A DEEPER LOOK AT HOW DIFFERENT WATERING SCHEDULES CAN IMPROVE TREE SURVIVAL

Fig.3: Examples of tree conditions. Left to right: healthy, stressed, dead.

Let us take a deeper look at how other cities in California and experts show that improving our tree watering practices in San Diego could not only prevent a loss of nearly 3000 of the 5000 trees we will be planting with our $10M grant, but also save our City up to $4.8 million dollars doing it!

In surveys conducted by Kate Sessions Commitment, trees were categorized as either (1) healthy, (2) stressed, (3) very stressed, (4) dead, or (5) missing. While an arborist may be best to assess subtler distinctions between "healthy" and "stressed" trees, I believe their survey data can't be ignored with respect to the numbers of "**very stressed**", "**dead**", or "**missing**" trees which were reported.

In their latest study, completed on 285 trees planted in 2022 in the Bay Terraces neighborhood, they found a 53% rate of **dead**, **missing**, or **very stressed** trees only **3 years** after planting (this number factors in 40 trees which had died and been replaced.) [1] We've also been informed of past studies:

- A 2020 survey of 272 trees [2] found a 34% rate of **dead**, **missing**, or **very stressed** trees only **4 years** after planting.
- A 2024 survey of 404 trees [3] found a 60% rate of **dead**, **missing**, or **very stressed** trees **8 years** after planting

Further highlighting our tree preservations problems, were statements made in the city's application for our "Ready, Set, Grow" grant, where we stated that, "Currently, the City of San Diego **plants an average of up to 2,000 new trees** per year." However, "Each year the City **loses nearly 2,000 trees** from pests, diseases, new development…" and "…periodic stress during warm, summer months when there is little or no precipitation." [4]

Two **Lidar** aerial tree canopy surveys confirmed that from 2014 through 2021, despite all of our sustained efforts at tree planting, due to regrettable simultaneous tree losses, -- our urban canopy only increased from 13% to 15%, representing only a 2% increase over a 7 year period. [5]

Remaining ever positive, however, the City of San Diego just launched an initiative to, "Increase our urban tree canopy cover to 35% by 2035," [6] – which is **17 X the rate** we've been able to achieve – clarifying also that, "Growing our urban forest means protecting and preserving existing trees," [4]

Being open to revising our current methods for tree preservation and care is essential if we wish to reach such lofty goals. In our September meeting, we began a look specifically at the watering schedule we have been using for newly planted trees. Several board members asked questions about how the City of San Diego came to adopt their watering practices, and how may we go about determining if there may be better ones. Let's begin to answer some of these questions looking at a comparison of our city to various other California cities, regarding how we are watering new trees.

City/Organization	Year 1	Year 2	Year 3	3-Year Total Water Used
City of San Jose [8]	15 gal/week	15 gal/ week	15 gal/ 2x mo.	1920 gal
City of San Francisco [9]	15 gal/week	15 gal/week	15 gal/week	2340 gal
Canopy.org for SF Bay Area & City of Palo Alto [10]	10-15 gal/week	10-15 gal/week	10-15 gal/week	up to 2340 gal
City of Santa Barbara [11]	15-20 gal/week	15-20 gal/week	15-20 gal/week	up to 3120 gal
Friends Of The Urban Forest – They water 1000 trees/week for City of San Francisco [12]	15-20 gal/week	15-20 gal/ week	15-20 gal/week	up to 3120 gal
California Re-Leaf [13]	10-20 gal/week	10-20 gal/week	10-20 gal/week	up to 3120 gal
Million Trees LA 380K trees for City of Los Angeles [14]	10-15 gal/ week	10-15 gal/week	10-15/gal/week	up to 2340 gal
San Diego Regional Urban Forests Council (SDRUFC) [16]	5 gal/week	5 gal/week	5 gal/week	780 gal
City of San Diego [14]	10 gal/ week	10 gal 2x/ month	10 gal 1x/ month	880 gal

In the first 3 years, the City of San Diego uses a total of one-half to one-third the amount of water for our newly planted trees, as compared with the above California cities – and some of these cities, such as Santa Barbara and San Francisco, receive **twice** our average annual rainfall.

