Carmel-by-the-Sea, CA

Community Tree Resource Analysis

2023

Davey Resource Group

Carmel-by-the-Sea, CA

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

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Executive Summary

Community trees are trees in the public rights-of-way, including trees along streets, in medians, and in parks. They provide numerous tangible and intangible benefits to residents, visitors, and neighboring communities. The City recognizes that trees are a valued resource, a critical component of the urban infrastructure, and a significant part of the community's identity.

In 2023, the City of Carmel-by-the-Sea contracted with Davey Resource Group, Inc. (DRG) to conduct an inventory of most community trees[1]. The tree inventory data was used in conjunction with i-Tree *Eco* benefit-cost modeling software to develop a detailed and quantified analysis of the current structure, function, benefits, and value of the community tree resource. This report details the results of that analysis. It is important to note that this analysis does not consider private trees.

Structure

A structural analysis is the first step towards understanding the benefits provided by community trees as well as their management needs. Carmel-by-the-Sea's community tree inventory includes 9,875 trees, 484 vacant sites, and 634 stumps. Considering species composition, diversity, and age distribution The following information characterizes Carmel-by-the-Sea's existing community tree inventory:

- 200 unique tree species are represented.
- The top three most prevalent species are California natives; *Quercus agrifolia* (coast live oak, 40.2%), *Pinus radiata* (Monterey pine, 18.1%), and *Cupressus macrocarpa* (Monterey cypress, 8.7%). These species account for 67% of the community tree resource.
- 47% of trees are 8 inches in diameter (DBH[2]) or less and 12.1% of trees are larger than 24 inches in diameter.
- 91% of trees are in fair or better condition.
- 475 (4.8%) trees are recommended for removal.
- Community trees are estimated to provide 80 acres of canopy cover, which is nearly 12% of all land cover.
- To date, Carmel-by-the-Sea's trees are storing 4,412 tons of carbon in woody and foliar biomass.
- To replace Carmel-by-the-Sea's 9,875 community trees with trees of equivalent size, species, and condition, would cost over $25.2 million.
- Approximately 79.5% of trees are at risk to pests and pathogens, including sudden oak death, polyphagous shot hole borer, gold spotted oak borer, and defoliating moths.
- Carmel-by-the-Sea's community tree stocking level is nearly 90%.

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[1] Some community trees on the east side of the city are not included in the current inventory.

[2] DBH: Diameter at Breast Height. DBH represents the diameter of the tree when measured at 1.4 meters (4.5 feet) above ground (U.S.A. standard).

Benefits

Many of the benefits from urban trees cannot be accurately quantified with current formulas and peer-reviewed consensus. Numerous studies indicate that urban trees provide a multitude of critical benefits to natural ecosystems, economies, and human health and welfare. Currently, i-Tree *Eco* is limited to quantifying the benefits from trees to air quality, stormwater runoff reduction, carbon sequestration, and energy[3].

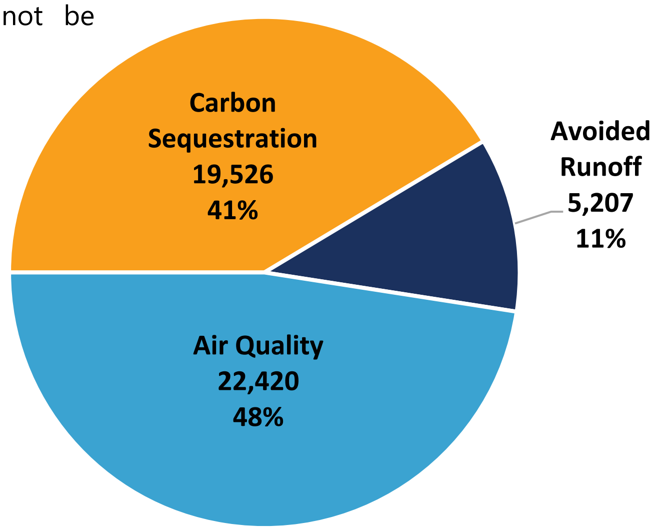


Figure 1: Quantified Annual Benefits from the Community Tree Resource

Annually, community trees provide quantifiable benefits to Carmel-by-the-Sea totaling $47,153. The average annual per tree benefit is $4.77. These benefits include:

- 582,667 gallons of avoided stormwater runoff, valued at $5,207, an average of $0.53 per tree.
- 3.1 tons of air pollution removed, improving air quality, and reducing adverse health incidents for a value of $22,420, an average of $2.27 per tree.
- 114.5 tons of carbon directly sequestered, valued at $19,526, an average of $1.98 per tree.

Management & Investment

Annually, the City invests approximately $385,000 ($39/tree, $110/capita) to manage community trees. Quantifiable benefits offset this investment by $47,153, for a net investment of $337,847. This is inarguably a conservative estimate of the true environmental and socioeconomic benefits from this vital resource, including, benefits to wildlife, property values, and public health and welfare.

The City of Carmel-by-the-Sea's tree inventory is a dynamic resource that requires continued investment to maintain and realize its full potential. Trees are one of the few community assets that have the potential to increase in value with time and proper management. Appropriate and timely tree care can substantially increase lifespan and benefit yield. When trees live longer, they provide greater benefits. As individual trees mature, and failing trees are replaced, the overall value of the community forest and benefits grow as well. However, this vital living resource is vulnerable to a host of stressors and ecologically sound and sustainable best management practices are required to ensure a healthy and safe community forest and a continued flow of benefits for future generations.

Although urban forest managers cannot foresee when a pest or pathogen may be introduced to the community forest, awareness and identification of potential threats allows them to approach management and prevention in a way that fits community expectations and available resources. Using

[3] Energy benefits cannot be quantified for Carmel's community trees as the inventory data does not include the cardinal direction and distance of each tree to the nearest dwelling.

best management practices to prepare for and/or manage pests and pathogens can lessen the detrimental impacts they have on the urban forest.

Overall, the community tree resource is in fair or better condition with a well-established age distribution. With proactive management, planning, and new and replacement tree planting, the benefits from this resource will continue to increase.

Based on this resource analysis, DRG recommends the following:

- Increase species diversity in new and replacement tree plantings to increase resiliency in the urban forest and reduce reliance on the most prevalent species.
    - Consider removing species that have the potential to become invasive from future planting lists (e.g., *Melaleuca quinquenervia*, *Acacia melanoxylon*, and *Schinus terebinthifolia*).
- Provide structural pruning for young trees and a routine pruning cycle for all trees.
- Protect and regularly inspect existing trees to identify and mitigate structural and age-related defects, manage risk, and reduce the likelihood of tree and branch failure.
- Monitor species performance (e.g., health, structure, longevity, pest and disease resistance) and consider new, promising species for future tree plantings.
- Consider successional planting of important species and individual trees.
- Replace trees that are removed and plant trees in available planting sites to increase the stocking level and optimize benefits.
- Follow integrated pest management and best management practices, when monitoring for and dealing with pests and diseases.
- Maintain and update the inventory database to include all community trees and available planting sites, track tree growth and condition, and consider adding distance and direction from the nearest dwelling to calculate energy benefits.

With adequate protection and planning, the value and resiliency of the community tree resource will continue to increase over time. Proactive management and a tree replacement plan are critical to ensuring that the community continues to enjoy the benefits of trees and canopy cover. Adequate funding for tree maintenance and inspection is critical to preserving benefits, prolonging tree life, and managing risk and public safety. Existing mature trees should be maintained and protected whenever possible since the greatest environmental benefits accrue from the continued growth and longevity of the existing canopy. Urban forest managers can take pride in knowing that community trees support a high quality of life for residents, visitors, and neighboring communities.

Street shaded by Community Trees

Introduction

Affectionately called a village in the forest, Carmel-by-the-Sea is a beach town located in Monterey County, California. The City's name originates from Spanish explorers. After naming the river Carmelo, for the Carmalite friers the Spanish were traveling with, the community was named Carmel-by-the-Sea. The community began to take shape after the Carmel Mission was built in 1771. By 1902 "The First Murphy House" was built, which today serves as the home of the Carmel Heritage Society (Carmel Chamber of Commerce, 2022).

Carmel-by-the-Sea enjoys a Mediterranean climate with mild winters and dry cool summers, with an average high temperature of 67°F and an average low temperature of 44°F. The average annual precipitation amounts to 20 inches, with most rainfall occurring during November and April (Weatherspark, 2023). Carmel-by-the-Sea experiences coastal fog, however the amount of summertime fog has been decreasing over time (Johnstone and Dawson 2010).

Urban trees play an essential role in the community providing many benefits, tangible and intangible, to residents, visitors, and neighboring communities. Research demonstrates that healthy urban trees can improve the local environment and lessen the impact resulting from urbanization and industry (Center for Urban Forest Research, 2017). Trees improve air quality, reduce energy consumption, help manage stormwater, reduce erosion, provide critical habitat for wildlife, and promote a connection with nature. When taken together, the community forest contributes to a healthier, more livable, and prosperous Carmel-by-the-Sea.

The community's tree inventory was analyzed with i-Tree *Eco* benefit-cost modeling software (Eco v6.0.32) to generate the data for this resource analysis. The software uses inventory data collected in the field along with local hourly air pollution and meteorological data to quantify urban forest structure, environmental effects, and value to the community. The program is a central computing engine that makes scientifically sound estimates of the effects of the urban forest using peer-reviewed equations to predict environmental and economic benefits. Aesthetic, human health, socio-economic, property value, and wildlife benefits are not calculated as part of this study although they are certainly part of the important benefits provided by Carmel-by-the-Sea's community tree resource.

This report provides an assessment of the structure and composition of the current community tree inventory, consisting of 9,875 trees. Where possible, it also quantifies the benefits derived from the tree resource. This baseline data can be used to make effective resource management decisions, develop policy, and set priorities. Ultimately, the results of the analysis allow the City of Carmel-by-the-Sea to better understand, prioritize, and manage the tree resource.

This summary report provides the following information:

- A description of the current structure of the community tree resource and an established baseline for future management decisions.
- Quantifiable economic value of benefits from the community tree resource to air quality, stormwater runoff reduction, and carbon sequestration.
- Data that may be used by resource managers in the pursuit of alternative funding sources, local assessment fees, legislative initiatives, and collaborative relationships with utility purveyors, non-governmental organizations, air quality districts, watershed managers, and federal and state agencies.

Urban trees play an essential role in the community of Carmel-by-the-Sea by providing many benefits, tangible and intangible, to residents, visitors, and neighboring communities.

Resource Structure

A tree resource is more thoroughly understood through examination of composition and structure. Consideration of stocking level, species diversity, canopy cover, age distribution, condition, and performance provide a foundation for planning and strategic management. Inferences based on this data can help managers understand the importance of individual trees and species populations to the overall forest as it exists today and provide a basis to plan for and project the future potential of the resource.

Species Diversity

Species diversity is calculated as the proportion of species representing the total community tree resource (Table 1, Figure 2). Carmel-by-the-Sea's community tree resource includes a mix of 200 unique species (Appendix C: Tables). Of these species, 76% are native to California.

Table 1: Population Summary of Carmel-by-the-Sea's Most Prevalent Species (representing >0.5%)

Species	DBH Class (inches)										# of Trees	% of Pop.
	0 - 4	4 - 8	8 - 12	12 - 18	18 - 24	24 - 30	30 - 36	36 - 42	42 - 48	48+		
Quercus agrifolia	733	1,080	1,112	812	178	40	12	4	0	0	3,971	40.21
Pinus radiata	129	107	127	301	363	359	244	114	29	14	1,787	18.10
Cupressus macrocarpa	139	93	94	147	122	118	47	34	23	47	864	8.75
Acacia melanoxylon	123	86	39	50	29	19	4	0	0	0	350	3.54
Sequoia sempervirens	58	46	49	57	26	18	18	6	2	3	283	2.87
Pittosporum undulatum	142	77	34	24	0	1	0	0	0	0	278	2.81
Heteromeles arbutifolia	91	56	12	2	0	0	0	0	0	0	161	1.63
Cedrus deodara	20	22	20	14	11	2	0	0	0	0	89	0.90
Acacia auriculiformis	53	21	7	5	1	0	0	0	0	0	87	0.88
Liquidambar styraciflua	16	22	24	12	5	2	0	0	0	0	81	0.82
Prunus ilicifolia	37	40	2	2	0	0	0	0	0	0	81	0.82
Prunus cerasifera	58	18	3	0	0	0	0	0	0	0	79	0.80
Arbutus unedo	50	14	9	3	1	0	0	0	0	0	77	0.78
Ceanothus thyrsiflorus	52	17	3	0	0	0	0	0	0	0	72	0.73
Acer palmatum	58	10	2	0	0	0	0	0	0	0	70	0.71
Olea europaea	46	10	7	4	1	0	1	0	0	0	69	0.70
Leptospermum laevigatum	11	26	13	10	2	1	0	0	0	0	63	0.64
Lyonothamnus floribundus	20	17	13	8	1	0	0	0	0	0	59	0.60
all other species	708	321	142	111	33	20	12	3	0	4	1,354	13.71
Total	**2,544**	**2,084**	**1,712**	**1,562**	**773**	**580**	**337**	**161**	**54**	**68**	**9,875**	**100%**

The species diversity in Carmel-by-the-Sea's community tree resource is higher than the mean of 185 species reported from 18 California communities (Muller and Bornstein, 2010). Five species in the inventory are considered invasive according to California Invasive Species Advisory Committee, including *Ailanthus altissima* (Tree of Heaven), *Eucalyptus globulus* (blue gum eucalyptus), *Melaleuca quinquenervia* (punk tree), *Schinus mole* (California peppertree), and *Schinus terebinthifolius* (Brazilian peppertree) (2010).

Many of the most prevalent species (representing >0.5% of the overall population) are native to Monterey Bay including *Quercus agrifolia* (coast live oak, 40.2%), *Pinus radiata* (Monterey pine, 18.1%), and *Cupressus macrocarpa* (Monterey cypress, 8.7%) (Table 1, Figure 2). These three species make up more than 67% of the overall population.

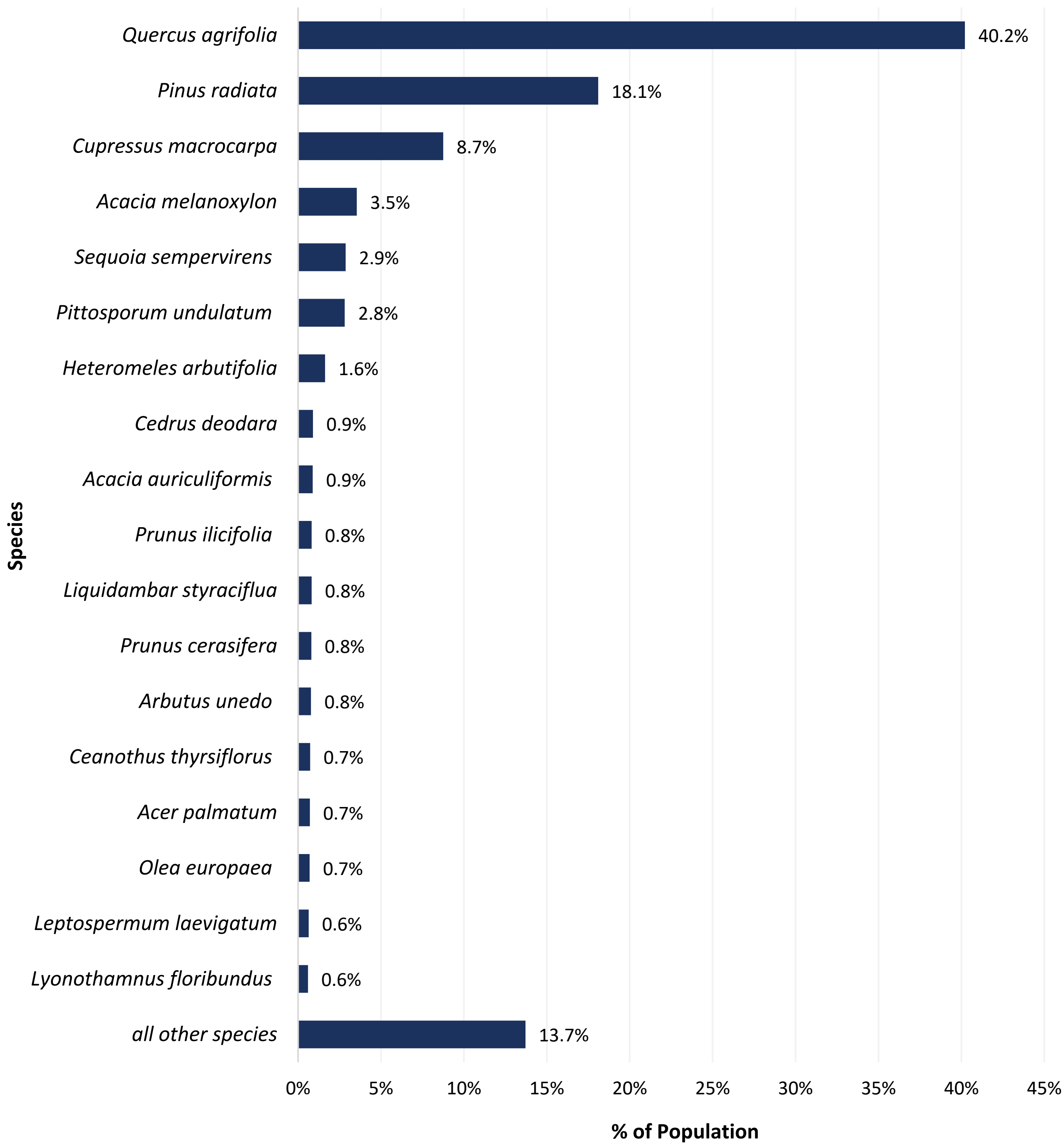


Figure 2: Species Diversity in Carmel-by-the-Sea's Community Tree Resource

Maintaining diversity in an urban forest is important. Dominance of any single species or genus can have detrimental consequences in the event of drought, disease, pests, or other species-specific stressors that can severely impact a tree resource and the flow of benefits and costs over time. Catastrophic pathogens, such as Dutch elm disease (*Ophiostoma ulmi*), emerald ash borer (*Agrilus planipennis*), Asian longhorned beetle (*Anoplophora glabripennis*), and sudden oak death (*Phytophthora ramorum*) are some examples of unexpected, devastating, and costly pests and pathogens that highlight the importance of diversity and the balanced distribution of species and genera.

Recognizing that all tree species have a potential vulnerability to pests and disease, urban forest managers have long followed a rule of thumb that no single species should represent greater than 10% of the total population and no single genus more than 20% (Santamour, 1990). In Carmel-by-the-Sea's community tree population, *Q. agrifolia* (40.2%) and *P. radiata* (18.1%) exceed this widely accepted rule at the species level. Among genera, *Quercus* (oak species) represents more than 41.5% of the overall population, which is more than double the recommendation. *Fagaceae* (beech family) exceeds the recommended 30%, with 42% of species belonging to this family. Managers should continue to strive for increased diversity to promote greater resiliency and reduce the risk of a significant loss in benefits should any species become a liability.

Importance Value

To quantify the significance of any one species in Carmel-by-the-Sea's community tree resource, an importance value (IV) is derived for each species. Importance values are particularly meaningful to urban forest managers because they indicate a reliance on the functional capacity (i.e., benefits) of a species. **I-Tree *Eco* calculates importance value based on the sum of two values: percentage of total population and percentage of total leaf area.** Importance value goes beyond tree numbers alone to suggest reliance on specific species based on the benefits they provide. The importance value can range from zero (which implies no reliance) to 200 (suggesting total reliance). A complete table, with importance values for all species, is included in Appendix C.

To reiterate, research strongly suggests that no single species should dominate the composition of an urban forest. Because importance value goes beyond population numbers, it can help managers to better comprehend the resulting loss of benefits from a catastrophic loss of any one species. When importance values are comparatively equal among the 10 to 15 most prevalent species, the risk of a significant reduction in benefits is reduced. Of course, suitability of the dominant species is another important consideration. Planting short-lived or poorly adapted species can result in short rotations and increased long-term management costs.

Table 2 lists the importance values of the most prevalent species in Carmel-by-the-Sea's community tree resource. These 18 species represent 86.3% of the overall population and 94.8% of the total leaf area for a combined importance value of 181.1. Carmel-by-the-Sea relies most heavily on *Quercus agrifolia* (coastal live oak, IV=80.9), followed by *Pinus radiata* (Monterey pine, IV=45.1), and *Cupressus macrocarpa* (Monterey cypress, IV=21.0). Together these three species represent 67.1% of the inventory and have a combined importance value of 147.0 (73.5% of the total).

