# City of Santa Monica Municipal Forest Assessment

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*With support from CALFIRE*

The City of Santa Monica is proud of its urban forest and has a vibrant program that conducts tree planting, maintenance and replacement. The city's website supplies information regarding the Urban Forest Master Plan, landmark trees, and the ongoing renewal program to residents (http://www.smgov.net/Portals/UrbanForest/). The Urban Forest Task Force advises the city staff about projects and species selection along with advocating for the urban forest. According to its 2009 tree inventory, the City of Santa Monica maintains 28,474 street trees consisting of 219 species. Assuming the city has a population of 89,736 and 160 linear street miles, there are about 0.32 trees per capita and 178 trees per mile of street. Santa Monica has approximately 84% of all sites planted, assuming there are two potential sites every 50-feet of street (McPherson and Rowntree 1989). This leaves 16% of the potential sites to be evaluated and planted with suitable species.

The most abundant species are Mexican fan palm (*Washingtonia robusta*) 13%, Indian Laurel Fig (*Ficus microcarpa 'nitida'*) 11%, southern magnolia (*Magnolia grandiflora*) 7%, and yew podocarpus (*Podocarpus macrophyllus*) 5%. The camphor tree (*Cinnamomum camphora*), jacaranda (*Jacaranda mimosifolia*), carrotwood (*Cupaniopsis anacardioides*), Canary Island pine (*Pinus canariensis*), and American sweetgum (*Liquidambar styraciflua)* all comprise 3% of the population each.

The ideal urban forest is not dominated by a few species. Rather, tree numbers are distributed fairly evenly among dozens of well-adapted species. Species diversity protects a community's tree canopy cover by limiting the amount of damage from any one threat such as pests, drought or storms (McPherson and Kotow 2013).
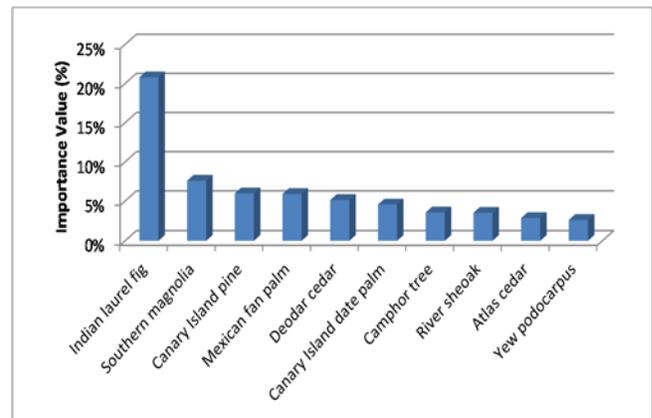


**Figure 1. Top ten species based on importance value (IV).**

Size matters as well and over-reliance on a few species made up of large, old trees increases the risk of losing substantial canopy cover and associated benefits. An even distribution of canopy cover and species increases stability of the urban forest. One way that this can be measured is through the importance value (IV) which incorporates the

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number, leaf area, and canopy cover of each tree species. No one species should account for more than 10% of the total IV. Because most of the Indian laurel figs are old and large they account for 21% of the IV (
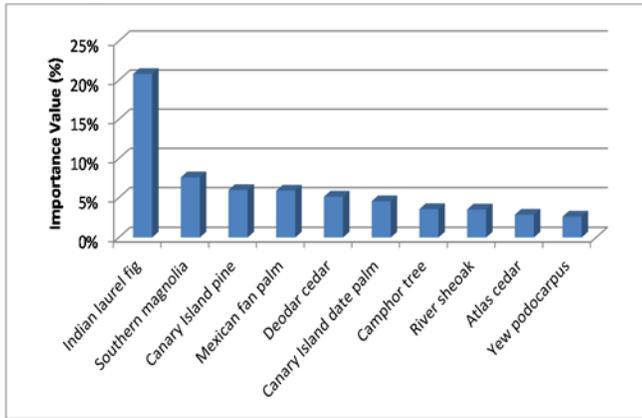


Figure 1). Note that the most abundant species are not always the ones with the highest IV (Table 1).

