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5 August 2015

Re: Proposed management activities Monarch Grove Sanctuary and George Washington Park August-September 2015

The following recommendations and assessments are based on site visits and a field tour with City Arborist Albert Weisfuss in June and July 2015. They are addressed in the context of the 2011 Management Plan and subsequent consultations with City staff and residents. The recommendations are based on previous scientific work, professional judgment, and detailed field assessments. They carefully balance monarch habitat needs, hazard reduction, and forest health, based on both short-term and long-term perspectives.

In this year's assessment we have included more background data on Monarch Grove Sanctuary (Xerces Society Thanksgiving Counts) to put it in context of the entire California monarch population. We have also incorporated butterfly monitoring data from the Pacific Grove Museum from the last two years to document habitat suitability and monarch use patterns.

Recent History and Current Conditions

Monarch Grove Sanctuary (MGS) continues to support one of the largest overwintering aggregations in California (Table 1). The ultimate size of the MGS aggregation is dependent on range-wide breeding success the previous summer, and the ability of the site to attract butterflies in the fall and provide suitable temperature, light, and wind conditions through the fall and winter. Since 1998, MGS supported between 1% and 14% of the Thanksgiving Count estimates for the entire state. From 2001 on, MGS supported between 17% and 58% of the Monterey County population (note that during 1997-2000 coverage of other Monterey County sites was poor).

From 1997 to 2008, the Sanctuary supported between 4,700 and 45,000 butterflies (Table 1). The severe drop in 2009 to 800 butterflies reflected a sharp decline rangewide from 220,000 to 55,000 because of a three year drought across the Western United States. The low numbers at MGS in 2009-2010 also followed hazard branch trimming (summer 2009) along the southern boundary where monarchs had clustered in most years. The relative contributions of low overall California numbers and branch trimming to the sharp decline compared to other aggregations are difficult to quantify. MGS had supported as few as 20% of the Monterey County population (in 2004) compared with 17% in 2009.

Numbers and ranking recovered in 2010 and 2011 with the end of the drought. In fall 2010, Robert Pacelli placed potted along the southern edge in fall 2010 to fill in low wind gaps. Adventitious branches filled the mid-level gaps created by the trimming, and wind

shelter improved on the southern boundary. Importantly, the blue gum trees planted in 1999 achieved heights (50-60') and crown volume that provided critical NW wind shelter, as envisioned in the 1998 management plan. In 2011-2012, butterflies moved from the southern edge into the grove interior for much of the season.

2012-2014 seasons

Creekside staff mapped the location of trees that have been tagged by monitoring crews from the Museum. These are mapped in Figure 1 as the green triangles. Note the two distinct areas for monarch clustering; the southern and far southeast boundary and the Monterey Pine on the adjacent property (*southern boundary*), and the interior stretching from the hotel driveway to 30-40 m west into the grove (*interior*). These maps combined with the monitoring database collected by the Museum paint a dynamic picture of monarch distribution and abundance in the Sanctuary for 2013 and 2014.

Details of the 2013-14 and 2014-15 overwintering season have been obtained from the Pacific Grove Museum of Natural History (Figure 2). The monitoring data have some limitations, but large numerical trends (factor of 1.5 to 2 approximately) are detectable. The overall movements of butterflies between the southern boundary and interior can be tracked as a measure of habitat suitability and response to weather. Wind data from Monterey Airport (Figure 3) provide context for local shifts in distribution.

Thanksgiving counts of 10,790 in 2012, 13,420 in 2013, and 18,128 in 2014 indicate that the Sanctuary continues to attract large numbers of butterflies that remained through the overwintering season. In 2012-2013, the butterflies largely moved onto pines and cypresses in the interior of the grove following strong storms in November and December 2012. The interior habitat provided suitable light and wind conditions through the remainder of the season. The 1999 blue gum trees are now 40-60' tall and provide critical NW wind shelter as part of a multi-species windbreak. Viewing opportunities were provided from the hotel driveway.

In 2013-2014, butterfly numbers peaked in late-November at 13,500 and remained at ~10-11,000 through early February, with a sharp drop in mid-February to <5,000 as they dispersed to the breeding grounds. Butterflies remained at the southern boundary through early January 2014. The strongest wind events during this period were in early December (max speeds 21-22 mph, gusts of 28-31 mph). By January 27, 2014, they had moved into the interior of the grove and were clustered on pines and cypress. There was a wind event on January 11 (max speed 16 mph, gusts to 28 mph). By February 14, butterflies had moved back to the southern boundary on Eucalyptus prior to dispersing away to breeding rounds.

In 2014-2015, numbers declined from 24,000 in mid-November to 16,000-18,000 from December through early January and persisted through strong storms in November-December. The decline to 6,000-7,000 by late January through February 10 represents dispersal to breeding grounds during a record warm January. Butterflies started clustering on the southern boundary, but by early December, following strong storms

(max winds 25 mph, gusts 40-65 mph) they moved to the interior and remained there through February 10. Apparently the interior conditions were suitable during the warm relatively calm January (one wind event with 30 mph gusts), and butterflies did not move back to the southern boundary. The butterflies that remained in the grove persisted through another high wind event in early February (32-37 mph gusts).