For some species, low importance values are primarily a function of species stature and/or age distribution. Immature trees and small-stature species frequently have lower importance values than their representation in the inventory might suggest. This is due to their relatively small leaf area and canopy coverage. For example, *Acer palmatum* (Japanese maple), which represents 0.7% of the overall resource and 0.3% of overall leaf area, currently has an importance value of 1.05 (0.5%). Nearly all

(96%) of this population is less than 8 inches in diameter and due to the small stature of this species, the importance value is not likely to increase over time. In contrast, *Pinus canariensis* (Canary Island pine, IV=0.37) represents 0.3% of the resource and 0.1% of overall leaf area and has a current importance value of 0.37 (0.2%). However, 61.5% of this large stature species is currently under 4 inches in diameter and as these young trees mature and increase in canopy (leaf area), the importance value of the species is likely to increase significantly over time.

Some species are more significant contributors to the urban forest than population numbers would suggest. For example, *Pinus radiata* (Monterey pine) represents 18.1% of the population and 27% of overall leaf area and has an importance value of 45.11 (10.5%).

Table 2: Importance Value (IV) of Prevalent Species in Carmel-by-the-Sea (Representing >0.5%)

Species	% of Pop.	% of Leaf Area	Importance Value (IV)	IV %
Quercus agrifolia	40.21	40.70	80.92	40.46
Pinus radiata	18.10	27.01	45.11	22.56
Cupressus macrocarpa	8.75	12.26	21.01	10.51
Acacia melanoxylon	3.54	3.71	7.25	3.63
Sequoia sempervirens	2.87	3.28	6.15	3.08
Pittosporum undulatum	2.82	1.43	4.25	2.12
Heteromeles arbutifolia	1.63	1.07	2.70	1.35
Cedrus deodara	0.90	0.84	1.74	0.87
Acacia auriculiformis	0.88	0.81	1.70	0.85
Liquidambar styraciflua	0.82	0.65	1.47	0.73
Prunus ilicifolia	0.82	0.52	1.34	0.67
Prunus cerasifera	0.80	0.48	1.28	0.64
Arbutus unedo	0.78	0.39	1.17	0.59
Ceanothus thyrsiflorus	0.73	0.37	1.10	0.55
Acer palmatum	0.71	0.34	1.05	0.52
Olea europaea	0.70	0.34	1.04	0.52
Leptospermum laevigatum	0.64	0.30	0.93	0.47
Lyonothamnus floribundus	0.60	0.27	0.87	0.44
all other species	13.71	5.20	29.16	14.58
Total	**100%**	**100%**	**200**	**100%**

Canopy Cover

Carmel covers an area of 676.3 acres. i-Tree *Eco* estimates that community trees are providing approximately 80 canopy acres which accounts for 11.8% of the total land area.

Stocking Level

A total of 1,118 vacant sites were identified during the tree inventory, including 634 sites that require stump removal prior to replanting. Considering a total of 10,993 planting sites (9,975 existing trees + 1,118 vacant sites), Carmel-by-the-Sea has a current estimated stocking level of 90%.

Relative Age Distribution

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

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

The age distribution of Carmel-by-the-Sea's community tree resource shows a nearly ideal, established population with many young, recently planted trees. Nearly 47% of all trees are less than 8 inches in diameter and 12.1% are greater than 24 inches (Figure 3).

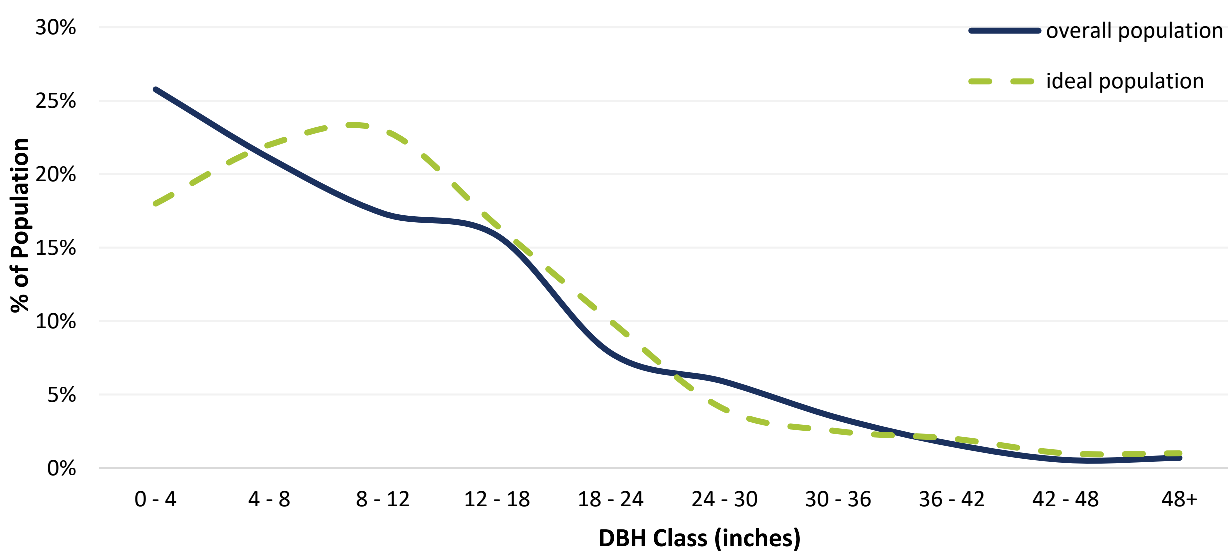
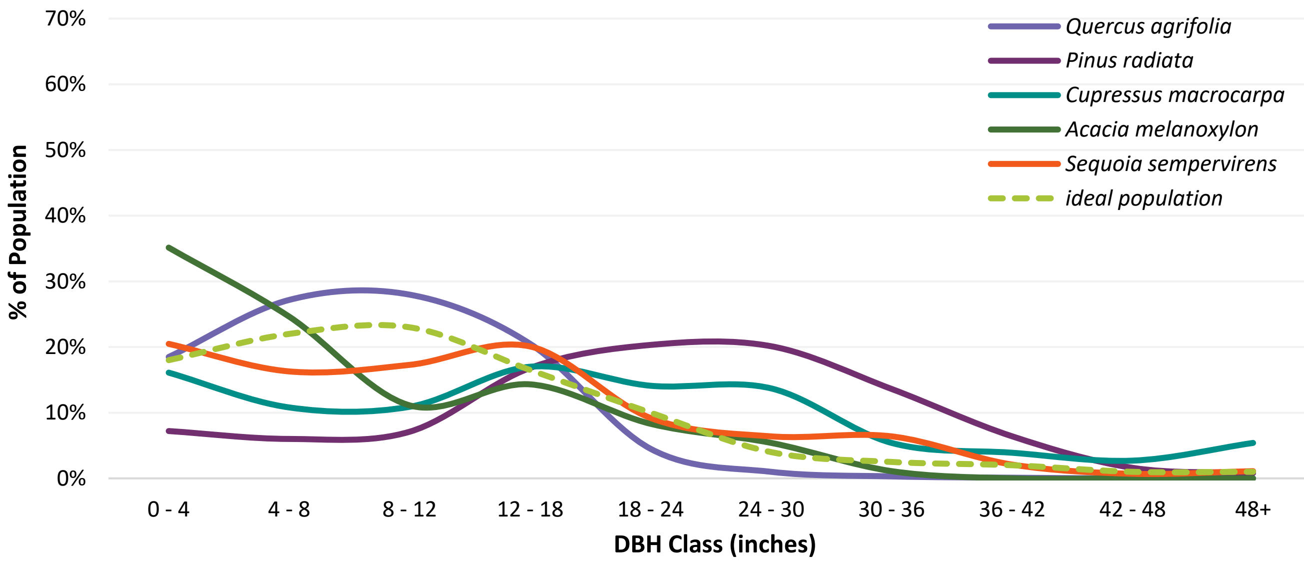


Figure 3: Community Tree Inventory Relative Age Distribution

Relative age distribution can also be evaluated for individual species. The 10 most prevalent community tree species are compared against the ideal distribution in Figure 4. Similar to the overall distribution, the majority of the top 10 most prevalent species show established populations well represented by trees less than 8 inches in diameter (e.g., *Sequoia sempervirens* [coast redwood]).



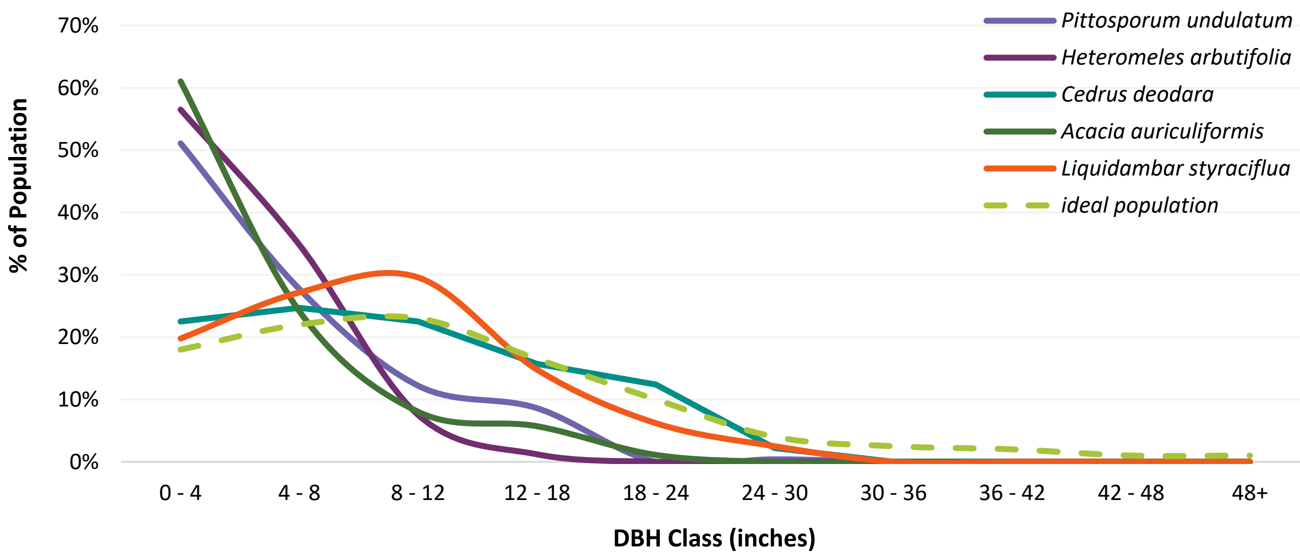


Figure 4: Relative Age Distribution of Carmel-by-the-Sea' Top 10 Most Prevalent Species

The age distribution of *Acacia melanoxylon* (black acacia), *Pittosporum undulatum*, (Victorian box), and *Acacia auriculiformis* (earleaf acacia) suggest that these three species have been recently planted. However, these species naturalize easily and may not have been purposefully planted. Although the California Invasive Plant Council does not currently consider any of these species invasive, the group does acknowledge that *A. melanoxylon can* be locally persistent and problematic and *P. undulatum* a high risk of becoming invasive in the future in California. Managers should monitor areas with existing stands of these species and evaluate whether management strategies are necessary to prevent undesirable spread. New and replacement tree planting should avoid species that are identified as invasive.

While the age distribution of *Heteromeles arbutifolia* (toyon) also suggests a young population relative to other species in Carmel, this California native species is small in stature and rarely exceeds 8 inches in diameter.

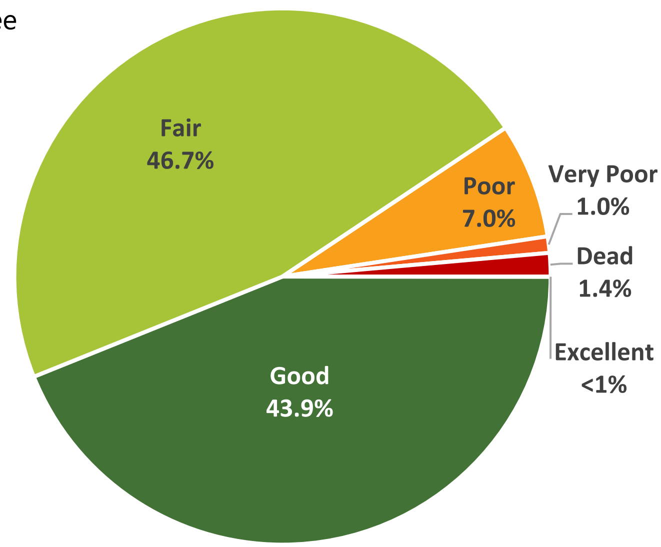
Of prevalent species, *Quercus agrifolia* (coast live oak), *Pinus radiata* (Monterey pine), *Sequoia sempervirens* (coast redwood), *Cupressus macrocarpa* (Monterey cypress), *Cedrus deodora* (deodar cedar), and *Liquidambar styraciflua* (sweetgum) each have high representation in small diameter trees, indicating that recent tree planting is adequate for maintaining these species at their current levels of representation.

Analysis of the age distribution of prevalent species can help resource managers to understand and foresee maintenance activities and budgetary needs. In addition to informing managers of the economics of prevalent species, managers can use the age distribution to determine trends in plantings and adopt strategies for species selection in the years to come.

Tree Condition & Relative Performance

Tree condition is an indication of how well trees are managed and how well they are performing in the region and in each site-specific environment (e.g., street, median, parking lot, etc.). Condition ratings can help managers anticipate maintenance and funding needs. In addition, tree condition is an important factor for the calculation of resource benefits.

A condition rating of good assumes that a tree has no major structural problems, no significant mechanical damage, and may have only minor aesthetic, insect, disease, or structural problems, and is in good health. When trees are performing at their peak, as those rated as good or better, the benefits they provide are maximized.



Based on the inventory data (2023), community trees in Carmel-by-the-Sea are in overall fair or better condition (90.6%). Approximately 1% of trees are in poor condition and 1.4% are dead (**Error! Reference source not found.**). A total of 475 (4.8%) trees are recommended for removal.

Relative Performance Index

The relative performance index (RPI) is one way to further analyze the condition and suitability of a specific tree species. The RPI provides an urban forest manager with a detailed perspective on how different species perform compared to each other. The index compares the condition ratings of each tree species with the condition rating of every other tree species within the inventory. An RPI of 1.0 or better indicates that the species is performing as well or better than average. An RPI value below 1.0 indicates that the species is underperforming in comparison to the rest of the population.

Among Carmel-by-the-Sea's 18 most prevalent tree species, 15 have an RPI of 1.0 or greater (Table 3). *Acer palmatum* (Japanese maple) has the highest RPI at 1.15. *Pinus radiata* (Monterey pine) has the lowest RPI of 0.93. The most abundant species, *Quercus agrifolia* (coast live oak, 40.2%) has an RPI of 0.97.

The RPI can be a useful tool for urban forest managers as an indicator of environmental suitability for species selection. If a community has been planting two or more new species, the RPI can be used to compare their relative performance. If the RPI indicates that one is performing relatively poorly, managers may decide to reduce or even stop planting that species and subsequently save money on both planting stock and replacement costs. For example, *Prunus caroliniana* (Carolina cherry laurel) has an RPI of 1.17 and *Auranticarpa rhombifolia* (Queensland pittosporum) has an RPI of 0.91 (Table 15). The data indicates that both species have recently been planted with 95.5% and 93.8% of these populations represented by trees less than 8 inches in diameter respectively. Between the two species, the RPI indicates that *P. caroliniana* is performing better in Carmel-by-the-Sea.

The RPI enables managers to look at the performance of long-standing species as well. Established species with an RPI of 1.00 or greater have performed well over time. These top performers should be retained, and planted, as a healthy proportion of the overall population. It is important to keep in mind that, because RPI is based on condition at the time of the inventory, it may not reflect cosmetic or nuisance issues, especially seasonal issues that are not threatening the health or structure of the trees.

Table 3: Relative Performance Index of Most Prevalent Species

Species	Excellent %	Good %	Fair %	Poor %	Very Poor %	Dead %	RPI	# of Trees	% of Trees
Quercus agrifolia	0.00	36.60	51.70	9.50	1.40	0.80	**0.97**	3,971	40.21
Pinus radiata	0.00	30.10	55.00	10.50	1.60	3.00	**0.93**	1,787	18.10
Cupressus macrocarpa	0.10	53.90	41.40	3.10	0.50	0.90	**1.05**	864	8.75
Acacia melanoxylon	0.00	47.40	45.10	6.60	0.00	0.90	**1.02**	350	3.54
Sequoia sempervirens	0.00	62.20	31.10	5.30	0.00	1.40	**1.07**	283	2.87
Pittosporum undulatum	0.00	54.70	40.60	2.90	1.40	0.40	**1.05**	278	2.82
Heteromeles arbutifolia	0.00	67.70	29.20	1.90	0.60	0.60	**1.10**	161	1.63
Cedrus deodara	0.00	48.30	46.10	4.50	0.00	1.10	**1.03**	89	0.90
Acacia auriculiformis	0.00	70.10	28.70	1.10	0.00	0.00	**1.12**	87	0.88
Liquidambar styraciflua	0.00	32.10	63.00	4.90	0.00	0.00	**0.99**	81	0.82
Prunus ilicifolia	0.00	40.70	59.30	0.00	0.00	0.00	**1.03**	81	0.82
Prunus cerasifera	0.00	58.20	36.70	5.10	0.00	0.00	**1.07**	79	0.80
Arbutus unedo	0.00	87.00	7.80	2.60	0.00	2.60	**1.14**	77	0.78
Ceanothus thyrsiflorus	0.00	65.30	30.60	4.20	0.00	0.00	**1.09**	72	0.73
Acer palmatum	0.00	84.30	14.30	0.00	0.00	1.40	**1.15**	70	0.71
Olea europaea	0.00	62.30	34.80	2.90	0.00	0.00	**1.09**	69	0.70
Leptospermum laevigatum	0.00	52.40	44.40	1.60	0.00	1.60	**1.05**	63	0.64
Lyonothamnus floribundus	0.00	52.50	44.10	0.00	0.00	3.40	**1.03**	59	0.60
all other species	0.07	58.09	37.47	1.92	0.3	2.22	**1.04**	1,354	13.71
Total	**<1%**	**43.89%**	**46.74%**	**6.97%**	**1.00%**	**1.41%**	**1.00**	**9,875**	**100%**

An RPI value less than 1.00 may be indicative of a species that is not well-adapted to local conditions. Poorly adapted species are more likely to present increased safety and maintenance issues. Species with an RPI less than 1.00 should be carefully considered before being selected for future planting choices. However, prior to selecting or deselecting trees based on RPI alone, managers should consider the age distribution of the species, among other factors. A species that has an RPI of less than 1.00 but also has a significant number of trees in larger DBH classes, may simply be exhibiting signs of population senescence. For example, *Pinus radiata* (Monterey pine), has an RPI of 0.93. This species is native to Carmel and is expected to continue to occupy its native range despite climate change. With a relatively large number of mature trees, (42.5% are larger than 24 inches in diameter) the low RPI is likely reflective of many of these trees reaching the end of their useful life. A complete table, with RPI values for all species, is included in Appendix C.

RPI is also helpful for identifying underused species that are demonstrating reliable performance. Species with an RPI value greater than 1.00 and an established age distribution may indicate their suitability for the local environment. These species should receive consideration for additional planting. As an example, *Eucalyptus ficifolia* (redflower gum) has an RPI of 1.06 and an age distribution that is represented by young to mature trees (5.6% are less than 8 inches in diameter and 61.2% are greater than 24 inches in diameter). The representation in the population and the age distribution combined support the high RPI. Alternatively, *Pittosporum eugenioides* (Japanese loquat) represents less than 1% of the population, has an RPI of 1.09, but is largely represented by trees less than 8 inches in diameter and does not have any trees greater than 24 inches in diameter. Although expected to do well in Carmel-by-the-Sea, the current age distribution cannot substantiate the high RPI as there are not enough mature trees, resulting in a lack of evidence for long-term performance.

RPI is most relevant when there is a moderately high representation of the species. In other words, if there is a single individual that has a high RPI (greater than 1.00) but is the only representative of the species at the site, additional trial plantings of the species can help test the accuracy of the RPI. It is important to use RPI as one of many factors for species selection. Species that have historically experienced major issues in Carmel-by-the-Sea should be avoided and species with a proven track record should be favored.

Replacement Value

Replacement value accounts for the historical investment in trees over their lifetime and is a way of describing the value of a tree population (and/or average value per tree) at a given time. In other words, the value of a tree is equal to the cost of replacing the tree in its current state (Cullen, 2002). There are several methods available for obtaining a fair and reasonable perception of a tree's value (Council of Tree and Landscape Appraisers, 2018; Watson, 2002). For this analysis, the replacement value reflects current population numbers and is based on the valuation procedures of the Council of Tree and Landscape Appraisers, which uses tree species, diameter, condition, and location information (Nowak et al 2002a; 2002b).

To replace all 9,875 community trees in Carmel-by-the-Sea with trees of equivalent size and condition would cost over $25 million, an average of $2,554.05 per tree (Table 4). *Pinus radiata* (Monterey pine) has the highest replacement value of approximately $9.9 million and accounts for the greatest proportion of the overall replacement value (39%). This species has the second highest importance value in the inventory and a well-established age distribution.

