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SAN BRUNO MOUN
HABITAT CONSERVAT

1998 ACTIVITIES REPORT FOR ENDANGERED SPECIES PERMIT PRT 2-9818

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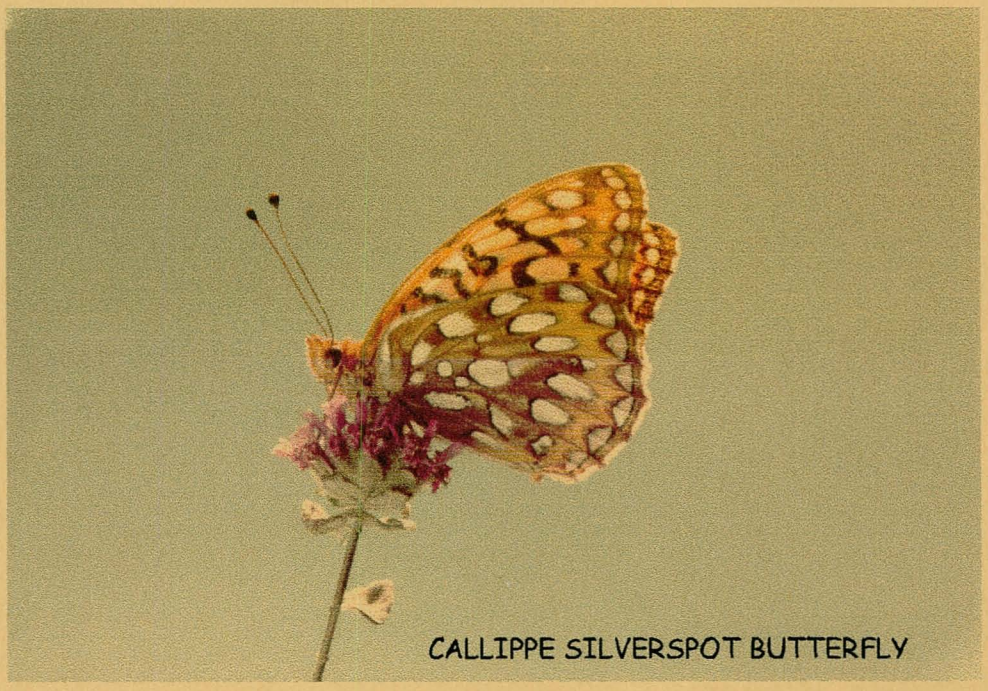

CALLIPPE SILVERSPOT BUTTERFLY

Prepared for San Mateo County and
the U.S. Fish and Wildlife Service

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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 1998 Calendar year. It provides information on the relative population status of the butterflies of concern, exotic species control work, and development activities. Anyone interested in reviewing field data or other information collected by Thomas Reid Associates should contact Patrick Kobernus at (650) 327-0429 or Roman Gankin at (650) 363-1826.

1. STATUS OF SPECIES OF CONCERN

Since 1983, TRA has annually monitored the relative population sizes and distribution of the endangered butterflies on San Bruno Mountain using a wandering transect method. The wandering transect monitoring system provides good geographic coverage of the Mountain for assessment of the butterfly populations while simultaneously allowing for the inspection of remote habitat areas for exotic plant infestations. However this monitoring technique does not allow for comparisons of specific habitat areas over time. As a result, in 1998 TRA initiated a set transect monitoring system for the Mission blue butterfly and a set point monitoring system for the San Bruno elfin butterfly.

The set transect system was installed to provide Mission blue data that was comparable to that collected by the National Parks Association in their Mission blue monitoring program in the Golden Gate National Recreation Area. The set transects system was also established to provide a standardized, repeatable monitoring system that could be used to test the effects of different variables such as slope aspect, slope disturbance, host plant type, host plant density, and other factors.

In 1999, a more standardized system of doing the wandering transects will be done in addition to the set transects to provide comparable data to previous years' monitoring. Also in 1999, set transects will be installed for the callippe silverspot butterfly, providing both specific habitat data and overall geographic coverage for each of the endangered butterfly species.

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

Methods

For the Mission blue monitoring, 28 set transects (each 50 meters long and 5 meters wide) were installed in various parts of the Mountain. Ideally each transect is monitored once every 7-10 days (the average adult life span for the Mission 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 2.5 minutes by two people, an observer and a recorder. After the transect observation period is over, average wind speed, maximum wind speed, air temperature, and humidity are recorded. Any butterflies observed inside the transect just before or after the monitoring period are included as transect observations. All butterflies observed outside of the transect or in the transect vicinity during travel time are recorded as incidental observations.

Data Analysis

The winter of 1998 was one of the wettest ever to occur on San Bruno Mountain. The El Niño storms brought over 30 inches of rainfall to San Bruno Mountain in the months of January and February, and over 11 inches in the months of March, April, and May. As a result of this extremely wet winter and spring, the Mission blue began flying later and were first recorded on April 10, 1998. The 1998 butterfly flight season was also shortened as a result of dieback in *Lupinus albifrons* at several locations. Plant dieback was noted at several colonies on the Southeast Ridge, Owl and Buckeye Canyons, and in the Guadalupe Hills. Dieback of *L. albifrons* was also noted at Mission blue colonies in the Golden Gate National Recreation Area and is thought to be the result of a root fungus (pers. comm. Janet Klein, National Parks Association). The root fungus may have been caused by the extreme wet weather.

The transect locations and numbers of observed Mission blue butterflies in 1998 are shown in Figure 1. A tally of the Mission blue data is included in Appendix A, and Table A-1 contains a summary of Mission blue field data. Due to the heavy rainfall and cool weather of 1998, monitoring opportunities were limited, and transects were not monitored every 7-10 days as planned. Visits varied between two and five visits per transect over the course of the monitoring season. Most transects were surveyed, however, within 1-3 days of one another, and four good monitoring events were conducted at most transects locations (4/16-4/19, 4/26-4/27, 5/18-5/20, and 6/5).

Summary of Transect Data by Subregion

Graphs A-1, a-d in Appendix A show the numbers of butterflies observed at each transect in each subregion of the Mountain. All transects were visited at least twice, but not all visits were conducted during optimum butterfly flight weather. Total numbers of butterflies observed at each transect and the average number of butterflies observed per visit is shown. Overall it appeared that butterfly observations were down this year, likely the result of the record rainfall in 1998. High numbers of butterfly observations were recorded at some sites, and these tended to be sites with the greatest host plant densities (transects 27 and 11 for instance).

Weather and Habitat Variables

Graph A-2 in Appendix A shows total and average numbers of butterfly observations on roadcuts and cut slopes versus natural slopes. Nine transects were placed on roadcuts and cut slope areas, and ten were placed on natural slopes. Roadcuts and cutslopes often have the highest densities of lupines and butterflies due to the fact that these disturbed areas favor the early successional lupines, and provide shelter from the wind. The two most productive transects this year (27 and 11) are located on a roadcut and a cut slope, respectively. Overall though, the average number of butterflies utilizing both landform types appeared to be nearly even. It is likely that topographical and soil conditions (natural slope vs. roadcut habitats), are not significant except in how they may influence host plant density, wind, and temperature conditions at habitat level.

Graph A-3 in Appendix A shows total and average numbers of butterfly observations at transects with different host plants. The preferred host plants for the Mission blue are *L. albifrons* and *L.formosus*. *L. variicolor* is also used by the Mission blue but to a much less degree. Nineteen transects were placed in *L. albifrons*, and 7 were placed in *L. formosus*. The average number of observations per transect was approximately the same.

Graph A-4 in Appendix A shows the relationship between wind speed and butterfly observations. Only transects with greater than 5 total observations which had 3 or more visits during the monitoring season were used in this analysis. Observations were highest below 2 mph average wind speed, and then quickly declined as speeds reached above 4 mph (averaged over 1 minute period) suggesting that the optimum average wind speed to conduct mission blue surveys is below 4 mph.

Graph A-5 in Appendix A shows the relationship between air temperature and butterfly observations. Butterflies were recorded at temperatures between 60 and 74° F, but were more often seen at temperatures above 74° F.

Isolating the effects of one variable (such as wind, air temperature, or host plant size/density) upon butterfly observations requires a multiple regression analysis. Data collected under a wide range of conditions for each of these factors would allow for the development of a model that could predict the number of expected observations during optimum weather conditions for each subarea or transect. With good corroboration of empirical data with predicted observations, it should be possible to correct for weather factors influencing butterfly observations, and provide greater resolution in estimating butterfly populations.

Due to the labor-intensiveness of conducting standardized transect monitoring, a crew of at least 8 people (4 teams of 2) is needed to cover the 4 separate subregions of the Mountain in order to take advantage of good weather windows and get good geographic coverage of the Mountain. The development of a dependable volunteer crew is a desirable cost effective way to conduct this work.

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

The callippe silverspot was listed as an endangered species by the U.S. Fish and Wildlife Service in December 1997. The County of San Mateo and cities of Brisbane, Daly City, and South San Francisco are in the process of seeking an amendment to Section 10(a)(1)(B) PRT-2 9818 to add the callippe to the incidental take provisions of that permit. No changes to the Habitat Conservation Plan are proposed.

Methods

Transects are walked by experienced field biologists and data is recorded on data logs and topography maps. The tabulated data for 1998 is contained in Appendix A, Table A-2. A butterfly sightings per hour figure is derived by dividing the total number of hours spent on transects by the total number of butterfly observations made. A sightings per hour figure can be calculated for each colony by using data from those colonies only (see Appendix A, page A-5).

Using a standard formula derived in 1982 (see Appendix A for explanation of formula), the sightings per hour data is used to determine relative population size for the entire population as well as for each colony. The numerical results are input into a computer graph spreadsheet and the data is depicted in graph form (see Figure 2). The distribution data is input directly from the field maps into a computer map of San Bruno Mountain. The resultant butterfly distribution map is contained in Figure 3. These tables and figures are included at the end of the report.

In 1998, random walking transects were used to assess the population status and relative distribution of the callippe silverspot on the Mountain. The locations of the 272 callippe adults observed in 1998 are shown in Figure 3. Figure 4 shows the relative population size of the callippe silverspot for years 1981-1998. Table 1 provides a breakdown of adult observations by month.

272 adult callippe were observed in 31.5 hours yielding a sightings per hour (S/H) of 8.2 -- just slightly lower than the 1997 S/H figure (8.8 S/H). The relative population of the callippe on San Bruno Mountain was high for the second year in a row, in comparison to the two preceding years, even though fewer adults were observed. The number of sightings per monitoring hour was relatively high in both 1996 and 1997 (9.4 S/H and 8.8 S/H respectively). In 1996, 296 adults were observed in 31.5 hours of surveying and in 1997, 404 callippe were observed in 46 hours of surveying.

The number of callippe sighted per monitoring hour in the Guadalupe Hills in 1998 was 9.7 individuals. In contrast, 9.9 callippes were sighted per hour in 1997. For the Southeast Ridge the sightings per hour figure was 7.5, only slightly lower than the 8.0 figure in 1997.

The callippe flight season started late in 1998, with initial observations made on May 31, 1998. The flight season was relatively short with the peak occurring from mid-June to mid-July. Observations dropped off quickly after July 15th. Although adults were observed at all the usual places (Northeast Ridge, Southeast Ridge, Transmission Line Ridge, Above Brisbane), the relative numbers at typical "hot spots" generally appeared to be lower than usual.

TABLE 1
MONTHLY TOTALS OF CALLIPPE SILVERSPOT ADULTS

	MAY	JUNE	JULY	AUGUST	TOTAL
1989	461	789	127	0	1377
1990	191	610	52	0	853
1991	0	611	314	2	927
1992	915	440	3	0	1358
1993	503	469	24	0	996
1994	22	461	124	0	607
1995	38	306	110	0	454
1996	132	160	4	0	296
1997	358	44	0	0	404*
1998	8	131	133	0	272

*(2 callippes observed in April not shown)

Distribution of the Callippe Silverspot on San Bruno Mountain Over Time

The following discussion was presented in the Environmental Assessment (EA) supporting the County's application to amend Section 10(a)(1)(B) PRT 2-9818 to include the listed endangered callippe silverspot. Refer to the full EA for additional discussion.

To provide a comparison of distribution and relative abundance of the callippe over time on San Bruno Mountain, two maps have been prepared using computer generated observation data for years 1989 to 1997. One maps shows distribution and relative abundance for years 1989 to 1992 (four year span) and the other for years 1993 to 1997 (five year span). Data collected before 1989 has not been entered into the computer database.

Figure 4 shows the 4,515 adult callippe that were observed on the Mountain from 1989 to 1992, and Figure 5 shows the 1,857 adult callippe that were observed from 1993 to 1997. The significantly lower total number of observations made in the last five years compared to the previous four years reflects the following: 1) significantly fewer numbers of person hours were spent monitoring the callippe in 1995, 1996 and 1997 than in the previous years; and 2) the drought years of 1989-91 were more favorable to adult flight than the recent wetter years. Figures 3,4, and 5 show that the overall distribution of the callippe on San Bruno Mountain has not significantly changed over the past 17 years. Except for specific areas where development has occurred on the Northeast Ridge, the mid-90's distribution of the callippe is similar to the early 80's distribution.

Distribution of *Viola pedunculata*

The distribution of the callippe's larval foodplant, *Viola pedunculata*, was generally mapped for the 1981 Endangered Species Survey. According to the 1982 report the viola is distributed broadly throughout the grassland of San Bruno Mountain, growing predominantly in the Guadalupe Hills, on the ridges in Owl and Buckeye Canyons and over the top of the South Ridge.

The general distribution of viola was assessed in March 1998 for the Environmental Assessment prepared for the amendment to the Section 10(a)(1)(B) permit. The current distribution is shown in Figure 6. Viola is still widely distributed throughout the grassland of San Bruno Mountain particularly on the South Ridge, the ridges in Owl and Buckeye Canyons, and in the Guadalupe Hills. There has been some loss of viola on the Northeast Ridge as a result of development of "The Ridge" project.