Canopy.org of Palo Alto is a non-profit which has performed yearly **Young Tree Care Surveys**,[15] from 2009-2020, which are similar to our city's 3 recent surveys performed by Kate Sessions Commitment.

Using a watering schedule of 10-15 gallons per week, each year for the first 3 years, they achieved the following impressive outcomes for tree survival rates. Here was their last pre-Covid survey: Table 1

Of 948 trees planted 5 years prior in 2016, only 9% were severely stressed, dead, or missing
Of 1065 trees planted 4 years prior in 2017, only 7% were severely stressed, dead, or missing
Of 1438 trees planted 3 years prior in 2018, only 9% were severely stressed, dead, or missing
Of 1566 trees planted 2 years prior in 2019, only 9% were severely stressed, dead, or missing

While San Diego lost **53%** of the trees we planted only 3 years ago, Palo Alto lost less than **10%** of trees they planted even 5 years previously. Another program **Million Trees LA,** planted 380,000 trees between 2006 to 2013, and won the 2012 "Best Urban Forestry Award" for achieving only a **4-5%** tree mortality rate! [14] Two significant factors behind each organization's successes may be their use of 2-3 times the **amount** of water, and a consistent **weekly** frequency of irrigation for the first 3 years.

Reaching out for expert opinions on San Diego's current watering schedule, here were some replies:

"Looking at the numbers you provided," San Diego's watering schedule shows "a severe deficit irrigation, which likely explains the high mortality. To reduce tree mortality, it's critical to minimize deficit irrigation during the early years, allowing trees to establish deep, healthy root systems." (Isaya Kisekka, PhD, Professor of Hydrology and Agricultural Water Management, University of California, Davis)

"The City's current schedule reduces frequency too quickly in Years 2 and 3 and is likely contributing to the high mortality you are observing. You cannot make up for a lack of frequency by dumping more water less often. [17] ***The SDRUFC's flat 5 gallons per week in Years 1 through 3 is closer to the evidence base than the City's schedule, but Year 1 generally needs more than 5 gallons per week…"***
(Matt Ritter, PhD, Urban Forest Ecosystems Institute, California Polytechnic State University, San Luis Obispo)

"In my previous role as a tree planting manager in San Francisco… the city watered trees with no less than 20 gallons, once a week, for the entire first 3 years. Even then, trees suffered in the establishment period. I worry 10 gallons is not enough for a 15-gallon tree. You may want to consider watering at least 15 gallons for the first 1-2 years to give your trees a fighting chance…" (Zeima Kassahun, M.S., Forest Resilience Division, Washington State Department Of Natural Resources.

With San Diego's dry inland and coastal desert climates, in addition to increasing the **quantity** of water we use, experts agree we need to increase our watering **frequency**, which is quickly reduced to bi-monthly in year 2, and even further reduced to only once monthly in year 3. This frequency is far less than what is employed by the California cities above, and it is even less than the minimum guidelines of the San Diego Regional Urban Forestry Council, which are mandated for our $10M grant's ~5000 new trees. The **SDRUFC** states trees need to be watered once per week for the first 3 years after planting. [16]

So, can we afford to water our trees with adequate amounts of water and a greater frequency?

***** Least case, if by using the **SDRUFC** schedule, increasing our watering frequency in years 2 & 3, with only **5 gallons weekly for 3 years**, we can save even ~10 % (500) trees of the 5000 trees we plant, vs. 60% we find dead, lost, or very stressed over 5 yrs with our current practices -- our estimated savings would be:

10% of Our $10 M Grant	+ $1,000,000
10% of mandated 5 Year tree removal and replanting costs for 500 trees X $1210 per tree [19]	+ $605,000
Carbon sequestration & saved water runoff for 3 years for 500 trees at $8/tree [20]	+ $4000
Subtract the added cost of doing weekly watering at 5 gal/week for 3 years - ~5000 X $192/tree [21]	- $960,000
If we can save ~500 trees by watering with 5 gal every week for 3 years, our net savings:	**+$649,000**

* Best case, if watering **10 gallons weekly, for 3 years** like other California cities, helps approach a 90 % tree survival rate, saving nearly 2500 (50%) of the 5000 trees we plant -- our estimated savings would be:

50% of Our $10 M Grant	+ $5,000,000
50% of mandated 5 Year tree removal and replanting costs for 2500 trees X $1210 per tree [19]	+ $3,025,000
Carbon sequestration & saved water runoff for 3 years for 4500 trees at $8/tree [20]	+ $36,000
Subtract the added cost of weekly watering at 10 gal/week for 3 years - ~ 5000 X $660/tree [22]	- $3,300,000
If we can save ~4500 trees by watering with 10 gal every week for 3 years, our net savings:	**+$4,761,000**

These numbers represent the estimated lowest to highest range of savings we could achieve by increased watering in our initial **5 years after planting.** On top of this savings, since the California Urban Forests Council states, "a single tree can provide up to $3,880 in benefits **over its lifetime**…" [18] -- our city could accrue an additional **$2M - $13M** net **lifetime savings** by increasing watering.

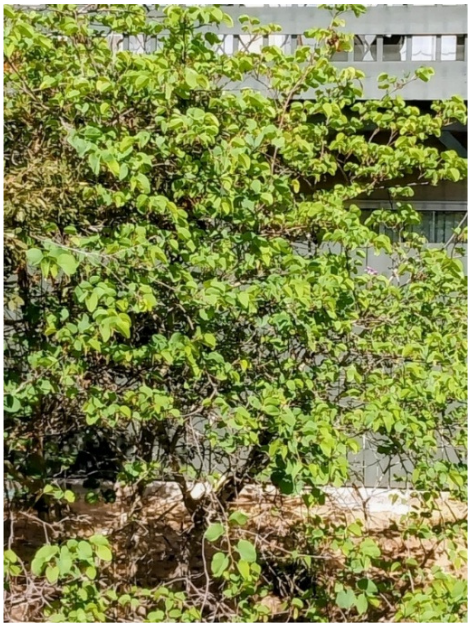
The recommendations of **Canopy.org,** and organizations supporting **Million Trees LA** which suggest watering with 10-15 gallons weekly for 3 years, are very compelling, with 11 years of surveys showing less than a 10% tree mortality rate for Palo Alto, and an impressive 4-5% tree mortality rate over many years for Los Angeles. Approaching such figures would go a long way toward furthering San Diego's goal of increasing our urban tree canopy cover from 15% all the way to 35% by 2035.

"There are obviously many factors to consider when establishing a tree (species of tree, microclimate of the planting site, soil type, mulching, existing irrigation, etc.), but the most important factor is the irrigation." (Joe DeWolf, Habitat Restoration Project Manager and associate biologist for the San Deigo Botanical Garden)

In the future, we can explore additional solutions to our tree mortality problem, such as improving species & nursery stock selection, mulching methods, pruning methods, staking practices, weeding practices, and increasing community involvement. However, our simplest and most immediate change can come through improving our watering practices. Perhaps we could implement such changes initially for a trial 3 year period, and monitor the results with further surveys. Let's not delay, when our own statistics show we are losing 5 more trees in San Diego with every passing day.[4]

Personal Experience - Effects of only 3 Weeks of watering on a 'very stressed' tree

HOA Tree In 'Fashion Hills' **Oct 3,2025**



Same Tree After Irrigation added **Oct 21, 2025**

TABLE 1 – EXCERPT FROM "2020" CANOPY.ORG YOUNG TREE CARE SURVEY FOR PALO ALTO [15]

III. Survey Results

The following table summarizes the results of the survey. The far left hand column lists the survey fields. The middle columns are the percentages from the previous four surveys for comparison. The far right hand columns list the total number of trees for which the answer was "true," and the percentage of the total for this year's survey. The final column on the right shows the percent change from the previous year to the current survey year.

