Western Riverside County
Multiple Species Habitat Conservation Plan (MSHCP)
Biological Monitoring Program

Quino Checkerspot Butterfly (*Euphydryas editha quino*)
Survey Report 2008

17 April 2009

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NOTE TO READER:

This report is an account of survey activities undertaken by the Biological Monitoring Program for the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). The MSHCP was permitted in June 2004. The Biological Monitoring Program monitors the distribution and status of the 146 Covered Species within the Conservation Area to provide information to Permittees, land managers, the public, the California Department of Fish and Game, and the U.S. Fish and Wildlife Service. Monitoring Program activities are guided by the MSHCP species objectives for each Covered Species, the information needs identified in MSHCP Section 5.3 or elsewhere in the document, and the information needs of the Permittees.

We would like to acknowledge the land managers in the MSHCP Plan Area, who in the interest of conservation and stewardship facilitate Monitoring Program activities on the lands for which they are responsible. A list of the lands where this year's data collection activities were conducted is included in Section 7.0 of the Western Riverside County Regional Conservation Authority (RCA) Annual Report to the Wildlife Agencies.

Partnering organizations and individuals contributing data to our projects are acknowledged in the text of appropriate reports. We would especially like to acknowledge the Santa Ana Watershed Association, the Center for Natural Lands Management, and the Orange County Water District for their willingness to initiate or modify their data collection to complement our survey efforts in 2008.

While we have made every effort to accurately represent our data and results, it should be recognized that our database is still under development. Any reader who would like to make further use of the information or data provided in this report should contact the Monitoring Program to ensure that they have access to the best available or most current data. All Monitoring Program data, including original datasheets and digital datasets are stored in the Monitoring Program office in downtown Riverside, CA.

The primary authors of this report were Lead Biologist Adam Malisch and Project Lead Rosina Gallego. If there are any questions about the information provided in this report, please contact the Monitoring Program Administrator. If you have questions about the MSHCP, please contact the Executive Director of the RCA. For further information on the MSHCP and the RCA, go to www.wrc-rca.org.

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INTRODUCTION

The Quino checkerspot butterfly (*Euphydryas editha quino*; "QCB") is federally listed as endangered and is narrowly distributed at relatively few locations within the MSHCP Plan Area. Species objective 4 for QCB states that "within the MSHCP Conservation Area, Reserve Managers will document the distribution of Quino checkerspot on an annual basis" (Dudek & Associates 2003).

The Biological Monitoring Program began developing a protocol in 2005 to determine the distribution of QCB across the Conservation Area. Additional goals were to estimate the detection probability of QCB, to calculate the proportion of area occupied by QCB (MacKenzie et al 2006) and to gather data regarding QCB resource selection, important distribution covariates, and important observation covariates. The protocol was refined and expanded in 2006 and 2007 based on previous years' results.

In 2008, the U.S. Fish and Wildlife Service (USFWS) initiated a range-wide QCB survey. Surveys were designed to determine QCB habitat use and distribution of adults within 80 m of recent historical (1997-2007) observation locations using an occupancy framework (MacKenzie et al 2006). Because the Monitoring Program wished to collaborate in this effort, we postponed continuing to implement the protocol developed in recent years, and participated by conducting the USFWS survey protocol at survey locations within the MSHCP Conservation Area. Other individuals and organizations also participated by surveying plots in western Riverside County and their data is presented here as well. Results from this range-wide effort outside of the MSHCP Conservation Area are not presented here, but are available from Dr. Alison Anderson at the USFWS Carlsbad Office.

As a separate pilot project this year we initiated surveys for larval forms of QCB at 2 locations near an established QCB population which were known to support patches of the primary host plant for QCB larvae, *Plantago erecta* (USFWS 2003). The short term goal of this project was to determine if QCB larvae can be detected in *P. erecta* patches within the Conservation Area via visual encounter surveys. The long term goal was to increase the overall encounter rate when searching an area for QCB and thus improve our understanding of QCB distribution within the Conservation Area.

Thus, the goals for 2008 QCB surveys were as follows:

A) test a protocol to survey for QCB larvae,

B) document QCB distribution across the Conservation Area, while collaborating with the USFWS range-wide effort,

C) calculate the detection probability of adult QCB during flight season and estimate QCB occupancy at sites where QCB were recently detected (MacKenzie et al 2006), and

D) provide data regarding adult QCB resource selection, important distribution covariates, and important observation covariates.

METHODS

Larvae Plot Establishment

We chose 2 locations to survey for QCB larvae: the Southwestern Riverside County Multi-Species Reserve (MSR) and the RCA property just south of the MSR called El Sol (Figure 1). These locations were selected because they are geographically close to a well-established QCB population at MSR, and because we assumed them to include appropriate habitat for QCB larvae and adults. Monitoring Program biologists visited these locations and identified areas with large patches of *P. erecta* (USFWS 2003). For this pilot effort, a patch was considered any area where *P. erecta* was abundant or dominant in the herbaceous cover. Three patches were chosen at El Sol (ESP2, ESP3, ESP4) and 1 at MSR (LSP5). We mapped the boundary of each patch using a Trimble GPS unit and marked it with garden stakes connected with twine. We established parallel survey transects at 2 m intervals running east-west and marked the transects with enough pinflags so that a surveyor could walk a straight line.

Personnel and Training for Larvae Surveys

Before larvae surveying began, Monitoring Program biologists completed training in appropriate larvae searching methods and demonstrated the ability to differentiate between QCB, chalcedon checkerspot (*Euphydryas chalcedona chalcedona*), and common buckeye (*Junonia coenia*) larvae, which are similar in appearance. This training session was conducted by Dr. Alison Anderson of USFWS. Surveyors conducting larvae surveys in 2008 included:

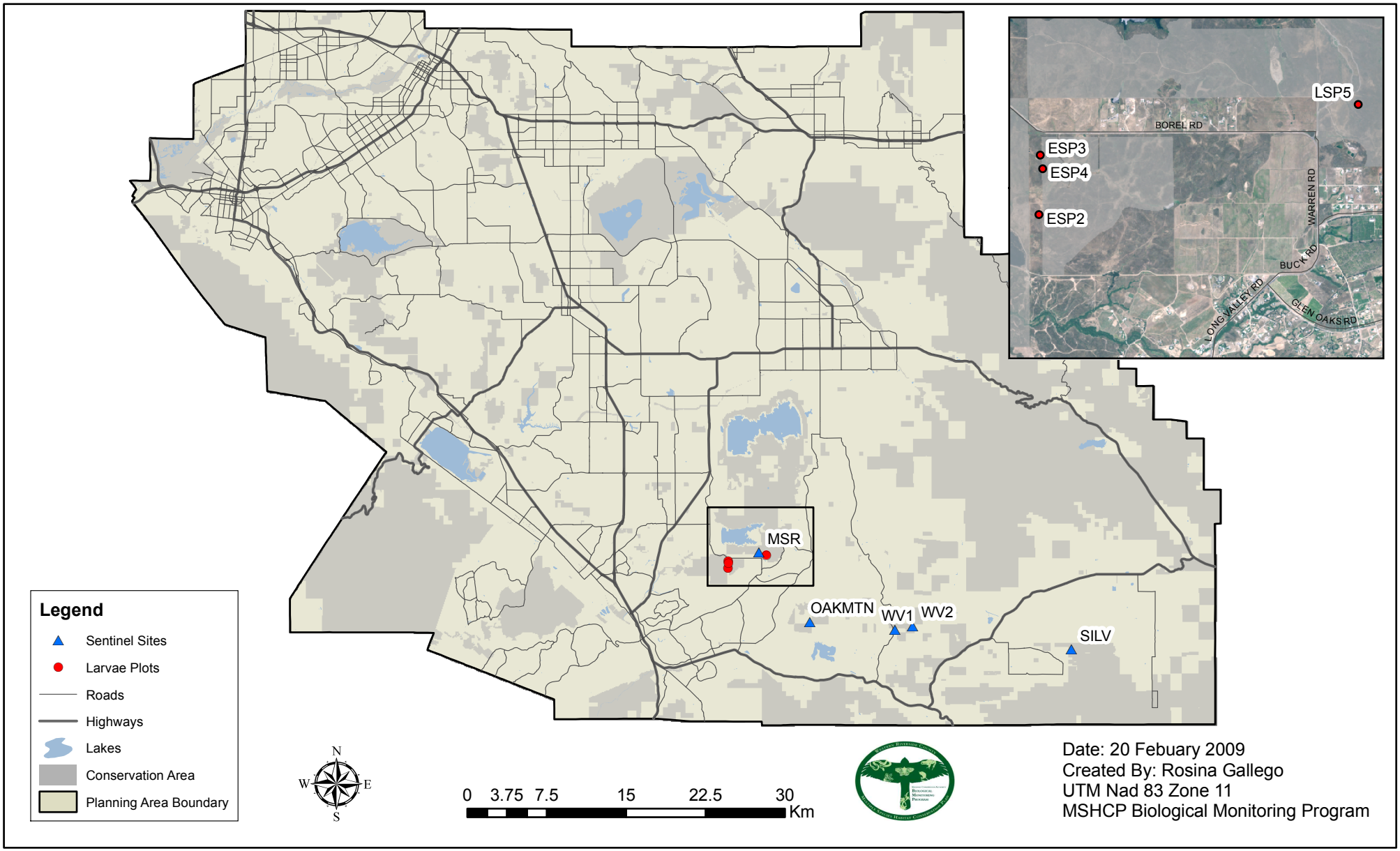
- Rosina Gallego, Project Lead (Regional Conservation Authority)
- Annie Bustamante (Regional Conservation Authority)
- Angela Coates (Regional Conservation Authority)
- Ryann Loomis (Regional Conservation Authority)
- Lynn Miller (Regional Conservation Authority)
- Joe Veverka (Regional Conservation Authority)

