	*Juglans hindsii*	Walnut, Black	DL	CESI
51	JURE	*Juglans regia*	Walnut, English	DL	CESI
52	JUSP 1	*Juniperus species*	Juniper spp.	CS	CS OTHER
53	KOPA	*Koelreuteria paniculata*	Golden Rain	DM	KOPA
54	LAIN	*Lagerstroemia indica*	Crape Myrtle	DS	LAIN
55	LANO	*Laurus nobilis*	Sweet Bay	BEM	CICA
56	LIDE	*Lithocarpus densiflora*	Tan Bark Oak	BEL	QUIL
57	LILU	*Ligustrum lucidum*	Privet, Glossy	BES	BES OTHER
58	LIST	*Liquidambar styraciflua*	Liquidambar	DL	LIST
59	LITU	*Liriodendron tulipifera*	Tulip Tree	DL	LIST
60	MABO	*Maytenus boaria*	Maytens	BEM	CICA
61	MAFL	*Malus floribunda*	Crabapple	DS	LAIN
62	MAGR	*Magnolia grandiflora*	Magnolia, Southern	BEM	MAGR
63	MASO	*Magnolia soulangiana*	Magnolia, Chinese	DS	LAIN
64	MASP	*Magnolia*	Magnolia Spp	DS	LAIN
65	MASP 1	*Malus spp*	Apple Spp	DS	LAIN
66	MEAZ	*Melia azedarach*	Texas Umbrella, China berry	DM	KOPA
67	MEGL	*Metasequoia glyptostroboides*	Dawn Redwood	DL	LIST

Species #	Code	Scientific Name	Common Name	Tree Type	Spp. Value Assignment
68	MELI	*Melaleuca linariifolia*	Flax, Paperbark	BEM	CICA
69	MOAL	*Morus alba*	Mulberry, White	DM	FRHO M
70	OLEU	*Olea europaea*	Olive	BEM	CICA
71	PEAM	*Persea americana*	Avacado	BEM	MAGR
72	PHCA	*Phoenix canariensis*	Palm, Canary	CS	CS OTHER
73	PIBR	*Pinus brutia*	Pine, Brutian	CL	PITH
74	PICA	*Pinus canariensis*	Pine, Canary Island	CL	PITH
75	PICH	*Pistacia chinensis*	Pistache, Chinese	DM	PICH
76	PIHA	*Pinus halapensis*	Pine, Aleppo	CL	PITH
77	PIMU	*Pinus mugo*	Pine, Mugo	CS	CS OTHER
78	PINI	*Pinus nigra*	Pine, Austrian Black	CM	CM OTHER
79	PIPI	*Pinus pinea*	Pine, Stone	CL	PITH
80	PIPO	*Pinus ponderosa*	Pine, Ponderosa	CL	PITH
81	PIPU	*Picea pungens*	Spruce, Blue	CL	PITH
82	PIRA	*Pinus radiata*	Pine, Monterey	CL	PITH
83	PISP	*Pinus spp*	Pine Spp	CL	PITH
84	PITH	*Pinus thunbergii*	Pine, Japanese Black	CL	PITH
85	PLAC	*Platanus acerifolia*	Sycamore, London Plane	DL	PLAC
86	PLRA	*Platanus racemosa*	Sycamore, California	DL	PLAC
87	PODE	*Populus deltoides*	Black Cottonwood	DL	CESI
88	PRAM	*Prunus amygdalus*	Almond	DS	LAIN
89	PRAR	*Prunus armenica*	Apricot	DS	LAIN
90	PRAV	*Prunus avium*	Cherry, Sweet	DM	PICH
91	PRCE	*Prunus cerasifera*	Plum, Flowering	DS	LAIN
92	PRSP	*Prunus spp*	Prunus Spp	DS	LAIN
93	PRSU	*Prunus subhirtella*	Cherry, Weeping	DS	LAIN
94	PTST	*Pterocarya stenoptera*	Chinese wingnut	DL	CESI
95	PUGR	*Punica granatum*	Pomengranate	DS	LAIN
96	PYCA	*Pyrus calleryana*	Pear, Ornamental	DM	PYCA
97	PYCA A	*Pyrus calleryana 'Aristocrat'*	Pear, Aristocrat	DM	PYCA
98	PYCA B	*Pyrus calleryana 'Bradford'*	Pear, Bradford	DM	PYCA
99	PYSP	*Pyrus spp*	Pear Spp	DM	PYCA
100	QUAG	*Quercus agrifolia*	Oak, Coast Live	BEL	QUIL
101	QUCO	*Quercus coccinea*	Oak, Scarlet	DL	PLAC
102	QUIL	*Quercus ilex*	Oak, Holly	BEL	QUIL
103	QULO	*Quercus lobata*	Oak, Valley	DL	CESI
104	QUPA	*Quercus palustris*	Oak, Pin	DL	ACSA
105	QURO	*Quercus robur*	Oak	DL	ACSA
106	QUSP	*Quercus spp*	Oak Spp	DL	ACSA
107	QUSU	*Quercus suber*	Oak, Cork	BEL	QUIL
108	QUVI	*Quercus virginiana*	Oak, Southern Live	BEL	QUIL
109	QUWI	*Quercus wislizenii*	Oak, Interior Live	BEL	QUIL
110	RHLA	*Rhus lancea*	African Sumac	BES	BES OTHER
111	ROAM	*Robinia ambigua*	Purple robe tree	DM	FROX R
112	SABA	*Salix babylonica*	Willow, Weeping	DM	FRPE M
113	SASE	*Sapium sebiferum*	Chinese Tallow	DM	ZESE
114	SCMO	*Schinus molle*	Pepper, California	BEM	CICA
115	SESE	*Sequoia sempervirens*	Redwood, Coast	CL	PITH
116	SOJA	*Sophora japonica*	Japanese Pagoda	DM	PICH
117	TIAM	*Tilia americana*	Linden, 'Redmond'	DS	LAIN
118	TICO	*Tilia cordata*	Linden, Little-leaf	DS	LAIN
119	TIEU	*Tilia x euchlora*	Linden, Crimean	DS	LAIN
120	ULPA	*Ulmus parvifolia*	Elm, Chinese	DL	CESI
121	ULSP	*Ulmus*	Elm Spp	DL	CESI
122	UMCA	*Umbellularia californica*	California Bay	BEL	QUIL
123	WAFI	*Washingtonia filifera*	Palm, California Fan	CS	CS OTHER
124	WARO	*Washingtonia robusta*	Palm, Mexican Fan	CS	CS OTHER
125	WIFL R	*Wisteria floribunda 'ROSEA'*	Wisteria 'ROSEA'	DS	LAIN
126	XYCO	*Xyloma congestum*	Xyloma	BES	BES OTHER
127	ZESE	*Zelkova serrata*	Zelkova	DM	ZESE
128	DL OTHER	Deciduous Large Other	"	DL	PLAC
129	DM OTHER	Deciduous Medium Other	"	DM	PICH
130	DS OTHER	Deciduous Small Other	"	DS	LAIN
131	BEL OTHER	Broadleaf Evergreen Large	"	BEL	QUIL
132	BEM OTHER	Broadleaf Evergreen Medium	"	BEM	CICA
133	BES OTHER	Broadleaf Evergreen Small	"	BES	BES OTHER
134	CL OTHER	Conifer Large Other	"	CL	PITH
135	CM OTHER	Conifer Medium Other	"	CM	CM OTHER
136	CS OTHER	Conifer Small Other	"	CS	CS OTHER

Appendix C: citywide & Zone Segment Public Street Tree Numbers

CITYWIDE

Species	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	Total
Deciduous Large								
PLAC	450	602	1,326	374	49	59	41	2,901
CESI	147	225	197	239	331	261	84	1,483
JUHI	124	157	56	30	0	23	526	917
FRVE G	8	0	0	0	96	163	124	390
FRVE	0	0	0	53	176	113	11	351
JURE	0	0	205	67	0	0	0	272
QULO	71	67	87	11	32	0	0	266
DL OTHER	264	116	220	140	53	88	62	942
Total	1,063	1,166	2,091	913	735	706	848	7,522
Deciduous Medium								
PICH	463	528	456	326	30	0	0	1,802
SASE	52	92	388	510	208	11	0	1,261
PYCA B	171	277	391	209	64	0	0	1,113
FRHO M	0	15	162	269	282	21	11	760
FROX R	411	29	96	22	9	0	0	566
GLTR	15	11	41	277	207	9	0	560
ZESE	171	62	18	61	166	79	0	557
PYCA A	78	157	241	22	0	0	0	497
CEAU	53	60	111	83	53	0	0	360
BEPE	0	28	195	66	0	0	12	301
SOJA	0	0	9	63	180	45	0	297
ROAM	75	120	71	0	0	0	0	267
PYCA	46	78	104	28	0	0	0	256
GIBI	72	9	32	116	26	0	0	254
DM OTHER	358	308	273	532	178	11	0	1,660
Total	1,966	1,775	2,587	2,581	1,403	176	22	10,509
Deciduous Small								
LAIN	646	622	87	0	0	0	0	1,355
PRCE	170	59	50	0	0	0	0	278
DS OTHER	289	223	123	40	16	0	0	691
Total	1,104	903	261	40	16	0	0	2,324
Broadleaf Evergreen Large								
QUSU	45	51	56	26	39	47	0	264
BEL OTHER	172	189	104	102	69	40	9	685
Total	217	241	160	128	107	87	9	949
Broadleaf evergreen Medium								
MAGR	252	101	41	38	9	0	0	441
BEM OTHER	73	87	39	26	0	22	0	247
Total	324	188	80	64	9	22	0	688
Broadleaf Evergreen Small								
RHLA	0	16	76	113	57	0	9	271
BES OTHER	12	0	33	33	0	0	0	77
Total	12	16	109	146	57	0	9	348
Conifer Large								
SESE	136	87	89	51	0	0	11	374
PICA	30	54	169	76	32	11	0	372
CL OTHER	0	33	98	345	105	83	40	705
Total	166	175	356	472	137	93	51	1,451
Conifer Medium								
CM OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Small & Palm								
CS OTHER	8	0	0	0	11	0	0	18
Total	8	0	0	0	11	0	0	18
Grand Total	4,860	4,465	5,643	4,343	2,475	1,084	939	23,810

ZONE SEGMENT 1

Species	DBH Class (cm [in])							Total
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	
Deciduous Large								
JUHI	124	147	56	23	0	23	519	891
PLAC	23	68	113	23	0	0	0	226
CESI	23	11	45	90	0	0	0	169
PLRA	79	34	0	0	0	0	0	113
QULO	45	56	11	0	0	0	0	113
DL OTHER	34	0	0	0	11	0	0	45
Total	327	316	226	135	11	23	519	1,556
Deciduous Medium								
SASE	34	11	102	338	147	11	0	643
PICH	124	113	45	0	0	0	0	282
ROAM	68	113	45	0	0	0	0	226
PYCA A	23	45	68	0	0	0	0	135
PYCA B	11	23	34	11	0	0	0	79
MOAL	0	56	0	0	0	0	0	56
BEPE	0	0	34	23	0	0	0	56
FRHO M	0	0	34	23	0	0	0	56
PYCA	11	0	34	11	0	0	0	56
DM OTHER	23	56	79	90	0	0	0	248
Total	293	417	474	496	147	11	0	1,838
Deciduous Small								
LAIN	124	90	45	0	0	0	0	259
DS OTHER	45	23	11	0	0	0	0	79
Total	169	113	56	0	0	0	0	338
Broadleaf Evergreen Large								
BEL OTHER	34	23	23	0	0	11	0	90
Total	34	23	23	0	0	11	0	90
Broadleaf Evergreen Medium								
BEM OTHER	0	0	0	0	0	11	0	11
Total	0	0	0	0	0	11	0	11
Broadleaf Evergreen Small								
BES OTHER	0	0	0	11	0	0	0	11
Total	0	0	0	11	0	0	0	11
Conifer Large								
PIPI	0	0	0	203	11	0	0	214
PICA	0	11	135	23	11	0	0	180
PIHA	0	0	34	68	23	0	0	124
SESE	90	11	0	23	0	0	0	124
CL OTHER	0	23	34	23	11	0	0	90
Total	90	45	203	338	56	0	0	733
Conifer Medium								
CM OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Small & Palm								
CS OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Grand Total	914	914	981	981	214	56	519	4,579

ZONE SEGMENT 2

Species	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	Total
Deciduous Large								
PLAC	22	108	366	11	0	0	0	505
CESI	0	32	32	11	0	0	0	75
DL OTHER	43	11	0	0	11	0	0	65
Total	65	151	398	22	11	0	0	645
Deciduous Medium								
PYCA B	22	54	194	183	54	0	0	505
PICH	43	151	140	129	0	0	0	462
SASE	0	0	151	54	0	0	0	204
FRHO M	0	0	0	43	65	11	11	129
PYCA A	22	22	54	22	0	0	0	118
CEAU	11	11	11	0	0	0	0	32
MEAZ	11	22	0	0	0	0	0	32
DM OTHER	11	32	54	22	0	0	0	118
Total	118	290	602	452	118	11	11	1,602
Deciduous Small								
LAIN	65	398	11	0	0	0	0	473
DS OTHER	11	22	11	0	0	0	0	43
Total	75	419	22	0	0	0	0	516
Broadleaf Evergreen Large								
BEL OTHER	0	0	0	11	0	0	0	11
Total	0	0	0	11	0	0	0	11
Broadleaf Evergreen Medium								
BEM OTHER	0	22	0	11	0	0	0	32
Total	0	22	0	11	0	0	0	32
Broadleaf Evergreen Small								
BES OTHER	0	0	65	43	0	0	0	108
Total	0	0	65	43	0	0	0	108
Conifer Large								
PICA	0	43	0	22	0	0	0	65
CL OTHER	0	11	0	11	0	0	0	22
Total	0	54	0	32	0	0	0	86
Conifer Medium								
CM OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Small & Palm								
CS OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Grand Total	258	935	1,086	570	129	11	11	2,999

ZONE SEGMENT 3

Species	DBH Class (cm [in])							Total
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	
Deciduous Large								
LITU	0	0	79	26	0	0	0	105
CESI	0	9	35	0	0	9	0	53
FRVE G	0	0	0	0	0	18	9	26
PLAC	0	9	9	0	0	0	0	18
ULPA	0	9	9	0	0	0	0	18
DL OTHER	0	0	0	9	0	0	0	9
Total	0	26	131	35	0	26	9	228
Deciduous Medium								
GIBI	9	9	0	105	26	0	0	149
GLTR	0	0	9	53	26	9	0	96
BEPE	0	18	53	0	0	0	0	70
ZESE	26	9	0	9	0	0	0	44
SASE	0	0	0	0	35	0	0	35
ALCO	0	0	9	18	0	0	0	26
FRHO M	0	0	9	18	0	0	0	26
CEAU	0	9	0	9	0	0	0	18
PICH	0	0	0	9	9	0	0	18
DM OTHER	0	9	26	18	9	0	0	61
Total	35	53	105	236	105	9	0	543
Deciduous Small								
LAIN	18	9	9	0	0	0	0	35
PRAM	0	0	0	18	9	0	0	26
PRCE	0	0	18	0	0	0	0	18
DS OTHER	0	9	0	0	0	0	0	9
Total	18	18	26	18	9	0	0	88
Broadleaf Evergreen Large								
QUIL	0	0	9	61	26	0	0	96
QUSU	0	0	0	26	18	26	0	70
UMCA	0	0	18	0	0	0	0	18
BEL OTHER	0	0	0	9	0	0	0	9
Total	0	0	26	96	44	26	0	193
Broadleaf Evergreen Medium								
BEM OTHER	0	0	18	0	0	0	0	18
Total	0	0	18	0	0	0	0	18
Broadleaf Evergreen Small								
RHLA	0	9	0	18	35	0	9	70
Total	0	9	0	18	35	0	9	70
Conifer Large								
SESE	0	0	18	18	0	0	0	35
PIBR	0	0	0	18	0	9	0	26
PIHA	0	0	0	0	9	0	9	18
CL OTHER	0	0	9	9	0	0	0	18
Total	0	0	26	44	9	9	9	96
Conifer Medium								
CM OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Small & Palm								
CS OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Grand Total	53	105	333	446	201	70	26	1,234

ZONE SEGMENT 4

Species	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	Total
Deciduous Large								
CESI	0	9	18	9	0	0	0	36
QUCO	0	0	0	18	0	9	0	27
PLAC	9	0	9	0	0	0	0	18
FRUH	0	0	0	9	0	0	0	9
FRVE G	0	0	0	0	0	9	0	9
Total	9	9	27	36	0	18	0	99
Deciduous Medium								
SOJA	0	0	0	63	180	45	0	288
ZESE	0	0	18	9	72	36	0	135
PICH	27	9	27	9	0	0	0	72
ALRH	9	0	27	27	0	0	0	63
FRHO M	0	0	0	27	18	0	0	45
MOAL	0	0	0	18	9	0	0	27
ALCO	0	0	9	9	0	0	0	18
SASE	0	0	18	0	0	0	0	18
CACA	0	0	9	0	0	0	0	9
KOPA	0	0	0	9	0	0	0	9
PYCA	9	0	0	0	0	0	0	9
PYCA B	0	0	9	0	0	0	0	9
Total	45	9	117	171	279	81	0	702
Deciduous Small								
MAFL	9	0	0	0	0	0	0	9
Total	9	0	0	0	0	0	0	9
Broadleaf Evergreen Large								
EUPO	0	0	0	0	0	0	9	9
Total	0	0	0	0	0	0	9	9
Broadleaf Evergreen Medium								
MAGR	0	0	0	9	9	0	0	18
Total	0	0	0	9	9	0	0	18
Braodleaf Evergreen Small								
RHLA	0	0	0	9	0	0	0	9
Total	0	0	0	9	0	0	0	9
Conifer Large								
CL OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Medium								
CM OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Small & Palm								
CS OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Grand Total	63	18	144	225	288	99	9	846

ZONE SEGMENT 5

Species	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	Total
Deciduous Large								
FRVE	0	0	0	42	147	105	11	305
FRVE G	0	0	0	0	42	95	116	252
CESI	42	53	11	32	74	32	0	242
PLAC	53	11	32	21	11	21	11	158
QULO	11	0	32	11	11	0	0	63
ULSP	0	0	0	0	0	11	32	42
ACSA	0	11	0	0	11	11	0	32
JURE	0	0	0	21	0	0	0	21
DL OTHER	0	0	11	11	11	0	0	32
Total	105	74	84	137	305	273	168	1,145
Deciduous Medium								
GLTR	0	0	21	32	126	0	0	179
FRHO M	0	0	42	32	11	0	0	84
PICH	0	0	0	42	21	0	0	63
CEAU	11	11	11	0	0	0	0	32
ZESE	11	21	0	0	0	0	0	32
AIAL	0	0	0	11	11	0	0	21
MOAL	0	0	0	0	11	11	0	21
DM OTHER	0	11	0	11	11	0	0	32
Total	21	42	74	126	189	11	0	462
Deciduous Small								
DS OTHER	11	0	0	0	0	0	0	11
Total	11	0	0	0	0	0	0	11
Broadleaf Evergreen Large								
QUSU	0	0	11	0	21	21	0	53
QUIL	0	0	0	11	11	0	0	21
BEL OTHER	0	0	0	11	0	0	0	11
Total	0	0	11	21	32	21	0	84
Broadleaf Evergreen Medium								
BEM OTHEF	0	0	0	0	0	11	0	11
Total	0	0	0	0	0	11	0	11
Broadleaf Evergreen Small								
RHLA	0	0	0	21	0	0	0	21
Total	0	0	0	21	0	0	0	21
Conifer Large								
SESE	0	0	11	0	0	0	11	21
CL OTHER	0	0	0	11	0	11	0	21
Total	0	0	11	11	0	11	11	42
Conifer Medium								
CM OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Small & Palm								
CS OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Grand Total	137	116	179	315	525	326	179	1,775

ZONE SEGMENT 6

Species	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	Total
Deciduous Large								
PLAC	8	8	53	68	38	38	8	220
ULSP	0	0	0	0	0	8	30	38
CESI	0	0	0	15	15	0	0	30
ACSA	8	0	0	0	0	8	0	15
FRVE	0	0	0	0	8	8	0	15
DL OTHER	0	0	0	0	0	0	8	8
Total	15	8	53	84	61	61	46	327
Deciduous Medium								
FRHO M	0	15	46	53	84	0	0	198
GLTR	0	0	0	8	23	0	0	30
PYCA	0	0	23	8	0	0	0	30
PYCA B	0	0	8	15	0	0	0	23
SASE	0	0	0	8	15	0	0	23
DM OTHER	8	8	0	8	0	0	0	23
Total	8	23	76	99	122	0	0	327
Deciduous Small								
LAIN	8	61	23	0	0	0	0	91
TICO	0	0	15	15	0	0	0	30
MAFL	15	0	0	0	0	0	0	15
DS OTHER	8	8	0	8	8	0	0	30
Total	30	68	38	23	8	0	0	167
Broadleaf Evergreen Large								
BEL OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Broadleaf Evergreen Medium								
LANO	0	8	30	8	0	0	0	46
BEM OTHER	0	0	0	15	0	0	0	15
Total	0	8	30	23	0	0	0	61
Broadleaf Evergreen Small								
BES OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Large								
CL OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Medium								
CM OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Small & Palm								
CS OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Grand Total	53	106	198	228	190	61	46	882

