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Albert Weisfuss  
City Arborist  
Pacific Grove, CA

9 August 2016

**Re: Proposed management activities Monarch Grove Sanctuary and George Washington Park September 2016**

The following recommendations and assessments are based on site visits and a field tour with City Arborist Albert Weisfuss in on July 13, 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 last year's and 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. Also, we have also incorporated butterfly monitoring data from the Pacific Grove Museum since 2013 to document habitat suitability and monarch use patterns relative to weather and time of season. Moving forward, this reporting on monarch abundance and distribution will be a standard component of this annual document and will constitute a long-term accessible record.

**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.

### **Ongoing Monitoring**

Creekside staff mapped the location of trees that have been tagged by monitoring crews from the Museum (Figure 1) 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, 2014, and 2015-16.

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.

#### *2015-2016 season summary*

In 2015-2016, butterflies arrived as usual in October and hit peak number quite similar to 2013-2014 (11,000, Figure 2). Numbers remained steady into late-January, and dropped in February as butterflies left the grove. A warm dry February led to dispersal to breeding grounds by the end of the month. Butterflies started clustering in October-November in the western and southern part of the grove, and by December had moved to the interior of the grove following several wind events (40 mph gusts), with the strongest gusts of the season (50 mph) were in December (Figure 3). In early January, Dr. Weiss observed monarchs clustering on a tall Monterey cypress, about 25 m off the northern boundary, well north of the typical interior cluster sites (Figure 1). They moved back into the interior and hotel driveway later that month.

#### *2013-2015 season summaries*

Thanksgiving counts of 10,790 in 2012, 13,420 in 2013, and 18,128 in 2014 indicate that the Sanctuary continued 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 grew to 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 from 2013-2016 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. The major wind directions that produce the highest sustained winds are SE-SW and W-NW (Figure 3) and the grove is much better protected, especially from W-NW in 2015-16 than in previous decades.

### **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, growing to 40-60' tall and 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 to heights of 15-20' 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 – some roosting has

- been observed on the taller trees. They will provide redundancy for the southern windbreak trees, and will eventually replace them decades from now.
- 3) The overplanted unauthorized trees should 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 can be boxed (as feasible) 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. Some densely planted cypress stands could be thinned.
  - 6) Understory live oaks could fill in parts of the grove and provide good native habitat. Understory native shrubs (toyon and ceanothus in particular) 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 in October and November. The yellow *Buddleia* has proven attractive (Photo 1), and the flowering red gum also attracted nectaring butterflies (Photo 2). 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 2015, and early-blooming *Prunus* has provided winter-spring nectar in addition to the blooming blue gums.

## Management Recommendations for 2016

### *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. Note the differences in the zone designations from previous reports in 2014 and 2015.

- 1) **Zone 1 Removal of pines with pitch canker (Photo3):** Along Grove Acre Avenue, dying Monterey pines heavily infested with pitch canker were removed in 2015 (Photo 1). One more relatively tall pine is succumbing to pitch canker and should be removed by 2017. Additional pines should be planted in this zone and receive irrigation, along with continued monitoring of the remaining trees.
- 2) **Zone 1 and 6 redwood management (Photo 4):** The redwood trees need consistent watering, especially during this record drought (Photo 2). In summer 2016, removal of dead branches and foliage from the redwoods should be considered. Given the irrigation practices in recent years, it is not clear if these

trees are viable in the long term. Redwoods are not well suited for Pacific Grove close to the ocean. 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 could 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 and the track record in the last three years is not encouraging.

- 3) **Zone 1 Cypress growth:** The rapidly growing cypress in this area will provide greater wind shelter in several years and replace the pines that have died, as well as providing an alternative to the redwoods.
- 4) **Zone 2 Understory Pines:** Many recently planted understory pines died and were removed in 2015 (Photo 8). We recommend that these sites be replanted where appropriate with 5 gallon Monterey pines, using pitch canker resistant stock 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.
- 5) **Zone 2 Pine removals done in 2015:** 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) **Zone 2 Acacia management:** An acacia with much dead foliage is noted along the western edge of Zone 2, and some removal of dead branches is appropriate. But, the dense fine branches are filling an important gap for SW wind shelter for the interior cluster sites, and removal of all of these dead branches at once should be delayed until established trees and new plantings can fill the gap.
- 7) **Zone 2 Oak plantings:** In Zone 2, live oaks should be planted just east of the trail to create low windbreak. Provision of irrigation for the first few years should be a priority.
- 8) **Zone 7 Cypress thinning:** In the interior of Zone 2, several young cypresses have failed to establish straight trunks and should be removed. Three cypresses were identified for removal to thin the stand. The remaining 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.
- 9) **Zone 7 Replanting pines and oaks next to snags:** In Zone 7, 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.