Viola populations in the Saddle area have increased as a result of gorse control activities. Broom removal activities in Owl and Buckeye Canyons by Thomas Reid Associates and Bay Area Mountain Watch have increased habitat quality for viola in those areas. The control of fennel and pampas grass in Tank and Juncus Ravines has improved habitat quality for viola and lupines.

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

For the San Bruno elfin butterfly elfin, 21 points were installed in four subregions of the Mountain. The locations of the 103 adult San Bruno elfin butterflies observed in 1998 are shown in Figure 7. See Table 2 for a breakdown of adult observations by month. Searches for elfin larvae were not made in 1998. A tally of the 1998 San Bruno elfin field data is included in Table A-3 in Appendix A.

TABLE 2
MONTHLY TOTALS OF SAN BRUNO ELFIN ADULTS

	FEBRUARY	MARCH	APRIL	TOTAL
1989	0	164	21	185
1990	0	161	1	162
1991	13	63	10	86
1992	38	202	3	243
1993	0	149	3	152
1994	0	56	3	59
1995	0	13	0	13
1996	0	30	0	30
1997	0	27	0	27
1998	3	100	0	103

In 1998 the adult population of San Bruno elfin on San Bruno Mountain reached triple digits and was much higher than it had been in the four previous years (see Table 3).

A new "point count" monitoring system was initiated in 1998. Point stakes were installed at 21 locations where San Bruno elfin are known to occur. Every 7 to 10 days each of these points was monitored by a field biologist. Monitoring consists of standing at the established point for five minutes and counting the number of adult elfin observed. The monitoring must be done during an acceptable weather window. Temperature, humidity, wind speed and direction, and cloud cover data are taken at each point. Incidental sightings of elfin on the way to and from the point locations are also recorded and mapped.

Graphs A-6 a-d in Appendix A show the average number of elfin observations per point visit and average number of observations per point area (includes incidental observations). Elfin were observed at 17 of the 21 point locations (see Figure 7). Elfin at the four locations where there were no observations in 1998 have had no documented occurrences since 1993. The four locations are: Point 1, above Brisbane; Point 14, Lone Pine Road; Point 18, Old Quarry; and Point 21, April Brook Trail. These elfin colonies may have been extirpated. Hopefully, one or all of these will be recolonized in the future.

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

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 1998.

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

No San Francisco garter snakes (SFGS) were observed on San Bruno Mountain by field crew while conducting biological activities and overseeing development activities in 1998.

f. Plants of Concern

The San Bruno Mountain Manzanita (*Arctostaphylos imbricata*) experienced extensive leaf damage at each of the 4 major colonies this past year. Preliminary analysis by the State of California Agricultural Department plant pathologists determined the dieback was caused by a chewing insect. Many plants appeared to partially recover from the initial damage, however the exact cause of the damage has not been identified. Currently TRA is organizing a visit to the Mountain with local Manzanita experts to further investigate the problem.

g. Bird List for San Bruno Mountain

In 1998 Doug Allshouse and Herb Brandt of the Friends of San Bruno Mountain updated the list of bird species known from the saddle and west side of San Bruno Mountain. The updated list is available from the Friends of San Bruno Mountain.

2. VEGETATION MANAGEMENT

a. 1998 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. Primary emphasis is placed on controlling exotic infestations that are invading or threatening to invade habitat of the three endangered butterflies.

Currently there are 35-40 exotic pest plant species that exist on San Bruno Mountain. As a rule, hand control methods are used to control low density infestations, while high density infestations (gorse, broom, fennel, and eucalyptus) are controlled using herbicides.

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

Acacia sp. (Acacia)
Carduus pychnocephalus (Italian thistle)
Carpobrotus edulis (hottentot fig, iceplant)
Centranthus ruber (red valerian)
Cirsium vulgare (bull thistle)
Conium maculatum (poison hemlock)
Cortaderia jubata (pampas grass)
Cotoneaster sp. (Cotoneaster)
Cytissus striatus (Portuguese broom)
Erechtites arguta (New Zealand fireweed)
Erodium cicutarium
Eucalyptus globulus (blue gum tree)
Foeniculum vulgare (fennel)
Genista monspessulana (French broom)
Hedera helix (English Ivy)
Hirschfeldia incana (mustard)
Holcus lanatus (velvet grass)
Hypocheris radicata
Lactuca virosa (wild lettuce)
Lactuca serriola (prickly lettuce)
Lobularia maritima (Lobularia)
Myoporum laetum (Myoporum)
Picris echiodes (bristly ox-tongue)
Pinus radiata (Monterey Pine)
Pyrocantha crenato-serrata (Pyrocantha)
Rubus discolor (Himalaya blackberry)
Scabiosa atropurpurea
Senecio mikeniodes (German Ivy)
Silybum marianum (milk thistle)
Ulex europaeus (gorse)

TRA maintains daily record sheets for all exotic pest plant work conducted on the Mountain. For hand control work an accounting of the number of all plants removed is recorded and for herbicide work the estimated number of acres treated is recorded. In 1998, over 50,000 exotic pest plants were removed by hand and approximately 35 acres of pest plant infestations were treated with herbicides (see Tables B-1 and 2 in Appendix B). In addition approximately 3 acres of dense gorse in the Saddle along Guadalupe Canyon Parkway was mowed using a mechanical brush cutter/mulcher. The brush cutter was also used on a ½ acre Portuguese broom infestation near the Northeast Ridge water tank. Figure 8 shows a generalized view of the locations where hand and herbicide control work was conducted. Volunteers of the Friends of San Bruno Mountain and Bay Area Mountain Watch have also been active in removing weeds from the Mountain.

b. Exotics Control Strategy and Future Goals

Treatment of individual exotic plant infestations are prioritized as follows:

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 native 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 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. By using Garlon4 herbicide, which is non-toxic to grasses, the surrounding plant life is impacted only minimally.

In accordance with the 1996 San Bruno Mountain HCP Five Year Strategic Plan, exotic pest plant control work has expanded into different areas of the Mountain in recent years. Infestations on Callippe Hill, Radio Ridge, Buckeye Canyon, and portions of the Saddle have been targeted and brought under control. Because maintenance of all areas previously controlled will continue to be a priority, expansion of treatment into new areas is slow. High priorities for expanded exotics control work include: 1) the Southeast Ridge and South slope areas where fennel and pampas grass are a continuing problem, and 2) areas on the south side of the Brisbane industrial park where French and Portuguese broom infestations have expanded. Sources of additional funding will be sought again in 1998 to supplement the HCP budget and provide for expanded exotics control work on the Mountain. For more information, refer to the 1996 San Bruno Mountain HCP Five Year Strategic Plan, which provides a comprehensive breakdown of habitat management goals under different funding scenarios.

c. Eucalyptus Removal and Native Habitat Restoration

The goals of the eucalyptus removal and native habitat restoration on San Bruno Mountain are to 1) provide corridors and restored grassland habitat for the three endangered butterflies on the Mountain (Mission blue, callippe silverspot, and San

Bruno elfin) and 2) restore native habitats for other native wildlife species.

In 1995, 63 acres of eucalyptus trees were clear-cut on San Bruno Mountain. The 63 acres are broken up into seven different restoration units (Figure 9). The restoration units are Dairy Ravine (22.4 acres), Pacific Nursery (21 acres), Wax Myrtle Ravine (6.4 acres), Hoffman Street (5 acres), Botanic Garden (4 acres -- within the Dairy Ravine site), Colma Creek (4.8 acres), and April Brook (3.6 acres). Since the time of the cutting, restoration work has been done on approximately 40 acres (Dairy Ravine, Botanic Garden, April Brook, Colma Creek, Hoffman Street, and part of Wax Myrtle Ravine). The remaining 23 acres are within Wax Myrtle Ravine and the Pacific Nursery site.

The restoration work has been a combined effort among TRA, San Mateo County Parks, the Friends of San Bruno Mountain, and Rana Creek Habitat Restoration Corporation. Detailed restoration plans for each site are described in the 1996 San Bruno Mountain Restoration Plan prepared by Paul Kephart. Habitat types being restored include mixed grassland, northern coastal scrub, and central coast riparian scrub. The plant list for each site was prepared based on the composition of adjacent native flora at each site. Plants to be used include the larval host plants and adult nectar plants of the Mission blue butterfly, the San Bruno elfin butterfly, and the callippe silverspot butterfly, as well as many other native grasses, herbs, and shrubs found on the Mountain.

1998 Summary of Restoration work

Restoration work in 1998 focused on eucalyptus herbicide treatment, stump lowering and grinding, slash burning, and continued replanting at the Botanic Garden site. Table B-3 in Appendix B shows a breakdown of restoration activities at each of the restoration sites.

Burning

In 1998 large piles of eucalyptus debris along the lower section of the Eucalyptus Loop Trail were burned, as well as isolated piles of debris within the Dairy Ravine restoration site. Eucalyptus debris on the north side of Guadalupe Canyon Parkway that had been piled from an earlier eucalyptus removal project in the early 1990's was also burned. The April Brook and Colma Creek sites are essentially clear of eucalyptus debris from prior burns conducted in 1995-1997.

Stump Lowering and Grinding

Over 250 stumps were ground in the past two years along the Old Eucalyptus Loop Trail and on the April Brook Trail. All large stumps within 50 feet on either side of the trails, and as well as many others throughout the sites were ground this year. Smaller stumps were lowered within the 50 foot zone by the CCC (Daly City crew of the Pacific Bays District of the California Conservation Corps). The CCC also cleaned up scattered wood debris near the trails and smoothed out disturbed areas created by the stump grinding work.

Herbicide

Herbicide weed control was done on approximately 12 acres, primarily at the Dairy Ravine, Wax Myrtle Ravine, and Hoffman Street sites. The primary targets at all sites are perennial weeds (i.e. eucalyptus, gorse, Himalaya blackberry, and cape ivy). Proliferation of annual weeds has occurred at all the restoration sites, especially at sites where intensive site preparation (discing) was done (e.g. Botanic Garden). Approximately 1 acre of invasive grasses was treated at the Botanic Garden in 1998.

Planting

Replanting has been done only at the Colma Creek and Botanic Garden sites with limited success. Due to the proliferation of exotic pest plants and weedy grasses, the Friends of San Bruno Mountain have adopted a planting island approach. Instead of trying to plant out large areas with natives and having to control weeds throughout, they are now focusing on establishing planting "islands" and controlling weeds within and around the islands as a first priority. Initially this seems to be working with Pacific stonecrop (host plant for the San Bruno Elfin butterfly) and other natives becoming successfully established on one such island in 1998.

The Botanic Garden was planted with approximately 2,000 plants by volunteers in 3 planting islands (wetlands, rocky outcrop/coastal meadow, and coastal scrub habitats) on "Restoration Day", December 6, 1998. Local schools that have participated on Restoration Day and other planting days throughout the year include Brisbane Elementary, Panorama Elementary, Lippman Middle School, and Jefferson High School (pers. comm. Kathy Manus, FSBM).

Future Restoration Objectives

- Hand weeding and herbicide work at all restoration sites
- Stump lowering and grinding at the Colma Creek site
- Slash burning of debris at the Wax Myrtle Ravine and Dairy Ravine site
- Removal of slash debris from the Hoffman site
- Grass seeding of open areas
- Controlled field burning, grazing, and/or mowing to reduce annual weeds
- Planting of native species with emphasis upon Lupines, Viola, and Sedum (and appropriate butterfly nectar plants) at suitable habitat locations

d. Special Projects

Special projects have expanded the exotics control work on the Mountain to new areas. Current projects include the Daly City/North Saddle Gorse project; the Guadalupe Valley Quarry broom project; and the Brisbane Transmission Line Ridge broom project. See Table B-4 in Appendix B. These cooperative projects are an important component in the overall weed control on the Mountain. Exotic pest plant infestations located on lands adjacent to conserved habitat provide a constant source of seed that spreads back into the habitat and compounds control efforts within the HCP area.

Daly City/ SBM Park Boundary Gorse Project

Large scale gorse removal was conducted this past year on the north slopes of the Saddle area of the park as part of the Daly City/ SBM Park boundary gorse project. Approximately 4 ½ acres of dense gorse was cleared by chainsaw work and by a mechanical brush cutter. This device (a Rayco T175 brushcutter) was used to cut and mulch gorse on slopes < 20°, and proved to be a very effective method of removing mature gorse infestations. Gorse on slopes steeper than 20° is being cut and piled at designated burn areas through a coordinated effort between TRA and San Mateo County Park staff.

The brush removal machine provides an important new tool in the eradication of exotic pest plants on San Bruno Mountain. The tool cuts through dense scrub, mulches, and disturbs the soil less than discing. It is extremely useful in providing access to areas that would otherwise be inaccessible to herbicide crews. These recently opened areas will need consistent annual follow-up herbicide work to control gorse seedlings and stump sprouts. Grass seeding of open areas may also be needed in certain areas to provide erosion control and inhibit gorse re-invasion.

e. Assessment of Native Scrub Expansion on San Bruno Mountain

To date, the primary tools used in managing the ecological plant communities of San Bruno Mountain State and County Park have been herbicide or hand labor. These methods have been effective at controlling the spread and/or reducing the amount of target species such as gorse, French broom, eucalyptus, pampas grass, Portuguese broom, and others. These highly invasive species have been seen as the greatest threat to the native plant communities and endangered species on the Mountain. As a result, control efforts have focused on these species since the inception of the HCP in 1983. However, other types of vegetative changes have occurred on the Mountain and are impacting the native plant communities and the endangered butterflies. One or more of these changes are occurring simultaneously in many areas of the Mountain. This section describes these changes and proposes a more comprehensive vegetation management program that incorporates the additional tools of grazing and fire to manage the San Bruno Mountain ecosystem and optimize endangered butterfly habitat.