ZONE SEGMENT 7

Species	DBH Class (cm [in])							Total
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	
Deciduous Large								
CESI	0	32	11	53	221	158	74	546
FRVE G	0	0	0	0	32	42	0	74
FRVE	0	0	0	11	21	0	0	32
DL OTHER	21	0	21	0	11	0	0	53
Total	21	32	32	63	284	200	74	704
Deciduous Medium								
FRHO M	0	0	21	63	84	11	0	179
CEAU	11	0	42	63	21	0	0	137
ALJU	0	0	11	32	0	0	0	42
MEAZ	0	0	21	11	0	0	0	32
ZESE	21	11	0	0	0	0	0	32
FROX R	0	0	21	0	0	0	0	21
GLTR	0	0	0	0	21	0	0	21
DM OTHER	21	0	0	0	32	0	0	53
Total	53	11	116	168	158	11	0	515
Deciduous Small								
CEOC 1	21	11	0	0	0	0	0	32
PRSP	0	11	11	0	0	0	0	21
TIEU	0	0	21	0	0	0	0	21
DS OTHER	11	0	0	0	0	0	0	11
Total	32	21	32	0	0	0	0	84
Broadleaf Evergreen Large								
QUSU	11	21	0	0	0	0	0	32
BEL OTHER	0	11	0	0	0	0	0	11
Total	11	32	0	0	0	0	0	42
Broadleaf Evergreen Medium								
BEM OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Broadleaf Evergreen Small								
BES OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Large								
CACU	0	0	0	0	21	32	21	74
PICA	0	0	0	32	21	0	0	53
PIHA	0	0	0	0	0	21	11	32
Total	0	0	0	32	42	53	32	158
Conifer Medium								
CM OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Small & Palm								
CS OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Grand Total	116	95	179	263	483	263	105	1,502

ZONE SEGMENT 8

Species	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	Total
Deciduous Large								
PLAC	43	109	141	22	0	0	0	315
CESI	0	0	11	11	22	0	0	43
ACSA	22	11	0	0	0	0	0	33
DL OTHER	0	0	0	0	22	22	0	43
Total	65	120	152	33	43	22	0	435
Deciduous Medium								
PICH	43	65	185	98	0	0	0	391
CABE	0	0	65	120	22	0	0	206
SASE	0	33	76	87	11	0	0	206
ZESE	33	11	0	43	65	33	0	185
BEPE	0	11	109	43	0	0	0	163
GLTR	0	0	0	152	11	0	0	163
MEAZ	65	33	0	0	11	0	0	109
FRSP	0	0	11	76	22	0	0	109
PYCA A	11	43	54	0	0	0	0	109
ALRH	0	0	0	33	43	0	0	76
PYCA	0	33	22	0	0	0	0	54
CEAU	22	0	11	11	0	0	0	43
PYCA B	0	11	33	0	0	0	0	43
ACRU	11	22	0	0	0	0	0	33
FRHO M	0	0	0	11	22	0	0	33
FROX R	0	0	11	22	0	0	0	33
DM OTHER	43	0	22	0	0	0	0	65
Total	228	261	598	695	206	33	0	2,021
Deciduous Small								
LAIN	130	11	0	0	0	0	0	141
PRCE	0	33	33	0	0	0	0	65
CEOC	11	11	33	0	0	0	0	54
MAFL	11	22	22	0	0	0	0	54
ACBU	33	0	0	0	0	0	0	33
Total	185	76	87	0	0	0	0	348
Broadleaf Evergreen Large								
QUVI	22	54	22	0	0	0	0	98
BEL OTHER	11	22	0	0	11	0	0	43
Total	33	76	22	0	11	0	0	141
Broadleaf Evergreen Medium								
MAGR	22	11	0	0	0	0	0	33
BEM OTHER	0	0	0	11	0	0	0	11
Total	22	11	0	11	0	0	0	43
Broadleaf Evergreen Small								
LILU	0	0	33	22	0	0	0	54
Total	0	0	33	22	0	0	0	54
Conifer Large								
CL OTHER	0	22	33	0	11	22	0	87
Total	0	22	33	0	11	22	0	87
Conifer Medium								
CM OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Small & Palm								
CS OTHER	0	0	0	0	11	0	0	11
Total	0	0	0	0	11	0	0	11
Grand Total	532	565	924	761	283	76	0	3,140

ZONE SEGMENT 9

Species	DBH Class (cm [in])							Total
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	
Deciduous Large								
PLAC	23	69	495	230	0	0	23	840
CESI	23	69	35	12	0	0	0	138
LIST	12	0	69	46	0	0	0	127
QULO	0	0	23	0	0	0	0	23
Total	58	138	621	288	0	0	23	1,127
Deciduous Medium								
PICH	69	12	0	0	0	0	0	81
SASE	0	0	35	23	0	0	0	58
KOPA	23	0	0	12	12	0	0	46
PYCA B	0	12	35	0	0	0	0	46
SABA	0	0	0	46	0	0	0	46
FROX R	0	0	23	0	0	0	0	23
DM OTHER	23	0	12	0	0	0	12	46
Total	115	23	104	81	12	0	12	345
Deciduous Small								
MAFL	23	23	0	0	0	0	0	46
DS OTHER	12	0	0	0	0	0	0	12
Total	35	23	0	0	0	0	0	58
Broadleaf Evergreen Large								
QUSU	35	0	23	0	0	0	0	58
BEL OTHER	12	12	0	0	0	0	0	23
Total	46	12	23	0	0	0	0	81
Broadleaf Evergreen Medium								
MAGR	207	69	12	0	0	0	0	288
LANO	58	69	0	0	0	0	0	127
Total	265	138	12	0	0	0	0	414
Broadleaf Evergreen Small								
RHLA	0	0	12	12	12	0	0	35
BES OTHER	12	0	0	0	0	0	0	12
Total	12	0	12	12	12	0	0	46
Conifer Large								
SESE	0	0	46	0	0	0	0	46
CL OTHER	0	0	0	0	12	0	0	12
Total	0	0	46	0	12	0	0	58
Conifer Medium								
CM OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Small & Palm								
CS OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Grand Total	529	334	817	380	35	0	35	2,128

ZONE SEGMENT 10

Species	DBH Class (cm [in])							Total
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	
Deciduous Large								
PLAC	228	107	99	0	0	0	0	434
JURE	0	0	205	46	0	0	0	251
CESI	38	0	0	8	0	0	0	46
DL OTHER	38	30	0	8	0	0	0	76
Other	304	137	304	61	0	0	0	807
Deciduous Medium								
FROX R	411	8	8	0	0	0	0	426
PICH	114	137	38	8	0	0	0	297
PYCA B	23	84	61	0	0	0	0	167
ACRU	99	23	0	0	0	0	0	122
PYCA A	23	38	53	0	0	0	0	114
KOPA	8	91	8	0	0	0	0	107
PYCA	15	46	15	0	0	0	0	76
SASE	8	38	8	0	0	0	0	53
ZESE	38	0	0	0	8	0	0	46
DM OTHER	91	15	38	8	8	0	0	160
Other	829	479	228	15	15	0	0	1,567
Deciduous Small								
LAIN	259	53	0	0	0	0	0	312
PRCE	114	8	0	0	0	0	0	122
DS OTHER	53	30	0	0	0	0	0	84
Other	426	91	0	0	0	0	0	517
Broadleaf Evergreen Large								
QUVI	38	53	23	0	0	0	0	114
QUAG	8	38	15	0	0	8	0	68
BEL OTHER	38	8	8	0	0	0	0	53
Other	84	99	46	0	0	8	0	236
Broadleaf Evergreen Medium								
BEM OTHER	38	0	0	0	0	0	0	38
Other	38	0	0	0	0	0	0	38
Broadleaf Evergreen Small								
BES OTHER	0	8	0	0	0	0	0	8
Other	0	8	0	0	0	0	0	8
Conifer Large								
SESE	46	23	15	0	0	0	0	84
PICA	30	0	23	0	0	0	0	53
CL OTHER	0	0	0	15	8	0	0	23
Other	76	23	38	15	8	0	0	160
Conifer Medium								
CM OTHER	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0
Conifer Small & Palm								
CS OTHER	8	0	0	0	0	0	0	8
Other	8	0	0	0	0	0	0	8
Grand Total	1,765	837	616	91	23	8	0	3,340

ZONE SEGMENT 11

Species	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	Total
Deciduous Large								
PLAC	42	116	11	0	0	0	0	168
CESI	21	11	0	0	0	63	11	105
QULO	0	11	11	0	21	0	0	42
PLRA	0	11	21	0	0	0	0	32
ACNE	0	0	0	11	0	11	0	21
ACSA	0	0	21	0	0	0	0	21
LIST	11	0	0	0	0	11	0	21
QUPA	21	0	0	0	0	0	0	21
DL OTHER	0	11	0	11	0	0	0	21
Total	95	158	63	21	21	84	11	452
Deciduous Medium								
PYCA B	116	95	11	0	0	0	0	221
PICH	42	42	21	32	0	0	0	137
ZESE	32	0	0	0	21	11	0	63
CEAU	0	0	11	0	32	0	0	42
GIBI	0	0	21	11	0	0	0	32
FROX R	0	11	11	0	0	0	0	21
SASE	11	11	0	0	0	0	0	21
DM OTHER	21	11	21	0	0	0	0	53
Total	221	168	95	42	53	11	0	588
Deciduous Small								
CEOC	0	74	0	0	0	0	0	74
MAFL	42	0	0	0	0	0	0	42
LAIN	32	0	0	0	0	0	0	32
ACBU	21	0	0	0	0	0	0	21
DS OTHER	21	0	0	0	0	0	0	21
Total	116	74	0	0	0	0	0	189
Broadleaf Evergreen Large								
EUSP	0	0	0	0	21	21	0	42
QUAG	11	0	11	0	0	0	0	21
Total	11	0	11	0	21	21	0	63
Broadleaf Evergreen Medium								
MAGR	0	11	21	11	0	0	0	42
Total	0	11	21	11	0	0	0	42
Broadleaf Evergreen Small								
RHLA	0	0	0	11	11	0	0	21
Total	0	0	0	11	11	0	0	21
Conifer Large								
SESE	0	32	0	0	0	0	0	32
Total	0	32	0	0	0	0	0	32
Conifer Medium								
CM OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Conifer Small & Palm								
CS OTHER	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
Grand Total	441	441	189	84	105	116	11	1,386

Appendix D: Citywide Private Street Tree Numbers

CITYWIDE

Species	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)	Total
Deciduous Large								
PLAC	41	108	132	52	23	0	0	355
QULO	55	86	89	22	0	0	0	251
CESI	52	21	29	17	0	0	8	126
JURE	0	43	43	20	0	0	0	106
LIST	23	44	0	21	0	0	0	88
DL OTHER	74	40	61	44	52	11	0	282
Total	244	342	354	175	74	11	8	1,207
Deciduous Medium								
BEPE	89	248	187	22	23	0	0	569
PICH	71	45	9	22	11	0	0	157
SASE	20	11	76	45	0	0	0	152
PRAV	34	18	20	33	0	11	0	116
ALJU	29	11	20	43	0	0	0	103
GIBI	45	23	11	11	0	0	0	89
PYCA	34	43	0	0	0	0	0	77
MOAL	0	0	0	44	22	0	11	76
FROX R	26	0	19	30	0	0	0	75
DM OTHER	204	136	133	89	18	11	9	600
Total	551	535	475	338	73	22	20	2,013
Deciduous Small								
LAIN	402	173	93	0	0	11	0	679
PRCE	122	81	98	11	0	0	0	313
PRAM	47	22	43	20	0	0	0	131
MASP	59	40	11	11	0	0	0	120
DS OTHER	177	105	63	22	11	0	0	378
Total	807	421	308	64	11	11	0	1,621
Broadleaf Evergreen Large								
BEL OTHER	21	44	9	11	32	0	9	125
Total	21	44	9	11	32	0	9	125
Broadleaf evergreen Medium								
OLEU	0	11	11	11	30	11	9	81
BEM OTHER	69	98	32	11	11	0	0	222
Total	69	109	43	22	41	11	9	303
Broadleaf Evergreen Small								
LILU	0	64	60	11	11	11	0	156
CISP	86	22	33	0	0	0	0	140
RHLA	0	0	22	22	32	0	11	86
BES OTHER	0	0	9	21	0	0	0	30
Total	86	86	123	53	43	11	11	413
Conifer Large								
SESE	143	106	109	120	20	42	11	551
PICA	11	33	47	91	43	0	33	258
CEAT	0	22	172	22	0	11	0	226
CL OTHER	65	33	99	54	21	0	11	282
Total	218	193	427	286	84	53	55	1,316
Conifer Medium								
CM OTHER	0	0	11	22	0	0	0	33
Total	0	0	11	22	0	0	0	33
Conifer Small & Palm								
WARO	0	0	18	70	32	0	20	140
CS OTHER	11	0	42	11	11	0	11	84
Total	11	0	61	80	43	0	30	224
Grand Total	2,007	1,730	1,810	1,051	400	117	141	7,256

Appendix E: Resource Units for All Species by DBH Class

AVERAGE ELECTRICITY BENEFIT (KWH/TREE)

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
ACBU	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
ACCA	4.872708	14.74806	70.60311	133.228	132.7813	131.1127	130.2838
ACNE	9.374202	38.51069	88.64817	163.7957	245.7957	330.5901	347.4129
ACPA	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
ACPS	9.045688	31.46419	89.08861	177.3983	230.2153	227.7164	227.7164
ACRU	9.045688	31.46419	89.08861	177.3983	230.2153	227.7164	227.7164
ACSA	9.374202	38.51069	88.64817	163.7957	245.7957	330.5901	347.4129
AECA 1	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
AIAL	6.231487	26.51606	85.30822	133.9379	132.7661	131.2891	130.5554
ALCO	4.872708	14.74806	70.60311	133.228	132.7813	131.1127	130.2838
ALJU	2.351117	13.48957	34.47597	89.66384	143.1689	193.4017	215.3271
ALRH	4.872708	14.74806	70.60311	133.228	132.7813	131.1127	130.2838
ARUN	4.491813	42.1804	110.1877	110.1877	110.1877	110.1877	110.1877
BENI	13.5062	55.71677	126.0345	122.6777	122.6777	122.6777	122.6777
BEPA	13.5062	55.71677	126.0345	122.6777	122.6777	122.6777	122.6777
BEPE	13.5062	55.71677	126.0345	122.6777	122.6777	122.6777	122.6777
CABE	4.872708	14.74806	70.60311	133.228	132.7813	131.1127	130.2838
CABE F	4.872708	14.74806	70.60311	133.228	132.7813	131.1127	130.2838
CACA	4.872708	14.74806	70.60311	133.228	132.7813	131.1127	130.2838
CACU	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
CADE	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
CASP	9.374202	38.51069	88.64817	163.7957	245.7957	330.5901	347.4129
CEAT	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
CEAU	8.963306	33.73027	112.5443	216.5355	238.0149	227.7164	227.7164
CECA	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
CEDE	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
CEOC	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
CEOC1	5.023221	15.20362	79.29117	154.7093	218.6751	240.0186	247.3317
CESI	5.023221	15.20362	79.29117	154.7093	218.6751	240.0186	247.3317
CESI 1	3.007398	16.9475	50.33201	123.1303	162.0661	243.3711	303.7645
CESP	5.023221	15.20362	79.29117	154.7093	218.6751	240.0186	247.3317
CICA	3.007398	16.9475	50.33201	123.1303	162.0661	243.3711	303.7645
CISP	4.491813	42.1804	110.1877	110.1877	110.1877	110.1877	110.1877
CRSP	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
CYRE	3.441054	25.96777	32.68521	32.68521	32.68521	32.68521	32.68521
DIKA	4.872708	14.74806	70.60311	133.228	132.7813	131.1127	130.2838
ERDE	4.491813	42.1804	110.1877	110.1877	110.1877	110.1877	110.1877
EUPO	2.246834	10.45418	43.93019	117.1811	178.6851	193.6365	195.791
EUSI R	2.246834	10.45418	43.93019	117.1811	178.6851	193.6365	195.791
EUSP	2.246834	10.45418	43.93019	117.1811	178.6851	193.6365	195.791
FICA	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
FRHO M	9.045688	31.46419	89.08861	177.3983	230.2153	227.7164	227.7164
FROX R	10.4979	35.7291	96.8297	122.6777	122.6777	122.6777	122.6777
FRSP	6.269535	21.55057	59.6014	110.2805	207.3539	237.8041	245.5048
FRUH	6.269535	21.55057	59.6014	110.2805	207.3539	237.8041	245.5048

Species Code	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
FRVE	10.4979	35.75082	97.01093	140.2544	122.6777	122.6777	122.6777
FRVE G	10.4979	35.75082	97.01093	140.2544	122.6777	122.6777	122.6777
GIBI	4.984071	17.01324	50.10136	99.55932	125.8413	151.3217	166.0051
GLTR	2.351117	13.48957	34.47597	89.66384	143.1689	193.4017	215.3271
JUHI	5.023221	15.20362	79.29117	154.7093	218.6751	240.0186	247.3317
JURE	5.023221	15.20362	79.29117	154.7093	218.6751	240.0186	247.3317
JUSP 1	3.441054	25.96777	32.68521	32.68521	32.68521	32.68521	32.68521
KOPA	15.98303	56.05954	113.2762	145.5458	122.6777	122.6777	122.6777
LAIN	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
LANO	3.007398	16.9475	50.33201	123.1303	162.0661	243.3711	303.7645
LIDE	2.246834	10.45418	43.93019	117.1811	178.6851	193.6365	195.791
LILU	4.491813	42.1804	110.1877	110.1877	110.1877	110.1877	110.1877
LIST	3.334653	18.49296	50.39662	107.8436	162.7885	208.4307	229.9644
LITU	3.334653	18.49296	50.39662	107.8436	162.7885	208.4307	229.9644
MABO	3.007398	16.9475	50.33201	123.1303	162.0661	243.3711	303.7645
MAFL	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
MAGR	4.827324	39.2934	128.2457	229.8598	248.3807	248.3807	248.3807
MASO	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
MASP	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
MASP 1	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
MEAZ	15.98303	56.05954	113.2762	145.5458	122.6777	122.6777	122.6777
MEGL	3.334653	18.49296	50.39662	107.8436	162.7885	208.4307	229.9644
MELI	3.007398	16.9475	50.33201	123.1303	162.0661	243.3711	303.7645
MOAL	9.045688	31.46419	89.08861	177.3983	230.2153	227.7164	227.7164
OLEU	3.007398	16.9475	50.33201	123.1303	162.0661	243.3711	303.7645
PEAM	4.827324	39.2934	128.2457	229.8598	248.3807	248.3807	248.3807
PHCA	3.441054	25.96777	32.68521	32.68521	32.68521	32.68521	32.68521
PIBR	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
PICA	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
PICH	6.231487	26.51606	85.30822	133.9379	132.7661	131.2891	130.5554
PIHA	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
PIMU	3.441054	25.96777	32.68521	32.68521	32.68521	32.68521	32.68521
PINI	4.425533	38.37649	126.4196	160.3767	160.3767	160.3767	160.3767
PIPI	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
PIPO	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
PIPU	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
PIRA	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
PISP	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
PITH	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
PLAC	5.023221	15.20362	79.29117	172.6923	233.195	251.7134	260.9121
PLRA	5.023221	15.20362	79.29117	172.6923	233.195	251.7134	260.9121
PODE	5.023221	15.20362	79.29117	154.7093	218.6751	240.0186	247.3317
PRAM	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
PRAR	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
PRAV	6.231487	26.51606	85.30822	133.9379	132.7661	131.2891	130.5554
PRCE	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
PRSP	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
PRSU	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
PTST	5.023221	15.20362	79.29117	154.7093	218.6751	240.0186	247.3317
PUGR	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
PYCA	4.872708	14.74806	70.60311	133.228	132.7813	131.1127	130.2838
PYCA A	4.872708	14.74806	70.60311	133.228	132.7813	131.1127	130.2838
PYCA B	4.872708	14.74806	70.60311	133.228	132.7813	131.1127	130.2838
PYSP	4.872708	14.74806	70.60311	133.228	132.7813	131.1127	130.2838
QUAG	2.246834	10.45418	43.93019	117.1811	178.6851	193.6365	195.791
QUCO	5.023221	15.20362	79.29117	172.6923	233.195	251.7134	260.9121
QUIL	2.246834	10.45418	43.93019	117.1811	178.6851	193.6365	195.791
QULO	5.023221	15.20362	79.29117	154.7093	218.6751	240.0186	247.3317
QUPA	9.374202	38.51069	88.64817	163.7957	245.7957	330.5901	347.4129
QURO	9.374202	38.51069	88.64817	163.7957	245.7957	330.5901	347.4129
QUSP	9.374202	38.51069	88.64817	163.7957	245.7957	330.5901	347.4129
QUSU	2.246834	10.45418	43.93019	117.1811	178.6851	193.6365	195.791
QUVI	2.246834	10.45418	43.93019	117.1811	178.6851	193.6365	195.791
QUWI	2.246834	10.45418	43.93019	117.1811	178.6851	193.6365	195.791
RHLA	4.491813	42.1804	110.1877	110.1877	110.1877	110.1877	110.1877
ROAM	10.4979	35.7291	96.8297	122.6777	122.6777	122.6777	122.6777
SABA	6.269535	21.55057	59.6014	110.2805	207.3539	237.8041	245.5048
SASE	8.963306	33.73027	112.5443	216.5355	238.0149	227.7164	227.7164
SCMO	3.007398	16.9475	50.33201	123.1303	162.0661	243.3711	303.7645
SESE	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
SOJA	6.231487	26.51606	85.30822	133.9379	132.7661	131.2891	130.5554
TIAM	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
TICO	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
TIEU	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
ULPA	5.023221	15.20362	79.29117	154.7093	218.6751	240.0186	247.3317
ULSP	5.023221	15.20362	79.29117	154.7093	218.6751	240.0186	247.3317
UMCA	2.246834	10.45418	43.93019	117.1811	178.6851	193.6365	195.791
WAFI	3.441054	25.96777	32.68521	32.68521	32.68521	32.68521	32.68521
WARO	3.441054	25.96777	32.68521	32.68521	32.68521	32.68521	32.68521
WIFL R	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
XYCO	4.491813	42.1804	110.1877	110.1877	110.1877	110.1877	110.1877
ZESE	8.963306	33.73027	112.5443	216.5355	238.0149	227.7164	227.7164
DL OTHER	5.023221	15.20362	79.29117	172.6923	233.195	251.7134	260.9121
DM OTHER	6.231487	26.51606	85.30822	133.9379	132.7661	131.2891	130.5554
DS OTHER	20.8624	54.3944	51.31578	51.31578	51.31578	51.31578	51.31578
BEL OTHER	2.246834	10.45418	43.93019	117.1811	178.6851	193.6365	195.791
BEM OTHER	3.007398	16.9475	50.33201	123.1303	162.0661	243.3711	303.7645
BES OTHER	4.491813	42.1804	110.1877	110.1877	110.1877	110.1877	110.1877
CL OTHER	4.425533	23.89849	93.60411	231.4337	288.0684	354.6956	387.7914
CM OTHER	4.425533	38.37649	126.4196	160.3767	160.3767	160.3767	160.3767
CS OTHER	3.441054	25.96777	32.68521	32.68521	32.68521	32.68521	32.68521

