SAN BRUNO MOUNTAIN
HABITAT CONSERVATION PLAN

Year 2002 Activities Report
For Endangered Species Permit PRT-2-9818

Submitted to the
United States Fish and Wildlife Service
by the
County of San Mateo
January 31, 2003

Table of Contents

Cover photo: Johnny jump-up (*Viola pedunculata*) along the summit trail of San Bruno Mountain.

List of Tables and Figures

SUMMARY

In 2002, a variety of habitat management work was conducted on San Bruno Mountain to satisfy the requirements under the HCP operating permit. This work included monitoring sensitive species, conducting exotics control work and habitat restoration, monitoring development activities, and coordinating with volunteer groups and oversight agencies (USFWS, CDFG).

Under the San Bruno Mountain Habitat Conservation Plan, the primary emphasis of the biological monitoring is to evaluate the status of the populations of the Mission blue and Callippe silverspot butterflies. In 2002, transect data for the Mission blue and Callippe silverspot butterflies was analyzed using Analysis of Variance (ANOVA). For Mission blue, 2000 was found to be a significantly good year for the butterflies relative to the years 1998 ($p=0.015$), 1999 ($p=0.003$), and 2001 ($p=0.042$) for the five years of data analyzed. For Callippe silverspot however, 2001 was found to be the best year and it was significantly better than 2000 ($p=0.008$), and 2002 ($p=0.036$).

Though we are not able to establish trends at this point, the fixed transect system may provide this opportunity in the future. This has not been possible with prior monitoring methods (i.e. wandering surveys only). For management purposes, the transect system is providing a data set to statistically evaluate the butterfly populations and provide information to the habitat manager and supervising agencies (USFWS).

An analysis of three years of the Mission blue fixed transect data by Courtney (SEI, 2002) concluded that the current fixed transect system did not have enough statistical power, and could not predict trends in the Mission blue population that would be useful on a timescale to allow habitat managers to perceive a precipitous decline in the population. Before abandoning the transect system, we suggest conducting another power analysis using five years of Mission blue data, and standardizing for weather.

The San Bruno Mountain Habitat Conservation Plan (Biological Program, page III-20) states that (1) "the monitoring should allow the Plan Operator (San Mateo County) to determine whether the populations are essentially stable in numbers, decreasing, increasing or fluctuating" and (2) "whether the distribution of the animals is shifting". We recommend that to address these two questions, both a transect monitoring system (such as what is currently in place) and a presence/absence system (based on what Courtney recommends or a modified wandering survey system) be used. A list of monitoring priorities for 2003 are provided.

The SBE point data (1998-2002) has shown that the SBE are still present and in substantial numbers at most or all of the monitoring points. There was not time to run statistical analysis on the data, and this will be a priority for 2003. In 2002, rare plant work focused on GPS mapping of all of the manzanitas on San Bruno Mountain. No other sensitive species were mapped or recorded on the Mountain in 2002.

Approximately 56 acres of gorse, fennel, blue gum Eucalyptus, French broom, and Portuguese broom, and 34 acres of other assorted weeds were treated with herbicide in 2002. The greatest herbicide efforts went into removing gorse from the Saddle area and fennel from the Saddle, Water tank/Spumoni and NE and SE Ridge areas. Hand removal

methods resulted in the removal of exotics on approximately 13 acres. Gorse, blue gum Eucalyptus, French broom and fennel, were controlled as well as 11 acres of assorted weeds. 2002 handwork focused on fennel and French broom removal along the Northeast Ridge fenceline and Guadalupe Canyon Parkway.

Habitat restoration work conducted by Shelterbelt Builders focused on the maintenance of five habitat islands, and the creation of two new habitat islands in the Dairy Ravine/Botanic Garden area. The habitat island approach has been successful in providing habitat for the butterflies within a relatively short time-period (≤5 years). Lupine survival at Saddle island 2 (S2), which is located in a former gorse infestation, has been over 50% in the first two years (211 lupines).

Volunteers also conducted exotics control and/or restoration work in specific areas in 2002 (Friends of San Bruno Mountain, California Native Plant Society, Bay Area Mountain Watch, Pointe Pacific Homeowners Association).

Funding for a pilot grazing project was approved by the HCP Trustees in January 2003. The grazing experiment will utilize goats and/or sheep, and will also incorporate mowing treatments in different seasons and areas. Preliminary results will be reported in the 2003 SBM HCP Annual Report.

No controlled burns were conducted on San Bruno Mountain in 2002. Controlled burns are planned in Juncus Ravine and Wax Myrtle Ravine in the Summer of 2003. An uncontrolled burn occurred on the SE Ridge in August, 2002. The 18-acre burn burned a large patch of grassland containing CS habitat. The burn may provide important information for the use of burning on San Bruno Mountain, and a separate report addressing the burn, monitoring methods, and burn policy of the HCP is in process.

Incidental take of habitat for the MB butterfly on San Bruno Mountain was authorized under the Endangered Species Act Section 10(a)(1)(B) Permit. Development related activity which may have resulted in take of the MB occurred during grading for "the Commons" neighborhood of the Terrabay Project. A separate report documenting the status of restoration work at each of the development areas will be submitted to the County and the USFWS in Spring, 2003.

No take of CS occurred or was authorized in 2002. Since the listing of the CS in 1997, take of the CS or it's habitat (*Viola pedunculata*) either through development, routine maintenance, and/or restoration work is not authorized under the Habitat Conservation Plan. An amendment to the HCP is currently being developed to address this issue.

INTRODUCTION

This report describes biological and development related activities which took place on San Bruno Mountain under Endangered Species Act Section 10(a) Permit PRT 2-9818 for the 2002 calendar year. It provides information on the relative population status of the butterflies of concern, habitat restoration and exotic species control work, and development activities. All figures (maps and graphs) and appendices containing data collected in 2002 are located at the end of the report. Anyone interested in reviewing field data or other information collected by Thomas Reid Associates should contact Patrick Kobernus at (650) 327-0429 (ext. 89), Eben Polk (650) 327-0429 (ext. 86) or Sam Herzberg with the County of San Mateo Parks and Recreation Division at (650) 363-1823. Previous reports and data is also available on-line at http://www.traenviro.com/sanbruno.

1. STATUS OF SPECIES OF CONCERN

Two monitoring methods were used in 2002 to assess the status of the endangered butterflies of San Bruno Mountain: fixed transects (AKA set transects) established in 1998, and wandering transects which have been used since 1982.

Wandering transects are routes that cover large areas (up to a mile) of the mountain and are monitored typically 1-2 times during the butterfly flight season. The wandering transects are not standardized routes, but rather the surveyor walks and records butterflies as they are encountered. The wandering transects provide distribution data on the butterflies, and allow monitors to check on the status of butterfly habitat in remote areas of the park.

The wandering surveys conducted every year since 1982 have provided useful data showing the overall distribution of the butterflies. Over 20,000 butterfly observation points have been recorded (San Bruno Mountain Ecological Database). However, since the survey routes are not standardized by area, statistical comparison of the data is problematic. For this reason, the relative population statistic calculated every year in previous SBM HCP annual reports may have no relation to the actual populations of the butterflies.

The purpose of the fixed transect monitoring is not to obtain an absolute population size of the butterflies, but rather to calculate an index that is related in a systematic way to the number of butterflies that are present. The fixed transects provide data that is standardized by location, time, (and weather for the Mission blue and San Bruno elfin). The transect locations are spread out over the mountain within different habitats and slope exposures to provide a sample that is representative of the overall population of the butterflies. The transect locations were not chosen randomly but were placed in different types of habitat areas where higher densities of the butterflies could be observed. Even in these locations, observing butterflies is not a guaranteed result even during optimum weather conditions. This difficulty in obtaining enough butterfly observations for statistical comparison necessitated choosing the most likely habitat areas to observe them. With this caveat, it is expected that the transects do provide a representative sample of the butterfly habitat on the Mountain.

a. Mission Blue Butterfly (*Icaricia icarioides missionensis*)

Methods

Fixed transects for the Mission blue are 50-meter-long transects marked in the field that are surveyed frequently during the flight season. These transects provide repeatable, site specific data on butterfly presence/absence and vegetation characteristics. Each transect is monitored once every 7-10 days (the average adult life span for the blue) and all transects are surveyed during warm, calm weather conditions within 1-2 days of one another. Each 50-meter transect is walked in approximately 2 ½ minutes by one person. After the transect observation period ends, average wind speed (1 minute duration) and air temperature are recorded. Only transect visits that had temperatures greater than or equal to 18^0C and wind speeds less than or equal to 5.0 mph were used in the analysis. Any butterflies observed inside the transect just before or after the 2 ½ minute monitoring period are included as transect observations. All butterflies observed outside of the transect or in the transect vicinity during travel between transects are recorded as incidental observations.

Mission blue (MB) butterflies use three larval host plants: *Lupinus albifrons collinus, Lupinus formosus formosus* and *Lupinus variicolor.* Early (March, April) flying MB butterflies are associated with *L. albifrons*, and late (May, June) flying blues are associated with the *L. formosus*. *L. variicolor* is used less frequently.

Typically, MB butterflies begin adult flight in March, are most abundant in April, and begin to drop off by late May/ early June. The timing of the flight season is also influenced by microclimate. Colonies on the warmer, dryer south facing slopes begin and end the flight season earlier than colonies on the cooler north facing slopes. In 2002 MB surveys began in early April and ended on May 24.

Results

In 2002, we recorded the first MB butterflies on San Bruno Mountain on April 15, at transects 22 and 27. The last MB of the season was observed on July 2 on the subridge between Owl and Buckeye canyons. The butterflies were probably flying at least a few days prior and after these observations.

The fixed transect locations and MB butterflies observed on San Bruno Mountain in 2002 are shown in Figure 1. Table 1 shows the average number of MBs observed per transect over the past five years. The number of transect surveys (visits) has varied between years, however taking the average number of butterflies observed per transect minimizes this variation. 2000 and 2001 were similar in number of transect visits, but 2000 had 1.9 times more butterfly observations. MB numbers on the transects were down in 2002 (1.022 MB/transect). This is lower than the past three years, but higher than 1998 which was only 0.355 MB/transect. For the last five years of transect monitoring, 2000 was by far the best year with an average of over 3 butterflies observed at each transect. The high numbers in this year were observed at both *L. albifrons* (2, 17, 28) and *L. formosus* transects (3, 5, 22), (Figure 2).

Table 1. Average number of Mission blue observations per transect for the years 1998-2002.

Year	Number of MB/ Transect	Total Number of Transect Surveys
1998	0.355	66
1999	1.244	71
2000	3.188	80
2001	1.688	78
2002	1.022	53

There were a total of 49 MB observed in 2002 on the fixed transects. Seven of these observations were excluded from statistical analysis since they occurred outside of weather parameters. The highest numbers of MBs were recorded at transects 5 (Owl Canyon. *L.. formosus*), 6 (Owl Canyon, *L. albifrons*), 22 (Northeast Ridge Water Tank, *L. formosus)*, and 24 (Linda Vista, *L. albifrons/ L. formosus*). All of the transects are located in conserved park areas with the exception of Transect 24, which is restored habitat. MB have been recorded periodically at this restoration site since at least 1995.

In 2002, MB observations were lower than the previous years on many of the *Lupinus albifrons* transects (transects 7, 17, 18, 25, 26), Figure 3. The decline in average number per transect this year did not appear to be due to hostplant health, though MB numbers at some of the *L. albifrons* transects do not appear to have fully recovered from the severe dieback that occurred after the El Niño rains in 1997-98 (transects 7, 14, 18, 23, 26, 27). There were no MB butterflies observed at *L. albifrons* transects 14, 18, 25, and 26. Of these, transects 14 and 26 have not had MB observations in the last 3 years. The cause for the drop in numbers this past year could be due to a dry early spring (see rainfall discussion below).

Overall, habitat condition at the transects appears good. Exceptions to this were at transects where habitat destruction occurred, and these events have influence butterfly observations. MB were observed at all *L. formosus* transects this year except transect 12. Transect 12 is located upslope of the Terrabay Phase I development, and was partially mowed by restoration crews working for Terrabay in 2000. Since that time the lupines have recovered. Transects 3 and 4 are transects which had no observations in 2001, however one MB was observed at each of these transects in 2002. Transect 3 is located on a San Francisco Water Department (SFWD) easement (roadway). This roadway was re-graveled in 2001 during replacement of a water pipeline. Though some MB lupines were spared, the loss of the lupines on the road resulted in a major impact to this small MB colony. A restoration plan is being developed by SFWD to replace the habitat in an appropriate location off of the roadway. Transect 4 is located in Devil's Arroyo and has much fewer lupines than the other transects. This transect had not had a MB observation since 1999. Growth of weedy exotics such as *Vicia sativa*, coastal scrub succession, and off road vehicle damage in 2002 have impacted this site.

Rainfall and MB Abundance

2001- 2002 was a moderately wet rain year on San Bruno Mountain. Rainfall for the year (July 2001 - June 2002) was 30.6 inches. December 2001, was extremely wet with 12.6 inches. However, after this time the months of January, February, and March 2002 were unusually dry. Average daily high temperatures and rainfall for the months of January through June for the last five rain years (1998- 2002) are shown in Table 2.

Rainfall for the transect monitoring years 1998-2002 is shown in Figure 4. The figure shows a pattern of moderate to heavy rainfall during the months of January, February, and March for the rain years of 98-99, 99-00, and 00-01. These years had the highest numbers of MB observations per transect. 1997-98 (El Nino year) and 2001-02 deviate from this pattern and had the lowest number of MB observations per transect. The data appears to support the conclusion that extreme weather years (either a very wet spring, or a very dry spring) cause a decline in MB abundance.

Table 2. Weather data for San Bruno Mountain: 1997-98---2001-02. Average high daily temperature and rainfall shown by month. Data recorded at weather station at County park entrance. T= Average Temperature in Fahrenheit. R= Rainfall in inches. The two wettest months for each year are shown in **bold** type.

Temp.	97-98	98-99	99-00	00-01	01-02	Rain	97-98	98-99	99-00	00-01	01-02
	T	T	T	T	T		R	R	R	R	R
July	66.6	66.5	64.9	62.7	70	**July**	0.29	0.31	0.05	0.23	0.26
Aug	69.1	68.5	65.5	65.7	65	**Aug**	0.86	0.18	0.47	1.80	0.44
Sep	72.4	67.6	66.3	73.7	70	**Sep**	0.12	0.35	0.50	0.46	0.51
Oct	64.9	65.9	68.4	61.0	68	**Oct**	1.08	0.51	0.61	3.21	0.56
Nov.	59.8	56.2	59.1	54.7	60	**Nov.**	6.94	4.29	2.57	1.40	**5.75**
Dec	53.2	50.7	55.6	56.0	52	**Dec**	4.06	1.61	0.68	1.16	**12.55**
Jan	54.5	52.2	53.8	52	51	**Jan**	**14.6**	**5.63**	**7.23**	**5.01**	2.44
Feb	52.3	52.0	54.7	53.3	57	**Feb**	**16.1**	**7.57**	**10.7**	**7.43**	3.14
Mar	56.4	53.4	57.9	59.2	57	**Mar**	3.03	3.42	2.92	2.04	2.97
Apr	58.6	57.9	60.7	56.5	58	**Apr**	3.23	2.77	2.21	2.34	0.72
May	59.8	57.0	71.7	67.6	63	**May**	4.91	0.39	1.81	0.19	1.02
Jun	63.6	62.0	65.7	68.2	67	**Jun**	0.46	0.44	0.37	0.25	0.27
						Total	**55.7**	**27.5**	**30.1**	**25.5**	**30.63**

MB Fixed Transects: Five Year Data Analysis (1998-2002)

The last five years of transect data (1998-2002) were analyzed in order to determine if our sampling efforts are sufficient to determine a relative change in MB numbers between years and between years at a given transect (Knight, Appendix A-2). This exercise is also a chance to make sure that our data are statistically robust and that they characterize the

MB flight season as best as possible. The number of MB observed per transect during each survey visit was analyzed to look for statistically significant ($p \leq 0.05$) differences between transects and years.

Only transects that had temperatures greater than or equal to18° C, and average wind speeds equal to or less than 5.0 mph were considered in the analysis. See Appendix A, Tables A-1 and A-2 for the 2002 MB data.

The data was analyzed using a statistical testing procedure called Analysis of Variance (ANOVA). ANOVA allows us to test whether the means (averages) from more than two population samples are equal. All differences in sample means are statistically significant (or not) by comparing them to the variation within samples.

The analysis shows that both year and transect are significant predictors for the number of MB observed (2-factor ANOVA with interactions). Year was the strongest predictor of MB observed (F-Statistic = 5.289, p=0.0004). In addition, there is a significant interaction between year and transect. In other words, there is a significant difference between years for the number of MB observed, and there is a significant difference between transects. The interaction term indicates that the relative quality of transects for MB habitat also changed from year to year.

Further tests (Scheffe Post-Hoc) reveal that it was the extreme low MB year in 1998 and extraordinarily high year in 2000 that drove the result that year is significant in the ANOVA. In addition, this significant result was also due to different levels of survey effort per transect. To counter act this, transect surveys need to be increased and each transect should be surveyed roughly the same number of times as the others.

Transect to transect variation in butterfly numbers is likely to be strongly related to density and therefore availability of habitat, especially host plants. And year to year variation is likely to be related to a temporal change in the quality of the physical habitat. The current sampling scheme is at a level that can detect differences between years, but not transects. To do this, survey effort at each transect must be increased. Knight suggests that the average number of transect surveys per year be increased to a approximately 100, and a minimum of 80, (a 15-30% increase in the current monitoring effort).

MB transects are located on both roadways and natural slopes, and some of the lower numbers at specific transects were attributable to destruction of MB habitat on roadways. These events do not occur as frequently in natural habitat. It is assumed that the number of transects susceptible to disturbance on roadways is proportional to these same impacts occurring in MB habitat on the entire Mountain.

Host plant data collected on the transects could be informative if lupine abundance varies greatly within transects and between years. If we had had host plant data for every year at each transect, it may have correlated with year to year variation, though unlikely with transect to transect variation. With a greater sample size (survey visits), and using a host plant assessment technique (e.g. counting of flower heads), correlations of host plant data with transect to transect variation could also be possible.