These observations indicate that Monarch Grove Sanctuary continues to provide enough wind shelter and varied light conditions to support a large monarch aggregation through the entire season. There is sufficient wind shelter for the interior of the grove for butterflies to remain there following storms, and sufficient light that they can take flight as needed.

A long-term view

Management of Monarch Grove Sanctuary is a long-term process. This section looks ahead to anticipated changes and issues over the next decades, so that current management recommendations can be put into context.

- 1) The 1999 blue gum plantings are working as anticipated, providing NW wind shelter and allowing monarchs to stay in the interior of the grove following storms. These trees will continue to function for many decades as part of a multi-species windbreak that includes pines and cypress.
- 2) The authorized blue gum plantings inside the southern boundary have been growing and are beginning to provide additional wind shelter at low heights. These trees will eventually reach heights where monarchs can roost in a more wind sheltered dappled light environment. They will provide redundancy for the southern windbreak trees, and will eventually replace them decades from now.
- 3) The overplanted unauthorized trees will be thinned year by year to encourage healthy blue gums that can grow rapidly. The canopies of remaining trees will fill in any gaps left by removal of the overplanted trees. These trees will be boxed and left in place until the canopies of the planted Blue Gums flourish.
- 4) The pines continue to succumb to pitch canker and drought. Continuing plantings to maintain a substantial pine component in the grove is important, but pines still cannot be counted upon to provide long-term overstory.
- 5) Many of the cypress planted over the last decade are in their period of rapid growth and will provide significant wind shelter in coming years and decades. The cypress along with blue gums will provide the backbone of the grove, given the uncertainties on pine survival in the long run.
- 6) Understory live oaks could fill in parts of the grove and provide good native habitat. Understory native shrubs and forest floor forbs could be introduced in parts of the Sanctuary, but need to be protected from deer browsing.
- 7) Maintaining the irrigation system for tree establishment and for watering during droughts, as well as developing a rigorous irrigation management plan implemented by City staff, is critical.
- 8) Continued provision of tested fall blooming nectar plants will help retain butterflies early in the season. The beds should be maintained with those plants

that prove to be used by butterflies. Away from the nectar beds, use of bottlebrush was noted in fall 2014, and early-blooming *Prunus* has provided winter-spring nectar in addition to the blooming blue gums.

Management Recommendations for 2015

Monarch Grove Sanctuary

Several issues in forest and habitat management at Monarch Grove Sanctuary were identified in the field, and are keyed to zones identified in Figure 4.

- 1) In Zone 1, along Grove Acre Avenue, dying Monterey pines are heavily infested with pitch canker should be removed (Photo 1). These trees are in advanced decline and a major source of infection for the rest of the grove. Standing dead trees will become a fire hazard. Following final determination by the City Arborist, the trees should be removed this September. The effects of removing these trees on monarch habitat is minimal over the long-term, because the trees will not provide wind shelter for very much longer even if they are allowed to remain standing. In the short-term there is sufficient wind shelter deeper in the grove to ameliorate increased wind exposure from removal of these trees. Additional pines should be planted in this zone and receive irrigation.
- 2) Also in Zone 1, the redwood trees need consistent watering, especially during this record drought (Photo 2). The drip system to un-watered redwoods was re-established in 2014 and trees are showing some signs of recovery. All irrigation scheduling should be done by the City Arborist. In the longer-term (10+ years) they may eventually provide 40-60' of dense windbreak along the western border, in conjunction with other pines (if they survive) and cypresses. But it is likely that the redwoods will require irrigation in many, if not most years. In spring 2016, removal of dead branches and foliage from the redwoods should be considered.
- 3) In Zone 2, many recently planted understory pines have died. These trees should be removed, and the sites replanted where appropriate with 5gallon genetic resistance Monterey pines, if available. Provision of drip irrigation until the trees are established is critical for high survival of these trees. All irrigation scheduling should be done by the City Arborist.
- 4) The overall irrigation system in the Sanctuary should be reviewed, reinstalled where appropriate, carefully managed, and maintained as necessary for establishing and maintaining plantings. We suggest that a more formal irrigation management plan be developed.
- 5) At the western edge of Zone 2, several pines infested with pitch canker, were removed in 2014 to slow the progression of the disease deeper into the grove. Small pitch canker infestations were noted in several trees much farther in the interior and should be monitored. Replanting pines, oaks, and cypress will fill any gaps created by removal of dying pines.
- 6) An acacia with much dead foliage was noted along the western edge of Zone 2. The dense fine branches are filling an important gap for SW wind shelter for the

