City of Brisbane
MEMORANDUM

TO: Mayor and City Council

FROM: Hal Toppel, Robin Leiter and Judy Malamut

SUBJECT: Northeast Ridge Compliance Hearing – Response to Public Comments

DATE: For Council Meeting on February 1, 2010

BACKGROUND:

At the compliance hearing conducted by the City Council on January 19, 2010, the City Council requested staff to respond to public comments opposing the adoption of Resolution No. 2010-01 and 2010-02, granting final approval of the Northeast Ridge 2007 Modified Project. Most of these comments dealt with the sufficiency of the environmental reviews, as set forth in the 2007 Addendum to the Northeast Ridge EIR ("NER EIR"), and the 2009 Addendum to the Environmental Impact Report/Environmental Assessment for the HCP ("HCP EIR/EA"), and the merits of the HCP itself. The central theme was that use of an addendum was inappropriate, and the City should instead prepare a new EIR or, at the least, a supplement to the existing EIR.

The CEQA law and Guidelines authorize an addendum to an existing EIR to be used, rather than a supplemental or subsequent EIR, when there has been some change to the project but none of the conditions described in Section 21166 of the Public Resources Code and Section 15162 of the CEQA Guidelines have been met. These conditions are:

(1) substantial changes in the project which will require major revisions of the previous EIR due to the involvement of new significant environmental impacts not considered in the previous EIR; or

(2) substantial changes in the circumstances under which the project is being undertaken which would require important revisions to the previous EIR because of new significant impacts not considered in the previous EIR; or

(3) new information becomes available, which was not known and could not have been known at the time the previous EIR was certified and such new information shows any of the following: (i) that the project will have significant effects not previously discussed in the EIR; or (ii) significant effects previously examined will be substantially more severe than shown in the EIR; or (iii) mitigation measures or alternatives previously found not to be feasible would, in fact, be feasible and would substantially reduce one or more significant effects of the project; or (iv) mitigation measures or

alternatives not previously considered in the EIR would substantially lessen one or more of the significant effects on the environment.

Members of the public argued that an addendum should not be used because the circumstances have changed since the preparation of the original EIR and new information is now available that would require further environmental review. Some additional arguments unrelated to CEQA were also raised as reasons why the 2007 Modified Project should not be approved. Responses to these arguments are set forth below.

COMMENTS AND RESPONSES:

1. **Listing of callippe:** The listing of the callippe silverspot butterfly under the federal Endangered Species Act ("ESA"), by itself, is a changed circumstance that should require preparation of a new EIR.

Response:

The listing of the callippe cannot be characterized as a change in the project. Presumably, project opponents believe that the listing represents a change in circumstances or new information that will result in effects more severe than those analyzed in the EIR. This is incorrect, both as a matter of fact and of law.

In 1982, when the HCP was adopted, the callippe silverspot and mission blue butterflies were the primary species of concern. The mission blue was already listed as endangered under the ESA at this time. The callippe had not been listed under the ESA but was regarded as imperiled, and its population biology and ecology on the mountain were studied in detail in preparing the HCP. In fact, the U.S. Fish and Wildlife Service ("Service") had proposed to list the callippe under the ESA in 1978. In 1980, however, all areas available for development within San Bruno Mountain were designated as critical habitat for the endangered mission blue butterfly. The Service therefore allowed the listing proposal for the callippe to expire on the basis that the designation of mission blue habitat also protected the callippe, which uses essentially the same habitat. (See HCP at page II-3). As indicated by the Service's representatives at the hearing on January 19th, the callippe was later listed because of illegal poaching by collectors and not as a result of development activity or failure of the HCP.

Given this context, the eventual listing of the callippe does not represent a significant change in circumstances or significant new information that would lead to environmental effects more severe than those evaluated in the NER EIR. The courts have long recognized that the change in legal characterization does not trigger the need for a subsequent EIR or supplement to an EIR. In *Fort Mojave Indian Tribe v. Cal. Dept. Health Services* (2d Dist. 1995), 38 Cal. App 4th 1574, petitioners challenged the licensing, construction, and operation of a low-level radioactive waste disposal facility. The final EIR was issued in 1991, and it analyzed impacts to "crucial habitat" for the federally listed desert tortoise and included mitigation measures to reduce those impacts. Before the Department of Health Services certified the EIR in 1993, the Fish and Wildlife Service proposed to designate over 6,000,000 acres critical habitat for the desert tortoise, including the 90-acre project site. Petitioners had argued that the proposal to designate was "new

information" that warranted recirculation of the EIR or preparation of a supplement to analyze new impacts. The court rejected this view:

> "No changes were made or discovered in the project or its physical, environmental effects; the "new information" was an already anticipated recharacterization of the site's status under the federal act. . . . [H]owever legally characterized, the habitat would be affected the same as before. . . . [¶] Petitioners' view is that the EIR should have been redone because of a change not in physical circumstances but in impending federal legal and scientific review. . . . [W]hatever the significance of that inquiry under federal law and for the federal decision about this project, its impendency does not amount to the type of new or changed circumstances requiring supplementation or recirculation of the present EIR, which already has served the practical and informational functions of CEQA with respect to this project's impact on the tortoise and its habitat."

Fort Mojave, supra, 38 Cal.App 4th at p. 1605. The same reasoning applies here. The project's potential effects on callippe were fully evaluated in the project EIR, and the listing of the callippe as endangered does not change those effects. Therefore, a subsequent or supplemental EIR is not required.

2. Loss of flight corridor: The project will destroy the flight corridor along the north side of the project and will create a barrier to movement, causing fragmentation that will lead to extinction of the callippe.

Response:

This issue has been raised several times. It was previously addressed on page 16 of the 2008 Agenda Report, and was addressed extensively by the Service in its Finding of No Significant Impact (the "FONSI") (see pages 13-15), the 2009 Biological Opinion (see pages 44-46), and the Service's responses to public comments, dated May 2009 (see, for example, the Service responses to comments 20, 73-4, 73-5, 73-6, 73-8, 73-9, 73-11, 87-17, and 88-10). The 2009 HCP EIR/EA Addendum Technical Analysis section addresses this subject extensively, under "Habitat Fragmentation and Butterfly Movement Corridors."

In addition, the Service clearly stated at the January 19, 2010 City Council hearing that the revised project would not prevent callippe from moving to other areas of the Mountain. This conclusion is supported by the letter recently submitted to the City Council by Patrick Kobernus, dated January 23, 2010, wherein he states on pages 5-6 that the 2007 Modified Project would not restrict movement of the species because: (1) they have used the land adjacent to Guadalupe Canyon Parkway as a corridor and will continue to do so; (2) the callippe are strong flyers who can fly for long distances above the auto traffic; (3) the callippe can move through gaps between structures; (4) there is a corridor of native vegetation that can be used to go around the 2007 Modified Project; and (5) undeveloped ridges on each side of the parkway and each side of the 2007 Modified Project make it easier to fly across the road. A copy of the Kobernus letter is attached hereto as Exhibit "A".

No credible scientific evidence has been presented to refute the conclusion of the Service and other qualified experts that the 2007 Modified Project will not create a barrier to movement of the callippe. On the contrary, the Service has concluded in its FONSI that the project actually will reduce fragmentation of the habitat because of the removal of all development from callippe hill, having a very high habitat value that otherwise would be lost, and relocating and consolidating a reduced number of housing units in an area having low habitat value. (FONSI, see page 13, and as quoted in Resolution 2010-01).

3. **Old and defective data; the HCP is a failure:** The HCP amendment is based upon 20 year old data and defective survey methods for determining the status of the butterfly. The HCP is a failure because the population of the mission blue and callippe silverspot is declining.

Response:

Most of these comments center on the criticisms found in the "Longcore" report - in particular, the use of "wandering transects" rather than fixed transects to survey for butterflies. Such comments are misplaced, as the monitoring program was modified to a set transect system in 2001, and this system is used currently. HCP Amendment No. 5 utilizes data from the revised survey protocol. Additionally, a recent paper by Longcore, Kobernus *et al.* published in the *Journal of Insect Conservation* concludes that useful data can be extracted from the wandering surveys. A copy of this paper is attached hereto as Exhibit "B". Patrick Kobernus further states in his letter at page 4:

> "Though purists and statisticians may not like the 'wandering' method used on San Bruno Mountain because it did not follow set routes, it actually has worked beautifully to monitor the butterflies' distribution; protect the endangered species and their habitat over the 27-year span of the HCP, and to identify areas of concern that require more intensive management."

Two peer reviews were conducted on the alternative monitoring program proposed by Travis Longcore and the current set transect system used on the Mountain. These reviews were conducted by Dr. Erica Fleishman PhD., and Dr. Stuart Weiss, PhD. – each of whom are highly respected conservation biologists with extensive experience in butterfly monitoring. Both of these reviewers concluded that the current set transect monitoring system was working effectively to monitor the endangered species. Each reviewer also concluded that the alternative monitoring program proposed by Travis Longcore was not cost effective, nor was it likely to provide any additional benefits for detecting changes in butterfly populations on the Mountain.

Finally, it should be noted that in issuing the FONSI and its own 2009 Biological Opinion, the Service relied upon current data and not merely the 1982 HCP EIR/EA or the 1989 HCP EIR/EA Addendum (see, for example, the Service responses to comments 3, 82-5, 84, and 125-7). Moreover, no scientific evidence (credible or otherwise) has been presented that the HCP (and by extension the construction of the last "planned parcel" or the 2007 Modified Project) is causing a decline in the population of the endangered species. In response to comment 86-1 that the original EIR was deeply flawed, that the HCP is not

working, and after 25 years the callippe silverspot is now fully endangered, the Service stated as follows:

> "The commenter's opinion regarding the EIR/EA is noted. The commenter's opinion regarding the success of the HCP is also noted. However, as the Service stated when it listed the callippe silverspot as endangered, there is no evidence to indicate that the callippe silverspot is declining as a result of the HCP (Service 1997, p. 64306, 64310). In addition, the Service disagrees with the commenter's assertion that the HCP is not working. The Service believes the objectives intended to be met by the HCP were sound, but have not been implemented in the manner anticipated due to restrictions in funding. Funding is the limiting factor, not the actual HCP."

This conclusion is echoed in both the 2010 Longcore paper and the January 23, 2010 letter from Patrick Kobernus, wherein both state that survey data collected from 1982 to 2000 shows that the population of the mission blue and callippe silverspot butterflies has remained stable. The stability of the butterfly population has also been documented in the 2007 Habitat Management Plan approved by the HCP Trustees and the Service. However, the expert testimony presented to the City Council by the Service, and supported by Longcore and Kobernus, clearly shows that the survival of the endangered species on San Bruno Mountain is threatened by the continued loss of grassland habitat from the spread of coastal scrub and other invasive vegetation and that the additional funding that will be provided by the 2007 Modified Project is critically needed to combat this threat.

4. **Habitat creation or restoration does not work:** Experience has shown that it is impossible to create or restore viola habitat. Therefore, money spent for this purpose is wasted and it is further evidence that the HCP is not working.

Response:

This is an issue related to habitat management and not part of either the HCP Amendment No. 5 or final approval of the 2007 Modified Project. However, in response to the same comment being repeatedly made to the Service, it was noted that the Service's Environmental Assessment ("EA") and 2009 Biological Opinion do not rely upon habitat restoration or the creation of new habitat, but rather the preservation of *existing* habitat and prevention of further loss through the control of invasive vegetation. As stated in the Service's response to comment 72-4 & 72-5: "The EA states that restored areas will be restored to grassland habitat, not viola. The EA does not rely upon restoration of viola in any way for mitigation of impacts to callippe silverspot butterflies; it assumes that loss of viola is permanent. Thus, there is no additional impact to callippe if the restoration is not 'successful.' " Similarly, in response to comment 87-17, the Service stated: "[T]he success of the HCP and the survival of the callippe silverspot do not depend upon recreation of callippe silverspot habitat. The HCP is designed primarily to conserve existing habitat and protect existing populations of listed species. The Biological Study has found that the proposed Amendment is consistent with these goals."

5. **Changed global environment:** Environmental circumstances have changed due to global climate change, greenhouse gases, water availability, and increased traffic. This is new information that needs to be studied in a supplemental EIR.

Response:

LSA has provided a detailed response to comments regarding global climate change in a Memorandum dated January 26, 2010, attached hereto as Exhibit "C". LSA and City staff have also responded extensively to comments regarding water availability, traffic, air quality, as well as storm drainage, hydrology and geotechnical issues related to the 2007 Modified Project in previous memoranda and staff reports (see staff reports to the Planning Commission and City Council dated September 13, 2007 and March 10, 2008).

It should also be remembered that the action to be taken by the City Council is approval of a *modification* to an existing, approved development. This is not an initial approval of an application for which no land use entitlements have been granted. The comparison of environmental impacts is to be made between the 1989 Vested Tentative Map and the 2007 Modified Project. Since the proposed modification will substantially reduce the intensity and extent of development, any potential effects of the project on greenhouse gas emissions, water supply, traffic, etc., will be significantly reduced compared to the project as previously analyzed and approved. Consequently, as determined through the analysis contained in the 2007 NER EIR Addendum and subsequent review, the project will not generate any new impacts or increase the severity of previously identified impacts.

6. **The 1989 project cannot be built:** The 1989 approval should not be used as a basis of comparison since it cannot be built. The high voltage PG&E power lines cannot be moved and are a hazard that should be studied. In addition, the 1989 approvals were invalid because the city did not have an open space plan at that time. This is an amendment to a specific plan that should be placed on the ballot.

Response:

Some years ago, Brookfield obtained an agreement from PG&E to relocate the power lines. Whether it would be cost effective to do so is irrelevant since the 2007 Modified Project is not dependent upon a relocation of these lines. Moreover, this is an economic question having no bearing on the legal validity of the 1989 VTM. If the commenter is correct that the power lines constitute a health hazard, then that would be an additional justification for approval of the modified project, which avoids the construction of homes in that area, and therefore represents an environmentally superior alternative. But in any case, the alleged health hazard from the power lines is irrelevant and does not constitute "new information" affecting the 2007 Modified Project.

At the public hearing on January 19th, John Burr distributed copies of Government Code Sections 65561 through 65567 and claimed that the existing project approvals are invalid because the City did not have a local open space plan. However, he neglected to provide the City Council with a copy of Government Code Section 65560, which states that " 'Local open-space plan' is the open-space element of a county or city general plan adopted

by the board or council..." The 1980 General Plan for the City of Brisbane does include an Open Space Element that would serve as the City's local open space plan.

Mr. Burr also claimed that the 2007 Modified Project is an amendment to a specific plan and should be placed on the ballot. This statement is incorrect. No specific plan is being amended. The only amendments are the tentative subdivision map, the PD permit, the design permit and the grading permit – all of which are administrative actions and not legislative. No voter approval is legally required.

The 1989 NER project remains a valid, outstanding land use entitlement, as recognized by the City, the County and the Service. As stated by the Service in response to comment 87-11: "[T]he 1989 VTM is a legally valid development plan that confers vested rights on Brookfield. Comparing the proposed Amendment to these existing development rights is not 'obfuscation;' it is logical since those actions are already part of the existing HCP."

7. **Income from the endowment will be less than projected:** The HCP endowment will not generate the level of income that has been projected. Consequently, the estimates of additional funding contained in the HCP amendment are inaccurate.