Larvae Surveys

Surveys for QCB larvae on each plot were conducted twice per week between 1000 h and 1400 h. Surveyors navigated to the first transect of the plot and recorded the patch ID, surveyor name, arrival time, temperature at ground level, and average wind speed.

Throughout the survey, the surveyor would walk slowly and carefully along each transect within a given patch looking for caterpillars. Depending on the size of the patch, surveys lasted between 1.5 – 2 hours. Transects were walked in an east-west direction from the south edge of the plot to the north edge. Surveying plots in this way allowed for

Figure 1. Quino checkerspot butterfly sentinel sites and larvae plot locations in 2008.



the sun to always be at the surveyor's back and thus permitted the surveyor to look into their shadow for larvae and maximize that shadow with a sunshade. QCB caterpillars are more easily found within shade because they are mostly black in appearance and when in the shade they can be distinguished from the shadows created by surrounding plants. When a surveyor saw a QCB larvae they were to record a GPS waypoint, note the transect ID, take a photo of the caterpillar next to a ruler for scale, and record its length in millimeters. If caterpillars of any other species were seen, they were identified and the number found recorded.

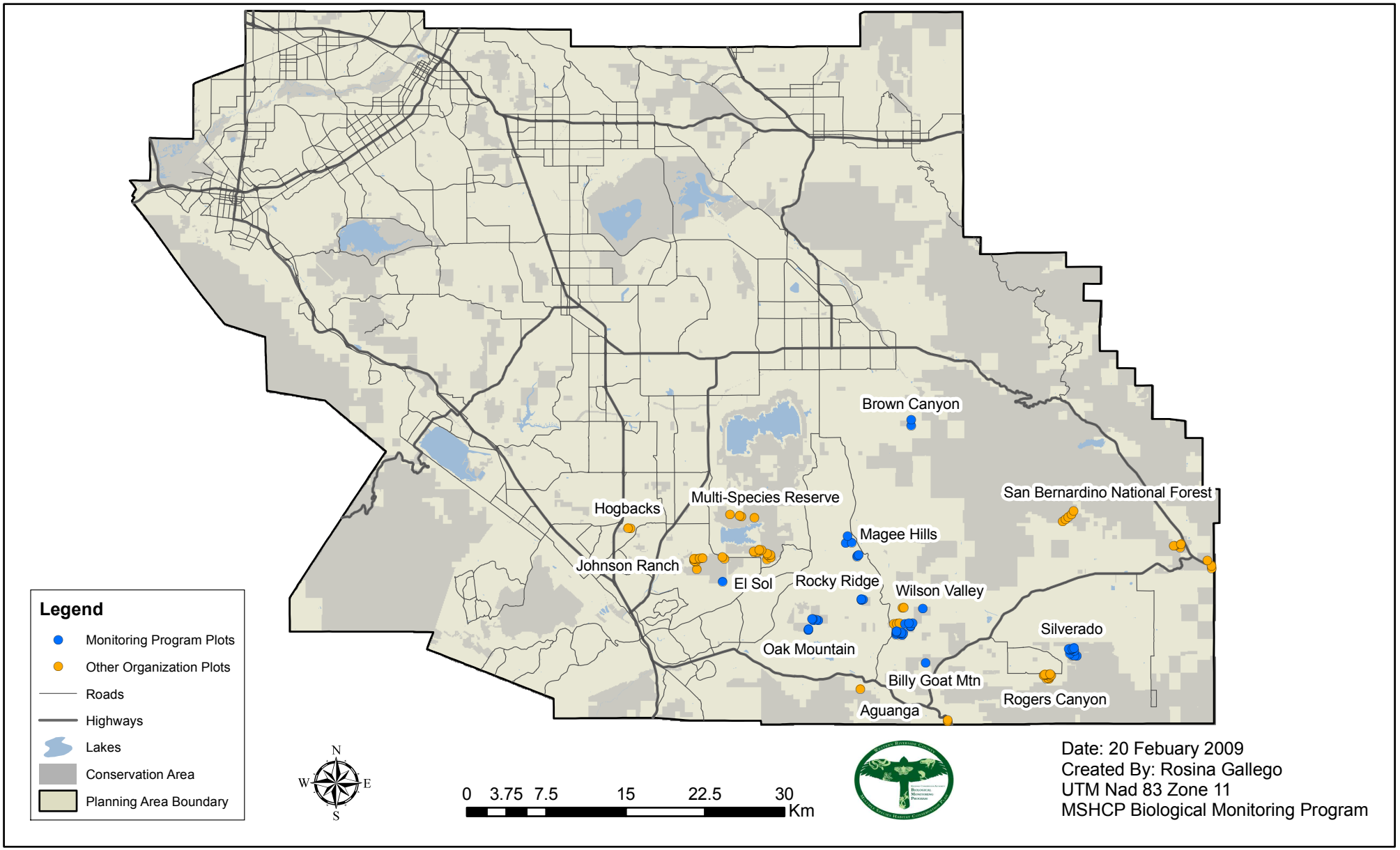
In addition to searching for QCB larvae, surveyors also noted which QCB host plants were observed and their general condition (green, flowering, or senesced). The presence of cryptogramic soil crusts and evidence of caterpillar grazing were also documented. At the end of the survey the time, temperature, and wind speed were collected again. For a complete description of QCB larvae surveys see the *Western Riverside County MSHCP Biological Monitoring Program Pilot Protocol for Quino Checkerspot Larvae Surveys* dated February 2008 (Appendix A).

Because we were concerned about the negative impacts of focused larvae surveys with repeat visits to the same locations, we initiated a pilot vegetation sampling study to determine the impact, if any, that QCB larvae surveys have on QCB habitat, including changes in vegetative species composition and abundance and changes in ground cover. This vegetation sampling study was abandoned before completion because it became apparent that the vegetation sampling itself was having a more substantial impact on the vegetation in the plots than the larvae surveys.

Adult Survey Plot Locations

The USFWS selected plots by applying an 80 m buffer to any location with at least 1 confirmed QCB observation within the last 10 years and then systematically placing survey locations within the resulting polygons. The Monitoring Program surveyed 45 plots in western Riverside County in collaboration with the USFWS effort. Plots were established and surveyed by Monitoring Program biologists at the following locations in 2008: 1 in Johnson Ranch, 2 in Brown Canyon, 6 in Magee Hills, 3 at Rocky Ridge, 7 in Oak Mountain, 14 in Wilson Valley, 1 in Billy Goat Mountain, and 11 in Silverado (Figure 2). In addition to these 45 plots, other participating individuals surveyed another 62 plots within western Riverside County, for a total of 107 plots in the Conservation Area. Andrew Forde surveyed 3 plots in Aguanga; Allison Anderson, in cooperation with Sarah Thorne, surveyed 5 plots in the San Bernardino National Forest; Christine Moen surveyed 16 plots at the MSR; Eric Porter surveyed 11 plots in Rogers Canyon; Ken Osborne surveyed 2 plots in the Hogbacks, 2 at El Sol, 11 in Johnson Ranch, and 5 in Wilson Valley; and Scott Quinnell surveyed 7 plots in the San Bernardino National Forest. A small number of additional plots were originally selected for survey by partnering organizations or individuals but were never surveyed.

