Western Addition Properties

Bay checkerspot butterfly surveys 2021

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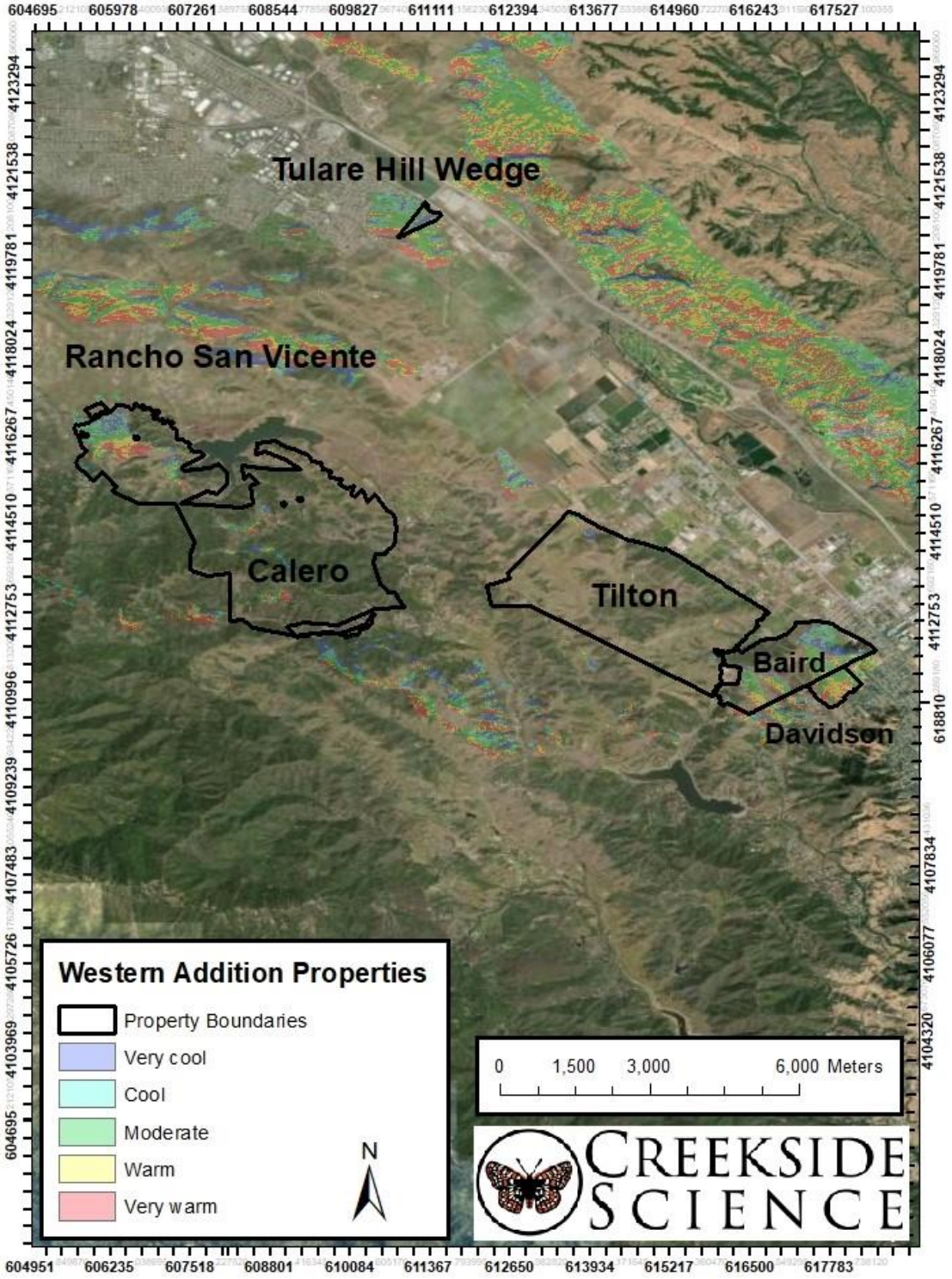
Introduction

Several properties along the eastern Santa Cruz Mountain foothills have recently been enrolled into the Santa Clara Valley Habitat Agency Reserve System or are about to be enrolled. A few of these properties rise above the Coyote Valley area by Morgan Hill, California, including the Davidson Ranch (94 acres), Baird Ranch (603 acres) and Tilton Ranch (1,861 acres) Reserves. Further northwest along the foothills toward San Jose are Calero County Park (4,471 acres, Santa Clara County Parks), Rancho San Vicente Open Space Preserve (996 acres, Santa Clara County Parks) and Tulare Hill Wedge Reserve (36 acres) (Map 1). As of this report, Calero County Park and Rancho San Vicente Open Space Preserve have not yet been enrolled in the reserve system, but the process is underway.

All these properties encompass serpentine grasslands, which provide habitat for the federally endangered Bay checkerspot butterfly (BCB). Edaphic properties such as low nitrogen content, a high magnesium to calcium ratio and high nickel and chromium concentrations (among other heavy metals) make it difficult for plants to establish in serpentine areas, giving adapted native plants a competitive edge over nonnative plants that lack tolerance of the poor conditions (Alexander et al. 2007). Because BCB host and nectar plants can thrive on serpentine soils without being outcompeted by nonnative plants, in the south Bay these areas have become refugia for BCB (Weiss 1999). Most of California's fertile grasslands have become dominated by primarily Eurasian nonnative grasses (Stromberg et al. 2007).

Creekside Science has been working with BCB and their habitat for more than 40 years. In 2021 we were approached by the Santa Clara Valley Habitat Agency to conduct BCB larvae and adult surveys to determine BCB occupancy patterns in the new reserve system properties. Here we report what we

found through the 2021 BCB season.



Map 1: Overview of all the Western Addition properties surveyed in this project. In this document, the color-coded insolation layer is clipped to only show up in previously mapped serpentine bedrock extents.