Response:

The projections of annual income to be generated by the endowment have always been characterized as an estimate and not a guaranteed yield. However, as pointed out by the Service, the estimated 5 percent annual rate of return "is a conservative estimate based upon performance of numerous endowment funds established for species' conservation banks over the last 20 years within the Sacramento Fish and Wildlife Service's jurisdiction. The 5 percent annual rate of return is also within the range used by various conservancy organizations and accepted by other government agencies." (See response to comment 88-13). The endowment is intended to be permanent. Consequently, it is reasonable to predict that future earnings will reflect the expected recovery from the current economic recession.

Moreover, the issue is not whether the overall HCP funding is sufficient – the time to challenge that has long since passed – but whether additional management activities funded by the supplemental funding provided by HCP Amendment No. 5 are beneficial. Thus, the estimated annual income is just a target, one that the Service found to be reasonable based on its past experience setting up endowments for other preserves. If less income is generated in any particular year, the HCP Trustees will determine what management activities occur as prioritized in the 2007 Habitat Management Plan (as subsequently amended or updated). No one disputes that additional management is beneficial for the Mountain's butterfly species and the substantial increase in the income available to the HCP Trustees from the $4,000,000 endowment and the increased homeowner contributions will enable performance of additional management activities that

are critical for preservation of the habitat.[1] We note that this additional funding is being provided even though the HCP says that no additional funding can be required.

8. **Alternate site should be used:** The remaining homes for Unit II should be built at another location.

Response:

No viable alternative site owned by the developer has been identified. The developer cannot be compelled to relocate the project to other land it does not own. Moreover, this issue is irrelevant. We are not dealing with the development of a new project but rather the modification of an *existing approved project* for which vested development rights have already been granted. As noted above, the appropriate comparison of environmental impacts must be made between the 1989 vested tentative map and the 2007 Modified Project.

9. **Developer will not comply with conditions of approval:** The developer has not complied with existing conditions of approval. Consequently, there is no assurance that it will comply with the additional conditions for funding the HCP endowment.

Response:

This is an enforcement issue having nothing to do with modification of the tentative map. However, it should be noted that neither the City nor the Service has accused Brookfield of violating any conditions of its development approval. As stated by the Service in response to comment 88-12: "[T]he commenter has provided no evidence of the stated violations. To date, Brookfield has complied with all requirements of the HCP and cooperated with the Service and made significant voluntary efforts to preserve the listed species, including modifying the Northeast Ridge development to minimize impacts to listed species and their habitat."

With regard to performance of Brookfield's agreement to establish the endowment fund and make additional financial contributions to the City for construction of public improvements, these payments will be collected as a condition for issuance of building

[1] The range of management programs was described by the Service in its response to comment 88-13 as follows: "Estimates for the cost of an expanded management program vary widely, depending on the financial assumptions and level of management included. For example, the 2006 TRA Special Report on management costs modeled expenditures using the most aggressive potential management scenario and arrived at an estimate of $425,000 ($415,000 for management plan $10,000 annually for a contingency fund). This model, however, reflects only the uppermost limit of a range of hypothetical scenarios for expanded management. The full menu of financial scenarios for expanded management ranges from approximately $140,000 per year (for the existing 'core program' aimed at controlling exotic species, plus controlled burning and grazing) to approximately $383,000 per year (for comprehensive management of all Priority One areas) to a maximum of approximately $415,000 per year (for comprehensive management of all Priority One areas plus extensive monitoring every year)."

permits or certificates of occupancy. Consequently, if the remaining homes in Unit II are built, the additional funding will be received.

NOTE REGARDING UPDATE OF RESOLUTIONS:

If adopted on February 1, 2010, the second recital on page 9 of Resolution 2010-01 and the third recital on page 9 of Resolution 2010-02 will be updated to reflect that the public hearing was conducted on January 19, 2010 *and February 1, 2010.* In addition, Exhibit A-2 attached to both resolutions, being the list of additional documents included in the Administrative Record, will be updated to include this Memorandum along with the letter from Patrick Kobernus attached hereto as Exhibit A, the Longcore/Kobernus paper attached hereto as Exhibit B, and the letter from LSA attached hereto as Exhibit C.

EXHIBIT A

Coast Range Ecology
Biological Surveys • Restoration Planning • Research and Education

January 26, 2010

Dear Brisbane Council Members,

I attended the public hearing on January 19, 2010, and I agree with the comments made by Chris Nagano and Cay Goude of the US Fish and Wildlife Service at the hearing, and with the conclusions stated in the May 20, 2009, USFWS Biological Opinion for the Amendment to the San Bruno Mountain Habitat Conservation Plan (USFWS 2009).

I have provided here a response to provide factual information and to counter the several inaccurate and misleading claims made at the hearing jin regards to the endangered butterfly species of San Bruno Mountain and the San Bruno Mountain Habitat Conservation Plan. There are three main points that I would like to state here:

1) The SBM HCP monitoring program has provided important data necessary to inform management and protect the species;

2) The Proposed Brookfield 2007 VTM for the Northeast Ridge will not isolate the Callippe silverspot and mission blue butterflies on the Northeast Ridge, and;

3) The level of funding augmentation offered to the HCP through the Brookfield 2007 VTM Proposal is necessary to protect the butterflies' habitat from coastal scrub succession and grassland degradation from excessive thatch build up.

Professional Background

As a biologist for TRA Environmental Sciences, I worked as the supervisor of the San Bruno Mountain HCP endangered butterfly monitoring and habitat management programs from 1995-2007. I was the principal author of the San Bruno Mountain HCP Annual Reports submitted to the USFWS during this period. I also was the principal author of the 2007 Habitat Management Plan for the Mountain (revised 2008) which summarizes the results of the butterfly monitoring and habitat management programs over the first 25 years of the HCP (1982 – 2007) and provides a roadmap for future monitoring and management. I also co-authored a paper on San Bruno Mountain with Travis Longcore that was recently published in the Journal of Insect Conservation, entitled "Extracting useful data from imperfect monitoring schemes: Endangered Butterflies at San Bruno Mountain, San Mateo County, California (1982–2000) and Implications for Habitat Management" (Longcore et al 2010). I have also led the North American Butterfly Association (NABA) butterfly counts on

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San Bruno Mountain in June for the past 4 years (2006-2009). The NABA counts are volunteer counts that are conducted once per year throughout North America, similar to the Audubon Christmas bird counts. I have also recently (December 2009) completed a study for the USFWS on the distribution of the Lilian's silverspot butterfly (*Speyeria callippe liliana*) in the north San Francisco Bay Area (Coast Range Ecology, 2009). The Lilian's silverspot is a closely related subspecies to the Callippe silverspot.

Since I left TRA Environmental Sciences in 2007, I have continued to hike the Mountain, and photograph the endangered butterflies and their habitat during the spring and summer on San Bruno Mountain. Cumulatively, I have hiked the mountain repeatedly over the past 15 years searching and mapping butterfly observations and recording the status of their habitat. I have spent countless hours working on the Mountain and analyzing data, with the sole purpose of ensuring the survival of these species. In summary, I have spent essentially one-third of my life monitoring the endangered Callippe silverspot, mission blue and San Bruno elfin butterflies on San Bruno Mountain. It is based on this cumulative experience that I am responding to the claims made by San Bruno Mountain Watch and their supporters at the recent City of Brisbane public hearing.

Butterfly Monitoring and Status of the Butterfly Populations

The San Bruno Mountain HCP butterfly monitoring program has worked well to track the distribution of the butterflies on San Bruno Mountain, and has provided important information necessary for management decisions to protect their habitat. Though the original monitoring design implemented in 1982 did not use set transects based on the Pollard method, as was used by many other butterfly monitoring programs at the time (Pollard 1977), the monitoring program was conducted consistently for two decades and has provided occupancy data that has been extremely valuable for assessing population distribution changes that have occurred on the Mountain (Longcore et al 2010). The monitoring program utilized 'wandering transects' which allowed monitors the flexibility to cover different areas, and this has resulted in a much wider portion of the Mountain being covered than possible with set transects (Longcore et al 2010)[1]. A more statistically rigorous design using set transects has the advantage of detecting changes in relative

[1] *In 2000 and 2001, set transects were installed to monitor the Mission blue and Callippe silverspot butterflies to replace the wandering transect system. The set transects are based on the Pollard method, and have been used since their installation to the present (2010) to assess the status of the Mission blue and Callippe silverspot butterflies. This system was employed with the intention of providing a more accurate assessment of the relative population sizes of the butterflies. The system was reviewed by the USFWS, and by conservation biologists Stuart Weiss, PhD, and Erica Fleishman, PhD; both of whom also reviewed Travis Longcore's proposed revised monitoring method for San Bruno Mountain. Both Weiss and Fleishman were critical of Longcore's methodology, and determined the current monitoring system was effective (Fleishman 2005; Weiss 2005). The set transect system will need to be supplemented with data provided through additional monitoring that covers a wider geographical area, to insure that all habitat areas are covered on the Mountain. However, at this time, the funding program for the HCP cannot support additional monitoring.*

abundance of butterflies, but is less useful for determining changes in butterfly distribution. Many biologists agree (Travis Longcore included) that monitoring distribution of the species is arguably more valuable for protecting populations of species (Longcore et al 2010). Though Travis Longcore has been critical of the initial set up of the program, the monitoring has provided exactly what has been needed to inform management to protect the butterfly species on San Bruno Mountain.

Analysis of the butterfly data collected from 1982-2000, using a method that tested for trends in butterfly occupancy over time revealed that the populations of both the Mission blue and Callippe silverspot butterflies were stable over this time period (Longcore et al 2010) . Further analysis of the vegetation within transects where negative trends were observed revealed that coastal scrub succession and loss of grassland habitat was associated with the negative trend in butterfly occupancy. This information corroborates what butterfly monitors have been observing on San Bruno Mountain for years; 1) that all three endangered butterfly species continue to be locally abundant on San Bruno Mountain; and 2) the amount of available habitat for mission blue and Callippe silverspots within the conservation area has declined as result of coastal scrub succession, and management needs to address this issue in a more comprehensive way.

Figure 1 shows butterfly monitoring data that was collected on San Bruno Mountain from 1981 – 2001. Over this period, the range of the Callippe silverspot has been reduced on the Mountain, and this graphic highlights the problem[2]. A similar reduction in habitat for the mission blue has also occurred. The butterfly habitat is being reduced due to brush succession and the grasslands are shrinking. Based on the rate of succession calculated from orthophotographs of the mountain in 2004 (San Mateo County Parks Department, 2008), the mountain lost approximately 122 acres of grassland to coastal scrub succession from 1982 – 2004. Extrapolating this number to 2010 based on the rate of succession, it is estimated that the total is now approximately 150 acres (11%).

Figure 2 shows a view of Buckeye Canyon, and just how dramatic the change in vegetation has been. Several other areas have lost significant acreage of grassland to coastal scrub succession, namely Wax Myrtle Ravine, Hill West of Quarry, the Northeast Ridge Water Tank Parcel, Owl Canyon, the Rio Verde parcel and the Saddle. Each of these areas has had a gradual decline in butterfly observations over the past 27 years (Figure 3). These areas are now, in most places, composed of impenetrable scrub and each site needs to be thinned out to allow for grassland butterfly habitat to reestablish.

Figure 1 also indicates that butterfly observations have declined on the lower portions of the south slope. This decline is likely to be at least partly due to thatch build up which

[2] *Figure 1 graphic shows a partly exaggerated view of the decline in butterfly observations, because it compares data collected over 17 years (1981-1997) to only 4 years (1998-2001). Nevertheless the declines are real, both in loss of butterfly habitat and declines in butterfly observations.*

suppresses native forbs such as *Viola pedunculata,* the host plant for the Callippe silverspot butterfly. Extremely high levels of biomass have been measured within these grasslands (Figure 4). Increases in soil nitrogen, deposited from air pollution sources, may also be contributing to thatch build up by allowing invasive annual weeds to outcompete native grasses and forbs. This process has been documented in grasslands at Edgewood County Park in southern San Mateo County and at Kirby Canyon Land Trust in eastern Santa Clara County (Weiss 1999).

Though purists and statisticians may not like the 'wandering' method used on San Bruno Mountain because it did not follow set routes, it actually has worked beautifully to monitor the butterflies' distribution; protect the endangered species and their habitat over the 27-year span of the HCP, and to identify areas of concern that require more intensive management. This information is covered in more detail in the article San Bruno Mountain published in the Journal of Insect Conservation (Longcore et al 2010).

It also should be mentioned that monitoring insect populations is very unlike monitoring vertebrate species. As Chris Nagano, Chief of the Endangered Species Division of the Sacramento US Fish and Wildlife Service office, pointed out at the January 19 public hearing, butterfly populations are more influenced by annual and daily weather conditions, and therefore counts can be highly variable. As a result, their populations can vary annually by an order of magnitude (10x) due to the influences of weather on their survival rates. This is what Tom Reid was referring to (as quoted by a San Bruno Mountain Watch representative at the January 19, 2010 Public Hearing) when he said that "the variance in the data is so high, that it is not likely to be useful for directing policy". This is not due to a poorly designed monitoring program, it is due to the nature of monitoring highly variable insect populations. When you consider that San Bruno Mountain has many steep slopes, summertime fog and variable wind conditions, the variance in the monitoring data becomes even more difficult to control as these factors affect the ability of monitors to collect consistent data.

In spite of these difficulties, the data has been collected, year after year, and it provides a very useful picture of what is occurring on San Bruno Mountain. Though the butterfly populations have not undergone a significant decline yet, they are on borrowed time. The processes of coastal scrub succession is converting approximately 5 acres of grassland per year to coastal scrub; and the buildup of thatch within grasslands due to the lack of biomass removal from grazing and/or burning, is degrading the quality of much of the grassland habitat, especially on south facing slopes. These processes are not exclusive to San Bruno Mountain, and in fact, they are occurring all over the state of California. It is typically only where rare species occur do we have monitoring data to track these changes that are occurring to the native grasslands.

At Kirby Canon Land Trust in eastern Santa Clara County, controlled grazing has been implemented for over 20 years, and is critical to maintaining the habitat of the threatened

bay checkerspot butterfly (*Euphydryas editha bayensis*), (Weiss 1999). Where cattle grazing is conducted with ecological management as the goal, it is extremely effective at managing and maintaining butterfly habitat. Sears Point is another site where cattle grazing is being effectively used to manage butterfly habitat. Figure 5 shows a photo taken from Sears Point in March 2009 where *Viola pedunculata*, the host plant for the callippe silverspot, is thriving under cattle grazing.

Cattle grazing was removed from San Bruno Mountain in the 1960's, and since that time the Mountain has lost approximately 250 acres (18%) of grassland. For over a decade, TRA Environmental Sciences has been recommending the implementation of a pilot grazing project on San Bruno Mountain, and a grazing plan was written for San Bruno Mountain in 2002 (Amme 2002). However due to funding constraints and political opposition from environmental groups such as San Bruno Mountain Watch, there has been little headway toward establishing grazing.

Butterfly Corridor between the Northeast Ridge and the Main Ridge of San Bruno Mountain

Figure 6 shows callippe silverspot observations on the Northeast Ridge and along Guadalupe Canyon Parkway in 2005 and 2006, and Figure 7 shows the available corridor for Callippes and mission blue butterflies. Both figures show the 2007 VTM overlaid on the Northeast Ridge. I do not believe the 2007 VTM will restrict movement for these species between the Northeast Ridge and the main Mountain for the following reasons.

