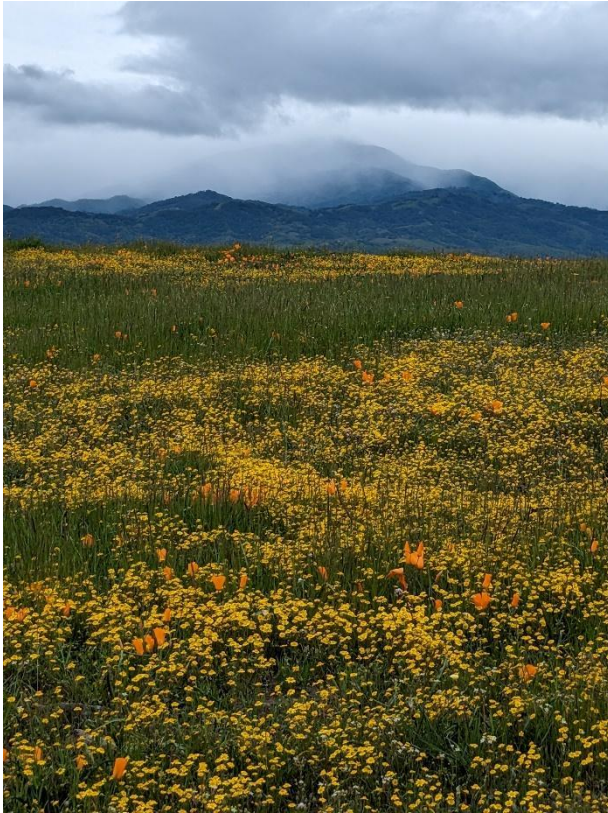


Máayyan 'Ooyákma

Coyote Ridge Open Space Preserve

BCB and Plant Species Composition Monitoring; Cover Plant Surveys

Annual Report 2024



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Executive Summary

Máyyan ‘Ooyákma Coyote Ridge Open Space Preserve (MOCR) is a 1,831-acre open space preserve in the Diablo Foothills, which contains over 1400 acres of modeled serpentine plant communities. The Santa Clara Valley Open Space Authority (SCVOSA) purchased the property in 2015. The Santa Clara Valley Habitat Agency (Habitat Agency) holds a conservation easement over 1,802 acres of MOCR. The conservation easement is enrolled in the Santa Clara Valley Habitat Conservation Plan/Natural Community Conservation Plan (Habitat Plan) Reserve System. According to SCVOSA (2015), “The Coyote Ridge property encompasses one of the most significant wildlife habitat areas in the Bay Area. Because it contains nearly a fifth of the remaining undeveloped serpentine grassland habitat in Santa Clara County, its lasting protection is vital to the recovery of serpentine-dependent species including the federally threatened Bay checkerspot butterfly and federally endangered Metcalf Canyon jewelflower. For this reason, it is one of the top priorities for protection necessary to implement the Santa Clara Valley Habitat Conservation Plan’s conservation strategy.”

Creekside Center for Earth Observation (DBA Creekside Science) was contracted by the Habitat Agency to conduct annual monitoring of Bay checkerspot butterfly (*Euphydryas editha bayensis*) and covered plants, including Santa Clara Valley dudleya (*Dudleya abramsii* ssp. *setchellii*), Coyote Ridge jewelflower (*Streptanthus albidus* ssp.), Loma Prieta hoita (*Hoita strobilina*), Mount Hamilton thistle (*Cirsium occidentale* var. *campylon*), and smooth lessingia (*Lessingia micradenia*).

Weather. Precipitation and temperature influence the reproductive success of Bay checkerspot butterfly and vegetation composition at MOCR. The previous weather year drives Bay checkerspot observations, and the current year drives vegetation composition.

2023: MOCR received 79.8 cm of precipitation (135% of average). Rainfall was particularly heavy in December, January, and March. Temperatures in March and April were below average. March 2023 was the coldest observed in the last nine years.

2024: The total precipitation at MOCR was 55.0 cm, which is just below average and significantly lower than rainfall received the prior year (2023). The 2024 precipitation year started out slowly with below-average rainfall in October and

November. December through May were about average or just below average precipitation, with the exception of February when above-average precipitation was received. Temperatures in March and April were below average (WestMap 2024).

Grazing regime. Cattle stocking rate data allow the correlation of grazing intensity with habitat conditions for target species. In the first rockfield, grazing intensity dropped slightly compared to the previous two years. In the second rockfield, the grazing regime was slightly higher than the previous two years.

Bay checkerspot butterfly. The Coyote Ridge complex, which extends from north of Metcalf Canyon to Anderson Dam, supports the core of the Bay checkerspot butterfly population in Santa Clara Valley (Coyote Ridge population). MOCR is part of the Coyote Ridge complex and usually supports a large proportion of the Coyote Ridge population. Postdiapause larval surveys conducted at MOCR in 2024 yielded a population estimate of ~3000 individuals, the lowest on record. The overall Coyote Ridge larval population rose slightly in 2024 (based strictly on a slight increase at the Kirby Canyon Butterfly Reserve). MOCR now represents approximately 2% of the 2024 Coyote Ridge population. These estimates do not include survey results from Richmond Ranch, which was not quantitatively monitored. (Creekside Science conducted reconnaissance monitoring in 2024 and has created monitoring plots to begin quantitative monitoring in 2025.) Normally we discuss population fluctuations in the context of metapopulation dynamics, because decades of data show BCB populations recovering from low points, and individual areas within suitable habitat fluctuating independently of the larger population. This is an important process on Coyote Ridge. However, another year of record low numbers at MOCR (as well as neighboring LTSCV and VTA properties) is concerning.

Adult survey results demonstrate that the Bay checkerspot butterfly is found throughout MOCR, albeit in historically low numbers. Three transects had their lowest encounter rates to date and this year was the first time a transect required two visits to establish occupancy.

Plant species composition. Regionally, cover of BCB host plants was low and nectar sources were low to moderate. *Plantago erecta* ranged from 0.6% to 1.9% cover. *Castilleja* spp. ranged from 0.2% to 1.2% cover. *Lasthenia californica* ranged from 0.03% to 4.4% cover. *Layia gaillardoides* ranged from 0% to 0.4% cover. *Allium serra* ranged from 0.03% to 0.05% cover. *Muilla maritima* ranged from 0.4% to 0.7% cover. Host plants and nectar sources appeared adequate to support the life cycle, however the connection between low host plant cover and low BCB numbers is difficult to ignore. BCB populations have stayed stable or increased with similarly low cover, but this does warrant continued monitoring. The effects of this year's weather and vegetation availability will be reflected in next year's larval monitoring numbers. Nonnative grass cover was variable across the site, ranging from 13.4% to 21.7%, and was observed to increase in cover additionally after our quantitative monitoring was complete. This happens especially in extended springs (like 2023 and 2024), when grasses continue to grow later in the season past the point when the early spring BCB host and nectar sources need to be monitored. Grazing pressure should be kept high to deal with increased biomass from the wet year.

Santa Clara Valley dudleya. Survey results show that this taxon is widespread and abundant on MOCR. Creekside Science estimated 113,800 rosettes within the study area; considerably higher than the baseline estimate of 66,900 (Creekside Science 2018). We believe the main cause of the increase was based on a more thorough search: our increased knowledge of the property, the ability to target a lot of the search effort using the baseline map, and a higher amount of personnel hours assigned to the task. It is also possible the population increased somewhat. This season we also installed six dudleya macroplots and collected baseline data. In a related effort, Santa Clara University and Creekside Science are partnering on the CVPCP grant "Ensuring Santa Clara Valley Dudleya Live Forever." Results from the genetic, pollination, seed dispersal, metapopulation dynamics, and propagation experiments are directly applicable

to ongoing Santa Clara Valley dudleya conservation on this property and throughout its range. Monitoring at the same time as other properties (VTA and LTSCV properties, 2026, 2031, etc.) makes comparisons more robust (i.e., if one property declines while the others increase, there may be a management issue, whereas if all properties decline, it is likely due to unfavorable weather).

Coyote Ridge jewelflower. The eight macroplots established and read in 2018 were monitored this year using the same methodology. Five plots increased, and three plots decreased. Years of monitoring on neighboring properties have shown that large interannual fluctuations are common. Monitoring at the same time as other properties (VTA and LTSCV properties, 2025, 2030, etc.) makes comparisons more robust. We suggest aligning the monitoring schedule on MOCR with other properties in the region that are monitored by Creekside Science. The mean colors in each macroplot did not significantly change over the three years. Based on findings from our Name that Jewelflower CDFW LAG grant, we recommend amending the Valley Habitat Plan to protect the four zones of Coyote Ridge jewelflowers and the evolutionary processes leading to their intermixing, rather than attempting to tease out which taxa are present in discrete occurrences. Likewise, we recommend collecting seed from each of the four zones to store at a Center for Plant Conservation certified botanic garden.

Loma Prieta hoita. Compared to visits in 2016, MOCR occurrence 1 increased from 11 to 32 individuals, and occurrence 2 increased from 265 to 650. More plants were found between the two previously mapped polygons at occurrence 2, so the polygons were merged and expanded. Seed collection did not take place because the only flowering plants located were producing aborted seeds.

Mount Hamilton thistle. Overall population showed significant declines with two of twenty plots unoccupied during 2024 surveys. Our 2017 baseline estimate was about 79,000 plants, which declined to nearly 34,000 in 2024. Years of drought combined with cattle trampling could explain the declines, and we recommend protective fencing at several locations. Monitoring on the same five year schedule (2027, 2032, etc.) as adjacent properties will greatly enhance the value of the data.

Smooth lessingia. Qualitatively, we confirm that plants are abundant and widespread, without identified threats.

Key recommendations. More recommendations are included within the text of this report, with key recommendations summarized here:

- Ongoing monitoring is recommended to inform management of covered taxa at MOCR. Bay checkerspot butterfly and associated vegetation monitoring are especially important as larval numbers hit record lows in 2024.
- Covered plants should be monitored on the same schedule as neighboring properties to increase value of the data (i.e., to differentiate between effects in management vs. interannual weather). The current schedule for neighboring parcels is Coyote Ridge jewelflower macroplots 2025, Santa Clara Valley dudleya 2026, Mount Hamilton thistle 2027, fragrant fritillary 2028, and Coyote Ridge jewelflower distribution mapping 2029, etc. every five years.
- Grazing pressure should be kept high to address increased biomass from the wet spring. Plants that may be negatively impacted by high grazing pressure, i.e., Mount Hamilton thistle, should be protected (see below).
- Continue the Envoy Plus graminicide spraying experiment. SCVHA and OSA should lobby the Santa Clara County Agricultural commissioner to remove regulatory hurdles required to continue this experiment.
- Amend the Habitat Plan to incorporate findings from “Name that Jewelflower.” Both jewelflower taxa are found on Coyote Ridge, at varying color frequencies. Rather than teasing out which taxa are present in discrete

occurrences, and setting conservation objectives based on the two taxa, the Plan should protect the four zones of Coyote Ridge jewelflowers and the evolutionary processes leading to their intermixing.

- Collect seed from each of the four zones to store at a Center for Plant Conservation certified botanic garden.
- Annually repeat Loma Prieta hoita surveys and seed collection efforts. Consider collecting cuttings/rhizomes for propagation, or investigating whether inbreeding depression is causing the aborted fruits observed.
- To protect Mount Hamilton thistle, experimentally fence areas around plots 2, 13, 18, and 20. Consider active seeding/transplanting in areas that are unoccupied and don't have nearby donor material for passive recruitment (i.e., plot 1).

Weather and Climate

Interannual changes in California annual grassland habitats tend to be driven by climatic variation (D'Antonio et al. 2006). Weather patterns can be a more important driver of habitat quality than management. As such, it is important to consider weather patterns and climactic conditions when evaluating Bay checkerspot butterfly and covered plant populations.

Data are presented for the Kirby Canyon Butterfly Reserve, located on Coyote Ridge about 1600 m south of MOCR. From 1981 to 2010 (which we will consider a baseline), they show average precipitation at 58.9 cm, with a standard deviation of 22.5 cm. Each weather year runs from October 1 to September 30. Total precipitation in 2024 was just below average at 55.0 cm (WestMap 2024) (Figure 1).

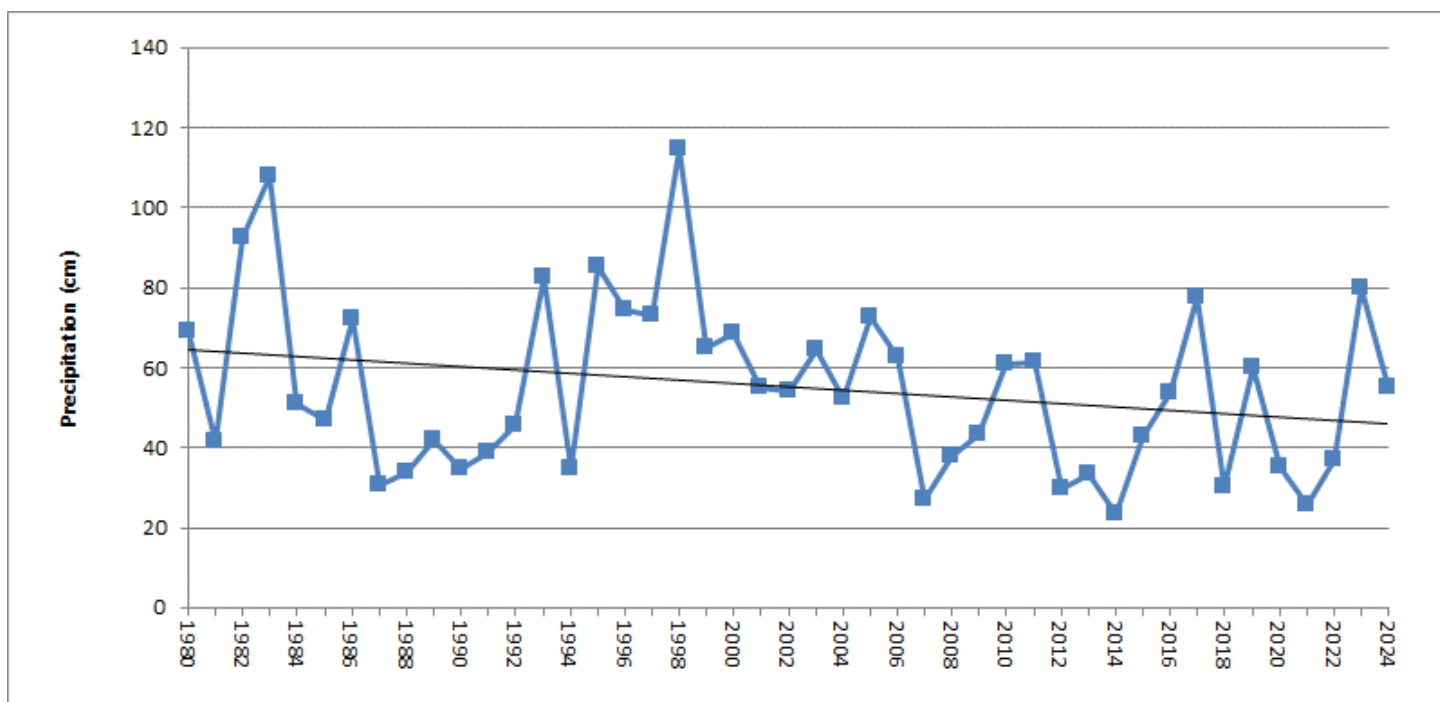


Figure 1. Annual precipitation at Kirby Canyon (WestMap 2024, 2023, 2022, 2021, 2020, 2019, 2018), with trendline

Perhaps more important than total precipitation is the pattern of precipitation, which also varies widely. Similar amounts of rainfall have different effects on Bay checkerspot butterflies and associated vegetation depending on when

it occurs. For example, early rains are usually beneficial as germination events induce Bay checkerspots to emerge from diapause, while heavy rains during the flight season could limit reproductive success.

Monthly patterns for 2023 and 2024 are shown in Figures 2-3. Two years are shown because the previous year drives Bay checkerspot patterns, and the current year drives vegetation patterns.

The 2023 water year was wet, with 79.6 cm or 135% average precipitation. Rainfall was especially heavy in December (17.8 cm), January (28.6 cm) and March (18.0 cm) (Figure 2).

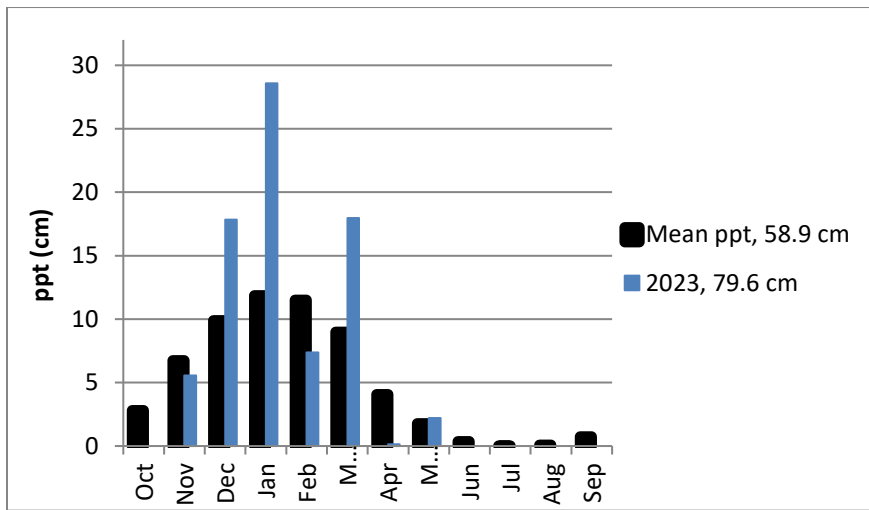


Figure 2. 2023 precipitation compared with average (WestMap 2023)

The 2024 water year was just below average at 55.0 cm (94%). While most people’s impressions were of a wet year, the slow start in October and November (and early December) kept the yearly total below average. December 2023 (9.1 cm) and January 2024 (10.6 cm) were just below average, and February was well above average with 17 cm. March was slightly above average at 9.9 cm. Significant rainfall (2.0 cm) continued into May 2024.

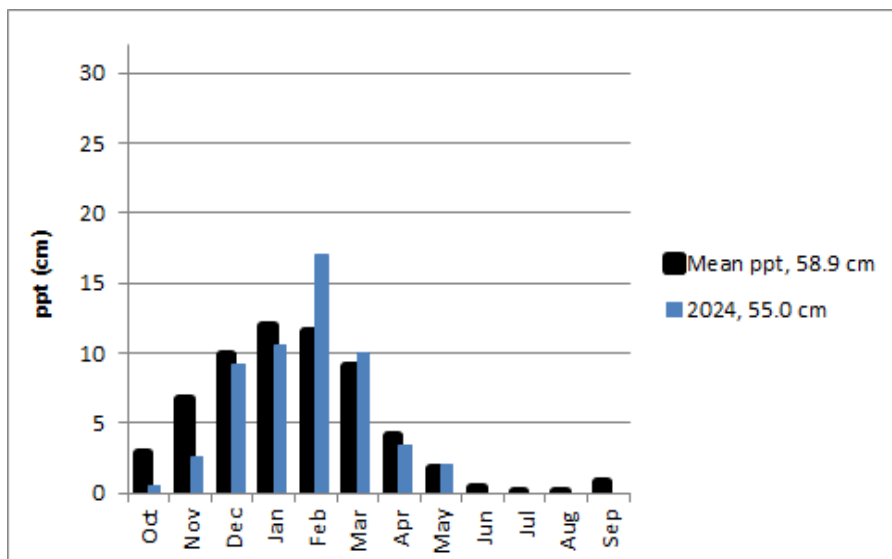


Figure 3. 2024 precipitation compared with average (WestMap 2024)

Temperature also influences Bay checkerspot host plant availability. Cool springs extend the availability of host plants, greatly increasing the likelihood that prediapause larvae get large enough to enter diapause before their host plants dry up and they starve to death. This is the largest source of mortality in Bay checkerspots. Temperatures in March and April 2023 were below average. March 2023 was the coldest in the last nine years (Table 1). Below average temperatures extended the growing season and should have reduced prediapause larval mortality in 2023, leading to higher larval Bay checkerspot butterfly numbers in 2024.

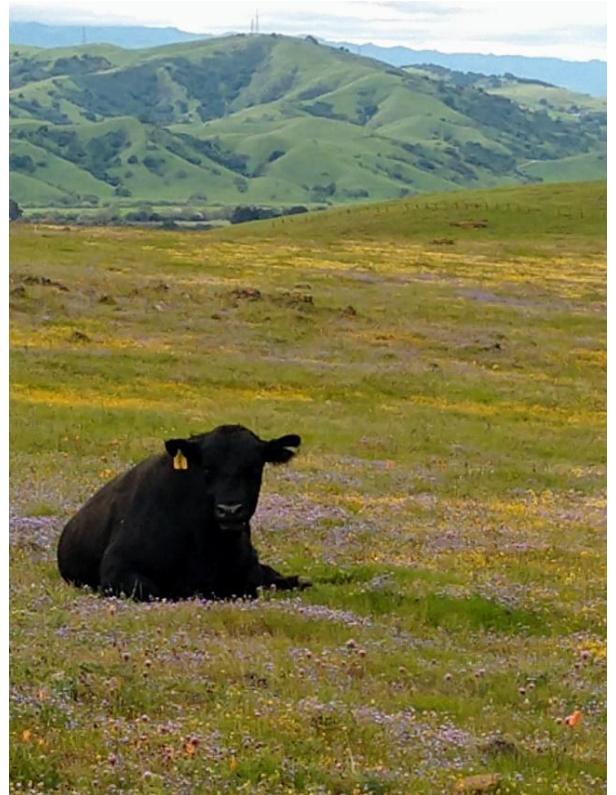
The cool spring temperatures continued in 2024, which could be key factors in any BCB recovery in 2025. Note that 2024 temperatures are relevant only to 2025 larval numbers and are presented here to inform larval predictions.

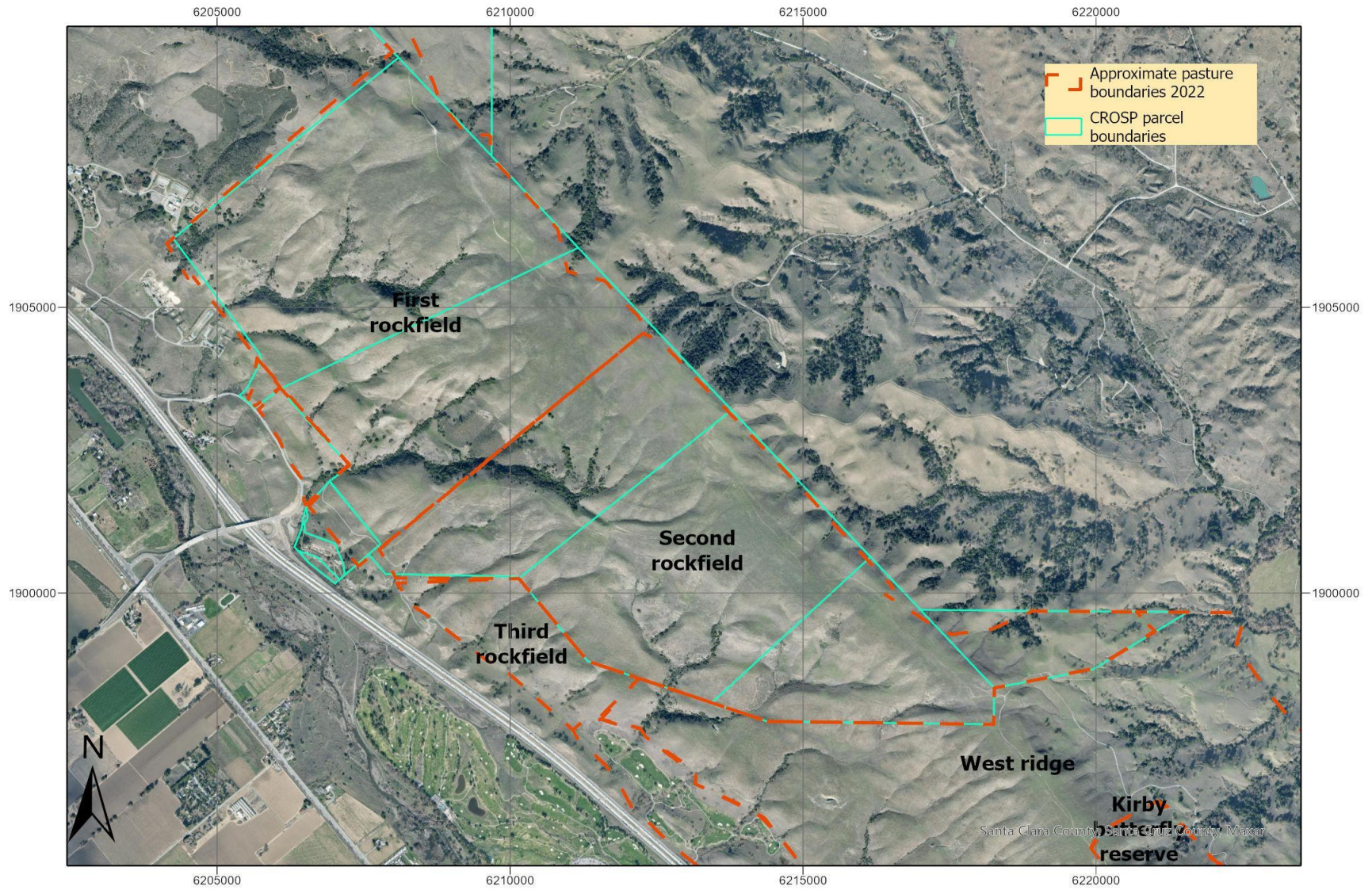
	March	April
2015	21.9	19.9
2016	18.5	20.7
2017	18.8	19.1
2018	16.5	20.2
2019	16.3	21.4
2020	16.1	20.3
2021	16.8	21.0
2022	20.3	21.1
2023	14.4	20.1
2024	16.2	20.1
Average 1981-2010	18.2	20.6

Table 1. Coyote Ridge maximum temperatures (°C) compared with average (WestMap 2024, 2023, 2022, 2021, 2020, 2019, 2018)

Grazing Regime

Tracking cattle stocking rates on MOCR is necessary to correlate grazing intensity with observed habitat conditions. SCVOSA completed a fence realignment project in early 2022, aligning fences with property boundaries (Map 1). MOCR is broken into two main pastures each larger than 800 acres (Table 2). Justin Fields is the livestock operator for these pastures, referred to as the first and second rockfields. Both pastures are now entirely on MOCR. Stocking rates for the two pastures are shown in Tables 3-4. Longer-term data can be accessed for the second rockfield and the west ridge for historical context in the baseline report.





Map 1. New MOCR pasture boundaries more closely reflect property lines

Pasture	Total acres	Previous acreage
First rockfield	834	840
Second rockfield	822	810

Table 2. Total pasture acreage

Year	Regime
2016	57 cow/calf pairs from Feb. 19 to May 24; 113 dry cows June 15 to Aug. 8.; 93 dry cows Aug. 9 to Sep. 30
2017	38 cow/calf pairs Mar. 10 to May 10; 99 dry cows June 17 to Sep. 1
2018	99 cow/calf pairs April 1 to May 1; 102 dry cows June 1- Sep. 1
2019	102 cow/calf pairs April 1 to May 9; 93 dry cows June 24 to Sep. 15
2020	91 cow/calf pairs April 1 to May 8; 92 dry cows June 2 to Oct. 1; 46 dry cows Oct. 1 to Dec. 1
2021	89 cow/calf pairs May 23 to Sep. 15
2022	88 cow/calf pairs March 1-April 18; 75 dry cows April 22-June 20; 84 dry cows June 22-Aug. 25
2023	103 dry cows June 4-July 16, 53 cow/calf pairs July 16-Oct. 8
2024	89 cow calf/pairs June 20-Oct. 8

Table 3. First rockfield stocking rates

In the first rockfield, numbers in 2024 were more similar to 2021-2022.

Year	Regime
2016	69 cow/calf pairs from Feb. 25 to May 26. 93 dry cows Sep. 30 to Nov. 30
2017	87 cow/calf pairs from March 10 to May 10; 99 dry cows Sep. 1 to ~Nov. 30
2018	99 cow/calf pairs Feb. 1 to April 1; 102 pairs Sep. 1 to Nov. 1
2019	102 cow/calf pairs Feb. 8 to April 1; 91 pairs Sep. 5 to Nov. 25
2020	91 cow/calf pairs Feb. 3 to April 1; 45 dry cows Oct. 1 to Dec. 1
2021	92 cow/calf pairs Feb. 15 to April 28; dry 89 cows Sep. 15 to Oct. 31
2022	84 dry cows Aug. 25-Nov. 1
2023	83 cow/calf pairs Mar. 1-May 16, 91 cow/calf pairs Oct. 11-Nov. 21
2024	91 cow/calf pairs Mar. 1-April 23; 89 cow/calf pairs Oct. 8-present

Table 4. Second rockfield stocking rates

The grazing regime in the second rockfield in 2024 was slightly higher than the previous two years.

Bay Checkerspot Butterfly

The Bay checkerspot butterfly (*Euphydryas editha bayensis*) is a federally threatened subspecies. A member of the family Nymphalidae, it is a medium-sized butterfly with a wingspan of about 5 cm. The wings have black bands with orange and white spots. It is an annual, univoltine taxon (USFWS 1998). It is closely associated with serpentine grasslands, which support its larval food plants (dwarf plantain and owl's clover) and various adult nectar sources. The grazing program at MOCR is intended to manage the serpentine grasslands on the property specifically for the benefit of this species and for rare, serpentine-associated plants. Bay checkerspot numbers are naturally prone to large fluctuations. Per the Habitat

Plan, the baseline will consist of an average of the first five years (but additional years if determined necessary by the qualified biologist, see Appendix D, *Monitoring Protocols*, Section D.3.1, *Bay Checkerspot Butterfly*) of annual monitoring data for Bay checkerspot butterfly host and nectar plants and postdiapause larvae and adult butterflies. The baseline may also incorporate existing data to reduce overlap in the survey efforts for efficiency.

Larval survey records on MOCR go back intermittently into the 1990s. Surveys have been performed annually since 2008, so there is a 10-year baseline that includes population fluctuations. Survey methods employed by Creekside Science have been peer-reviewed and provide statistically rigorous population estimation. Population time series are by necessity plotted on a logarithmic scale, the natural scale for multiplicative processes like population growth and decline (Hastings 2013).

Adult surveys are discussed below and are used to establish occupancy when larval densities are too low to reliably detect larvae using standard, stratified methods. That said, larval densities don't always match adult densities due to large variation in larval mortality from year to year. Weather can also affect the length of larval or adult flight seasons within a given season. For this reason, the adult surveys are quite useful in understanding population trends.

Methods

Postdiapause larvae

The basic method of population estimation is timed counts of larvae in a stratified sampling design (Murphy and Weiss 1988, Weiss 1996). The habitat is stratified into thermal strata based on March 21 insolation values calculated in GIS. The 5 strata are: Very Warm (>18 MJ/m²), Warm (16.50-18), Moderate (15 -16.49), Cool (13-14.99), and Very Cool (<13).

Larvae are counted in 10 person-minute intervals over irregularly shaped sample areas (0.25-1 ha) corresponding to patches of relatively uniform insolation, and the counts are converted into density by the equation:

$$\ln(\text{density}) = -4.33 + 0.88 * \ln(\text{count}), n = 13, r^2 = 0.85 \text{ (Weiss 1996)}$$

Generally, a 10 person-minute timer is set while observers search for the first larva. When the first is found (or the timer runs out), the official 10 person-minute timer begins. This creates almost double the search time when larvae are present at low densities. Factors can lead observers to abandon the first timed interval and use the official 10 person-minute timer only. These factors can include no larval detections across the landscape (doubling search time), no larval detections in specific topoclimates (i.e., very warm and warm plots tend to be occupied mostly in high density years), and weather conditions that limit search timing (i.e., lots of rainy and/or cloudy weather during the search months).

Larval plots are distributed across the landscape and grouped into "population zones" in which average densities and absolute numbers are estimated. These correspond to natural breaks in the landscape, modified locally by property lines for regulatory purposes. If no larvae are found in a population zone, then surveys for adults are conducted to establish presence or absence.



95% confidence intervals on the mean density in each population zone were calculated from methods referenced in Weiss 1996. If low counts caused the symmetrical lower confidence interval to drop below 0, the interval was calculated using a general linear model using a Poisson distribution in JMP 14.

A total of 71 plots were sampled across MOCR in 2024 (one very warm plot was not surveyed this year). Due to the low density of larvae regionally (especially on the warmer slopes) and the high number of rainy/cloudy days, one very warm and ten warm slopes were searched only with the official ten person-minute timer.

