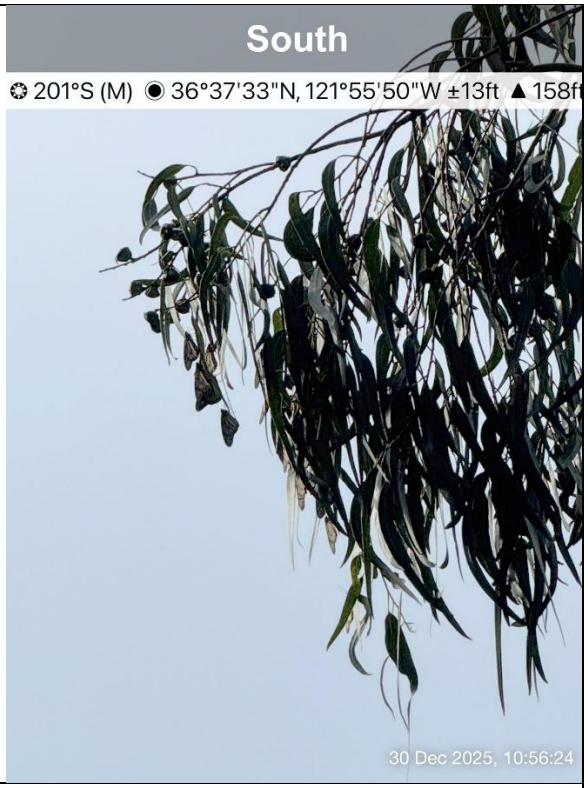
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Assessment and proposed management activities Monarch Grove Sanctuary and George Washington Park for 2026





Left: Accumulated eucalyptus leaves, branches, and bark peelings along S and E edges of Monarch Grove Sanctuary are a fire hazard. **Right**: Sillouhetted monarchs on South Edge, example of how difficult it can be to find small numbers among the trees.

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Scorched eucalyptus trunk after a small fire on March 31, 2024, emphasizing the need for cleaning up ground fuels like shed bark, branches, and leaves

Executive Summary

In fall 2025, the California overwintering population was estimated at 12,260 butterflies during the Mid-Season (Thanksgiving) Counts, up by ~33% from 9,119 in 2024. The Western monarch butterfly migration had made a great comeback from perilously low numbers (~2000) in 2020, rising to 250,000 in 2021-2022, 335,000 in 2022-2033, and 233,000 in 2023-2024. Hypothesized causes of the crash and the recovery are covered in the 2023 review Appendix. The crash in 2024-2025 (-96%) led to the second lowest overwintering population ever. The leading cause of the crash was the record heat across nearly the entire interior breeding grounds in June-July 2024 (discussed in 2025 review). The small increase is encouraging, and well within the typical fluctuations, but the western monarch population still is at perilously low numbers.

Monarch numbers at Monarch Grove Sanctuary (MGS) peaked at 226 on December 12, 2025 (the reported number for the Mid-Season counts was 188 on Nov 21). The remainder of the year afforded two brief periods of low numbers (December 24 and January 9), after high wind events, followed by recovery to pre-wind numbers. The monarchs emigrated from the grove by early February.

After arriving in early October, the butterflies clustered in sunny areas on the South and SW edge of the grove, the vast majority on eucalyptus and only a handful on Monterey pines or cypress. Through the rest of the season, they remained on the South and SW edge on eucalyptus. 94% of the observations were on eucalyptus, 5% on pine, and 2% on Monterey cypress throughout the entire season.

The implementation of the 2025 management recommendations included removal of dead small trees in Southeastern corner, and removal of supporting stakes and wires on sapling trees where appropriate. No new trees were planted, as recommended. Recommended rearrangement of forest floor debris and removal of hanging litter around large eucalyptus trees was not done. The remnant pine trunk along the main path was removed.

Relatively little management is recommended for 2026. The major short-term actions recommended for 2026 are:

1) In September, remove and redistribute downed bark, branches, and leaves along the South Edge to reduce fire hazards (cover photo), especially where eucalyptus debris has piled up the trunks of the trees. Some debris, with several foot wide fuel breaks, can be left on the ground to allow monarchs to get off the ground if they fall. *But continuous fine fuel on the forest floor is too great a risk given the fire potential* (i.e. the March 2023 fire, photo on TOC page). In the future, this work should commence each year in the spring, at the start of the dry season, and be an annual exercise.

2) Remove hazard trees and branches as they are identified.
3) Drop the large fallen tree in the interior to the ground and break up piles of branches, needles, and fine fuel.
4) Hiatus on new tree plantings, with one exception – plant a double row of cypress along property boundary with hotel in the NE corner of MGS. Shrub and understory plantings can continue.
5) Initiate and continue thinning of overly dense trees, especially planted cypress NE of nectar beds. Continue to remove dead and sickly trees from overly dense eucalyptus stand in SE corner.
6) Remove old stakes and cages as trees become self-supporting.
7) Protect the trunks of oaks along the W boundary (and other oaks) from deer by caging.
8) Manage nectar beds and plan for replacement and selective pruning of poor-performing species and beds.
9) Re-examine irrigation scheduling and implementation. Continue implementing deeper watering at George Washington Park, longer time between waterings with more water per watering.

Introduction

The following assessments and recommendations are based on site visits over the 2025-2026 season and on-site consultations with new City Arborist John Kelly and environmental manager George Fuerst in January 2026 and early June 2026. They are presented in the context of the 2011 Management Plan (Weiss 2011) and subsequent consultations with City staff and residents, including annual recommendations from 2014-2025 (Weiss 2014-2025). The recommendations are based on work at Monarch Grove Sanctuary since 1997, decades of scientific and conservation work at dozens of monarch sites, professional judgment, input from stakeholders in Pacific Grove, and field assessments. They attempt to carefully balance monarch habitat needs, hazard reduction, and forest health, based on both short-term and long-term perspectives.

Background data on monarch numbers at Monarch Grove Sanctuary (Xerces Society Monarch Counts, https://westernmonarchcount.org/)) provide context of the entire California monarch population. High-frequency (weekly) butterfly monitoring data from the Pacific Grove Museum since 2013 have documented monarch use patterns and habitat suitability relative to weather and time of season. This consistent reporting on monarch abundance and distribution provides a long-term accessible record for the local community and has been key to understanding the function of MGS.

The major elements of this report are:

1. The numbers at Pacific Grove in California context, including both Mid-Season (Thanksgiving) and Late-Season (New Years') Counts.
2. Monitoring data from the PG Museum on monarch numbers and distribution through the 2025-2026 season, and interpretation.

3. A graphical view of Monterey Airport data, to identify high wind events and warm periods to aid in interpreting the movement of monarchs within MGS.
4. A brief review of management actions completed in recent years.
5. Recommendations for management actions in summer 2026.
6. Photographs of monarchs and habitats with notes. Note that several photos are repeated from previous years because they illustrate ongoing issues and recommendations.

Other recent reports

In 2020, City Arborist Albert Weisfuss completed a detailed report with his recommendations, and those were considered in the 2020 report (Weisfuss 2020). The assessments and recommendations (with a few noted exceptions) are a solid foundation for guiding management, and the input of a professional arborist is essential especially on matters of tree health and species suitability.

A horticultural report (Regan Biological and Horticultural Consulting 2022) was developed that addresses issues with the nectar beds.

Appendices addressing key issues - the 2020 collapse and subsequent recovery, outlines of a new long-term management plan, and LiDAR visualizations - were included in the 2023 report and will not be repeated here for sake of brevity. A similar account of the 2024 collapse is in the 2025 report.

An analysis of the poisoning incident in 2024 has been published in the peer-reviewed journal *Environmental Toxicology and Chemistry* (Cibotti et al. 2025). The authors concluded that pyrethroid insecticides were the most likely cause of the mortality of 200+ monarchs.

Monarch Grove Sanctuary in California Context

Monarch Grove Sanctuary (MGS) supported a peak of 226 monarch butterflies on December 12, 2025 (Pacific Grove Museum Counts). The official Mid-Season (Thanksgiving) Count (MS) was 188 butterflies. The California MS total was 12,260 monarchs at more than 100 sites from Sonoma County to Baja California. The numbers of monarchs at Pacific Grove primarily reflect the ups and downs of the overall California population ($r^2 = 0.56$), with some variations among years (Table 1, Figure 1). The 2025 data fall close to the average line (blue circle). MGS has served as one of the major overwintering sites in California, accounting for an average of 7% (range 1% to 14%) of the MS counts since 1999. Its rank among all CA sites ranged from 1st (2006) to 17th (2009), and MGS is usually in the top 10 sites. For Monterey County (from 2001 on), MGS accounted for an average of 37% (range 17% to 58%) of the county population.

In 2025-2026, MGS supported 1.5% of the CA population, and 12% of the Monterey County population during the MS Counts. Most of the Monterey County population was

at the private site near Big Sur (Esalen). MGS was the 16th largest site in California this low year, below its rank in most years.

The Late Season Counts, (Table 2, New Years' counts, LS) across several nearby sites indicate how well sites maintain monarch numbers into early January. MGS retained 131 butterflies (70%) on January 10, and 209 butterflies (>100%) on January 17, within the 50-88% rate since LS counts were instituted. Retention rates at Natural Bridges (62%), Lighthouse Field (73%) and Moran Lake (77%) were comparable and Pismo North was substantially lower (20%), Monterey County monarchs overall retained 81%, driven primarily by the private property site in Bug Sur. California as a whole retained a total of 53% of the monarchs from MS to LS.

Seasonal Monarch Behavior

Monarchs seek wind-sheltered and sunny/dappled sites within forest groves along the coast where winter temperatures are mild. They "crowdsource the microclimate" – leaving sites when conditions are too warm or too cool, too sunny, or too shady, and especially too windy (if conditions are suitable for flight). They tend to land where other monarchs are clustered, because the best indicator of good conditions for monarchs is the presence of other butterflies. The butterfly clusters move around according to the weather and time of year; exposure to higher winds is often the proximal cause of shifts. They have often clustered just outside MGS to the south on an isolated Monterey Pine; and they use a mixture of tree species (eucalyptus, pine, and cypress) that varies from week to week and year to year.

The seasonal course of monarch numbers at MGS since 2013 (Figure 2a) shows arrival in October, peaks in late-November through early-December, and declines in January and February as monarchs die or leave the site. In two seasons (2018-2019 and 2022-2023) monarchs were present in March (as they were in 2010-2011, SBW pers. obs.). All three of these years were relatively cool.

Butterflies move around MGS, often associated with wind events – they often start the season along the sunny South-Edge and move into the interior following southerly storm winds. Emigration and mortality usually reduce numbers throughout the remainder of the season. Mating and emigration are stimulated by warmer temperatures and longer days that break reproductive diapause, leading to a final exodus by mid-February into early March (but emigration can occur by the end of January in warm years). The details of recent seasons (2013-2024) are described in previous reports.

In 2025-2026 (thick black line in Figure 2a and 2b), monarchs arrived in small numbers in mid-October. Figure 2b shows the monarch numbers on a reduced scale along with 2018-2019 and 2019-2020, for clarity. The population rose to 188 by mid-November and was above 200 in mid- December. Numbers observed then collapsed to 3 on Dec 26 (in response to a strong wind event on Dec 24-25, see below), increased to 131 on January

2, indicating that monarchs scattered rather than emigrated. Then another decline to 25 observed on January 7, and recovery to 203 on Jan 17. Emigration was completed by February 7. It is important to note that widely dispersed monarchs in small clusters or as individuals are difficult to detect, so some undercounting is likely after monarchs scatter from clusters.