The replacement value for Carmel-by-the-Sea's community tree resource reflects the vital importance of these assets to the community. With proper care and maintenance, the value will continue to increase over time. It is important to recognize that replacement values are separate and distinct from the value of annual benefits produced by this resource and in some instances the replacement value of a tree may be greater than or less than the benefits that a particular tree may provide.

Table 4: Replacement Value for Most Prevalent Species

Species	# of Trees	Replacement Value ($)	% of Replacement Value	% of Pop.
Quercus agrifolia	3,971	7,013,575	0.28	40.21
Pinus radiata	1,787	9,864,331	0.39	18.10
Cupressus macrocarpa	864	4,345,046	0.17	8.75
Acacia melanoxylon	350	549,507	0.02	3.54
Sequoia sempervirens	283	998,581	0.04	2.87
Pittosporum undulatum	278	213,420	0.01	2.82
Heteromeles arbutifolia	161	95,422	0.00	1.63
Cedrus deodara	89	173,330	0.01	0.90
Acacia auriculiformis	87	59,610	0.00	0.88
Liquidambar styraciflua	81	132,479	0.01	0.82
Prunus ilicifolia	81	52,320	0.00	0.82
Prunus cerasifera	79	32,700	0.00	0.80
Arbutus unedo	77	44,222	0.00	0.78
Ceanothus thyrsiflorus	72	35,315	0.00	0.73
Acer palmatum	70	17,287	0.00	0.71
Olea europaea	69	45,092	0.00	0.70
Leptospermum laevigatum	63	84,360	0.00	0.64
Lyonothamnus floribundus	59	60,426	0.00	0.60
all other species	1,354	1,404,240	0.06	13.71
Total	**9,875**	**$25,221,264**	**100%**	**100%**

Resource Benefits

Community trees continuously mitigate the effects of urbanization and development and protect and enhance the quality of life within the community. The amount and distribution of leaf surface area is the driving force behind the ability of the urban forest to produce benefits for the community (Clark et al, 1997). Healthy trees are vigorous, often producing more leaf surface area each year.

Quantifiable benefits from the urban forest are based on the environmental functions trees perform. In addition to air quality benefits, trees slow down stormwater and remove pollutants, reducing the impact of stormwater as well as management costs for municipalities. Tree growth sequesters carbon in woody stems and roots. The economic value of these ecosystem functions is calculated in terms of both volume and cost savings. It is important to note that this assessment accounts for only a small part of all of the benefits trees provide. Trees are known to contribute significantly to ecosystems, human health and welfare, and to have positive impacts on economies. Without formulas and peer-reviewed consensus, estimates of the dollar of the value of these benefits are not currently possible.

Annual environmental benefits tend to increase with an increase in the number and size of healthy trees (Nowak et al, 2002). Through proper management, urban forest values can be increased over time as trees mature and with improved longevity and as stocking levels are increased. Climate, pests, and weather events can cause values to decrease if the amount of healthy tree cover declines. Excluding energy benefits, the community tree resource provides quantifiable annual environmental benefits valued at approximately $47,153 (Appendix B).

Air Quality

Urban trees improve air quality in five fundamental ways:

- Absorption of gaseous pollutants such as ozone (O_3), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2) through leaf surfaces
- Reduction of emissions from power generation by reducing energy consumption
- Increase of oxygen levels through photosynthesis
- Transpiration of water and shade provision, resulting in lower local air temperatures, thereby reducing ozone levels Interception of particulate matter ($PM_{2.5}$ and PM_{10})

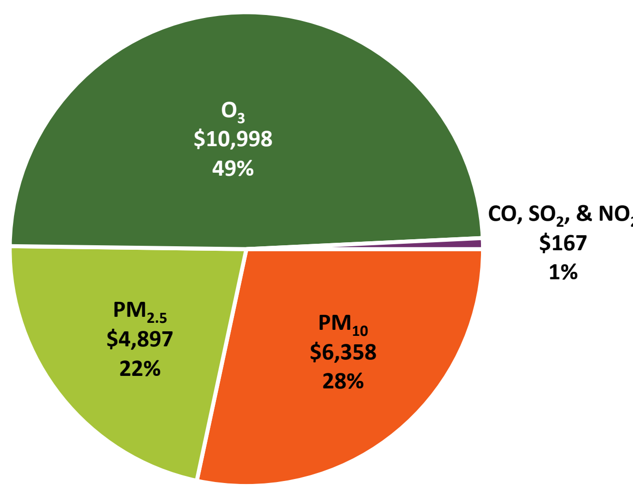


Figure 6: Annual Air Pollution Benefits

Air pollutants are known to contribute adversely to human health. Trees decrease the amount of air pollutants in the atmosphere, which can reduce the incidence of numerous negative health effects (

Table 6). Ozone is an air pollutant that is particularly harmful to human health. Carmel-by-the-Sea's community trees reduce adverse health effects associated with ozone by nearly 4 incidents annually, a value of $10,998. Ozone forms when nitrogen oxide from fuel combustion and volatile organic gasses from evaporated petroleum products react in the presence of sunshine. In the absence of cooling effects provided by trees, higher temperatures contribute to ozone formation. In addition to consequences to human health, short-term increases in ozone concentrations are statistically associated with increased tree mortality for 95 large US cities (Bell et al, 2004).

Table 5: Annual Air Pollution Removal Benefits

Air Pollutant	Removal (lb.)	Annual Value ($)
Ozone (O_3)	3,873	$10,997.67
Particulate matter less than 10 microns (PM_{10})	1,937	$6,358.45
Particulate matter less than 2.5 microns ($PM_{2.5}$)	33	$4,896.67
Nitrogen dioxide (NO_2)	265	$88.92
Carbon monoxide (CO)	103	$72.21
Sulfur dioxide (SO_2)	42	$6.09
Total	**6,253**	**$22,420.01**

Table 6: Adverse Health Incidents Avoided Due to Changes in Pollutant Concentration Levels and Economic Values[4]

	NO_2		O_3		$PM_{2.5}$		SO_2	
	Incidence (Reduction/yr.)	Value ($/yr.)	Incidence (Reduction/yr.)	Value ($/yr.)	Incidence (Reduction/yr.)	Value ($/yr.)	Incidence (Reduction/yr.)	Value ($/yr.)
Acute Respiratory Symptoms	0.03	0.85	3.05	260.35	0.16	16.01	0.00	0.05
Asthma Exacerbation	0.43	35.80			0.07	5.76	0.02	1.32
Work Loss Days					0.03	4.99		
Lower Respiratory Symptoms					0.00	0.09		
Mortality			0.00	10,476.84	0.00	4,790.73		
Upper Respiratory Symptoms					0.00	0.06		
Acute Bronchitis					0.00	0.01		
Acute Myocardial Infarction					0.00	7.13		
Chronic Bronchitis					0.00	64.82		
Emergency Room Visits	0.00	0.26	0.00	0.60	0.00	0.04	0.00	0.05
Hospital Admissions, Cardiovascular					0.00	3.63		
Hospital Admissions, Respiratory					0.00	3.39		
Hospital Admissions	0.00	52.01	0.01	189.25			0.00	4.67
School Loss Days			0.72	70.62				
Total	**0.46**	**$88.92**	**3.77**	**$10,997.67**	**0.27**	**$4,896.67**	**0.02**	**$6.09**

[4] Health effects are not analyzed for each pollutant. Blank values indicate that incidents and their associated values are note estimated for that pollutant and/or health effect (i-Tree Eco User Manual, 2021).

Deposition, Interception, & Avoided Pollutants

Each year, more than 6,250 pounds of nitrogen dioxide, carbon monoxide, sulfur dioxide, small particulate matter ($PM_{2.5}$ and PM_{10}), and ozone are intercepted or absorbed by community trees, for a total value of $22,420. As a population, *Quercus agrifolia* (coast live oak) is the greatest contributor to pollutant deposition and interception accounting for 40.7% of the benefit. This is directly related to the species prevalence in the overall population and contributions to the overall leaf area (40.7%).

The value of air pollutants removed by community trees is more than $22,420, an average of $2.27 per tree. Among prevalent species, *Pinus radiata* (Monterey pine, $3.39/tree), *Cupressus macrocarpa* (Monterey cypress $3.18/tree), and *Sequoia sempervirens* (coast redwood, $2.94/tree) remove the most pollutants on average per tree (Figure 7). Combined, these three species provide nearly 43% of the annual benefit ($9,636 annually).

Trees produce oxygen during photosynthesis, and community trees in Carmel-by-the-Sea produce an estimated 305.3 tons of oxygen annually. Additionally, trees contribute to energy savings by reducing air pollutant emissions (NO_2, $PM_{2.5}$, SO_2, and VOCs) that result from energy production.

Figure 7: Top 5 Species for Air Pollution Removal Benefits

While trees do a great deal to absorb air pollutants (especially ozone and particulate matter), they also negatively contribute to air pollution. Trees emit volatile organic compounds (VOCs), which also contribute to ozone and carbon monoxide formation. The i-Tree *Eco* analysis accounts for these VOC emissions in the air quality cumulative benefit. Trees in Carmel-by-the-Sea are estimated to emit 9,932 pounds of volatile organic compounds (VOCs) (3,809.7 pounds of isoprene and 6,122.3 pounds of monoterpenes) annually. Emissions vary based on species characteristics (e.g., some genera such as oaks are high isoprene emitters) and amount of leaf biomass. The highest volume of VOC emissions is generated by *Quercus agrifolia* (coast live oak), accounting for approximately 80.8% of the overall emissions, largely due to their size (40.7% of overall leaf area) and species attributes. Regardless, the net air quality benefit of *Quercus agrifolia* is positive.

Air quality impacts of trees are complex, and the i-Tree *Eco* software models these interactions to help urban forest managers evaluate the true impact of urban trees on the Carmel-by-the-Sea's air quality. The cumulative and interactive effects of trees on climate, pollution removal, VOCs, and power plant emissions determine the net impact of trees on air pollution. Local urban forest management decisions also can help improve air quality by prioritizing tree species recognized for their ability to improve air quality and planting next to large traffic corridors.

Table 7: Annual Air Quality Benefits by Most Prevalent Species

Species	# of Trees	% of Pop.	Pollution Removal (ton/yr.)	Pollution Removal ($/yr.)	Average $/tree	% of Annual Benefit
Quercus agrifolia	3,971	40.21	1.27	9,125.97	2.30	40.70
Pinus radiata	1,787	18.10	0.84	6,056.35	3.39	27.01
Cupressus macrocarpa	864	8.75	0.38	2,748.77	3.18	12.26
Acacia melanoxylon	350	3.54	0.10	736.16	2.10	3.28
Sequoia sempervirens	283	2.87	0.12	830.74	2.94	3.71
Pittosporum undulatum	278	2.82	0.03	188.56	0.68	0.84
Heteromeles arbutifolia	161	1.63	0.01	66.63	0.41	0.30
Cedrus deodara	89	0.90	0.02	107.93	1.21	0.48
Acacia auriculiformis	87	0.88	0.01	82.65	0.95	0.37
Liquidambar styraciflua	81	0.82	0.02	145.12	1.79	0.65
Prunus ilicifolia	81	0.82	0.01	39.29	0.49	0.18
Prunus cerasifera	79	0.80	0.00	25.16	0.32	0.11
Arbutus unedo	77	0.78	0.01	61.08	0.79	0.27
Ceanothus thyrsiflorus	72	0.73	0.00	10.81	0.15	0.05
Acer palmatum	70	0.71	0.00	12.80	0.18	0.06
Olea europaea	69	0.70	0.01	58.40	0.85	0.26
Leptospermum laevigatum	63	0.64	0.02	115.90	1.84	0.52
Lyonothamnus floribundus	59	0.60	0.01	55.78	0.95	0.25
all other species	1,354	13.71	0.18	1,951.92	282.49	8.71
Total	**9,875**	**100%**	**3.13**	**$22,420.02**	**$1.53**	**100%**

Atmospheric Carbon Dioxide Reductions

As environmental awareness continues to increase, conversations around global warming and the effects of greenhouse gas (GHG) emissions are increasing. As energy from the sun (sunlight) strikes the Earth's surface it is reflected into space as infrared radiation (heat). GHGs absorb some of this infrared radiation and trap heat in the atmosphere, modifying the temperature of the Earth's surface. Many chemical compounds in the Earth's atmosphere act as GHGs, including carbon dioxide (CO_2), water vapor, and human-made (gases/aerosols). As GHGs increase, the amount of energy radiated back into space is reduced, and more heat is trapped in the atmosphere. An increase in the average temperature of the Earth may result in changes in weather, sea levels, and land-use patterns, commonly referred to as "climate change" (NASA, 2020).

Because urban trees use carbon as a building component for wood and foliar growth, they can help offset carbon emissions and should be recognized as a part of a community's solution for meeting carbon offset goals identified in climate action plans and other environmental policies. i-Tree tools can be used to estimate the GHG and carbon sequestration benefits of tree planting projects (California Air Resource Board, 2020).

Urban trees reduce atmospheric CO_2 in two ways:

- Directly, through growth and the sequestration of CO_2 in wood, foliar biomass, and soil

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

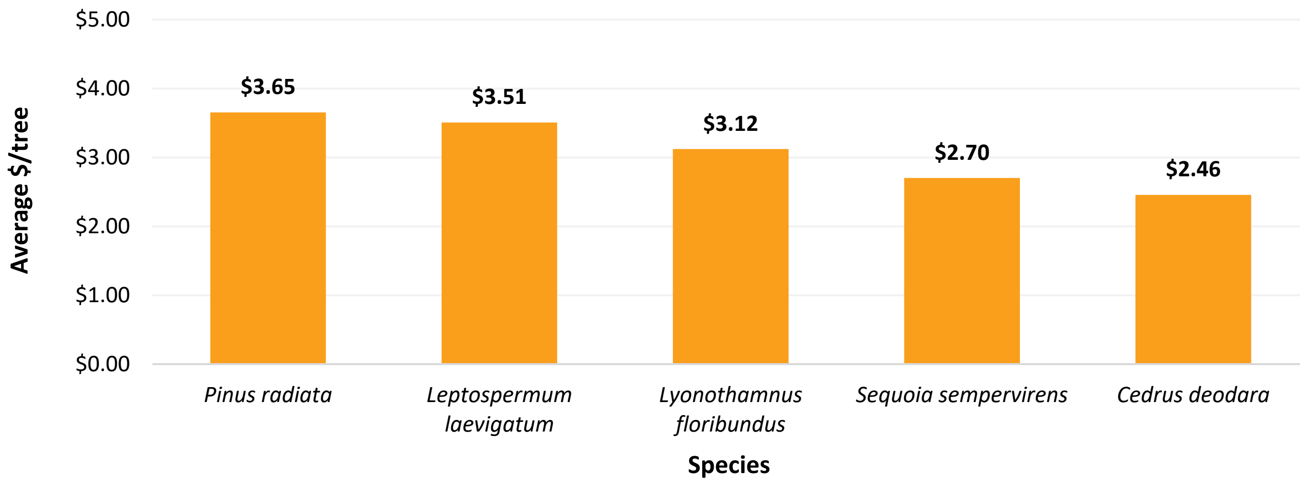


Figure 8: Top 5 Species for Carbon Benefits

Table 8: Annual Carbon Sequestration Benefits by Most Prevalent Species

Species	# of Trees	% of Pop.	Carbon Sequestration (ton/yr.)	Carbon Sequestration ($/yr.)	Average $/tree	% of Annual Benefit
Quercus agrifolia	3,971	40.21	43.91	7,488.55	1.89	38.35
Pinus radiata	1,787	18.10	38.29	6,530.69	3.65	33.45
Cupressus macrocarpa	864	8.75	4.31	735.88	0.85	3.77
Acacia melanoxylon	350	3.54	1.50	255.41	0.73	1.31
Sequoia sempervirens	283	2.87	4.48	764.50	2.70	3.92
Pittosporum undulatum	278	2.82	2.34	399.45	1.44	2.05
Heteromeles arbutifolia	161	1.63	1.57	268.23	1.67	1.37
Cedrus deodara	89	0.90	1.28	218.69	2.46	1.12
Acacia auriculiformis	87	0.88	0.23	39.34	0.45	0.20
Liquidambar styraciflua	81	0.82	0.81	137.39	1.70	0.70
Prunus ilicifolia	81	0.82	0.84	143.33	1.77	0.73
Prunus cerasifera	79	0.80	0.37	62.44	0.79	0.32
Arbutus unedo	77	0.78	0.37	63.37	0.82	0.32
Ceanothus thyrsiflorus	72	0.73	0.40	67.75	0.94	0.35
Acer palmatum	70	0.71	0.13	21.35	0.31	0.11
Olea europaea	69	0.70	0.34	57.58	0.83	0.29
Leptospermum laevigatum	63	0.64	1.30	220.99	3.51	1.13
Lyonothamnus floribundus	59	0.60	1.08	184.22	3.12	0.94
all other species	1,354	13.71	10.89	1,867.13	1.38	9.56
Total	**9,875**	**100%**	**114.49**	**$19,526.29**	**$1.98**	**100%**

To date, Carmel-by-the-Sea's community trees are estimated to be storing 4,412.1 tons of carbon (CO_2) in woody and foliar biomass valued at nearly $752,000. Annually, the community tree resource directly sequesters an additional 114.5 tons of carbon valued at $19,526, with an average value of $1.98 per tree (Table 8). Among prevalent species, *Pinus radiata* (Monterey pine, $3.65/tree), *Leptospermum laevigatum* (coastal tea-tree, $3.51/tree), and *Lyonothamnus floribundus* (lyontree, $3.12/tree) provide the greatest annual per-tree benefits to atmospheric carbon removal, sequestering more than 40.7 tons of carbon annually (Figure 8). These three species account for 35.5% of overall carbon benefit and 19.3% of the overall population.

Stormwater Runoff Reductions

Rainfall interception by trees reduces the amount of stormwater that enters collection and treatment facilities during large storm events (**Error! Reference source not found.**). Trees intercept rainfall in their canopy, acting as mini reservoirs, controlling runoff at the source. Healthy urban trees reduce the amount of runoff and pollutant loading in receiving waters in three primary ways:

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

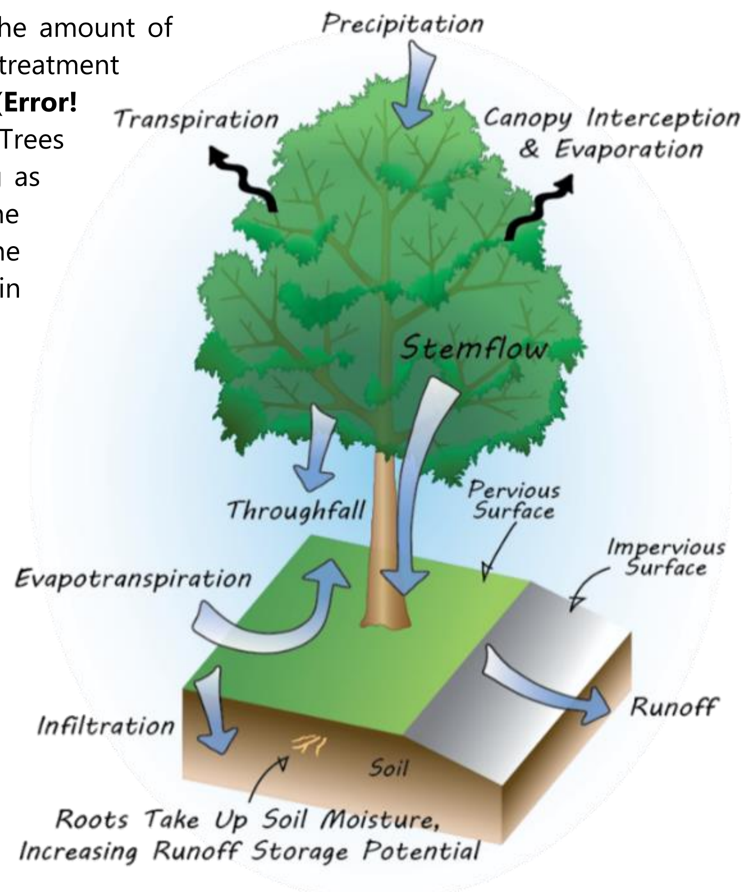


Figure 9: How Trees Impact Stormwater

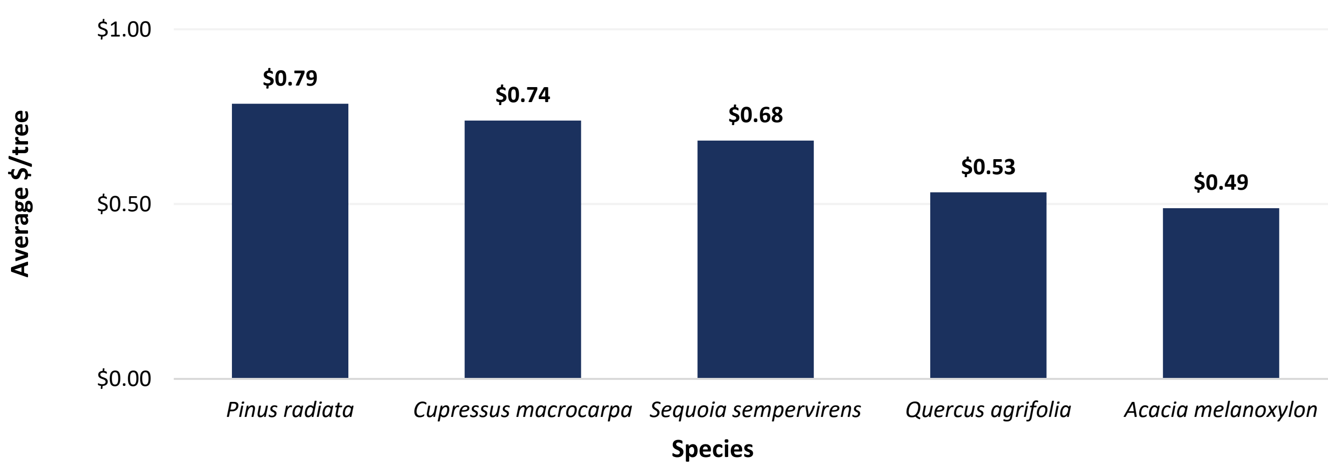


Figure 10: Top 5 Species for Stormwater Benefits

Carmel-by-the-Sea's community tree resource is estimated to contribute to the avoidance of nearly 583,000 gallons of stormwater runoff annually through the interception of precipitation on the leaves and bark of trees for an average of 53.5 gallons per tree (Table 9). The total value of this benefit is $5,206 annually, an average of $0.53 per tree.