The Callippes and mission blues have been utilizing the lands adjacent to Guadalupe Canyon Parkway (GCP)[3] as a corridor for over four decades (since GCP was built), and likely have used this area for centuries prior to this. Most of this corridor will remain intact after the 2007 VTM is built.

The location of GCP between callippe habitat areas on the Northeast Ridge, the Saddle, and Rio Verde likely results in some callippes being hit by cars, however callippes are strong flyers(Howe 1975), and typically fly approximately 1-3 meters (3.3 – 11 feet) above the ground. Their flight period is typically between 9:00 – 3:00 PM, and they are less active during commute hours when there is more traffic on GCP. They are therefore less likely to be hit by cars as a result. Callippes and mission blues do fly low when searching for host and/or nectar plants, due to the fact that their host plants are low-growing species. However they often will fly higher when traveling or moving over vegetation. I have observed Callippes flying over 40 feet high, when pursuing other callippe (potential mates or rivals), and when moving over brush stands. In 2005, I observed a callippe fly up the

[3] Silver lupine, the preferred host plant for the Mission blue butterfly, is prevalent along disturbed roadcuts along Guadalupe Canyon Parkway, and these areas provide important habitat for the Mission blue, as do roadcuts and rocky, disturbed, cut slopes in other areas of the Mountain (Figure 8).

middle of the Guadalupe Canyon Parkway for over 500 feet from the Northeast ridge to the Saddle (TRA Environmental Sciences callippe monitoring in 2005). The callippe can readily cross slopes of grassland, scrub, and rock for several hundred feet in single flights. It also should be noted that herbaceous invasive weeds such as pin cushion plant (*Scabiosa atropurpurea*), wild radish (*Raphanus sativa*) and Italian thistle (*Carduus pycnocephalus*) often colonize roadsides and provide preferred nectar sources for the callippe (and mission blue) and movement of individual butterflies across roads is a common activity among butterflies when utilizing available nectar resources.

Callippes can move through gaps between structures in order to reach habitat areas, and though they may not fly over or through extensive urban areas (several thousand feet or more), the 2007 VTM does not present an extensive urban barrier. The maximum distance is less than a 1000 feet across the northern portion of the proposed development (Figure 7), and there is a corridor of native vegetation the butterflies can use to go around the 2007 VTM area. The presence of undeveloped ridges on each side of the parkway and each side of the 2007 VTM also makes it easier for callippes to fly across the road and the development, because of the reduced height they will need to fly over, and because the undeveloped hilltops provide congregation areas for the callippe. The corridor width as described in the EA is approximately 90 – 300 feet, however this width is actually larger, approximately 500 feet, when one considers the full width of the Rio Verde parcel (Figure 7). The corridor width also widens to the west of Carter Street (Saddle area) to more than a 1000 feet.

One of the speakers at the January 19, 2010 public hearing expressed concern that the observations of Callippe have declined along Guadalupe Canyon Parkway (Transect 13), and quotes the San Bruno HCP 2008 annual report. I have reviewed this data, and I believe the reason for this is the following: 1) only two of the five visits were conducted during good monitoring weather; 2) transect 13 is the shortest transect on the Mountain and only takes 12 minutes or less to walk, therefore monitors could miss Callippes during this short period; and 3) most importantly, this area has suffered a decline in available grassland butterfly habitat due to coastal scrub succession (Longcore et al 2010), and will continue to do so until brush control programs to reduce native coastal scrub vegetation are implemented.

It is important to note that the Callippe does not have to make daily movements from the NER to the rest of San Bruno Mountain (though they can and do) because they have all of their habitat needs satisfied (hilltops, viola and nectar plants) in each of these areas. For genetic exchange to occur, only one individual (unmated female, mated female that lays eggs, or an early arriving male) needs to travel between the areas to maintain genetic variability. Hypothetically this minimal threshold is all that needs to occur, however I believe several more individuals will continue to exchange between these areas after the 2007 VTM is built, because essentially the NER and main portions of San Bruno Mountain

are contiguous as far as the Callippe is concerned, based on its' flight ability, the topography, and the connectivity of these areas. To insure the Callippes and mission blue colonies on the Northeast Ridge stay connected to the main Mountain colonies, brush control programs need to be implemented within the Rio Verde parcel, the eastern Saddle, the Northeast Ridge Water Tank Parcel, Wax Myrtle Ravine and the Hill West of Quarry areas.

Summary and Conclusions

Over 80% (approximately 2800 acres) of the land on San Bruno Mountain has been protected from development, and this land is in permanent conservation. This land has been protected from development on San Bruno Mountain, and will be protected in perpetuity as long as the Endangered Species Act is in effect. It is not the amount of land that is in question any longer; it is how these conserved lands are managed that will determine the fate of the endangered butterfly species over the long term. A biologist in support of San Bruno Mountain Watch, wrote in his letter to Brisbane Council members that *"the Northeast Ridge in its current state is still in a state of 'wild'ness"..."and "a wild place more or less takes care of itself"*. This is more of an idealized view of grassland habitat, and is not realistic or accurate. Grasslands on San Bruno Mountain are not static habitats and without some form of disturbance in the form of grazing and or burning, over time they either convert to brush, or they become dense with thatch and are more prone to invasions by invasive species. There are exceptions to these on steep slopes, where thin soils and herbivore activity from brush rabbits and disturbance from burrowing rodents appears to be maintaining the grasslands; however this is the exception rather than the rule.

Most areas outside of San Bruno Mountain that provide habitat for the mission blue, San Bruno elfin and/or Callippe silverspot butterfly, have not benefited from having such an intensive monitoring and management program as provided through the HCP for the past 27 years. For instance the status of the San Bruno elfin at Montara Mountain, the status of mission blue in the Pacifica hills, and the status of the Callippe silverspot in the Oakland hills is largely unknown. These areas are not monitored with any consistency, nor is the endangered species habitat being managed.

To label the HCP management a failure for not controlling the process of brush succession, due to lack of funding, is in my opinion an unfair criticism. There are very few management programs in effect today that are effectively managing brush succession, invasive species and thatch build up within grasslands. The habitat management programs on San Bruno Mountain have been successful at removing invasive species, primarily the woody invasives such as gorse, French broom, Eucalyptus and Portuguese broom, among others (San Mateo County Parks 2008). The level of effort to control these species has been significant for almost three decades, both by the HCP subcontractors, (primarily West Coast Wildlands), and by volunteer groups. Much of this work by the HCP contractors goes into maintaining habitats that have long been cleared of large invasive infestations. These areas

will always need to have some level of management due to the emergence of seedlings of gorse or broom in these areas every year. This management goes on, relatively unnoticed by the critics of the HCP, because there are no large observed landscape changes within these areas; however this ongoing maintenance is critical to the control of the invasive species and the protection of the habitat.

Despite these successes, the management, as it is currently conducted, is being asked to manage a system 'with one hand tied behind it's back'. Without grazing, there is no practical way to control the processes of coastal scrub succession and thatch build up within the grasslands. The San Bruno Mountain Stewardship Grazing Plan and the San Bruno Mountain Habitat Management Plan (San Mateo County 2008), provide a roadmap for how and where to implement these tools in the future to protect the endangered butterfly species.

San Bruno Mountain Watch and their supporters have often warned that the butterflies of San Bruno Mountain are in danger of suffering the same fate as the Xerces Blue (*Glaucopsyche xerces*), a butterfly species that once existed in the coastal sand dunes of the Sunset District of San Francisco, but was extirpated by road building and development in the 1940's. I do not believe this is an appropriate comparison to the butterflies of San Bruno Mountain, because development is not the major threat to these species. A more appropriate comparison would be to compare the butterflies of San Bruno Mountain to the large blue (*Glaucopsyche (Maculinea) arion*), a species that occurs in Great Britain. The large blue, a grassland endemic species, similar in habitat requirements to the mission blue, San Bruno elfin and Callippe silverspot, became extirpated in Great Britain as a result of removal of grazing and subsequent conversion of its habitat to tall grasses and brush. This species has since been successfully reintroduced to Great Britain from source populations in other parts of Europe, and cattle grazing is now an integral part of maintaining its' habitat (Center for Ecology and Hydrology 2009).

I am in agreement with Chris Nagano and the USFWS that the Brookfield 2007 VTM proposal will 1) reduce impacts from development (that would have occurred from the 1989 VTM); 2) will not create a barrier to mission blues and/or Callippe silverspots, and; 3) will provide the funding needed to address the habitat issues on the Mountain. The 2007 VTM project is not perfect, because some butterfly habitat would be taken (12 acres of grassland) but the fact that the development was moved off of a prime Callippe hilltop habitat area and a huge suffusion of money will be provided for HCP habitat management and monitoring, is a win-win prospect in my opinion. This increased funding will provide the necessary funding to remove brush and enhance the movement corridor for these species on the Northeast Ridge and surrounding parcels, as well as supplement a more comprehensive habitat management program for the whole of San Bruno Mountain.

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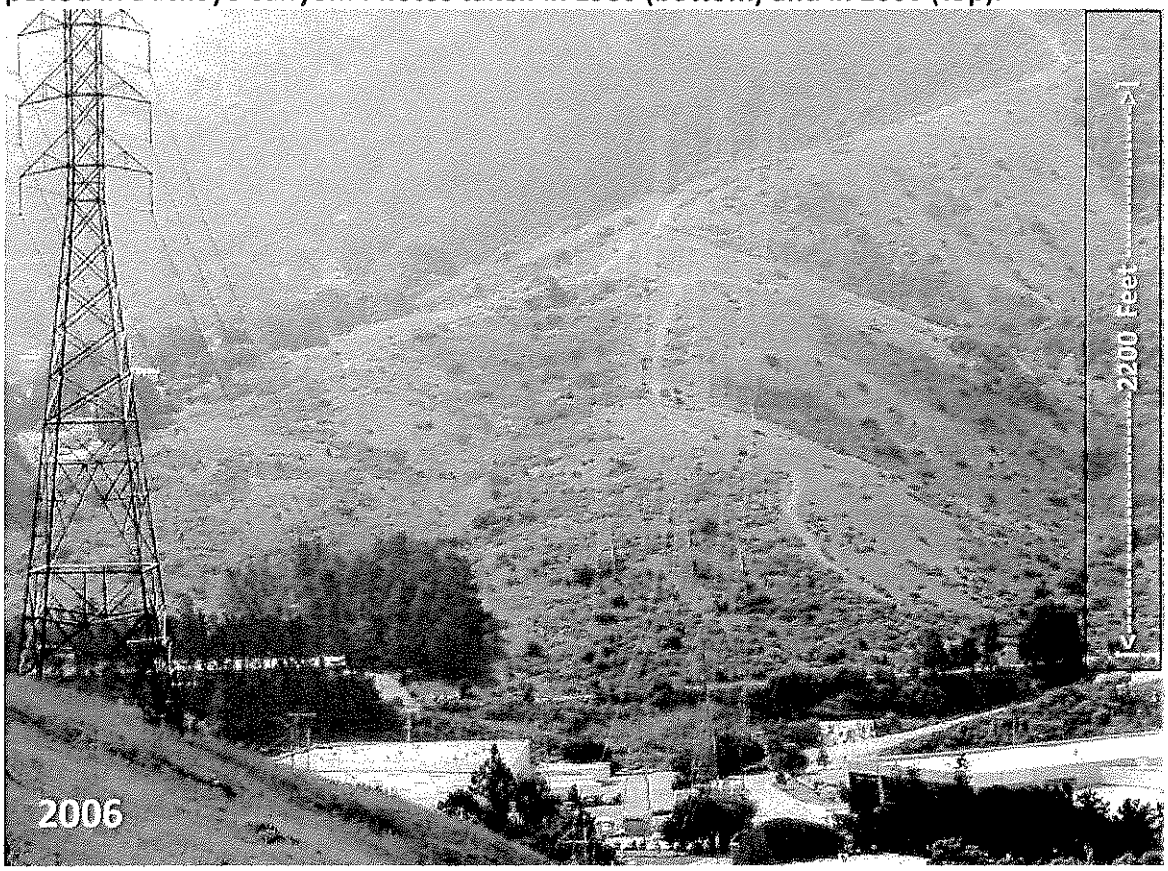
Figure 1. Distribution Changes of Mission Blue and Callippe Silverspot Butterflies on San Bruno Mountain. Map by Creekside Center for Earth Observation. Data source: San Bruno Mountain HCP Butterfly data (San Mateo County Parks Department).

Legend

Viola pedunculata
1998-2001 Callippe Points
1981-1997 Callippe Points

0 0.25 0.5 1 1.5 2 2.5 Miles

Figure 2. Extent of increase in cover of coastal scrub and loss of grassland over a 20-year period in Buckeye Canyon. Photos taken in 1986 (bottom) and in 2006 (top).



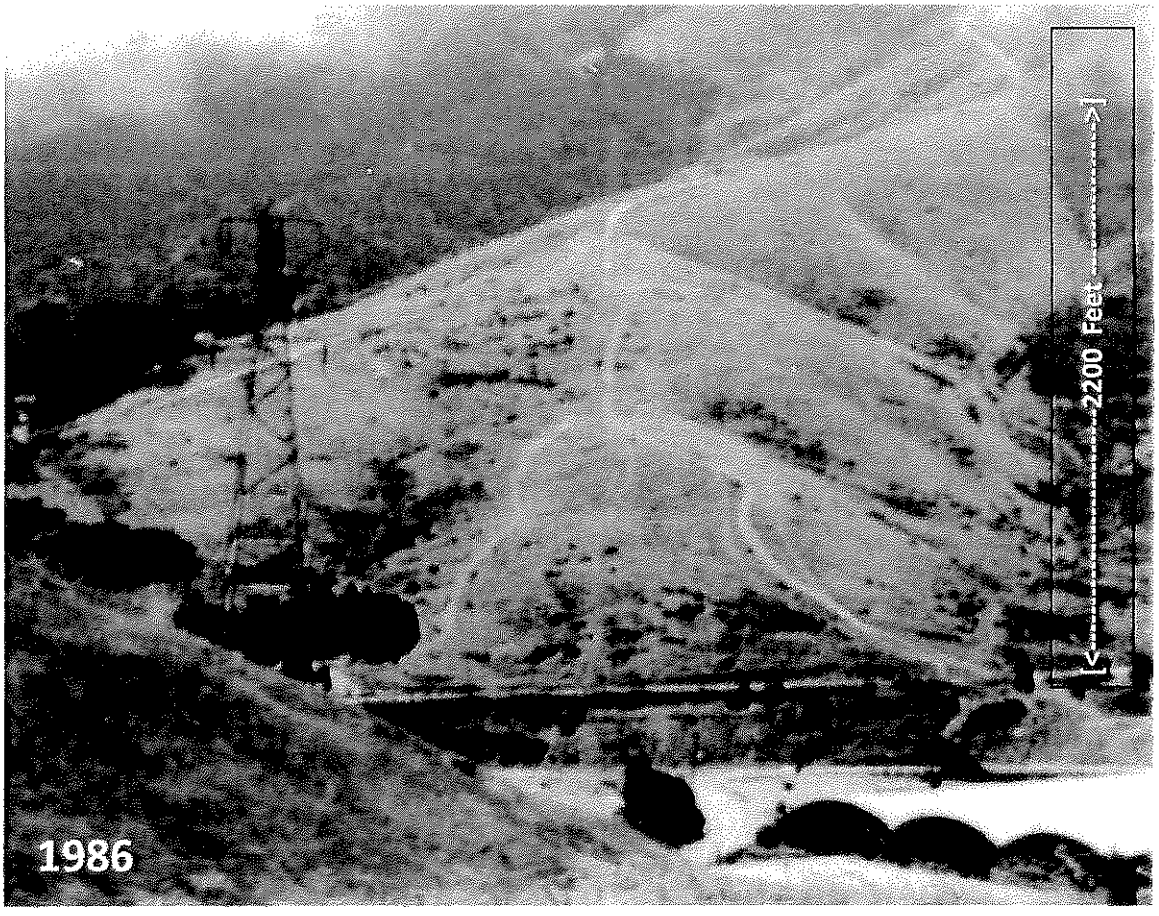


Figure 3. Areas of San Bruno Mountain where declines in occupancy for Mission Blue and Callippe Silverspot butterflies has occurred. (Longcore et al 2010).