AVERAGE NATURAL GAS BENEFIT (KBTU/TREE)

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
ACBU	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
ACCA	2.614474	7.913142	67.3948	96.81274	81.7014	81.7014	81.7014
ACNE	1.330801	34.37297	102.8341	166.7148	221.4992	281.2784	302.4724
ACPA	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
ACPS	6.877169	27.21827	95.23973	175.7888	245.9413	328.6262	380.08
ACRU	6.877169	27.21827	95.23973	175.7888	245.9413	328.6262	380.08
ACSA	1.330801	34.37297	102.8341	166.7148	221.4992	281.2784	302.4724
AECA 1	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
AIAL	3.343533	20.26041	78.63915	97.78997	81.7014	81.7014	81.7014
ALCO	2.614474	7.913142	67.3948	96.81274	81.7014	81.7014	81.7014
ALJU	0	2.756749	8.543479	27.25372	89.63847	150.1099	177.4095
ALRH	2.614474	7.913142	67.3948	96.81274	81.7014	81.7014	81.7014
ARUN	6.062528	60.18462	141.4416	141.4416	141.4416	141.4416	141.4416
BENI	11.29819	55.92499	112.105	106.021	151.5127	197.1536	219.8249
BEPA	11.29819	55.92499	112.105	106.021	151.5127	197.1536	219.8249
BEPE	11.29819	55.92499	112.105	106.021	151.5127	197.1536	219.8249
CABE	2.614474	7.913142	67.3948	96.81274	81.7014	81.7014	81.7014
CABE F	2.614474	7.913142	67.3948	96.81274	81.7014	81.7014	81.7014
CACA	2.614474	7.913142	67.3948	96.81274	81.7014	81.7014	81.7014
CACU	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
CADE	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
CASP	1.330801	34.37297	102.8341	166.7148	221.4992	281.2784	302.4724
CEAT	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
CEAU	6.814536	29.8932	122.9275	196.6574	256.0594	302.0028	302.0028
CECA	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
CEDE	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
CEOC	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
CEOC1	5.916221	17.90643	96.79284	152.754	192.5016	195.0886	194.1699
CESI	5.916221	17.90643	96.79284	152.754	192.5016	195.0886	194.1699
CESI 1	1.7005	16.72243	57.62489	110.5277	163.9026	214.7854	240.269
CESP	5.916221	17.90643	96.79284	152.754	192.5016	195.0886	194.1699
CICA	1.7005	16.72243	57.62489	110.5277	163.9026	214.7854	240.269
CISP	6.062528	60.18462	141.4416	141.4416	141.4416	141.4416	141.4416
CRSP	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
CYRE	3.736062	22.51639	43.54199	43.54199	43.54199	43.54199	43.54199
DIKA	2.614474	7.913142	67.3948	96.81274	81.7014	81.7014	81.7014
ERDE	6.062528	60.18462	141.4416	141.4416	141.4416	141.4416	141.4416
EUPO	0.483614	7.457825	52.59819	97.43163	143.9587	261.4217	261.4217
EUSI R	0.483614	7.457825	52.59819	97.43163	143.9587	261.4217	261.4217
EUSP	0.483614	7.457825	52.59819	97.43163	143.9587	261.4217	261.4217
FICA	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
FRHO M	6.877169	27.21827	95.23973	175.7888	245.9413	328.6262	380.08
FROX R	8.781689	32.62651	103.848	102.0869	102.0869	102.0869	102.0869
FRSP	7.384098	25.66216	72.53701	134.9686	183.2415	195.3668	194.3994
FRUH	7.384098	25.66216	72.53701	134.9686	183.2415	195.3668	194.3994

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
FRVE	8.781689	32.65182	104.0593	105.5476	103.9152	134.0579	149.0308
FRVE G	8.781689	32.65182	104.0593	105.5476	103.9152	134.0579	149.0308
GIBI	0.080164	0.328765	19.8177	65.03896	86.8474	106.4833	118.2776
GLTR	0	2.756749	8.543479	27.25372	89.63847	150.1099	177.4095
JUHI	5.916221	17.90643	96.79284	152.754	192.5016	195.0886	194.1699
JURE	5.916221	17.90643	96.79284	152.754	192.5016	195.0886	194.1699
JUSP 1	3.736062	22.51639	43.54199	43.54199	43.54199	43.54199	43.54199
KOPA	13.37011	56.32455	112.474	100.7137	105.8183	131.1531	143.7376
LAIN	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
LANO	1.7005	16.72243	57.62489	110.5277	163.9026	214.7854	240.269
LIDE	0.483614	7.457825	52.59819	97.43163	143.9587	261.4217	261.4217
LILU	6.062528	60.18462	141.4416	141.4416	141.4416	141.4416	141.4416
LIST	0	4.134894	12.971	48.39597	112.7178	168.8227	195.6344
LITU	0	4.134894	12.971	48.39597	112.7178	168.8227	195.6344
MABO	1.7005	16.72243	57.62489	110.5277	163.9026	214.7854	240.269
MAFL	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
MAGR	2.729558	44.10046	114.5146	209.0841	216.8992	216.8992	216.8992
MASO	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
MASP	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
MASP 1	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
MEAZ	13.37011	56.32455	112.474	100.7137	105.8183	131.1531	143.7376
MEGL	0	4.134894	12.971	48.39597	112.7178	168.8227	195.6344
MELI	1.7005	16.72243	57.62489	110.5277	163.9026	214.7854	240.269
MOAL	6.877169	27.21827	95.23973	175.7888	245.9413	328.6262	380.08
OLEU	1.7005	16.72243	57.62489	110.5277	163.9026	214.7854	240.269
PEAM	2.729558	44.10046	114.5146	209.0841	216.8992	216.8992	216.8992
PHCA	3.736062	22.51639	43.54199	43.54199	43.54199	43.54199	43.54199
PIBR	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
PICA	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
PICH	3.343533	20.26041	78.63915	97.78997	81.7014	81.7014	81.7014
PIHA	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
PIMU	3.736062	22.51639	43.54199	43.54199	43.54199	43.54199	43.54199
PINI	5.498812	46.19119	90.85	202.7316	202.7316	202.7316	202.7316
PIPI	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
PIPO	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
PIPU	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
PIRA	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
PISP	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
PITH	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
PLAC	5.916221	17.90643	96.79284	159.4579	195.9458	193.6195	192.4639
PLRA	5.916221	17.90643	96.79284	159.4579	195.9458	193.6195	192.4639
PODE	5.916221	17.90643	96.79284	152.754	192.5016	195.0886	194.1699
PRAM	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
PRAR	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
PRAV	3.343533	20.26041	78.63915	97.78997	81.7014	81.7014	81.7014
PRCE	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
PRSP	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
PRSU	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
PTST	5.916221	17.90643	96.79284	152.754	192.5016	195.0886	194.1699
PUGR	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
PYCA	2.614474	7.913142	67.3948	96.81274	81.7014	81.7014	81.7014
PYCA A	2.614474	7.913142	67.3948	96.81274	81.7014	81.7014	81.7014
PYCA B	2.614474	7.913142	67.3948	96.81274	81.7014	81.7014	81.7014
PYSP	2.614474	7.913142	67.3948	96.81274	81.7014	81.7014	81.7014
QUAG	0.483614	7.457825	52.59819	97.43163	143.9587	261.4217	261.4217
QUCO	5.916221	17.90643	96.79284	159.4579	195.9458	193.6195	192.4639
QUIL	0.483614	7.457825	52.59819	97.43163	143.9587	261.4217	261.4217
QULO	5.916221	17.90643	96.79284	152.754	192.5016	195.0886	194.1699
QUPA	1.330801	34.37297	102.8341	166.7148	221.4992	281.2784	302.4724
QURO	1.330801	34.37297	102.8341	166.7148	221.4992	281.2784	302.4724
QUSP	1.330801	34.37297	102.8341	166.7148	221.4992	281.2784	302.4724
QUSU	0.483614	7.457825	52.59819	97.43163	143.9587	261.4217	261.4217
QUVI	0.483614	7.457825	52.59819	97.43163	143.9587	261.4217	261.4217
QUWI	0.483614	7.457825	52.59819	97.43163	143.9587	261.4217	261.4217
RHLA	6.062528	60.18462	141.4416	141.4416	141.4416	141.4416	141.4416
ROAM	8.781689	32.62651	103.848	102.0869	102.0869	102.0869	102.0869
SABA	7.384098	25.66216	72.53701	134.9686	183.2415	195.3668	194.3994
SASE	6.814536	29.8932	122.9275	196.6574	256.0594	302.0028	302.0028
SCMO	1.7005	16.72243	57.62489	110.5277	163.9026	214.7854	240.269
SESE	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
SOJA	3.343533	20.26041	78.63915	97.78997	81.7014	81.7014	81.7014
TIAM	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
TICO	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
TIEU	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
ULPA	5.916221	17.90643	96.79284	152.754	192.5016	195.0886	194.1699
ULSP	5.916221	17.90643	96.79284	152.754	192.5016	195.0886	194.1699
UMCA	0.483614	7.457825	52.59819	97.43163	143.9587	261.4217	261.4217
WAFI	3.736062	22.51639	43.54199	43.54199	43.54199	43.54199	43.54199
WARO	3.736062	22.51639	43.54199	43.54199	43.54199	43.54199	43.54199
WIFL R	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
XYCO	6.062528	60.18462	141.4416	141.4416	141.4416	141.4416	141.4416
ZESE	6.814536	29.8932	122.9275	196.6574	256.0594	302.0028	302.0028
DL OTHER	5.916221	17.90643	96.79284	159.4579	195.9458	193.6195	192.4639
DM OTHER	3.343533	20.26041	78.63915	97.78997	81.7014	81.7014	81.7014
DS OTHER	10.59217	58.36295	74.50221	74.50221	74.50221	74.50221	74.50221
BEL OTHER	0.483614	7.457825	52.59819	97.43163	143.9587	261.4217	261.4217
BEM OTHER	1.7005	16.72243	57.62489	110.5277	163.9026	214.7854	240.269
BES OTHER	6.062528	60.18462	141.4416	141.4416	141.4416	141.4416	141.4416
CL OTHER	5.498812	29.06686	104.3853	218.1597	304.0974	304.0974	304.0974
CM OTHER	5.498812	46.19119	90.85	202.7316	202.7316	202.7316	202.7316
CS OTHER	3.736062	22.51639	43.54199	43.54199	43.54199	43.54199	43.54199

AVERAGE NET AVOIDED CO_2 FROM REDUCED ENERGY (KG/TREE)

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
ACBU	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
ACCA	2.714117	8.214727	41.55843	76.12429	72.7473	67.03708	64.20063
ACNE	4.941685	22.48758	53.5578	97.19728	143.6875	191.9985	202.2892
ACPA	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
ACPS	3.796228	13.80352	42.38465	86.24351	127.5431	137.7056	140.889
ACRU	3.796228	13.80352	42.38465	86.24351	127.5431	137.7056	140.889
ACSA	4.941685	22.48758	53.5578	97.19728	143.6875	191.9985	202.2892
AECA 1	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
AIAL	3.470962	15.22587	50.00294	76.56483	72.69518	67.64072	65.13
ALCO	2.714117	8.214727	41.55843	76.12429	72.7473	67.03708	64.20063
ALJU	1.09213	7.057196	18.45029	48.36562	80.71531	111.2304	124.6181
ALRH	2.714117	8.214727	41.55843	76.12429	72.7473	67.03708	64.20063
ARUN	2.778216	26.33501	67.60143	67.60143	67.60143	67.60143	67.60143
BENI	7.829437	33.00328	73.56609	71.07485	71.07485	71.07485	71.07485
BEPA	7.829437	33.00328	73.56609	71.07485	71.07485	71.07485	71.07485
BEPE	7.829437	33.00328	73.56609	71.07485	71.07485	71.07485	71.07485
CABE	2.714117	8.214727	41.55843	76.12429	72.7473	67.03708	64.20063
CABE F	2.714117	8.214727	41.55843	76.12429	72.7473	67.03708	64.20063
CACA	2.714117	8.214727	41.55843	76.12429	72.7473	67.03708	64.20063
CACU	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
CADE	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
CASP	4.941685	22.48758	53.5578	97.19728	143.6875	191.9985	202.2892
CEAT	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
CEAU	5.144265	19.68003	67.41804	126.698	142.2833	136.0032	129.6596
CECA	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
CEDE	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
CEOC	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
CEOC1	3.04158	9.205849	48.26871	91.44891	127.4885	138.7064	142.4136
CESI	3.04158	9.205849	48.26871	91.44891	127.4885	138.7064	142.4136
CESI 1	1.681702	10.01687	30.35106	71.947	96.09136	141.9275	175.0434
CESP	3.04158	9.205849	48.26871	91.44891	127.4885	138.7064	142.4136
CICA	1.681702	10.01687	30.35106	71.947	96.09136	141.9275	175.0434
CISP	2.778216	26.33501	67.60143	67.60143	67.60143	67.60143	67.60143
CRSP	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
CYRE	2.059616	15.11336	20.1727	20.1727	20.1727	20.1727	20.1727
DIKA	2.714117	8.214727	41.55843	76.12429	72.7473	67.03708	64.20063
ERDE	2.778216	26.33501	67.60143	67.60143	67.60143	67.60143	67.60143
EUPO	1.19689	5.962837	26.66483	67.88414	103.1652	122.8511	131.2807
EUSI R	1.19689	5.962837	26.66483	67.88414	103.1652	122.8511	131.2807
EUSP	1.19689	5.962837	26.66483	67.88414	103.1652	122.8511	131.2807
FICA	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
FRHO M	3.796228	13.80352	42.38465	86.24351	127.5431	137.7056	140.889
FROX R	5.191547	21.21943	77.5069	140.4401	140.4401	140.4401	140.4401
FRSP	6.085549	18.42017	37.01054	61.77063	81.02159	71.07485	71.07485
FRUH	6.085549	18.42017	37.01054	61.77063	81.02159	71.07485	71.07485

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
FRVE	3.796228	16.20442	62.41654	119.1082	136.478	143.3939	146.8293
FRVE G	3.796228	16.20442	62.41654	119.1082	136.478	143.3939	146.8293
GIBI	2.144937	8.796705	27.37231	56.33382	75.32137	93.501	103.3226
GLTR	1.09213	7.057196	18.45029	48.36562	80.71531	111.2304	124.6181
JUHI	3.04158	9.205849	48.26871	91.44891	127.4885	138.7064	142.4136
JURE	3.04158	9.205849	48.26871	91.44891	127.4885	138.7064	142.4136
JUSP 1	2.059616	15.11336	20.1727	20.1727	20.1727	20.1727	20.1727
KOPA	9.265238	33.21052	67.00533	82.7805	69.17166	56.24993	49.8313
LAIN	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
LANO	1.681702	10.01687	30.35106	71.947	96.09136	141.9275	175.0434
LIDE	1.19689	5.962837	26.66483	67.88414	103.1652	122.8511	131.2807
LILU	2.778216	26.33501	67.60143	67.60143	67.60143	67.60143	67.60143
LIST	1.548998	9.776818	27.00692	59.35315	92.59294	120.4071	133.5555
LITU	1.548998	9.776818	27.00692	59.35315	92.59294	120.4071	133.5555
MABO	1.681702	10.01687	30.35106	71.947	96.09136	141.9275	175.0434
MAFL	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
MAGR	2.699384	23.62755	74.89026	134.5188	144.6745	144.6745	144.6745
MASO	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
MASP	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
MASP 1	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
MEAZ	9.265238	33.21052	67.00533	82.7805	69.17166	56.24993	49.8313
MEGL	1.548998	9.776818	27.00692	59.35315	92.59294	120.4071	133.5555
MELI	1.681702	10.01687	30.35106	71.947	96.09136	141.9275	175.0434
MOAL	3.796228	13.80352	42.38465	86.24351	127.5431	137.7056	140.889
OLEU	1.681702	10.01687	30.35106	71.947	96.09136	141.9275	175.0434
PEAM	2.699384	23.62755	74.89026	134.5188	144.6745	144.6745	144.6745
PHCA	2.059616	15.11336	20.1727	20.1727	20.1727	20.1727	20.1727
PIBR	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
PICA	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
PICH	3.470962	15.22587	50.00294	76.56483	72.69518	67.64072	65.13
PIHA	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
PIMU	2.059616	15.11336	20.1727	20.1727	20.1727	20.1727	20.1727
PINI	2.70135	23.31217	72.15729	98.15585	98.15585	98.15585	98.15585
PIPI	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
PIPO	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
PIPU	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
PIRA	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
PISP	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
PITH	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
PLAC	3.04158	9.205849	48.26871	101.2427	135.2474	144.6348	149.2977
PLRA	3.04158	9.205849	48.26871	101.2427	135.2474	144.6348	149.2977
PODE	3.04158	9.205849	48.26871	91.44891	127.4885	138.7064	142.4136
PRAM	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
PRAR	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
PRAV	3.470962	15.22587	50.00294	76.56483	72.69518	67.64072	65.13
PRCE	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
PRSP	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
PRSU	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
PTST	3.04158	9.205849	48.26871	91.44891	127.4885	138.7064	142.4136
PUGR	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
PYCA	2.714117	8.214727	41.55843	76.12429	72.7473	67.03708	64.20063
PYCA A	2.714117	8.214727	41.55843	76.12429	72.7473	67.03708	64.20063
PYCA B	2.714117	8.214727	41.55843	76.12429	72.7473	67.03708	64.20063
PYSP	2.714117	8.214727	41.55843	76.12429	72.7473	67.03708	64.20063
QUAG	1.19689	5.962837	26.66483	67.88414	103.1652	122.8511	131.2807
QUCO	3.04158	9.205849	48.26871	101.2427	135.2474	144.6348	149.2977
QUIL	1.19689	5.962837	26.66483	67.88414	103.1652	122.8511	131.2807
QULO	3.04158	9.205849	48.26871	91.44891	127.4885	138.7064	142.4136
QUPA	4.941685	22.48758	53.5578	97.19728	143.6875	191.9985	202.2892
QURO	4.941685	22.48758	53.5578	97.19728	143.6875	191.9985	202.2892
QUSP	4.941685	22.48758	53.5578	97.19728	143.6875	191.9985	202.2892
QUSU	1.19689	5.962837	26.66483	67.88414	103.1652	122.8511	131.2807
QUVI	1.19689	5.962837	26.66483	67.88414	103.1652	122.8511	131.2807
QUWI	1.19689	5.962837	26.66483	67.88414	103.1652	122.8511	131.2807
RHLA	2.778216	26.33501	67.60143	67.60143	67.60143	67.60143	67.60143
ROAM	5.191547	21.21943	77.5069	140.4401	140.4401	140.4401	140.4401
SABA	6.085549	18.42017	37.01054	61.77063	81.02159	71.07485	71.07485
SASE	5.144265	19.68003	67.41804	126.698	142.2833	136.0032	129.6596
SCMO	1.681702	10.01687	30.35106	71.947	96.09136	141.9275	175.0434
SESE	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
SOJA	3.470962	15.22587	50.00294	76.56483	72.69518	67.64072	65.13
TIAM	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
TICO	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
TIEU	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
ULPA	3.04158	9.205849	48.26871	91.44891	127.4885	138.7064	142.4136
ULSP	3.04158	9.205849	48.26871	91.44891	127.4885	138.7064	142.4136
UMCA	1.19689	5.962837	26.66483	67.88414	103.1652	122.8511	131.2807
WAFI	2.059616	15.11336	20.1727	20.1727	20.1727	20.1727	20.1727
WARO	2.059616	15.11336	20.1727	20.1727	20.1727	20.1727	20.1727
WIFL R	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
XYCO	2.778216	26.33501	67.60143	67.60143	67.60143	67.60143	67.60143
ZESE	5.144265	19.68003	67.41804	126.698	142.2833	136.0032	129.6596
DL OTHER	3.04158	9.205849	48.26871	101.2427	135.2474	144.6348	149.2977
DM OTHER	3.470962	15.22587	50.00294	76.56483	72.69518	67.64072	65.13
DS OTHER	11.57493	32.50478	32.13565	32.13565	32.13565	32.13565	32.13565
BEL OTHER	1.19689	5.962837	26.66483	67.88414	103.1652	122.8511	131.2807
BEM OTHER	1.681702	10.01687	30.35106	71.947	96.09136	141.9275	175.0434
BES OTHER	2.778216	26.33501	67.60143	67.60143	67.60143	67.60143	67.60143
CL OTHER	2.70135	14.5402	56.23448	136.0181	188.8653	247.2568	276.2618
CM OTHER	2.70135	23.31217	72.15729	98.15585	98.15585	98.15585	98.15585
CS OTHER	2.059616	15.11336	20.1727	20.1727	20.1727	20.1727	20.1727