Methods

Larval Survey Methods

Potential larval survey sites were determined in the office using GIS data including property boundaries (supplied by SCVHA), serpentine bedrock data (USGS), CNDDB records of previous BCB sightings, and satellite imagery. Insolation was determined by applying a Digital Elevation Model (DEM) to create a topographic imagery layer that sorts the landscape into a range of topoclimates: Very Warm (>18 MJ/m^2), Warm (16.5-18 MJ/m^2), Moderate (15-16.5 MJ/m^2), Cool (13-15 MJ/m^2), and Very Cool (<13 mJ/m^2) zones. Plots were created in the office to capture a range of topoclimates at each site. At this point we established 2 plots at Davidson, 25 at Baird, 3 at Tilton, 9 at Calero, 15 at Rancho San Vicente and 3 at Tulare Hill (see Map 2 for an example). Georeferenced PDF maps of these plots were created for use in the field.

Because Creekside Science staff conducts the larvae surveying on Coyote Ridge (Coyote Ridge Open Space Preserve, Kirby Butterfly Reserve, Valley Transportation Authority's Coyote Ridge Reserve, Los Esteros Critical Energy Reserve, Don von Raesfield Preserve and Young Ranch) and Tulare Hill (on properties adjacent to the Wedge: Metcalf Energy Center Ecological Preserve and Santa Clara County Parks) we followed developing larvae through the season and knew when to begin searches on the Western Addition properties. All BCB seasons vary from year to year depending on weather conditions including the timing of germinating rains, temperatures and general rainfall distribution patterns.

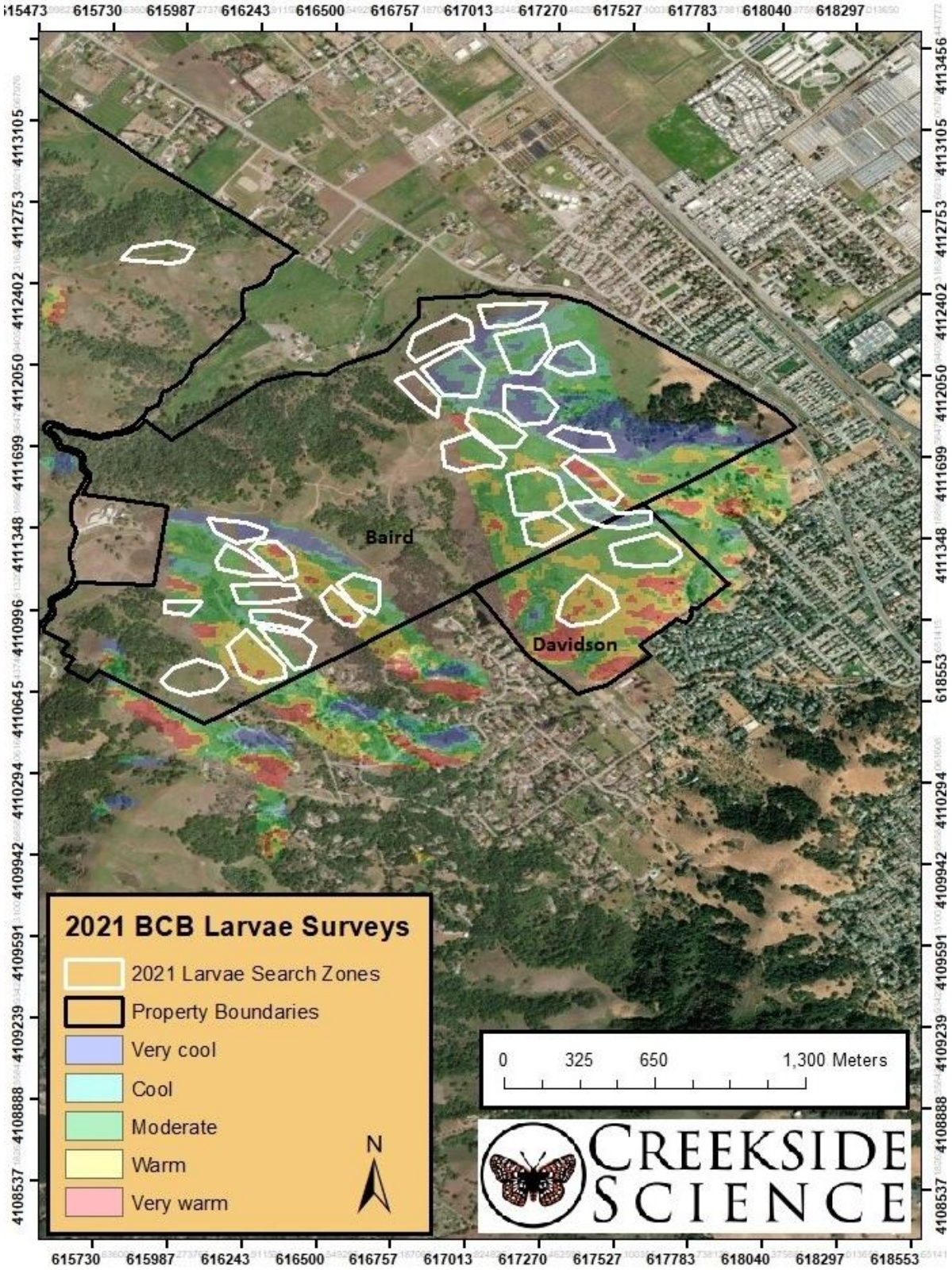
Because we knew from regional surveys that BCB numbers at warmer plots were down this year, we spent more time on moderate and cool slopes than on warm slopes. Because phenology between Coyote Ridge and the Western Addition properties was so similar (which the adult surveys affirmed), we are confident searches took place at appropriate times. Larval searches began February 24 and ended March 24, 2021.

The surveys entailed accessing the office-drawn plots and counting larvae 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:

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

95% confidence intervals on the mean density in each population zone are calculated from methods referenced in Weiss 1996. In cases where low counts cause the symmetrical lower confidence interval to drop below 0, the interval is calculated using a general linear model using a Poisson distribution in JMP 15.1 (SAS Institute).