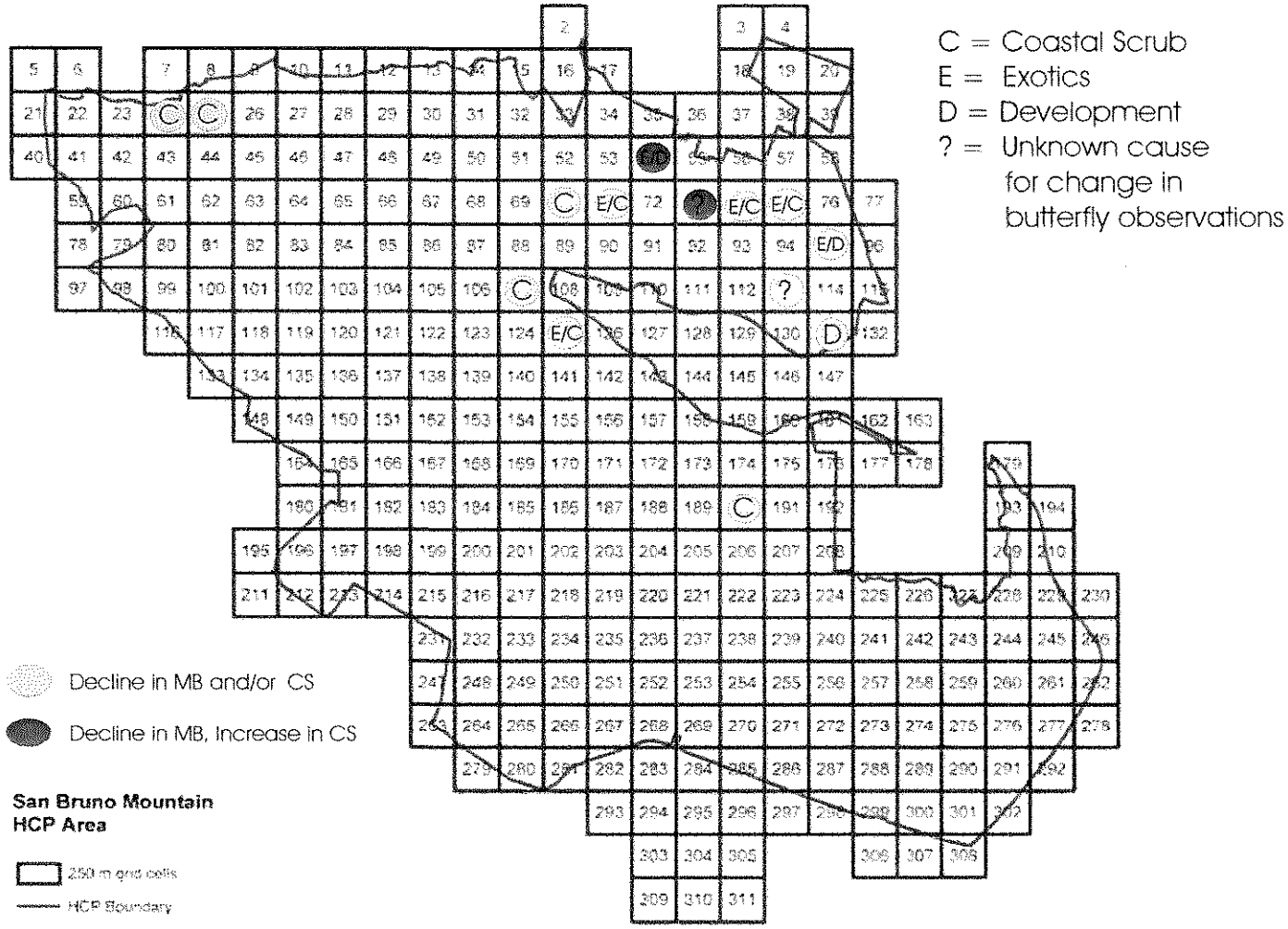


Figure 4. Above ground live and dead biomass Juncus Ravine 2003.

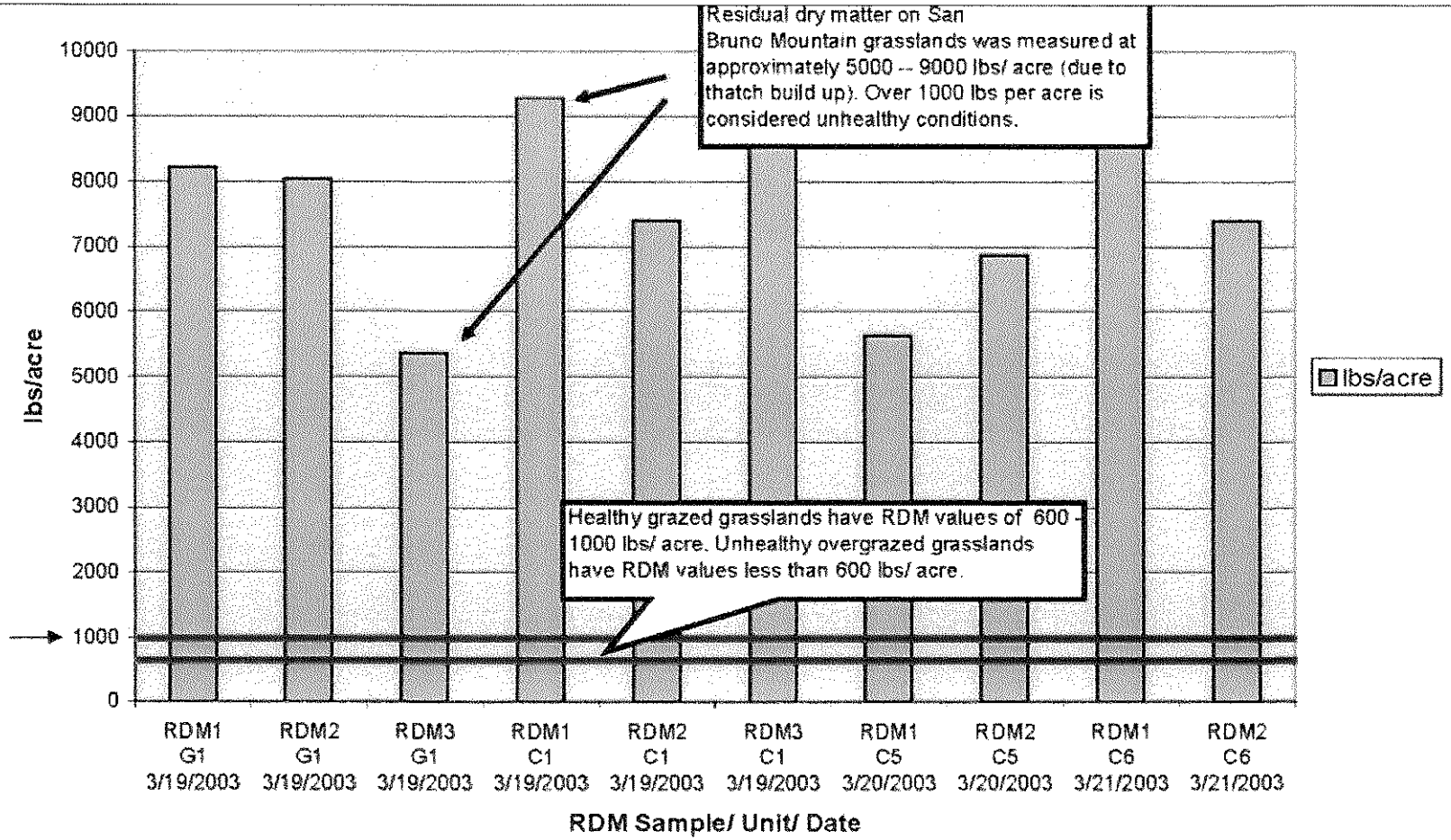


Figure 5. View of Sears Point (Sonoma County Land Trust) in March 2009. This site has over 2000 acres of grassland, and is protected as habitat for the Callippe silverspot butterfly. *Viola pedunculata*, host plant for the Callippe silverspot, is thriving under cattle grazing. Cattle grazing also benefits many other native wildflowers as well as native grasses.

Figure 6. Callippe Silverspot Observations on the Northeast Ridge in 2005 and 2006 and the Brookfield 2007 VTM Boundary.

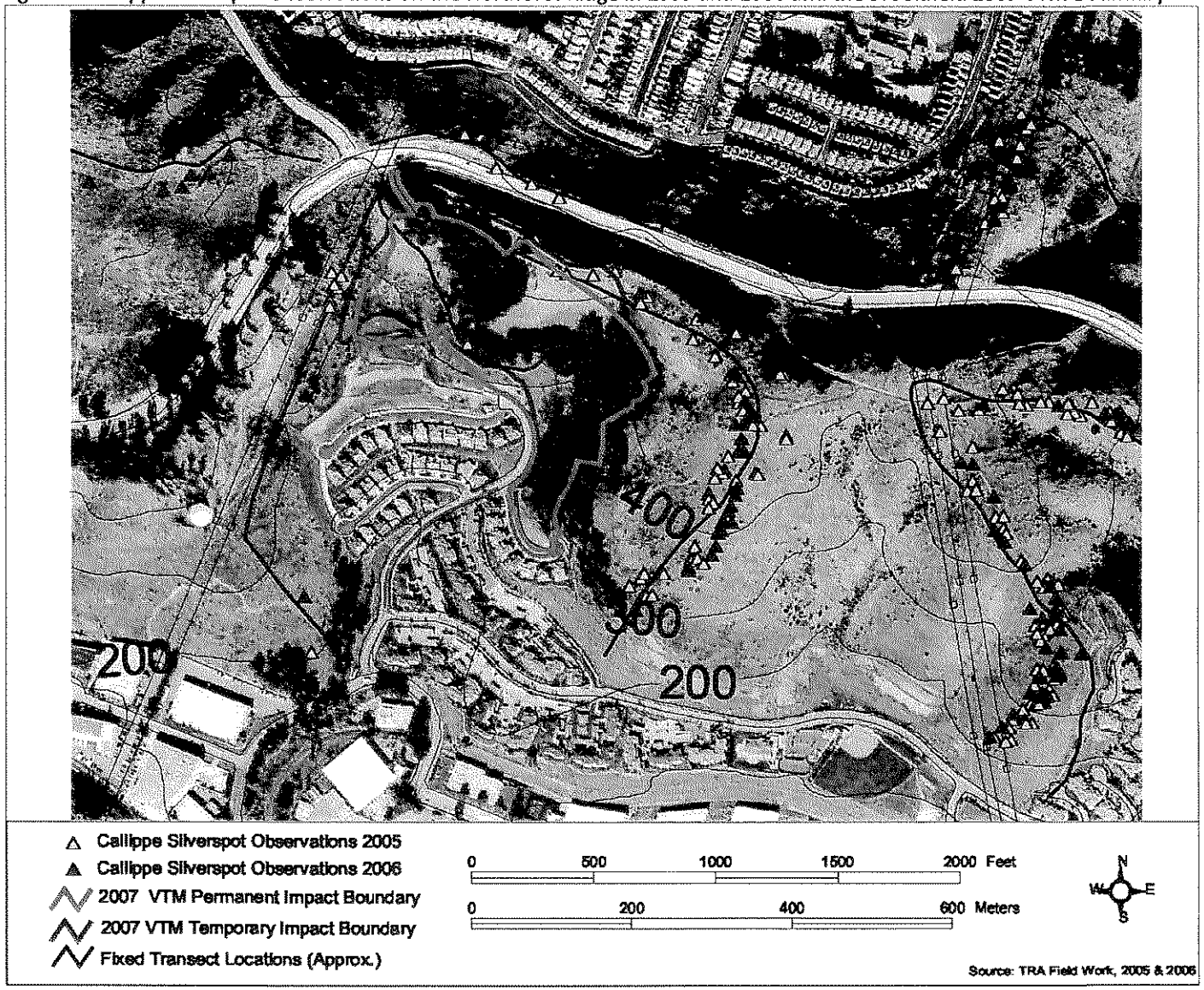


Figure 7. Butterfly Movement Corridors Between NorthEast Ridge and the Main Mountain, and 2007 VTM.

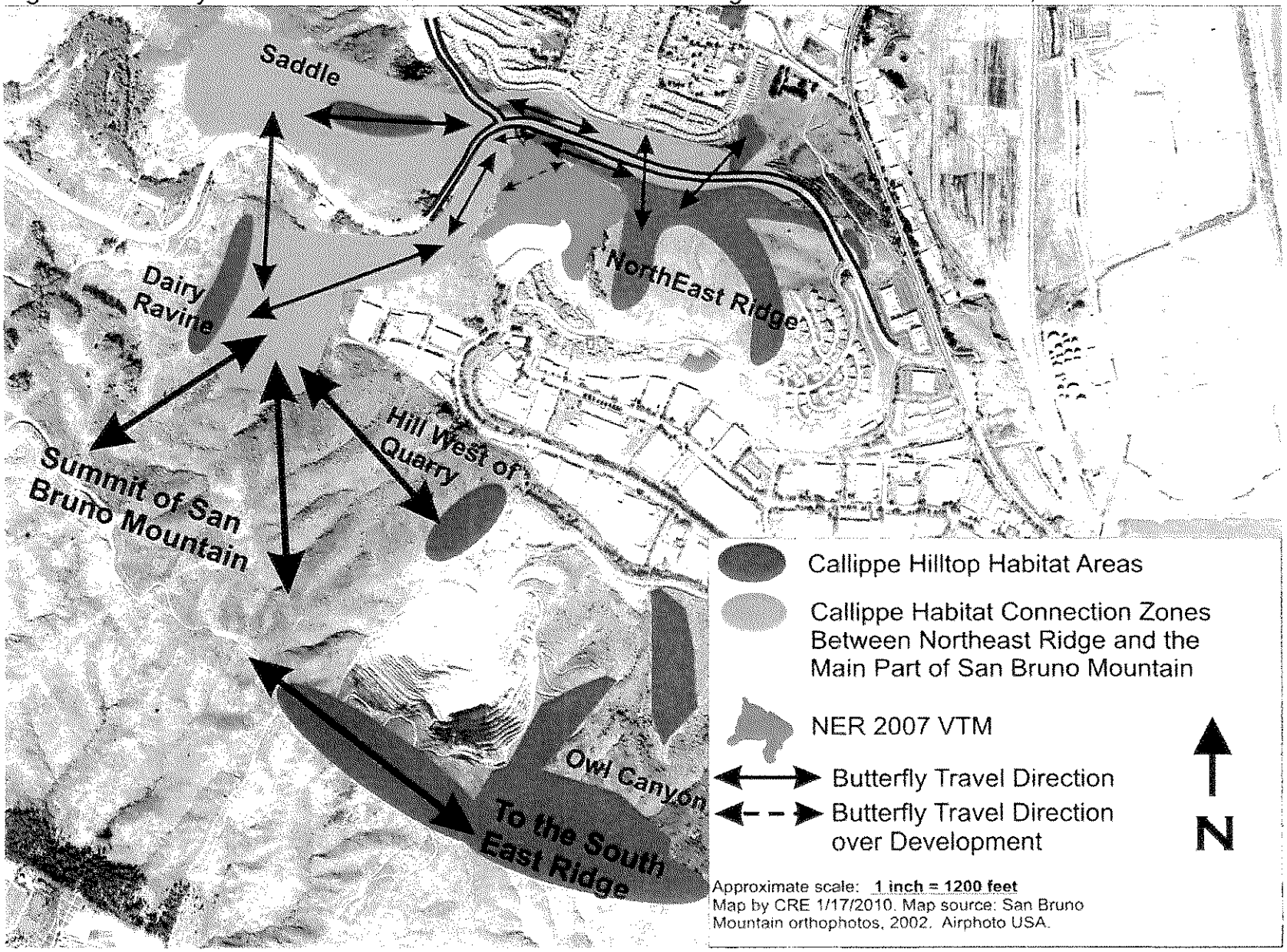


Figure 8. Natural recruitment of Silver Lupine (*Lupinus albifrons var. collinus*), host plant for the mission blue butterfly on graded slopes on the Southeast Ridge. The patch of lupines shown above is the densest stand of Lupinus albifrons on San Bruno Mountain, and supports a thriving mission blue colony. Lupines have also established on portions of the graded slopes on the NER, and mission blue butterflies utilize these areas.