AVERAGE NET SEQUESTERED CO_2 (SEQUESTERED LESS RELEASES) (KG/TREE)

Species Code	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
ACBU	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
ACCA	1.450712	4.390821	76.87386	53.14482	17.74544	17.74544	17.74544
ACNE	1.608452	27.53329	80.54377	229.732	408.8679	570.6581	601.0003
ACPA	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
ACPS	1.112885	12.11417	79.73732	257.766	460.1641	231.2121	113.5546
ACRU	1.112885	12.11417	79.73732	257.766	460.1641	231.2121	113.5546
ACSA	1.608452	27.53329	80.54377	229.732	408.8679	570.6581	601.0003
AECA 1	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
AIAL	1.726443	17.56804	81.33717	36.62818	15.50159	15.50159	15.50159
ALCO	1.450712	4.390821	76.87386	53.14482	17.74544	17.74544	17.74544
ALJU	0.907598	19.40751	58.91454	195.465	281.7119	269.3129	253.1817
ALRH	1.450712	4.390821	76.87386	53.14482	17.74544	17.74544	17.74544
ARUN	2.607181	34.11772	44.2845	44.2845	44.2845	44.2845	44.2845
BENI	1.086959	17.8961	56.36631	15.2129	15.2129	15.2129	15.2129
BEPA	1.086959	17.8961	56.36631	15.2129	15.2129	15.2129	15.2129
BEPE	1.086959	17.8961	56.36631	15.2129	15.2129	15.2129	15.2129
CABE	1.450712	4.390821	76.87386	53.14482	17.74544	17.74544	17.74544
CABE F	1.450712	4.390821	76.87386	53.14482	17.74544	17.74544	17.74544
CACA	1.450712	4.390821	76.87386	53.14482	17.74544	17.74544	17.74544
CACU	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
CADE	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
CASP	1.608452	27.53329	80.54377	229.732	408.8679	570.6581	601.0003
CEAT	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
CEAU	2.156518	16.73297	102.8551	156.5069	62.90031	20.45088	5.503846
CECA	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
CEDE	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
CEOC	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
CEOC1	1.510941	4.573114	86.02198	175.7731	152.6262	61.68232	61.68232
CESI	1.510941	4.573114	86.02198	175.7731	152.6262	61.68232	61.68232
CESI 1	1.226506	17.29738	62.95205	150.3201	138.5154	79.82476	54.89842
CESP	1.510941	4.573114	86.02198	175.7731	152.6262	61.68232	61.68232
CICA	1.226506	17.29738	62.95205	150.3201	138.5154	79.82476	54.89842
CISP	2.607181	34.11772	44.2845	44.2845	44.2845	44.2845	44.2845
CRSP	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
CYRE	1.955413	12.12633	5.791216	5.791216	5.791216	5.791216	5.791216
DIKA	1.450712	4.390821	76.87386	53.14482	17.74544	17.74544	17.74544
ERDE	2.607181	34.11772	44.2845	44.2845	44.2845	44.2845	44.2845
EUPO	1.313664	14.33499	93.80561	294.3277	336.4122	197.2339	127.435
EUSI R	1.313664	14.33499	93.80561	294.3277	336.4122	197.2339	127.435
EUSP	1.313664	14.33499	93.80561	294.3277	336.4122	197.2339	127.435
FICA	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
FRHO M	1.112885	12.11417	79.73732	257.766	460.1641	231.2121	113.5546
FROX R	4.862153	36.20617	208.8643	29.02842	29.02842	29.02842	29.02842
FRSP	2.062783	8.862148	34.39162	68.39375	29.41488	8.807097	7.129954
FRUH	2.062783	8.862148	34.39162	68.39375	29.41488	8.807097	7.129954

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
FRVE	1.63516	17.2958	112.9567	225.2731	92.30068	92.30068	92.30068
FRVE G	1.63516	17.2958	112.9567	225.2731	92.30068	92.30068	92.30068
GIBI	3.67731	13.64661	65.49013	182.2372	342.3864	557.3011	675.3536
GLTR	0.907598	19.40751	58.91454	195.465	281.7119	269.3129	253.1817
JUHI	1.510941	4.573114	86.02198	175.7731	152.6262	61.68232	61.68232
JURE	1.510941	4.573114	86.02198	175.7731	152.6262	61.68232	61.68232
JUSP 1	1.955413	12.12633	5.791216	5.791216	5.791216	5.791216	5.791216
KOPA	1.632735	26.19538	75.78627	70.62439	28.57755	28.57755	28.57755
LAIN	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
LANO	1.226506	17.29738	62.95205	150.3201	138.5154	79.82476	54.89842
LIDE	1.313664	14.33499	93.80561	294.3277	336.4122	197.2339	127.435
LILU	2.607181	34.11772	44.2845	44.2845	44.2845	44.2845	44.2845
LIST	1.095484	17.64548	60.04496	149.6642	212.0072	234.3001	243.122
LITU	1.095484	17.64548	60.04496	149.6642	212.0072	234.3001	243.122
MABO	1.226506	17.29738	62.95205	150.3201	138.5154	79.82476	54.89842
MAFL	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
MAGR	0.606445	9.168739	36.41722	40.5136	25.00292	9.441383	1.71147
MASO	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
MASP	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
MASP 1	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
MEAZ	1.632735	26.19538	75.78627	70.62439	28.57755	28.57755	28.57755
MEGL	1.095484	17.64548	60.04496	149.6642	212.0072	234.3001	243.122
MELI	1.226506	17.29738	62.95205	150.3201	138.5154	79.82476	54.89842
MOAL	1.112885	12.11417	79.73732	257.766	460.1641	231.2121	113.5546
OLEU	1.226506	17.29738	62.95205	150.3201	138.5154	79.82476	54.89842
PEAM	0.606445	9.168739	36.41722	40.5136	25.00292	9.441383	1.71147
PHCA	1.955413	12.12633	5.791216	5.791216	5.791216	5.791216	5.791216
PIBR	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
PICA	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
PICH	1.726443	17.56804	81.33717	36.62818	15.50159	15.50159	15.50159
PIHA	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
PIMU	1.955413	12.12633	5.791216	5.791216	5.791216	5.791216	5.791216
PINI	1.284029	31.70822	76.78119	22.76003	22.76003	22.76003	22.76003
PIPI	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
PIPO	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
PIPU	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
PIRA	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
PISP	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
PITH	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
PLAC	4.507357	13.64227	165.6804	208.5297	33.49744	30.82326	30.82326
PLRA	4.507357	13.64227	165.6804	208.5297	33.49744	30.82326	30.82326
PODE	1.510941	4.573114	86.02198	175.7731	152.6262	61.68232	61.68232
PRAM	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
PRAR	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
PRAV	1.726443	17.56804	81.33717	36.62818	15.50159	15.50159	15.50159
PRCE	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
PRSP	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
PRSU	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
PTST	1.510941	4.573114	86.02198	175.7731	152.6262	61.68232	61.68232
PUGR	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
PYCA	1.450712	4.390821	76.87386	53.14482	17.74544	17.74544	17.74544
PYCA A	1.450712	4.390821	76.87386	53.14482	17.74544	17.74544	17.74544
PYCA B	1.450712	4.390821	76.87386	53.14482	17.74544	17.74544	17.74544
PYSP	1.450712	4.390821	76.87386	53.14482	17.74544	17.74544	17.74544
QUAG	1.313664	14.33499	93.80561	294.3277	336.4122	197.2339	127.435
QUCO	4.507357	13.64227	165.6804	208.5297	33.49744	30.82326	30.82326
QUIL	1.313664	14.33499	93.80561	294.3277	336.4122	197.2339	127.435
QULO	1.510941	4.573114	86.02198	175.7731	152.6262	61.68232	61.68232
QUPA	1.608452	27.53329	80.54377	229.732	408.8679	570.6581	601.0003
QURO	1.608452	27.53329	80.54377	229.732	408.8679	570.6581	601.0003
QUSP	1.608452	27.53329	80.54377	229.732	408.8679	570.6581	601.0003
QUSU	1.313664	14.33499	93.80561	294.3277	336.4122	197.2339	127.435
QUVI	1.313664	14.33499	93.80561	294.3277	336.4122	197.2339	127.435
QUWI	1.313664	14.33499	93.80561	294.3277	336.4122	197.2339	127.435
RHLA	2.607181	34.11772	44.2845	44.2845	44.2845	44.2845	44.2845
ROAM	4.862153	36.20617	208.8643	29.02842	29.02842	29.02842	29.02842
SABA	2.062783	8.862148	34.39162	68.39375	29.41488	8.807097	7.129954
SASE	2.156518	16.73297	102.8551	156.5069	62.90031	20.45088	5.503846
SCMO	1.226506	17.29738	62.95205	150.3201	138.5154	79.82476	54.89842
SESE	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
SOJA	1.726443	17.56804	81.33717	36.62818	15.50159	15.50159	15.50159
TIAM	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
TICO	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
TIEU	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
ULPA	1.510941	4.573114	86.02198	175.7731	152.6262	61.68232	61.68232
ULSP	1.510941	4.573114	86.02198	175.7731	152.6262	61.68232	61.68232
UMCA	1.313664	14.33499	93.80561	294.3277	336.4122	197.2339	127.435
WAFI	1.955413	12.12633	5.791216	5.791216	5.791216	5.791216	5.791216
WARO	1.955413	12.12633	5.791216	5.791216	5.791216	5.791216	5.791216
WIFL R	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
XYCO	2.607181	34.11772	44.2845	44.2845	44.2845	44.2845	44.2845
ZESE	2.156518	16.73297	102.8551	156.5069	62.90031	20.45088	5.503846
DL OTHER	4.507357	13.64227	165.6804	208.5297	33.49744	30.82326	30.82326
DM OTHER	1.726443	17.56804	81.33717	36.62818	15.50159	15.50159	15.50159
DS OTHER	0.854154	8.355382	6.827917	6.827917	6.827917	6.827917	6.827917
BEL OTHER	1.313664	14.33499	93.80561	294.3277	336.4122	197.2339	127.435
BEM OTHER	1.226506	17.29738	62.95205	150.3201	138.5154	79.82476	54.89842
BES OTHER	2.607181	34.11772	44.2845	44.2845	44.2845	44.2845	44.2845
CL OTHER	1.284029	15.58431	78.84713	77.30121	34.14004	34.14004	34.14004
CM OTHER	1.284029	31.70822	76.78119	22.76003	22.76003	22.76003	22.76003
CS OTHER	1.955413	12.12633	5.791216	5.791216	5.791216	5.791216	5.791216

AVERAGE OZONE UPTAKE (KG/TREE)

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
ACBU	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
ACCA	0.004199	0.012708	0.227496	0.775045	0.921786	1.016912	1.064163
ACNE	0.001141	0.0175	0.050792	0.211548	0.544246	1.169933	1.736072
ACPA	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
ACPS	0.001359	0.011847	0.072785	0.335701	1.488475	2.944084	2.944084
ACRU	0.001359	0.011847	0.072785	0.335701	1.488475	2.944084	2.944084
ACSA	0.001141	0.0175	0.050792	0.211548	0.544246	1.169933	1.736072
AECA 1	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
AIAL	0.002242	0.042977	0.275181	1.041013	1.237113	1.382304	1.454425
ALCO	0.004199	0.012708	0.227496	0.775045	0.921786	1.016912	1.064163
ALJU	0.000329	0.008718	0.03078	0.22085	0.960106	2.608606	3.631249
ALRH	0.004199	0.012708	0.227496	0.775045	0.921786	1.016912	1.064163
ARUN	0.004258	0.087483	0.623883	0.623883	0.623883	0.623883	0.623883
BENI	0.007096	0.083419	0.37408	0.661262	0.77982	0.898767	0.957852
BEPA	0.007096	0.083419	0.37408	0.661262	0.77982	0.898767	0.957852
BEPE	0.007096	0.083419	0.37408	0.661262	0.77982	0.898767	0.957852
CABE	0.004199	0.012708	0.227496	0.775045	0.921786	1.016912	1.064163
CABE F	0.004199	0.012708	0.227496	0.775045	0.921786	1.016912	1.064163
CACA	0.004199	0.012708	0.227496	0.775045	0.921786	1.016912	1.064163
CACU	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
CADE	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
CASP	0.001141	0.0175	0.050792	0.211548	0.544246	1.169933	1.736072
CEAT	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
CEAU	0.002298	0.027354	0.193335	0.849594	1.586599	1.87141	1.985752
CECA	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
CEDE	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
CEOC	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
CEOC1	0.001756	0.005315	0.153036	0.64176	1.843466	2.996677	3.480115
CESI	0.001756	0.005315	0.153036	0.64176	1.843466	2.996677	3.480115
CESI 1	0.000545	0.012834	0.049001	0.319282	1.058915	1.931333	2.340237
CESP	0.001756	0.005315	0.153036	0.64176	1.843466	2.996677	3.480115
CICA	0.000545	0.012834	0.049001	0.319282	1.058915	1.931333	2.340237
CISP	0.004258	0.087483	0.623883	0.623883	0.623883	0.623883	0.623883
CRSP	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
CYRE	0.008988	0.117023	0.185515	0.185515	0.185515	0.185515	0.185515
DIKA	0.004199	0.012708	0.227496	0.775045	0.921786	1.016912	1.064163
ERDE	0.004258	0.087483	0.623883	0.623883	0.623883	0.623883	0.623883
EUPO	0.000268	0.00388	0.027058	0.212473	1.007317	2.306227	2.971206
EUSI R	0.000268	0.00388	0.027058	0.212473	1.007317	2.306227	2.971206
EUSP	0.000268	0.00388	0.027058	0.212473	1.007317	2.306227	2.971206
FICA	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
FRHO M	0.001359	0.011847	0.072785	0.335701	1.488475	2.944084	2.944084
FROX R	0.01312	0.093262	0.526587	1.478543	1.669032	1.860145	1.955077
FRSP	0.009702	0.046622	0.20297	0.411207	0.844954	0.926767	0.939607
FRUH	0.009702	0.046622	0.20297	0.411207	0.844954	0.926767	0.939607

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
FRVE	0.001403	0.018689	0.129027	0.989312	2.139301	3.067819	3.529043
FRVE G	0.001403	0.018689	0.129027	0.989312	2.139301	3.067819	3.529043
GIBI	0.000304	0.001207	0.010666	0.085578	0.666684	5.716786	9.343423
GLTR	0.000329	0.008718	0.03078	0.22085	0.960106	2.608606	3.631249
JUHI	0.001756	0.005315	0.153036	0.64176	1.843466	2.996677	3.480115
JURE	0.001756	0.005315	0.153036	0.64176	1.843466	2.996677	3.480115
JUSP 1	0.008988	0.117023	0.185515	0.185515	0.185515	0.185515	0.185515
KOPA	0.00122	0.029861	0.149687	0.580086	0.893989	1.138547	1.260026
LAIN	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
LANO	0.000545	0.012834	0.049001	0.319282	1.058915	1.931333	2.340237
LIDE	0.000268	0.00388	0.027058	0.212473	1.007317	2.306227	2.971206
LILU	0.004258	0.087483	0.623883	0.623883	0.623883	0.623883	0.623883
LIST	0.000658	0.014248	0.076242	0.395874	1.399738	3.669866	4.905583
LITU	0.000658	0.014248	0.076242	0.395874	1.399738	3.669866	4.905583
MABO	0.000545	0.012834	0.049001	0.319282	1.058915	1.931333	2.340237
MAFL	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
MAGR	0.001171	0.022945	0.136143	0.581198	1.093015	1.606509	1.861579
MASO	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
MASP	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
MASP 1	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
MEAZ	0.00122	0.029861	0.149687	0.580086	0.893989	1.138547	1.260026
MEGL	0.000658	0.014248	0.076242	0.395874	1.399738	3.669866	4.905583
MELI	0.000545	0.012834	0.049001	0.319282	1.058915	1.931333	2.340237
MOAL	0.001359	0.011847	0.072785	0.335701	1.488475	2.944084	2.944084
OLEU	0.000545	0.012834	0.049001	0.319282	1.058915	1.931333	2.340237
PEAM	0.001171	0.022945	0.136143	0.581198	1.093015	1.606509	1.861579
PHCA	0.008988	0.117023	0.185515	0.185515	0.185515	0.185515	0.185515
PIBR	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
PICA	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
PICH	0.002242	0.042977	0.275181	1.041013	1.237113	1.382304	1.454425
PIHA	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
PIMU	0.008988	0.117023	0.185515	0.185515	0.185515	0.185515	0.185515
PINI	0.002242	0.092863	0.51592	0.778561	0.778561	0.778561	0.778561
PIPI	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
PIPO	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
PIPU	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
PIRA	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
PISP	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
PITH	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
PLAC	0.007779	0.023543	0.419384	1.234402	1.815431	1.9261	1.981073
PLRA	0.007779	0.023543	0.419384	1.234402	1.815431	1.9261	1.981073
PODE	0.001756	0.005315	0.153036	0.64176	1.843466	2.996677	3.480115
PRAM	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
PRAR	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
PRAV	0.002242	0.042977	0.275181	1.041013	1.237113	1.382304	1.454425
PRCE	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
PRSP	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
PRSU	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
PTST	0.001756	0.005315	0.153036	0.64176	1.843466	2.996677	3.480115
PUGR	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
PYCA	0.004199	0.012708	0.227496	0.775045	0.921786	1.016912	1.064163
PYCA A	0.004199	0.012708	0.227496	0.775045	0.921786	1.016912	1.064163
PYCA B	0.004199	0.012708	0.227496	0.775045	0.921786	1.016912	1.064163
PYSP	0.004199	0.012708	0.227496	0.775045	0.921786	1.016912	1.064163
QUAG	0.000268	0.00388	0.027058	0.212473	1.007317	2.306227	2.971206
QUCO	0.007779	0.023543	0.419384	1.234402	1.815431	1.9261	1.981073
QUIL	0.000268	0.00388	0.027058	0.212473	1.007317	2.306227	2.971206
QULO	0.001756	0.005315	0.153036	0.64176	1.843466	2.996677	3.480115
QUPA	0.001141	0.0175	0.050792	0.211548	0.544246	1.169933	1.736072
QURO	0.001141	0.0175	0.050792	0.211548	0.544246	1.169933	1.736072
QUSP	0.001141	0.0175	0.050792	0.211548	0.544246	1.169933	1.736072
QUSU	0.000268	0.00388	0.027058	0.212473	1.007317	2.306227	2.971206
QUVI	0.000268	0.00388	0.027058	0.212473	1.007317	2.306227	2.971206
QUWI	0.000268	0.00388	0.027058	0.212473	1.007317	2.306227	2.971206
RHLA	0.004258	0.087483	0.623883	0.623883	0.623883	0.623883	0.623883
ROAM	0.01312	0.093262	0.526587	1.478543	1.669032	1.860145	1.955077
SABA	0.009702	0.046622	0.20297	0.411207	0.844954	0.926767	0.939607
SASE	0.002298	0.027354	0.193335	0.849594	1.586599	1.87141	1.985752
SCMO	0.000545	0.012834	0.049001	0.319282	1.058915	1.931333	2.340237
SESE	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
SOJA	0.002242	0.042977	0.275181	1.041013	1.237113	1.382304	1.454425
TIAM	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
TICO	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
TIEU	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
ULPA	0.001756	0.005315	0.153036	0.64176	1.843466	2.996677	3.480115
ULSP	0.001756	0.005315	0.153036	0.64176	1.843466	2.996677	3.480115
UMCA	0.000268	0.00388	0.027058	0.212473	1.007317	2.306227	2.971206
WAFI	0.008988	0.117023	0.185515	0.185515	0.185515	0.185515	0.185515
WARO	0.008988	0.117023	0.185515	0.185515	0.185515	0.185515	0.185515
WIFL R	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
XYCO	0.004258	0.087483	0.623883	0.623883	0.623883	0.623883	0.623883
ZESE	0.002298	0.027354	0.193335	0.849594	1.586599	1.87141	1.985752
DL OTHER	0.007779	0.023543	0.419384	1.234402	1.815431	1.9261	1.981073
DM OTHER	0.002242	0.042977	0.275181	1.041013	1.237113	1.382304	1.454425
DS OTHER	0.002266	0.048581	0.226072	0.226072	0.226072	0.226072	0.226072
BEL OTHER	0.000268	0.00388	0.027058	0.212473	1.007317	2.306227	2.971206
BEM OTHER	0.000545	0.012834	0.049001	0.319282	1.058915	1.931333	2.340237
BES OTHER	0.004258	0.087483	0.623883	0.623883	0.623883	0.623883	0.623883
CL OTHER	0.002486	0.037005	0.219556	1.062819	1.307641	1.307641	1.307641
CM OTHER	0.002242	0.092863	0.51592	0.778561	0.778561	0.778561	0.778561
CS OTHER	0.008988	0.117023	0.185515	0.185515	0.185515	0.185515	0.185515