- 10) **Zone 7 Removal of dead pines near driveway:** Trees OO and QQ in Zone 7 towards the eastern edge are dead and pose a hazards to the hotel driveway and other trees, and should be removed this year.
- 11) **Zone 2 Dead pines removed in 2015:** The medium sized pine toward the southern edge of Zone 2 died, were removed in 2015.
- 12) **Zone 3 Authorized blue gum plantings (2011) status:** 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 (Photo 5), and occasionally support clustering monarchs in the fall.
- 13) **Zone 3 Unauthorized blue gum plantings (2013) status:** 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. We recommended in 2014 and 2015 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. No trees appear to have been removed in 2015. 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 5 and 6).
- 14) **Zone 3 Removal of unauthorized blue gums:** We recommend that additional unauthorized trees be removed, preferably 10'+ spacing, but to a minimum spacing of 6'. Several trees have died and should be removed. Selection of individual trees for retention and removal will be conducted in the field by the City Arborist and others prior to any actions.
- 15) **Zone 3 Potted Trees:** The potted trees can be moved around to fill gaps, but should not be planted in the ground without City authorization.
- 16) **Zone 3 Mulch Management:** 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.
- 17) **Zone 3 Drip system:** At this point, the broken drip system for the authorized blue gums is not needed as the trees are well established, so no repairs are suggested at this point. Hose watering provides an alternative, but the established trees should not need irrigation.
- 18) **Zone 3 South fence line trees:** The trees planted next to the fence will eventually damage the fence as they grow in girth (Photo 5). No immediate actions are suggested other than removing the dead trees, but monitoring the situation is important. At some point in the future a realignment of the fence, or removal of what will then be much larger trees will be necessary.
- 19) **Zone 4 Hazard branches/trees over trail:** In Zone 4, several hazard branches over trails were removed in 2014. No further hazard reduction actions appear necessary here.

- 20) **Zone 4 Closing south edge gap:** 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 or a nursery raised blue gum.
- 21) **Zone 5 no action:** No actions are suggested for Zone 5 in 2016 at this time.
- 22) **Zone 6 clean-up:** There some dead trees and branches in Zone 6 that should be removed, and the Ecchium needs some removal of overgrown branches..
- 23) **Nectar beds:** It is clear that the yellow Buddleya is a favored fall nectar source. The bushes are getting quite large, and accumulating dead foliage and branches in their interiors. We suggest that half of these bushes be trimmed in spring 2017, to allow for refreshed growth, and the other half be trimmed back in 2018. There are species that have been tested that are not favored, so replacement of some of the other species with Buddleya should be considered. The bottle brush and red gums do provide alternatives to Buddleya . Continued experimentation with fall blooming species should be continued in at least one of the beds. Appropriate irrigation management – not overwatering – is essential for the nectar beds.
- 24) **Understory plantings:** Toyon (Photo 8) and blueblosson ceanothus are two species that can thrive in the grove and provide native understory. Plantings of these two species need to be caged for several years to protect against deep browsing, but once established can live for decades.
- 25) **Irrigation system:** 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. The reliable early survival of new plantings is dependent on appropriate irrigation.
- 26) **Governance:** 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. We executed a similar process for 2015, with a BNRC presentation in mid-August, a field tour in late-August and implementation in September, and recommend the same for 2016 for the third time.
- 27) **Management of trees at the Butterfly Grove Inn:** The City and the Hotel need to coordinate actions in this sensitive area. In summer 2016, the new owners of the hotel did major tree maintenance on their property to alleviate potential hazards. The trimming was brought to the attention of the City Arborist, who intervened and reduced the intensity of branch trimming and thinning. Fortunately, the hotel structure itself provides much of the wind shelter from that direction and the branch thinning will only affect the upper canopy where monarchs rarely cluster. The cypress above the hotel driveway, which has been a major cluster tree in recent years, had a broken branch that poses a hazard to people watching the butterflies from below, and that branch was removed.

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.

- 28) **Southern Neighbors:** 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. Outreach by the City is important to find out plans and anticipate changes. Management of hazards over these yards should be done on a case by case basis. 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 and 2015 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 2016-17.



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- 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 is occurring. Ingrowth of poison oak is effectively shutting some social trails.
- 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 trees, create and maintain a mid-story of oaks and pines, and maintain wind shelter from all directions around defined canopy gaps.