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ORIGINAL PAPER

Extracting useful data from imperfect monitoring schemes: endangered butterflies at San Bruno Mountain, San Mateo County, California (1982–2000) and implications for habitat management

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Abstract Managers surveyed for sensitive butterfly species in the San Bruno Mountain Habitat Conservation Plan area between 1982 and 2000 using an opportunistic "wandering transect" method. To extract as much valuable information as possible from the data collected by this method we analyzed patterns of surveys and butterfly presence and absence within 250 m square cells gridded across the area within a Geographic Information System. While estimates of butterfly abundance were not possible, the data could be tested for trends in butterfly occupancy. For those cells surveyed during at least 10 years, no trends in the total number of occupied cells was evident for either Callippe silverspot or mission blue butterfly. There were cells, however, that showed positive or negative trends ($P < 0.20$) in occupancy for each species (Callippe silverspot: 14 positive, 15 negative, 6 cells occupied all years; mission blue butterfly: 40 positive, 40 negative, 2 cells occupied all years). We conclude that for the period 1982–2000 the population of each species was stable in overall total distribution, but indicate geographic areas of concern for each, specifically the edges of the northeast ridge for Callippe silverspot butterfly and the northwest of the study area for mission blue butterfly. Vegetation composition analysis using orthophotography with field corroboration indicates that those areas with declines in occupancy for these species experienced native coastal scrub succession and a corresponding loss in grassland butterfly habitat, while positive trending and stable cells had stable grassland proportions. Habitat managers at San Bruno Mountain should therefore incorporate programs for protecting grassland butterfly habitat not only from invasive weeds but also from succession to native coastal scrub. This approach illustrates the feasibility of using occupancy as an indicator to track butterfly status in a protected area even when suboptimal data collection methods are used, but the difficulties of using these data also reinforces the need for managers to devise monitoring schemes appropriate for their objectives before implementing them.

Keywords Monitoring · Endangered species · Succession · Lepidoptera

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The Habitat Conservation Plan (HCP) at San Bruno Mountain just south of San Francisco, California was, in 1982, the first of its kind, opening a pathway for a new type of conservation mechanism wherein loss of habitat for species listed under the Endangered Species Act is permitted in exchange for conservation actions to benefit the species (Beatley 1994). Approximately 80% of the mountain has been conserved as open space through land purchases, donations and exchanges, and is managed as habitat for listed butterflies through the HCP. As part of the management of the reserve established at San Bruno Mountain, yearly surveys were conducted to count listed butterfly species and butterfly species of regulatory concern (Thomas Reid Associates 2000). The surveys have been digitized and compiled in a Geographic Information System (ArcGIS), which facilitates in-depth analysis of the

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status and trends of populations of these sensitive species. This article presents the results of an analysis of these data and an assessment of the survey methodology.

The surveys at San Bruno Mountain record incidence of two species, mission blue butterfly (*Icaricia icarioides missionensis*) and Callippe silverspot butterfly (*Speyeria callippe callippe*). A third species, San Bruno elfin (*Incisalia mossii bayensis*), was surveyed but is not addressed here. The surveys, called "Wandering Surveys" by Thomas Reid Associates ("TRA"), followed no fixed route and were conducted throughout the flight seasons of both species from 1982 to 2000. The rationale for using the wandering transect methodology was to monitor as much of the butterflies' habitat as possible at the least cost, and to allow monitors flexibility to cover different habitat areas as conditions change over time for the purposes of informing and directing habitat management. Such a methodology presents immediate difficulties for drawing statistical inference or even detecting qualitative trends. The goal of our analysis is to extract useful information from the dataset, while acknowledging the flaws inherent in the survey methods.

Several challenges are posed by the analysis of the San Bruno Mountain butterfly data. Some can be solved, some are likely intractable. The first problem posed by the dataset is that surveys were not completed in the same geographic locations each year. Most butterfly monitoring schemes involve repeated, fixed transects (Pollard et al. 1975; Pollard and Yates 1993; van Swaay et al. 2008). In this manner, the number of individuals each year can be compared with some degree of confidence. The second problem is that the data provide no obvious way to estimate what proportion of butterflies is being observed each year. Detection probability is a central part of monitoring schemes; for butterflies it can be calculated either from mark-recapture data (Gall 1985) or distance sampling (Buckland et al. 1993). In our analysis, neither option is available. Detection probability is affected by the use of different survey locations each year that may have different habitat features that increase or decrease detection, or detection probability may vary by sex, time of day, or weather (Dennis et al. 2006a; Dennis and Sparks 2006; Harker and Shreeve 2008). Because of these two difficulties with estimating butterfly abundance, we chose rather to investigate trends in the distribution of the species, which although still sensitive to variation in detection should be somewhat less sensitive to it than are abundance estimates.

Knowledge of trends in the geographic distribution of the butterflies on San Bruno Mountain is in some ways superior to knowledge of trends in abundance. Butterflies are notoriously variable in abundance from year to year and wide fluctuations may obscure directional trends (Pollard 1988). Occupancy (or at least observation) and abundance are related: butterflies will be detected in more locations in years when butterflies are abundant if only because the chances of encountering a butterfly are increased (Zonneveld et al. 2003). Aside from this apparent increase in occupancy resulting from greater population size, some patches may indeed be colonized during years with many adult butterflies. In either instance, if butterflies are observed in more areas it is a good sign for the species. Indeed, mathematical models of metapopulation persistence often record only the number and occupancy rate of habitat patches, not the number of butterflies at each patch (Hanski 1999), and occupancy of more locations is associated with decreased risk of extinction (Schultz and Hammond 2003).

The research questions therefore involve the distribution patterns of mission blue butterfly and Callippe silverspot 1982–2000.

- Has each species exhibited directional trends in total area occupied?
- What areas have exhibited directional trends in occupancy?
- What areas have exhibited large and small variability in occupancy?

A second set of research questions address the survey methodology.

- What areas exhibited trends in survey coverage?
- What areas were surveyed frequently and infrequently?
- What was the relationship between survey frequency and occupancy?

Study system and life history

San Bruno Mountain is a 1395-ha state and county park located 1 km south of San Francisco, California (Fig. 1). Elevation ranges from 20 to 400.5 m. The mountain's western boundary is 4 km east of the Pacific Ocean and the eastern boundary is less than 1 km from San Francisco Bay. Average annual rainfall is 56 cm per year. Marine air flow consisting of strong westerly winds and summertime fog strongly influences the distribution of plant communities on San Bruno Mountain, and the vegetation is dominated by northern coastal scrub and grassland. Woodland vegetation (coast live oak woodland and central coast riparian scrub) is primarily limited to narrow ravines. Invasive plant communities are also present, with the densest stands located on the northern edge of the study area.

The mission blue butterfly is univoltine and has a flight period that extends from March to mid-June. Three perennial lupines (*Lupinus albifrons* var. *collinus*, *L. formosus* var. *formosus*, and *L. variicolor*) are larval host

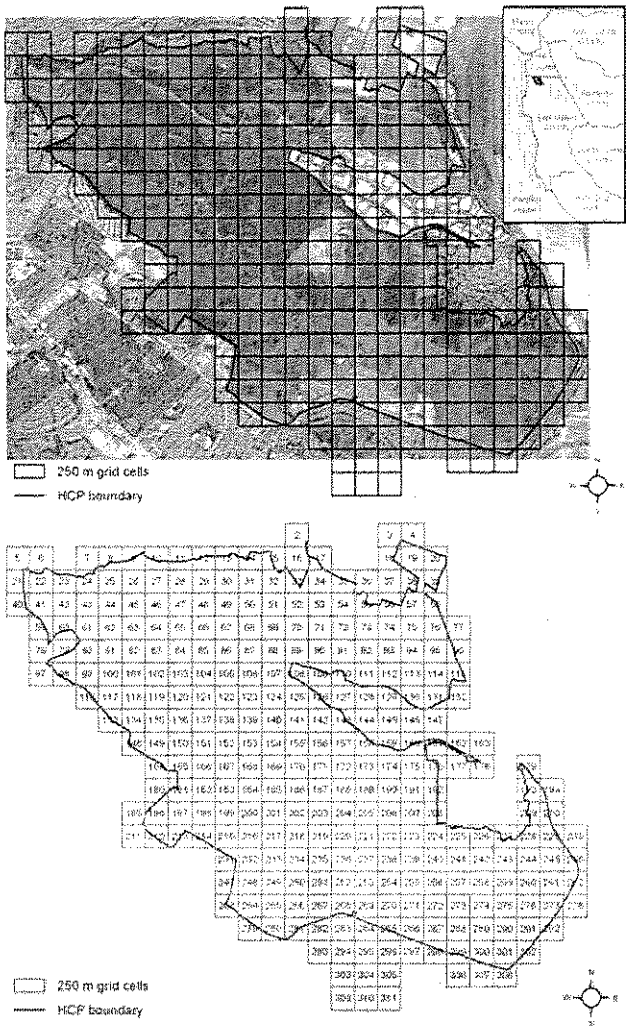

Fig. 1 *Top* aerial photograph and location of San Bruno Mountain HCP. *Bottom* numbered grid for analysis of butterfly survey data

plants for the species. Throughout their flight period, the females lay their eggs on the host plants soon after mating. Single eggs are deposited primarily on the leaves, but also the stems, flowers, and seedpods of the host plants. The eggs hatch in about 4–10 days (Downey 1957; Guppy and Shepard 2001). The first and second instar larvae feed on the mesophyll of the hostplants. About 3 weeks after eclosion the second instar larvae begin an obligate diapause, typically at the base of the foodplants. The following spring the larvae break diapause and resume feeding. The last instar larvae pupate on or near the base of the *Lupinus* foodplant (Arnold 1983). The pupal stage lasts approximately 3 weeks (Guppy and Shepard 2001). Mark-recapture data showed that the majority of movements by adult butterflies are <64 m, with males moving on average slightly more than females (Arnold 1983). Maximum observed movement was on the order of 150 m for both sexes (Arnold 1983).

The Callippe silverspot is univoltine and has a flight period that generally extends from mid-May to mid-July (Arnold 1981). Callippe silverspot larvae consume one host plant, *Viola pedunculata*, a perennial forb that typically grows in high densities within grassland habitats where it is present. During the early summer flight season, the adult females lay their eggs in the vicinity of *Viola pedunculata*, but not on it (Mattoon et al. 1971). Larvae hatch from the eggs in about a week (Arnold 1981). After hatching, larvae eat the lining of the eggshell, take shelter in ground litter, and then enter diapause (Arnold 1981; Mattoon et al. 1971). Most Callippe silverspot larvae remain in diapause from early summer until the following spring, but some briefly interrupt diapause by seeking shelter from adverse conditions during this period, followed by a return to diapause (Mattoon et al. 1971). After diapause, Callippe silverspot larvae begin feeding on the leaves of their foodplant and develop through five instars (Arnold 1981). After the fifth instar, larvae enter the pupal stage, which lasts about 2 weeks (Arnold 1981). Callippe silverspots are strong fliers, as is the genus as a whole. Mark-recapture data show movement of individuals between two colonies at San Bruno Mountain, over 1 km distant (Thomas Reid Associates 1982a). Most individuals fly within an area that is 1.2 km across at San Bruno Mountain, only 5–6% of individuals were found at a distance greater than this from the site of first capture (Thomas Reid Associates 1982a). On average adults of a related silverspot species move 68.6 m/day, but some individuals move up to 1.6–1.8 km (Nagal et al. 1991; Ricketts 2001).

The mission blue butterfly's distribution on San Bruno Mountain is closely tied to the distribution of its host plants and is most frequently encountered flying over or resting on or within a few feet of its host plants. All three host plants are patchily distributed within grasslands, rocky outcrops and disturbed areas (roadcuts, landslides, hiking trails). The Callippe silverspot's larval host plant, *Viola pedunculata*, is also found in grasslands and disturbed habitats. Hostplants for both species are not present in topographic swales or ravines with deeper soils and wetter conditions, or in areas that have dense stands of invasive weeds, dense stands of native scrub or woodlands. Both species overlap in distribution considerably. The mission blue is more widespread, however, occurring in open grasslands and isolated hilltops and roadcuts on the east and west side of the Mountain, whereas the Callippe silverspot is largely restricted to the more extensive grasslands on the east side of San Bruno Mountain. The Callippe silverspot is a hilltopping species, and frequently is encountered in high densities on hilltops adjacent to open grassland slopes with *Viola pedunculata* and preferred nectar plants. Both mission blue and the Callippe silverspot nectar at a wide variety of native and nonnative forbs

(Arnold 1981; Thomas Reid Associates 1982a). The mission blue and Callippe silverspot butterflies populations on San Bruno Mountain are demographically isolated by the surrounding cities.

Methodology

Thomas Reid Associates (now TRA Environmental Sciences) conducted butterfly surveys in the San Bruno Mountain HCP area (Fig. 1) every year between 1982 and 2000. Prior to this, the distribution and habitat preferences of both the mission blue butterfly and the Callippe silverspot were identified and mapped on the entire HCP area, and the populations of both species were estimated using mark and recapture techniques during the 1980–1981 flight seasons (Thomas Reid Associates 1982a).

The 1982–2000 surveys were characterized as "wandering" transects, because the observers did not follow any set route but rather conducted surveys across the mountain and recorded survey routes and locations of any butterflies observed. Timing of surveys and weather conditions were also recorded. Surveys were conducted through the adult flight season of both butterfly species. Results from these surveys were digitized by TRA and are managed in a Geographic Information System.