Monarchs have clustered on a variety of tree species (eucalyptus, pines, and cypress) over the 2013-20265 period and tree use has shifted through the season (see previous reports for some examples). In 2025-2026 (Figure 2c), monarchs remained primarily on eucalyptus along the southern edge. Pines (5% of observations) and cypress (2% of observations) were lightly used. A similar pattern was observed in 2024-2025. These uses of trees contrast strongly with patterns in 2023-2024 (Figure 2d), when they started on eucalyptus, moved primarily to pines, and then to cypress at the end of the season.

The spatial distribution of monarchs in 2025-2026 (Figure 2e, the zones are shown in Figure 4) remained on the South Edge (blue, primarily on eucalyptus Figure 2b), and on the SW-Edge (light orange) throughout the whole season. Only a few monarchs were in the South Interior (just north of the main trail) on pines. This pattern was very similar to 2024-2025 (Figure 2f). These distributions contrast strongly with 2023-2024 (Figure 2g) when they moved from the South Edge to the South Interior by mid-November, and to the Interior in early January, and to the Driveway in February. In 2022-2023 (Figure 2g), and in 2016-2017 not shown), successive strong storms drove the butterflies even deeper into the grove to the North Interior, followed by a regrouping along the Driveway at the end of the season.

Preferences for pines and cypress in most years season is the result of the wind-sheltered interior being dominated by pines and cypress, not an intrinsic preference for those species. Monarchs also cluster on hanging lace lichens in the interior. In 2025-2026 (and in 2024-2025) monarchs overwhelmingly used eucalyptus during the bulk of the season, when they remained along the South Edge.

Weather 2025-2026

Weather, especially wind, is the primary driver of short-term monarch movements within MGS. The daily weather at Monterey Airport (KMRY, Figure 3a-c) provides a view of the regional synoptic meteorology (passage of storm fronts, high wind events, and temperature extremes). While KMRY does not absolutely represent the conditions within MGS, high winds there are representative of the conditions outside the canopy at MGS. KMRY serves as an indicator of high regional wind events that can be tied to historical monarch movements within MGS. It also provides the only nearby long-term climatology for observing historical ranges of variability and trends with climate change.

The 2025-2026 overwintering season started off in October with three days close to 80°F (Figure 3a). Many days in October, November, and January reached 70°F. The first

mild rainfall occurred on October 14, followed by soaking rains in mid-November, and one multi-day rainy period in late December (Figure 3b). Another multi-day rainy period occurred in early January. No notable periods of high hourly winds >20 mph occurred in the fall (but many days had winds >15 mph, Figure 3c). Peak hourly winds occurred on December 24-25 (29 mph). Observed monarch numbers declined sharply after this event. Only one period (around Jan 10) over the entire season through February 7 had minimum temperatures <40°F, so there was no risk of freezing. Late January had seven days >70°F, and monarchs left the grove during a period of temperatures in the high 70s. High temperatures prime the monarchs to break diapause, and they entirely emigrated from the grove by the first week of February.

With heavy rain returning in mid-February (and in April, after a record warm March), the season provided a fourth year of good growing conditions for the vegetation, after a 3-year drought period from 2020-2022. For example, several "volunteer" Monterey pines near the nectar beds put on several feet of new growth (Photo 20) after barely hanging on through the drought years in 2020-2022.

Comparison with Previous Seasons

2025-2026 was a mild overwintering season, with one strong wind event (>25 mph on December 24-25), and one multi-day period of consistent moderately strong wind (January 4-8), and relatively warm temperatures. The monarchs remained on eucalyptus on the southern and SW edges for the entire season as they did in another mild season in 2024-2025 (Figures 2e and 2f). In contrast, in 2023-2024 and 2022-2023 (and other years) monarchs made successive movements farther into the interior of the grove to escape persistent strong winds (Figures 2g and 2h).

One caveat about the 2025-2026 season is that the low numbers of monarchs make counting errors relatively more important in discerning habitat use. When small groups or individuals roost among the complex forest canopy, they are not easily detectable during the morning hours when counts occur. When there are only ~200 monarchs, missing groups of 5-10 butterflies can make a substantial difference in relative use of trees and locations. For example, in late December, numbers declined sharply to 7 butterflies; it represented a scattering of individuals in the grove, followed by reaggregation, rather than outright emigration. The numbers recovered in mid-January. In low number years, it is particularly important to observe monarchs in the afternoon as they find roosting sites for the night. *This is not a criticism of the skill, determination, and expertise of the monitors of the Pacific Grove Museum, it is only an observation of the difficulties of finding individual and small clusters of butterflies among the trees.* The Museum monitors are adjusting their methods (Natalie Johnson, pers. comm).

Hypothesized Causes of large Population Fluctuations of Western Monarchs

Monarch Grove Sanctuary exists within the larger context of the entire western monarch population. Climate change and resultant weather events and land-use affect

the breeding range and migratory routes. While the overwintering sites are the most obvious indicators of the monarch population, most of the drivers of population fluctuations occur in the breeding range. This section summarizes some of the hypothesized drivers of large population fluctuations of western monarchs over time, focused on sharp declines (Table 1).

Late 1990s: The overwintering population dropped from more than 1 million butterflies in 1997 to the low hundreds of thousands. An extreme El Nino in 1998 may be a primary short-term driver, and over the long-term, the loss of breeding habitat in the Central Valley from farming practices and increasing use of neonicitinoid (and other) pesticides were contributing factors.

2002 and 2007: These were both drought years across much of the western United States and overwintering monarch population decreased more than 50% from the previous year.

2009: The lowest population (~60,000) since the Western Monarch Counts were established. This decline followed a drought year, that had many hot days in coastal California over the summer. This was also the year that the MGS population fell below 1,000 butterflies. The unfortunate trimming of branches on the South Edge coincided with this decline.

2018: Warm temperatures in January and February led to early emigration from overwintering sites across the state. Winter returned in force in March 2018, with many cool rainy days and snow down to 1000' which led to mortality and delayed milkweed emergence, and the loss of much pf the first breeding generation. The population could not catch up over subsequent generations that summer.

2020 The lowest population (~2,000 for California as a whole, and 0 at MGS) followed a sequence of events where "everything that could go wrong did." A false spring in February (like 2018) was followed by a cool rainy March. Drought, heatwaves and fires across the western US permeated the breeding season, and large smoke clouds interfered with the migration back to the coast. Warm temperatures in October and early November delayed final migration to the immediate coast and a hard freeze in the Coast Ranges in mid-November finished the season. This year is discussed in detail in the 2021 review.

2021: The "miracle recovery" to ~250,000 remains somewhat of a mystery, but a likely contributor was a near-record SW monsoon season in Arizona which provided for lush milkweed growth and high larval survival. The breeding population in Arizona includes both California and Mexican monarchs, so the western population may have been rescued by contributions from Mexico. The recovery was primarily in the southern part of the CA overwintering range – overwintering sites north of MGS in the Bay Area did not recover until 2022. This recovery is discussed in detail in the 2022 review.

2024: The 96% decline in 2024 can be attributed to a massive heatwave across the western US that encompassed the early summer breeding range. This is discussed in detail in the 2025 review.

Nectar

Monarchs will visit many species of flowers for nectar. Early season (October-November) nectar allows monarchs to "refuel" after their often-long migration, and helps keep monarchs at MGS, where they can attract other monarchs arriving from the breeding grounds. Nectar provides energy for flight, and the high nectar availability at many California overwintering sites allows monarchs to conserve fat reserves and maintain body mass through the overwintering season. Monarch Nectaring Photographs 1-4 are representative of nectar use from previous years.

The major species used at MGS in the early season are tree daisy (Monarch Nectaring Photo 1), bottlebrush (2), and English Ivy (3). The ivy-covered stump at the sunny NE corner had attracted hundreds of butterflies in the fall, but that stump and ivy were removed by the hotel in 2024.

Yellow butterfly bush (*Buddleia*) is also frequently used, but the bushes in the nectar beds are overgrown and need some pruning to freshen flower production and force flowering during the critical October-November period. *It is recommended that a portion (30-50%) of the canopies of these bushes be pruned at a time of the season that will stimulate regrowth and flowering in October. Consulting with a horticulturalist is important.*

Blue gum eucalyptus come into flower in January and provide copious nectar for the latter part of the season. The flowering red gum (*E. filicifolia*) sometimes blooms in the fall and is visited frequently during warm weather – the tree is often shaded during the season.

Monarchs will avoid shade when air temperatures are cool, so the sunny areas near the nectar beds are crucial and should be used to the fullest. The sunniest areas are at the north end of the nectar beds, near the bench. As trees south and west of the beds grow, parts of the nectar area will be increasingly shaded in the fall.

Another non-native species that should be considered is orange colored Mexican sunflower, which is heavily used in the fall at the Gill Tract in Albany (Monarch Photo 4). Several native species that provide fall nectar are identified by the Xerces Society and would be a welcome addition to the understory in the grove. The sunny areas along the trail and split rain fence and around the NW bench are prime for native shrubs and perennial forbs.

Nectar source management, including a detailed analysis of sun exposure, is an area for more detailed exposition.

Recent and Current state of Monarch Grove Sanctuary

In recent years, Monarch Grove Sanctuary continued to provide high-quality overwintering habitat. A high fraction of monarchs has persisted throughout recent overwintering seasons, indicating that the grove provides sufficient wind shelter and dappled light, even under extreme storm conditions in years like 2022-2023. Some vulnerabilities remain and may develop into the future if actions are not taken in advance, given how long it takes for trees to grow compared with how quickly trees and branches can fall and open wind tunnels or take out other key trees and create wind vulnerabilities.

The depth of MGS has allowed monarchs to take refuge from strong southerly winds in the far Northern Interior section in 2022-2023 (Figure 2g). This pattern was also observed in 2017 and other stormy years. The shelterbelt of eucalyptus and other species planted in 1999 (Photo 11) is well established (>60' tall) and now provides solid NW wind protection along with the pines and cypress, so that monarchs can remain in the Interior zone when winds shift from southerly to northwesterly following storms. An additional row of eucalyptus was planted in 2011 between the main trail and the South Edge. These trees are growing (some are 30-35 ft tall), albeit slowly because of shade and root competition by the large eucalyptus along the South Edge (Photo 13). Monarchs sometimes cluster on these trees early in the season. Overly dense plantings of blue gums in the SE corner, not authorized by the City, are resulting in stressed unhealthy trees and several of these trees have died from overcrowding and are being removed one by one.

In terms of recent active management, most hazard trees and branches have been removed over time, and other upper canopy pines are close to death. *Prompt action on large standing dead trees (such as in Photo 17) is essential for public safety and protection of existing live trees.*

New tree plantings of cypress from 2020 will eventually fill in some wind gaps, as well as provide cluster sites in favorable microsites like the SE corner (Photo 9). The most recent plantings of cypress are well established and growing, helped by four consecutive wet years (Photo 12). Additional eucalyptus trees (*E. ficifolia*) were planted to seal gaps on the South Edge (Photo 14). The main remaining wind gap is along the NE edge at the hotel property line, and planting a double row of cypress and pine here will eventually seal it up with no effect on sun exposure within the grove.

Pine saplings, both planted and natural, are distributed in the interior. Natural pine recruits are the best saplings to encourage because they have developed appropriate root systems for their microsites and are not affected by irrigation (which often leads to shallow root systems). The four consecutive wet years have led to high growth rates of

the naturally recruiting pines (Photo 20). But the long-term survival of pines is always in doubt with the presence of pitch canker disease, so pines cannot be depended upon for long-term wind shelter and should be supplemented with cypress if the area is essential for wind shelter.

It is also very important to realize that the interior of MGS could become too shaded as new trees grow. The Interior cluster sites are at the N edge of a canopy gap that affords dappled light on the cluster trees (Figure 5). This is a potential problem over the next 10-15 years; no action is needed now.

Habitat photos, with documentation of location and photo orientation, of various parts of MGS are presented below with brief descriptions. A detailed analysis of the forest structure and microclimate is found in the 2011 Site Assessment and Management Plan (Weiss 2011).