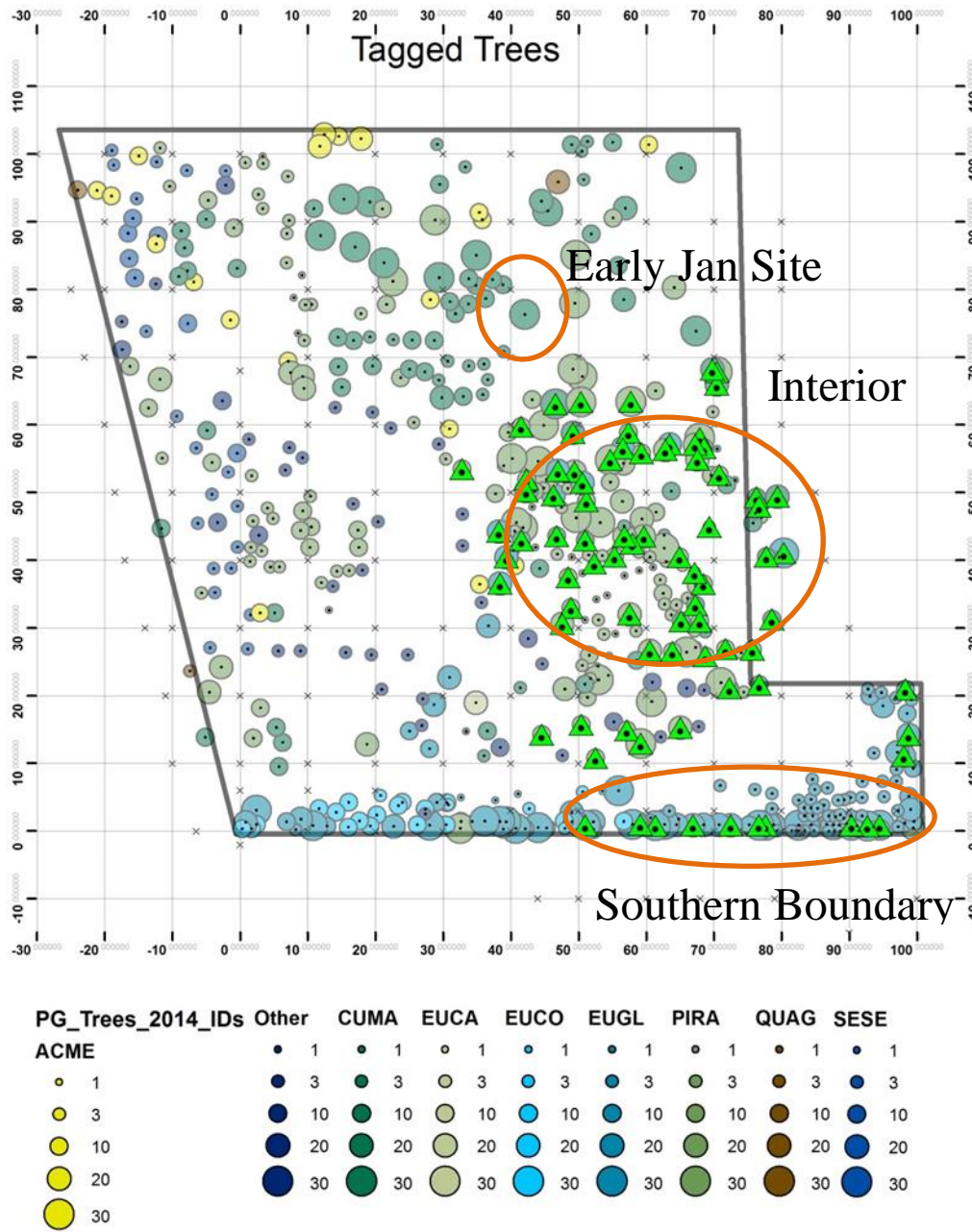
In summary, forest management at George Washington Park is needed, and the first steps of removal of some dead standing trees, clean-up of some forest floor debris, and re-routing some informal trails have been implemented. This will set the stage for plantings and restoration of the forest in GWP.