**Table 1. Benefits of top ten species by importance value (IV).**

| Species | Number | % of Total IV | Total Benefits ($) | Avg. $/tree |
|---|---|---|---|---|
| Indian laurel fig | 3,007 | 21% | $745,916 | $248.06 |
| Southern magnolia | 1,926 | 8% | $425,685 | $221.02 |
| Canary Island pine | 862 | 6% | $255,954 | $296.93 |
| Mexican fan palm | 3,757 | 6% | $226,096 | $60.18 |
| Deodar cedar | 682 | 5% | $507,265 | $743.79 |
| Canary Island date palm | 994 | 5% | $64,332 | $64.72 |
| Camphor tree | 996 | 4% | $174,678 | $175.38 |
| River sheoak | 686 | 4% | $331,942 | $483.88 |
| Atlas cedar | 499 | 3% | $283,068 | $567.27 |
| Yew podocarpus | 1,296 | 3% | $52,268 | $40.33 |

Because young trees are most vulnerable, the model urban forest contains a surplus of juveniles that constantly replace dying trees. Although large, old trees produce more services than young trees, they

are also susceptible to health threats and are expensive to remove and replace. As a result, the ideal urban forest has relatively few old or senescent trees and more semi-mature and mature trees. Santa Monica is made up of 20% juvenile trees, 23% semi-mature, 41% mature and 16% senescent trees (Figure 2).
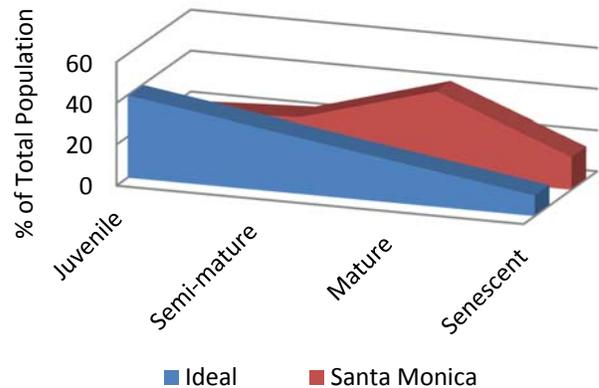


Figure 2. Age structure of Santa Monica's and the "ideal" street tree population.

There are one-half the number of juvenile trees than the ideal and 22% more mature trees than desired. As trees age they require more maintenance and, as much as they are an asset, they may also prove to be a liability. The percentage of the population labeled senescent (dbh 24+") is 16%, exceeding the ideal of 10%.

Trees provide a myriad of benefits, especially when located in urban areas where they can shade buildings, clean the air and reduce stormwater runoff. The street trees in Santa Monica provide over $5.1 million annually in ecosystem services, averaging $57 per capita and $180 per tree (Table 2).

**Table 2. Value of annual benefits of Santa Monica's street trees.**

| Category | Total ($) | $/capita | $/tree |
|---|---|---|---|
| Energy | $261,988 | $2.92 | $9.20 |
| Carbon Dioxide | $31,291 | $0.35 | $1.10 |
| Air Quality | $423,435 | $4.72 | $14.87 |

| | | | |
|---|---|---|---|
| Stormwater | $160,261 | $1.79 | $5.63 |
| Aesthetics/ Property Value | $4,248,848 | $47.35 | $149.22 |
| Grand Total | $5,125,824 | $57.12 | $180.02 |

The largest benefit is attributed to increased property values and aesthetic enjoyment at over $4.2 million (Figure 3).
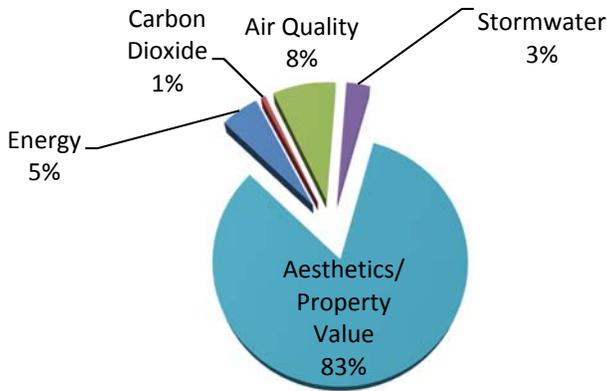