To analyze the butterfly survey data, we overlaid a 250 m square grid over the San Bruno Mountain HCP area (Fig. 1). The grid size provides a sufficient number of cells to identify differences across the study area but not so many that analysis is intractable. Furthermore, each grid cell is sufficiently large to incorporate the elements necessary for butterfly reproduction, including foodplants, nectar sources, and potentially ridgelines for hilltopping.

For each 250 m square cell and for each year for each species, the number of visits, total length of surveys, and presence of the butterfly was recorded. For this analysis, we considered that a cell was "surveyed" if at least 250 m of surveys were conducted within the cell during a particular year. This constitutes a substantial assumption, because detection of butterflies depends on the number, length, and timing of surveys (Zonneveld et al. 2003). The risk of choosing 250 m as a cut-off is that some cells where the butterfly was actually present will be recorded as absences because (1) too few surveys were conducted to detect a small population, (2) surveys were timed improperly to detect adults, or (3) the butterfly was too cryptic to detect because of behavioral or weather conditions. While such false negatives are possible, false positives are not, at least in the sense that the butterflies are in an area, except for the instance of the misidentification of an adult butterfly. This will lead to a very conservative analysis because it considers butterflies present in a cell even if the individual is a vagrant that is not using any resources. The cumulative result of such an approach is a bias that may overestimate occupancy (Dennis 2001). That is, we are measuring presence of each species without necessarily establishing "occupancy" in the manner of studies that connect butterflies to their essential resources (Dennis et al. 2003, 2006b). Summary statistics such as the number of years each cell was surveyed and the proportion of years butterflies were observed were also recorded.

For each cell and each butterfly, we completed a logistic regression of occupancy with year as the independent variable. Trends with $P < 0.20$ were recorded. This relatively low confidence threshold serves to provide a conservative analysis that can identify potential areas of change in the distribution of each species. If a requirement to meet a higher significance level is required, then greater confidence can be achieved but the opportunity for remediation would be delayed. To investigate the spatial pattern of these trends we calculated the ratio of positive to negative trends in the 9-cell neighborhood surrounding each cell with a positive or negative trend, hypothesizing that in a metapopulation positive and negative trends would be clustered.

Callippe silverspots are a hilltopping species so one would expect that males would have been more frequently observed on ridge tops (Shields 1967). We analyzed the use of ridgelines by both species to test this hypothesis. Ridgelines were identified by querying a 10-m digital elevation model (DEM) to assign a rank to each cell relative to all other cells within a 30 m circular radius, using the ElevResidGrid algorithm (written by John Gallant, CSIRO Land and Water). The ranking ranges from 0 (lowest cell within 30 m) to 1 (highest grid cell). The DEM was clipped at the HCP boundary to avoid interference from the urban topography surrounding it. Ridgelines were identified as those cells with a ranking of 0.66 and higher. A higher value (e.g., 0.75) would present few sparse grid cells across the study area to identify contiguous ridgelines. A lower value (e.g., 0.60) would classify an excessive number of cells as ridgelines, including cells that were predominantly hillslopes. We then mapped a 25 m buffer around ridgeline cells and recorded the number of butterflies of each sex found within the buffer area. For comparison, we recorded the same data for mission blue butterfly, which Arnold (1983) had considered to hilltop for mate location, but later decided it was found on hilltops because of food resources and was not a true hilltopping species.

For each cell identified with a significant change in butterfly occupancy, changes in land use and vegetation were investigated using vegetation maps, terrestrial and aerial imagery, and orthophotography of San Bruno Mountain for the period between 1982 and 2004. Land use

and vegetation changes observed for each cell were then corroborated in the field.

Results

During the 19 years of surveys, 295 of 310 cells were surveyed at least one time (Fig. 2). Some cells were surveyed significantly less frequently over time. The number of cells surveyed that did not support either endangered butterfly decreased significantly over time, as did the total length of survey routes per year (Fig. 3). This change in survey distribution indicates that surveyors directed efforts in locations where butterflies had been found before, and avoided areas that had yielded negative results for a number of years. While some cells were surveyed for many years (>15) with no butterflies of either species found, they were located along routes to sites that support the target species.

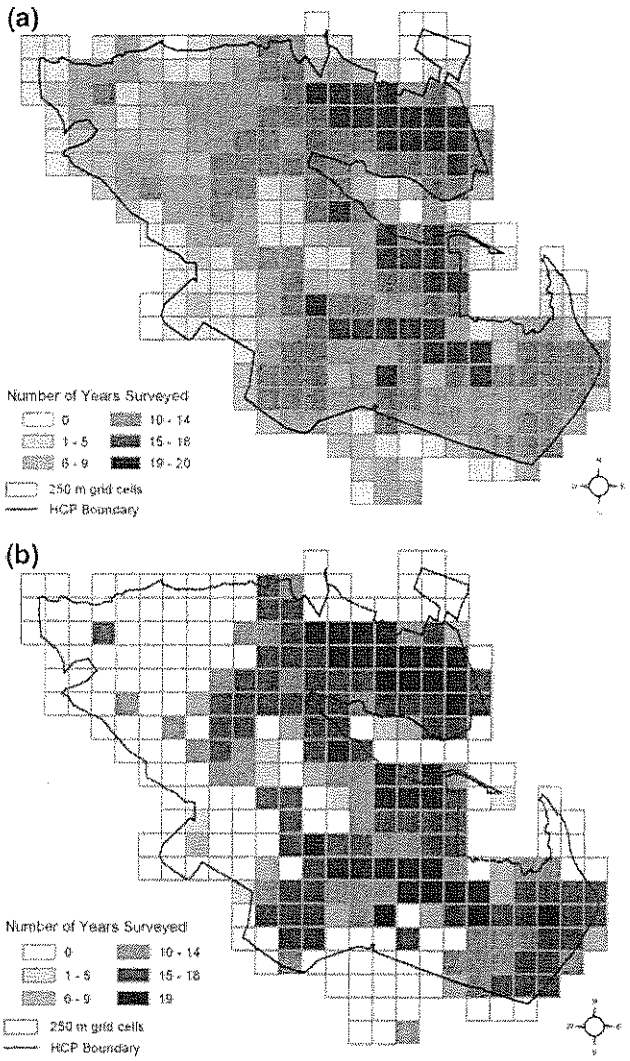

Fig. 2 Distribution and frequency of surveys for mission blue butterfly (**a**) and Callippe silverspot butterfly (**b**) at San Bruno Mountain, 1982–2000

Survey distribution for mission blue butterfly and Callippe silverspot both show a concentration in the northeast ridge and along other ridge-tops where access is less difficult (Fig. 4). The western side of the HCP area has been surveyed somewhat less than the eastern regions, reflecting, among other things, the climatic preferences of the butterflies (Weiss and Murphy 1990) and the scarcity of the butterflies' host plants on the west side of the mountain.

The tendency over time was for the surveyors to stop searching for the butterflies in areas that had been surveyed with negative results several times. Consequently, the number of "empty" cells surveyed decreases significantly during the study period (Fig. 3a). This was accompanied by a significant overall decrease in the total length of surveys each year (Fig. 3b).

The changing effort and location of surveys each year violates the assumptions of random sampling and uniform methodology. Several of the metrics that might be used to track population status therefore reveal instead artifacts of the methodology. For example, the average number of Callippe silverspots observed per meter of transect appears to show a positive trend over time (Fig. 3c). This trend is spurious, because surveys over time concentrated increasingly on cells where butterflies were present, even though some presumably unsuitable habitat was surveyed en route to grassland areas. Without surveying marginal habitats with butterflies absent, the apparent density of butterflies increases. All such butterflies per meter estimates derived from these data are similarly uninformative in evaluating population status because they are not comparable year to year. Similarly, the raw proportion of cells occupied by either butterfly is a spurious measure because of the decreasing number of "absent" cells surveyed over time (Fig. 3d). Therefore, while the proportion of cells with Callippe silverspot present each year increased significantly, the absolute number of occupied cells showed no statistical trend (Fig. 3e). But the absolute number of occupied cells is also misleading, because of the decreasing number of total cells surveyed over time. Therefore the best measure of trends in occupancy involves analysis of the proportion of cells occupied, when limited to those cells where the species was observed at least once. For these cells with at least one observation, neither butterfly shows a significant trend in the number of cells occupied over time (Fig. 3f).

Given that no overall trends in the proportion of the range occupied by either species exist for the study period, the analysis concentrates on trends within individual cells over time. The limits of such trend analysis extend to the 218 cells that were occupied at least once by mission blue

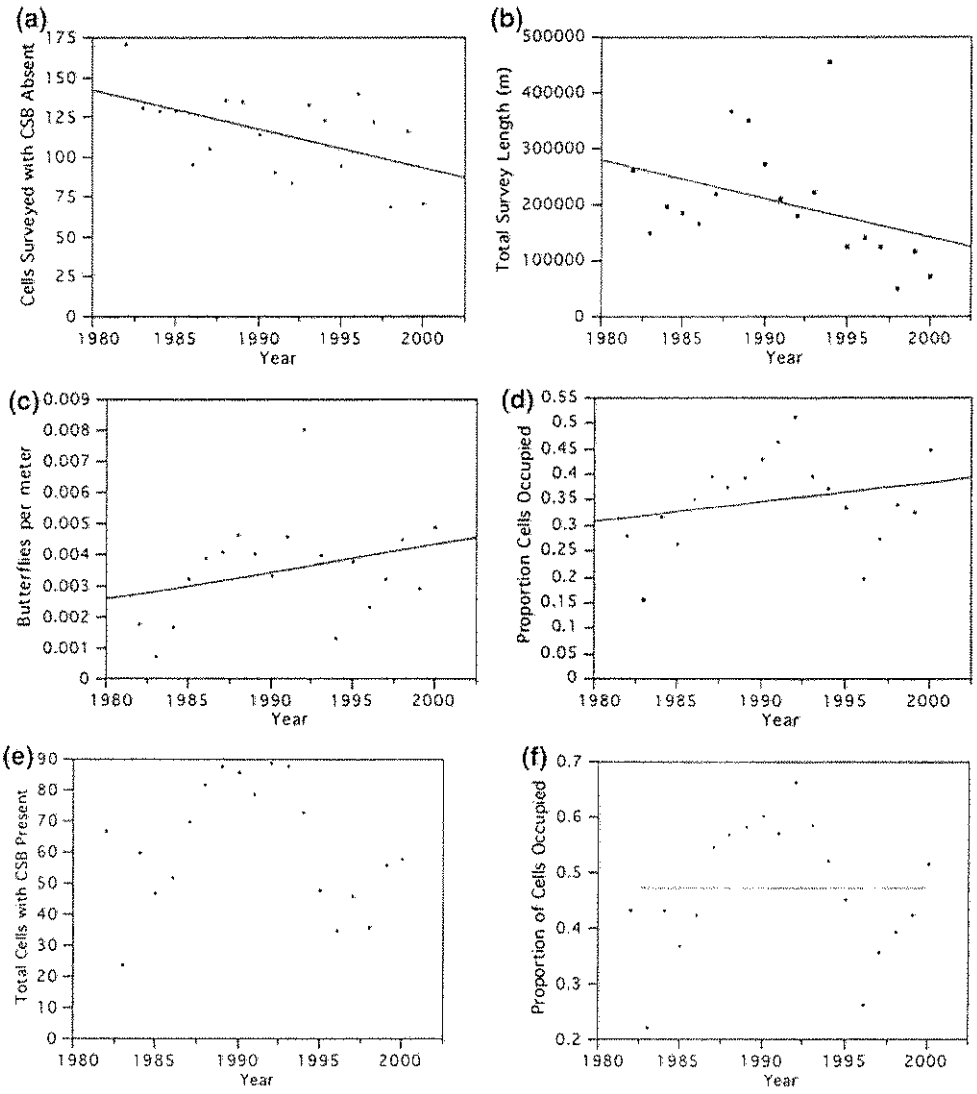

Fig. 3 Characteristics of surveys for Callippe silverspot butterfly. **a** Number of cells surveyed per year where species was not detected with linear regression. **b** Total survey length per year with linear regression. **c** Number of butterflies observed per meter of transect—a spurious measure of population status because transect location and effort were not fixed. **d** Proportion of cells occupied each year—also influenced by changing survey effort. **e** Total number of cells with butterfly present per year. **f** Proportion of cells occupied of those cells where butterfly was located at least once during any year. The *horizontal line* indicates the mean (47%)

butterfly, and 165 cells that were occupied at least once by Callippe silverspot. Figure 5 depicts the cells for each species that were surveyed at least 10 years with each species present at least once, showing the proportion of years the butterfly was present. It also depicts cells where a trend during the study period was detected ($P < 0.20$). These results are based on occupancy for years surveyed, and so do not represent differences in survey frequency over time.

The cells with trends ($P < 0.20$), including those surveyed fewer than 10 years, were evenly split for mission blue butterfly (40 positive, 40 negative, with 2 cells occupied every year surveyed), and for Callippe silverspot (14 positive, 15 negative, with 6 cells occupied every year surveyed) (Fig. 6). The most stable cells for both species are concentrated on the northeast ridge, but this is also the location with a far greater proportion of negative trending cells. For Callippe silverspot, the northern half of the study area (cell numbers < 150) contains 11 of 15 negative trending cells (73%) but only 5 of 14 positive trending cells (36%). A similar, but less dramatic pattern is seen for mission blue butterfly.

The cells with positive and negative trends were spatially clustered with other cells with similar trends. For mission blue butterfly, the ratio of positive to negative trends in surrounding cells was significantly greater for positive cells (of those cells with trends, 78% were positive) than for negative cells (of those cells with trends, 32% were positive; $P < 0.0001$). For Callipe silverspot the same clustering occurred with 50% of surrounding trends positive for positive trending cells and 17% of surrounding trends positive for negative cells ($P < 0.05$).