Pinus radiata (Monterey pine) provide 27.0% of the estimated total avoided runoff and provide the greatest per tree benefit of $0.79 (Table 10, Figure 10). Their age distribution and stature allow them to provide a larger benefit in comparison to other species. In contrast, *Heteromeles arbutifolia* (toyon), which represents 1.6% of the population, reduce less than 1% of the estimated total avoided runoff. This small stature species is limited in its ability to intercept stormwater. Characteristics that contribute to greater stormwater capture include large leaves, broad or dense canopies, and furrowed bark.

Table 9: Stormwater Benefits by Most Prevalent Tree Species

Species Name	# of Trees	Leaf Area (acres)	Potential ET[5] (gal./yr.)	Evaporation (gal./yr.)	Transpiration (gal//yr.)	Water Intercepted (gal./yr.)	Avoided Runoff (gal./yr.)	Avoided Runoff ($/yr.)	Average $/tree	% of Annual Benefit
Quercus agrifolia	3,971	145.87	14,983,884	1,301,233	5,936,963	1,302,253	237,172.23	2,119.37	0.53	40.70
Pinus radiata	1,787	96.81	9,943,897	863,549	3,940,003	864,227	157,396.85	1,406.50	0.79	27.01
Cupressus macrocarpa	864	43.94	4,513,190	391,935	1,788,231	392,243	71,436.97	638.36	0.74	12.26
Acacia melanoxylon	350	11.77	1,208,690	104,965	478,911	105,048	19,131.74	170.96	0.49	3.28
Sequoia sempervirens	283	13.28	1,363,987	118,452	540,443	118,544	21,589.85	192.93	0.68	3.71
Pittosporum undulatum	278	3.01	309,596	26,886	122,669	26,907	4,900.43	43.79	0.16	0.84
Heteromeles arbutifolia	161	1.06	109,397	9,500	43,346	9,508	1,731.59	15.47	0.10	0.30
Cedrus deodara	89	1.73	177,217	15,390	70,217	15,402	2,805.07	25.07	0.28	0.48
Acacia auriculiformis	87	1.32	135,697	11,784	53,766	11,793	2,147.88	19.19	0.22	0.37
Liquidambar styraciflua	81	2.32	238,272	20,692	94,409	20,708	3,771.48	33.70	0.42	0.65
Prunus ilicifolia	81	0.63	64,507	5,602	25,559	5,606	1,021.05	9.12	0.11	0.18
Prunus cerasifera	79	0.40	41,309	3,587	16,368	3,590	653.86	5.84	0.07	0.11
Arbutus unedo	77	0.98	100,292	8,710	39,738	8,716	1,587.47	14.19	0.18	0.27
Ceanothus thyrsiflorus	72	0.17	17,757	1,542	7,036	1,543	281.06	2.51	0.03	0.05
Acer palmatum	70	0.20	21,017	1,825	8,327	1,827	332.67	2.97	0.04	0.06
Olea europaea	69	0.93	95,894	8,328	37,995	8,334	1,517.85	13.56	0.20	0.26
Leptospermum laevigatum	63	1.85	190,295	16,526	75,399	16,539	3,012.08	26.92	0.43	0.52
Lyonothamnus floribundus	59	0.89	91,590	7,954	36,290	7,960	1,449.74	12.95	0.22	0.25
all other species	1,354	31.15	3,204,830	278,314	1,269,828	278,533	50,727.53	453.35	0.36	8.71
Total	**9,875**	**358.36**	**36,811,316**	**3,196,774**	**14,585,499**	**3,199,281**	**582,667**	**$5,206.72**	**$0.53**	**100%**

[5] Evapotranspiration (ET)

As trees grow, the benefits that they provide tend to grow as well. Some species provide more benefits than others, based on their architecture and leaf morphology. Other trees have characteristics that hinder their ability to be strong contributors to stormwater runoff reduction, including trees with smaller leaves and thinner canopy (i.e. less leaf surface area).

Energy Savings

Trees modify climate and conserve energy in three principal ways:

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

The heat island effect describes the increase in urban temperatures in relation to surrounding suburban and rural areas. Heat islands are associated with an increase in hardscape and impervious surfaces. Trees and other vegetation within an urbanized environment help reduce the heat island effect by lowering air temperatures 5°F (3°C) compared with outside the green space (Chandler, 1965). On a larger scale, temperature differences of more than 9°F (5°C) have been observed between city centers without adequate canopy coverage and more vegetated suburban areas (Akbari et al, 1997). The relative importance of these effects depends upon the size and configuration of trees and other landscape elements (McPherson, 1993). Tree spacing, crown spread, and vertical distribution of leaf area each influence the transport of warm air and pollutants along streets and out of urban canyons. Trees reduce conductive heat loss from buildings by reducing air movement into buildings and against conductive surfaces (e.g., glass, metal siding). Trees can reduce wind speed and the resulting air infiltration by up to 50%, translating into potential annual heating savings of 25% (Heisler, 1986).

Electricity & Natural Gas Reductions

Energy reduction metrics are calculated using data on tree distance and direction from buildings. The annual energy reductions from Carmel-by-the-Sea's community trees were not calculated because this data is not currently captured in the inventory database. However, trees in Carmel-by-the-Sea contribute to electric and natural gas savings through shading and climate buffering effects.

Aesthetic, Property Value, & Socioeconomic Benefits

Trees provide beauty in the urban landscape, privacy and screening, improved human health, a sense of comfort and place, and habitat for urban wildlife. Research shows that trees promote better business by stimulating more frequent and extended shopping and a willingness to pay more for goods and parking (Wolf, 2007). In residential areas, the values of these benefits are captured as a percentage of the value of the property on which a tree stands. There is no current model for calculating the aesthetic benefits of an urban forest. Although, there are many indicators that suggest trees and tree canopy cover contribute significantly to quality of life and community well-being.

It is important to acknowledge that this assessment does not account for all the benefits provided by the tree resource. Some benefits are intangible and/or difficult to quantify, such as:

- Impacts on psychological and physical health and wellness

- Increases in tourism revenue
- Quality of life
- Wildlife habitat
- Socio-economic impacts
- Increases in property values

Empirical evidence of these benefits does exist (Wolf, 2007; Kaplan and Kaplan, 1989; Ulrich, 1986), but there is limited knowledge about the physical processes at work and the complex nature of interactions make quantification imprecise. Tree growth and mortality rates are highly variable. A true and full accounting of benefits and investments must consider variability among sites (e.g., tree species, growing conditions, maintenance practices), as well as variability in tree growth. In other words, trees are worth far more than what one can ever quantify!

Calculating Tree Benefits

While all these tree benefits are provided by the community forest, it can be useful to understand the contribution of just one tree. Individuals can calculate the benefits of individual trees to their property by using i-Tree *Design* (design.itreetools.org).

Calculate My Tree Benefits

Annual Benefits of Most Prevalent Species

It is important to keep in mind that a benefits analysis provides a snapshot of the community tree inventory as it exists today. The calculated benefits are based on the size and condition of existing trees. To provide greater context for the overall per tree and per species benefits of the most prevalent tree species (**Error! Reference source not found.**, Table 10), and to determine if these benefits are a true indicator of performance, the age distribution and stature of the species must also be considered (Table 1,

Figure 4).

The most prevalent tree species in Carmel-by-the-Sea's community tree resource, *Quercus agrifolia* (coast live oak, 40.2%) is providing the greatest overall annual benefit, a value of $18,734, which is attributable to its prevalence in the population as well as species characteristics (**Error! Reference source not found.**). *Q. agrifolia* is a California native with a broad canopy that contributes greatly to the community. However, the prevalence of this species places Carmel-by-the-Sea at risk for a catastrophic loss of environmental benefits in the event of an introduced pest, disease, or other environmental stress. Additionally, this species is within the genus *Quercus* and the family *Fagaceae*, which are exceeding the recommended threshold for genus and family. Managers should monitor for pests and pathogens that affect oaks as well as plant a more diverse range of species to protect the urban forest resource.

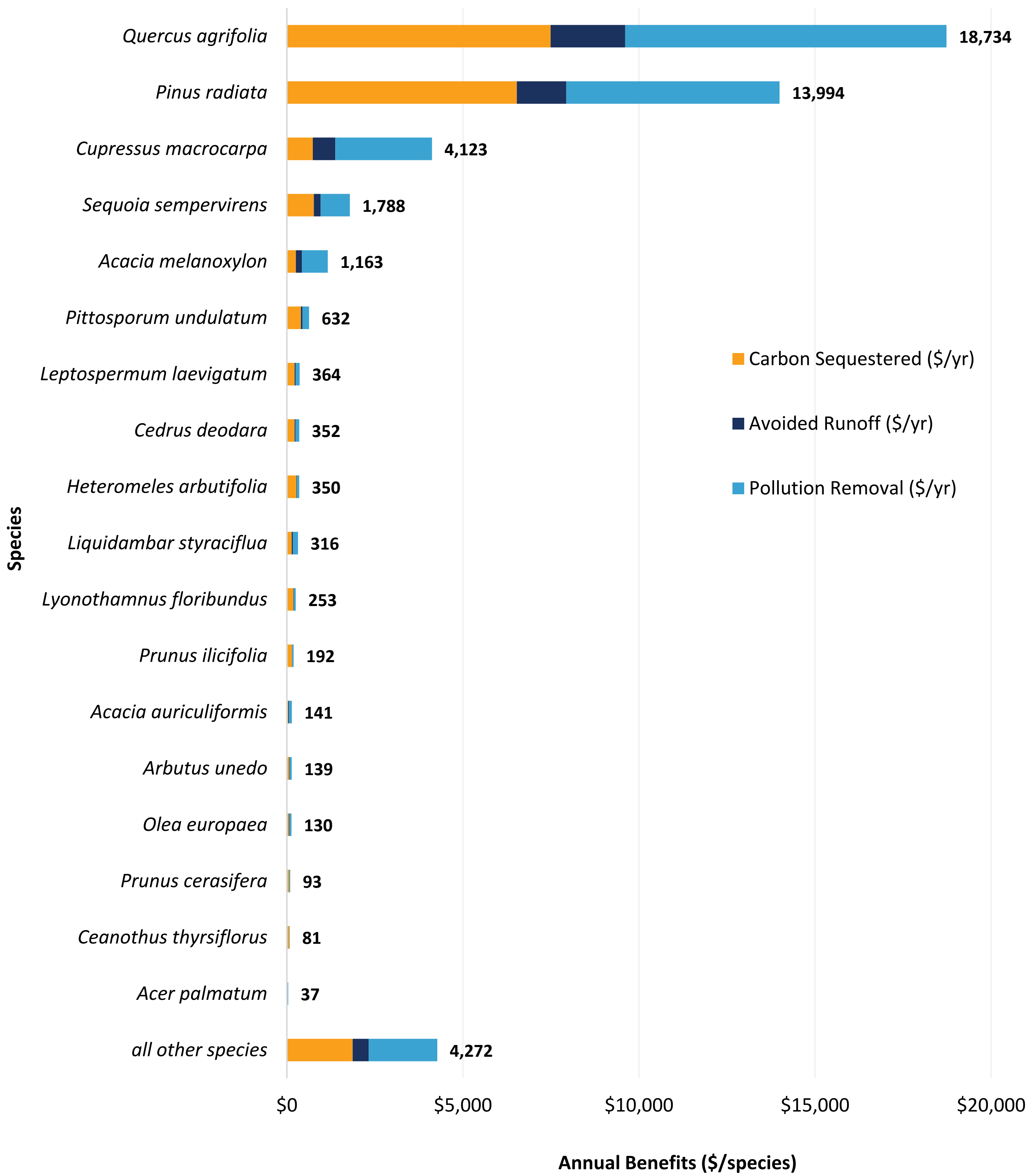


Figure 11: Summary of Annual Benefits for Most Prevalent Species

Pinus radiata (Monterey pine) provide $13,994 in annual benefits and the highest per tree benefit, an average of $7.83 per tree. *Acer palmatum* (Japanese maple) provide the least amount in annual benefits ($37) among prevalent species and the lowest per tree benefit, an average of $0.53 per tree. As the majority (97.2%) of *Acer palmatum* measure less than 8 inches in diameter, which for this small stature tree is likely mature and the annual per tree benefits are unlikely to increase over time.

Table 10: Summary of Annual Benefits of Most Prevalent Species

Species	# of Trees	% of Pop.	Carbon Sequestration (ton/yr.)	Carbon Sequestration ($/yr.)	Avoided Runoff (gal./yr.)	Avoided Runoff ($/yr.)	Pollution Removal (ton/yr.)	Pollution Removal ($/yr.)	Total Benefits ($/yr.)
Quercus agrifolia	3,971	40.21	43.91	7488.55	237,172	2,119.37	1.27	9,125.97	$18,733.89
Pinus radiata	1,787	18.10	38.29	6530.69	157,397	1,406.50	0.84	6,056.35	$13,993.54
Cupressus macrocarpa	864	8.75	4.31	735.88	71,437	638.36	0.38	2,748.77	$4,123.01
Acacia melanoxylon	350	3.54	1.50	255.41	19,132	170.96	0.10	736.16	$1,162.53
Sequoia sempervirens	283	2.87	4.48	764.50	21,590	192.93	0.12	830.74	$1,788.17
Pittosporum undulatum	278	2.82	2.34	399.45	4,900	43.79	0.03	188.56	$631.80
Heteromeles arbutifolia	161	1.63	1.57	268.23	1,732	15.47	0.01	66.63	$350.33
Cedrus deodara	89	0.90	1.28	218.69	2,805	25.07	0.02	107.93	$351.69
Acacia auriculiformis	87	0.88	0.23	39.34	2,148	19.19	0.01	82.65	$141.18
Liquidambar styraciflua	81	0.82	0.81	137.39	3,771	33.70	0.02	145.12	$316.21
Prunus ilicifolia	81	0.82	0.84	143.33	1,021	9.12	0.01	39.29	$191.74
Prunus cerasifera	79	0.80	0.37	62.44	654	5.84	0.00	25.16	$93.44
Arbutus unedo	77	0.78	0.37	63.37	1,587	14.19	0.01	61.08	$138.64
Ceanothus thyrsiflorus	72	0.73	0.40	67.75	281	2.51	0.00	10.81	$81.07
Acer palmatum	70	0.71	0.13	21.35	333	2.97	0.00	12.80	$37.12
Olea europaea	69	0.70	0.34	57.58	1,518	13.56	0.01	58.40	$129.54
Leptospermum laevigatum	63	0.64	1.30	220.99	3,012	26.92	0.02	115.90	$363.81
Lyonothamnus floribundus	59	0.60	1.08	184.22	1,450	12.95	0.01	55.78	$252.95
all other species	1,354	13.71	10.89	1867.13	50,728	453.35	0.18	1,951.92	$4,272.40
Total	**9,875**	**100%**	**114.49**	**$19,526.29**	**582,667**	**$5,206.72**	**3.13**	**$22,420.02**	**$47,153.03**

Net Annual Benefits

Carmel-by-the-Sea receives substantial benefits from their community tree resource; however, managers should understand and evaluate the investment required to preserve the community tree resource along with the benefits that it provides. A limitation of the annual benefits summary is that i-Tree *Eco* does not fully account for all benefits provided by community tree resource. Many of the documented environmental and socioeconomic benefits provided by trees are intangible and not able to be quantified using current methods (University of Washington, 2018; University of Illinois, 2018).

Carmel-by-the-Sea's community tree resource has a beneficial effect on the environment, and annually contributes $47,153 in quantifiable benefits to the community (Figure 12). Individual components of the environmental benefits include improved air quality $22,420 (47.6%), carbon reduction of $19,526 (41.4%), and stormwater management for $5,207 (11%).

Annually, community trees provide a total benefit of $47,153, a value of $4.77 per tree and $12.67 per capita.

Annual Investment & Benefit Offset

Carmel-by-the-Sea's urban forestry staff provided estimated investment costs. The total annual cost of managing the community tree resource in Carmel-by-the-Sea is approximately $385,000. Based on budget information from 2023 and 2024, in total, 39% of the costs are attributed to annual pruning, 39% to tree removal, and 10% to purchasing and planting trees. The remaining 12% of costs are for weed abatement, emergency response, and equipment/software. The quantifiable benefits from i-Tree *Eco* offset this investment by $47, 153 (Table 11).

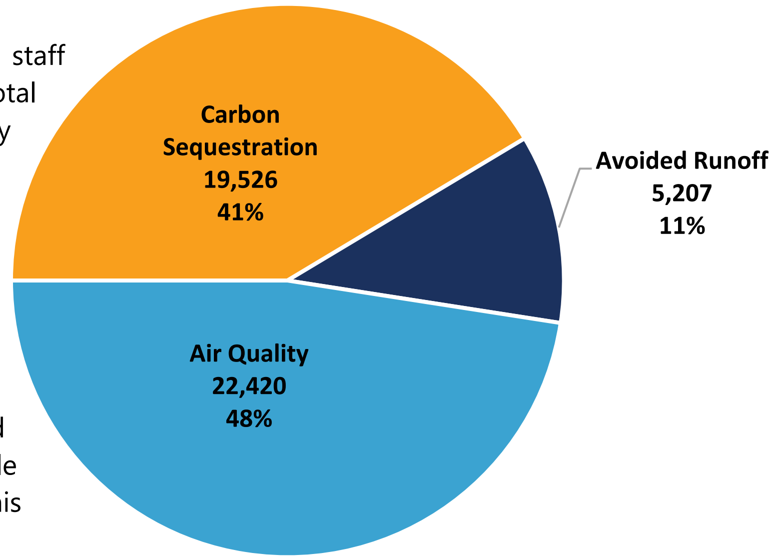


Figure 12 Annual Environmental Benefits

Table 11: Quantifiable Benefits and Investments

Benefits	Total ($)	($)/tree	($)/capita
Pollution Removal	22,420	2.27	6.02
Carbon Sequestration	19,256	1.98	5.25
Avoided Runoff	5,207	0.53	1.40
Total Benefits	**$47,153**	**$4.77**	**$12.67**

Investments	Total ($)	($)/tree	($)/capita
Planting	40,000	4.05	11.43
Pruning	150,000	15.19	42.86
Tree & Stump Removal/Disposal	150,000	15.19	42.86
Weed Abatement	20,000	2.03	5.71
Emergency Response	15,000	1.52	4.29
Equipment/software	10,000	1.01	2.86
Total Investments	**$385,000**	**$38.99**	**$110.00**

Pest and Pathogen Threats

Management of pests and disease organisms can be a challenge in any urban forest. In some cases, a pest or disease can result in significant tree damage or loss and/or be costly to manage. Involvement in the global economy, close proximity to major ports, and a highly mobile human population increase the risk of an invasive pest or pathogen introduction into Carmel-by-the-Sea. To further investigate the risk of pests and pathogens, i-Tree *Eco* identifies the susceptibility of tree populations to 50 emerging and existing pests and pathogens in the United States (Appendix B). According to the analysis, 7,848 (79.5%) of Carmel-by-the-Sea's community trees are susceptible to the included pests and pathogens and the potential risk is estimated at $76.9 million. The pests and pathogens identified as most relevant to Carmel-by-the-Sea are included in Table 12. Anticipating and monitoring for these threats is an important part of urban forest management.

According to the analysis, the pests of greatest concern for Carmel-by-the-Sea's community forest are threats to oaks (*Quercus* spp.) and include the polyphagous shot hole borer, defoliating moths, sudden oak death, and gold spotted oak borer.