MB Wandering Surveys

In 2002 wandering surveys were done in Brisbane Acres, Southslope(west), Dairy Ravine, Saddle, Southeast Ridge, Tank Ravine/Hillside, and Northeast ridge/Carter Martin. The location of each adult butterfly observation is shown in Figure 5. In 2002, a total of 113 MB butterflies were observed in the 28-hour monitoring period. This figure includes incidental MB butterflies and survey hours on the CS fixed transects within MB habitat areas. Since the implementation of the MB fixed transect system in 1998, less time has been spent on the wandering surveys than in previous years.

b. Callippe Silverspot Butterfly (*Speyeria callippe callippe*)

Methods

Two monitoring methods were used in 2002 to assess the status of the Callippe silverspot (CS) butterfly: fixed transects and wandering surveys. Twelve fixed transects were established for CS in spring 2000. These vary from 470 to 2180 meters in length, and are spread out over the Mountain (Figure 6). Ideally the transects are surveyed several times through the flight season, but the occurrence of unfavorable weather conditions limits the number of visits. Wandering surveys are done to assess areas not covered by the fixed transects.

Fixed Transects

The transects were monitored from May 17 to July 9, and a total of 307 CS were observed. Figure 7 shows CS sightings per hour on the fixed transects for the years 2000 – 2002. For 2002, the highest numbers and most consistent observations were recorded on the summit of the Southeast Ridge (transect 11), Buckeye Canyon (transect 10), Owl Canyon (transect 9) the Northeast Ridge (transects 3 and 5), and the Levinson property (transect 4). The transects with the lowest numbers of observations included Dairy Ravine (transect 1), Brisbane water tank (transect 6), and the SE Ridge transect 12. In general, numbers were up on the Saddle and NE Ridge transects, and down on the summit transects. 2002 was similar to year 2000, in that the flight season came to a close in mid-July, whereas 2001 extended into August. A cursory comparison of weather data for the CS flight season for those years did not provide any obvious explanation for this disparity. A closer examination of weather factors including degree days, could provide some useful correlations.

CS Fixed Transects: Three Year Data Analysis (2000-2002)

The CS transects are longer and of variable length in comparison to the MB transects, and a sightings per hour statistic is used rather than number of butterflies observed on the transect. A sightings per hour statistic is calculated for each transect survey and these were analyzed to look for statistically significant ($p \leq 0.05$) differences between transects and years.

CS are stronger flyers than MB, and they are active during a wider range of weather conditions. Although weather conditions do influence flight activity, our data for the past three seasons indicates that average wind speed and temperature are not strongly correlated with how many CS are seen per hour. All surveys conducted were attempted during good weather days during the flight season of CS and all of the transect surveys were used in the statistical analysis.

The last three years of transect data (2000-2002) were analyzed using a two-factor ANOVA by Knight, in order to determine if our sampling efforts are sufficient to determine a relative change in CS numbers between years and between transects (Appendix A-3). This exercise is also a chance to make sure that our data are statistically robust and that they characterize the CS flight season as best as possible. There was a significant difference for the number of CS we observed from year to year (ANOVA, $F=5.69$, $p=0.0046$), and between transects (ANOVA, $F=3.54$, $p=0.0003$). Both year and transect are significant predictors for the number of CS observed (2-factor ANOVA with interactions). In addition, there is a significant interaction between year and transect.

The analysis showed a significant difference in butterfly observations between the years 2001 and 2000 ($p=0.008$), and between the years 2001 and 2002 ($p=0.036$). This shows that 2001 was significantly higher in butterfly sightings per hour than 2000 and 2002. 2002 had higher observations per hour than year 2000 but was not significantly different ($P=0.803$).

CS Wandering Surveys

The first CS observation of the season occurred very early compared to previous years at the Southeast Ridge on May 8, on the NE Ridge. The last CS of the season were recorded on July 9 during fixed transect surveys (several locations). CS were probably flying at least a few days prior to and after these recorded observations.

In 2002, CS observation effort was focused primarily on the fixed transects. Wandering surveys for CS were focused on areas not covered by the transects, the SE ridge (southern ridges), the Saddle and the Hillside area.

In 2002, 120 CS adults were observed in 6.5 hours of monitoring during the wandering surveys (also includes incidentals observed on MB transects). The tabulated data for 2002 is contained in Appendix A, Tables A-3. Most of the effort during the 2002 CS monitoring season was spent on fixed transect surveys (23 hours, 10 min). It should be noted that CS transects cover a significant portion of the overall habitat for CS, and transect surveys have replaced where most wandering surveys had been done in the past.

Management Implications for Mission Blue and Callippe Silverspot butterflies

For MB, 2000 was found to be a significantly good year for the butterflies relative to 1998 (p=0.015), 1999 (p=0.003), and 2001 (p=0.042) for the five years of data analyzed. For CS however, 2001 was found to be the best year and it was significantly better than 2000 (p=0.008), and 2002 (p=0.036). The two species are separate in both the timing of their life cycle and their habitat requirements, so it is not surprising to see that a good year for the MB is not necessarily a good year for CS, and vice-versa.

For the MB, to determine trends, we ask the question "Is the MB population increasing or decreasing". For this we would need to establish a correlation or regression. For correlations, 8 years is the minimum number before correlations across years would become significant, so an increase in years of data would be necessary to answer this (personal communication, C. Knight). The MB have decreased since 2000, but only back to their pre-2000 levels. 2001 and 2002 both had more MB than 1998 and 1999. If we look at the analysis w/o 2000 we would conclude that the population is stable.

For the CS, we ask the same question: "Is the CS population increasing or decreasing". For the same reasons stated above for the MB, we do not have enough years of data to determine a trend. All we can say is that there has been variation from year to year, and for our three years of data, 2001 was the best year, and 2000 and 2002 were not significantly different.

Though we are not able to establish trends at this point, the fixed transect system may provide this opportunity in the future. This has not been possible with prior monitoring methods (i.e. wandering surveys only). For management purposes, the transect system is providing a data set to statistically evaluate the butterfly populations and provide information to the habitat manager and supervising agencies (USFWS).

An analysis of the MB fixed transect data by Courtney (SEI, 2002), concluded that the current fixed transect system did not have enough statistical power, and could not predict trends in the MB population that would be useful on a timescale to allow habitat managers to perceive a precipitous decline in the population. Courtney recommends to redesign the monitoring program to a presence/absence system, instead of attempting to identify population trends. In his assessment, Courtney used only three years of data and did not standardize the data using weather parameters. Before abandoning the transect system, we suggest conducting another power analysis using five years of MB data, and standardizing for weather.

We recommend that to satisfy the HCP requirements for monitoring both a transect monitoring system (such as what is currently in place) and a presence/absence system based on what Courtney recommends, be used. The San Bruno Mountain Habitat Conservation Plan (Biological Program, page III-20) states that (1) "the monitoring should allow the Plan Operator (San Mateo County) to determine whether the populations are essentially stable in numbers, decreasing, increasing or fluctuating" and (2) "whether the distribution of the animals is shifting". These statements suggest that a transect or other similar system should be used to monitor population trends, and a presence/absence system (butterflies and/or host plants) should be employed to monitor the distribution of the butterflies and how management may impact the distribution of the butterflies in areas not

intercepted by the transects. In the past the wandering surveys have been utilized to monitor the distribution of the butterflies, and this system may provide more comparable data with some modifications to the program.

Monitoring Priorities for 2003

The difficulty in obtaining butterfly monitoring data on San Bruno Mountain cannot be understated. Summertime fog and wind decrease the number of available weather windows for monitoring, and survey visits cannot be scheduled more than 1-2 days in advance because of weather variability. Flexibility to work when the weather dictates (weekends, holidays) is sometimes necessary to be able to obtain consistent data. In addition, monitoring begins in the early spring and extends into mid-late summer and hiking the steep terrain repeatedly makes it a physically challenging job. These restrictions are important to consider in a monitoring program.

In the past, the transect and wandering surveys have been scheduled with an attempt to monitor only one time during the lifespan period (every 7-10 days for the MB butterfly, and every 2-3 weeks for the CS) so as to minimize double counting of individuals. More data points could be obtained if available weather windows were better utilized. We must assume that variation between cohorts within years is insignificant for our purposes of comparing the differences between years.

Recommendations

1) Increasing the number of MB fixed transect surveys to 100 visits (a 20-30% increase in current level of effort), including an increase in transect visits at beginning and end of the flight season to more precisely characterize flight season.

2) Consider increasing the number of CS fixed transect visits to a minimum of 5, preferably more per season. This would better characterize the flight season and it may be possible to decrease the number of transects (pers. comm. Travis Longcore).

3) Monitor MB and CS transects sometimes within 6 days or less to take advantage of good weather windows.

4) Consider establishing a presence/absence butterfly (and/or host plant) monitoring system based on Steve Courtney's recommendations to evaluate management impacts to habitat (i.e. succession, grazing, restoration) in areas that are not intercepted by the transects. A standardized method of conducting the wandering surveys could also be used for this purpose.

5) Place new MB transects (or presence/absence monitoring points) in Colma Creek, Dairy Ravine and in the Saddle habitat restoration islands where host plants are becoming well established.

6) Investigate the possible correlation between degree-days and butterfly abundance and length of flight season for MB and CS.

c. San Bruno Elfin (*Callophrys mossii bayensis*)

In 1998, 21 points monitoring points for San Bruno elfin (SBE) were installed on San Bruno Mountain (refer to 1998 Annual Report for details on point methodology). High densities of *Sedum*, wind protection, and a northeast to northwest slope aspect are the factors present at the points with consistent observations.

In 2002, 15 survey points were monitored regularly for adults and 8 points were monitored for larvae on one occasion. Figure 8 shows the location of the monitoring points and the number of SBE observations in 2002. In 2002, a total of 111 adult SBE butterflies were observed on the transects, and 44 incidentals were observed off transect. This is slightly lower than the 118 adults observed in 2001. However fewer surveys were conducted In 2002, (44 surveys compared to 60 in 2001).

A total of 330 SBE larvae were observed at the points in 2002. This is lower than the 573 observed in 2001, but this is the result of half as many points being surveyed this year compared to last (8 compared to 17). A minimum of 8 points have been surveyed for larvae every year since 1998. A tally of the 2002 SBE field data (adults and larvae) is included in Table A-4 in Appendix A.

The first SBE observations were recorded on March 4. Peak observations were recorded on March 28. The last recorded SBE observations were on April 22 of the flight season. SBE were likely flying a few days prior to and after the recorded observations.

The highest numbers of adult SBE observations (5 or more) were found at the following points: 1.1, 3, 6, 8, 13, and 17. High counts of larvae were found at points 6 (100), 13 (42), and 8 (45), 7 (39), 9 (39), and 16 (34). No adults were recorded at points 9, 15, 16, yet each of these had substantial numbers of larvae. The larval counts are helpful because they can provide confirmation of SBE presence and abundance when no adults are observed.

Points where the fewest SBE adults were recorded (2 or fewer) included points 9, 5, 20, and 19. Points 14, 11, 12, and 18 had no SBE observations this year, yet they were only surveyed once or not at all. Detection of adults at these points has been infrequent, and larval counts in 2003 would provide instructive data on whether SBE are still present.

The SBE point data (1998-2002) has shown that the SBE are still present and in substantial numbers at most or all of the monitoring points. There was not time to run statistical analysis on the data, and this will be a priority for 2003.

d. Bay Checkerspot Butterfly (*Euphydryas editha bayensis*)

A small population of Bay checkerspot butterflies was present on San Bruno Mountain (near the summit) up until the 1980's, but have not been seen for approximately 20 years. No Bay checkerspot butterflies (larvae or adults) were observed on San Bruno Mountain by field crew while conducting biological activities and overseeing development activities in 2002 . In October 2000, the U.S. Fish and Wildlife Service proposed critical habitat for the bay checkerspot butterfly. The proposed critical habitat designation includes the historic bay checkerspot habitat on San Bruno Mountain.

e. San Francisco Garter Snake (*Thamnophis sirtalis tetrataenia*)

San Francisco garter snake was identified in the San Bruno Mountain HCP (1982) as having potential habitat on San Bruno Mountain. No San Francisco garter snakes (SFGS) were observed on the Mountain by field crew while conducting biological activities and overseeing development activities in 2002. There have been no confirmed observations of SFGS on San Bruno Mountain in the 21 years of the HCP monitoring program. Based on the lack of ponds and other aquatic habitats, it is unlikely this species is present.

f. California Red-legged Frog (*Rana aurora draytonii*)

The California red-legged frog (CRLF) shares similar aquatic habitat as SFGS. Though it was not identified as a sensitive species at the time of the HCP, it has since become federally listed as a Threatened species. No California red-legged frogs (CRLF) were observed on San Bruno Mountain by field crew while conducting biological activities and overseeing development activities in 2002. There have been no confirmed observations of CRLF on San Bruno Mountain in the 21 years of the HCP monitoring program. Based on the lack of ponds and other aquatic habitats on San Bruno Mountain, it is unlikely this species would be present.

g. Plants of Concern

Several rare and listed plant species are found on San Bruno Mountain, and TRA has been working on creating updated maps for these species in GIS format. In 2002, rare plant work focused on GPS mapping of all of the manzanitas on San Bruno Mountain.

Maps showing the general location of vegetation communities and some of the rare plant and animal species of San Bruno Mountain are identified in the San Mateo County Parks Vegetation Resources (County of San Mateo, 2002), and in the Draft San Bruno Mountain State and County Park Master Plan (San Mateo County, 2001). The maps and distribution data presented in these documents should not be considered complete, since a limited amount of data was used to produce them. The San Bruno Mountain Ecological Database (San Mateo County), and San Bruno Mountain HCP Annual Reports (1983-2001) should be consulted for more detailed information on sensitive species distributions.

The flora of San Bruno Mountain includes the San Bruno Mountain manzanita (*Arctostaphylos imbricata* ssp. *imbricata*), Montara manzanita (*A. imbricata montaraensis*), Pacific manzanita (*A.* X *Pacifica*), bearberry (*A. uva-ursi*), and the brittleleaf manzanita (*A. tomentosa crustacea*). The San Bruno Mountain manzanita is a state-listed endangered species and on CNPS List 1B (plants rare, threatened, or endangered in California and elsewhere), and the Montara manzanita is also on CNPS List 1B. Mapping of the manzanita species was conducted by Patrick Kobernus and Sharon Komarow of TRA. Roman Gankin (San Mateo County Parks) and Mike Vasey (San Francisco State University) assisted in locating and identifying some of the specimens. Figure 9 shows the distribution of manzanitas on the mountain.

The taxonomy of some of San Bruno Mountain's manzanitas is currently problematic. The Montara manzanita, known from nearby Montara Mountain, is similar to the San Bruno

Mountain manzanita in every aspect except growth form. The San Bruno Mountain manzanita grows as a prostrate, spreading mat, while the Montara manzanita grows as an upright shrub. There are specimens on San Bruno mountain that grow upright, some of them adjacent to the prostrate form. It is debatable as to whether these individuals are the result of environmental factors influencing the growth pattern of the San Bruno Mountain manzanita, or are the separate subspecies, the Montara manzanita. It would be necessary to use genetic analysis to answer this question. For the purposes of the 2002 mapping work, areas where the specimens appeared to be significantly more upright (around 2 m tall) than a typical specimen of the San Bruno Mountain manzanita were mapped as Montara manzanita.

San Bruno Mountain includes three forms of *Arctostaphylos uva-ursi*: forma *coactilis*, forma *suborbiculata*, and forma *leobreweri*. One characteristic of this species is bifacial leaves, meaning that stomata are found on the upper surface of the leaves, but not on the lower surface. However on San Bruno Mountain, there is a high level of variability in the leaf shape and stomatal distribution within this species. There are several specimens lumped into the category of *A. uva-ursi* forma *coactilis*, simply for lack of any better taxonomic category to place them in, though they have atypical characteristics such as glandular hairs on the branchlets. It is possible that hybridization has been the source of so much variability. *A. uva-ursi* forma *suborbiculata* is found on Kamchatka Point. *A. uva-ursi* forma *leobreweri* is found in two locations above the quarry. All of the *A. uva-ursi* forma *leobreweri* plants were planted by James Roof from cuttings of a single plant that grew on San Bruno Mountain and was destroyed in the fire in 1964. San Bruno Mountain also includes one specimen of the hybrid *A.* X *pacifica*, found west of Pacific Rock. There is some confusion as to the parents of this hybrid. In *A Flora of the San Bruno Mountains*, the parents are listed as *A. uva-ursi* and *A. glandulosa*.

One location of *Arctostaphylos tomentosa* ssp. *crustacea* was mapped in 2002 in Brisbane Acres. There are at least 14 plants in this location. Because the surrounding vegetation of oaks and hazelnut is extremely thick, it was impossible to map the perimeter of the colony. This species is identified in *A Flora of the San Bruno Mountains* as *Arctostaphylos glandulosa*, the Eastwood manzanita. The specimens at this location have some glands but do not show the characteristic glands of *A. glandulosa*. The large (>2 m tall), upright shrubs with bifacial, large leaves and a visible burl at the base were identified as *A. tomentosa* ssp. *crustacea* by Mike Vasey. Another population is also known to occur in Buckeye Canyon, but we did not locate it in our surveys.

A Tussock month infestation at the manzanita colonies at Kamchatka Point, first observed in 1999 has disappeared (pers. comm. Roman Gankin). The *A. uva-ursi* forma suborbiculata has fully regenerated following the leaf-stripping action of the moth. *A. imbricata imbricata* is still present at this locality; however, there is no regeneration of those plants that were killed (*Baccharis*, *Erigeron,* and *Symphoricarpos* have since moved in). It may be appropriate to do some spot burning of the dead shrubs. There is also the possibility that at some time in the future a natural fire might occur at the site as in previous years that would regenerate this manzanita (pers. comm. Roman Gankin).

Additional Species

The manzanita mapping was part of the effort to map all of the rare plant populations on San Bruno Mountain. In 2001, the occurrences of Diablo rockrose (*Helianthella castanea* - CNPS List 1B) and San Francisco campion (*Silene verecunda verecunda* - CNPS List 1B) were mapped. Rare plant mapping and compiling a GIS database will continue in 2003. The San Francisco gum plant (*Grindelia hirsutula* var. *maritima* - CNPS 1B) and popcorn flower (*Plagiobothrys chorisianus* - CNPS 1B) may occur on San Bruno Mountain, and work is needed to gain more information about their location and taxonomy. These species will be the priority for rare plant mapping in 2003.