Figure 2. Quino checkerspot butterfly adult survey plot locations in 2008.



Each plot consisted of a 50 m radius circle with the center and the edges in each of the 4 cardinal directions marked using pin flags to aid surveyors in identifying the boundaries of the plot. Each plot was sectioned into quadrants (NE, SE, NW, SW) which were used when identifying the location of a QCB within a plot.

Personnel and Training for Adult Surveys

Before participating in any surveys, all field surveyors demonstrated the ability to identify QCB and passed the USFWS Quino checkerspot butterfly practical exam. Biologists also attended a training session at the USFWS Carlsbad Office prepared by Dr. Allison Anderson to learn the USFWS survey protocol for this effort. Monitoring Program biologists conducting adult QCB surveys in 2008 included:

- Rosina Gallego, Project Lead (Regional Conservation Authority)
- Annie Bustamante (Regional Conservation Authority)
- Angela Coates (Regional Conservation Authority)
- Ryann Loomis (Regional Conservation Authority)
- Lynn Miller (Regional Conservation Authority)
- Joe Veverka (Regional Conservation Authority)

Surveyors from other organizations included: Andrew Forde (USFWS), Allison Anderson (USFWS), Christine Moen (Riverside County Parks), Eric Porter (USFWS), Ken Osborne (independent biologist), Scott Quinnell (Caltrans), and Sarah Thorne (U.S. Forest Service). These surveyors provided their data directly to the USFWS. We obtained copies of their datasheets from the USFWS and have included those data in this report.

Sentinel Site Visits

To determine when to begin surveys in a given area, we monitored previously established "sentinel sites" at 4 locations across the Conservation Area known to support populations of QCB. We believe these sites are representative of the currently known distribution of QCB within the MSHCP Conservation Area. Sentinel sites were located at the MSR, Oak Mountain, Wilson Valley, and Silverado Ranch (Figure 1).

When spring conditions developed (i.e., sunny days with temperatures above 16 C), a Monitoring Program biologist visited each sentinel site approximately once per week to monitor the status of QCB at that site. Observers recorded QCB host plant status on-site, available nectar resources, number of QCB adults and larvae seen, co-occurring butterflies, start and end time, and weather during each sentinel site visit (Appendix B).

When 1 or more adult QCB were observed at a given sentinel site, QCB surveying began in the surrounding areas within 1 week of its observance. Once an adult QCB was observed, the sentinel site was no longer visited and efforts were concentrated on surveying plots established in the surrounding area.

Adult Survey Methods

The USFWS provided survey points, a protocol, and datasheets (Appendix C). As per the USFWS protocol, surveys were only conducted between the hours of 0930 h and 1430 h if weather permitted. Surveyors used GPS units to navigate to the north edge of the plot and installed a pinflag. From here the survey began and lasted for 15 minutes. During this time surveyors put pinflags in the center of the plot and at the edge of the plot at each of the remaining cardinal directions, all while looking for QCB and noting habitat conditions. Pinflags were only installed on the first day. For each of the following visits, surveyors navigated to any edge of the plot and started the 15 minute survey. When a QCB was detected in the plot, the quadrant it was seen in and the number of QCB observed was recorded. Each plot was surveyed on 5 separate occasions. On the final visit, all pinflags were collected and removed from the site. If QCB were detected while in route to or from a plot, the coordinates of the location were recorded on the datasheet as incidental observations.

The following habitat variables were recorded during surveys because they were suggested to be potentially important to QCB: percent cover of bare ground (having no vegetative debris or litter), percent shrub cover, percent of the plot that was recently burned, dominant shrubs in the plot, potential nectar plants for adult QCB in the plot (e.g., *Chaenactis glabriuscula, Eschscholzia spp.*) and the approximate number of recognized QCB host plants: *Plantago erecta, P. patagonica, Antirrhinum coulterianum, Cordylanthus rigidus,* and *Castilleja exserta* (USFWS 2003). All percent area estimates were recorded in the following categories: 0-25%, 26-50%, 51-75%, 76-100%. Host plant abundance estimates were recorded in the following categories: 0, 1-20, 21-100, 101-1000, >1000.

Data Analysis

Before analyzing data, survey results were divided into six 1-week intervals and surveys occurring too close together in time (i.e., >1 survey within a given interval) were removed. We removed 53 survey results from a total of 488 surveys leaving 435 for analysis. Detection probabilities were then calculated for each interval, and assumed to remain constant during the entire interval.

We used program MARK (White and Burnham 1999) to compute an adult QCB detection probability, using the established detection history, and assuming that the detection probability was constant among each 1-week survey interval but variable between intervals. We also used program MARK to calculate an estimate of occupancy in 2008 at sites where QCB were recently detected.

Habitat conditions on survey plots (e.g., percent cover bare ground, presence/absence and abundance category of host plants) were explored for effects on QCB presence/absence using multiple logistic regression with forward selection and $p < 0.05$ for variable entry into the model and Student's t-tests in NCSS Statistical System for Windows (Hintze 2001). Because habitat data were often recorded during each of

multiple visits to a given plot we combined data for each plot. When habitat data were taken in a presence/absence format (e.g., noting the presence of dominant shrub species on the plot) any notation of a species on a given plot was taken as evidence of that species' presence on that plot (i.e., the species did not have to be recorded during every visit to be included as 'present' in this analysis). When habitat data were recorded in abundance categories (e.g., host plant abundance) the maximum abundance category recorded was taken as the value for a given plot (i.e., if a host plant species was recorded as having 21-100 individuals within a plot for 3 visits and 101-1000 individuals for 2 visits, it was considered as present on this plot with 101-1000 individuals). Student's t-tests were used when comparing grouped data (e.g., the number of dominant shrub species) for occupied plots and plots without detections. Plots without reported habitat data were removed for these analyses.

RESULTS

Larvae Surveys

Each patch was surveyed 7 times between 15 February and 18 March 2008. No QCB larvae were detected on any of the patches. On the patch at MSR, 5 *Hemileuca electra*, 1 cutworm, and 1 unidentified caterpillar species were observed. Besides *Plantago erecta*, the only other QCB host plant detected was *Castilleja exserta*, which was found on 2 of 3 patches at El Sol and the MSR patch. *Castilleja exserta* remained green and flowering throughout all 7 visits on each of the patches where it was present. *P. erecta* was beginning to desiccate and show signs of water stress by the last visits. Cryptogramic soil crusts were found on all patches, but no evidence was found of caterpillar grazing.

Sentinel Site Visits

The first adult QCB observed in 2008 was on 11 March at MSR. A second visit to MSR occurred on 12 March 2008 and another adult was observed. Two previous sentinel site surveys were done at this site in January which yielded no adult QCB but did yield 1 larva observation. On 20 March 2008, the only sentinel site visit occurred at Oak Mountain and yielded over 20 QCB observations. The Silverado Ranch sentinel site was visited once on 26 March 2008 and 7 QCB adults were detected. The 2 visits that were done at the Wilson Valley sites yielded no QCB detections (Table 1). Sentinel site visits to Wilson Valley were suspended without any QCB detections because it was deemed that if QCB were flying in Silverado, a site southeast of Wilson Valley and at a higher elevation, they would likely already be flying in the Wilson Valley area but were simply not detected.

Adult Surveys

The Biological Monitoring Program conducted 206 surveys on 42 plots between 24 March and 8 May 2008. Three plots in Silverado were excluded from future surveying after the first survey due to thick vegetation that prevented surveyors from completing

Table 1. Quino Checkerspot Butterfly Sentinel Site Survey Results in 2008

Sentinel Site Location	Date of First Visit	Date of Last Visit	Total Number of Visits	Total QCB Observed
Multi-Species Reserve	1/29/2008	3/12/2008	4	2
Oak Mountain	3/20/2008	3/20/2008	1	>20
Wilson Valley 1	3/21/2008	3/26/2008	2	0
Wilson Valley 2	3/21/2008	3/26/2008	2	0
Silverado Ranch	3/26/2008	3/26/2008	1	7

their survey as outlined in the USFWS protocol. All plots were visited at least once per week for 5 consecutive weeks, weather permitting. The only exceptions were for the 2 Brown Canyon plots and the Johnson Ranch plot. Brown Canyon was only surveyed 4 times and Johnson Ranch was only surveyed 3 times. Surveys were prematurely concluded at both sites due to poor environmental and habitat conditions (e.g., high temperatures, desiccated host and nectar plants) that were a result of surveying beginning too late in the season in those areas.