Recent Management Actions in 2020- 2025

The major action in fall 2020 was plantings of boxed Monterey cypress that had been brought into MGS in 2019. Several cypress trees were planted in the open area south of the main entrance and kiosk, where 1 or 2 trees were recommended as cluster trees (Photo 9). More cypresses were planted farther west, south of the main trail. Cypresses were also planted east of the nectar beds to build wind shelter (Photo 12) as the large acacia died back. Some bottlebrushes and eucalyptus trees were also planted. Some toyon and ceanothus were planted and caged. These trees are growing well, especially with a series of wet years.

Identified hazard trees and branches have been removed each year. The complete death of the large pine NW of the nectar beds necessitated closing the trail in December 2023 that connects to Grove Acre Ave. to protect public safety. (See previous reports for photos). The dangerous tree was removed after the monarchs emigrated in 2024.

The irrigation scheduling appears to be working better (Photos 28, 29). However, for some other trees, documentation has been lacking. There has been a tendency to overwater in past years, especially in the nectar beds.

The ongoing recommendation that new low-growing native nectar plants be established along the trail through the nectar beds has not been implemented. Suggested management of the existing nectar plants by selective pruning was not observed by June 2026.

The new tree plantings have not been mapped as of 2026, pending a new mapping effort for all trees, so a complete inventory is not available. A new tree map and health assessment would greatly facilitate grove management.

In 2022, the neighbors at 1070 Short removed a cypress in their backyard that was developing into a good windbreak tree. This emphasizes how important it is to have MGS as self-contained as possible in the absence of enforceable restrictions on neighboring properties.

The 2023 recommendations were not implemented in late summer because of delays in authorization and the early arrival of monarchs. Some of those recommended actions were completed following the emigration of the monarchs in 2024.

In 2024, along the N boundary, several acacia trees and cypress branches impinging on the neighboring structures were trimmed or removed (Photos 4 and 5).

In 2025 and late-spring 2026, many of the old tree stakes and straps were removed as recommended. But management of forest floor and ladder fuels, primarily eucalyptus bark, leaves, and branches has not been executed in a timely manner.

General Ongoing Recommendations

The general recommendation is that good forestry practices be consistently implemented. These considerations and practices include:

1. **This is not a "natural" forest.** Direct thoughtful forestry and arborist prescriptions are necessary to maintain the microclimatic structure of wind shelter and moderate light that attracts and retains monarchs. Non-native eucalyptus trees provide key forest structures and the existing trees, including the 1999 shelterbelt, should be maintained.
2. **Manage stem densities through selective thinning to allow for the development of healthy individual trees.** The overly dense eucalyptus planted in 2013 (without City authorization) in the SE corner have had 13 years of growth, and have developed into a stand of crowded, unhealthy trees (Photo 10). Some of these trees have died. The removal of selected trees will reduce canopy competition for light and reduce root competition for water and nutrients. The remaining trees will expand their canopies and grow faster, producing better wind shelter that will more than compensate for the short-term loss of sickly canopies. This work can be phased in over several years but should continue with an eventual minimum spacing of 10-15' as the target. This also applies to some of the cypress stands behind the nectar beds, where thinning started in 2022 and continued in 2025 (Photo 15). An additional one or two trees should be selected for removal in 2026.
3. **Slow down new plantings**. Several dozen trees, including cypress, eucalyptus, and pines have been planted in recent years. The performance of these trees needs to be evaluated. A hiatus in new plantings, except in the very limited areas discussed below (filling in the gap along the NE property boundary with the hotel, Photos 5, 6), is recommended, along with more attention on taking care of the recently planted trees with well-planned (deep and infrequent) irrigation when necessary. Trees should be weaned from irrigation after one or two years,

so they develop deep root systems. Supplemental irrigation during intense droughts may be necessary. There is a long-term danger of the forest becoming too dense (especially in the Interior Zone), cutting out the sunlight that monarchs require in addition to wind shelter.

4. **Proactive hazard reduction of dead trees and branches that threaten people and other trees**. The path is the obvious target, and several hazards were identified in 2023 (discussed below). But interior dead trees that do not have a trail as a target are a threat to other trees - the large tree that fell in 2023 in the Interior Zone took out a desirable healthy young pine tree (Photo 21). Large standing dead trees do not benefit monarchs and are a liability for public safety and threat to other trees.
5. **Management of fine ground fuels.** Fine fuels, like eucalyptus leaves, bark peelings, and small branches accumulate on the forest floor and pose a major fire risk (cover photo). At the same time, the debris provide places for monarchs to crawl off the cold ground and regain flight, so complete removal to bare ground is not recommended. Prompt raking away from tree trunks and creation of fuel breaks (a few feet wide) can help reduce fire spread and risk to healthy trees. *These actions can occur just after the monarchs emigrate to be ready for the dry season.*

Specific 2025 short-term recommendations

The most urgent set of recommendations relates to fire fuels management. The accumulation of fine ground fuels, and near-ground fuels and ladder fuels on trees pose a major threat to the Sanctuary should an ignition occur. *The fire (of unknown origin) on March 31, 2024, was a clarion warning.*

1. **Remove ground fuels around the eucalyptus (Photos 1, 2, 3, 4, and 5)**. Accumulated eucalyptus bark, branches, and leaves on the ground along the South Boundary are a major fire hazard, and should be raked out, and dead lower branches removed. March 2024 was a wet cool month (see Figure 3) so fuel moisture was high, and grasses were green. If the fire had ignited during the summer or fall, or even more frightening, during one of the few hot dry periods (like early October 2023 when temperatures exceeded 90°F, Figure 3) the results could have been catastrophic. Removal of debris stacked around tree trunks is particularly important. As mentioned above, redistribution of raked material with breaks in fuel continuity can provide structures for monarchs to crawl up if grounded. *This is a highest priority action and should be done ASAP, generally just after monarchs emigrate from the grove in February and March to be ready for the dry season.*
2. **Limb up selected cypress trees in western parts of the Sanctuary (Photo 17):** There are several cypresses (and pines) that have lower limbs that are collecting dry fallen scales, needles, and small branches and act as ladder fuels. These limbs should be cleaned and even removed. Lower branches often have only a small tip still alive, cypress and pines naturally lose their lowest branches. There will

not be an impact on wind because of the low heights involved, but the decrease in fire risk is very important.

3. **A hiatus on major tree plantings** until a full inventory and structural assessment is completed as part of a new management plan (see Appendix A from 2023 report). There are plenty of new trees in the ground for now and their growth and health should be monitored closely as part of the new monitoring and adaptive management plan. These new trees are growing well and now exceed 20' height in some cases (Photo 9). Eventually, it may be necessary to thin some trees to encourage individual tree health. Cypress trees can grow quite wide and crowding and shade can become issues.
4. **Fill the NE Driveway gap (Photo 6a, b).** The exception to the hiatus on new tree plantings is a new double row of cypress planted along the actual hotel property boundary in the NE corner of the Sanctuary. This will seal this edge against E and NE winds. The recommended configuration is spacing of 15 ft, which allows for rapid growth and healthy trees while still providing solid wind protection. These trees will not negatively affect sun exposure during the overwintering season because they are on the NE exposure. Note also the new split rail fencing, a model for new fencing within MGS.
5. **Protect the trunks of oak trees near the W boundary (Photo 7).** Deer have rubbed the trunks and threaten the health of several oak trees by girdling. Building protective cages or some structure with plenty of room for trunk expansion can eliminate this threat. Examine on a tree-by-tree basis.
6. **Remove large fallen tree near nectar beds (Photo 10).** This tree should be dropped and bucked up to the ground, and branches removed to eliminate fuel buildup.
7. **Refine monarch monitoring.** *The monarch monitoring program by the Museum is second to none in California – the weekly counts are invaluable in assessing the quality of the habitat.* But a few simple refinements will increase the utility of the already excellent data collection.
    a. Note the monarch zone (Figure 4) during monitoring, in addition to any tree tags. The zones can be deduced from the tags, but when new trees are used it can be confusing to locate them.
    b. Add in a cluster height estimate –a height reference scale could be added to a prominent tree along the main path, and perhaps elsewhere in the grove. Consistent monitoring of cluster height can reveal monarch reactions to weather and changing sun angles through the season.
    c. When numbers are low, visits in the mid- to late-afternoon while monarchs are active will identify roosting places. The right cover photo show individual monarchs against the sky and highlights the difficulty of seeing them when they scatter from clusters.
8. **Manage large, downed wood.** Buck up the trunk of the large fallen pine so that the trunk is in contact with the ground and can continue to decompose. Cut smaller branches and either scatter, pile, or chip onsite (Photo 25). Collect a good sample of the cones, to spread in bare areas where pine seedling

recruitment is desired. Leave the upturned trunk as potential wildlife habitat. The major goal over time is to avoid excessive fuel accumulation. This tree took out a healthy mid-sized pine tree (Photo 25), serving as a lesson as to why large snags and structurally unsound trees near senescence need to be dealt with promptly.

9. **Shrub plantings.** Planting native shrubs like toyon along the south boundary with 1070 Short will help fill in the wind gaps produced by the removal of the cypress in the backyard and create a more attractive edge. Newly planted cypress and eucalyptus just inside MGS facing this gap will provide mid-story wind protection after a few years. Planting native shrubs along trails and in open understory areas can diversify the understory, but plants need protection from deer browsing, wider cages will help protect the tops of the shrubs and allow for height growth (Photo 23). Understory shrubs also provide places for downed monarchs to climb onto.
10. **Further thinning the cypress stand toward the NW corner (Photo 15)** with removal of one or two more trees to be selected in the field, to allow for more room for the remaining trees while maintaining wind shelter. The remaining trees will expand their canopies in the absence of competition and fill out the canopy openings.
11. **Continue thinning small eucalyptus in the SE corner (Photo 10, 5).** The targets for now are the weakest crowded eucalyptus in the SE corner to allow for development of healthier remaining trees). Some of these trees are already dead, after 11 years of growth in crowded conditions. Plan on removing a few trees each year until a suitable density (10' spacing minimum) is achieved. Some of the trees immediately along the fence (Photo 5) should be thinned as well – these will impinge on the fence as trunks develop. The remaining trees will respond strongly to increased space and fill in the canopy rapidly, and individual trees will be much healthier and grow more rapidly.
12. **Incremental removal of dead acacia canopies.** Several of the sprawling acacias have dead sections of canopy. Incrementally removing these dead sections will reduce fuels and leave room for live plants to be established.
13. **Removal of *Marah* (wild cucumber) vines after the leaves senesce.** These vines, when they form dense canopies, can block light and provide ladder fuels. They can be readily pulled down before they dry. The large tubers will regrow canopies each year.
14. **Remove old stakes and cages (Photo 21).** Some trees planted in the last decade still have stakes, collars, and cages that are no longer needed. Several sets of stakes and cages have been removed. Each remaining staked tree should be evaluated, and the stake/cage removed if no longer needed.
15. **Manage and monitor nectar beds. (Photo 22, 24)** A report on the nectar beds was produced a few years ago (Regan Biological and Horticultural Consulting 2022) and provides excellent assessments and recommendations. The yellow Buddleia bushes should be pruned to refresh growth and force flowering in the fall (Photo 22). A third or half of the canopy should be pruned to a density

determined by consultations with a master gardener or other horticultural expert. Some nectar beds support species that are not used by monarchs (such as the mallow) and could be replaced to maximize nectar availability for the monarchs. Mexican sunflower (*Tithonia rotundifolia*, Monarch Nectaring Photo 4) is an excellent addition for fall nectar – it is heavily used at the Gill Tract in Albany. Additional native nectar plantings in sunny trailside areas should be considered now that the rope fencing is replaced with split rail.