On site we ground-truthed the plots and made general notes about habitat quality using such metrics as the presence of BCB host plants (*Plantago erecta, Castilleja* spp.) and nectar sources (such as *Lasthenia californica, Lomatium* spp., *Muilla maritima,* among others), nonnative annual grass cover, bare ground cover, and topographic heterogeneity. These notes assisted us in selecting prime adult survey areas.

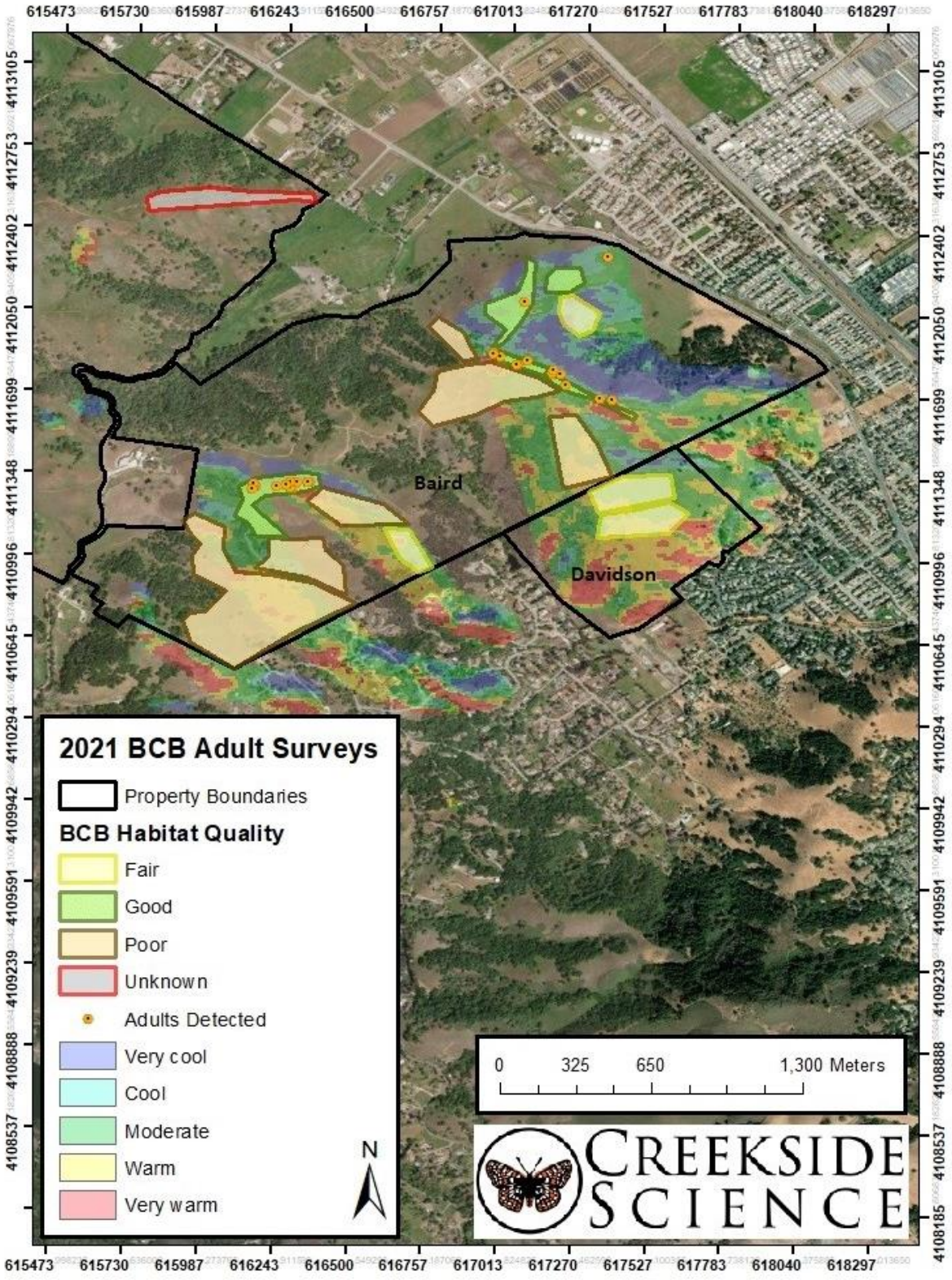


Map 2. Example of larval plots at Davidson and Baird

Adult Survey Methods

With notes made during the larvae surveys, Creekside Science staff delineated prime areas for adult surveys on georeferenced PDF maps (see Map 3 for an example). As with larval development, we track the entire BCB flight season on Coyote Ridge and Tulare Hill and used that phenological data to guide our adult surveys on the Western Addition properties. The flight season at Kirby Butterfly Reserve on Coyote Ridge paralleled those at the Western Addition sites, with peak flight generally occurring at the end of the first week of April at all sites. Our tracking of the flight season at Coyote Ridge enabled us to precisely time our visits to the new sites. Adult searches on Western Addition properties began on March 24 and ended April 20, 2021.

Adult surveys involved walking through appropriate habitat on sunny and relatively warm days (typically >60 degrees F) with low winds (<24 km/hr). We recorded search time and recorded each observed BCB location with a GPS point. The time spent in the various areas allows us to track encounter rates, which we report as butterflies per hour.



Map 3: Example at Davidson and Baird of adult zones determined by habitat quality observations made during larval searches. Note that most adults detected during the flight season occurred on prime habitat.

Results

Larval Survey Results

No larvae were encountered on any of the properties. Eventual adult presence (next section) show that larvae were present on most of the properties but at densities too low to detect.

Adult Survey Results

Creekside Science staff saw multiple adults on all the Western Addition properties except for Davidson Ranch Reserve.

We found the first adult early in the flight season on Baird Ranch Reserve on March 24, 2021. We went on to see a total of 33 adults on Baird Ranch Reserve over the course of four visits (averaging 1.8 butterflies per hour of searching), the last one being on April 20, 2021 (Table 1 and Photo 1). Baird occupancy was well distributed with most of the adults flying along the two highest serpentine ridges of the property (Map 4). We did not see any adults on Davidson over the course of three visits (Table 2).