Appropriate survey timing is necessary to ensure postdiapause larvae are large enough to be detected but have not entered the pupation phase. Proper timing is determined by tracking germination on mesoclimatic and topoclimatic scales following the first rains after the dry season. First germinating rains often occur between November and December but can occur as early as October and as late as February. Two to three weeks after significant germination occurs, we begin looking for larvae throughout the habitat, often revisiting sites every 7 to 14 days. We begin surveying when most larvae on the warm and moderate slopes are in the 6th instar. Larval development rates vary based on weather conditions: cloudy and cool weather prolongs development, while stretches of sunny and warm weather accelerate development. Larval development on various topoclimates and aspects is assessed throughout the survey season. Larval phenology can vary on larger spatial scales throughout the BCB range. In the wet season of 2023-2024, germination didn't begin in earnest until well into December. We monitored larval development from December through February. This year MOCR plots were surveyed from February 28 to March 26 while we paid close attention to differential temporal development along topoclimatic scales.

The MOCR property is divided into multiple population zones (Map 2). Most larval plots are in MOCR North, South, and Border. Forty-nine plots are within those three population zones (Table 5). These zones are aligned with historical population estimates. Confidence intervals have been calculated, and provide continuous time series back to 2008, and discontinuous series ranging back into the 1990s. Additional areas where population estimates are calculated include the Kirby Canyon Butterfly Reserve, Young Ranch, and four zones on VTA. Reports that include these estimates and time series can be provided upon request.

The remaining 23 plots are located outside population zones. At this point, we have not been given the resources to add enough evenly stratified plots to integrate these plots into population estimate. However, the fluctuations of raw data among these more widely distributed plots are informative. Furthermore, note that some additional plots straddle boundaries with LTSCV and VTA parcels. These sites establish breeding occupancy, and a local density estimate for the plots, but an integrated population density is not feasible across these areas because of low sample sizes. Annual overall occupancy of the plots sampled each year is reported for the 2008-2024 period.

Zone	MOCR North	MOCR South	MOCR Border	Other	Total
# Plots	20	19	10	23	72

Table 5. Larval plots per population zone

Adults

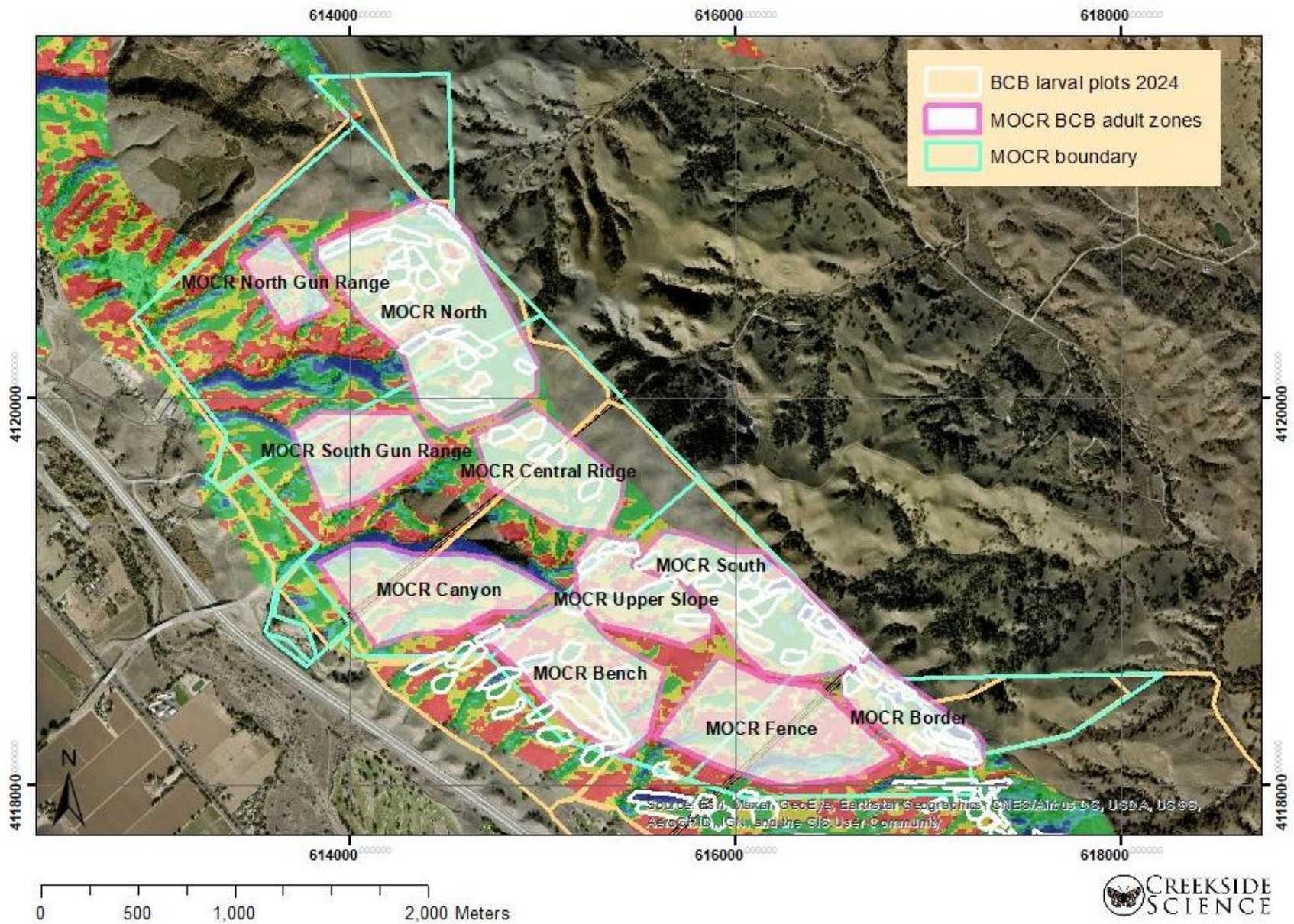
Adult monitoring provides supplemental distribution data and contributes to predictions for the following year's populations. Adult surveys are conducted if no larvae are found in any of the six BCB zones that contain larval plots in Map 2. Observers do not walk a set transect in these zones, but use best professional judgment to locate BCB at the time of the survey.

Adult surveys are also conducted in the four additional zones that don't have larval plots. Adult surveys are conducted in established transects that include topoclimatic variation with a focus on north-facing slopes and hilltops where adults are most abundant.

No larvae were observed in the MOCR Central Ridge Zone and Upper Slope Zone in 2024. Adult surveys were conducted to establish occupancy in those zones and the four zones that do not contain larval plots.

Adult transects are surveyed during peak flight season, on sufficiently warm (65°F +) and preferably sunny days (less than ~50% cloud cover) with winds less than 15 mph. When surveying to establish occupancy (as opposed to abundance), sufficiently high temperature and low wind speed are more important than cloud cover. BCB do fly on warm, calm days, even when it is cloudy. Transects are visited up to three times if no adults are encountered. A Creekside Science biologist walks the transects with a pace of approximately 50 meters/90 seconds, recording adult BCB observations within ~5 meters of the transect. GPS coordinates are collected for each adult BCB observed within 5 meters of the transect. Once the transect loop is completed, the total walking time is recorded to obtain encounter rates (butterflies per hour).

Adult surveys on MOCR were performed on April 9, 17, and 30, 2024. Temperatures were 65-70°F each day. Winds ranged from 5-10 mph on April 9, 0-5 mph on April 17, and 15-20 mph on April 30.



Map 2. Larval population zones on MOCR with four additional adult monitoring zones in areas without larval plots

Results

Postdiapause larvae

The number of larvae found per 10-minute search in 2024 is shown in Maps 3-4. In 2024, 43 of 49 plots in larval zones along the ridgetop were unoccupied (compared with 37 in both 2022 and 2023, two in 2021, zero in 2020, six in 2019, and 13 in 2018). The mid elevations were unoccupied, and the low MOCR Bench had one larva.

Defined population zones

As documented in the methods section, the Poisson method was used in these three cases due to low counts that caused the symmetrical lower confidence interval to drop below 0.

At MOCR North, 5 larvae were found in plots, yielding a population estimate of 690 (245-1475). This is the lowest estimate on record. The 2023 estimate was slightly higher at 1100 (500-1900), similar to the 2022 estimate of 1500 (930-2355). This zone has historically had some of the highest larval densities on Coyote Ridge, with a peak estimate of $740,000 \pm 280,000$ in 2015 (Figure 4a) and has dipped to as low as $\sim 5,000$ larvae in 1993 and 2010 (Table 6).

At MOCR South, 10 larvae were found (in one plot) this year, yielding a population estimate of 130 (7-568). In 2023, there was an estimated 260 (4-700). None were found in 2022, although adults were found later in the season thus demonstrating occupancy. The peak estimate in this zone was $98,000 \pm 30,000$ in 2015 (Figure 4b), and the previous lowest estimates were $1,700 \pm 1,000$ larvae in 1997, and $5,000 \pm 2,600$ in 2011 (Table 6).

At MOCR Border, 7 larvae were found in plots, yielding a population estimate of 2150 (920-4150). This is slightly lower than the 2023 estimate of 2,600 larvae (1400-4300), which was lower than the 2022 estimate of $10,300 \pm 8300$. Even with these low numbers, this has been the larval zone with the highest larval population from 2022-2024. The peak estimates in this zone were $137,000 \pm 85,000$ in 2003, and $118,000 \pm 68,000$ in 2015 (Figure 4c) – the difference is not statistically significant. The lowest previous estimate in MOCR border was $2,800 \pm 1,800$ larvae in 2010 (Table 6).

The total number of larvae within the three defined population zones across the MOCR property decreased to 3000 ± 1700 in 2024, slightly down from 3900 ± 2500 in 2023. This is down from 2022's $11,800 \pm 8600$, which was the previous low. The 2024 estimate is down more than tenfold from $112,000 \pm 47,000$ in 2021, and $182,000 \pm 58,000$ in 2020. For context, the highest estimate on record was $950,000 \pm 310,000$ in 2015 (Table 6).

	MOCR North	MOCR South	MOCR Border	Overall	Trend
2008	42,000 ± 31,000	11,000 ± 8,200	5,500 ± 3,459	58,000 ± 33,000	n/a
2009	32,000 ± 19,000	15,000 ± 7,400	10,000 ± 7817	52,000 ± 22,000	Stable
2010	4,400 ± 4000	12,000 ± 8,200	2,800 ± 1,800	16,000 ± 6,600	Decrease
2011	48,000 ± 37,000	5,000 ± 2,600	2,900 ± 3,200	56,000 ± 37,000	Increase
2012	110,000 ± 55,000	11,000 ± 5,600	7,900 ± 4,400	130,000 ± 56,000	Increase
2013	230,000 ± 83,000	28,000 ± 15,000	93,000 ± 73,000	350,000 ± 130,000	Increase
2014	330,000 ± 158,000	69,000 ± 37,000	46,000 ± 3,1000	440,000 ± 170,000	Stable
2015	740,000 ± 280,000	98,000 ± 30,000	118,000 ± 68,000	950,000 ± 310,000	Increase
2016	151,000 ± 81,000	30,000 ± 14,000	10,000 ± 7,000	200,000 ± 82,000	Decrease
2017	59,000 ± 36,000	6,000 ± 2,000	3,310 (650-16,711)*	70,000 ± 36,000	Decrease
2018	47,000 ± 42,000	10,000 ± 6,000	7,800 (2,900-21,000)*	62,000 ± 43,000	Stable
2019	200,000 ± 125,000	95,000 ± 56,000	11,000 (5,000-25,000)*	307,000 ± 138,000	Increase
2020	88,000 ± 53,000	67,000 ± 18,000	28,000 ± 14,000	182,000 ± 58,000	Decrease
2021	61,000 ± 43,000	15,000 ± 7,000	35,600 ± 17,600	112,000 ± 47,000	Decrease
2022	1500 (930-2,355)*	present	10,300 ± 8300	11,800 ± 8,600	Decrease
2023	1100 (500-1,900)*	260 (4-700)*	2600 (1400-4,300)*	3,900 ± 2,500	Decrease
2024	690 (245-1475)*	130 (7-568)*	2150 (920-4,150)*	3,000 ± 1,700	Decrease

*an asymmetric CI using a Poisson approximation because of low numbers

Table 6. Integrated BCB larval population estimate by Defined Population Zone

Overall occupancy trends are shown in Table 7.

Year	MOCR North	MOCR South	MOCR Border	Overall (sum of three zones)	Overall Occupancy Trend
2008	100% 14/14 Occupied	79% 11/14 Occupied	55% 5/9 Occupied	81% 30/37 Occupied	n/a
2009	100% 17/17 Occupied	82% 14/17 Occupied	90% 9/10 Occupied	91% 40/44 Occupied	Increase
2010	50% 7/14 Occupied	71% 12/17 Occupied	55% 5/9 Occupied	60% 24/40 Occupied	Decrease
2011	96% 19/20 Occupied	79% 15/19 Occupied	50% 5/10 Occupied	80% 39/49 Occupied	Increase
2012	100% 20/20 Occupied	84% 16/19 Occupied	80% 8/10 Occupied	90% 44/49 Occupied	Increase
2013	100% 20/20 Occupied	100% 19/19 Occupied	100% 10/10 Occupied	98% 48/49 Occupied	Increase
2014	100% 20/20 Occupied	89% 17/19 Occupied	100% 10/10 Occupied	96% 47/49 Occupied	Decrease
2015	100% 20/20 Occupied	100% 19/19 Occupied	100% 10/10 Occupied	100% 49/49 Occupied	Increase
2016	100% 20/20 Occupied	100% 19/19 Occupied	70% 7/10 Occupied	92% 45/49 Occupied	Decrease
2017	100% 20/20 Occupied	84% 16/19 Occupied	70% 7/10 Occupied	86% 42/49 Occupied	Decrease
2018	95% 19/20 Occupied	84% 16/19 Occupied	30% 3/10 Occupied	78% 38/49 Occupied	Decrease
2019	100% 20/20 Occupied	89% 17/19 Occupied	60% 6/10 Occupied	88% 43/49 Occupied	Increase
2020	100% 20/20 Occupied	100% 19/19 Occupied	100% 10/10 Occupied	100% 49/49 Occupied	Increase
2021	100% 20/20 Occupied	95% 18/19 Occupied	90% 9/10 Occupied	96% 47/49 Occupied	Decrease
2022	20% 4/20 Occupied	0% 0/19 Occupied	80% 8/10 Occupied	24% 12/49 Occupied	Decrease
2023	25% 5/20 Occupied	11% 2/19 Occupied	50% 5/10 Occupied	24% 12/49 Occupied	Stable
2024	10% 2/20 Occupied	5% 1/19 Occupied	30% 3/10 Occupied	12% 6/49 Occupied	Decrease

Table 7. Percent of surveyed BCB larval plots occupied

Outside defined population zones – 2016-2024

Creekside Science calculates population estimates for the three larval zones discussed above because they represent the highest quality BCB habitat on MOCR. There are also larval plots in areas outside the defined population zones. While we haven't calculated population estimates in these zones, we can offer raw numbers of observed larvae to demonstrate how those numbers change over time (Table 8). An integrated population density is not feasible across these areas because of low sample sizes, but the large changes in raw numbers clearly illuminate change.

	Total larvae found in 5 plots of MOCR Central Ridge	Total larvae found in 6 plots of MOCR Upper Slopes	Total larvae found in 12 plots of MOCR Bench
2016	298	106	24
2017	136	17	9
2018	107	49	28
2019	554	131	84
2020	165	263	149
2021	96	85	109
2022	1	3	0
2023	0*	0	0
2024	0*	0	1

Table 8. BCB larval observations outside defined population zones over time

*An adult was observed April 14, 2023 and April 9, 2024, establishing occupancy.

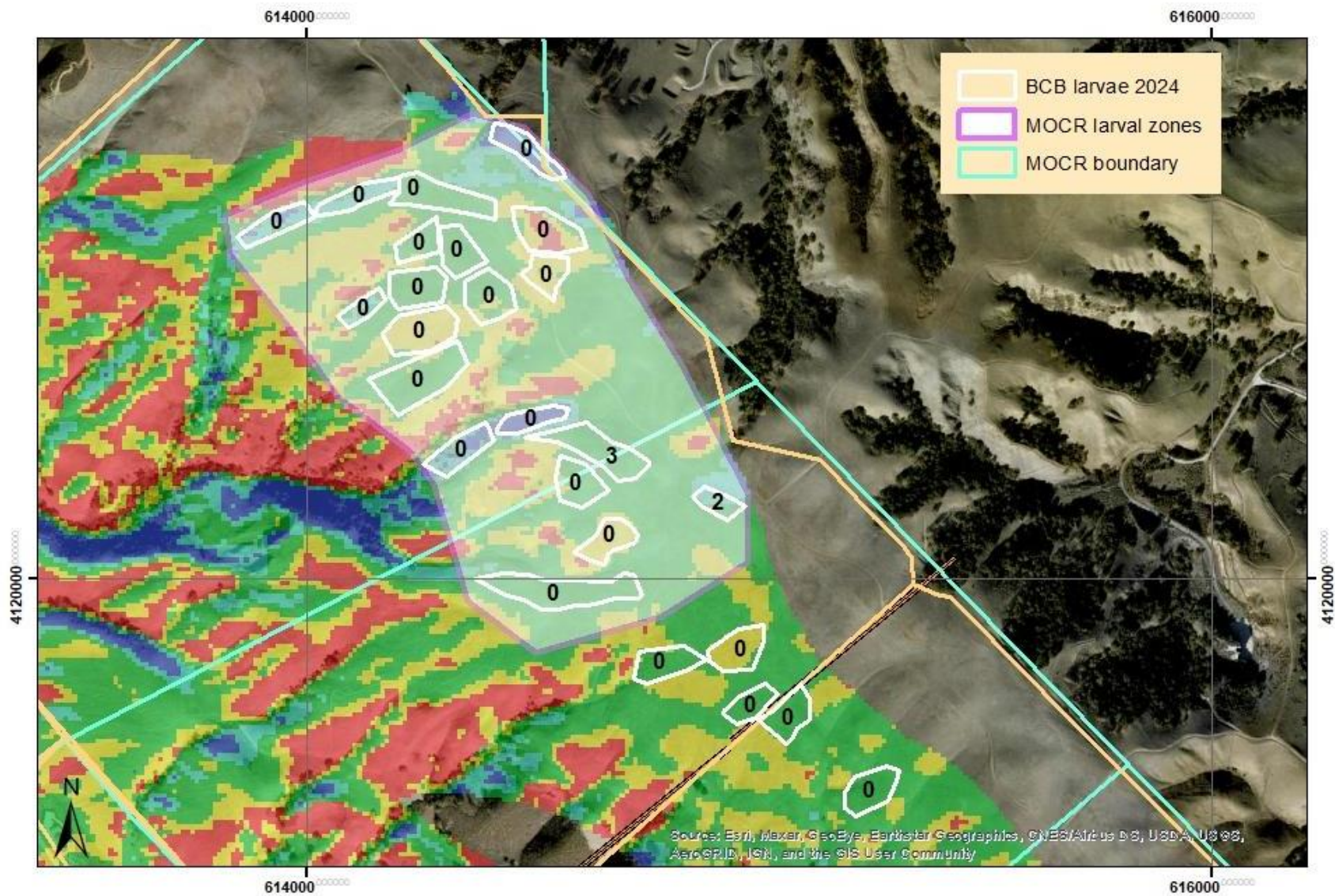
No larvae were observed at MOCR Central Ridge in 2023 or 2024. One adult each year was found in a subsequent search on April 14, 2023 and April 9, 2024, establishing occupancy. No larvae were found at MOCR Upper Slopes in 2023 or 2024, and no adults were found in two subsequent searches on April 14 and 25, 2023; and April 9, 17, and 30, 2024. One larva was found at MOCR Bench in 2024. No larvae were found at MOCR Bench in 2022 and 2023. No adults were found in a subsequent search on April 14, 2023. In 2022, adults were found within 100 m at the adjacent LTSCV parcels, indicating local presence in the low hundreds.

The remainder of MOCR was not surveyed for larvae, and adult surveys took place instead.

Occupancy trends outside the defined population zones are shown in Table 9.

Year	MOCR Outside Zones	Overall Occupancy Trend
2008	60% 6/10 Occupied	n/a
2009	44% 7/16 Occupied	Stable
2010	18% 2/11 Occupied	Decrease
2011	33% 6/18 Occupied	Increase
2012	50% 9/18 Occupied	Increase
2013	75% 15/20 Occupied	Increase
2014	90% 18/20 Occupied	Increase
2015	90% 19/21 Occupied	Stable
2016	75% 15/20 Occupied	Decrease
2017	62% 13/21 Occupied	Decrease
2018	62% 13/21 Occupied	Stable
2019	81% 17/21 Occupied	Increase
2020	87% 20/23 Occupied	Increase
2021	96% 22/23 Occupied	Increase
2022	30% 7/23 Occupied	Decrease
2023	0% 0/23 Occupied	Decrease
2024	4% 1/23 Occupied	Stable

Table 9. Percent of surveyed plots occupied by BCB larvae



Map 3. Larval counts (# per 10 person-minutes) at MOCR North in 2024

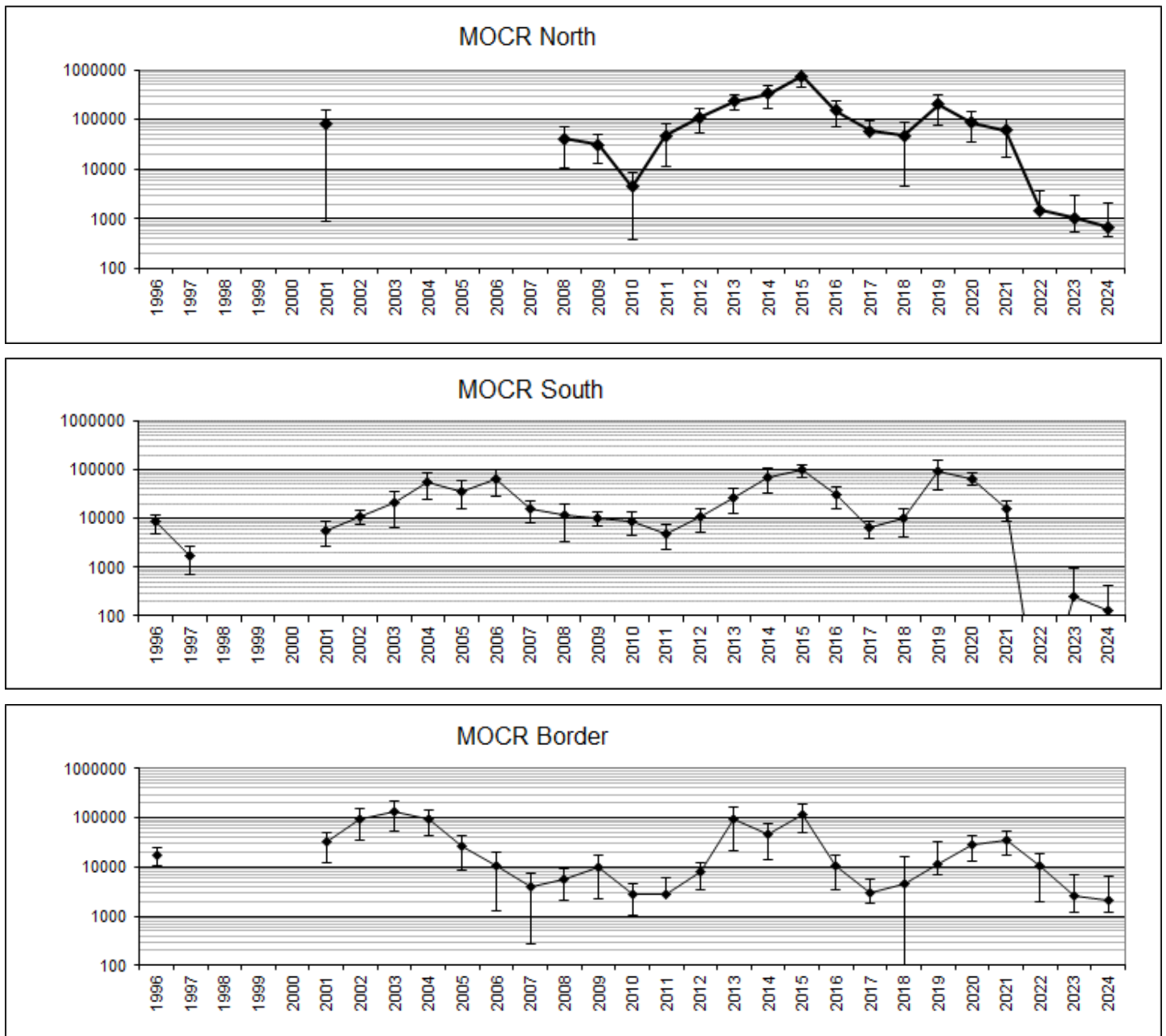


Figure 4a-c. Bay checkerspot population history on MOCR, ± 95% CI

Adults

The number of adult BCB observed per transect is shown in Table 10. Note this is the first year a second visit was required to establish occupancy on a transect. MOCR Canyon was the only transect with multiple adults, and only two were observed. The encounter rates at three transects were the lowest recorded (Table 11). This was not unexpected given low larval observations in the general vicinity.

The location of each of these sightings is provided in Maps 5-9. Observers walk the transect mapped with a green line.

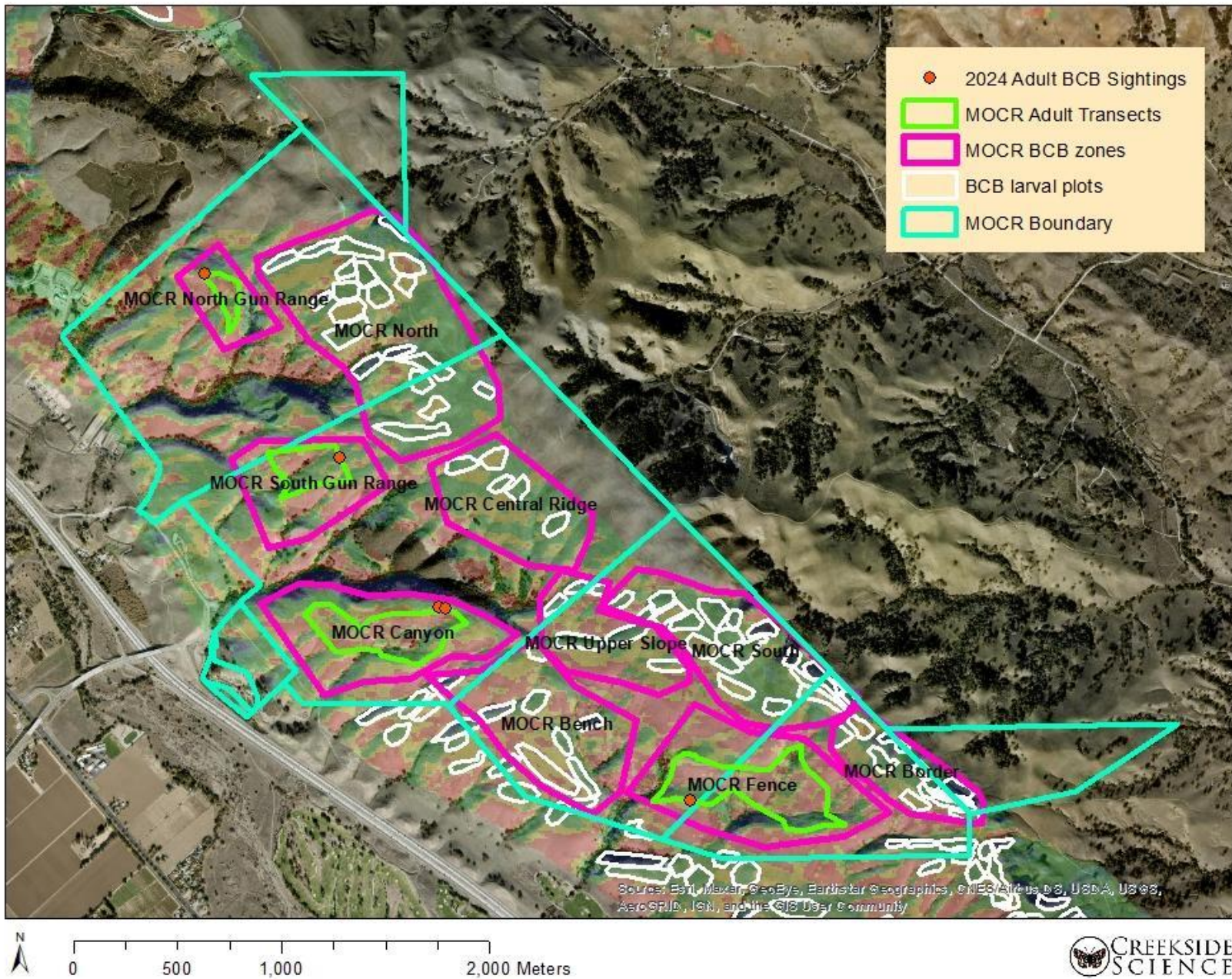
Additionally, because no larvae were detected in the MOCR Central Ridge and Upper Slope Zones, we recorded adult presence there during flight season. One adult was found at Central Ridge on the first visit. None were found at the Upper Slope Zone, even with three visits. No specific transect is walked in these zones that have larval plots.