Several rare plants that are common and widespread over the mountain have yet to be mapped. These species include San Francisco collinsia (*Collinsia multicolor* - CNPS 1B), coast rock cress (*Arabis blepharophylla*) and San Francisco wallflower (*Erysimum franciscanum*). Coast rock cress and San Francisco wallflower are on CNPS List 4, which is a list of plants with limited distribution or that are infrequent throughout a broader area in California, though their vulnerability or susceptibility to threat appears relatively low at this time. Because there are so many occurrences on San Bruno Mountain, systematic mapping of the distribution of these three rare species is not currently feasible. However, we will continue to GPS occurrences when they are encountered during butterfly monitoring and other field work. San Francisco collinsia will be the priority among these three species due to its CNPS 1B listing.

There are four rare plant species that are no longer thought to occur on San Bruno Mountain within the HCP. The 2001 surveys included searching for the white rayed pentachaeta (*Pentachaeta bellidiflora* - state-listed endangered, federally-listed endangered, CNPS List 1B), however no occurrences were observed. This species has not been observed on the Mountain in decades, and the original reporting of this species may have been a mistake. The San Francisco owl's clover (*Triphysaria floribunda* - CNPS 1B) has not been observed on the mountain since the 1960's, and is believed to be extirpated. Two rare species occur on private property in Daly City outside of the HCP boundary, just west of the Point Pacific development. These species, San Francisco lessingia (*Lessingia germanorum* - state-listed endangered, federally-listed endangered, CNPS List 1B) and San Francisco Bay spine flower (*Chorizanthe cuspidata* var. *cuspidata* - CNPS 1B), are not known to occur anywhere else on San Bruno Mountain.

In addition to the rare and listed plant species, San Bruno Mountain is home to several range limited or California endemic species. Mapping range limit plant species will be a future goal once all of the rare and listed species on San Bruno Mountain have been mapped using GPS.

h. San Bruno Mountain Cooperative Website and Data Resources

A cooperative website for San Bruno Mountain was developed by TRA in 2001. The site serves as a center for information, announcements, contacts, references, and mapping resources for San Bruno Mountain. This site is used by volunteers, professionals, government employees, and members of the public who are involved in preservation, restoration, biological monitoring, and planning at San Bruno Mountain.

The site includes:

- Bulletin Board for San Bruno Mountain
- Links to websites of organizations concerned with San Bruno Mountain
- The San Bruno Mountain HCP document
- San Bruno Mountain Stewardship Grazing Plan by David Amme
- Mapping and GIS resources, including 1"=500' basemaps with aerial photography
- Contact information for persons concerned with San Bruno Mountain

The purpose of the San Bruno Mountain Cooperative Site is:

1) To facilitate open communication amongst the many parties involved in the various types of work on San Bruno Mountain, in the State and County Park and Habitat Conservation Plan areas.

2) To connect groups and individuals by providing links to other San Bruno Mountain websites and contact information for individuals representing ALL organizations involved in the Park or in the HCP, as volunteers, educators, biologists, geologists, restoration experts, landowners, planners, rangers, naturalists, advocates, law enforcement, developers, and the public.

3) To provide a place where mapping and other resources can be shared amongst various groups working at San Bruno Mountain.

2. VEGETATION MANAGEMENT AND RESTORATION

a. San Bruno Mountain Five Year Plan

The habitat management of the San Bruno Mountain HCP follows the objectives set forth in the 1996 San Bruno Mountain HCP Five Year Strategic Plan. The Five Year plan provides a comprehensive breakdown of habitat management goals under different funding scenarios. The specific objectives for exotics control followed are set forth in the medium-level funding scenario in the (1996-2001) plan. The 1996-2001 plan focused on exotic weed control, and expanded this program to cover most of San Bruno Mountain. This was necessary as invasive species such as Fennel (*Foeniculum vulgare*), French broom *(Genista monspessulana*), and Portuguese broom (*Cytisus striatus*) had been expanding into butterfly habitat areas on the South Slope, Brisbane Acres, and the slopes above Brisbane Industrial Park. Prior to 1996, control efforts were focused primarily on the Saddle, Radio Ridge, Northeast Ridge and in Owl and Buckeye Canyons.

The framework for a new expanded five year plan for 2002-2007 is currently in preparation. The plan for will address the following activities: 1) Exotics Control, 2)Sensitive Species Population Monitoring and Mapping, 3) Habitat Restoration, 4)Development Mitigation, and 5) Public Participation.

b. Exotics Control

The primary tool for habitat management since the inception of the HCP has been control of exotic weed infestations through hand removal, mechanical removal, and herbicide treatment. Due to the size of San Bruno Mountain (approximately 3000 acres), and the number of exotic species, infestations must be prioritized based on their threat to sensitive habitat areas.

Priority 1:	Small patches of exotics within native habitat
Priority 2:	Small patches of exotics at the periphery of native habitat
Priority 3:	Edges of large exotic infestations threatening habitat
Priority 4:	Large exotic infestations

As a general rule, all Priority 1 infestations are treated using hand removal techniques. Priority 2 infestations are treated using both hand and herbicide techniques, and Priority 3 and 4 infestations are treated using herbicide (in combination with mechanical clearing (mowing) of vegetation in some cases).

Herbicide treatment has consisted of spraying targeted species with an herbicide solution containing either Garlon 4® or Roundup®. These herbicides are used due to their high effectiveness, low toxicity rating, and short half-life in the soil. Herbicide is applied one to two times per year in suitable weather (low wind, low humidity) for maximum plant uptake. The plants are left to decay in place, a process that takes from one to five years, depending upon the size of the plants. In sensitive areas (within 150 feet of private property) mature stands of exotic plants are removed by chainsaw or mowing, followed by seedling and stump herbicide treatment. Garlon 4® herbicide is the preferred chemical since it does not harm monocots (grasses).

2002 Exotic Pest Plant Treatment Summary

Exotic pest plant control activities are being conducted to protect, enhance, and restore the native vegetation communities on San Bruno Mountain. Currently there are 35-40 exotic pest plant species that exist on San Bruno Mountain. Exotics of primary concern that receive the most control work include gorse, French broom, Portuguese broom, fennel, eucalyptus, Himalaya blackberry, cotoneaster, cape Ivy, English ivy, and iceplant.

The following plant species receive exotics control work on San Bruno Mountain:

Acacia sp. (Acacia)
Carduus pycnocephalus (Italian thistle)
Carpobrotus edulis (hottentot fig, iceplant)
Centaurea melitensis (Napa thistle)
Centranthus ruber (red valerian)
Cirsium vulgare (bull thistle)
Conium maculatum (poison hemlock)
Cortaderia jubata (pampas grass)
Cotoneaster sp. (Cotoneaster)
Cytisus striatus (Portuguese broom)
Delairea odorata (Cape ivy)
Hirschfeldia incana (mustard)
Holcus lanatus (velvet grass)
Hypochaeris radicata
Lactuca virosa (wild lettuce)
Lactuca serriola (prickly lettuce)
Lobularia maritima (Lobularia)
Myoporum laetum (Myoporum)
Oxalis pes caprae (Bermuda buttercup)
Picris echioides (bristly ox-tongue)
Pinus radiata (Monterey pine)
Pyrocantha crenato-serrata (Pyrocantha)

Erechtites arguta (New Zealand fireweed)
Erodium cicutarium
Eucalyptus globulus (blue gum tree)
Foeniculum vulgare (fennel)
Genista monspessulana (French broom)
Hedera helix (English ivy)
Rubus discolor (Himalaya blackberry)
Scabiosa atropurpurea
Silybum marianum (milk thistle)
Ulex europaeus (gorse)

Figure 10 shows the locations where hand and herbicide weed control was done in 2002. West Coast Wildlands, subcontractor to TRA, maintains daily record sheets for all exotic pest plant work conducted on the Mountain. For both herbicide and hand control work the treatment area is recorded and mapped in acres on the daily record sheet (see Tables B-1 and B-2 in Appendix B). In 2002, approximately 56 acres of gorse, fennel, blue gum Eucalyptus, French broom, and Portuguese broom plants were controlled with herbicides, and approximately 34 acres of assorted weeds were also sprayed. The greatest herbicide efforts went into removing gorse from the Saddle area and fennel from the Saddle, Water tank/Spumoni and NE and SE Ridge areas.

Hand removal methods resulted in the removal of exotics on approximately 13 acres. Gorse, blue gum Eucalyptus, French broom and fennel, were controlled as well as 11 acres of assorted weeds. 2002 handwork focused on fennel and French broom removal along the Northeast Ridge fenceline and Guadalupe Canyon Parkway.

Additional Exotics Control Work

Shelterbelt Builders, subcontractor to TRA, conducted annual weed control work to prepare and maintain planting island sites in the Saddle, Colma Creek, and Dairy Ravine. See Appendix C for a summary report on the habitat restoration activities conducted by Shelterbelt on San Bruno Mountain in 2002.

Other areas on San Bruno Mountain receiving exotics control work are the Botanic Garden and bog area by the Friends of San Bruno Mountain; the headwaters of Colma Creek area in the Saddle by Heart of the Mountain (California Native Plant Society); Owl and Buckeye Canyons, Devil's Arroyo, and Brisbane Acres by Bay Area Mountain Watch (funded through a Coastal Conservancy Grant), eucalyptus regrowth control in Wax Myrtle Ravine and Dairy Ravine by San Mateo County Parks (also funded through a Coastal Conservancy grant ; and gorse, fennel, orchard grass control at Point Pacific by the Point Pacific Homeowners Association.

c. Restoration of Habitat and Butterfly Utilization

Early attempts at large scale planting on San Bruno Mountain were difficult to maintain and monitor, due to the large influx of weeds. As a result, a strategy of creating small high quality habitat islands has been developed and has been proven to be successful in eucalyptus cut areas, former gorse patches, and on development slopes. This approach has been implemented in several areas of the Mountain. Restoration of MB habitat has been successful in several locations (Colma Creek, Terrabay, Linda Vista, NE Ridge). However CS has not been restored due to a lack of understanding in how to successfully propagate and maintain *Viola* plantings. In 2001 and 2002, restoration work conducted by

PG&E was very successful in establishing *Viola* at transmission tower sites on the NE Ridge and Army Road. Their methods are now being shared with other restoration contractors on the Mountain.

With continued maintenance of the planting islands and continued creation of additional planting islands each year, it should be possible to restore (and likely surpass in time) the amount of butterfly habitat taken by development through the HCP.

Restoration guidelines for MB and CS

HCP funded restoration work in the form of weed control, erosion control, and planting has been ongoing on the mountain since the mid-1980's. The primary goal of the restoration work is the establishment of high quality habitat for the MB and CS butterflies. Because the HCP does not specify what is required for successful restoration, *Habitat Restoration Guidelines for MB and CS* were produced in November 2000 by TRA to address some of the previous problems and assist restoration professionals with accomplishing the habitat restoration goals of the HCP. The guidelines include suggested methods on how to select appropriate restoration sites, recommended host plant densities to support the endangered butterflies, and propagation methods. They are to be used in conjunction with the *Standards for Acceptance of any Dedicated Lands by the County of San Mateo in Accordance with the San Bruno Mountain Area Habitat Conservation Plan*, prepared by Roman Gankin (in *San Mateo County Parks Draft Master Plan, Appendix 1*).

Eucalyptus-cut areas

In 1995, 63 acres of eucalyptus trees were clear-cut on San Bruno Mountain. The 63 acres are broken up into five different restoration units: Dairy Ravine (22.4 acres), Wax Myrtle Ravine (6.4 acres), Hoffman Street (5 acres), Colma Creek (4.8 acres), and April Brook (3.6 acres). The Botanic Garden site (4 acres) is within the Dairy Ravine site and is managed by the Friends of San Bruno Mountain.

The goals of the eucalyptus removal and native habitat restoration on San Bruno Mountain are: 1) to provide corridors and restored grassland habitat for the three endangered butterflies on the Mountain (MB, CS, and SBE), and 2) to restore native habitats for other native wildlife species.

Since the time of the initial cutting, restoration work has been done on approximately 43 acres (Dairy Ravine, Botanic Garden, April Brook, Colma Creek, Hoffman Street, and part of Wax Myrtle Ravine). Five habitat restoration islands have been created within the Botanic Garden (managed by the Friends of San Bruno Mountain), and the Colma Creek and Dairy Ravine sites (managed by TRA and Shelterbelt builders). To date, two habitat islands have had confirmed presence of the endangered butterflies (MB at Colma Creek, and SBE butterfly at Botanic Garden).

Other Restoration Islands in Park Areas and Volunteer Site Stewardship Activities

- Heart of the Mountain, CNPS. The California Native Plant Society formed a group specifically to do volunteer work on San Bruno Mountain ("Heart of the Mountain").

Led by Mary Petrilli, the group has conducted weed control, erosion control, and replanting in the headwaters of Colma Creek, and has conducted public outreach activities since 1999.

- Friends of San Bruno Mountain: The Friends of San Bruno Mountain have been active on San Bruno Mountain since 1995 conducting weed control, replanting and public outreach activities. They have created butterfly habitat islands within the Botanic Garden, where they have successfully established habitat for the SBE butterfly. In January 2003, 100 *L. formosus* plants were planted on the eastern hillock of the garden to provide habitat for the MB butterfly.

- Pointe Pacific Patrick MacNamara and volunteers from the Pointe Pacific Homeowners Association have been conducting exotic pest plant control for several years within and around their development. In 2002, the group conducted further work on removing coastal scrub that has been expanding into MB habitat, controlling weeds such as orchard grass *(Dactylis glomerata)*, and replanting with *L. albifrons* and other native plants.

d. Grazing and Burning

Since the cessation of livestock grazing in the early 1960's and the more efficient prevention of fires since that time, the native prairie grassland has been threatened by the expansion of coastal scrub, and the influx of weeds. A stewardship grazing plan was written for the Mountain in April 2002 (D. Amme, 2002), and funding for a pilot grazing project was approved by the HCP Trustees in January 2003. The grazing experiment will utilized goats and/or sheep and will be used to determine how to best utilize grazing to enhance and restore native grasslands on San Bruno Mountain. The grazing experiment will also incorporate mowing treatments in different seasons and areas. Mowing may also be a useful tool in areas where slopes are accessible (Appendix D). Preliminary results will be reported in the 2003 SBM HCP Annual Report.

No controlled burns were conducted on San Bruno Mountain in 2002. A controlled burn has been planned for the Juncus Ravine/Tank Ravine area since 2001. The goals of the burn are to conduct training for fire crews, reduce invasive species, and reinvigorate native plant species. A controlled burn is also planned for removal of eucalyptus debris in Wax Myrtle Ravine. The burns are scheduled to occur in summer 2003, if the California Department of Forestry can provide necessary support at that time.

An uncontrolled burn occurred on the SE Ridge in August, 2002. The 18-acre burn burned a large patch of grassland containing CS habitat. The burn may provide important information for the use of burning on San Bruno Mountain, and a separate report addressing the burn, monitoring methods, and burn policy of the HCP is in process.

3. DEVELOPMENT ACTIVITIES

Incidental take of habitat for the MB butterfly on San Bruno Mountain was authorized under the Endangered Species Act Section 10(a)(1)(B) Permit PRT 2-9818.

Development related activity which may have resulted in take of the MB occurred during grading for "the Commons" neighborhood of the Terrabay Project. The 2001 San Bruno Mountain HCP Operating Program is included as Appendix E to this report. A separate report documenting the status of restoration work at each of the development areas will be submitted to the County and the USFWS in Spring, 2003.

No take of CS occurred or was authorized in 2002. Since the listing of the CS in 1997, take of the CS or it's habitat (*Viola pedunculata*) either through development, routine maintenance, and/or restoration work is not authorized under the Habitat Conservation Plan. An amendment to the HCP is currently being developed under oversight by the USFWS to address this issue.

REFERENCES

County of San Mateo, 1982. San Bruno Mountain Habitat Conservation Plan, Volume I and II. Prepared by Thomas Reid Associates.

County of San Mateo, 2002. San Mateo County Parks Vegetation Resources. prepared by Rana Creek Habitat Restoration, March 2002.

County of San Mateo, 2001. Draft San Bruno Mountain State and County Park Master Plan, Prepared by Roysten, Hanamoto, Alley & Abey.

County of San Mateo, 2001. The San Bruno Mountain Ecological Database (CD). Prepared by Thomas Reid Associates.

San Bruno Mountain HCP Annual Reports (1983-2001). Prepared by Thomas Reid Associates.

County of San Mateo, 2002. San Bruno Mountain Stewardship Grazing Plan. Prepared by David Amme, April 2002.

SEI, 2002. Review of the San Bruno Mountain Habitat Conservation Plan Monitoring Program.

**All documents/ resources available on-line at* http://www.traenviro.com/sanbruno/ *or from County of San Mateo Parks and Recreation Division.*

Personal Communications

Roman Gankin, San Mateo County. Communications re: Arctostaphylos

Charley Knight, Max Planck Institute. Communications re: MB and CS data analysis.

Travis Longcore, Urban Wildlands Group. Communications re: CS monitoring

Study Participants

Annual Report Prepared by: Patrick Kobernus, Eben Polk, Sharon Komarow, Wendy Knight, Victoria Harris and Tom Reid of Thomas Reid Associates

2002 Thomas Reid Associates Field Crew: Patrick Kobernus, Eben Polk, Sharon Komarow

County Coordinators for San Bruno Habitat Conservation Plan: Sam Herzberg and Roman Gankin

Special thanks for their help and cooperation to:

San Mateo County Parks and Recreation Division
- Sam Herzberg
- Ron Weaver
- Mary Burns
- Gary Lockman
- Michael Murphy (County Council)

The Friends of San Bruno Mountain
- Louis and Kathy Manus
- Doug Allshouse
- Eric McHuron and all the volunteers

California Native Plant Society, Heart of the Mountain
- Mary Petrilli and all the volunteers

Pointe Pacific Homeowners Association
- Patrick McNamera and all the volunteers

Interns and Field assistants:
- Alex Polk
- Dave Williams
- Karen Dehnert

TRA Subconsultants and Area of Expertise:

Exotic Pest Plant Control: West Coast Wildlands, Michael Forbert, Supervisor
Native Plant Restoration: Shelterbelt Builders, Inc. Mark Heath, Supervisor

TABLE A-1. MISSION BLUE FIXED TRANSECT DATA 2002
(y = within survey weather parameters >18C, and <5.0 average mph wind speed).