AVERAGE NO_2 UPTAKE (KG/TREE)

Species Code	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
ACBU	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
ACCA	0.001544	0.004673	0.083086	0.282086	0.33532	0.369828	0.386968
ACNE	0.000423	0.006438	0.018677	0.077554	0.199123	0.427335	0.63337
ACPA	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
ACPS	0.000502	0.004353	0.026706	0.122831	0.542744	1.252394	1.602754
ACRU	0.000502	0.004353	0.026706	0.122831	0.542744	1.252394	1.602754
ACSA	0.000423	0.006438	0.018677	0.077554	0.199123	0.427335	0.63337
AECA 1	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
AIAL	0.000825	0.015729	0.100541	0.378869	0.45001	0.502679	0.528842
ALCO	0.001544	0.004673	0.083086	0.282086	0.33532	0.369828	0.386968
ALJU	0.000122	0.00321	0.011318	0.080923	0.350517	0.949516	1.320614
ALRH	0.001544	0.004673	0.083086	0.282086	0.33532	0.369828	0.386968
ARUN	0.001564	0.031999	0.22698	0.22698	0.22698	0.22698	0.22698
BENI	0.002607	0.030482	0.136336	0.240568	0.283576	0.326725	0.348159
BEPA	0.002607	0.030482	0.136336	0.240568	0.283576	0.326725	0.348159
BEPE	0.002607	0.030482	0.136336	0.240568	0.283576	0.326725	0.348159
CABE	0.001544	0.004673	0.083086	0.282086	0.33532	0.369828	0.386968
CABE F	0.001544	0.004673	0.083086	0.282086	0.33532	0.369828	0.386968
CACA	0.001544	0.004673	0.083086	0.282086	0.33532	0.369828	0.386968
CACU	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
CADE	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
CASP	0.000423	0.006438	0.018677	0.077554	0.199123	0.427335	0.63337
CEAT	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
CEAU	0.000847	0.010024	0.070754	0.309857	0.577442	0.680767	0.722246
CECA	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
CEDE	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
CEOC	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
CEOC1	0.000647	0.001959	0.056072	0.23439	0.671511	1.089885	1.265267
CESI	0.000647	0.001959	0.056072	0.23439	0.671511	1.089885	1.265267
CESI 1	0.000202	0.004714	0.017991	0.116801	0.386	0.702687	0.851041
CESP	0.000647	0.001959	0.056072	0.23439	0.671511	1.089885	1.265267
CICA	0.000202	0.004714	0.017991	0.116801	0.386	0.702687	0.851041
CISP	0.001564	0.031999	0.22698	0.22698	0.22698	0.22698	0.22698
CRSP	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
CYRE	0.003289	0.042644	0.067493	0.067493	0.067493	0.067493	0.067493
DIKA	0.001544	0.004673	0.083086	0.282086	0.33532	0.369828	0.386968
ERDE	0.001564	0.031999	0.22698	0.22698	0.22698	0.22698	0.22698
EUPO	9.92E-05	0.001428	0.009945	0.07779	0.36726	0.838759	1.080011
EUSI R	9.92E-05	0.001428	0.009945	0.07779	0.36726	0.838759	1.080011
EUSP	9.92E-05	0.001428	0.009945	0.07779	0.36726	0.838759	1.080011
FICA	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
FRHO M	0.000502	0.004353	0.026706	0.122831	0.542744	1.252394	1.602754
FROX R	0.004819	0.034104	0.192154	0.537868	0.606969	0.676296	0.710733
FRSP	0.003562	0.017064	0.074073	0.150001	0.307488	0.337169	0.341826
FRUH	0.003562	0.017064	0.074073	0.150001	0.307488	0.337169	0.341826

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
FRVE	0.000517	0.006859	0.047303	0.360777	0.778257	1.115115	1.282444
FRVE G	0.000517	0.006859	0.047303	0.360777	0.778257	1.115115	1.282444
GIBI	0.000114	0.00045	0.003936	0.031487	0.244197	2.080748	3.399179
GLTR	0.000122	0.00321	0.011318	0.080923	0.350517	0.949516	1.320614
JUHI	0.000647	0.001959	0.056072	0.23439	0.671511	1.089885	1.265267
JURE	0.000647	0.001959	0.056072	0.23439	0.671511	1.089885	1.265267
JUSP 1	0.003289	0.042644	0.067493	0.067493	0.067493	0.067493	0.067493
KOPA	0.00045	0.010942	0.054708	0.21133	0.325211	0.413932	0.458003
LAIN	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
LANO	0.000202	0.004714	0.017991	0.116801	0.386	0.702687	0.851041
LIDE	9.92E-05	0.001428	0.009945	0.07779	0.36726	0.838759	1.080011
LILU	0.001564	0.031999	0.22698	0.22698	0.22698	0.22698	0.22698
LIST	0.000245	0.005245	0.027986	0.144879	0.510665	1.334943	1.783475
LITU	0.000245	0.005245	0.027986	0.144879	0.510665	1.334943	1.783475
MABO	0.000202	0.004714	0.017991	0.116801	0.386	0.702687	0.851041
MAFL	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
MAGR	0.000432	0.008416	0.049764	0.211493	0.397182	0.583479	0.676019
MASO	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
MASP	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
MASP 1	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
MEAZ	0.00045	0.010942	0.054708	0.21133	0.325211	0.413932	0.458003
MEGL	0.000245	0.005245	0.027986	0.144879	0.510665	1.334943	1.783475
MELI	0.000202	0.004714	0.017991	0.116801	0.386	0.702687	0.851041
MOAL	0.000502	0.004353	0.026706	0.122831	0.542744	1.252394	1.602754
OLEU	0.000202	0.004714	0.017991	0.116801	0.386	0.702687	0.851041
PEAM	0.000432	0.008416	0.049764	0.211493	0.397182	0.583479	0.676019
PHCA	0.003289	0.042644	0.067493	0.067493	0.067493	0.067493	0.067493
PIBR	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
PICA	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
PICH	0.000825	0.015729	0.100541	0.378869	0.45001	0.502679	0.528842
PIHA	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
PIMU	0.003289	0.042644	0.067493	0.067493	0.067493	0.067493	0.067493
PINI	0.000915	0.028416	0.171969	0.317162	0.317162	0.317162	0.317162
PIPI	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
PIPO	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
PIPU	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
PIRA	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
PISP	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
PITH	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
PLAC	0.002861	0.008659	0.153131	0.449614	0.660495	0.700641	0.720583
PLRA	0.002861	0.008659	0.153131	0.449614	0.660495	0.700641	0.720583
PODE	0.000647	0.001959	0.056072	0.23439	0.671511	1.089885	1.265267
PRAM	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
PRAR	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
PRAV	0.000825	0.015729	0.100541	0.378869	0.45001	0.502679	0.528842
PRCE	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
PRSP	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
PRSU	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
PTST	0.000647	0.001959	0.056072	0.23439	0.671511	1.089885	1.265267
PUGR	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
PYCA	0.001544	0.004673	0.083086	0.282086	0.33532	0.369828	0.386968
PYCA A	0.001544	0.004673	0.083086	0.282086	0.33532	0.369828	0.386968
PYCA B	0.001544	0.004673	0.083086	0.282086	0.33532	0.369828	0.386968
PYSP	0.001544	0.004673	0.083086	0.282086	0.33532	0.369828	0.386968
QUAG	9.92E-05	0.001428	0.009945	0.07779	0.36726	0.838759	1.080011
QUCO	0.002861	0.008659	0.153131	0.449614	0.660495	0.700641	0.720583
QUIL	9.92E-05	0.001428	0.009945	0.07779	0.36726	0.838759	1.080011
QULO	0.000647	0.001959	0.056072	0.23439	0.671511	1.089885	1.265267
QUPA	0.000423	0.006438	0.018677	0.077554	0.199123	0.427335	0.63337
QURO	0.000423	0.006438	0.018677	0.077554	0.199123	0.427335	0.63337
QUSP	0.000423	0.006438	0.018677	0.077554	0.199123	0.427335	0.63337
QUSU	9.92E-05	0.001428	0.009945	0.07779	0.36726	0.838759	1.080011
QUVI	9.92E-05	0.001428	0.009945	0.07779	0.36726	0.838759	1.080011
QUWI	9.92E-05	0.001428	0.009945	0.07779	0.36726	0.838759	1.080011
RHLA	0.001564	0.031999	0.22698	0.22698	0.22698	0.22698	0.22698
ROAM	0.004819	0.034104	0.192154	0.537868	0.606969	0.676296	0.710733
SABA	0.003562	0.017064	0.074073	0.150001	0.307488	0.337169	0.341826
SASE	0.000847	0.010024	0.070754	0.309857	0.577442	0.680767	0.722246
SCMO	0.000202	0.004714	0.017991	0.116801	0.386	0.702687	0.851041
SESE	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
SOJA	0.000825	0.015729	0.100541	0.378869	0.45001	0.502679	0.528842
TIAM	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
TICO	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
TIEU	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
ULPA	0.000647	0.001959	0.056072	0.23439	0.671511	1.089885	1.265267
ULSP	0.000647	0.001959	0.056072	0.23439	0.671511	1.089885	1.265267
UMCA	9.92E-05	0.001428	0.009945	0.07779	0.36726	0.838759	1.080011
WAFI	0.003289	0.042644	0.067493	0.067493	0.067493	0.067493	0.067493
WARO	0.003289	0.042644	0.067493	0.067493	0.067493	0.067493	0.067493
WIFL R	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
XYCO	0.001564	0.031999	0.22698	0.22698	0.22698	0.22698	0.22698
ZESE	0.000847	0.010024	0.070754	0.309857	0.577442	0.680767	0.722246
DL OTHER	0.002861	0.008659	0.153131	0.449614	0.660495	0.700641	0.720583
DM OTHER	0.000825	0.015729	0.100541	0.378869	0.45001	0.502679	0.528842
DS OTHER	0.000832	0.017751	0.093219	0.191022	0.288825	0.386949	0.435691
BEL OTHER	9.92E-05	0.001428	0.009945	0.07779	0.36726	0.838759	1.080011
BEM OTHER	0.000202	0.004714	0.017991	0.116801	0.386	0.702687	0.851041
BES OTHER	0.001564	0.031999	0.22698	0.22698	0.22698	0.22698	0.22698
CL OTHER	0.000915	0.013553	0.080285	0.38692	0.643239	0.878165	0.99486
CM OTHER	0.000915	0.028416	0.171969	0.317162	0.317162	0.317162	0.317162
CS OTHER	0.003289	0.042644	0.067493	0.067493	0.067493	0.067493	0.067493

AVERAGE PM_{10} UPTAKE (KG/TREE)

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
ACBU	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
ACCA	0.004066	0.012307	0.181783	0.571883	0.672541	0.73773	0.770111
ACNE	0.001441	0.017326	0.049238	0.187072	0.455686	0.937898	1.352544
ACPA	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
ACPS	0.001524	0.011417	0.066042	0.281544	1.144596	2.497292	3.16108
ACRU	0.001524	0.011417	0.066042	0.281544	1.144596	2.497292	3.16108
ACSA	0.001441	0.017326	0.049238	0.187072	0.455686	0.937898	1.352544
AECA 1	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
AIAL	0.00229	0.036378	0.22227	0.767295	0.901847	1.001359	1.05079
ALCO	0.004066	0.012307	0.181783	0.571883	0.672541	0.73773	0.770111
ALJU	0.000491	0.008864	0.029903	0.192433	0.760799	1.929348	2.633896
ALRH	0.004066	0.012307	0.181783	0.571883	0.672541	0.73773	0.770111
ARUN	0.004031	0.072748	0.45642	0.45642	0.45642	0.45642	0.45642
BENI	0.006667	0.067694	0.284565	0.483293	0.564558	0.64609	0.68659
BEPA	0.006667	0.067694	0.284565	0.483293	0.564558	0.64609	0.68659
BEPE	0.006667	0.067694	0.284565	0.483293	0.564558	0.64609	0.68659
CABE	0.004066	0.012307	0.181783	0.571883	0.672541	0.73773	0.770111
CABE F	0.004066	0.012307	0.181783	0.571883	0.672541	0.73773	0.770111
CACA	0.004066	0.012307	0.181783	0.571883	0.672541	0.73773	0.770111
CACU	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
CADE	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
CASP	0.001441	0.017326	0.049238	0.187072	0.455686	0.937898	1.352544
CEAT	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
CEAU	0.002389	0.024092	0.162789	0.656604	1.169869	1.365412	1.44381
CECA	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
CEDE	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
CEOC	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
CEOC1	0.001879	0.005687	0.133122	0.513644	1.385555	2.176688	2.508493
CESI	0.001879	0.005687	0.133122	0.513644	1.385555	2.176688	2.508493
CESI 1	0.000663	0.012113	0.045315	0.26585	0.808989	1.414424	1.695479
CESP	0.001879	0.005687	0.133122	0.513644	1.385555	2.176688	2.508493
CICA	0.000663	0.012113	0.045315	0.26585	0.808989	1.414424	1.695479
CISP	0.004031	0.072748	0.45642	0.45642	0.45642	0.45642	0.45642
CRSP	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
CYRE	0.007621	0.088727	0.135719	0.135719	0.135719	0.135719	0.135719
DIKA	0.004066	0.012307	0.181783	0.571883	0.672541	0.73773	0.770111
ERDE	0.004031	0.072748	0.45642	0.45642	0.45642	0.45642	0.45642
EUPO	0.000348	0.003924	0.025888	0.180929	0.77294	1.674429	2.130601
EUSI R	0.000348	0.003924	0.025888	0.180929	0.77294	1.674429	2.130601
EUSP	0.000348	0.003924	0.025888	0.180929	0.77294	1.674429	2.130601
FICA	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
FRHO M	0.001524	0.011417	0.066042	0.281544	1.144596	2.497292	3.16108
FROX R	0.012261	0.077566	0.412096	1.079431	1.209942	1.340881	1.405922
FRSP	0.008986	0.03978	0.159615	0.31922	0.621612	0.677771	0.686567
FRUH	0.008986	0.03978	0.159615	0.31922	0.621612	0.677771	0.686567

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
FRVE	0.001524	0.01716	0.113953	0.763009	1.562547	2.200256	2.517026
FRVE G	0.001524	0.01716	0.113953	0.763009	1.562547	2.200256	2.517026
GIBI	0.000548	0.001851	0.01185	0.084491	0.575311	4.228526	6.829178
GLTR	0.000491	0.008864	0.029903	0.192433	0.760799	1.929348	2.633896
JUHI	0.001879	0.005687	0.133122	0.513644	1.385555	2.176688	2.508493
JURE	0.001879	0.005687	0.133122	0.513644	1.385555	2.176688	2.508493
JUSP 1	0.007621	0.088727	0.135719	0.135719	0.135719	0.135719	0.135719
KOPA	0.001294	0.026091	0.122	0.437077	0.652394	0.820245	0.903621
LAIN	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
LANO	0.000663	0.012113	0.045315	0.26585	0.808989	1.414424	1.695479
LIDE	0.000348	0.003924	0.025888	0.180929	0.77294	1.674429	2.130601
LILU	0.004031	0.072748	0.45642	0.45642	0.45642	0.45642	0.45642
LIST	0.000937	0.014369	0.0701	0.333615	1.090375	2.674773	3.53077
LITU	0.000937	0.014369	0.0701	0.333615	1.090375	2.674773	3.53077
MABO	0.000663	0.012113	0.045315	0.26585	0.808989	1.414424	1.695479
MAFL	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
MAGR	0.001245	0.02056	0.111104	0.427102	0.778649	1.131348	1.306546
MASO	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
MASP	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
MASP 1	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
MEAZ	0.001294	0.026091	0.122	0.437077	0.652394	0.820245	0.903621
MEGL	0.000937	0.014369	0.0701	0.333615	1.090375	2.674773	3.53077
MELI	0.000663	0.012113	0.045315	0.26585	0.808989	1.414424	1.695479
MOAL	0.001524	0.011417	0.066042	0.281544	1.144596	2.497292	3.16108
OLEU	0.000663	0.012113	0.045315	0.26585	0.808989	1.414424	1.695479
PEAM	0.001245	0.02056	0.111104	0.427102	0.778649	1.131348	1.306546
PHCA	0.007621	0.088727	0.135719	0.135719	0.135719	0.135719	0.135719
PIBR	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
PICA	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
PICH	0.00229	0.036378	0.22227	0.767295	0.901847	1.001359	1.05079
PIHA	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
PIMU	0.007621	0.088727	0.135719	0.135719	0.135719	0.135719	0.135719
PINI	0.00254	0.065546	0.360549	0.637763	0.637763	0.637763	0.637763
PIPI	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
PIPO	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
PIPU	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
PIRA	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
PISP	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
PITH	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
PLAC	0.007575	0.022926	0.333286	0.926246	1.328576	1.404401	1.442066
PLRA	0.007575	0.022926	0.333286	0.926246	1.328576	1.404401	1.442066
PODE	0.001879	0.005687	0.133122	0.513644	1.385555	2.176688	2.508493
PRAM	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
PRAR	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
PRAV	0.00229	0.036378	0.22227	0.767295	0.901847	1.001359	1.05079
PRCE	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
PRSP	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
PRSU	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
PTST	0.001879	0.005687	0.133122	0.513644	1.385555	2.176688	2.508493
PUGR	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
PYCA	0.004066	0.012307	0.181783	0.571883	0.672541	0.73773	0.770111
PYCA A	0.004066	0.012307	0.181783	0.571883	0.672541	0.73773	0.770111
PYCA B	0.004066	0.012307	0.181783	0.571883	0.672541	0.73773	0.770111
PYSP	0.004066	0.012307	0.181783	0.571883	0.672541	0.73773	0.770111
QUAG	0.000348	0.003924	0.025888	0.180929	0.77294	1.674429	2.130601
QUCO	0.007575	0.022926	0.333286	0.926246	1.328576	1.404401	1.442066
QUIL	0.000348	0.003924	0.025888	0.180929	0.77294	1.674429	2.130601
QULO	0.001879	0.005687	0.133122	0.513644	1.385555	2.176688	2.508493
QUPA	0.001441	0.017326	0.049238	0.187072	0.455686	0.937898	1.352544
QURO	0.001441	0.017326	0.049238	0.187072	0.455686	0.937898	1.352544
QUSP	0.001441	0.017326	0.049238	0.187072	0.455686	0.937898	1.352544
QUSU	0.000348	0.003924	0.025888	0.180929	0.77294	1.674429	2.130601
QUVI	0.000348	0.003924	0.025888	0.180929	0.77294	1.674429	2.130601
QUWI	0.000348	0.003924	0.025888	0.180929	0.77294	1.674429	2.130601
RHLA	0.004031	0.072748	0.45642	0.45642	0.45642	0.45642	0.45642
ROAM	0.012261	0.077566	0.412096	1.079431	1.209942	1.340881	1.405922
SABA	0.008986	0.03978	0.159615	0.31922	0.621612	0.677771	0.686567
SASE	0.002389	0.024092	0.162789	0.656604	1.169869	1.365412	1.44381
SCMO	0.000663	0.012113	0.045315	0.26585	0.808989	1.414424	1.695479
SESE	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
SOJA	0.00229	0.036378	0.22227	0.767295	0.901847	1.001359	1.05079
TIAM	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
TICO	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
TIEU	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
ULPA	0.001879	0.005687	0.133122	0.513644	1.385555	2.176688	2.508493
ULSP	0.001879	0.005687	0.133122	0.513644	1.385555	2.176688	2.508493
UMCA	0.000348	0.003924	0.025888	0.180929	0.77294	1.674429	2.130601
WAFI	0.007621	0.088727	0.135719	0.135719	0.135719	0.135719	0.135719
WARO	0.007621	0.088727	0.135719	0.135719	0.135719	0.135719	0.135719
WIFL R	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
XYCO	0.004031	0.072748	0.45642	0.45642	0.45642	0.45642	0.45642
ZESE	0.002389	0.024092	0.162789	0.656604	1.169869	1.365412	1.44381
DL OTHER	0.007575	0.022926	0.333286	0.926246	1.328576	1.404401	1.442066
DM OTHER	0.00229	0.036378	0.22227	0.767295	0.901847	1.001359	1.05079
DS OTHER	0.002117	0.039281	0.186167	0.371405	0.556644	0.742491	0.834806
BEL OTHER	0.000348	0.003924	0.025888	0.180929	0.77294	1.674429	2.130601
BEM OTHER	0.000663	0.012113	0.045315	0.26585	0.808989	1.414424	1.695479
BES OTHER	0.004031	0.072748	0.45642	0.45642	0.45642	0.45642	0.45642
CL OTHER	0.00254	0.032016	0.181213	0.788424	1.273325	1.717494	1.938127
CM OTHER	0.00254	0.065546	0.360549	0.637763	0.637763	0.637763	0.637763
CS OTHER	0.007621	0.088727	0.135719	0.135719	0.135719	0.135719	0.135719