Survey data provided adequate information to observe the importance of topographic relief to the two species (Fig. 4). For mission blue butterfly, the proportion of male butterflies seen within ridgeline areas (68.9%) was extremely close to the proportion of males recorded in the whole population (68.3%), and the same was true for females

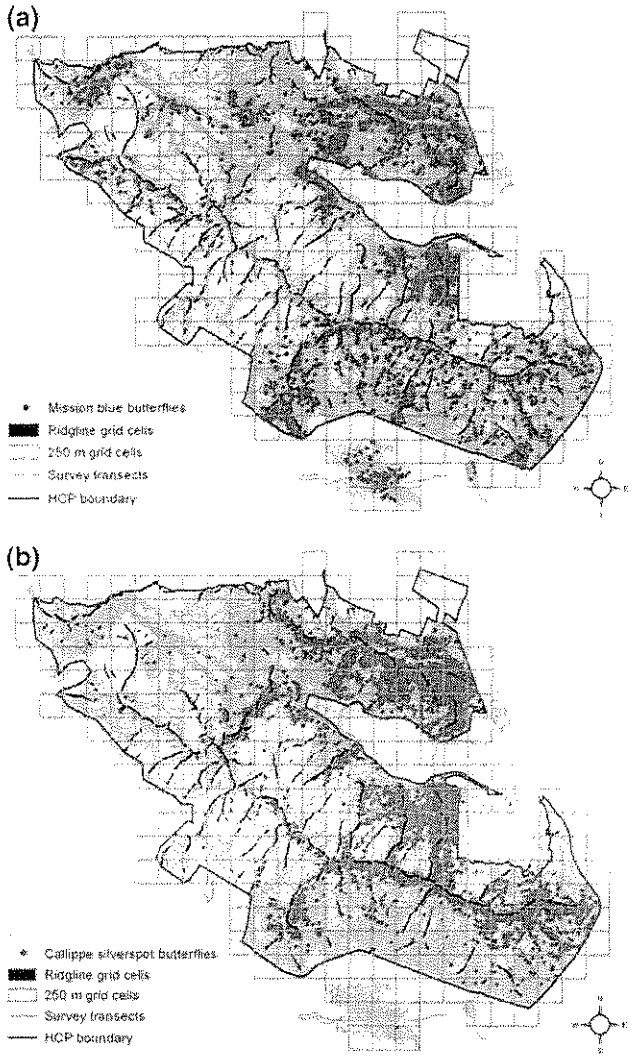

Fig. 4 Distribution of surveys and observations of mission blue butterfly (**a**) and Callippe silverspot butterfly (**b**) relative to ridgelines, 1982–2000

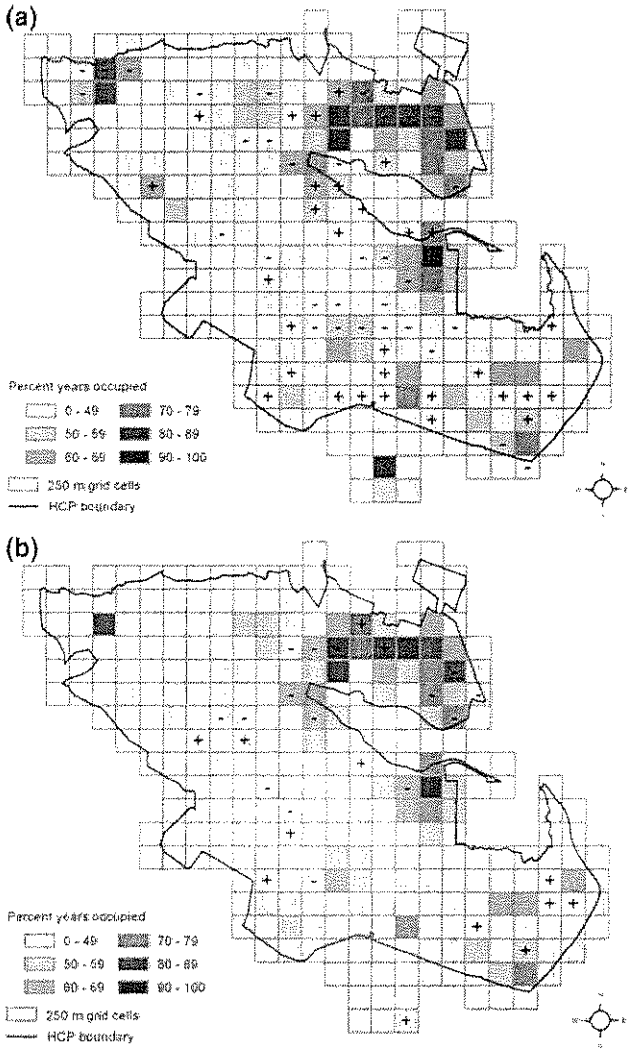

Fig. 5 Status and trends of mission blue butterfly (**a**) and Callippe silverspot butterfly (**b**) at San Bruno Mountain. Percentage of years occupied is depicted for all cells surveyed for 10 or more years 1982–2000. Trends in occupancy ($P < 0.20$) determined by a logistic regression are indicated with + and − symbols in cells surveyed >10 years

(26.1 vs. 26.5%). For Callippe silverspot butterfly, males were in slightly greater proportion within the 25-m buffer zones (41.2 vs. 37.8%) while females were present in slightly lower proportion than observed in the population (34.6 vs. 40.6%). The percentage of Callippe silverspots of unknown sex was greater within ridgeline buffers than in the population as a whole (24.2 vs. 21.4%). These results are consistent with the observation that male Callippe silverspots use hilltops somewhat more than females.

Discussion and conclusions

The wandering transects violate most tenets of survey design. It is "convenience sampling" (Anderson 2001), providing no replication for comparison. This does not

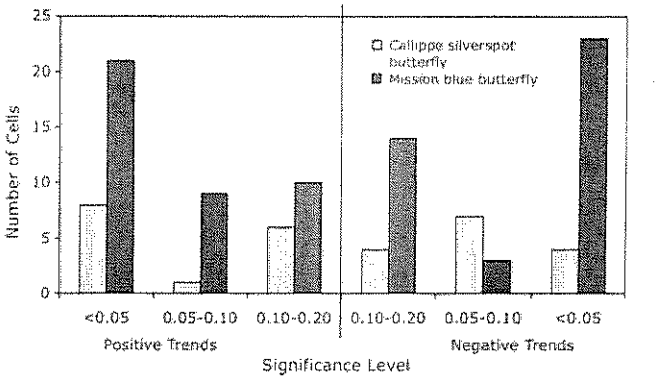

Fig. 6 Significance of trends in presence by cell for Callippe silverspot butterfly and mission blue butterfly

suggest that the surveys were easy to complete—to the contrary, fieldwork on San Bruno Mountain is notoriously difficult and physically taxing. Rather, the design was a compromise between budget constraints and the amount of habitat area that needed to be covered. It was opportunistic rather than pre-structured, making it haphazard rather than random. Ample scientific literature was available at the time that the survey technique was designed to indicate the value of replication in the form of fixed, repeated transects (Pollard 1977; Pollard et al. 1975). Failure to apply such methods, or to develop a statistically rigorous sampling scheme, reduced the scientific value of the monitoring program. The lack of regularly repeated transects also hampers the application of subsequent techniques to estimate population size and other flight period characteristics (Mattoni et al. 2001; Zonneveld 1991).

Although the wandering surveys were deficient as a technique to gather data about butterflies from which statistical inferences can be made, they have had other benefits for those managing the natural resources at San Bruno Mountain, such as detection of invasive plants and directing management to protect butterfly habitat over a wide range of the Mountain. The value of this information is significant for protecting the habitat of the endangered species in perpetuity, which is the primary purpose of the San Bruno Mountain Habitat Conservation Plan. The purpose of this analysis, however, is to evaluate what information can be gained from the wandering transect surveys. Notwithstanding the deficiencies in survey design, sufficient information can be gained from the surveys to describe, however imperfectly, the distribution of the two butterfly species over time. Some researchers believe that survey data that lacks an estimate of search efficiency is useless for scientific analysis (Anderson 2001, 2003), but we do not subscribe to this view. The assumptions that we have made, most importantly that a survey length of 250 m within cells is sufficient to detect the butterflies if present, provide a conservative analysis of the situation. As discussed above, false negatives are possible, but false positives will be very rare. By switching the emphasis from abundance to occupancy, the effects of search efficiency on the results are diminished, but not eliminated. The analysis does not allow inference to cells that were not surveyed. In contrast, had the survey routes been chosen randomly, and repeated, inference could have been drawn about areas not surveyed.

For the period 1982–2000 the distribution of Callippe silverspot butterfly and mission blue butterfly in those areas surveyed at San Bruno Mountain was stable. The distribution of the population experienced changes as certain areas were colonized (or were more regularly occupied) and others exhibited trends toward local extinction.

While information relevant to the management and conservation of these species has been extracted here from the wandering transects, it is evident that the survey methodology can be improved. This analysis of the survey data has, however, yielded sufficient information to identify areas in need of management action, as well as those areas important to the survival of these two listed butterfly species.

The approach described here was devised to extract data from a sampling scheme that was not directly suited to trend analysis. Our focus on geographic distribution rather than abundance may be both applicable and useful for species monitoring schemes that are closely tied to changing habitats. In this instance, abundance of insect species that are tied in part to weather and climate variables (Weiss and Murphy 1990) may be less important to monitoring objectives than is the geographic distribution of the species. Because more butterflies are, all other things being equal, more detectible, abundance and geographic extent are correlated in surveys of butterflies (Longcore 2007). In this manner analysis of geographic extent incorporates both proxy information about overall population size and important information about changing distribution that will be useful to land managers.

This approach adds a geographic dimension to the monitoring schemes for endangered butterfly species proposed by Haddad et al. (2008) and Nowicki et al. (2008). Haddad et al. (2008) presented techniques to determine population parameters for the purpose of undertaking population viability analysis and concluded that a combination of transect and mark–recapture sampling would generate the most accurate results at least cost and harm to the butterflies. Nowicki et al. (2008) addressed efforts to define butterfly distribution and concluded that they must be improved by incorporation of statistical correctors for detectability (MacKenzie et al. 2002, 2003).

For our purposes, calculation of detection probabilities was not possible, but we note that Pellet's (2008) estimates of detectability of four butterflies at nearby Jasper Ridge indicate that false absences diminish rapidly with number of visits, with fewer than five visits necessary to reduce that rate to <5%. This result is consistent with calculations based on the characteristic abundance curve of butterflies (Zonneveld et al. 2003). Our 250 m per cell cut-off to count a cell as surveyed allows for single visits to be counted. A survey scheme of presence that was designed for implementation would require multiple visits during a flight season (Zonneveld et al. 2003).

Many of the significant trends in occupation for both Callippe silverspot and mission blue butterfly were located in cells that were occupied fewer than 50% of the times surveyed. These trends can be caused by a single year or two of presence at the end of the survey period for a positive trend or at the beginning for a negative trend. While interesting if connected to known changes in habitat

conditions, they are of less interest to an assessment of the overall health of the population. Of considerably more interest are those cells where the butterfly was located for a significant proportion of years surveyed (>70%). For Callippe silverspot, five cells with greater than 70% occupancy show negative trends, all of which are found in the northern portion of the study area. In comparison, only two cells in this northern region showed positive trends. Mission blue butterfly also exhibited negative trends in nine cells that were occupied >70% of the surveys. These include two cells in the northwest, six in the northeast and one in the southern portion of the site.

The Northeast Ridge appears to be an important location for both butterflies, but especially Callippe silverspot. The edges of this area have shown negative trends, namely the slopes west of the Brisbane Industrial Park, the eastern Saddle and the eastern edge of the Northeast Ridge. The cell-by-cell trend analysis similarly reveals areas of concern for mission blue butterfly. The slopes west of the Brisbane Industrial Park, the northern edge of the Northeast Ridge and Guadalupe Canyon Parkway, and the northwestern corner of the Mountain exhibits negative trends. In contrast, several positive trending cells are found for both species on the south slope and southeast ridge where the majority of the habitat for both species is located.

An analysis of the vegetation composition over time within the negative trending cells revealed that coastal scrub succession and a corresponding loss of grassland habitat is likely the primary cause for the observed declines in butterfly occupancy (Fig. 7). Coastal scrub refers to native brush stands on San Bruno Mountain that consist of coyotebrush (*Baccharis pilularis*), poison oak (*Toxicodendron diversilobum*), California coffeeberry (*Rhamnus californica*), California blackberry (*Rubus ursinus*), California sagebrush (*Artemisia californica*), sticky monkey flower (*Mimulus aurantiacus*), lizard tail (*Eriophyllum staechadifolium*), and blueblossom (*Ceanothus thyrsiflorus*), among others. Stands vary by species due to slope and exposure. Mapping of vegetation types on San Bruno Mountain was conducted in 2007 by TRA Environmental Sciences by digitizing and field checking vegetation types using 1-m pixel resolution 2004 orthophotography (TRA Environmental Sciences 2008). This analysis revealed that over the period of 1982–2004, 49 ha of grassland had converted to coastal scrub vegetation (TRA Environmental Sciences 2008). Review of this data as well as terrestrial and aerial imagery of the Mountain from 1982 to 2004, and field inspection of each of the cells with recorded trends and >70% occupancy, revealed that most of the declining cells were located in grassland areas that had converted to coastal scrub vegetation over the past 22 years (Fig. 7). Specifically, cells with declining trends had either (1) a large increase in aerial extent of coastal scrub vegetation (cells 24, 25, 70, 107, 190); or (2) a large increase in aerial extent of both coastal scrub and invasive species (i.e. exotics) (cells 71, 74, 75, 125). Only two cells with a declining trend were identified and coastal scrub had not increased (cells 54 and 131). A review of the positive trending cells with >70% occupancy revealed only minor changes in vegetation, and grassland remained as the dominant (>50%) vegetation type. Of the fourteen cells identified as showing significant declines for either mission blue or Callippe silverspot, nine cells had transitioned from grassland to coastal scrub as the dominant (>50%) vegetation type. These areas are located on north facing slopes known as Buckeye Canyon, the Saddle, Hill West of Quarry, Northeast Ridge (western portion) and Wax Myrtle Ravine. By the mid-1990s, transect routes through each of these areas had to be eliminated or rerouted due to the increased density of coastal scrub vegetation.

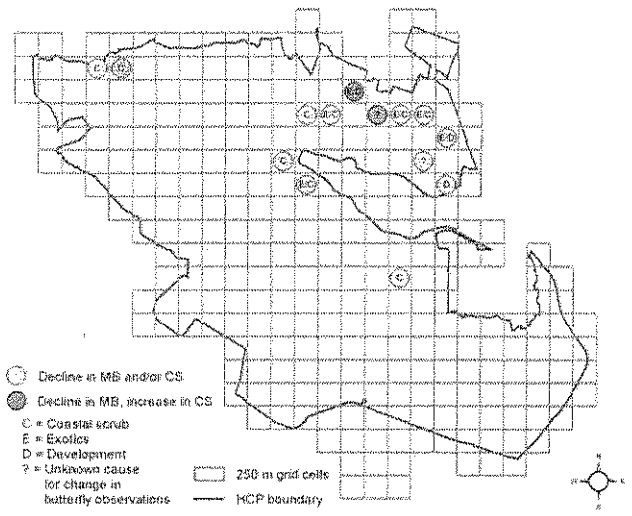

Fig. 7 Observed habitat changes within cells with >70% occupancy and significant declining trends for mission blue butterfly and Callippe silverspot butterfly

The loss of approximately 49 ha of grassland habitat corresponds to a rate of conversion from grassland to scrub of 2.2 ha per year (TRA Environmental Sciences 2008). Most of this conversion has occurred on lower elevation, north facing slopes (Fig. 8). The conversion of grassland to 'brush' on San Bruno Mountain was also calculated in 1982, when it was estimated that approximately 541 acres (219 ha) of grasslands had converted to brush between 1932 and 1981 (Thomas Reid Associates 1982b). This corresponds to a rate of conversion of 4.4 ha per year.