The polyphagous shot hole borer is involved in a disease called Fusarium dieback. The beetles introduce fungi, some of which are tree pathogens that disrupt the flow of water and nutrients. The damage causes cankers, branch dieback, and over time can kill the tree (Eskalen, 2018). Within the United States, the polyphagous shot hole borer has been detected in southern California, but this pest may have the potential to spread northward to Monterey County because of its large host range (consisting of more than 260 plant species) and ability to colonize healthy or stressed trees. An estimated 54.5% of trees in Carmel-by-the-Sea are at risk to polyphagous shot hole borer.

Defoliating moths, such as the spongy moth (*Lymantria dispar*) and winter moth (*Operophtera brumata*), are not yet present in California, but they threaten a range of tree hosts present in Carmel-by-the-Sea (~42% trees susceptible). During outbreaks, the feeding damage weakens the tree host, and renders it more vulnerable to other pests and diseases (Collins, 1996). The spongy moth is known to feed on hundreds of species of trees and shrubs; oaks (*Quercus* spp.) are one of their preferred hosts.

Sudden oak death (caused by the pathogen *Phytophthora ramorum*) is documented in Monterey County (California Oak Mortality Taskforce, 2020). In susceptible hosts, the pathogen can become systemic and girdle trees as quickly as one year after infection (Daugherty and Hung, 2020). Of Carmel-by-the-Sea's community trees, 46.2% are at risk to sudden oak death. *Quercus agrifolia* (coastal live oak) is highly susceptible to sudden oak death and incurs high mortality rates upon infection.

The gold spotted oak borer (*Agrilus auroguttatus*) causes mortality to mature coastal live oak, canyon live oak, and California black oak in southern California. These beetles cause feeding damage in the phloem; the tissue that carries sugars and plant hormones throughout the tree, as well as the xylem tissues that transport water. Gold spotted oak borer may not be noticed during the initial stages of infestation, but trees exhibit crown thinning, dieback, staining, woodpecker damage, and beetle exit holes during later stages. Typically, infested oak trees die after several years of feeding damage (Flint et al, 2013). Currently, 40.6% of trees are susceptible. *Quercus agrifolia* (coastal live oak) makes up 40.2% of the inventory and the 26.4% mature individuals (>12-inches DBH) are at the most risk.

Table 12: Pest & Pathogen Threats to Carmel-by-the-Sea

Pest Name	Pest Name	# of Trees Susceptible	# of Trees Not Susceptible	Replacement Value ($) Susceptible	Replacement Value ($) Not Susceptible	Leaf Area (%) Susceptible	Leaf Area (%) Not Susceptible	Leaf Area (acre) Susceptible	Leaf Area (acre) Not Susceptible
Phyllocnistis populiella	Aspen Leafminer	20	9,855	10,982	25,210,281	0.10	100	0.20	358.20
Anoplophora glabripennis	Asian Longhorned Beetle	184	9,691	106,812	25,114,451	0.50	100	1.80	356.60
Armillaria spp.	Armillaria Root Disease	27	9,848	73,701	25,147,563	0.30	100	0.90	357.50
Sirococcus clavigignenti juglandacearum	Butternut Canker	1	9,874	7,171	25,214,093	0.00	100	0.10	358.30
Euproctis chrysorrhoea	Browntail Moth	32	9,843	19,021	25,202,242	0.10	100	0.30	358.10
Leptographium wageneri	Black Stain Root Disease	23	9,852	58,888	25,162,375	0.20	100	0.80	357.50
Discula destructiva	Dogwood Anthracnose	15	9,860	1,292	25,219,971	0.00	100	0.00	358.30
Leptographium wageneri var. pseudotsugae	Douglas-fir Black Stain Root Disease	23	9,852	58,888	25,162,375	0.20	100	0.80	357.50
Ophiostoma novo-ulmi	Dutch Elm Disease	6	9,869	4,310	25,216,954	0.00	100	0.10	358.30
Dendroctonus pseudotsugae	Douglas-Fir Beetle	18	9,857	51,231	25,170,033	0.20	100	0.70	357.70
Agrilus planipennis	Emerald Ash Borer	1	9,874	114	25,221,150	0.00	100	0.00	358.40
Scolytus ventralis	Fir Engraver	18	9,857	51,231	25,170,033	0.20	100	0.70	357.70
Cronartium quercuum f. sp. Fusiforme	Fusiform Rust	2	9,873	1,955	25,219,309	0.00	100	0.00	358.30
Malacosoma disstria	Forest Tent Caterpillar	34	9,841	19,417	25,201,847	0.10	100	0.30	358.10
Agrilus auroguttatus	Goldspotted Oak Borer	4,011	5,864	7,078,492	18,142,772	41.00	59	147.10	211.30
Heterobasidion irregulare/occidentale	Heterobasidion Root Disease	29	9,846	62,001	25,159,262	0.20	100	0.90	357.50
Choristoneura pinus	Jack Pine Budworm	2	9,873	7,504	25,213,759	0.00	100	0.20	358.20
Choristoneura conflictana	Large Aspen Tortrix	36	9,839	20,014	25,201,250	0.10	100	0.40	358.00
Raffaelea lauricola	Laurel Wilt	8	9,867	4,699	25,216,564	0.00	100	0.10	358.30
Xyleborus monographus	Mediterranean Oak Borer	1	9,874	0	25,221,264	0.00	100	0.00	358.40
Dendroctonus ponderosae	Mountain Pine Beetle	7	9,868	15,162	25,206,102	0.10	100	0.30	358.10
Ceratocystis fagacearum	Oak Wilt	4,099	5,776	7,260,120	17,961,144	42.30	58	151.50	206.90
Leptographium wageneri var. ponderosum	Pine Black Stain Root Disease	5	9,870	7,657	25,213,606	0.00	100	0.10	358.20
Phytophthora lateralis	Port-Orford-Cedar Root Disease	3	9,872	2,698	25,218,566	0.00	100	0.00	358.30
Tomicus piniperda	Pine Shoot Beetle	1,867	8,008	10,010,984	15,210,280	27.70	72	99.30	259.10
Euwallacea nov. sp.	Polyphagous Shot Hole Borer	5,379	4,496	8,699,644	16,521,620	50.30	50	180.30	178.00
Matsucoccus resinosae	Red Pine Scale	5	9,870	4,506	25,216,758	0.00	100	0.10	358.30
Lymantria dispar	Spongy Moth	4,254	5,621	7,457,403	17,763,860	43.30	57	155.10	203.30
Dendroctonus rufipennis	Spruce Beetle	4	9,871	2,293	25,218,971	0.00	100	0.00	358.30
Choristoneura fumiferana	Spruce Budworm	22	9,853	53,524	25,167,740	0.20	100	0.70	357.60
Lycorma delicatula	Spotted Lanternfly	207	9,668	124,360	25,096,904	0.60	99	2.10	356.30
Phytophthora ramorum	Sudden Oak Death	4,559	5,316	8,358,729	16,862,535	46.20	54	165.60	192.70
Dendroctonus frontalis	Southern Pine Beetle	1,853	8,022	9,962,046	15,259,218	27.50	73	98.60	259.80
Sirex noctilio	Sirex Wood Wasp	1,849	8,026	9,959,753	15,261,511	27.50	73	98.60	259.80
Geosmithia morbida	Thousand Canker Disease	1	9,874	7,171	25,214,093	0.00	100	0.10	358.30
Dryocoetes confusus	Western Bark Beetle	5	9,870	7,657	25,213,606	0.00	100	0.10	358.20
Acleris gloverana	Western Blackheaded Budworm	18	9,857	51,231	25,170,033	0.20	100	0.70	357.70
Operophtera brumata	Winter Moth	4,076	5,799	7,162,109	18,059,155	41.50	59	148.70	209.60
Dendroctonus brevicomis	Western Pine Beetle	5	9,870	7,657	25,213,606	0.00	100	0.10	358.20
Choristoneura occidentalis	Western Spruce Budworm	29	9,846	68,685	25,152,578	0.30	100	1.00	357.40
All Pests		**7,848**	**2,027**	**$76,861,112**	**$931,989,434**	**82.40%**	**17.60%**	**295.40**	**62.90**

Pest Management

Although managers cannot foresee when a pest or pathogen may be introduced to the urban forest, being aware of potential threats is the first step in a preparedness program. Following Integrated Pest Management (IPM) protocol and best management practices when preparing for and addressing pest and diseases can help to minimize their economic, health, and environmental consequences (Wiseman and Raupp, 2016). Some management practices include:

- Obtain current information on emergent pests and pathogens
- Increase understanding of the biology of the pest and pathogen as well as the tree symptoms that indicate infestation/infection
- Identify procedures and protocols that will be followed in the case of an introduced pest or pathogen
- Complete training and licensing in the case of pesticide or fungicide use
- Plant tree species that are resistant or tolerant to identified pest and pathogen threats
- Choose healthy, vigorous nursery stock
- Diversify plantings at the genus level, as many pests threaten several species within a genus
- Prevent the movement of felled tree materials that may be harboring pests or pathogens such as untreated logs, firewood, and woodchips

Maintaining a diverse community tree resource is important in integrated pest management.

Conclusion

This analysis describes the current structural characteristics of Carmel-by-the-Sea's community tree resource using established numerical modeling and statistical methods to provide a general accounting of the benefits. The analysis provides a "snapshot" of this resource at its current population, structure, and condition. Carmel-by-the-Sea's 9,875 community trees are providing quantifiable impacts on air quality, reduction in atmospheric CO_2, stormwater runoff, and aesthetic benefits worth $47,153 annually, a value of $4.77 per tree and $12.67 per capita.

Industry standards suggest that no single tree species should represent more than 10% of the urban forest and no single genera should represent more than 20%. In Carmel-by-the-Sea's community tree inventory, *Pinus radiata* and *Quercus agrifolia* exceed this rule at the species level and *Q. agrifolia* exceeds the rule at the genus level. Although native to California and the Monterey Peninsula, these species are still subject to stress and harm related to climate, pests, or pathogen pressures. The rule provides a baseline for increasing genetic diversity. Future plantings can protect the overall tree resource by reducing reliance on these species.

Carmel-by-the-Sea's community tree resource has an established population in mostly fair or better condition with 200 distinct species. The City should continue to focus resources on preserving existing and mature trees to promote health, strong structure, and tree longevity. Structural and training pruning for young trees will maximize the value of this resource, reduce long-term maintenance costs, reduce risk, and ensure that as trees mature, they provide the greatest possible benefits over time.

Based on this resource analysis, DRG recommends the following regarding the management of the City's trees:

- Increase genus and species diversity in new and replacement tree plantings to reduce reliance on over-represented species, including *Quercus agrifolia* which represents more than 10% of the overall population.
- Protect and regularly inspect existing trees to identify and mitigate structural and age-related defects, manage risk, and reduce the likelihood of tree and branch failure.
- Provide structural pruning for young trees and a routine pruning for all trees.
- Use new tree plantings to improve diversity, increase benefits, and support an ideal age distribution of community trees.
    - Consider successional planting of important species and individual trees.
- Monitor species performance (e.g., health, structure, longevity, pests and disease resistance) and increase resilience in the urban forest by planting species that perform well in local and regional conditions, including introducing new species that indicate promising traits.
    - Consider species performance data when reviewing and updating the tree planting palette.
- Monitor species with the potential to become invasive (e.g., *Melaleuca quinquenervia*, *Acacia melanoxylon*, and *Schinus terebinthifolia*) and implement management strategies as needed.
- Prioritize planting replacement trees for those trees that are removed and plant available vacant sites to increase the stocking level for optimal benefits.
- Follow integrated pest management and best management practices when monitoring for and dealing with pests and diseases.

- Maintain and update the inventory database to include new tree plantings, removals, as well as changes in diameter and condition.
    - Consider adding information on distance and orientation to nearest structure/building so that energy benefits can be calculated in future analyses.
    - Inventory trees that were not collected during the 2023 collection.

Urban forest managers can better anticipate future trends with an understanding of the composition and structure of the tree population. Managers can also anticipate challenges and devise plans to optimize efficiency and anticipate budgetary needs. Performance data from this analysis can be used to make determinations regarding species selection, distribution, and maintenance policies. Documenting current structure is necessary for establishing goals and performance objectives and can serve as a baseline for measuring future success.

Carmel-by-the-Sea's community trees are of vital importance to the environmental, social, and economic well-being of the community. Inventory data can be used to plan a proactive and forward-looking approach to the care of community trees. Updates should continue to be incorporated into the inventory as regular maintenance is performed, including changes in the diameter and condition of existing trees. Current and complete inventory data will help staff to track maintenance activities and tree health more efficiently and will provide a strong basis for making informed management decisions. A continued commitment to planting, maintaining, and preserving these trees will support the health and welfare of the community for generations to come.

Trees are of vital importance to the environmental, social, and economic well-being of the community.

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Carmel-by-the-Sea's community tree resource includes a mix of 200 distinct species.

Appendix B: Methods

i-Tree *Eco* Model and Field Measurements

All field data was collected during the leaf-on season to properly assess tree canopies. The i-Tree *Eco* model uses inventory data, local hourly air pollution, and meteorological data to quantify the urban forest and its structure and benefits (Nowak & Crane, 2000), including:

- Urban forest structure (e.g., genus composition, tree health, leaf area, etc.).
- Amount of pollution removed hourly by the urban forest, and its associated percent air quality improvement throughout a year. Pollution removal is calculated for ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide and particulate matter (<2.5 microns).
- Total carbon stored and net carbon annually sequestered by the urban forest.
- Structural value of the forest as a replacement cost.
- Potential impact of infestations by pests or pathogen.

Definitions and Calculations

Avoided surface water runoff value is calculated based on rainfall interception by vegetation, specifically the difference between annual runoff with and without vegetation. Although tree leaves, branches, and bark may intercept precipitation and thus mitigate surface runoff, only the precipitation intercepted by leaves is accounted for in this analysis. The U.S. value of avoided runoff, $0.1 gallon, is based on the U.S. Forest Service's Community Tree Guide Series (McPherson et al, 1999-2010; Peper et al, 2009; 2010; Vargas et al, 2007a-2008).

Carbon emissions were calculated based on the total City carbon emissions from the 2010 US per capita carbon emissions (Carbon Dioxide Information Analysis Center, 2010) This value was multiplied by the population of Carmel-by-the-Sea (3,722) to estimate total City carbon emissions.

Carbon sequestration is removal of carbon from the air by plants. Carbon storage and carbon sequestration values are calculated based on $171 per short ton (EPA, 2015; Interagency Working Group on Social Cost of Carbon, 2015).

Carbon storage is the amount of carbon bound up in the above-ground and below-ground parts of woody vegetation. Carbon storage and carbon sequestration values are calculated based on $171 per ton (EPA, 2015; Interagency Working Group on Social Cost of Carbon, 2015).

Diameter at Breast Height (DBH) is the diameter of the tree measured 4’5” above grade.

Household emissions average is based on average electricity kWh usage, natural gas Btu usage, fuel oil Btu usage, kerosene Btu usage, LPG Btu usage, and wood Btu usage per household in 2009 (EIA, 2013; EIA, 2014), CO_2, SO_2, and NO_3 power plant emission per KwH (Leonardo Academy, 2011), CO emission per kWh assumes 1/3 of one percent of C emissions is CO (EIA, 2014), PM_{10} emission per kWh (Layton 2004), CO_2, NO_3, SO_2, and CO emission per Btu for natural gas, propane and butane (average used to represent LPG), Fuel #4 and #6 (average used to represent fuel oil and kerosene) (Leonardo Academy, 2011), CO_2 emissions per Btu of wood (EIA, 2014), CO, NO_3 and SO_2 emission per Btu based on total emissions and wood burning (tons) from (British Columbia Ministry, 2005; Georgia Forestry Commission, 2009).

Leaf area was estimated using measurements of crown dimensions and percentage of crown canopy missing.

Monetary values ($) are reported in US dollars throughout the report.

Ozone (O_3) is an air pollutant that is harmful to human health. Ozone forms when nitrogen oxide from fuel combustion and volatile organic gases from evaporated petroleum products react in the presence of sunshine. In the absence of cooling effects provided by trees, higher temperatures contribute to ozone (O_3) formation.

Pollution removal is calculated based on the prices of $1,397 per ton (carbon monoxide), $5,680 per ton (ozone), $672 per ton (nitrogen dioxide), $292 per ton (sulfur dioxide), $293,786 per ton (particulate matter less than 2.5 microns), and $6,565 per ton (particulate matter less than 10 microns) (Nowak et al., 2014).

Potential pest impacts were estimated based on tree inventory information from the study area combined with i-Tree *Eco* pest range maps. The input data included species, DBH, total height, height to crown base, crown width, percent canopy missing, and crown dieback. In the model, potential pest risk is based on pest range maps and the known pest host species that are likely to experience mortality.

Pest range maps for 2012 from the Forest Health Technology Enterprise Team (FHTET) (Forest Health Technology Enterprise Team, 2014) were used to determine the proximity of each pest to Yolo County For the county, it was established whether the insect/disease occurs within the county, is within 250 miles of the county edge, is between 250 and 750 miles away, or is greater than 750 miles away. FHTET did not have pest range maps for Dutch elm disease and chestnut blight. The range of these pests was based on known occurrence and the host range, respectively (Eastern Forest Environmental Threat Assessment Center; Worrall 2007). Due to the dates of some of these resources, pests may have encroached closer to the tree resource in recent years.

Replacement value is based on the physical resource itself (e.g., the cost of having to replace a tree with a similar tree). Structural values were based on valuation procedures of the Council of Tree and Landscape Appraisers, which uses tree species, diameter, condition, and location information (Nowak et al 2002a; 2002b).

Ton is equivalent to a U.S. short ton, or 2,000 pounds.

Appendix C: Tables

Table 13: Botanical and Common Names of Tree Species in Carmel-by-the-Sea's community tree resource

Botanical Name	Common Name	# of Trees	% of Pop.
Quercus agrifolia	coast live oak	3,971	40.21
Pinus radiata	Monterey pine	1,787	18.10
Cupressus macrocarpa	Monterey cypress	864	8.75
Acacia melanoxylon	black acacia	350	3.54
Sequoia sempervirens	coast redwood	283	2.87
Pittosporum undulatum	Victorian box	278	2.82
Heteromeles arbutifolia	toyon	161	1.63
Cedrus deodara	deodar cedar	89	0.90
Acacia auriculiformis	northern black wattle	87	0.88
Liquidambar styraciflua	sweetgum	81	0.82
Prunus ilicifolia	hollyleaf cherry	81	0.82
Prunus cerasifera	cherry plum	79	0.80
Arbutus unedo	strawberry tree	77	0.78
Ceanothus thyrsiflorus	blue blossom	72	0.73
Acer palmatum	Japanese maple	70	0.71
Olea europaea	olive	69	0.70
Leptospermum laevigatum	coastal tea-tree	63	0.64
Lyonothamnus floribundus	lyontree	59	0.60
Ilex aquifolium	English holly	46	0.47
Pittosporum eugenioides	tarata	46	0.47
Quercus chrysolepis	canyon live oak	40	0.41
Quercus ilex	holly oak	39	0.39
Dodonaea viscosa	Florida hopbush	38	0.38
Quercus wislizeni	interior live oak	37	0.37
Pittosporum tobira	Japanese pittosporum	33	0.33
Ligustrum japonicum	Japanese privet	32	0.32
Magnolia grandiflora	southern magnolia	30	0.30
Acacia confusa	small Philippine acacia	27	0.27
Acacia dealbata	silver wattle	27	0.27
Pinus canariensis	Canary Island pine	26	0.26
unknown	unknown	25	0.25
Syzygium paniculatum	brush cherry	25	0.25
Callistemon citrinus	crimson bottlebrush	24	0.24
Ginkgo biloba	ginkgo	23	0.23
Podocarpus macrophyllus	yew podocarpus	23	0.23
Ulmus parvifolia	Chinese elm	23	0.23

Botanical Name	Common Name	# of Trees	% of Pop.
Prunus caroliniana	Carolina laurelcherry	22	0.22
Pittosporum viridiflorum	cape cheesewood	20	0.20
Prunus spp.	Plum species	20	0.20
Eucalyptus ficifolia	redflower gum	18	0.18
Maytenus boaria	mayten	18	0.18
Pseudotsuga menziesii	douglas fir	18	0.18
Pittosporum rhombifolia	Queensland pittosporum	16	0.16
Robinia pseudoacacia	black locust	16	0.16
Pittosporum crassifolium	stiffleaf cheesewood	15	0.15
Schinus terebinthifolia	Brazilian peppertree	15	0.15
Albizia julibrissin	Persian silk tree	14	0.14
Eriobotrya japonica	loquat tree	14	0.14
Platanus x hybrida	London planetree	14	0.14
Podocarpus gracilior	fern pine	14	0.14
Cotoneaster buxifolius	box-leaf cotoneaster	13	0.13
Juniperus chinensis	Chinese juniper	13	0.13
Metrosideros excelsa	New Zealand Christmas tree	13	0.13
Ligustrum lucidum	glossy privet	12	0.12
Platanus racemosa	California sycamore	12	0.12
Melaleuca quinquenervia	punk tree	11	0.11
Myoporum laetum	mioporo	11	0.11
Pistacia chinensis	Chinese pistache	11	0.11
Schinus molle	California peppertree	11	0.11
Camellia japonica	camellia	10	0.10
Cordyline australis	giant dracaena	10	0.10
Ficus carica	common fig	10	0.10
Laurus nobilis	bay laurel	10	0.10
Ailanthus altissima	tree of heaven	9	0.09
Cornus spp.	dogwood species	9	0.09
Malus spp.	apple species	9	0.09
Photinia serrulata	photinia	9	0.09
Pinus pinea	Italian stone pine	9	0.09
Pyracantha coccinea	fire thorn	9	0.09
Yucca spp.	yucca species	9	0.09
Acacia baileyana	bailey acacia	8	0.08
Betula pendula	European white birch	8	0.08
Pyrus calleryana	Callery pear	8	0.08
Acer macrophyllum	bigleaf maple	7	0.07