- interior cluster sites, and removal of these dead branches should be delayed until established trees and new plantings can fill the gap.
- 7) In the interior of Zone 2, several young cypresses have failed to establish straight trunks and should be removed. Recent cypress plantings are dense enough to fill in for these removed trees. Final selection of trees to be removed will be made in the field by the City Arborist.
 - 8) Also in Zone 2, there are opportunities to replant pines alongside the many wildlife snags in the open area, to re-establish forest cover. These snags were dead or hazardous Monterey pines that were removed and left to act as a habitat / granary snags. Natural re-forestation is non-existent in Zone 2. Oaks would be a suitable understory in this area. While the canopy is open overhead, this site does not receive much direct light during the overwintering season because of tall canopy to the south. Again, provision of drip irrigation for the initial plantings increases chances for success.
 - 9) Tree QQ in Zone 2 towards the eastern edge is nearly dead and is leaning, and poses a hazard to the hotel driveway, and should be considered for removal this year.
 - 10) The medium sized pine toward the southern edge of Zone 2 has died, and should be removed.
 - 11) In Zone 3, City-authorized plantings of blue gums were carefully planned to fill in gaps in wind protection, be appropriately spaced, and their rapid growth and health is essential to the long-term habitat suitability of the Sanctuary. A minimum of 10-15 feet (3-4.5 m) between trees is necessary for tree health and rapid growth in the long-term. These trees are now ~15-20' tall.
 - 12) The unauthorized blue gums (formerly potted) are planted much too densely in 2013 (Figure 5 and Photos 3-6). Crowding the authorized trees with the additional unauthorized plantings serves to slow growth and create unhealthy individual trees.
 - 13) We recommended in 2014 that the unauthorized blue gums in this area be thinned back to the originally planned configuration. A number of these trees were removed, but many are still too closely planted. A close-up of the SE corner shows the numerous trees planted in this area (Figure 3). Some trees were planted too shallow and may be structurally deficient (Photos 4 and 5). We recommend that additional unauthorized trees be removed, to a minimum spacing of 6', but preferably 10'. Selection of individual trees for retention and removal will be conducted in the field by the City Arborist and others prior to any actions.
 - 14) The potted trees can be moved around to fill gaps, but should not be planted in the ground without City authorization.
 - 15) Surface blue gum duff was raked from around the small trees in 2015 (Photo 6). This duff is important mulch to retain limited water, and such raking should be discouraged in the future. The duff also provides structure for monarchs to climb away from the ground if they are dislodged.
 - 16) We also recommend that the drip system in Zone 3 be reinstalled and appropriately operated under the supervision of the City Arborist until the

- authorized trees are established. Re-staking retained trees where necessary is recommended.
- 17) In Zone 3 as well, the trees planted next to the fence will eventually damage the fence as they grow in girth (Photo 5). No immediate actions are suggested, but monitoring the situation is important.
 - 18) In Zone 4, several hazard branches over trails were removed in 2014. No further hazard reduction actions appear necessary here.
 - 19) On the south edge of Zone 4, there is a substantial low canopy gap that should be filled in by planting one of the potted trees.
 - 20) No actions are suggested for Zones 5 and 6 at this time.
 - 21) The nectar beds should be maintained, and species that have not been used by monarchs should be replaced with species that are used. Continued experimentation is important.
 - 22) Because of the record ongoing drought since 2011-2012 many established trees in the Sanctuary have been highly stressed, leading to loss of leaves, needles, and branches, and even whole tree mortality. Further mortality is anticipated even if 2015-2016 is average or wetter than average. As noted through the document, maintaining and operating the irrigation system for establishing trees, and avoiding over-watering and under-watering is a critical management action.
 - 23) We note a long history of governance issues regarding City control over activities in Monarch Grove Sanctuary, and ongoing controversies. In order to create a deliberate and open decision-making process, in 2014 we proposed a progression of meetings to discuss the rationale and implementation of these recommendations, adjust them if appropriate. This sequence is outlined in the Adaptive Management section of the 2011 report. Public input is sought at appropriate times and through official channels. In 2014, the process included a presentation to the BNRC and Monarch Committee in July 2014, followed by a City staff sponsored field tour, and implementation of recommendations in September 2014.
 - 24) We recommend a similar process for 2015, with a BNRC presentation in mid-August, a field tour in late-August and implementation in September.
 - 25) The cypress above the hotel driveway, which has been a major cluster tree in recent years, has a broken branch that poses a hazard to people watching the butterflies from below. The City and the Hotel need to coordinate actions in this sensitive area. Removal of the dead branch should not affect use of the other branches on the tree because the wind shelter in this area is provided by surrounding trees and the hotel itself. Removing this branch may avoid death and injury to monarchs should the branch fall while butterflies are clustered.
 - 26) South of the Sanctuary, trees in the neighbors' yards provide cluster sites (the pine near the shed), and additional wind shelter. While beyond the direct control of the City, maintenance of these trees by the neighbors is important. But, management actions within the Sanctuary itself are designed to eventually make it more self-contained and less reliant on neighboring property owners.