Other organizations conducted 274 surveys on 62 plots between 20 March and 16 May 2008. One plot at the MSR and 1 plot in Rogers Canyon were only surveyed once. Also at the MSR, 10 plots were surveyed 4 times and 4 plots were surveyed 3 times. The 5 San Bernardino National Forest plots surveyed by Sarah Thorne and Allison Anderson were only surveyed 4 times.

On Monitoring Program plots, 18 total QCB were observed during surveys (Figure 3). One was in Magee Hills, 4 were found in Oak Mountain on 4 plots, and 13 were found in Silverado on 5 plots (Appendix D). No QCB were observed in Wilson Valley, Billy Goat Mountain, Rocky Ridge, Johnson Ranch, or Brown Canyon by Monitoring Program biologists in 2008. Twenty adult QCB were incidentally observed while walking to and from plots (Figure 3). All incidental observations were made in areas already known to be occupied by QCB.

On plots surveyed by other organizations, 152 QCB observations were made on 14 of 62 plots. Twenty-eight QCB observations were made on 6 MSR plots and 124 QCB observations were made on 8 Rogers Canyon plots. In addition to QCB seen on plots, 69 incidental observations were reported. An additional 5 incidental observations in the Silverado area, not associated with any plot survey, were reported to us by Dr. Gordon Pratt via personal communication.

Figure 3. Quino checkerspot butterfly adult observation locations in 2008.

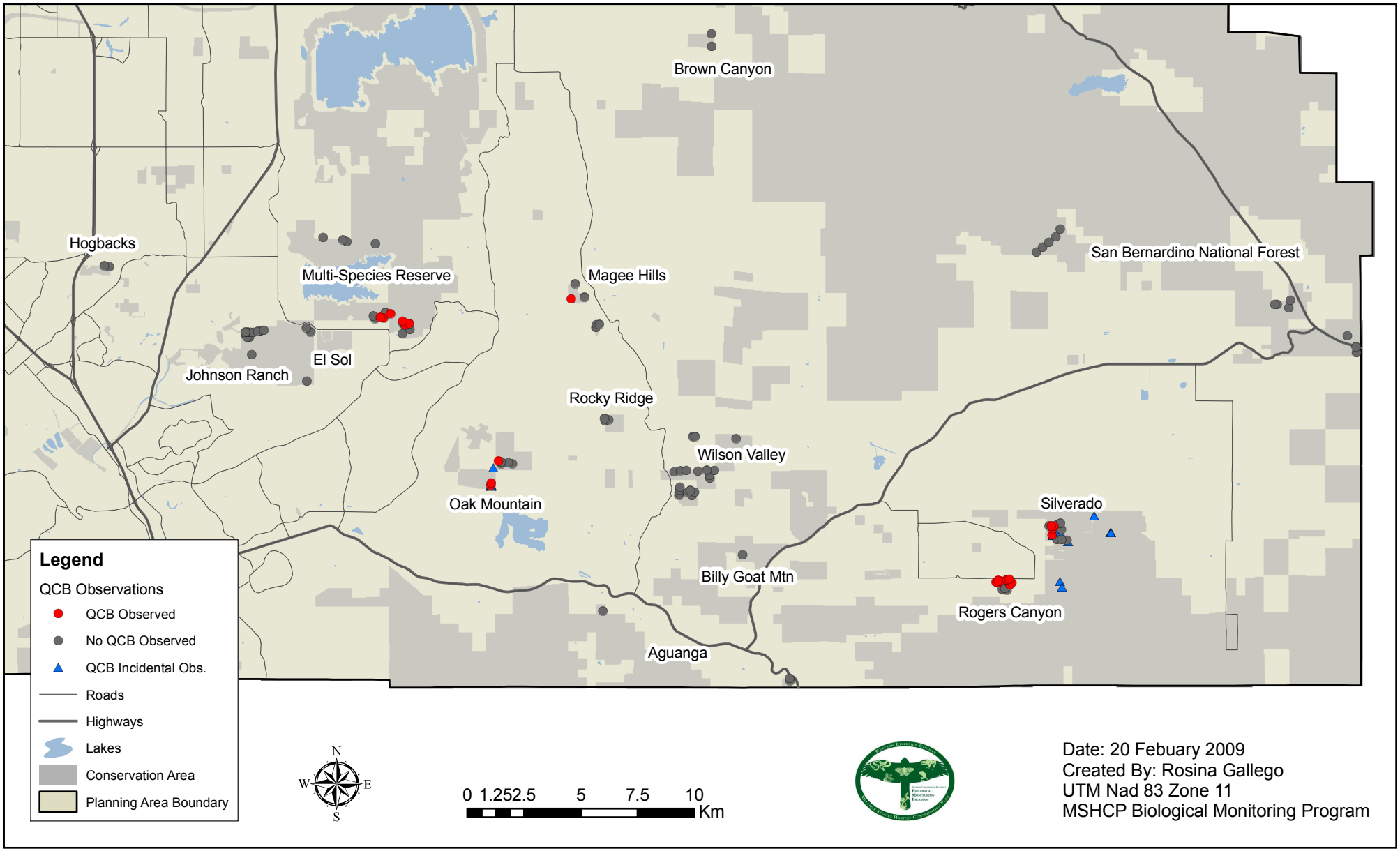


Table 3. Adult QCB Detection Probability (p), Lower Confidence Interval (LCI), Upper Confidence Interval (UCI), and Cumulative Detection Probability (cum p) in 2008

Visit	p	LCI	UCI	cum p
1	0.76	0.51	0.91	0.76
2	0.65	0.47	0.79	0.92
3	0.47	0.31	0.64	0.96
4	0.27	0.17	0.42	0.97
5	0.13	0.05	0.27	0.97
6	0.05	0.01	0.22	0.97

Overall in 2008, QCB occupied 22 out of 107 (21%) plots where at least one survey was conducted. The detection probability for adult QCB began relatively high early in the season and declined steadily as the season progressed (Table 3). Nevertheless, after 3 visits the cumulative detection probability was 0.96 meaning that we had a 96% chance of observing at least 1 QCB on a given plot **if** the plot was truly occupied. The revised occupancy estimate using the calculated detection probability was 23% (95% confidence intervals: 0.16 – 0.34), only a very slight increase from the naïve estimate. Note that this is an estimate of the number of sites that were occupied in 2008 from a pool of locations where QCB have been recently detected, not an estimate of QCB occupancy throughout suitable habitat within its range.

Plantago erecta was significantly more likely to be present on plots with QCB detections (17/21, 81%) than on plots without detections (44/78, 56%) ($p < 0.05$, S.E. = 0.63) (Table 4). However, when present, *P. erecta* was found at approximately the same abundance on plots with detections (13/17, 76% of plots were in the highest abundance category) and on plots without detections (33/44, 75% of plots were in the highest abundance category) (Table 5). Other host plants were found relatively infrequently in the study area, except *Castilleja exserta* which was found on roughly one-third of occupied plots, and half of plots without QCB detections.

The only nectar plant found significantly more often on occupied plots (14/14, 100%) than on plots without detections (47/60, 78%) was *Dichlostemma capitatum* ($p < 0.05$, S.E. = 0.03). Because there were 77 separate nectar plants species or genera recorded on QCB survey plots these results are not presented in a table. Note that the number of plots discussed for each habitat variable analysis differs because plots without reported habitat data for a given variable were removed for the corresponding analysis. When all nectar plant species were grouped together there was no significant difference in the average number of species on occupied plots (mean = 10.5), compared to plots without observations (mean = 9.4).

Two common shrub species were significantly less likely to be found on occupied plots than on plots without detections ($p < 0.05$). *Adenostoma fasciculatum* was found on

Table 4. Percentage of unoccupied and occupied plots with QCB host plants.

Species	Unoccupied plots	Occupied plots
Antirrhinum coulterianum	13/78 (17%)	1/21 (5%)
Castilleja exserta	41/78 (53%)	8/21 (38%)
Cordylanthus rigidus	4/78 (5%)	0
Plantago erecta	44/78 (56%)	17/21 (81%)
Plantago patagonica	2/78 (3%)	0

2 out of 20 occupied plots (10%) and 33 out of 76 plots without detections (43%) (S.E. = 0.85). *Eriogonum fasciculatum* was found on 10 out of 20 (50%) occupied plots and 65 out of 76 plots without observations (86%) (S.E. = 0.63). Because there were 38 separate shrub species or genera recorded on QCB survey plots these results are not presented in a table. When all shrub species were grouped together there were significantly fewer species on average per occupied plot (mean = 2.75) than on plots without detections (mean = 3.97) ($p < 0.05$). The percent cover of bare ground, burned area, and shrub cover did not differ significantly between occupied plots and plots without QCB observations (Table 6).