Year	Date	Transect	# MB	A.wind	temp	time
2002	15-Apr	27	2	y	y	15:22
2002	19-Apr	2	2	y	y	11:19
2002	19-Apr	6	0	y	y	12:20
2002	19-Apr	7	0	y	y	12:02
2002	19-Apr	13	0	y	y	13:53
2002	19-Apr	14	0	y	y	13:30
2002	19-Apr	17	1	4.6	y	11:36
2002	19-Apr	18	0	y	y	11:17
2002	19-Apr	24	0	y	y	13:23
2002	19-Apr	25	0	4.9	y	14:02
2002	19-Apr	27	1	4.6	y	12:31
2002	19-Apr	28	0	4.7	y	13:10
2002	8-May	2	0	y	y	10:49
2002	8-May	6	2	y	y	12:06
2002	8-May	7	1	y	y	11:48
2002	8-May	13	1	y	y	13:08
2002	8-May	18	0	y	y	11:34
2002	8-May	24	1	y	y	13:12
2002	8-May	26	0	4.4	y	10:54
2002	8-May	27	0	y	y	11:02
2002	8-May	28	1	y	y	12:07
2002	23-May	2	1	y	y	10:55
2002	23-May	6	2	y	y	10:55
2002	23-May	7	0	y	y	10:38
2002	23-May	13	0	4.1	y	12:08
2002	23-May	17	0	y	y	11:15
2002	23-May	18	0	y	y	11:06
2002	23-May	24	3	y	y	10:34
2002	23-May	26	0	4.4	y	10:38
2002	23-May	27	1	y	y	10:37
2002	23-May	28	1	y	y	11:38
2002	24-May	13	2	y	y	10:44
2002	24-May	14	0	Y	Y	10:18
2002	24-May	23	0	y	y	11:25
2002	24-May	25	0	y	y	11:53
2002	15-Apr	22	4	y	y	12:39
2002	19-Apr	1.1	0	y	y	11:34
2002	19-Apr	3	0	y	y	11:47
2002	19-Apr	4	1	y	y	12:58
2002	19-Apr	5	2	y	y	12:38
2002	19-Apr	12	0	y	y	13:50
2002	19-Apr	22	0	4.5	y	13:47
2002	8-May	3	0	y	y	12:39
2002	8-May	4	0	y	y	12:24
2002	8-May	21	1	y	y	11:20
2002	8-May	22	3	y	y	12:35
2002	23-May	1.1	2	y	y	11:08
2002	23-May	3	1	y	y	11:31
2002	23-May	4	2	y	y	11:36
2002	23-May	5	3	y	y	11:13
2002	23-May	21	0	y	y	10:48
2002	24-May	12	0	y	y	10:56
2002	23-May	22	1	y	y	

Analysis of MB transect data from 1998 to 2002, provided by Charles Knight.
November 1, 2002

General overview of data

1998 had the lowest number of MB observations.
2000 had the most observations, about 9 times as many.
1999, 2001, 2002 all had intermediate levels of observations.

Year	Number of MB/transect	Number of transects surveyed
1998	0.3551	66
1999	1.244	71
2000	3.188	80
2001	1.688	78
2002	1.022	53

Statistical Analysis

We performed a 2-factor ANOVA with interactions. Year and transect were the factors. The analysis shows that both and year and transect are significant predictors for the number of MB you observe. In addition, there is a significant interaction between year and transect. In other words, there is a significant difference between years for the number of MB you observe, and there is a significant difference between transects. The interaction term tells you that the relative quality of transects for MB habitat also changed from year to year.

We also performed Scheffe Post Hoc tests to evaluate which years were significantly different from one another and which years drove the significant results for the full ANOVA. Post Hoc tests indicated that 1998 and 2000 were significantly different from each other. 2000 and 1999 are significantly different (0.05 confidence interval). All of the rest of the comparisons of years were not significantly different. That means that the exceptionally low year of 1998 and the exceptionally high year of 2000 drove the overall result that year is a significant factor in the ANOVA. If, for example, 1998 and 2000 had similar levels of MB observations as 1999, 2001, and 2002, year may not have been a significant factor. You might also notice that 2000 and 1999 were significantly different, whereas 2000 and 2002 were not significantly different from each other, even though 2002 has a lower mean than 1999. This is of course driven by the fact that 1999 had more observations than 2002, which had only 53. It is this kind of result which leads me to suggest that you make sure that your average number of transect surveys per year remains no lower than 71 or 80 surveys per year, and I would say that greater than 80 would be optimal. The reason that I suggest greater than 80 is that 2000 and 2001 had similar levels of visitation, and the mean of 2000 was nearly twice as great as 2001, yet that difference is not significant.

We also performed the post hoc tests for mean total number of MB observed on each transect across all years (transect means for the 5 year period). This helps to determine which transects drove the significant results for the transect factor in the full ANOVA. The result is that all the transects are pretty similar. None of them are significantly different from each other (which means that Transect #9, for example, is no different from any other transect. It's not assured that you will find MB on transect #9, just as it's not a sure bet to find MB on any other transect). But if you take year into

account, as the ANOVA does, transects are a predictor for MB abundance...but only if you take year into account. This is another observation which leads me to suggest that you may want to increase the number of visits per transects per year. Overall, Transect #1 had the highest MB observation frequency. It had 5 visits between 1998 and 2002. Transects #4 and #18, #26 had the lowest MB sighting frequency between 0.3 and 0.4 MB per transect overall all the years. But these transects were visited 19, 16 and 16 times, respectively. As you can see, as the number of visits per transect increases, the mean number of observations per transect decreases. The ANOVA takes this variation in number of transect visits per year into account when calculating transect and year to year variation and MB abundance. Stated again, what this means is that the means across the 5-year sampling time for each transect are not significantly different from each other. The fact that transect is a significant factor in the full ANOVA means that years are what drive differences in transects. Differences in transects are predictable across years. In the two good years, 1998 and 2000, the same transects may have done well and the same transects may have done poorly.

This may bolster your argument that the selection of transects is unbiased. However, in the full ANOVA, we can tell that transects do vary across years in a significant fashion and are a significant predictor for MB abundance.

DESIGN

Dependent variables

Name	Code
MB	MB

Type of analysis: OLS ANOVA

Factors

Name	Code	Nested in	F/R	Kind
Year	Yr	()	Fix	Disc

Partial (Type 3) Sums of Squares

Interactions up to 1 - way

No Modifications

RESULTS

General Results

348 total cases

ANOVA

Analysis of Variance For **MB**
No Selector

Source	df	Sums of Squares	Mean Square	F-ratio	Prob
Const	1	320.563	320.563	164.54	≤ 0.0001
Yr	4	41.1997	10.2999	5.2869	0.0004
Error	343	668.237	1.94821		
Total	347	709.437			

Results for factor Yr

Coefficients

Expected Cell Means

Expected Cell Means of: MB on Yr

Level of Yr	Expected Cell Mean	Cell Count
1998	0.7576	66
1999	0.662	71
2000	1.575	80
2001	0.8846	78
2002	0.7925	53

Scheffe Post Hoc Tests

	Difference	std. err.	Prob
1999 - 1998	-0.0956039	0.2387	0.996932
2000 - 1998	0.817424	0.2321	0.0157899
2000 - 1999	0.913028	0.2276	0.00333666
2001 - 1998	0.12704	0.2334	0.990014
2001 - 1999	0.222644	0.2289	0.917702
2001 - 2000	-0.690385	0.2221	0.0486046
2002 - 1998	0.0348771	0.2574	0.999958
2002 - 1999	0.130481	0.2534	0.99191
2002 - 2000	-0.782547	0.2472	0.0420444
2002 - 2001	-0.0921626	0.2485	0.997728

TABLE A-2. MISSION BLUE AND CALLIPPE SILVERSPOT BUTTERFLY WANDERING SURVEY DATA (and Incidental butterfly observations) – 2002.

DATE	LOCATION	ELAPSED TIME (min)	MB OBSERVED	ELAPSED TIME (min)	CS OBSERVED
4/22	Radio Ridge	Inc	3	Inc	
4/23	Cable Ravine/ April Brook	102	0		
4/24	SouthSlope (west)	150	27		
5/14	West Peak	69	1		
5/15	Buckeye Canyon	83	10		
5/15	Subridge- Buckeye Canyon	78	13		
5/15	NE Ridge	91	8	91	15
5/29	Callippe T# 8			Inc	1
6/4	Dairy Ravine	38	0		
6/4	Saddle	68	2	68	8
6/5	SE Ridge	107	0	107	70
6/5	SE Ridge	114	1	114	4
6/6	Hillside	67	0		
6/10	Summit trail	11	2	11	
Several Dates	MB incidentals observed off transect on MB transects		26		
Several Dates	CS Incidentals observed on MB Transects			Inc	22
Several dates	MB observed on CS Transects during MB flight season	701	20		
TOTAL	**ALL AREAS**	**27.98 hours**	**113**	**6.52 hours**	**120**

TABLE A-3. CALLIPPE SILVERSPOT FIXED TRANSECT DATA: 2000- 2002. Weather data not provided, and not found to be a significant predictor of CS observations.

Year	Date	Transect	#CS	minutes	CS/Hour
2000	6/14	1	0	18	0.00
2000	6/15	1	2	26	4.62
2000	7/10	1	0	28	0.00
2001	5/23	1	0	24	0.00
2001	5/30	1	0	25	0.00
2001	6/7	1	7	34	12.35
2001	7/3	1	1	14	4.29
2002	5/22	1	0	20	0.00
2002	5/29	1	0	23	0.00
2002	6/10	1	3	25	7.20
2002	7/9	1	1	23	2.61
2000	6/2	2	3	49	3.67
2000	6/14	2	4	40	6.00
2000	7/10	2	0	31	0.00
2001	5/30	2	1	42	1.43
2001	6/7	2	9	40	13.50
2001	7/3	2	0	24	0.00
2002	5/29	2	11	34	19.41
2002	6/11	2	6	36	10.00
2002	7/9	2	1	22	2.73
2000	6/2	3	16	32	30.00
2000	6/9	3	24	42	34.29
2000	6/15	3	3	24	7.50
2000	6/29	3	4	29	8.28
2000	7/12	3	1	26	2.31
2001	5/21	3	6	34	10.59
2001	5/30	3	19	21	54.29
2001	6/13	3	11	32	20.63
2001	7/3	3	0	15	0.00
2002	5/17	3	4	28	8.57
2002	5/29	3	21	26	48.46
2002	6/11	3	14	25	33.60
2002	7/1	3	14	25	33.60
2000	6/9	4	15	44	20.45
2000	6/16	4	7	32	13.13
2000	7/12	4	2	38	3.16
2001	5/21	4	5	51	5.88
2001	5/30	4	5	39	7.69
2001	6/13	4	21	39	32.31
2001	7/4	4	40	41	58.54
2002	5/17	4	3	33	5.45
2002	5/29	4	20	31	38.71
2002	6/11	4	8	27	17.78
2002	7/1	4	1	26	2.31
2000	6/9	5	4	39	6.15
2000	6/16	5	6	35	10.29
2000	6/29	5	2	27	4.44
2000	7/13	5	0	28	0.00
2001	5/21	5	2	51	2.35
2001	5/31	5	25	28	53.57
2001	6/13	5	5	30	10.00
2001	7/4	5	26	32	48.75
2002	5/17	5	12	35	20.57
2002	5/29	5	32	34	56.47
2002	6/11	5	10	36	16.67

Year	Date	Transect	#CS	minutes	CS/Hour
2002	7/1	5	1	30	2.00
2000	6/9	6	2	36	3.33
2000	6/16	6	0	17	0.00
2000	7/10	6	0	23	0.00
2001	5/21	6	0	23	0.00
2001	5/30	6	3	43	4.19
2001	7/3	6	0	25	0.00
2002	5/17	6	4	32	7.50
2002	5/29	6	4	20	12.00
2002	6/11	6	7	25	16.80
2002	7/9	6	0	10	0.00
2000	6/1	7	14	58	14.48
2000	6/14	7	15	51	17.65
2000	6/28	7	33	42	47.14
2000	7/14	7	1	27	2.22
2001	5/22	7	22	46	28.70
2001	6/5	7	3	32	5.63
2001	6/14	7	53	62	51.29
2001	7/3	7	11	45	14.67
2002	5/29	7	1	30	2.00
2002	6/7	7	3	31	5.81
2002	6/10	7	5	43	6.98
2002	7/9	7	15	44	20.45
2000	6/1	8	16	22	43.64
2000	6/16	8	4	20	12.00
2000	7/10	8	0	12	0.00
2001	5/23	8	7	52	8.08
2001	6/7	8	11	28	23.57
2001	7/3	8	0	12	0.00
2002	5/23	8	1	13	4.62
2002	5/29	8	6	12	30.00
2002	6/7	8	7	15	28.00
2002	7/2	8	2	19	6.32
2000	6/1	9	3	32	5.63
2000	6/14	9	2	29	4.14
2000	6/28	9	9	56	9.64
2000	7/14	9	1	49	1.22
2001	5/22	9	13	58	13.45
2001	6/5	9	54	54	60.00
2001	7/3	9	0	27	0.00
2002	5/22	9	1	50	1.20
2002	5/29	9	9	35	15.43
2002	6/10	9	16	42	22.86
2002	7/2	9	13	31	25.16
2000	6/1	10	23	60	23.00
2000	6/14	10	10	50	12.00
2000	6/28	10	5	38	7.89
2000	7/10	10	2	37	3.24
2001	5/22	10	23	39	35.38
2001	6/5	10	19	35	32.57
2001	7/3	10	3	4	45.00
2002	5/22	10	6	45	8.00
2002	5/29	10	11	39	16.92
2002	6/10	10	15	35	25.71
2002	7/2	10	3	45	4.00
2000	6/1	11	37	63	35.24
2000	6/14	11	16	25	38.40

Year	Date	Transect	#CS	minutes	CS/Hour
2000	6/28	11	13	28	27.86
2000	7/10	11	0	20	0.00
2001	5/22	11	100	50	120.00
2001	6/5	11	41	46	53.48
2001	6/14	11	83	38	131.05
2001	7/3	11	5	26	11.54
2002	5/29	11	2	29	4.14
2002	6/7	11	8	24	20.00
2002	6/10	11	8	32	15.00
2002	7/9	11	6	19	18.95
2000	6/14	12	17	36	28.33
2000	7/10	12	0	31	0.00
2001	5/22	12	36	65	33.23
2001	6/5	12	43	95	27.16
2001	7/3	12	0	29	0.00
2002	5/22	12	0	29	0.00
2002	5/29	12	5	50	6.00
2002	6/7	12	0	20	0.00
2002	6/10	12	0	36	0.00

Charlie Knight, January 24, 2003

Pasted below is the ANOVA for the callippe data. There are significant differences between years (Yr) and significant differences between transects (Trt) There is even almost a significant interaction between years and transects (Yr*Trt) which would mean that variation between transects changes through the years.

Wind speed and temperature do not have a significant effect on how many Callippe you see per hour. The correlation coefficients are pasted below.

They would have had to have been -.22 or greater to reach statistical significance. There is a significant negative correlation between wind speed and temperature (when wind speed is higher it is colder = -.222).

Pearson Product-Moment Correlation

	CS/Hour
Ave.wind	-0.176
temp	0.037

DESIGN

Dependent variables

Name	Code
CS/Hour	C/H

Type of analysis: OLS ANOVA

Factors

Name	Code	Nested in	F/R	Kind
Year	Yr	()	Fix	Disc
Transect	Trt	()	Fix	Disc

Partial (Type 3) Sums of Squares

Interactions up to 2 - way

No Modifications

RESULTS

General Results

131 total cases

ANOVA

Analysis of Variance For **CS/Hour**
No Selector

Source	df	Sums of Squares	Mean Square	F-ratio	Prob
Const	1	36161.1	36161.1	116.65	≤ 0.0001
Yr	2	3526.16	1763.08	5.6876	0.0046
Trt	11	12062.7	1096.61	3.5376	0.0003
Yr*Trt	22	10945.9	497.543	1.6051	0.0613
Error	95	29448.6	309.985		
Total	130	56654			

Results for factor Yr

Coefficients

Expected Cell Means

Expected Cell Means of: CS/Hour on Yr

Level of Yr	Expected Cell Mean	Cell Count
2000	11.25	42
2001	23.63	42
2002	13.75	47

Scheffe Post Hoc Tests

	Difference	std. err.	Prob
2001 - 2000	12.3851	3.914	0.00856859
2002 - 2000	2.51756	3.798	0.803148
2002 - 2001	-9.86757	3.765	0.0362698

TABLE A-4. SAN BRUNO ELFIN ADULT AND LARVAL OBSERVATIONS –2002 BY DATE AND POINT # (point/incidental)

Adult Counts											Larval Counts
POINT #	Mar 4	Mar 11	Mar 19	Mar 20	Mar 27	Mar 28	Apr 22	Total Adults (Tran-sects)	TOTAL Adults	Survey visits	LARVAE* (5/29 - 5/31/02)
1.1	N		4			5		9	9	2	
1.1 - INC						3			3		
2			1			3		4	4	2	
2 - INC			4			2			6		
3			1			4		5	5	2	
3 - INC			2			9			11		
4										0	
4 - INC											
5	0			0	1	1		2	2	4	
5 - INC				6	2	5			13		
5.1	0		2			2	0	4	4	4	
5.1 - INC			3						3		
6	1		4		5		0	10	10	4	100
6 - INC			3						3		
7			1		2		0	3	3	3	39
7 - INC	1				2				3		
8			1		3		1	5	5	3	45
8 - INC					2				2		
9	0		0		0			0	0	3	39
9 - INC					1				1		
10			1		0		0	1	1	3	
10 - INC											
11											
11 - INC											
12	0		1					1	1	2	
12 - INC											
13	4		3		3			10	10	3	42
13- INC											
14			0					0	0	1	
14 - INC											
15		0		0				0	0	2	25
15 - INC		1		1					2		
16		N		0				0	0	1	34

Adult Counts											Larval Counts
POINT #	**Mar 4**	**Mar 11**	**Mar 19**	**Mar 20**	**Mar 27**	**Mar 28**	**Apr 22**	**Total Adults (Tran-sects)**	**TOTAL Adults**	**Survey visits**	**LARVAE* (5/29 - 5/31/02)**
16 - INC											
17		5		2				7	7	2	
17 - INC				2					2		
18											
18 - INC											
19		N	1					1	1	1	6
19- INC											
20			0							1	
20 - INC											
21											
21 - INC											
22				0				0	0	1	
22 - INC											
TOTAL	**6**	**6**	**32**	**11**	**21**	**34**	**1**	**62**	**111**	**44**	**330**

*Larvae are counted on one occasion at eight points during the spring each year. All Sedum spathulifolium plants (primarily the flower heads) are searched within a 25-meter radius of the points.