Botanical Name	Common Name	# of Trees	% of Pop.
Aesculus californica	California buckeye	7	0.07
Cercis canadensis	eastern redbud	7	0.07
Citrus spp.	citrus species	7	0.07
Ligustrum sinense	Chinese privet	7	0.07
Alnus glutinosa	European alder	6	0.06
Cercis canadensis v. texensis	western redbud	6	0.06
Eucalyptus spp.	gum species	6	0.06
Eucalyptus robusta	beakpod euclayptus	6	0.06
Photinia x fraseri	fraser photinia	6	0.06
Quercus tomentella	island live oak	6	0.06
Araucaria heterophylla	Norfolk Island pine	5	0.05
Calocedrus decurrens	incense cedar	5	0.05
Sphaeropteris cooperi	Cooper's cyathea	5	0.05
Eucalyptus globulus	blue gum eucalyptus	5	0.05
Eucalyptus polyanthemos	silver dollar eucalyptus	5	0.05
Tristaniopsis confertus	vinegartree	5	0.05
Magnolia x soulangeana	saucer magnolia	5	0.05
Pinus spp.	pine species	5	0.05
Pinus halepensis	Aleppo pine	5	0.05
Pinus ponderosa	ponderosa pine	5	0.05
Pinus thunbergii	Japanese black pine	5	0.05
Platycladus orientalis	oriental arborvitae	5	0.05
Ulmus americana	American elm	5	0.05
Umbellularia californica	California laurel	5	0.05
Citrus limon	lemon	4	0.04
Eriobotrya deflexa	bronze loquat	4	0.04
Eucalyptus sideroxylon	mugga ironbark	4	0.04
Gleditsia triacanthos	honeylocust	4	0.04
Juniperus californica	California juniper	4	0.04
Juniperus communis	common juniper	4	0.04
Ligustrum ovalifolium	California privet	4	0.04
Picea pungens	blue spruce	4	0.04
Rhamnus cathartica	European buckthorn	4	0.04
Thuja plicata	western red cedar	4	0.04
Washingtonia robusta	Mexican fan palm	4	0.04
Araucaria columnaris	coral reef araucaria	3	0.03
Casuarina equisetifolia	Australian pine	3	0.03
Eucalyptus cinerea	silver dollar eucalyptus	3	0.03

Botanical Name	Common Name	# of Trees	% of Pop.
Lagerstroemia indica	common crapemyrtle	3	0.03
Liquidambar formosana	Chinese sweet gum	3	0.03
Nerium oleander	oleander	3	0.03
Paraserianthes lophantha	plume albizia	3	0.03
Platanus occidentalis	American sycamore	3	0.03
Rhododendron spp.	rhododendron species	3	0.03
Acacia spp.	acacia species	2	0.02
Brachychiton populneus	kurrajong	2	0.02
Callistemon	bottlebrush species	2	0.02
Callistemon viminalis	weeping bottlebrush	2	0.02
Cedrus spp.	cedar species	2	0.02
Cornus florida	flowering dogwood	2	0.02
Cornus kousa	kousa dogwood	2	0.02
Crataegus spp.	hawthorn species	2	0.02
Cupressus sempervirens	Italian cypress	2	0.02
Eucalyptus lehmannii	bushy yate	2	0.02
Filicium decipiens	fern tree	2	0.02
Hymenosporum flavum	sweetshade	2	0.02
Ilex vomitoria	yaupon	2	0.02
Liriodendron tulipifera	tulip tree	2	0.02
Magnolia virginiana	sweetbay	2	0.02
Myrtus communis	myrtle	2	0.02
Persea americana	avocado	2	0.02
Phoenix canariensis	Canary Island date palm	2	0.02
Pinus sylvestris	Scots pine	2	0.02
Pinus torreyana	Torrey pine	2	0.02
Populus fremontii	fremont cottonwood	2	0.02
Prunus persica	peach	2	0.02
Quercus suber	cork oak	2	0.02
Ravenala madagascariensis	traveler's tree	2	0.02
Rhamnus frangula	alderleaf buckthorn	2	0.02
Taxus brevifolia	Pacific yew	2	0.02
Tilia cordata	littleleaf linden	2	0.02
Tilia tomentosa	silver linden	2	0.02
Acer buergerianum	trident maple	1	0.01
Acacia farnesiana	sweet acacia	1	0.01
Acer grandidentatum	bigtooth maple	1	0.01
Acer negundo	boxelder	1	0.01

Botanical Name	Common Name	# of Trees	% of Pop.
Acer rubrum	red maple	1	0.01
Acer shirasawanum	Shirasawa's maple	1	0.01
Arecastrum spp.	Arecastrum palm species	1	0.01
Arctostaphylos manzanita	whiteleaf manzanita	1	0.01
Betula papyrifera	paper birch	1	0.01
Betula platyphylla	Asian white birch	1	0.01
Catalpa speciosa	northern catalpa	1	0.01
Cedrus atlantica	atlas cedar	1	0.01
Cinnamomum camphora	camphor tree	1	0.01
Cladrastis kentukea	American yellowwood	1	0.01
Cornus alternifolia	alternateleaf dogwood	1	0.01
Eucalyptus citriodora	lemonscented gum	1	0.01
Cotinus coggygria	smoke tree	1	0.01
Coprosma repens	creeping mirrorplant	1	0.01
Cornus sericea	red osier dogwood	1	0.01
Cryptomeria japonica	Japanese red cedar	1	0.01
Crataegus phaenopyrum	Washington hawthorn	1	0.01
Echium candicans	Pride of Madeira	1	0.01
Eucalyptus camaldulensis	red gum eucalyptus	1	0.01
Eucalyptus nicholii	willow-leaved gimlet	1	0.01
Ficus microcarpa	Indian laurel	1	0.01
Fremontodendron californicum	California flannelbush	1	0.01
Fraxinus velutina	velvet ash	1	0.01
Garrya elliptica	wavyleaf silktassel	1	0.01
Juglans nigra	black walnut	1	0.01
Magnolia spp.	magnolia species	1	0.01
Malus sylvestris	European crabapple	1	0.01
Ochroma pyramidale	west Indian balsa	1	0.01
Pinus elliottii	slash pine	1	0.01
Pinus monophylla	singleleaf pinyon pine	1	0.01
Pinus palustris	longleaf pine	1	0.01
Prunus angustifolia	chickasaw plum	1	0.01
Prunus domestica	common plum	1	0.01
Prunus emarginata	bitter cherry	1	0.01
Prunus laurocerasus	cherry laurel	1	0.01
Prunus serrulata	Japanese flowering cherry	1	0.01
Pyrus communis	common pear	1	0.01
Quercus spp.	oak species	1	0.01

Botanical Name	Common Name	# of Trees	% of Pop.
Quercus hypoleucoides	silver leaf oak	1	0.01
Quercus lobata	California white oak	1	0.01
Quercus virginiana	live oak	1	0.01
Rhus integrifolia	lemonade berry	1	0.01
Sambucus nigra	European black elderberry	1	0.01
Taxus baccata	English yew	1	0.01
Thuja occidentalis	northern white cedar	1	0.01
Trachycarpus fortunei	windmill palm	1	0.01
Ulmus spp.	elm species	1	0.01
Viburnum spp.	viburnum species	1	0.01
Washingtonia filifera	California palm	1	0.01
Yucca gloriosa	moundlily yucca	1	0.01
Total		**9,875**	**100.00%**

Table 14: Importance Value (IV) for All Tree Species

Species	% of Pop.	% of Leaf Area	Importance Value (IV)	IV %
Quercus agrifolia	40.21	40.70	80.92	40.46
Pinus radiata	18.10	27.01	45.11	22.56
Cupressus macrocarpa	8.75	12.26	21.01	10.51
Acacia melanoxylon	3.54	3.71	7.25	3.63
Sequoia sempervirens	2.87	3.28	6.15	3.08
Pittosporum undulatum	2.82	1.43	4.25	2.12
Heteromeles arbutifolia	1.63	1.07	2.70	1.35
Cedrus deodara	0.90	0.84	1.74	0.87
Acacia auriculiformis	0.88	0.81	1.70	0.85
Liquidambar styraciflua	0.82	0.65	1.47	0.73
Prunus ilicifolia	0.82	0.52	1.34	0.67
Prunus cerasifera	0.80	0.48	1.28	0.64
Arbutus unedo	0.78	0.39	1.17	0.59
Ceanothus thyrsiflorus	0.73	0.37	1.10	0.55
Acer palmatum	0.71	0.34	1.05	0.52
Olea europaea	0.70	0.34	1.04	0.52
Leptospermum laevigatum	0.64	0.30	0.93	0.47
Lyonothamnus floribundus	0.60	0.27	0.87	0.44
Ilex aquifolium	0.47	0.26	0.73	0.36
Pittosporum eugenioides	0.47	0.25	0.71	0.36
Quercus chrysolepis	0.41	0.21	0.62	0.31
Quercus ilex	0.39	0.20	0.59	0.30
Dodonaea viscosa	0.38	0.18	0.56	0.28
Quercus wislizeni	0.37	0.17	0.55	0.27
Pittosporum tobira	0.33	0.17	0.50	0.25
Ligustrum japonicum	0.32	0.17	0.49	0.25
Magnolia grandiflora	0.30	0.12	0.42	0.21
Acacia confusa	0.27	0.11	0.39	0.19
Acacia dealbata	0.27	0.11	0.39	0.19
Pinus canariensis	0.26	0.11	0.37	0.19
Magnoliopsida	0.25	0.11	0.36	0.18
Syzygium paniculatum	0.25	0.11	0.36	0.18
Callistemon citrinus	0.24	0.10	0.35	0.17
Ginkgo biloba	0.23	0.10	0.34	0.17
Podocarpus macrophyllus	0.23	0.10	0.33	0.17
Ulmus parvifolia	0.23	0.09	0.32	0.16
Prunus caroliniana	0.22	0.08	0.31	0.15
Pittosporum viridiflorum	0.20	0.07	0.28	0.14
Prunus	0.20	0.07	0.27	0.14
Eucalyptus ficifolia	0.18	0.07	0.25	0.13
Maytenus boaria	0.18	0.07	0.25	0.12
Pseudotsuga menziesii	0.18	0.06	0.24	0.12

Species	% of Pop.	% of Leaf Area	Importance Value (IV)	IV %
Pittosporum rhombifolium	0.16	0.06	0.22	0.11
Robinia pseudoacacia	0.16	0.06	0.22	0.11
Pittosporum crassifolium	0.15	0.06	0.21	0.11
Schinus terebinthifolia	0.15	0.06	0.21	0.10
Podocarpuys gracilior	0.14	0.06	0.20	0.10
Albizia julibrissin	0.14	0.06	0.20	0.10
Eriobotrya japonica	0.14	0.05	0.19	0.10
Platanus x hybrida	0.14	0.05	0.19	0.10
Cotoneaster buxifolius	0.13	0.05	0.18	0.09
Juniperus chinensis	0.13	0.05	0.18	0.09
Metrosideros excelsa	0.13	0.05	0.18	0.09
Ligustrum lucidum	0.12	0.05	0.17	0.08
Platanus racemosa	0.12	0.04	0.16	0.08
Melaleuca quinquenervia	0.11	0.04	0.15	0.08
Myoporum laetum	0.11	0.04	0.15	0.08
Pistacia chinensis	0.11	0.04	0.15	0.08
Schinus molle	0.11	0.04	0.15	0.08
Camellia japonica	0.10	0.04	0.14	0.07
Cordyline australis	0.10	0.04	0.14	0.07
Ficus carica	0.10	0.04	0.14	0.07
Laurus nobilis	0.10	0.03	0.13	0.07
Ailanthus altissima	0.09	0.03	0.12	0.06
Cornus	0.09	0.03	0.12	0.06
Malus	0.09	0.03	0.12	0.06
Photinia serrulata	0.09	0.03	0.12	0.06
Pinus pinea	0.09	0.03	0.12	0.06
Pyracantha coccinea	0.09	0.03	0.12	0.06
Yucca	0.09	0.03	0.12	0.06
Acacia baileyana	0.08	0.03	0.11	0.05
Betula pendula	0.08	0.03	0.11	0.05
Pyrus calleryana	0.08	0.03	0.11	0.05
Acer macrophyllum	0.07	0.03	0.10	0.05
Aesculus californica	0.07	0.03	0.10	0.05
Cercis canadensis	0.07	0.02	0.09	0.05
Citrus	0.07	0.02	0.09	0.05
Ligustrum sinense	0.07	0.02	0.09	0.05
Alnus glutinosa	0.06	0.02	0.08	0.04
Cercis canadensis v. texensis	0.06	0.02	0.08	0.04
Eucalyptus	0.06	0.02	0.08	0.04
Eucalyptus robusta	0.06	0.02	0.08	0.04
Photinia x fraseri	0.06	0.02	0.08	0.04
Quercus tomentella	0.06	0.02	0.08	0.04
Araucaria heterophylla	0.05	0.02	0.07	0.04

Species	% of Pop.	% of Leaf Area	Importance Value (IV)	IV %
Calocedrus decurrens	0.05	0.02	0.07	0.03
Sphaeropteris cooperi	0.05	0.02	0.07	0.03
Eucalyptus globulus	0.05	0.02	0.07	0.03
Eucalyptus polyanthemos	0.05	0.02	0.07	0.03
Tristaniopsis conferta	0.05	0.02	0.07	0.03
Magnolia x soulangeana	0.05	0.02	0.07	0.03
Pinus	0.05	0.02	0.07	0.03
Pinus halepensis	0.05	0.02	0.07	0.03
Pinus ponderosa	0.05	0.02	0.07	0.03
Pinus thunbergii	0.05	0.02	0.07	0.03
Platycladus orientalis	0.05	0.01	0.06	0.03
Ulmus americana	0.05	0.01	0.06	0.03
Umbellularia californica	0.05	0.01	0.06	0.03
Citrus limon	0.04	0.01	0.05	0.03
Eriobotrya deflexa	0.04	0.01	0.05	0.03
Eucalyptus sideroxylon	0.04	0.01	0.05	0.03
Gleditsia triacanthos	0.04	0.01	0.05	0.03
Juniperus californica	0.04	0.01	0.05	0.03
Juniperus communis	0.04	0.01	0.05	0.03
Ligustrum ovalifolium	0.04	0.01	0.05	0.03
Picea pungens	0.04	0.01	0.05	0.03
Rhamnus cathartica	0.04	0.01	0.05	0.02
Thuja plicata	0.04	0.01	0.05	0.02
Washingtonia robusta	0.04	0.01	0.05	0.02
Araucaria columnaris	0.03	0.01	0.04	0.02
Casuarina equisetifolia	0.03	0.01	0.04	0.02
Eucalyptus cinerea	0.03	0.01	0.04	0.02
Lagerstroemia indica	0.03	0.01	0.04	0.02
Liquidambar formosana	0.03	0.01	0.04	0.02
Nerium oleander	0.03	0.01	0.04	0.02
Paraserianthes lophantha	0.03	0.01	0.04	0.02
Platanus occidentalis	0.03	0.01	0.04	0.02
Rhododendron	0.03	0.01	0.04	0.02
Acacia	0.02	0.01	0.03	0.01
Brachychiton populneus	0.02	0.01	0.03	0.01
Callistemon	0.02	0.01	0.03	0.01
Callistemon viminalis	0.02	0.01	0.03	0.01
Cedrus	0.02	0.01	0.03	0.01
Cornus florida	0.02	0.01	0.03	0.01
Cornus kousa	0.02	0.01	0.03	0.01
Crataegus	0.02	0.01	0.03	0.01
Cupressus sempervirens	0.02	0.01	0.03	0.01
Eucalyptus lehmannii	0.02	0.01	0.03	0.01

Species	% of Pop.	% of Leaf Area	Importance Value (IV)	IV %
Filicium decipiens	0.02	0.01	0.03	0.01
Hymenosporum flavum	0.02	0.01	0.03	0.01
Ilex vomitoria	0.02	0.01	0.03	0.01
Liriodendron tulipifera	0.02	0.01	0.03	0.01
Magnolia virginiana	0.02	0.00	0.02	0.01
Myrtus communis	0.02	0.00	0.02	0.01
Persea americana	0.02	0.00	0.02	0.01
Phoenix canariensis	0.02	0.00	0.02	0.01
Pinus sylvestris	0.02	0.00	0.02	0.01
Pinus torreyana	0.02	0.00	0.02	0.01
Populus fremontii	0.02	0.00	0.02	0.01
Prunus persica	0.02	0.00	0.02	0.01
Quercus suber	0.02	0.00	0.02	0.01
Ravenala madagascariensis	0.02	0.00	0.02	0.01
Rhamnus frangula	0.02	0.00	0.02	0.01
Taxus brevifolia	0.02	0.00	0.02	0.01
Tilia cordata	0.02	0.00	0.02	0.01
Tilia tomentosa	0.02	0.00	0.02	0.01
Acacia farnesiana	0.01	0.00	0.01	0.01
Acer buergerianum	0.01	0.00	0.01	0.01
Acer grandidentatum	0.01	0.00	0.01	0.01
Acer negundo	0.01	0.00	0.01	0.01
Acer rubrum	0.01	0.00	0.01	0.01
Acer shirasawanum	0.01	0.00	0.01	0.01
Arctostaphylos manzanita	0.01	0.00	0.01	0.01
Arecastrum	0.01	0.00	0.01	0.01
Betula papyrifera	0.01	0.00	0.01	0.01
Betula platyphylla	0.01	0.00	0.01	0.01
Catalpa speciosa	0.01	0.00	0.01	0.01
Cedrus atlantica	0.01	0.00	0.01	0.01
Cinnamomum camphora	0.01	0.00	0.01	0.01
Cladrastis kentukea	0.01	0.00	0.01	0.01
Coprosma repens	0.01	0.00	0.01	0.01
Cornus alternifolia	0.01	0.00	0.01	0.01
Cornus sericea	0.01	0.00	0.01	0.01
Eucalyptus citriodora	0.01	0.00	0.01	0.01
Cotinus coggygria	0.01	0.00	0.01	0.01
Crataegus phaenopyrum	0.01	0.00	0.01	0.01
Cryptomeria japonica	0.01	0.00	0.01	0.01
Echium candicans	0.01	0.00	0.01	0.01
Eucalyptus camaldulensis	0.01	0.00	0.01	0.01
Eucalyptus nicholii	0.01	0.00	0.01	0.01
Ficus microcarpa	0.01	0.00	0.01	0.01

Species	% of Pop.	% of Leaf Area	Importance Value (IV)	IV %
Fraxinus velutina	0.01	0.00	0.01	0.01
Fremontodendron californicum	0.01	0.00	0.01	0.01
Garrya elliptica	0.01	0.00	0.01	0.01
Juglans nigra	0.01	0.00	0.01	0.01
Magnolia	0.01	0.00	0.01	0.01
Malus sylvestris	0.01	0.00	0.01	0.01
Ochroma pyramidale	0.01	0.00	0.01	0.01
Pinus elliottii	0.01	0.00	0.01	0.01
Pinus monophylla	0.01	0.00	0.01	0.01
Pinus palustris	0.01	0.00	0.01	0.01
Prunus angustifolia	0.01	0.00	0.01	0.01
Prunus domestica	0.01	0.00	0.01	0.01
Prunus emarginata	0.01	0.00	0.01	0.01
Prunus laurocerasus	0.01	0.00	0.01	0.01
Prunus serrulata	0.01	0.00	0.01	0.01
Pyrus communis	0.01	0.00	0.01	0.01
Quercus	0.01	0.00	0.01	0.01
Quercus hypoleucoides	0.01	0.00	0.01	0.01
Quercus lobata	0.01	0.00	0.01	0.01
Quercus virginiana	0.01	0.00	0.01	0.01
Rhus integrifolia	0.01	0.00	0.01	0.01
Sambucus nigra	0.01	0.00	0.01	0.01
Taxus baccata	0.01	0.00	0.01	0.01
Thuja occidentalis	0.01	0.00	0.01	0.01
Trachycarpus fortunei	0.01	0.00	0.01	0.01
Ulmus	0.01	0.00	0.01	0.01
Viburnum	0.01	0.00	0.01	0.01
Washingtonia filifera	0.01	0.00	0.01	0.01
Yucca gloriosa	0.01	0.00	0.01	0.01
Total	**100%**	**100%**	**200**	**100%**