DISCUSSION

We were encouraged to see QCB flying within the Conservation Area in 2008 after observing no larvae or adults in 2007. QCB larvae are known to be capable of re-entering diapause if available food resources are exhausted or possibly remaining in diapause for over a year in order to wait for suitable emergence conditions (USFWS 2003).

The steadily declining detection probability calculated for 2008 surveys suggests that we began surveys mid-way through the flight season. Detection probabilities are highest at the peak of the flight season and the survey period should ideally include this peak.

There are several vegetation, slope, and soil characteristics that are thought to determine what comprises suitable habitat, but surveys in what seems to be appropriate habitat (i.e., locations that at least superficially resemble occupied areas) routinely return no QCB observations. Adult butterflies are reasonably conspicuous and detection probabilities calculated in recent years (0.73 in 2005, not calculable in 2006 or 2007, up to 0.76 in 2008) suggest that if a given plot is surveyed multiple times, the likelihood of observing at least 1 QCB is relatively high. Therefore, 2 primary possibilities exist to explain why we observe QCB so rarely in areas that appear to be suitable habitat but that are not known to regularly support QCB populations. Either QCB are very patchily distributed throughout the landscape and do not occupy large patches of suitable habitat, or our understanding of what constitutes suitable habitat is overly inclusive and inaccurate.

Table 5. Abundance categories for QCB host plants on unoccupied and occupied plots

Antirrhinum coulterianum	**Unoccupied plots**	**Occupied plots**
1-20	4/13 (31%)	1/1 (100%)
21-100	7/13 (54%)	0
101-1000	2/13 (15%)	0
>1000	0	0
Castilleja exserta	**Unoccupied plots**	**Occupied plots**
1-20	7/41 (17%)	3/8 (38%)
21-100	6/41 (15%)	0
101-1000	23/41 (56%)	5/8 (63%)
>1000	5/41 (12%)	0

Table 5 continued

Cordylanthus rigidus	**Unoccupied plots**	**Occupied plots**
1-20	4/4 (100%)	0
21-100	0	0
101-1000	0	0
>1000	0	0
Plantago erecta	**Unoccupied plots**	**Occupied plots**
1-20	2/44 (5%)	1/17 (6%)
21-100	2/44 (5%)	1/17 (6%)
101-1000	7/44 (16%)	2/17 (12%)
>1000	33/44 (75%)	13/17 (76%)
Plantago patagonica	**Unoccupied plots**	**Occupied plots**
1-20	1/2 (50%)	0
21-100	0	0
101-1000	0	0
>1000	1/2 (50%)	0

The habitat conditions at occupied locations and areas without QCB observations were mostly similar in 2008, with a few exceptions. The finding that *P. erecta* was observed more often on occupied plots than plots without detections is not unexpected as this species is recognized as the primary host plant for QCB larvae (USFWS 2003). However, this result does provide optimism for a statistically supported model of areas more likely to support QCB populations. QCB adults are generally believed to prefer more open vegetation communities so it follows that they are less likely to be observed in

Table 6. Percent cover categories for shrubs, burned area, and bare ground on unoccupied and occupied plots

Shrub cover	**Unoccupied plots**	**Occupied plots**
0-25%	16/81 (20%)	3/18 (17%)
26-50%	23/81 (28%)	3/18 (17%)
51-75%	30/81 (37%)	11/18 (61%)
76-100%	12/81 (15%)	1/18 (6%)
Burned area	**Unoccupied plots**	**Occupied plots**
0-25%	75/80 (94%)	14/16 (88%)
26-50%	4/80 (5%)	2/16 (13%)
51-75%	1/80 (1%)	0
76-100%	0	0
Bare ground	**Unoccupied plots**	**Occupied plots**
0-25%	37/82 (45%)	8/19 (42%)
26-50%	30/82 (37%)	6/19 (32%)
51-75%	13/82 (16%)	5/19 (26%)
76-100%	2/82 (2%)	0

areas with the shrubs *Adenostoma fasciculatum* and *Eriogonum fasciculatum*, which can create a relatively denser ground cover. However, the percent cover of shrubs on survey plots was not significantly different between occupied plots and plots without observations which is contrary to the above finding. Note that including 0% cover as a part of the 0-25% cover category when estimating percent cover across a plot for bare ground, shrubs, and recently burned area was a mistake and could have confused any real differences in these habitat variables between occupied and unoccupied plots. Plots totally lacking any bare ground, shrubs, or recently burned areas should have been scored 0%, and plots with small amounts of these variables should have been scored in a 1-25% category. Although there was no significant difference between the number of nectar plant species on occupied plots and on plots without observations, perhaps a more important metric would be percent cover on each survey plot of any suitable nectar plant, which was not recorded in 2008.

More research will be necessary to determine if the currently accepted determinants of QCB habitat suitability are correct. However, habitat data collected thus far suggest that there are several areas in western Riverside County that provide suitable habitat conditions for QCB presence, but that are not regularly occupied. There is a need for a quantitative multi-year dataset of habitat attributes at locations regularly used by QCB in order to build a well supported model of suitable QCB habitat.

Recommendations for Future Surveys

For the 2009 survey season we plan to discontinue larvae surveys because of their failure to improve our understanding of the distribution of QCB. It may be appropriate to pursue larvae surveys in the future if areas where QCB larvae can be reliably found outside of the sentinel sites are identified.

Results from surveys for adult QCB in 2008 suggest that we began surveying mid-way through the flight season. The sentinel sites should be monitored earlier in the year so that we are confident that we observe the beginning of the flight season and can initiate plot surveys accordingly. If personnel availability allows, sentinel sites should continue to be regularly monitored until the end of the flight season so that there is ongoing confirmation of adult QCB flying while plot surveys in nearby areas are being conducted, and so that the duration of the flight season at the various sentinel site areas is known.

We anticipate that future survey efforts will focus on improving our ability to understand and confidently identify appropriate QCB habitat. Additionally, we need to develop methods to monitor the extent and patchiness of each occupied area. We plan to meet these needs by concentrating future survey efforts on known occupied areas and the immediate vicinity of those areas. We will implement a study design with repeat visits to these locations in order to determine the fine-scale distribution of adult Quino at occupied locations, and will gather vegetation and other potentially important habitat data at surveyed locations with and without QCB detections to better quantify QCB habitat associations. Particular habitat attributes of interest include the presence, abundance, and phenology of host plants, the composition of the vegetation community (e.g., percent cover of vegetative functional groups including native and non-native shrubs, herbs, grasses, and associated amount of bare ground), soil type, slope, aspect, and distance from nearest known area where QCB are known to reproduce regularly. Concentrating efforts on known occupied areas will also produce larger sample sizes for each survey area and potentially allow for comparisons of habitat attributes between areas.

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Appendix A. Western Riverside County MSHCP Biological Monitoring Program Pilot Protocol for Quino Checkerspot Larvae Surveys, February 2008

Goals:

A) (short-term): To determine if Quino Checkerspot Butterfly (QCB) larvae can be detected in *Plantago erecta* patches within the Conservation Area via visual encounter surveys.

B) (long-term): To increase the encounter rate when surveyors are looking for QCB. This will improve our understanding of QCB distribution within the Conservation Area.

Timing: Surveys will begin once post-diapause larvae have been observed in the field. Weekly visits by Monitoring Program Biologists or by partnering organizations to known larvae locations will be made to monitor for post-diapause larvae. This usually occurs in mid-February. Larvae survey plots will be visited twice per week after post-diapause larvae are detected.

Survey Locations: For the 2008 pilot, we will establish the boundaries of 4 *P. erecta* patches, and will conduct walking visual encounter surveys within these patches. One patch has been identified on a historically, but not recently occupied QCB site at the Southwestern Riverside County Multi-Species Reserve (MSR) and 3 patches have been identified at El Sol (an RCA-owned property near the MSR).