N= No data recorded. Point was visited, but weather was poor (high wind, low temperature, fog) so data was not recorded.

APPENDIX B — EXOTIC PEST PLANTS REMOVED BY HAND AND HERBICIDE WORK ON SBM IN 2002

Table B-1. Acres of Exotic Pest Plants Removed by Hand Work on San Bruno Mountain in 2002[1]

Area	UE	EG	GM	FV	Other	Total Acres
Hillside School	0	0	0	0.17	0.33	0.5
Pt. Pacific/Village	0	0	0.3	0.3	1.4	2.0
NER fenceline	0	0	1.0	2.5	2.5	6.0
Dairy Ravine	0	0.65	0	0	1.35	2.0
Water Tank/Spumoni	0	0	0.64	0.83	1.53	3.0
Old Ridge Road	0.06	0.06	0.06	0.07	0	0.25
Kamchatka	0	0	0	0	0.38	0.38
Linda Vista/Bay Ridge	0.16	0	0.6	0.61	0.38	1.75
Callippe Hill/Arnold	0	0	0.5	0.5	0	1.0
Red Tail Canyon	0	0.1	0.1	0.1	0.2	0.5
SER/Summit	0	0	0.2	0.4	1.4	2.0
Brisbane Office Park	0	0	0.12	0.25	0.13	0.5
Ridge Trail West	0	0	0.12	0.13	0	0.25
Guadalupe Canyon Parkway	0.5	0.03	0.5	1.3	1.17	3.5
Total	**0.72**	**0.84**	**4.14**	**7.16**	**10.77**	**23.63**

1. Plants were removed using weed wrenches, maddox's or by hand pulling. Categories represented are: **UE**: *Ulex europaeus* (gorse), **EG**: *Eucalyptus globulus* (blue-gum tree), **GM**: *Genista monspessulana* (French broom), **FV**: *Foeniculum vulgare* (fennel). Other category includes additional weed species receiving hand control or a combination of several weed species in a given treatment. Other species include bristly ox-tongue (*Picris echioides*), Cape ivy (*Delaeria odorata*), Cotoneaster (*Cotoneaster* sp.), English ivy (*Hedera helix*), Monterey cypress (*Cupressus macrocarpa*), mustard (*Hirschfeldia incana*), Portuguese broom (*Cytisus striatus*), pampas grass (*Cortaderia* sp.), poison hemlock (*Conium maculatum*), wild lettuce (*Lactuca virosa*), and wild radish (*Raphanus raphanistrum).*

Table B-2 Acreages of exotic pest plants treated with herbicide at Saddle and Main Mountain areas in 2002.

Area	EG	UE	GM	CS	FV	Other	Total
Hillside School	0	0	0	0	0.34	0.66	1.0
Water Tank/ Spumoni	0	0.7	1.2	1.6	1.3	1.2	6.0
April Brook	0.2	0	0	0	0	1.3	1.5
Pointe Pacific/Village	0	0	0.48	0	0.47	3.05	4.0
Linda Vista/Bay Ridge	0	0.16	0.52	0	0.16	0.16	1.0
Radio Ridge/Summit	0	0.17	0.17	0	0.17	0.49	1.0
Ridge Trail - East	0	0	0.6	0	1.2	1.2	3.0
Ridge Trail - West	0	0	0.29	0	0.29	1.17	1.75
Ridge Trail/West Peak	0	0	0.5	0.9	0.6	1.0	3.0
West Peak/Hoffman	0.5	0	0.37	0.38	0.38	0.37	2.0
Hoffman Street	0.36	0	0	0.36	0.36	1.92	3.0
Colma Canyon	0.1	0	0	0	0.3	0.6	1.0
Guadalupe Cyn Pkwy	0	0.52	0.68	0.52	0.78	0.5	3.0
Saddle	0	12.29	1.55	0.57	1.67	2.92	19.0
Kamchatka	0	0	0	0	0	0.13	0.13
Terrabay Fenceline	0	0	0	0	1.5	4.5	6.0
SE Ridge/Summit	0	0	1.6	0	2.25	5.15	9.0
Tank Ravine	0	0	0	0	1.3	2.7	4.0
Dairy Ravine	0.3	0.66	0	0	0	3.04	4.0
Callippe Hill / Arnold	0	0	0.88	1.13	0.99	0	3.0
NER fenceline	0	0	1.95	1.55	1.95	0.55	6.0
Cherry Ridge	0	0.25	0	0	0.25	1.5	2.0
Brisbane Office Park	0	0	0.17	0	0.17	0.16	0.5
Red Tail Canyon	0	0	0.5	1.0	0.5	0	2.0
Old Ranch Road	0.43	0.43	0.71	0	0.18	0	1.75
Quarry	0	0	0.6	0.8	0.6	0	2.0
Total	**1.89**	**15.18**	**12.77**	**8.81**	**17.71**	**34.27**	**90.63**

Categories represented are: EG: *Eucalyptus globulus* (blue-gum tree), UE: *Ulex europaeus* (gorse), GM: *Genista monspessulana* (French broom), CS: *Cytissus striatus* (Portuguese broom), FV: *Foeniculum vulgare* (fennel). Other category includes Bermuda buttercup (*Oxalis pes-caprae*), Cape ivy (*Delaeria odorata*), Cotoneaster (*Cotoneaster* sp.), English ivy (*Hedera helix*), Himalayan blackberry (*Rubus discolor*), Italian thistle (*Carduus pycnocephalus*), mustard (*Hirschfeldia incana*), ox-eye daisy (*Leucanthemum vulgare*), pampas grass (*Cortaderia* sp.), poison hemlock (*Conium maculatum*), purple star thistle (*Centaurea calcitrapa*), red valerian (*Centranthus ruber*), wild lettuce (*Lactuca virosa*), and wild radish (*Raphanus raphanistrum*).

2002 Butterfly Island Year End Report
SAN BRUNO MOUNTAIN

January 26, 2003

Prepared by

Mark Heath
Shelterbelt Builders INC
An Open Land Management and Restoration Company
3088 Claremont Avenue
Berkeley, California 94705

2002 (Year 4) Island planting summary

Colma Creek Watershed

The Colma Creek planting islands are establishing well. Lupine have been observed to be establishing from seed at CC1 and Mission Blue butterfly larvae have been observed at CC2. After excellent survivability of lupine in the first year (1999/2000), we planted additional host and nectar plants at each site in year 2 (2000/2001) and year 3 (2001/2002). Year 4 (2002/2003) required no additional plants, as each island is sufficiently dense with butterfly host and nectar plants. Six species of nectar plants were planted for three years at both sites; they include *Aster chiloensis*, *Cirsium quercetorum*, *Erigeron glaucus*, *Eriogonum latifolium*, *Heterotheca sessiflora*, and *Horkelia californica*. Coast buckweat (*Eriogonum latifolium*) and golden aster (*Heterotheca sessiflora*) established very well at each of the sites.

Colma Creek 1 (CC1): Lower restoration site

Total Lupine Planted	Size	Years Planted	Current Surviving Lupine	Survivability
524	2"/ D16	2	**unknown**	*

***CC1 has been planted with >90% *Lupinus formosus* which is summer dormant perennial. It typically does not emerge from dormancy until February or March. Surviveability can not be determined until later in the Spring when plants are visible.**

Colma Creek 2 (CC2): Upper restoration site

Total Lupine Planted	Size	Years Planted	Current Surviving Lupine	Survivability
464	2"/ D16	3	109 *L. albifrons*	23% over 4 years

As in CC1, the *L.formosus* were not visible at the time of monitoring, so true survivability is actually slightly higher.

Dairy Ravine

These butterfly island sites are scattered throughout the Dairy Ravine restoration area. The islands with the least amount of weed competition, especially annual grasses, tend to have the best establishment. Dairy Ravine 1 is situated on a saddle with shallow, rocky soils and has become the model for this area of Dairy Ravine. *Aster chiloensis*, *Cirsium quercetorum*, *Erigeron glaucus*, *Eriogonum latifolium*, *Heterotheca sessiflora*, and *Horkelia californica* were all planted at DR1. *Eriogonum* and *Erigeron* have both established very well throughout the island.

Dairy Ravine 2 and 3, which were created in 2000 and 2001, have both been abandoned since annual grass competition was severe and very few lupine were able to establish in these islands. DR 4 (Elfin Ridge) now has very dense stands of *Sedum*, both naturally occurring and planted, which extends the Elfin butterfly habitat up along the ridge separating Dairy Ravine from Wax Myrtle canyon.

Two new islands were created this year in 2003. DR5 was created downslope from DR1. This island , like DR1, has shallow rocky soils along a ridge line with little annual grass competition. DR6 was created in the Friends of San Bruno Mountain Botanical Garden in lower Dairy Ravine. This island was installed by volunteers of the Friends of San Bruno Mountain on a rocky mound in the garden. This island will showcase the island concept and also allow volunteers to steward and learn about the butterfly host plants throughout the year.

Dairy Ravine 1 (DR1)

Total Lupine Planted	Size	Years Planted	Current Surviving Lupine	Survivability
586	2"/ D16	3	148 *L. albifrons*	25% over 4 years

Dairy Ravine 5 (DR5): New Island for 2002

Total Lupine Planted	Size	Years Planted	Current Surviving Lupine	Survivability
311	D16	1	*	*

Dairy Ravine 6 (DR6): Friends of San Bruno Mountain Botanical Garden Island

Total Lupine Planted	Size	Years Planted	Current Surviving Lupine	Survivability
100	D16	1	*	*

* Survival rates not calculated yet. Plants installed in January, 2003.

Saddle

The Saddle 2 (S2) island continues to be a great surprise success for the butterfly island restoration strategy. Second year observations continue to support that gorse along the saddle can be converted quickly to butterfly habitat. These observations are only short-term and may change in the future as we learn how invasive weeds colonize the gorse restoration areas. Still, restoration techniques developed at S2 might prove useful in the restoration of more gorse infested areas throughout the Saddle region.

Native cover is critical for the long term success of this island. For the last two years, we have taken advantage of the lack of invasive grasses to outplant hundreds of native perennial bunch grass plugs. 750 additional grass plugs were installed this year to fill in gaps in last year's planting and seeded areas. The grasses have established very well and we hope to fill-in all bare ground areas with native grasses and herbaceous perennials to support the butterfly host plants.

89 additional lupine were added this year to supplement last year's plantings. The lupine and nectar plants are very robust and grow very quickly in the post-gorse nitrogen enriched soils.

Phacelia californica and *Eriogonum latifolium* are the two top performing nectar plants at the site. Natural recruitment has been recorded for both species in the second year! Lupine recruitment has also been documented at this island.

Saddle 2 (S2): GCP Saddle island

Total Lupine Planted	Size	Years Planted	Current Surviving Lupine	Survivability
389	D16	2	211	54% over 2 years

Weed management and Stewardship

GCP Bowl Site

This site is adjacent to S2, just north of Guadalupe Canyon Parkway (GCP). The site is a bowl-shaped area approximately 2 acres in size that was cleared of gorse (a dense 10-15' high 'forest of gorse') about 5 years ago. Since the gorse was removed, invasive grasses and herbacious plants moved quickly moved in.

Weed control at this site was very effective this year. Two well timed mows knocked out most of these plants before they set seed. We also hand pulled hemlock out of the adjacent native scrub. Some Italian thistle set seed before our first mow, so this species will continue to be persistent on the site. Since this site is next to the S2 butterfly island, it is important to control the late summer seed-set of these exotics. We feel the continued summer mowing of the GCP bowl has helped reduced the exotic plant establishment at S2.

April Brook Hemlock Control Site

This site is approximately 4 acres in size, and was clear-cut of Eucalyptus forest in 1995. The site has not had replanting work done, however a diverse assemblage of native coastal scrub has developed on site along with a major infestation of poison hemlock (*Conium maculatum*), and cape ivy.

The main poison hemlock patch was only mowed this year. Budget restraints didn't allow us to follow-up the hand pulling we did last year on the small satellite patches down the Colma Creek drainage. This hemlock patch remains one of the largest exotic plant threats to the central part of the watershed. Without future treatment, the wet stretch of Colma Creek between the islands and the botanic garden will only fill in completely with hemlock.

The cape ivy swath created last year near Summit Road was maintained this year. We continued to head off the ivy by maintaining a bare ground control swath around the entire infestation. The ivy/coastal scrub debris complex was piled in the center of the infestation. This infestation needs

to be constantly monitored so it isn't allowed to radiate into anymore intact coastal scrub. A second application of herbicide to the living ivy in the pile would be helpful in killing off this persistent exotic.

Colma Creek

The restored coastal scrub between CC1 and CC2 is maturing very well. Three successive years of weed management have reduced the amount of radish, mustard, hemlock, and thistle on the site. A few more years of weed management will allow the scrub to fill in completely without any dominant weed patches. The reduction of weeds in this area insures the butterfly islands continue to remain free of large competitive exotics.

Analysis of Grassland Areas for Mowing on San Bruno Mountain

by Eben Polk, TRA

One potential tool in vegetation management efforts on San Bruno Mountain is mowing. Experiments in grassland ecosystems have shown that mowing can effectively reduce the cover and diversity of non-native invasive weeds, apparently restoring a competitive balance to native grasses and herbs. A likely effect of mowing on San Bruno Mountain would be improved conditions for *Viola pedunculata*, the Callippe silverspot host plant. One element of a determination of the potential effectiveness of mowing is a field experiment in areas where non-native herbs and grasses are present in the vegetation matrix. A second element, addressed here, is an analysis of the locations and areas on San Bruno Mountain where mowing may be feasible.

Mowing, as a vegetation management tool, is likely to be limited in three ways: 1) to grassland-dominated areas; 2) to areas of a gentle slope; and 3) to areas that are accessible. We identified the location and size of grassland areas with a suitable slope for mowing, using aerial photography to delineate grassland areas, combined with a digital elevation model in a GIS.

Results indicate that approximately 400 acres on SBM meet these criteria and thus potentially might be mowed for vegetation management. Figure D-1 shows the extent of grassland on San Bruno Mountain, based on an aerial photo from 2000. Figure D-2 shows the result of overlaying the grassland areas with areas of a gentle slope. Table D-1 shows the results of our analysis, summarized by work areas on SBM. Significantly, approximately 30% of the grassland on the Northeast Ridge, the Saddle, and the far Southeast Ridge fit the analysis criteria.

For the purposes of our analysis, we defined slopes of 20 degrees or less to be sufficiently gentle for mowing. The makers of at least one commercially available mower, the DR Brush Cutter (17 horsepower), claim that it can handle up to 25 degree slopes.

We estimate that there are approximately 1100 acres of grassland on San Bruno Mountain, based on the aerial photography from 2000. Approximately 1650 acres of the 3520 acres in the San Bruno Mountain HCP have a slope of 20 degrees or less. Grassland areas cover approximately 425 acres of this. Some of this acreage is not likely to be accessible, which is why we round downwards for the estimate of acreage that might be mowed for vegetation management.

Given the results of this analysis, we believe that mowing's potential as a vegetation management tool on San Bruno Mountain should be tested experimentally this year.

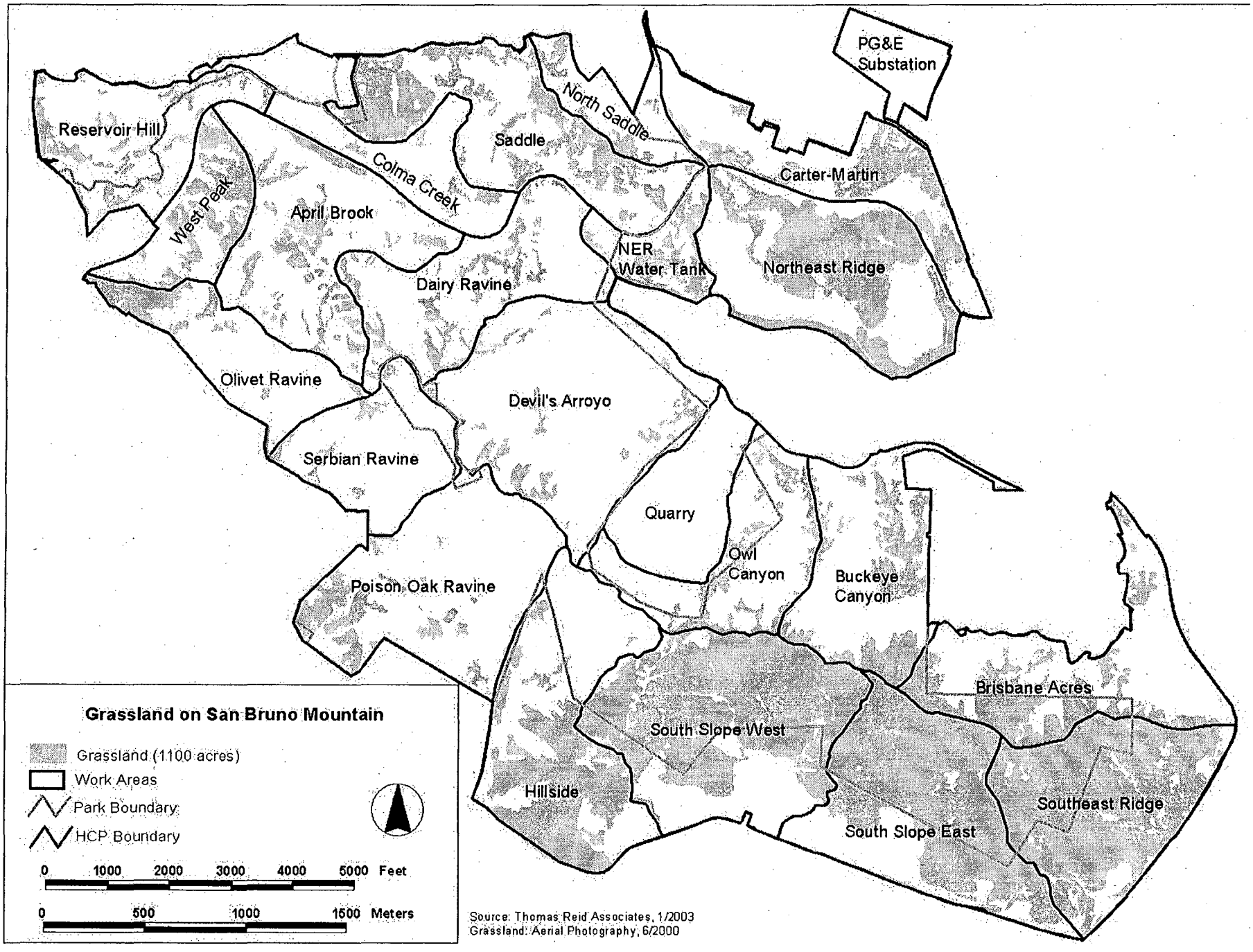


Figure D-1. Grasslands on San Bruno Mountain.