Four types of vegetation changes are occurring on San Bruno Mountain:

1) Invasive of exotic perennial shrubs and trees (Gorse, French broom, eucalyptus, etc.) replacing grassland and coastal scrub,

2) Invasion of native coastal scrub replacing mixed native/non-native grassland,

3) Invasive of European grasses and forbs replacing native grassland, and

4) Senescence of coastal scrub (*Ceanothus* and *Arctostaphylos* of primary concern).

Transition of Vegetation Communities on San Bruno Mountain

Coastal scrub is found in areas where soils are deeper and the climate tends to be cooler and wetter. Alternatively grassland is favored in areas that have thinner soils and warmer and drier micro-climates. The Mountain generally transitions from coastal scrub to grassland from west to east. Juxtaposed on this pattern is the dominance of coastal scrub on north-facing slopes and within ravines, while grassland dominates south-facing slopes and ridge lines.

Comparisons of an early photogrammetric Forest Service Map with 1981 air photos showed that the contiguous natural lands on San Bruno Mountain diminished by 30 percent from 1930 to 1981, with the greatest loss in the extent of grassland. Of 4,047 acres of grassland present around 1930, 1,811 acres remained in 1981 (Reid, 1986). Roughly half of the loss resulted from urban development; the other half of the loss resulted from expansion of both native and non-native brush communities.

Coastal Scrub Expansion

A reassessment of aerial photographs from 1935 to 1997 confirms the earlier conclusions and shows further expansion of coastal scrub on San Bruno Mountain. The most dramatic changes have occurred on lower north-facing slopes along the entire main ridge line. These areas are likely to be predisposed toward coastal scrub succession due to greater moisture and deeper soils than south-facing slopes. Some of these former grassland areas did contain endangered butterfly habitat (i.e. Mission blue and callippe silverspot) as recently as 1983, but have since converted to coastal scrub. An estimated 25-50% of the lower 300 - 500 feet of these slopes (several hundred acres) has succeeded from grassland to coastal scrub in the past 60 years (Figure 10).

In contrast, south-facing slopes on the northeast ridge and south slope appear to have retained most of their grassland habitat over the last 60 years. Scrub expansion has occurred yet appears to be limited to ravines and a few isolated areas such as the Hillside School/Juncus Ravine area. An estimated 5-10% of grassland habitat on south facing slopes on the Mountain has converted to coastal scrub.

Coyote brush (*Baccharis pilularis*), bracken fern (*Pteridium aquilinum*) and California sagebrush (*Artemisia californica*) are found in grassland, coastal scrub, and oak woodland habitats (Reeburg, 1987). These three species are probably initial invaders of the grassland, their importance varying on different sites on the mountain. Coyote brush is the most common and prolific invader, although sticky monkey flower (*Mimulus aurantiacus*), bracken fern, California sagebrush, and poison oak (*Toxicodendron diversilobum*) also play prominent roles in succession throughout the mountain.

Coyote brush is a wind dispersed species, which is also capable of resprouting following a fire, after approximately five years of growth (Reeberg, 1987). In most areas of the Mountain, coyote brush moves into areas by establishing itself in a random pattern rather than moving as a front. Providing that these plants are not killed through grazing or fire, the landscape begins to fill in and coastal scrub takes form.

Cattle grazing ceased on the Mountain in the 1940's and deer were extirpated from the Mountain by the 1960's. The absence of large native grazing animals and the cessation of livestock grazing on the Mountain are likely the most important reasons for the expansion of coastal scrub on the Mountain, although the reduction in fire frequency may also play a role.

Expansion of European Grasses and Forbs

European grasses such as ryegrass (*Lolium multiflorum*), wild oat (*Avena sp.*), ripgut brome (*Bromus diandrus*), rattlesnake grass (*Briza maxa*), velvet grass *(Holcus lanatus*) and several others are widespread and dominate much of the grassland habitat areas on San Bruno Mountain. Native grass populations are still prevalent in many areas of the Mountain, but they appear to be continually losing ground to the invasive annuals.

Besides being the native habitat for the endangered Mission blue and callippe silverspot butterflies, native grasslands have other benefits. Perennial grasses have greater capacity to stabilize surface and sub-soils. Once established, they hold nutrients more tightly and recycle them more efficiently than annuals. They are less flammable than alien annuals, and they help to build soil organic matter, thereby increasing site fertility and sustained productivity. Additionally, they present an aesthetically pleasing textured landscape appearance and increase the biodiversity of the flora and associated fauna. Unfortunately, perennial grasses are slower than many alien annuals in establishing themselves.

In addition to exotic grasses, introduced forbs such as bristly ox-tongue, wild lettuce, Italian thistle, bull thistle, and filaree are a few examples of over 30 forbs that have invaded San Bruno Mountain. These tenacious invaders have received localized hand removal efforts within some areas of butterfly habitat, but are often not controlled in many areas because of their low priority. The impact of these species upon the native habitat is likely to vary among species, with the higher density species having more of an impact. For example, rosette-forming forbs such as filaree can block emerging perennial grass seedling emergence, therefore reducing native seedling growth rates (Menke, 1992).

Senescence

Paul Reeberg found that the ceanothus chaparral (*Ceanothus thyrsiflorus*) on the north side of Radio Ridge had increased in net acreage (1987). The increase in area of the ceanothus was probably due to a large, hot fire that took place in 1964, providing the heat pulse that released the large seedbank upslope from the original stand out of its dormant state. At the time of the report there were no plants younger than 10 years old. If fires occur in this area at regular intervals (20-80 years), the population will maintain itself indefinitely. As of 1998, the ceanothus colony has not burned for 34 years, and significant dieback is now evident throughout the colony.

The manzanita (*Arctostaphylos sp.*) colonies on the Mountain have not shown the same level of senescence as the ceanothus, but some or all of these species may also need some type of management (i.e controlled burning) to reinvigorate aging

populations. More research needs to be conducted to determine how each Manzanita species responds to burning.

3. Development Activities

Incidental take of habitat for the Mission blue butterfly on San Bruno Mountain was authorized under the Endangered Species Act Section 10(a) Permit PRT 2-9818. Figure 11 shows the land status of parcels as of December 1998. The only development related activity which may have resulted in take of the Mission blue butterfly occurred during installation of an authorized water line for the Northeast Ridge project. No take of the callippe silverspot occurred. The following is the status of the major development projects on the Mountain:

* The Northeast Ridge project (A.P. 1-07) continued home building in the Phase 1 area and many of the completed homes have become occupied. A new water line was installed.

* The Terrabay project site (2-04) continued home construction and new residents have moved in. A Draft EIR for Phases 2 and 3 of the project was distributed for public review.

* The final home construction phase of the Golden Hills at Bay Ridge (1-01) in Daly City is in progress and is expected to be completed in 1999.

The 1999 San Bruno Mountain HCP Operating Program is included as Appendix C to this report.

Bibliography and References

Klein, Janet. Mission Blue Monitoring Project Supervisor for Golden Gate National Recreation Area, National Park Service. Personal Communication, 1998.

Manus, Kathy. Co-Founder, Friends of San Bruno Mountain. Personal Communication 1998.

Menke, John M., 1992. Grazing and Fire Management for Native Perennial Grass Restoration on California Grasslands, Fremontia. Volume 20, No. 2. April 1992.

National Park Service. 1996 Survey of the Endangered Mission Blue Butterfly on the Marin Headlands. Golden Gate National Recreation Area. Report prepared by V. K. Rashbrook, and J. H.Cushman.

Reeberg, Paul. 1987. A Study of Brush Succession on San Bruno Mountain. 1987 San Bruno Mountain Area Habitat Conservation Plan Activities Report, Appendix C. San Mateo County.

Reid, T.S. & Walsh, R.C., 1986. Habitat Reclamation for Endangered Species on San Bruno Mountain. Presentation given at the California Native Plant Society

Conference, 1986. Published in 1986 San Bruno Mountain Area Habitat Conservation Plan Activities Report, Appendix C. San Mateo County.

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City of South San Francisco Public Works Department
City of Brisbane Public Works Department
San Mateo County Department of Public Works