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

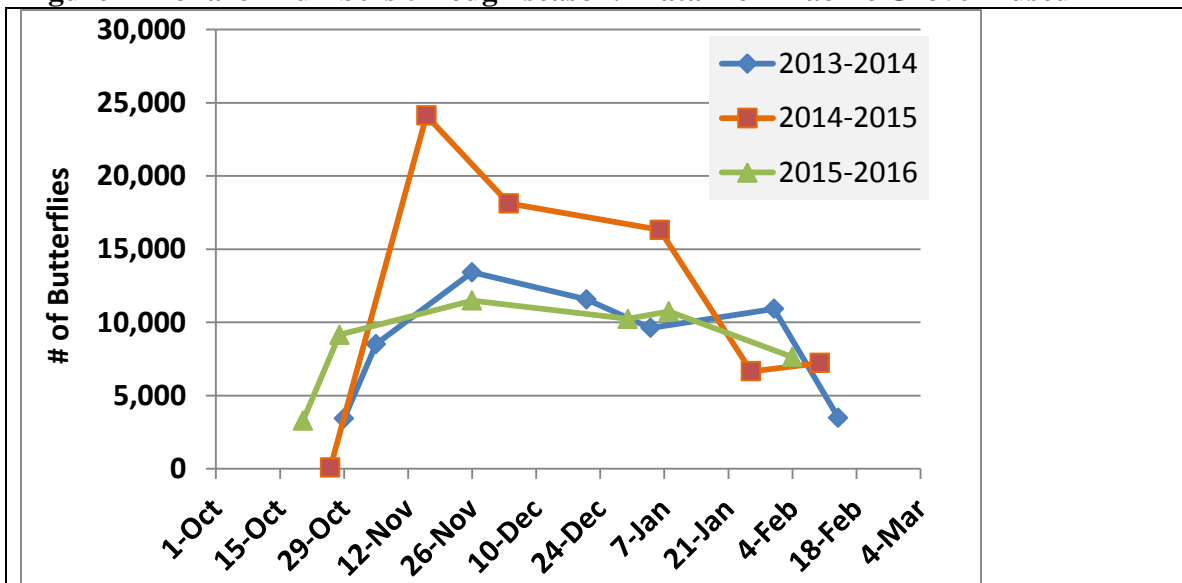
<b>Year</b>	<b>MGS</b>	<b>GWP</b>	<b>CA Total</b>	<b>Monterey Co.</b>	<b>MGS % CA</b>	<b>MGS % Monterey</b>	<b>MGS CA Rank</b>
<b>1997</b>	45,000		1,235,490	45,000	4%	100%*	10 (tie)
<b>1998</b>	35,000		564,349	41,000	6%	85%	5
<b>1999</b>	25,000		267,574	25,000	9%	100%*	3 (tie)
<b>2000</b>	20,000	0	390,057	20,000	5%	100%*	6 (tie)
<b>2001</b>	14,960		209,570	31,203	7%	48%	4
<b>2002</b>	4,700		99,353	11,593	5%	41%	5 (tie)
<b>2003</b>	22,802	2,750	254,378	68,979	9%	33%	2
<b>2004</b>	10,867	4,325	205,085	54,481	5%	20%	4 (tie)
<b>2005</b>	12,199	2	218,679	37,540	6%	32%	4
<b>2006</b>	28,746	11,795	221,058	59,957	13%	48%	1
<b>2007</b>	8,181	2	86,437	15,426	9%	53%	3
<b>2008</b>	17,866	0	131,889	31,063	14%	58%	2
<b>2009</b>	793	0	58,468	4,735	1%	17%	17
<b>2010</b>	4,968	0	143,204	8,634	3%	58%	4
<b>2011</b>	12,265	61	222,525	27,788	6%	44%	4
<b>2012</b>	10,790	0	144,812	29,048	7%	37%	4 (tie)
<b>2013</b>	13,420	1	211,275	35,772	6%	38%	3 (tie)
<b>2014</b>	18,128	0	234,731	55,879	8%	32%	3
<b>2015</b>	11,472	0	263,728	27,787	4%	41%	3 (tie)