Methods:

I. Patch Establishment and Mapping

Surveyors will initially scout sites near historically occupied QCB areas to determine locations of patches of *P. erecta* and will mark the center of observed patches with a GPS waypoint. For this pilot, a patch is any area where *P. erecta* is abundant or dominant in the herbaceous cover. Large patches will be selected for survey. The perimeter of each selected patch will be mapped using a Trimble GPS Unit and marked with garden stakes. One surveyor will walk slowly along the edge of the identified patch with a Trimble to record the perimeter of the patch. Another surveyor will walk behind with stakes and place a stake at approximately 5 m intervals to mark the patch boundary. Once the entire area has been staked, a piece of twine will be used to mark the area between the stakes, making a ring around the entire perimeter of the patch. Within the patch, parallel transects running from east to west will be placed at 2 m intervals. Transects will be marked with pinflags. Biologist will use a declinated compass to determine east-west directionality and place only enough pinflags so that surveyors can walk an approximately straight line. Transects will be marked using alternating colors of

pinflags. Each transect will have a unique alphabetical ID. A GPS point will be taken with the patch ID at the start of the first transect to identify where surveys will begin.

II. Larval Surveys

Before surveying begins, Monitoring Program biologists must have completed training in appropriate larvae searching methods and have demonstrated knowledge on how to tell the difference between Quino Checkerspot, Chalcedon Checkerspot, and Common Buckeye larvae. The survey period is from 10:00 a.m. to 2:00 p.m., but surveys cannot be done:

- During periods of fog, drizzle, or rain;
- Sustained winds greater than 15 miles (24 kilometers) per hour measured 4-6 feet (1.2-1.8 m) above ground level;
- Temperature in the shade at ground level less than 60° F (15.5°C) on a clear, sunny day; or less than 70°F (21°C) on an overcast or cloudy day.

Equipment:

GPS	Camera
Datasheets	Compass
Sunshade	Kestrel
Ruler	

Surveying:

Surveys will be conducted from 10:00 am to 2:00 pm. Surveyors will navigate to the beginning of the first transect using a GPS unit. Surveys will begin on the southeast corner of the patch and will run along the east-west transects. All transects will be marked using alternating colors but a compass bearing should be taken to get proper orientation before beginning to walk.

Transects will be walked in slow careful fashion. Surveyors will use their bodies and hand carried umbrellas or sun shades to create shade in which to look for caterpillars. Surveyors will stop every few steps or as appropriate to visually survey the shaded area. The umbrella or sun shade will be used to expand the shaded area. Special attention will be paid to areas where *P. erecta* is present with bare ground or other open areas. Surveyors will look for basking caterpillars on twigs and care will be taken to avoid brushing against or otherwise trample the standing vegetation.

While conducting surveys, observers will also assess the condition of the host plants. Characteristics such as height, general size, flowering stage, and if plants are senescing will be noted and recorded on the datasheet. The presence of cryptogamic soil crusts and the presence of any non-QCB caterpillar species will be noted.

Recording Data:

Each surveyor will carry 1 datasheet per patch on a survey day. Upon arrival at the assigned patch the surveyor should record: site location, patch ID, surveyor name, arrival time, temperature at ground level, and average wind speed.

When a QCB caterpillar is found, the surveyor will mark its location with a GPS unit. Surveyors should also take a photograph of the larvae next to a ruler for scale. The transect ID, larvae length, perpendicular distance from larvae to transect, larvae behavior, waypoint ID, and photo number should all be recorded on the datasheet for each QCB larvae sighting. If no QCB caterpillars are detected on the patch during a survey then this should be noted on the datasheet. Data collected at the end of the survey are: departure time, temperature at ground level, and average wind speed.

Quino Checkerspot Larvae Survey Datasheet

Site:_____ Patch ID:_____ Visit #:_____

Date:_____ Surveyor:_____

Time:_____
Arrival: _ Temp. (ºC):_____ Avg. Wind Speed (mph)_____
Weather (circle one): Clear, Partly Cloudy, Cloudy, Raining

Time:_____
Departure: _ Temp. (ºC):_____ Avg. Wind Speed (mph)_____
Weather (circle one): Clear, Partly Cloudy, Cloudy, Raining

Quino Larvae Observations

Transect ID	Distance of observation from transect (cm)	larvae length (mm)	Behavior of Larvae (basking,feeding, etc.)	UTM East	UTM North	Photo ID

Other Caterpillar Spp. observed

Spp. observed:_____	How Many?:_____	Spp. observed:_____	How Many?:_____
Spp. observed:_____	How Many?:_____	Spp. observed:_____	How Many?:_____

Host Plants Observed

Host Plants Observed	Host Plant Condition: Green, Flowering or Senesced	Describe plant conditions (size of patch(es),plant height, etc.)
Plantago erecta	**G F S**	
Plantago patagonica	**G F S**	
Castilleja exserta	**G F S**	
Antirrhinum coulterianum	**G F S**	
Cordylanthus rigidus	**G F S**	

Cryptogamic Soils present? _____ Evidence of grazing?_____

Additional Notes:

Appendix B: Quino Checkerspot Butterfly Sentinel Site Survey Datasheet

Date: _____ Site:_____
Surveyors:_____

Arrival: Time: _____ Temp. (°C):_____ Avg. Wind Speed (mph):_____

Weather (circle one): Clear, Partly Cloudy, Cloudy, Raining

Departure: Time: _____ Temp. (°C):_____ Avg. Wind Speed (mph): _____

Weather (circle one): Clear, Partly Cloudy, Cloudy, Raining

# of Quino Larvae observed (tally): _____ Avg. Larval length (mm): _____

# of Quino Adults observed (tally): _____

Host Plants Observed	**Host Plant Condition: Green, Flowering or Senesced**	**Describe plant patch conditions (size of patch(es), height, etc.)**
Plantago erecta	**G F S**	
Plantago patagonica	**G F S**	
Castilleja exserta	**G F S**	
Antirrhinum coulterianum	**G F S**	
Cordylanthus rigidus	**G F S**	

General Habitat Description:
_____
_____

Nectaring Plants Present (list):
_____
_____

Photos taken (photo names):
_____
_____

Additional Notes:
_____

Co-occurring butterfly detections on other side

Co-occurring butterfly species:

(Check box if present. Number observed is not necessary)

Swallowtails:		**Brush-footed Butterflies** (cont.):	
Pale Swallowtail (*Papilo eurymedon)*		Mourning Cloak (*Nymphalis antiopa*)	
Anise Swallowtail (*P. zelicaon*)		California Sister (*Adelpha bredowii*)	
West Tiger Swallowtail (*P. Rutulus*)		Satyr Anglewing (*Polygonia satyrus*)	
Whites/Oranges:		Lorquin's Admiral (*Basilarchia lorquini*)	
Sara Orangetip (*Anthocaris sara*)		**Blues, Metalmarks, Coppers:**	
Felder's Orangetip (*A. cethura*)		Western Tailed Blue (*Everes amyntula*)	
Cabbage White (*Artogeia rapae)*		Southern Blue (*Glaucopysche lygdamus australis*)	
Sleepy Orange (*Eurema nicippe*)		Echo Blue (*Celastrina ladon echo*)	
Common (Checkered) White (*Pontia protodice*)		Sonoran Blue (*Philotes sonorensis*)	
California Dogface (Zerene eurydice)		Marine Blue (*Leptotes marina*)	
Alfalfa Butterfly (*Colia eurytheme*)		Acmon Blue (*Icaricia acmon*)	
Harford's Sulfur (*C. Harfordi*)		Pygmy Blue (*Brephidium exilis*)	
Brush-footed Butterflies:		Gray Hairstreak (*Strymon melinus*)	
California Ringlet (*Coenonympha californiaca*)		Brown Elfin (*Incisalia augustinus*)	
Monarch (*Danaus plexipus*)		Perplexing Hairstreak (*Callohyrys perplexa*)	
Queen (*D. gilippus)*		Great Purple Hairstreak (*Atlides halesus*)	
Henne's Checkerspot (Euphydryas chalcedona hennei*)*		Behr's Metalmark (*Apodemia moro virgulti*)	
Chalcedon Checkerspot (*E. chalcedona chalcedona*)		Wright's Metalmark (*Calephelis wrightii*)	
Gabb's Checkerspot (*Charidryas gabbi*)		**Skippers:**	
Leanira (Wright's) Checkerspot (*Thessalia leanira wrighti*)		Fiery Skipper (*Hylephila phyleus*)	
Mylitta Cresent (*Phyciodes mylitta*)		Funeral Dusky Wing (*Erynnis funeralis*)	
Painted Lady (*Vanessa cardui*)		**Other:**	
West Coast Lady (*V. annabella*)		Unknown Blue	
Virginia Lady (*V. virginiensis*)		Unknown White	
Red Admiral (*V. atalanta*)		Unknown Yellow/Sulphur	
Buckeye (*Junonia coenia*)			

Appendix C: Quino Survey Protocol 2008 USFWS study

Survey plots will be visited at least once per week and no more than 2 times per week (7 day period) for a total of 5 visits, starting at the beginning of the peak flight season. All visits must be at least 12 hours apart. The peak flight season will be determined by the FWS for each survey area and will be approximately 1 week after the first adults are observed at monitored reference sites. Surveys will only be completed between the hours of 0930 and 1430, when temperatures in the shade at ground level are >15.5 ^{o} C on a clear, sunny day; or >21 ^{o} C on an overcast or cloudy day, and wind speeds are <24 km per hour measured 1.2-1.8 m above ground level. Surveys shall not be conducted outside of these hours or weather conditions, and not when there is fog or precipitation on-site. All surveyors will have FWS permits to conduct Quino surveys and be able to identify the following plants prior to flowering: *Plantago erecta, Plantago patagonica, Antirrhinum coulterianum, Cordylanthus rigidus,* and *Castilleja exserta*.

