

LAKE CACHUMA OAK TREE RESTORATION PROGRAM

2017 ANNUAL REPORT

with

Fiscal Year 2017-2018 Financials and Water Usage



Prepared for: Cachuma Operation and Maintenance Board

Prepared by: Timothy H. Robinson (COMB), Scott J. Volan (COMB), Daniel Razo (COMB) and Kenneth A. Knight (Kenneth A. Knight, Consulting)

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Executive Summary

The following is the annual report for the Lake Cachuma Oak Tree Restoration Program that contains the results of the 2017 annual inventory of all planted mitigation oak trees and the Fiscal Year 2017-2018 financial and water usage details. The results of the 2015 Lakeshore Survey set the mitigation number for the Lake Cachuma Oak Tree Restoration Program at 4,721 (COMB, 2016). This number included the established mitigation ratio of two to one (2:1) and an 18% mortality rate that was determined from the 2015 and 2016 annual survey reports (COMB, 2017a; COMB, 2017b). As of the end of this year's inventory, 4,414 oak trees have been planted and 3,674 are alive which is a survival rate of 82.21%. The number of mitigation trees still to be planted is **1,047** trees (mitigation number minus total alive trees). The cost of the program during Fiscal Year 2017-2018 was \$128,752 with a total cost of the program since it started in 2005 of \$1,507,029. Water usage for irrigation over the year was 1.31 acre-feet.

Introduction/Background

This Annual Report presents the results of the 2017 oak tree inventory and Fiscal Year 2017/2018 (FY17/18) maintenance with water use and financials for the Lake Cachuma Oak Tree Restoration Program (Program). For Program details and objectives, see the 2-Year Plan for Fiscal Years 2013/14 and 2014/15 (COMB, 2014). This annual report contains oak tree survival rates, maintenance with water usage, financials, and suggested program improvements.

There were no oak trees planted in FY17/18 due to a drought year and poor conditions for planting. Incorporated into the program during this recording year were 124 trees planted by the US Bureau of Reclamation dam tenders from approximately 2001 through 2010 and are referenced as the Dam Tender (DT) trees. These trees are located near the Bradbury Dam Tenders Office and the dam overlook just to the east. The survey results for this reporting period are presented by the year of the program that they were planted they were and include the financials and maintenance effort.

Results

The 2017 inventory (or survey) of the oak trees planted through the Lake Cachuma Oak Tree Restoration Program was completed in April 2018 with the data entry and quality-assurance/quality-control occurring during the following month. The objective of the annual survey is to determine the status and success rate of the trees planted since the beginning of the program with 9 years of plantings; Year 1 (2005-2006), Year 2 (2006-2007), Year 3 (2007-2008), Year 4 (2008-2009), Year 5 (2009-2010), Year 6 (2010-2011), Year 7 (2014-2015), Year 8 (2015-2016), Year 9 (2016-2017) and the DT trees (approximately 2001 through 2010) in four different locations around Lake Cachuma (Figure 1). The DT trees are newly incorporated (Figure 2) and are included in this inventory and financial report. Annual surveys traditionally are conducted in the late fall and early winter to best document the survival after the dry season and growth since the last survey. With the increased number of planted trees in recent years, the annual inventory takes longer with the objective now of completion by middle of the spring of the following year. Methods for reducing the survey time continue to be investigated.