AVERAGE VOCS AVOIDED FROM REDUCED ENERGY USE (KG/TREE)

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
ACBU	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
ACCA	9.25E-06	2.8E-05	0.000238	0.000343	0.000289	0.000289	0.000289
ACNE	4.71E-06	0.000122	0.000364	0.00059	0.000784	0.000995	0.00107
ACPA	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
ACPS	2.61E-05	9.6E-05	0.0003	0.000528	0.000681	0.000691	0.000688
ACRU	2.61E-05	9.6E-05	0.0003	0.000528	0.000681	0.000691	0.000688
ACSA	4.71E-06	0.000122	0.000364	0.00059	0.000784	0.000995	0.00107
AECA 1	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
AIAL	1.18E-05	7.17E-05	0.000278	0.000346	0.000289	0.000289	0.000289
ALCO	9.25E-06	2.8E-05	0.000238	0.000343	0.000289	0.000289	0.000289
ALJU	0	9.75E-06	3.02E-05	9.64E-05	0.000317	0.000531	0.000628
ALRH	9.25E-06	2.8E-05	0.000238	0.000343	0.000289	0.000289	0.000289
ARUN	2.14E-05	0.000213	0.0005	0.0005	0.0005	0.0005	0.0005
BENI	4E-05	0.000198	0.000397	0.000375	0.000536	0.000697	0.000778
BEPA	4E-05	0.000198	0.000397	0.000375	0.000536	0.000697	0.000778
BEPE	4E-05	0.000198	0.000397	0.000375	0.000536	0.000697	0.000778
CABE	9.25E-06	2.8E-05	0.000238	0.000343	0.000289	0.000289	0.000289
CABE F	9.25E-06	2.8E-05	0.000238	0.000343	0.000289	0.000289	0.000289
CACA	9.25E-06	2.8E-05	0.000238	0.000343	0.000289	0.000289	0.000289
CACU	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
CADE	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
CASP	4.71E-06	0.000122	0.000364	0.00059	0.000784	0.000995	0.00107
CEAT	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
CEAU	2.41E-05	0.000106	0.000435	0.000696	0.000906	0.001172	0.001319
CECA	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
CEDE	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
CEOC	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
CEOC1	2.09E-05	6.33E-05	0.000342	0.00054	0.000681	0.00069	0.000687
CESI	2.09E-05	6.33E-05	0.000342	0.00054	0.000681	0.00069	0.000687
CESI 1	6.02E-06	5.92E-05	0.000204	0.000391	0.00058	0.00076	0.00085
CESP	2.09E-05	6.33E-05	0.000342	0.00054	0.000681	0.00069	0.000687
CICA	6.02E-06	5.92E-05	0.000204	0.000391	0.00058	0.00076	0.00085
CISP	2.14E-05	0.000213	0.0005	0.0005	0.0005	0.0005	0.0005
CRSP	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
CYRE	1.32E-05	7.97E-05	0.000154	0.000154	0.000154	0.000154	0.000154
DIKA	9.25E-06	2.8E-05	0.000238	0.000343	0.000289	0.000289	0.000289
ERDE	2.14E-05	0.000213	0.0005	0.0005	0.0005	0.0005	0.0005
EUPO	1.71E-06	2.64E-05	0.000186	0.000345	0.000509	0.001069	0.001411
EUSI R	1.71E-06	2.64E-05	0.000186	0.000345	0.000509	0.001069	0.001411
EUSP	1.71E-06	2.64E-05	0.000186	0.000345	0.000509	0.001069	0.001411
FICA	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
FRHO M	2.61E-05	9.6E-05	0.0003	0.000528	0.000681	0.000691	0.000688
FROX R	2.43E-05	0.000116	0.000504	0.001402	0.002718	0.004039	0.004695
FRSP	3.11E-05	9.84E-05	0.000225	0.000394	0.000369	0.000385	0.000445
FRUH	3.11E-05	9.84E-05	0.000225	0.000394	0.000369	0.000385	0.000445

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
FRVE	2.61E-05	0.000113	0.000444	0.000638	0.000692	0.000686	0.000683
FRVE G	2.61E-05	0.000113	0.000444	0.000638	0.000692	0.000686	0.000683
GIBI	2.84E-07	1.16E-06	7.01E-05	0.00023	0.000307	0.000377	0.000418
GLTR	0	9.75E-06	3.02E-05	9.64E-05	0.000317	0.000531	0.000628
JUHI	2.09E-05	6.33E-05	0.000342	0.00054	0.000681	0.00069	0.000687
JURE	2.09E-05	6.33E-05	0.000342	0.00054	0.000681	0.00069	0.000687
JUSP 1	1.32E-05	7.97E-05	0.000154	0.000154	0.000154	0.000154	0.000154
KOPA	4.73E-05	0.000199	0.000398	0.000356	0.000374	0.000464	0.000509
LAIN	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
LANO	6.02E-06	5.92E-05	0.000204	0.000391	0.00058	0.00076	0.00085
LIDE	1.71E-06	2.64E-05	0.000186	0.000345	0.000509	0.001069	0.001411
LILU	2.14E-05	0.000213	0.0005	0.0005	0.0005	0.0005	0.0005
LIST	0	1.46E-05	4.59E-05	0.000171	0.000399	0.000597	0.000692
LITU	0	1.46E-05	4.59E-05	0.000171	0.000399	0.000597	0.000692
MABO	6.02E-06	5.92E-05	0.000204	0.000391	0.00058	0.00076	0.00085
MAFL	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
MAGR	9.66E-06	0.000156	0.000405	0.00074	0.001071	0.001404	0.001569
MASO	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
MASP	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
MASP 1	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
MEAZ	4.73E-05	0.000199	0.000398	0.000356	0.000374	0.000464	0.000509
MEGL	0	1.46E-05	4.59E-05	0.000171	0.000399	0.000597	0.000692
MELI	6.02E-06	5.92E-05	0.000204	0.000391	0.00058	0.00076	0.00085
MOAL	2.61E-05	9.6E-05	0.0003	0.000528	0.000681	0.000691	0.000688
OLEU	6.02E-06	5.92E-05	0.000204	0.000391	0.00058	0.00076	0.00085
PEAM	9.66E-06	0.000156	0.000405	0.00074	0.001071	0.001404	0.001569
PHCA	1.32E-05	7.97E-05	0.000154	0.000154	0.000154	0.000154	0.000154
PIBR	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
PICA	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
PICH	1.18E-05	7.17E-05	0.000278	0.000346	0.000289	0.000289	0.000289
PIHA	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
PIMU	1.32E-05	7.97E-05	0.000154	0.000154	0.000154	0.000154	0.000154
PINI	1.95E-05	0.000163	0.000321	0.000717	0.000717	0.000717	0.000717
PIPI	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
PIPO	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
PIPU	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
PIRA	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
PISP	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
PITH	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
PLAC	2.09E-05	6.33E-05	0.000342	0.000564	0.000693	0.000685	0.000681
PLRA	2.09E-05	6.33E-05	0.000342	0.000564	0.000693	0.000685	0.000681
PODE	2.09E-05	6.33E-05	0.000342	0.00054	0.000681	0.00069	0.000687
PRAM	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
PRAR	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
PRAV	1.18E-05	7.17E-05	0.000278	0.000346	0.000289	0.000289	0.000289
PRCE	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
PRSP	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
PRSU	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
PTST	2.09E-05	6.33E-05	0.000342	0.00054	0.000681	0.00069	0.000687
PUGR	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
PYCA	9.25E-06	2.8E-05	0.000238	0.000343	0.000289	0.000289	0.000289
PYCA A	9.25E-06	2.8E-05	0.000238	0.000343	0.000289	0.000289	0.000289
PYCA B	9.25E-06	2.8E-05	0.000238	0.000343	0.000289	0.000289	0.000289
PYSP	9.25E-06	2.8E-05	0.000238	0.000343	0.000289	0.000289	0.000289
QUAG	1.71E-06	2.64E-05	0.000186	0.000345	0.000509	0.001069	0.001411
QUCO	2.09E-05	6.33E-05	0.000342	0.000564	0.000693	0.000685	0.000681
QUIL	1.71E-06	2.64E-05	0.000186	0.000345	0.000509	0.001069	0.001411
QULO	2.09E-05	6.33E-05	0.000342	0.00054	0.000681	0.00069	0.000687
QUPA	4.71E-06	0.000122	0.000364	0.00059	0.000784	0.000995	0.00107
QURO	4.71E-06	0.000122	0.000364	0.00059	0.000784	0.000995	0.00107
QUSP	4.71E-06	0.000122	0.000364	0.00059	0.000784	0.000995	0.00107
QUSU	1.71E-06	2.64E-05	0.000186	0.000345	0.000509	0.001069	0.001411
QUVI	1.71E-06	2.64E-05	0.000186	0.000345	0.000509	0.001069	0.001411
QUWI	1.71E-06	2.64E-05	0.000186	0.000345	0.000509	0.001069	0.001411
RHLA	2.14E-05	0.000213	0.0005	0.0005	0.0005	0.0005	0.0005
ROAM	2.43E-05	0.000116	0.000504	0.001402	0.002718	0.004039	0.004695
SABA	3.11E-05	9.84E-05	0.000225	0.000394	0.000369	0.000385	0.000445
SASE	2.41E-05	0.000106	0.000435	0.000696	0.000906	0.001172	0.001319
SCMO	6.02E-06	5.92E-05	0.000204	0.000391	0.00058	0.00076	0.00085
SESE	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
SOJA	1.18E-05	7.17E-05	0.000278	0.000346	0.000289	0.000289	0.000289
TIAM	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
TICO	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
TIEU	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
ULPA	2.09E-05	6.33E-05	0.000342	0.00054	0.000681	0.00069	0.000687
ULSP	2.09E-05	6.33E-05	0.000342	0.00054	0.000681	0.00069	0.000687
UMCA	1.71E-06	2.64E-05	0.000186	0.000345	0.000509	0.001069	0.001411
WAFI	1.32E-05	7.97E-05	0.000154	0.000154	0.000154	0.000154	0.000154
WARO	1.32E-05	7.97E-05	0.000154	0.000154	0.000154	0.000154	0.000154
WIFL R	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
XYCO	2.14E-05	0.000213	0.0005	0.0005	0.0005	0.0005	0.0005
ZESE	2.41E-05	0.000106	0.000435	0.000696	0.000906	0.001172	0.001319
DL OTHER	2.09E-05	6.33E-05	0.000342	0.000564	0.000693	0.000685	0.000681
DM OTHER	1.18E-05	7.17E-05	0.000278	0.000346	0.000289	0.000289	0.000289
DS OTHER	3.75E-05	0.000206	0.000258	0.000204	0.00015	9.54E-05	6.85E-05
BEL OTHER	1.71E-06	2.64E-05	0.000186	0.000345	0.000509	0.001069	0.001411
BEM OTHER	6.02E-06	5.92E-05	0.000204	0.000391	0.00058	0.00076	0.00085
BES OTHER	2.14E-05	0.000213	0.0005	0.0005	0.0005	0.0005	0.0005
CL OTHER	1.95E-05	0.000103	0.000369	0.000772	0.001876	0.002997	0.003555
CM OTHER	1.95E-05	0.000163	0.000321	0.000717	0.000717	0.000717	0.000717
CS OTHER	1.32E-05	7.97E-05	0.000154	0.000154	0.000154	0.000154	0.000154

AVERAGE NO_2 AVOIDED FROM REDUCED ENERGY USE (KG/TREE)

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
ACBU	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
ACCA	0.000208	0.000631	0.00537	0.007714	0.00651	0.00651	0.00651
ACNE	0.000106	0.002739	0.008194	0.013284	0.017649	0.022413	0.024101
ACPA	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
ACPS	0.000588	0.002163	0.006765	0.011888	0.015341	0.015565	0.015502
ACRU	0.000588	0.002163	0.006765	0.011888	0.015341	0.015565	0.015502
ACSA	0.000106	0.002739	0.008194	0.013284	0.017649	0.022413	0.024101
AECA 1	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
AIAL	0.000266	0.001614	0.006266	0.007792	0.00651	0.00651	0.00651
ALCO	0.000208	0.000631	0.00537	0.007714	0.00651	0.00651	0.00651
ALJU	0	0.00022	0.000681	0.002172	0.007143	0.011961	0.014136
ALRH	0.000208	0.000631	0.00537	0.007714	0.00651	0.00651	0.00651
ARUN	0.000483	0.004796	0.01127	0.01127	0.01127	0.01127	0.01127
BENI	0.0009	0.004456	0.008933	0.008448	0.012073	0.015709	0.017516
BEPA	0.0009	0.004456	0.008933	0.008448	0.012073	0.015709	0.017516
BEPE	0.0009	0.004456	0.008933	0.008448	0.012073	0.015709	0.017516
CABE	0.000208	0.000631	0.00537	0.007714	0.00651	0.00651	0.00651
CABE F	0.000208	0.000631	0.00537	0.007714	0.00651	0.00651	0.00651
CACA	0.000208	0.000631	0.00537	0.007714	0.00651	0.00651	0.00651
CACU	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
CADE	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
CASP	0.000106	0.002739	0.008194	0.013284	0.017649	0.022413	0.024101
CEAT	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
CEAU	0.000543	0.002382	0.009795	0.01567	0.020403	0.026389	0.029714
CECA	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
CEDE	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
CEOC	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
CEOC1	0.000471	0.001427	0.007713	0.012172	0.015339	0.015545	0.015472
CESI	0.000471	0.001427	0.007713	0.012172	0.015339	0.015545	0.015472
CESI 1	0.000135	0.001332	0.004592	0.008807	0.01306	0.017114	0.019145
CESP	0.000471	0.001427	0.007713	0.012172	0.015339	0.015545	0.015472
CICA	0.000135	0.001332	0.004592	0.008807	0.01306	0.017114	0.019145
CISP	0.000483	0.004796	0.01127	0.01127	0.01127	0.01127	0.01127
CRSP	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
CYRE	0.000298	0.001794	0.003469	0.003469	0.003469	0.003469	0.003469
DIKA	0.000208	0.000631	0.00537	0.007714	0.00651	0.00651	0.00651
ERDE	0.000483	0.004796	0.01127	0.01127	0.01127	0.01127	0.01127
EUPO	3.85E-05	0.000594	0.004191	0.007763	0.011471	0.024075	0.031783
EUSI R	3.85E-05	0.000594	0.004191	0.007763	0.011471	0.024075	0.031783
EUSP	3.85E-05	0.000594	0.004191	0.007763	0.011471	0.024075	0.031783
FICA	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
FRHO M	0.000588	0.002163	0.006765	0.011888	0.015341	0.015565	0.015502
FROX R	0.000548	0.002621	0.011362	0.031575	0.061228	0.090978	0.105755
FRSP	0.0007	0.002216	0.005072	0.008876	0.00832	0.008664	0.01002
FRUH	0.0007	0.002216	0.005072	0.008876	0.00832	0.008664	0.01002

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
FRVE	0.000588	0.002549	0.009991	0.014377	0.015589	0.015452	0.015385
FRVE G	0.000588	0.002549	0.009991	0.014377	0.015589	0.015452	0.015385
GIBI	6.39E-06	2.62E-05	0.001579	0.005182	0.00692	0.008485	0.009425
GLTR	0	0.00022	0.000681	0.002172	0.007143	0.011961	0.014136
JUHI	0.000471	0.001427	0.007713	0.012172	0.015339	0.015545	0.015472
JURE	0.000471	0.001427	0.007713	0.012172	0.015339	0.015545	0.015472
JUSP 1	0.000298	0.001794	0.003469	0.003469	0.003469	0.003469	0.003469
KOPA	0.001065	0.004488	0.008962	0.008025	0.008432	0.01045	0.011453
LAIN	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
LANO	0.000135	0.001332	0.004592	0.008807	0.01306	0.017114	0.019145
LIDE	3.85E-05	0.000594	0.004191	0.007763	0.011471	0.024075	0.031783
LILU	0.000483	0.004796	0.01127	0.01127	0.01127	0.01127	0.01127
LIST	0	0.000329	0.001034	0.003856	0.008982	0.013452	0.015588
LITU	0	0.000329	0.001034	0.003856	0.008982	0.013452	0.015588
MABO	0.000135	0.001332	0.004592	0.008807	0.01306	0.017114	0.019145
MAFL	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
MAGR	0.000217	0.003514	0.009125	0.01666	0.024127	0.031618	0.035339
MASO	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
MASP	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
MASP 1	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
MEAZ	0.001065	0.004488	0.008962	0.008025	0.008432	0.01045	0.011453
MEGL	0	0.000329	0.001034	0.003856	0.008982	0.013452	0.015588
MELI	0.000135	0.001332	0.004592	0.008807	0.01306	0.017114	0.019145
MOAL	0.000588	0.002163	0.006765	0.011888	0.015341	0.015565	0.015502
OLEU	0.000135	0.001332	0.004592	0.008807	0.01306	0.017114	0.019145
PEAM	0.000217	0.003514	0.009125	0.01666	0.024127	0.031618	0.035339
PHCA	0.000298	0.001794	0.003469	0.003469	0.003469	0.003469	0.003469
PIBR	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
PICA	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
PICH	0.000266	0.001614	0.006266	0.007792	0.00651	0.00651	0.00651
PIHA	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
PIMU	0.000298	0.001794	0.003469	0.003469	0.003469	0.003469	0.003469
PINI	0.000438	0.003681	0.007239	0.016154	0.016154	0.016154	0.016154
PIPI	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
PIPO	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
PIPU	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
PIRA	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
PISP	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
PITH	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
PLAC	0.000471	0.001427	0.007713	0.012706	0.015613	0.015428	0.015336
PLRA	0.000471	0.001427	0.007713	0.012706	0.015613	0.015428	0.015336
PODE	0.000471	0.001427	0.007713	0.012172	0.015339	0.015545	0.015472
PRAM	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
PRAR	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
PRAV	0.000266	0.001614	0.006266	0.007792	0.00651	0.00651	0.00651
PRCE	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
PRSP	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
PRSU	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
PTST	0.000471	0.001427	0.007713	0.012172	0.015339	0.015545	0.015472
PUGR	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
PYCA	0.000208	0.000631	0.00537	0.007714	0.00651	0.00651	0.00651
PYCA A	0.000208	0.000631	0.00537	0.007714	0.00651	0.00651	0.00651
PYCA B	0.000208	0.000631	0.00537	0.007714	0.00651	0.00651	0.00651
PYSP	0.000208	0.000631	0.00537	0.007714	0.00651	0.00651	0.00651
QUAG	3.85E-05	0.000594	0.004191	0.007763	0.011471	0.024075	0.031783
QUCO	0.000471	0.001427	0.007713	0.012706	0.015613	0.015428	0.015336
QUIL	3.85E-05	0.000594	0.004191	0.007763	0.011471	0.024075	0.031783
QULO	0.000471	0.001427	0.007713	0.012172	0.015339	0.015545	0.015472
QUPA	0.000106	0.002739	0.008194	0.013284	0.017649	0.022413	0.024101
QURO	0.000106	0.002739	0.008194	0.013284	0.017649	0.022413	0.024101
QUSP	0.000106	0.002739	0.008194	0.013284	0.017649	0.022413	0.024101
QUSU	3.85E-05	0.000594	0.004191	0.007763	0.011471	0.024075	0.031783
QUVI	3.85E-05	0.000594	0.004191	0.007763	0.011471	0.024075	0.031783
QUWI	3.85E-05	0.000594	0.004191	0.007763	0.011471	0.024075	0.031783
RHLA	0.000483	0.004796	0.01127	0.01127	0.01127	0.01127	0.01127
ROAM	0.000548	0.002621	0.011362	0.031575	0.061228	0.090978	0.105755
SABA	0.0007	0.002216	0.005072	0.008876	0.00832	0.008664	0.01002
SASE	0.000543	0.002382	0.009795	0.01567	0.020403	0.026389	0.029714
SCMO	0.000135	0.001332	0.004592	0.008807	0.01306	0.017114	0.019145
SESE	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
SOJA	0.000266	0.001614	0.006266	0.007792	0.00651	0.00651	0.00651
TIAM	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
TICO	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
TIEU	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
ULPA	0.000471	0.001427	0.007713	0.012172	0.015339	0.015545	0.015472
ULSP	0.000471	0.001427	0.007713	0.012172	0.015339	0.015545	0.015472
UMCA	3.85E-05	0.000594	0.004191	0.007763	0.011471	0.024075	0.031783
WAFI	0.000298	0.001794	0.003469	0.003469	0.003469	0.003469	0.003469
WARO	0.000298	0.001794	0.003469	0.003469	0.003469	0.003469	0.003469
WIFL R	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
XYCO	0.000483	0.004796	0.01127	0.01127	0.01127	0.01127	0.01127
ZESE	0.000543	0.002382	0.009795	0.01567	0.020403	0.026389	0.029714
DL OTHER	0.000471	0.001427	0.007713	0.012706	0.015613	0.015428	0.015336
DM OTHER	0.000266	0.001614	0.006266	0.007792	0.00651	0.00651	0.00651
DS OTHER	0.000844	0.00465	0.005936	0.005936	0.005936	0.005936	0.005936
BEL OTHER	3.85E-05	0.000594	0.004191	0.007763	0.011471	0.024075	0.031783
BEM OTHER	0.000135	0.001332	0.004592	0.008807	0.01306	0.017114	0.019145
BES OTHER	0.000483	0.004796	0.01127	0.01127	0.01127	0.01127	0.01127
CL OTHER	0.000438	0.002316	0.008318	0.017383	0.042245	0.067511	0.080062
CM OTHER	0.000438	0.003681	0.007239	0.016154	0.016154	0.016154	0.016154
CS OTHER	0.000298	0.001794	0.003469	0.003469	0.003469	0.003469	0.003469