George Washington Park

There are several issues in forest and habitat management at George Washington Park

- 1) This is a unique site for California monarchs; it is one of the few remaining Monterey pine/live oak habitats.
- 2) The site has been used intermittently by monarchs, a few individuals can be found there every year at some point, but major clusters were found in only a few years (Table 1). In 2006, for example, there were more than 10,000 monarchs at GWP and very few at Monarch Grove Sanctuary. Since then, there has been only one year (2011) with more than 1 or 2 monarchs at Thanksgiving. Individual monarchs have been observed here during other times of the overwintering season.
- 3) The historic cluster sites in GWP have had sufficient wind shelter for monarchs, but changes in the forest as mature trees senesce are threatening this important component of habitat suitability. In particular, the largest pine at the historical overwintering site has died, but there are several mid-story pines that are in positions to replace this tree over coming decades. Losses of forest cover to the south and west through overstory tree mortality is reducing wind shelter.
- 4) Removal of dead standing trees is recommended where they have stationary targets, especially around the edge of GWP. Dead trees that may fall across trails in the interior should be evaluated on a case-by-case basis. Trees can be left as safe wildlife snags where appropriate, but a more naturalistic topping should be considered.
- 5) Reduction of accumulated deadfall by CALFIRE in 2014 removed large piles of downed tree debris. This is important preparation for eventual site restoration. Some branch and log piles have been retained and downed logs are used to redirect foot traffic to fewer trails.
- 6) Plantings of pine seedlings to the SW of the historical cluster site, similar to the plantings at the southern end of GWP, should commence assuming that sufficient rain falls in fall-early winter.
- 7) Operations on the perimeter of the park are the priority, to maintain safety from falling dead trees on adjacent roads, and to create a fire buffer.
- 8) The ongoing drought is likely to drive increased loss of leaves, needles, and branches, and mortality of entire trees. The consequences of drought will eventually have to be managed.
- 9) Establishment of a designated trail system and decommissioning of meandering paths impacting root systems of the trees should be considered for long term forest health.
- 10) Now that there have been reductions in downed trees and debris, the long-term suitability of George Washington Park for monarchs should be assessed, with methods similar to those employed at Monarch Grove Sanctuary.
- 11) Once the assessment is done, a long-term planting scheme (pines, oaks, and native understory shrubs) should be developed and implemented. The key elements of such a planting scheme should be to provide eventual replacements for canopy

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trees, create and maintain a mid-story of oaks and pines, and maintain wind shelter from all directions around defined canopy gaps.

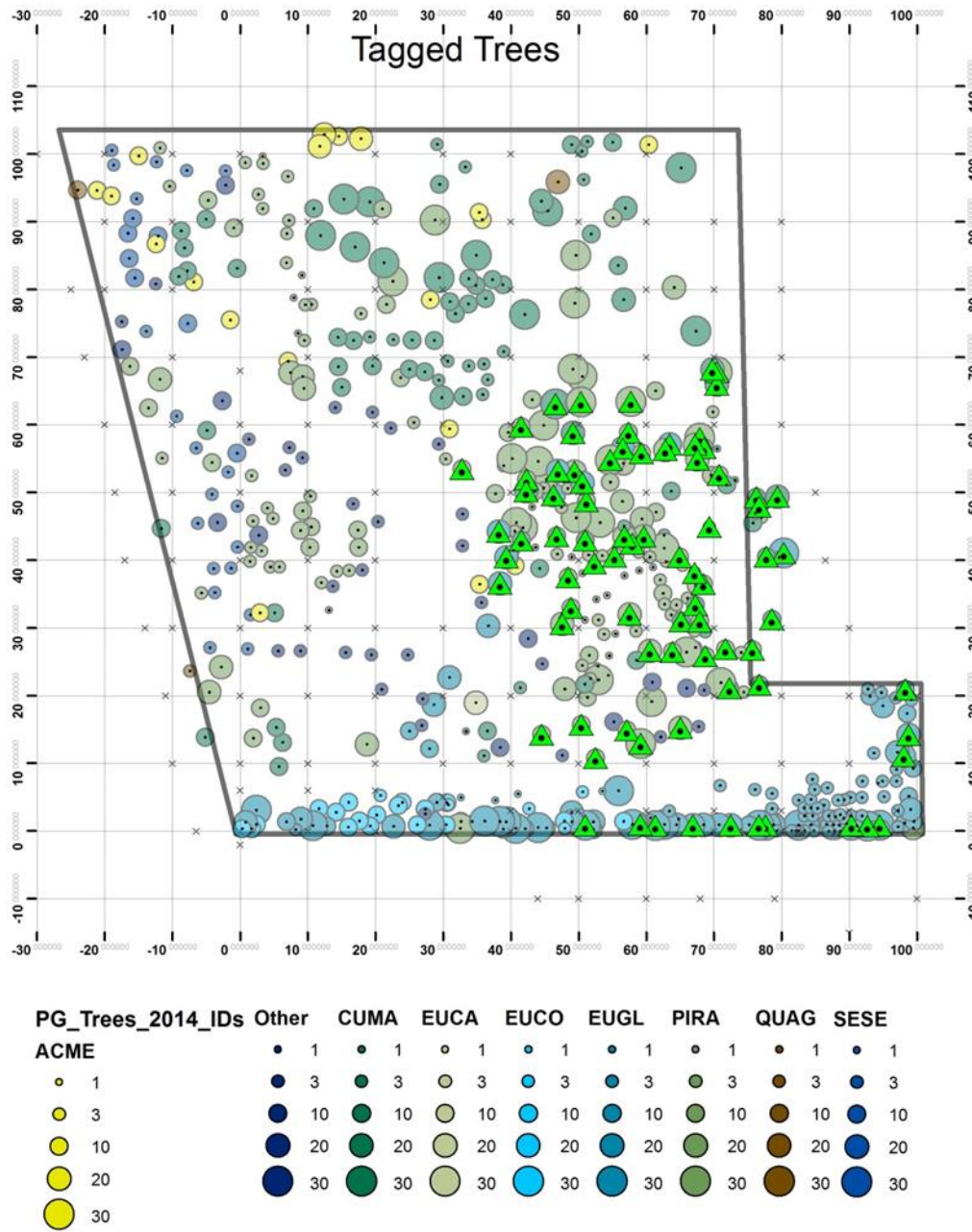
In summary, forest management at George Washington Park is needed, and the first steps of removal of some dead standing trees, clean-up of some forest floor debris, and re-routing some informal trails have been implanted. This will set the stage for plantings and restoration of the forest in GWP.