Transect	BCB observed April 9, 2024	BCB observed April 17, 2024
Canyon	2	n/a
Fence	1	n/a
North gun range	0	1
South gun range	1	n/a

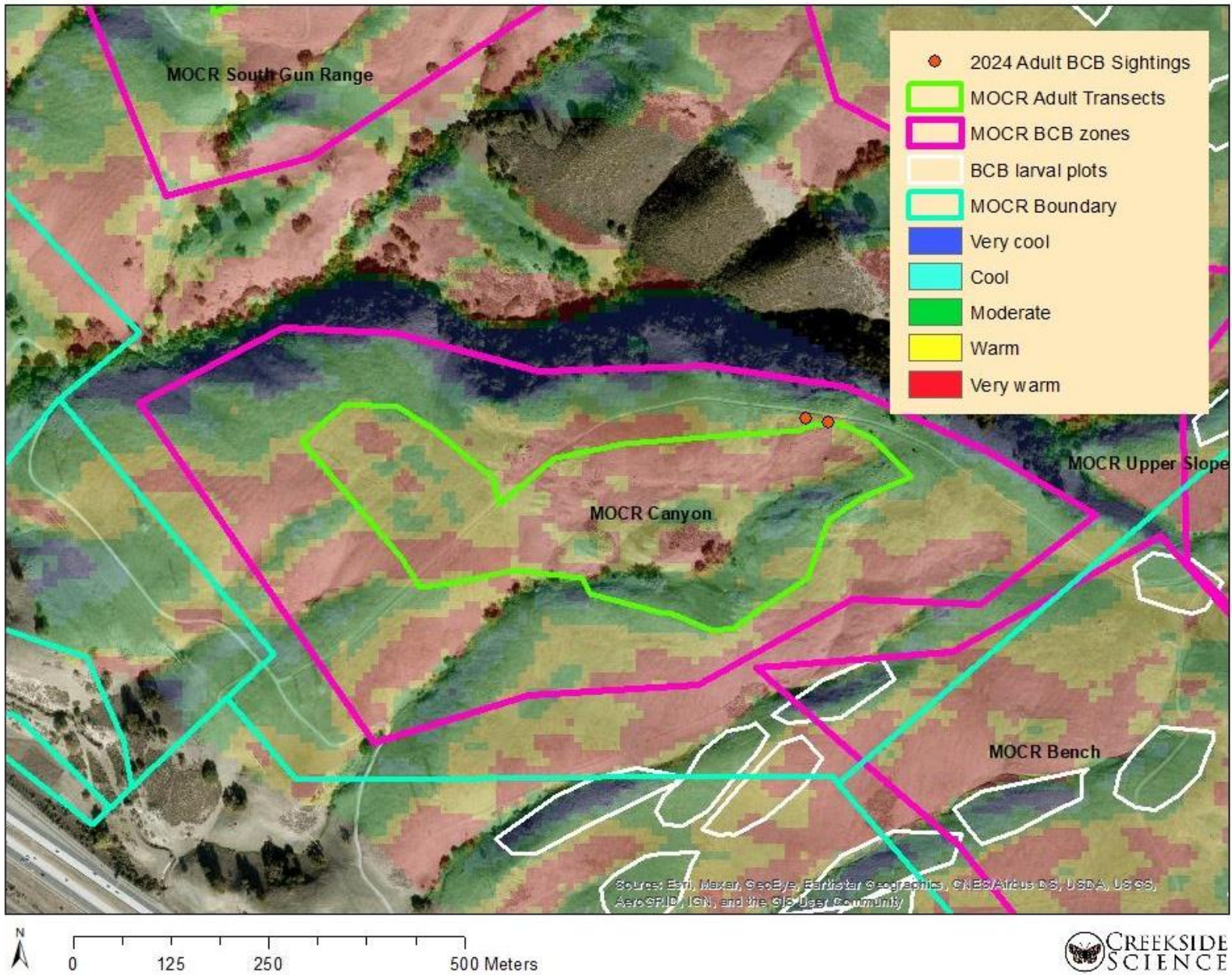
Table 10. Adult transect survey dates and encounters, 2024

Transect	2024 encounter rate (butterflies/hr)	2023 encounter rate	2022 encounter rate	2021 encounter rate	2020 encounter rate	2019 encounter rate	2018 encounter rate
Canyon	2.6	11	41	160	6	11	17
Fence	0.8	0.6	17	75	27	21	11
North gun range	2.9*	13	3	94	24	60	53
South gun range	1.5	6.5	19	218	25	29	19
*or 1.2 butterflies/hr if both search days are used in the search time calculation							

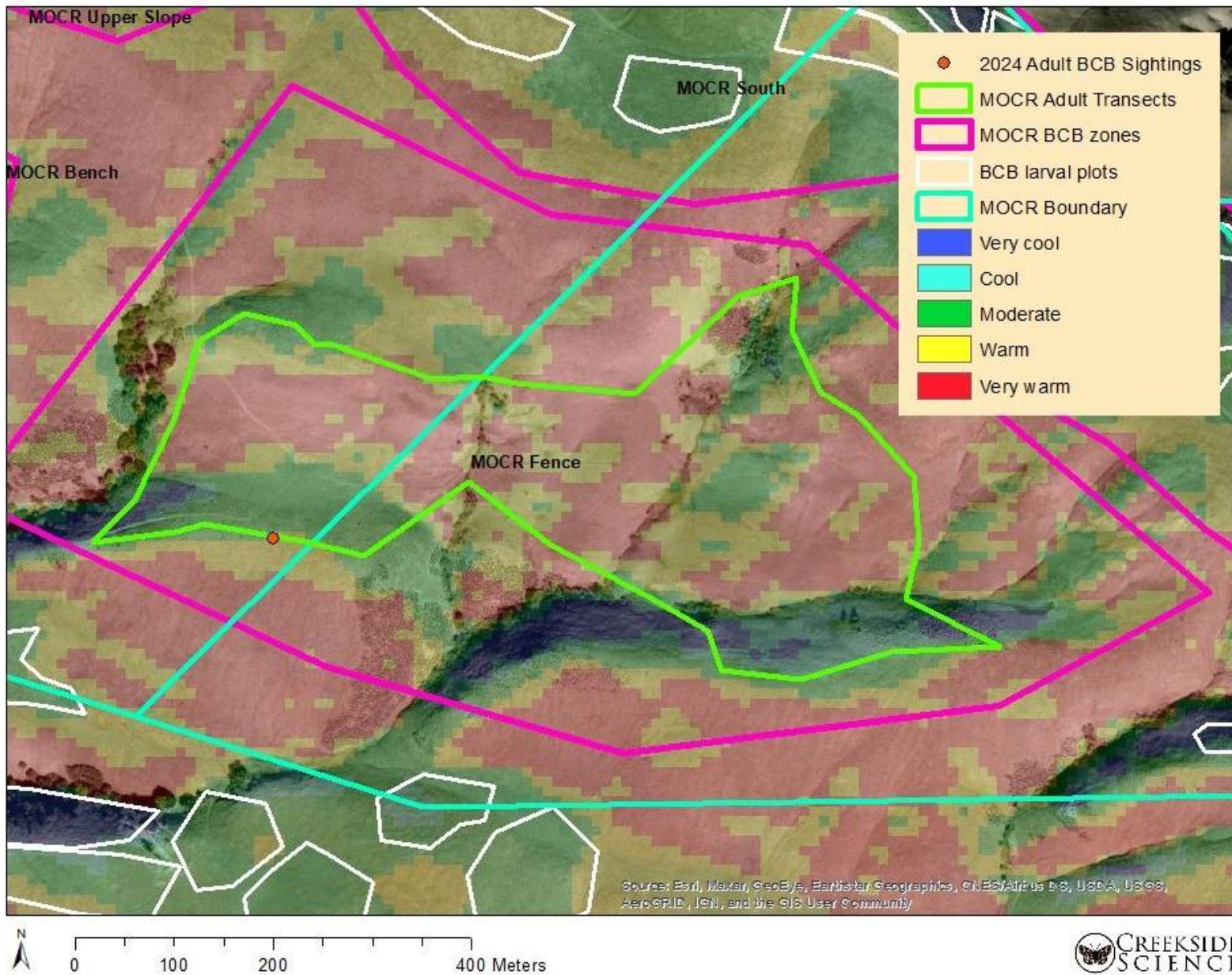
Table 11. Adult transect survey dates and encounter rates over time



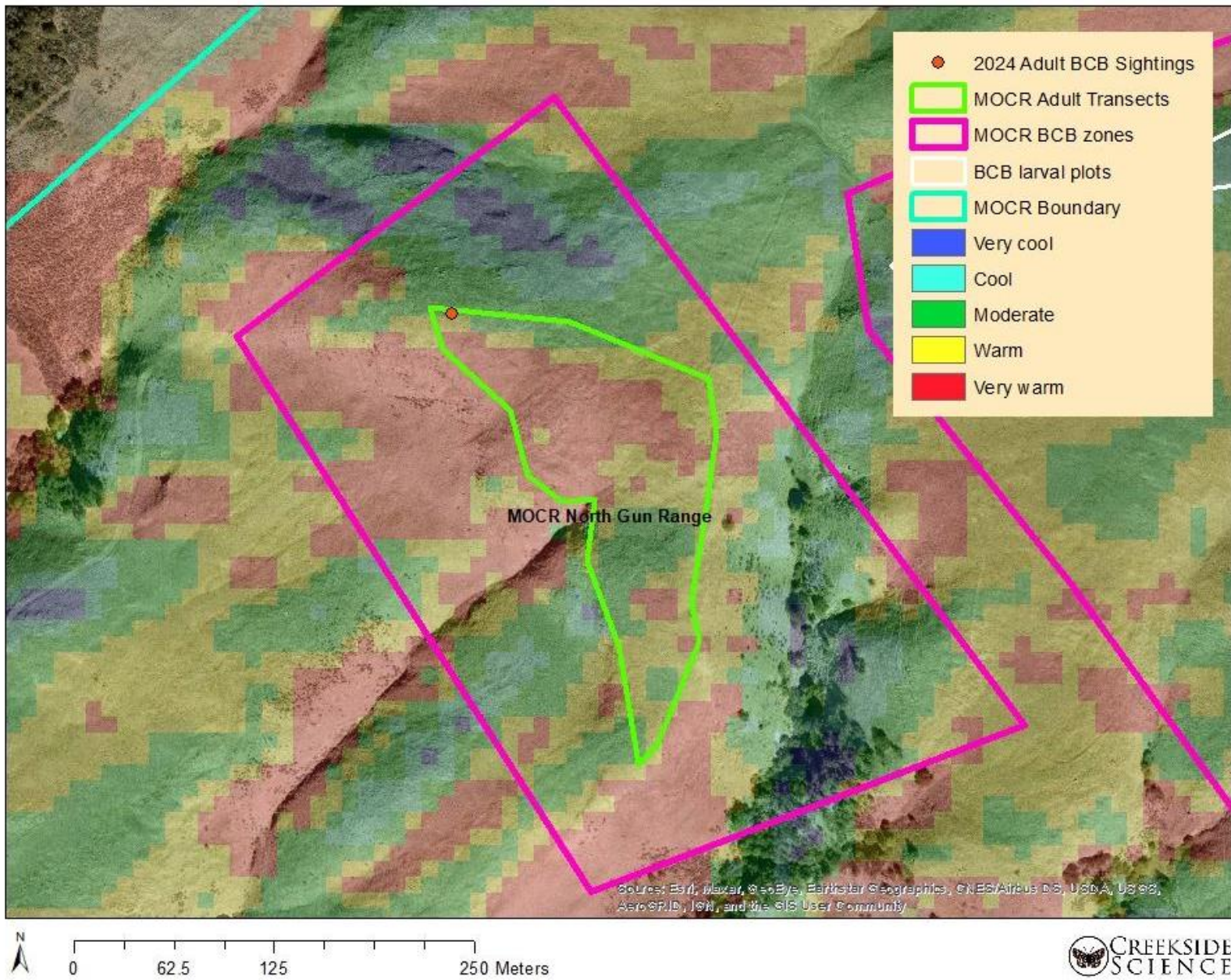
Map 5. MOCR overall BCB adult sightings in 2024



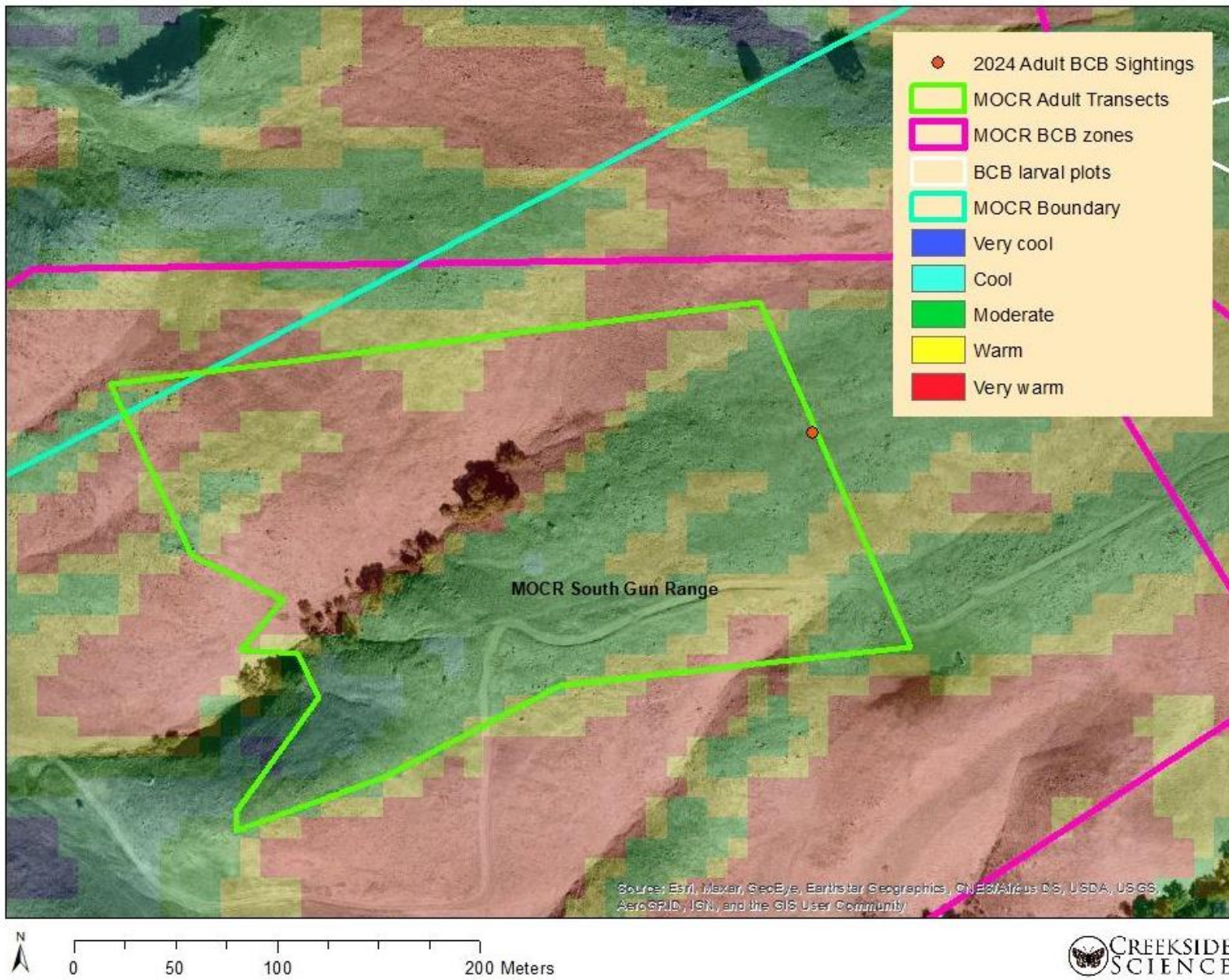
Map 6. MOCR Canyon BCB adult sightings in 2024 (2 BCB April 9)



Map 7. MOCR Fence BCB adult sightings in 2024 (1 BCB April 9)



Map 8. MOCR North Gun Range BCB adult sightings in 2024 (0 BCB April 9, 1 BCB April 17)



Map 9. MOCR South Gun Range BCB adult sightings in 2024 (1 BCB April 9)

Discussion/Recommendations

The Coyote Ridge complex, which extends from north of Metcalf Canyon to Anderson Dam, supports the core of the Bay checkerspot butterfly population in Santa Clara Valley (Coyote Ridge population). MOCR is part of the Coyote Ridge complex and usually supports a large proportion of the Coyote Ridge population. Postdiapause larval surveys conducted at MOCR in 2024 yielded a population estimate of ~3000 individuals, the lowest on record. The overall Coyote Ridge larval population rose slightly in 2024 (based strictly on a slight increase at the Kirby Canyon Butterfly Reserve). MOCR now represents approximately 2% of the 2024 Coyote Ridge population. It should be noted that these calculations do not include numbers from Richmond Ranch, which has not yet been monitored quantitatively. Quantitative plots on that property have been created from 2024 reconnaissance sightings, and quantitative monitoring will begin in 2025.

Larval estimates increased slightly at the Kirby Canyon Butterfly Reserve, south of MOCR. This increase drove the slight increase in the overall Coyote Ridge larval population estimate.

Estimates there have decreased from $187,000 \pm 42,000$ in 2021, to $170,000 \pm 43,000$ in 2022, to $109,000 \pm 41,000$ in 2023. The 2024 estimate is $117,000 \pm 30,000$, which is not significantly different from the 2023 estimate.

The decrease in larvae is likely due to extreme drought and warm spring temperatures in previous years. Abnormally dry and warm conditions lead to senescence in host plants before prediapause larvae are large enough to enter diapause. In 2022, we predicted that above average spring temperatures would have a negative effect on 2023 larval estimates. The drought broke in water year 2023. Larval estimates in 2024 remained low despite increased precipitation and cool spring temperatures in 2023. The wet years in 2023 and 2024 brought high nonnative grass cover, and it is possible BCB numbers on MOCR have gotten low enough that it may be difficult to recover.

Normally we discuss our booms and busts in the context of metapopulation dynamics, because we have decades of data showing BCB recovering from low points, and documentation of colonies within individual areas of the larger habitat fluctuating independently. This is an important process on Coyote Ridge. However, another year of record low numbers at MOCR (as well as neighboring LTSCV and VTA properties) is concerning.

We anticipate the parcels immediately adjacent to Kirby Canyon (i.e., VTA) will be most able to benefit from any BCB dispersing from that parcel. With MOCR at a farther distance away, recovery will be more dependent on internal population growth. The fact that Kirby Canyon is not at an all time low is somewhat reassuring, as is the discovery of a robust population with favorable topography on Richmond Ranch.

Adult survey results again show that Bay checkerspot butterfly is found throughout the preserve, although three transects had their lowest encounter rates on record. This year was the first time a transect needed two visits to establish occupancy (North Gun Range). Both observers noted the transect was very grassy.

Adult numbers are not surprising given low the larval estimates across the property this year. Survey timing mostly coincided with peak flight season at nearby Kirby Canyon, where adults were monitored over two months in 2024. The third visit to establish occupancy at Upper Slopes was perhaps too late in the season.

Core habitat on MOCR is essential for the long-term persistence of healthy Bay checkerspot butterfly populations. This seems especially true this year as we observe high numbers of butterflies to the south at Kirby Canyon Butterfly Reserve and to the north at Richmond Ranch.

Survey results continue to illustrate the variability inherent in Bay checkerspot populations and reinforce the need for annual monitoring. Estimates have fluctuated from ~16,000 larvae in 2010 to ~950,000 in 2015, and now a record low of ~3000. Bay checkerspot populations follow a boom-and-bust cycle; just as the high numbers of 2015 were not likely to

be maintained indefinitely, we expect an increase over the next few years. Additional declines could spur discussion about translocating larvae or other activities. The following are recommendations based on the Valley Habitat Plan biological goals and objectives and the survey results.

- 1.** Management actions undertaken by the Habitat Agency and OSA are not believed to be causing the larger decrease at MOCR relative to Kirby Canyon.
- 2.** Maintain current grazing regime in the different pastures at MOCR, which includes providing the ranchers flexibility in adjusting annual stocking rates and timing as documented over the last decade (see Grazing Regime section above). The grazing tenant has shown he has the experience and skills necessary to balance his goals (removing mostly nonnative grass to feed livestock) with conservation goals, while responding to the extreme interannual climatic variations of the region. The property was grassy in 2024, and while we should point this out to the grazing tenant and ask for higher grazing pressure, he is sure to be aware of this already. The current regime supports a rich variety of native species, both common and covered. Managers should be cautious about making major changes. More intensive techniques such as mowing and seeding are not recommended at this time. Additional management comments are provided in the Discussion/Recommendations of the Plant Species Composition section below.
- 3.** Large population fluctuations are natural but require ongoing data collection to detect problematic declines. Monitoring next year is especially important. Ongoing declines could trigger discussions about translocating larvae.

Plant Species Composition

The serpentine grasslands of Coyote Ridge support many covered species, including Bay checkerspot butterfly, Tiburon paintbrush, Santa Clara Valley dudleya, fragrant fritillary, smooth lessingia, Metcalf Canyon jewelflower, and most beautiful jewelflower. The purpose of monitoring the overall composition of the serpentine grassland is to provide a reliable system for detecting major changes in grassland composition in response to climate, topography, and management. A standard methodology is being used at multiple sites in the region (i.e., Kirby Canyon Butterfly Reserve, VTA-Coyote Ridge, Los Esteros Critical Energy Facility Ecological Preserve, Don von Raesfeld Ecological Preserve/Silicon Valley Power, and Metcalf Energy Center Ecological Preserve on Tulare Hill). The system is designed to monitor large changes in composition from year to year (interannual), across topography (elevation and slope/aspect), and edaphic (soil) gradients, while at the same time being efficient for data collection and



interpretation. Key data include cover of Bay checkerspot butterfly host plants, which are larval food sources, and nectar plants, which are adult food sources. Other important parameters for assessing Bay checkerspot butterfly habitat quality are cover of nonnative annual grass, native perennial grass, perennial forbs, annual forbs, native cover, nonnative cover, native richness, thatch, and bare ground. Results are used to determine if different pastures or parts of the property are responding similarly to weather, or whether management changes (usually changes in grazing pressure) are recommended, in the context of managing for Bay checkerspot butterfly and overall native cover and richness. Bay checkerspot butterfly host and nectar sources, native cover, and richness are all desirable. The forbs (non-woody, non-graminoid plants) mostly include what are commonly called wildflowers. Nonnative forbs include thistles and other broadleaf weeds, but these are mostly absent from the serpentine soil areas of the property. The nonnative cover in the region's serpentine grasslands is almost entirely nonnative annual grass, which is undesirable at high cover because they and their associated thatch compete with forbs, especially the annual forbs that are important Bay checkerspot resources. The native perennial bunchgrasses do not outcompete these plants and are considered desirable. Bare ground is also desirable because it favors forbs over grass.

Methods

Three plant species composition/cover monitoring clusters, consisting of four sampling transects each, were established on serpentine soils of MOCR. One cluster, MOCR South, was installed in 2007 and originally had 6 transects, two of which were dropped in 2016 to conform with other clusters. The MOCR North and Mid clusters were installed in spring 2016.

The clusters were spread throughout the site to target different elevations and pastures/grazing regimes. MOCR North and Mid are in the same pasture (first rockfield), which is generally grazed winter and spring. MOCR South is in a pasture (second rockfield) that is normally grazed spring through fall (Map 10).

The different elevations encompass different rates of nitrogen deposition. Serpentine soils are characteristically low in nitrogen and thus nutrient deficient for the growth of most plant species. Species associated with serpentine habitats are more suited to low nitrogen levels. Nutrient amendment in the form of nitrogen deposition can have a significant impact on vegetative species composition. Deposition can further encourage the growth and spread of nonnative

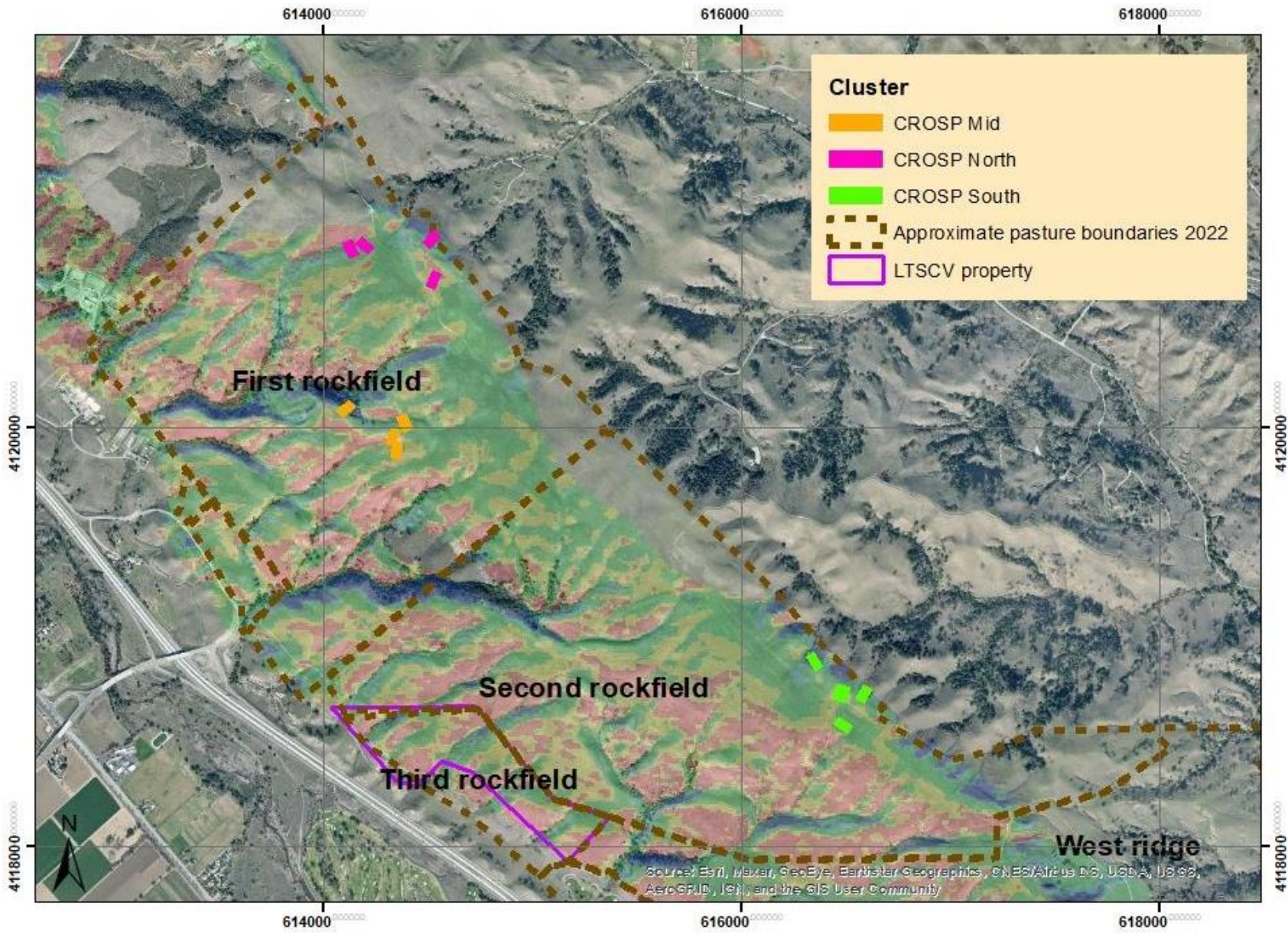
grasses that compete for space with native species such as Bay checkerspot host and nectar plants. Nitrogen deposition is caused by air pollution and formed by fuel-burning sources such as combustion vehicles and natural gas power plants (Weiss 1999). The North and South clusters are at the ridge's summit, and Mid is about halfway down. The summit of Coyote Ridge generally has lower nitrogen deposition rates (~11 kg/ha/yr), and the mid elevations are ~14 kg/ha/yr (H.T. Harvey and CCEO 2008).

It should be noted that the Los Esteros Critical Energy Facility and Don von Raesfeld Ecological Preserves, outlined on Map 10 as LTSCV property, are no longer in the same pasture as MOCR South. As of spring 2022, the new fenceline created a third rockfield that encompasses these LTSCV properties, as well as the SCVHA Castle and Cooke Reserve. At this point there are no vegetation transects low on the second rockfield pasture. There is also no longer any MOCR property in the west ridge pasture. (Reports for those properties are available upon request.) Closeups of each cluster are shown in Maps 11-13.

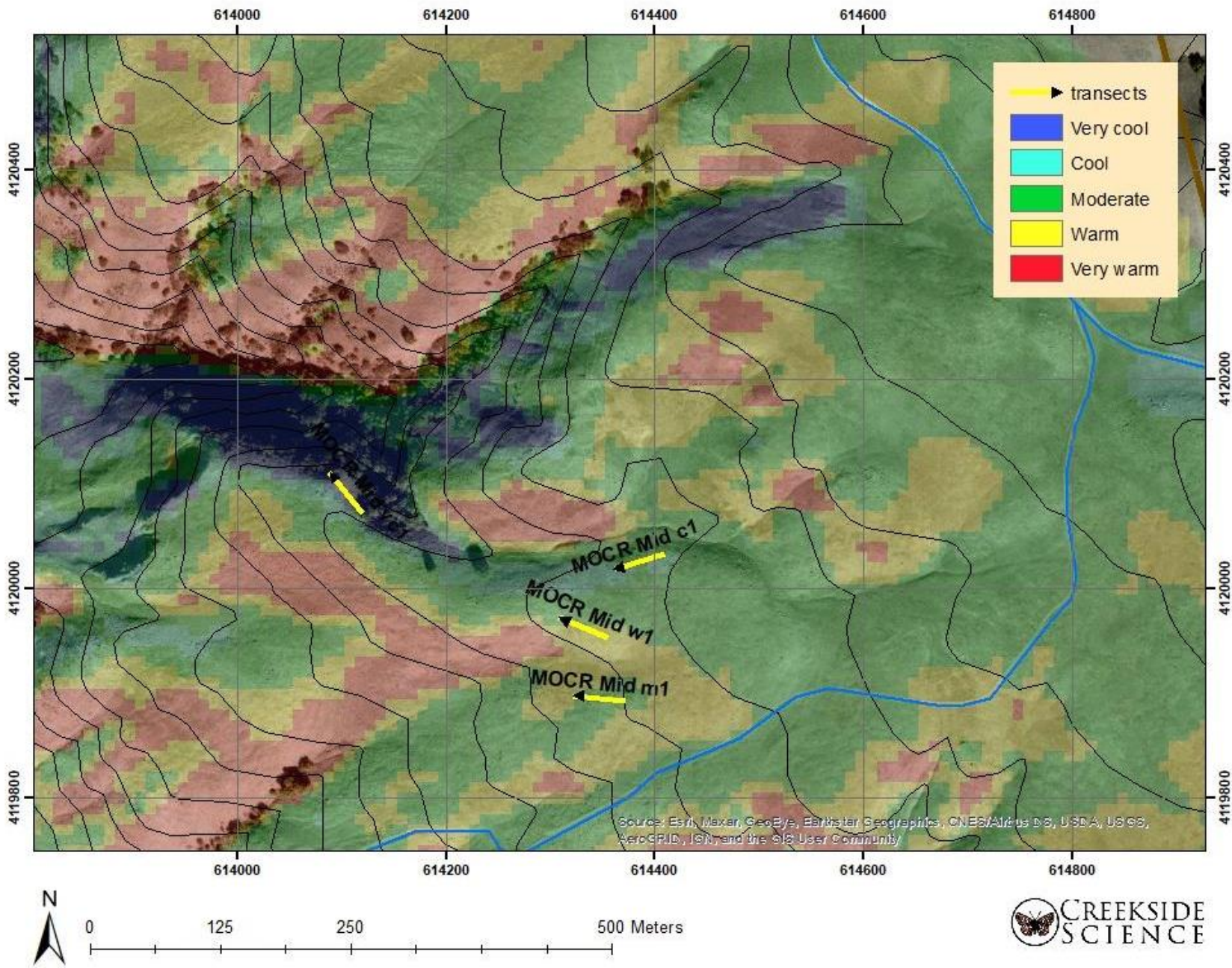
Each of the four clusters has a transect set up in a warm (south-facing >10° slope), moderate (mostly flat), cool (north-facing >10° slope, and very cool (north-facing >20° slope) topoclimate. Transects are 50 meters long and permanently marked at each end with rebar. During sampling, a 50-m tape is stretched along the transect, and a 0.5 x 0.5 m (0.25 m²) quadrat is placed at 10, 20, 30, 40, and 50 m along the right side of the tape, and at 5, 15, 25, 35, and 45 m along the left side of the tape. The percent relative cover (on a cover class scale of 1, 2, 5, 10, 20, 30, 40 . . . 100%) of each plant species within the quadrat is recorded. Percent cover of bare ground, rock, and thatch are included in the cover total, which should fall between 96% and 105%. Rocks that take up less than 1% cover are considered bare ground.

Monitoring is conducted during the peak spring flowering season. Timing of monitoring varies with transect location due to differences in phenology among areas with different topoclimates, and will vary among years. This year monitoring took place between April 1 and 30, 2024.

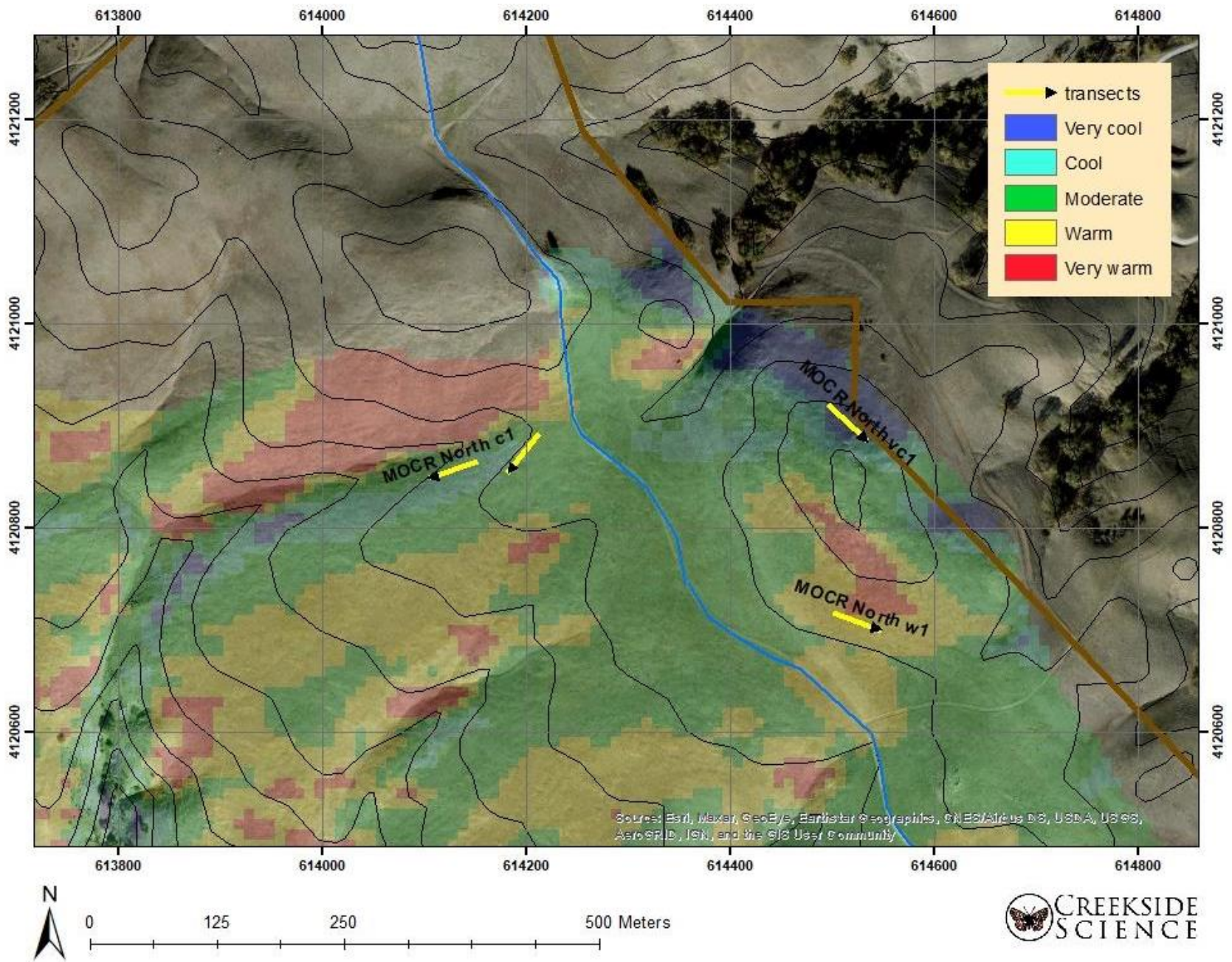
Photopoints are taken at each transect and are shown in Appendix A.