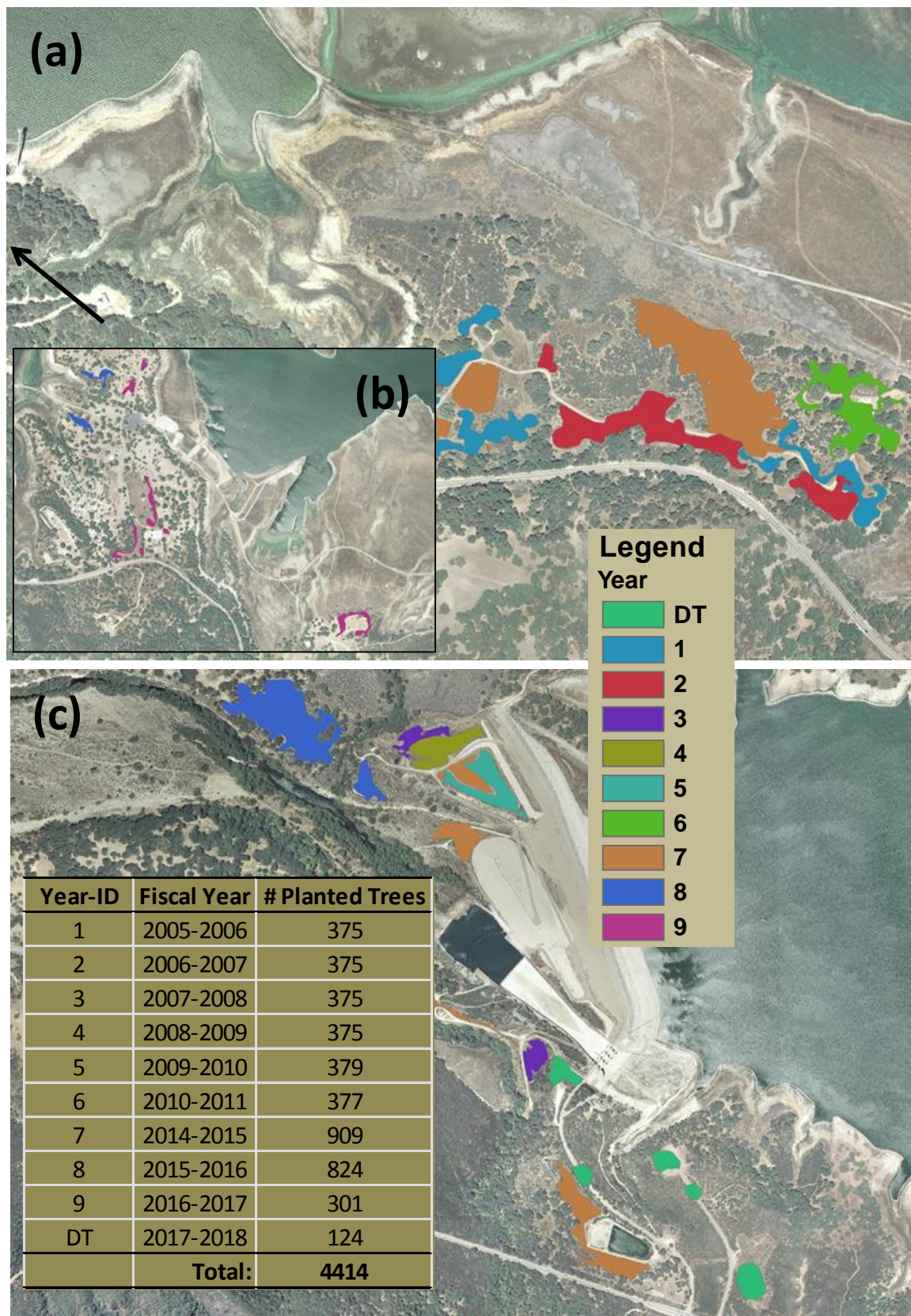


Figure 1: Oak tree planting locations by year planted at; (a) Storke Flats, (b) Cachuma Lake Recreation Area (County Park), and (c) Bradbury Dam area.



Figure 2: Dam Tender trees near Bradbury Dam as mapped in FY17/18.

The following figures and tables are the results of the survey in 2017 with 2016 results included for comparison; overall success rates in 2016 and 2017 (Figures 3 and 4) and success by planting year in 2016 and 2017 (Figures 5-12). The overall success rate went from 81.5% in 2016 to 82.2% in 2017; the increase is due to incorporation of the DT trees (all alive and self-sustaining), replanting of the dead found within the Year 8 and Year 9 planted trees, and adoption of a few native saplings into the program. Year 9 and DT trees have a 100% success rate and had no comparison to the previous year; hence figures were not included for those years for this report.

This was the sixth of seven years of below average rainfall that has made it difficult for planted trees to survive particularly in the Year 1 through Year 6 trees that were thought to be self-sustaining by now at a minimum of six years since planted. The number of required mitigated trees from the Lake Cachuma Surcharge Project was set in 2015 and reported in the 2015 Lakeshore Survey Report (COMB, 2016). The required mitigation ratio is two to one (2:1) survival rate (self-sustaining) in 2025. The results of the 2015 Lakeshore Survey found there were 879 dead and 1,122 at-risk oak trees. With a 2:1 mitigation ratio and an estimated 18% mortality rate, it was estimated that 4,722 trees would need to be planted to meet our mitigation requirements in 2025. To date, there are 3,674 planted alive trees suggesting that **1,047** trees (mitigation number minus total alive trees) still need to be planted and soon to get established and be self-sustaining within seven years (2025).