Table 15: Condition and RPI for All Tree Species

Species	Excellent	Good	Fair	Poor	Very Poor	Dead	RPI	# of Trees	% of Trees
Quercus agrifolia	0.00	36.60	51.70	9.50	1.40	0.80	**0.97**	3,971	40.21
Pinus radiata	0.00	30.10	55.00	10.50	1.60	3.00	**0.93**	1,787	18.10
Cupressus macrocarpa	0.10	53.90	41.40	3.10	0.50	0.90	**1.05**	864	8.75
Acacia melanoxylon	0.00	47.40	45.10	6.60	0.00	0.90	**1.02**	350	3.54
Sequoia sempervirens	0.00	62.20	31.10	5.30	0.00	1.40	**1.07**	283	2.87
Pittosporum undulatum	0.00	54.70	40.60	2.90	1.40	0.40	**1.05**	278	2.82
Heteromeles arbutifolia	0.00	67.70	29.20	1.90	0.60	0.60	**1.10**	161	1.63
Acacia auriculiformis	0.00	70.10	28.70	1.10	0.00	0.00	**1.12**	87	0.88
Cedrus deodara	0.00	48.30	46.10	4.50	0.00	1.10	**1.03**	89	0.90
Arbutus unedo	0.00	87.00	7.80	2.60	0.00	2.60	**1.14**	77	0.78
Liquidambar styraciflua	0.00	32.10	63.00	4.90	0.00	0.00	**0.99**	81	0.82
Prunus cerasifera	0.00	58.20	36.70	5.10	0.00	0.00	**1.07**	79	0.80
Prunus ilicifolia	0.00	40.70	59.30	0.00	0.00	0.00	**1.03**	81	0.82
Acer palmatum	0.00	84.30	14.30	0.00	0.00	1.40	**1.15**	70	0.71
Ceanothus thyrsiflorus	0.00	65.30	30.60	4.20	0.00	0.00	**1.09**	72	0.73
Olea europaea	0.00	62.30	34.80	2.90	0.00	0.00	**1.09**	69	0.70
Leptospermum laevigatum	0.00	52.40	44.40	1.60	0.00	1.60	**1.05**	63	0.64
Lyonothamnus floribundus	0.00	52.50	44.10	0.00	0.00	3.40	**1.03**	59	0.60
Ilex aquifolium	0.00	76.10	21.70	0.00	2.20	0.00	**1.12**	46	0.47
Pittosporum eugenioides	0.00	78.30	17.40	2.20	0.00	2.20	**1.12**	46	0.47
Dodonaea viscosa	0.00	89.50	7.90	2.60	0.00	0.00	**1.17**	38	0.38
Quercus chrysolepis	0.00	10.00	85.00	5.00	0.00	0.00	**0.92**	40	0.41
Quercus ilex	0.00	64.10	30.80	5.10	0.00	0.00	**1.09**	39	0.39
Quercus wislizeni	0.00	13.50	73.00	10.80	2.70	0.00	**0.90**	37	0.37
Acacia confusa	0.00	48.10	51.90	0.00	0.00	0.00	**1.05**	27	0.27
Acacia dealbata	0.00	40.70	59.30	0.00	0.00	0.00	**1.03**	27	0.27
Ligustrum japonicum	0.00	90.60	6.30	3.10	0.00	0.00	**1.17**	32	0.32
Magnolia grandiflora	0.00	70.00	26.70	0.00	3.30	0.00	**1.10**	30	0.30
Magnoliopsida	0.00	12.00	0.00	0.00	0.00	88.00	**0.15**	25	0.25
Pinus canariensis	0.00	80.80	19.20	0.00	0.00	0.00	**1.15**	26	0.26
Pittosporum tobira	0.00	63.60	33.30	3.00	0.00	0.00	**1.09**	33	0.33
Syzygium paniculatum	0.00	40.00	56.00	4.00	0.00	0.00	**1.02**	25	0.25
Callistemon citrinus	0.00	75.00	25.00	0.00	0.00	0.00	**1.13**	24	0.24
Eucalyptus ficifolia	0.00	55.60	44.40	0.00	0.00	0.00	**1.07**	18	0.18
Ginkgo biloba	0.00	39.10	60.90	0.00	0.00	0.00	**1.03**	23	0.23
Maytenus boaria	0.00	88.90	11.10	0.00	0.00	0.00	**1.18**	18	0.18
Pittosporum crassifolium	0.00	53.30	46.70	0.00	0.00	0.00	**1.07**	15	0.15
Pittosporum rhombifolia	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	16	0.16
Pittosporum viridiflorum	0.00	10.00	90.00	0.00	0.00	0.00	**0.94**	20	0.20
Podocarpus macrophyllus	0.00	87.00	13.00	0.00	0.00	0.00	**1.17**	23	0.23
Prunus caroliniana	0.00	86.40	13.60	0.00	0.00	0.00	**1.17**	22	0.22
Prunus spp.	0.00	60.00	35.00	5.00	0.00	0.00	**1.07**	20	0.20
Pseudotsuga menziesii	0.00	38.90	50.00	5.60	0.00	5.60	**0.96**	18	0.18
Robinia pseudoacacia	0.00	31.30	62.50	6.30	0.00	0.00	**0.98**	16	0.16
Schinus terebinthifolia	0.00	66.70	33.30	0.00	0.00	0.00	**1.11**	15	0.15
Ulmus parvifolia	0.00	34.80	65.20	0.00	0.00	0.00	**1.01**	23	0.23
Acacia baileyana	0.00	12.50	87.50	0.00	0.00	0.00	**0.94**	8	0.08
Acer macrophyllum	0.00	28.60	71.40	0.00	0.00	0.00	**0.99**	7	0.07
Aesculus californica	0.00	42.90	42.90	14.30	0.00	0.00	**0.99**	7	0.07
Ailanthus altissima	0.00	44.40	44.40	11.10	0.00	0.00	**1.01**	9	0.09

Species	Excellent	Good	Fair	Poor	Very Poor	Dead	RPI	# of Trees	% of Trees
Albizia julibrissin	0.00	71.40	28.60	0.00	0.00	0.00	**1.12**	14	0.14
Alnus glutinosa	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	6	0.06
Araucaria heterophylla	0.00	80.00	20.00	0.00	0.00	0.00	**1.15**	5	0.05
Betula pendula	0.00	62.50	25.00	12.50	0.00	0.00	**1.06**	8	0.08
Calocedrus decurrens	0.00	60.00	40.00	0.00	0.00	0.00	**1.09**	5	0.05
Camellia japonica	0.00	80.00	20.00	0.00	0.00	0.00	**1.15**	10	0.10
Cercis canadensis	0.00	85.70	14.30	0.00	0.00	0.00	**1.17**	7	0.07
Cercis canadensis v. texensis	0.00	16.70	83.30	0.00	0.00	0.00	**0.96**	6	0.06
Citrus spp.	0.00	85.70	14.30	0.00	0.00	0.00	**1.17**	7	0.07
Cordyline australis	0.00	70.00	30.00	0.00	0.00	0.00	**1.12**	10	0.10
Cornus spp.	0.00	88.90	11.10	0.00	0.00	0.00	**1.18**	9	0.09
Cotoneaster buxifolius	0.00	92.30	7.70	0.00	0.00	0.00	**1.19**	13	0.13
Eriobotrya japonica	0.00	78.60	21.40	0.00	0.00	0.00	**1.14**	14	0.14
Eucalyptus	0.00	16.70	83.30	0.00	0.00	0.00	**0.96**	6	0.06
Eucalyptus globulus	0.00	40.00	60.00	0.00	0.00	0.00	**1.03**	5	0.05
Eucalyptus polyanthemos	0.00	60.00	20.00	20.00	0.00	0.00	**1.03**	5	0.05
Eucalyptus robusta	0.00	66.70	33.30	0.00	0.00	0.00	**1.11**	6	0.06
Ficus carica	0.00	50.00	50.00	0.00	0.00	0.00	**1.06**	10	0.10
Juniperus chinensis	0.00	92.30	0.00	0.00	0.00	7.70	**1.12**	13	0.13
Laurus nobilis	0.00	80.00	20.00	0.00	0.00	0.00	**1.15**	10	0.10
Ligustrum lucidum	0.00	50.00	50.00	0.00	0.00	0.00	**1.06**	12	0.12
Ligustrum sinense	0.00	85.70	14.30	0.00	0.00	0.00	**1.17**	7	0.07
Magnolia x soulangeana	0.00	80.00	0.00	20.00	0.00	0.00	**1.09**	5	0.05
Malus spp.	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	9	0.09
Melaleuca quinquenervia	0.00	72.70	27.30	0.00	0.00	0.00	**1.13**	11	0.11
Metrosideros excelsa	0.00	84.60	15.40	0.00	0.00	0.00	**1.16**	13	0.13
Myoporum laetum	0.00	45.50	54.50	0.00	0.00	0.00	**1.04**	11	0.11
Photinia serrulata	0.00	77.80	22.20	0.00	0.00	0.00	**1.14**	9	0.09
Photinia x fraseri	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	6	0.06
Pinus	0.00	0.00	40.00	0.00	0.00	60.00	**0.36**	5	0.05
Pinus halepensis	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	5	0.05
Pinus pinea	0.00	66.70	33.30	0.00	0.00	0.00	**1.11**	9	0.09
Pinus ponderosa	0.00	80.00	20.00	0.00	0.00	0.00	**1.15**	5	0.05
Pinus thunbergii	0.00	80.00	20.00	0.00	0.00	0.00	**1.15**	5	0.05
Pistacia chinensis	0.00	81.80	18.20	0.00	0.00	0.00	**1.15**	11	0.11
Platanus racemosa	0.00	0.00	83.30	8.30	8.30	0.00	**0.83**	12	0.12
Platanus x hybrida	0.00	7.10	78.60	14.30	0.00	0.00	**0.89**	14	0.14
Platycladus orientalis	0.00	80.00	20.00	0.00	0.00	0.00	**1.15**	5	0.05
Podocarpus gracilior	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	14	0.14
Pyracantha coccinea	0.00	55.60	44.40	0.00	0.00	0.00	**1.07**	9	0.09
Pyrus calleryana	0.00	62.50	37.50	0.00	0.00	0.00	**1.10**	8	0.08
Quercus tomentella	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	6	0.06
Schinus molle	0.00	72.70	27.30	0.00	0.00	0.00	**1.13**	11	0.11
Sphaeropteris cooperi	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	5	0.05
Tristaniopsis conferta	0.00	40.00	60.00	0.00	0.00	0.00	**1.03**	5	0.05
Ulmus americana	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	5	0.05
Umbellularia californica	0.00	80.00	20.00	0.00	0.00	0.00	**1.15**	5	0.05
Yucca spp.	0.00	88.90	11.10	0.00	0.00	0.00	**1.18**	9	0.09
Acacia farnesiana	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Acacia spp.	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	2	0.02
Acer buergerianum	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Acer grandidentatum	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01

Species	Excellent	Good	Fair	Poor	Very Poor	Dead	RPI	# of Trees	% of Trees
Acer negundo	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Acer rubrum	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Acer shirasawanum	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Araucaria columnaris	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	3	0.03
Arctostaphylos manzanita	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Arecastrum spp.	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Betula papyrifera	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Betula platyphylla	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Brachychiton populneus	0.00	50.00	50.00	0.00	0.00	0.00	**1.06**	2	0.02
Callistemon spp.	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	2	0.02
Callistemon viminalis	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	2	0.02
Casuarina equisetifolia	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	3	0.03
Catalpa speciosa	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Cedrus	50.00	0.00	50.00	0.00	0.00	0.00	**1.21**	2	0.02
Cedrus atlantica	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Cinnamomum camphora	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Citrus limon	0.00	75.00	25.00	0.00	0.00	0.00	**1.13**	4	0.04
Cladrastis kentukea	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Coprosma repens	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Cornus alternifolia	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Cornus florida	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	2	0.02
Cornus kousa	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	2	0.02
Cornus sericea	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Cotinus coggygria	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Crataegus phaenopyrum	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Crataegus spp.	0.00	50.00	50.00	0.00	0.00	0.00	**1.06**	2	0.02
Cryptomeria japonica	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Cupressus sempervirens	0.00	50.00	50.00	0.00	0.00	0.00	**1.06**	2	0.02
Echium candicans	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Eriobotrya deflexa	0.00	75.00	25.00	0.00	0.00	0.00	**1.13**	4	0.04
Eucalyptus camaldulensis	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Eucalyptus cinerea	0.00	33.30	66.70	0.00	0.00	0.00	**1.01**	3	0.03
Eucalyptus citriodora	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Eucalyptus lehmannii	0.00	50.00	50.00	0.00	0.00	0.00	**1.06**	2	0.02
Eucalyptus nicholii	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Eucalyptus sideroxylon	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	4	0.04
Ficus microcarpa	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Filicium decipiens	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	2	0.02
Fraxinus velutina	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Fremontodendron californicum	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Garrya elliptica	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Gleditsia triacanthos	0.00	50.00	50.00	0.00	0.00	0.00	**1.06**	4	0.04
Hymenosporum flavum	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	2	0.02
Ilex vomitoria	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	2	0.02
Juglans nigra	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Juniperus californica	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	4	0.04
Juniperus communis	0.00	25.00	50.00	0.00	0.00	25.00	**0.76**	4	0.04
Lagerstroemia indica	0.00	66.70	33.30	0.00	0.00	0.00	**1.11**	3	0.03
Ligustrum ovalifolium	0.00	75.00	25.00	0.00	0.00	0.00	**1.13**	4	0.04
Liquidambar formosana	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	3	0.03
Liriodendron tulipifera	0.00	50.00	50.00	0.00	0.00	0.00	**1.06**	2	0.02

Species	Excellent	Good	Fair	Poor	Very Poor	Dead	RPI	# of Trees	% of Trees
Magnolia spp.	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Magnolia virginiana	0.00	50.00	50.00	0.00	0.00	0.00	**1.06**	2	0.02
Malus sylvestris	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Myrtus communis	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	2	0.02
Nerium oleander	0.00	66.70	33.30	0.00	0.00	0.00	**1.11**	3	0.03
Ochroma pyramidale	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Paraserianthes lophantha	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	3	0.03
Persea americana	0.00	0.00	50.00	50.00	0.00	0.00	**0.76**	2	0.02
Phoenix canariensis	0.00	50.00	50.00	0.00	0.00	0.00	**1.06**	2	0.02
Picea pungens	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	4	0.04
Pinus elliottii	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Pinus monophylla	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Pinus palustris	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Pinus sylvestris	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	2	0.02
Pinus torreyana	0.00	50.00	50.00	0.00	0.00	0.00	**1.06**	2	0.02
Platanus occidentalis	0.00	33.30	66.70	0.00	0.00	0.00	**1.01**	3	0.03
Populus fremontii	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	2	0.02
Prunus angustifolia	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Prunus domestica	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Prunus emarginata	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Prunus laurocerasus	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Prunus persica	0.00	50.00	0.00	50.00	0.00	0.00	**0.91**	2	0.02
Prunus serrulata	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Pyrus communis	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Quercus hypoleucoides	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Quercus lobata	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Quercus spp.	0.00	0.00	0.00	0.00	0.00	#####	**0.00**	1	0.01
Quercus suber	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	2	0.02
Quercus virginiana	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Ravenala spp. madagascariensis	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	2	0.02
Rhamnus cathartica	0.00	75.00	25.00	0.00	0.00	0.00	**1.13**	4	0.04
Rhamnus frangula	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	2	0.02
Rhododendron spp.	0.00	33.30	66.70	0.00	0.00	0.00	**1.01**	3	0.03
Rhus integrifolia	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Sambucus nigra	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Taxus baccata	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Taxus brevifolia	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	2	0.02
Thuja occidentalis	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Thuja plicata	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	4	0.04
Tilia cordata	0.00	50.00	50.00	0.00	0.00	0.00	**1.06**	2	0.02
Tilia tomentosa	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	2	0.02
Trachycarpus fortunei	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Ulmus spp.	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	1	0.01
Viburnum spp.	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Washingtonia filifera	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Washingtonia robusta	0.00	0.00	100.00	0.00	0.00	0.00	**0.91**	4	0.04
Yucca gloriosa	0.00	100.00	0.00	0.00	0.00	0.00	**1.21**	1	0.01
Total	**<1%**	**43.89%**	**46.74%**	**6.97%**	**1.00%**	**1.41%**	**1.00**	**9,875**	**100%**

Table 16: Annual Benefits for All Species

Species	# of Trees	% of Pop.	Carbon Sequestration (ton/yr.)	Carbon Sequestration ($/yr.)	Avoided Runoff (gal./yr.)	Avoided Runoff ($/yr.)	Pollution Removal (ton/yr.)	Pollution Removal ($/yr.)
Quercus agrifolia	3,971	40.21	43.91	7,489	237,172	2,119.37	1.27	9,125.97
Pinus radiata	1,787	18.10	38.29	6,531	157,397	1,406.50	0.84	6,056.35
Cupressus macrocarpa	864	8.75	4.31	736	71,437	638.36	0.38	2,748.77
Acacia melanoxylon	350	3.54	1.50	255	19,132	170.96	0.10	736.16
Sequoia sempervirens	283	2.87	4.48	765	21,590	192.93	0.12	830.74
Pittosporum undulatum	278	2.82	2.34	399	4,900	43.79	0.03	188.56
Heteromeles arbutifolia	161	1.63	1.57	268	1,732	15.47	0.01	66.63
Cedrus deodara	89	0.90	1.28	219	2,805	25.07	0.02	107.93
Acacia auriculiformis	87	0.88	0.23	39	2,148	19.19	0.01	82.65
Liquidambar styraciflua	81	0.82	0.81	137	3,771	33.70	0.02	145.12
Prunus ilicifolia	81	0.82	0.84	143	1,021	9.12	0.01	39.29
Prunus cerasifera	79	0.80	0.37	62	654	5.84	0.00	25.16
Arbutus unedo	77	0.78	0.37	63	1,587	14.19	0.01	61.08
Ceanothus thyrsiflorus	72	0.73	0.40	68	281	2.51	0.00	10.81
Acer palmatum	70	0.71	0.13	21	333	2.97	0.00	12.80
Olea europaea	69	0.70	0.34	58	1,518	13.56	0.01	58.40
Leptospermum laevigatum	63	0.64	1.30	221	3,012	26.92	0.02	115.90
Lyonothamnus floribundus	59	0.60	1.08	184	1,450	12.95	0.01	55.78
Ilex aquifolium	46	0.47	0.25	43	630	5.63	0.00	24.26
Pittosporum eugenioides	46	0.47	0.28	47	643	5.75	0.00	24.75
Quercus chrysolepis	40	0.41	0.44	75	1,960	17.51	0.01	75.41
Quercus ilex	39	0.39	0.99	168	4,748	42.43	0.03	182.69
Dodonaea viscosa	38	0.38	0.21	35	196	1.75	0.00	7.54
Quercus wislizeni	37	0.37	0.43	73	1,982	17.71	0.01	76.28
Pittosporum tobira	33	0.33	0.13	23	426	3.80	0.00	16.38
Ligustrum japonicum	32	0.32	0.16	27	324	2.90	0.00	12.47
Magnolia grandiflora	30	0.30	0.29	49	1,258	11.24	0.01	48.40
Acacia confusa	27	0.27	0.04	7	276	2.47	0.00	10.63
Acacia dealbata	27	0.27	0.07	12	985	8.80	0.01	37.88
Pinus canariensis	26	0.26	0.09	16	607	5.42	0.00	23.36
Magnoliopsida	25	0.25	0.00	1	4	0.04	0.00	0.17
Syzygium paniculatum	25	0.25	0.17	30	238	2.12	0.00	9.14
Callistemon citrinus	24	0.24	0.09	16	104	0.93	0.00	3.99
Ginkgo biloba	23	0.23	0.01	2	92	0.82	0.00	3.53
Podocarpus macrophyllus	23	0.23	0.05	9	204	1.82	0.00	7.84
Ulmus parvifolia	23	0.23	0.34	59	672	6.01	0.00	25.86
Prunus caroliniana	22	0.22	0.08	13	135	1.21	0.00	5.19
Pittosporum viridiflorum	20	0.20	0.13	22	220	1.96	0.00	8.45
Prunus	20	0.20	0.15	25	295	2.64	0.00	11.37
Eucalyptus ficifolia	18	0.18	0.21	36	6,243	55.79	0.03	240.23
Maytenus boaria	18	0.18	0.14	24	313	2.79	0.00	12.03