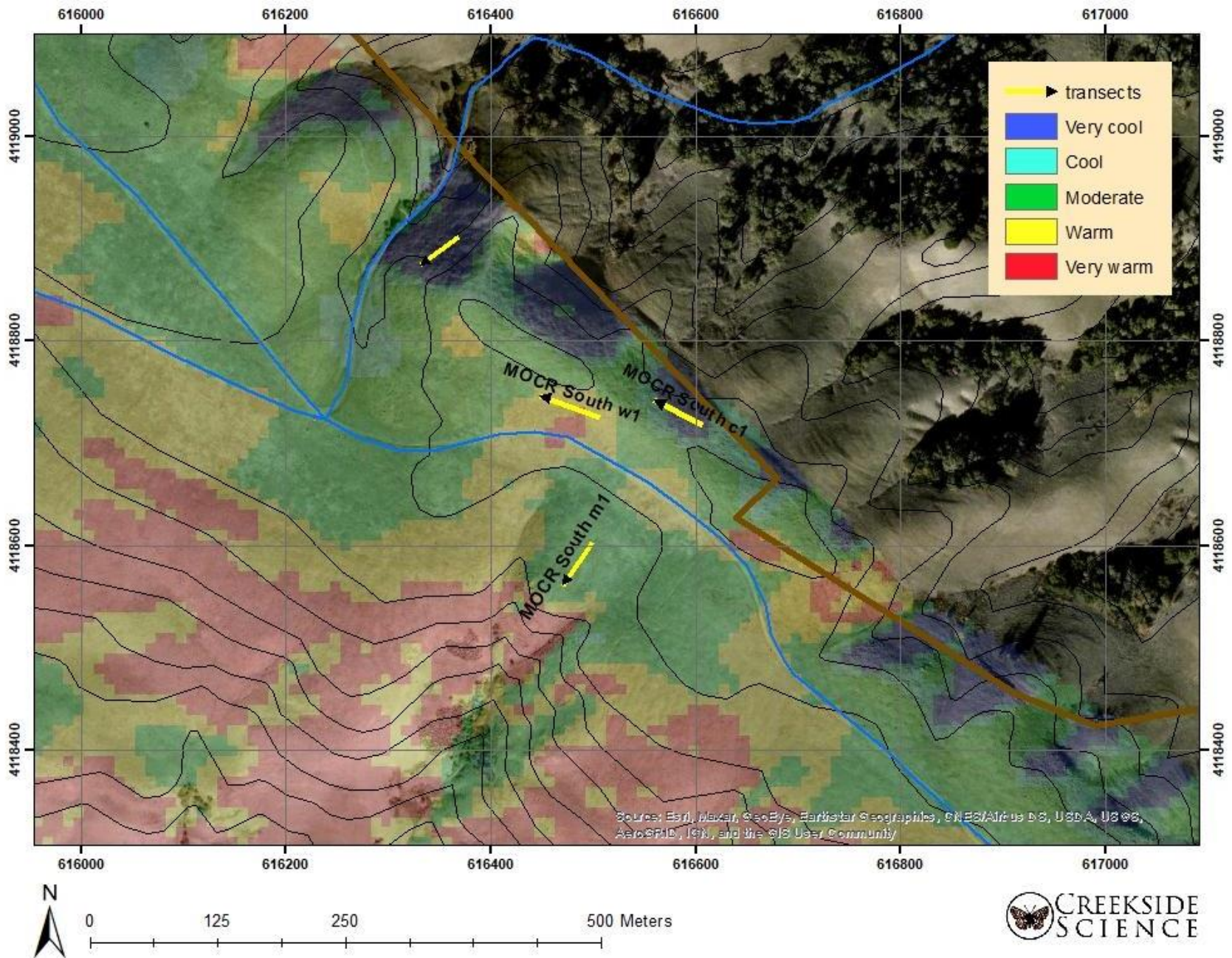
Map 10. Vegetation composition clusters on MOCR. Note new fenceline installed in 2022.



Map 11. Closeup view of MOCR Mid cluster



Map 12. Closeup view of MOCR North cluster



Map 13. Closeup view of MOCR South cluster

Results

Cover of key species and guilds is shown below in Tables 12-14. Five years of data are shown for context.

Key Species and Guilds	2020	2021	2022	2023	2024	Change from 2023 to 2024
Checkerspot Host and Nectar Plants						
Dwarf plantain (<i>Plantago erecta</i>)	0.6 ± 0.1	0.6 ± 0.1	0.6 ± 0.1	0.6 ± 0.1	0.6 ± 0.1	Stable
Owl's clover (<i>Castilleja</i> spp.)	0.1 ± 0.1	0.03 ± 0.03	0.05 ± 0.03	0.1 ± 0.1	0.2 ± 0.1	Stable
Goldfields (<i>Lasthenia californica</i>)	0.3 ± 0.1	0.2 ± 0.1	0.1 ± 0.1	0.05 ± 0.03	0.03 ± 0.03	Stable
Tidy tips (<i>Layia gaillardoides</i>)	0.03 ± 0.03	0 ± 0	0 ± 0	0 ± 0	0 ± 0	Stable
Jeweled onion (<i>Allium serra</i>)	0.03 ± 0.03	0.03 ± 0.03	0.3 ± 0.3	0.05 ± 0.03	0.05 ± 0.03	Stable
Seaside muilla (<i>Muilla maritima</i>)	0.4 ± 0.1	0.5 ± 0.2	0.3 ± 0.1	0.3 ± 0.1	0.4 ± 0.1	Stable
Functional Guilds						
Native perennial grasses	1.6 ± 0.4	1.2 ± 0.3	2.1 ± 0.5	1.2 ± 0.4	1.7 ± 0.6	Stable
Nonnative annual grasses	24.4 ± 2.5	31.0 ± 3.6	27.4 ± 3.3	24.4 ± 2.2	21.7 ± 2.1	Stable
Perennial forbs	2.3 ± 0.3	2.4 ± 0.5	3.1 ± 0.7	2.3 ± 0.4	2.7 ± 0.6	Stable
Annual forbs	10.7 ± 1.0	6.4 ± 0.5	7.2 ± 0.6	8.7 ± 0.8	8.5 ± 0.8	Stable
Native/Nonnative						
Native species richness	13.2 ± 0.5	10.5 ± 0.5	11.2 ± 0.4	11.5 ± 0.4	11.5 ± 0.4	Stable
Native cover	20.1 ± 1.3	16.7 ± 2.0	20.2 ± 2.2	19.2 ± 1.8	19.8 ± 1.8	Stable
Total nonnative cover	24.5 ± 2.5	31.2 ± 3.6	27.4 ± 3.3	24.4 ± 2.2	21.9 ± 2.1	Stable
Abiotic						
Thatch	5.7 ± 0.9	8.3 ± 1.4	7.0 ± 1.0	8.1 ± 1.4	5.2 ± 0.9	Decrease
Bare	42.9 ± 3.1	41.6 ± 3.3	42.6 ± 3.5	46.3 ± 2.8	51.3 ± 2.4	Stable

Table 12. Mean cover ± SE for key species and guilds at MOCR-South over time

Key Species and Guilds	2020	2021	2022	2023	2024	Change from 2023 to 2024
Checkerspot Host and Nectar Plants						
Dwarf plantain (<i>Plantago erecta</i>)	0.9 ± 0.2	0.7 ± 0.1	1.0 ± 0.2	2.4 ± 0.8	1.9 ± 0.6	Stable
Owl's clover (<i>Castilleja</i> spp.)	0.4 ± 0.1	0 ± 0	0 ± 0	0.2 ± 0.1	1.2 ± 0.6	Increase
Goldfields (<i>Lasthenia californica</i>)	1.6 ± 0.3	4.1 ± 1.4	1.5 ± 0.4	4.8 ± 1.2	4.4 ± 1.0	Stable
Tidy tips (<i>Layia gaillardoides</i>)	0.2 ± 0.1	0.2 ± 0.1	0.2 ± 0.1	0.3 ± 0.1	1.0 ± 0.5	Increase
Jeweled onion (<i>Allium serra</i>)	0.08 ± 0.04	0.05 ± 0.03	0.05 ± 0.03	0.08 ± 0.04	0.03 ± 0.03	Stable
Seaside muilla (<i>Muilla maritima</i>)	1.5 ± 0.3	0.9 ± 0.1	1.0 ± 0.3	0.8 ± 0.1	0.7 ± 0.1	Stable
Functional Guilds						
Native perennial grasses	5.7 ± 1.2	3.0 ± 0.8	4.1 ± 0.9	2.5 ± 0.7	1.5 ± 0.3	Decrease
Nonnative annual grasses	9.3 ± 2.6	16.1 ± 3.1	12.3 ± 2.8	13.4 ± 2.4	19.6 ± 3.2	Increase
Perennial forbs	3.6 ± 0.8	3.5 ± 0.8	3.3 ± 0.9	3.9 ± 0.8	3.9 ± 0.6	Stable
Annual forbs	10.0 ± 1.1	11.5 ± 1.7	13.2 ± 1.9	18.0 ± 2.0	17.7 ± 2.0	Stable
Native/Nonnative						
Native species richness	11.7 ± 0.4	12.5 ± 0.5	11.9 ± 0.6	13.5 ± 0.4	12.9 ± 0.6	Stable
Native cover	27.0 ± 2.0	32.9 ± 3.0	39.3 ± 3.6	40.4 ± 2.8	33.1 ± 2.3	Decrease
Total nonnative cover	9.3 ± 2.6	16.1 ± 3.1	12.3 ± 2.8	13.4 ± 2.4	19.6 ± 3.2	Increase
Abiotic						
Thatch	14.2 ± 1.9	7.1 ± 1.4	2.7 ± 0.5	2.8 ± 0.7	4.0 ± 0.9	Stable
Bare	35.9 ± 2.4	41.5 ± 2.3	42.1 ± 3.1	41.5 ± 2.4	43.1 ± 2.4	Stable

Table 13. Mean cover ± SE for key species and guilds at MOCR-North over time

Key Species and Guilds	2020	2021	2022	2023	2024	Change from 2023 to 2024
Checkerspot Host and Nectar Plants						
Dwarf plantain (<i>Plantago erecta</i>)	1.7 ± 0.5	0.9 ± 0.04	1.0 ± 0.1	0.9 ± 0.1	1.8 ± 0.5	Increase
Owl's clover (<i>Castilleja</i> spp.)	0.5 ± 0.1	0.03 ± 0.03	0.05 ± 0.03	0.03 ± 0.03	0.3 ± 0.1	Increase
Goldfields (<i>Lasthenia californica</i>)	1.2 ± 0.2	1.9 ± 0.6	1.6 ± 0.8	3.6 ± 1.3	4.2 ± 1.4	Stable
Tidy tips (<i>Layia gaillardoides</i>)	0.2 ± 0.1	0.2 ± 0.1	0.1 ± 0.1	0.3 ± 0.3	0.4 ± 0.3	Stable
Jeweled onion (<i>Allium serra</i>)	0.10 ± 0.05	0.03 ± 0.03	0 ± 0	0.03 ± 0.03	0.05 ± 0.03	Stable
Seaside muilla (<i>Muilla maritima</i>)	0.4 ± 0.1	0.4 ± 0.1	0.5 ± 0.1	0.4 ± 0.1	0.4 ± 0.1	Stable
Functional Guilds						
Native perennial grasses	1.5 ± 0.4	1.6 ± 0.4	2.2 ± 0.5	2.2 ± 0.6	1.4 ± 0.4	Stable
Nonnative annual grasses	9.8 ± 1.4	9.4 ± 2.0	6.8 ± 1.6	11.4 ± 2.1	13.4 ± 2.2	Stable
Perennial forbs	4.2 ± 0.7	3.4 ± 0.6	3.2 ± 0.5	4.2 ± 0.8	5.1 ± 0.8	Stable
Annual forbs	12.3 ± 1.2	10.7 ± 1.1	15.7 ± 2.1	19.4 ± 2.2	17.3 ± 2.1	Stable
Native/Nonnative						
Native species richness	13.6 ± 0.4	13.0 ± 0.5	12.2 ± 0.4	12.3 ± 0.4	11.7 ± 0.5	Stable
Native cover	28.8 ± 2.0	30.2 ± 2.9	43.9 ± 3.8	45.3 ± 2.4	39.5 ± 2.8	Decrease
Total nonnative cover	10.0 ± 1.4	9.6 ± 2.0	6.9 ± 1.6	11.5 ± 2.1	13.5 ± 2.2	Stable
Abiotic						
Thatch	5.1 ± 1.3	4.0 ± 1.1	3.3 ± 0.9	3.5 ± 1.1	2.8 ± 0.7	Stable
Bare	49.5 ± 2.6	52.0 ± 2.9	41.3 ± 3.3	36.3 ± 2.1	37.8 ± 2.7	Stable

Table 14. Mean cover ± SE for key species and guilds at MOCR-Mid over time

Bay Checkerspot Host Plants. In 2024, dwarf plantain cover was very low again at MOCR-South (0.6%). At MOCR-North it remained moderate (1.9%) and at MOCR-Mid it increased from a low value of 0.9% to 1.8% (a moderate value) (Figure 5). This year, owl's clover was detected at all three sites. Cover values remained low at MOCR-South (0.2%) while MOCR-Mid and MOCR-North both increased. MOCR-Mid increased to a moderate value (0.3%) while MOCR-North increased to a high value of 1.2% (the third highest value among sites since 2016) (Figure 6).

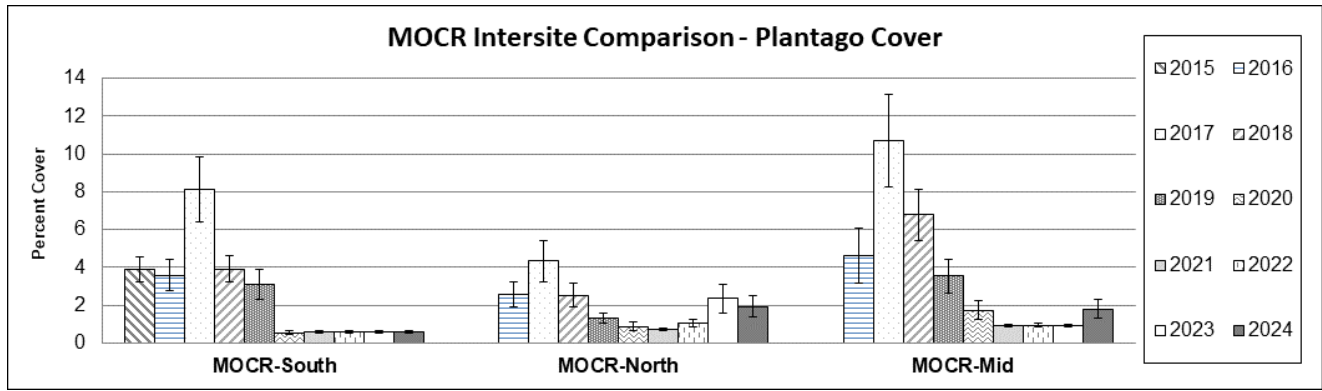


Figure 5. Average cover of dwarf plantain (*Plantago erecta*), ± SE

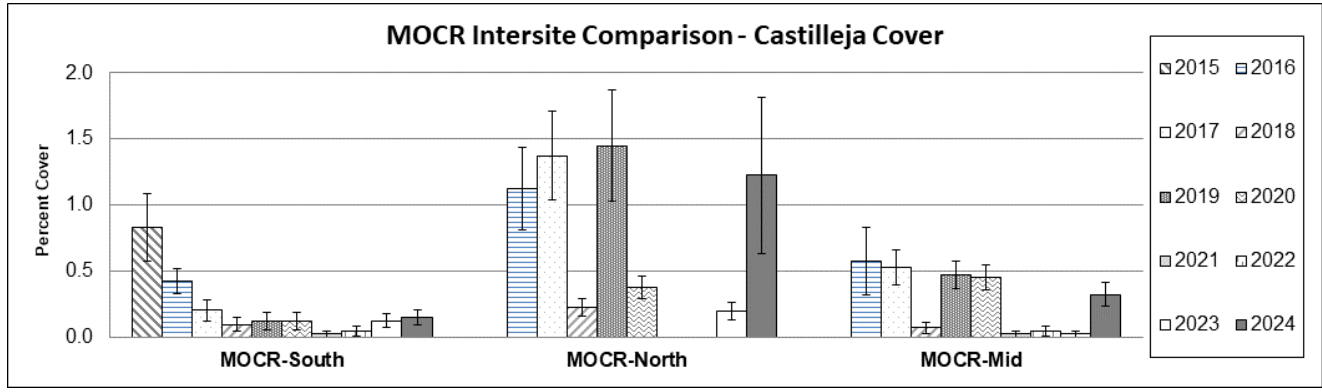


Figure 6. Average cover of owl's clover (*Castilleja* spp.), ± SE

Bay Checkerspot Nectar Sources. Goldfields cover remained moderate at MOCR-North and MOCR-Mid this year (4.4% and 4.2%, respectively). Cover at MOCR-South remained historically low this year at 0.03%. Tidy tips went undetected again this year at MOCR-South, had moderate cover values at MOCR-Mid (0.4%) and hit a very high value at MOCR-North (1.0%). This value was the highest value recorded for the site and the second highest across all sites and years. Jeweled onion (*Allium*) values remained low ranging from 0.03% (MOCR-North) to 0.05% (MOCR-South and MOCR-Mid). Muilla cover values remained stable at all sites this year ranging from 0.4% (MOCR-South and MOCR-Mid) to 0.7% (MOCR-North). Overall Muilla was at moderate cover values (Figures 7-10).

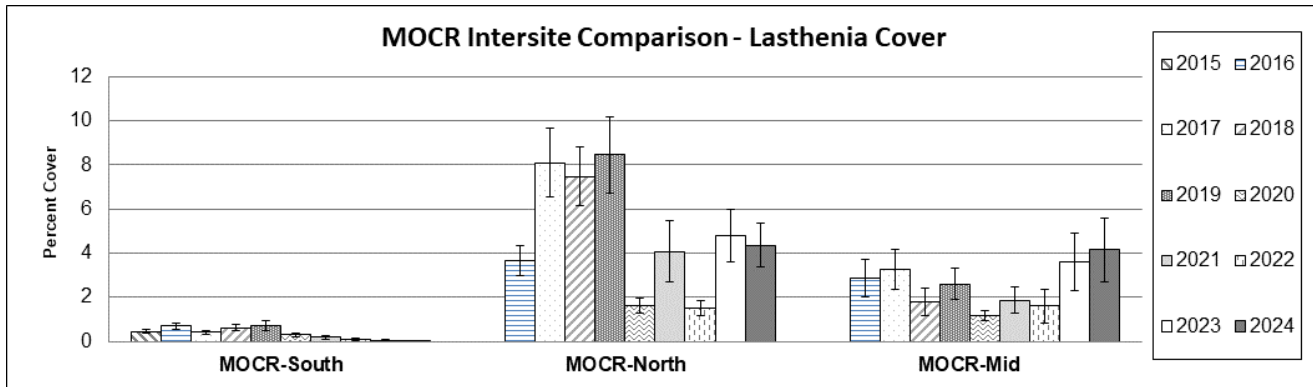


Figure 7. Average cover of goldfields (*Lasthenia californica*), \pm SE

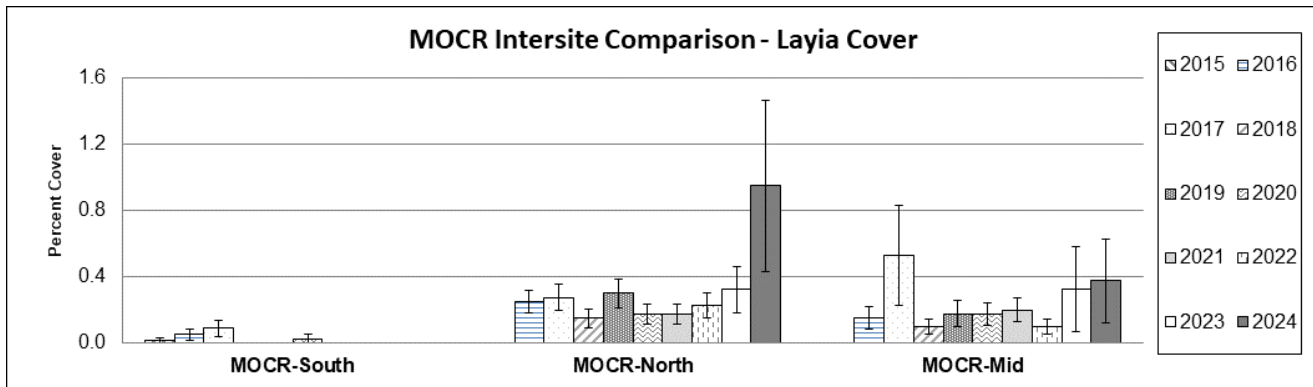


Figure 8. Average cover of tidy tips (*Layia gaillardoides*), \pm SE

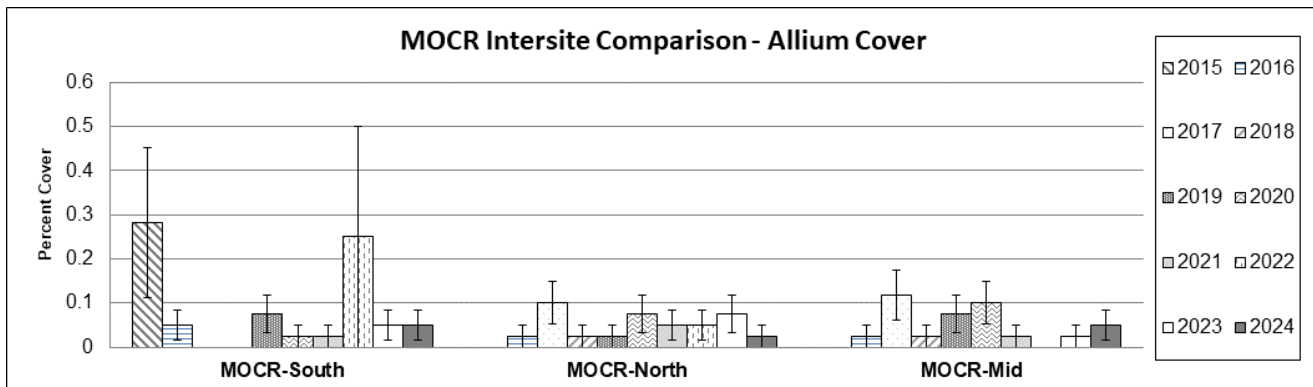


Figure 9. Average cover of jeweled onion (*Allium serra*), \pm SE

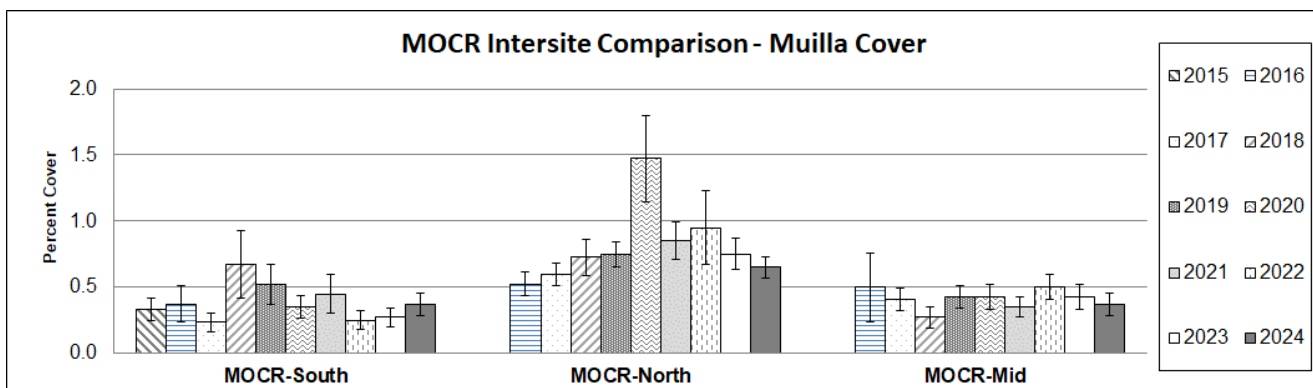


Figure 10. Average cover of seaside muilla (*Muilla maritima*), \pm SE

Grasses and Thatch. The perennial grasses (bunchgrasses) measured are all native. MOCR-South had the highest value at 1.7% and MOCR-Mid had the lowest at 1.4%. Nonnative annual grasses remained stable to slightly up with moderate values observed at MOCR-South (21.7%) and MOCR-North (19.6%) but a relatively low value observed at MOCR-Mid (13.4%). Thatch cover was stable at MOCR-North and MOCR-Mid this year and decreased at MOCR-South from 8.1% to 5.2%. Overall values ranged from 2.8% at MOCR-Mid to 5.2% at MOCR-South (Figure 11-13).

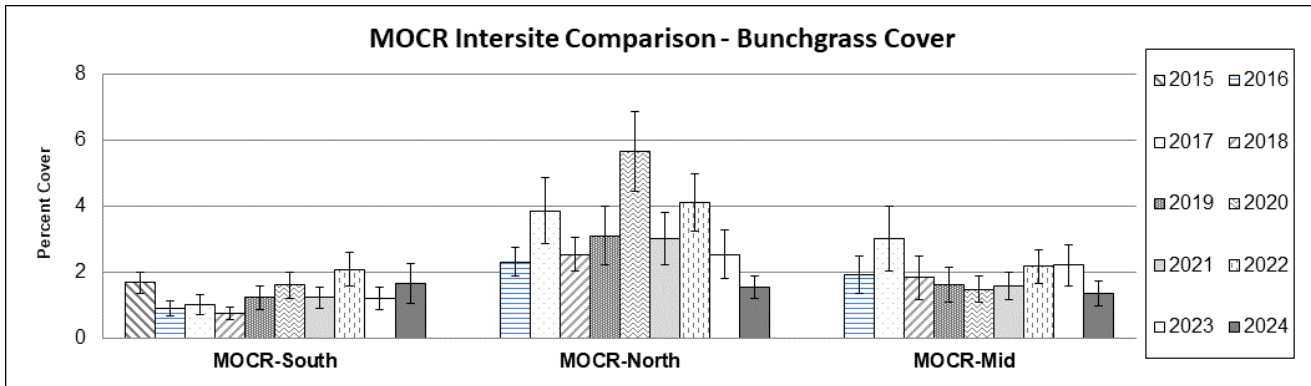


Figure 11. Average cover of perennial grasses, ± SE

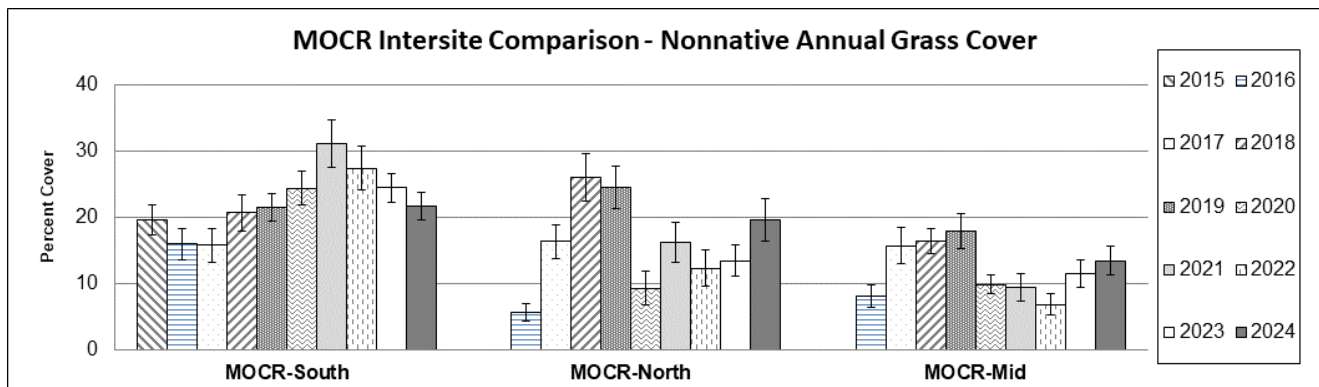


Figure 12. Average cover of nonnative annual grasses, ± SE

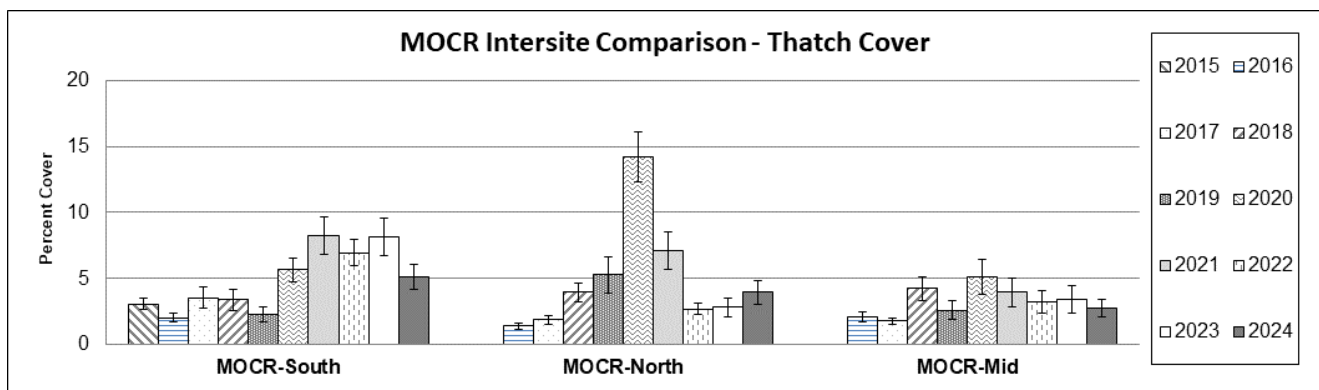


Figure 13. Average cover of thatch, ± SE

Annual forbs are almost entirely native on MOCR’s serpentine soils. They remained stable this year at low to moderate values. Cover values ranged from 8.5% at MOCR-South to 17.7% at MOCR-North. Cover values for perennial forbs, which are all native in the plots, remained at moderate to high values at all sites. Values ranged from 2.7% at MOCR-South to 5.1% at MOCR-Mid. MOCR-North remained stable at a historical high of 3.9% (Figures 14-15).

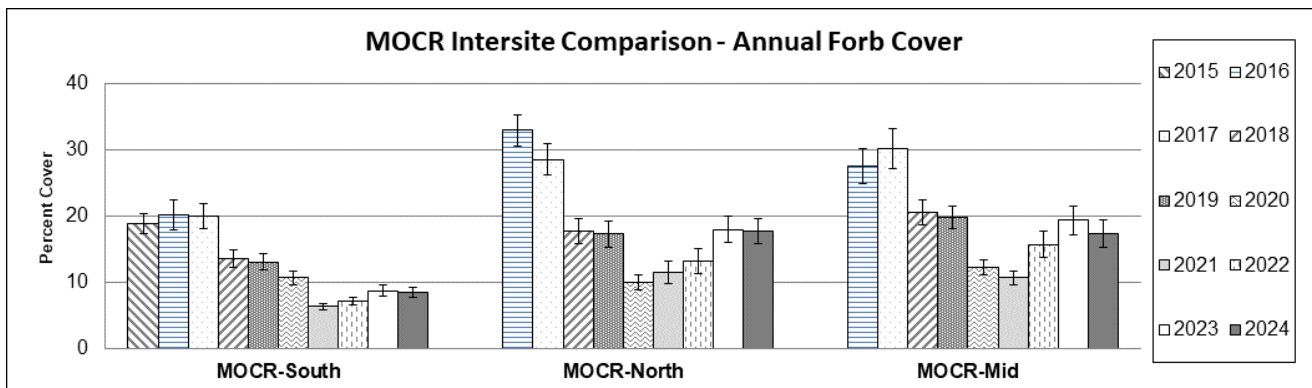


Figure 14. Average cover of annual forbs, ± SE

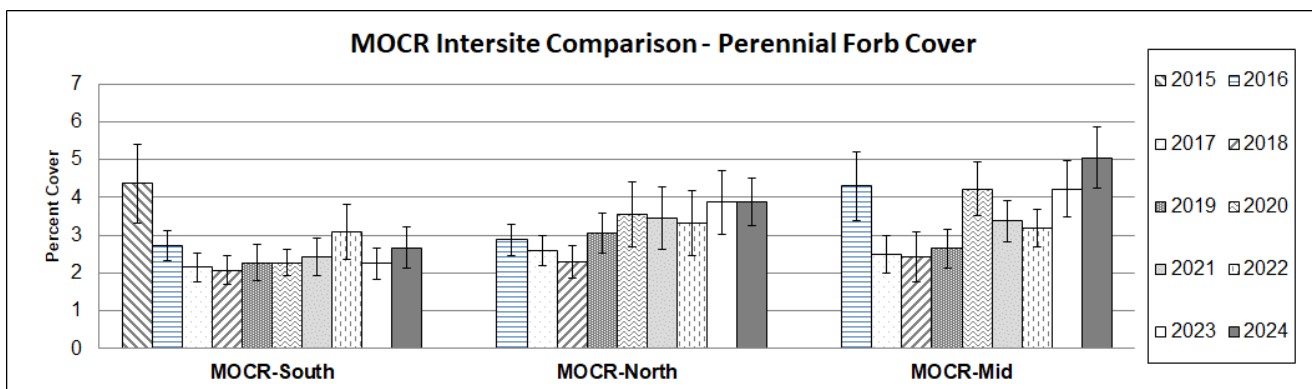


Figure 15. Average cover of perennial forbs, ± SE

Bare was moderate to high across sites in 2024. It was highest at MOCR-South (51.3%) and lowest at MOCR-Mid (37.8%) (Figure 16).