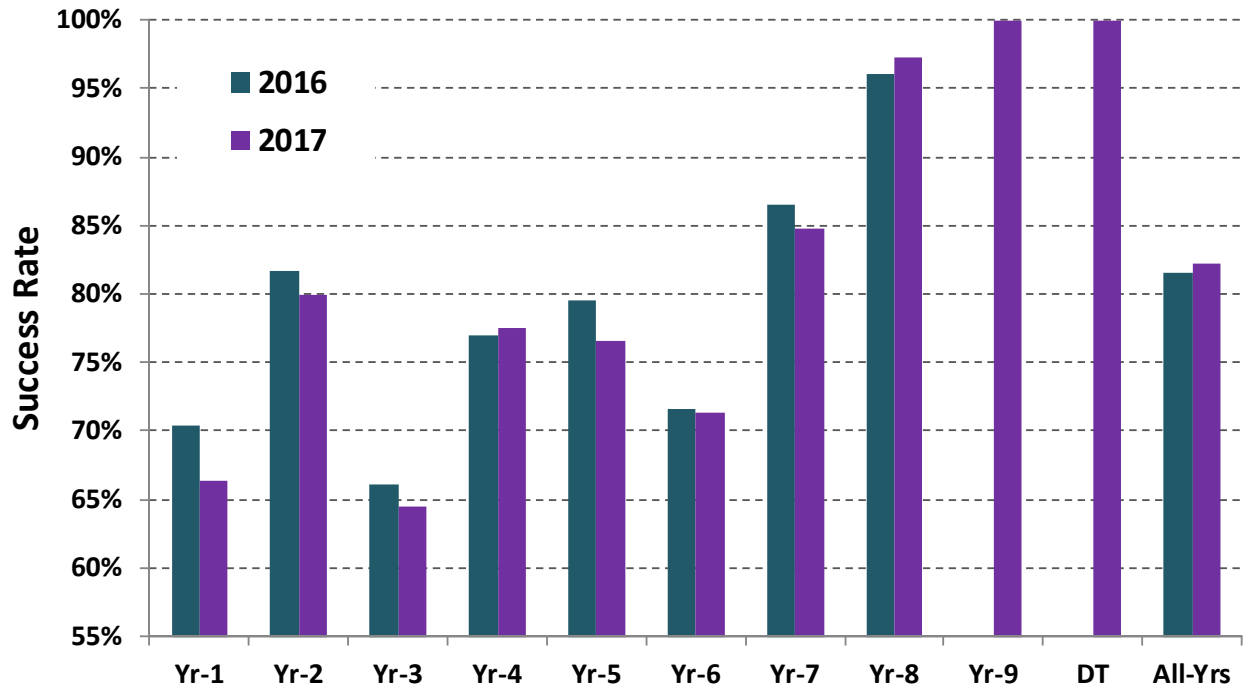
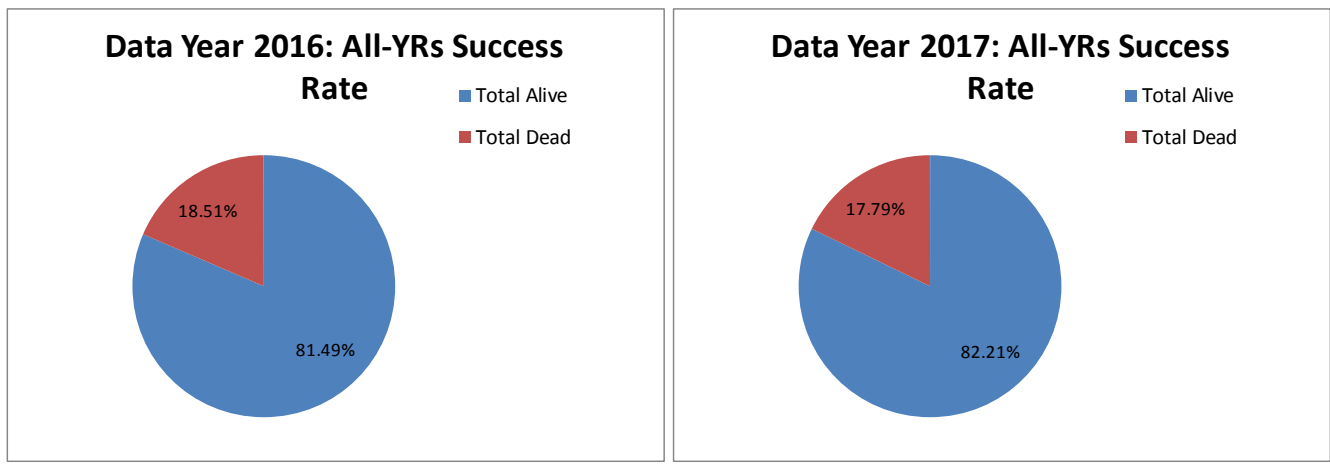
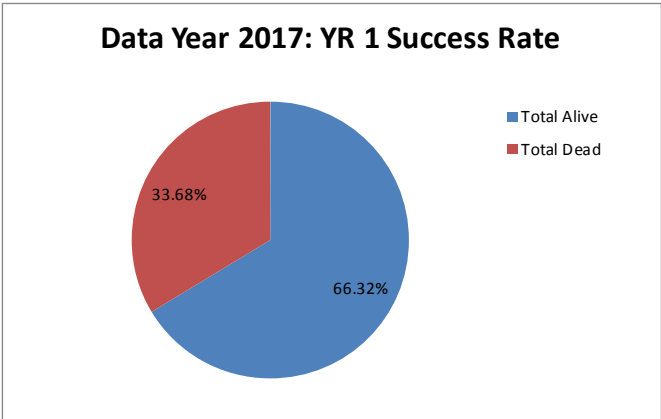
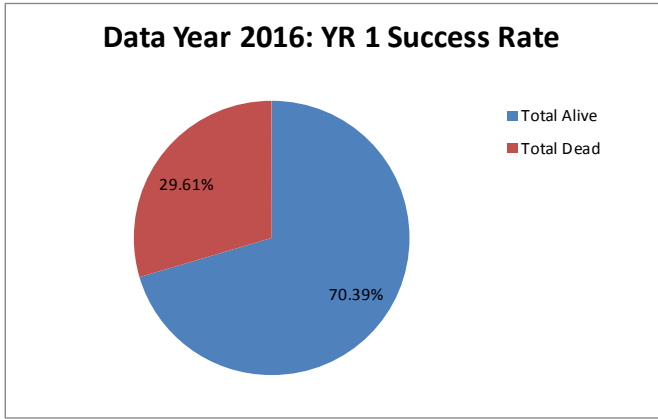


Figure 3: Success rate comparison from 2016 to 2017 for each and all tree years (Yr).



All Years - Total Observed in 2016				Percent of Total		All Years - Total Observed in 2017				Percent of Total	
Total Coast Live Oak (alive)	2894	Total Alive	3289	81.49%	Total Coast Live Oak (alive)	3272	Total Alive	3674	82.21%		
Total Valley Oak (alive)	394	Total Dead	747	18.51%	Total Valley Oak (alive)	402	Total Dead	795	17.79%		
Ratio Coast/Valley	7.3	Total	4036	100.00%	Ratio Coast/Valley	8.1	Total	4469	100.00%		