AVERAGE PM_{10} AVOIDED FROM REDUCED ENERGY USE (KG/TREE)

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
ACBU	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
ACCA	1.28E-05	3.87E-05	0.000329	0.000473	0.000399	0.000399	0.000399
ACNE	0	9.68E-06	3.02E-05	7.56E-05	0.000178	0.000385	0.000489
ACPA	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
ACPS	3.61E-05	0.000133	0.000415	0.000729	0.000941	0.000955	0.000951
ACRU	3.61E-05	0.000133	0.000415	0.000729	0.000941	0.000955	0.000951
ACSA	0	9.68E-06	3.02E-05	7.56E-05	0.000178	0.000385	0.000489
AECA 1	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
AIAL	1.63E-05	9.9E-05	0.000384	0.000478	0.000399	0.000399	0.000399
ALCO	1.28E-05	3.87E-05	0.000329	0.000473	0.000399	0.000399	0.000399
ALJU	0	1.35E-05	4.18E-05	0.000133	0.000438	0.000734	0.000867
ALRH	1.28E-05	3.87E-05	0.000329	0.000473	0.000399	0.000399	0.000399
ARUN	2.96E-05	0.000294	0.000691	0.000691	0.000691	0.000691	0.000691
BENI	5.52E-05	0.000273	0.000548	0.000518	0.000741	0.000964	0.001075
BEPA	5.52E-05	0.000273	0.000548	0.000518	0.000741	0.000964	0.001075
BEPE	5.52E-05	0.000273	0.000548	0.000518	0.000741	0.000964	0.001075
CABE	1.28E-05	3.87E-05	0.000329	0.000473	0.000399	0.000399	0.000399
CABE F	1.28E-05	3.87E-05	0.000329	0.000473	0.000399	0.000399	0.000399
CACA	1.28E-05	3.87E-05	0.000329	0.000473	0.000399	0.000399	0.000399
CACU	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
CADE	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
CASP	0	9.68E-06	3.02E-05	7.56E-05	0.000178	0.000385	0.000489
CEAT	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
CEAU	3.33E-05	0.000146	0.000601	0.000961	0.001252	0.001619	0.001823
CECA	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
CEDE	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
CEOC	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
CEOC1	0	0	2.55E-05	8.06E-05	0.000398	0.001009	0.001305
CESI	0	0	2.55E-05	8.06E-05	0.000398	0.001009	0.001305
CESI 1	8.31E-06	8.17E-05	0.000282	0.00054	0.000801	0.00105	0.001175
CESP	0	0	2.55E-05	8.06E-05	0.000398	0.001009	0.001305
CICA	8.31E-06	8.17E-05	0.000282	0.00054	0.000801	0.00105	0.001175
CISP	2.96E-05	0.000294	0.000691	0.000691	0.000691	0.000691	0.000691
CRSP	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
CYRE	1.83E-05	0.00011	0.000213	0.000213	0.000213	0.000213	0.000213
DIKA	1.28E-05	3.87E-05	0.000329	0.000473	0.000399	0.000399	0.000399
ERDE	2.96E-05	0.000294	0.000691	0.000691	0.000691	0.000691	0.000691
EUPO	2.36E-06	3.65E-05	0.000257	0.000476	0.000704	0.001477	0.00195
EUSI R	2.36E-06	3.65E-05	0.000257	0.000476	0.000704	0.001477	0.00195
EUSP	2.36E-06	3.65E-05	0.000257	0.000476	0.000704	0.001477	0.00195
FICA	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
FRHO M	3.61E-05	0.000133	0.000415	0.000729	0.000941	0.000955	0.000951
FROX R	3.36E-05	0.000161	0.000697	0.001937	0.003756	0.005582	0.006488
FRSP	4.29E-05	0.000136	0.000311	0.000545	0.00051	0.000532	0.000615
FRUH	4.29E-05	0.000136	0.000311	0.000545	0.00051	0.000532	0.000615

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
FRVE	0	4.18E-06	3.49E-05	0.00026	0.000831	0.001384	0.001658
FRVE G	0	4.18E-06	3.49E-05	0.00026	0.000831	0.001384	0.001658
GIBI	3.92E-07	1.61E-06	9.69E-05	0.000318	0.000425	0.000521	0.000578
GLTR	0	1.35E-05	4.18E-05	0.000133	0.000438	0.000734	0.000867
JUHI	0	0	2.55E-05	8.06E-05	0.000398	0.001009	0.001305
JURE	0	0	2.55E-05	8.06E-05	0.000398	0.001009	0.001305
JUSP 1	1.83E-05	0.00011	0.000213	0.000213	0.000213	0.000213	0.000213
KOPA	6.54E-05	0.000275	0.00055	0.000492	0.000517	0.000641	0.000703
LAIN	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
LANO	8.31E-06	8.17E-05	0.000282	0.00054	0.000801	0.00105	0.001175
LIDE	2.36E-06	3.65E-05	0.000257	0.000476	0.000704	0.001477	0.00195
LILU	2.96E-05	0.000294	0.000691	0.000691	0.000691	0.000691	0.000691
LIST	0	2.02E-05	6.34E-05	0.000237	0.000551	0.000825	0.000956
LITU	0	2.02E-05	6.34E-05	0.000237	0.000551	0.000825	0.000956
MABO	8.31E-06	8.17E-05	0.000282	0.00054	0.000801	0.00105	0.001175
MAFL	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
MAGR	1.33E-05	0.000216	0.00056	0.001022	0.00148	0.00194	0.002168
MASO	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
MASP	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
MASP 1	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
MEAZ	6.54E-05	0.000275	0.00055	0.000492	0.000517	0.000641	0.000703
MEGL	0	2.02E-05	6.34E-05	0.000237	0.000551	0.000825	0.000956
MELI	8.31E-06	8.17E-05	0.000282	0.00054	0.000801	0.00105	0.001175
MOAL	3.61E-05	0.000133	0.000415	0.000729	0.000941	0.000955	0.000951
OLEU	8.31E-06	8.17E-05	0.000282	0.00054	0.000801	0.00105	0.001175
PEAM	1.33E-05	0.000216	0.00056	0.001022	0.00148	0.00194	0.002168
PHCA	1.83E-05	0.00011	0.000213	0.000213	0.000213	0.000213	0.000213
PIBR	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
PICA	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
PICH	1.63E-05	9.9E-05	0.000384	0.000478	0.000399	0.000399	0.000399
PIHA	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
PIMU	1.83E-05	0.00011	0.000213	0.000213	0.000213	0.000213	0.000213
PINI	2.69E-05	0.000226	0.000444	0.000991	0.000991	0.000991	0.000991
PIPI	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
PIPO	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
PIPU	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
PIRA	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
PISP	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
PITH	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
PLAC	0	0	2.55E-05	9.81E-05	0.000733	0.001483	0.001855
PLRA	0	0	2.55E-05	9.81E-05	0.000733	0.001483	0.001855
PODE	0	0	2.55E-05	8.06E-05	0.000398	0.001009	0.001305
PRAM	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
PRAR	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
PRAV	1.63E-05	9.9E-05	0.000384	0.000478	0.000399	0.000399	0.000399
PRCE	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
PRSP	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
PRSU	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
PTST	0	0	2.55E-05	8.06E-05	0.000398	0.001009	0.001305
PUGR	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
PYCA	1.28E-05	3.87E-05	0.000329	0.000473	0.000399	0.000399	0.000399
PYCA A	1.28E-05	3.87E-05	0.000329	0.000473	0.000399	0.000399	0.000399
PYCA B	1.28E-05	3.87E-05	0.000329	0.000473	0.000399	0.000399	0.000399
PYSP	1.28E-05	3.87E-05	0.000329	0.000473	0.000399	0.000399	0.000399
QUAG	2.36E-06	3.65E-05	0.000257	0.000476	0.000704	0.001477	0.00195
QUCO	0	0	2.55E-05	9.81E-05	0.000733	0.001483	0.001855
QUIL	2.36E-06	3.65E-05	0.000257	0.000476	0.000704	0.001477	0.00195
QULO	0	0	2.55E-05	8.06E-05	0.000398	0.001009	0.001305
QUPA	0	9.68E-06	3.02E-05	7.56E-05	0.000178	0.000385	0.000489
QURO	0	9.68E-06	3.02E-05	7.56E-05	0.000178	0.000385	0.000489
QUSP	0	9.68E-06	3.02E-05	7.56E-05	0.000178	0.000385	0.000489
QUSU	2.36E-06	3.65E-05	0.000257	0.000476	0.000704	0.001477	0.00195
QUVI	2.36E-06	3.65E-05	0.000257	0.000476	0.000704	0.001477	0.00195
QUWI	2.36E-06	3.65E-05	0.000257	0.000476	0.000704	0.001477	0.00195
RHLA	2.96E-05	0.000294	0.000691	0.000691	0.000691	0.000691	0.000691
ROAM	3.36E-05	0.000161	0.000697	0.001937	0.003756	0.005582	0.006488
SABA	4.29E-05	0.000136	0.000311	0.000545	0.00051	0.000532	0.000615
SASE	3.33E-05	0.000146	0.000601	0.000961	0.001252	0.001619	0.001823
SCMO	8.31E-06	8.17E-05	0.000282	0.00054	0.000801	0.00105	0.001175
SESE	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
SOJA	1.63E-05	9.9E-05	0.000384	0.000478	0.000399	0.000399	0.000399
TIAM	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
TICO	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
TIEU	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
ULPA	0	0	2.55E-05	8.06E-05	0.000398	0.001009	0.001305
ULSP	0	0	2.55E-05	8.06E-05	0.000398	0.001009	0.001305
UMCA	2.36E-06	3.65E-05	0.000257	0.000476	0.000704	0.001477	0.00195
WAFI	1.83E-05	0.00011	0.000213	0.000213	0.000213	0.000213	0.000213
WARO	1.83E-05	0.00011	0.000213	0.000213	0.000213	0.000213	0.000213
WIFL R	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
XYCO	2.96E-05	0.000294	0.000691	0.000691	0.000691	0.000691	0.000691
ZESE	3.33E-05	0.000146	0.000601	0.000961	0.001252	0.001619	0.001823
DL OTHER	0	0	2.55E-05	9.81E-05	0.000733	0.001483	0.001855
DM OTHER	1.63E-05	9.9E-05	0.000384	0.000478	0.000399	0.000399	0.000399
DS OTHER	5.18E-05	0.000285	0.000364	0.000364	0.000364	0.000364	0.000364
BEL OTHER	2.36E-06	3.65E-05	0.000257	0.000476	0.000704	0.001477	0.00195
BEM OTHER	8.31E-06	8.17E-05	0.000282	0.00054	0.000801	0.00105	0.001175
BES OTHER	2.96E-05	0.000294	0.000691	0.000691	0.000691	0.000691	0.000691
CL OTHER	2.69E-05	0.000142	0.00051	0.001066	0.002592	0.004142	0.004912
CM OTHER	2.69E-05	0.000226	0.000444	0.000991	0.000991	0.000991	0.000991
CS OTHER	1.83E-05	0.00011	0.000213	0.000213	0.000213	0.000213	0.000213

AVERAGE ANNUAL CHANGE IN LEAF SURFACE AREA (M^2/TREE)

Species Code	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
ACBU	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
ACCA	2.640531	7.992008	8.555047	1.711367	0.170709	0.170709	0.170709
ACNE	4.395783	8.850837	12.821	17.53045	21.6246	24.83873	25.53604
ACPA	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
ACPS	3.152641	8.761682	12.65752	17.11714	15.22808	7.533792	7.533792
ACRU	3.152641	8.761682	12.65752	17.11714	15.22808	7.533792	7.533792
ACSA	4.395783	8.850837	12.821	17.53045	21.6246	24.83873	25.53604
AECA 1	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
AIAL	2.740532	7.63268	11.58337	2.163893	0.289493	0.289493	0.289493
ALCO	2.640531	7.992008	8.555047	1.711367	0.170709	0.170709	0.170709
ALJU	2.170757	5.088886	8.854251	15.2088	19.85146	19.69245	18.48156
ALRH	2.640531	7.992008	8.555047	1.711367	0.170709	0.170709	0.170709
ARUN	2.30309	3.470775	1.830989	1.830989	1.830989	1.830989	1.830989
BENI	3.345373	6.373125	3.526847	0.210028	0.210028	0.210028	0.210028
BEPA	3.345373	6.373125	3.526847	0.210028	0.210028	0.210028	0.210028
BEPE	3.345373	6.373125	3.526847	0.210028	0.210028	0.210028	0.210028
CABE	2.640531	7.992008	8.555047	1.711367	0.170709	0.170709	0.170709
CABE F	2.640531	7.992008	8.555047	1.711367	0.170709	0.170709	0.170709
CACA	2.640531	7.992008	8.555047	1.711367	0.170709	0.170709	0.170709
CACU	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
CADE	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
CASP	4.395783	8.850837	12.821	17.53045	21.6246	24.83873	25.53604
CEAT	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
CEAU	3.304701	9.416221	14.93965	12.23956	3.423423	0.781161	0.781161
CECA	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
CEDE	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
CEOC	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
CEOC1	3.112991	9.421987	16.88899	19.16651	10.4987	2.639282	2.639282
CESI	3.112991	9.421987	16.88899	19.16651	10.4987	2.639282	2.639282
CESI 1	1.911277	5.199904	9.231289	12.90409	10.48855	5.091515	2.408795
CESP	3.112991	9.421987	16.88899	19.16651	10.4987	2.639282	2.639282
CICA	1.911277	5.199904	9.231289	12.90409	10.48855	5.091515	2.408795
CISP	2.30309	3.470775	1.830989	1.830989	1.830989	1.830989	1.830989
CRSP	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
CYRE	1.538628	0.853943	0.082178	0.082178	0.082178	0.082178	0.082178
DIKA	2.640531	7.992008	8.555047	1.711367	0.170709	0.170709	0.170709
ERDE	2.30309	3.470775	1.830989	1.830989	1.830989	1.830989	1.830989
EUPO	1.201822	3.607	7.05427	11.81526	11.59651	5.728011	2.497052
EUSI R	1.201822	3.607	7.05427	11.81526	11.59651	5.728011	2.497052
EUSP	1.201822	3.607	7.05427	11.81526	11.59651	5.728011	2.497052
FICA	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
FRHO M	3.152641	8.761682	12.65752	17.11714	15.22808	7.533792	7.533792
FROX R	6.475615	16.58919	14.25499	0.12443	0.12443	0.12443	0.12443
FRSP	4.426615	11.42515	10.45425	9.161123	1.470155	0.045661	0.045661
FRUH	4.426615	11.42515	10.45425	9.161123	1.470155	0.045661	0.045661

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
FRVE	2.737491	7.929718	13.67571	11.60202	2.899141	2.899141	2.899141
FRVE G	2.737491	7.929718	13.67571	11.60202	2.899141	2.899141	2.899141
GIBI	1.8254	3.523413	7.929674	21.20326	58.88871	173.3806	248.1562
GLTR	2.170757	5.088886	8.854251	15.2088	19.85146	19.69245	18.48156
JUHI	3.112991	9.421987	16.88899	19.16651	10.4987	2.639282	2.639282
JURE	3.112991	9.421987	16.88899	19.16651	10.4987	2.639282	2.639282
JUSP 1	1.538628	0.853943	0.082178	0.082178	0.082178	0.082178	0.082178
KOPA	1.979	4.58171	6.360116	3.535903	0.854056	0.854056	0.854056
LAIN	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
LANO	1.911277	5.199904	9.231289	12.90409	10.48855	5.091515	2.408795
LIDE	1.201822	3.607	7.05427	11.81526	11.59651	5.728011	2.497052
LILU	2.30309	3.470775	1.830989	1.830989	1.830989	1.830989	1.830989
LIST	3.673601	6.437777	10.73928	17.19349	23.09675	26.13972	27.3843
LITU	3.673601	6.437777	10.73928	17.19349	23.09675	26.13972	27.3843
MABO	1.911277	5.199904	9.231289	12.90409	10.48855	5.091515	2.408795
MAFL	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
MAGR	1.736936	2.97022	3.538853	2.003697	1.830989	1.830989	1.830989
MASO	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
MASP	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
MASP 1	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
MEAZ	1.979	4.58171	6.360116	3.535903	0.854056	0.854056	0.854056
MEGL	3.673601	6.437777	10.73928	17.19349	23.09675	26.13972	27.3843
MELI	1.911277	5.199904	9.231289	12.90409	10.48855	5.091515	2.408795
MOAL	3.152641	8.761682	12.65752	17.11714	15.22808	7.533792	7.533792
OLEU	1.911277	5.199904	9.231289	12.90409	10.48855	5.091515	2.408795
PEAM	1.736936	2.97022	3.538853	2.003697	1.830989	1.830989	1.830989
PHCA	1.538628	0.853943	0.082178	0.082178	0.082178	0.082178	0.082178
PIBR	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
PICA	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
PICH	2.740532	7.63268	11.58337	2.163893	0.289493	0.289493	0.289493
PIHA	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
PIMU	1.538628	0.853943	0.082178	0.082178	0.082178	0.082178	0.082178
PINI	2.890102	6.459155	4.838842	0.550262	0.550262	0.550262	0.550262
PIPI	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
PIPO	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
PIPU	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
PIRA	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
PISP	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
PITH	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
PLAC	5.35076	16.19497	18.69751	9.943232	0.337871	0.174085	0.174085
PLRA	5.35076	16.19497	18.69751	9.943232	0.337871	0.174085	0.174085
PODE	3.112991	9.421987	16.88899	19.16651	10.4987	2.639282	2.639282
PRAM	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
PRAR	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
PRAV	2.740532	7.63268	11.58337	2.163893	0.289493	0.289493	0.289493
PRCE	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
PRSP	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
PRSU	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
PTST	3.112991	9.421987	16.88899	19.16651	10.4987	2.639282	2.639282
PUGR	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
PYCA	2.640531	7.992008	8.555047	1.711367	0.170709	0.170709	0.170709
PYCA A	2.640531	7.992008	8.555047	1.711367	0.170709	0.170709	0.170709
PYCA B	2.640531	7.992008	8.555047	1.711367	0.170709	0.170709	0.170709
PYSP	2.640531	7.992008	8.555047	1.711367	0.170709	0.170709	0.170709
QUAG	1.201822	3.607	7.05427	11.81526	11.59651	5.728011	2.497052
QUCO	5.35076	16.19497	18.69751	9.943232	0.337871	0.174085	0.174085
QUIL	1.201822	3.607	7.05427	11.81526	11.59651	5.728011	2.497052
QULO	3.112991	9.421987	16.88899	19.16651	10.4987	2.639282	2.639282
QUPA	4.395783	8.850837	12.821	17.53045	21.6246	24.83873	25.53604
QURO	4.395783	8.850837	12.821	17.53045	21.6246	24.83873	25.53604
QUSP	4.395783	8.850837	12.821	17.53045	21.6246	24.83873	25.53604
QUSU	1.201822	3.607	7.05427	11.81526	11.59651	5.728011	2.497052
QUVI	1.201822	3.607	7.05427	11.81526	11.59651	5.728011	2.497052
QUWI	1.201822	3.607	7.05427	11.81526	11.59651	5.728011	2.497052
RHLA	2.30309	3.470775	1.830989	1.830989	1.830989	1.830989	1.830989
ROAM	6.475615	16.58919	14.25499	0.12443	0.12443	0.12443	0.12443
SABA	4.426615	11.42515	10.45425	9.161123	1.470155	0.045661	0.045661
SASE	3.304701	9.416221	14.93965	12.23956	3.423423	0.781161	0.781161
SCMO	1.911277	5.199904	9.231289	12.90409	10.48855	5.091515	2.408795
SESE	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
SOJA	2.740532	7.63268	11.58337	2.163893	0.289493	0.289493	0.289493
TIAM	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
TICO	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
TIEU	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
ULPA	3.112991	9.421987	16.88899	19.16651	10.4987	2.639282	2.639282
ULSP	3.112991	9.421987	16.88899	19.16651	10.4987	2.639282	2.639282
UMCA	1.201822	3.607	7.05427	11.81526	11.59651	5.728011	2.497052
WAFI	1.538628	0.853943	0.082178	0.082178	0.082178	0.082178	0.082178
WARO	1.538628	0.853943	0.082178	0.082178	0.082178	0.082178	0.082178
WIFL R	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
XYCO	2.30309	3.470775	1.830989	1.830989	1.830989	1.830989	1.830989
ZESE	3.304701	9.416221	14.93965	12.23956	3.423423	0.781161	0.781161
DL OTHER	5.35076	16.19497	18.69751	9.943232	0.337871	0.174085	0.174085
DM OTHER	2.740532	7.63268	11.58337	2.163893	0.289493	0.289493	0.289493
DS OTHER	1.102906	1.390874	0.403837	0.403837	0.403837	0.403837	0.403837
BEL OTHER	1.201822	3.607	7.05427	11.81526	11.59651	5.728011	2.497052
BEM OTHER	1.911277	5.199904	9.231289	12.90409	10.48855	5.091515	2.408795
BES OTHER	2.30309	3.470775	1.830989	1.830989	1.830989	1.830989	1.830989
CL OTHER	2.890102	7.785271	11.05487	3.525605	0.825393	0.825393	0.825393
CM OTHER	2.890102	6.459155	4.838842	0.550262	0.550262	0.550262	0.550262
CS OTHER	1.538628	0.853943	0.082178	0.082178	0.082178	0.082178	0.082178