Management of the HCP area for the endangered butterflies for the past two and a half decades has focused almost exclusively on the control of invasive species. The most consistent treatment has been conducted on woody invasive brush and trees such as gorse (*Ulex europaea*), French broom (*Genista monspessulana*), Portuguese broom (*Cytisus*

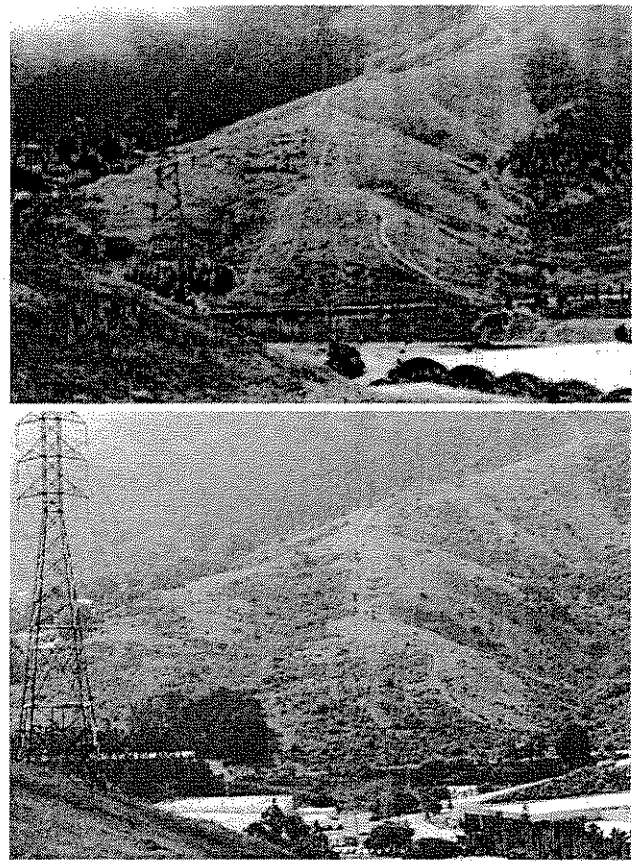

Fig. 8 View of Buckeye Canyon and eastern ridge in 1986 (*top*) and 2006 (*bottom*). Coastal scrub vegetation, and to a lesser extent invasive brush, have increased substantially over the 20 year period. Photos by TRA Environmental Sciences, Inc

striatus), and blue gum (*Eucalyptus globulus*) (TRA Environmental Sciences 2008). These efforts have either contained the spread or significantly reduced the extent of these species (gorse by approximately 80% and eucalyptus by approximately 30%) during that period (TRA Environmental Sciences 2008). However, based on the observed declining trends of butterfly occupancy and vegetative changes on north facing slopes, management needs to also address native coastal scrub succession to protect grassland habitat and the butterflies of concern from continued habitat loss.

Invasions of brush into grasslands have been documented in other grassland habitats in the San Francisco Bay area over the past 30–40 years (McBride 1974; Williams et al. 1987), and the process may be occurring as a result of grazing exclusion as well as from higher spring rainfall (Williams et al. 1987). The San Bruno Mountain habitat managers have been aware of the coastal scrub succession problem on the Mountain as it was identified in the HCP in 1982 and of the need to implement management tools such as mechanical thinning, grazing, or burning to counteract the process of succession (Thomas Reid Associates 1982b). Taking actions to provide disturbance and reverse or slow the process of coastal scrub succession has been difficult. It has been hampered by (a) the high cost and lack of funding to implement both invasive species control *and* native brush control programs, (b) political opposition to grazing, and (c) human safety concerns over conducting controlled burns near urban areas. While there has been a high level of concern over reports that the HCP habitat managers have not adequately controlled invasive species on San Bruno Mountain (Sigg 1993), there has far less concern over the threat to endangered butterfly habitat from native coastal scrub succession. The perception of native plants as 'good' and nonnative plants as 'bad' is a recurring theme in the current environmental public consciousness, but applying this as a uniform strategy for habitat management may not address actual threats to habitat for these butterfly species. The butterflies' grassland habitat can be as easily overtaken by native coastal scrub as it can by invasive species and actual threats to habitat areas need to be addressed on a local level based on slope, microclimate, surrounding vegetation and other factors.

Coastal scrub vegetation only becomes a threat to the butterflies' grassland habitat on San Bruno Mountain when it reaches a high enough density to negatively affect butterfly host and nectar resources, or the ability of the butterflies to locate those resources. This typically occurs in areas with more moisture and less solar exposure such as north facing slopes. Moderate densities of coastal scrub within the grasslands of San Bruno Mountain provide important resources for the endangered butterflies such as additional nectar sources, perching sites and partial shading and soil moisture retention that often benefits the butterflies' host and nectar plants, especially *Viola pedunculata* (TRA Environmental Sciences 2008). For these reasons, management of coastal scrub succession should be focused on brush thinning and control rather than eradication.

The importance of maintaining habitat on north facing exposures has been illustrated for the Bay checkerspot butterfly (*Euphydryas editha bayensis*), a threatened species also found in the San Francisco Bay area that utilizes grassland habitat (Weiss et al. 1988). In the northern hemisphere, north facing slopes are typically cooler and wetter than south facing slopes, with significant differences in vegetation composition as a result. The distribution of larvae of the Bay checkerspot changes substantially from year to year across slopes, reflecting spatial patterns of prediapause survivorship (Weiss et al. 1988). Larvae from egg masses laid on cooler slopes were found to nearly always have a better chance to reach diapause than those laid concurrently on warmer slopes, because of the later onset of plant senescence on cooler slopes. Cool slopes are high quality habitat for prediapause larvae, and become

better relative to warmer slopes as the flight season progresses (Weiss et al. 1988).

In general, the protection and management of habitat on a variety of slope exposures under different microclimatic conditions is a logical strategy to provide adequate habitat to support population shifts of grassland endemic butterfly species in response to climatic fluctuations. Populations inhabiting topographically uniform areas without cool slopes that can act as refuges are unable to undergo thermal retreat and are more vulnerable to extinction that populations in more diverse habitat patches (Weiss and Murphy 1990). North facing slopes, and other cooler exposures are likely to become even more important as refugia for grassland endemic butterflies if global climate trends continue as expected. These findings suggest that the mission blue and the Callippe silverspot populations on San Bruno Mountain were stable during the study period, but loss of grasslands to scrub succession in some areas is a cause for concern. The implementation of management programs to control native coastal scrub is needed to protect the habitat of the mission blue and Callippe silverspot butterflies especially on lower north-facing slopes, and other areas prone to coastal scrub succession on San Bruno Mountain.

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MEMORANDUM

DATE: January 28, 2010

TO: Hal Toppel and Robin Leiter,

FROM: Judith Malamut and Jason Paukovits, LSA Associates, Inc.

SUBJECT: Northeast Ridge Unit II 2007 Addendum, Global Climate Change

Comments were made at the January 19, 2010 City Council hearing regarding global climate change (GCC) and the energy efficiency of the Northeast Ridge Modified Project.

Global climate change is considered an "effect on the environment" and an individual project or plan's incremental contribution to global climate change, although small, can have a cumulatively significant impact when considered collectively with past, present, and future projects. Local, regional, State, and federal agencies are all continuing to develop strategies to control greenhouse gas (GHG) emissions that contribute to global climate change, including the State Assembly Bills 1493 and 32, Executive Order S-3-05 and Executive Order S-01-07. To assist public agencies in the mitigation of GHG emissions or analyzing the effects of GHGs under CEQA, including the effects associated with transportation and energy consumption, Senate Bill (SB) 97 requires the Governor's Office of Planning and Research (OPR) to develop CEQA guidelines on how to minimize and mitigate a project's GHG emissions. The Natural Resources Agency adopted the CEQA Guideline Amendments on December 30, 2009.

According to the CEQA Guideline Amendments, the lead agency should consider the following factors when assessing the significance of impacts from GHG emissions on the environment: (1) the extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting; (2) whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project; and (3) the extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions.

The CEQA Guideline Amendments state that the lead agency should make a good-faith effort, based to the extent possible on scientific and factual data, to describe, calculate or estimate the amount of GHG emissions resulting from a project. GHG emissions estimates provided in this memo are for informational purposes only, as there is not yet an established quantified GHG emissions threshold.

Construction activities, such as site preparation, site grading, utility engines, on-site heavy-duty construction vehicles, equipment hauling materials to and from the site, asphalt paving, and motor vehicles transporting the construction crew will produce combustion emissions from various sources. A precise construction schedule was not available at the time of this report, and a development timeline calculator was used to estimate the timing of the site grading, building construction, coating,

and paving construction phases.[1] Using the URBEMIS 2007 model, it is estimated that the total project construction emissions would be approximately 391 metric tons of carbon dioxide (CO_2).

Long-term operation of the proposed project would generate GHG emissions from area and mobile sources, and indirect emissions from sources associated with energy consumption and water use. Transportation associated with the project would result in GHG emissions from the combustion of fossil fuels in daily automobile and truck trips. Electricity use can result in GHG production if the electricity is generated by combusting fossil fuel. Water-related energy use consumes 19 percent of California's electricity every year, and related GHG emissions are based on water supply and conveyance, water treatment, water distribution, and wastewater treatment. Other area sources, including the use of landscape equipment, can contribute to the GHG emissions from the project. As shown in Table 1, motor vehicle emissions are the largest source of project-related GHG emissions at approximately 73 percent of the annual emissions. Energy use, including electricity and natural gas, are the next largest category at a combined 24 percent of the project's annual GHG emissions. Other area sources, including fireplaces and landscape equipment, are the remaining source of GHG emissions and comprise 3 percent of the total.

Table 1: Northeast Ridge - GHG Emissions for 71 Single-Family Units

	Emissions (Metric Tons Per Year)				
Emission Source	**CO_2**	**CH_4**	**N_2O**	**CO_2eq**	**Percent of Total**
Vehicles	890			890	73
Electricity Production	111	0.007	0.003	112	9
Natural Gas Combustion	188	0.004	0.003	188	15
Other Area Sources	31	--	--	31	3
Total Annual Emissions	1,219	0.011	0.006	1,220	100

Note: Column totals may vary slightly due to independent rounding of input data.
-- Estimates not available for this pollutant and/or category.
Source: LSA Associates, Inc., January 2010.

The proposed CEQA Guideline Amendments encourage lead agencies to consider many factors in performing a CEQA analysis, but preserve the discretion granted by CEQA to lead agencies in making their own determinations. A lead agency has the discretion to determine, in the context of a particular project, whether to (1) use a model or methodology to quantify greenhouse gas emissions resulting from a project, and which model or methodology to use; and/or (2) rely on a qualitative analysis or performance based standards.

The Bay Area Air Quality Management District (BAAQMD) currently does not have an adopted threshold of significance for GHG emissions. However, BAAQMD is in the process of developing GHG thresholds and held hearings in late 2009 and January 2010. BAAQMD released CEQA Air Quality Guidelines in December 2009, which is an update to its current CEQA Guidelines. Approval of the CEQA Guidelines by the BAAQMD Board of Directors, including the GHG threshold of significance, has been delayed until the spring of 2010. BAAQMD recommends that lead agencies

[1] San Joaquin Valley Air Pollution Control District, 2008. Development Timeline Calculator. Available at http://www.valleyair.org/ISR/ISRResources.htm. While the calculator was developed for the Indirect Source Review program in the San Joaquin Valley, it is not location-specific and is applicable to projects located in other areas. Outputs are designed to be used in URBEMIS 2007.

quantify GHG emissions resulting from *new* development[2] and apply all feasible mitigation measures to lessen the potentially adverse impacts. As of the date of this memo, the BAAQMD Guidelines are in draft form and subject to change; therefore, these guidelines are not addressed further in the analysis of the proposed project.

As the lead agency for environmental evaluations under CEQA, the City of Brisbane has not adopted new significance standards that would identify the threshold over which a project would be considered to have a significant impact on global climate change. For the purposes of this memo, the following criterion was used:

- *Would the project conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases?*

California's major initiative for reducing GHG emissions is outlined in Assembly Bill 32 (AB 32), the "Global Warming Solutions Act," passed by the California State legislature on August 31, 2006. This effort aims at reducing GHG emissions to 1990 levels by 2020. AB 32 includes a number of Statewide initiatives to reduce GHG emissions. AB 32 requires ARB to prepare a Scoping Plan that outlines the main State strategies for meeting the 2020 deadline and to reduce GHGs that contribute to global climate change. The Scoping Plan was approved by ARB on December 11, 2008, and includes measures to address GHG emission reduction strategies related to energy efficiency, water use, and recycling and solid waste, among other measures.[3] The measures in the Scoping Plan will not be binding until they are adopted through the normal rulemaking process. The ARB rulemaking process includes preparation and release of each of the draft measures, public input through workshops and a public comment period, followed by an ARB Board hearing and rule adoption. Local governments are essential partners in achieving California's goals to reduce GHG emissions. Many of the proposed statewide measures to reduce greenhouse gas emissions rely on local government actions. At this time, there are no adopted local (e.g., City of Brisbane) or regional plans to address GHG emissions that are applicable to the proposed project.

In addition to reducing GHG emissions to 1990 levels by 2020, AB 32 directed ARB and the Climate Action Team (CAT) [4] to identify a list of "discrete early action GHG reduction measures" that can be adopted and made enforceable by January 1, 2010. The combination of early action measures is estimated to reduce State-wide GHG emissions by nearly 16 million metric tons (MMT). Accordingly, the 44 early action items focus on industrial production processes, agriculture, and transportation sectors. Early action items associated with industrial production and agriculture do not apply to the proposed project. The transportation measures that would result in a reduction of GHG emissions associated with the proposed project include the Low Carbon Fuel Standard (LCFS), limitation of high GWP use in consumer products, and the tire pressure program. State measures include emission reductions assumed as part of the Scoping Plan, including light-duty vehicle GHG standards ("Pavley standards") and energy efficiency measures. These measures do not require

[2] As stated repeatedly in the staff reports, memos and other documents that make up the administrative record for the Northeast Ridge project, the 2007 Modified Project is not technically a "new" development project as the 1989 Northeast Ridge Vesting Tentative Map project remains a valid, outstanding land use entitlement, as recognized by the City, the County and the Service.

[3] California Air Resources Board. 2008. *Climate Change Scoping Plan: a framework for change.* December.

[4] CAT is a consortium of representatives from State agencies who have been charged with coordinating and implementing GHG emission reduction programs that fall outside of ARB's jurisdiction.

implementation or additional action by the proposed project, but would result in a reduction of GHG emissions.

In addition to the reductions associated with discrete early action measures and the AB 32 Scoping Plan, the project would be required to implement mitigation measures included in the 1983 EIR. The 1983 EIR evaluated the potential energy consumption impacts of the Northeast Ridge project and identified mitigations that have been incorporated into the project over time and into the Conditions of Approval (see Section G. Air Quality/Energy Use on pages III-60 to III-66 of the Final EIR, December 1982; see Conditions of Approval Section IV. Architectural/Design/Landscaping, part c.).

The 71 single-family units proposed under the 2007 Vesting Tentative Map (VTM) are still required to incorporate mitigations and comply with the Conditions of Approval. These mitigation measures include the following measures related to vehicle emissions:

- Promote decreased use of autos;
- Provide bicycle and pedestrian paths onsite and between the project and nearby commercial areas;
- Provide convenient access to public transit; and
- Provide a connection with the proposed Bay to Ocean Trail.

Mitigation measures included in the 1983 EIR will also reduce the energy "footprint" of the project and energy-related GHG emissions:

- Incorporate energy conservation measures into project and building design; and
- Orient structures for maximum solar and minimum wind exposure.

The modified Northeast Ridge Project as proposed in the 2007 VTM is a reduction of 80 units from the 1989 VTM, which is equivalent to a reduction of over 129,000 square feet of building area. The 2007 modified project would consume less energy and produce fewer GHG emissions than the project that was evaluated in the 1983 EIR and 1989 Addendum. The modified project also utilizes solar water heating, energy efficient appliances, and other methods to reduce energy consumption. The project would be subject to all applicable permit and planning requirements in place or adopted by the City of Brisbane, including green building requirements. Due to the reduced project size, there would also be a significant reduction in the number of vehicle trips to and from the development and the associated emissions.

Based on the analysis above, the proposed project would not conflict with the State goal of reducing GHG emissions and would not conflict with any applicable plan, policy or regulation for the purpose of reducing greenhouse gas emissions.