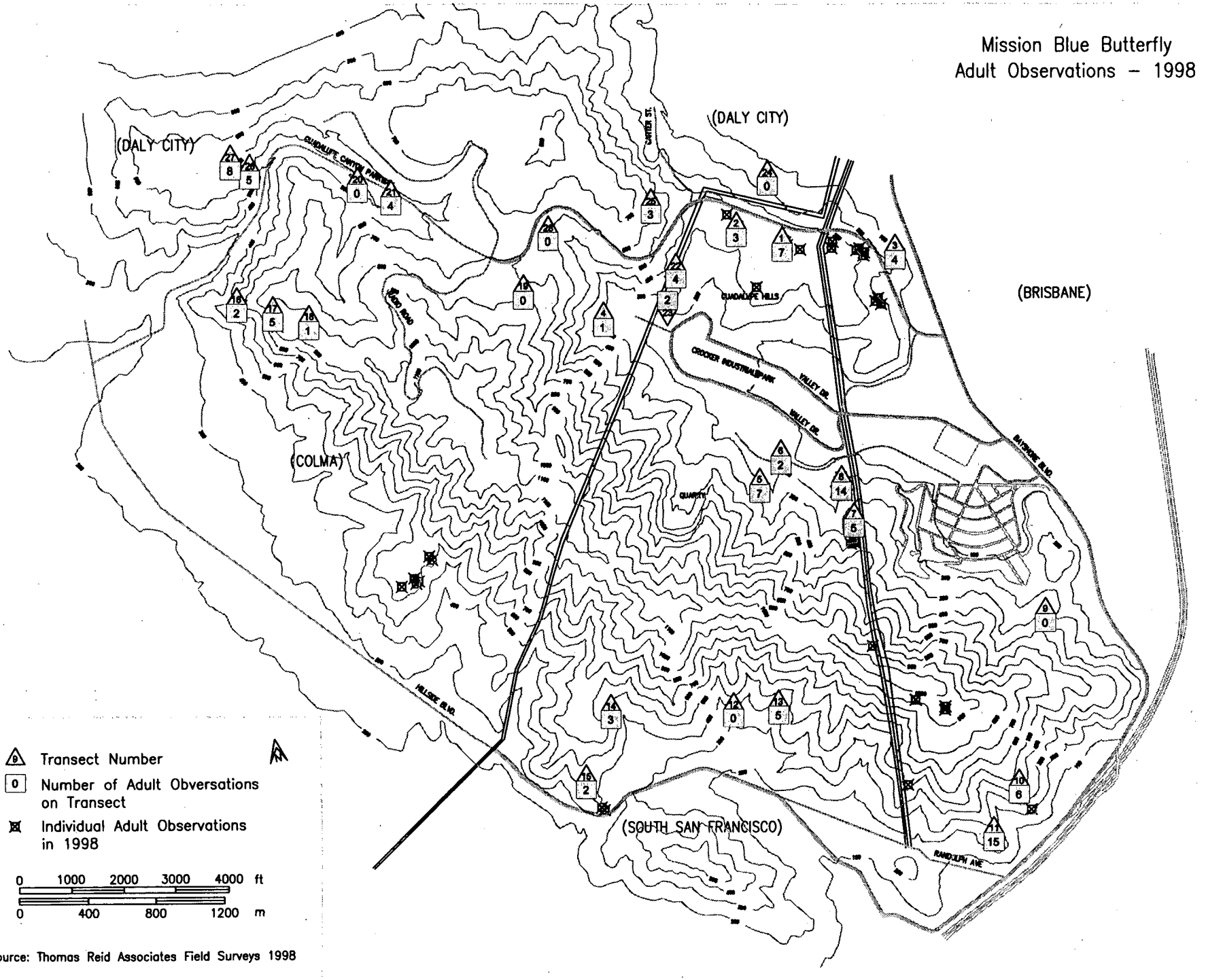


Figure 1 — Mission Blue Butterfly Transect Numbers and Adult Observations — 1998

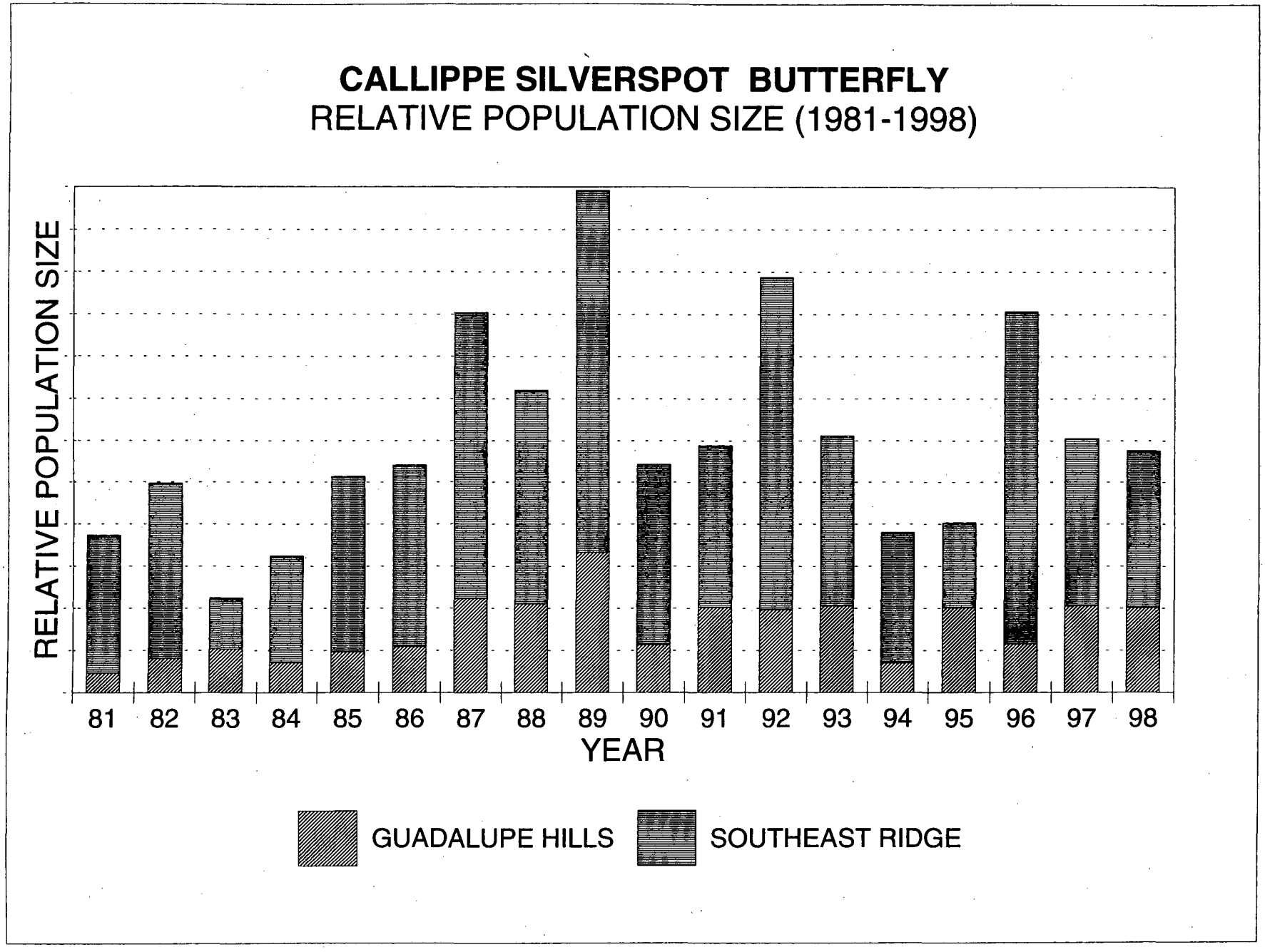
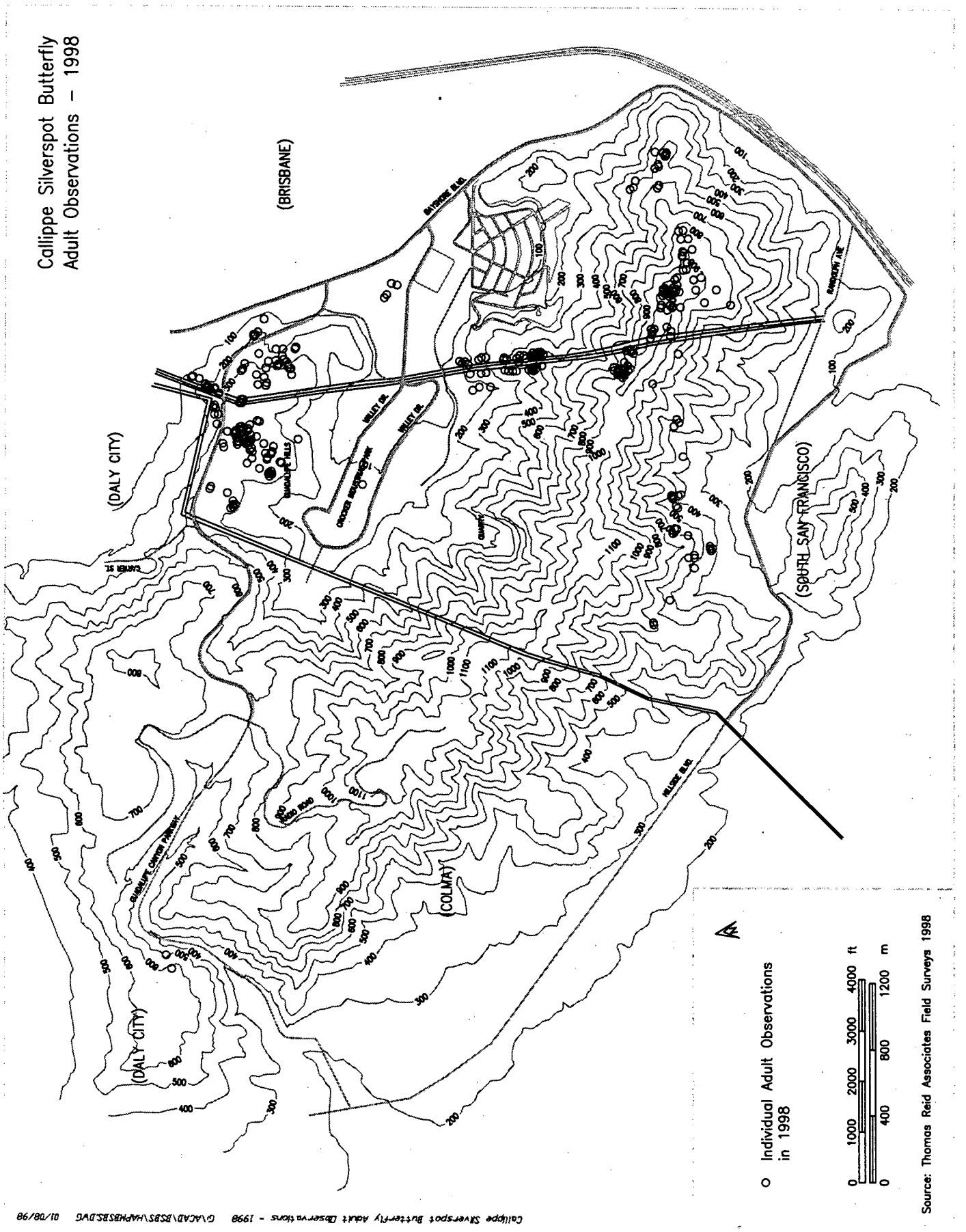


Figure 2 — Callippe Silverspot Butterfly Relative Population Size (1981-1998)