Table 1. Monarch Butterfly Thanksgiving Counts Xerces Society Monarch Grove Sanctuary (MGS) George Washington Park (GWP), Pacific Grove and California Totals

Year	MGS	GWP	CA Total	Monterey Co.	MGS % CA	MGS % Monterey	MGS CA Rank
1997	45,000		1,235,490	45,000	4%	100%*	10 (tie)
1998	35,000		564,349	41,000	6%	85%	5
1999	25,000		267,574	25,000	9%	100%*	3 (tie)
2000	20,000	0	390,057	20,000	5%	100%*	6 (tie)
2001	14,960		209,570	31,203	7%	48%	4
2002	4,700		99,353	11,593	5%	41%	5 (tie)
2003	22,802	2,750	254,378	68,979	9%	33%	2
2004	10,867	4,325	205,085	54,481	5%	20%	4 (tie)
2005	12,199	2	218,679	37,540	6%	32%	4
2006	28,746	11,795	221,058	59,957	13%	48%	1
2007	8,181	2	86,437	15,426	9%	53%	3
2008	17,866	0	131,889	31,063	14%	58%	2
2009	793	0	58,468	4,735	1%	17%	17
2010	4,968	0	143,204	8,634	3%	58%	4
2011	12,265	61	222,525	27,788	6%	44%	4
2012	10,790	0	144,812	29,048	7%	37%	4 (tie)
2013	13,420	1	211,275	35,772	6%	38%	3 (tie)
2014	18,128	0	234,731	55,879	8%	32%	3

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Figure 1. Monarch Occupied Trees (Green Triangles) 2012-2014, Grid in meters



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Figure 2 Monarch numbers through season. Data from Pacific Grove Museum