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

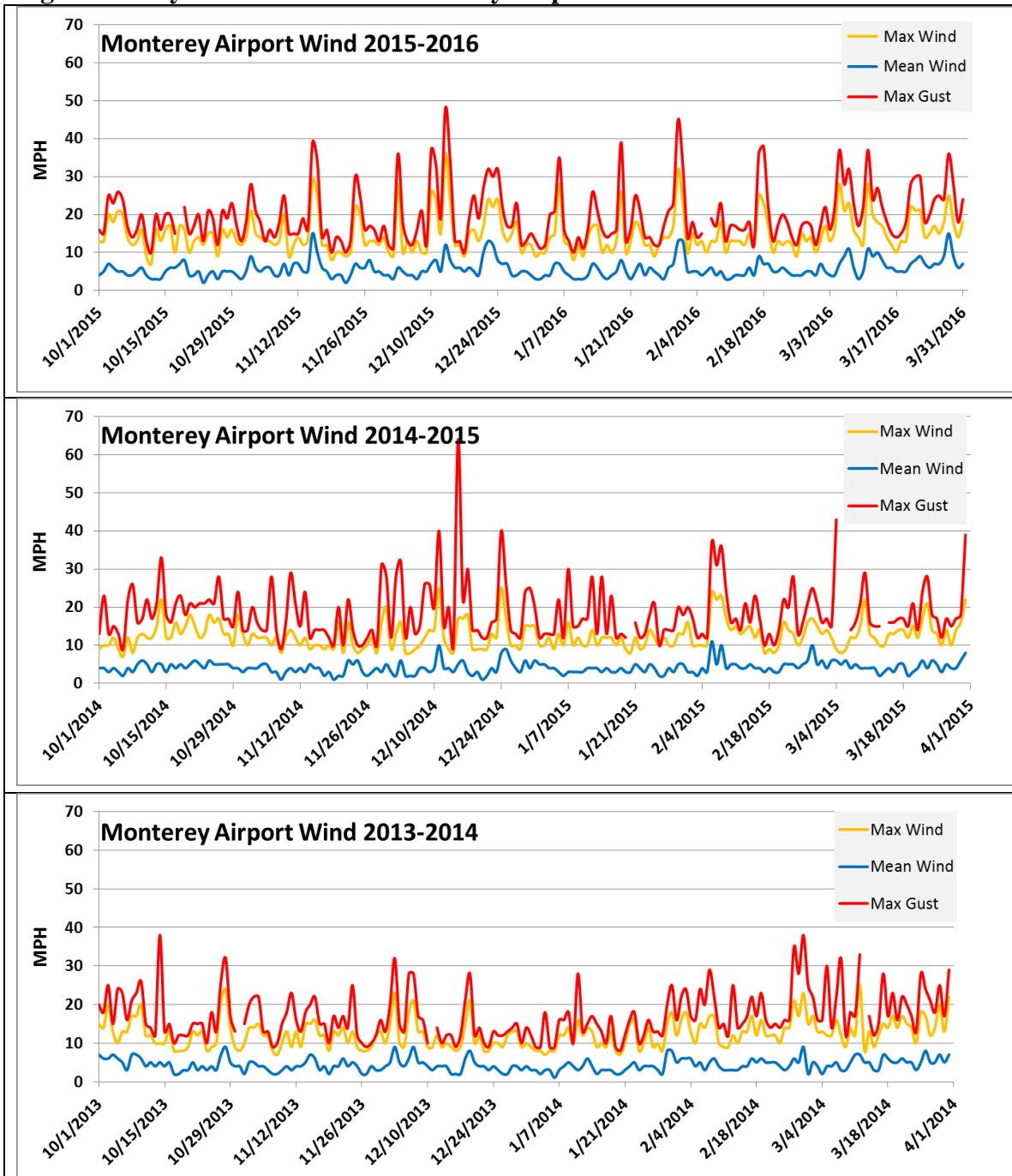


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**Figure 2 Monarch numbers through season. Data from Pacific Grove Museum**