Each surveyor will be assigned a group of survey plots that can be surveyed within the 5 hour survey window. The FWS will provide datasheets and plot locations. The order in which the plots are surveyed will vary with each visit, so that throughout the survey period the plots are visited at different times of day. This can be accomplished by altering the starting point of the survey route each week.

On their first visit surveyors will use GPS units to navigate to the plot perimeter point directly north of the center point and mark it with flagging tape or a pinflag. Before proceeding further, each surveyors will record the plot number, survey time, temperature, cloud cover (clear, partly cloudy, cloudy), and wind speed as measured by a pocket weather monitor, averaged over 10 seconds. After recording conditions, surveyors will begin surveying for Quino as they use a GPS unit or a compass and tape measure (or other measuring device) to move south 50 m from the north perimeter point and mark the plot center point. Still looking for Quino as much as possible, surveyors will similarly mark perimeter points for the other 2 compass directions with pinflags or flagging tape. The four marked plot perimeter areas and center point will serve as a guide for staying within the plot and delineate plot quadrants during the remainder of the first survey and the next four surveys. Surveyors will continue to search for Quino on the 50 m radius circular plot until 15 minutes have elapsed since survey time was first recorded. Surveyors are free to search the plots in their own manner, provided the *entire* plot is surveyed within the 15 minute search time and they do not leave the plot during the survey. During surveys, surveyors should focus all of their attention within the plot and ignore butterfly sightings outside of plots. Search times will be monitored using stopwatches or timers. Surveyors will record the number of Quino adults observed on the plot and the quadrant(s) of the Quino location(s) (e.g 2 males, northeast quadrant). Quino should be photographed if possible, and a noted as such if photos are taken. The following covariate data will also be recorded: percent cover of bare ground (having no vegetative debris or litter), percent shrub cover, percent of the plot that was recently

burned, dominant shrub in the plot, and the number of plants of the following species: *Plantago erecta, Plantago patagonica, Antirrhinum coulterianum, Cordylanthus rigidus,* and *Castilleja exserta.* All percent area estimates will be recorded in the following categories: 0%, 1-25%, 26-50%, 51-75%, 76-100%. Hostplant abundance estimates will be recorded in the following categories: 0, 1-20, 20-100, >100 (101-1000, <1000 for *Plantago spp.*). Covariate data will be recorded on each visit to the plot and average values from all 5 visits will be used for data analysis. Surveyors will record any incidental observations of immature Quino life stages and other relevant notes (habitat characteristics, butterfly behavior, etc.).

Surveyors will look for Quino at all times when not surveying plots (walking to and from plots). All observations outside of survey plots will be GPS'd and recorded on the data sheet, clearly marked as having occurred outside the plot. GPS units used for this project will be precise within 50 m.

All flagging and survey markers will be removed after the last survey, except for plots identified as requiring additional data collection. In addition to the plot covariate data recorded by Quino surveyors, a small team of surveyors will visit a randomly selected subset of the plots to take detailed measurements of covariate data. These detailed measurements of covariate data will be compared to the data collected by Quino surveyors. All plots within a 2007 fire perimeter will have the burn mosaic subsequently mapped and % burn area accurately recorded. Methodology for the detailed measurements of plot covariate data are provided in a separate document. The FWS will inform surveyors if flagging needs to remain in place.

List of equipment needed per surveyor

Maps of survey areas*
Datasheets*
Pinflags*
Pens
String or tape measure (if needed)
Compass (if needed)
GPS unit (precise within 50m)
Extra batteries
Stopwatch or timer
Pocket weather station (e.g. Kestrel)
Camera with zoom lens

Data Reporting

All data sheets will be emailed (Alison_Anderson@fws.gov) or FAXed to the FWS (760-431-5902, Attn: Alison Anderson) within 3 days of data collection. Original data sheets will be mailed to the FWS within 1 week of the end of the field season. Photocopies of the data sheets will be retained by the surveyors for their own records and as a backup copy.

USFWS Adult QCB 2008 Survey Form

Date _____ Plot number_____ Time start_____ end_____

Plot location _____

Surveyor _____

Temp (^{o}C) _____ Wind (km/hr) _____ Sky: clear, partly cloudy, cloudy

Observations (use additional sheets if needed)

Number of adults	**Quadrant (or GPS coordinates NAD 83 outside plot)**	**Number of adults**	**Quadrant (or GPS coordinates NAD 83 outside plot)**

Hostplant species	**Density per plot (estimate)**
Plantago erecta	0, 1-20, 20-100, 101-1000, >1000
Plantago patagonica	0, 1-20, 20-100, 101-1000, >1000
Antirrhinum coulterianum	0, 1-20, 20-100, >100
Corylanthis rigidus	0, 1-20, 20-100, >100
Castilleja exserta	0, 1-20, 20-100, >100
% Bare ground estimate	0-25%, 26-50%, 51-75%, >75%
% Burned area estimate	0-25%, 26-50%, 51-75%, >75%
% Shrub cover estimate	0-25%, 26-50%, 51-75%, >75%

Notes. Include dominant shrub species, GPS coordinates for other life stages observed, and other relevant information (e.g. butterfly behavior, nectar sources, other butterfly species, other life stages observed).

Date _____ Plot number_____

Co-occurring butterfly species:

(Check box if present. Number observed is not necessary)

Swallowtails:		**Brush-footed Butterflies** (cont.):	
Pale Swallowtail (*Papilo eurymedon)*		Mourning Cloak (*Nymphalis antiopa*)	
Anise Swallowtail (*P. zelicaon*)		California Sister (*Adelpha bredowii*)	
West Tiger Swallowtail (*P. Rutulus*)		Satyr Anglewing (*Polygonia satyrus*)	
Whites/Oranges:		Lorquin's Admiral (*Basilarchia lorquini*)	
Sara Orangetip (*Anthocaris sara*)		**Blues, Metalmarks, Coppers:**	
Felder's Orangetip (*A. cethura*)		Western Tailed Blue (*Everes amyntula*)	
Cabbage White (*Artogeia rapae)*		Southern Blue (*Glaucopysche lygdamus australis*)	
Sleepy Orange (*Eurema nicippe*)		Echo Blue (*Celastrina ladon echo*)	
Common (Checkered) White (*Pontia protodice*)		Sonoran Blue (*Philotes sonorensis*)	

California Dogface (Zerene eurydice)		Marine Blue (*Leptotes marina*)	
Alfalfa Butterfly (*Colia eurytheme*)		Acmon Blue (*Icaricia acmon*)	
Harford's Sulfur (*C. Harfordi*)		Pygmy Blue (*Brephidium exilis*)	
Brush-footed Butterflies:		Gray Hairstreak (*Strymon melinus*)	
California Ringlet (*Coenonympha californiaca*)		Brown Elfin (*Incisalia augustinus*)	
Monarch (*Danaus plexipus*)		Perplexing Hairstreak (*Callohyrys perplexa*)	
Queen (*D. gilippus)*		Great Purple Hairstreak (*Atlides halesus*)	
Henne's Checkerspot (Euphydryas chalcedona hennei*)*		Behr's Metalmark (*Apodemia moro virgulti*)	
Chalcedon Checkerspot (*E. chalcedona chalcedona*)		Wright's Metalmark (*Calephelis wrightii*)	
Gabb's Checkerspot (*Charidryas gabbi*)		**Skippers:**	
Leanira (Wright's) Checkerspot (*Thessalia leanira wrighti*)		Fiery Skipper (*Hylephila phyleus*)	
Mylitta Cresent (*Phyciodes mylitta*)		Funeral Dusky Wing (*Erynnis funeralis*)	
Painted Lady (*Vanessa cardui*)		**Other:**	
West Coast Lady (*V. annabella*)		Unknown Blue	
Virginia Lady (*V. virginiensis*)		Unknown White	
Red Admiral (*V. atalanta*)		Unknown Yellow/Sulphur	
Buckeye (*Junonia coenia*)			

Appendix D. Survey Results for Adult QCB Surveys in 2008. Each row represents a unique plot. "0" = no QCB observed, "1" = at least 1 QCB observed "_" = no survey.