Figure 3 — Callippe Silverspot Butterfly Adult Observations — 1998



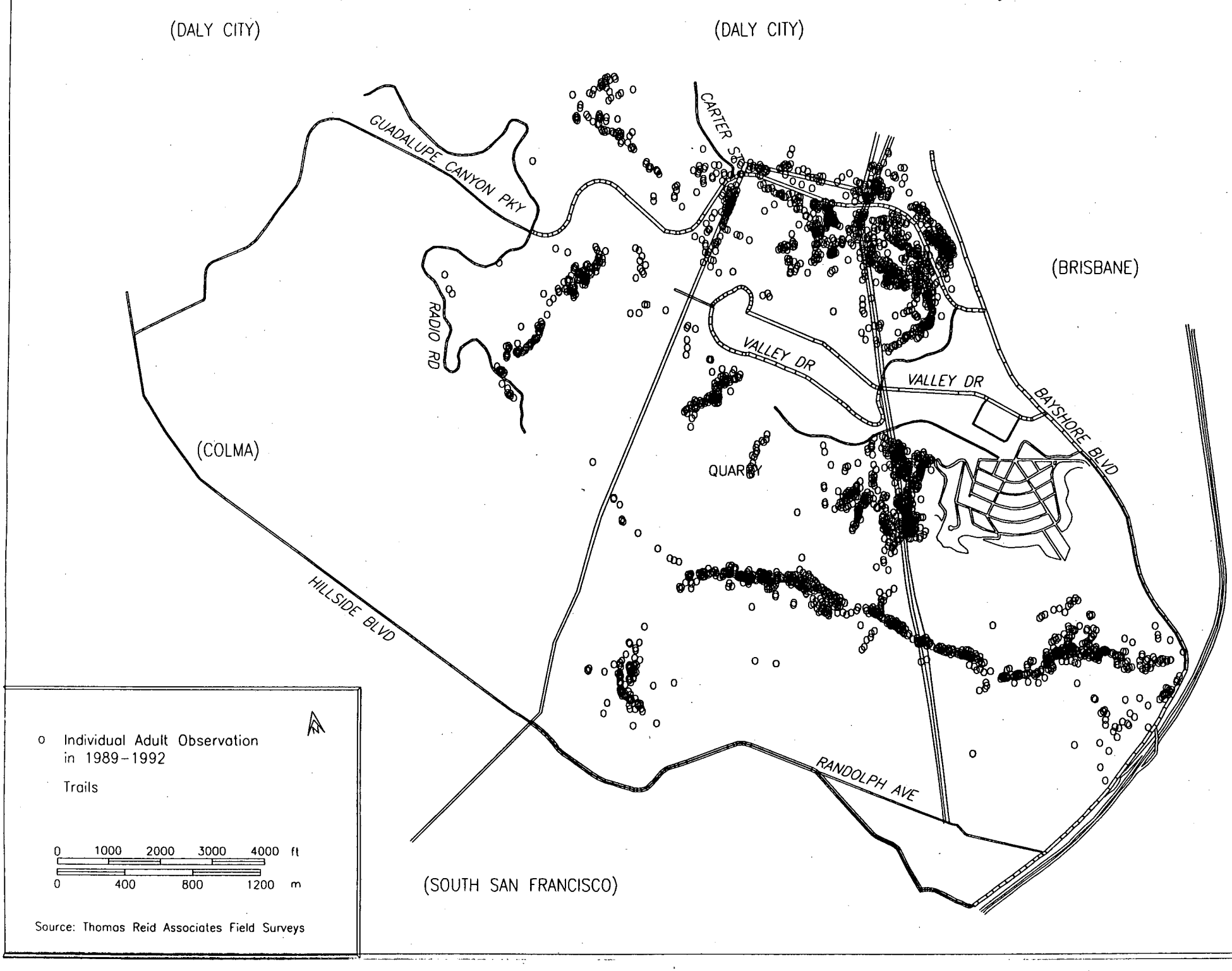


Figure 4 — Callippe Silverspot Butterfly Adult Observations — 1989 to 1992

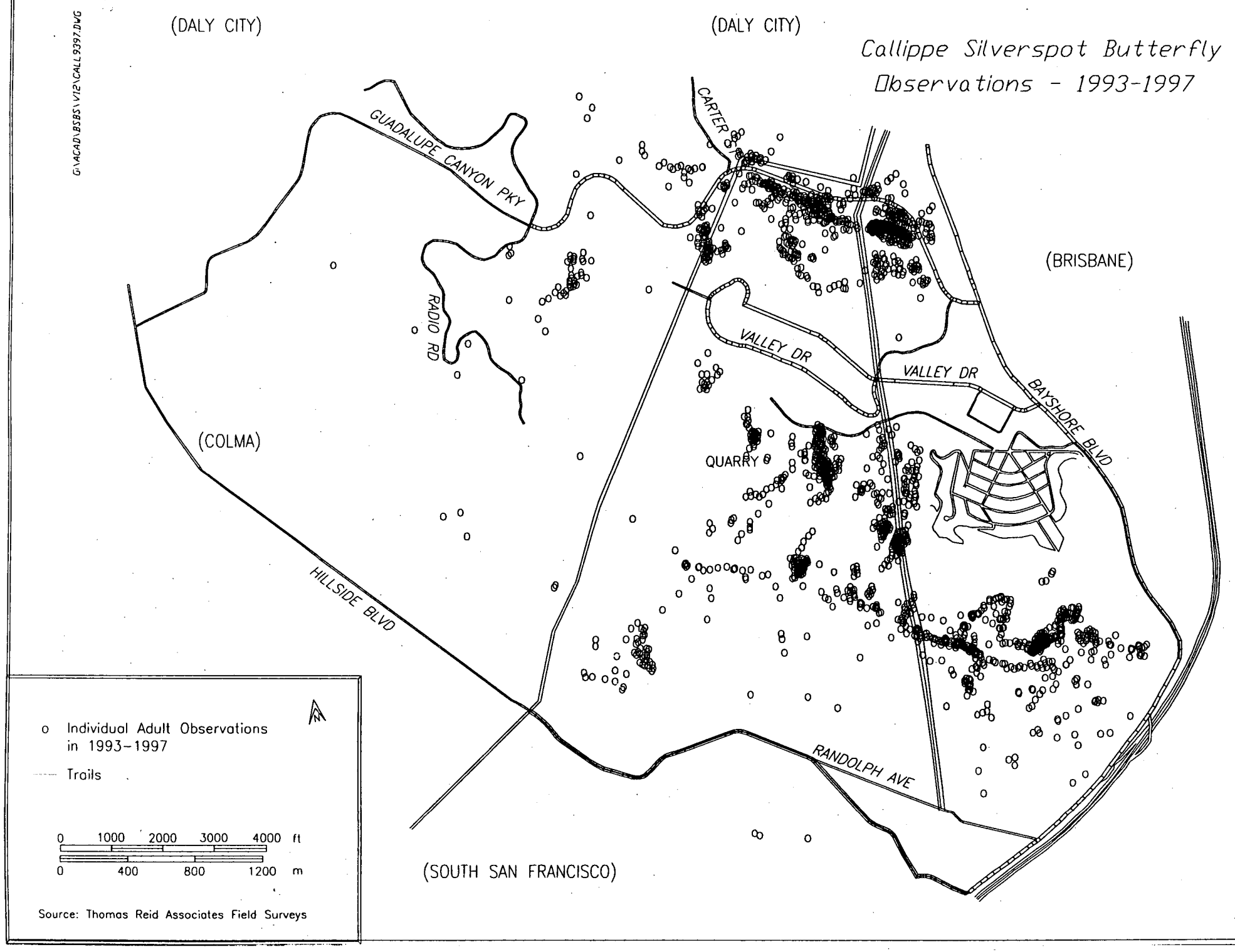
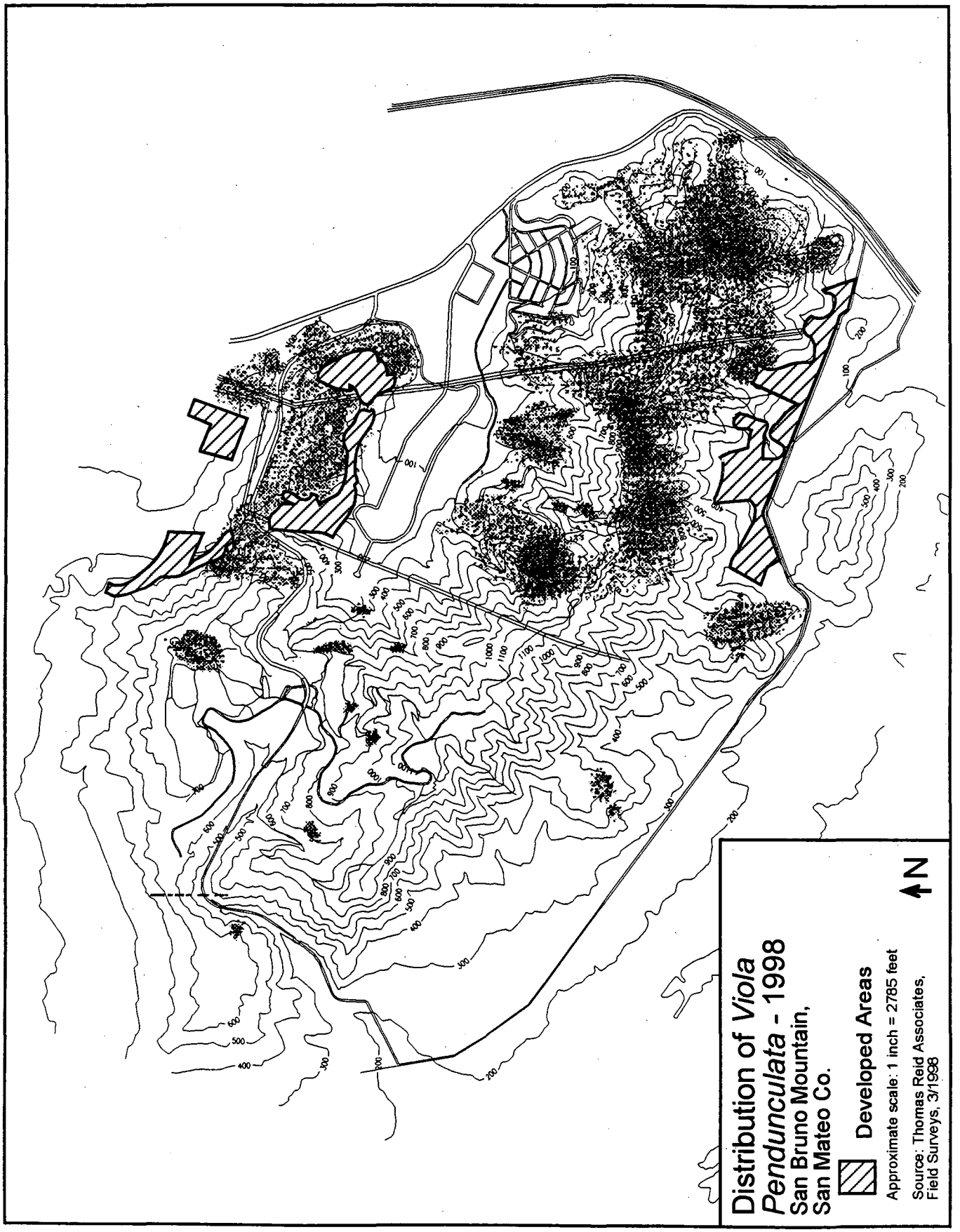
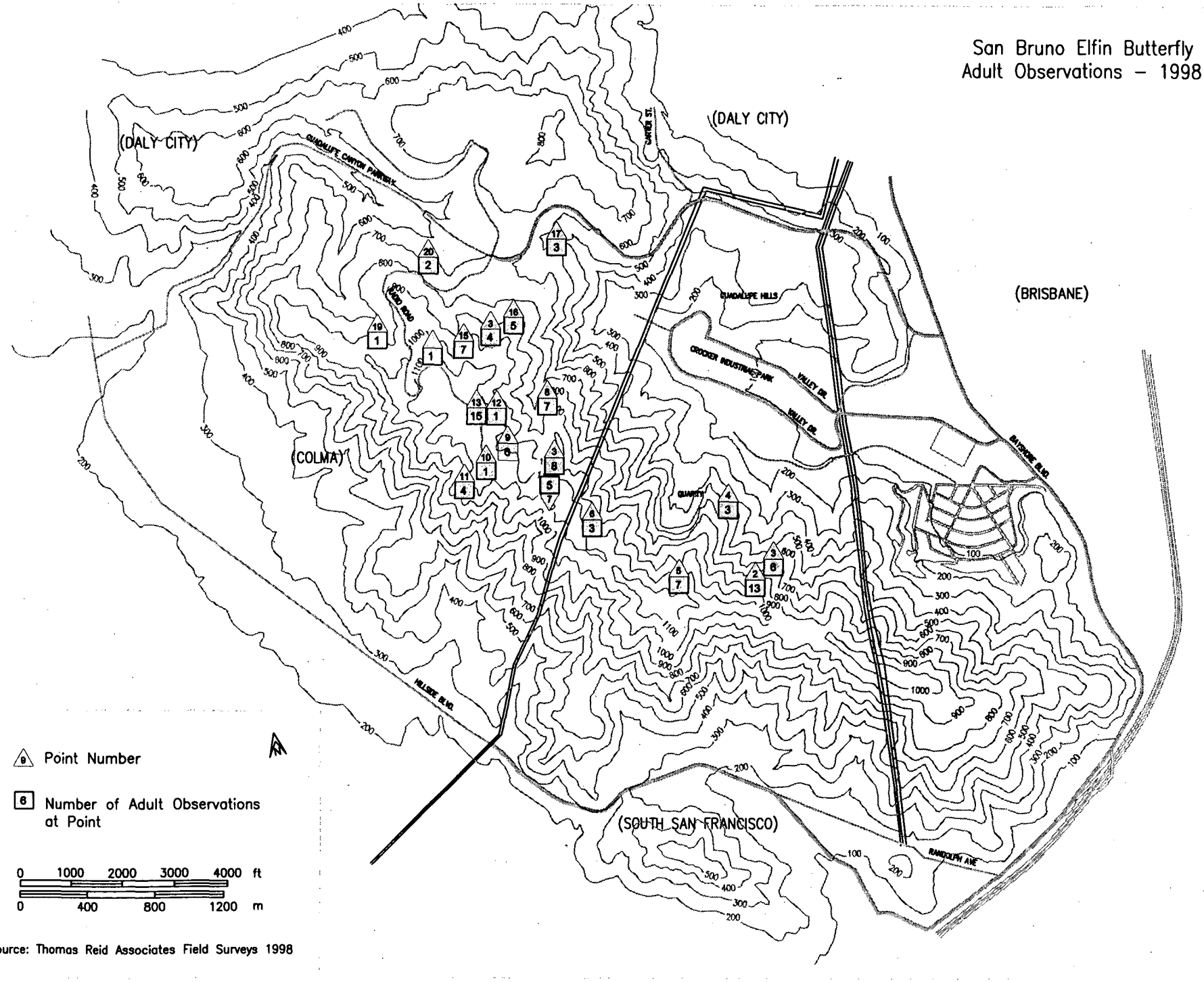