Date	Site	BCB Sightings	Search Time (Person Hours)	Butterflies/Hour
3/24/2021	Baird	1	5	0.2
4/1/2021	Baird	17	5	3.4
4/12/2021	Baird	12	4.5	2.7
4/20/2021	Baird	3	4	0.75
	Totals	**33**	**18.5**	**1.8**

Table 1: Baird Ranch Reserve butterflies per hour

Date	Site	BCB Sightings	Search Time (Person Hours)	Butterflies/Hour
4/1/2021	Davidson	0	1	0
4/12/2021	Davidson	0	0.5	0
4/20/2021	Davidson	0	0.5	0
	Totals	**0**	**2**	**0.00**

Table 2: Davidson Reserve butterflies per hour

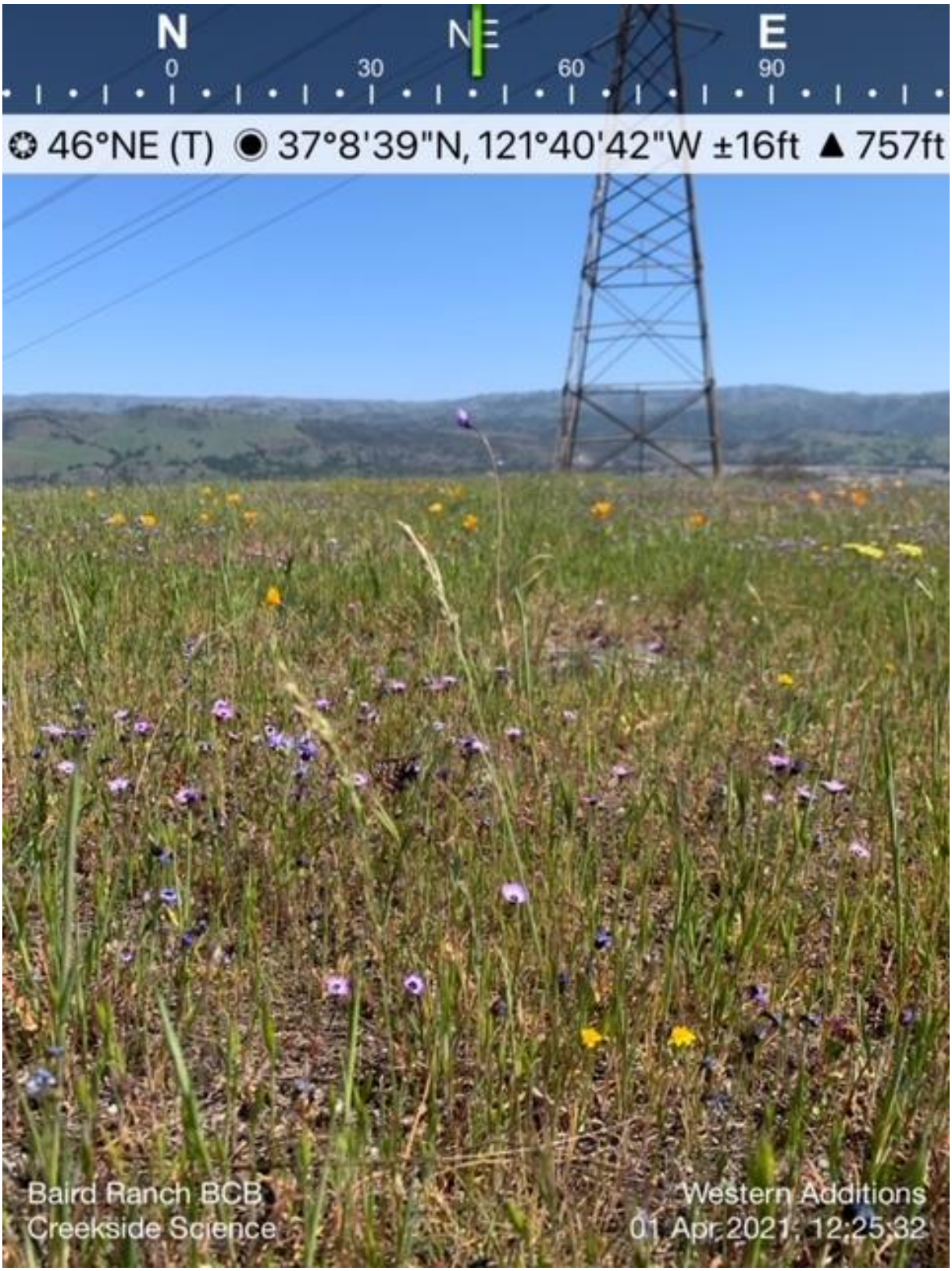
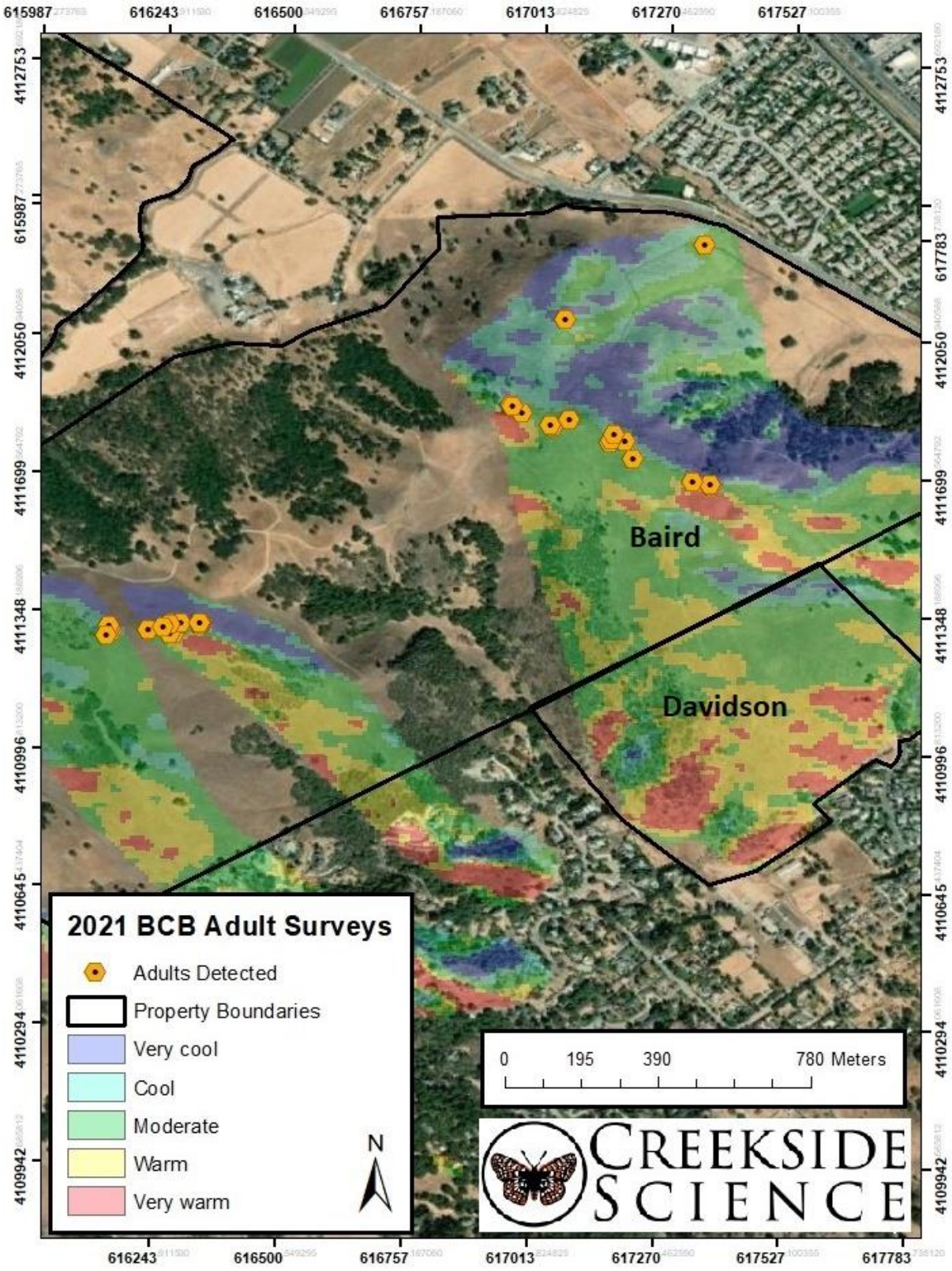