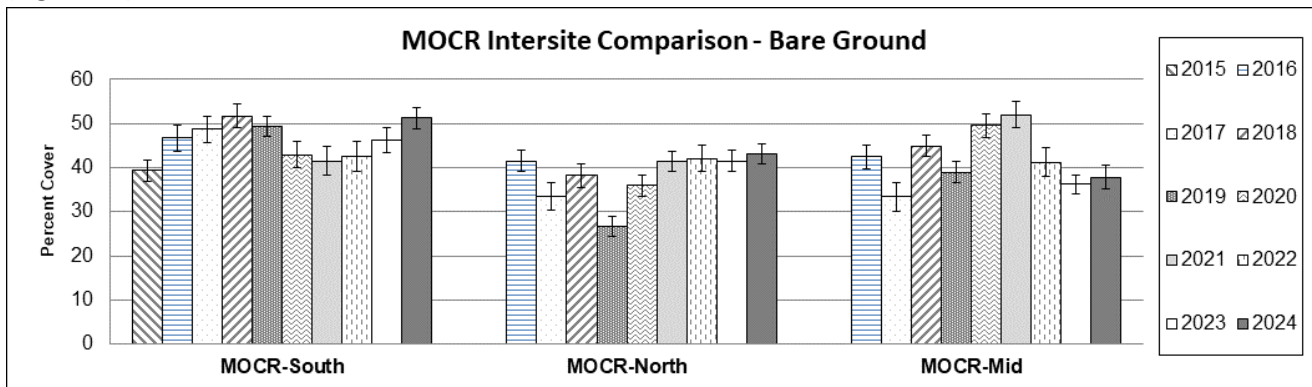


Figure 16. Average bare ground cover, ± SE

Native cover was high at MOCR-Mid again this year at 39.5%. MOCR-North had a moderate value (33.1%) while MOCR-South stayed at a low value (19.8%). Native richness remained stable across all sites in 2024. Values at MOCR-South and Mid were low (11.5 and 11.7 species per quadrat) and the cover value at MOCR-North was moderate (12.9 species per quadrat). Nonnative cover increased at MOCR-North to a moderate value and remained stable at low to moderate values at the other sites. It ranged from 13.5% at MOCR-Mid to 21.9% at MOCR-South (Figures 17-19). Note that Figures 12 and 19 are nearly identical because nonnative cover throughout MOCR is driven mostly by nonnative annual grass.

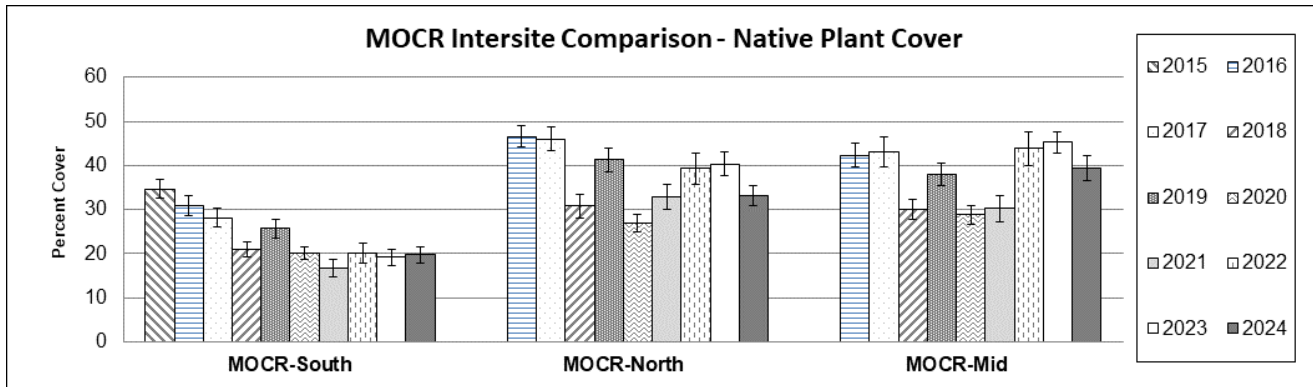


Figure 17. Average cover of native species, ± SE

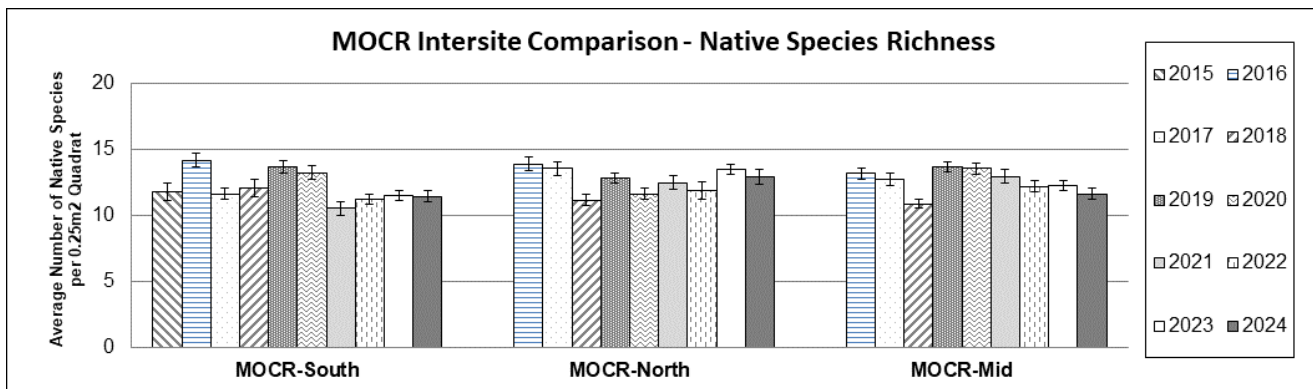


Figure 18. Average number of native species, ± SE

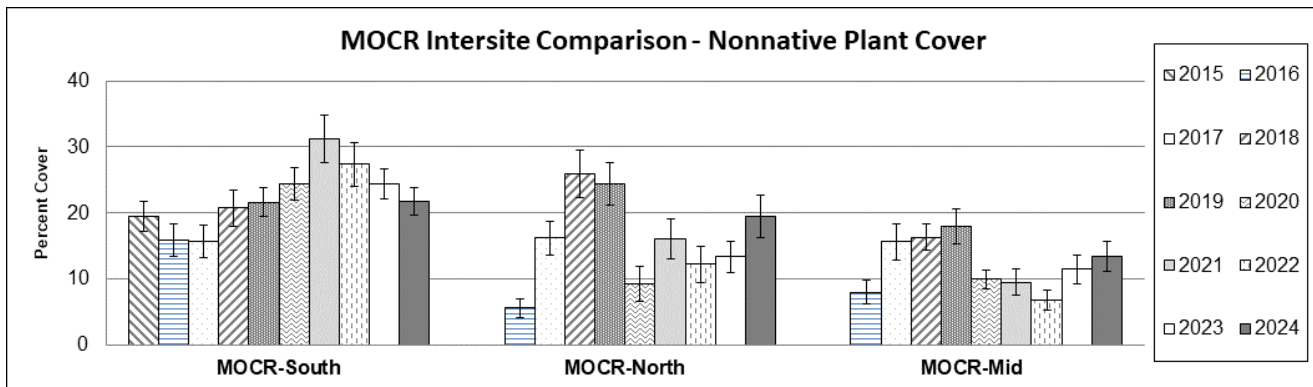


Figure 19. Average cover of nonnative species, ± SE

Discussion/Recommendations

The 2024 water year was just below average at 55.0 cm (94%). December 2023 (9.1 cm) and January 2024 (10.6 cm) were just below average, and February was well above average with 17 cm. March was slightly above average at 9.9 cm. Significant rainfall (2.0 cm) continued into May 2024 (WestMap 2024). We'll refer to key details from this weather summary below.

Regionally, cover of BCB host plants was low and nectar sources were low to moderate, as compared with graphed historical data. They appeared adequate to support the life cycle, however the connection between low host plant cover and low BCB numbers is difficult to ignore. BCB populations have stayed stable or increased with similarly low cover, but this does warrant continued monitoring. The effects of this year's weather and vegetation availability will be reflected in

next year's larval monitoring numbers. Nonnative grass cover was variable across the site and was observed to increase in cover after our quantitative monitoring was complete.

The MOCR property continues to provide high-quality serpentine grassland habitat, supporting diverse stands of native wildflowers that include BCB host plants and nectar sources, as well as other species covered by the Valley Habitat Plan. Compared with graphed historical data, BCB host plants were low to moderate this year and remain within the range of historical variability seen throughout Coyote Ridge. This year *Plantago* cover was low and *Castilleja* cover was moderate to high. Generally, *Castilleja* plays the role of extending the prediapause feeding season, which tends to lead to higher numbers in the next season when postdiapause larvae are monitored. March and April 2024 were cooler than average. Those cool temperatures extended the growing season and could be key factors in any BCB recovery in 2025, although BCB numbers continued to decline after the even cooler spring temperatures in 2023.

Adult nectar sources are varied and abundant at Coyote Ridge (especially when the different taxa are considered as a whole). When adult female BCB emerge, they tend to mate almost immediately with waiting males and lay their largest cluster of eggs (100+) soon after. Therefore, the BCB can complete its life cycle without nectar. With nectar sources, adults may live longer and be more likely to reach maximum reproductive potential. Even if cover of particular nectar species is low, the varied nectar sources overall mean that some source of nectar is always available. Therefore nectar tends not to be limiting for BCB but is an indicator of good habitat. Nectar sources were low to moderate this year.

Variable native plant cover was observed across transects. Native species richness values at MOCR-South and Mid were low (11.5 and 11.7 species per quadrat) and the cover value at MOCR-North was moderate (12.9 species per quadrat). Nonnative grass cover values were low to moderate across the property, but we did qualitatively observe high grass cover later in the season after monitoring had been completed. This happens especially in extended springs (like 2023 and 2024), when grasses continue to grow later in the season past the point when the early spring BCB host and nectar sources need to be monitored. Grazing pressure should be kept high to deal with increased biomass from the wet year.

MOCR-North had the highest habitat quality this year, with the highest dwarf plantain and owl's clover cover. It also had the highest goldfields and muilla cover, plus the highest native richness and highest annual forbs. This site had low thatch as well as moderate native plant cover. However nonnative annual grass cover was also moderate. Larval observations of BCB again decreased to a new historical low here, although the zone remained occupied.

MOCR-Mid had similarly high habitat quality. Overall, it had the highest total native cover and perennial forb cover as well as the lowest nonnative annual grass and thatch, as it did in 2023. Both owl's clover and dwarf plantain host plants were at adequate cover values to support the life cycle of the BCB. Nectar sources were low to moderate at this site this year. On the negative side, this site had the lowest bare and low native species richness. MOCR-Mid is in the MOCR Upper Slope BCB zone, where no larvae or adults were found in 2023 or 2024.

MOCR-South had adequate cover of host and nectar plants. Unfortunately, it also had the lowest total native cover and native richness as well as the highest nonnative cover. Nonnative annual grass and thatch cover was highest here again this year. MOCR-South had the lowest annual and perennial forb cover too; however, it did have the highest percent cover of bare ground and bunchgrass. BCB larvae were detected at low levels this year. MOCR-South is the only cluster in the second rockfield.

It should be noted that the North and South clusters are infested with barbed goatgrass. (Barbed goatgrass is reported with the nonnative annual grass guild but can be queried separately). Some studies are underway to assess the impacts of goatgrass on high quality habitats, and to determine if goatgrass necessitates different management responses relative to other nonnative grasses.

Creekside Science has been working with David Mauk, Natural Resources Technician at SCVOSA to treat barbed goatgrass and other nonnative annual grasses at the southern summit border of MOCR. This area may be a key location because it is the southern edge of the densest barbed goatgrass infestation at the summit, and because other nonnative annual grasses like Italian ryegrass are decreasing otherwise high habitat value, as documented in a previous RDM report (Guenther 2020 sic). A pilot spraying effort took place February 2021 and 2022. The area was resprayed in February 2023 with excellent effects (see 2023 report). Plans were in place to spray another area in 2024, but local graminicide use has been called into question, with both the local PCA and Santa Clara County Agricultural Commission wishing to clarify some of the wording on the labels before moving forward. Creekside Science is hoping to assist these parties in restoring this important management tool, which is especially effective in serpentine grasslands with low nonnative forb cover.

All MOCR sites surveyed provide suitable habitat for Bay checkerspot butterfly, with sufficient host plants and nectar sources. The data among sites show that different locations, elevations, and grazing regimes can support Bay checkerspot butterfly and their associated diverse native flora. This year's decrease in Bay checkerspot butterfly larvae is concerning. It can likely be attributed to early drying of host plants during the dry winter and warm spring of 2022, and the inability of the low numbers to recover in wet and grassy years. Monitoring on Tulare Hill, for example, detected zero larval or adult BCB this year, despite higher *Plantago* and *Lasthenia* cover than the reference at Kirby Canyon (Kent et al. 2024). The difference is that the more extreme and varied topography at Kirby Canyon allows it to serve as a BCB refuge, with critical plant resources staying fresh later in the season on the very cool slopes, which are near the warmer slopes that allow quicker BCB development.

Data for nearby ungrazed serpentine sites can be supplied on demand to better understand the habitat thresholds where Bay checkerspot butterflies disappear.

The following are recommendations based on the Valley Habitat Plan biological goals and objectives and the survey results.

1. Mostly maintain current grazing regime in the different pastures at MOCR, which includes providing the ranchers flexibility in adjusting annual stocking rates and timing as documented over the last decade (see Grazing Regime section above). Creekside Science recommends slight increases in grazing pressure but does not consider this a change in the grazing regime.
2. Lobby Santa Clara County Agricultural Commission to allow use of Envoy Plus or another appropriate graminicide in grazed open space. The 2023 treatment area does not need to be resprayed in 2025, but adjacent areas should be treated to expand the effect. Treatment will target nonnative annual grasses, including barbed goatgrass. Use the highest concentration recommended by the label. Personnel should carefully calibrate the amount of product used per area treated. This treatment should improve habitat for BCB and native vegetation, as well as increase visual enjoyment for visitors. We envision such treatments taking place annually at new locations on the ridge, perhaps 2-4 acres a year. Each year Creekside Science and SCVOSA will assess whether to respray an area. The goal is not to eradicate grass or even barbed goatgrass (which infests hundreds of acres on Coyote Ridge), but to reduce nonnative annual grass cover and increase native forb cover. Repeated spraying could select for herbicide resistant strains.
3. Continue annual monitoring to track vegetation community changes. Share key results with grazing tenants.
4. Manage key invasive plants.
5. Introduce prescribed fire on a trial basis, as supported by Richard Harris's (2021) Wildfire Management Coyote Ridge Open Space Preserve (MOCR) document. Prescribed fires were conducted on MOCR in 2006 and 2007 to treat barbed goatgrass, but lack of fuel in the selected burn unit resulted in poor burn coverage. We recommend

further studies as described in the Valley Habitat Plan's GRASS-2. Wildfires provide limited opportunity to study fire effects, because pre-burn data are lacking (i.e., the fire tends to burn a very small number of already established plots).

Santa Clara Valley Dudleya

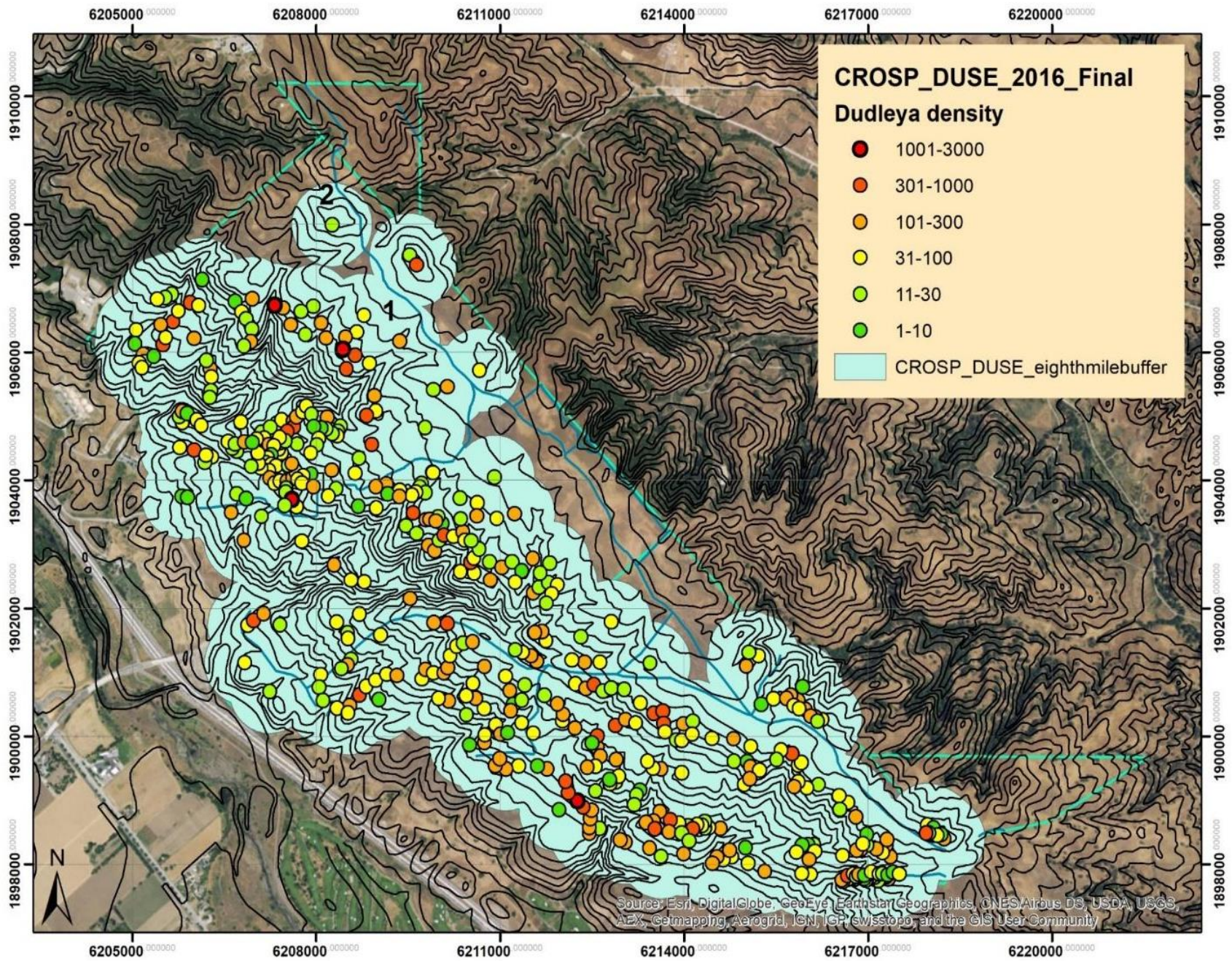
Santa Clara Valley dudleya (*Dudleya abramsii* ssp. *setchellii*) is a perennial, succulent forb in the Crassulaceae family. Listed as federally endangered and CNPS 1B.1, it is endemic to the ultramafic formations (serpentinite and peridotite) of the Santa Clara Valley. On MOCR, it is generally found on rocky outcrops, and other areas of exposed bedrock, more commonly on ridgelines and slopes. It can be found on both warm and cool exposures. It blooms April to October (CNPS 2017, HT Harvey and Creekside 2008), with May and early June usually being the peak on Coyote Ridge. It is differentiated from other Dudleya by its pale yellow flowers, generally simple primary inflorescence branches, and upper reduced leaves that are mostly 2-3 times as long as wide (Baldwin et al. 2012, Beidleman and Kozloff 2003).



Methods

Distribution Mapping

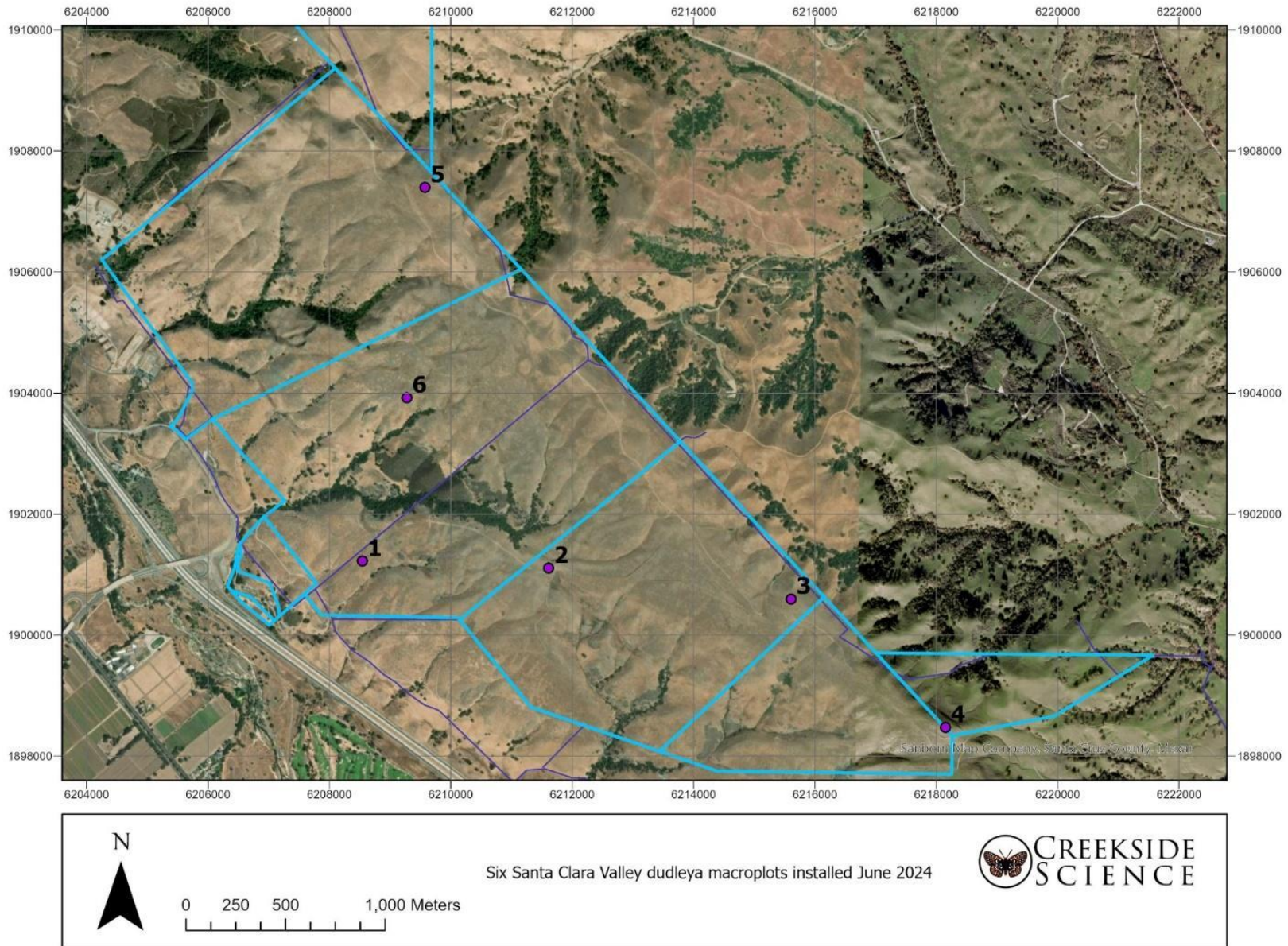
In 2016, Creekside Science created a distribution map at MOCR (then labeled Coyote Ridge Open Space Preserve or CROSP) (Map 14). In 2024, we were asked to conduct a qualitative assessment by revisiting the species distribution mapped during the baseline. Personnel revisited the previously mapped areas and branched out to new areas as well, focusing on rocky outcrops within serpentine grasslands and other likely habitat. At each occupied area found, a GPS point was taken. A log scale estimate of rosettes was recorded for each point with approximately a five-meter radius. Fieldwork took place mostly from May 21 to June 14, when the plants were in flower. A small amount of mop-up field work took place July 29 and September 6. The midpoint of each log scale estimate was summed to provide a MOCR estimate.



Map 14. Baseline Santa Clara Valley dudleya map created by Creekside Science in 2016.

Macroplots

We installed and read six new macroplots in June 2024 (Map 15). Each plot is 30x30m, like macroplots installed nearby on VTA and LTSCV properties. Within each plot, Santa Clara Valley dudleya were censused, with data recorded to the meter so distribution patterns can be revisited. Observers recorded both individual rosettes, which can objectively be counted, as well as rosette clusters, which are rosettes that are touching. This definition has been used as a proxy for individual plants, but it is impossible to tell if rosettes that are touching represent asexual reproduction of a single individual, or individual plants that have grown together.

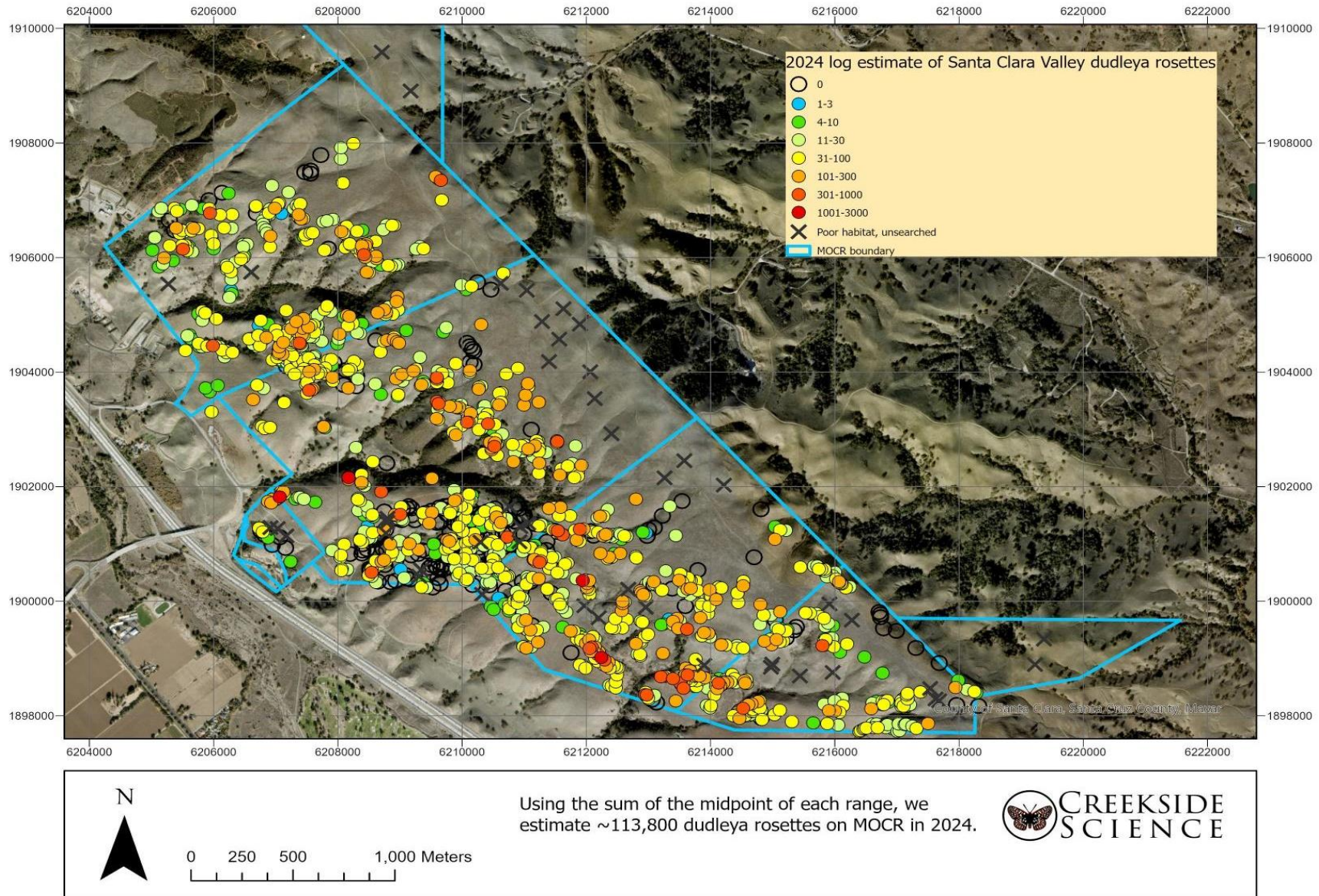


Map 15. Six new permanent Santa Clara Valley dudleya macroplots installed June 2024

Results

Distribution Mapping

The 2024 distribution map is shown below (Map 16). It shows a single occurrence with about 113,800 rosettes.



Map 16. Santa Clara Valley dudleya distribution map for MOCR, 2024

Macroplots

The baseline results of the rosettes and rosette clusters for new plots installed in 2024 are shown in Table 15. Figure 20 shows rosettes only.

Plot	Rosettes	Rosette clusters/individuals	Rosettes per cluster
1	173	52	3.3
2	438	172	2.5
3	429	171	2.5
4	55	20	2.8
5	397	117	3.4
6	225	71	3.2
average	286.2	100.5	2.9

Table 15. Baseline of rosettes and rosette clusters censused at each macroplot, 2024

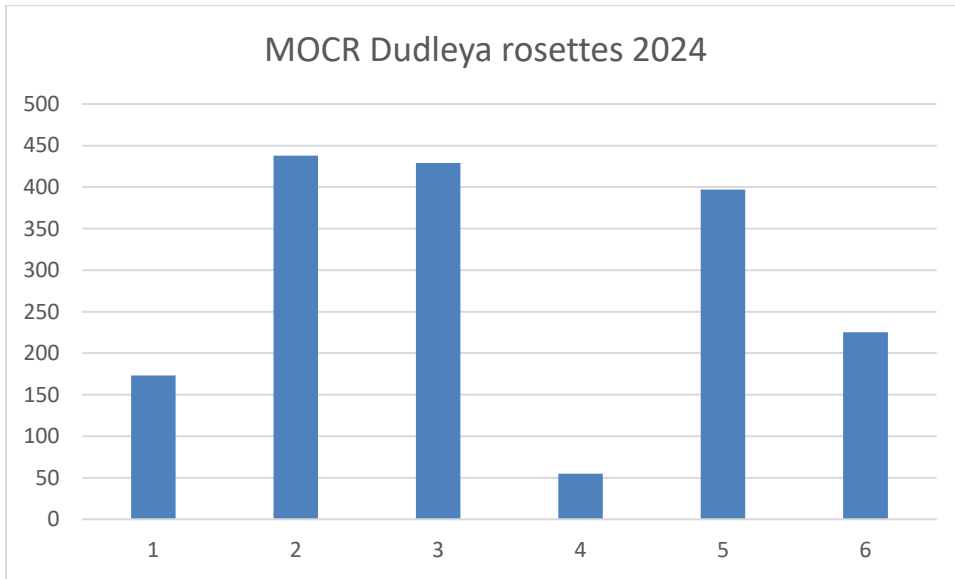


Figure 20. Baseline number of dudleya rosettes for each new macroplot

Discussion/Recommendations

Santa Clara Valley dudleya is abundant and widespread on MOCR. The estimate of 113,800 rosettes is considerably higher than the previous estimate of 66,900 (Creekside Science 2018). We are pleased we were able to more thoroughly map this plant on this large property. We believe the main cause of the increase was based on a more thorough search: our increased knowledge of the property, the ability to target a lot of the search effort using the 2016 baseline map, and a higher amount of personnel hours assigned to the task. There could also be an increase in the number of dudleya, but based on our data at other nearby sites, it's unlikely any increase was substantial.