Figure 5 — Callippe Silverspot Butterfly Adult Observations — 1993 to 1997

Figure 6 — Distribution of *Viola Pedunculata* — 1998





Source: Thomas Reid Associates Field Surveys 1998

San Bruno Butterfly Adult Observations - 1998 G:\ACAD\BSBS\HAPMBSBS.DWG 01/27/99

Figure 7 — San Bruno Elfin Butterfly Point Numbers and Adult Observations — 1998

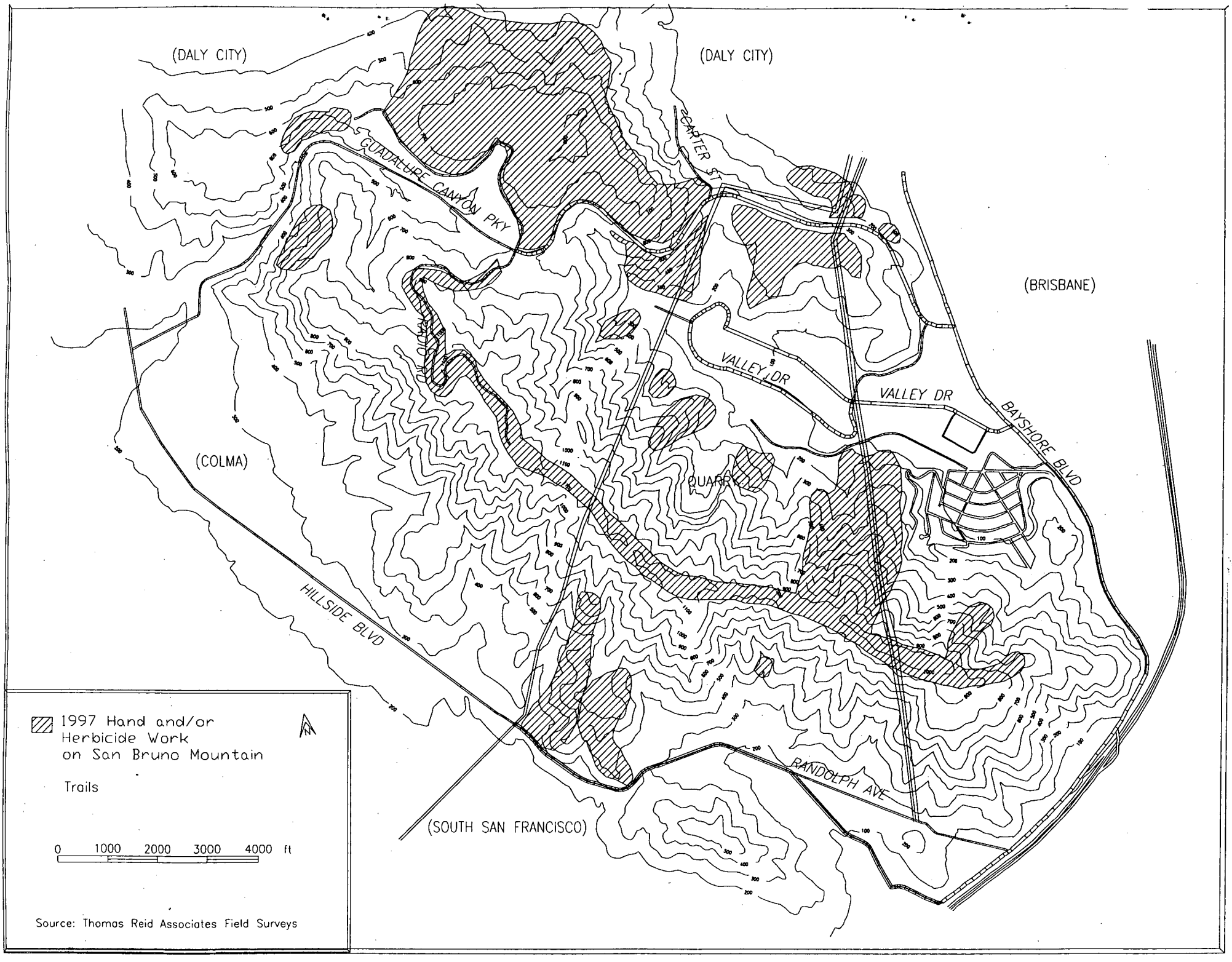


Figure 8 — Hand and Herbicide Exotics Control Work — 1998

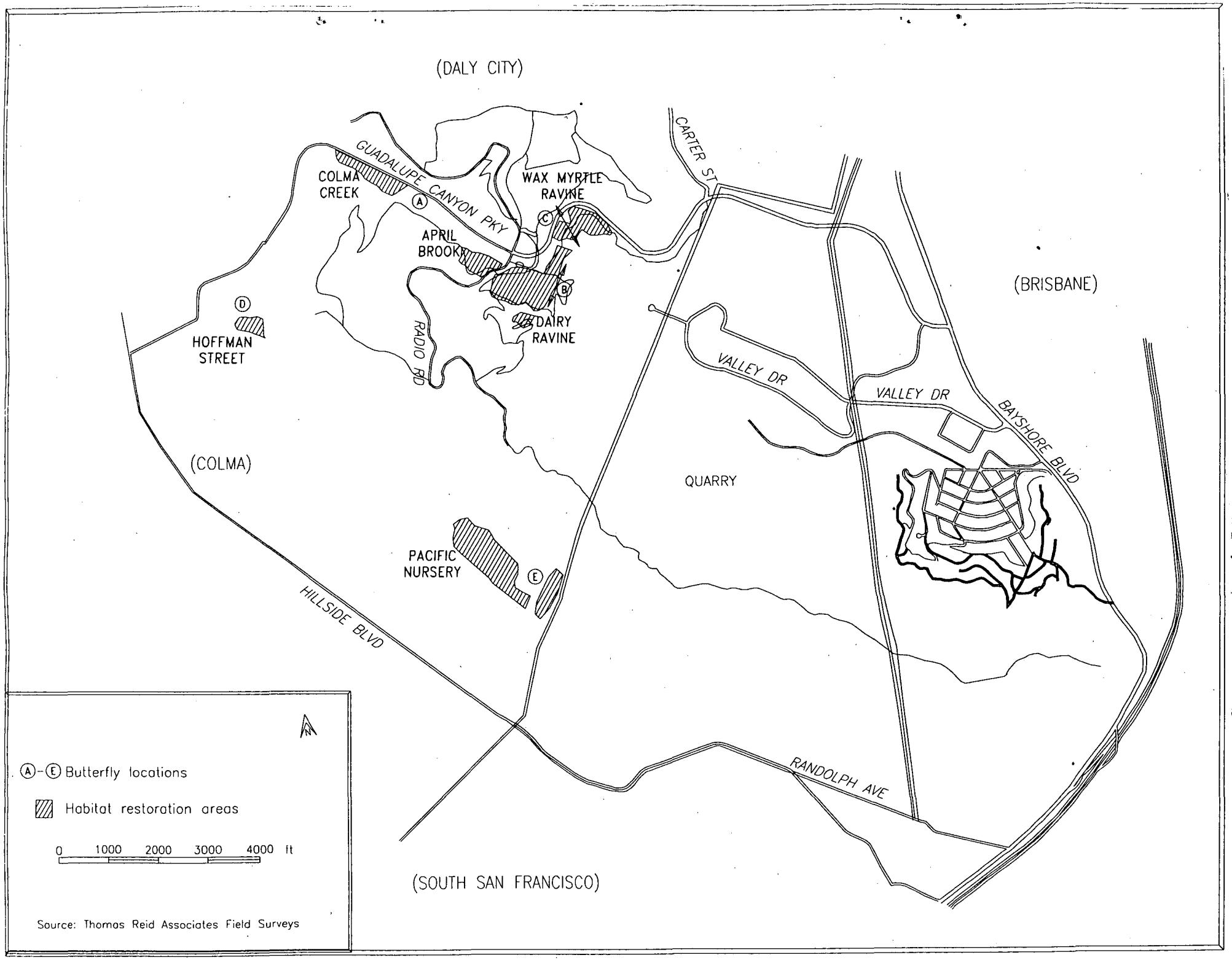
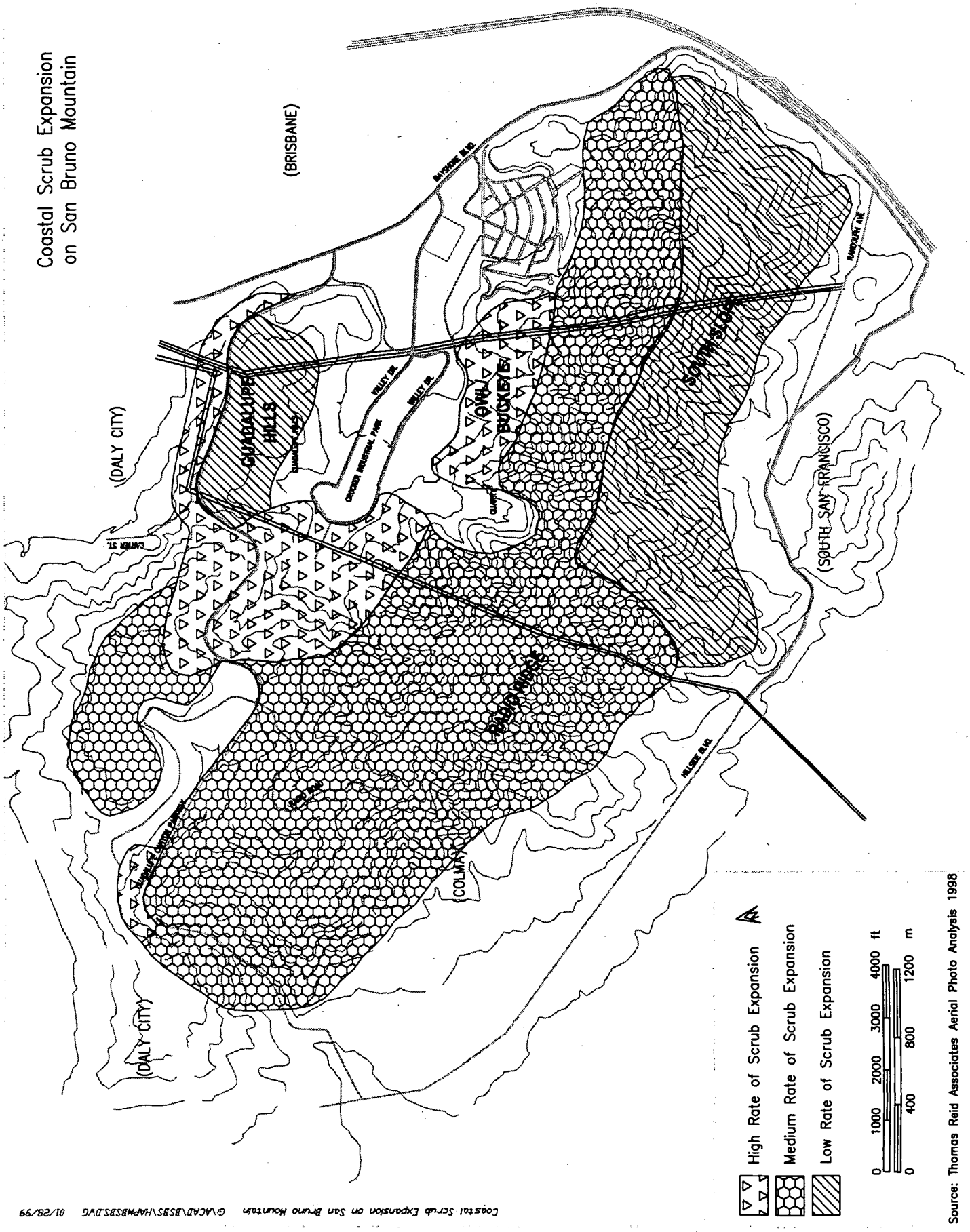


Figure 9 — Restoration Area on San Bruno Mountain

Figure 10 — Coastal Scrub Expansion on San Bruno Mountain



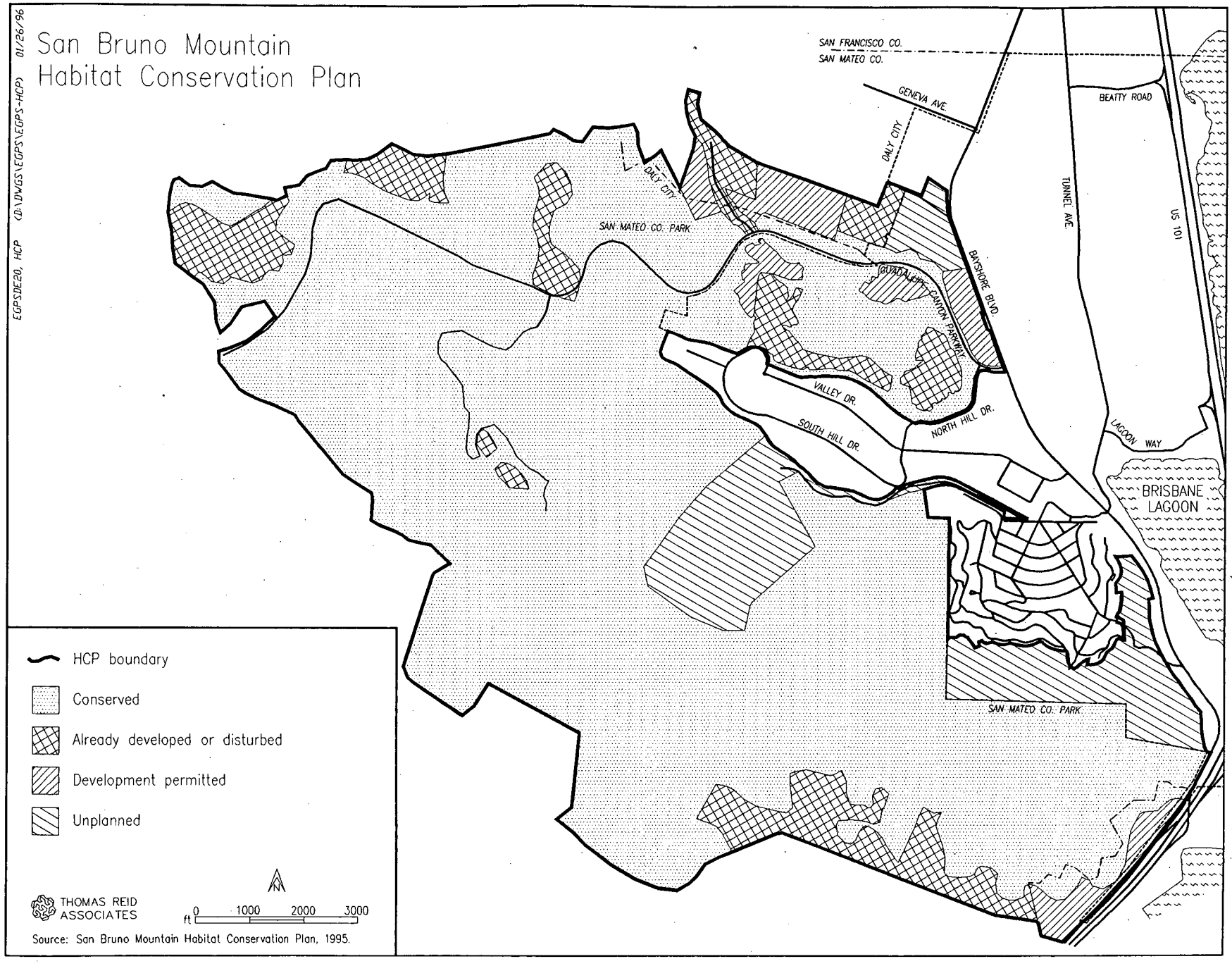


Figure 11 — 1998 Parcel Status

APPENDIX A
TABLE A-1
1998 BUTTERFLY FIELD DATA SUMMARY

MISSION BLUE BUTTERFLY

Transect Number	Transect Attempts and Sightings	Incidental Sightings	Total Mission Blue Sightings	Location
1	0,0,0,0	4,3	7	Northeast Ridge
2	2,0,0,0,0	1	3	Northeast Ridge
3	0,1,2,0	1	4	Brisbane Office Park
4	0,0,1,0		1	Butler Paper
5	0,1,2,4		7	Owl Canyon
6	0,2,0		2	Owl Canyon
7	3,0,0,0	2	5	Transmission Line Ridge
8	0,2,2,0	1,3,2,4	14	Transmission Line Ridge
9	0,0,0,0		0	Above Brisbane
10	2,3,0,0	1	6	Above Terrabay Phase 3
11	3,4,0,2	3,1,1,1	15	Trash Terrace, Terrabay
12	0,0,0,0		0	Above Goat Farm, Terrabay
13	02,3,0		5	Above Goat Farm, Terrabay
14	0,1,0	2	3	Upper Juncus Ravine
15	0,0,0	2	2	Lower Juncus Ravine
16	0,0,2,0		2	Above Olivet Ravine
17	02,2,0	1	5	Above Serbian Ravine
18	0,0,1,0		1	Nike Road
19	0,0,0		0	Dairy Ravine
20	0,0		0	Colma Creek Euc. Area
21	3,1,0		4	Colma Creek Natural Area
22	0,2,1	1	4	Brisbane Water Tank
23	0,2,0		2	Brisbane Water Tank
24	0,0,0		0	Linda Vista

Transect Number	Transect Attempts and Sightings	Incidental Sightings	Total Mission Blue Sightings	Location
25	0,0,0,0,0	1,1,1	3	East Saddle Above Carter Street
26	2,3,0,0		5	Pointe Pacific Lower
27	2,3,0,0	3	8	Pointe Pacific Upper
28	0,0,0,0		0	Wax Myrtle Ravine
Other		6	6	4/26 Hill South of Golf Course
Other		4	4	5/31 Northeast Ridge
Other		4	4	6/14 Southeast Ridge
Other		1	1	6/15 Above Terrabay Phase 3
Other		5	5	6/20 Northeast Ridge
Other		2	2	6/20 Brisbane Office Park
Other		1	1	6/21 Southeast Ridge Trail
Other		1	1	6/26 Northeast Ridge
TOTAL	68	64	132	

Number of Mission Blue By Planning Area

Southeast Ridge	65
Main Ridge	4
Buckeye Canyon	19
Owl Canyon	9
Juncus Ravine	5
Above Terrabay	28
Saddle	16
Saddle	3
Pointe Pacific	13
Guadalupe Hills	33
Northeast Ridge	20
Brisbane Office Park	6
Butler Paper	1
Brisbane Water Tank	6
Radio Ridge	18
Colma Creek	4
Nike Base	8
Above Golf Course	6

TABLE A-2
CALLIPPE SILVERSPOT BUTTERFLY

DATE	LOCATION	ELAPSED TIME	NUMBER OBSERVED	WEATHER CONDITIONS
531	Northeast Ridge	2.0	8	Temp: 60's Wind: 5-15
614	Southeast Ridge	4.00	13	Temp: 70's Wind: 5-10
615	Southeast Ridge	2.00	5	Temp:80's Wind: 5-20
616	Tank Ravine	1.50	7	Temp: 70's Wind: 5-20
618	Northeast Ridge	1.00	7	Temp: 60's Wind: windy
620	Northeast Ridge and Brisbane Office Park	4.00	33	Temp: Sunny Wind: ?
621	Southeast Ridge	3.50	28	Temp: 60-70 Wind: ?
626	Northeast Ridge	2.00	38	Temp: low 70's Wind: 0-10
706	Northeast Ridge	1.00	9	Temp: ? Wind: windy
706	Linda Vista	1.00	13	Temp: ? Wind: windy
706	East Saddle	0.50	3	Temp: ? Wind: windy
711	Owl/Buckeye and Transmission L R	4.00	45	Temp: 70's Wind: 0 - 5 mph
713	Above Brisbane	1.50	5	Temp: ?, clear Wind: windy
715	Southeast Ridge Trail	5.00	58	Temp: ?, sunny and hot Wind: 0-5 mph
TOTAL	ALL AREAS	33.000	272	= 8.2 Sightings Per Hour