Photo 1: Baird Ranch BCB on April 1, 2021

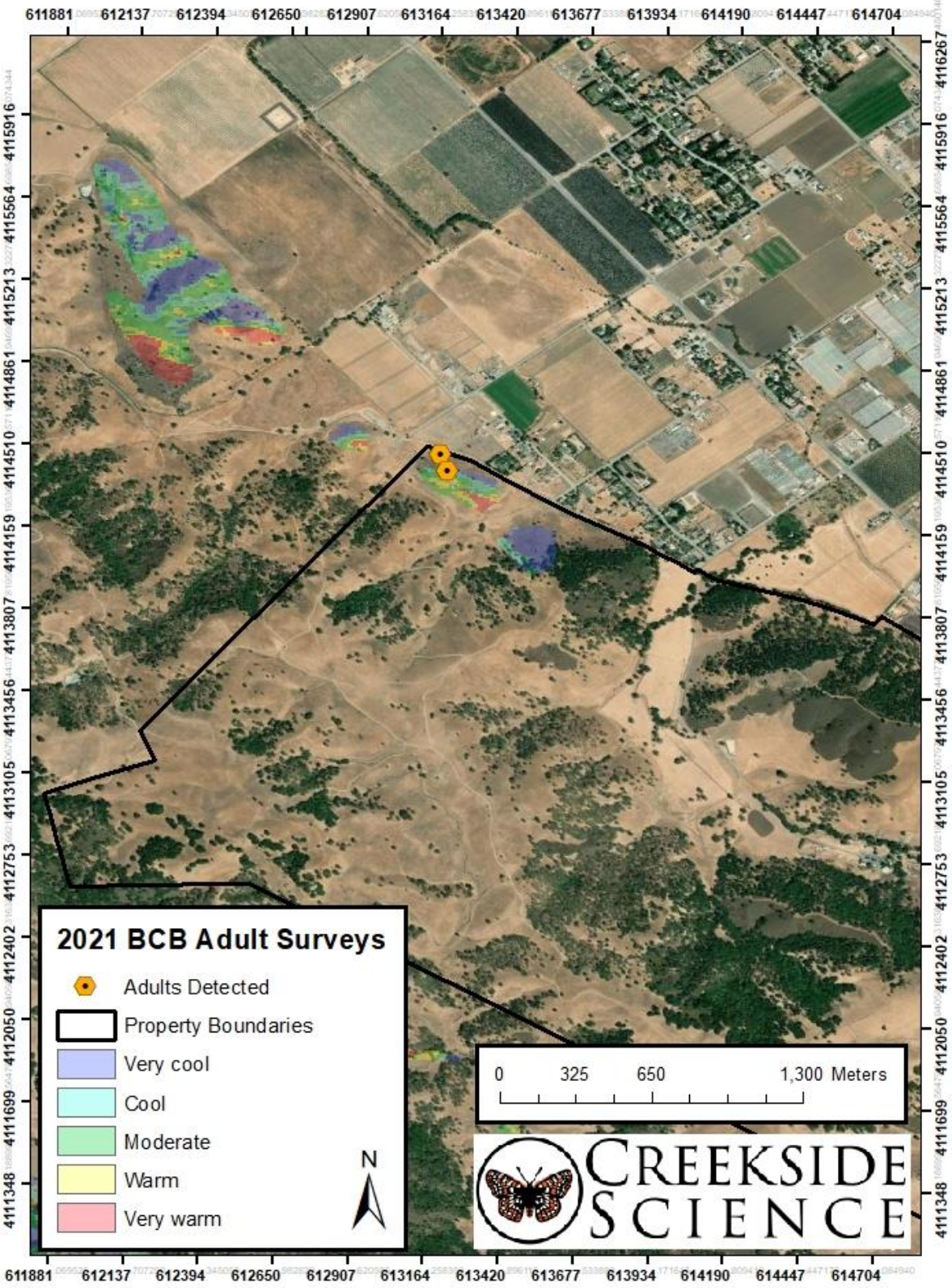


Map 4: Baird Ranch Reserve BCB adult sightings. None were found on Davidson Ranch Reserve.

We also saw a first adult early on at Tilton Ranch Reserve on March 24, 2021. We saw one other adult there a week later near where the first one was spotted (Table 3 and Map 5). These two adults over 4 site visits at 1 hour each produces a butterfly encounter rate of 0.5 per hour.

Date	Site	BCB Sightings	Search Time (Person Hours)	Butterflies/Hour