16. **Manage pine seedlings**. Maintain and cage pine saplings in the interior (Photo 16). Apply irrigation as needed in the first one or two years for establishment of planted pines – the emphasis should be on relatively few deep irrigations over the dry season, not frequent shallow irrigations.
    a. There are several natural recruits from seed east of the nectar beds that should be retained and encouraged (Photo 20). Trees that naturally recruit develop resilient root systems that explore the soil to great depth. The string of four wet years has stimulated high growth rates of these naturally recruiting trees.
    b. Experiments with pine seeding on patches of freshly bare soil could develop a method for recruitment of healthy pines. Collecting cones from fallen trees could provide a good source of seeds for such experiments.
17. **Continue to monitor for spread of pitch canker.** This disease can lead to mortality of even large pines, and crates doubt about the long-term survival of pines as windbreaks. A full tree inventory and map would be a key baseline.
18. **Maintain the open area in the interior. (Photos 26, 27)** Monarchs seek sites with dappled light and avoid deeply shaded sites. The opening in the interior provides a gap that allows dappled sunlight on cluster trees north of the gap. Care should be taken in managing small trees so that this gap is maintained so that the cluster trees do not become too shaded.
19. **Irrigation.** The irrigation regime for new plantings be continued, but trees and shrubs should be weaned off irrigation after a few years once established. An evaluation of the irrigation program by the City arborist is recommended. Again, the emphasis should be on a few deep irrigations over the dry season, not frequent shallow irrigation. Documentation is important (Photos 28, 29).
    a. The developing El Nino in 2026-2027 makes it likely that another year of above average rainfall will occur. The deep soaking will provide an opportunity to wean many trees off irrigation and allow them to develop deeper root systems.
20. **Neighbors.** Take a broader view of the site and work with neighbors. Trees in the surrounding neighborhoods can provide critical wind shelter. For example, a growing cypress south of MGS at 1070 Short Street was taken out leaving a gap in the wind shelter. New plantings of cypress, eucalyptus, and toyon within MGS will eventually seal this gap. The trees on the hotel property are also integral to the monarch habitat. Working out lines of communications and responsibilities will help site management progress more smoothly. *The insecticide incident is a wake-up call for better education*.

2026 Recommendations for George Washington Park

The bulk of the consideration of GWP is in the 2023 Appendix as part of the long-term management plan outline. No major actions, except immediate hazard tree management, are recommended until a fuller site assessment is completed. Photos 30 and 31 show recent pine plantings in GWP.

One immediate issue is adjusting the irrigation schedule for the numerous pines that have been planted in recent years. Long-term survival and health of these pines require that they grow roots to tap deeper soil water once irrigation is stopped after several years. Volunteers have devoted much time and effort irrigating these trees, and it is important to have an effective irrigation schedule for deeper watering. The current irrigation schedule only provides shallow water, which encourages the pines to grow roots in the shallow wet zone at the expense of deeper roots. *It is highly recommended that the watering regime be changed to deep irrigation so that each tree receives much more water in each watering, with less frequent watering.* The exact rotational schedule needs to be worked out, but as a start, twice the water at half the frequency is suggested, next reduced to three times the water at a third of the frequency, eventually to one or two deep waterings over the dry season until the trees can survive on natural rainfall.

Again, the projected high rainfall year driven by El Nino may provide an opportunity to wean new pine plantings off irrigation, as they will develop deeper root systems into saturated deep soils. In summer 2027, the pines should be watched for signs of water stress (or lack thereof) and irrigation decisions made on an ad hoc basis.

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Tables

Table 1. Monarch Butterfly Thanksgiving Counts from Xerces Society for Monarch Grove Sanctuary (MGS) George Washington Park (GWP), Monterey County, and California Totals. *MGS was the only site counted that year.

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
2015	11,472	0	292,888	27,787	4%	41%	3 (tie)
2016	17,100	0	298,464	64,804	6%	26%	3
2017	7,350	0	192,629	35,657	4%	21%	8
2018	705	0	28,429	2,758	2.5%	26%	15
2019	642	0	21,944	2,792	2.9%	25%	8
2020	0	0	1,914	58	0	0	--
2021	13,608	0	247,237	26,502	5.5%	51%	5
2022	15,960	0	335,479	25,920	4.8%	62%	4
2023	6,608	0	233,394	17,061	2.8%	38%	10
2024	228	0	9,119	275	2.5%	83%	12
2025	188	0	12,260	1601	1.5%	12%	16

Table 2. Comparisons of Mid-Season (Nov) with Late-Season (Jan) counts at selected sites from 2023-24 to 2025-26. For previous years' data (back to 2016-2017) consult previous MGS reports.

SITE NAME	Nov 2025	Jan 2026	2025%	Nov 2024	Jan 2025	2024%	Nov 2023	Jan 2024	2023%
MGS	**188**	**131**	**70%**	228	52	23%	6,608	5,785	88%
Lighthouse Field	**1,095**	**804**	**73%**	1,406	1,500	107%	10,000	8,446	84%
Natural Bridges	**2,500**	**1,540**	**62%**	1,400	0	0%	6,500	6,600	102%
Moran Lake	**673**	**520**	**77%**	645	800	124%	7,050	4,970	70%
Pismo North	**471**	**95**	**20%**	556	623	112%	16,044	10,152	63%
Monterey Co	**1,601**	**1,291**	**81%**	275	1,886	686%	17,061	16,860	99%
CA Total	**12,2601**	**6,450**	**53%**	9,110	5,389	59%	193,442	138,448	72%

Figures

Figure 1. Relationship between total California monarch numbers and MGS numbers, Xerces Mid-Season Counts. Blue point is 2025.

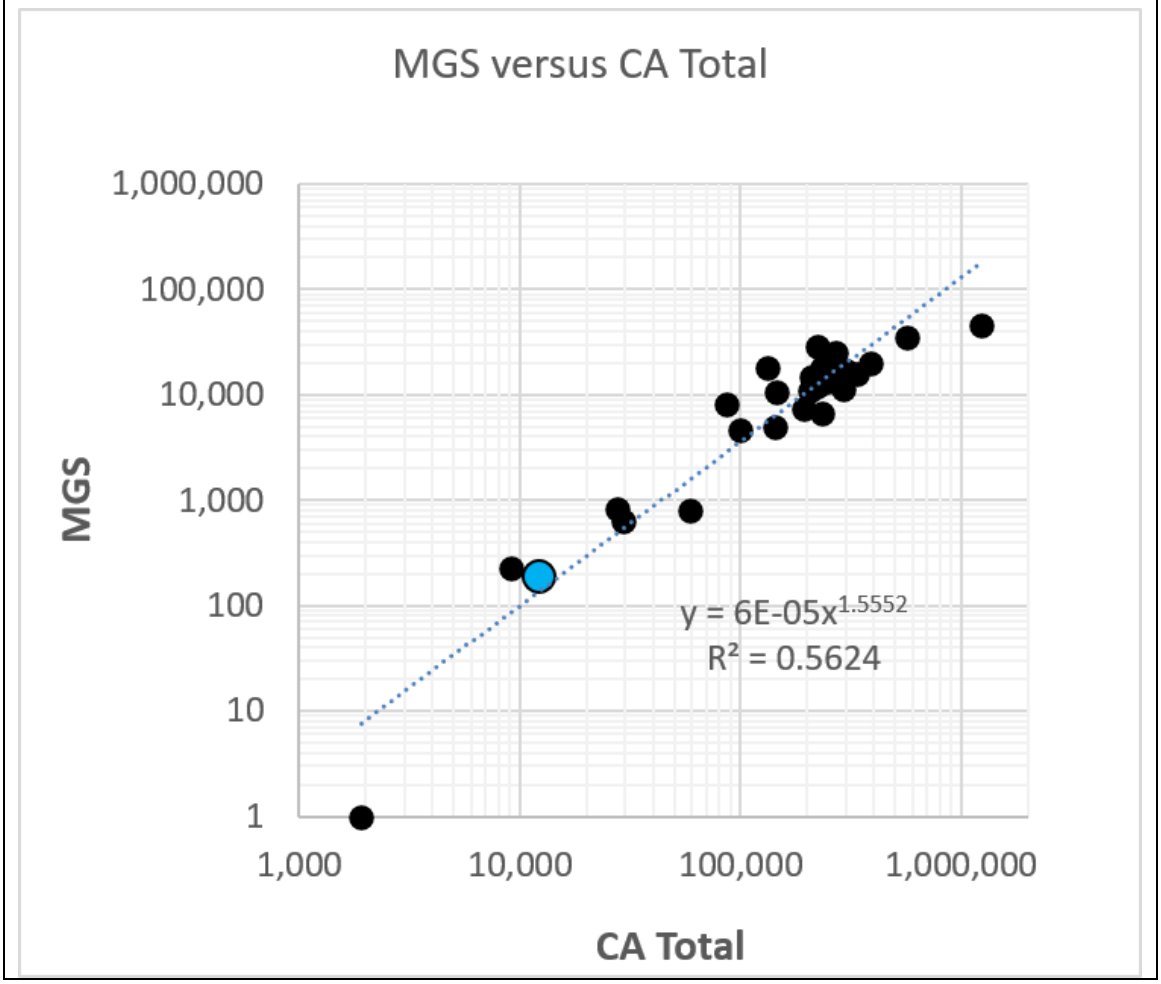


Figure 2a. Monarch counts through overwintering seasons 2013-2014 to 2025-2026. Data from Pacific Grove Museum