TABLE A-3
SAN BRUNO ELFIN BUTTERFLY

Transect Number	Transect Attempts and Sightings	Incidental Sightings	Total Elfin Sightings	Location
1	0,0	0	0	Above Brisbane
2	0,0,2,0	11	13	Above #3 at Ridge Trail
3	1,2,0	3	6	Above Buckeye Canyon
4	1,2,0	0	3	Above Owl Canyon
5	1,3,1,0	2	7	Above Quarry, Southeast
6	1,0,0	2	3	Above Quarry, Northwest
7	0,4,1	8	13	North of #6 at Ridge Trail
8	1,2,0	4	7	Above Devil's Arroyo
9	0,3,1,1	1	6	West of #8
10	0,0,0	1	1	West of #9 at Ridge Trail
11	0,0,1,0	3	4	North of #10 at Ridge Trail
12	0,1,0	0	1	Below Building E, Watson
13	0,3,4,0	8	15	The Summit, Watson
14	0,0,0,0	0	0	Lone Pine Road
15	2,1,0,1	3	7	Below Kamchatka Point
16	2,0,0	3	5	East of Dairy Ravine
17	0,0	3	3	Wax Myrtle Ravine
18	0,0	0	0	Old Quarry Across from School
19	1,0,0	0	1	Reeberg Spot
20	0,0,0,0	2	2	Middle Radio Road
21	0,0,0	0	0	April Brook Trail
Other	-	1	1	Horseshoe Ridge
Other	-	5	5	Between # 15 and #16
TOTAL	42	60	103	

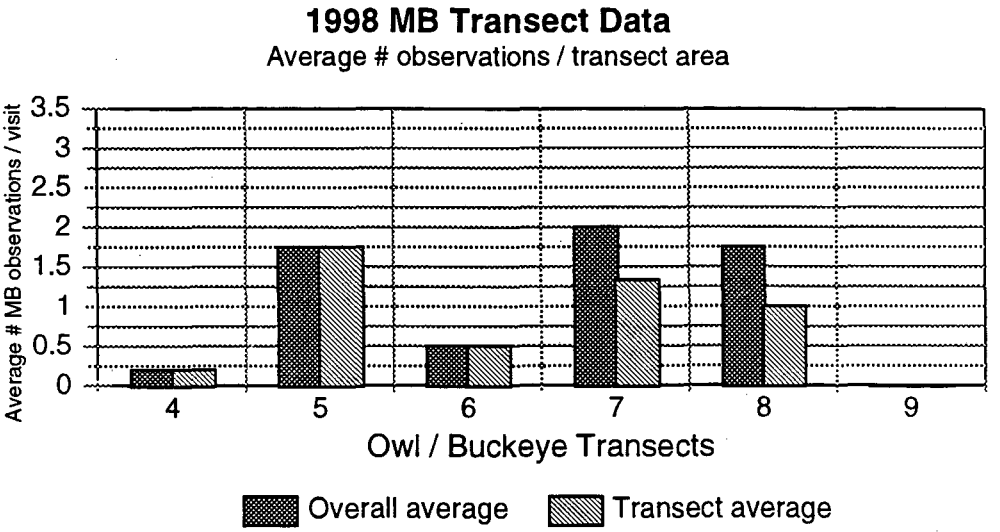
Formula for Determining Relative Population Size For Callippe Silverspot Butterfly

The productivity ratio, the ratio of sightings to hours spent, is the measure of density. Density is expressed as sightings/hour (S/H). The productivity ratio is directly proportional to density, related by a constant. The Area (A) of grassland in the colony is the measure of the total resource in a colony. The product of density (sightings/hour) times Area yields a measure of the insects present. The actual value of the product has no direct meaning -- it is related to the true number of insects by an unspecified constant. However, if the product for the various colonies is summed and the product for one colony is expressed as a percentage of the total, then the unspecified constant cancels out. The result is a valid estimate of the proportion of all insects in the colony.

For the callippe, the productivity ratio formula was applied to the 1998 butterfly counts for the following regional categories. All conserved habitat is included within these regional categories.

Colony	**Sightings per Hour**	**Area** (hectares)	**A x S/H**	**% of Population**
Guadalupe Hills	9.7	207	2008.0	35%
Southeast Ridge	7.5	500	3750.0	65%

Graph A-1 a



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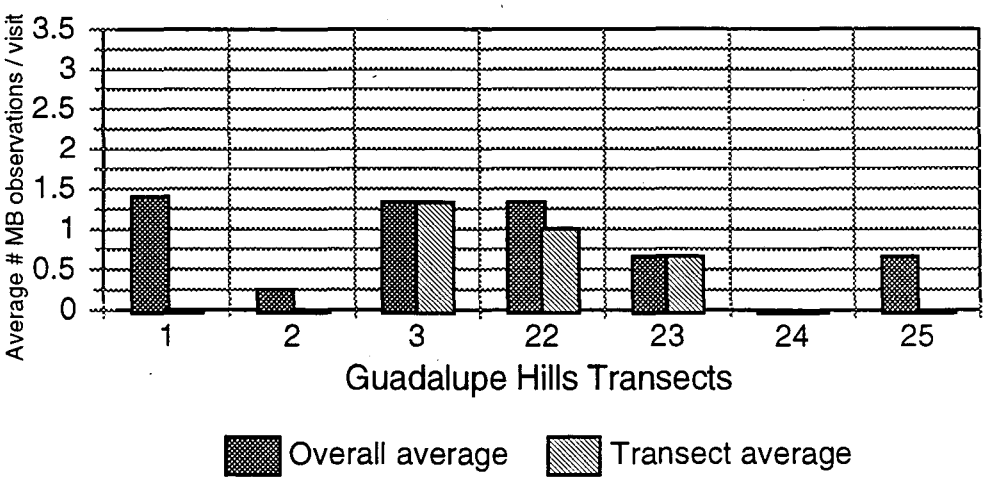

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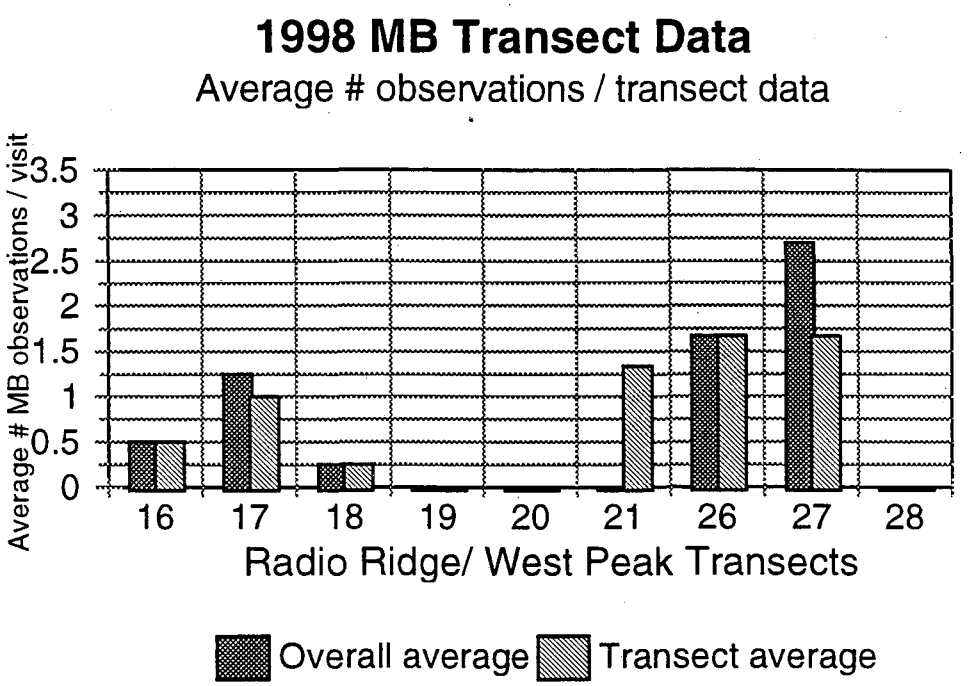

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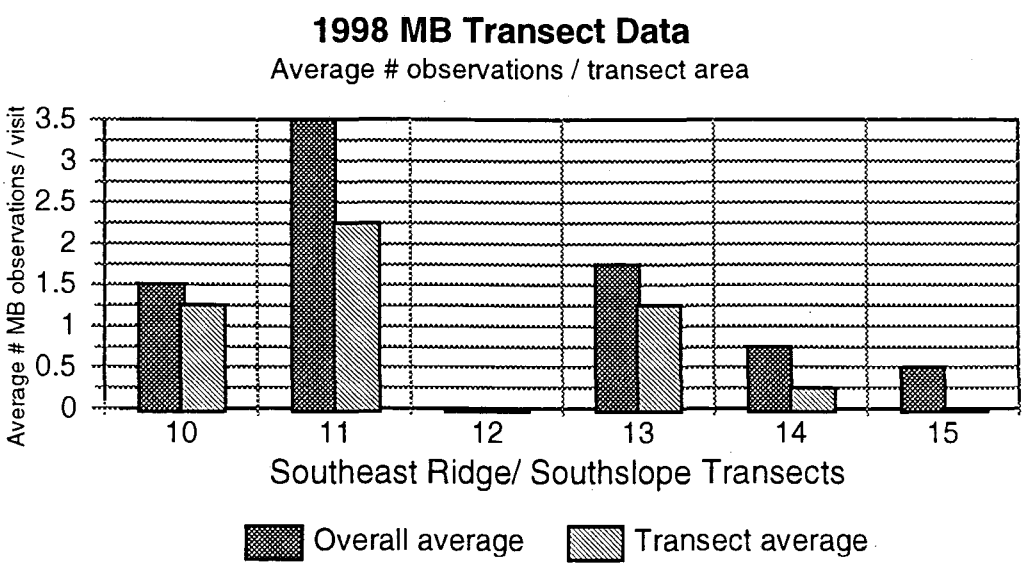
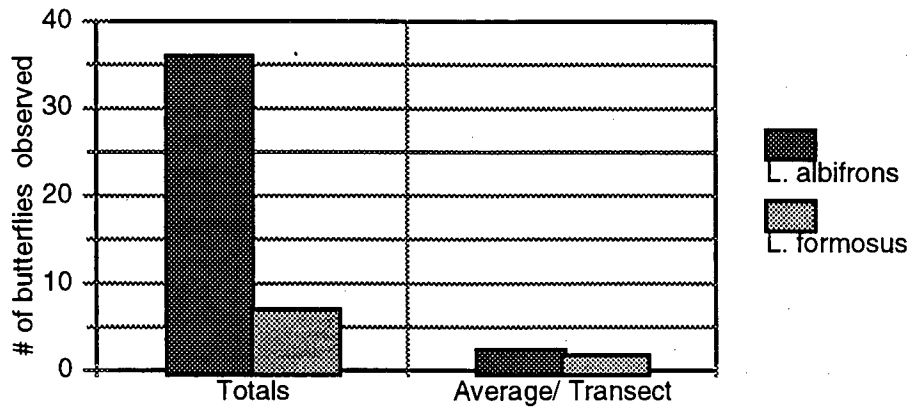