3/24/2021	Tilton	1	1	1
4/1/2021	Tilton	1	1	1
4/12/2021	Tilton	0	1	0
4/20/2021	Tilton	0	1	0
	Totals	**2**	**4**	**0.50**

Table 3: Tilton Ranch Reserve butterflies per hour

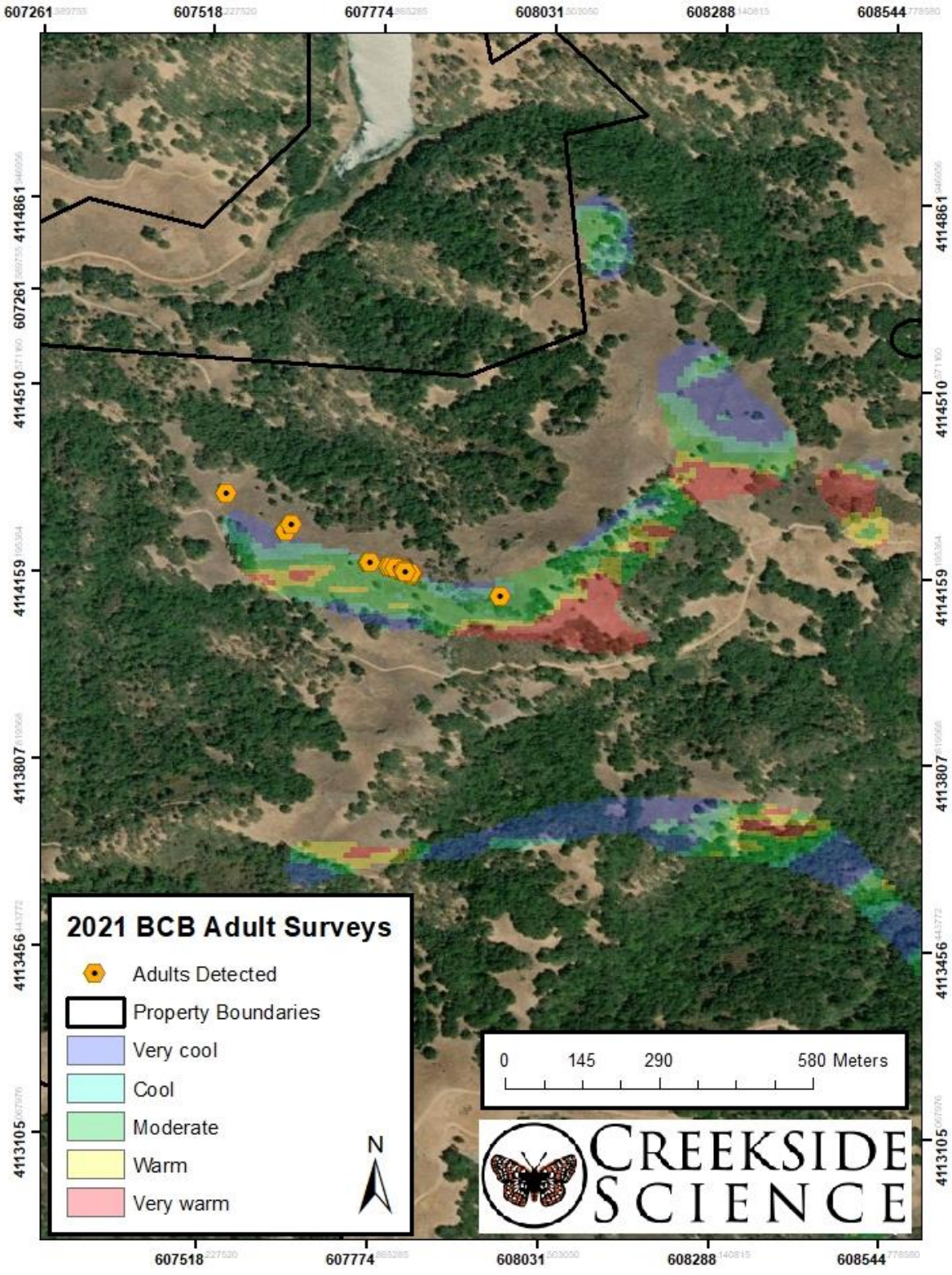


Map 5: Tilton Ranch Reserve BCB adult sightings

Like Baird Ranch Reserve, we also encountered 33 adults at Calero County Park over four visits for an average of 2.6 butterflies per hour of searching (Table 4 and Map 6). This includes 18 in one visit on April 2 in an area that we did not search for larvae.