General	2016	2017	2018	2019	2020 #	2020%	Change
Trees Surveyed	948	1065	1438	1566	1466	-	
Condition Rating	**2016**	**2017**	**2018**	**2019**	**2020 #**	**2020%**	**Change**
Excellent	28%	35%	22.7%	19.4%	449	30.6%	11.2%
Good	43%	42%	62.7%	65.8%	701	47.8%	-18%
Fair	15%	12%	9.4%	9.7%	149	10.2%	0.5%
Poor	6%	3%	3.6%	2.2%	31	2.1%	-0.1%
Dead	1%	1%	0.5%	1.3%	42	2.9%	1.6%
Red Flag	2%	2%	1.3%	2.0%	39	2.7%	0.7%
Tree Not Found	2%	3%	5%	5.1%	24	1.6%	-3.5%
No Rating Recorded / Did not survey	-	2%	1%	0.8%	24	1.6%	0.8%
Homeowner Concerns	**2016**	**2017**	**2018**	**2019**	**2020 #**	**2020%**	**Change**
Needs water	29%	36%	37%	53.3%	537	36.6%	-16.7%
Over-watered	4%	2%	3.4%	1.9%	40	2.7%	0.8%
Needs mulch	31%	23%	21.6%	25.2%	308	21%	-4%
Competing lawn or plants	23%	20%	15.4%	15.8%	188	12.8%	-3%
Needs weeding	-	-	14%	15.5%	170	11.6%	-3.9%
Mechanical damage or injury	5%	6%	1.3%	2.0%	45	3.1%	1.1%
City Concerns	**2016**	**2017**	**2018**	**2019**	**2020 #**	**2020%**	**Change**
Needs basin re-building	21%	21%	23%	27.8%	265	18.1%	-9.7%
Suckers need to be pruned	9%	5%	7.2%	10.7%	124	8.5%	-2.2%
Needs to be re-staked/re-strapped	7%	8%	7.8%	6.8%	86	5.9%	-0.9%
Stakes need to be removed	11%	16%	14.2%	13.3%	162	11.1%	-2.2%
Root flare buried	19%	19%	12.7%	8.2%	88	6%	-2%
Needs structural pruning	15%	10%	9.3%	7.3%	238	16.2%	8.9%
Needs clearance pruning	4%	5%	5.8%	5.8%	65	4.4%	-1.4%

(-) Dash means the information was not collected that year.

REFERENCES

(1) "Factors Affecting Condition and Growth of Bay Terraces Street Trees Planted in 2022," Emma Smith and Elizabeth Castelo-Gil, Kate Sessions Commitment, November 12, 2025 "Of 285 trees planted, 27 were Very Stressed, 42 were Dead, 41 were Missing," … and 40 had been replaced https://katestrees.org/tree-conditions/ https://drive.google.com/file/d/123NQfgHE4QFRGJbgyibFnfHdK5DvwXi1/view

(2) "Factors Affecting Condition and Growth of Street Trees Planted in Otay Mesa-Nestor in 2020," Ian Navapanich & Sabrina Hua, Kate Sessions Commitment, February 2, 2025 https://katestrees.org/tree-conditions/ https://drive.google.com/file/d/1OA2g1bwOJyURfmA-0JY1iSMvkVNxaIPf/view

(3) "Factors Affecting Tree Condition and Growth of Street Trees Trees planted on Imperial, Market and Ocean View & other streets in 2016," Emma Smith & Kirra Snyder, January 2025 https://katestrees.org/tree-conditions/ https://drive.google.com/file/d/1UFpEkDijqUjCg8-aHUR69P66rEgZl833/view

(4) Inflation Reduction Act (IRA) Urban and Community Forestry (UCF) Grant Narrative and Budget, City of San Diego, revised application for Ready, Set, Grow grant (page 2) https://drive.google.com/file/d/1BpjdlwQsIB9eqgUp2PQmlirlJ0Jb_YFa/view

(5) Urban Forestry Program Update Fiscal Year 2025, Environment Committee, May 22, 2025. https://drive.google.com/file/d/1OkaaLEsXDEfywjREDz6QG9xXk5_apiQC/view?usp=sharing

(6) The City Of San Diego Staff Report to the City Council, March 5,2024 https://drive.google.com/file/d/1-E4n4bWI3hAM4xYjE_iI-CuO44ZnPpcs/view

(7) https://lacountycfmp.org/wp-content/uploads/documents/tree-management/5.Watering%20Guidelines.pdf