		Visit number					
Surveyor	**Location**	**1**	**2**	**3**	**4**	**5**	**Total QCB Observed**
A. Forde	Aguanga	0	0	0	0	0	0
A. Forde	Aguanga	0	0	0	0	0	0
A. Forde	Aguanga	0	0	0	0	0	0
C. Moen	MSR*	0	0	0	0	_	0
C. Moen	MSR	0	0	0	0	_	0
C. Moen	MSR	1	0	0	0	_	4
C. Moen	MSR	0	0	0	0	_	0
C. Moen	MSR	1	0	0	0	_	2
C. Moen	MSR	1	0	0	0	_	4
C. Moen	MSR	0	0	0	_	_	0
C. Moen	MSR	1	1	0	0	0	7
C. Moen	MSR	1	0	0	_	_	2
C. Moen	MSR	0	0	0	_	_	0
C. Moen	MSR	1	1	0	0	_	9
C. Moen	MSR	0	0	0	0	_	0
C. Moen	MSR	0	_	_	_	_	0
C. Moen	MSR	0	0	0	_	_	0
C. Moen	MSR	0	0	0	0	_	0
C. Moen	MSR	0	0	0	0	_	0
E. Porter	Rogers Canyon	0	_	_	_	_	0
E. Porter	Rogers Canyon	0	0	0	0	0	0
E. Porter	Rogers Canyon	0	0	0	0	0	0
E. Porter	Rogers Canyon	1	0	0	0	0	1
E. Porter	Rogers Canyon	1	0	1	1	0	12
E. Porter	Rogers Canyon	1	0	0	1	0	12
E. Porter	Rogers Canyon	1	1	1	1	0	21
E. Porter	Rogers Canyon	1	1	1	1	1	23
E. Porter	Rogers Canyon	1	1	1	1	0	13
E. Porter	Rogers Canyon	1	1	1	1	1	33
E. Porter	Rogers Canyon	1	0	1	0	0	9
K. Osborne	El Sol	0	0	0	0	0	0
K. Osborne	El Sol	0	0	0	0	0	0
K. Osborne	Hogbacks	0	0	0	0	0	0
K. Osborne	Hogbacks	0	0	0	0	0	0
K. Osborne	Johnson Ranch	0	0	0	0	0	0

K. Osborne	Johnson Ranch	0	0	0	0	0	0
K. Osborne	Johnson Ranch	0	0	0	0	0	0
K. Osborne	Johnson Ranch	0	0	0	0	0	0
K. Osborne	Johnson Ranch	0	0	0	0	0	0
K. Osborne	Johnson Ranch	0	0	0	0	0	0
K. Osborne	Johnson Ranch	0	0	0	0	0	0

		Visit number					
Surveyor	**Location**	**1**	**2**	**3**	**4**	**5**	**Total QCB Observed**
K. Osborne	Johnson Ranch	0	0	0	0	0	0
K. Osborne	Johnson Ranch	0	0	0	0	0	0
K. Osborne	Johnson Ranch	0	0	0	0	0	0
K. Osborne	Johnson Ranch	0	0	0	0	0	0
Monitoring Program	Johnson Ranch	0	0	0	_	_	0
K. Osborne	Wilson Valley	0	0	0	0	0	0
K. Osborne	Wilson Valley	0	0	0	0	0	0
K. Osborne	Wilson Valley	0	0	0	0	0	0
K. Osborne	Wilson Valley	0	0	0	0	0	0
K. Osborne	Wilson Valley	0	0	0	0	0	0
Monitoring Program	Billy Goat Mountain	0	0	0	0	0	0
Monitoring Program	Brown Canyon	0	0	0	0	_	0
Monitoring Program	Brown Canyon	0	0	0	0	_	0
Monitoring Program	Magee Hills	0	0	0	0	0	0
Monitoring Program	Magee Hills	0	0	0	0	0	0
Monitoring Program	Magee Hills	0	0	0	0	0	0
Monitoring Program	Magee Hills	1	0	0	0	0	1
Monitoring Program	Magee Hills	0	0	0	0	0	0
Monitoring Program	Magee Hills	0	0	0	0	0	0
Monitoring Program	Oak Mountain	0	1	0	0	0	1
Monitoring Program	Oak Mountain	0	1	0	0	0	1
Monitoring Program	Oak Mountain	0	0	0	0	0	0
Monitoring Program	Oak Mountain	0	0	0	0	0	0
Monitoring Program	Oak Mountain	0	0	0	0	0	0
Monitoring Program	Oak Mountain	0	0	0	0	0	0
Monitoring Program	Oak Mountain	1	1	0	0	0	2
Monitoring Program	Rocky Ridge	0	0	0	0	0	0
Monitoring Program	Rocky Ridge	0	0	0	0	0	0
Monitoring Program	Rocky Ridge	0	0	0	0	0	0
Monitoring Program	Silverado Ranch	0	0	0	0	0	0
Monitoring Program	Silverado Ranch	0	_	_	_	_	0
Monitoring Program	Silverado Ranch	0	_	_	_	_	0
Monitoring Program	Silverado Ranch	1	1	1	0	0	6
Monitoring Program	Silverado Ranch	0	0	0	0	0	0

Monitoring Program	Silverado Ranch	0	0	0	0	1	1
Monitoring Program	Silverado Ranch	1	0	0	0	0	2
Monitoring Program	Silverado Ranch	1	0	1	0	0	4
Monitoring Program	Silverado Ranch	0	_	_	_	_	0
Monitoring Program	Silverado Ranch	0	0	0	0	0	0
Monitoring Program	Silverado Ranch	0	0	0	0	0	0
Monitoring Program	Wilson Valley	0	0	0	0	0	0
Monitoring Program	Wilson Valley	0	0	0	0	0	0

		Visit number					
							Total QCB
Surveyor	**Location**	**1**	**2**	**3**	**4**	**5**	**Observed**
Monitoring Program	Wilson Valley	0	0	0	0	0	0
Monitoring Program	Wilson Valley	0	0	0	0	0	0
Monitoring Program	Wilson Valley	0	0	0	0	0	0
Monitoring Program	Wilson Valley	0	0	0	0	0	0
Monitoring Program	Wilson Valley	0	0	0	0	0	0
Monitoring Program	Wilson Valley	0	0	0	0	0	0
Monitoring Program	Wilson Valley	0	0	0	0	0	0
Monitoring Program	Wilson Valley	0	0	0	0	0	0
Monitoring Program	Wilson Valley	0	0	0	0	_	0
Monitoring Program	Wilson Valley	0	0	0	0	0	0
Monitoring Program	Wilson Valley	0	0	0	0	0	0
Monitoring Program	Wilson Valley	0	0	0	0	0	0
S. Quinnell	SBNF**	0	0	0	0	0	0
S. Quinnell	SBNF	0	0	0	0	0	0
S. Quinnell	SBNF	0	0	0	0	0	0
S. Quinnell	SBNF	0	0	0	0	0	0
S. Quinnell	SBNF	0	0	0	0	0	0
S. Quinnell	SBNF	0	0	0	0	0	0
S. Quinnell	SBNF	0	0	0	0	0	0
S. Thorne/A. Anderson	SBNF	0	0	0	0	_	0
S. Thorne/A. Anderson	SBNF	0	0	0	0	_	0
S. Thorne/A. Anderson	SBNF	0	0	0	0	_	0
S. Thorne/A. Anderson	SBNF	0	0	0	0	_	0
S. Thorne/A. Anderson	SBNF	0	0	0	0	_	0

*MSR = Southwestern Riverside County Multi-Species Reserve **SBNF = San Bernardino National Forest