**Figure 3 Daily Wind Data from Monterey Airport**



**Figure 3 (Continued) Maximum wind and wind direction Monterey Airport**

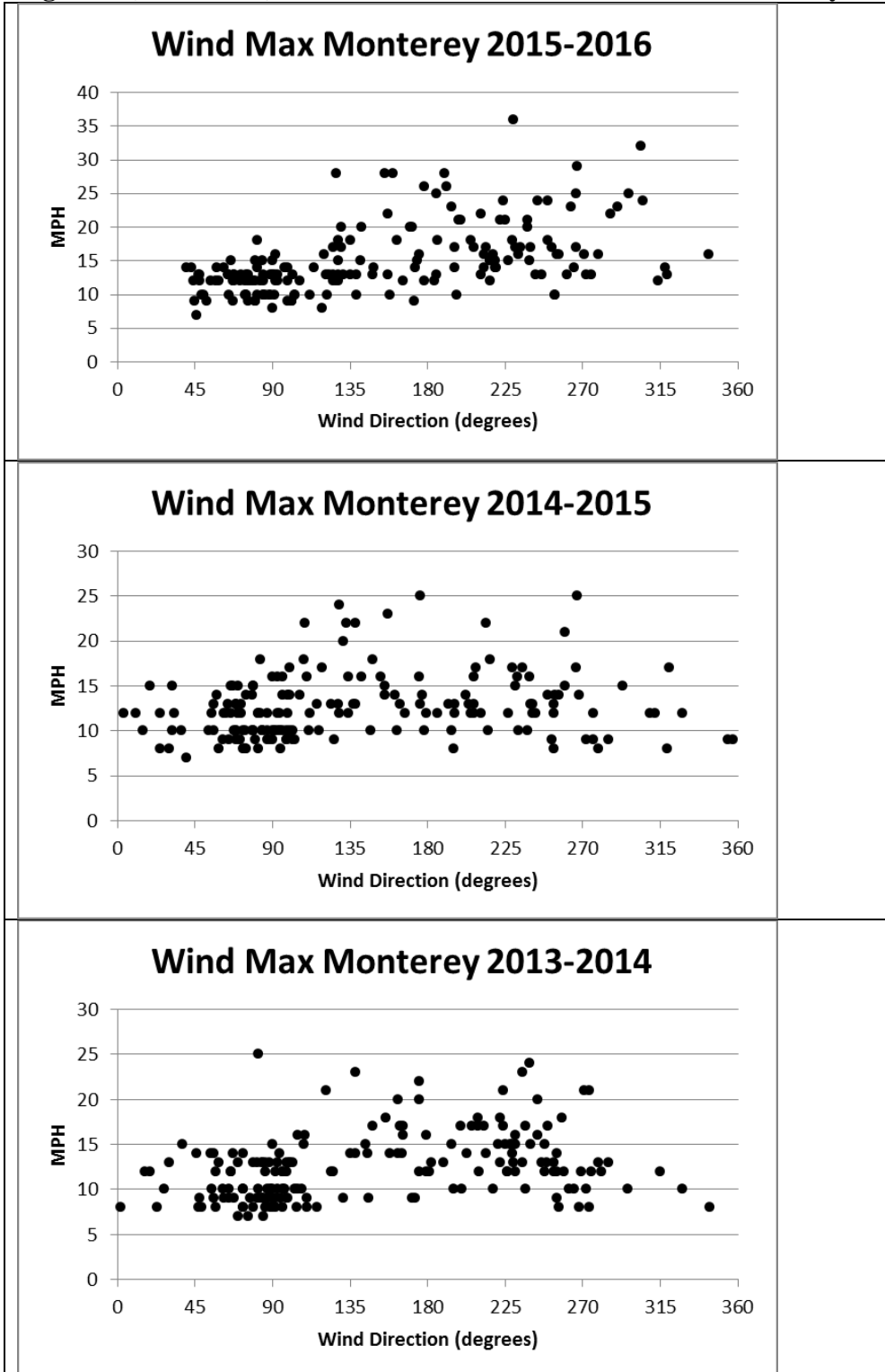
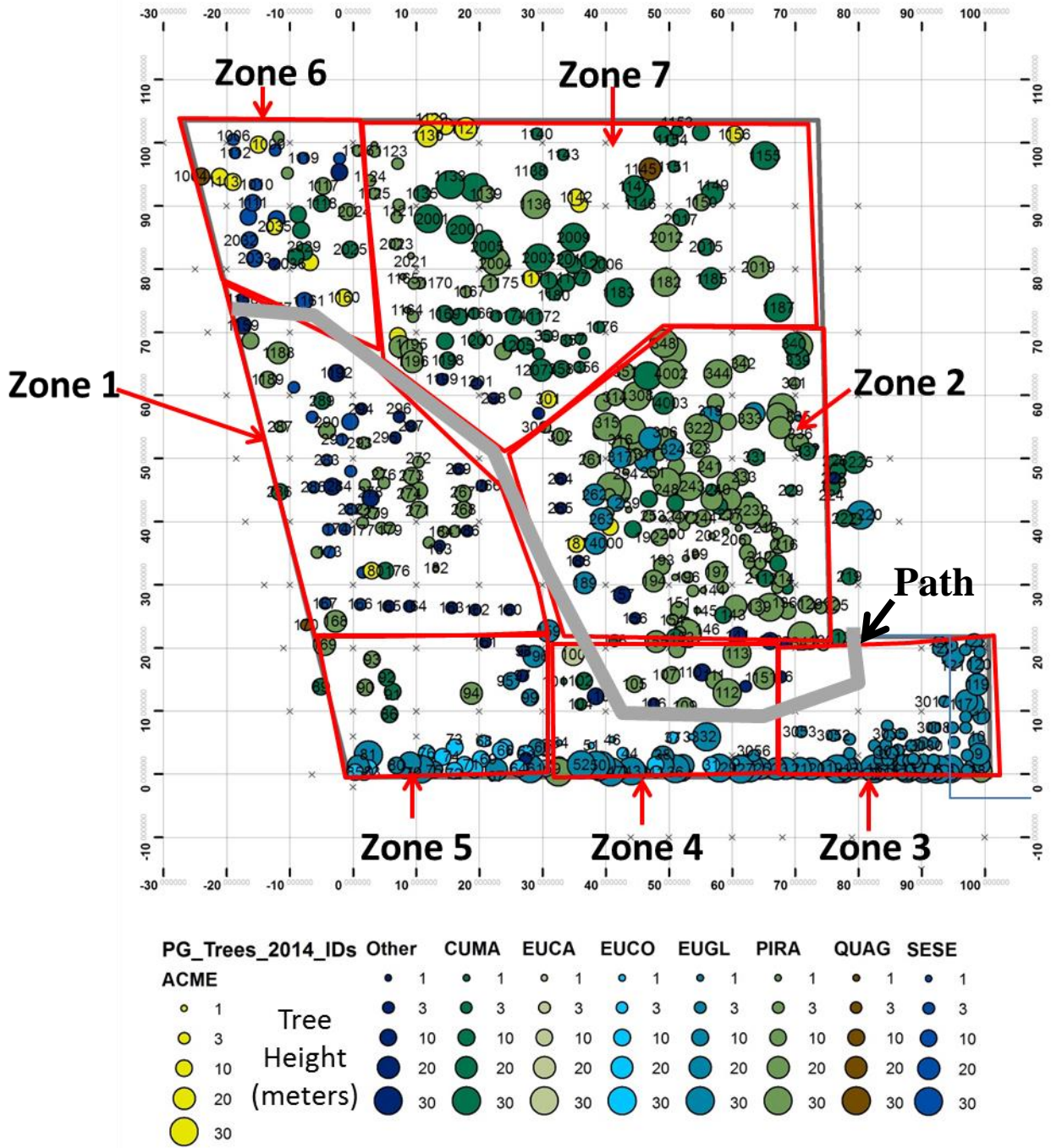