Our baseline effort in 2016 had 90 contracted hours through SCVHA. This year's effort was funded by two sources: an 88 hour contract through SCVHA plus 124 hours we received through the subcontract with Santa Clara University for the above grant. The extra grant-funded hours were necessary for more accurately surveying MOCR. Unfortunately it's unclear whether any new points represent new plants, or whether the points that overlap with the baseline represent

the same individuals/rosettes. The macroplots are a better tool for identifying changes in numbers and distribution on a small scale, although technically they don't track individuals either.

The macroplots provide baseline numbers. Comparing the numbers in one macroplot with another is not that useful. It will be most useful to compare numbers to themselves over time. We can also capture some information about whether the clusters moved since they were mapped to the square meter, although again we're not technically tracking individuals/rosettes (i.e., if a rosette dies and is replaced with another, that won't be captured).

The following are recommendations based on the Valley Habitat Plan biological goals and objectives and the survey results.

1. Support the CVPCP grant "Ensuring Santa Clara Valley Dudleya Live Forever," a partnership between Santa Clara University and Creekside Science. Results from the genetic, pollination, seed dispersal, metapopulation dynamics, and propagation experiments are directly applicable to ongoing Santa Clara Valley dudleya conservation on this property and throughout its range.
2. Monitor the macroplots every five years, preferably in conjunction with monitoring on other properties to account for variances in interannual weather and other stressors. The current schedule is 2026, 2031, 2036, etc.

Coyote Ridge Jewelflower

Metcalf Canyon (*Streptanthus albidus* ssp. *albidus*) and most beautiful jewelflowers (*Streptanthus albidus* ssp. *peramoenus*) are two very closely related annual forbs. Both are serpentine endemics known from grasslands in southern Santa Clara County that grow up to 1m tall and bloom April to July. Metcalf Canyon jewelflower is listed as federally endangered and CNPS 1B.1. It is known by its white, sometimes green-tinged sepals. The most beautiful jewelflower is listed as CNPS 1B.2. It is known by its pink sepals.

The two jewelflowers on MOCR pose difficulties in quantification efforts. Metcalf Canyon jewelflower (white) and most beautiful jewelflower (pink) can co-occur, and plants exhibit the whole range of colors between white and dark pink. Preliminary observations over two years on MOCR imply that the majority color at a given point can change year to year. This is a complex zone of interbreeding.

This makes it difficult to identify which taxon an individual or group of plants are in. Jewelflower expert Dr. Justen Whittall (Santa Clara University) has stated that a few white individuals within a pink population should still be identified as most beautiful jewelflower, but we have no clear rule about what size a population should be or what proportion of individuals tips the balance one way or the other. In which taxon is a plant with very pale pink sepals? Do a few small areas of one taxon within a larger matrix of another comprise an occurrence of each, or should the majority rule, and if so, on what scale? To further complicate things, preliminary observations showed the majority colors shifting over time at some sites.

Creekside Science and Dr. Whittall received, through SCVHA, a CDFW Local Assistance Grant (LAG) that allowed them to further examine the distinction between the two taxa, especially in areas where they intermix. They documented color frequencies of populations throughout Coyote Ridge and nearby areas, and mapped four zones on Coyote Ridge with similar color frequencies. They recommended to CDFW and SCVHA that the amended Valley Habitat Plan create



Metcalf Canyon jewelflower
© 1995 Dean Wm. Taylor, CNPS 2017



Most beautiful jewelflower
© 1994 Robert E. Preston, CNPS 2017

conservation objectives related not simply to the two jewelflower taxa, but to the different zones of Coyote Ridge jewelflower. This allows managers to prioritize the natural process of intermixing, rather than trying to differentiate individuals and populations (Whittall et al. 2023).

This grant project (titled Name that Jewelflower) was completed in 2023. Based on our recommendations of how to address jewelflowers of mixed colors, we recommend the plants found on MOCR should be called Coyote Ridge jewelflower zone 3. Zone 3 is described as “a continuous cline in flower color variation with mixed populations containing white, pink, and dark pink individuals” (Whittall et al. 2023).

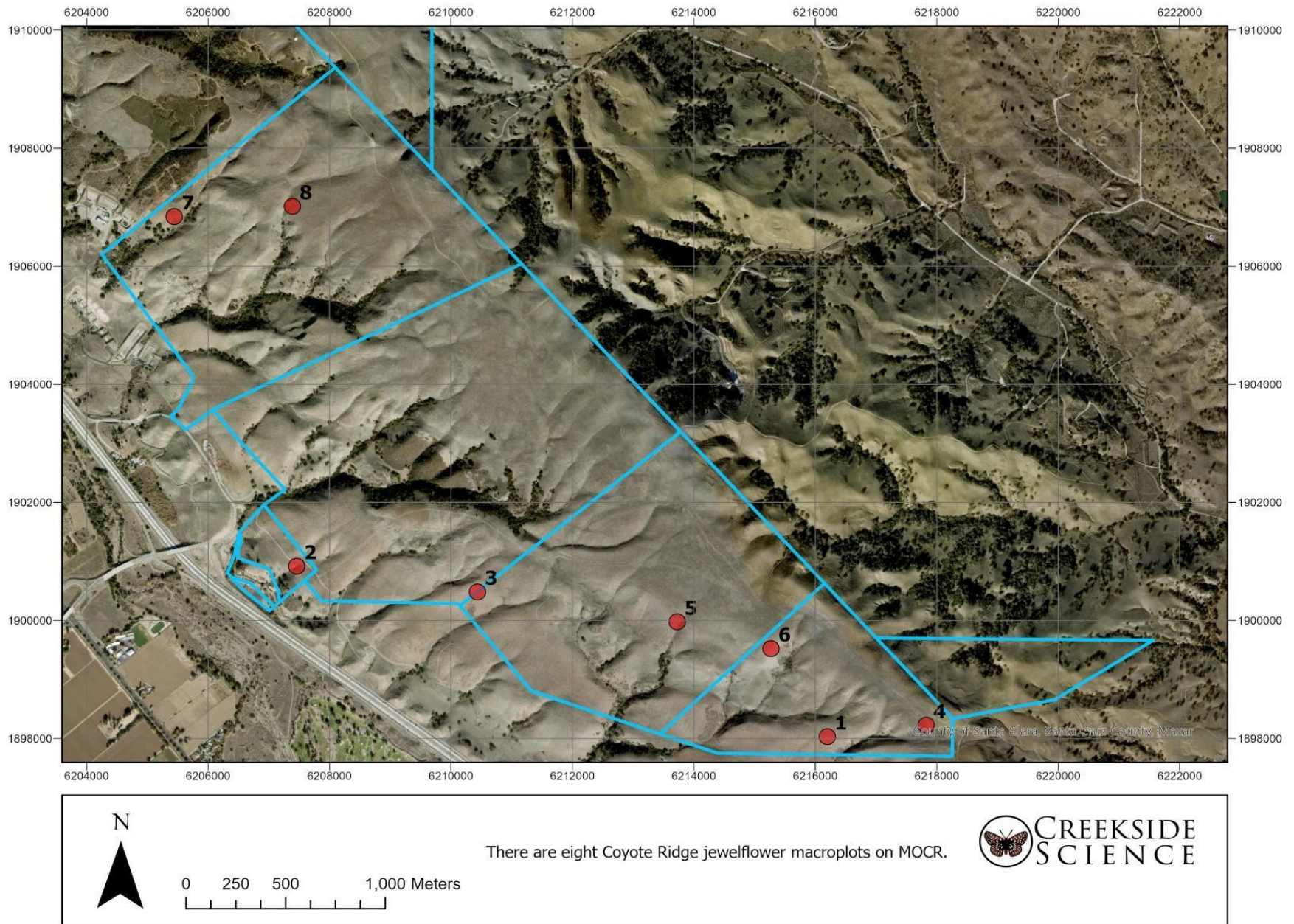
Methods

Creekside Science installed eight permanent macroplots in 2017 (Map 17). This macroplot monitoring protocol is also used for jewelflowers on the adjacent VTA and SVLC properties on Coyote Ridge (Niederer et al. 2021, 2020, Weiss et al. 2021). It is similar to that used for Presidio clarkia (*Clarkia franciscana*) at the Presidio of San Francisco and at serpentine prairie at Redwood Regional Park in Oakland (Stringer 2006, EBRPD 2008). During the peak flowering period, density is counted along 0.5 x 50m transects with a restricted random distribution within permanent 50 x 50m macroplots dispersed throughout the property. Such long skinny transects excel in areas with clumped plant distributions. A single long transect tends to encounter both dense and sparse patches, minimizing variability between sampling units. Macroplots were visited May 20-May 29, 2024.

These densities give an estimate of the jewelflower in each macroplot, to the 80% confidence level. These numbers will be tracked over time to detect changes. Managers may consider moving the macroplots if jewelflower populations drop dramatically within them. Plot selection is detailed in Creekside Science (2018).

Color frequency data were collected at the same time to confirm plants should still be called Coyote Ridge jewelflower zone 3. At each site, a 100 m transect was placed and color data was collected on the flowering jewelflower closest to each 2-meter mark. Because flower color can vary slightly even on the same plant, the flower nearest the tip in full anthesis (anthers exerted) was selected. Color was scored to a laminated Dunn-Edwards paint chip that most closely matched the sepal color (Photo 1). Observer records the number of plants assigned to each color on the tool. This method was established in Whittall et al. (2023).

The same areas were sampled in 2021 and 2022 as part of the Name that Jewelflower study, so quantitative comparisons across time are possible. Each color card has a defined value, hue, and chroma (see Whittall et al. 2023). The frequencies of each color card were used to calculate mean value, hue, and chroma for each macroplot for 2021, 2022, and 2024 to examine if there were significant changes in color. Statistical analysis (one way ANOVA across years for each macroplot) was done in JMP 17 (SAS Institute).



Map 17. Eight jewelflower macroplots on MOCR

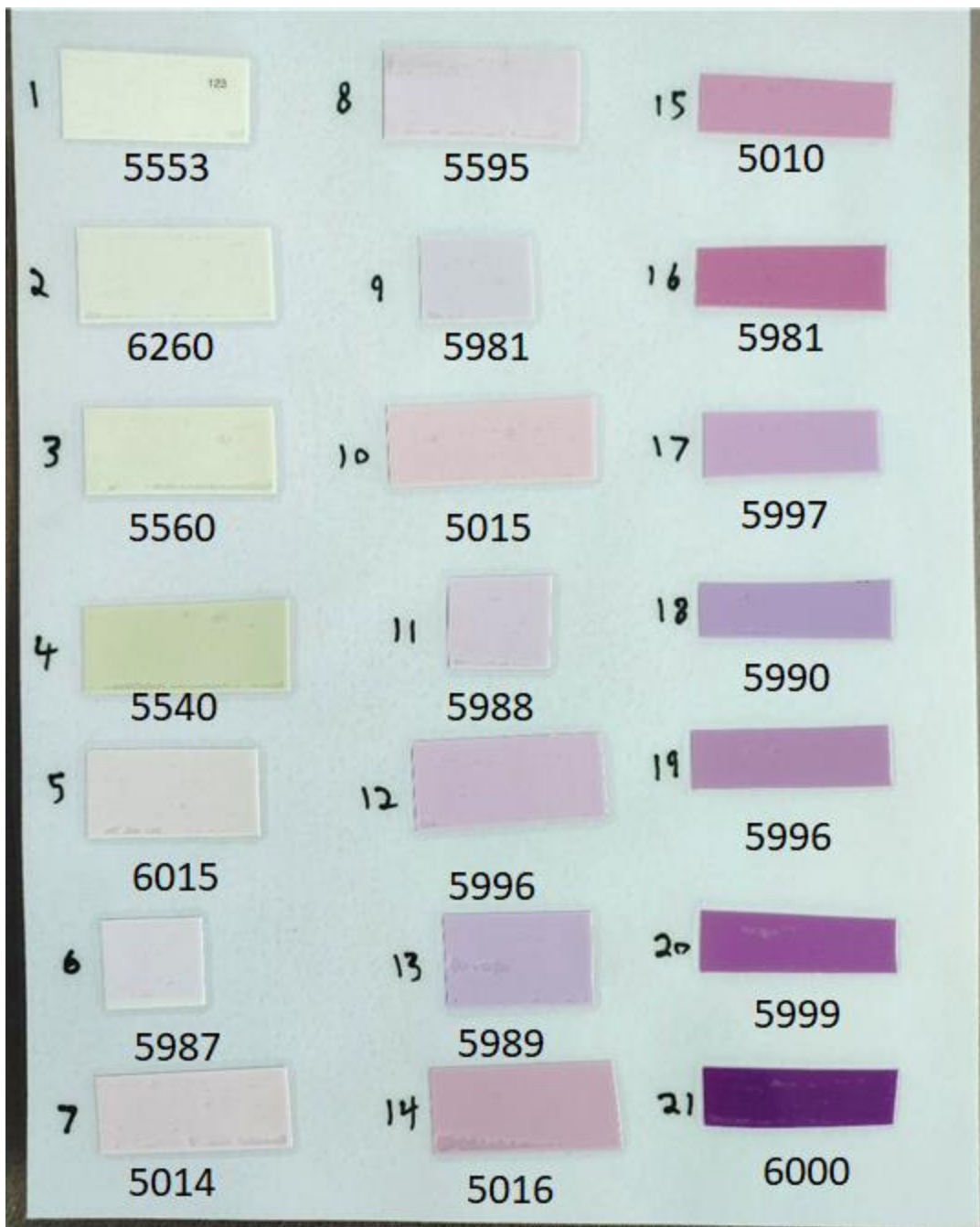


Photo 1. Field ready laminated Dunn-Edwards color tool representing the range of colors observed in preliminary studies of Metcalf Canyon jewelflower, most beautiful jewelflower, and bristly jewelflower (*Streptanthus glandulosus*). Field-use numbers are to the left of swatches, and Dunn-Edwards numbers are below.

Results

Estimates for the eight permanent macroplots are shown in Figure 21. Five plots increased, and three plots decreased.

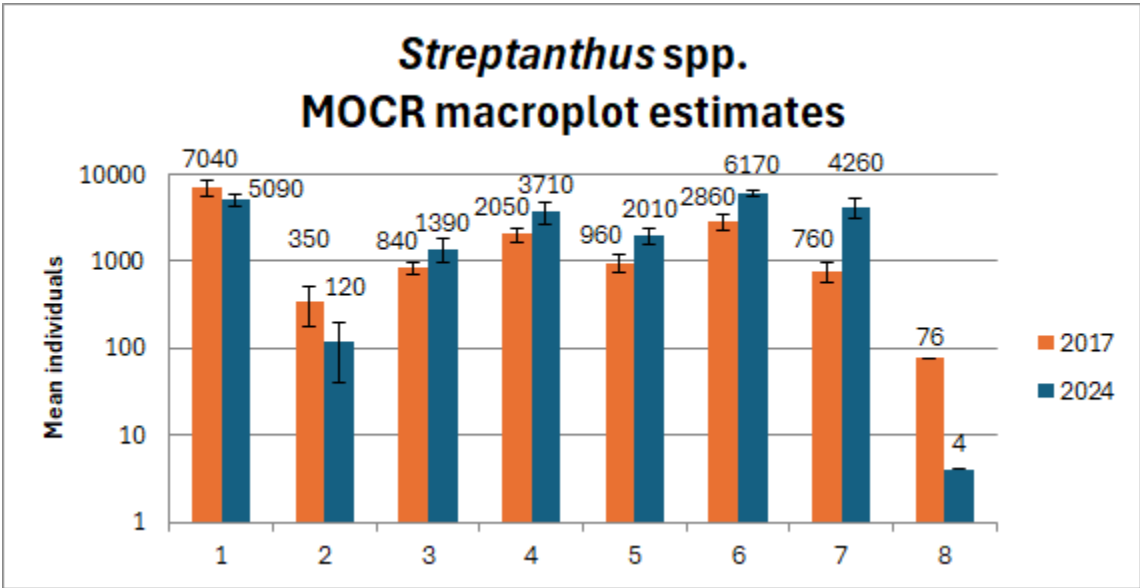


Figure 21. Macroplot estimates with 80% confidence intervals. *8 was censused.

The color frequencies for the eight macroplots in 2024 are shown in Table 16.

DE Color	Code	MOCR Macroplot 1	MOCR Macroplot 2	MOCR Macroplot 3	MOCR Macroplot 4	MOCR Macroplot 5	MOCR Macroplot 6	MOCR Macroplot 7	MOCR Macroplot 8
5553	1		11	7		6	1	11	4
6260	2			4		1		10	
5560	3							5	
5540	4							2	
6015	5	1	19	12	3	5	5	17	
5987	6	8	5	5	6	7	2		
5014	7	1					8	1	
5995	8	1		2		3	13		
5981	9	5		5	7	17	4		
5015	10						2		
5988	11	8		8	9	2	2	1	
5996	12	3		2	8	1	4		
5989	13	14	1	3	9	5	5	3	
5016	14								
5010	15								
5011	16								
5997	17	6		2	3	1	3		
5990	18	2			4	1			
5998	19	1			1	1	1		
5999	20								
6000	21								
TOTAL		50	36	50	50	50	50	50	4
Value	mean	7.53	8.84	8.54	7.59	8.36	7.53	8.97	9.6
Hue	mean	6.29	4.49	5.72	6.41	5.65	6.29	5.07	1.4
Chroma	mean	5.56	1,80	3.16	5.34	3.69	5.56	1.61	0.8

Table 16. Color frequencies found in the eight macroplots. Note only four plants were found in the entire macroplot 8.

Comparisons of the mean value, hue, and chroma across 2021, 2022, and 2024 showed no significant changes in any macroplot over those time intervals. (Figure 22). Confidence intervals are excluded for visibility.

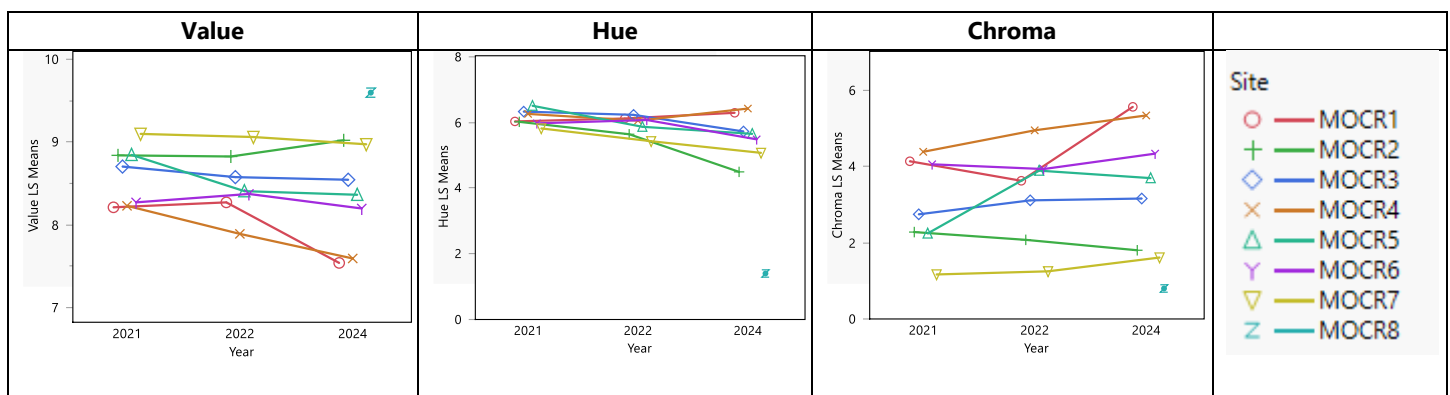


Figure 22. Mean value, hue, and chroma through time for each macroplot.

Discussion/Recommendations

The Habitat Plan is outdated in its objectives that seek to differentiate between occurrences of Metcalf Canyon and most beautiful jewelflowers on Coyote Ridge. We have come to better understand the complexity of intermixing, and determined that it is useful to refer to the four zones of Coyote Ridge jewelflowers. MOCR is largely comprised of zone 3, “a continuous cline in flower color variation with mixed populations containing white, pink, and dark pink individuals” (Whittall et al. 2023).

Coyote Ridge jewelflowers continue to be abundant throughout MOCR. The macroplots show both increasing and declining plots. Years of monitoring on neighboring properties have shown that large interannual fluctuations are common. Monitoring at the same time as other properties (VTA and LTSCV properties) makes comparisons more robust (i.e., if one property declines while the others increase, there may be a management issue, whereas if all properties decline, it is likely due to unfavorable weather). Similarly, distribution monitoring along a grid dispersed through the property can also capture shrinking and expanding populations, and implied seedbank dynamics, on a more widespread scale than the relatively small macroplots. We suggest adding this type of monitoring on the same schedule as the other properties.

The mean colors in each macroplot did not significantly change over the three years (2021, 2022, 2024). Value (light to dark) was the color component that best defined the north to south cline from white to increasing frequencies of light and dark pink. Macroplot 8, with only four plants, all DE 5553 (white) had the highest value.

The issue of seedbanking was tabled in 2018 due to taxonomic difficulties. Collecting seeds throughout each of the four zones should be prioritized.

The following are recommendations based on the Valley Habitat Plan biological goals and objectives and the survey results.

1. Amend Valley Habitat Plan to incorporate findings from “Name that Jewelflower.” Both jewelflower taxa are found on Coyote Ridge, at varying color frequencies. Rather than teasing out which taxa are present in discrete occurrences, and setting conservation objectives based on the two taxa, the Plan should protect the four zones of Coyote Ridge jewelflowers and the evolutionary processes leading to their intermixing.
2. Collect seed from each of the four zones to store at a Center for Plant Conservation certified botanic garden.
3. Map jewelflower distribution on the property every five years, preferably in conjunction with monitoring on other properties to account for variances in interannual weather and other stressors. The current schedule is 2029, 2034, 2039, etc.
4. Monitor the macroplots every five years, preferably in conjunction with monitoring on other properties to account for variances in interannual weather and other stressors. The current schedule is 2025, 2030, 2035, etc.
5. Continue color card scoring when monitoring macroplots every five years to track changes in color frequencies to determine spatial changes in color.

Loma Prieta Hoita

Loma Prieta hoita (*Hoita strobilina*) is a perennial herb from the Fabaceae (pea) family. It is ranked CNPS 1B.1 (rare, threatened, or endangered in California and elsewhere, seriously endangered in California). It is not federal- or state-listed.

It is usually found on serpentine, but is not entirely endemic. It is known from chaparral, cismontane woodland, and riparian woodland. Sites are usually mesic. It is known from Santa Clara, Santa Cruz, and Contra Costa Counties, and presumed extirpated in Alameda County, with 28 presumed extant occurrences in the CNDDDB and 1 presumed extirpated (CNPS 2016).



Photo by Janell Hillman, CalPhotos

It is usually less than 1 m tall, with erect pubescent stems and white and blue/purple flowers 13-19 mm long (blooming May to October). It has tomentose pinnate leaves with three leaflets; the petioles are usually under 8 cm long. The calyx is distinctly irregular (Baldwin et al. 2012, Thomas 1961). Vegetatively, the three leaflets can make it look similar to poison oak (*Toxicodendron diversilobum*), which is oily, and various berries (*Rubus* spp.), which have spines or prickles.

Methods

Creekside Science was tasked with surveying the populations and collecting seed if possible. We revisited the two known occurrences on MOCR on dates across the period of blooming/fruitletting. Plants at Site 1 were censused on 6/20/24. Site 1 was revisited on 7/29/24 to look for seed to collect. Site 2 was visited on 6/20/24 and again on 9/9/24. Plants were found outside of the polygons mapped in 2016, and we used GPS coordinates from those sites to expand the polygon for Site 2 accordingly (Map 18). The number of plants at Site 2 was estimated visually on a log scale. It should be noted that it is difficult to tell whether multiple stems emerging from the ground belong to one or more individual Loma Prieta hoita. Creekside Science staff used best professional judgment in defining an individual in the field. The reference site was also checked as a phenological reference, since it was very easy to access. When the reference site was past flowering, we made the second visit to Site 1 in an attempt to collect seed. Since Site 2 is much shadier than the reference site or Site 1, we decided to make a second visit to that site later, since we were again hoping to find seed.

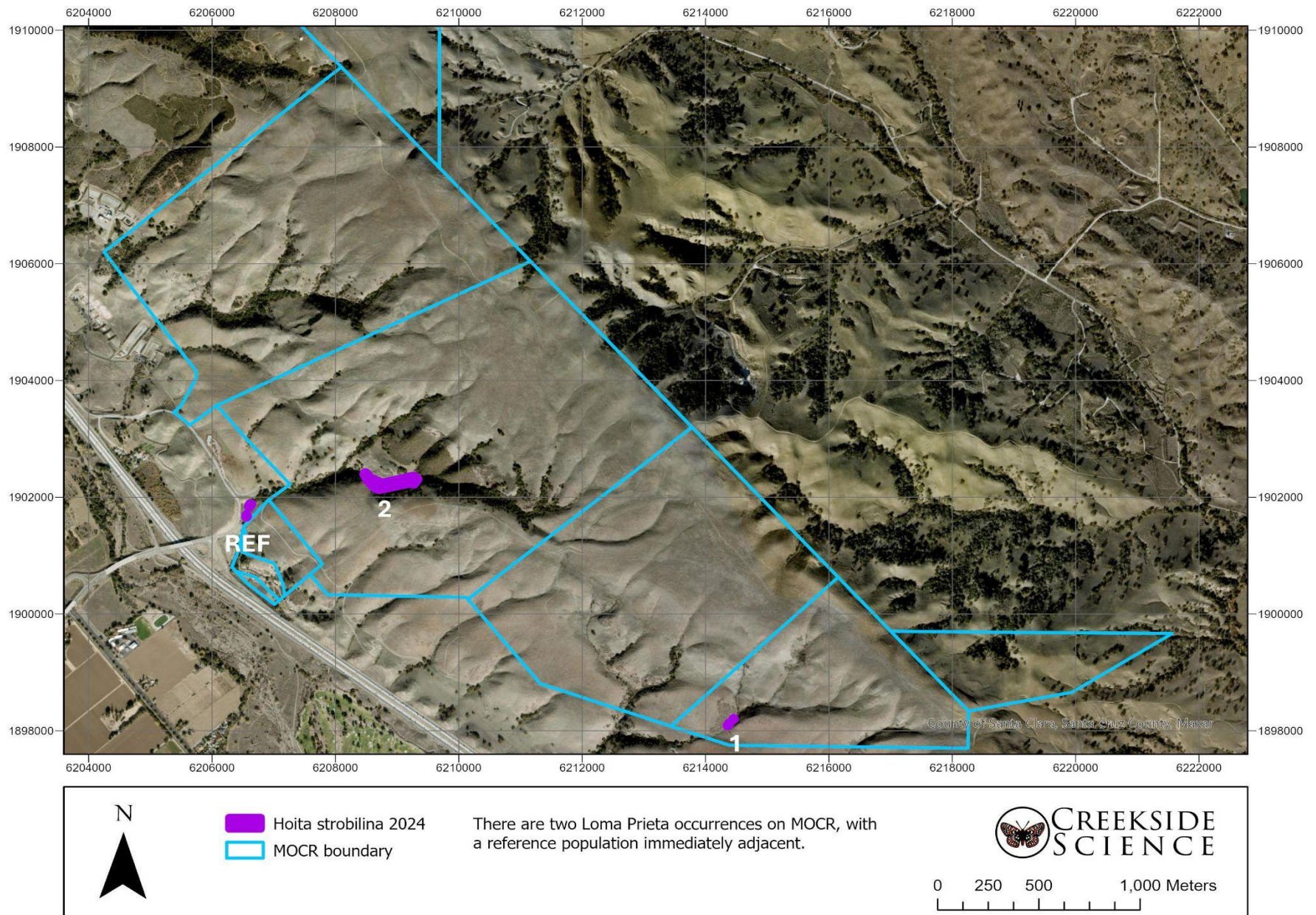
It should be noted that Site 2 is in a steep canyon and is difficult to access.

Results

The two known occurrences were revisited. Site 1 was censused, and Site 2 was visually estimated on a log scale. In this case, we estimated between 301 and 1,000 individuals for Site 2. Plants were found outside of the 2 small polygons originally demarcated as Site 2, so the polygons were expanded and merged into one. The increase in Site 2 numbers is in part driven by a better understanding of the site's parameters than we had in 2016 and also likely driven by an actual increase in the number of individuals. Both sites had considerably more plants than were counted in 2016 (Table 17).

Species	Code	Location	Site #	CNDDDB Occ. #	# Individuals 2016	# Individuals 2024
Loma Prieta Hoita	LPHO	MOCR	1	35	11	32
Loma Prieta Hoita	LPHO	MOCR	2	11	265	650

Table 17. Two Loma Prieta hoita occurrences were found on MOCR in 2016. They were revisited and counted again in 2024. CNDDDB occurrence 11 actually includes Site 2 and the reference Site, but since the reference site is off of MOCR, only the subset at Site 2 are considered here.



Map 18. There are two occurrences of Loma Prieta hoita on MOCR. Site 2 is part of CNDDDB occurrence 11, which also includes the reference site that is technically off the property.

No seeds were observed, and therefore none were collected.

Status/Threats

Population estimates are higher than 2016. The population at Site 1 remains critically low. We have not observed signs sexual reproduction (seed production) at any of the populations on MOCR. Flowering plants were found at Site 1 on both visits, and as well as at the reference site. During the September visit to Site 2, there was no evidence that the plants had flowered. Thus, we assume these plants will not flower this year. While Site 1 and the reference site had flowers, we were unable to find fruits with viable seed. All fruits seen had been aborted (Photo 2). It is unclear why these plants seem to be aborting their fruits, but one explanation is that these individual plants are products of asexual reproduction, so there is little to no genetic variability, and they are self-incompatible.

We also observed grazing and trampling at Site 2 and less intensely at Site 1 (Photo 3). However, this is restricted to where the cows can easily access, which is a small portion of Site 2. In general, plants seen appeared healthy and free of disease. The small populations and potential for inbreeding depression may be some of the biggest threats to these plants.



Photo 2. Hoita aborted fruits at Site 1.



Photo 3. Hoita trampled by cattle, and also browsed

Discussion/Recommendations

Habitat Plan Section 5.4.15 provides the conservation strategy for Loma Prieta hoita. It states “The Implementing Entity will protect, maintain the viability of, and increase the number and size of populations of Loma Prieta hoita by acquiring and enhancing four extant occurrences within the study area (Table 5-16), if no additional occurrences are found during the permit term. Of the four occurrences, three are currently located in County parks. Loma Prieta hoita is expected to benefit from acquisition and enhancement of natural communities that serve as primary or secondary modeled habitat and/or contain known or undiscovered occurrences, including chaparral and coastal scrub . . . , oak and conifer woodlands . . . , and mixed riparian forest and woodland.”

The Habitat Plan concedes that very little is known about the ecology of this species, and lists multiple directed studies to inform adaptive management. It does not state a target size for populations, but lists studies that will inform such a target. Habitat Plan and the Wildlife Agencies aim to develop target sizes by Year 10 of Habitat Plan implementation.

Section 5.4.15 further fleshes out some questions that are pertinent to Loma Prieta management. Studies “will be conducted to determine factors limiting the expansion of extant occurrences (STUDIES-5). Other studies may focus on factors related to management and microsite needs of the species at all life stages from germination through maturity (STUDIES-5). Adaptive management decisions can then be developed on the basis of monitoring results.”

“Loma Prieta hoita has not been well studied, and little is known about its population biology or ecological effects and needs. Because management and conservation decisions for this species are limited in their potential efficacy, the

Implementing Entity has little information with which to design and plan specific management and monitoring protocols. Accordingly, directed studies are needed to successfully establish and maintain new occurrences in perpetuity (STUDIES-5).

The actual occurrence size and age structure of the extant occurrences of Loma Prieta hoita in the study area are currently unknown. A key management action will be to survey and monitor the new occurrence when it is added to the Reserve System and at regular intervals thereafter to quantify and track the occurrence structure over time (STUDIES-5). This information will also be used to determine the targeted viable occurrence size of managed occurrences.

Threats to Loma Prieta hoita are thought to include cattle grazing and trampling, feral pig rooting, development, and vegetation clearing. Studies may be conducted to investigate the details of these threats and the best measures to mitigate them (STUDIES-5).” Niederer has also observed exposed rhizomes from erosion in an incised stream channel at nearby CNDDDB occurrence #10 on the VTA property. Occurrences on MOCR did not appear to be threatened by anything but their small population sizes and some modest trampling/browsing.

The following are recommendations based on the Habitat Plan biological goals and objectives and the survey results.