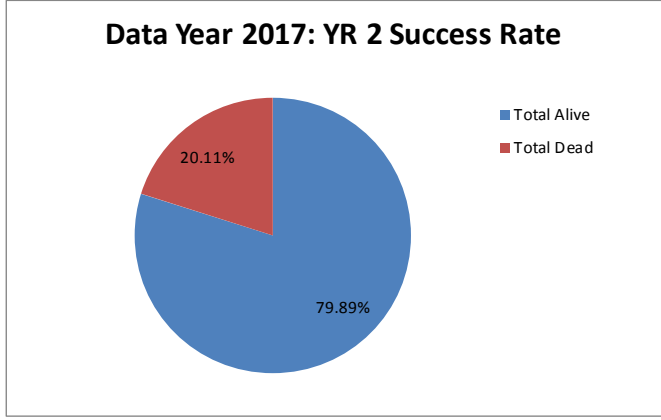
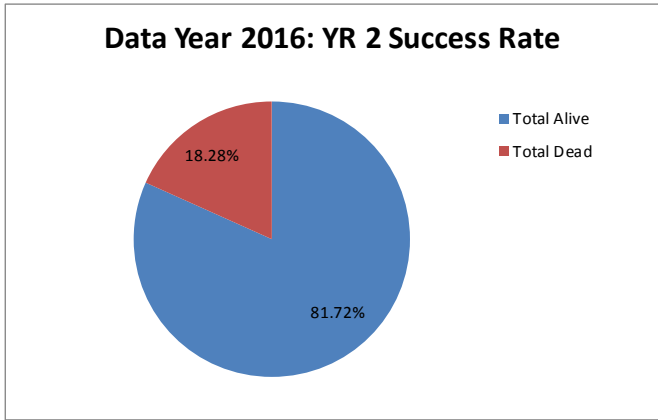
Figure 4: 2015 and 2016 status of oak trees from all years (Years 1 through 8) planted; including DT trees.



Year 1 - Total Observed in 2016		Percent of Total	
Total Coast Live Oak (alive)	250	Total Alive	271 70.39%
Total Valley Oak (alive)	21	Total Dead	114 29.61%
Ratio Coast/Valley	11.9	Total	385 100.00%

Year 1 - Total Observed in 2017		Percent of Total	
Total Coast Live Oak (alive)	236	Total Alive	256 66.32%
Total Valley Oak (alive)	20	Total Dead	130 33.68%
Ratio Coast/Valley	11.8	Total	386 100.00%

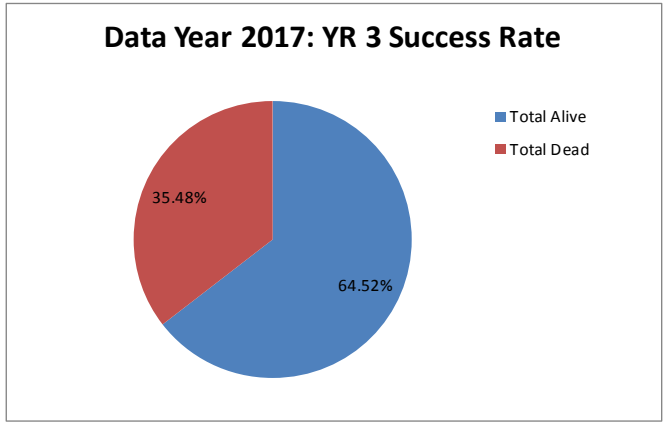
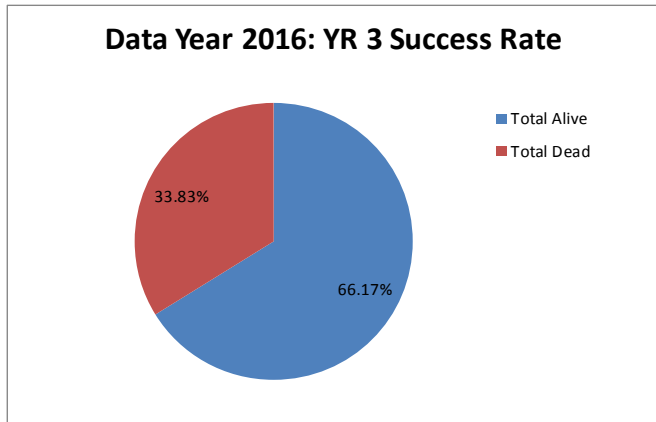
Figure 5: Status comparison of Year (YR) 1 trees from 2016 to 2017.



Year 2 - Total Observed in 2016		Percent of Total	
Total Coast Live Oak (alive)	278	Total Alive	304 81.72%
Total Valley Oak (alive)	26	Total Dead	68 18.28%
Ratio Coast/Valley	10.7	Total	372 100.00%

Year 2 - Total Observed in 2017		Percent of Total	
Total Coast Live Oak (alive)	273	Total Alive	298 79.89%
Total Valley Oak (alive)	25	Total Dead	75 20.11%
Ratio Coast/Valley	10.9	Total	373 100.00%

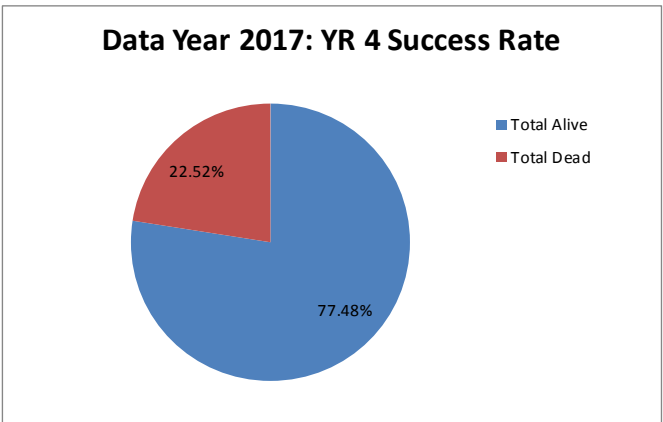
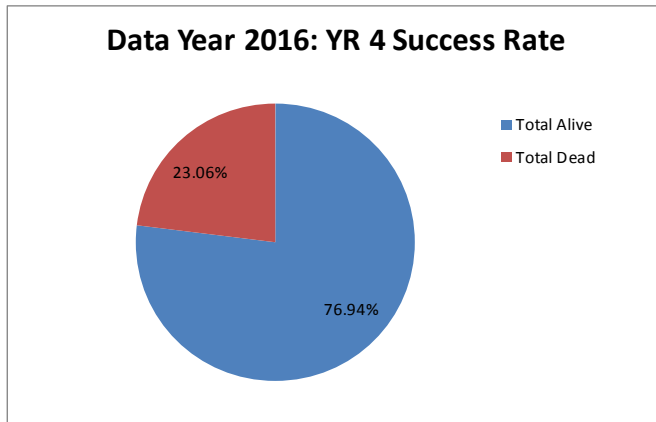
Figure 6: Status comparison of Year 2 trees from 2016 to 2017.