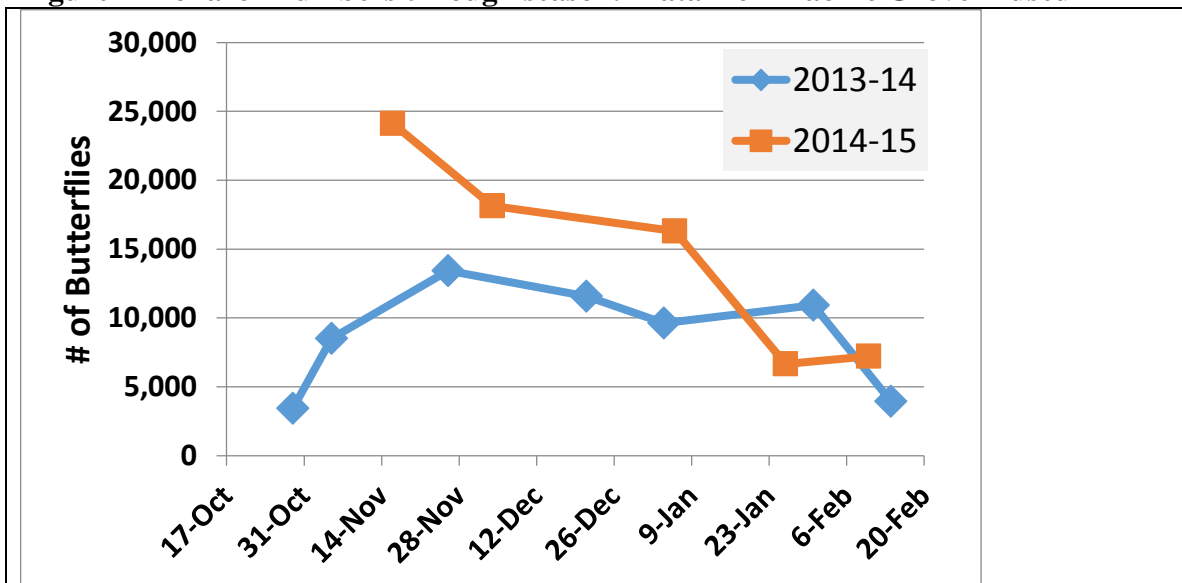


Figure 3 Daily Wind Data from Monterey Airport

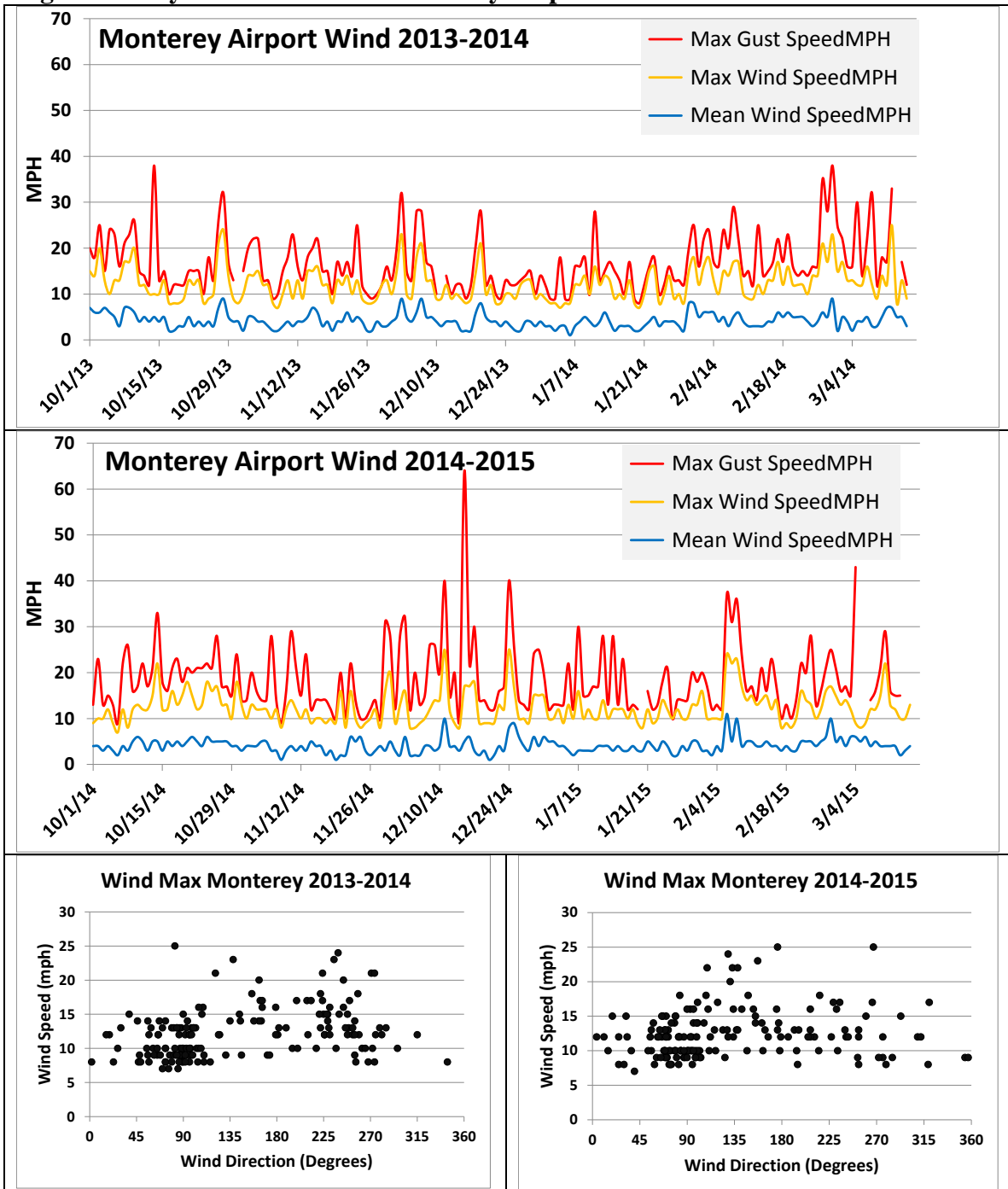