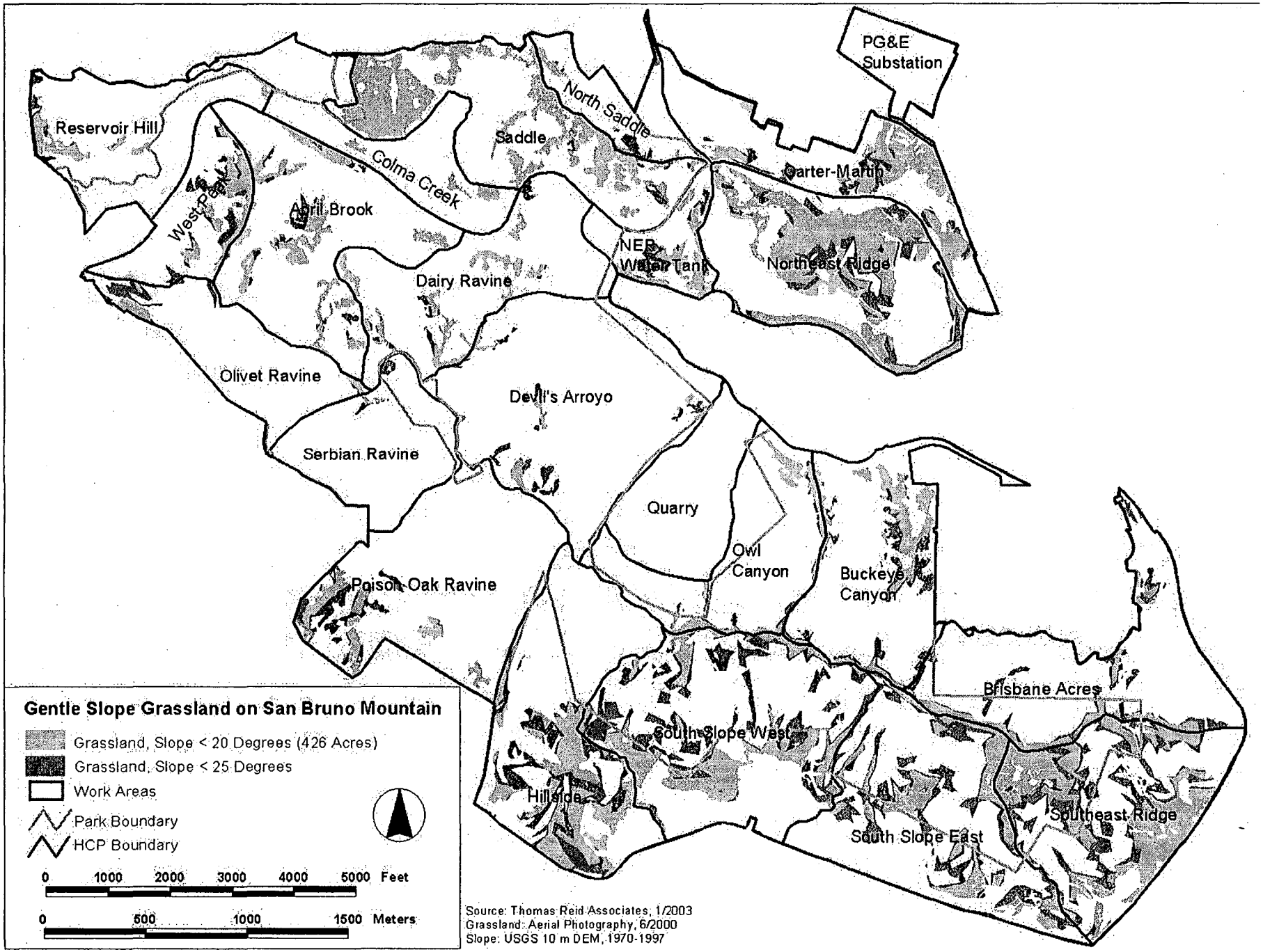


Figure D-2. Gentle Slope Grasslands on San Bruno Mountain.

Table D-1. Grassland and Gentle Slope Grassland in Work Areas on San Bruno Mountain

Work Area (23)	Total Area (Acres)	Grassland (Acres)	Percent Grassland	Area with Slope < 20 Degrees (Acres)	Grassland Area with Slope < 20 Degrees (Acres)	Percent Grassland with Slope < 20 Degrees
April Brook	195	31	15.9	150.6	20.2	10.4
Brisbane Acres	190	58	30.5	46.6	12.5	6.6
Buckeye Canyon	160	42.3	26.4	63.2	14.6	9.1
Carter-Martin	129	35.3	27.4	98	24.5	19
Colma Creek	110	5.1	4.6	108	4	3.6
Dairy Ravine	164	19.5	11.9	103.6	10.8	6.6
Devil's Arroyo	268	16.3	6.1	74.9	4.4	1.6
Hillside	219	87.4	39.9	84.5	35.4	16.1
NER Water Tank	51	17.9	35.1	28.1	9.1	17.8
North Saddle	56	8.5	15.2	20.7	2.2	3.8
Northeast Ridge	214	102.3	47.8	152.6	68.3	31.9
Olivet Ravine	105	17	16.2	22.7	3	2.8
Owl Canyon	134	21.6	16.1	40.4	8.5	6.3
PG&E Substation	43	x	x	x	x	
Poison Oak Ravine	217	24.6	11.4	77.8	10.7	4.9
Quarry	96	0.2	0.2	33.9	0	0
Reservoir Hill	127	17.3	13.7	70.8	7.1	5.6
Saddle	186	64	34.4	172.9	57.1	30.7
Serbian Ravine	111	5.2	4.7	20.6	0.3	0.3
South Slope East	218	156.7	71.9	81.2	30.2	13.8
South Slope West	259	177.8	68.6	99.7	37.8	14.6
Southeast Ridge	191	157.4	82.4	76.8	54.6	28.6
West Peak	78	29.5	37.9	21.4	11.2	14.3
San Bruno Mountain HCP	3521	1095		1649	426	

Thomas Reid Associates, 1/2003. Grassland estimates: aerial photography dated 6/2000. Slope calculations: USGS 10m DEM, 1970-1997

Administrative Parcel	Species Monitoring	Exotics Control	Revege-tation	*Planning Assistance
GUADALUPE HILLS (1)				
01 Linda Vista III (Bay Ridge)	X	X	X	X
02 Carter St.	X	X		
03 Rio Verde Heights	X			X
04 Levinson Property	X			
05 Brisbane Office Park	X			
06 Parcel Z	X		X	X
07 Northeast Ridge Project	X	X	X	X
08 Guadalupe Valley West	X	X		
09 State Park	X	X	X	X
10 Guadalupe Canyon Pkwy.	X	X		X
11 PG&E Transmission Lines	X			X
12 PG&E Fee	X			
13 Water Pipelines	X	X	X	X
14 Linda Vista I	X	X		
15 Water Tank				
16 Parcel V	X	X		
SOUTHEAST RIDGE (2)				
01 Quarry	X	X	X	X
02 Owl and Buckeye Canyons	X	X	X	
03 Brisbane Acres	X	X		X
04 Terrabay Project	X	X	X	X
05 County Park	X	X		X
06 Hillside School				
07 PG&E Transmission Lines	X	X		X
08 Juncus Ravine	X	X	X	X
09 Water Pipelines	X			x
10 Fire Breaks	X			X
RADIO RIDGE (3)				
01 Telecommunications Site	X	X		X

Administrative Parcel	Species Monitoring	Exotics Control	Revege-tation	*Planning Assistance
02 County Park	X	X	X	X
03 Guadalupe Canyon Pkwy.	X	X		
04 PG&E Transmission Lines	X		X	X
SADDLE (4)				
01 Pointe Pacific	X	X		
02 Village-in-the-Park		X		
03 South Hills Estates		X		
04 State Park	X	X	X	X
05 Guadalupe Canyon Pkwy.	X	X		X
06 Water Tanks				

* Includes monitoring of construction, project design review, and HCP compliance review

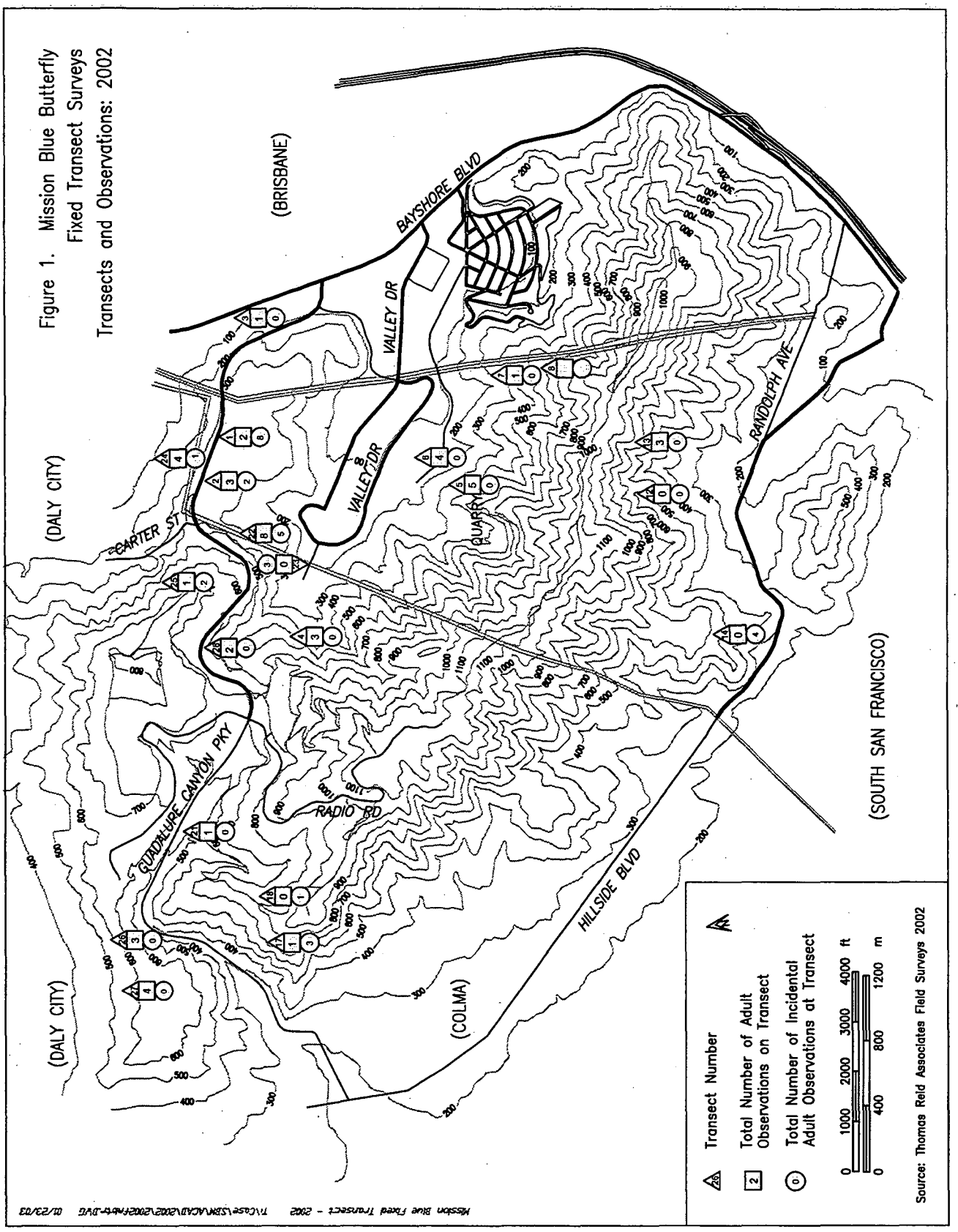
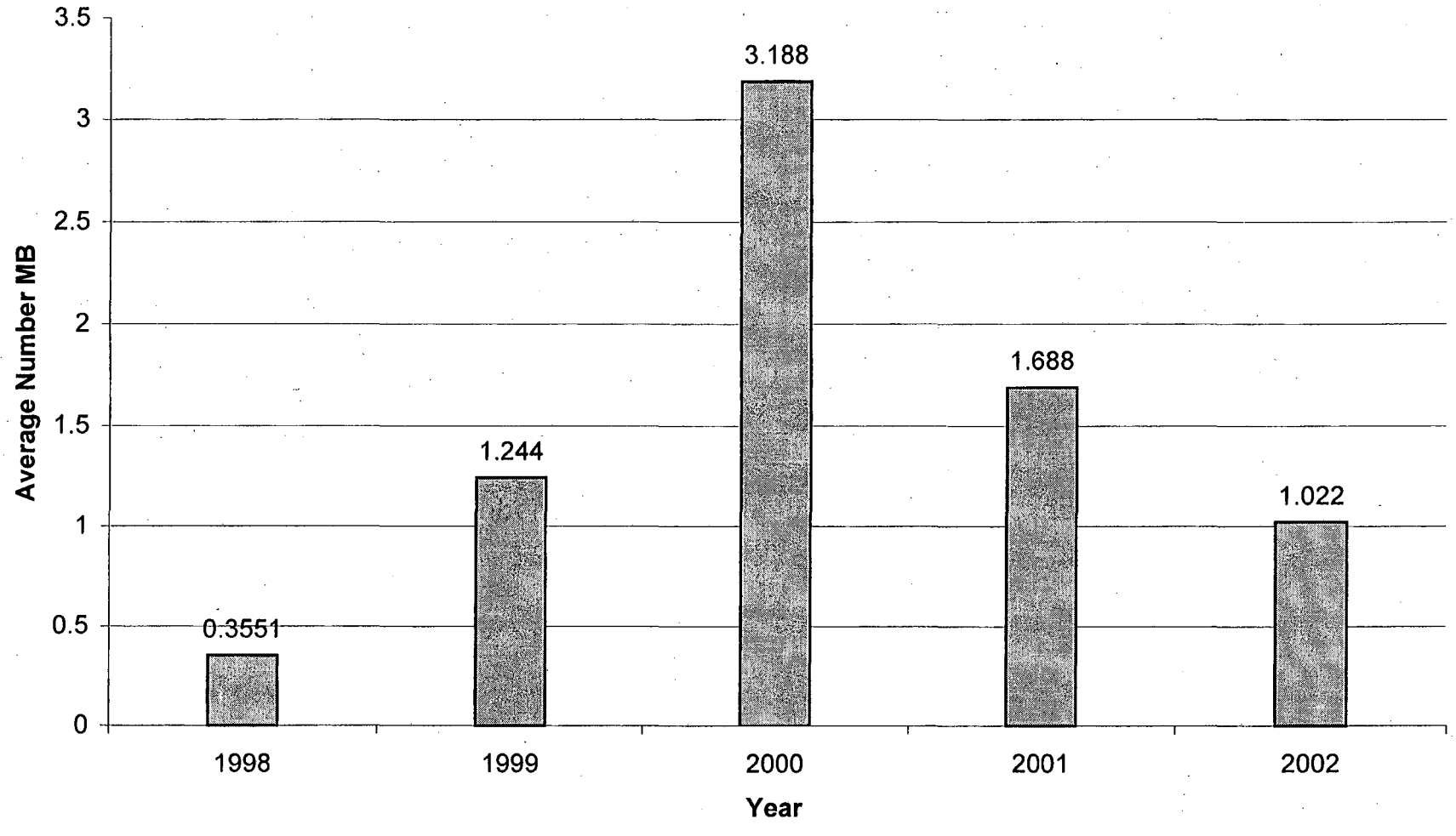


Figure 1. Mission Blue Butterfly
Fixed Transect Surveys
Transects and Observations: 2002
(DALY CITY)
(BRISBANE)
(DALY CITY)
(COLMA)
(SOUTH SAN FRANCISCO)
BAYSHORE BLVD
VALLEY DR
CARTER ST
GUADALUPE CANYON PKY
RADIO RD
HILLSIDE BLVD
RANDOLPH AVE
QUARRY
Transect Number
Total Number of Adult Observations on Transect
Total Number of Incidental Adult Observations at Transect
0 1000 2000 3000 4000 ft
0 400 800 1200 m
Source: Thomas Reid Associates Field Surveys 2002

Figure 2. Average number of Mission Blue butterflies at all transects per year: 1998 - 2002