Year 3 - Total Observed in 2016				Percent of Total
Total Coast Live Oak (alive)	239	Total Alive	264	66.17%
Total Valley Oak (alive)	24	Total Dead	135	33.83%
Ratio Coast/Valley	10.0	Total	399	100.00%

Year 3 - Total Observed in 2017				Percent of Total
Total Coast Live Oak (alive)	237	Total Alive	260	64.52%
Total Valley Oak (alive)	23	Total Dead	143	35.48%
Ratio Coast/Valley	10.3	Total	403	100.00%

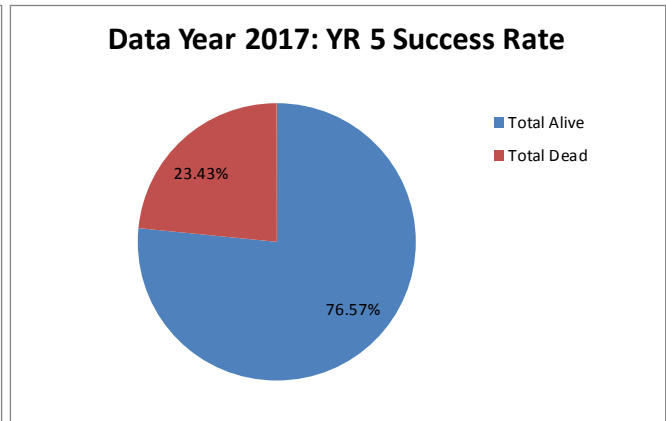
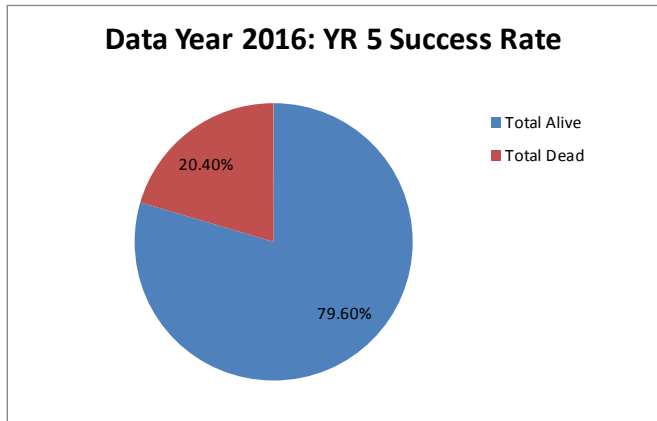
Figure 7: Status comparison of Year 3 trees from 2016 to 2017.



Year 4 - Total Observed in 2016				Percent of Total
Total Coast Live Oak (alive)	261	Total Alive	287	76.94%
Total Valley Oak (alive)	26	Total Dead	86	23.06%
Ratio Coast/Valley	10.0	Total	373	100.00%

Year 4 - Total Observed in 2017				Percent of Total
Total Coast Live Oak (alive)	260	Total Alive	289	77.48%
Total Valley Oak (alive)	29	Total Dead	84	22.52%
Ratio Coast/Valley	9.0	Total	373	100.00%

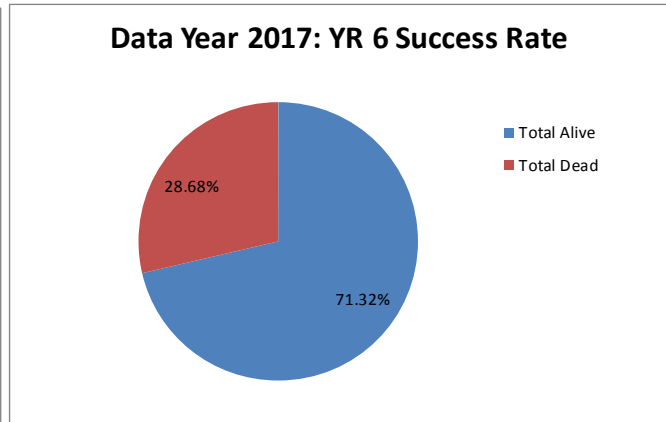
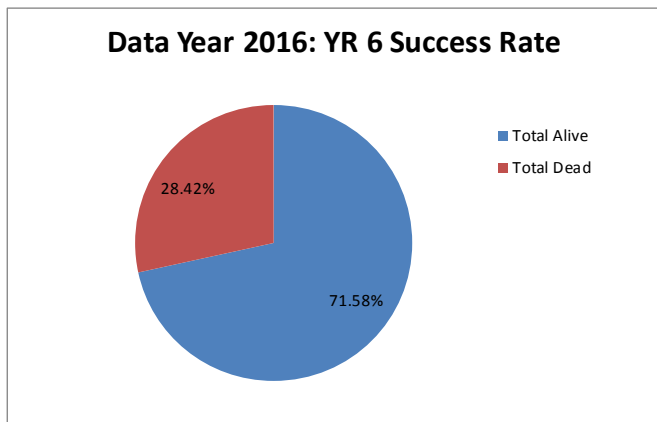
Figure 8: Status comparison of Year 4 trees from 2016 to 2017.