Date	Site	BCB Sightings	Search Time (Person Hours)	Butterflies/Hour
3/26/2021	Calero	0	1.5	0
4/2/2021	Calero	18	4	4.5
4/13/2021	Calero	9	4	2.3
4/19/2021	Calero	6	3	2
	Totals	**33**	**12.5**	**2.6**

Table 4: Calero County Park butterflies per hour

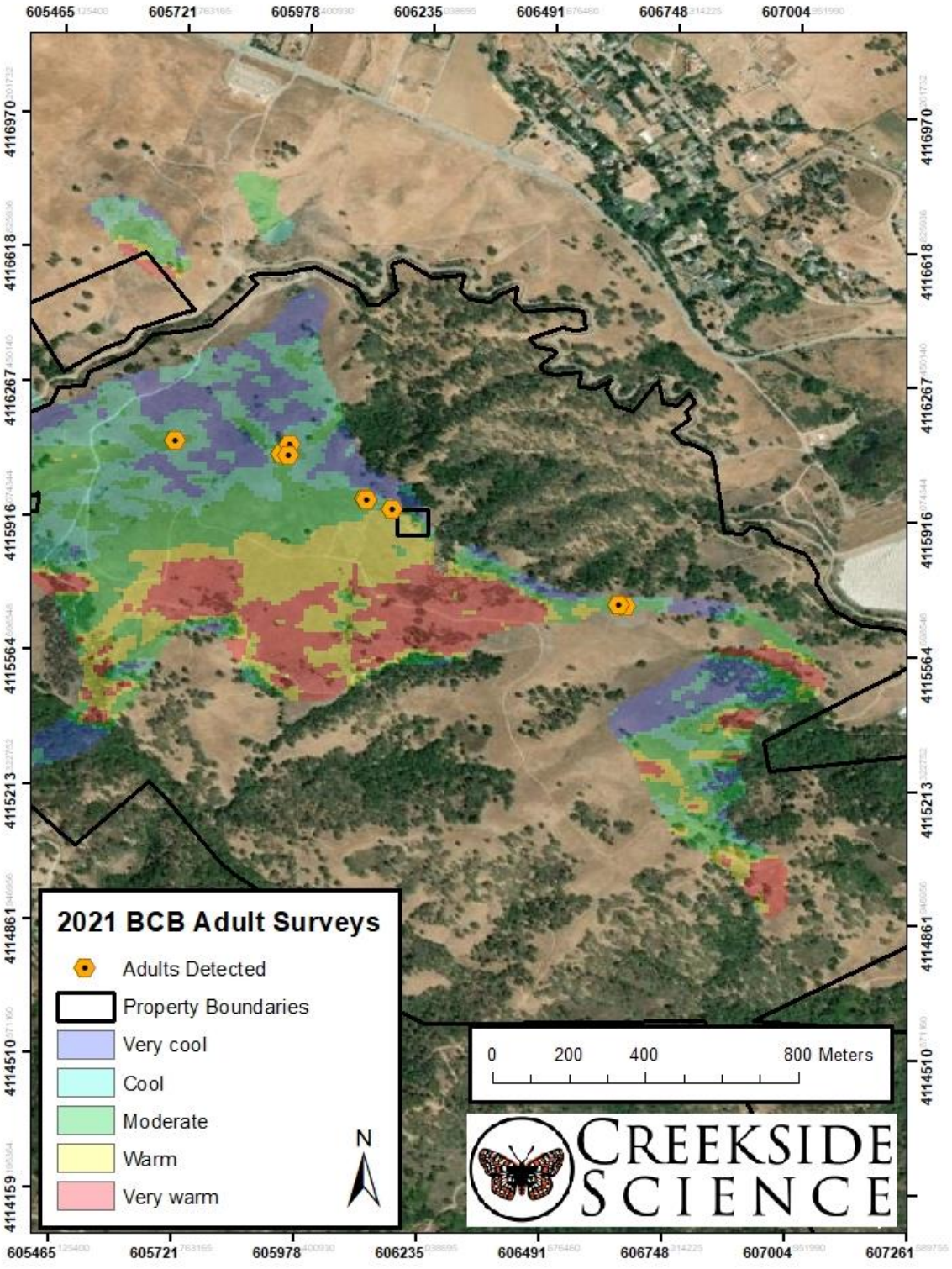


Map 6: Calero County Park BCB adult sightings

At Rancho San Vicente, a total of 9 BCB were seen over 4 visits for an encounter rate of 0.6 butterflies per hour (Table 5 and Map 7).

Date	Site	BCB Sightings	Search Time (Person Hours)	Butterflies/Hour
3/24/2021	RSV	2	4	0.5
4/1/2021	RSV	2	4	0.5
4/12/2021	RSV	3	3.75	0.8
4/19/2021	RSV	2	4	0.5
	Totals	**9**	**15.75**	**0.6**