(8) https://www.ourcityforest.org/blog/2015/2/26/the-ultimate-watering-guide

(9) https://sfpublicworks.org/services/caring-your-new-street-tree

(10) https://canopy.org/tree-info/caring-for-trees/trees-and-water/watering-guidelines/

(11) https://santabarbaraca.gov/sites/default/files/documents/Public%20Works/Water%20Conservation/Tree%20Watering%20Flyer.pdf

(12) https://www.friendsoftheurbanforest.org/faq-treecare

(13) https://californiareleaf.org/programs/saveourtrees/

(14) https://la2050.org/organizations/million-trees-la-a-project-of-community-partners

(15) https://canopy.org/our-work/tree-care/young-tree-care-survey/

(16) https://sdrufc.com/treewatering/

(17) In letter reference: UF/IFAS Establishment Irrigation and Research pages synthesizing Beeson and Gilman 1992, Gilman et al. 1994, Gilman and Beeson 1996, Gilman et al. 1996, Gilman 2001, Gilman et al. 2002, Harris & Gilman 1993, Watson & Himelick 1982. https://hort.ifas.ufl.edu/woody/documents/articles/EFG9803.pdf

(18) https://caufc.org/why-urban-forests/

(19) https://sdrufc.com/treewatering/

(20) I-Tree Ecosystem Analysis San Diego 400 Trees 2016 -- Carbon Sequestration, Air pollution removal, saved water runoff: https://drive.google.com/file/d/1aQSq1KoQ9k9pBvvjbsQq52NH-n0lQV_9/view?usp=drive_link

For references (21) & (22) below, see Cost v. Benefit Analysis on next page…

Email correspondence with above quoted experts is available upon request to drmichaelackerman@outlook.com

Calculations Used In The Cost Vs. Benefit Analyses (Page 3):

With our city's current contract, we are paying $10 for watering each tree with 10 gallons of water, this costs:

YEAR ONE:	**10 gallons per week**	**(52 X $10)**	**$520**
YEAR TWO:	**10 gallons bi-monthly**	**(26 X $10)**	**$260**
YEAR THREE:	**10 gallons monthly**	**(12 X $10)**	**$120**

With our current diminishing watering schedule, for 3 years our we are paying = $900 per tree

(21) If we adopt the SDRUFC recommended watering schedule, using 5 gallons per watering, but keeping up a consistent weekly frequency for three years, due needing half the water and half the time for each tree, perhaps we could negotiate a slightly lower contract -- say $7 vs. $10 per tree:

YEAR ONE:	**5 gallons per week**	**(52 X $7)**	**$364**
YEAR TWO:	**5 gallons per week**	**"**	**$364**
YEAR THREE:	**5 gallons per week**	**"**	**$364**

With a yearly 5 gallon/week consistent watering schedule, for 3 years our total cost = $1092 per tree

***Adopting a watering schedule which uses the SDRUFS's consistent frequency of watering, and only 5 gallons vs.10 gallons per tree, would cost over a 3 year period- $1092 - $900 (our current cost) = $192 extra per tree**

(22) If we adopt a watering schedule closer to other California cities & Canopy.org, using 10 gallons per watering, but keeping up a consistent weekly frequency for three years, per tree we would spend …

YEAR ONE:	**10 gallons per week**	**(52X $10)**	**$520**
YEAR TWO:	**10 gallons per week**	**"**	**$520**
YEAR THREE:	**10 gallons per week**	**"**	**$520**

With a yearly 10 gallon/week consistent watering schedule, for 3 years our total cost = $1560 per tree

***Adopting a watering schedule closer to other California cities, and Canopy.org, using 10 gallons and consistent weekly watering over 3 years would cost- $1560 - $900 (our current cost) = $660 extra per tree**

ADDITIONAL NOTE REGARDING CALCULATIONS:

Our current $10 M grant stipulates that dead trees need to be replaced during their 5 year monitoring period: "After trees are planted, inspections of trees will be made within the first 6 months, and replacement trees will be planted as needed. Inspections will continue on an annual basis as needed." Ready, Set, Grow data suggests that a typical new planting cost per tree is $210. Removing a dead tree and replacing it -- depending on it's age -- can cost more than $1000 according to the SDRUFC. [21]