Species	# of Trees	% of Pop.	Carbon Sequestration (ton/yr.)	Carbon Sequestration ($/yr.)	Avoided Runoff (gal./yr.)	Avoided Runoff ($/yr.)	Pollution Removal (ton/yr.)	Pollution Removal ($/yr.)
Pseudotsuga menziesii	*18*	*0.18*	*0.15*	*26*	*1,148*	*10.25*	*0.01*	*44.16*
Pittosporum rhombifolium	*16*	*0.16*	*0.08*	*13*	*113*	*1.01*	*0.00*	*4.36*
Robinia pseudoacacia	*16*	*0.16*	*0.29*	*50*	*569*	*5.09*	*0.00*	*21.90*
Pittosporum crassifolium	*15*	*0.15*	*0.09*	*15*	*160*	*1.43*	*0.00*	*6.18*
Schinus terebinthifolia	*15*	*0.15*	*0.24*	*41*	*390*	*3.48*	*0.00*	*15.00*
Albizia julibrissin	*14*	*0.14*	*0.07*	*12*	*151*	*1.35*	*0.00*	*5.79*
Eriobotrya japonica	*14*	*0.14*	*0.07*	*12*	*84*	*0.75*	*0.00*	*3.24*
Platanus x hybrida	*14*	*0.14*	*0.09*	*15*	*360*	*3.22*	*0.00*	*13.87*
Podocarpuys gracilior	*14*	*0.14*	*0.04*	*6*	*162*	*1.45*	*0.00*	*6.23*
Cotoneaster buxifolius	*13*	*0.13*	*0.06*	*10*	*52*	*0.47*	*0.00*	*2.01*
Juniperus chinensis	*13*	*0.13*	*0.11*	*20*	*271*	*2.42*	*0.00*	*10.43*
Metrosideros excelsa	*13*	*0.13*	*0.12*	*21*	*127*	*1.14*	*0.00*	*4.89*
Ligustrum lucidum	*12*	*0.12*	*0.04*	*8*	*136*	*1.22*	*0.00*	*5.24*
Platanus racemosa	*12*	*0.12*	*0.10*	*17*	*996*	*8.90*	*0.01*	*38.33*
Melaleuca quinquenervia	*11*	*0.11*	*0.28*	*48*	*1,015*	*9.07*	*0.01*	*39.06*
Myoporum laetum	*11*	*0.11*	*0.13*	*22*	*185*	*1.66*	*0.00*	*7.13*
Pistacia chinensis	*11*	*0.11*	*0.03*	*5*	*42*	*0.37*	*0.00*	*1.61*
Schinus molle	*11*	*0.11*	*0.07*	*11*	*70*	*0.62*	*0.00*	*2.68*
Camellia japonica	*10*	*0.10*	*0.04*	*7*	*58*	*0.52*	*0.00*	*2.22*
Cordyline australis	*10*	*0.10*	*0.04*	*7*	*61*	*0.55*	*0.00*	*2.37*
Ficus carica	*10*	*0.10*	*0.11*	*18*	*410*	*3.66*	*0.00*	*15.76*
Laurus nobilis	*10*	*0.10*	*0.04*	*7*	*54*	*0.48*	*0.00*	*2.08*
Ailanthus altissima	*9*	*0.09*	*0.12*	*21*	*204*	*1.82*	*0.00*	*7.84*
Cornus	*9*	*0.09*	*0.01*	*2*	*15*	*0.14*	*0.00*	*0.59*
Malus	*9*	*0.09*	*0.06*	*10*	*85*	*0.76*	*0.00*	*3.27*
Photinia serrulata	*9*	*0.09*	*0.04*	*7*	*50*	*0.45*	*0.00*	*1.93*
Pinus pinea	*9*	*0.09*	*0.13*	*22*	*693*	*6.19*	*0.00*	*26.66*
Pyracantha coccinea	*9*	*0.09*	*0.10*	*18*	*131*	*1.17*	*0.00*	*5.04*
Yucca	*9*	*0.09*	*0.06*	*11*	*139*	*1.24*	*0.00*	*5.34*
Acacia baileyana	*8*	*0.08*	*0.02*	*4*	*127*	*1.14*	*0.00*	*4.90*
Betula pendula	*8*	*0.08*	*0.06*	*11*	*236*	*2.11*	*0.00*	*9.09*
Pyrus calleryana	*8*	*0.08*	*0.04*	*7*	*78*	*0.70*	*0.00*	*3.02*
Acer macrophyllum	*7*	*0.07*	*0.11*	*18*	*404*	*3.61*	*0.00*	*15.53*
Aesculus californica	*7*	*0.07*	*0.02*	*4*	*119*	*1.07*	*0.00*	*4.59*
Cercis canadensis	*7*	*0.07*	*0.01*	*2*	*20*	*0.17*	*0.00*	*0.75*
Citrus	*7*	*0.07*	*0.04*	*8*	*50*	*0.45*	*0.00*	*1.94*
Ligustrum sinense	*7*	*0.07*	*0.03*	*6*	*269*	*2.40*	*0.00*	*10.34*
Alnus glutinosa	*6*	*0.06*	*0.03*	*5*	*90*	*0.80*	*0.00*	*3.46*
Cercis canadensis v. texensis	*6*	*0.06*	*0.01*	*1*	*8*	*0.08*	*0.00*	*0.33*
Eucalyptus	*6*	*0.06*	*0.17*	*29*	*486*	*4.34*	*0.00*	*18.68*
Eucalyptus robusta	*6*	*0.06*	*0.42*	*71*	*2,274*	*20.32*	*0.01*	*87.51*

Species	# of Trees	% of Pop.	Carbon Sequestration (ton/yr.)	Carbon Sequestration ($/yr.)	Avoided Runoff (gal./yr.)	Avoided Runoff ($/yr.)	Pollution Removal (ton/yr.)	Pollution Removal ($/yr.)
Photinia x fraseri	*6*	*0.06*	*0.02*	*3*	*20*	*0.18*	*0.00*	*0.77*
Quercus tomentella	*6*	*0.06*	*0.04*	*7*	*103*	*0.92*	*0.00*	*3.98*
Araucaria heterophylla	*5*	*0.05*	*0.02*	*3*	*56*	*0.50*	*0.00*	*2.15*
Calocedrus decurrens	*5*	*0.05*	*0.04*	*7*	*318*	*2.84*	*0.00*	*12.24*
Eucalyptus globulus	*5*	*0.05*	*0.22*	*38*	*8,355*	*74.66*	*0.04*	*321.47*
Eucalyptus polyanthemos	*5*	*0.05*	*0.09*	*16*	*103*	*0.92*	*0.00*	*3.96*
Magnolia x soulangeana	*5*	*0.05*	*0.03*	*5*	*74*	*0.66*	*0.00*	*2.83*
Pinus	*5*	*0.05*	*0.02*	*3*	*90*	*0.81*	*0.00*	*3.47*
Pinus halepensis	*5*	*0.05*	*0.07*	*12*	*594*	*5.31*	*0.00*	*22.85*
Pinus ponderosa	*5*	*0.05*	*0.03*	*5*	*191*	*1.71*	*0.00*	*7.37*
Pinus thunbergii	*5*	*0.05*	*0.02*	*4*	*135*	*1.21*	*0.00*	*5.20*
Platycladus orientalis	*5*	*0.05*	*0.02*	*4*	*33*	*0.30*	*0.00*	*1.28*
Sphaeropteris cooperi	*5*	*0.05*	*0.09*	*15*	*149*	*1.33*	*0.00*	*5.74*
Tristaniopsis conferta	*5*	*0.05*	*0.10*	*16*	*153*	*1.37*	*0.00*	*5.89*
Ulmus americana	*5*	*0.05*	*0.02*	*3*	*31*	*0.28*	*0.00*	*1.21*
Umbellularia californica	*5*	*0.05*	*0.02*	*3*	*33*	*0.30*	*0.00*	*1.27*
Citrus limon	*4*	*0.04*	*0.01*	*2*	*11*	*0.10*	*0.00*	*0.41*
Eriobotrya deflexa	*4*	*0.04*	*0.01*	*2*	*11*	*0.10*	*0.00*	*0.42*
Eucalyptus sideroxylon	*4*	*0.04*	*0.14*	*23*	*195*	*1.74*	*0.00*	*7.49*
Gleditsia triacanthos	*4*	*0.04*	*0.03*	*4*	*40*	*0.36*	*0.00*	*1.54*
Juniperus californica	*4*	*0.04*	*0.02*	*3*	*25*	*0.23*	*0.00*	*0.98*
Juniperus communis	*4*	*0.04*	*0.01*	*2*	*50*	*0.45*	*0.00*	*1.92*
Ligustrum ovalifolium	*4*	*0.04*	*0.02*	*3*	*37*	*0.33*	*0.00*	*1.43*
Picea pungens	*4*	*0.04*	*0.01*	*2*	*35*	*0.32*	*0.00*	*1.37*
Rhamnus cathartica	*4*	*0.04*	*0.01*	*2*	*13*	*0.12*	*0.00*	*0.52*
Thuja plicata	*4*	*0.04*	*0.00*	*0*	*13*	*0.12*	*0.00*	*0.51*
Washingtonia robusta	*4*	*0.04*	*0.01*	*2*	*90*	*0.81*	*0.00*	*3.47*
Araucaria columnaris	*3*	*0.03*	*0.02*	*3*	*65*	*0.58*	*0.00*	*2.49*
Casuarina equisetifolia	*3*	*0.03*	*0.07*	*12*	*50*	*0.45*	*0.00*	*1.92*
Eucalyptus cinerea	*3*	*0.03*	*0.06*	*10*	*667*	*5.96*	*0.00*	*25.68*
Lagerstroemia indica	*3*	*0.03*	*0.01*	*1*	*8*	*0.07*	*0.00*	*0.31*
Liquidambar formosana	*3*	*0.03*	*0.02*	*4*	*162*	*1.45*	*0.00*	*6.24*
Nerium oleander	*3*	*0.03*	*0.01*	*2*	*6*	*0.06*	*0.00*	*0.25*
Paraserianthes lophantha	*3*	*0.03*	*0.03*	*5*	*26*	*0.23*	*0.00*	*0.99*
Platanus occidentalis	*3*	*0.03*	*0.05*	*8*	*345*	*3.09*	*0.00*	*13.29*
Rhododendron	*3*	*0.03*	*0.00*	*1*	*9*	*0.08*	*0.00*	*0.36*
Acacia	*2*	*0.02*	*0.00*	*1*	*8*	*0.07*	*0.00*	*0.30*
Brachychiton populneus	*2*	*0.02*	*0.10*	*17*	*347*	*3.10*	*0.00*	*13.34*
Callistemon	*2*	*0.02*	*0.00*	*1*	*5*	*0.04*	*0.00*	*0.19*
Callistemon viminalis	*2*	*0.02*	*0.01*	*1*	*531*	*4.75*	*0.00*	*20.44*
Cedrus	*2*	*0.02*	*0.01*	*1*	*3*	*0.02*	*0.00*	*0.11*

Species	# of Trees	% of Pop.	Carbon Sequestration (ton/yr.)	Carbon Sequestration ($/yr.)	Avoided Runoff (gal./yr.)	Avoided Runoff ($/yr.)	Pollution Removal (ton/yr.)	Pollution Removal ($/yr.)
Cornus florida	*2*	*0.02*	*0.00*	*0*	*3*	*0.02*	*0.00*	*0.10*
Cornus kousa	*2*	*0.02*	*0.00*	*0*	*2*	*0.02*	*0.00*	*0.08*
Crataegus	*2*	*0.02*	*0.01*	*3*	*25*	*0.22*	*0.00*	*0.96*
Cupressus sempervirens	*2*	*0.02*	*0.01*	*1*	*353*	*3.16*	*0.00*	*13.60*
Eucalyptus lehmannii	*2*	*0.02*	*0.05*	*8*	*66*	*0.59*	*0.00*	*2.52*
Filicium decipiens	*2*	*0.02*	*0.02*	*3*	*38*	*0.34*	*0.00*	*1.47*
Hymenosporum flavum	*2*	*0.02*	*0.01*	*1*	*8*	*0.07*	*0.00*	*0.30*
Ilex vomitoria	*2*	*0.02*	*0.00*	*0*	*5*	*0.04*	*0.00*	*0.18*
Liriodendron tulipifera	*2*	*0.02*	*0.02*	*3*	*60*	*0.53*	*0.00*	*2.29*
Magnolia virginiana	*2*	*0.02*	*0.00*	*1*	*9*	*0.08*	*0.00*	*0.35*
Myrtus communis	*2*	*0.02*	*0.00*	*0*	*3*	*0.02*	*0.00*	*0.10*
Persea americana	*2*	*0.02*	*0.01*	*1*	*6*	*0.05*	*0.00*	*0.23*
Phoenix canariensis	*2*	*0.02*	*0.01*	*1*	*93*	*0.83*	*0.00*	*3.57*
Pinus sylvestris	*2*	*0.02*	*0.04*	*7*	*245*	*2.19*	*0.00*	*9.44*
Pinus torreyana	*2*	*0.02*	*0.05*	*8*	*229*	*2.04*	*0.00*	*8.80*
Populus fremontii	*2*	*0.02*	*0.02*	*3*	*34*	*0.30*	*0.00*	*1.31*
Prunus persica	*2*	*0.02*	*0.01*	*1*	*6*	*0.05*	*0.00*	*0.21*
Quercus suber	*2*	*0.02*	*0.03*	*5*	*201*	*1.80*	*0.00*	*7.74*
Ravenala madagascariensis	*2*	*0.02*	*0.01*	*1*	*47*	*0.42*	*0.00*	*1.83*
Rhamnus frangula	*2*	*0.02*	*0.01*	*2*	*17*	*0.15*	*0.00*	*0.66*
Taxus brevifolia	*2*	*0.02*	*0.02*	*3*	*55*	*0.49*	*0.00*	*2.11*
Tilia cordata	*2*	*0.02*	*0.02*	*4*	*94*	*0.84*	*0.00*	*3.60*
Tilia tomentosa	*2*	*0.02*	*0.00*	*0*	*5*	*0.05*	*0.00*	*0.21*
Acacia farnesiana	*1*	*0.01*	*0.00*	*0*	*7*	*0.06*	*0.00*	*0.26*
Acer buergerianum	*1*	*0.01*	*0.01*	*1*	*20*	*0.18*	*0.00*	*0.76*
Acer grandidentatum	*1*	*0.01*	*0.02*	*3*	*57*	*0.51*	*0.00*	*2.19*
Acer negundo	*1*	*0.01*	*0.01*	*1*	*18*	*0.16*	*0.00*	*0.68*
Acer rubrum	*1*	*0.01*	*0.01*	*3*	*23*	*0.21*	*0.00*	*0.89*
Acer shirasawanum	*1*	*0.01*	*0.00*	*0*	*2*	*0.02*	*0.00*	*0.07*
Arctostaphylos manzanita	*1*	*0.01*	*0.00*	*0*	*2*	*0.02*	*0.00*	*0.08*
Arecastrum	*1*	*0.01*	*0.00*	*0*	*1*	*0.01*	*0.00*	*0.05*
Betula papyrifera	*1*	*0.01*	*0.00*	*0*	*6*	*0.06*	*0.00*	*0.24*
Betula platyphylla	*1*	*0.01*	*0.00*	*1*	*12*	*0.10*	*0.00*	*0.44*
Catalpa speciosa	*1*	*0.01*	*0.00*	*0*	*4*	*0.03*	*0.00*	*0.14*
Cedrus atlantica	*1*	*0.01*	*0.01*	*2*	*23*	*0.21*	*0.00*	*0.90*
Cinnamomum camphora	*1*	*0.01*	*0.05*	*8*	*92*	*0.83*	*0.00*	*3.55*
Cladrastis kentukea	*1*	*0.01*	*0.00*	*0*	*1*	*0.01*	*0.00*	*0.03*
Coprosma repens	*1*	*0.01*	*0.01*	*2*	*9*	*0.08*	*0.00*	*0.35*
Cornus alternifolia	*1*	*0.01*	*0.00*	*0*	*1*	*0.01*	*0.00*	*0.03*
Cornus sericea	*1*	*0.01*	*0.00*	*0*	*1*	*0.01*	*0.00*	*0.04*
Cotinus coggygria	*1*	*0.01*	*0.00*	*0*	*2*	*0.01*	*0.00*	*0.06*

Species	# of Trees	% of Pop.	Carbon Sequestration (ton/yr.)	Carbon Sequestration ($/yr.)	Avoided Runoff (gal./yr.)	Avoided Runoff ($/yr.)	Pollution Removal (ton/yr.)	Pollution Removal ($/yr.)
Crataegus phaenopyrum	*1*	*0.01*	*0.00*	*1*	*3*	*0.03*	*0.00*	*0.11*
Cryptomeria japonica	*1*	*0.01*	*0.00*	*0*	*1*	*0.01*	*0.00*	*0.04*
Echium candicans	*1*	*0.01*	*0.00*	*0*	*1*	*0.01*	*0.00*	*0.04*
Eucalyptus camaldulensis	*1*	*0.01*	*0.06*	*9*	*137*	*1.23*	*0.00*	*5.28*
Eucalyptus citriodora	*1*	*0.01*	*0.03*	*5*	*41*	*0.37*	*0.00*	*1.59*
Eucalyptus nicholii	*1*	*0.01*	*0.09*	*15*	*233*	*2.08*	*0.00*	*8.95*
Ficus microcarpa	*1*	*0.01*	*0.00*	*1*	*6*	*0.05*	*0.00*	*0.22*
Fraxinus velutina	*1*	*0.01*	*0.00*	*0*	*4*	*0.03*	*0.00*	*0.14*
Fremontodendron californicum	*1*	*0.01*	*0.01*	*1*	*5*	*0.04*	*0.00*	*0.19*
Garrya elliptica	*1*	*0.01*	*0.01*	*1*	*4*	*0.03*	*0.00*	*0.15*
Juglans nigra	*1*	*0.01*	*0.07*	*12*	*170*	*1.52*	*0.00*	*6.53*
Magnolia	*1*	*0.01*	*0.00*	*0*	*2*	*0.02*	*0.00*	*0.09*
Malus sylvestris	*1*	*0.01*	*0.00*	*1*	*5*	*0.04*	*0.00*	*0.18*
Ochroma pyramidale	*1*	*0.01*	*0.00*	*0*	*7*	*0.06*	*0.00*	*0.28*
Pinus elliottii	*1*	*0.01*	*0.01*	*2*	*55*	*0.49*	*0.00*	*2.11*
Pinus monophylla	*1*	*0.01*	*0.00*	*0*	*11*	*0.10*	*0.00*	*0.44*
Pinus palustris	*1*	*0.01*	*0.00*	*0*	*2*	*0.02*	*0.00*	*0.09*
Prunus angustifolia	*1*	*0.01*	*0.01*	*1*	*9*	*0.08*	*0.00*	*0.33*
Prunus domestica	*1*	*0.01*	*0.00*	*1*	*5*	*0.04*	*0.00*	*0.17*
Prunus emarginata	*1*	*0.01*	*0.00*	*0*	*3*	*0.03*	*0.00*	*0.11*
Prunus laurocerasus	*1*	*0.01*	*0.00*	*1*	*3*	*0.03*	*0.00*	*0.13*
Prunus serrulata	*1*	*0.01*	*0.00*	*1*	*2*	*0.02*	*0.00*	*0.08*
Pyrus communis	*1*	*0.01*	*0.00*	*0*	*3*	*0.03*	*0.00*	*0.11*
Quercus	*1*	*0.01*	*0.00*	*0*	*0*	*0.00*	*0.00*	*0.00*
Quercus hypoleucoides	*1*	*0.01*	*0.01*	*2*	*13*	*0.11*	*0.00*	*0.48*
Quercus lobata	*1*	*0.01*	*0.03*	*4*	*113*	*1.01*	*0.00*	*4.35*
Quercus virginiana	*1*	*0.01*	*0.00*	*1*	*1*	*0.01*	*0.00*	*0.04*
Rhus integrifolia	*1*	*0.01*	*0.00*	*1*	*7*	*0.07*	*0.00*	*0.28*
Sambucus nigra	*1*	*0.01*	*0.01*	*1*	*6*	*0.05*	*0.00*	*0.23*
Taxus baccata	*1*	*0.01*	*0.01*	*2*	*43*	*0.39*	*0.00*	*1.66*
Thuja occidentalis	*1*	*0.01*	*0.00*	*0*	*1*	*0.01*	*0.00*	*0.05*
Trachycarpus fortunei	*1*	*0.01*	*0.00*	*0*	*2*	*0.02*	*0.00*	*0.09*
Ulmus	*1*	*0.01*	*0.02*	*3*	*65*	*0.58*	*0.00*	*2.50*
Viburnum	*1*	*0.01*	*0.02*	*4*	*30*	*0.27*	*0.00*	*1.15*
Washingtonia filifera	*1*	*0.01*	*0.00*	*0*	*11*	*0.10*	*0.00*	*0.43*
Yucca gloriosa	*1*	*0.01*	*0.00*	*0*	*1*	*0.01*	*0.00*	*0.03*
Total	**9,875**	**100%**	**114.49**	**$19,526.29**	**582,667**	**$5,206.72**	**3.13**	**$22,420.02**