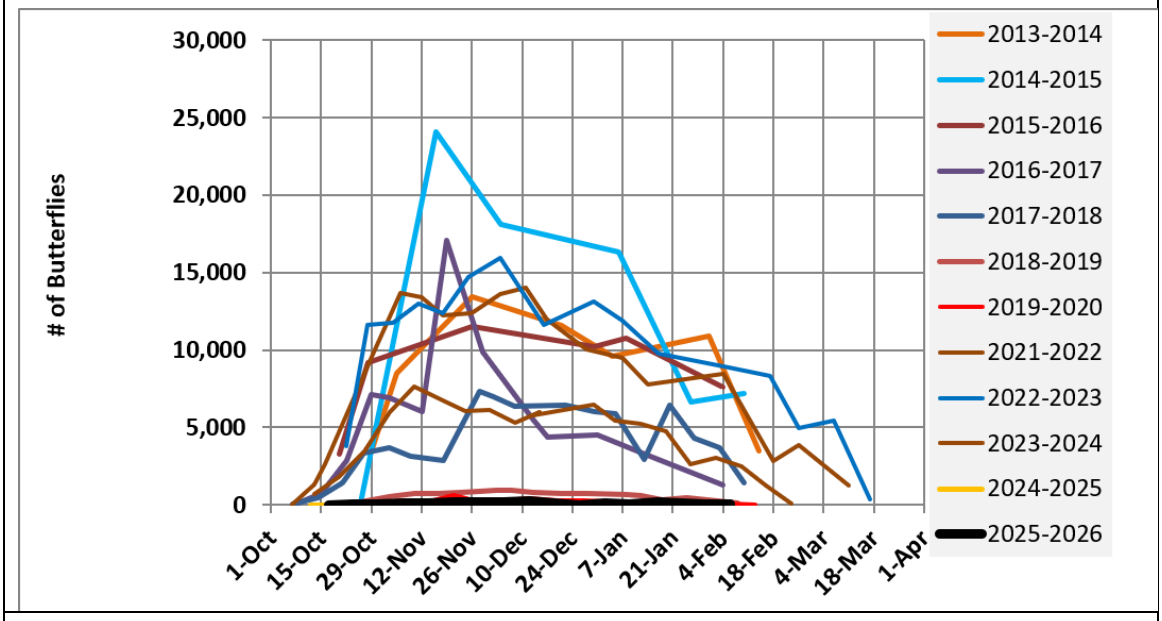


Figure 2b. Monarch Counts in low years

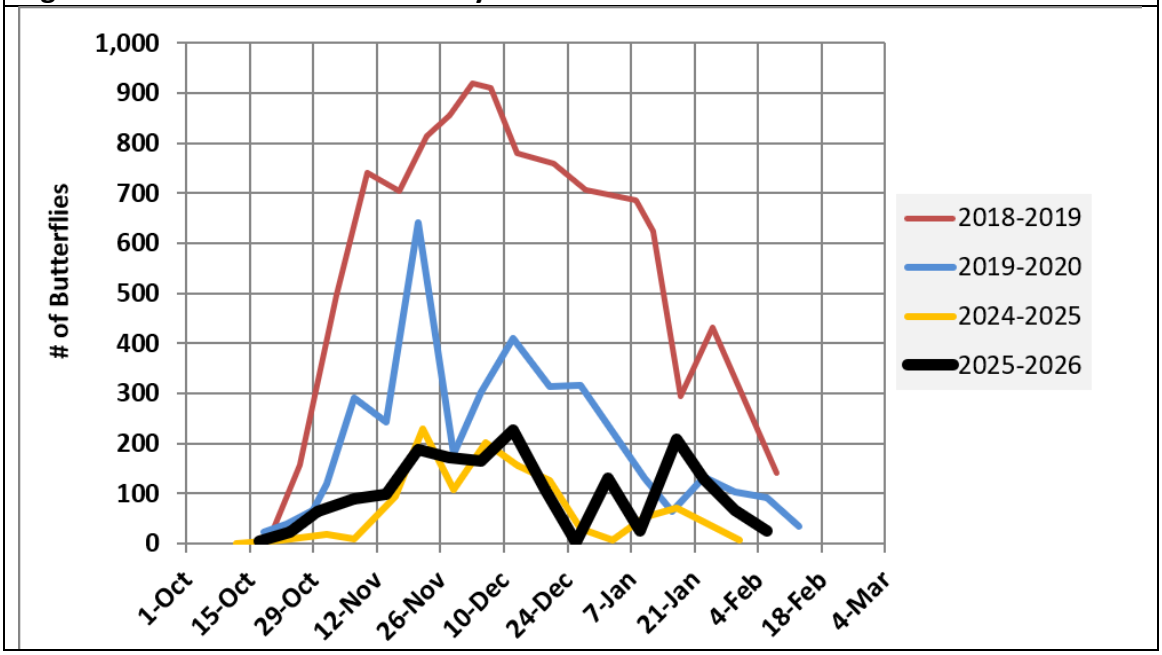


Figure 2c. Monarch Distribution by Tree Species 2024-2025

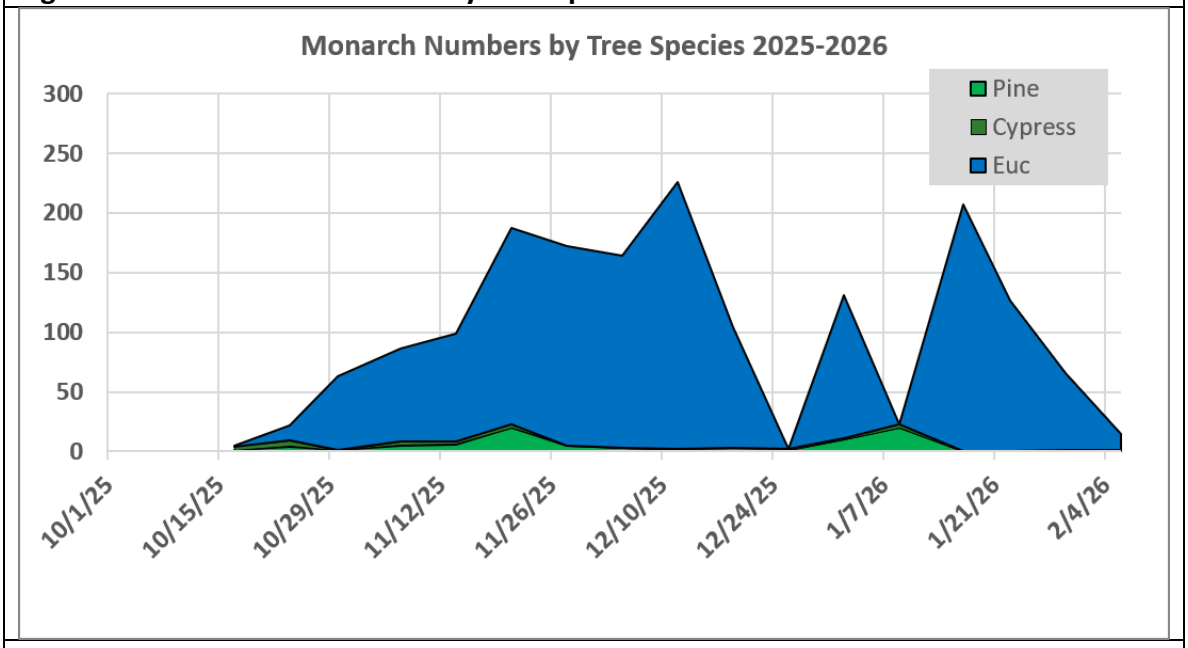


Figure 2d Monarch Distribution by Tree Species 2023-2024

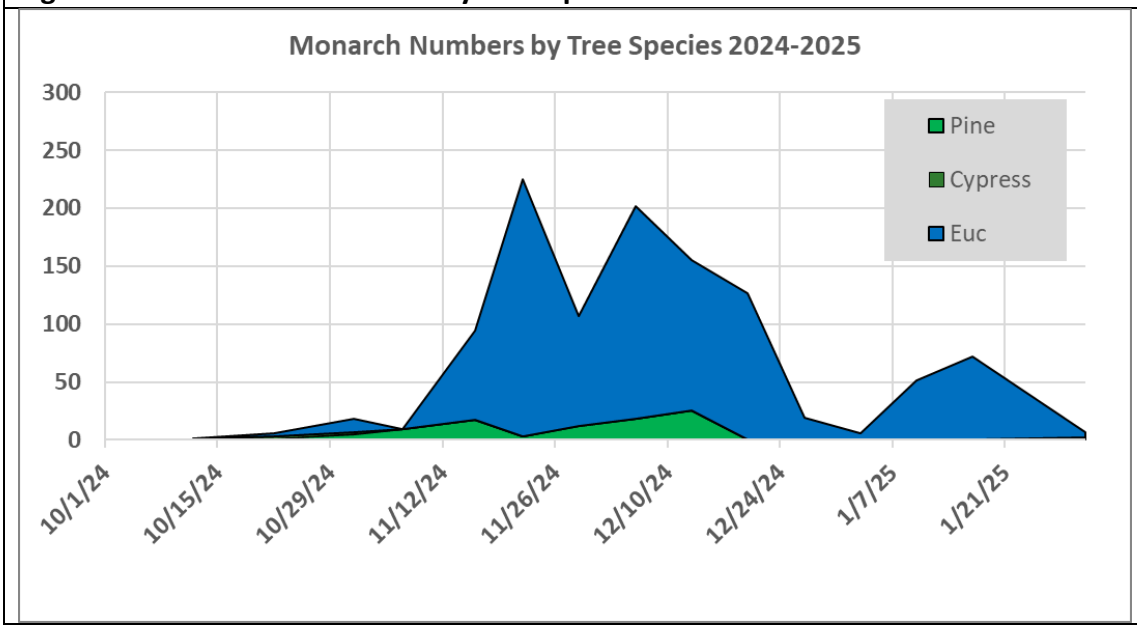


Figure 2e. Monarch Spatial Distribution by Zones 2024-2025

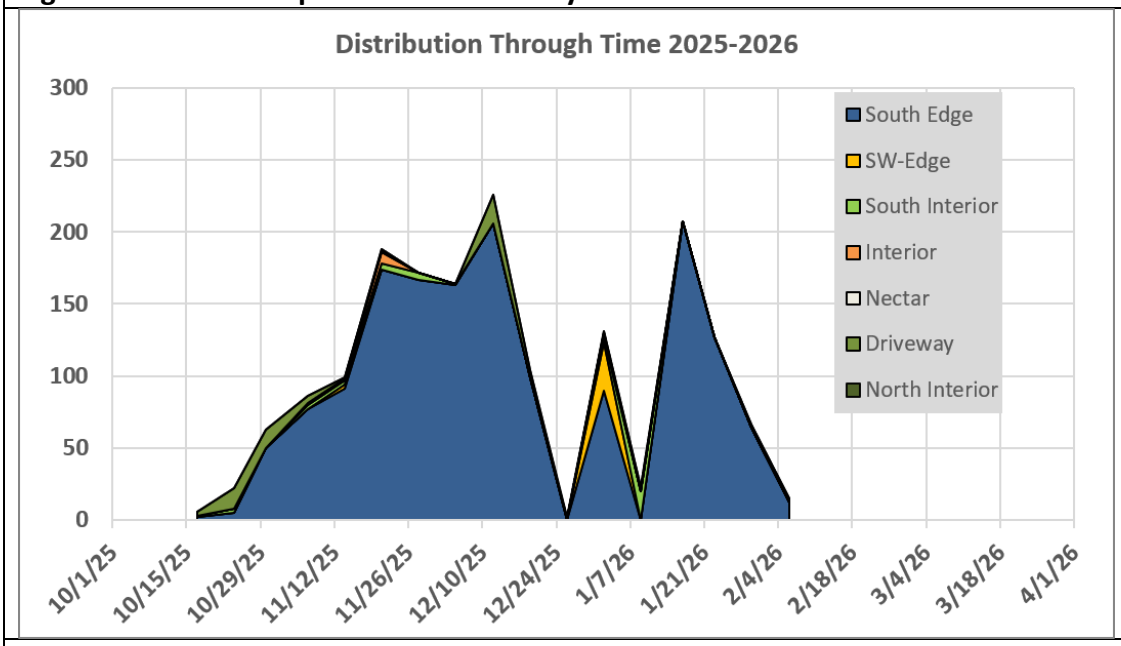


Figure 2f. Monarch Spatial Distribution by Zones 2024-2025

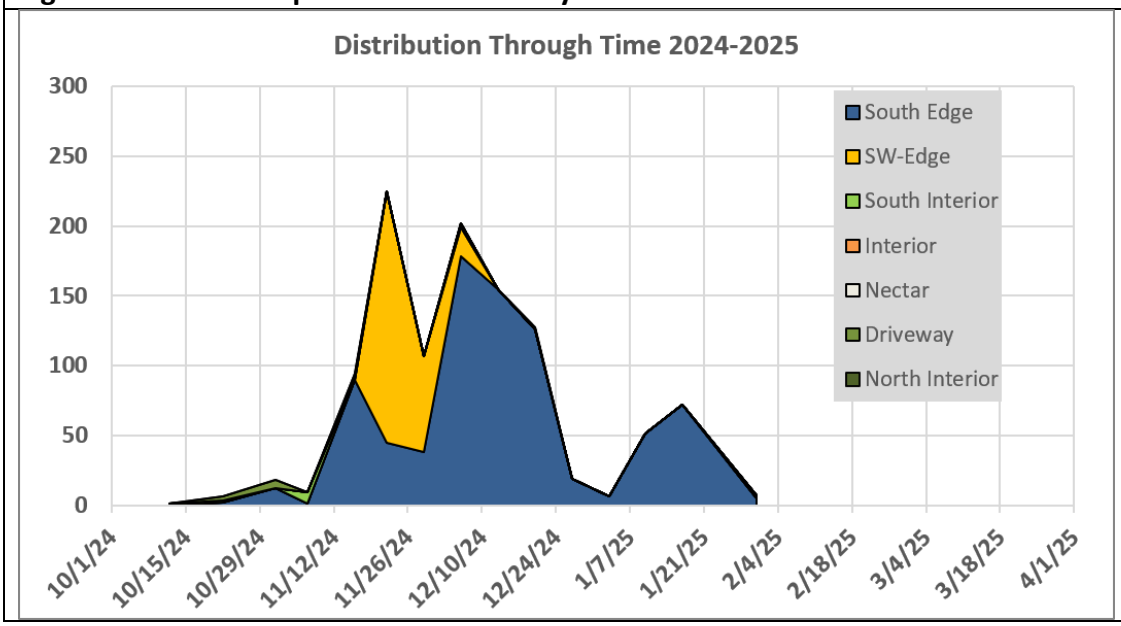


Figure 2g. Monarch Spatial Distribution by Zones 2023-2024