TOTAL AVERAGE ANNUAL PRECIPITATION INTERCEPTION (M^3/TREE)

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
ACBU	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
ACCA	0.096153	0.291024	1.10109	2.296853	2.523135	2.652216	2.716335
ACNE	0.1536	0.522696	1.114352	2.267056	3.909847	6.189409	6.984464
ACPA	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
ACPS	0.098549	0.355016	1.072595	2.573855	4.940527	6.80215	7.647203
ACRU	0.098549	0.355016	1.072595	2.573855	4.940527	6.80215	7.647203
ACSA	0.1536	0.522696	1.114352	2.267056	3.909847	6.189409	6.984464
AECA 1	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
AIAL	0.08247	0.388576	1.394676	2.879152	3.289002	3.592291	3.742945
ALCO	0.096153	0.291024	1.10109	2.296853	2.523135	2.652216	2.716335
ALJU	0.07355	0.302974	0.71397	1.968198	4.329076	6.440342	7.314466
ALRH	0.096153	0.291024	1.10109	2.296853	2.523135	2.652216	2.716335
ARUN	0.259044	1.275122	3.8852	3.8852	3.8852	3.8852	3.8852
BENI	0.137778	0.550775	1.267058	1.561874	1.685297	1.809124	1.870633
BEPA	0.137778	0.550775	1.267058	1.561874	1.685297	1.809124	1.870633
BEPE	0.137778	0.550775	1.267058	1.561874	1.685297	1.809124	1.870633
CABE	0.096153	0.291024	1.10109	2.296853	2.523135	2.652216	2.716335
CABE F	0.096153	0.291024	1.10109	2.296853	2.523135	2.652216	2.716335
CACA	0.096153	0.291024	1.10109	2.296853	2.523135	2.652216	2.716335
CACU	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
CADE	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
CASP	0.1536	0.522696	1.114352	2.267056	3.909847	6.189409	6.984464
CEAT	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
CEAU	0.099701	0.386952	1.355281	3.20167	4.788958	5.302496	5.502228
CECA	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
CEDE	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
CEOC	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
CEOC1	0.110505	0.334463	1.519478	3.642471	6.482876	8.391317	9.289173
CESI	0.110505	0.334463	1.519478	3.642471	6.482876	8.391317	9.289173
CESI 1	0.154449	0.644498	1.662223	4.872895	9.397215	12.83434	14.29377
CESP	0.110505	0.334463	1.519478	3.642471	6.482876	8.391317	9.289173
CICA	0.154449	0.644498	1.662223	4.872895	9.397215	12.83434	14.29377
CISP	0.259044	1.275122	3.8852	3.8852	3.8852	3.8852	3.8852
CRSP	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
CYRE	0.270492	1.442633	1.8858	1.8858	1.8858	1.8858	1.8858
DIKA	0.096153	0.291024	1.10109	2.296853	2.523135	2.652216	2.716335
ERDE	0.259044	1.275122	3.8852	3.8852	3.8852	3.8852	3.8852
EUPO	0.089971	0.341635	1.121332	3.641734	9.316114	14.38102	16.6695
EUSI R	0.089971	0.341635	1.121332	3.641734	9.316114	14.38102	16.6695
EUSP	0.089971	0.341635	1.121332	3.641734	9.316114	14.38102	16.6695
FICA	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
FRHO M	0.098549	0.355016	1.072595	2.573855	4.940527	6.80215	7.647203
FROX R	0.239996	0.833269	2.350948	3.604382	3.726698	3.849416	3.910374
FRSP	0.155618	0.469891	0.936871	1.558832	2.34618	2.522388	2.545133
FRUH	0.155618	0.469891	0.936871	1.558832	2.34618	2.522388	2.545133

Species Code	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
FRVE	0.086369	0.348671	1.253179	3.921045	5.359994	5.471996	5.527632
FRVE G	0.086369	0.348671	1.253179	3.921045	5.359994	5.471996	5.527632
GIBI	0.100727	0.289362	0.844363	2.10177	4.39576	6.184375	6.85667
GLTR	0.07355	0.302974	0.71397	1.968198	4.329076	6.440342	7.314466
JUHI	0.110505	0.334463	1.519478	3.642471	6.482876	8.391317	9.289173
JURE	0.110505	0.334463	1.519478	3.642471	6.482876	8.391317	9.289173
JUSP 1	0.270492	1.442633	1.8858	1.8858	1.8858	1.8858	1.8858
KOPA	0.061871	0.298481	0.823084	1.904296	2.356636	2.592478	2.709628
LAIN	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
LANO	0.154449	0.644498	1.662223	4.872895	9.397215	12.83434	14.29377
LIDE	0.089971	0.341635	1.121332	3.641734	9.316114	14.38102	16.6695
LILU	0.259044	1.275122	3.8852	3.8852	3.8852	3.8852	3.8852
LIST	0.095026	0.440513	1.136032	2.589376	4.682264	7.17812	8.434221
LITU	0.095026	0.440513	1.136032	2.589376	4.682264	7.17812	8.434221
MABO	0.154449	0.644498	1.662223	4.872895	9.397215	12.83434	14.29377
MAFL	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
MAGR	0.161073	0.627523	1.653377	3.720781	5.692253	7.670189	8.652694
MASO	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
MASP	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
MASP 1	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
MEAZ	0.061871	0.298481	0.823084	1.904296	2.356636	2.592478	2.709628
MEGL	0.095026	0.440513	1.136032	2.589376	4.682264	7.17812	8.434221
MELI	0.154449	0.644498	1.662223	4.872895	9.397215	12.83434	14.29377
MOAL	0.098549	0.355016	1.072595	2.573855	4.940527	6.80215	7.647203
OLEU	0.154449	0.644498	1.662223	4.872895	9.397215	12.83434	14.29377
PEAM	0.161073	0.627523	1.653377	3.720781	5.692253	7.670189	8.652694
PHCA	0.270492	1.442633	1.8858	1.8858	1.8858	1.8858	1.8858
PIBR	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
PICA	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
PICH	0.08247	0.388576	1.394676	2.879152	3.289002	3.592291	3.742945
PIHA	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
PIMU	0.270492	1.442633	1.8858	1.8858	1.8858	1.8858	1.8858
PINI	0.201785	1.138231	2.931706	3.799867	3.799867	3.799867	3.799867
PIPI	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
PIPO	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
PIPU	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
PIRA	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
PISP	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
PITH	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
PLAC	0.18348	0.555333	2.009139	3.997565	5.045724	5.219066	5.305171
PLRA	0.18348	0.555333	2.009139	3.997565	5.045724	5.219066	5.305171
PODE	0.110505	0.334463	1.519478	3.642471	6.482876	8.391317	9.289173
PRAM	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
PRAR	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
PRAV	0.08247	0.388576	1.394676	2.879152	3.289002	3.592291	3.742945
PRCE	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
PRSP	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
PRSU	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
PTST	0.110505	0.334463	1.519478	3.642471	6.482876	8.391317	9.289173
PUGR	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
PYCA	0.096153	0.291024	1.10109	2.296853	2.523135	2.652216	2.716335
PYCA A	0.096153	0.291024	1.10109	2.296853	2.523135	2.652216	2.716335
PYCA B	0.096153	0.291024	1.10109	2.296853	2.523135	2.652216	2.716335
PYSP	0.096153	0.291024	1.10109	2.296853	2.523135	2.652216	2.716335
QUAG	0.089971	0.341635	1.121332	3.641734	9.316114	14.38102	16.6695
QUCO	0.18348	0.555333	2.009139	3.997565	5.045724	5.219066	5.305171
QUIL	0.089971	0.341635	1.121332	3.641734	9.316114	14.38102	16.6695
QULO	0.110505	0.334463	1.519478	3.642471	6.482876	8.391317	9.289173
QUPA	0.1536	0.522696	1.114352	2.267056	3.909847	6.189409	6.984464
QURO	0.1536	0.522696	1.114352	2.267056	3.909847	6.189409	6.984464
QUSP	0.1536	0.522696	1.114352	2.267056	3.909847	6.189409	6.984464
QUSU	0.089971	0.341635	1.121332	3.641734	9.316114	14.38102	16.6695
QUVI	0.089971	0.341635	1.121332	3.641734	9.316114	14.38102	16.6695
QUWI	0.089971	0.341635	1.121332	3.641734	9.316114	14.38102	16.6695
RHLA	0.259044	1.275122	3.8852	3.8852	3.8852	3.8852	3.8852
ROAM	0.239996	0.833269	2.350948	3.604382	3.726698	3.849416	3.910374
SABA	0.155618	0.469891	0.936871	1.558832	2.34618	2.522388	2.545133
SASE	0.099701	0.386952	1.355281	3.20167	4.788958	5.302496	5.502228
SCMO	0.154449	0.644498	1.662223	4.872895	9.397215	12.83434	14.29377
SESE	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
SOJA	0.08247	0.388576	1.394676	2.879152	3.289002	3.592291	3.742945
TIAM	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
TICO	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
TIEU	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
ULPA	0.110505	0.334463	1.519478	3.642471	6.482876	8.391317	9.289173
ULSP	0.110505	0.334463	1.519478	3.642471	6.482876	8.391317	9.289173
UMCA	0.089971	0.341635	1.121332	3.641734	9.316114	14.38102	16.6695
WAFI	0.270492	1.442633	1.8858	1.8858	1.8858	1.8858	1.8858
WARO	0.270492	1.442633	1.8858	1.8858	1.8858	1.8858	1.8858
WIFL R	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
XYCO	0.259044	1.275122	3.8852	3.8852	3.8852	3.8852	3.8852
ZESE	0.099701	0.386952	1.355281	3.20167	4.788958	5.302496	5.502228
DL OTHER	0.18348	0.555333	2.009139	3.997565	5.045724	5.219066	5.305171
DM OTHER	0.08247	0.388576	1.394676	2.879152	3.289002	3.592291	3.742945
DS OTHER	0.05309	0.249807	0.672502	1.243113	1.813724	2.386206	2.670576
BEL OTHER	0.089971	0.341635	1.121332	3.641734	9.316114	14.38102	16.6695
BEM OTHER	0.154449	0.644498	1.662223	4.872895	9.397215	12.83434	14.29377
BES OTHER	0.259044	1.275122	3.8852	3.8852	3.8852	3.8852	3.8852
CL OTHER	0.201785	0.832525	2.593705	5.236498	6.529726	7.69376	8.271974
CM OTHER	0.201785	1.138231	2.931706	3.799867	3.799867	3.799867	3.799867
CS OTHER	0.270492	1.442633	1.8858	1.8858	1.8858	1.8858	1.8858

TOTAL AVERAGE LEAF SURFACE AREA (M^2/TREE)

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
ACBU	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
ACCA	8.939049	27.05552	108.1874	206.3978	224.8558	236.5385	242.3416
ACNE	14.73344	51.60248	111.4635	226.6295	374.6197	561.8372	673.4389
ACPA	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
ACPS	10.28915	35.33819	97.57037	202.6348	371.4141	562.0155	649.3533
ACRU	10.28915	35.33819	97.57037	202.6348	371.4141	562.0155	649.3533
ACSA	14.73344	51.60248	111.4635	226.6295	374.6197	561.8372	673.4389
AECA 1	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
AIAL	8.541116	39.6562	140.2244	275.1662	299.7027	317.5719	326.4482
ALCO	8.939049	27.05552	108.1874	206.3978	224.8558	236.5385	242.3416
ALJU	7.110773	31.65224	76.24425	206.0608	425.7378	703.8562	847.5689
ALRH	8.939049	27.05552	108.1874	206.3978	224.8558	236.5385	242.3416
ARUN	10.4606	56.74448	164.308	297.8659	431.4238	565.4195	631.9795
BENI	12.32473	49.51773	122.6407	163.5793	178.19	192.8487	200.1301
BEPA	12.32473	49.51773	122.6407	163.5793	178.19	192.8487	200.1301
BEPE	12.32473	49.51773	122.6407	163.5793	178.19	192.8487	200.1301
CABE	8.939049	27.05552	108.1874	206.3978	224.8558	236.5385	242.3416
CABE F	8.939049	27.05552	108.1874	206.3978	224.8558	236.5385	242.3416
CACA	8.939049	27.05552	108.1874	206.3978	224.8558	236.5385	242.3416
CACU	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
CADE	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
CASP	14.73344	51.60248	111.4635	226.6295	374.6197	561.8372	673.4389
CEAT	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
CEAU	10.31762	39.63582	136.6635	307.9326	420.5834	456.5572	470.7106
CECA	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
CEDE	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
CEOC	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
CEOC1	9.891796	29.93917	142.5	314.6307	553.1365	704.4644	765.2253
CESI	9.891796	29.93917	142.5	314.6307	553.1365	704.4644	765.2253
CESI 1	6.075955	27.97504	76.09682	199.366	359.6454	485.5736	538.8761
CESP	9.891796	29.93917	142.5	314.6307	553.1365	704.4644	765.2253
CICA	6.075955	27.97504	76.09682	199.366	359.6454	485.5736	538.8761
CISP	10.4606	56.74448	164.308	297.8659	431.4238	565.4195	631.9795
CRSP	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
CYRE	8.154756	36.8549	59.99549	84.16683	108.3382	132.5888	144.6348
DIKA	8.939049	27.05552	108.1874	206.3978	224.8558	236.5385	242.3416
ERDE	10.4606	56.74448	164.308	297.8659	431.4238	565.4195	631.9795
EUPO	3.84892	15.42713	54.69796	163.1577	354.5668	542.5131	631.1115
EUSI R	3.84892	15.42713	54.69796	163.1577	354.5668	542.5131	631.1115
EUSP	3.84892	15.42713	54.69796	163.1577	354.5668	542.5131	631.1115
FICA	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
FRHO M	10.28915	35.33819	97.57037	202.6348	371.4141	562.0155	649.3533
FROX R	21.88623	68.69751	153.5531	268.6958	346.8989	358.2822	361.5055
FRSP	15.09292	52.00872	144.5583	232.1638	241.4196	250.7056	255.3183
FRUH	15.09292	52.00872	144.5583	232.1638	241.4196	250.7056	255.3183

Species Code	DBH Class (cm [in])						
	0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
FRVE	8.768109	29.23955	75.84929	137.9278	368.4108	545.3441	611.8707
FRVE G	8.768109	29.23955	75.84929	137.9278	368.4108	545.3441	611.8707
GIBI	10.15928	27.93943	76.66322	215.25	581.9628	1626.455	2302.286
GLTR	7.110773	31.65224	76.24425	206.0608	425.7378	703.8562	847.5689
JUHI	9.891796	29.93917	142.5	314.6307	553.1365	704.4644	765.2253
JURE	9.891796	29.93917	142.5	314.6307	553.1365	704.4644	765.2253
JUSP 1	8.154756	36.8549	59.99549	84.16683	108.3382	132.5888	144.6348
KOPA	6.459876	31.36492	85.79876	176.7321	218.4436	249.178	264.4448
LAIN	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
LANO	6.075955	27.97504	76.09682	199.366	359.6454	485.5736	538.8761
LIDE	3.84892	15.42713	54.69796	163.1577	354.5668	542.5131	631.1115
LILU	10.4606	56.74448	164.308	297.8659	431.4238	565.4195	631.9795
LIST	12.50209	47.23358	118.7189	282.7316	541.8232	887.8081	1065.626
LITU	12.50209	47.23358	118.7189	282.7316	541.8232	887.8081	1065.626
MABO	6.075955	27.97504	76.09682	199.366	359.6454	485.5736	538.8761
MAFL	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
MAGR	6.27554	27.29841	73.75275	149.9597	217.0204	284.3011	317.7215
MASO	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
MASP	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
MASP 1	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
MEAZ	6.459876	31.36492	85.79876	176.7321	218.4436	249.178	264.4448
MEGL	12.50209	47.23358	118.7189	282.7316	541.8232	887.8081	1065.626
MELI	6.075955	27.97504	76.09682	199.366	359.6454	485.5736	538.8761
MOAL	10.28915	35.33819	97.57037	202.6348	371.4141	562.0155	649.3533
OLEU	6.075955	27.97504	76.09682	199.366	359.6454	485.5736	538.8761
PEAM	6.27554	27.29841	73.75275	149.9597	217.0204	284.3011	317.7215
PHCA	8.154756	36.8549	59.99549	84.16683	108.3382	132.5888	144.6348
PIBR	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
PICA	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
PICH	8.541116	39.6562	140.2244	275.1662	299.7027	317.5719	326.4482
PIHA	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
PIMU	8.154756	36.8549	59.99549	84.16683	108.3382	132.5888	144.6348
PINI	7.755844	42.34931	107.2702	167.4778	211.2394	255.1445	276.9536
PIPI	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
PIPO	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
PIPU	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
PIRA	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
PISP	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
PITH	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
PLAC	17.12377	51.82796	196.5914	372.5658	453.8536	467.4032	474.1337
PLRA	17.12377	51.82796	196.5914	372.5658	453.8536	467.4032	474.1337
PODE	9.891796	29.93917	142.5	314.6307	553.1365	704.4644	765.2253
PRAM	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
PRAR	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246

Species Code	DBH Class (cm [in]) 0-7.5 (0-3)	7.6-15.1 (3-6)	15.2-30.4 (6-12)	30.5-45.6 (12-18)	45.7-60.9 (18-24)	61.0-76.2 (24-30)	>76.2 (>30)
PRAV	8.541116	39.6562	140.2244	275.1662	299.7027	317.5719	326.4482
PRCE	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
PRSP	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
PRSU	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
PTST	9.891796	29.93917	142.5	314.6307	553.1365	704.4644	765.2253
PUGR	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
PYCA	8.939049	27.05552	108.1874	206.3978	224.8558	236.5385	242.3416
PYCA A	8.939049	27.05552	108.1874	206.3978	224.8558	236.5385	242.3416
PYCA B	8.939049	27.05552	108.1874	206.3978	224.8558	236.5385	242.3416
PYSP	8.939049	27.05552	108.1874	206.3978	224.8558	236.5385	242.3416
QUAG	3.84892	15.42713	54.69796	163.1577	354.5668	542.5131	631.1115
QUCO	17.12377	51.82796	196.5914	372.5658	453.8536	467.4032	474.1337
QUIL	3.84892	15.42713	54.69796	163.1577	354.5668	542.5131	631.1115
QULO	9.891796	29.93917	142.5	314.6307	553.1365	704.4644	765.2253
QUPA	14.73344	51.60248	111.4635	226.6295	374.6197	561.8372	673.4389
QURO	14.73344	51.60248	111.4635	226.6295	374.6197	561.8372	673.4389
QUSP	14.73344	51.60248	111.4635	226.6295	374.6197	561.8372	673.4389
QUSU	3.84892	15.42713	54.69796	163.1577	354.5668	542.5131	631.1115
QUVI	3.84892	15.42713	54.69796	163.1577	354.5668	542.5131	631.1115
QUWI	3.84892	15.42713	54.69796	163.1577	354.5668	542.5131	631.1115
RHLA	10.4606	56.74448	164.308	297.8659	431.4238	565.4195	631.9795
ROAM	21.88623	68.69751	153.5531	268.6958	346.8989	358.2822	361.5055
SABA	15.09292	52.00872	144.5583	232.1638	241.4196	250.7056	255.3183
SASE	10.31762	39.63582	136.6635	307.9326	420.5834	456.5572	470.7106
SCMO	6.075955	27.97504	76.09682	199.366	359.6454	485.5736	538.8761
SESE	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
SOJA	8.541116	39.6562	140.2244	275.1662	299.7027	317.5719	326.4482
TIAM	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
TICO	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
TIEU	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
ULPA	9.891796	29.93917	142.5	314.6307	553.1365	704.4644	765.2253
ULSP	9.891796	29.93917	142.5	314.6307	553.1365	704.4644	765.2253
UMCA	3.84892	15.42713	54.69796	163.1577	354.5668	542.5131	631.1115
WAFI	8.154756	36.8549	59.99549	84.16683	108.3382	132.5888	144.6348
WARO	8.154756	36.8549	59.99549	84.16683	108.3382	132.5888	144.6348
WIFL R	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
XYCO	10.4606	56.74448	164.308	297.8659	431.4238	565.4195	631.9795
ZESE	10.31762	39.63582	136.6635	307.9326	420.5834	456.5572	470.7106
DL OTHER	17.12377	51.82796	196.5914	372.5658	453.8536	467.4032	474.1337
DM OTHER	8.541116	39.6562	140.2244	275.1662	299.7027	317.5719	326.4482
DS OTHER	4.892584	25.59037	60.23232	94.69967	129.167	163.7474	180.9246
BEL OTHER	3.84892	15.42713	54.69796	163.1577	354.5668	542.5131	631.1115
BEM OTHER	6.075955	27.97504	76.09682	199.366	359.6454	485.5736	538.8761
BES OTHER	10.4606	56.74448	164.308	297.8659	431.4238	565.4195	631.9795
CL OTHER	9.517045	40.89154	133.2966	294.3126	383.4787	464.0501	504.0724
CM OTHER	7.755844	42.34931	107.2702	167.4778	211.2394	255.1445	276.9536
CS OTHER	8.154756	36.8549	59.99549	84.16683	108.3382	132.5888	144.6348