Figure 4. Management Zones Grid in Meters

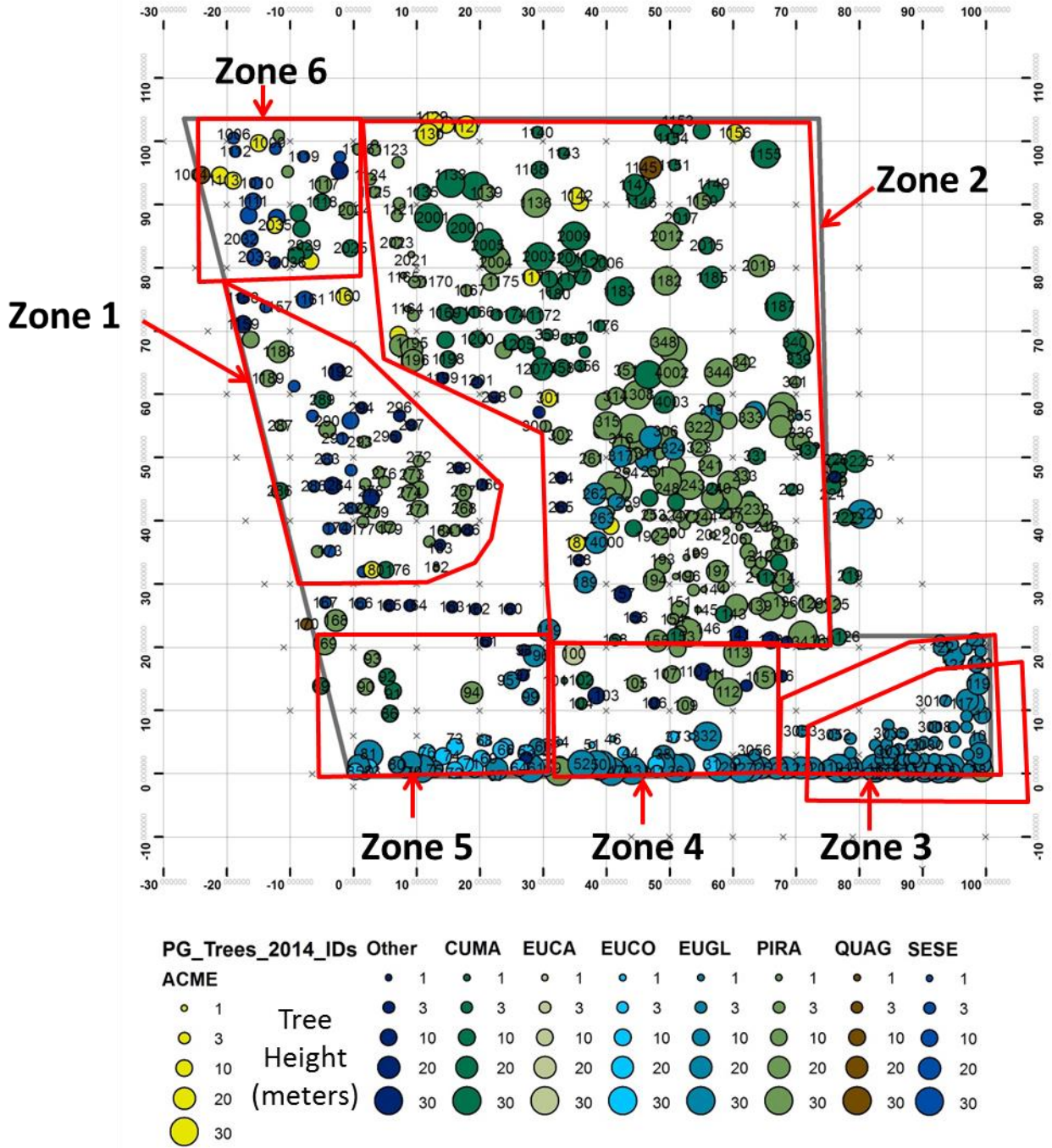
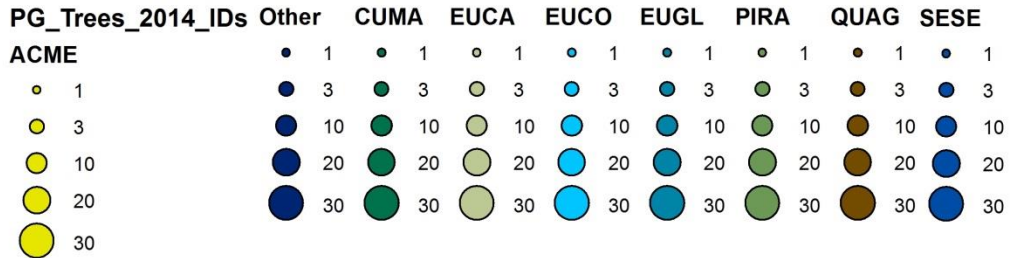
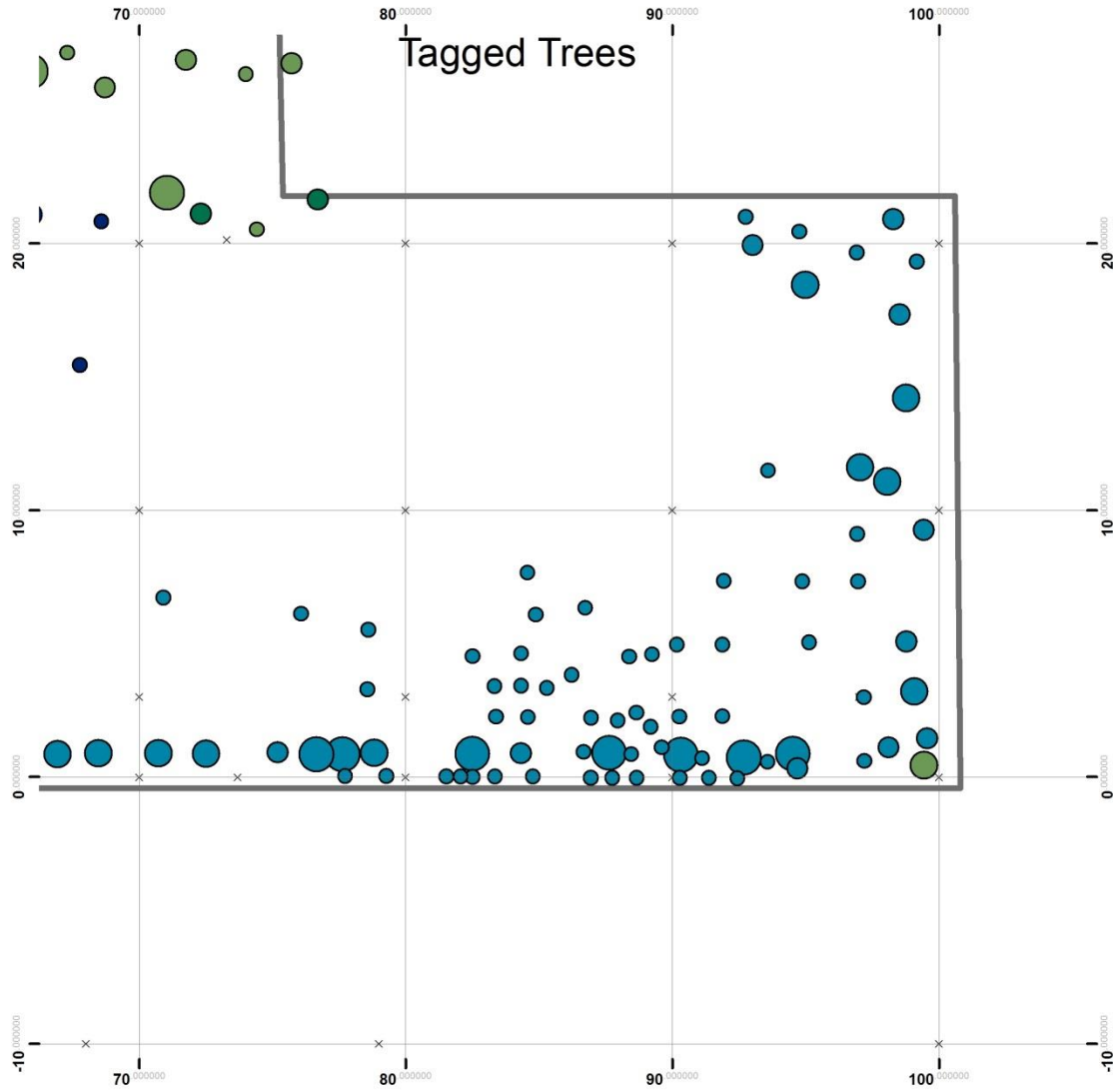