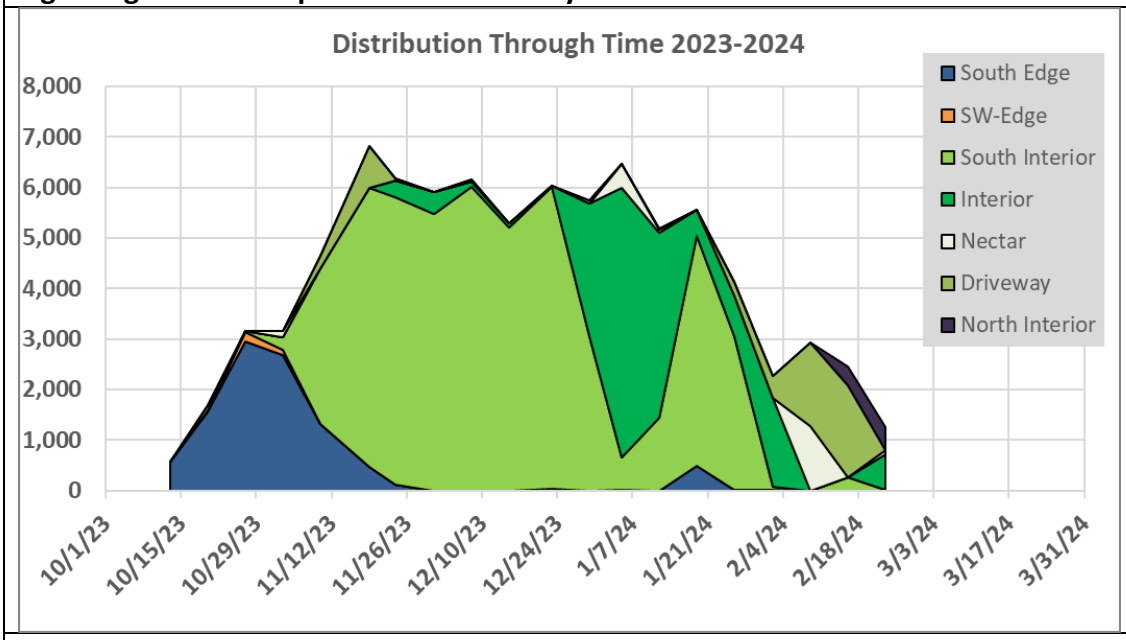


Figure 2h. Monarch Spatial Distribution by Zones 2022-2023

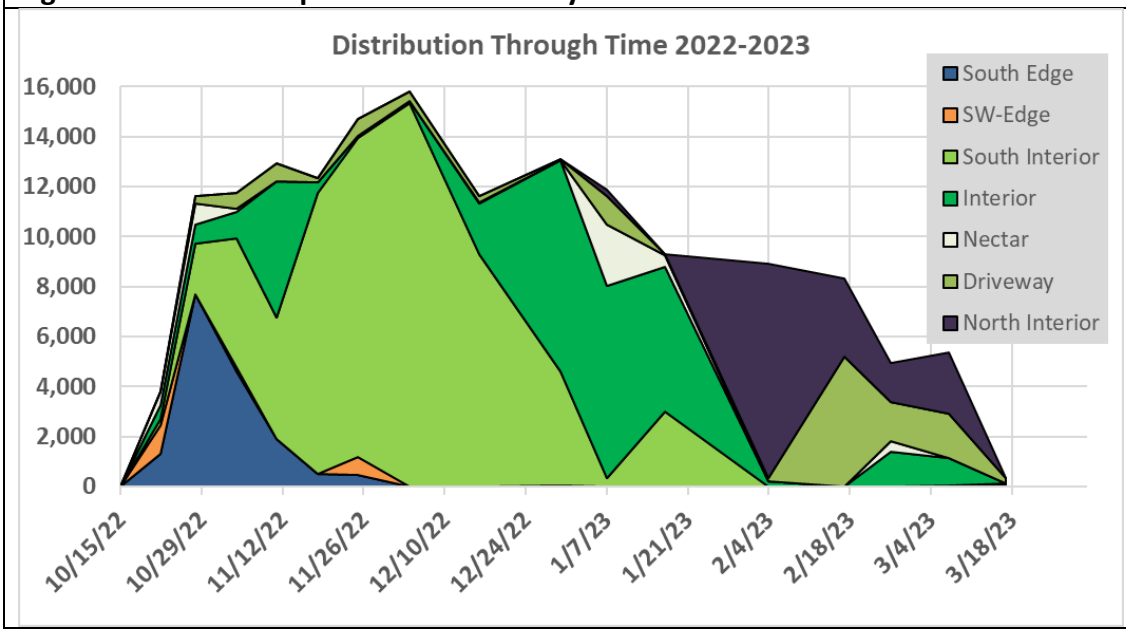


Figure 3a. Daily Maximum and Minimum Temperature at Monterey Airport

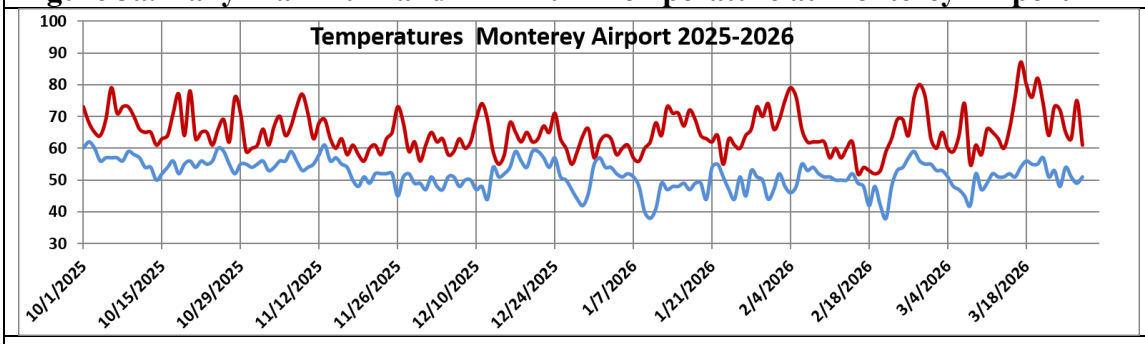


Figure 3b. Daily Rainfall at Monterey Airport

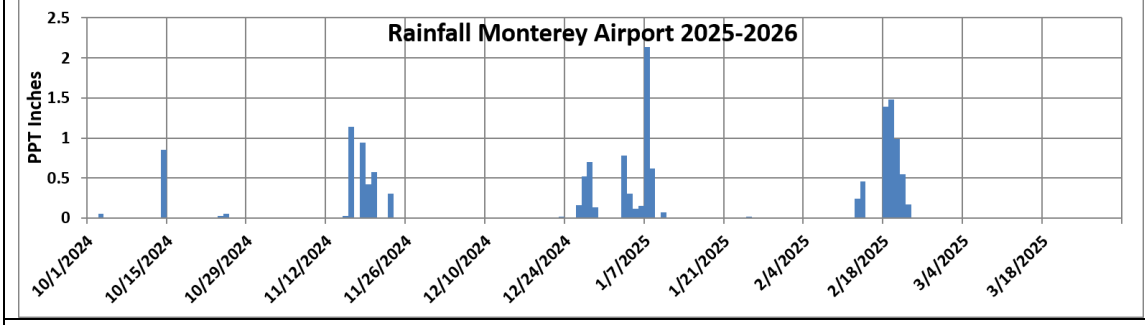


Figure 3c. Daily maximum Hourly Wind Speed at Monterey Airport.

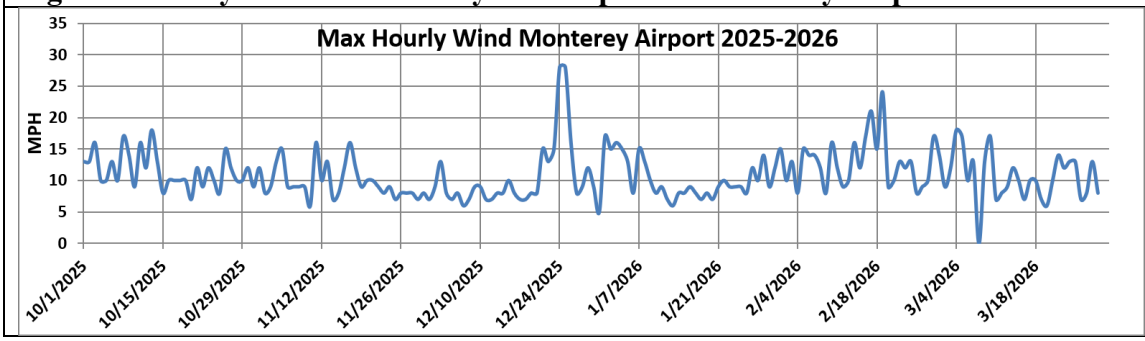
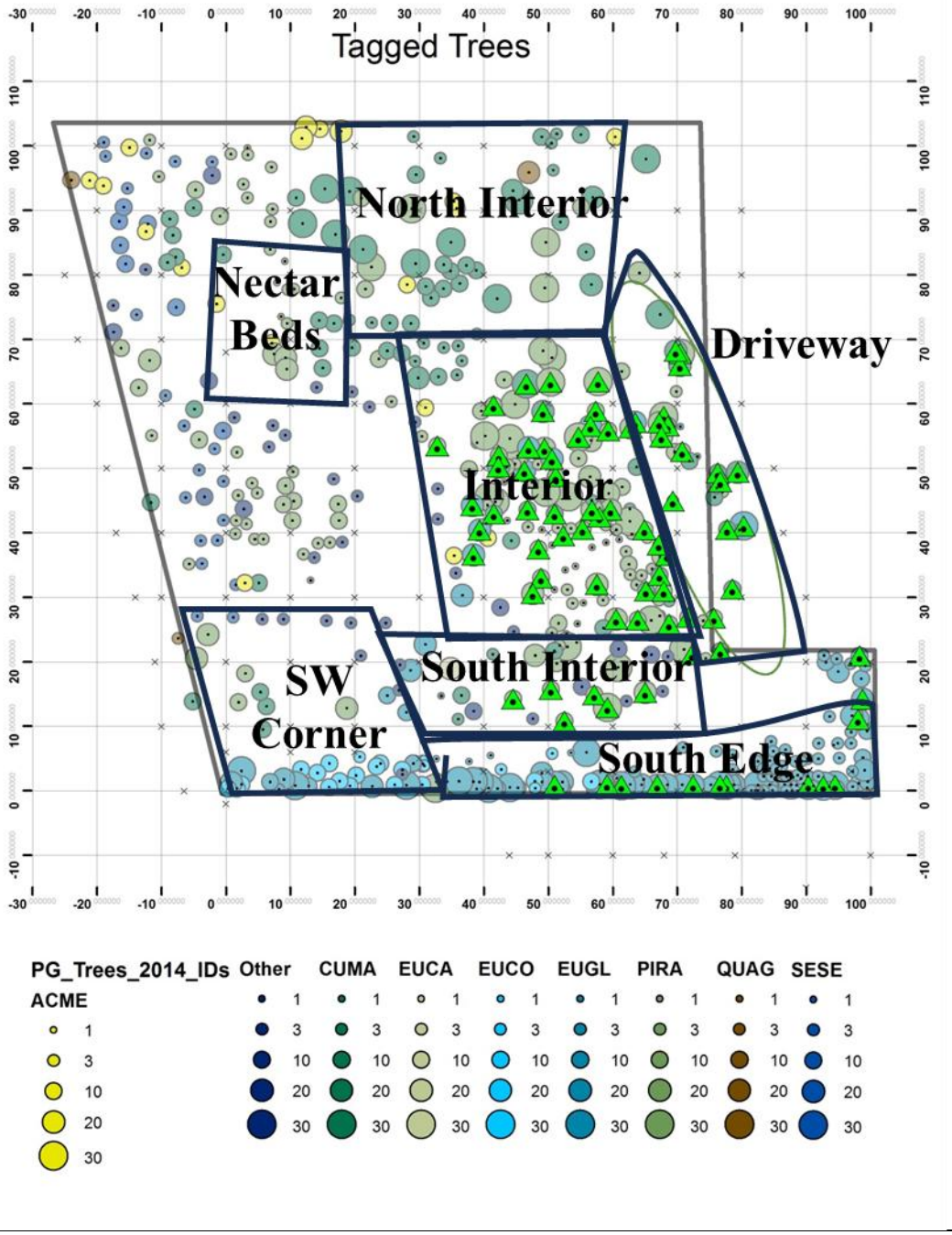
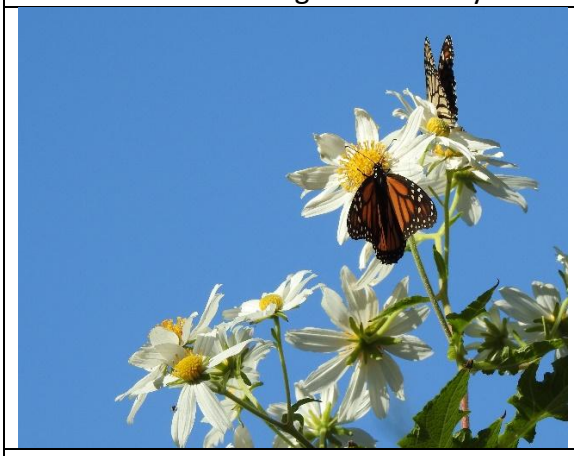