Figure 4. Management Zones. Grid in Meters



**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.**

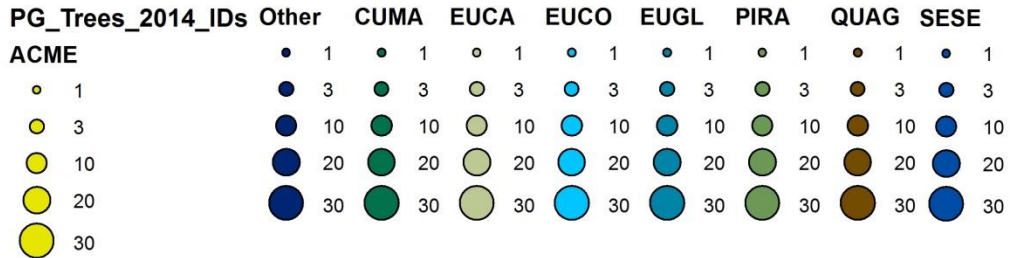
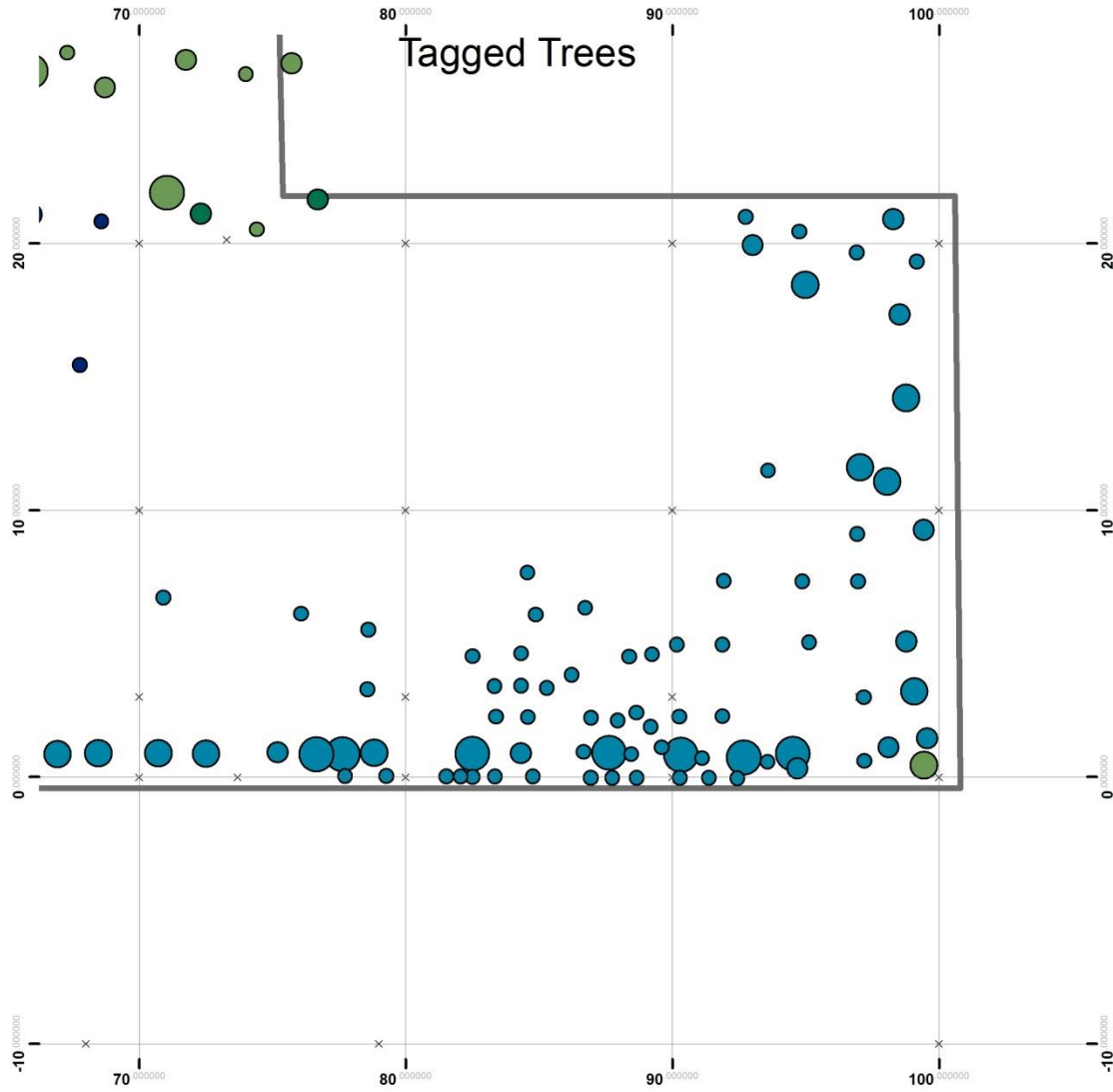