Table 5: Rancho San Vicente Open Space Preserve butterflies per hour

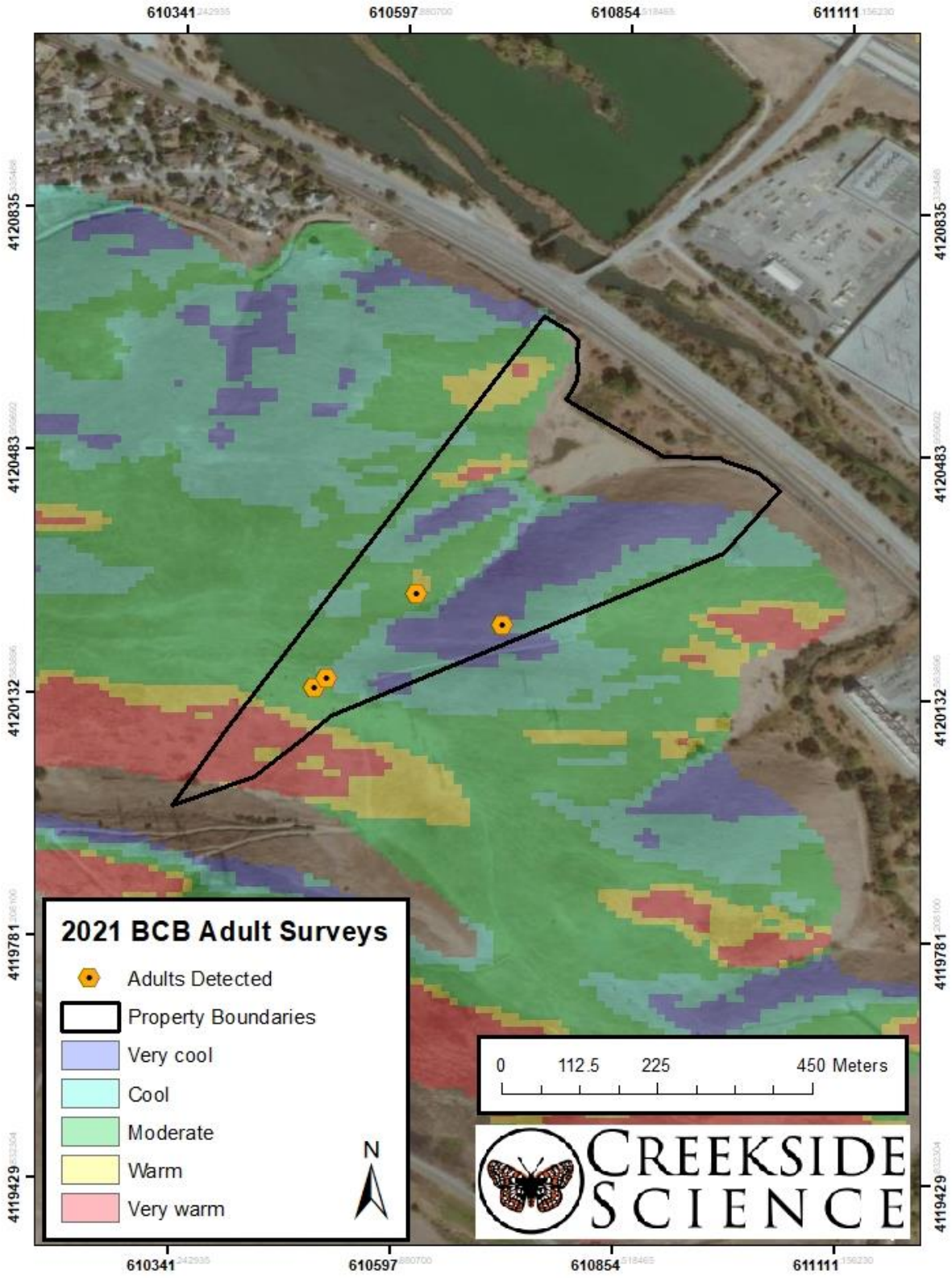


Map 7: Rancho San Vicente Open Space Preserve BCB adult sightings

Four BCB were seen at Tulare Hill Wedge Reserve over three visits for an encounter rate of 1.3 butterflies per hour (Table 6 and Map 8).

Date	Site	BCB Sightings	Search Time (Person Hours)	Butterflies/Hour
3/29/2021	TH Wedge	1	1	1
4/6/2021	TH Wedge	3	1	3
4/11/2021	TH Wedge	0	1	0
	Totals	**4**	**3**	**1.3**

Table 6: Tulare Hill Wedge Reserve butterflies per hour



Map 8: Tulare Hill Wedge Reserve BCB adult sightings

Discussion

The fact that no larvae were found was not surprising based on the low densities of BCB at each site. The subsequent adult surveys highlighted this year's BCB hotspots, and this information could be used to alter location of some of the larval search plots. Specifically, we recommended adjusting larval search areas at Calero County Park. One hotspot for adults was not prioritized for larvae searches at the initial stage of this project because it was at the edge of previously mapped serpentine bedrock zones. The density we saw during flight season at this part of Calero suggests that this would be a spot where we may be more likely to detect larvae. However, even at the adult hotspots, larval densities would have been very low, and they could have remained undetected. In boom years, larvae may become detectable in some places, but in general, adult surveys are the better method for establishing presence at these properties due to low densities.

At Calero County Park, the area further east along the band of serpentine from where we saw the bulk of the adults this year has promising habitat that we speculate would be inhabited on cooler, wetter years.

No adults were found at Davidson Ranch Reserve this year. However, Davidson Ranch possesses high quality habitat in terms of host and nectar cover. Because it is dominantly south and west facing, it is a warmer site, and regionally we saw BCB favoring cooler locations given the extreme drought conditions present in 2020 and 2021. We believe that Davidson has high potential to be inhabited on cooler, wetter years when occupancy can shift to warmer slopes.

Conclusion

All properties were occupied with BCB except Davidson and all properties had at least some substantial areas of high-quality serpentine grassland habitat with varied topoclimates and abundant host plants and nectar sources, maintained through cattle grazing.

BCB phenology shifts every year, and their visible life stages are always ephemeral. This demands constant tracking of conditions and regional phenology to appropriately time surveys. We found that phenology was very similar throughout the region this year, from Coyote Ridge to Calero to Baird.

On Coyote Ridge we use larvae surveys for population estimates, but there are some areas on Coyote Ridge Open Space Preserve (CROSP) where we use adult surveys to determine occupancy. As we mentioned in the initial SOW for this project, BCB occupancy is best determined by adult surveys, especially in areas of very low densities. Because adults are easier to detect at low densities, surveying them on the Western Addition properties shed light on where to place postdiapause larval plots. However, because of the low densities at these properties, we recommend adult surveys as the primary means of tracking annual presence.

BCB follow metapopulation dynamics in which small patches wink out and can be recolonized. Typical of most insects, BCB exhibit large interannual fluctuations, which can increase the probability of a smaller population disappearing. Annual adult monitoring of these properties will provide understanding of overall long-term trends and confirm occupancy over time, an important metric for a reserve property.

There are many ways to survey adult butterfly populations, from the Mark-Release-Recapture technique to established adult walk transects. We believe that site visits through the flight season with the methods outlined in this report will yield valuable data in the years to come.

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