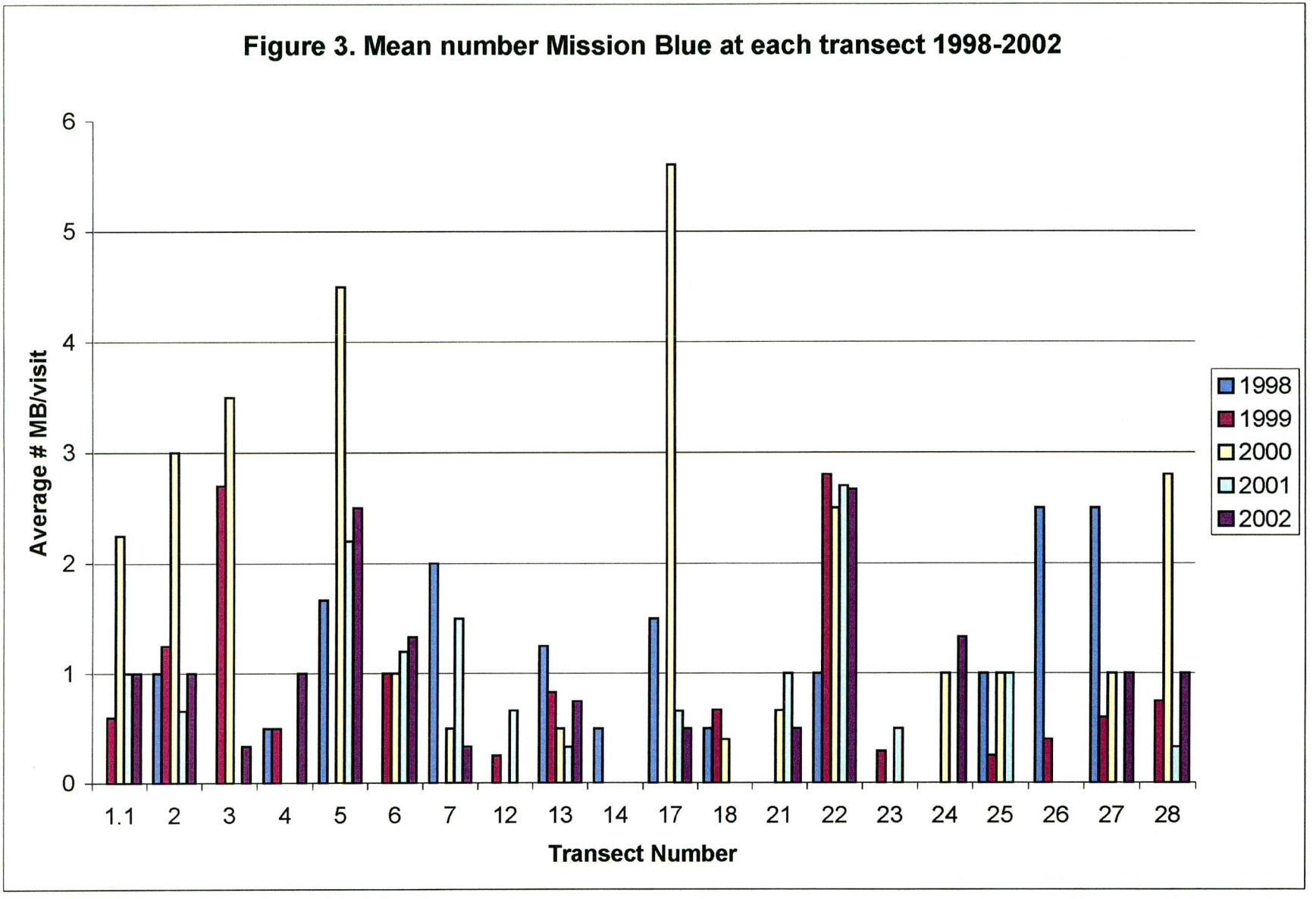


Figure 3. Mean number Mission Blue at each transect 1998-2002
Average # MB/visit
0
1
2
3
4
5
6
1.1
2
3
4
5
6
7
12
13
14
17
18
21
22
23
24
25
26
27
28
Transect Number
1998
1999
2000
2001
2002

Figure 4. Rainfall (by month) on San Bruno Mountain
1997-98-----2001-02 Rain Years

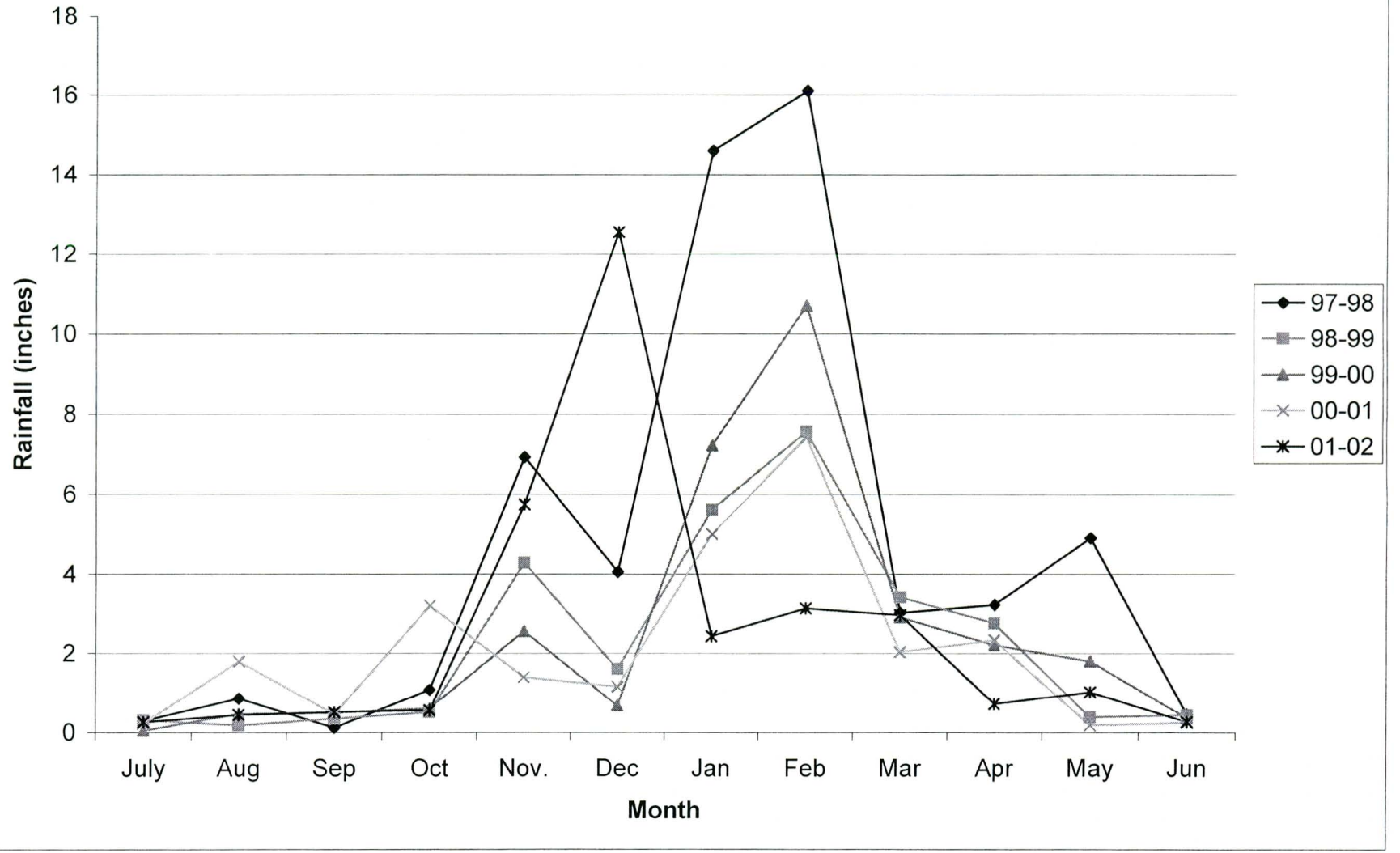


Figure 5. Mission Blue and Callippe Silverspot Wandering Surveys and Observations: 2002.

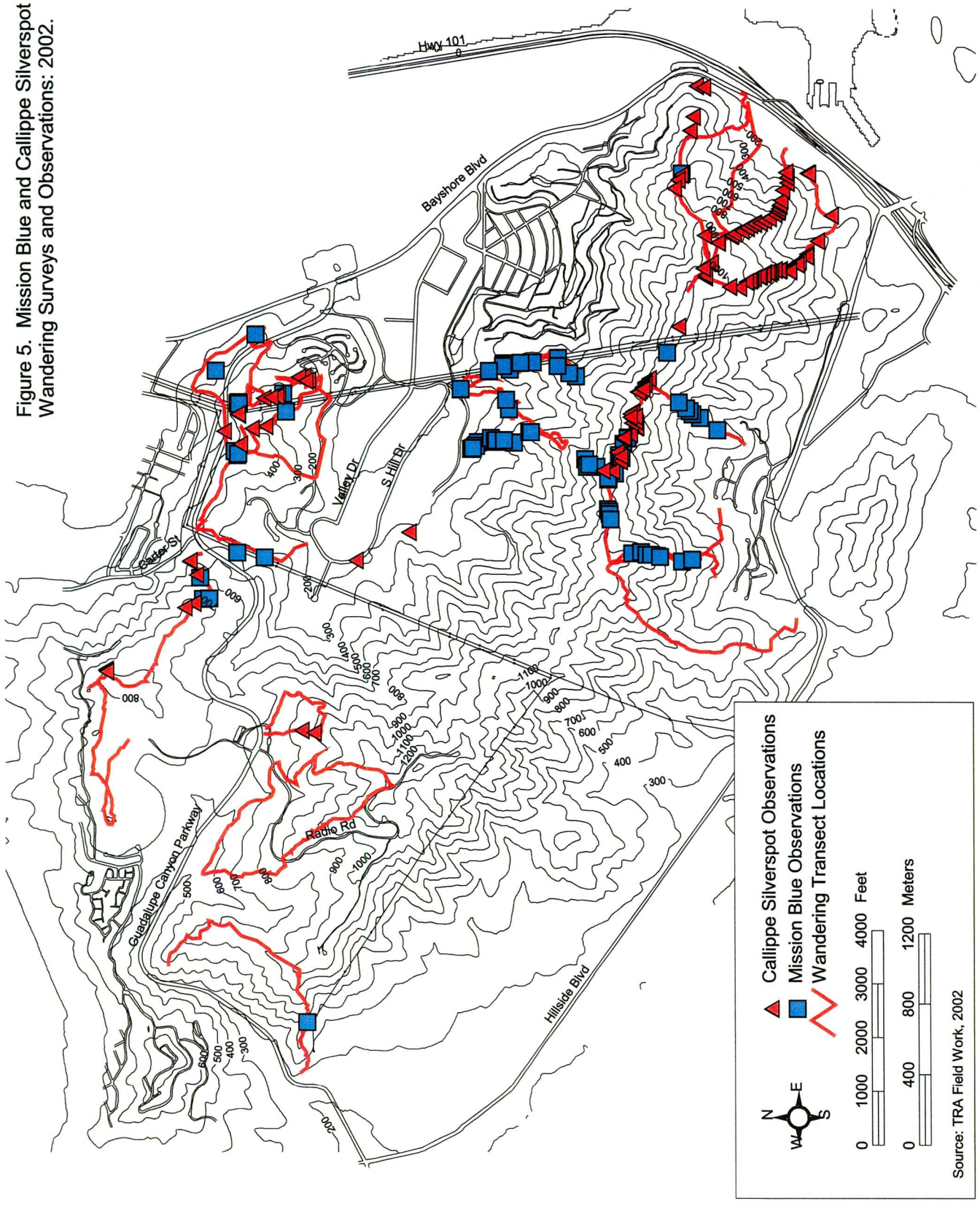


Figure 6. Callippe Silverspot Fixed Transects and Observations: 2002

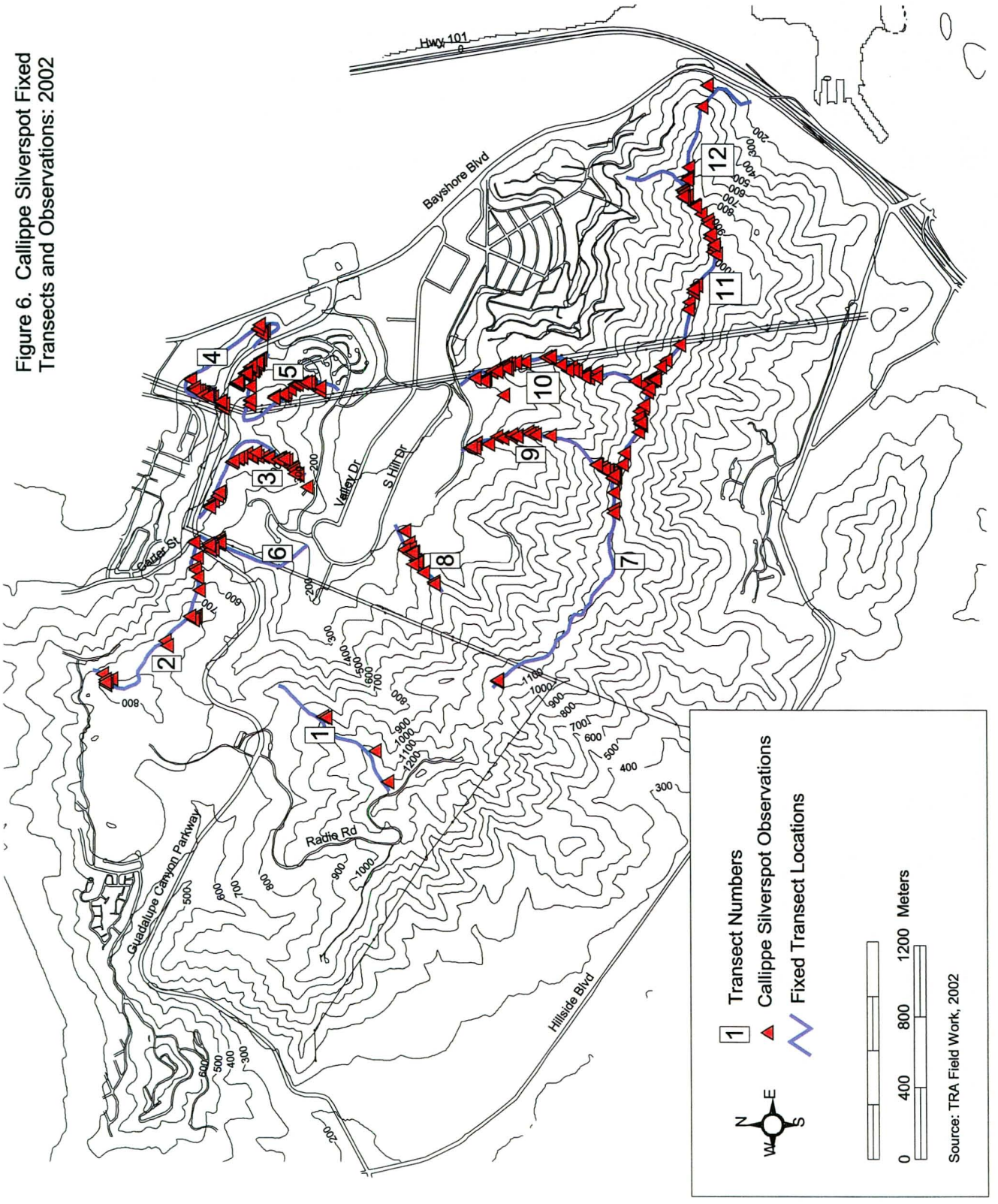


Figure 6

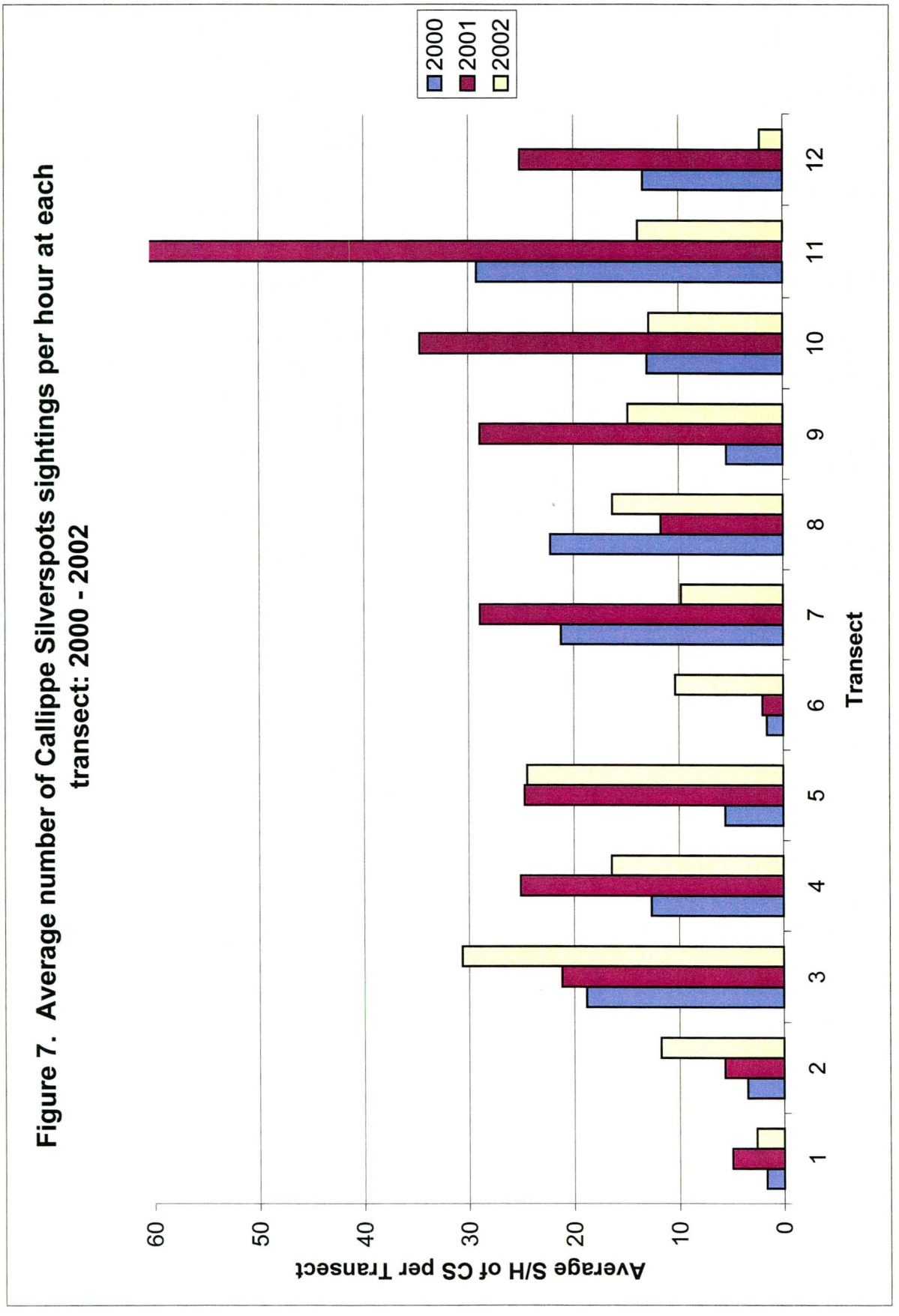


Figure 7. Average number of Callippe Silverspots sightings per hour at each transect: 2000 - 2002