Photo 1. Nectaring on red gum October 21, 2015.



Photo 2. Nectaring on yellow Buddleya October 21, 2015.



Photo 3 Pitch Canker infested Pines



Photo 4 Redwoods in Zone 1

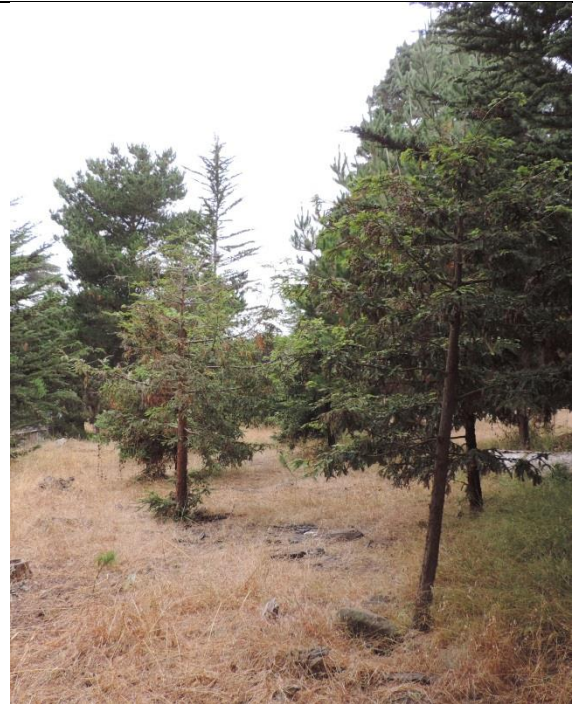


Photo 5 2011 planted blue gums inside  
Note height (>20') of circled tree crown

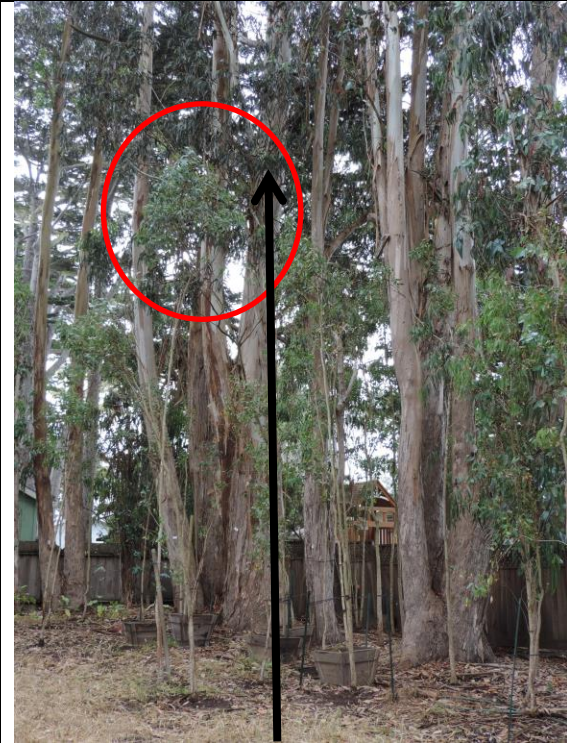


Photo 6 Overplanted blue gums and boxed trees 2016



Photo 6 Blue gums by fence 2016



Photo 7 Duff removal 2015



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Photo 8 Understory clean-up in Zone 2



Photo 9 Toyon (white flowers) in Zone 2