Figure 4. Monarch Occupied Trees (Green Triangles) and cluster zones, Grid in meters



Monarch nectaring photos

1. Monarchs nectaring on tree daisy	2. Monarchs nectaring on bottlebrush
	
3. Monarchs nectaring on English ivy. This ivy stand growing on a stump was removed from the Hotel driveway.	4. Monarchs on Mexican sunflower (*Tithonia rotundifolia*) at Gill Tract, Albany
	

Habitat Photos

Photos taken on various visits illustrate management issues. Several photos are previous to 2025-2026 but are included because they show some of the issues better than current photos. It is suggested that the page be magnified for viewing.

Photo 1. Site of March 31, 2024, fire. Note scorching on eucalyptus trunk. If this fire started during the dry season, instead of at the end of a wet month, then the dry fuels on the forest floor would allow for rapid spread.



Photo 2. Close-up of scorched trunk. The fire could not spread quicky because of high fuel moisture in late March.

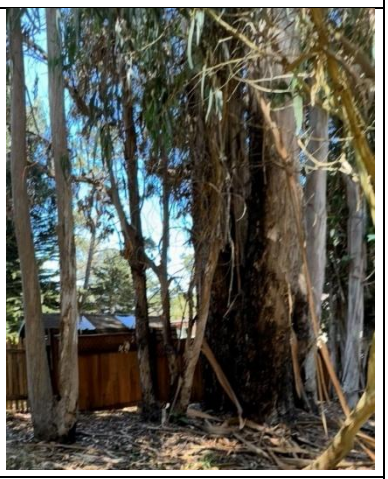


Photo 3a,b,c. Typical accumulation of bark peelings, small branches, and leaves create fine fuels that should be raked away, especially around the trunks of large trees.



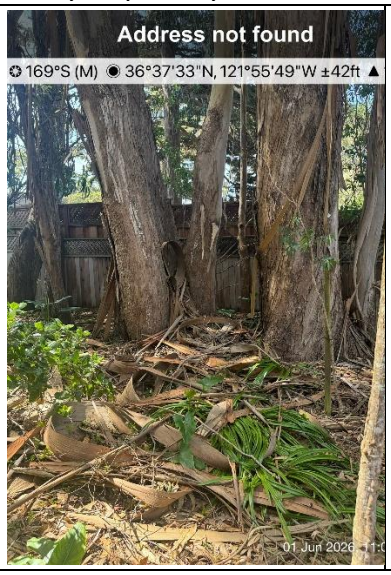




Photo 4. More examples of fuel accumulation. The accumulations should be raked away from the tree trunks, and strings of bark on the trunks removed. A several foot buffer between remaining litter and the tree trunks will minimize the risk of fire damaging the trees.

Photo 5. Dense trees along wooden fence on South Edge, with large accumulations of ground fuels. The combination of a wooden fence and ground fuels is a major fire hazard. Eventually, these trees will impinge on the fence.



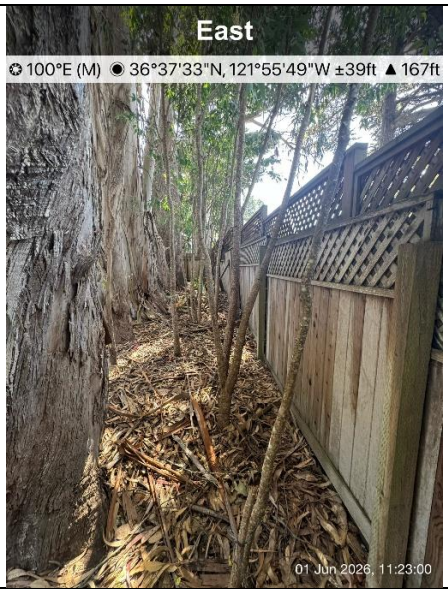


Photo 6a,b. a. Looking into the Sanctuary from the driveway and the new split rail fence. This gap along the E boundary with the hotel should be filled with a double row of cypress, planted at ~15 ft. spacing on the actual property boundary. **b.** looking out from the interior highlighting the open sky visible to the East.





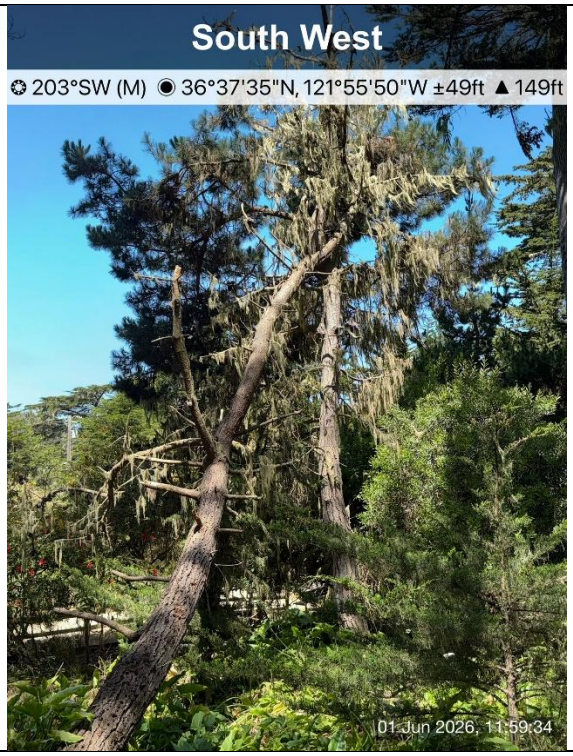
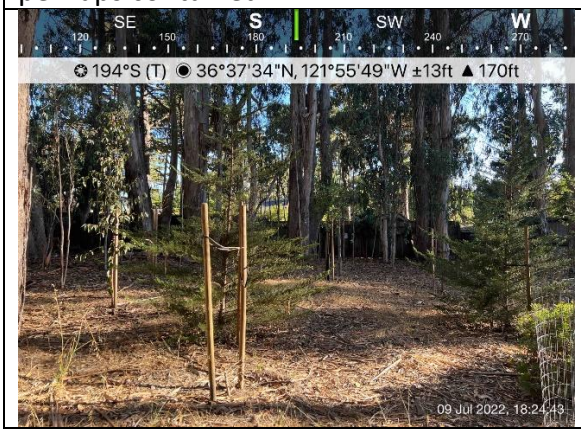
Photo 7. Oak tree damaged by deer rubbing, nearly girdling the tree. Protecting these trunks with cages will ensure that they will continue to grow.	**Photo 8.** Large fallen tree near nectar beds should be dropped and branches removed from site to reduce fuels.
	
Photo 9. Two cypresses planted in the open area of the SE corner of MGS. These trees may develop into cluster trees in a wind-sheltered area with dappled light. The horizontal spread of the branches of these trees must be considered and perhaps contained	**Photo 10.** SE corner. These eucalyptus trees were planted too densely in 2013 (3-5' apart) and are growing poorly and in poor shape. The well-spaced trees (10-15' apart) that were officially authorized in 2012 are much healthier and taller.
	

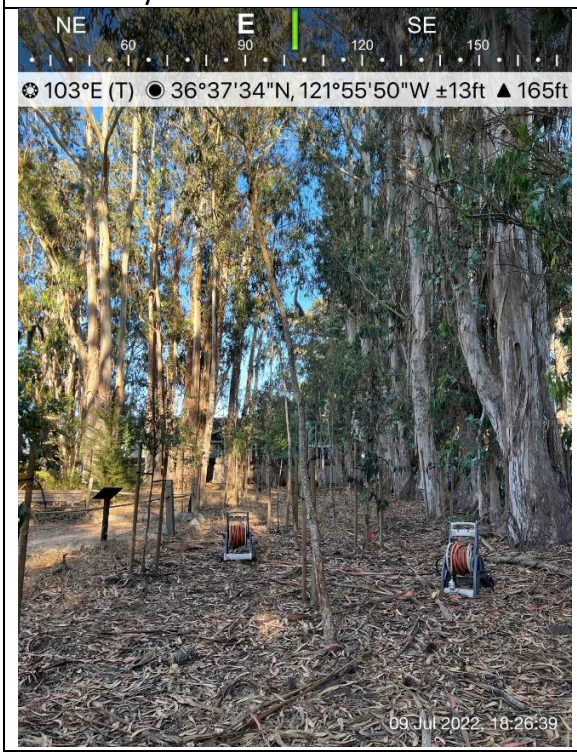
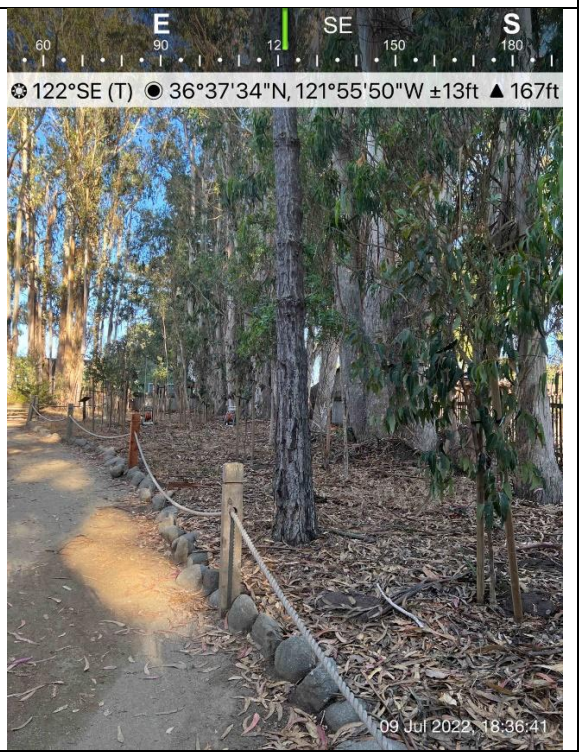
Photo 11. The NW-side of the eucalyptus windbreak planted in 1999. This mixed species shelterbelt provided critical NW wind protection for the interior of the grove where monarchs clustered in 2021-2022 (and other years).	**Photo 12**. Newly planted cypress (2020) east of nectar beds, part of a double row of trees planted to seal up this edge and protect the interior cluster zone.
	