Year 5 - Total Observed in 2016		Percent of Total	
Total Coast Live Oak (alive)	266	Total Alive	316
			79.60%
Total Valley Oak (alive)	50	Total Dead	81
			20.40%
Ratio Coast/Valley	5.3	Total	397
			100.00%

Year 5 - Total Observed in 2017		Percent of Total	
Total Coast Live Oak (alive)	259	Total Alive	304
			76.57%
Total Valley Oak (alive)	45	Total Dead	93
			23.43%
Ratio Coast/Valley	5.8	Total	397
			100.00%

Figure 9: Status comparison of Year 5 trees from 2016 to 2017.



Year 6 - Total Observed in 2016		Percent of Total	
Total Coast Live Oak (alive)	237	Total Alive	272
			71.58%
Total Valley Oak (alive)	35	Total Dead	108
			28.42%
Ratio Coast/Valley	6.8	Total	380
			100.00%

Year 6 - Total Observed in 2017		Percent of Total	
Total Coast Live Oak (alive)	234	Total Alive	271
			71.32%
Total Valley Oak (alive)	37	Total Dead	109
			28.68%
Ratio Coast/Valley	6.3	Total	380
			100.00%

Figure 10: Status comparison of Year 6 trees from 2016 to 2017.

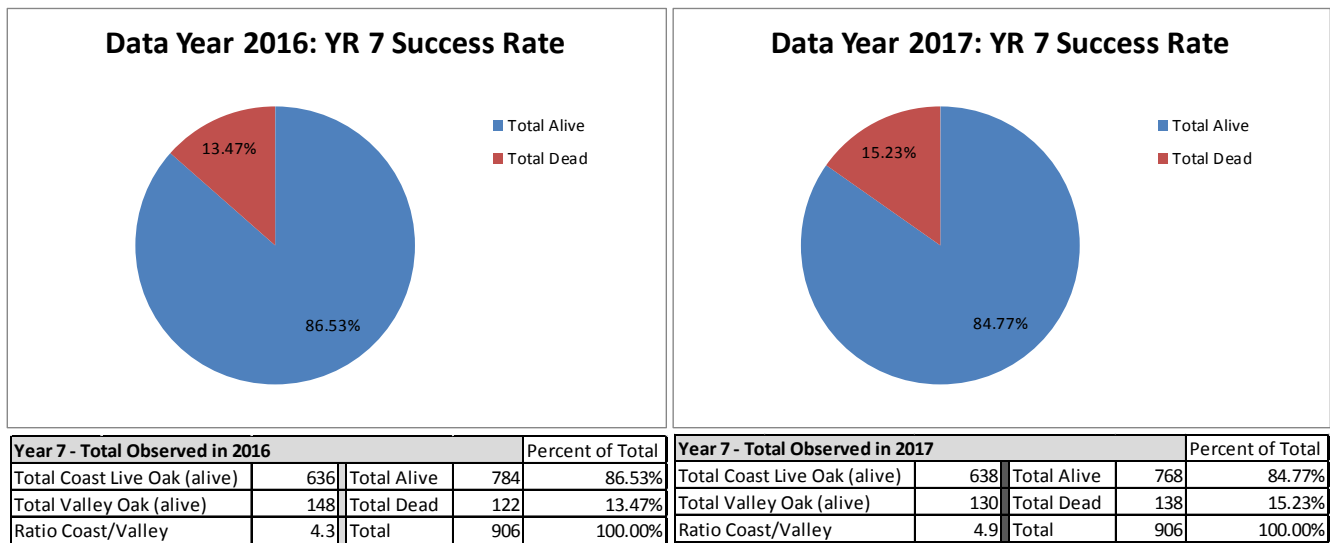


Figure 11: Status comparison of Year 7 trees from 2016 to 2017.