Graph A-2

1998 MB Transect Data

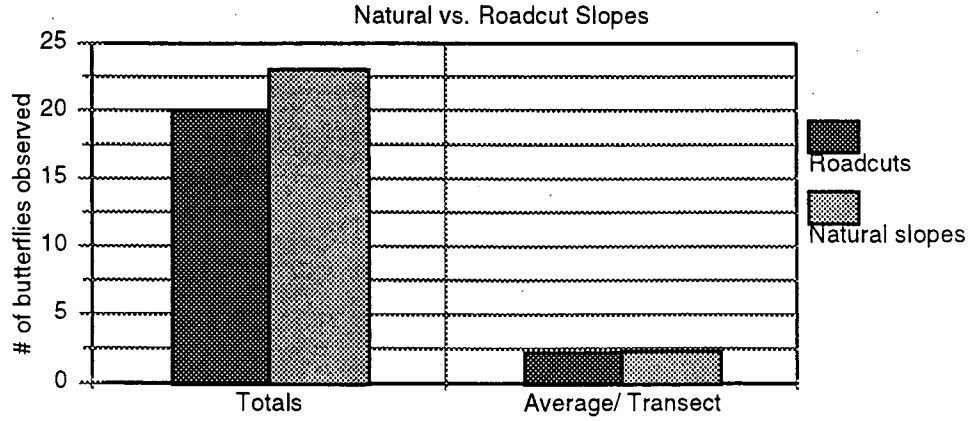
Host Plant Types



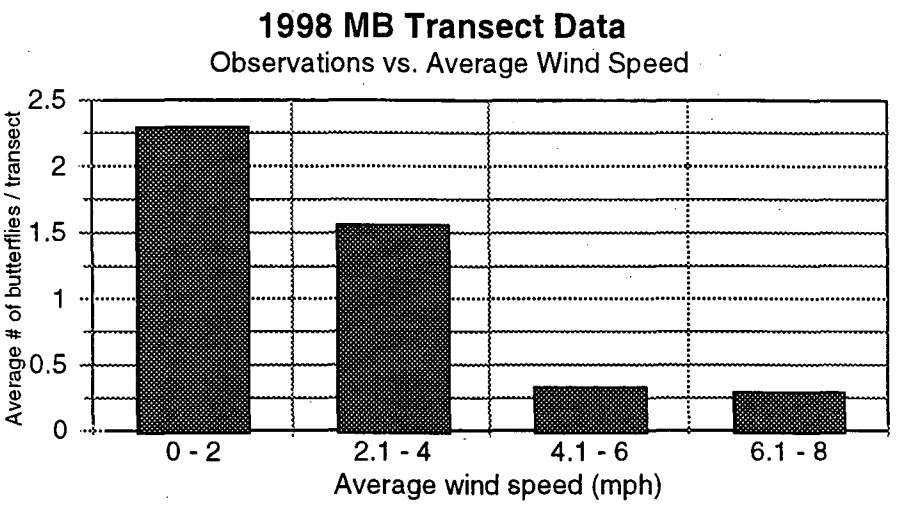
Graph A-3

1998 MB Transect Data

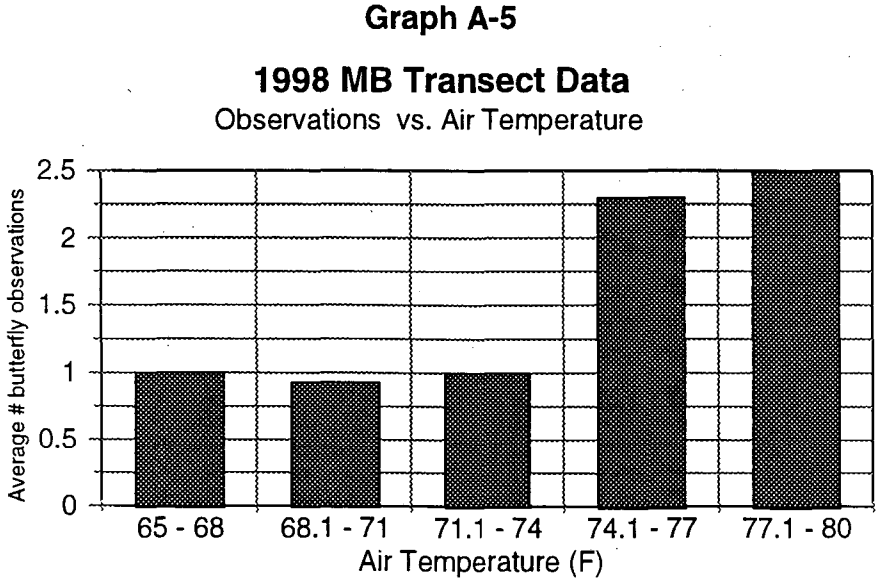
Natural vs. Roadcut Slopes



Graph A-4



Graph A-5



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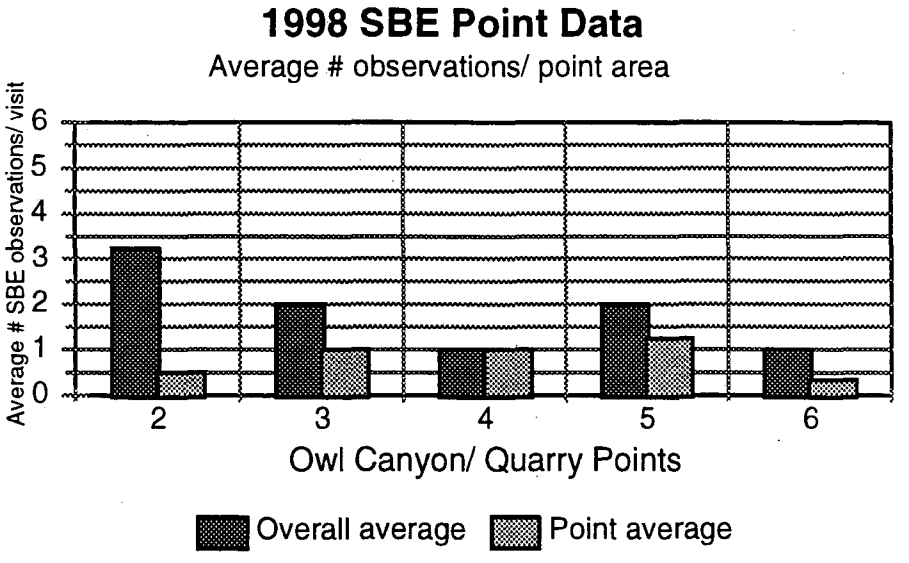

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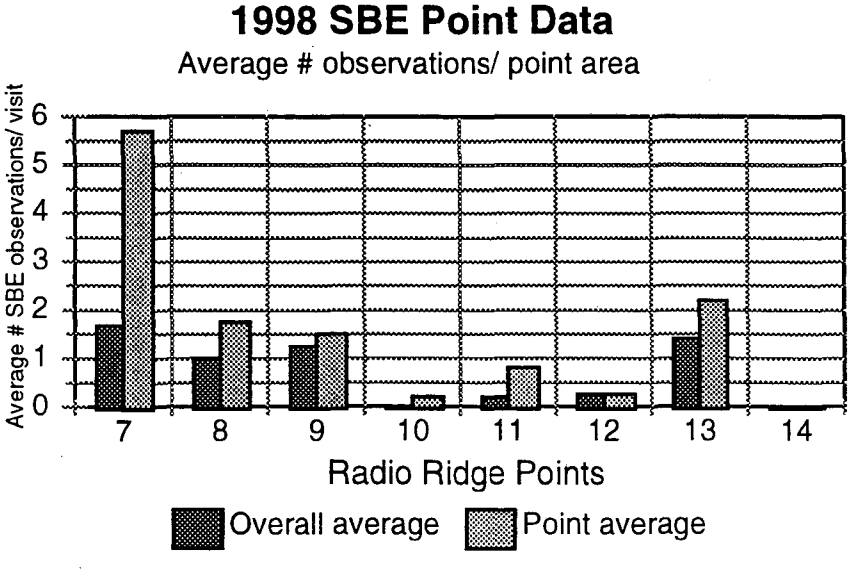

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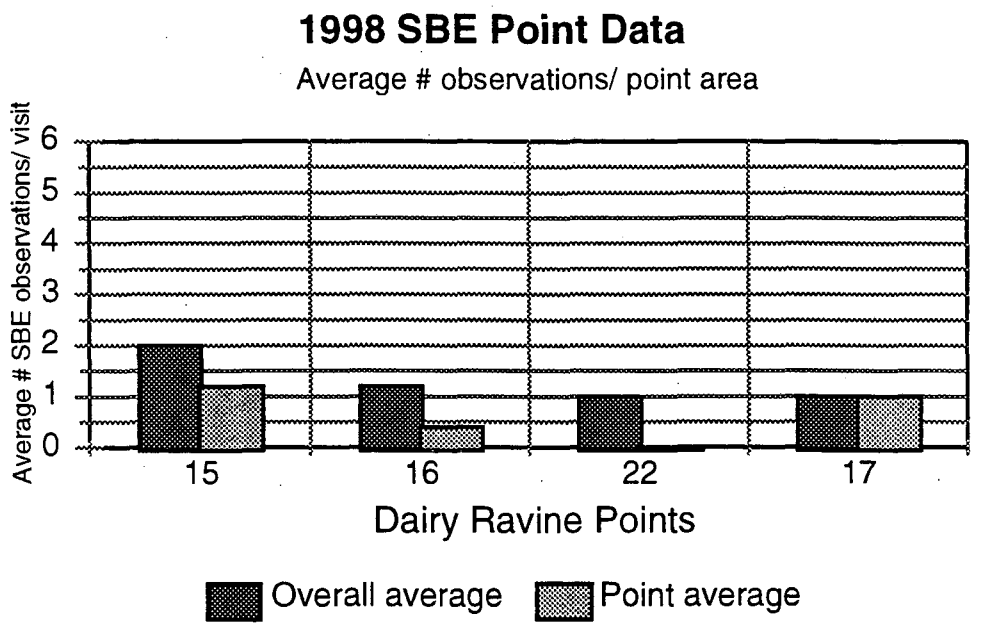

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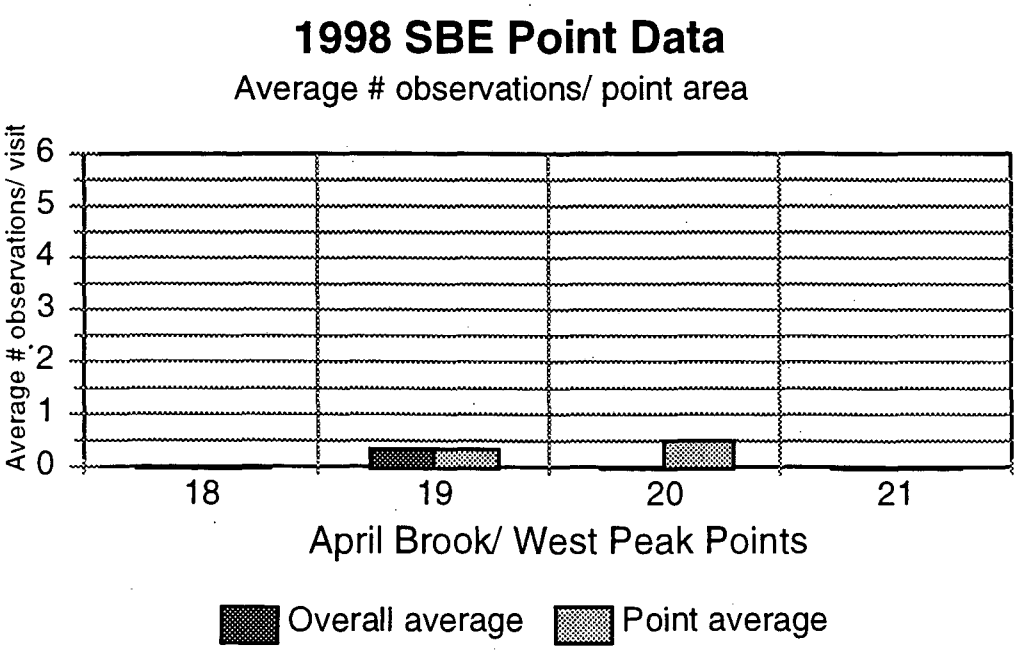

APPENDIX B — EXOTIC PEST PLANTS REMOVED BY HAND AND HERBICIDE WORK ON SBM IN 1998

Table B-1. Numbers of Exotic Pest Plants Removed by Hand Work on San Bruno Mountain in 1998[1]

Area	UE	EG	GM	CS	FV	LV	PE	Other[2]
Radio Rd./ Summit	415	173	281		21	2068		1767
Ridge Trail			208		1137	1060		1144
Saddle	33	80	260		719	47	50	400
Devil's Arroyo		37		1896	699	181		154
Callippe Hill				5	1065	114	7	
Buckeye Canyon			5741	2249	316	279	51	736
Owl/Buckeye Subridge			14					831
Brisbane Acres			56		1681	645		91
Bitter Cherry Ridge		1			6			666
Terrabay/ South Slope			225		4694	391	232	198
Juncus Ravine/ Hillside					8093	1638	1827	892
Tank Ravine					2462	725		804
Pointe Pacific	17	149	300					634
Totals	465	440	7085	4150	20,893	7148	2167	8317
Grand Total								**50,665**

1. Plants were removed using weed wrenches, maddox's or by hand pulling. This table does not reflect four additional days of hand work on the Ridge Trail and at Juncus Ravine were the field crew did not record numbers of plants removed. Categories represented are: **UE**: *Ulex europaeus* (gorse), **EG**: *Eucalyptus globulus* (blue-gum tree), **GM**: *Genista monspessulana* (French broom), **CS**: *Cytissus striatus* (Portuguese broom), **FV**: *Foeniculum vulgare* (fennel), **LV**: *Lactuca virosa* (wild lettuce), and **PE**: *Picris echiodes* (bristly ox-tongue).
2. Other category includes 22 additional weed species receiving hand control.

Table B-2 Acreages of exotic pest plants treated with herbicide at Saddle and Main Mountain areas in 1998.

Area	Gorse (UE)		F.Broom (GM)		P.Broom (CS)		Fennel (FV)		Comb-ined infest.		Other[1]	
	L	H	L	H	L	H	L	H	L	H	L	H
Saddle- Main treatment areas	10	2.5							0.8			
Saddle- Burn area	.3											
Bitter Cherry Ridge/ Hoffman site									4			
Hill West of Quarry					.25							
Industrial Park		.6							.5			
NE Ridge / Water Tank Area					.5	.5						
Wax Myrtle Ravine		.5										
GCP/ Radio Road									1.1			
Brisbane Acres / Brisbane Water Tank				1.8								
Linda Vista Area			0.8						1.0			
SE Ridge							1	.3	2			
Tank Ravine									0.8		.3	
Juncus Ravine							2.3		3			
Totals	**10.3**	**3.6**	**0.8**	**1.8**	**.75**	**.5**	**3.3**	**.3**	**13.2**		**.3**	
Grand Total												**35**

H=High density >50% cover, L=Low density = 0-50% cover. Density and acreages were visually estimated in field. High density infestations are typically sprayed with a spray rig, while low density infestations are typically sprayed using backpack sprayers.
Categories represented are: UE: *Ulex europaeus* (gorse), EG: *Eucalyptus globulus* (blue-gum tree), GM: *Genista monspessulana* (French broom), CS: *Cytissus striatus* (Portuguese broom), FV: *Foeniculum vulgare* (fennel).
1.Other category includes German ivy, English ivy, cotoneaster, pampas grass, iceplant, (*Carpobrotus edulis*), and Echium sp.

Table B-3. Restoration Activities on San Bruno Mountain at Eucalyptus Restoration sites.

Restoration site	Debris piling/Trail clearing[1]	Stump cutting/ grinding[2]	Herbicide[3]	Re-Planting[4]	Hand weeding[5]
Colma Creek					
April Brook	X	X	X		
Dairy Ravine	X	X	X		X
Botanic Garden	X	X	X	X	X
Wax Myrtle Ravine	X		X		
Pacific Nursery					
Hoffman Street			X		

1.Trail clearing and stump cutting was done by the Daly City Crew of the Pacific Bays District of the California Conservation Corps.
2.Stump grinding was performed on 300+ stumps by Reliable Tree Service.
3.Planting and hand weeding was conducted at the Botanic Garden by the Friends of
4.Herbicide was conducted by TRA on approximately 12 acres.
5.Hand weeding was done at the Dairy Ravine and Wax Myrtle Ravine sites with assistance from San Mateo County Sherriffs Work Furlough Program.

Table B-4. Special Projects on San Bruno Mountain: Acreages of exotic pest plants treated with herbicide or cleared of exotic infestations.

Project	Gorse		French Broom		Vegetation clearing (mowing/ chainsaw) (acres)
	L	H	L	H	
Daly City/ Park boundary Gorse project					7
Transmission line Ridge Broom Project					
Daly City Water Department		0.75			
Guadalupe Quarry				3.25	

APPENDIX C
OPERATING PROGRAM BY ADMINISTRATIVE PARCEL -- 1999

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
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
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
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
09 Water Pipelines	X			x
10 Fire Breaks	X			
RADIO RIDGE (3)				
01 Telecommunications Site	X	X		X
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