1. Repeat surveys annually to detect evidence of reproduction (flowering/fruitletting/seedling establishment), and assess population size. Adjacent occurrences on Coyote Ridge could also be surveyed (11 reference, 10 on VTA, and undocumented occurrence noted by Quenelle on Santa Clara County Motorcycle Park).
2. Collect seed to store at a Center for Plant Conservation certified botanic garden. Continue to search populations for viable seed and collect if possible.
3. Consider collecting cuttings/rhizomes for nursery propagation and potential experiments. It is possible we could produce seeds with plants in a nursery that could then be used to bolster populations.
4. Discuss amongst stakeholders and experts the possibility of inbreeding depression in these populations and conduct experiments to determine whether this is a threat.
5. Expand MOCR Site 1. While target sizes have not been set, this is clearly a small and vulnerable population. It may need active management to persist. Outplanting propagated plants could be an option.

Mount Hamilton Thistle

Mount Hamilton thistle (*Cirsium occidentale* var. *campylon*) is a serpentine endemic from the Asteraceae (sunflower) family. It is ranked CNPS 1B.2 (rare, threatened, or endangered in California and elsewhere, fairly endangered in California). It is not federal- or state-listed.

A short-lived perennial herb, it is found in serpentine seeps, streams and other mesic areas in Valley and foothill grasslands, chaparral, and cismontane woodland. It is known from Santa Clara, Alameda, and Stanislaus Counties, with 41 presumed extant occurrences in the CNDDDB (CNPS 2016).

Growing up to 2 m tall, it can be identified by its nodding white to pink-lavender flowering heads made of disk flowers only (blooming February to October); spiny involucre; hairless phyllaries that recurve for more than half their length; and velvety, fleshy, almost succulent leaves. It is distinguished from conspecifics by its phyllary spines that are generally 2-6 mm, and longer spines of cauline leaves 10-18 mm (Baldwin et al. 2012, Corelli and Chandik 1995, Beidleman and Kozloff). The plants are monocarpic (flower once and then die).



Photo by David Tharp, CalPhotos

In 2017, Creekside Science and SCVHA recorded 13 occurrences of Mount Hamilton thistle on MOCR. At that time, it was assumed that populations within a discrete drainage are most likely to share genetic material (Map 19).

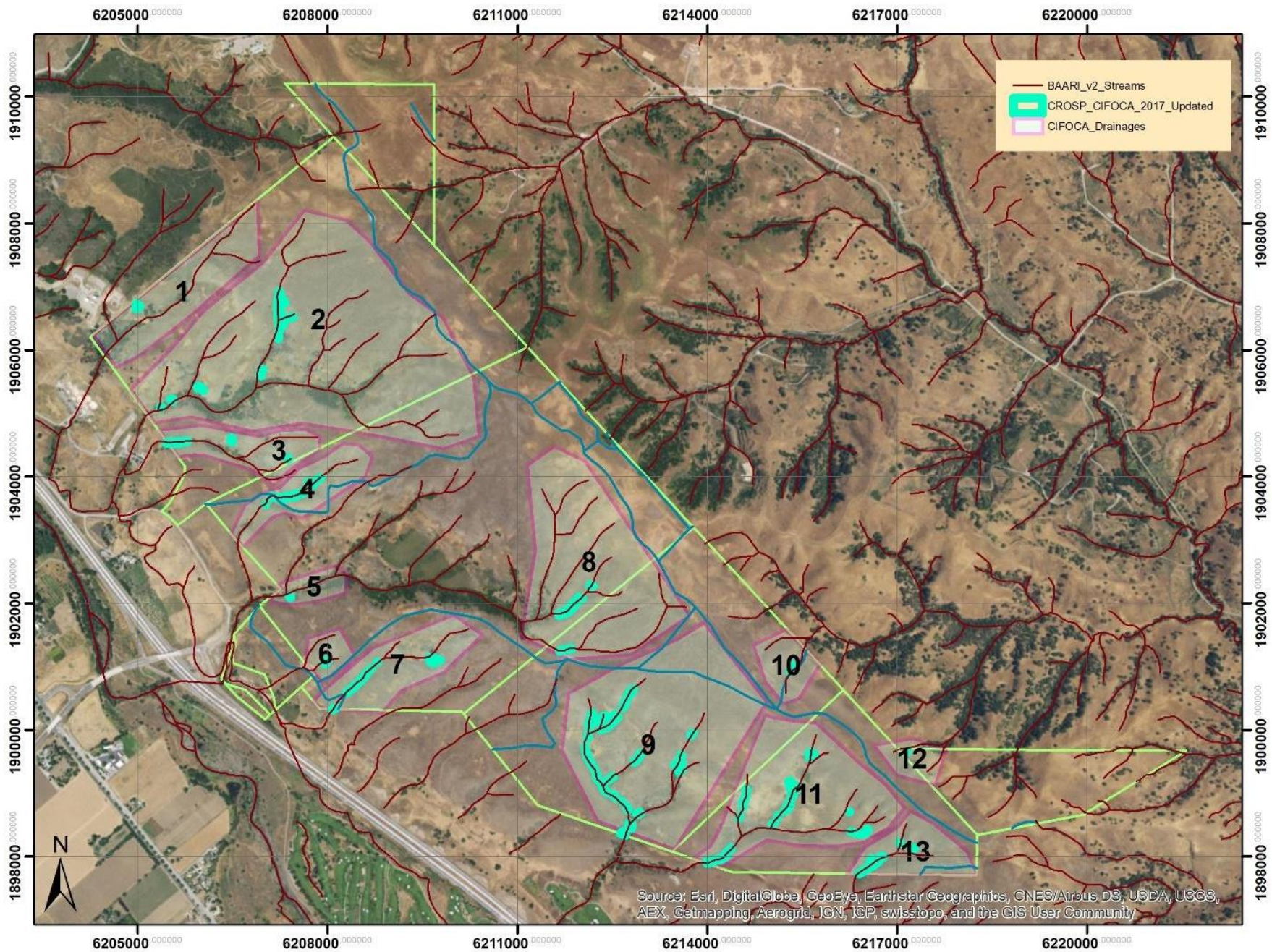
Methods

In 2017, Creekside Science installed 20 index plots distributed throughout MOCR to monitor each occurrence (except 3, which is immediately behind the county gun range) and account for a range of elevations, different watershed positions, and grazing regimes (Map 20). Plots were stratified to provide geographical dispersion, with specific locations selected randomly using methods detailed in the 2016-2017 baseline report (Creekside Science 2018).

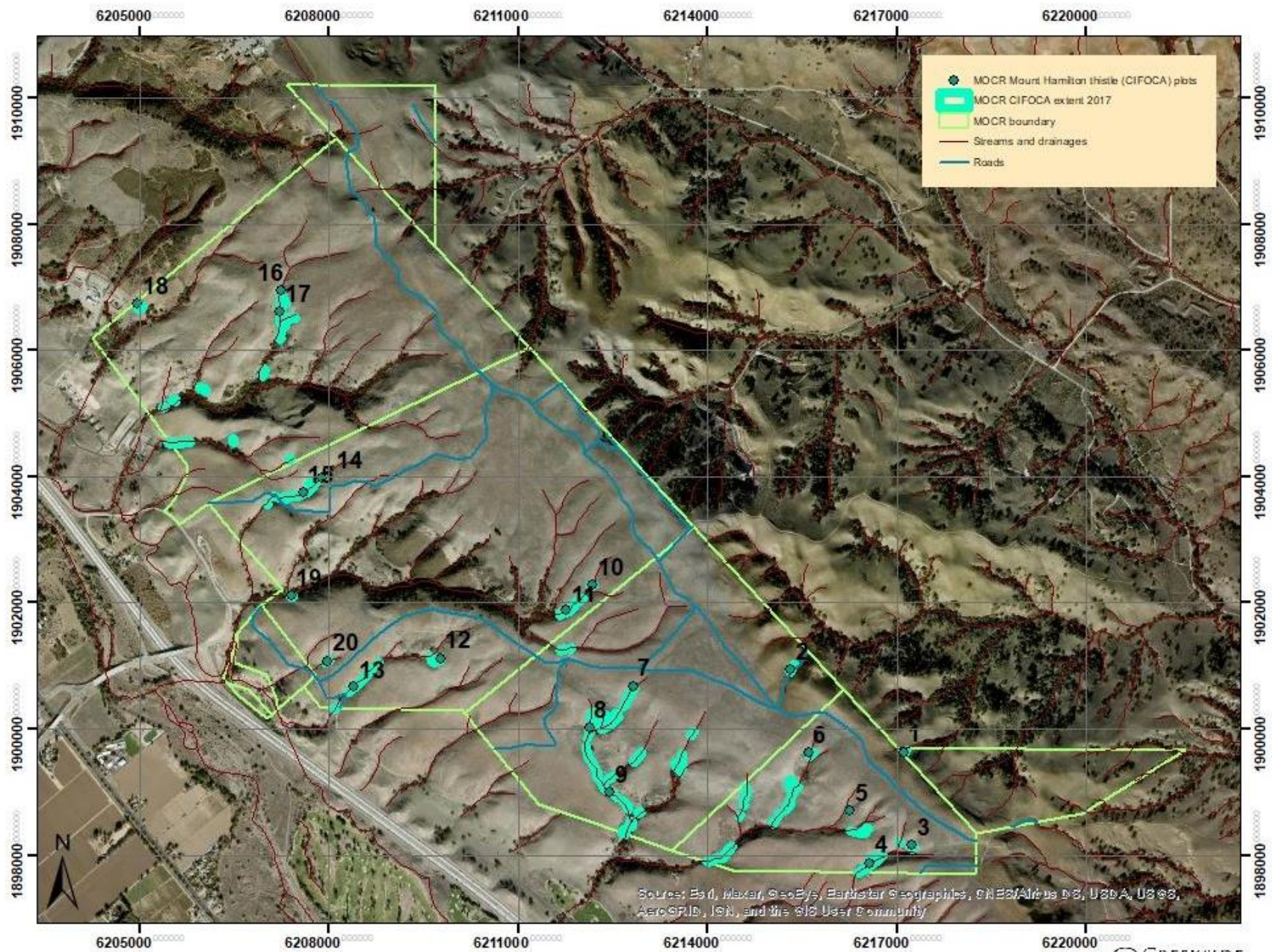
Plots were either headwaters, linear, or floodplain/wide seep. Headwater plots capture the highest populations in a given drainage. The uppermost plants were sought, so that headwater dispersal can be monitored, i.e., if plants are able to move upstream. When the uppermost individual in a drainage was found, rebar was used to delineate its position. The plot extended 5 m downstream, with four pieces of rebar delineating the upper and lower extents of the plot on each side of the drainage. The linear colonies are most common on MOCR and are found where plants are restricted to a relatively narrow stream channel. The floodplain/wide seep shapes occur when the stream channel widens and even combines with other channels as it enters the floodplain, or in low gradient seeps. The two shapes of colonies are monitored differently.

Linear plots were set up like headwaters plots. The plot extended 5 m downstream, with four pieces of rebar delineating the upper and lower extents of the plot on each side of the drainage. The one floodplain/wide seep plot contains a single 1-m wide transect set up perpendicular to flow, marked on each end with rebar.

Plots were monitored from August 27 to September 3, 2024.



Map 19. There are 13 occurrences of Mount Hamilton thistle on MOCR



There are 20 Mount Hamilton thistle index plots on MOCR.



Map 20. Index plot locations

Monitors take photopoints when collecting data. Previous years' photopoints are taken into the field to ensure the closest match when reshooting. Monitoring will preferably be done after peak bloom, usually July to September, to avoid damaging flowering plants. This year's photopoints are shown in Appendix B.

Data collection, linear plots

Looking downstream, the individual plant farthest left and farthest right from the thalweg (deepest part of the channel) was recorded to the nearest meter. The minimum distance was 1 m, indicating all plants on that side are within a meter of the thalweg. Plot width was as wide as needed to incorporate all Mount Hamilton thistle, and therefore varied from plot to plot. Within the entire plot, individuals were counted within the following classes: < 3 cm, 3 cm to 15 cm, >15 cm, and flowering. Measurements refer to the length of the longest leaf. Flowering individuals may be any size, and were not double counted into other size classes. These classes captured the range of sizes from seedling to reproductive maturity.

When returning to headwaters plots, plants were scouted upstream. The distance to any Mount Hamilton thistle found upstream of a headwaters plot was recorded, as this indicates uphill dispersal.

Data collection, wide floodplain plots

Mount Hamilton thistle is much more numerous and dense in these wide areas, prompting a different sampling technique. Permanent markers delineate a perpendicular 1 meter wide transect across the population. Within each 1-meter segment of the quadrat, recorded as distance on the datasheet, individuals were counted within the following classes: < 3 cm, 3 cm to 15 cm, >15 cm, and flowering. As above, measurements refer to the length of the longest leaf. Flowering individuals may be any size and are not double counted.

For all plots, any identified threats, such as overgrazing, extensive trampling or erosion, changes in water quality or quantity, severe insect infestations, etc., should be recorded in the comments. Excessive threats should be discussed as soon as possible between land managers and biologists.

Index results are used to estimate CNDDDB occurrences on MOCR, as well as the entire population on the property. The mean mature plants per linear meter in plots is calculated. This is multiplied by the total linear occupied area (in 2017) in each occurrence. A 95% CI is calculated using $t * (\text{standard deviation}/\sqrt{n})$, where $t = 2.086$ and $n = 20$.

Results

Populations decreased significantly when compared to the 2017 baseline, which is the last time the plots were monitored at this property.

Table 18 shows baseline results for all plots. The final column, mature plants, is the plot total minus seedlings (longest leaf < 3 cm). Table 19 shows 2024 results. Note that overall from 2017 to 2024, seedlings dropped from 3107 to 1006, flowering plants dropped from 212 to 105, and total plants dropped from 5820 to 2107. Two plots (CIFO-1 and CIFO-13) completely blinked out. Only one plot (CIFO-07) had an increase in both total and total mature plants. CIFO-15 and -19 had an increase in total plants, and CIFO-16 had a small increase in mature plants. Note in 2017 only two plots had no flowering plants; in 2024 there were 13 plots with no flowering plants.

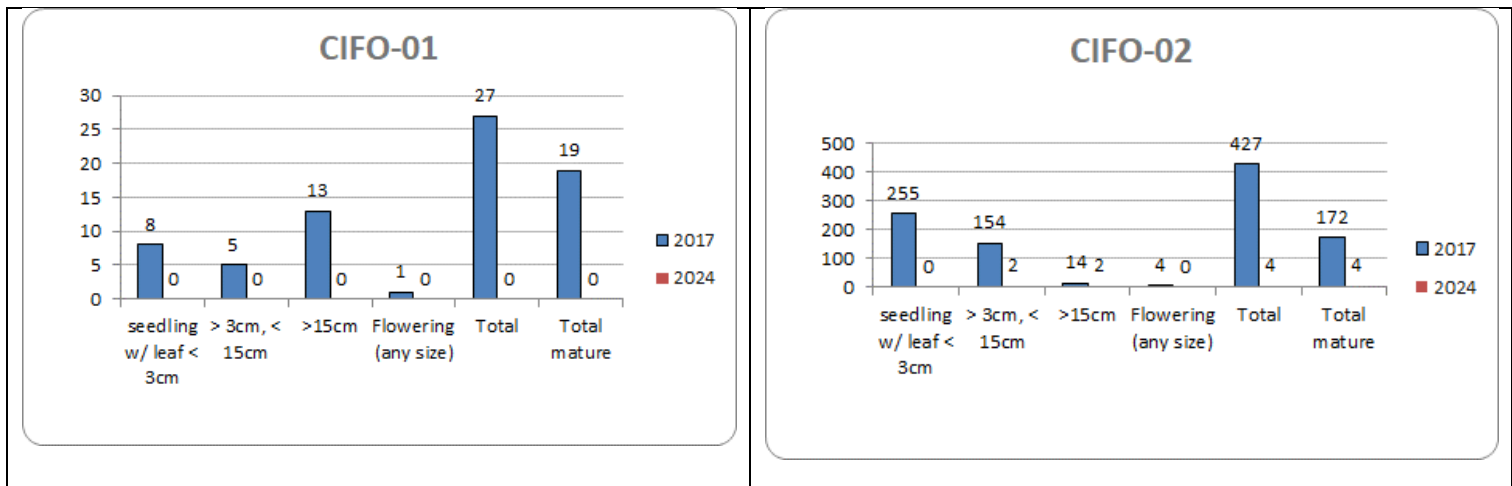
Date	Plot	Location Type	Farthest left, looking downstream (m)	Farthest right (m)	seedling w/ leaf < 3cm	> 3cm, < 15cm	>15cm	Flowering (any size)	Total	Total mature
8/8/2017	CIFO-01	East	1	3.4	8	5	13	1	27	19
8/8/2017	CIFO-02	East	4.3	1	255	154	14	4	427	172
8/8/2017	CIFO-03	Headwaters	3	4.7	37	99	46	14	196	159
8/8/2017	CIFO-04	Above bench	3.3	2.7	33	30	22	25	110	77
8/8/2017	CIFO-05	Above bench	3	2.8	195	47	15	9	266	71
8/16/2017	CIFO-06	Floodplain/ wide seep	0	27	840	390	97	37	1364	524
8/16/2017	CIFO-07	Headwaters	1.7	1	9	5	15	1	30	21
8/16/2017	CIFO-08	Below bench	1	1	205	305	28	5	543	338
8/16/2017	CIFO-09	Below bench	1	1	316	141	3	17	477	161
8/16/2017	CIFO-10	Headwaters	5	5	139	79	27	5	250	111
8/16/2017	CIFO-11	Above bench	1	4.7	33	10	18	6	67	34
8/21/2017	CIFO-12	Below bench	1.8	1.8	156	7	30	19	212	56
8/21/2017	CIFO-13	Below bench	1	1	1	1	5	4	11	10
8/21/2017	CIFO-14	Headwaters	1	1	34	26	7	3	70	36
8/21/2017	CIFO-15	Below bench	1.7	1	4	17	7	0	28	24
8/21/2017	CIFO-16	Headwaters	1	1	5	0	0	0	5	0
8/21/2017	CIFO-17	Above bench	3.7	3.2	22	20	83	9	134	112
8/21/2017	CIFO-18	Below bench	3.1	4.6	363	142	45	11	561	198
9/18/2017	CIFO-19	Below bench	7.6	1	111	108	29	4	252	141
9/18/2017	CIFO-20	Below bench	7	4	341	198	213	38	790	449
Totals					3107	1784	717	212	5820	2713

Table 18. Mount Hamilton thistle baseline in index plots, 2017

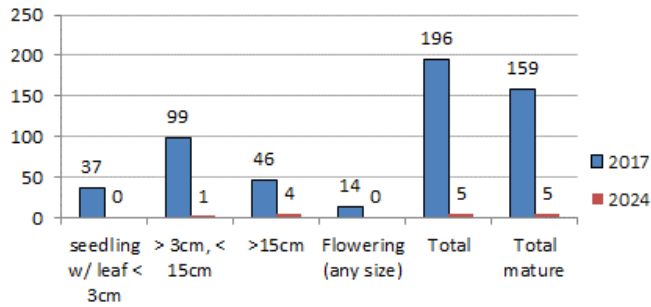
Date	Plot	Location Type	Farthest left, looking down-stream (m)	Farthest right (m)	seedling w/ leaf < 3cm	> 3cm, < 15cm	>15cm	Flowering (any size)	Total	Total mature
9/3/2024	CIFO-01	East	n/a	n/a	0	0	0	0	0	0
9/3/2024	CIFO-02	East	1	1	0	2	2	0	4	4
9/3/2024	CIFO-03	Headwaters	3.2	n/a	0	1	4	0	5	5
9/3/2024	CIFO-04	Above bench	1	6.8	11	4	34	14	63	52
9/3/2024	CIFO-05	Above bench	1	1	0	1	6	0	7	7
9/3/2024	CIFO-06	Floodplain/wide seep	n/a	n/a	238	67	32	12	349	111
8/30/2024	CIFO-07	Headwaters	1.2	4.1	82	21	8	6	117	35
8/30/2024	CIFO-08	Below bench	1	1	50	79	35	7	171	121
8/30/2024	CIFO-09	Below bench	1	1	29	10	36	21	96	67
8/27/2024	CIFO-10	Headwaters	4.9	0	2	6	4	0	12	10
8/27/2024	CIFO-11	Above bench	1	2.2	0	3	5	0	8	8
8/30/2024	CIFO-12	Below bench	1	1	1	7	2	0	10	9
8/29/2024	CIFO-13	Below bench	0	0	0	0	0	0	0	0
8/27/2024	CIFO-14	Headwaters	1	1	2	5	2	0	9	7
8/27/2024	CIFO-15	Below bench	1	1	42	21	0	0	63	21
8/27/2024	CIFO-16	Headwaters	1	1	0	2	0	0	2	2
8/27/2024	CIFO-17	Above bench	1.3	1	5	18	8	0	31	26
8/29/2024	CIFO-18	Below bench	4.2	2.8	131	122	41	2	296	165
8/27/2024	CIFO-19	Below bench	6.9	1	2	19	13	0	34	32
9/3/2024	CIFO-20	Below bench	7.5	5.5	411	236	140	43	830	419
Totals					1006	624	372	105	2107	1101

Table 19. Mount Hamilton thistle in index plots, 2024; yellow boxes show increase from 2017 baseline

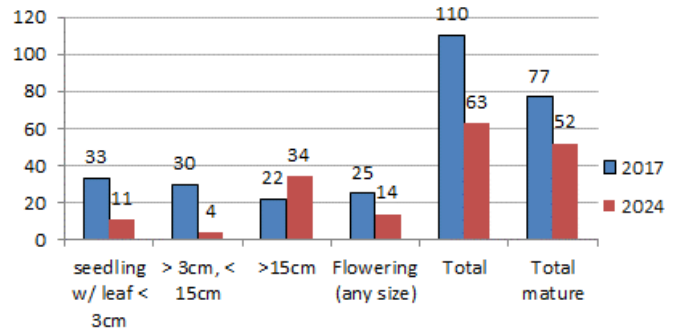
A histogram showing comparing each plot’s Mount Hamilton thistles by size class (length of longest leaf) in 2017 and 2024 is provided in Figure 23.



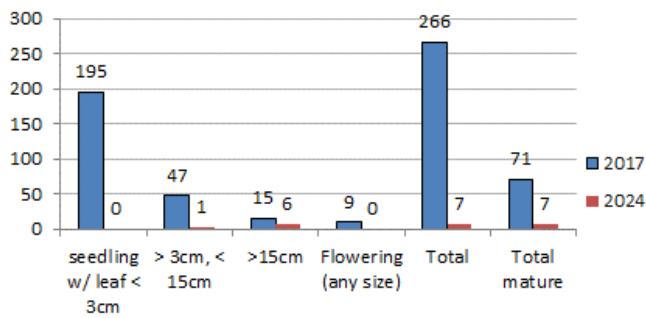
CIFO-03



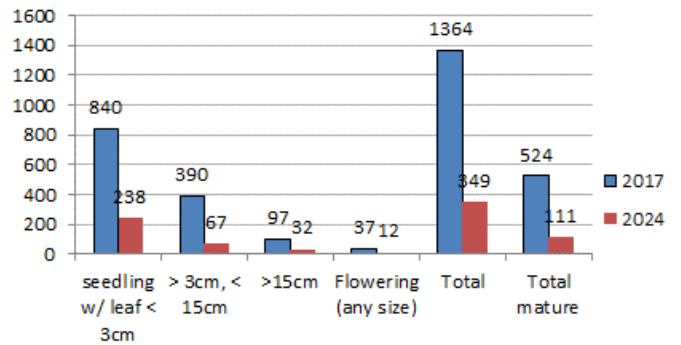
CIFO-04



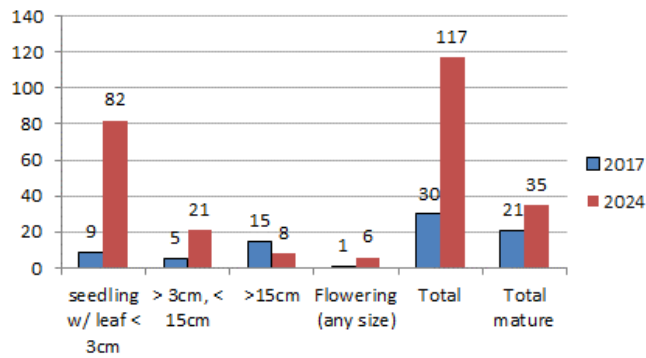
CIFO-05



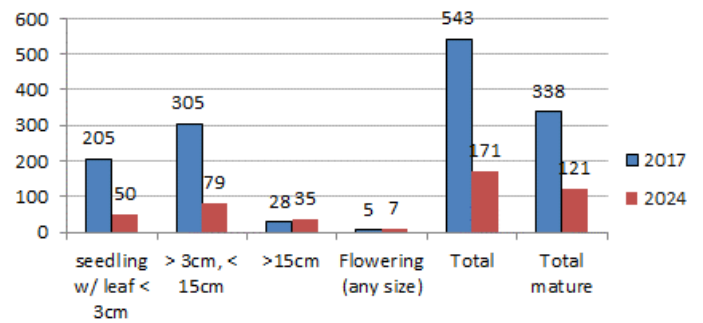
CIFO-06



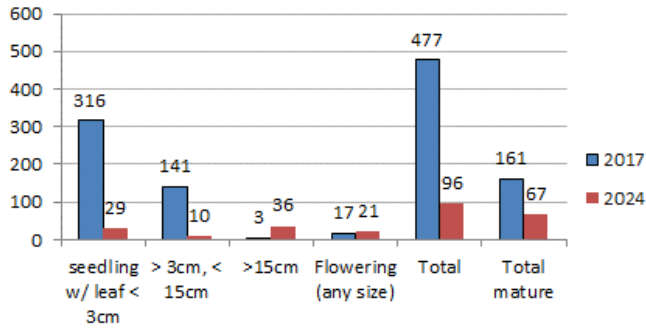
CIFO-07



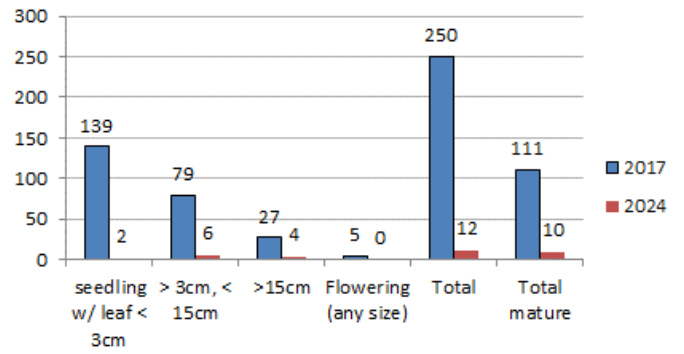
CIFO-08



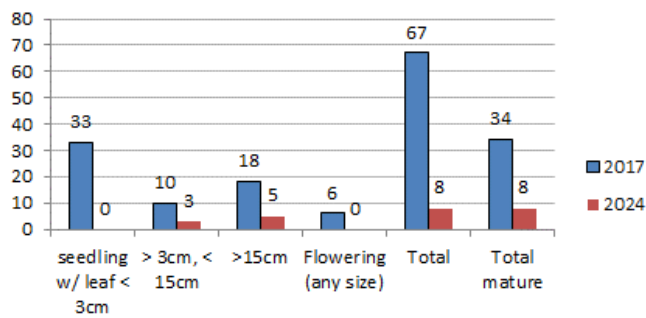
CIFO-09



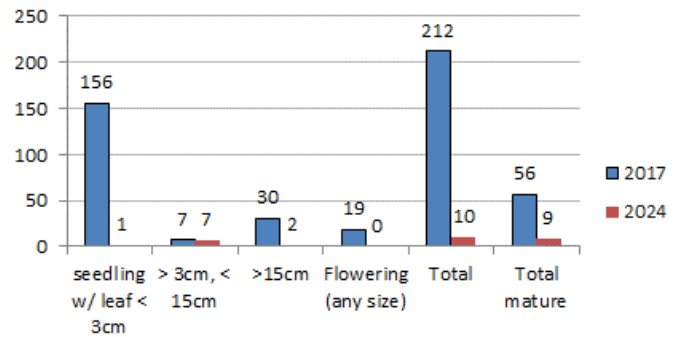
CIFO-10



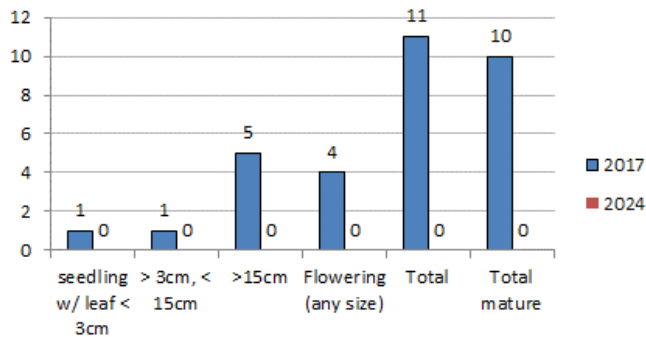
CIFO-11



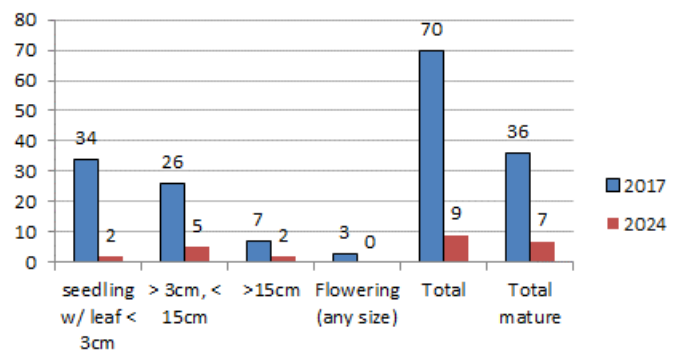
CIFO-12



CIFO-13



CIFO-14



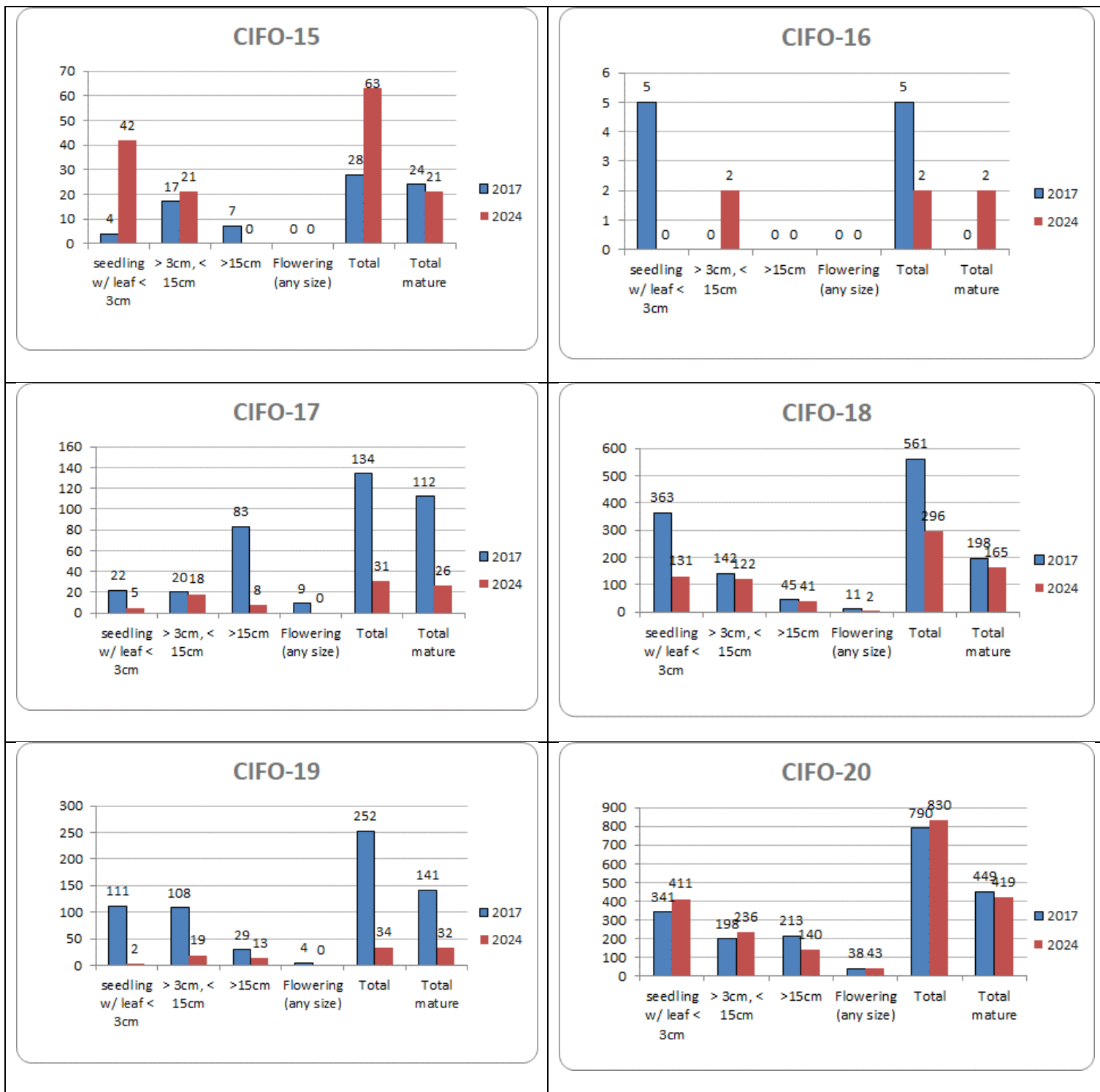


Figure 23. Histograms for Mount Hamilton thistle plots, 2017 and 2024

Index plots were used to create a population estimate.