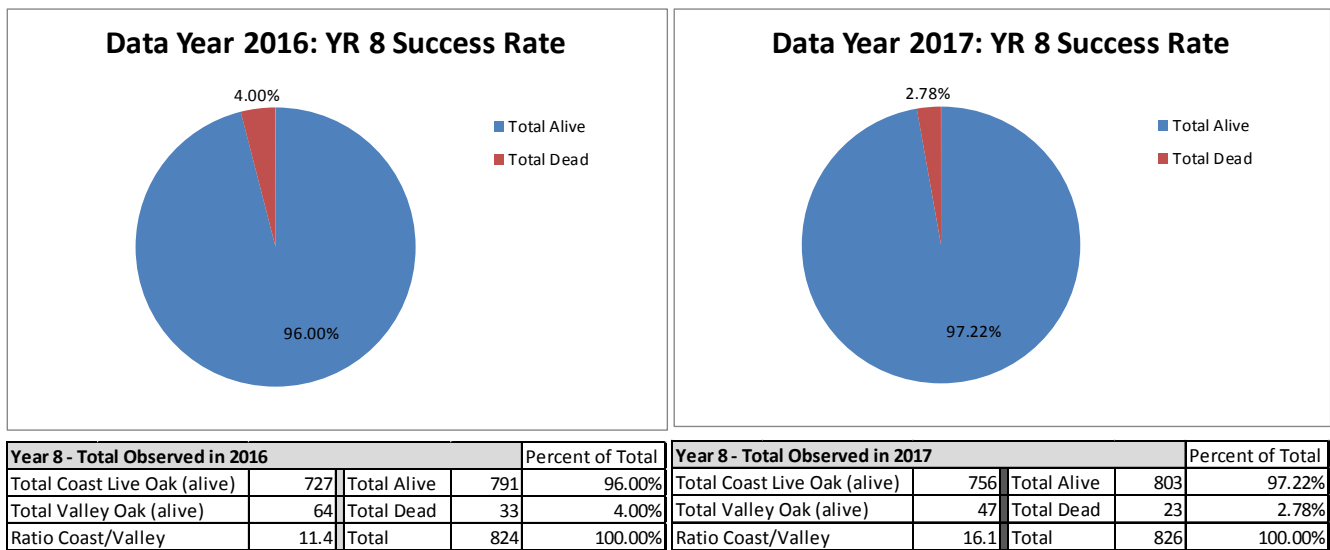


Figure 12: Status comparison of Year 8 trees from 2016 to 2017.

Maintenance

Maintenance of all planted oak trees in FY17/18 included irrigating, weeding, mulching, and deer cage maintenance is presented in Table 1. The total amount of water used from Lake Cachuma to irrigate oak trees from all years in FY17/18 was 1.31 acre-feet which was slightly higher than last year at 0.92 acre-feet due to more trees in the program and the continuation of drought conditions (Table 2).

Information presented in Tables 1 and 2 does include Year 9 and DT trees.

Table 1: Cachuma Oak Tree Restoration Program completed maintenance in FY17/18.

	July 2017	Aug 2017	Sep 2017	Oct 2017	Nov 2017	Dec 2017	Jan 2018	Feb 2018*	March 2018*	April 2018*	May 2018	June 2018
Year 9 Oaks (2016-2017)	Irrigated Weeded	Irrigated Weeded	Irrigated Weeded		Irrigated Weeded		Irrigated Weeded	Mulched			Irrigated Weeded	Weeded Roads
Year 8 Oaks (2015-2016)	Irrigated Weeded	Irrigated Weeded	Irrigated Weeded		Irrigated Weeded	Irrigated Weeded		Mulched	Mulched	Mulched	Irrigated Weeded	Weeded Weeded Roads
Year 7 Oaks (2014-2015)			Irrigated Weeded						Mulched Deer Cages	Mulched Weeded		Irrigated Weeded Weeded Roads
Year 6 Oaks (2010-2011)				Irrigated Weeded Deer Cages	Pruning Deer Cages		Deer Cages	Deer Cages				Weeded Roads
Year 5 Oaks (2009-2010)					Deer Cages	Irrigated Weeded						
Year 4 Oaks (2008-2009)						Irrigated Weeded					Deer Cages	Weeded Roads
Year 3 Oaks (2007-2008)						Irrigated Weeded					Deer Cages	Weeded Roads
Year 2 Oaks (2006-2007)				Irrigated Weeded Deer Cages								Weeded Roads
Year 1 Oaks (2005-2006)				Irrigated Weeded Deer Cages								Weeded Roads
*Annual Oak Tree Inventory												

Table 2: Cachuma Oak Tree Restoration Program water usage from Lake Cachuma for irrigation during FY17/18.

	Gallons	Acre-feet
July	32,250	0.099
August	74,550	0.229
September	74,550	0.229
October	58,600	0.180
November	23,925	0.073
December	39,950	0.123
January	8,350	0.026
February	10,775	0.03
April	5,150	0.016
May	56,925	0.175
June	41,900	0.129
Total:	426,925	1.31

Financials

Annual expenses by Fiscal Year since the beginning of the Lake Cachuma Oak Tree Restoration Program in FY05/06 are presented in Table 3. The totals include COMB staff (plus burden) and consulting arborist hours, material, supplies, fuel expenses, GPS mapping, conducting the annual inventory, replanting trees over the period, and reporting. The breakout for those costs is presented by labor (Table 4) and the total cost (labor, materials, and supplies) in Table 5. The financials do include the Year 9 and DT planting and mapping efforts.

Table 3: Total program costs by Fiscal Year including planting, maintenance, mapping, conducting the annual inventory, and reporting by year (Year-ID) and number of trees planted during those years.

# of Years	Fiscal Year	Operator	Year-ID	# Planted Trees	Cost
1	2005-2006	Fournier	1	375	\$116,731
2	2006-2007	Fournier	2	375	\$117,620
3	2007-2008	Fournier	3	375	\$138,786
4	2008-2009	Fournier	4	375	\$137,872
5	2009-2010	Fournier	5	379	\$136,900
6	2010-2011	Fournier	6	377	\$137,878
7	2011-2012	Fournier	-	-	\$79,439
8	2012-2013	COMB	-	-	\$101,431
9	2013-2014	COMB	-	-	\$48,097
10	2014-2015	COMB	7	909	\$134,054
11	2015-2016	COMB	8	824	\$128,241
12	2016-2017	COMB	9	300	\$101,227
13	2017-2018	COMB	DT	124	\$128,752
Total:				4289	\$1,507,029

Table 4: Labor costs for the Lake Cachuma Oak Tree Program during FY17/18.

	Total
COMB Staff (hours):	
Seasonal Biologist Aide A	662
Seasonal Biologist Aide B	750
Seasonal Biologist Aide C	80
Seasonal Biologist Aide D	336.5
Seasonal Biologist Aide E	54
Water Service Worker I	36
Water Service Worker III	40
Biologist Assistant	1581.75
Project Biologist A	18
Project Biologist B	118.25
Senior Resource Scientist	148
Total Staff Hours:	3824.5
Cost - Labor plus burden	
	\$111,473.12
Consultant Service Hours (Ken Knight):	
	9.5
Consultant Cost	
	\$950.00
Total Personnel/Consultant Cost	
	\$112,423.12

Table 5: Total expenses (labor, materials and supplies) for the Lake Cachuma Oak Tree Program during FY17/18.