Figure 5. SE corner of Sanctuary, highlighting the closely spaced small trees. The grid is 10 m (33'), some of the trees are less than 1m apart.



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Photo 1. Dead and dying pines in Zone 1 near Grove Acre Ave.



Photo 2 Redwoods in Zone 1



Photo 3 Recently Planted blue gums inside southern boundary, note height growth



Photo 4 Overplanted blue gums and boxed trees



Photo 5 Blue gums by fence

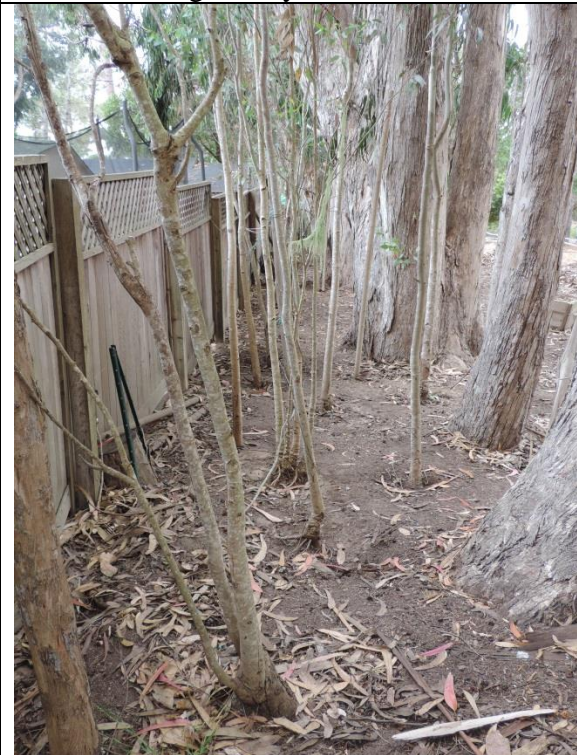


Photo 6 Duff removal