Mature plants counted in plots were 1101. Mean mature plants per linear meter in plots was 10.91, with a standard error of 4.48. Multiplying total linear occupied area in each occurrence by average mature plants per linear meter, the population estimate is 33,721 mature plants. The 95% CI is calculated at $\pm 28,156$ ($t = 2.086$; standard deviation = 19.53;

total linear m occupied = 3091.4m; n = 20). This leaves the 2024 estimate of mature plants at 33,721 ± 28,156. This compares with the 2017 mature plant baseline of 79,073 ± 43,685. The estimate is broken down by occurrence in Table 20.

MOCR CIFOCA Occurrence #	CNDD B Occ. #	2017 index plot estimate	2024 index plot estimate	Net increase or decrease ()
1	n/a	729	307	(422)
2	38	7,286	3,064	(4,222)
3	n/a	3,756	1,579	(2,177)
4	39	7,579	3,187	(4,392)
5	32	368	155	(213)
6	n/a	708	298	(410)
7	7	7,273	3,059	(4,214)
8	8	4,889	2,056	(2,833)
9	8	28,128	11,830	(16,298)
10	11	172	424	252
11	8	14,045	5,907	(8,138)
12	n/a	19	122	103
13	8	4,121	1,733	(2,388)
	TOTAL	79,073	33,721	(45,352)

Table 20. Estimate of Mount Hamilton thistle per occurrence on MOCR

Discussion/Recommendations

First, we recommend regular monitoring, preferably on the schedule of adjacent properties like VTA. Mount Hamilton thistle is monitored there every five years, with regular monitoring starting 2017 and 2022, with plans to monitor in 2027 and 2032, etc. Being on the same schedule allows for better comparison across properties and identification of problems.

We note that Mount Hamilton thistle has been in documented decline on the adjacent VTA Coyote Ridge property, where Creekside Science conducts monitoring using the same protocol (Figure 24).

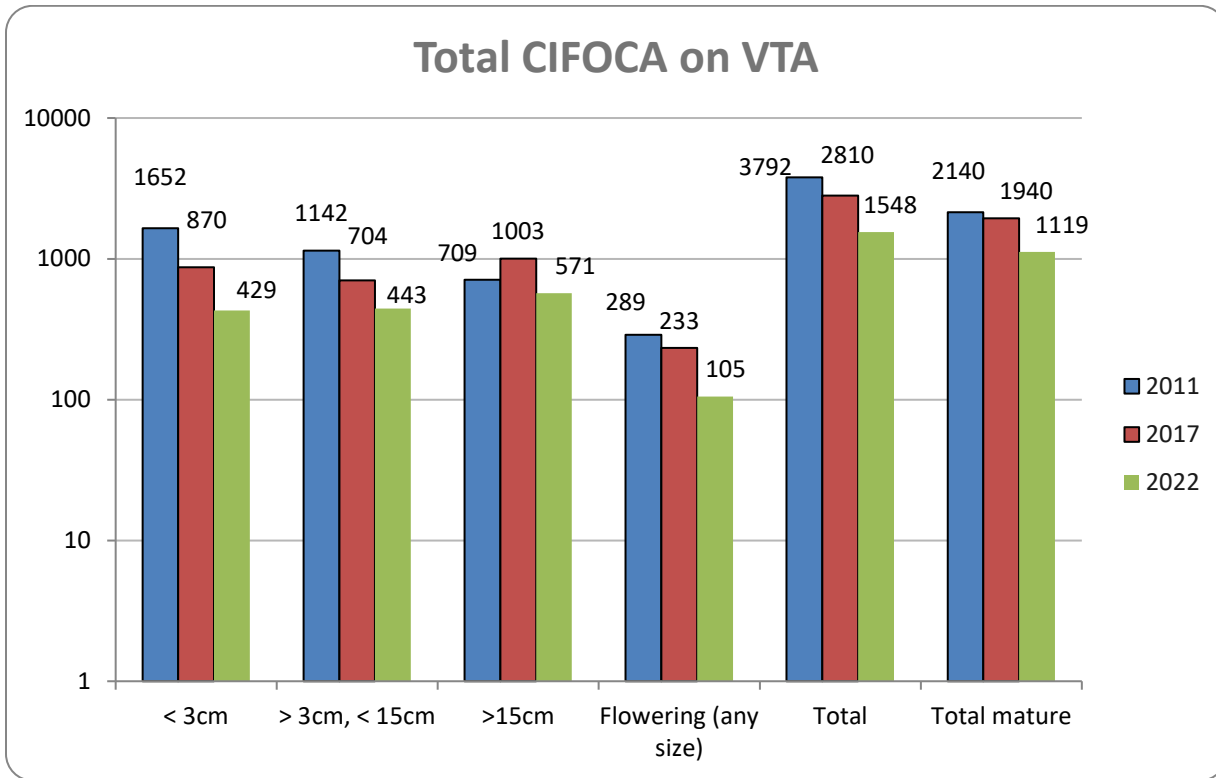


Figure 24. Declining trend of Mount Hamilton thistle on adjacent VTA Coyote Ridge property. Note log scale mutes size of changes (Creekside Science 2023).

The declines at VTA were somewhat expected, as the region had experienced severe drought from 2012-2022, with an above average wet year in 2017 and about average in 2019. Because this taxon’s habitat is so closely tied to year-round moisture, we observe its habitat contract in dry years, but expect it to expand again in wet years, such as 2023 and 2024. While we imagine a single wet year may not be enough to counteract the effects of long-term drought, we generally observe these plants flowering and having plentiful pollinators, and seedlings present where fruits have fallen on appropriate habitat. We would have expected them to be doing well after two wet years. Finding 13/20 plots with zero flowering plants (and 8/20 with no flowering plants within the viewshed) was unexpected.

While we can’t directly manage the climate, there are other management options.

Trampling (mostly cattle) seems to be reducing habitat at many sites. Some sites have lots of high bare ground cover, little associated vegetation. Plot 2, at an easily accessible pond east of the summit, showed a dramatic decline from 427 total plants (172 mature) in 2017 to only 4 mature plants total in 2024. Those plants were relegated to a vertical bank. There was plenty of what looked like appropriate habitat in the area, but it was heavily trampled. Fencing a portion of that pond (or the upstream area between the trough and the pond) could be beneficial. To see what difference fencing makes, note the fencing just downstream of plot 15 on the Serpentine Spring trail. Photo 4 shows multiple Mount Hamilton thistle plants within the fenced enclosure (left), and one lone plant outside the enclosure. Photo 5 does not have any Mount Hamilton thistle in it, but is an example of how much bare ground and trampling can be found outside of the fenced enclosure. Plot 10 had heavy trampling and few plants, even though there was plenty of seepy habitat.

South East Elevation

☉ 347° NW (T) ● 37.216781, -121.716134 ±8 m ▲ 189m



Photo 4. Multiple Mount Hamilton thistle found inside fenced enclosure on Serpentine Spring trail. M. Kent is pointing to the sole individual found immediately outside.

North Elevation

☀ 190° S (T) ● 37.21682, -121.716027 ±472 m ▲ 182m



Photo 5. Also on the Serpentine Spring trail, the effect of fencing is clear. Outside the enclosure (right) is trampled with high bare ground cover.

Some of the nicer sites were in steeper or otherwise remote areas that were harder to access and therefore presumably have fewer visits by cattle. For example, plot 9 (remote but not steep), had dense Mount Hamilton thistles and little bare ground (although less than half the mature plants and even fewer seedlings than in 2017). While the habitat was restricted to a narrow stream, the plants were very dense in this area. This was one of the highest quality plots. Another example of a plot that did well and was in a steep and hard to access area was plot 4, which had only a slight decrease in plants since 2017.

But this signal had many exceptions. For example, plot 20 had the biggest increase in plants since 2017 and by far the highest number of total and mature plants this year, and it is in a presumably highly used stock pond at the western base of the ridge. Mount Hamilton thistle can coexist with cows. But perhaps there would be more plants if the area were fenced. We also documented a population blinking out at plot one, a seep with a trough on the eastern side of the ridge. While there were bare areas and signs of trampling, in general the associated vegetation was thick and showed little sign of cattle herbivory. (The trough also had 225 *Dittrichia graveolens*, which we pulled. We also alerted SCVOSA staff David Mauk and Aaron Herbert.)

Feral pigs were observed throughout the monitoring process, and they could be having similar impacts to cattle.

Plot 13 also blinked out (although there were plants nearby upstream and downstream), and had tall and lush associated vegetation, and therefore presumably little impacts by cattle. But it is an easily accessible site and could have been trampled and overgrazed in previous years.

We recommend experimental fencing at plots 2, 13, 18, and 20 based on heavy trampling and to proximity to roads. We don't recommend fencing all the plots or all the occurrences at this point. It's probably not necessary to fence some of the more remote or steep populations. We also wonder whether there is some level of disturbance that is beneficial. It's possible that the pock marks of the hooves can create habitat by slowing water flow, or micro-ponding that increases water retention. If that is true, we imagine it's only a low level that is beneficial.

Another option to create or enhance habitat would be to pump water from springs and troughs to create more wet Mount Hamilton thistle habitat, and/or possibly create check dams or other features in drainages that are otherwise incised or quickly draining. This should be discussed further if there is interest in this route.

We could also recommend further research into seed predation if other steps aren't helpful. In 2017 Creekside Science was tasked with seed collections for seed banking, and we had difficulty finding sufficient seeds. Larvae were observed time and again eating seeds. A certain amount of herbivory can take place without impacting long-term viability of a population, but it's unclear where that point is. Valley Water employee Janell Hillman completed her master's thesis (2007) on this local taxon, and concluded in her abstract:

"Effects of seed predation indicated some pre-dispersal loss, presence of the introduced flowerhead weevil *Rhinocyllus conicus*, and considerable post-dispersal predation by mammals. While the majority of seedling recruitment occurred in the wetland, some recruitment occurred in the adjacent upland but was followed by heavy seedling mortality due to moisture stress. These potential limiting factors do not appear to significantly affect population persistence. The large seed rain, high viability, germinability and probable lack of seed dormancy appear to ensure successful regeneration of *C. fontinale* var. *campylon* as long as suitable habitat exists."

Her work was extremely detailed and thorough. Results of repeating the work could very well be different based on the specific years in which research is conducted. Hillman's fieldwork was in water years 2005 and 2006, a fairly wet period that hadn't had real drought for more than a decade. Note in Figure 1 the multiple drought years that have taken place since 2006, and we can imagine the accumulated effects of multiple drought years on this wetland endemic. Redoing research like this could be warranted (to identify other stressors such as insect predators) if other steps aren't effective. It's not immediately clear what management actions would be feasible if insect herbivory (or other stressors) was noted to be more problematic than previously recorded.

All sites had some nonnative cover, but we don't currently believe that to be an issue driving population reductions.

The following are recommendations based on the Valley Habitat Plan biological goals and objectives and the survey results.

1. Continued monitoring of index plots every five years in conjunction with monitoring on other properties to account for variances in interannual weather. The current schedule is 2027, 2032, 2037, etc.
2. Experimentally fence plots 2, 13, 18, and 20 based on heavy trampling and to proximity to roads. Study cattle grazing effects. Occurrences that are very large or on steep terrain are less likely to be impacted by cattle. Smaller occurrences, especially those in flatter areas or near troughs, tend to be impacted by cattle trampling

(Niederer per. obs.). Cattle exclosures at the more vulnerable occurrences could be installed experimentally. The working hypothesis is that plants within the exclosure would be more numerous, less trampled, and more likely to reproduce. Alternately, some level of trampling may be beneficial, however, with cattle footprints creating micro-ponding that potentially increases retention time of moisture (Niederer pers. obs.).

3. Consider active seeding/transplanting in areas that have blinked out and don't have nearby donor material for passive recruitment (i.e., plot 1).

Smooth Lessingia

Smooth lessingia (*Lessingia micradenia*) is an annual forb in the Asteraceae family. It has no federal status, but is listed as CNPS 1B.2. It is a serpentine endemic known only from Santa Clara County, with pink to lavender blooms visible from July to November. It grows up to 60 cm tall (CNPS 2017, ICF 2012). During the course of this project, *Lessingia* taxonomy on Coyote Ridge was resolved. Per *Lessingia* expert Staci Markos, it is very unlikely any of the similar and more common *Lessingia nemaclada* are present on Coyote Ridge. Markos, a U.C. Berkeley and Jepson Herbarium employee, has written the *Lessingia* treatment for the second edition of the Jepson Manual and as such is considered the California expert on this genus. While Markos earlier stated that collections of *Lessingia* on Coyote Ridge appeared to be hybridizing, she reviewed fresh collections from MOCR in 2016 along with previously collected samples (from Tulare Hill, and sites on Coyote Ridge owned by LTSCV, VTA, and SCVWD). Her assessment was that all the samples were *Lessingia micradenia* var. *glabrata*. On a visit to the Jepson Herbarium on October 18, 2016, she stated her belief that *Lessingia micradenia* var. *glabrata* probably evolved from *L. nemaclada*, and as such may occasionally possess ancestral characters. There may occasionally be a plant more hairy or glandular than the typical form, but that doesn't necessarily push the plant back to *L. nemaclada*. She now believes they are not actually hybridizing because there is no clear source of *L. nemaclada* genes. The main character Markos uses to distinguish the taxa is the dense glands throughout the phyllaries of *L. nemaclada*. *L. micradenia* var. *glabrata* phyllaries have glands on the margin. Occasionally they are found elsewhere on the phyllaries but never very dense. Creekside Science provided a more detailed discussion of herbarium specimens and Markos's descriptions of each taxon to the Habitat Agency in a letter (Niederer 2016).



Photo by David Tharp (ICF 2012)

Creekside Science was asked to provide a qualitative assessment of plants on the preserve. They are abundant and wide-ranging. No known threats were identified. While it is important to occasionally check in formally with this taxon, this continues to be the taxon we are least worried about.

Conclusion

MOCR is a biologically rich property that supports multiple taxa covered by the Valley Habitat Plan. This year a mix of favorable and unfavorable trends were documented. The most notable concern is the record low numbers of BCB, as well as low cover of host plants and nectar sources. High cover of nonnative annual grass was observed later in the season, as the spring rains extended the growth period beyond the peak bloom when vegetation composition monitoring needs to be completed. Mount Hamilton thistle also declined across the board, and experimental fencing

may be needed to help some populations rebound. Loma Prieta populations were doing well, but we again noted a lack of seed production, leading to concerns that the isolated colonies may be too inbred to reproduce sexually. Coyote Ridge jewelflowers showed mixed increases and decreases. We are hopeful that the new interpretation of taxonomy will lead to important conservation gains, including a clear mandate for how to collect and bank seed. Santa Clara Valley dudleya numbers were up, thanks to an exhaustive mapping effort. Smooth lessingia continues to be widespread and abundant.

MOCR is an excellent part of the Valley Habitat Plan's reserve system. Its high number of covered taxa and connectivity to additional sensitive habitats make it a critical property in the conservation of the covered taxa. Creekside Science looks forward to assisting with the Habitat Agency's mission over the coming years.

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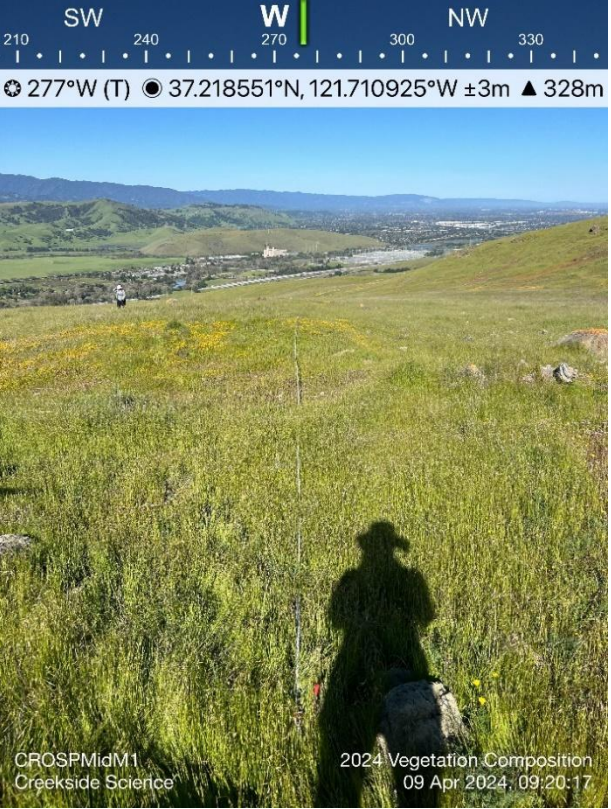


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Appendix A: 2024 Vegetation Composition Transect Photopoints

<p>MOCR Mid C1</p>  <p>SW W NW 210 240 270 300 330 ☀ 262°W (T) ● 37.219811°N, 121.710467°W ±4m ▲ 340m</p> <p>CROSPMidC1 Creekside Science</p> <p>2024 Vegetation Composition 09 Apr 2024, 10:16:06</p>	<p>MOCR Mid M1</p>  <p>SW W NW 210 240 270 300 330 ☀ 277°W (T) ● 37.218551°N, 121.710925°W ±3m ▲ 328m</p> <p>CROSPMidM1 Creekside Science</p> <p>2024 Vegetation Composition 09 Apr 2024, 09:20:17</p>
<p>MOCR Mid VC1</p>  <p>W NW N 270 300 330 0 30 ☀ 325°NW (T) ● 37.220186°N, 121.713754°W ±4m ▲ 315m</p> <p>CROSPMidVC1 Creekside Science</p> <p>2024 Vegetation Composition 30 Apr 2024, 11:31:44</p>	<p>MOCR Mid W1</p>  <p>SW W NW N 240 270 300 330 0 ☀ 293°NW (T) ● 37.219079°N, 121.711080°W ±5m ▲ 330m</p> <p>CROSP MidW1 Creekside Science</p> <p>2024 Vegetation Composition 01 Apr 2024, 11:05:27</p>

MOCR North C1

S 80 210 SW 240 W 270 300 NW

251°W (T) 37.227351°N, 121.713272°W ±4m ▲ 382m



CROSPNorthC1
Creekside Science

2024 Vegetation Composition
30 Apr 2024, 08:53:28

MOCR North M1

S 150 180 SW 210 240 W 270

219°SW (T) 37.227601°N, 121.712571°W ±3m ▲ 387m



CROSP North mod 1
Creekside Science

2024 Vegetation Composition
12 Apr 2024, 14:36:07

MOCR North VC1

E 60 90 E 120 SE 150 S 180

119°SE (T) 37.227738°N, 121.709416°W ±7m ▲ 409m



CROSPNorthVC1
Creekside Science

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MOCR North W1

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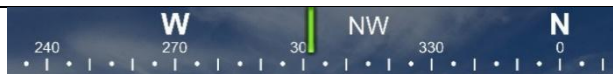
107°E (T) 37.225954°N, 121.709339°W ±3m ▲ 396m



CROSPNW1
Creekside Science

2024 Vegetation Composition
09 Apr 2024, 14:20:10

MOCR South C1



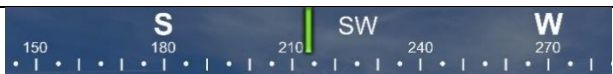
☉ 302°NW (T) ● 37.207695°N, 121.685913°W ±4m ▲ 388m



CROSPSouthC1
Creekside Science

2024 Vegetation Composition
17 Apr 2024, 12:56:21

MOCR South M1



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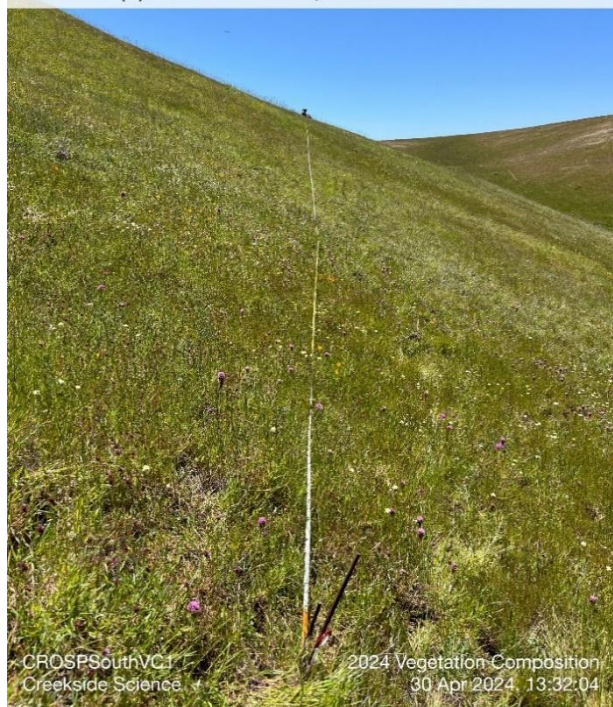
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Creekside Science

2024 Vegetation Composition
17 Apr 2024, 11:39:15

MOCR South VC1



☉ 231°SW (T) ● 37.209428°N, 121.688575°W ±4m ▲ 373m



CROSPSouthVC1
Creekside Science

2024 Vegetation Composition
30 Apr 2024, 13:32:04

MOCR South W1



☉ 292°W (T) ● 37.207738°N, 121.687046°W ±4m ▲ 389m



CROSPSouthW1
Creekside Science

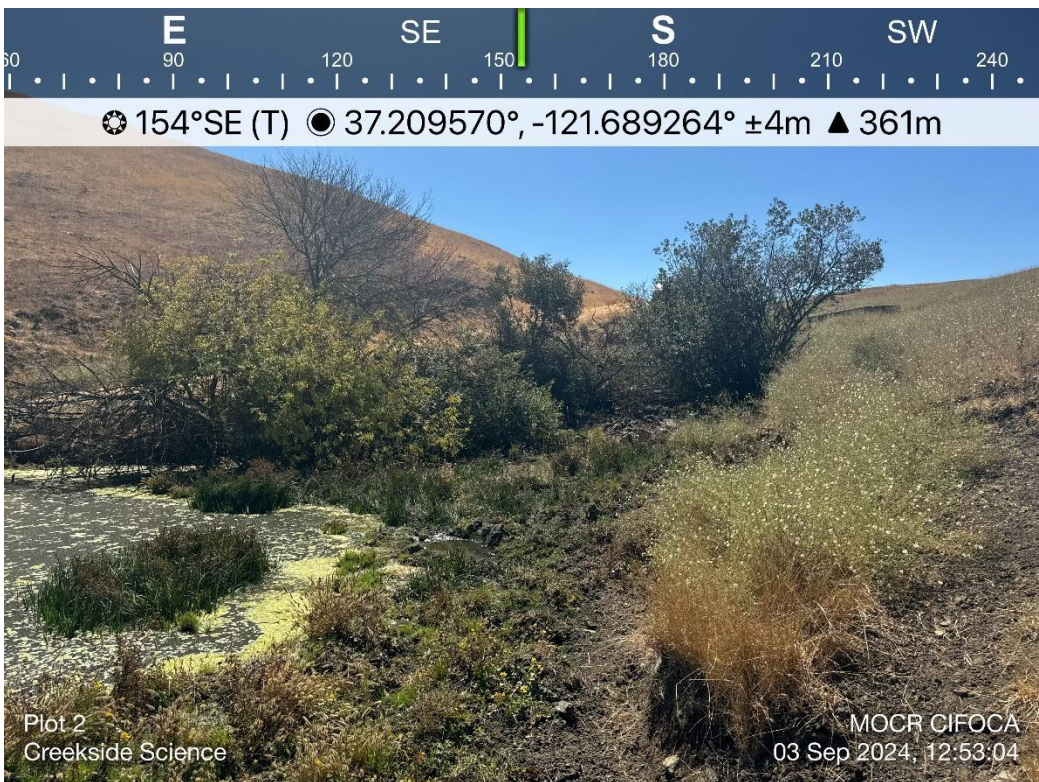
2024 Vegetation Composition
17 Apr 2024, 09:53:54

Appendix B: 2024 Mount Hamilton Thistle Photopoints

Plot 1



Plot 2



Plot 3



Plot 4



Plot 5



Plot 6



Plot 7



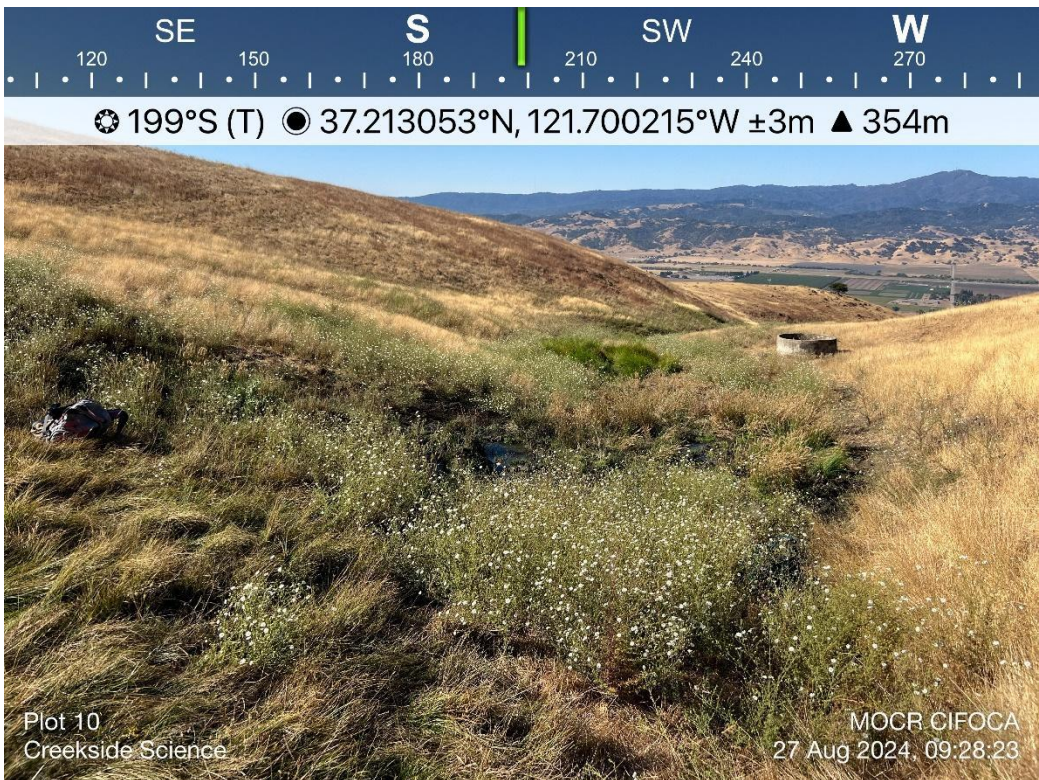
Plot 8



Plot 9



Plot 10



Plot 11



Plot 12



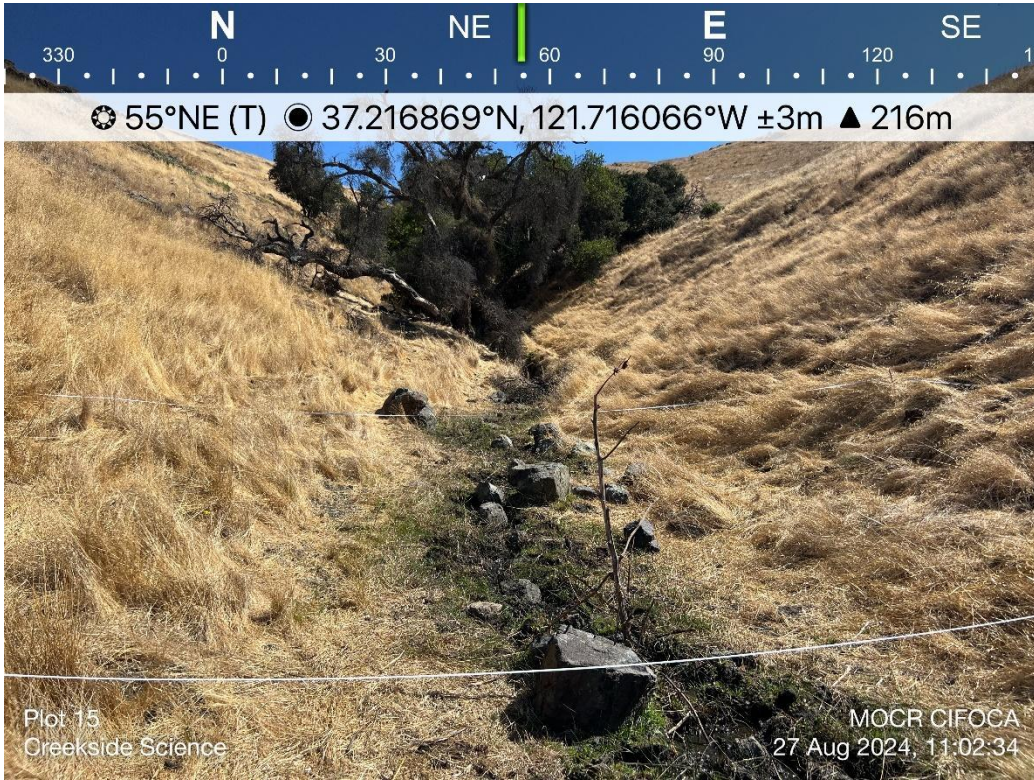
Plot 13



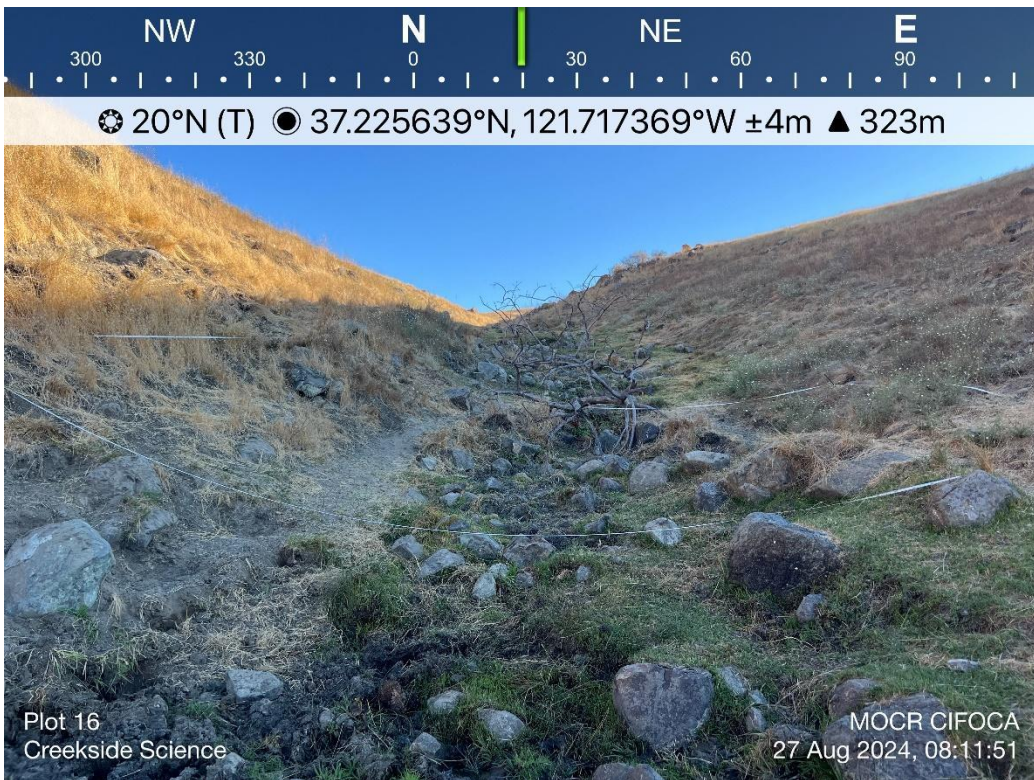
Plot 14



Plot 15



Plot 16



Plot 17



Plot 18



Plot 19



Plot 20