	Total
Materials and Supplies:	
Oak trees	\$3,167.90
Tree stakes	
Tree tags	
Mulch	\$1,018.37
Compost	\$457.35
Fertilizer	\$50.10
Gopher baskets	
Protective deer caging/netting	\$4,435.77
Hand tools	\$2,696.80
Rebar	\$36.59
Hoses	\$349.19
Cable ties	\$30.12
PPE	\$174.75
Backhoe mobilization	
Vehicle Fuel Cost	\$1,446.60
Equipment Fuel Cost (incl. diesel H2O truck)	\$2,465.06
Total Materials and Supplies	\$16,328.60
TOTAL EXPENSES (labor, materials + supplies)	\$128,751.72

The total cost of the Lake Cachuma Oak Tree Restoration Program in FY17/18 was \$128,752 which includes any replanting and mapping costs of the DT trees. Again, the total reflects personnel cost (labor plus burden), materials, supplies, expenses (vehicle and equipment fuel), and consultant fees. For comparison, during the first six years of the project annual consultant costs were approximately \$136,000 to plant approximately 375 and maintain the previously planted trees. In FY16/17, COMB staff planted 301 trees and maintained all previously planted trees (4,290 trees) at a cost of \$101,227. The ability to keep costs down is attributed to multiple factors, which include but are not limited to:

- Relying on the COMB Fisheries Division seasonal staff to conduct the bulk of field activities.
- Minimizing the amount of full-time staff being used.
- Reduced equipment needs as the bulk of purchases occurred during the fiscal year when COMB took over the project.
- Reduced consultant hours due to staff gaining more tree care experience.
- Planting fewer trees than the previous year that allowed the Fisheries Division crew to conduct all the planting and not utilize the assistance of the California Conservation Corps.
- Reduced vehicle gas consumption as some of the seasonal staff live in the Santa Ynez Valley and use their own vehicles to travel to oak tree locations.
- Reduced equipment (generator/pumps) gas consumption from more efficient irrigation hosing and better delivery technique for extracting water from Lake Cachuma.

Summary and Recommendations for Program Improvements

There are 3,674 (including Year 9 and DT trees) alive oak trees attributed to the mitigation effort of the Program. The survival rate to date is 82.21% (Years 1-9 and DT trees) which would be considered very respectful in any open range oak tree planting effort in a similar climate. The number of mitigation trees still to be planted is **1,047** trees.

Challenges for the Program, specifically tree survival, are six of seven years of an extraordinary drought (WY2012-WY2018, except WY2017), inadequate initial planting methodology during the first 6 years (compromised gopher wire baskets, trees planted too low, deer cages removed too soon, auger hole planting, etc.), and a limited staff to take care of an extensive number of trees. Some planting areas have better soils and topography than others, for example the Year 3 planting area has shallow soils with southern exposure whereas the Year 7 planting area is just the opposite.

Lessons learned by the COMB staff from six years of conducting this Program have been put into practice and are recommended for future work, specifically:

- Systematically mulching all trees once a year, particularly newly planted trees.
- Maintain deer cages for all trees below deer browsing level (approximately 6 feet).
- Clear the dirt away from the tree base.
- Expose gopher wire baskets at the surface wherever possible to prohibit gopher travel over the top of the wire basket.
- Plant new trees in professional gopher wire baskets using backhoe dug holes (no auger holes that limit the spread of tree roots); plant the trees slightly above grade to accommodate subsidence; and use sturdy wire deer cages instead of netting or chicken wire.
- Plant well established trees from the nursery (at least a foot tall) instead of acorns as they have a better success rate.
- Structurally pruned planted trees grow larger and taller faster than unpruned trees thus becoming more likely to survive and be self-sustaining (Figure 13).
- Continue to use Grow-Tubes as they appear to be quite successful particularly in areas with poor soils (Figure 14) and where surface rodent impacts are noticed, such as near brushy natural vegetation found along the margins of planting areas (Figure 15).
- Wrap the bottom of deer cages with fine mesh shade cloth to prohibit surface rodents from accessing planted trees in areas near the margins of planting areas (Figure 16).



Figure 13: Structural pruning instruction given by the project consulting arborist at (a) Year 6 and (b) Year 2 planting areas.



Figure 14: Oak trees planted with grow tubes showing (a) extensive vertical growth and (b) tree protection from surface rodents along margins of planting areas both at the Wastewater planting area (Year 7).



Figure 15: Removal of a wood rat nest along the margins of the Wastewater planting area (Year 7 trees) where tree trunk damage was observed showing (a) the nest with a planted oak tree beyond utilizing a grow tube for protection and (b) a cross-section of the partially removed nest.



Figure 16: Use of fine mesh shade cloth to prohibit surface rodents from accessing planted oak trees along the margins of planted areas at (a) Storke Flats (Year 7 trees) and (b) near the County Park Waste Water Treatment Plant (Year 7 trees).

References:

COMB, 2016. 2015 Lakeshore Survey Report. Cachuma Operation and Maintenance Board (COMB).

COMB, 2017a. 2015 Annual Report of the Lake Cachuma Oak Tree Restoration Program. Cachuma Operation and Maintenance Board (COMB).

COMB, 2017b. 2016 Annual Report for the Lake Cachuma Oak Tree Restoration Program. Cachuma Operation and Maintenance Board.