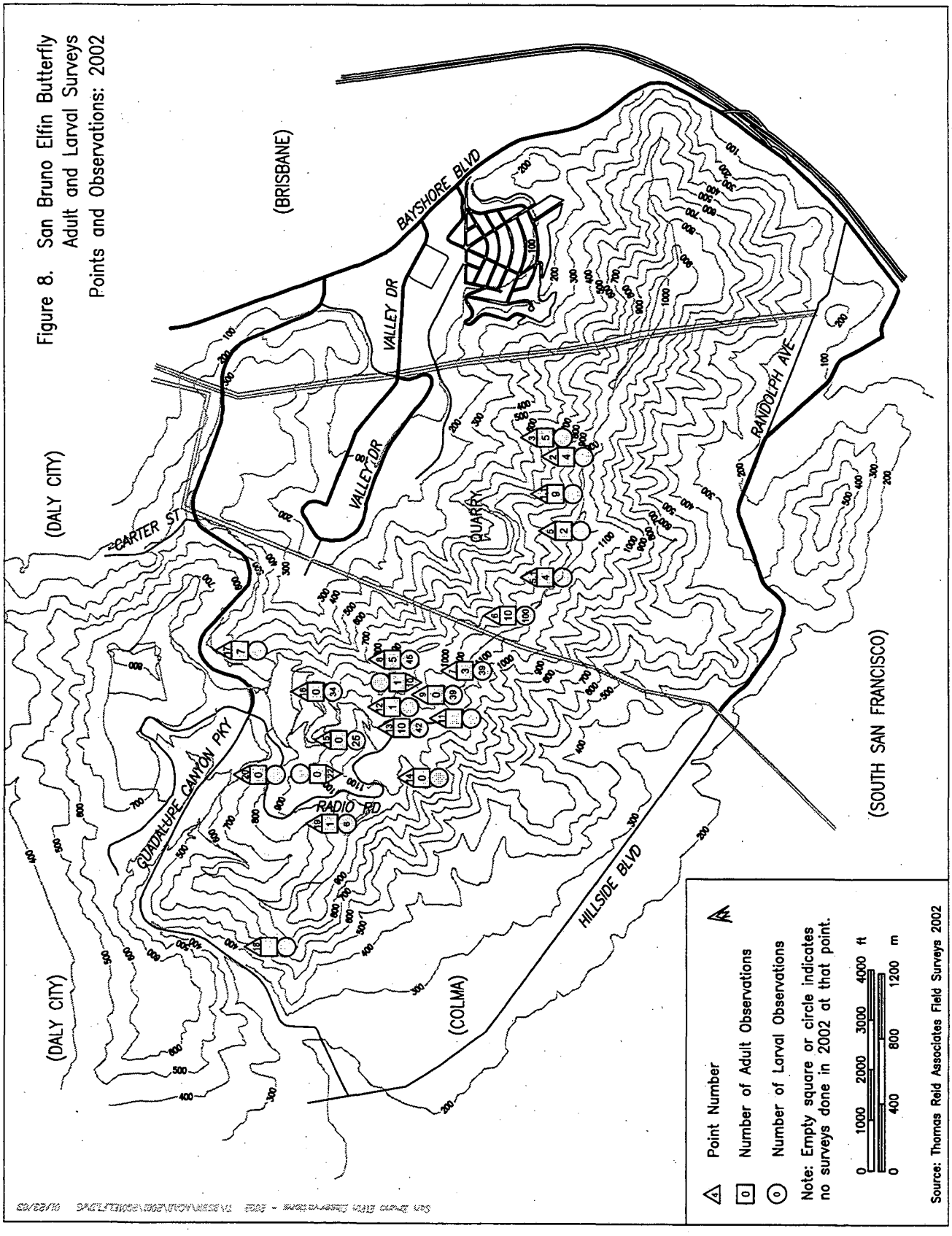


Figure 8. San Bruno Elfin Butterfly
Adult and Larval Surveys
Points and Observations: 2002
(DALY CITY)
(BRISBANE)
(COLMA)
(SOUTH SAN FRANCISCO)
CARTER ST
VALLEY DR
BAYSHORE BLVD
QUARRY
RANDOLPH AVE
GUADALUPE CANYON PKY
RADIO RD
HILLSIDE BLVD
Point Number
Number of Adult Observations
Number of Larval Observations
Note: Empty square or circle indicates no surveys done in 2002 at that point.
0 1000 2000 3000 4000 ft
0 400 800 1200 m
Source: Thomas Reid Associates Field Surveys 2002

1. Kamchatka Point: Arctostaphylos imbricata imbricata, A. uva-ursi forma suborbiculata
2. Summit, Above Radio Road: A. imbricata imbricata
3. Ridge Trail "Hanging Gardens": A. uva-ursi forma coactilis, A. imbricata imbricata
4. Pacific Rock: A. imbricata imbricata, A. imbricata montaraensis, A. x pacifica, A. uva-ursi forma coactilis
5. Manzanita Dike: A. imbricata imbricata, A. imbricata montaraensis
6. Powerline Ridge: A. imbricata imbricata
7. Ridge Trail, Above Quarry: A. uva-ursi forma leobreweri
8. Brisbane Acres: A. tomentosa crustacea (also occurs in Buckeye Canyon, but not mapped in 2002)

(Boundaries of species in each colony are available in TRA GIS database)

Figure 9. Manzanita distribution on San Bruno Mountain, 2002

0 800 1600 2400 3200 Fe

0 300 600 900 Meters

N W E S

Source: TRA Field Work, 2002

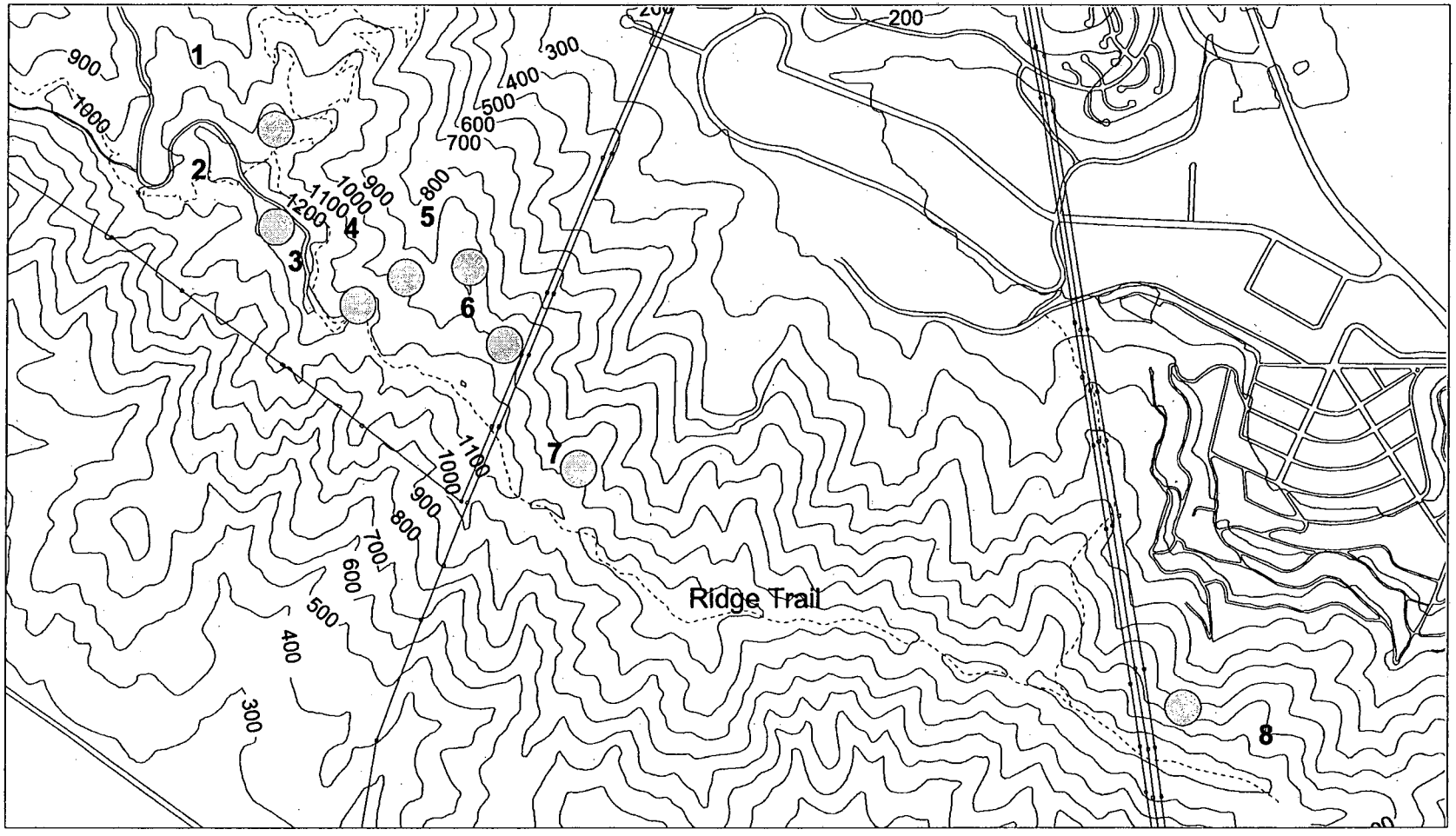
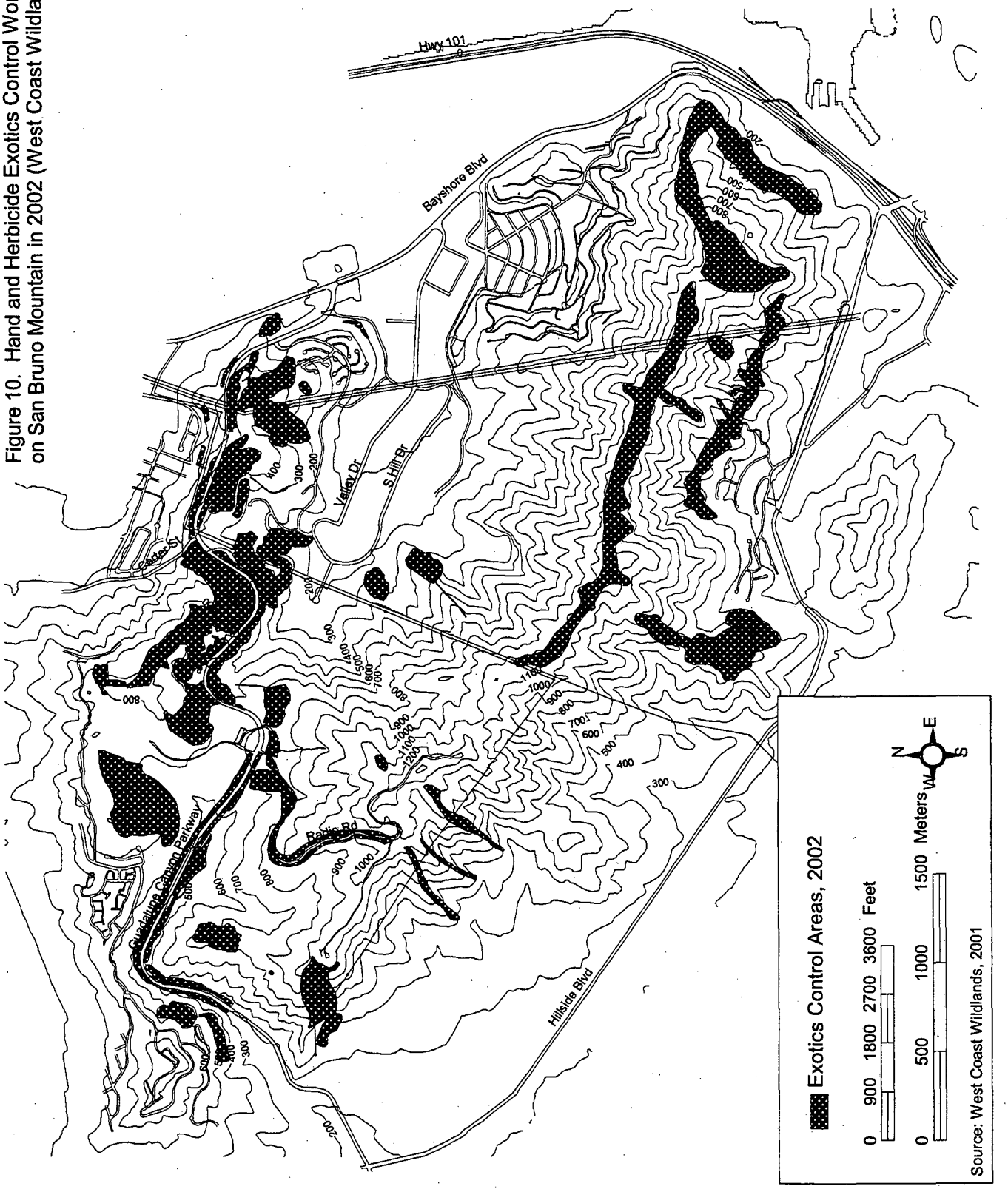


Figure 10. Hand and Herbicide Exotics Control Work on San Bruno Mountain in 2002 (West Coast Wildlands)



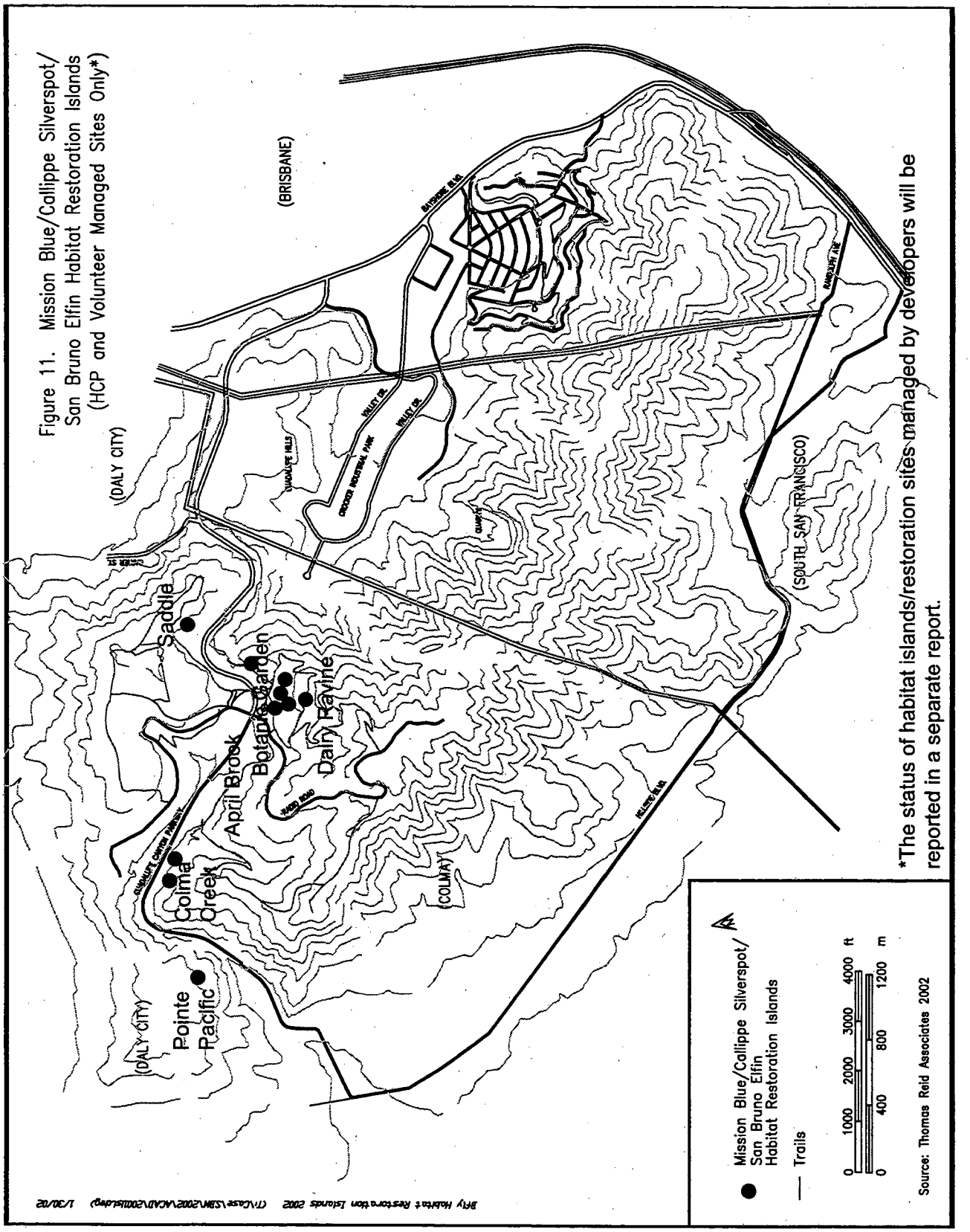


Figure 11. Mission Blue/Callippe Silverspot/ San Bruno Elfin Habitat Restoration Islands (HCP and Volunteer Managed Sites Only*)
(DALY CITY)
(BRISBANE)
(COLMA)
(SOUTH SAN FRANCISCO)
Saddle
Botanical Garden
Dairy Ravine
April Brook
Colma Creek
Pointe Pacific
(DALY CITY)
Mission Blue/Callippe Silverspot/ San Bruno Elfin Habitat Restoration Islands
Trails
0 1000 2000 3000 4000 ft
0 400 800 1200 m
Source: Thomas Reid Associates 2002
*The status of habitat islands/restoration sites managed by developers will be reported in a separate report.