**Figure 3. Distribution of annual benefits from Santa Monica's street trees.**

Roughly 5% or $261,988 of total benefits are energy savings from shading and air temperature reduction effects on nearby buildings. Trees help improve air quality by removing particulates from the air and this is returning a savings of $423,435. Street trees intercept over 22 million gallons of rainfall, reducing stormwater management costs by $160,261 every year. Just over 29,809 metric tonnes of $CO_2$ are stored by Santa Monica's street trees, giving annual returns of $31,291.

Santa Monica's municipal forest will provide a stream of future benefits over time, similar to other capital investments such as roads and utilities. To calculate its asset value these future benefits were discounted to their present value using discount rates of 4.125% and 0% for the next 100 years. Discounting future services to their present value incorporates the time value of money. The farther ahead in time one goes, the less value a dollar has. A benefit derived in 50 years is worth far less than the same benefit today. By applying this method to the future stream of benefits, the street tree population's asset value is calculated in today's dollars. The present value of future services with a 0% discount rate is over $480 million ($15,243/tree), with a discount rate of 4.125% that value becomes slightly over $168 million ($5,341/tree).

The benefits of urban trees are largely based on their size; therefore the greatest benefits come from large, older trees. Santa Monica's tree population is 22% large stature, 37% medium-, and 41% small stature trees. Evergreen trees, when placed around a building so that they do not block winter sunshine, can be more effective than deciduous trees at capturing rainfall and cleaning pollutants from the air. Santa Monica's street tree canopy is made up of 90% evergreen and 10% deciduous trees.

Inventories from 12 cities in the Southern California Coast were processed in i-Tree Streets, a Forest Service computer tool for planning and management (https://www.itreetools.org/). Compared to the average city for this climate zone, Santa Monica has nearly twice the number of street trees per mile and nearly three times the number of benefits (

Table 3).

**Table 3. Comparison of Santa Monica's street tree attributes to the mean for 12 Southern California Coast cities.**

| Category | Santa Monica | Southern CA Coast Mean | % Difference |
|---|---|---|---|
| # trees | 28,474 | 13,157 | 116.4% |
| Trees/capita | 0.32 | 0.22 | 44.2 |
| Trees/mile | 178 | 92 | 92.3% |
| Total Benefits ($/yr.) | $5,125,824 | $1,486,002 | 244.0% |
| $/capita/yr. | $57.12 | $24.33 | 134.8% |
| $/tree/yr. | $180.02 | $102.66 | 75.4% |
| Asset value(0%)/ capita | $5,354.40 | $3,596.66 | 48.9% |
| Asset value (0%)/tree | $16,874.42 | $16,612.66 | 1.6% |

Annually, there are more benefits per capita ($57 vs $22 the average) and per tree ($180 vs $102 the average). The large mature, evergreen population has sizeable impacts on the benefits Santa Monica is receiving.



**Figure 4. One of Santa Monica's many tree-lined streets.**

The City of Santa Monica has several strategies it can employ to improve the health and structure of its municipal forest. The number one priority should be to jump start its tree planting campaign and to continue caring for its young tree population through inspections and pruning. Formative and routine pruning can ensure that younger trees will have good structure and replacement plantings will help maintain the stream of benefits as the mature trees begin to age.

The city should place an emphasis on planting a diverse number of species that will stabilize the population and ensure future benefits are realized. A second priority is providing intensive care that extends the useful lifespan of older trees. The large cedars, figs and pines are responsible for producing most of the municipal forest's ecosystem services. Keeping those trees healthy and safe is key to sustaining long-term benefits.

**Figure 5. Camphor trees comprised 3% of Santa Monica's street tree population in 2009.**



Santa Monica has a great program and a healthy urban forest. With wise planting choices and proper care, its municipal forest will provide benefits for generations to come.

## Bibliography

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