Photo 13. Eucalyptus planted in 2012 at appropriate spacing (10-15') are now 30+ ft tall and are establishing a second row north of the main South Edge eucalyptus row. Monarchs have clustered on these trees early in the season.	**Photo 14.** Second row of eucalyptus planted in 2021, to fill in gaps in the southern boundary.
	

Photo 15. Group of cypress panted in mid-2000s, thinned in 2022 by removing two trees to allow for more rapid growth and health of remaining trees. Two additional trees were removed in 2024 and 2025. One more tree may be considered for removal. Wind shelter will not be compromised, and the remaining trees will fill in.	**Photo 16.** Pine saplings planted in interior. These new trees need to be cared for by initial caging and staking and irrigation for up to 2 years. Natural pine recruits should be encouraged, as they will develop robust natural root systems without irrigation.
	
Photo 17. Accumulated dead scales and branches low down on a cypress near the NW corner. Several trees have this accumulation, which act as ladder fuels and should be removed. The low height of these accumulations will not compromise wind shelter.	**Photo 18.** Fallen Prunus tree. Removla of this tree is recommended as it interferes with the trailand will not recover even if strightened out..
	

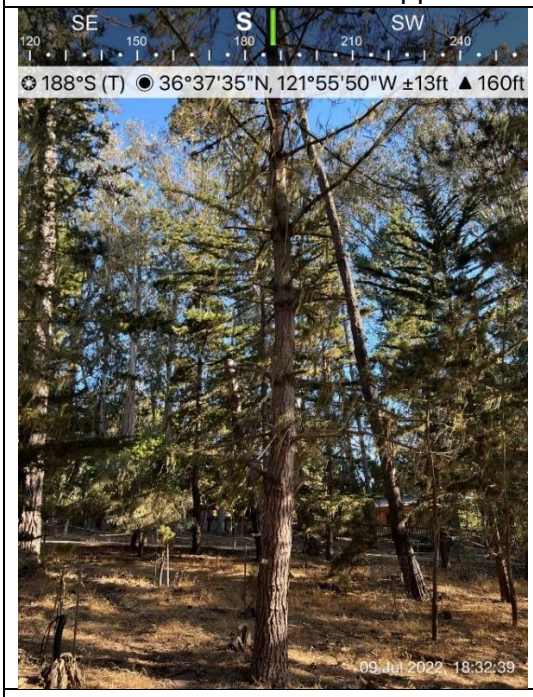
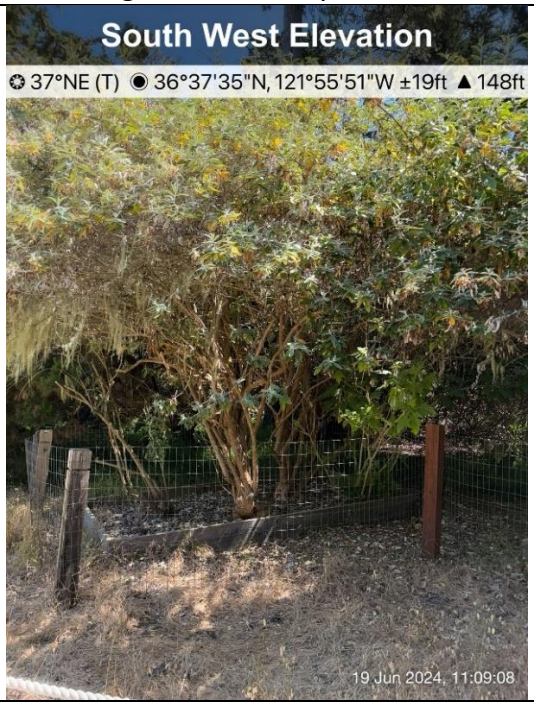
Photo 19. Nearly dead pine in interior. This relatively small tree does not threaten other trees and can be retained for now the lichen provides some wind shelter function and cluster opportunities	**Photo 20.** Healthy “volunteer” pine tree along main path. The last four years of good growing conditions have accelerated growth. Self-established pines adjust better than planted ones.
	
Photo 21 Typical unnecessary old stakes and collar. These have largely been removed.	**Photo 22.** Overly dense yellow butterfly bush in need of selective pruning. Removing the boxes may be considered.
	

Photo 23. Toyons in cages. Making cages larger in diameter can help avoid browsing on the tops of these shrubs and allow them to attain more tree-like heights.



Photo 24. Tree daisy in bloom in early-June. These shrubs should be monitored for flowering times, as they are important for monarchs in October and November.



Photo 25. Medium-sized healthy pine taken out by treefall, an example of why it is important to remove large standing dead trees.

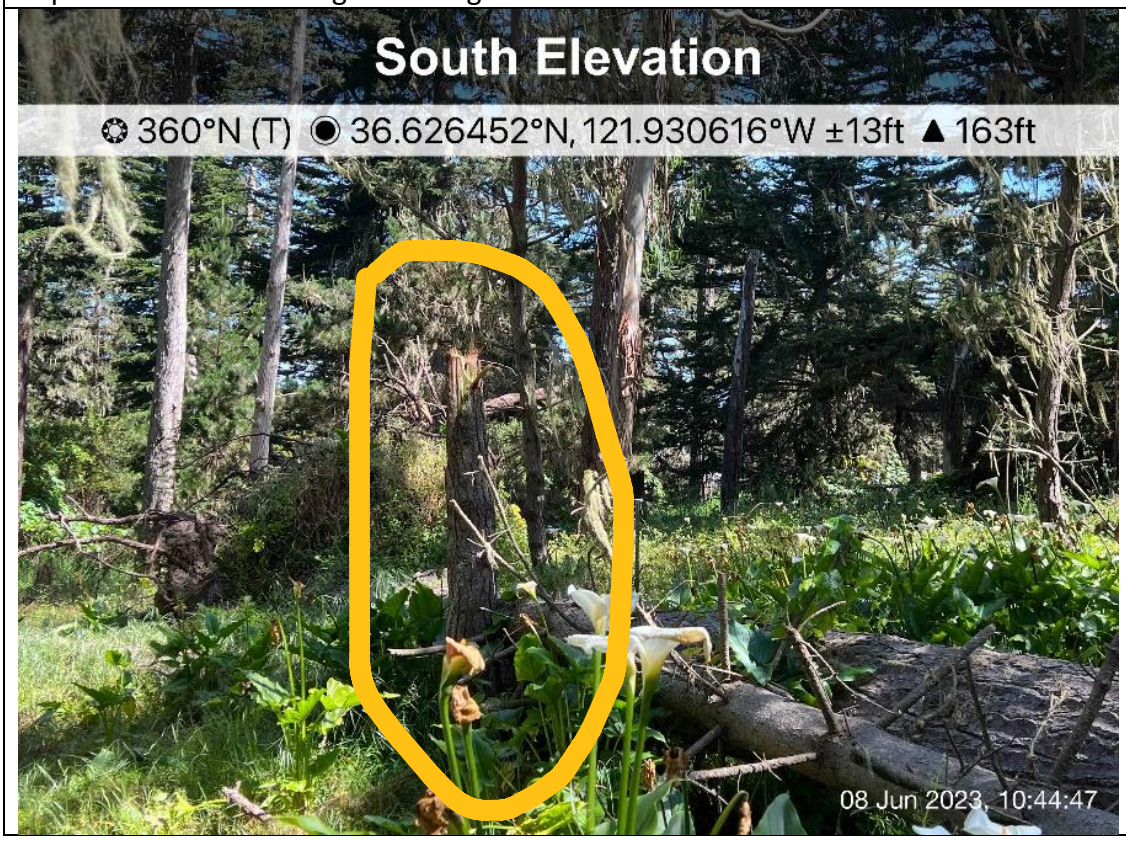


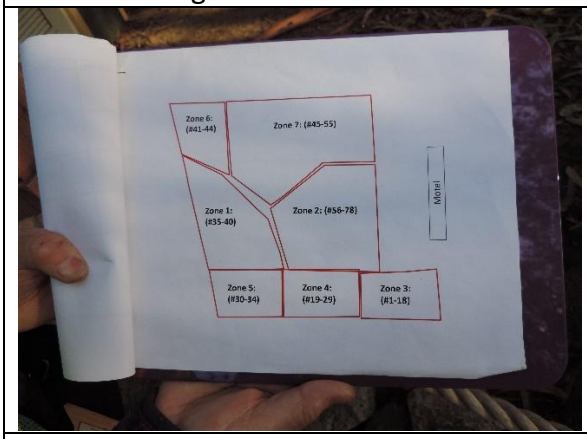
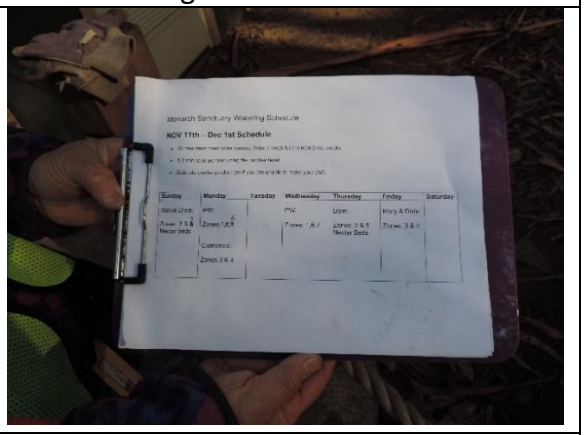
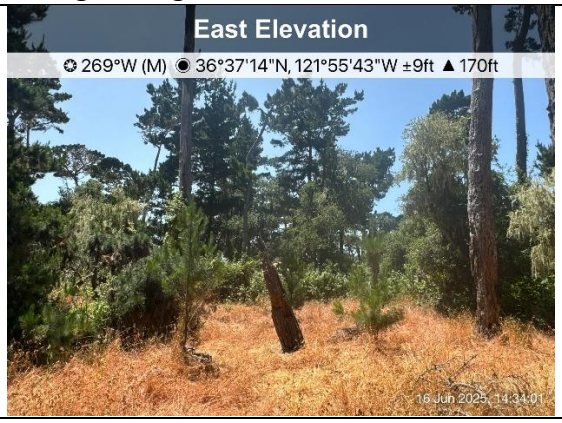
Photo 26. View into Interior cluster zone of pines. Maintaining some relatively open habitat with dappled light in this area is important for monarchs.	**Photo 27.** Cypress sapling near bend in the trail, with 1999 eucalyptus shelterbelt in background and relatively open interior to east.
	
Photo 28. Irrigation Zones	**Photo 29.** Irrigation documentation
	
Photo 30. Pine plantings in George Washington Park. Note the stakes and cages. Irrigation should be withdrawn unless there is another drought year	**Photo 31.** Pine plantings in George Washington Park. Note lack of cages/stakes as these pines grow into sapling stage. Four wet years have allowed for vigorous growth of trees.
	

Photo 32. Wide angle view of degraded forest canopy at George Washington Park. More trees will die in coming years. Large standing dead trees will continue to fall, leading to fuel accumulations and obstruction of trails. Developing a plan for GWP that accounts for ongoing tree senescence, recruitment, fuel accumulation, and eventual monarch habitat has been talked about for many years.



Photo 33. Fuel accumulationin GWP, posing a major fire hazard. Much fuel reduction work has been completed around the edges, along with removal of standing dead trees that could fall on the road or even houses.

